Government of the People's Republic of Bangladesh
Ministry of Road Transport and Bridges
Roads and Highways Department (RHD)

Preparatory Survey for Chattogram- Cox's Bazar Highway Improvement Project in Bangladesh

ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

November 2022

Prepared by

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EQMS

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Prepared for

Roads and Highways Department

Sarak Bhaban, Tejgaon, Dhaka

DOCUMENT DETAILS

Document Title	Environmental Impact Assessment (EIA) of the Preparatory Survey for Chattogram-Cox's Bazar Highway Improvement Project in Bangladesh
Document Type	Draft Report
Date	25 September 2022
Author	Roads and Highways Department

DISTRIBUTION LIST

Hardcopy	Softcopy	CDs	Other form
✓	×	×	×

DOCUMENT HISTORY

Version	Date	Description
V-1	25 September 2022	Submission for DoE's review

November 2022

Environmental Impact Assessment (EIA) for the Chattogram-Cox's Bazar Highway Improvement Project in Bangladesh

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E-1 Introduction

Background of the Project

The Dhaka-Chattogram-Cox's Bazar Highway is the major roadway of Bangladesh in terms of its importance in national economy. This is the main transport and distribution way for the goods from Chattogram Port, the largest functional sea port of the country. Although Dhaka-Chattogram portion of the highway was widened and developed from two-lane to four-lane road, the Chattogram-Cox's Bazar portion remained a two-lane road. However, the attention is given to develop this portion as the significance of the road will be increased after completion of the deep-sea port, which is currently under construction in Matarbari, Cox's Bazar. As the primary transport route to Matarbari Port, the Chattogram-Cox's Bazar Highway is expected to become a key route for freight traffic, connecting the port to Dhaka and Chattogram, the country's commercial and industrial centers. According to the Matarbari Port Development Project (2017), the necessary travel time from Matarbari Port to Chattogram (approx. 130 km) is estimated to increase from 123 minutes in 2017 to 438 minutes in 2035. Anticipating the opening of Matarbari Port, the Chattogram - Cox's Bazar Highway Improvement Project (CCHIP) will contribute to the smooth and safe transport of passengers and freight through the construction of flyovers and bypass roads in urban sections of the major transport route N1 between Chattogram and Cox's Bazar, and is consistent with the policies of the Government of Bangladesh. For this purpose, five major bottleneck points, viz. Patiya, Dohazari, Keranihat, Lohagara, and Chakaria have been identified where outer road/bypass or flyover will be constructed.

Overview of the Project

The project will construct four bypass roads in Patiya, Dohazari, Lohagara, and Chakaria bottleneck area. In Keranihat, the construction of flyover is under consideration instead of a bypass road. However, there is also a bypass option in Keranihat, which is subject to the EIA study. There is already a bypass in Patiya constructed few years back. The new bypass will be constructed along the old bypass alignment, however, there will be distortion in some locations to straighten the road. In addition to the the bypass and flyover in major bottleneck area, a couple of minor bottleneck areas have also been considered for improvement.

Scope of the Study

The main objectives of the Environmental Impact Assessment (EIA) study are to identify and assess potential impacts on natural and social environment and pollution caused by the Project and to prepare an EIA Study Report which includes environmental management plan & monitoring plan for the necessary actions to the identified impacts.

E-2 Methodology

The study was conducted following appropriate methodology, including secondary data collection, primary data collection, literature review, qualitative survey, impact identification and evaluation, preparing management and monitoring plan, and preparing emergency response plan. A brief description of the components of methodology is given below:

Data Collection: Both primary and secondary data have been collected for this study. The primary data were collected through baseline study, including baseline environmental study and ecological survey. The baseline environmental study includes several environmental components like ambient air quality, weather, noise level, and surface water quality. On the other hand, the ecological survey includes natural habitats, flora, and fauna. The secondary data were collected from government organizations, previous reports, research papers, etc.

Qualitative Survey: In addition to quantitative environmental and ecological survey, the qualitative survey has also been conducted. The qualitative survey includes Focus Group Discussion (FGD), Key Informants Interview (KII), and Public Consultation Meeting (PCM). The PCM was conducted in two stages, such as scoping stage before identification of impacts and disclosure stage after identification of impacts.

Impact Identification: The potential impacts of the project, including the impacts during construction phase and operation phase have been identified. The identified impacts are grouped in three areas, such as impacts on physical environment, impacts on ecological resources, and impacts on social environment. After impact identification, appropriate mitigation measures during and after construction period are suggested.

Formulating Management and Monitoring Plan: An Environmental and Social Management and Monitoring Plan has been formulated to implement the mitigation measures as well as to monitor the progress. The report also set monitoring parameters, monitoring frequency, implementation and supervision organization, and budget.

Formulating Emergency Plan: An emergency response plan has been prepared to mitigate, response, and manage the emergency situations like fire, accident, flood, earthquake, vandalism, electric and falling hazards, etc. Besides, the organization and responsibilities of emergency response team have also been suggested.

E-3 Legislative, Regulation and Policy Consideration

There are several policies, laws, and rules related to environmental protection and safeguard established in Bangladesh. The important policy includes National Environmental Policy 2018 and National Environmental Management Action Plan 1995, which formulated the master framework of nationwide environmental actions with a set of broad sector wise action guidelines. National environmental laws and regulations include Environmental Conservation Act 1995, and Environmental Conservation Rules 1997 (ECR 1997). The ECR 1997 established reference values of different pollutants, including air, water, noise, and effluent. It also formulated the necessity of obtaining Environmental Clearance Certificate (ECC) and conducting Environmental Impact Assessment (EIA) for designated industries and development projects. The rules defined four categories for industries and construction projects based on the magnitude of the impacts and set the procedure of obtaining ECC for each category. There are some laws and rules that established the provisions related to health safety and environmental safeguard and management in industries and projects. They laws are: Bangladesh Labor Act 2006, Public Health Emergency Provisions Ordinance 1994, Maternity Benefit Act 1950, etc. Moreover, the Acquisition and Requisition of Immovable Property Act 2017 has also been considered for this study.

JICA also set Guidelines for Environmental and Social Considerations. In this regulation, the projects are categorized into four categories on the basis of their impact severity and extent. The Project, as per the above categorization, falls under Category A for the purpose of environmental investigations. Gap analysis and gap filling measures between GoB regulations and JICA Guidelines also been discussed for this project. In addition to these, required permits and approvals before/during and after construction also considered during this study.

E-4 Project Description

Project Activities and Characteristics

The project will be implemented in five major bottleneck areas, e.g., Patiya, Dohazari, Keranihat, Lohagara, and Chakaria situated in five Upazilas, such as Patiya, Chandanaish, Satkania, Lohagara, and Chakaria. The length of bypass/flyover in Patiya, Dohazari, Keranihat, Lohagara, and Chakaria will be 5.4, 3.3, 3.5, 5.1, and 6.8 km, respectively. In Patiya, Dohazari, and Lohagara, the main road will be a 04-lane carriageway with provision of space for future expansion to build another lane on both sides.

That means the main road will be consists of 06-lanes in future. Also, there will be two service roads on both sides of main road and the width of service lane will be 02-lane on each side. In Chakaria, the main road will be a 04-lane carriageway with two service roads on both sides of main road and the width of service lane will be 02-lane on each side. In Keranihat, the viaduct of flyover will accommodate a roadway of 06-lanes.

Alternatives of the Alignment

Several alternative options for the alignment of bypass roads in Patiya, Dohazari, Keranihat, Lohagara, and Chakaria were primarily examined. A flyover option has also been examined instead of bypass in Keranihat. To select a final alignment out of many alternatives, different controlling factors like location of agricultural land, settlement, water body, railway, electric grid line, bridge, protected area, etc. have been considered. Finally, a bypass alignment has been selected in Patiya, Dohazari, Lohagara, and Chakaria. On the other hand, a flyover option is selected in Keranihat due to interruption by Chattogram-Cox's Bazar Railway.

E-5 Baseline Environmental Condition

The baseline environmental condition describes the current environmental characteristics of project areas, including physical environment, biological environment, and environmental quality. The physical environment of project areas includes geological characteristics, topography, soil characteristics, climate, and water resources.

Physical Environment

Chattogram area is situated within the tertiary hill region of folded flank of Bengal fore deep. The folded part is composed of the Tipam sandstone formation and Girujan clay formation of Pliocene age at the bottom and Dupi Tila formation of Plio-Pleistocene age at the top. The project area is comparatively plain with slight variations in altitude. The alignment of Chattogram-Cox's Bazar Highway goes through a foothill region of Chittagong Hill Tracts. There are two types of soil, e.g., grey piedmont soil and acidic sulphate soil in the project area. The soils of greater Chittagong region consist of hard red clay with a mixture of fine brown sand. The project area is situated in south-eastern climatic sub-zone, which covers both Chattogram and Cox's Bazar District. The mean temperature varies from 13 to 32°C and the average rainfall is 254 cm on an annual basis.

Biological Environment

The biological environment deals with the biodiversity of project areas, including flora, fauna, and habitats. Generally, wildlife habitats of Chattogram and Cox's Bazar district is covered by hill forest, massive coastal belt, river system, wetland, and homestead vegetation. There are different types of habitats in the project area like river, pond, wetland, crop land, agricultural land, forest, homestead vegetation, wildlife habitat, etc. The major floral species found in the project area includes *Colocasia Esculenta, Hydrilla verticillata, Eichhornia crassipes, Mangifera indica, Ziziphus mauritiana, Musa acuminate, Albizia lebbeck, Citrus aurantifolia, Tectona grandis, Dalbergia sissoo, Areca catechu, Artocarpus chaplasha, Tectona grandis,* etc. The major faunal species found in the project area includes *Duttaphrynus melanostictus, Xenochrophis piscator, Herpestes auropunctatus, Elephas maximus, Macaca mulatta, Hierococcyx varius, Otus sunia, Corvus macrorhynchos, Corvus splendens*, etc. There are several fish species found the project areas during ecological survey, including *Anabas testudineus, Ilisha megaloptera, Heteropneustes nani, Amblypharyngodon microlepis, Channa striatas, Clarias batrachus,* etc.

Environmental Quality

Environmental quality refers to the existing characteristics of the components of natural environment, e.g., air, water, noise, vibration, etc. that have significant impacts on health and standard of living of human. Ambient air quality has been monitored in 12 locations during monsoon and winter season. Two air quality monitoring locations were selected from each alignment option. Different parameters of

air quality, including PM_{10}, $PM_{2.5}$, NO_2, SO_2, and CO have been measured during the monitoring. The results shows that no over standard concentration of any pollutants was found during both monsoon and winter season. The concentration of particulate matter was higher in winter season than monsoon season. The baseline study also analyzed surface water quality in the project area. The surface water samples were collected from 10 locations, including two locations from each bottleneck point. The overall condition of surface water is good, except some out of standard range level of pH, DO, and BOD in few sampling locations. In addition, ambient noise level and vibration level has also been monitored in and around the alignment. Noise level has exceeded the permissible limits in most of the monitoring locations. However, vibration level has been found within the permissible limit of Japanese standards at all the monitoring locations.

E-6 Socio Economic Environment

The major bottleneck section proposed project is located over the two districts titled Chattogram and Cox's-Bazar and five Upazilla are Patiya, Chandanaish, Satkania, Lohagara and Chakaria. Based on the assessment of the project, its surroundings and its environmental & social influence, RoW of proposed road considered as the study area for the social study. As the project intend to construct four bypasses road and one flyover in five major bottlenecks of Chattogram-Cox's Bazar highways to reduce traffic congestion and to enhance a smooth traffic operation. The bottleneck locations where a bypass is planned to construct are Patiya, Dohazari, Lohagara, and Chakaria. On the other hand, a flyover will be built in Keranihat to avoid the conflict with nearby Chattogram-Cox's Bazar Railway.

Population and Demography

In the proposed study area, which consists of 13 unions and 3 wards, there are about 62095 households (HHs) with a total population of 336010 that will be influenced by the implementation of the proposed project. The average sex ratio is 106 and the average household size 5.35. Muslims are the major in number (87%) rather than other religions.

Literacy Profile

Concentration of literate people in underlying Unions of selected Upazila as within 5 km area is 54.7% which is lower than the national literacy rate of 56.7%.

Occupation & Livelihood

In the study area, Service is the dominant source of employment in the project area. A significant number of male 46% and 61% female involved in service sector. Study finds that, 41.4% male and 31% female involved in the agricultural activities including crops cultivation, fishing, direct farming, sharecropping, agricultural laborers etc. Only 13% male and 9% female involved in industry sector.

Settlement and Housing

According to the population and housing census (2011), total households of the project study area is 62095. The types of structures have been categorized into kutcha (temporary) semi-pucca (semi-permanent), pucca (permanent) and Jhupri (huts). The predominant structure of this study area is Kutcha (57.3%) followed by Semi-pucka (16.7%), Pucka (15.6%) and Jhupri (10.4%). Housing tenancy of the study area is owned by (89%), rented (9.6%) and rent free (1.4%).

Utilities and Access to services

At the project study area, the major source of drinking water is tube-well where about 92.7% population use tube-wells water. Studied Unions have 3.1% access to tap water. On the other hand, 3.9% people have access neither tube-well nor tap water.

About 22% and 50% of the households use non-water sealed and water-sealed sanitary latrine facility respectively, whereas about 26% households use non-sanitary facilities. On the contrary, only 2% households defecate in open places with no access to hygienic latrine facilities.

Socio-Economic Status of Project Affected Persons (PAPs) of Major Bottlenecks

Demographic Profile of PAPs

A total of 2552 entity have been identified as project affected unit by losing residential households, plain land owners, and shops will be affected in five bottleneck sections of the project area. Survey found that ,a total 2508 HHs will be partially affected in the project area where 2289 nos. Male headed and 219 nos. Female headed HHs comprising a total of 11,413 population. Among them Male 6044 (52.96%) and Female 5369 (47.04). The male-female ratio is 100:89. The average household size among the affected people is 4.55

Age distribution, Marital and Health Status of PAPs

Census and SES survey found that, age distribution of the population, about 26.37% are up to 14 years of age, and about 3.90 % are more than 65+ while elderly population (more than 65+). About 47.50 % are married, 48.28% are unmarried 4.13% divorced/widow and 0.10% identified as Separated. Health status of the population shows that about 98.83% people say they do not have any chronic disease.

Status of Religion and Ethnicity

The project area is dominated by Muslim, where about 92.30% (2,315) of the affected Households religious are found Islam while 7.70% (193) are identified as Hindu by faith. Moreover, no indigenous community has been identified during survey.

Level of Education

The average literacy rate in the project area it is about 84.79% which is significantly higher than the national average literacy rate 74.68%

Occupational Pattern of PAPs

Among various types of occupation business (11.07%), housewives (24.46%), and students (32.29%) are found mostly affected in the project areas. Livelihood restoration programs can enhance the capacity of the people particularly female and vulnerable people for doing more income-generating activities.

Income and poverty Status

According to the census, SES survey, it is found that nearly half (47.41%) of the population of the affected area lives below poverty line. Their maximum income range is below 24,000 taka which comparatively much lower than population whose income is more than 50,000 taka. The table shows that only 11.44% people income is more than 50,000 while a great percentage of population (41.15) live under a lower middle class whose income level is up to BDT 50,000

E-7 Potential Impacts and Mitigation Measures

Impacts on Physical Environment

The potential impacts on different variables of physical environment, including air quality, water quality, topography and soil, waste, noise, vibration, ground subsidence, offensive odors, bottom sediments, flood and drainage, borrow pits, etc. as well as their mitigation measures are given in following table.

Area of Impact	Potential Impact	Mitigation Measures
Air Pollution	• Dust from earth works and material stockpiles; • Fly ash from asphalt mixing plant; • Emissions from vehicles, machines, household combustion;	• Water spray and covering of material stockpile; • Maintenance of vehicles and machines to control exhaust emission;
Surface Water Pollution	• Surface runoff and discharge of turbid water and effluent; • Disposal of solid waste and hazardous waste;	• Sediment fence and soil compaction; • Drip pan for containing hazardous waste; • Settling tank and oil-water separator;
Topography and Soil Erosion	• Land use change; increasing of elevation in the alignment; • Removing of topsoil and soil pollution by hazardous waste;	• Tree plantation; • Manage hazardous waste • Avoid open toilet without sanitary pit
Waste	• Solid waste: organic and inorganic solid waste • Hazardous waste: burnt Mobil, sharp metal, scrap, medical waste, grease, chemicals	• Solid waste: segregation, landfill, and selling to recycle company • Hazardous waste: selling burnt oil to recycle company, oil-water separator, manage as per the rules.
Noise	• Noise from piling, demolition, rebar cutting and binding, hammering; • Noise from vehicles and machineries;	• Noise barrier between residential and commercial area and the project; • Maintenance of vehicle and machines; canopy, muffler, silencer in machines;
Vibration	• Vibration from pile driving and boring • Vibration from soil compaction and rolling, heavy vehicles and machines • May affect nearby weak structure	• Design should consider vibration mitigation; • Avoid concurrent demolition, piling, and compaction work
Ground Subsidence	• Slope failure or land slide in borrow pit and pile foundation; • Subsidence of road due to poor compaction;	• Shoring with sheet piling; • Proper compaction; good quality construction materials;
Offensive Odors	• Bad odors from solid waste, effluent, land clearing, etc.	• Avoid open discharge of effluent, slurry, and solid waste
Bottom Sediment	• Soil erosion may generate sediments • Piling during bridge construction	• Sediment fence; water spray; compaction and rolling of sand and soil
Flood and Drainage	• Inundation during construction work due to heavy rainfall • Alteration of natural drainage system. This can create flood	• Pumping and discharge of stagnant water • Construction of adequate number of cross drainage channel
Source of Materials, and Disposal Sites	• Land degradation and contamination	• Minimize the use of topsoil

Area of Impact	Potential Impact	Mitigation Measures
	• Mosquito breeding	• Use of dredged material for land filling

Impacts on Ecological Resources

The potential impacts of major and minor bottleneck sites on different ecological resources, including protected area, biota and ecosystem, fisheries, and aquatic biology, etc. as well as their mitigation measures are given in following table.

Area of Impact	Potential Impact	Mitigation Measures
Protected Area	• Disturbance to wildlife and • Degradation of protected ecosystem	• Restrict construction activities and waste disposal inside the PAs • Strictly prohibit poaching, hunting, or any harm to wildlife • Train workers on conservation of natural resources
Biota and Ecosystem	• Loss of trees • Vegetation clearance • Generation of dust and noise • Loss of habitat and/ or habitat degradation	• Reduce unnecessary tree felling especially large trees • Ensure proper implementation of mitigation measures for physical environmental variables • Implement the plantation plan
Fisheries and Aquatic Biology	• Deterioration of aquatic ecosystem • Disturbance to fish and aquatic biology	• Ensure proper disposal of construction materials, dredged materials and other wastes • Manage all liquid waste disposal and ensure no accidental spills of liquid waste into the river • Consider fish migration routes

Impacts on Social Environment

The assessment of socio-economic impacts has been undertaken with respect to the receptors across natural capital, human capital, social capital, economic capital and physical capital to have a significant interaction with the activities linked to the project across its lifecycle. The areas of impact as well as their mitigation measures are given in following table.

Area of Impact	Potential Impact	Mitigation Measures
Involuntary Resettlement	• Loss of Land • Loss of structure • Loss of Livelihood	• land acquisition process through the enforcement of Acquisition and Requisition of Immovable Property Act, 2017 (ARIPA) • Compensation will be provided to the affected as per Cash Compensation Law (CCL) • Stakeholder Engagement Plan and Grievance Redressal Mechanism
Poor	• In the Major Bottleneck area 47.4% of the population are living below poverty line	• Define the displaced persons and criteria for determining their eligibility for compensation

Area of Impact	Potential Impact	Mitigation Measures
		• Establish external monitoring committee consists of the third party
Indigenous or Ethnic Minority People	• As per survey conducted in the proposed project area there is no indigenous or ethnic minority available	• No mitigation measure will be required
Loss of Livelihood	• Losing of Business opportunity • Impact on wage earners • Impact on street vendors	• All direct income lost should be properly compensated as per RAP; • Livelihood Restoration Plan should be initiated who have loss their existing opportunity • Ensure employment opportunity for street vendors who are located at the RoW of Lohagara and Keranirhat section; • Project Affected Persons should be prioritized during employment opportunities related to this project; • Female wage labour should be well trained in compliance with another profession as they loss their existing jobs employed in different sectors; • Affected vendors may get resettlement benefits to restore their business elsewhere
Land Use and Utilization of Local Resources	• Loss of agricultural land • Changes in land use • Loss of tress	• Proper design of project should also minimize the impact on land; • Land used for labor and worker accommodation should be revamp as per previous condition after the completion of construction period; • Tree plantation program should be initiated as compensation for the demolition of huge number trees;
Disruption of Agricultural Activities	• Loss of agricultural land • Land owners as well as cultivators, wage earners, sharecroppers will be impacted	• Ensure adequate compensation for land owner as well as cultivator; • Sharecropper should be compensated as per RAP; • Consideration of alternative design to minimize the impact on the agricultural land.
Water Use	• Excessive withdrawal of ground water • Depletion of aquifers	• Reducing water consumption and wastage

Area of Impact	Potential Impact	Mitigation Measures
		• Construction of Rain water harvesting ponds • Regular inspections at site to monitor leakages in water storage tanks • Adoption of the advance technologies and machinery
Social Service Facilities	• During the construction period due to blockage and restriction on road people may have faces problem to access the existing facilities of social services	• Restriction on access to social services should not be implied; • Creation of awareness among the people about the alternative way of accessing social services; • Find out better alternative option by consultation with relevant stakeholders
Social Institutions and Local Decision-making Institutions	• Total 31 and 33 Community property resources (CPR) such as Mosque, Mazar, Graveyard, non-government school, Temple and Madrasah are affected in the project right of way of Major and minor bottleneck section respectively. • 13 government and non-government offices/institutions are also affected. The Offices/institutions include Government school, health clinic, political party club, government office, passenger shed of a bus stop, etc also be impacted in major bottleneck section	• Proper compensation as per RAP, • Alternative access facilities should be incorporated consultation with the communities; • Proper signage and fencing during demolition of these institutions; • Implement swift alternative means regarding displacement or demolition of religious institutions e.g., mosque, temple etc.
Local Conflict of Interest	• Increase of employment opportunity leading to local conflict	• Fairness in providing jobs • Clear dissemination of the needs of labor • The job skills and the priority for the affected people shall be taken into account
Gender	• Wage discrimination between male and female workers during construction	• Proper monitoring system
Children's Rights	• Increase of child labor • Educational opportunity of school going children in PAHs of the Project or in local community	• Impose strict prohibition of child labor

Area of Impact	Potential Impact	Mitigation Measures
Infectious Disease, such as HIV/AIDS	• Migrant workers might spread infectious diseases	• Provide surveillance for worker's health • Conducting immunization programs for workers • Create awareness
Occupational Health and Safety	• Possibility to occur accidents in the construction phase	• Provide adequate health care facilities and first aid within construction site • Provide OHS training program • Ensure proper maintenance of PPE and the instruction of proper use

E-8 Environmental and Social Management and Monitoring Plan

The environmental and social management and monitoring plan includes the mitigation strategy, monitoring parameter and frequency, implementing and supervising organization, and budget for different area of impacts. A summary of the plan is given in following table.

Area of Impact	Impacts	Mitigation Plan	Monitoring Plan
A. Physical Environment			
Air Quality	• Dust from earth works and material stockpiles; • Vehicle hauling for transportation generated dust; • Fly ash from asphalt mixing plant; • Emissions from vehicles, machines, household combustion; • Dismantling and demolition generated dust; • Solid waste burning;	• Inclusion of Air Quality Management Plan at CEMP • Dust suppression program including Water spray and covering of material stockpile; • Spoil management plan preparation; • Maintenance of vehicles and machines to control exhaust emission; • Temporary enclosure at site.	**Monitoring Parameters** PM_{10}, $PM_{2.5}$, SO_2, NO_2, CO **Monitoring Frequency** Quarterly, but can be changed as per consultant's requirement **Monitoring Location** Hot mix plant, concrete mixing plant/stone crushers at construction sites and sensitive locations near the site **Implementing Organization:** Contractor **Supervision Organization** Consultant and RHD **Budget:** Contractor's scope
Surface Water	• Surface runoff and discharge of turbid water and effluent; • Disposal of solid waste and hazardous waste; • Discharge of effluents; • Spilling and washing out of oil and grease; • Piling works and excavation induced impact on bottom sediment.	• Sediment fence and soil compaction; • Drip pan for containing hazardous waste; • Prohibiting direct discharge; • Settling tank and oil-water separator; • Cement solidifiers or other materials for ground improvement should not use.	**Monitoring Parameters** pH, Temp., DO, BOD, COD, TSS, Color, TC, Turbidity, As, Oil & Grease **Monitoring Frequency** Quarterly or as per requirement of consultant **Location:** River and Major water body **Implementing Organization:** Contractor **Supervision Organization** Consultant, RHD **Budget:** Contractor's scope
Ground Water	• Rare chance of penetration of toxic chemicals;	• Drip pan should be placed under machineries;	**Monitoring Parameters** pH, TDS, EC, Oil & Grease, Turbidity **Monitoring Frequency:** Quarterly

Area of Impact	Impacts	Mitigation Plan	Monitoring Plan
	• Leachate generated at the solid waste may contaminate groundwater.	• Solid waste should be disposed at designated site; • Cement solidifiers or other materials for ground improvement should not use.	**Location:** Drinking water for construction camps and ground water near project site **Implementing Organization:** Contractor **Supervision Organization:** RHD **Budget:** Contractor's scope
Topography and Soil	• Land use change; • increasing of elevation in the alignment; • Removing of topsoil and soil pollution by hazardous waste;	• Tree plantation; • Oil and lubricant spilled from machines and vehicles need to be absorbed using sponge; • Proper management of hazardous waste; • Avoid open toilet without sanitary pit;	**Monitoring Parameters** Visual check for Soil erosion and siltation **Monitoring Frequency:** Monthly **Location:** All major water bodies **Implementing Organization:** Contractors **Supervision Organization:** Consultant, RHD **Budget:** Contractor's scope
Solid Waste and Hazardous Waste	• Solid waste: organic and inorganic solid waste from construction sites; • Hazardous waste: burnt Mobil, sharp metal, scrap, medical waste, grease, chemicals; • Sewage sludges from toilet; • Spoil soil from earthwork; • Construction scraps.	• Introducing waste management plan at CEMP; • Solid waste: segregation, landfill, and selling to recycle company; • Hazardous waste: selling burnt oil to recycle company, oil-water separator, manage as per the rules.	**Monitoring Parameters** Inspection and record keeping during site visit **Monitoring Frequency:** Weekly **Location:** Construction Yard, dumping site **Implementing Organization:** Contractor **Supervision Organization:** Consultant, RHD **Budget:** Contractor's scope
Noise	• Noise from piling, demolition, rebar cutting and binding, hammering, jackhammer, concrete chipper, steel rod cutting saw, etc.; • Noise from vehicles and machines; • Noise from demolition works;	• Noise management should be included in CEMP; • Baseline preparation for noise; • Noise barrier between residential and commercial area and the project;	**Monitoring Parameters** Noise level dB(A) **Monitoring Frequency** Monthly or as per consultant's requirement **Monitoring Location** Construction sites and

Area of Impact	Impacts	Mitigation Plan	Monitoring Plan
	• Noise from batching plant and asphalt mixing plant.	• Maintenance of vehicle and machines; canopy, muffler, silencer in machines; • No work should be permitted in holidays; • All mixing and other plants should be operated with sound proofing; • Stationary units, e.g., aggregate breaker, compressor should be placed in sound-absorbing areas or tents.	inhabited locations and sensitive areas **Implementing Organization** Consultant (design stage), contractor (construction phase) **Supervision Organization:** Consultant, RHD **Budget:** Consultant's scope (design stage), contractor's scope (construction phase)
Vibration	• Vibration from pile driving and boring • Vibration from soil compaction and rolling, heavy vehicles and machines • May affect nearby weak structure	• Design and construction specifications should consider vibration mitigation; • Avoid concurrent demolition, piling, and compaction work; • Vibration tolerance assessment for adjacent structures.	**Monitoring Parameters:** Vibration level **Monitoring Frequency** Monthly or as per consultant's requirement **Monitoring Location:** Construction sites and inhabited locations and sensitive areas **Implementing Organization** Consultant (design stage), Contractor (construction phase) **Supervision Organization:** Consultant, RHD **Budget:** Consultant's scope (design stage), contractor's scope (construction phase)
Ground Subsidence	• Slope failure or land slide in borrow pit and pile foundation; • Subsidence of road due to poor compaction;	• Lithological study should conduct to assess the formation of aquifer underneath; • Pile foundation and borrow pit area should be enclosed with hard barrier; • Shoring with sheet piling;	**Monitoring Parameters** No specific parameter. Safety measures will be inspected during site visit **Monitoring Frequency:** Not applicable **Implementing Organization:** Consultant (design stage), contractor (construction phase)

Area of Impact	Impacts	Mitigation Plan	Monitoring Plan
		• Proper compaction; good quality construction materials; • Slope could be paved; • Drainage system should be sufficient; • Overweight vehicles should be prohibited and strictly monitored.	**Supervision Organization:** Consultant, RHD **Budget:** Consultant's scope (design stage), contractor's scope (construction phase)
Offensive Odors	• Bad odors from solid waste, effluent, sewage, slurry and land clearing, etc.	• Avoid open discharge of effluent, slurry, and solid waste; • Sewage sludge generated from stationary toilets in offices, workers accommodation, and construction yards should be managed with sanitary pit.	**Monitoring Parameters** No specific parameter. Monitoring will be conducted during site visit **Monitoring Frequency:** Weekly **Implementing Organization:** Contractor **Supervision Organization:** Consultant, RHD **Budget:** Contractor's scope
Bottom Sediments	• Earth works and soil erosion may generate sediments and that may discharge into water body by surface runoff and wind erosion and transportation; • Piling during bridge construction	• Sediment fence/silt fence; water spray; compaction and rolling of sand and soil; • Slurry from batching plant should be dried up away from water body; • No oil and lubricant shall be disposed or discharged into water body; • sediment mixed water should be settled in drain by check dam.	**Monitoring Parameters** TSS, TDS, Turbidity, EC, Oil and Grease in water **Monitoring Frequency:** Quarterly or as per consultant's demand **Location:** River and Major water body **Implementing Organization:** Contractor **Supervision Organization:** Consultant, RHD **Budget:** Contractor's scope
Flood and Drainage	• Inundation during construction work due to heavy rainfall; • Road embankment may create water logging by blocking surface drainage;	• Catchment level surface drainage/hydrological study should be conducted; • Height of the road embankments and bridges should be determined after	**Monitoring Parameters** Check drainage plan implemented correctly and conduct regular inspection **Monitoring Frequency:** Weekly during monsoon **Location:** Construction Site

Area of Impact	Impacts	Mitigation Plan	Monitoring Plan
	• Alteration of natural drainage system. This can create flood; • Major earthworks may interrupt the existing surface and ground water system.	analyzing the historic flood depth data; • River morphology should be examined for bridge construction; • Temporary drains should be constructed in and around the construction sites; • Pumping and discharge of stagnant water; • Construction of adequate number of cross drainage channel; • Construction of appropriate pipe culverts, box culverts and bridges on the road with adequate opening; • Cross-drainage infrastructures should be maintained by cleaning and dredging regularly.	**Implementing Organization** Consultant (design stage), contractor (construction phase) **Supervision Organization:** Consultant, RHD **Budget:** Consultant's scope (design stage), contractor's scope (construction phase)
Source of Materials and Haul Routes, and Disposal Sites	• Land use change; • Land degradation and contamination; • Danger to other roads users, in particular pedestrians and non-motorized and farm vehicles.	• Minimize the use of earth/topsoil as filling materials for road embankment. Instead, maximize the use of dredged materials as filling materials; • The waste disposal sites should be away from water body; the spoil disposal site should be levelled and compacted regularly; • The haul route and schedule should be selected causing least disturbance to local community and traffic.	**Monitoring Parameters** No specific parameter. Monitoring will be conducted during site visit. **Monitoring Frequency:** Monthly **Location:** Waste disposal sites **Implementing Organization:** Contractor **Supervision Organization;** Consultant, RHD **Budget;** Contractor's scope

Area of Impact	Impacts	Mitigation Plan	Monitoring Plan
B. Ecological Resources			
Protected Area	• Disturbance to wildlife and • Degradation of protected ecosystem	• Restrict construction activities and waste disposal inside the PAs • Strictly prohibit poaching, hunting, or any harm to wildlife • Train workers on conservation of natural resources • Install proper signages for skipping horns and speed limit	**Monitoring Parameters** Regular monitoring will be conducted during site visit. **Monitoring Frequency:** Daily **Location:** Project site near protected area **Implementing Organization:** Contractor **Supervision Organization:** Consultant, RHD **Budget:** Contractor's scope
Biota and Ecosystem	• Loss of trees • Vegetation clearance • Generation of dust and noise • Loss of habitat and/ or habitat degradation	• Reduce unnecessary tree felling especially large trees • Restrict and enforce dumping and storage of spoil and other materials close to trees • Strictly prohibit poaching, hunting, or any harm to wildlife • Train workers on conservation of natural resources • Reuse topsoil for new plantation • Provide proper fencing for borrow pits • Ensure proper waste management system • Ensure proper implementation of mitigation measures for physical environmental variables • Implement the plantation plan • Provide under passes for animal movement as required	**Before Construction Phase** **Monitoring Parameters** • Visual confirmation of wildlife including valuable species (monitoring method will be established in close consultation with the Forest Department). **Monitoring Frequency:** During tree felling and site clearing operations **Implementing Organization:** Contractor **Supervision Organization:** Consultant, RHD **Budget:** Contractor's scope **During Construction Phase** **Monitoring Parameters** Number of trees planted and survival rate (at least 75%) during tree plantation programme Visual confirmation of wildlife (including valuable species)

Area of Impact	Impacts	Mitigation Plan	Monitoring Plan
			Monitoring Frequency Quarterly for tree plantation program and Monthly for visual inspection **Implementing Organization:** Contractor **Supervision Organization:** Consultant, RHD **Budget:** Contractor's scope
Fisheries and Aquatic Biology	• Deterioration of aquatic ecosystem • Disturbance to fish and aquatic biology	• Ensure proper disposal of construction materials, dredged materials and other wastes • Manage all liquid waste disposal and ensure no accidental spills of liquid waste into the river • Consider fish migration routes • Consider fish breeding season (July to September) • Consider avoiding fishponds during land acquisition. • Avoid disrupting natural flow of any waterbodies • Consider limiting piling activities if dolphin movement occurs in Sangu River	**Monitoring Parameters** Mitigation measures will be inspected regularly during the site visit **Monitoring Frequency:** Monthly **Location:** All major water bodies **Implementing Organization:** Contractor **Supervision Organization** Consultant, RHD **Budget** Contractor's scope
C. Social Environment			
Involuntary Resettlement	• Loss of land (405.1965 acres) • Loss of livelihood • Loss of structure	• Provide compensation as per RAP • Establish Monitoring unit • Avoid damages of commercial structures	**Monitoring Parameters** Proper disbursement of compensation as per RAP **Monitoring Frequency** During land acquisition and Resettlement Implementation Process

Area of Impact	Impacts	Mitigation Plan	Monitoring Plan
			Implementing Organization: DC office/ NGO **Supervision Organization:** RHD/CSE **Budget:** Land acquisition and Resettlement cost
Poor	• Identified households living in below poverty line	• displaced persons eligibility for compensation • Establishment of external monitoring committee consists of the third party	**Monitoring Parameters:** Proper disbursement of compensation as per RAP **Monitoring Frequency:** Quarterly **Implementing Organization:** Contractor **Supervision Organization:** RHD/ Supervision Consultant **Budget:** Land acquisition and Resettlement cost
Loss of Livelihood	• Loss of business (712 business entity) • Loss of Wage earners (641) • Loss of vendors Change in the livelihood of some marginal local fishermen residing near Sangu River Bridge area may occur if they are unable to access to nearby river	• All direct income lost should be properly compensated as per RAP; • Implementation of Livelihood Restoration Plan • Ensure employment opportunity for street vendors of selected area. • Prioritization of PAPs during employment opportunity • Ensure resettlement benefit for the vendors. • Inform nearby fishermen before starting any bridge construction activities in the river. • Ensure proper implementation of mitigation measures related to surface water quality and aquatic ecosystem	**Monitoring Parameters** Proper disbursement of compensation as per RAP **Monitoring Frequency:** Quarterly **Implementing Organization:** Contractor **Supervision Organization** RHD/ Supervision Consultant **Budget:** Land acquisition and Resettlement cost

Area of Impact	Impacts	Mitigation Plan	Monitoring Plan
Disruption of Agricultural Activities	• Most of the affected land is Null 322(79.47%) of total 405.196 Acres.	• Ensure adequate compensation for landowner as well as cultivator and sharecroppers; • Consideration of alternative design to minimize the impact on the agricultural land	**Monitoring Parameters** Proper disbursement of compensation as per RAP **Monitoring Frequency:** Quarterly **Implementing Organization:** Contractor **Supervision Organization:** RHD/ Supervision Consultant **Budget:** Land acquisition and Resettlement cost
Land Use and Utilization of Local Resources	• Changes in land use • Demolition of 85,402 trees number trees	• Proper design of project should also minimize the impact on land; • Land used for labor and worker accommodation should be revamp as per previous condition after the completion of construction period; • Tree plantation program should be initiated as compensation for the demolition of huge number trees.	**Monitoring Parameters** Number of employment opportunities for local residents and number of businesses around the construction area **Monitoring Frequency:** Quarterly **Implementing Organization:** Contractor **Supervision Organization:** RHD/ Supervision Consultant **Budget:** Land acquisition and Resettlement cost
Social Institutions and Local Decision-making Institutions	• Loss of total 31 Community Property Resources (CPR) • Loss of 13 Government and non-government offices/institutions offices	• Ensure Proper compensation as per RAP, • Alternative access facilities should be incorporated consultation with the communities; • Proper signage and fencing during demolition of these institutions; • Implement swift alternative means regarding displacement or demolition	**Monitoring Parameters** Proper disbursement of compensation as per RAP **Monitoring Frequency:** Quarterly **Implementing Organization:** Contractor **Supervision Organization** RHD/ Supervision Consultant **Budget** Land acquisition and Resettlement cost

Area of Impact	Impacts	Mitigation Plan	Monitoring Plan
		of religious institutions e.g., mosque, temple etc.	
Local Conflict of Interest	• Conflict between migrant labor and local community	• Job opportunities should be provided in fair way; • The job skills and the priority for the affected people shall be taken into account and the workers can be chosen.	**Monitoring Parameters:** Number of grievance record in terms of conflict **Monitoring Frequency;** Based on occurrence **Implementing Organization:** Contractor **Supervision Organization:** RHD/ Supervision Consultant **Budget:** Contractor's Scope
Gender	• Wage discrimination between male and female worker	• Proper monitoring to minimize the wage gap between male and female	**Monitoring Parameters** Gender among those who are to be recruited **Monitoring Frequency:** Quarterly **Implementing Organization;** Contractor **Supervision Organization** RHD/ Supervision Consultant **Budget;** Contractor's Scope
Children Rights	• May impact on educational opportunity of school going children in PAHs of the Project • Disruption of children's commuting to school • Impact of the project on increase of child labor	• Support of sending children to school • Signal man should be appointed, and safety signage should be placed near school • Child labour should be strictly prohibited.	**Monitoring Parameters** Check logbook of labour recruitment to verify child labour **Monitoring Frequency** Quarterly/ Daily (Child Labor) **Implementing Organization:** Contractor **Supervision Organization:** RHD/ Supervision Consultant **Budget:** Contractor's Scope
Infectious Disease, such as HIV/AIDS	• Spreading of infectious disease	• To provide surveillance for worker's health;	**Monitoring Parameters:** Labor health records **Monitoring Frequency;** Quarterly

Area of Impact	Impacts	Mitigation Plan	Monitoring Plan
		• Prevention of illness among workers by undertaking health awareness and by conducting immunization programs; • Educating project personnel and area residents on risks, prevention, and available treatment; • Promoting collaboration with local authorities to enhance access of worker's families and the community to public health services and promote immunization as necessary; • Prevention of larval and adult propagation through sanitary improvements and elimination of breeding habitats close to human settlements; Elimination of unusable impounded water	**Implementing Organization;** Contractor **Supervision Organization** RHD/ Supervision Consultant **Budget** Contractor's Scope
Working Conditions including Occupational Health & Safety	• Possibility to occur accidents and incident during construction works; • Physical trouble, noise, vibration, lighting, electrical, heat and cold, nuisance dust, fire/explosion, machine grinding, working space, Chemical, Gases, dusts, fumes, vapors, liquids are the major hazards which are harmful for workers health; • May insect and snake bite in the labour camp;	• To provide adequate health care facilities and first aid within construction sites; • To provide OHS training program and information of basic site rules of work; • To provide adequate lavatory facilities for the number of people expected to work in the facility; • To provide adequate supplies and easy access of drinking water with a sanitary;	**Monitoring Parameters** As per Occupational Health and Safety Plan **Monitoring Frequency** Based on occurrence **Implementing Organization** Contractor **Supervision Organization** RHD/ Supervision Consultant **Budget** Contractor's Scope

Area of Impact	Impacts	Mitigation Plan	Monitoring Plan
	• Road Accident	• To arrange for provision of clean eating areas where workers are not exposed to the hazardous or noxious substances; • Adequate preventive measures from negative factors; • To establish rights-of-way, site speed limits, vehicle inspection requirements, operating rules and procedures, and control of traffic patterns or direction; • Identify and provide appropriate PPE	
Water Use	• ground water uses for construction • water uses at accommodation • groundwater depletion due to excessive withdrawal	• Rainwater harvesting; • Regular inspections; • Creating awareness among construction workers; • Adoption of the advance technologies and machinery; • Storing the curing run-off and waste • Covering storage tanks to prevent evaporation losses;	**Monitoring Parameters** Check logbook of water use Water quality testing report **Monitoring Frequency:** Monthly **Implementing Organization:** Contractor **Supervision Organization** RHD **Budget** Contractor
C. Others			
Temporary construction Yard and Workers' accommodation	• Land requisition for temporary construction yard and workers' accommodation.	• Proper compensation should be provided as per ARIPA 2017 for the leased land. • Agricultural land should be avoided if possible	**Monitoring Parameters:** Proper disbursement of compensation as per RAP **Monitoring Frequency:** Bi-annually **Implementing Organization:** Contractor **Supervision Organization** RHD/ Supervision Consultant

Area of Impact	Impacts	Mitigation Plan	Monitoring Plan
			Budget: Land acquisition, requisition and resettlement cost
Accidents	• Due to movement of heavy construction vehicle accident would be increased • As bottleneck's point and accident occurs zone will have straightened, the accident rate on the highway will be minimized.	• Follow Health and Safety Management Plan (HSMP) rules and regulations designated by contractors; • Provision of traffic sings, road mark, bump, zebra mark, guard rail and pole, and curb stones etc	**Monitoring Parameters:** Traffic Movement **Monitoring Frequency:** Continuous records **Implementing Organization:** Contractor **Supervision Organization** RHD/ Supervision Consultant **Budget:** Contractor's Scope

EMP Implementation Schedule

An implementation schedule has been prepared based on the environmental components that may be affected during the construction and operation of the project. Since project is likely to have impact on various components of environment, a comprehensive EMP implementation schedule covering terrestrial and aquatic ecology, soil erosion, drainage congestion, tree plantation, air quality, noise, and vibration are provided in **Table 8-2**. Monitoring Plan has been suggested for pre-construction, construction and operation phase in **Table 8-1.**

Environmental Budget

The Contractor will allocate a separate budget for environmental management plan implementation, training, environmental monitoring, analysis and reporting, verification monitoring and capacity building. It should be noted that cost for many in-built mitigation measures, such as drainage network, bank protection, embankment, dust management, traffic management and construction safety etc., are already included in the construction cost estimate and/or operating cost estimates. The overall costs of the EMP will comprise:

- Environmental monitoring through sample collection and analysis;
- Any remedial measures necessary to reduce or avoid environmental damage;
- Designing and implementing all mitigating and enhancement measures;
- Supervision staff from RHD and consultants including direct costs and travel subsistence.

The total budget is estimated as BDT 95.76 million or 1.126 million USD.

Institutional Roles and Responsibilities

As the project developer, the RHD has the responsibility to ensure that the project follows the legal requirements for environmental assessment. The RHD has an Environmental and Social Circle (ESC) headed by the Superintending Engineer who is supported by the Executive Engineer, Subdivision Engineer, Assistant Engineer and Sub-assistant Engineer.

Project Implementation Units (PIU) will be responsible for implementing the project. PIU is headed by a Project Director (PD) who is supported by Additional Project Directors (APD). At the site level there will be a Project Managers (PM). PM will be further supported by Deputy PM, Assistant Engineers and Sub Assistant Engineers.

The APD will serve as the environmental focal persons under the PIU. One of Assistant Engineers serve as the environmental focal person at the site level and support the APD on environment safeguard matters. Further the Supervision Consultant (SC) responsible for supervising the civil works contractor will provide support to the respective PIU for day to day monitoring and reporting on environment safeguards.

Reporting Requirements

Three types of environmental reports will be submitted to the Client (RHD) and funding agency (JICA) in English, containing air, noise, and water quality data, maps, diagrams, plans, tables, etc. All environmental data should be reflected in the Reports. The following reports are required to prepare during the construction stage of the project.

- Monthly Environmental Report
- Quarterly Environmental Report
- Annual Environmental Report

Capacity Building

The EIA and EMP are referred to the DoE in the Ministry of Environment Forests and Climate Change (MOEFCC) for approval. The ESC in RHD is not directly involved with project implementation but has more administrative responsibility to ensure environmental compliance and a general role to increase

environmental awareness for RHD. It is therefore not clear if RHD/ESC has the capacity to check the adequacy of the developed EMP for this project.

The most significant challenge for environmental management on this project is the lack of human and financial resources and necessary infrastructure in PIU. To enhance the capacity of the RHD Environmental and Social Circle and PIU for effective implementation of proposed mitigation measures and monitoring the resultant effect, some training programs and awareness workshop are proposed. The detailed training plan is provided at **Table 8-5**.

Grievance Redress Mechanism

To facilitate the resolution of affected people's concerns, complaints, and grievances about the social and environmental performance of the project, a Grievance Redress Mechanism (GRM) is established which aims to provide a time bound and transparent mechanism to voice and resolve social and environmental concerns.

Grievances related to the implementation of the project, particularly regarding the environmental management plan will be acknowledged, evaluated, and responded to the complainant with corrective actions proposed using understandable and transparent processes that are gender responsive, culturally appropriate, and readily accessible to all segments of the affected people. The responsibility for addressing the grievances along with proper timelines will be clearly indicated. Records of grievances received, corrective actions taken and their outcomes will be properly maintained and form part of the environmental monitoring report for submission to JICA.

The Project Implementation Unit (PIU) of RHD shall make the public aware of the GRM with the support of SC through methods such as public awareness campaigns. Grievances can be filed in writing or by phone with any member of the PIU or SC.

E-9 Consultation with Stakeholder/Public Consultation

Several types of stakeholder consultations like Public Consultation Meeting (PCM), Focus Group Discussion (FGD), and Key Informants Interview (KII) have been conducted in all bottleneck areas of the project.

Public Consultation Meetings

The Public Consultation Meetings were conducted in two stages. The objective of first round consultation meetings was to inform people about the project and to obtain their opinions. On the other hand, the second-round meetings (IDM) were conducted mainly to disclose the findings of the study. Total five PCMs have been conducted in five bottleneck points in first round. The participants of the meetings include the project affected persons, beneficiaries, local leaders, representatives of local governments, farmers, teachers, businessman, labours, remittance earners, etc. During first round meeting, the participants raised their concerns regarding proposed alignments, land acquisition, resettlement, environmental pollution, obstacles of natural drainage, employment, etc. The representatives of consultants responded their questions by stating that necessary measures will be taken as per the established laws and rules of the country and lender. Despite this, many people expressed their support to the project as it will improve the regional communication system.

It is deemed necessary to disclose the findings of the EIA study to the PAPs, local residents and other relevant stakeholders. Hence, a total of eleven Information Disclosure Meeting including one meeting in each major and minor bottleneck point was organized throughout the alignment of the CCHIP. All meetings were conducted in participation of project affected people, beneficiaries, residents, representative of local governments, public leaders, government and non-government officials, etc. A range of questions and opinions were raised from participants and all their questions were answered properly. The questions were answered by the RHD representative, EQMS consultants, and in some case, by national representative of JICA Study Team who presented in the meeting. During the meetings, there were no specific objections to the project itself.

Focus Group Discussion

FGD was conducted in two stages throughout the alignment of the project. The aim of FGD was to collect information from the group of people about their perceptions, attitude and experience on predetermined topics. To collect information from the different group of people, including community people, land owners, land dependents, business owners, women group in five bottleneck points, several FGDs were conducted. To disseminate and collect the information from the specific group of people, the target participants of the FGDs were the group of people who were absentees in the Public Consultation Meeting.

The participants of the survey were very hopeful about the positive outcomes of the project like reduction of traffic congestion, reduction in travel time, and development of local economy. In contrast, they expressed some concerned related to loss of homes and land, loss of business, loss of employment, etc. They have been informed about the possible mitigation measures as per the laws.

Key Informants Interview

The purpose of key informant interviews is to collect information from a wide range of people—including community leaders, professionals, or officials—who have first-hand knowledge about the project areas. A total of 23 KIIs have been conducted with the Upazila level offices, including the Department of Fisheries, Department of Agriculture, Department of Education, Department of Public Health Engineering, Executive Engineer of Roads and Highways Division, Dohazari, Chattogram, Sub Divisional Engineer of Chakaria, Cox's Bazar, and Department of Environment, Chattogram Divisional Office. In these interview, necessary baseline data were collected from the officials. In addition, their opinions and suggestions regarding the project have also been collected. They pointed out some important issues like loss of fisheries, obstacles of irrigation, source of soil and other fill materials, loss of trees, which need to be addressed properly.

E-10 Emergency Response Plan

Potential Source of Emergencies

The potential sources of emergencies include system, equipment, and engineering failure; anthropogenic activities; and natural calamities. The system, equipment, and engineering failure related emergencies are fire, fuel and chemical spillage, leakage from gas cylinder, medical emergency, and toppling of heavy vehicles. The anthropogenic activities like workers agitation, socio-political unrest, and community agitation can also cause emergency situation. Moreover, natural calamities like earthquake, flood, and cyclone can also create emergency situations.

Emergency Notification and Evacuation

Any emergency at the site shall be notified by sounding the alarm by activating the siren system or public address system. The emergency rescue leading team will initiate the evacuation procedure, if needed, based on the nature and magnitude of the accident or emergency. After handling the emergency, a head count will be conducted to identify any potential missing persons. Then, the workers will entry the site after securing the area and mitigating all emergency sources. There shall be an assembly or muster point where the workers and visitors will gather during an emergency.

Emergency Response

After any accident or hazard occurs, emergency response will be conducted as per the procedures set in this section. The person who recognizes the hazard for the first time will inform nearest supervisor or any personnel from the emergency rescue leading team. The Site In-charge will declare the emergency and start the response procedure in coordination with HSE Manager. There are separate procedures set for different emergency situations like fire, chemical accident, gas cylinder accident, medical condition, road and vehicle accident, natural hazard and disaster, social and political crisis, etc., which will be followed during the emergency.

Emergency Communication

A clear communication is essential for proper response to an emergency. Therefore, multiple approaches need to be implemented during an emergency as one single method of communication may not be sufficient to communicate the emergency to the designated site personnel and off-site agencies in a timely manner. The emergency communications are made by the site personnel through emergency signage and direct communication.

Emergency Response Plan Review

The Project Manager and HSE Manager along with contractor's other representatives (members of the Emergency Rescue Leading Group) will annually review this plan. In addition, the Employer and the Consultant will also be involved in monitoring and review the emergency drill records and training records to assess the effective implementation of the procedure.

Conclusion

The project is classified 'A' in accordance with JICA's environmental and social consideration 2010 requiring preparation of an Environmental Impact Assessment Report. As per the Environmental Conservation Act, 1995 of Bangladesh, the project falls under Red category and requires preparation of an EIA. This report is prepared following the JICA and GOB environmental requirements.

Essentially primary data was used to assess the environmental impacts in a comprehensive manner. Site survey for environmental data collection, public consultation and specific studies (flora, fauna, land use,) were carried out to complete the environmental impact assessments and recommend suitable mitigation measures.

The potential environmental impacts were assessed in a comprehensive manner. The EIA report assesses the potential environmental impacts associated with the Chattogram-Cox's Bazar highway improvement project, and suitable mitigation measures have been recommended. In case any design details of the project are changed, the EIA and EMP shall be reviewed and revised accordingly and submitted to DoE & JICA for acceptance.

CHAPTER 1

Introduction

1 INTRODUCTION

1.1 Background

In the People's Republic of Bangladesh, the demand for transportation has increased in line with the GDP growth of over 6% per year over the last ten years. The road sector, which accounts for 70% of passenger traffic and 60% of freight traffic in all modes of transport, plays an important role in the economic growth of the country. National Highway 1 (N1), which runs from Dhaka to Cox's Bazar via Chattogram, has been positioned in Bangladesh's Road Master Plan (2009) as the country's most important arterial road linking the country's major cities. As the primary transport route to Matarbari Port, the construction of which is currently being supported by an ODA Loan, the N1 is expected to become a key route for freight traffic, connecting the port to Dhaka and Chattogram, the country's commercial and industrial centers. However, currently, the southern section of N1 (from Chattogram to Cox's Bazar) is a two-lane road with insufficient width. In addition to vehicles like passenger cars, buses, and trucks, there are other modes of transport, including rickshaws and auto-rickshaws (known as slow moving vehicle), especially in the urban sections. This causes chronic traffic congestion and safety hazards. After completion of Matarbari Port, N1 is expected to experience a significant increase in traffic volume, including large container vehicles. According to the Matarbari Port Development Project (2017), the necessary travel time from Matarbari Port to Chattogram (approx. 130 km) is estimated to increase from 123 minutes in 2017 to 438 minutes in 2035. The improvement of road quality and road safety to promote further economic growth has been included in the Government of Bangladesh's various policies, such as the Seventh Five Year Plan (2016/17 to 2020/2021) and the Road Master Plan (2009), which have also set forth the repair and rehabilitation of major national highways as a priority issue. In addition, the development of Matarbari Port is the highest priority project in Vision 2021, which prescribes the country's long-term development agenda. This port development is also positioned as a project that will contribute to the realization of the Bay of Bengal Industrial Growth Belt (BIG-B) Initiative, set forth by the Governments of Japan and the Governments of Bangladesh. Anticipating the opening of Matarbari Port, the Chattogram - Cox's Bazar Highway Improvement Project (hereinafter referred to as "the Project") will contribute to the smooth and safe transport of passengers and freight through the construction of flyovers and bypass roads in urban sections of the major transport route N1 between Chattogram and Cox's Bazar, and is consistent with the policies of the Government of Bangladesh. For this purpose, five major bottleneck points, viz. Patiya, Dohazari, Keranihat, Lohagara, and Chakaria have been identified where outer road/bypass or flyover will be constructed. **Figure 1-1** shows the alignment of Chattogram-Cox's Bazar Highway and five major bottleneck points.

The overall objective of the Project is to achieve smooth cargo transportation between Matarbari Port and Chattogram by improving roads at congested town area along the National Highway No. 1, thereby contributing to improvement of logistics in Bangladesh and to the economic growth of the surrounding area.

Figure 1-1: Alignment of Chattogram-Cox's Bazar Highway with five major bottleneck points

1.2 Overview of the Project

The project intends to construct four bypasses road and one flyover in five major bottlenecks of Chattogram-Cox's Bazar highways to reduce traffic congestion and to enhance a smooth traffic operation. The bottleneck locations where a bypass is planned to construct are Patiya, Dohazari, Lohagara, and Chakaria. On the other hand, a flyover will be built in Keranihat to avoid the conflict with nearby Chattogram-Cox's Bazar Railway. **Table 1-1** shows the locations and length of planned bypass roads and flyover under this project. Moreover, three bridges will be built in Dohazari, Lohagara, and Chakaria Bypass Alignment, which will cross Sangu River, Tangkabati Canal, and Matamuhuri River.

Table 1-1: Sub-Project Components in Major Bottleneck Areas

District	Bottleneck Areas		Ultimate Length of Planned Road (km)
Chattogram	1.	Patiya	5.23
	2.	Dohazari	3.51
	3.	Keranihat (Flyover)	3.30
	4.	Lohagara	4.27
Cox's Bazar	5.	Chakaria	7.92

Source: JICA Study Team, 2021

1.3 Scope of EIA Study

1.3.1 Applicable Reference Framework

The applicable reference framework for this study includes:

- Environment Clearance Rules, 1997
- JICA Guidelines for Environmental and Social Considerations, 2010

1.3.2 Scope of Work

The main objectives of the EIA study are to identify and assess potential impacts on natural and social environment and pollution caused by the Project and to prepare an EIA Study report which includes environmental management plan & monitoring plan for the necessary actions to the identified impacts. More specifically, the scope of this environmental impact assessment is exclusively confined within the development works to be carried out in Patiya, Dohazari, Keranihat, Lohagara, and Chakaria bottleneck points. The approved Terms of Reference (ToR) for this study is given in **Appendix A.**

The road will be developed by Roads and Highway Department (RHD) of the Government of Bangladesh which is the project proponent of the JICA Study. The EIA Study shall cover all requirements of the Bangladesh Environmental Conservation Rules 1997 (ECR), as elaborated in a Guide to Environmental Clearance Procedure (of August 2010) provided by the Department of Environment, and the JICA Guidelines for Environmental and Social Considerations (2010).

This project is classified as JICA's Environmental Category A due to the large-scale land acquisition and resettlement. In addition, the project requires the full EIA since the Project is conducted for the national road according to the ECR. Since the ADB DD study of 2015 covered the whole Chittagong-Cox's Bazar - Teknaf Road Section, the Environmental Impact Assessment study is available. On the other hand, the alignment for the selected 5 bottleneck sections is partly changed and some of relevant data should be updated including data on seasonal changes on natural environment. A detailed scope of study is given below as per the technical specifications of contract documents that includes alternative considerations, impact assessment, field measurement survey and impact assessment, preparation of mitigation measures, preparation of environmental and social management and monitoring plan, and public consultation.

A. Scoping Report: A scoping report need to prepare at the beginning of the study to identify the potential area of impacts and to present a description of the background environment of project locations. This scoping stage is necessary as it create pathway for further impact identification and evaluation.

B. Baseline Study: The baseline study comprises the examination and evaluation of current environmental conditions, including natural environmental condition, ecological condition, physical environmental condition, and socio-economic conditions of the project area.

- **Physical Environment:** Physical environment will include geology, soil, topography, climate and hydrological description of the project areas.
- **Ecological Environment:** Ecological environment will include existing habitats, floral composition (aquatic and terrestrial vegetation), and faunal composition (amphibious, reptiles, mammals, birds, and fish diversity).
- **Environmental Quality:** The study of environmental quality includes the sampling and analysis of different elements of environmental quality, e.g., ambient air quality, surface water quality, noise level, and vibration level. In addition to historic climatic data collected from related BMD stations, the weather parameters (temperature, wind speed, and wind direction) will also be measured onsite during environmental baseline study.
- **Socio-economic Environment:** The socio-economic environment of the project areas includes demographic profile and ethnic composition, settlement and housing, traffic and transport, public utilities (water supply, sanitation, and solid waste), economy and employment, and fisheries (fishing activities, fishing communities, commercial important species, fishing resources, commercial factors).

C. Stakeholder Consultation and Social Studies: The objectives of public consultation or stakeholder consultation are to inform project affected people about the potential impacts of the project and their mitigation measures as well as to seek the opinions of the participants. The stakeholder consultation and social studies process includes Public Consultation Meeting (PCM), Focus Group Discussion (FGD), and Key Informants Interview (KII).

D. Environmental Impact Assessment: Based on analysis results of the primary data and secondary data and field reconnaissance, significant environmental and social impacts will be identified and assessed quantitatively as much as possible. Special attention will be given to noise/vibration, water pollution, and air pollution, and they will be measured as the baseline data as described in the methodology section. Based on the baseline data, the impacts during construction and operation stages will be estimated and evaluated as quantitatively as possible to meet requirements under the EIA system in Bangladesh and the JICA Environmental Guidelines. Especially, noise in the operational phase shall be forecasted quantitatively by using the ASJ RTN-Model 2018, a road traffic noise forecasting model proposed by the Acoustical Society of Japan.

For the noise and vibration measurements, equipment for the noise and vibration will be brought by JET from Japan. At the time of the noise and vibration measurements, a traffic volume survey will be conducted by types of the vehicle such as passenger cars, buses, and heavy trucks according to the RHD's vehicle classifications.

For the air quality measurement, the ambient air quality of the areas affected by the project will be monitored with the applicable methods for sampling and measurements of the national air quality regulation as specified in the ECR and other relevant national regulations.

For the water quality measurement, the parameters to be surveyed depends on a classification of the water body as specified in the ECR. Therefore, at first, the water class of the targeted water body will be identified. Water samples will be analyzed in accordance with the methods specified in the APHA.

E. Environment and Social Management and Monitoring Plan: Based on the identified mitigation measures, the Environmental and Social Management and Monitoring Plan

(ESMMP) shall be prepared. It shall cover mitigation actions, monitoring parameters, methods, implementation stage, frequency and responsible organization(s) for each negative impact for each mitigation action at minimum. The management and monitoring plan shall be separately prepared for pre-construction, construction, operational stages, respectively.

1.4 Approach and Methodology

The approach and methodology are outlined based on information available about the proposed project, previous experience of understanding similar kinds of projects, and regulatory requirements in Bangladesh and the requirements to meet the DOE standards.

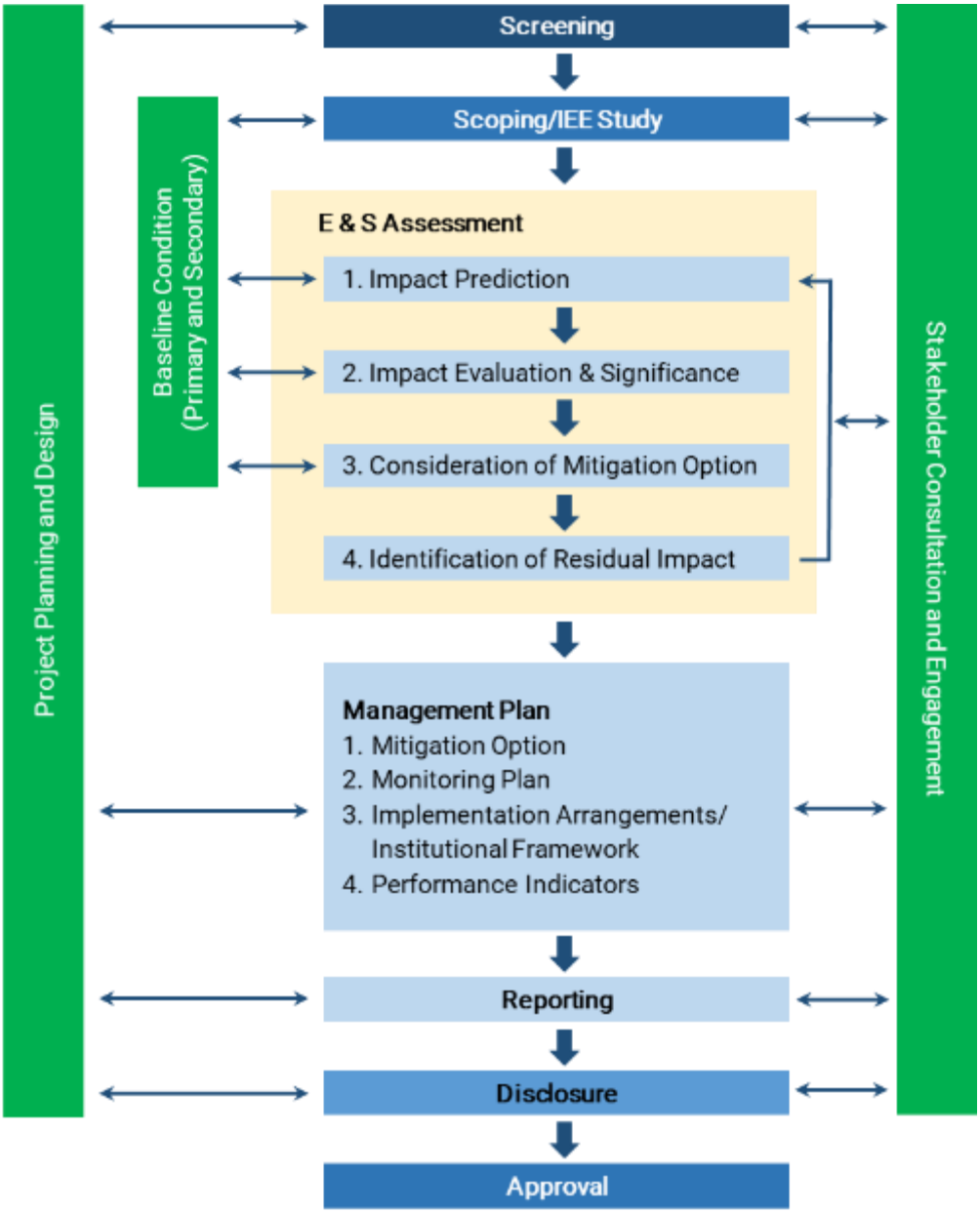
1.4.1 Approach for the EIA Study

In order to attain the earlier mentioned scope of work, the study is based on the review of the available project related information including primary and secondary baseline environment and social data, forecasting and evaluation of impacts of significance. Following approach and methodology was used to complete the EIA study. The EIA of the project was followed a systematic process of:

- **Screening Study:** The proposed project falls under the "**Red**" Category as per Schedule-1 of the Environment Conservation Rules, 1997, therefore, would require ECC from the DOE based on EIA, carried out as per the approved terms of reference for the EIA study;
- Consult **environmental and social baseline conditions** against which the assessment will be undertaken;
- **Consult with stakeholder** and integrate their views into the project design and mitigation;
- Systematically **predict and evaluate the positive and negative changes** in these baseline conditions;
- All impacts and benefits of the project should be documented and fully explained within the **EIA report**;
- **Identify the mitigation measures** that the client will take to avoid, reduce, remedy offset, or compensate for adverse impacts, and to provide or enhance benefits from the project; and
- Develop an **Environmental Management Plan (EMP).**

The approach proposed for conducting the Environmental Impact Assessment (EIA) study for the selected project is presented in **Figure 1-2**.

Figure 1-2: Approach to the EIA Study



Source: EQMS

1.4.2 Methodology for the EIA Study

To attain the earlier mentioned scope of work, the EIA study was based on the collection of primary and secondary baseline information, impact assessment, and delineation of EMP. The methodology was followed to complete the EIA study for the selected project is divided into the following tasks as presented in Table 1-2 and elaborated in subsequent sections.

Table 1-2: Tasks Undertaken for the EIA Study

Task Number	Task
Task-1	Kick-off Meeting
Task-2	Project Description
Task-3	Analysis of alternatives

Task Number	Task
Task-4	Environmental and Social Baseline Conditions
Task-5	Environmental Impact Assessment
Task-6	Development of EMP
Task-7	Preparation of Draft EIA Report
Task-8	Preparation of Final EIA Report

1.4.2.1 Task-1: Kick-off Meeting and Team Mobilization

Immediately following the completion of the contract negotiation and contract signing, the proponent, together with the project manager completed all logistical arrangements. In accordance with the EQMS quality requirements, the project manager formalizes team briefing notes outlining the scope of work and outputs required from each of the team members. A kick-off meeting was held with the officials of the client for understanding the major objectives of the project, project details, activities, current status, project milestones, legal requirements, scope, etc.

1.4.2.2 Task-2: Scoping

A scoping report has been prepared at the beginning of the study to anticipate the potential impacts of the project on physical and social environment. Scoping is a process to identify key environmental and social issues prior to in-depth investigation and analysis. This scoping report has been prepared in accordance with the JICA GL.

1.4.2.3 Task-3: Project Description

A section on the project description was prepared. This was developed to a level of detail needed to adequately understand potentially significant project impacts. This covered project location, size, life, schedule, implementation arrangements, and information inventories and maps using appropriate scales. Also, identify components of key environmental indicators on physical, biological, and social environments.

1.4.2.4 Task-4: Analysis of Alternatives

An analysis of alternatives, including benefits due to the proposed project versus no project scenario was considered, as is required under the DoE guidance. This requires close liaison with client contract personnel to understand the alternatives and decision-making processes considered to date.

1.4.2.5 Task-5: Environmental and Social Baseline Conditions

An expert team from EQMS Consulting Limited was engaged to carry out environmental and social baseline data collection from June 2020 to June 2021. Socio-economic data collection and consultations with the local community and other government departments were conducted at the same time. Secondary data were collected from different government departments, local bodies, and through literature review, etc. All the data were compiled and compared with applicable standards where relevant and was presented in the EIA report. Environmental baselines study the following:

- Meteorological data at the project site;
- Ambient Air Quality;
- Ambient Noise Level;
- Vibration Level;
- Water Resources and Quality - surface water;
- Ecology - covering terrestrial and aquatic flora and fauna, habitats, and ecologically sensitive spots within the project site and surrounding areas;
- Road network and Traffic factor;

- Prevailing land use; and
- Socio-economic status.

1.4.2.6 Primary Baseline Data Collection

With the assistance of the client, EQMS has identified an accredited environmental laboratory of repute which was engaged in the analysis of the collected environmental quality samples on ambient air quality, surface water quality, ambient noise level, vibration level as per aspects detailed in Table 1-3.

Table 1-3: Primary Baseline Data for the EIA Study

S/N	Environmental Attribute	Locations	Frequency	Remarks
1	Ambient Air Quality	12	8 Hours monitoring during dry & rainy seasons (Week Day)	One point at the roadside and another point about l km distance from the roadside to the nearest residential/commercial buildings in each bottleneck area. For the Keranihat site, field measurement at both FOB and bypass sites shall be conducted. Therefore, field measurement shall be conducted at l2 locations in total.
2	Surface Water Quality	12	Two seasons during the EIA Baseline survey (Week Day)	One or two locations at main river and stream, where the wastewater due to construction and operation of the proposed road is emitted into. For the Keranihat site, field measurement at both FOB and bypass sites shall be conducted. Therefore, field measurement shall be conducted at 12 locations in total at max.
4	Ambient Noise Level	12	24-hour monitoring (once) during the EIA Baseline survey (Week Day)	A total of 12 locations in and around the existing road and future roads alignment.
5	Vibration Level	12	24-hour monitoring (once) during the EIA Baseline survey (Week Day)	A total of 12 locations in and around the existing road and future roads alignment.
6	Flora and Fauna	Study area	Two seasons during the Baseline survey	The ecological survey was undertaken to assess the biodiversity aspects

S/N	Environmental Attribute	Locations	Frequency	Remarks
7	Socio-economic	Study area	One-time survey during the Baseline	Mostly assessed through KII and FGDs and available secondary information

1.4.2.6.1 Stakeholder Consultation

Since EIA study requires in-depth understanding of the perception of the project affected persons and other stakeholders, qualitative data have been collected through several social study methods, such as Public Consultation Meeting (PCM), Focus Group Discussion (FGD), and Key Informants Interview (KII). The PCM have been conducted in two stages, e.g., scoping stage and result disclosure stage. The main objectives of PCM during scoping stage are mainly informing the stakeholders about the project and obtaining their opinions regarding potential environmental and social impacts. On the other hand, disclosure of the results of baseline study, potential environmental and social impacts, environmental and social mitigation strategies and monitoring plan are main objectives of second stage PCMs. The stakeholders are allowed to give their opinion in this stage also and their views have been addressed in the final version of the report. Apart from PCM, several number of FGD have also been conducted mainly in participation of women, elderly people, young people and other vulnerable groups. Furthermore, KII has been interview with Upazila, District, and Divisional level government officials, including agriculture, fisheries, education, public health engineering, and environmental officials. A summary of the stakeholder engagement process and the profile of the groups and their opinions have been given in Chapter 8 of this report.

1.4.2.6.2 Secondary Baseline Data Collection

In addition to environmental baseline study to collect primary data, the secondary data and information, including previous environmental monitoring data, previous environmental impact assessment reports of similar projects in concerned areas, other related reports and papers, social and statistical data of different government organizations have been collected and reviewed. Besides, a reconnaissance survey has been conducted to inspect the project location visually for identifying the environmental and social issues. Most of the secondary data for describing social environment have been collected from Bangladesh Bureau of Statistics (BBS). Moreover, some time historical time series data related to meteorology and hydrology have been collected from Bangladesh Meteorological Department (BMD) and Bangladesh Water Development Board (BWDB).

A. Physical Environment

- Regional Setting
  - Physiography, Geomorphology, Land Use, Geology, Drainage, Hydrology, and Soil.
- Climate and Meteorology
  - Climatic Pattern, Ambient Temperature, Relative Humidity, Rainfall, and Regional Wind Patterns (Wind Speed and Direction).
- Hazard and Risks
  - Natural Hazards: Floods, Seismic Activities, Seasonal Storms and Cyclones, Tidal Surges, Droughts, Salinity Intrusion, and Erosion.

B. Socio-economic Environment

- Demographic Profile
- Education and Literacy
- Economic Activities and Livelihood Pattern
- Socio-economic Infrastructure and Indicators
  - Health Care Facilities,
  - Education Facilities,

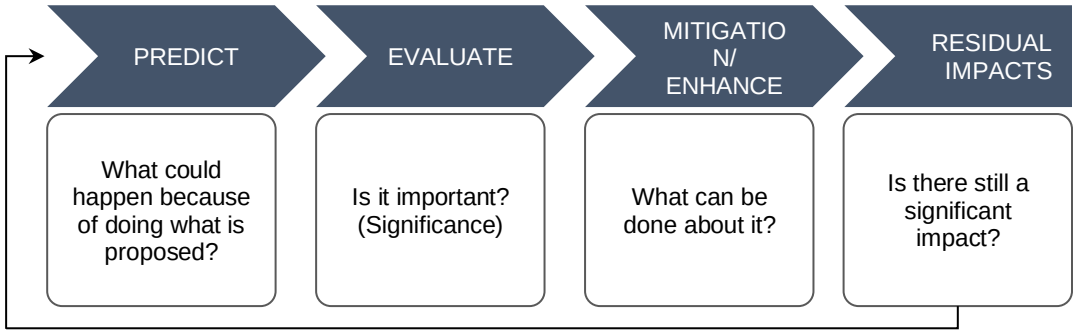
	- Drinking-Water and Sanitation, - Transportation Facilities, and - Sites of Cultural/Archaeological Importance.
C. Ecology and Biodiversity	• IUCN Red List Status 2015 • Flora and Fauna • Biodiversity Condition • Existing Terrestrial Ecosystem • Aquatic Fauna and Vegetation

1.4.2.7 Task-6: Impact Assessment

The EIA was evaluated potential impacts using a methodology based on the evaluation of the "significance" of identified issues and impacts on baseline parameters. Analysis of the baseline results and the incremental impacts of the project were assessed in accordance with the national standards for air, water, and Noise Pollution (Control) Rules, 2006 as mentioned in the ECR, 1997, and its subsequent amendments.

The impact assessment covered the full project lifecycle, including pre-construction, construction, and operations activities. The impact assessment has involved the forecasting, evaluation, and mitigation of impacts and report on impacts including residual impacts and cumulative impacts. Impact forecasting was considering control measures that are part of the project design. Additional mitigation measures aimed at further reducing forecasted impacts are proposed where necessary or appropriate.

Figure 1-3: Impact Assessment Process for the EIA Study



The impacts were identified and quantified for the intensity using matrix techniques and evaluated as very high, high, medium-high, medium-low, low, and very low impacts on the environment and communities in the study area. Aspects which were considered in the impact assessment, for the pre-construction, construction, and operation phase of the proposed project, include land acquisition/requisition, land use, indigenous population, water quality (surface and ground), noise, ecology, waste, landscape and visual, traffic, flood and other natural disaster risks, sedimentation and erosion, socio-economic, occupational and community health and safety, etc.

The principal aim of this task was to identify and assess potential impacts on various environmental and social components due to the proposed project. Based on baseline data collected in the study area, information on the type and quantity of pollutants, and surveys of the study area, the EQMS EIA team identifies and predicts potential impacts due to the proposed project on the surrounding environment during pre-construction, construction, and operation phases of the project. To identify the impacts, it is necessary to identify the area and source of impacts. To identify the area and source of impacts, the established and relevant laws, rules, policy of Bangladesh and JICA Environmental and Social Considerations as well as previous EIA study of the Sub Regional Transport Project Preparatory Facility (Road Component: Package 2 (SRTPP2)) have been considered.

Table 1-4 shows the potential impact area as well as conceivable impacts that have been assessed in this study.

Table 1-4: Conceivable environmental and social impacts

Item	Conceivable Impacts	
	Preconstruction and Construction Stage	**Operational and Maintenance Stage**
A. Physical Environment		
1. Flood and drainage	• Potential for some flooding site, existing road and adjacent areas during rainy season.	• Water-logging due to blockage of natural drainage • Interruption of irrigation and natural water courses • Surface and groundwater contamination due to road activities
2. Air pollution	• Emissions from construction vehicles and equipment • Emissions from concrete, asphalt mixing plants, stone crushes, etc. • Dust from general construction activities	• Emissions from vehicles using the road • Emissions from repair and maintenance activities
3. Noise and vibration pollution	• Noise from construction vehicles and equipment on site • Noise from concrete and asphalt mixing plants, stones, crushers • Noise from vehicles on access routes transporting materials	• From vehicles using the road • From repair and maintenance activities
4. Topography and soil pollution	• Potential disfigurement of topography due to borrow pits and construction activities • Potential pollution of soil and sub soil from construction activities	• Loss and destruction of soil and subsoil may cause erosion near road alignment • Potential pollution from oil, dicing and non-slip materials from tire wear
5. Surface water pollution	• Improper discharge of effluents and liquid waste from construction and project/labor camps • Dredging for fill materials may pollute surface water	
6. Groundwater pollution	• Pollution of groundwater from labor camps latrines • Pollution of groundwater by spillage of chemicals, fuel, lubricants	

Item	Conceivable Impacts	
	Preconstruction and Construction Stage	**Operational and Maintenance Stage**
	• Pollution of groundwater by unregulated disposal of solid waste	
7. Seismology	• The road passes through the seismic Zone-2 of Bangladesh which possess a risk for some impacts to occur	
8. Borrow pits, other sources of materials and haul routes as well as materials sites	• Increase in open water and potential breeding ground for mosquitoes • Loss of agricultural land • Danger to other road users, in particular pedestrians and non-motorized and farm vehicles	
B. Ecological Resources		
1. Fisheries and aquatic biology	• Construction work may affect migration of fish and health of fish • Commercial fish may be impacted	
2. Wildlife (fauna) excluding impacts of elephants	• Impact of local ecosystem and species, particularly endangered species and their continued health and sustainability • Loss of trees near the road	• Loss of fauna particularly endangered species through disturbance to habitat
3. Wildlife (elephants)	• Impact on elephant road crossing corridors • Impact on local elephant habitat	• Impact on elephant road crossing corridors • Impact on local elephant habitat
4. Trees and vegetation (flora) and protected areas	• Loss of trees may increase soil erosion from rain and wind • Loss of trees will impact on other flora and may affect wildlife, particularly birds and mammals that rely on trees for their food sources	
C. Economic Development		
1. Land use	• Loss of land/acquisition of land • Loss of agricultural land for borrow pits or stock piling	

Item	Conceivable Impacts	
	Preconstruction and Construction Stage	**Operational and Maintenance Stage**
2. Disruption in agricultural activities	• Disturbances to farmers access and activities • Dust will affect production	• Some disturbance to farmers activities where road passes through land used by them
D. Social and Culture		
1. Displacement of legal and illegal occupants within ROW	• Loss of land/acquisition of land	
2. Health and education	• Health and education facilities/users may be located within the proposed road alignment	
3. Cultural heritage	• There may be mosques and temples within the proposed road alignment that should be relocated	
4. Indigenous peoples use of land	• There might be indigenous peoples use of land	
5. Occupational Health and Safety	• The construction workers may be at risk for occupational health hazards due to the materials handled and working condition	
6. Loss of Livelihood	• Losing of Business opportunity • Impact on wage earners • Impact on street vendors	
7. Involuntary Resettlement	• Loss of Land • Loss of structure • Loss of Livelihood	Some conflicts may arise among PAPs if RAP implementation not done properly

1.4.2.8 Task-7: Development of EMP

Appropriate mitigation strategies for identified environmental and social impacts have been formulated in Environmental and Social Management and Monitoring Plan. For smooth implementation of the plan, the implementing and supervision authority has been mentioned for every mitigation strategy. Environmental and Social Monitoring is an important and effective was to evaluate the performance of mitigation implementation during construction and operation period. Therefore, relevant parameters, monitoring frequency, and estimated cost have also been included in the plan to monitor the implementation of mitigation measures. The EMP is comprised of the following aspects based on the impacts assessed for the project:

- Introduction to the purpose of the EMP;
- Institutional mechanism - roles and responsibilities for EMP implementation;
- Tentative cost for the implementation of the EMP;

- Summary of significant adverse impacts and potential hazards;
- Mitigation measures and control technologies, safeguards, etc. to minimize adverse impacts on air, water, noise, biological and socio-economic environment, measures to minimize associated hazards and control the emergency; and
- The project monitoring program for effective implementation of the mitigation measures and ascertain the efficacy of the environmental management and hazard control systems in place.

This sets out the mitigation and management measures required during project implementation to avoid or reduce the environmental and/or social impacts, including developing the action plan in accordance with DOE requirements. A monitoring plan included here, covering the type of monitoring to be done, responsible parties, schedule, standards to be used, resources, and tentative cost. Plans that can be developed at a later stage (e.g., construction waste management plan, emergency response plan, traffic management plan, etc.) identified and provided as initial documents which will be updated before the start of construction activities by the contractor.

1.4.2.9 Tasks-8 and 9: Reporting - Draft and Final EIA Report

A draft EIA report is prepared upon completion of the above tasks as per the prescribed TOR was given by the DOE and submitted to the client for providing their comments and suggestions.

Based on one set of consolidated comments of the client, Draft EIA will be finalized for submission to the DOE, Bangladesh to get an Environmental Clearance Certificate (ECC).

1.5 Limitation

This EIA is limited to investigating and managing potential impacts associated to construction and operation stage. This EIA should not be in any way construed as providing impact assessment for any further work or developments on this or any other site. No assessment has been made for any future projects or activities that may arise because of this Project. If or when any such developments are proposed, additional environmental impact assessment should be carried out at that stage in accordance with the legal requirements of Bangladesh.

This EIA is confined to the study of the potential impacts of the Project on the physical, biological, and socio-economic environments of the study area. This study has been carried out by accessing data from a wide range of primary and secondary data. These include literature reviews, reports and other documents, which have been supplemented with primary field data collection. Assessment of the Project is limited by the quantity and quality of available data.

Certain provisions in this EIA report assume reliance on conceptual design and technical information. If the design of the Project changes from that assessed due to design development, inclusion of new information, changing motivations or any other reason, the results of any impact assessment or mitigation measures provided in this report may be inconsistent.

1.6 EIA Team

The composition of the EIA team is shown in Table 1-5.

Table 1-5: EIA Team Composition

S/N	Name	Position Assigned/Role
1	Kazi Farhed Iqubal	Team Leader
2	Tauhidul Hasan	Environmental Consideration Expert
3	Md. Abdul Halim	Social Consideration Expert
4	Ferdowsi Akhter	Gender Issue Expert
5	Sk. Salahuddin Ahmed	Noise and Vibration Control Expert

S/N	Name	Position Assigned/Role
6	Ferdows Alam Quaraishi	Air Quality Expert
7	Md. Mahfuzur Rahman	PCM Expert
8	Nourin Ahosan Habib	Natural Environment Expert
9	Md. Shahparan	Junior Noise and Vibration Control Expert

1.7 Structure of the Report

The EIA report has been prepared to meet the requirement of national policies to approve by DOE. The report is divided into ten chapters that follow the activities stipulated in the approved TOR of the EIA study. The outline of the present EIA is as under:

0. **Executive Summary:** The executive summary provides an overview of the EIA report.
1. **Introduction:** The chapter describes the background of the study, brief description, scope of the study, approach and methodology, limitation, EIA study team combination, and structure of the report.
2. **Administrative and Legal Framework:** This chapter covers all the legal provisions, including environmental and social laws, applicable to the project. The chapter also covers all the national standards applicable to the project.
3. **Project Description:** This chapter provides a detailed description of the proposed project comprising project justification, location, layout, and project components.
4. **Baseline Environmental Condition:** This chapter covers the environmental baseline parameters on the physical environment (meteorology, ambient air quality, ambient noise level, vibration level, surface water quality, geology, topography, soil, flood and water resources) and biological environment within the study area.
5. **Socio-Economic Environment:** This chapter covers the details of the socio-economic status of the PAPs, demography, public utilities, economy and development, fisheries etc.
6. **Screening and Scoping:** This chapter covers the details of screening, scoping matrix and the results of scoping for environmental and social considerations.
7. **Identification, Forecasting and Evaluation of Impacts:** This chapter covers the detailed impact of the proposed project on different environmental and social components during the construction and operation phase of the project.
8. **Environmental and Social Management and Monitoring Plan:** The chapter covers a comprehensive EMP including recommendations for its implementation during the pre-construction, construction, and operation phase of the project. The EMP consists of the set of mitigation, management, monitoring and institutional measures to be taken during the implementation of the proposed project to eliminate adverse environmental impacts, offset them or reduce them to acceptable limits.
9. **Public Consultation and Disclosure:** This chapter presents stakeholder consultation, comprises public consultations, disclosures, FGD and KII conducted in the study area.
10. **Emergency Management Plan:** This chapter includes the preparedness and emergency management plan including risk assessment and damage control.
11. **Conclusion and Recommendations:** This chapter presents the conclusion and recommendations of the report.

CHAPTER 2

Administrative and Legal Framework

2 ADMINISTRATIVE AND LEGAL FRAMEWORK

This chapter provides legal and regulatory framework, covering national requirements as well as guidelines and standards to address environmental and social risks of the proposed project and its associated components and to protect and conserve the environment from any adverse impacts. The intent of this chapter is to discuss the regulatory context, which is directly related to environmental compliance, which must be adhered to by all parties involved in the project throughout the planning, construction, and operation.

2.1 Environment Related Policies in Bangladesh

The National Environment Policy of 1992 and the associated legislation on environmental protection and conservation represent the most important documents that relate to environmental protection and management in Bangladesh. The requirement of EIA for projects is described in these documents.

2.1.1 National Environment Policy, 2018

In 1992, the Bangladesh Government developed the National Environmental Policy (NEP) which defines the overall environmental framework and assigns responsibility for regulatory development, administration and enforcement. This responsibility has been given to the Department of Environment (DOE) which is under the Ministry of Environment, Forest and Climate Change. The National Environment Council, with the head of the government as chairperson, provides the overall policy direction.

In 26 years since adoption of Environment Policy, 1992, the nature and level of environment and ecological degradation have been changed. In order to address all those changes and with a view to protect and conserve environment and ecosystem in a rigorous, pragmatic and sustainable manner as well as to bring the climate change to the mainstream of the environment and development, the government has revised the National Environment Policy, 1992 and adopted the revised National Environment Policy, 2018.

Following are the key subject matters covered under the National Environment Policy, 2018:

- Ensuring sustainable development through reducing human pressure on nature and natural resources.
- Considering environment protection as integral part of the development programs planned to meet the need of the present and future generation.
- Making natural resources extraction, use, environmental conservation etc. to be based on science.
- Considering environmental impacts and risks in extracting and using natural resources.
- Evaluating economic contribution of ecosystem services simultaneously to that of natural resources.
- Giving priority to poor and under privileged group of people in order to ensure their participation, equity, justice, accessibility to the use of natural resources and getting ecosystem services on which, they are dependent.
- Taking initiatives to prevent misuse and ensure optimum of water, land, natural gas and other natural resources in the production process as well as day-to-day purposes.
- Encouraging sustainable use of new and renewable resources.
- Enhancing long term poverty alleviation and food security through conserving biological diversity.
- Realizing compensation from persons and institutes those who are liable to environmental pollution through applying polluter pay principle.
- Including environmental conservation and preservation in all national policies and ensuring implementation of the environment policy at both government and nongovernment level.

- Giving priority to preventive measures over curative measures in environmental conservation.
- Including adaptation and mitigation program in all development projects in order to address adverse impacts of climate change.
- Ensure sustainable utilization of ecosystem goods and services.
- Implementation of 3R principle in utilization of resources.
- Strengthening institutional and legal capacity of institution (Government, local, private and technical) relevant to the enforcing and implementation of rules and regulation relating to environment policy and environment conservation.
- Ensuring considerations of climate change and challenges of calamities in all kind of infrastructure projects.
- Reducing of all SLCP (Short-Lived climate pollutants) which are harmful to health and environment.
- Taking development programs considering sustainable production and consumption as integral part of environmental conservation to meet the need of present and future generation.
- Allocating necessary funds to all areas of environmental conservation, preservation and control.
- Taking up programs in favor of flourishing environment friendly economy.

The policy has provided sector wise policy coverage for 24 different sectors along with their plan of implementation, identification of respective implementing agencies, legal and institutional framework and directives on compliances.

2.1.2 The National Biodiversity Strategy and Action Plan, 2004

The National Biodiversity Strategy and Action Plan (NBSAP) of Bangladesh provides a framework for conservation, sustainable use and sharing the benefits of biodiversity of the country. A major focus of the NBSAP is the need for cross-sectoral linkages, reflecting the fact that in Bangladesh, more so than most other countries, biodiversity conservation is closely inter-woven with social and economic development. Thus, the NBSAP also provides a framework for securing the necessary environmental conditions to reduce poverty, ensure sustainable development and respond to the implementation of elements of the country's Poverty Reduction Strategy Paper (PRSP). The major objectives of the NBSAP are to:

- Conserve and restore the biodiversity of the country for wellbeing of the present and future generations;
- Ensure that long-term food, water, health and nutritional securities of the people are met through conservation of biological diversity;
- Maintain and improve environmental stability of ecosystems;
- Ensure preservation of the unique biological heritage of the nation for the benefit of the present and future generations;
- Guarantee the safe passage and conservation of globally endangered migratory species, especially birds and mammals in the country; and
- Stop introduction of invasive alien species, genetically modified organisms and living modified organisms.

2.1.3 Relevant National Policies

During recent years a number of national policy documents have been prepared and were accepted by GOB. These policy initiatives, strategies and plans all emphasize consideration of the environment and natural resources in order to achieve sustainable development. A summary of the major relevant policy documents prepared is given in **Table 2-1**. It is relevant to mention that GoB has prepared a National Strategy for Accelerated Poverty Reduction showing its strong commitment to achieving the Millennium Development Goals as defined by the UN. While the Government has made important strides towards

achieving these targets, this report highlights a number of sources of environmental degradation that merit greater emphasis, not only to bring Bangladesh closer to achieving its targets but also to contribute to the removal of environmental constraints to poverty reducing growth.

Table 2-1: Relevant Major Policies

Policy	Brief Description	Responsible Agency
National Land Transport Policy (2004)	New roads and major improvements will be subjected to an EIA, Funding will be provided for mitigation measures, Environmental (design) standards for new roads	LGED
The National Water Policy (1999)	Protection and restoration of water resources; Protection of water quality, including strengthening regulations concerning agro-chemicals and industrial effluents; Sanitation and potable water; Fish and Fisheries; Participation of local communities in water sector development	Ministry of Water Resources
National Land Use Policy (2001)	The policy deals with land uses for several purposes including agriculture, housing, forestry, industrialization, railways and roads. The plan identifies land use constraints in these sectors.	Ministry of Land
National Forest Policy and Forest Sector Review (1994, 2005)	Afforestation of 20% land; Bio-diversity of the existing degraded forests; Strengthening of agricultural sector Control of global warming, desertification, control of trade in wild birds and animals; Prevention illegal occupation of the forestlands, tree felling	Ministry of Environment and Forest
National Biodiversity Strategy and Action plan (2004)	Conserve, and restore the biodiversity of the country; Strategy and Action - Maintain and improve environmental stability of ecosystems; Ensure preservation of the unique biological heritage of the nation for the benefit of the present	Ministry of Environment and Forest (MOEF)

Policy	Brief Description	Responsible Agency
	and future generations; Guarantee safe passage, and conservation of globally endangered migratory species, especially birds and mammals in the country; Stop introduction of invasive alien species, genetically modified organisms and living modified organisms.	
National Fisheries Policy (1998) and Inland Capture Fisheries Strategy (2004)	Preservation, management and exploitation of fisheries and resources in inland open water; Fish cultivation and management in inland closed water; Prawn and fish cultivation in coastal areas; Preservation, management and exploitation of sea fishery resources	Ministry of Fisheries and Livestock
National Agricultural Policy, 1999	The policy deals with programs to make the nation self-sufficient in food through increased production of all crops and to ensure a dependable food security system	Ministry of Agriculture
Draft Wetland Policy, 1998	Establishment of principles for sustainable use of wetland resources; Maintenance of existing level of biological diversity; Maintenance of the functions and values of wetlands Promotion and recognition of the value of wetland functions in resource management and economic development	Ministry of Environment and Forest
Bangladesh Climate - Change Strategy and Action Plan (2008)	Establishment of six strategic pillars for action, including (l) food security, social protection and health, (2) disaster management, (3) protective infrastructure, (4) research and knowledge management, (5) Decreased carbon development, and (6) capacity building and institutional	Ministry of Environment and Forest

Policy	Brief Description	Responsible Agency
	strengthening. A first list of 37 programs is identified.	

2.2 Environment and Social Related Legislations in Bangladesh

The main acts and regulations guiding environmental protection and conservation in Bangladesh are outlined in the following subsections.

2.2.1 The Environment Conservation Act, 1995 and Subsequent Amendments

The Bangladesh Environmental Conservation Act (BECA), 1995 is the main legislation for conservation of the environment, improvement of environmental standards, and control and mitigation of environmental pollution.

The provisions of the act authorize the Director General of DOE to undertake any activity that is deemed fit and necessary to conserve and enhance the quality of the environment and to control, prevent and mitigate the pollution. The main highlights of the act are:

- Declaration of Ecologically Critical Areas (ECAs);
- Obtaining an Environmental Clearance Certificate (ECC);
- Regulation with respect to vehicles emitting smoke harmful to the environment;
- Regulation of development activities from an environmental perspective;
- Promulgation of standards for quality of air, water, noise, and soils in different areas and for different purposes;
- Promulgation of acceptable limits for discharging and emitting waste; and
- Formulation of environmental guidelines relating to control and mitigation of environmental pollution, conservation, and improvement of the environment.

2.2.2 The Environment Conservation Rules, 1997 and Subsequent Amendments

The Environment Conservation Rules (ECR), 1997 is the main subsidiary legislation of the Environment Conservation Act, 1995 which outlines various procedures or measures that need to be taken for compliance with the related provisions of the Environment Conservation Act, 1995. The Environment Conservation Rules, 1997 is the first set of rules promulgated under the Environment Conservation Act, 1995. These rules provide for, inter alia, the following:

- The NEQS for ambient air, surface water, groundwater, drinking water, industrial effluents, emissions, noise, and vehicular exhaust;
- Categorization of industries, development projects, and other activities on the basis of actual (for existing industries/development projects/activities) and anticipated (for proposed industries/development projects/activities) pollution load;
- Procedure for obtaining ECC;
- Requirements for undertaking IEE and EIA's as well as formulating EMP according to categories of industries/development projects/activities; and
- Procedure for damage-claim by persons affected or likely to be affected due to polluting activities or activities causing hindrance to normal civic life.

The ECR provides specific rules and procedures for various categories of projects in relation to their approval prior to construction and operation. For projects and activities listed within the Red category, the ECR requires that an Initial Environmental Evaluation (IEE) be first submitted for approval and this can be accompanied with the terms of reference (TOR) for an EIA, which is to follow the IEE. However,

this stage may be opted out by an application to directly submit an Environmental Impact Assessment (EIA) report to the DOE for its review and approval prior to the issuance of an Environmental Clearance Certificate (ECC). The EIA is to be based on a TOR that has the prior approval of the DOE.

2.2.3 Noise Pollution (Control) Rules, 2006

This rule has been promulgated under the provision of clause 20 of the Environment Conservation Act, 1995. The rules provide for standard limits of noise level of vehicles and designated areas. According to the Rules, motor honking within a 100-meter radius of a hospital, school and office is prohibited. The rules also do not allow use of brick crushers and cement mixers within 500-meter radius of a residential area. Besides, prior permission is mandatory for using loudspeakers or megaphones. The rules stipulate safety and precautionary measures in work places, designated authorities for allowing noise generating appliances.

2.2.4 EIA Guidelines for Industry, 2021

The EIA Guidelines are a handbook for procedures for preparing the EIAs and for reviewing them for the benefit of the development partners, EIA consultants, reviewers, and academicians. While preparing these guidelines, the present environmental status, as well as the need for the rapid economic development of Bangladesh, has been kept in view. These considerations have essentially resulted in simpler procedures to be followed to prepare the EIAs and their review.

The EIA Guidelines for Industry, 2021, introduced by the Department of Environment, Bangladesh, is the only guideline for conducting an Environmental Impact Assessment in Bangladesh. It is not only for industries but also for all types of development works. It includes EIA procedures, methodology, guidelines for impact identification, forecasting and evaluation, plans for mitigation measures, and monitoring program.

2.2.5 The Acquisition and Requisition of Immovable Property Act 2017

The principal legal instrument governing land acquisition in Bangladesh is the Acquisition and Requisition of Immovable Property Act-2017. The 2017 Act requires that compensation be paid for (i) land and assets permanently acquired (including houses, trees, and standing crops,); and (ii) any other impacts caused by such acquisition. The Act stipulates some rules and considerations for ensuring fair compensation of acquired properties. According to the Act-2017, the Deputy Commissioner (DC) determines and considers:

i. market price of acquired land by averaging corresponding price of previous 12 months from the date of serving notice under section-4 (u/s-4) for each type of land within the vicinity;

ii. Fair compensation for structures, trees and standing crops on the acquired land during Joint Survey.

iii. Compensation for detachment from the residual productive land.

iv. Compensation for loss of income generated from the acquired land.

v. Shifting cost of housing and commercial structures in case of displacement.

vi. May undertake appropriate step/action to resettle households displaced from homestead with living /housing structures.

vii. If acquired land has standing crops cultivated by tenant (*bargadar*), the law requires that part of the compensation money be paid in cash to the tenants.

Compensation payments or "awards" determines by the Deputy Commissioner popularly known as Cash Compensation under Law (CCL).

The Acquisition and Requisition of Immovable Property Act-2017 have some provisions adjusting determined value with the current market price of acquired properties. These are as follows:

a. The Deputy Commissioner will pay additional 200% of assessed/determined price for land.

b. The Deputy Commissioner will pay additional 100% of assessed/determined value for structures, trees, standing crops and other affected properties.

The Resettlement Action Plan (RAP) for the project has been prepared in compliance with the Resettlement Framework (RF) prepared based on relevant national (GoB) Law with the policy of the JICA Guidelines for Environmental and Social Considerations and World Bank OP 4.12. The RAP will be implemented after obtaining relevant approvals.

2.2.6 Occupational Health and Safety Related Laws and Rules

During construction, the project will confirm the labor laws, for occupational and health related rules as outlined in **Table 2-2**.

Table 2-2: Occupational health and safety related law and rules

Title	Overview
Bangladesh Labor Act 2006	Provides for safety of work force during construction period. The act provides guidance of employer's extent of responsibility and the workmen's right to compensation in case of injury caused by accident while working.
Water Supply and Sewerage Authority Act 1996	The act calls for ensuring water supply and sewerage system to the public, preservation of system, and other related health and environmental facilities for the community
Labor Relations under Labor Laws, 1996 (Revisions to scattered Acts and Ordinances to formulate a unified code)	General concerns during the project implementation state that the project manager must recognize labor unions.
Public Health Emergency Provisions Ordinance, 1994	Calls for special provisions with regard to public health. In case of emergency, it is necessary to make special provisions for preventing the spread of disease, safeguarding the public health, and providing adequate medical service, and other services essential to the health of respective communities and workers during construction-related work
Bangladesh Factory Act, 1979	Workplaces provisions: these Act and Labor Laws require medical facilities, first aid, accident and emergency arrangements, and childcare services to be provided to the workers at workplace.
The Employees State Insurance Act, 1948	Health, injury, and sickness benefit should be paid.
The Employer's Liability Act, 1938	Covers accidents, risks and damages with respect to employment injuries
Maternity Benefit Act, 1950	Framed rules for female employees, who are entitled to various benefits for maternity.

2.2.7 Other Relevant Laws and Regulations

Other laws and policies that address issues of environment and development in Bangladesh include: Water Pollution Control Ordinance (1973), Environment Pollution Control Ordinance (1977), Forest Policy (1994), Fisheries Policy (1998), Water Policy (1998), New Agriculture Extension Policy (1995), etc.

2.2.7.1 The Environment Court Act, 2010

The Environment Court Act, 2010 provides for the establishment of environment courts and matters incidental thereto. This act also provides the establishment of special magistrate's court, trial procedure in special magistrate's court, jurisdictions of environment court, the penalty for violating court's order, judgment of offence by special magistrate's court, procedure of judgment of special magistrate's court, the power of entry and arrest, the procedure for search, impose case and investigation, procedure and power of environment court, power of impose penalty, procedure for collection of penalty, power for inspection of environment court, appeal procedure and formation of environment appeal court.

2.2.7.2 The Forest Act, 1927 (and all amendments)

The Forest Act of 1927 provides for reserving forests over which the Government has an acquired property right. This Act has made many types of unauthorized uses or destruction of forest produce punishable. The Government may assign any village community its right to or over any land, which has constituted a reserved forest.

According to the Act, the Government may prohibit certain Activities in the declared reserved forest area such as any intervention kindles keeps or carries any firearms; trespasses or pastures cattle, or permits cattle to trespass, causes any damage by negligence in felling any tree or cutting or dragging any timber etc.

Near the proposed location of the coal-based Power Plant, no mangrove forest exists at all. Therefore, the proposed Project complies with this requirement of legislation. During the study this law and rules and regulations under it has been reviewed to explore whether the proposed Activities of the Project violates any provisions of the Forest Act. The Supplementary Rules of 1959 empowered the concerned Governmental bodies to restrict totally and for a specified period, the shooting, hunting or catching of various birds, animals and reptiles in the controlled and vested forests. The Private Forest Ordinance of 1959 provides for the conservation of private forests and for the forestation, in certain cases, of waste-land in Bangladesh.

2.2.7.3 Wildlife (Conservation and Security, 2012

The Wildlife (protection and safety) Act 2012, passed in Parliament on 8 July 2012. Under this Act, the hunting, trapping, killing of wildlife are strictly prohibited. After the establishment of this Act, a Board will be formed with the concerned members recommended by the Government. There are certain provisions kept in this Act, e.g., entrance, management, rules and regulation of the protected area etc. If any person without license performs any kind of trade, he will be jailed for at least a year.

2.2.7.4 Bangladesh Water Rules, 2018

According to the Clause-16 of Bangladesh Water Rules, 2018, for taking the initiative to establish the following projects by the person or authority, Clearance Certificate (CC) has to be taken either Resources Planning Organizations (WARPO) (Director General)/District Committee (Deputy Commissionaire)/Upazila Committee (Upazila Nirbahi Officer)/Union Committee (Chairman) for the specific project. The projects are:

a) Flood Control and management project;
b) Surface water extraction, supply and use related project and part of the project;
c) Irrigation project using surface water;

d) Construction of hydraulic structures;
e) Water conservation project;
f) Flood-affected plain land and wetland development project;
g) Surface water for industrial use;
h) Riverbank protection and river control project;
i) River excavation and dredging project;
j) Canal excavation and re-excavation project;
k) Fisheries development in surface water project;
l) Groundwater extraction, supply and use related project and part of the project; and
m) Others project.

2.2.7.5 International Treaties

Bangladesh has signed most international treaties, conventions and protocols on environment, pollution control, bio-diversity conservation and climate change, including the Ramsar Convention, the Bonn Convention on migratory birds, the Rio de Janeiro Convention on biodiversity conservation and the Kyoto protocol on climate change. An overview of the relevant international treaties and conventions signed by GOB is shown in **Table 2-3.**

Table 2-3: Relevant international treaties, conventions and protocols signed by Bangladesh

Treaty or Convention	In	Brief Description	Responsible Agency
On Protection of birds, Paris	1950	Protection of birds in wild state	Department of Environment/ Department of Fisheries
Convention on oil pollution damage (Brussels)	1969	Civil liability on oil pollution damage from ships	Department of Environment/ Ministry of Shipping
Ramsar Convention	1971	Protection of wetlands	Department of Environment/ Department of Fisheries
World Cultural and Natural Heritage (Paris)	1972	Protection of major cultural and natural monuments	Department of Archaeology
CITES Convention (Washington)	1973	Ban and restrictions on international trade in endangered species of wild fauna and flora	Department of Environment/ Department of Fisheries
Bonn Convention	1979	Conservation of migratory species of wild animals	Department of Environment/ Department of Fisheries
Prevention and Control of Occupational hazards (Geneva)	1974	Protect workers against occupational exposure to carcinogenic substances and agents	Ministry of Health and Family Welfare

Treaty or Convention	In	Brief Description	Responsible Agency
Occupational hazards due to air pollution, noise & vibration (Geneva)	1977	Protect workers against occupational hazards in the working environment	Ministry of Health and Family Welfare
Occupational safety and health in working environment (Geneva)	1981	Prevent accidents and injury to health by minimizing hazards in the working environment	Ministry of Health and Family Welfare
Occupational Health Services (Geneva)	1985	To promote a safe and healthy working environment	Ministry of Health and Family Welfare
Vienna convention	1985	Protection of ozone layer	Department of Environment/Ministry of Environment and Forest
Civil liability on transport of dangerous goods (Geneva)	1989	Safe methods for transport of dangerous goods by road, railway and inland vessels	Ministry of Communication
Convention on oil pollution (London)	1990	Legal framework and preparedness for control of oil pollution	Department of Environment/ Ministry of Shipping
London Protocol	1990	Control of global emissions that deplete ozone layer	Department of Environment/ Ministry of Environment and Forest
UN framework convention on climate change (Rio de Janeiro)	1992	Regulation of greenhouse gases emissions	Department of Environment/ Ministry of Environment and Forest
Convention on Biological Diversity (Rio de Janeiro)	1992	Conservation of bio-diversity, sustainable use of its components and access to genetic resources	Department of Environment/ Ministry of Environment and Forest
International Convention on Climate Changes (Kyoto Protocol)	1997	International treaty on climate change and emission of greenhouse gases	Department of Environment/ Ministry of Environment and Forest
Protocol on biological safety (Cartagena protocol)	2000	Biological safety in transport and use of genetically modified organisms	Department of Environment/

Treaty or Convention	In	Brief Description	Responsible Agency
			Ministry of Environment and Forest

2.3 Environmental Standards

The appropriate national environmental standards are applied under the ECR, 1997 and amendments. The standards, commonly known as Environmental Quality Standards (EQS), are legally binding. There is a separate schedule on industry-specific standards, other than the general industrial emission and effluent standards. For reference, the Bangladesh standards for ambient air, noise, and water is given in Annex-F.

2.4 JICA's Environmental and Social Consideration Guidelines and Gap Analysis

JICA environmental Guidelines which is applied to the Project is "Guidelines for Environmental and Social Considerations" (April 2010).

The JICA Guidelines confirm that project proponents are undertaking appropriate environmental and social considerations, through various measures, so as to prevent or minimize the impact on the environment and local communities which may be caused by the projects for which JICA provides funding, and not to bring about unacceptable effects. It will thus contribute to the sustainable development of developing regions. In its confirmation of environmental and social considerations, JICA places importance on dialogue with all involved partners (e.g., the host country, local governments, borrowers and project proponents) regarding environmental and social considerations. Transparent and accountable processes, as well as active participation of key stakeholders (e.g., local residents and local NGOs affected by the project) in all stages of the project are highly considered. The JICA Guidelines are formulated in reference to the World Bank Operational Policy.

The JICA Guidelines provide following four categories of projects as per its environmental classification system.

Category A: A proposed project is classified as Category A if it is likely to have significant adverse impact on the environment. Borrowers and related parties must submit Environmental Impact Assessment (EIA) reports. For projects that will result in large-scale involuntary resettlement, basic resettlement plans must be submitted. EIA and other reports need to be submitted through the borrower before the JICA environmental reviews.

Category B: A proposed project is classified as Category B if its potential adverse environmental impact is less adverse than that of Category A projects.

Category C: A proposed project is classified as Category C if it is likely to have minimal or no adverse environmental impact.

Category FI: A proposed project is classified as Category FI if it satisfies all of the following:

- ✓ JICA's funding of the project is provided to a financial intermediary etc.;
- ✓ the selection and assessment of the actual sub-projects is substantially undertaken by such an institution only after JICA's approval of the funding and therefore the subprojects cannot be specified prior to JICA's approval of funding (or assessment of the project); and
- ✓ Those sub-projects are expected to have potential impact on the environment.

The Project, as per the above categorization, falls under Category A for the purpose of environmental investigations. Final EIA report approved by DoE needs to be laid open for public inspection at the JICA headquarter 120 days before a loan agreement for category A projects.

2.4.1 Gap Analysis and Gap Filling Measures between GoB Regulations and JICA Guidelines

There are several gaps in between Bangladesh's environmental and land acquisition Law and JICA's Guidelines for Environmental and Social Consideration in preparation of EIA and RAP. Gap analysis and gaps filling measures related to environmental and social regulations are presented in the **Table 2-4** and **Table 2-5**.

Table 2-4: Major Gaps analysis between Environmental Regulations of GoB and the JICA Guidelines

Items	JICA Guidelines	Relevant laws/regulations/Guidelines in Bangladesh	Policies to be taken by the project
Environmental Policy and Regulations	• JICA Guidelines for Environmental and social consideration, April 2010	• Environment Conservation Act (1995) • Environment Conservation Rules (1997) • EIA guidelines on Industrial projects	-
Basic Matters/ Underlying Principles	• Environmental impact must be assessed and examined from the earliest possible planning stage. • Alternatives studies shall be made to avoid or minimize adverse impact must be examined and incorporated into the project plan.	• In case negative impacts on environment are predicted, EIA shall be implemented. • ECA (1995) and ECR (1997) do not explicitly ask for identification and assessment of alternatives.	• Alternative study shall be made to minimize the project impact
Public Consultation	• In projects, especially can have adverse effects on environment, information on projects needs to be known at early stage and stakeholders, such as local people, should be adequately consulted. The consultation	• There is a detailed provision for Public Consultation in the EIA Guidelines for Industries 2021.	• To implement public consultation accordingly throughout the preparation and implementation stages of the Project. During the preparation of the EIA report, consultations should be

Items	JICA Guidelines	Relevant laws/regulations/Guidelines in Bangladesh	Policies to be taken by the project
	result needs to be considered in projects. (Holding consultations is highly desirable, especially at scoping stage and when the draft report is being prepared)		implemented at scoping stage and after the draft report preparation.
Information Disclosure	• It is needed that EIA report is disclosed to projected countries and local people, and stakeholders, such as local people, can access to the report all the time. Also, allowance for copying the report is needed. JICA discloses EIA reports 120 days prior to concluding agreement documents.	• There is no provision for EIA disclosure in the EIA Guidelines for Industries 2021.	• Findings of the EIA should be disclosed to the stakeholders. Setting up the time of EIA disclosure can guarantee people to access to the report.
Impacted Items	• It include impacts on both natural environment along with health and safety issues. • Major items of natural environment includes air, water, soil, waste, water usage, climate change, ecosystems, fauna and flora, including trans-boundary or global scale impacts. • Major items of social includes	• EIA Guidelines for Industries 2021 has clear provision for the assessment of Direct, Indirect and Cumulative Impact.	• Direct, Indirect and Cumulative impacts of the project shall be assessed in line with the EIA Guidelines for Industries.

Items	JICA Guidelines	Relevant laws/regulations/Guidelines in Bangladesh	Policies to be taken by the project
	migration of population and involuntary resettlement, local economy such as employment and livelihood, utilization of land and local resources, social institutions such as social capital and local decision-making institutions, existing social infrastructures and services, vulnerable social groups such as poor and indigenous peoples, equality of benefits and losses and equality in the development process, gender, children's rights, cultural heritage, local conflicts of interest, infectious diseases such as HIV/AIDS, and working conditions including occupational safety. • In addition to the direct and immediate impacts of projects, their derivative, secondary, and cumulative impacts as well as the impacts of projects that are indivisible from the project are also to be		

Items	JICA Guidelines	Relevant laws/regulations/Guidelines in Bangladesh	Policies to be taken by the project
	examined and assessed to a reasonable extent. It is also desirable that the impacts that can occur at any time throughout the project cycle should be considered throughout the life cycle of the project.		
Monitoring/Grievance Redress Mechanism (GRM)	• Steps should be taken by the project proponent to make the monitoring results available to the local stakeholders of the project. • When third parties point out, in concrete terms, that environmental and social considerations are not being fully undertaken, forums for discussion and examination of countermeasures are established based on sufficient information disclosure, including stakeholders' participation in relevant projects. Project proponents etc. should make efforts to reach an agreement on procedures to be adopted with a view to resolving problems.	• There is no clear indication in EIA Guidelines for Industries 2021 regarding the disclosure of monitoring results. • No clear provision is stipulated in the EIA Guidelines for Industries regarding Grievance Redress Mechanism.	• Project proponent could be advised to publish Monitoring reports on the website. • Grievance Redress Mechanism should be established for the project, so that any person can submit grievance.

Items	JICA Guidelines	Relevant laws/regulations/Guidelines in Bangladesh	Policies to be taken by the project
Ecosystems and Biota	• Projects must not involve significant conversion or significant degradation of critical natural habitats and critical forests.	• ECA has a provision regarding the declaration of Ecologically Critical Area (ECA). • As per the ECA Management Rules 2016, alteration or any significant degradation of critical natural habitat and forests are strictly prohibited.	• Project shall comply with the Ecologically Critical Area Management Rules 2016.
Indigenous peoples	• Any adverse impacts that a project may have on indigenous peoples are to be avoided when feasible by exploring all viable alternatives. When, after such an examination, avoidance is proved unfeasible, effective measures must be taken to minimize impacts and to compensate indigenous peoples for their losses.	• There is no stipulated provision in EIA Guidelines for Industries 2021 regarding the Indigenous peoples.	• Project proponent should analyze the alternatives to check whether it is feasible or not to avoid any adverse impacts towards Indigenous peoples. • If the outcome of the alternatives become unfeasible, proper mitigation measures should be taken and compensations should be provided for loss.

Table 2-5: Comparison between the Government of Bangladesh and JICA Guidelines for Environment and Social Consideration - Land Acquisition and Resettlement

Sl.	Aspects/Issues	ARIPA-2017	JICA Policy/Guidelines (April 2017)	Gap Between GoB and JICA Policy/Guidelines
1.	Avoid Involuntary resettlement	Avoidance of resettlement is not specifically mentioned in the 2017 Act.	Involuntary resettlement and loss of means of livelihood should be avoided by exploring all viable alternatives.	Gaps with regard to this principle to avoid resettlement impact through alternative options.
2.	Minimize involuntary	The law only implicitly discourages unnecessary	When, after such an examination, avoidance	Notice u/s-4 under 2017 Act requires

Sl.	Aspects/Issues	ARIPA-2017	JICA Policy/Guidelines (April 2017)	Gap Between GoB and JICA Policy/Guidelines
	resettlement	and excess land acquisition, as excess land remains idle and unused and lands acquired for one purpose cannot be used for a different purpose. Land that remains unused should be returned to the original owner(s).	is proved unfeasible, effective measures to minimize impact and to compensate for losses must be agreed upon with the people who will be affected.	notification only; no consultation is required.
3.	Mitigate adverse social impact	The mitigation measures are cash compensation only for lost assets. The Complexities of resettlement are not addressed by the ARIPA-2017. .	People who must be resettled involuntarily and people whose means of livelihood will be hindered or lost must be sufficiently compensated and supported by project proponents etc. in a timely manner.	Only cash-based Compensation for acquired assets. The impacts of income and livelihood and the need for resettlement is not considered.
4.	Identify, assess and address the potential social and economic impacts	The 2017 Act requires preparation of a Land Acquisition Plan (LAP) for land acquisition and compensation purposes. However, GoB environmental rules/guidelines (1997) synchronize various applicable laws and policy frameworks of the country for early identification of impacts on biophysical, socioeconomic and cultural environment of a project intervention and their mitigation. Requires the assessment of technical alternatives, including the no action alternative to minimize adverse environmental impacts, include impact on human health and safety. EIA identifies measures to minimize the problems and	The impacts to be assessed with regard to environmental and social considerations. These also include social impacts including migration of population and involuntary resettlement, local economy such as employment and livelihood, utilization of land and local resources, social institutions and local decision making institutions, existing social infrastructures and services, vulnerable social groups such as poor and indigenous peoples, equality of benefits and losses and equality in the development process, gender, children's	Impact assessments are typically done in the case of externally funded projects; otherwise, a land acquisition plan is prepared for acquisition purposes. Project impacts on properties, livelihoods and employment, health and environment are discussed in IEE/EIA reports, but do not provide enough information to determine losses and basis for compensation. Existing laws do not have provision for identification of

Sl.	Aspects/Issues	ARIPA-2017	JICA Policy/Guidelines (April 2017)	Gap Between GoB and JICA Policy/Guidelines
		recommends ways to improve the projects.	rights, cultural heritage, local conflicts of interest, infectious diseases such as HIV/AIDS, and working conditions including occupational safety.	indigenous people to recognize their particular problem and inconveniences due to the project.
5.	Prepare mitigation plans for affected persons	The Deputy Commissioners (DCs) has the mandate in their respective jurisdiction as per law to acquire land for any requiring person (public agency or private person). The requiring body requeststhe Deputy Commissioners For acquisition of land for their project/scheme. DCs investigate physically the requirement of land and carry out Joint Verifications of assets and type of land for assessing the quantity of losses (u/s 9 (1) of the law). The Affected titled holders receive compensation the assessed and determined by DC according to the mouza rates plus 200% additional for land and 100% additional for Structures, Trees and crops. The Deputy Commissioner follows the rate of PWD for structure, DAE for crops, DoF for trees, etc.). Affected owners have the right to appeal on acquisition or on the compensation amounts determined as per law.	People who will be displaced must be resettled and people whose means of livelihood will be hindered or lost must be sufficiently compensated and supported by project proponents etc. in a timely manner.	Existing law and methods of assessment do not ensure replacement cost of property at current market price. The ARIPA-2017 has provision for resettlement of displaced households but don't have provision for rehabilitation of affected persons or their loss of income or livelihood resources. "Market value" of property is often found low in respect of current market price, it can be raised, if appealed, by a maximum of 10 percent each time which in most case is not sufficient to match with real market price.
6.	Consider alternative project design	Feasibility studies including social, political, cultural and environmental impact assessments, detailed	Involuntary resettlement and loss of means of livelihood are to be avoided when feasible	No specific laws for considering project design to avoid or minimize

Sl.	Aspects/Issues	ARIPA-2017	JICA Policy/Guidelines (April 2017)	Gap Between GoB and JICA Policy/Guidelines
		engineering surveys as basis for acquisition of private property or rights.	by exploring all viable alternatives.	involuntary resettlement. Feasibility study considers cost benefit more from technical than socio cultural considerations
7.	Involve and consult with stakeholders	The ARIPA- 2017 has provisions (Section 4 and 4/1) to notify the owners of property to be acquired. Any party having any objections can appear to DC for a hearing with 15 days of notification	Appropriate participation by affected people and their communities must be integrated in the planning, implementation, and monitoring of resettlement action plans and measures to prevent the loss of their means of livelihood.	There is no provision in the law for consulting the stakeholders but the land allocation committees at district, division and central government level. People have limited scope to negotiate with the government on the price of land, but have no right to refuse acquisition
8.	Disclose and inform PAPs of RAP and mitigation measures	The ARIPA-2017 requires serving a "notice" to be published at convenient places on or near the property in a prescribed form and manner stating that the property is proposed to be acquired (u/section 3).	In preparation of a resettlement action plan, consultations must be held with the affected people and their communities based on sufficient information made available to them in advance.	Disclosure takes place in case of donor-funded projects.
9.	Support existing social and cultural institutions of the affected persons	Generally, any social and cultural institutions should be avoided.	The impacts to be assessed with regard to environmental and social considerations. These also include social impacts, including social institutions such as social capital andlocal decision-making institutions, existing social infrastructures	If avoidance is not possible, the Government shall acquire, but will reconstruct or rebuild the social and cultural institutions.

Sl.	Aspects/Issues	ARIPA-2017	JICA Policy/Guidelines (April 2017)	Gap Between GoB and JICA Policy/Guidelines
			and services.	
10.	Build capacity of the borrower(s) in IR implementation	No provision in the ARIPA-2017.	JICA makes efforts to enhance the comprehensive capacity of organizations and operations in order for project proponents etc., to have consideration for environmental and social factors, appropriately and effectively, at all times.	There is a gap in regard to build capacity of borrower or clients of managing resettlement action plan implementation

2.5 Administrative Setup Related to Environment in Bangladesh

The MoEFCC is the nodal agency in the administrative structure of the GoB, for overseeing all environmental matters relating to national environmental policy and regulatory issues in the country. The MoEFCC oversees the activities of the following technical/implementing agencies:

- Department of Environment (DOE);
- Bangladesh Forest Department (BFD);
- Bangladesh Forest Industries Development Corporation (BFIDC);
- Bangladesh Forest Research Institute (BFRI);
- Bangladesh National Herbarium (BNH);
- Water Resources and Planning Organization (WARPO);
- Bangladesh Inland Water Transport Authority (BIWTA);
- Ministry of Fisheries and Livestock (MOFL);
- Bangladesh Power Development Board (BPDB);
- Ministry of Labor and Employment (MOLE);
- Ministry of Law and Parliamentary Affairs;
- Ministry of Land (MOL); and
- City Corporation/Pourashava/Union Parishad.

2.5.1 Department of Environment (DOE), Bangladesh

The DOE has been placed under the MoEFCC as its technical wing and is statutorily responsible for the implementation of the ECA, 1995. The department was created in 1989, to ensure sustainable development and to conserve and manage the environment of Bangladesh. The principal activities of the DOE are:

- Defining EIA procedures and issuing environmental clearance permits the latter being the legal requirement before the proposed Project can be implemented;
- Providing advice or taking direct action to prevent the degradation of the environment;
- Pollution control, including the monitoring of effluent sources and ensuring mitigation of environmental pollution;
- Setting the Quality Standards for environmental parameters;
- Declaring ECAs, where the ecosystem has been degraded to a critical state; and
- Review and evaluation of IEEs and EIAs prepared for projects in Bangladesh.

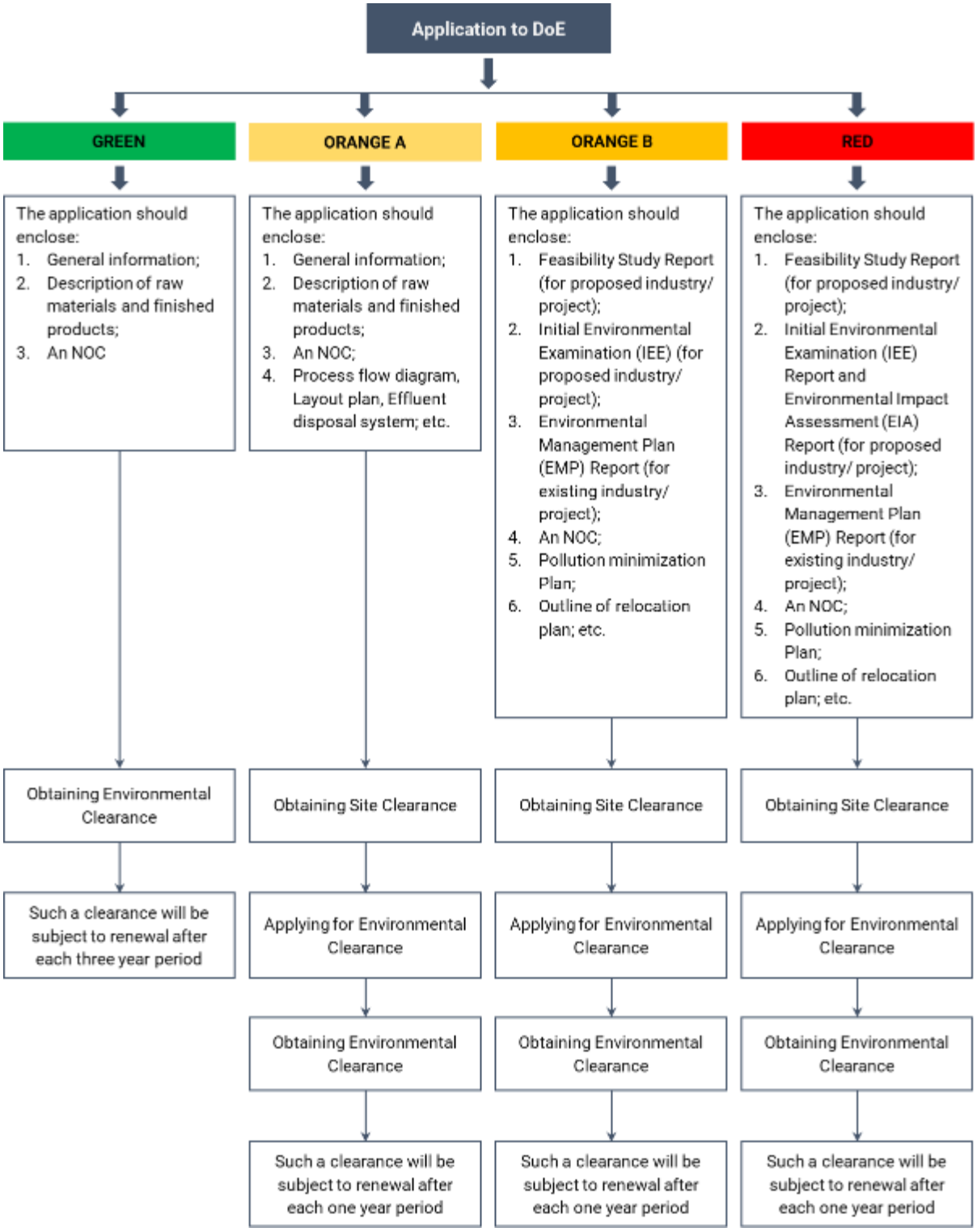
2.5.2 Procedure for obtaining ECC from DOE, Bangladesh

The applicability of environmental clearance and the process in Bangladesh is described in Figure 2-1. The EIA process consists of three stages, screening, IEE, and detailed EIA:

- Projects categorized as Green and Orange-A requires no IEE or EIA for environmental clearance, however, the proponent has to submit an application in a prescribed format along with specified documents;
- Projects categorized as Orange-B require an IEE to be submitted to the DOE along with an application in a prescribed format and other specified documents; and
- Red category projects require both IEE and EIA. An IEE is required for the location clearance and an EIA is required for the environmental clearance.

As per the Schedule-1 of ECR 1997, the project falls under the Red Category. The process of obtaining an Environmental Clearance Certificate for the proposed project is outlined in Figure 2-1.

Figure 2-1: DOE Environmental Clearance Applicability and Procedure



Source: Department of Environment (DOE), Bangladesh

2.6 Required Permits and Approvals

Followings are the major environmental permits and approval that will be required before, during and after construction and in operation phase of the project.

Table 2-6: Required permits and approval during pre-construction, construction, and operation phase

SL No.	Required Permit/Approval	Implementation Phase	Expected Deliverables	Institutional Responsibility	
				Implementation	Supervision
1.	Permission for establishment of Construction Yard from Roads and Highways Department (RHD)	Pre- construction	Approval letter	Contractor	Engineer/RHD
2.	Permission for Groundwater usage for construction from local Union Parishad/Paurashava	Pre-construction	Approval letter	Contractor	Engineer/RHD
3.	Permission for Surface water usage for construction from Union Parishad/Paurashava	Pre-construction	Approval letter	Contractor	Engineer/RHD
4.	Permission for tree cutting from the Department of Forest	Pre-construction	Approval letter	Contractor	Engineer/RHD
5.	Permission for construction waste disposal from Union Parishad/Paurashava	Construction	Approval letter	Contractor	Engineer/RHD
6.	Permission for Hill cutting from Prime Minister (if required)	Construction	Approval letter	Contractor	Engineer/RHD
7.	Approval from Bangladesh Inland Water Transport Authority (BIWTA) through RHD to select dredging site (if required).	Construction	Approval letter	Contractor	Engineer/RHD

CHAPTER 3

Project Description

3 PROJECT DESCRIPTION

3.1 Project Overview

The objective of the Project is to achieve smooth cargo transportation between Matarbari Port and Chattogram by improving roads at congested town area along the National Highway (N1), thereby contributing to improvement of logistics in Bangladesh and to the economic growth of the surrounding area.

In the Road Master Plan (2009) of the People's Republic of Bangladesh, National Highway No.1 (N1) from Dhaka to Cox's Bazar through Chattogram is regarded as an important highway connecting major cities. However, mixed traffic is causing frequent traffic congestion and traffic accidents in the section south of Chattogram of N1, which are induced by "one-direction one lane road", "narrow carriageway in urban sections", and "insufficient shoulders". In addition, a deep-sea port is now under construction in Matarbari by Japanese official development assistance, which will use this road for transport of the goods. This port is scheduled to open in March 2024. The "Preparatory Survey on the Matarbari Port Development" (2018, JICA) estimated that the travel time from Matarbari Port to Chattogram would increase from 123 minutes in 2017 to 438 minutes in 2035 if N1 is not improved. Since "quality of roads" and "improvement of traffic safety" are essential for the economic growth of Bangladesh, the improvement of N1 is deemed to be a priority project.

In 2013-2014, a feasibility study and detailed engineering design were carried out for the Chattogram – Cox's Bazar - Teknaf Road (208.8 km), including Cox's Bazar access road (5 km) under the road component of Sub-Regional Road Transport Project Preparatory Facility- II (SRTPPF-II) of the Roads and Highways Department (RHD) with the technical assistance of Asian Development Bank (ADB). The project considered the bypass/flyover in the built up/market areas and 2-lane carriageway (each carriageway 7.3 m wide) with separate SMVT lanes for entire alignment. An Environmental Impact Assessment (EIA) was conducted as integral part of the detail design under the SRTPPF-II project.

The Chattogram-Cox's Bazar Road is a part of the Asian Highway 41. The existing road condition is not feasible to operate smooth communication. To upgrade the communication system of Chattogram-Cox's Bazar Road as well as for the maintenance of main international highways and connecting roads, a preparatory survey namely the Cross-border Road Network Improvement Project (Bangladesh) was conducted by Japan International Cooperative Agency (JICA). This preparatory survey suggested the improvement of existing road between Chattogram and Cox's Bazar (Zone C) by constructing four bridges, e.g., Patiya Bridge, Mazar Point Bridge, Sangu Bridge, and Matamuhuri Bridge. Based on the study, these four bridges are now under construction. A comprehensive Environmental Impact Assessment (EIA) study was conducted for this cross-border road network improvement project and Environmental Clearance Certificate from Department of Environment (DoE) was obtained.

3.2 Project Activities

3.2.1 Project Components

The project components include the improvement of five major bottlenecks of Chattogram-Cox's Bazar Highway by constructing bypass roads and flyover. The five major bottleneck points are: Patiya, Dohazari, Keranihat, Lohagara, and Chakaria. In these locations, there area markets established on both sides of the highway, many temporary shops that partly occupies the road alignment and footpath, slow moving vehicles standing on the roads, etc., which makes the bus, trucks and other large vehicles to move slowly and creates traffic congestion. This situation highly reduces the efficiency of the highway that impacts on overall national economy. Therefore, this project intends to construct four bypass roads in Patiya, Dohazari, Lohagara, and Chakaria as well as one flyover will be built in Keranihat. There is an existing bypass in Patiya, which will be improved further. The new alignment of Patiya Bypass will distort from old bypass in some places in order to straighten the curvatures for more smooth traffic

operation and to reduce the chance of accidents. This development will contribute to smooth traffic operations reducing travel time and the chance of accidents. **Table 3-1** shows the lengths of the sub-project components of this project.

Table 3-1: Sub-Project Components with Length

Sub-Projects	Length (km)
Patiya (Outer Road)	5.4
Dohazari (Outer Road)	3.3
Keranihat Flyover	3.5
Lohagara (Outer Road)	5.1
Chakaria (Outer Road)	6.8

Source: JICA Study Team, 2022

3.2.2 Project Location

The project covers two districts, e.g., Chattogram and Cox's Bazar, five Upazilas, e.g., Patiya, Chandanaish, Satkania, Lohagara, and Chakaria, and several Union Parishads and Wards of Patiya and Chakaria Paurashava. **Table 3-2** shows the administrative and local government units where the project locations are situated. The location maps are depicted in **Figure 3-1** to **Table 3-5**.

Table 3-2: Administrative Location of Sub-Projects

Sl.	Location	Length (km)	District	Upazila	Union/Paurashava
1	Patiya (Outer Road)	5.4	Chattogram	Patiya	Bhatikhain, Kachuai, Patiya Pourashava (Word No-02, 06, 07)
2	Dohazari (Outer Road)	3.3		Chandanaish	Dohazari Pourasova
				Satkania	Kaliaish
3	Keranirhat Flyover	3.5		Satkania	Dhemsa, Keochia, Sadaha
4	Lohagara (Outer Road)	5.1		Lohagara	Amirabad, Lohagara
5	Chakaria (Outer Road)	6.8	Cox's bazar	Chakaria	Fasiakhali, Kakhara, Lakhyarchar, Chakaria Paurashava (Word No-09)

Figure 3-1: Route alignment of Patiya Bypass

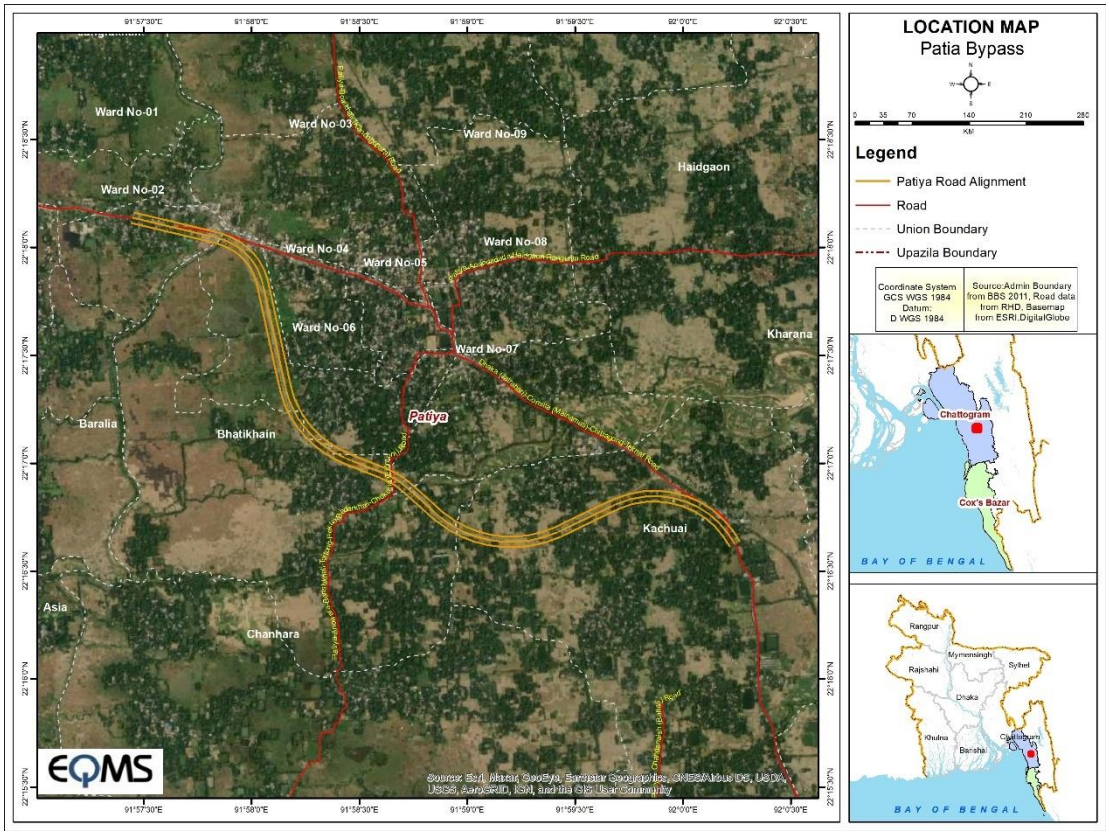


Figure 3-2: Route alignment of Dohazari Bypass

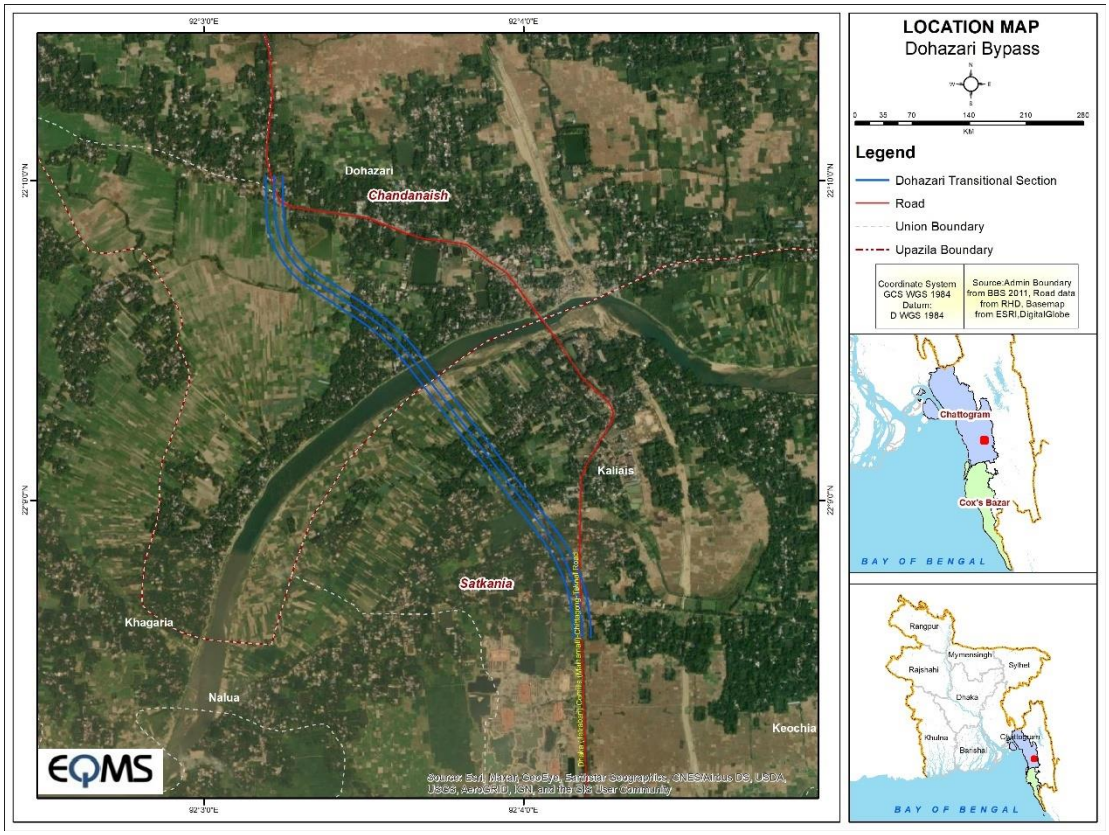


Figure 3-3: Route alignment of Keranihat Flyover

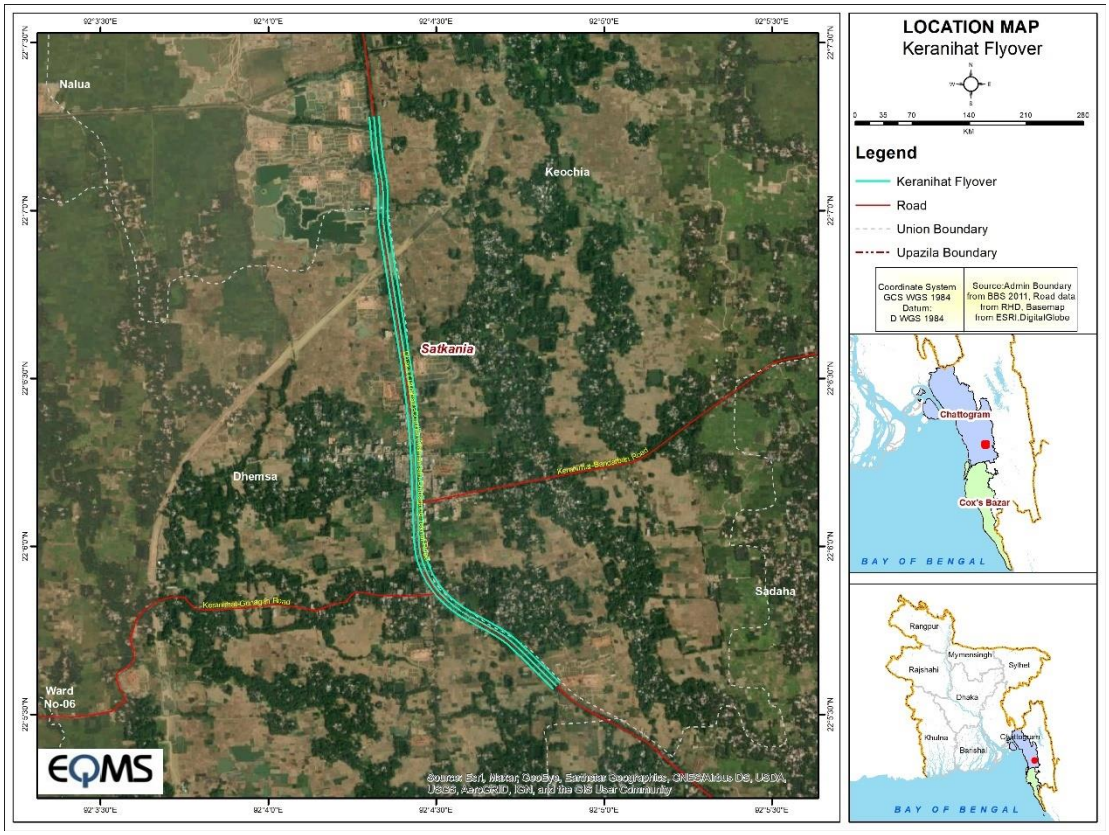


Figure 3-4: Route alignment of Lohagara Bypass

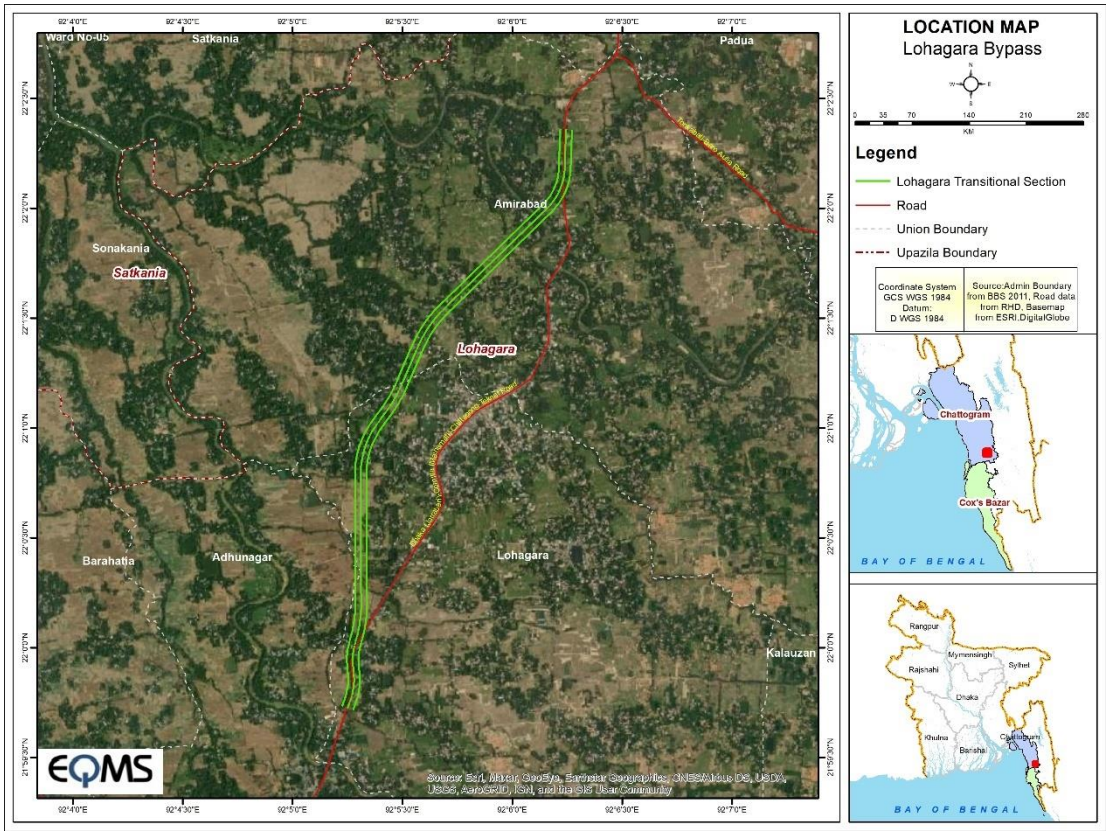
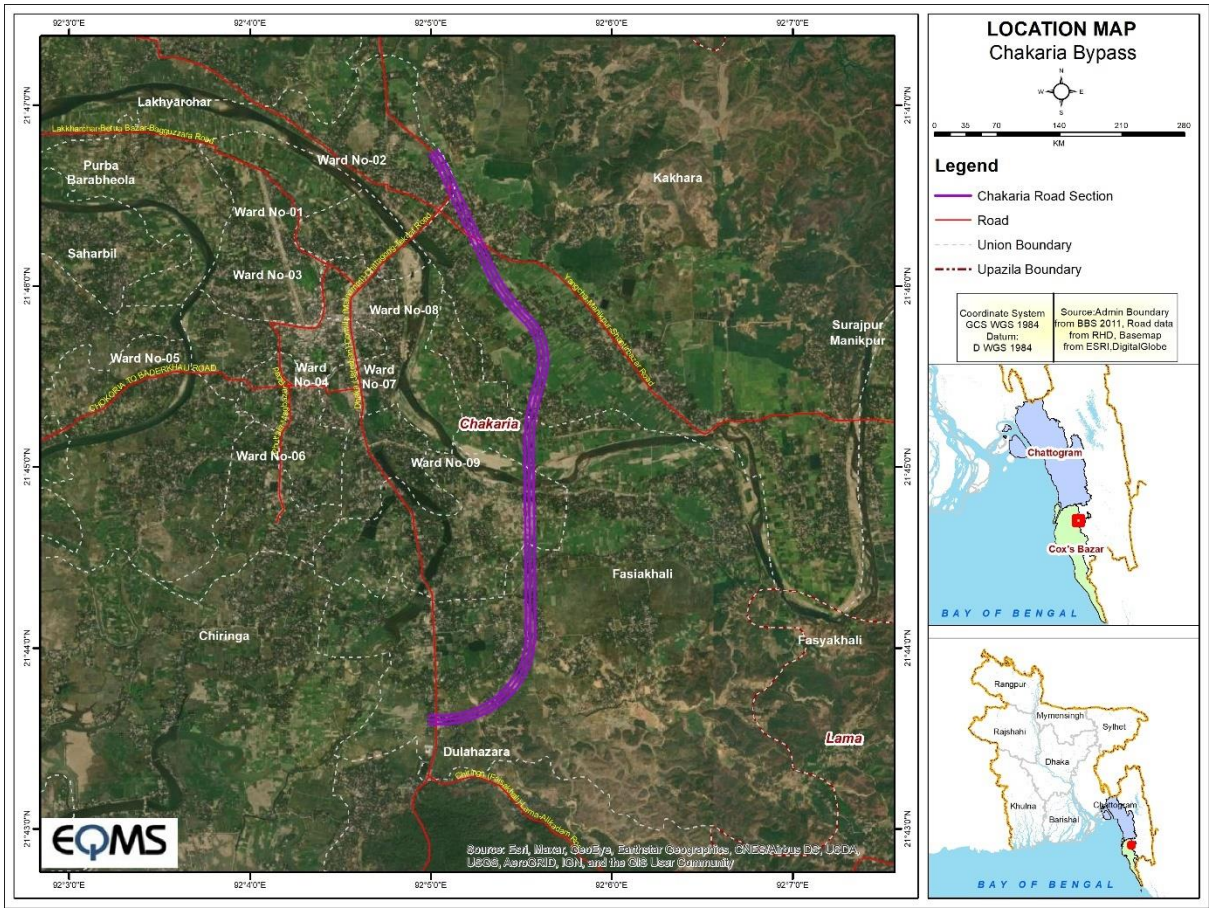


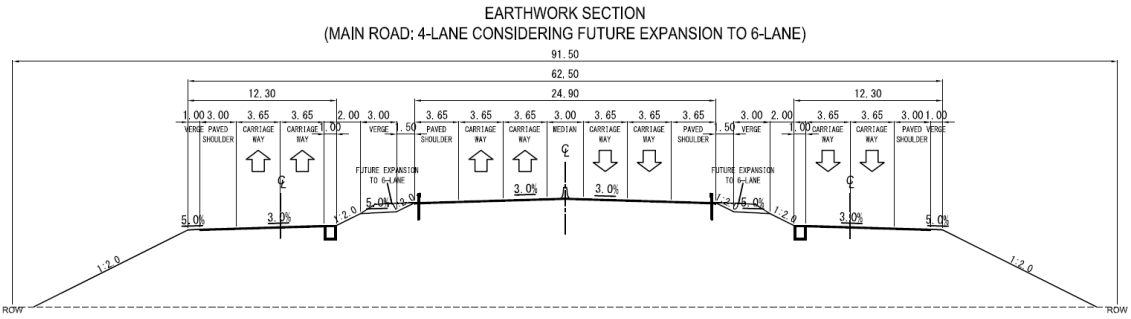
Figure 3-5: Route alignment of Chakaria Bypass



3.2.3 Design and Characteristics of Alignment

Figure 3-6 shows the cross section of proposed route alignment of Patiya, Dohazari, and Lohagara bypass roads. The main road will be a 04-lane carriageway with provision of space for future expansion to build another lane on both sides. That means the main road will be consists of 06-lanes in future. Also, there will be two service roads on both sides of main road and the width of service lane will be 02-lane on each side.

Figure 3-6: Cross section of route alignment in Patiya, Dohazari, and Lohagara



Source: JICA Study Team, 2021

The elevation of side roads will be lower than main road, but higher than ground level. Total width of the alignment in these three locations will be 300 ft, including main road, service road, provision for future expansion, and slopes. Average Embankment heights in these sections area given in **Table 3-3**.

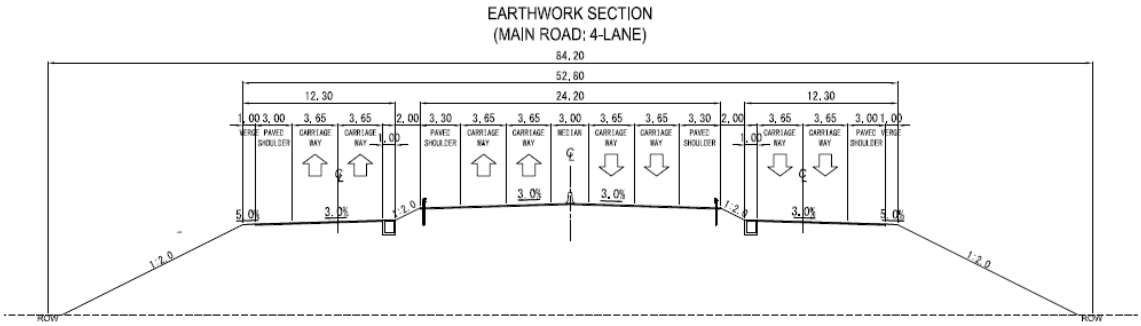
Table 3-3: Average Embankment Height (at CL of each road)

Bypass	Main Road	Side Road
Patiya	1.213m	0.789m
Dohazari	7.001m	3.738m
Lohagara	7.377m	2.866m

Source: JICA Study Team, 2021

Figure 3-7 shows the cross section of proposed route alignment of Chakaria Bypass Road. The main road will be a 04-lane carriageway with two service roads on both sides of main road and the width of service lane will be 02-lane on each side.

Figure 3-7: Cross section of route alignment in Chakaria



Source: JICA Study Team, 2021

The elevation of side roads will be lower than main road, but higher than ground level. Total width of the alignment in these three locations will be 280 ft, including main road, service road, provision for future expansion, and slopes. Average Embankment heights in these sections area given in **Table 3-4**.

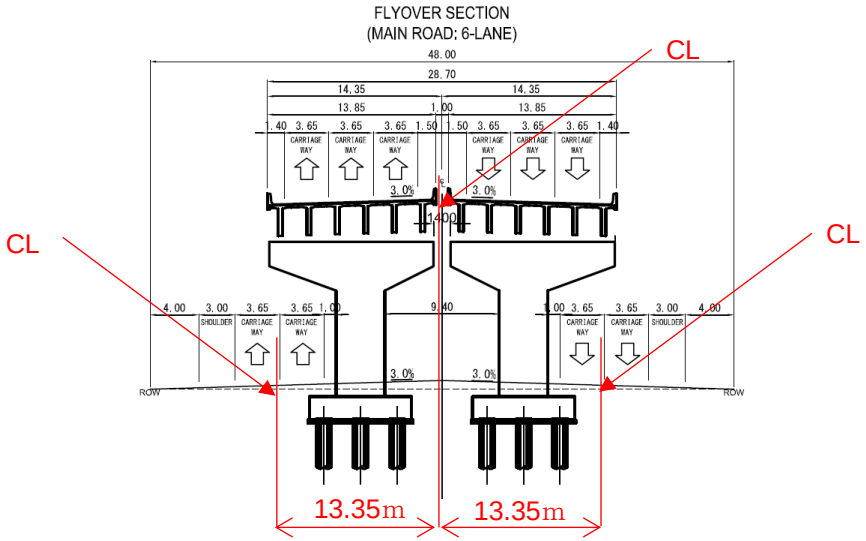
Table 3-4: Average Embankment Height (at CL of Chakaria)

Bypass	Main Road	Side Road
Chakaria	8.259m	3.302m

Source: JICA Study Team, 2021

In addition to these, **Figure 3-8** shows the cross section of flyover to be built in Keranihat, including viaduct, crossbeam, pier, and foundation. The viaduct of flyover will accommodate a carriageway of 06-lanes. The viaducts and I-girders will be placed on a crossbeam supported by two parallel piers. During construction period, there will be pathway on both sides to keep the road functional.

Figure 3-8: Cross section of flyover in Keranihat



Source: JICA Study Team, 2021

The width of viaduct will be about 90 ft and a space with width of about 157 ft will be required for construction period. Average Embankment heights in these sections area given in **Table 3-5**.

Table 3-5: Average Height at Keranihat

Flyover	Main Road	Side Road
Keranihat	10.026m	1.268m

Source: JICA Study Team, 2021

Table 3-6 shows characteristics of proposed alignment of bypasses and flyover along with major allied infrastructure in the alignment. The allied infrastructure will be built in part of the projects. Dohazari and Matamuhuri Bypasses will pass over Sangu and Matamuhuri Rivers, therefore, two major bridges need to be construct on the rivers. There is a narrow canal named Tangkabati Khal intercepted with the route alignment of Lohagara Bypass, which require the construction of a bridge too.

Table 3-6: Characteristics of sub-projects with major allied infrastructures

Sl. No.	Location	Proposed Option	Length (km)	Width (m)	Major Allied Infrastructure
1.	Patiya	Bypass	5.4	84.2	None
2.	Dohazari	Bypass	3.3	91.5	Bridge on Sangu River
3.	Keranihat	Flyover	3.5	48.0	Railway Overpass
4.	Lohagara	Bypass	5.1	91.5	Bridge on Tangkabati Khal
5.	Chakaria	Bypass	6.8	84.2	Bridge on Matamuhuri River

Source: JICA Study Team, 2021

The alignment of Chattogram-Cox's Bazar Railway intercepted both alignment of Chattogram-Cox's Bazar Highway and Keranihat Flyover. Hence, the starting point of the flyover need to be well ahead of the railway interception. An outline of the design elements of this project is given in **Table 3-7**.

Table 3-7: Design element of the project

Sl. No.	Design Area	Specific Item	Tentative Value
1.	Speed	Design Speed (km/h)	80km/h
		Design Vehicle (Semi-Trailer)	Semi-Trailer
2.	Stopping Control	Stopping Sight Distance (SSD)	120m
3.	Horizontal Control	Maximum super-elevation	5.0%
		Minimum curve radius	500m
		Minimum Transition	55m
4.	Vertical Control	Maximum gradient	3.0%
		Vertical curve K value minimum	70 (Crest), 70 (Sag)
5.	Cross-section Elements of Main Carriageway (Patiya/Chakaria)	Carriageway width (each direction)	7.30m
		Traffic lane width	3.65m
		Inner shoulder	1.0m
		Paved shoulder width	3.30-3.65m
		Cross fall	3.0%
		Central median	3.0m
6.	Cross-section Elements of Service Road/SMVT (both side)	Carriageway width	7.30m
		Cross fall	3.0%
		Inner marginal strip	1.0m
		Verge width	1.0m
		Verge slope	5.0%
		Embankment slope	1:2
7.	Vertical clearance	For Road (min)	5.7m
		For Rail (min)	7.35m
8.	Lateral clearance	For Road (min)	Edge of Slope
		For Rail (min) (from the track)	2.71m

Source: JICA Study Team, 2021

3.2.4 Cross Drainage Characteristics of the River Transit Area

The proposed alignment of the project will cross a couple of drainage network throughout the area. major cross drainage characteristics are given in **Table 3-13**, **Table 3-9**, **Table 3-10** and **Table 3-11**.

Table 3-8: Crossing waterway at Patiya

No.	Existing Condition				Crossing Plan	
	Station	Type	Name of Waterway	Width (m)	Station	Type
CWT01	0+280	River	Boalkhali River	24.8	0+280	BR L=50m
CWT02	0+324	River	-	7.5	0+324	BC 3.5 × 2.0
CWT03	0+360	River	-	3.4	0+360	BC 3.5 × 2.0
CWT04	0+415	River	-	3.4	0+415	BC 3.5 × 2.0
CWT05	1+034	River	-	4.6	1+034	BC 4.0 × 2.5

No.	Existing Condition				Crossing Plan	
	Station	Type	Name of Waterway	Width (m)	Station	Type
CWT06	1+323	River	-	4.7	1+323	BC 4.0 × 2.5
CWT07	1+644	River	-	5.7	1+644	BC 5.0 × 4.0
CWT08	3+110	River	-	20.0	3+110	BR L = 40m
CWT09	3+336	Pond	-	3.0	3+336	BC 3.0 × 2.0
CWT10	4+080	Pond	-	6.7	4+080	BC 3.5 × 2.0

Source: JICA Study Team, 2021

Table 3-9: Crossing waterway at Dohazari

No.	Existing Condition				Crossing Plan	
	Station	Type	Name of Waterway	Width (m)	Station	Type
CWT01	1+526	River	Sangu River	141.0	1+587	BR L=300m
CWT02	2+157	Canal	-	8.9	2+157	BC 6.0 × 4.5

Source: JICA Study Team, 2021

Table 3-10: Crossing waterway at Lohagara

No.	Existing Condition				Crossing Plan	
	Station	Type	Name of Waterway	Width (m)	Station	Type
CWT01	0+152	Canal	-	2.8	0+152	BC 3.0 × 2.0
CWT02	0+793	River	Tangkabati	38.9	-	BR L=50m
CWT03	4+360	Canal	-	7.5	4+360	BC 5.0 × 4.0 (2 nos)

Source: JICA Study Team, 2021

Table 3-11: Crossing waterway at Chakaria

No.	Existing Condition				Crossing Plan	
	Station	Type	Name of Waterway	Width (m)	Station	Type
CWT01	0+493	River	-	-	0+493	BC 3.5 × 2.0
CWT02	0+890	River	-	8.5	0+890	BR L=50m
CWT03	1+212	River	-	7.3	1+215	BC 3.5 × 2.0
CWT04	1+715	River	-	-	1+715	BC 1.5 × 1.5
CWT05	2+003	River	-	-	2+003	BC 4.0 × 2.5
CWT06	2+210	River	-	-	2+210	BC 2.85 × 0.35
CWT07	2+640	River	-	-	2+640	BC 1.5 × 1.5
CWT08	3+360	River	-	-	3+360	BC 2.0 × 2.0
CWT09	3+680	River	Matamuhuri River	-	3+710	BR L=400m
CWT10	4+540	River	-	-	4+540	BC 1.5 × 1.5
CWT11	4+967	River	SRR	-	4+958	BR L=30m

No.	Existing Condition				Crossing Plan	
	Station	Type	Name of Waterway	Width (m)	Station	Type
CWT11	4+967	River	Main Road	-	4+958	BR L=25m
CWT11	4+967	River	SRL	-	4+958	BR L=20m
CWT12	5+881	River	SRR	-	5+881	BR L=20m
CWT12	5+881	River	Main Road	-	5+881	BR L=32m
CWT12	5+881	River	SRL	-	5+881	BR L=15m
CWT13	6+103	River	Main Road	-	6+103	BR L=35m
CWT13	6+103	River	SRL	-	6+103	BR L=10m
CWT14	6+242	River	SRL	-	6+244	BR L=19m
CWT14	6+242	River	Main Road	-	6+244	BR L=50m
CWT14	6+242	River	SRL	-	6+244	BR L=15m

Source: JICA Study Team, 2021

3.3 Description of Alternatives

Several alternative routes of bypass roads and flyover have been considered for feasibility evaluation in all bottleneck points. After evaluating all alternate options, a final route has primarily been selected for construction. The objective of present study is to assess the environmental and social impacts of primarily selected options. To select the final option, several factors, including scope of work, location of city center or built-up area, location of river and canal, location of railway, location of other roads, locations of electric transmission line, etc. have been taken into consideration.

3.3.1 No Build Alternative

The Chattogram-Cox's Bazar Highway is one of the important portions of N1 Highway (Dhaka-Chattogram-Cox's Bazar). This highway (N1) serves as most important supply road of export and imported goods of the country. Cox's Bazar is a major and the most important tourist city of the country with world's longest sea beach. There is also an airport in the city. Currently, several development projects, including Matarbari Deep Sea Port, Matarbari Coal Powered Power Plant, Moheshkhali Special Economic Zone, etc. are being implemented in Moheshkhali of Cox's Bazar. There will be a huge demand of transportation using Chattogram-Cox's Bazar Highway after implementation of these development projects. Particularly, Matarbari Deep Sea Port will be highly depended on this road.

The Dhaka-Chattogram highway, the longest portion of N1, has been improved to 04-lane road from 02-lane road few years back. This improvement has brought a significant development in local and regional connectivity. However, another important portion of the N1, Chattogram-Cox's Bazar Highway, remained a two-lane road that restricts to obtain full benefits from this road. After initiating the construction of Matarbari Deep Sea Port, the necessity of improving this road is inevitable.

The Preparatory Survey on the Matarbari Port Development (2018, JICA) estimated that the travel time from Matarbari Port to Chattogram would increase from 123 minutes in 2017 to 438 minutes in 2035 if N1 is not improved. Since quality of roads" and improvement of traffic safety are essential for the economic growth of Bangladesh, the improvement of N1 is deemed to be a priority project. The focus of current project is to improve the traffic mobility in five major bottleneck points, e.g., Patiya, Dohazari, Keranihat, Lohagara, and Chakaria by constructing four bypass roads and one flyover. The implementation of this project will ease the traffic movement as well as will reduce the travel time and chances of accidents. It will contribute to the functionality of Matarbari Deep Sea Port and to overall national economy. In short, the implementation of this project is highly significant in terms of economic development of Bangladesh.

3.3.2 Alternative Alignment Options in Dohazari

Table 3-12 shows the comparisons between alternative alignment options of Dohazari Bypass roads from the perspective of their scope of works, location of built-up area, river, railway, and other roads. Total 03 options have been considering for feasibility evaluation and Option 2b is finally selected for implementation. **Figure 3-9** and **Figure 3-10** shows the map of all alternative alignments considered for Dohazari bypass.

Figure 3-9: Option 3 (combined bypass on east side for both Dohazari and Keranihat)

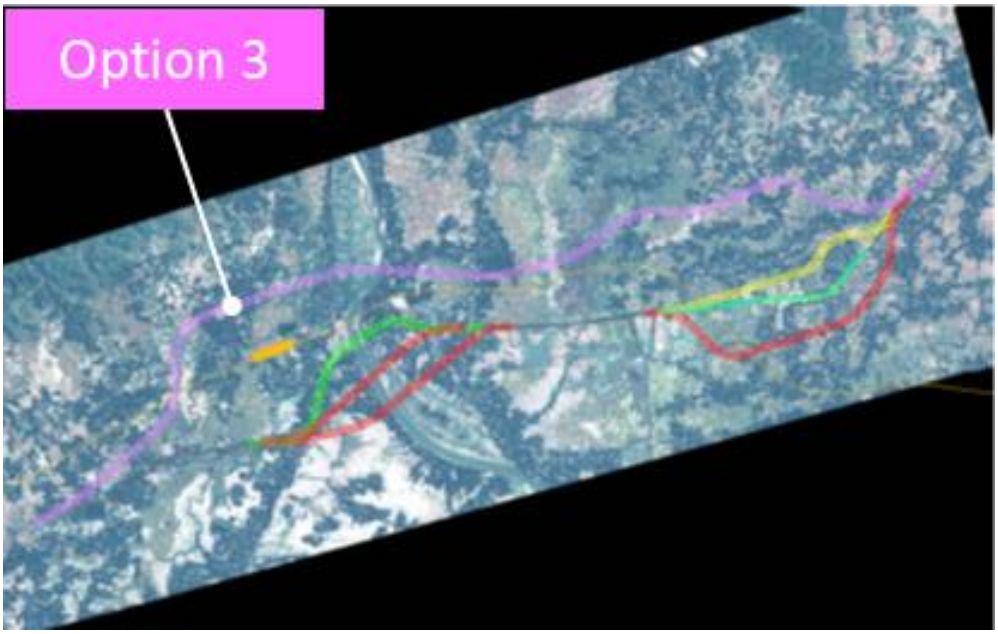


Figure 3-10: Option 1 and 2b of Dohazari bypass

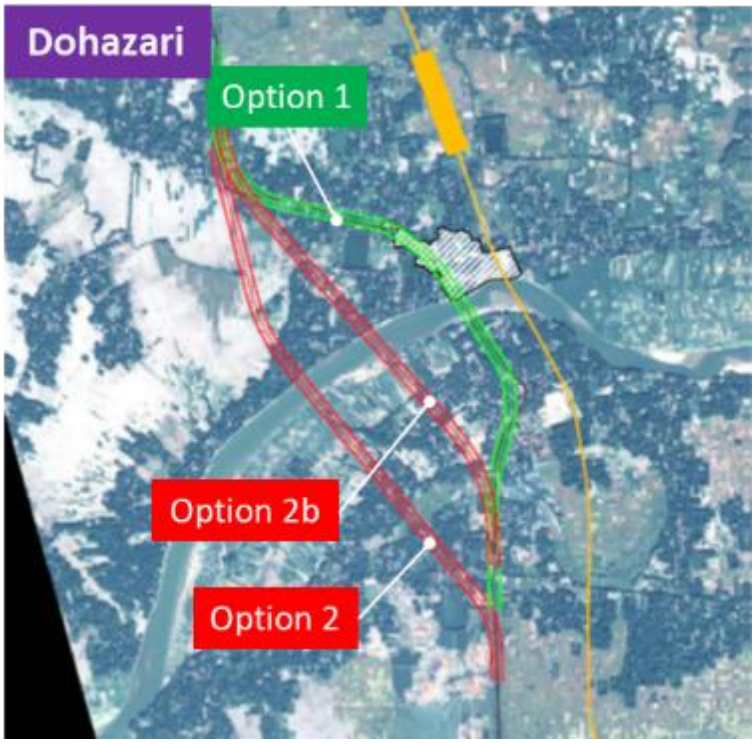


Table 3-12: Comparison between alternative alignment options in Dohazari

Item	Development Option		
	Option 1	**Option 2b**	**Option 3**
Concept	Utilize Existing ROW & New Sangu Bridge	Outer Road on West Side. Minimize river-related risk	Combined Outer Road for both Dohazari & Keranihat on East Side
Scope of Works	• Align Improvement • Widening **Large-scale structures:** None	• New Outer Road • Service Road **Large-scale structures:** Sangu River Crossing	• New Outer Road • Service Road **Large-scale structures:** • Sangu River Crossing • Railway Crossing N108 Crossing
Design Control	**Approach**		
City Center (Built-up area)	Pass through	Bypass	Pass through
Sangu River	Utilize the bridge to be built under another project	Construct a new bridge with large crossing angle	Construct a new bridge with large crossing angle
Railway (Under const.)	No impact	No impact	Construct Railway-Over-Bridge with large crossing angle
N108	No impact	No impact	Grade Separation by Interchange

3.3.3 Alternatives Options in Keranirhat

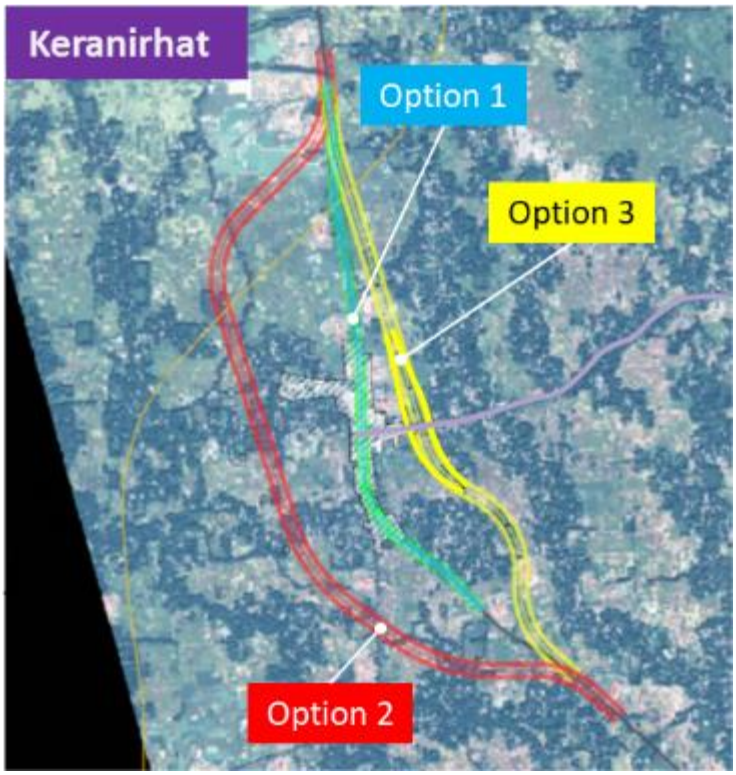
Table 3-13 shows the alternative alignment options in Keranihat bottleneck point. Total three options have been considered for Keranihat, e.g., utilizing existing ROW to construct a flyover, outer road on west side, and outer road on east side. Both Option 2 & 3 with intersect with Chattogram-Cox's Bazar Railway, and therefore, over-bridge with large crossing angle needs to be built to pass the rail line. Besides, secured offset distance need to be maintained from a high voltage electric transmission line in case of second option. All the three options will require resettlement and land acquisition, in some case, for implementation. Finally, the first option of the construction of a flyover using existing ROW has primarily been selected for implementation. However, both Option 1 & 3 are subject to the EIA study. **Figure 3-11** shows the three alternative alignment options of Keranihat.

Table 3-13: Comparison between alternative alignment options in Keranihat

Item	Development Option		
	Option 1	**Option 2**	**Option 3**
Concept	Utilize Existing ROW Construct Flyover	Outer Road on West Side	Outer Road on East Side
Scope of Works	• Align Improvement • Flyover	✓ New Outer Road ✓ Service Road	✓ New Outer Road ✓ Service Road

Item	Development Option		
	Option 1	**Option 2**	**Option 3**
	• Approach Road • Service Road **Large-scale structures:** Flyover	**Large-scale structures:** Railway Crossing	**Large-scale structures:** ✓ Railway Crossing N108 Crossing
Design Control	**Approach**		
City Center (Built-up area)	Pass through	Bypass	Bypass
Railway (Under const.)	Flyover needs to be extended to cross over the railway	Construct Railway-Over-Bridge with large crossing angle	Construct Railway-Over-Bridge with large crossing angle
N108	Grade Separation by Flyover	No impact	Grade Separation by Interchange
High Voltage Line	No impact	Secure offset distance	No impact

Figure 3-11: Three alignment options (02 bypasses and 01 flyover) in Keranihat



3.3.4 Alternative Alignment Options in Lohagara

Table 3-6 shows the comparative descriptions of different aspects of three different alignment options in Lohagara. The first option is a flyover utilizing existing ROW, while other two options are outer roads on west and east side, respectively. The first option goes through city centre and other two options go through mostly agricultural and settlement land that require large scale resettlement program. There will be need to construct a bridge with large crossing angle on Tankabati Khal in case of both second and third options. No option has any impact on railway and electric transmission line. After considering

all options, the second option has primarily been selected for implementation. **Figure 3-12** shows the alternative route alignments in Lohagara.

Figure 3-12: Three alternative alignment options in Lohagara

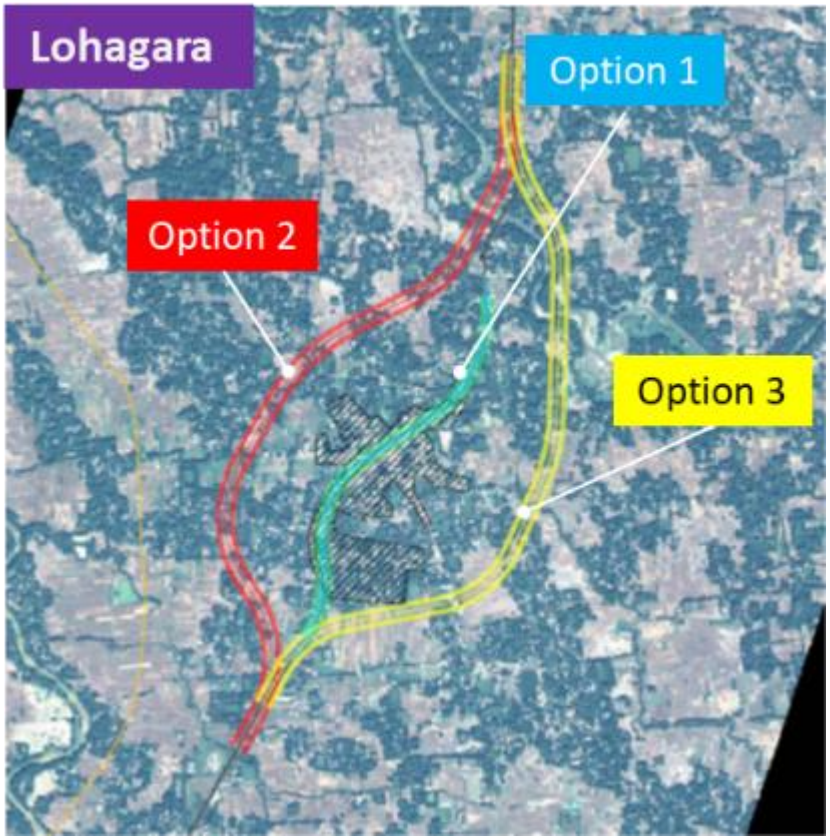


Table 3-14: Comparison between alternative alignment options in Lohagara

Item	**Development Option**		
	Option 1	**Option 2**	**Option 3**
Concept	Utilize Existing ROW Construct Flyover	Outer Road on West Side	Outer Road on East Side
Scope of Works	✓ Align Improvement ✓ Flyover ✓ Approach Road ✓ Service Road **Large-scale structures:** Flyover	✓ New Outer Road ✓ Service Road **Large-scale structures:** Tonkaboti Canal Crossing	✓ New Outer Road ✓ Service Road **Large-scale structures:** Tonkaboti Canal Crossing
Design Control	**Approach**		
City Center (Built-up area)	Pass through	Bypass	Bypass
Railway (Under const.)	No impact	No impact	No impact

Item	Development Option		
	Option 1	**Option 2**	**Option 3**
Tonkaboti Canal	No impact	Construct a new bridge with large crossing angle	Construct a new bridge with large crossing angle

3.3.5 Alternative Alignment Options in Chakaria

Table 3-15, **Table 3-16** and **Table 3-17** show the comparative characteristics of 07 alternative route alignments in Chakaria. Most of the alternative options go over Matamuhuri River, thus they require to build bridge with large crossing angle on the river. Matarbari access road need to be improved separately for first three options. In case of fourth and fifth option, there will be grade separation by interchange between bypass and Matarbari access road. Similar approach will be taken for Option 6 and 6a also. After considering all alternatives, the Option 6a has primarily been selected for implementation. **Figure 3-13** shows all alternative alignments in Chakaria.

Table 3-15: Comparison between alternative alignment options in Chakaria (Option 1-3)

Item	Development Option		
	Option 1	**Option 2**	**Option 3**
Concept	Utilize Existing ROW & New Matamuhuri Bridge	Utilize Existing ROW Construct Flyover	Outer Road on East Side
Scope of Works	✓ Align Improvement ✓ Widening **Large-scale structures:** Flyover	✓ Align Improvement ✓ Flyover ✓ Approach Road ✓ Service Road **Large-scale structures:** Flyover	✓ New Outer Road ✓ Service Road **Large-scale structures:** Matamuhuri River Crossing
Design Control	**Approach**		
City Center (Built-up area)	Pass through	Pass through	Bypass
Matamuhuri River	Utilize the bridge to be built under another project	Utilize the bridge to be built under another project	Construct a new bridge with large crossing angle
Railway (Under const.)	No impact	No impact	No impact
N1	To be improved under the Project	To be improved under the Project	To be connected smoothly
Matarbari Access Road	To be improved separately	To be improved separately	To be improved separately

Table 3-16: Comparison between alternative alignment options in Chakaria (Option 4-5)

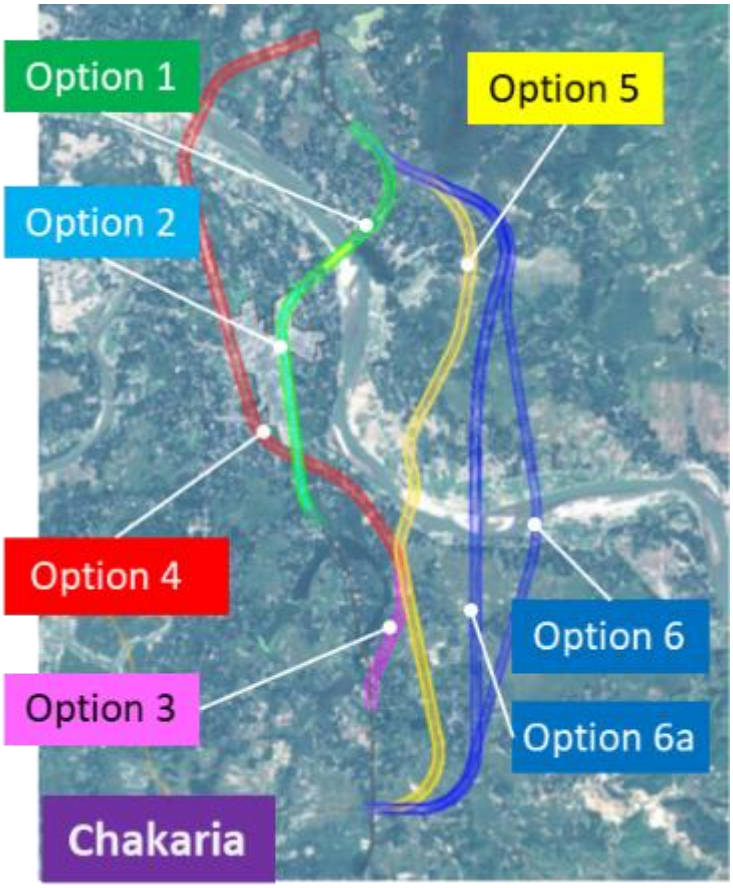
Item	Development Option	
	Option 4	**Option 5**
Concept	✓ Outer Road on West Side -> East Side Connect to Matarbari Access Road	✓ Outer Road on East Side Connect to Matarbari Access Road
Scope of Works	✓ New Outer Road ✓ Service Road **Large-scale structures:** ✓ Mathamuhuri River Crossing ✓ N1 Crossing Matarbari Access Road Crossing	✓ New Outer Road ✓ Service Road **Large-scale structures:** ✓ Mathamuhuri River Crossing Matarbari Access Road Crossing
Design Control	**Approach**	
City Center (Built-up area)	Bypass Impact on Army property	Bypass
Mathamuhuri River	Construct a new bridge with large crossing angle	Construct a new bridge with large crossing angle
Railway (Under const.)	No impact	No impact
N1	Grade Separation by Interchange	To be connected smoothly
Matarbari Access Road	Grade Separation by Interchange	Grade Separation by Interchange

Table 3-17: Comparison between alternative alignment options in Chakaria (Option 6 & 6a)

Item	Development Option	
	Option 6	**Option 6a**
Concept	✓ Avoid impact on Urban Area to be Developed ✓ Outer Road on East Side Connect to Matarbari Access Road	✓ Avoid impact on Urban Area to be Developed ✓ Outer Road on East Side ✓ Connect to Matarbari Access Road Minimize river-related risk
Scope of Works	✓ New Outer Road ✓ Service Road **Large-scale structures:** ✓ Mathamuhuri River Crossing Matarbari Access Road Crossing	✓ New Outer Road ✓ Service Road **Large-scale structures:** ✓ Mathamuhuri River Crossing Matarbari Access Road Crossing
Design Control	**Approach**	

Item	Development Option	
	Option 6	**Option 6a**
City Center (Built-up area)	Bypass	Bypass
Mathamuhuri River	Construct a new bridge with large crossing angle	Construct a new bridge with large crossing angle
Railway (Under const.)	No impact	No impact
N1	To be connected smoothly	To be connected smoothly
Matarbari Access Road	Grade Separation by Interchange	Grade Separation by Interchange

Figure 3-13: Seven alternative alignment options in Chakaria



3.4 Resource and Utilities Demand

Resource required to develop this project will be finalized during the detailed design phase of this project. At present, source and quantity has been estimated for construction materials. However, demand for utilities, waste generation, supporting infrastructure and manpower employment has not been estimated yet. A list of resource and utilities demand is given in **Table 3-18**.

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Table 3-18: Resources Demand

Sl no.	Construction Materials	Estimated Quantity and Source
1.	Soil	7.3 million m^3, borrow pit
2.	Stone Aggregate	0.7 million m^3, river/quarry site
3.	Steel	31 thousand ton, fabricated/purchased
4.	Concrete	0.3 million m^3, purchased

Source: JICA Study Team, 2021

3.5 Implementation Schedule

The detailed design phase of this project is expected to be started from January 2023. Details of the project implementation schedule is given in **Table 3-19**.

Table 3-19: Project Implementation Schedule

Sl. No.	Implementation Item	Implementation Schedule
1.	Detailed Design	January 2023 – December 2023
2.	Tender	January 2024 – December 2024
3.	Construction	January 2025 – June 2028
4.	Defect Notification Period	July 2028 – June 2029

Source: JICA Study Team, 2022

CHAPTER 4

Baseline Environmental Condition

4 BASELINE ENVIRONMENTAL CONDITION

4.1 Area of Influence (AoI)

The Area of Influence (AoI) of the project comprises of the project site and the surrounding area, where the influence of the project activities is anticipated. The areas likely to be affected by the project and its associated activities include:

- The project activities and facilities that are directly owned operated or managed by the project proponent (including by contractors) and that are components of the project;
- Impacts from unplanned but predictable developments caused by the project that shall occur later or at a related location such as increase in traffic on the approach road;
- Impacts on biodiversity or on ecosystem services upon which affected communities' livelihood are dependent.

Further to this, the AoI with respect to the environmental and social resources was considered based on the following reach of impacts:

Air Quality

- Impact on ambient air quality from vehicle exhaust- 500 meter from the project site
- Dust fall- typically up to 200 m from construction activities

Noise

- Noise impact area (defined as the area over which an increase in environmental noise levels due to the project can be detected) - typically 500 m on both sides from the road construction alignment.

Water

- Surface water bodies within 1 km of the project footprint

Flora and Fauna (Terrestrial and Aquatic)

- Impacts on flora and fauna due to project activities (increased dust and noise, anthropogenic disturbances and other project related activities) are limited to project sites and 500 meters on both sides from the road construction alignment.
- The AoI for flora and fauna studies was considered within 2 km on both side from the alignment of the road. Most of the areas are covered with modified habitats i.e., agricultural fields, plantation, homesteads, etc. But this conservative approach ensured to include wildlife habitats and protected areas in the project surrounding areas.

Socio-economic/Social

- The AoI for social receptors was fixed to include 1 km both side from alignment of the road which has been developed based on the reconnaissance site visits and stakeholder consultations with the local community.

4.2 Meteorology

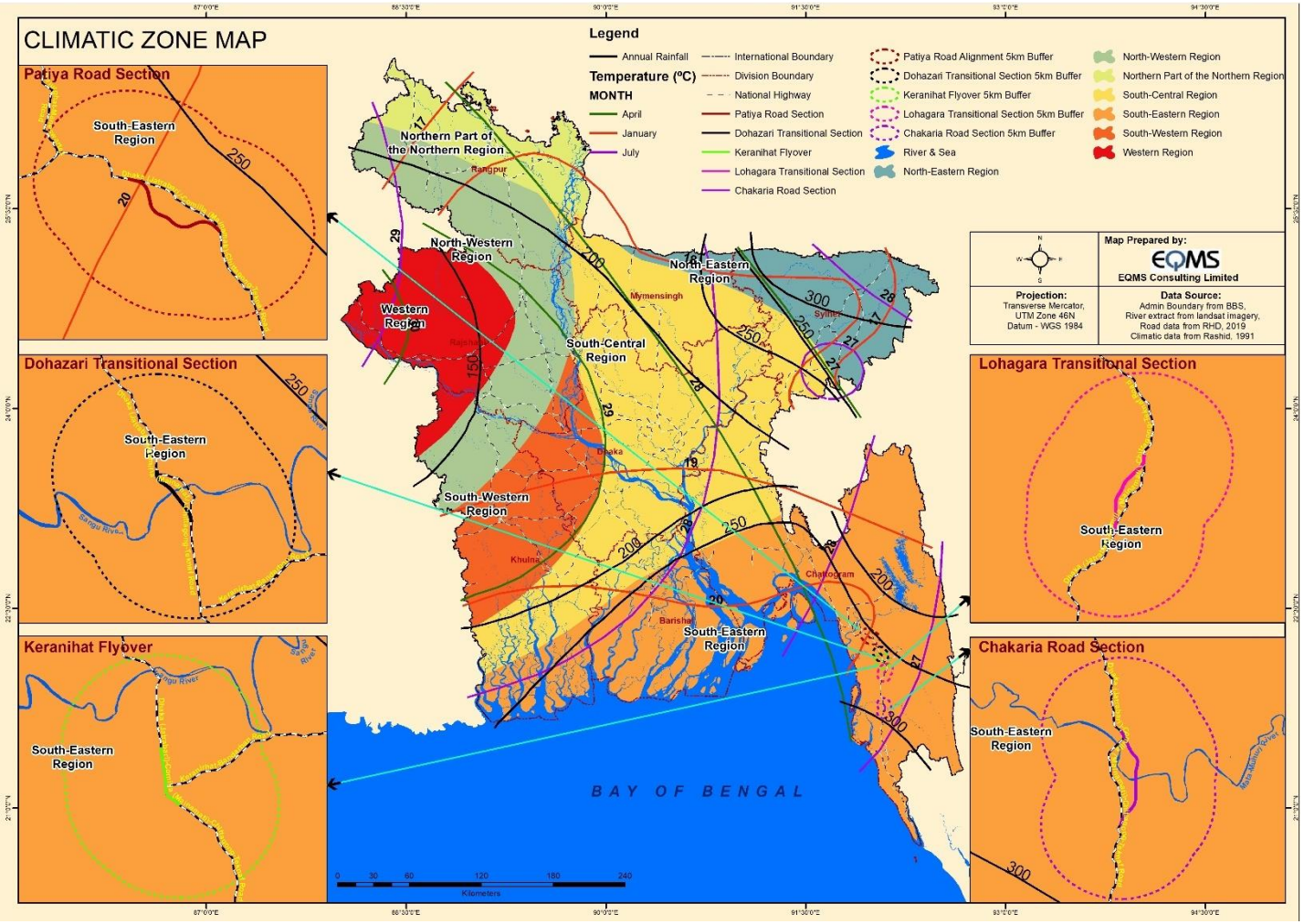
Bangladesh is located in the tropical monsoon region and its climate is characterized by high temperature, heavy rainfall, often excessive humidity, and fairly marked seasonal variations. From the climatic point of view, four distinct seasons[1] can be recognized in Bangladesh.

- Pre-Monsoon Hot Season (March to May) – Characterized by the highest temperatures of the year–up to 36°C. Certain rainfall may occur, with tropical cyclones occasionally affecting coastal areas;
- Rainy Monsoon Season (June to September) – Period of highest rainfall (up to 80% of the annual rainfall), humidity, and cloud cover. Increased rain and cloud cover generally cause a small reduction in mean daily temperatures;
- Post-Monsoon Season (October to November) – Temperature remains hot and humid, though cloud cover decreases in this season. Limited tropical thunderstorms may still, particularly in coastal areas; and
- Cool Dry Winter Season (December to February) – Coolest time of the year with mean minimum temperatures falling below 10°C in some areas. Reduced humidity and cloud cover. Rainfall is scarce.

Despite the general predictability of the seasons in Bangladesh, local conditions may still vary widely across the country. As such, Bangladesh can be divided into seven climatic sub-zones based on differences in a range of factors including rainfall, temperature, evapotranspiration, and local seasonality (Rashid, 1991). According to the climatic sub-regions of Bangladesh, the proposed project area is located in the South-Eastern Region. The climatic sub-regions of the study area are shown in **Figure 4-1.** This region comprises the Chittagong sub-region and a strip of land extending from south-west Sundarbans to the south of Comilla. The hills over 300 meters in height have zone B climate. The rest of the area has a small range of temperature, rarely going over a mean of 32°C and below a mean of 13°C. Rainfall is heavy, usually over 254 cm. In winter, dewfall is heavy. If the Koppen system is used this area would be classed as AM. The climatic data for the study area was obtained from the Bangladesh Meteorological Department (BMD). The nearest meteorological station from the proposed project site is at Cox's Bazar and Chattogram Meteorological Station.

[1] Brammer, H. (1996). *The Geography of the Soils of Bangladesh*. University Press Limited, Dhaka, Bangladesh.

Figure 4-1: Climatic Sub-regions of the Study Area



Source: Data from Rashid, H. E. 1991[2] and map prepared by EQMS

[2] Rashid, H. E. (1991). *Geography of Bangladesh*. University Press Limited, Dhaka.

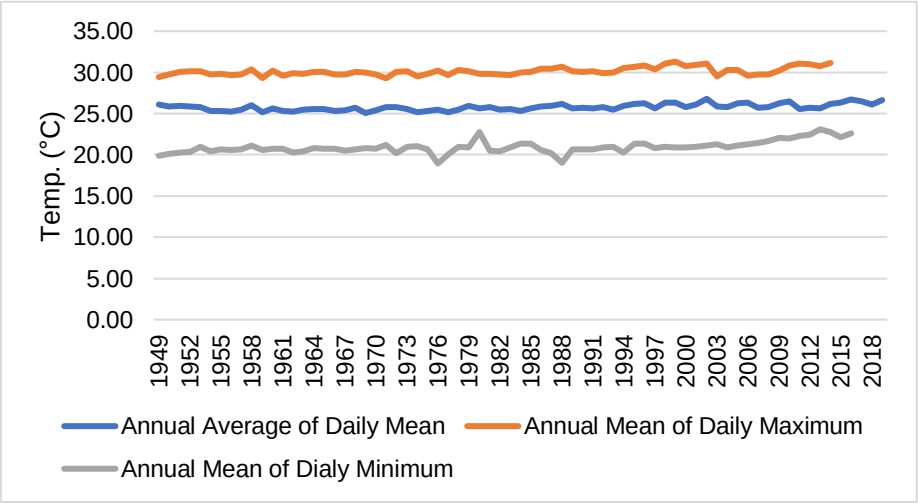
4.2.1 Temperature

There are two meteorological stations in the project area, e.g., Chattogram and Cox's Bazar Station. Table 4-1 shows the summary findings of the descriptive statistics and trend analysis of annual mean of daily average, daily maximum, and daily minimum temperature at Chattogram and Cox's Bazar Station from 1948 to 2019. The annual mean and standard deviation value of daily average temperature at both stations are almost same. There are slight variations in the values of annual mean and standard deviations of daily maximum and daily minimum temperature in Chattogram and Cox's Bazar Station. The slopes of trend line indicate that the yearly mean of all three types of temperature, such as daily average, daily maximum, and daily minimum at both stations have upward trends. It is also evident from r^2 value that the magnitude of changing trends in daily average, daily maximum, and daily minimum temperature at Chattogram Station are less strong with a positive direction. On the other hand, the magnitudes of the trends are moderately strong at Cox's Bazar Station as per the r^2 values. The r^2 value indicates the portion or percentage of dependent variables that can be defined by the independent variables if other controlling factors remain constant. The findings also reveal that the temperature in Cox's Bazar is slightly higher than Chattogram.

Table 4-1: Descriptive statistics and trends of temperature from 1948 to 2019

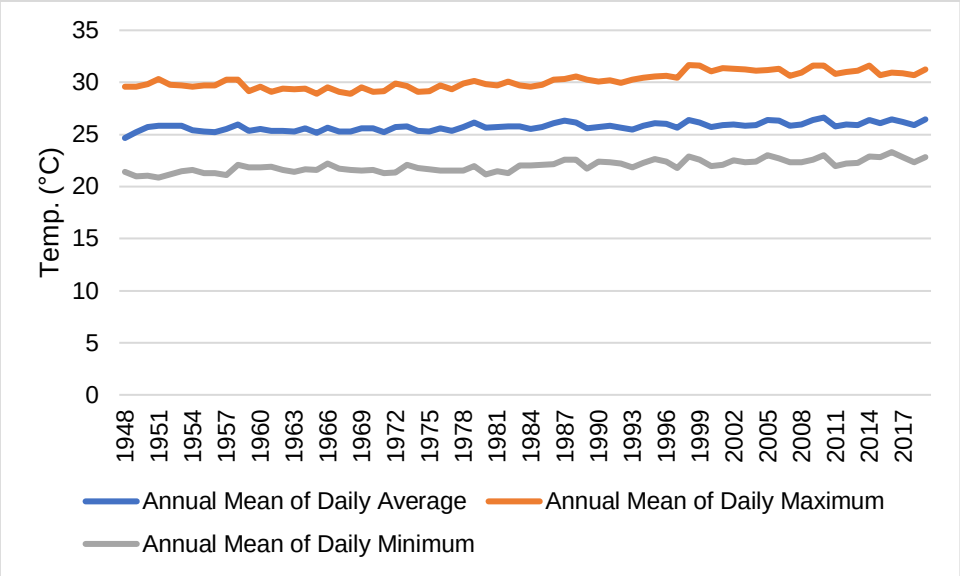
Station and Parameter	Annual Mean (°C)	Standard Deviation (°C)	Range (°C)	Trend	
				Slope (°C)	r^2
Chattogram Station					
Daily Average	25.78	0.40	1.73	0.011	0.34
Daily Maximum	30.13	0.48	1.99	0.013	0.31
Daily Minimum	20.95	0.76	4.15	0.021	0.36
Cox's Bazar Station					
Daily Average	25.76	0.38	1.96	0.013	0.51
Daily Maximum	30.19	0.78	2.76	0.030	0.63
Daily Minimum	21.98	0.57	2.45	0.022	0.66

Figure 4-2: Annual mean of daily average, maximum, and minimum temperature in Chattogram



Source: Bangladesh Meteorological Department (BMD)

Figure 4-3: Annual mean of daily average, maximum, and minimum temperature in Cox's Bazar



Source: Bangladesh Meteorological Department (BMD)

Outdoor temperature has been monitored during ambient air quality monitoring for environmental baseline survey. **Table 4-2** shows the summary findings of temperature measured by a portable weather station in every bottleneck area during day time. The findings suggest that the average temperature in monsoon season varies from 28.6°C in Patiya to 35.1°C in Keranihat (flyover), whereas the temperature extends from 22.2°C in Lohagara to 25.7°C in Keranihat (bypass) during winter season. It is found that the average temperature has decreased by 3 to 10 degree in winter season than monsoon season. The maximum temperature in monsoon season ranges from 32.3°C in Patiya to 36.5°C in Lohagara, whereas the minimum temperature extends from 24.8°C in Patiya/Keranihat (bypass) to 29.9°C in Keranihat (flyover). On the other hand, in winter season, the maximum temperature ranges from 26.9°C in Lohagara to 29.2°C in Patiya, while the minimum temperature varies from 14.8°C in Chakaria to 19.8°C in Keranihat (bypass).

Table 4-2: Temperature at the Bottleneck areas of the CCHIP

Location Code	Season	Temperature (°C)		
		Avg.	Max.	Min.
Patiya (AQ1 and AQ2)	Monsoon	28.6	32.3	24.8
	Winter	25.5	29.2	18.0
Dohazari (AQ3 and AQ4)	Monsoon	30.3	34.3	25.7
	Winter	24.2	28.7	16.2
Keranihat (flyover) (AQ5 and AQ6)	Monsoon	35.1	35.4	29.9
	Winter	25.3	28.5	19.3
Keranihat (bypass) (AQ7 and AQ8)	Monsoon	29.9	33.7	24.8
	Winter	25.7	28.6	19.8
Lohagara (AQ9 and AQ10)	Monsoon	32.8	36.5	28.2
	Winter	22.2	26.9	15.1
Chakaria (AQ11 and AQ12)	Monsoon	30.2	32.5	26.9
	Winter	23.0	27.4	14.8

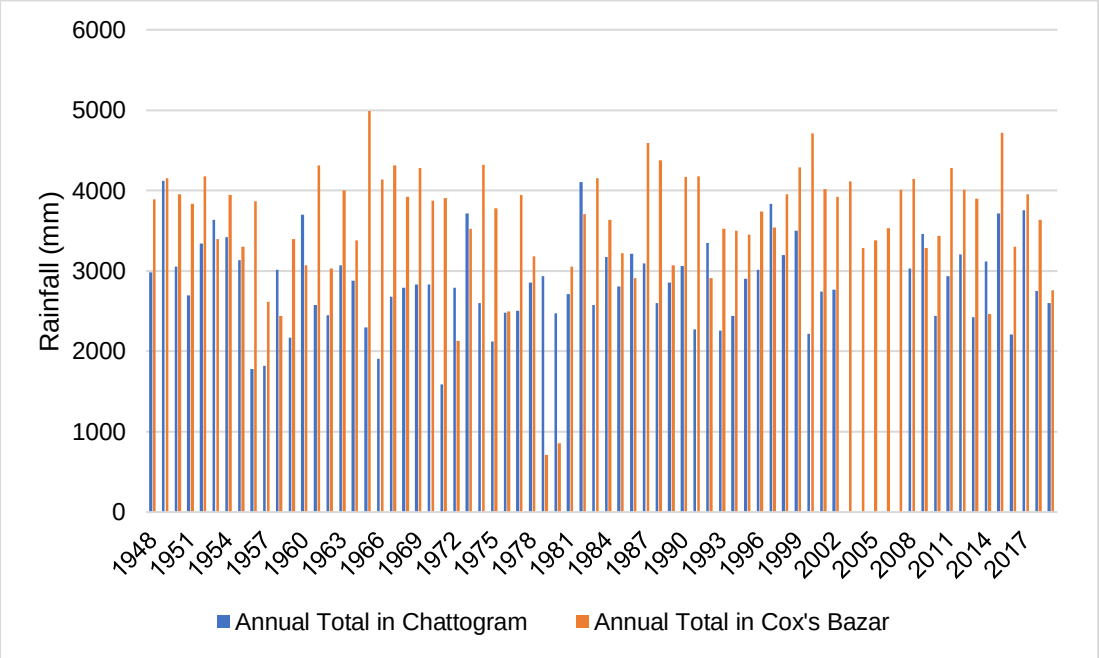
4.2.2 Rainfall

Table 4-2 shows the summary findings of the descriptive statistics and trend analysis of annual total rainfall in Chattogram and Cox's Bazar from 1948 to 2019. The annual mean rainfall in Cox's Bazar is higher than the annual mean rainfall Chattogram by around 26%. The standard deviation reveals that the distribution of annual total rainfall in both Chattogram and Cox's Bazar varies within, which is also indicated by the values of ranges. Unlike temperature, no considerable trend is found in case of rainfall at both stations. The r^2 values found from the trend analysis do not statistically establish any trend of changes over the years. However, the values of annual total rainfall in different years are not homogenous rather discrete that can be perceived from the values of standard deviation and range. **Figure 4-4** shows the graphical representation of annual total rainfall in Chattogram and Cox's Bazar Station from 1948 to 2019.

Table 4-3: Descriptive statistics and trends of rainfall from 1948 to 2019

Station and Parameter	Annual Mean (mm)	Standard Deviation (mm)	Range (mm)	Trend	
				Slope (mm)	r^2
Annual Total Rainfall in Chattogram Station	2859.37	542.21	2538	1.67	0.004
Annual Total Rainfall in Cox's Bazar Station	3609.96	750.71	4272	1.18	0.001

Figure 4-4: Annual Total Rainfall in Chattogram and Cox's Bazar Station from 1948 to 2019



Source: Bangladesh Meteorological Department (BMD)

4.2.3 Wind Speed and Wind Direction

The weather condition of project areas, especially wind speed, and wind direction have been monitored during ambient air quality monitoring for environmental baseline survey. Table 4 18 shows the summary findings of these weather parameters measured by a portable weather station in every bottleneck area during day time.

Table 4-4: Wind Speed and Wind Direction at the Bottleneck areas of the CCHIP

Location Code	Season	Average Wind Speed (m/s)	Wind Direction (Degree)
Patiya (AQ1 and AQ2)	Monsoon	0.55	281
	Winter	0.43	255
Dohazari (AQ3 and AQ4)	Monsoon	1.01	178
	Winter	0.63	175
Keranihat (flyover) (AQ5 and AQ6)	Monsoon	0.79	213
	Winter	0.47	288
Keranihat (bypass) (AQ7 and AQ8)	Monsoon	0.07	264
	Winter	3.75	272
Lohagara (AQ9 and AQ10)	Monsoon	0.79	212
	Winter	0.82	221
Chakaria (AQ11 and AQ12)	Monsoon	0.98	180
	Winter	1.5	288

Findings of wind speed reveal that in Patiya, Dohazari, and Keranihat (flyover) the average wind speed has decreased in winter season than monsoon season. On the other hand, the average wind speed in Keranihat (bypass), Lohagara, and Chakaria has increased in winter season than monsoon season. In monsoon season, the average wind speed varies from 0.07 m/s in Keranihat (bypass) to 1.01 m/s in Dohazari. In winter season, the average wind speed ranges from 0.43 m/s in Patiya to 3.75 m/s in Keranihat (bypass).

4.2.3.1 WR Plot of Patiya Bottleneck

It is observed that in Patiya area, the average wind speed during the monsoon period monitoring was 0.55 m/s. From **Figure 4-5**, it is evident that most of the time, wind direction was from the West to the East. Rest of the time, it was from the WSW and NNW to the ENE and SSE respectively. During monitoring period, wind was blowing almost 54.55% time of the monitoring day and rest of the time wind was calm.

During dry period monitoring, the average wind speed has been found 0.42 m/s. **Figure 4-6** represents that, the wind direction was mostly from the WNW to the ESE. Rest of the time it was from the West to the East and from the WSW to the ENE. During the monitoring period, wind was blowing almost 62.5% time of the monitoring day and rest of the time wind was calm.

Figure 4-5: Wind Direction over Patiya during Air Quality Monitoring Day in monsoon

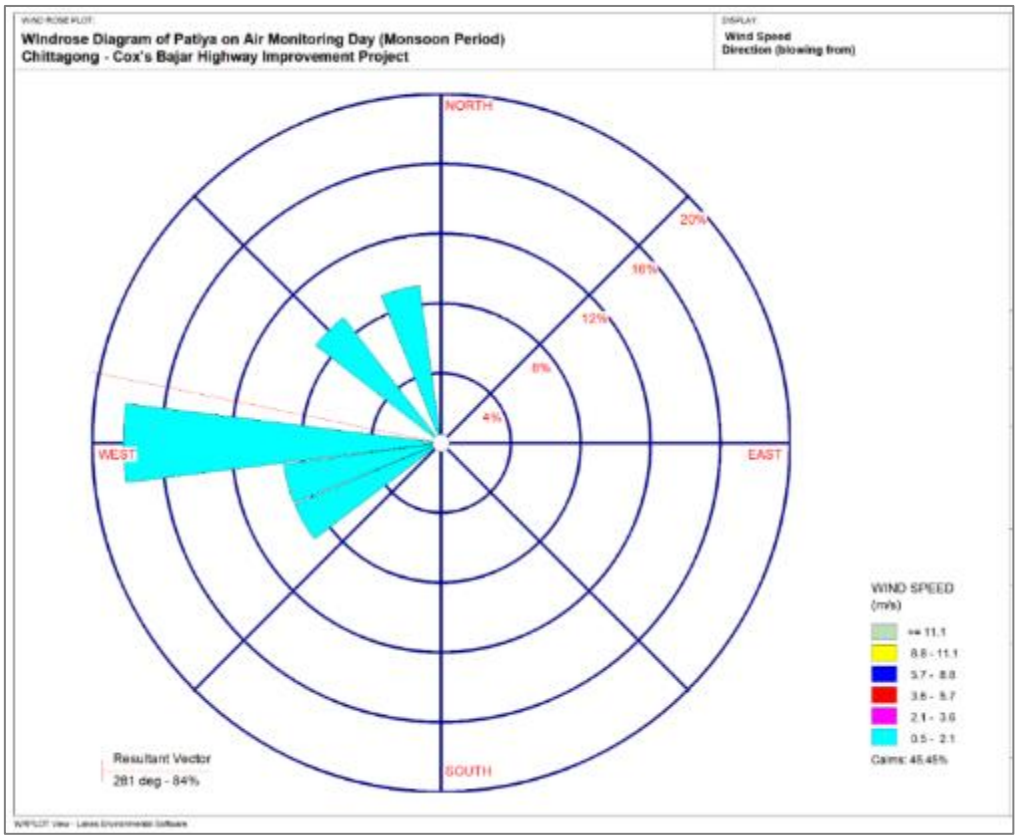
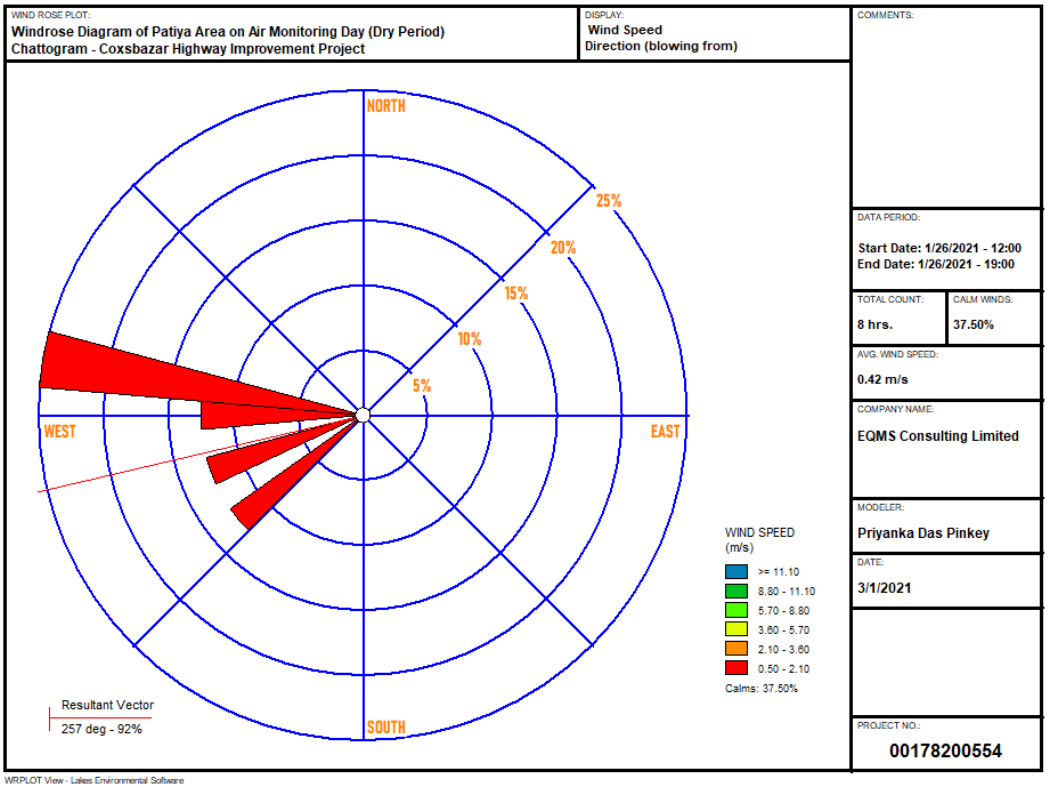


Figure 4-6: Wind Direction over Patiya during Air Quality Monitoring Day in winter season



4.2.3.2 WR Plot of Dohazari Bottleneck

In Dohazari area, the average wind speed was 1.01 m/s during the monsoon period. From the **Figure 4-7**, it has been observed that the wind directions are mostly from the SSW to the NNE area and the rest of the time from the SSE to the NNW area. The average wind speed was 1.01 m/s during dry period. During monitoring period, wind was blowing almost 80% time of the monitoring day and rest of the time wind was calm.

During dry period, the average wind speed at Dohazari area was 0.5 m/s. **Figure 4-8** shows that, the wind directions during dry period was mostly from the SSE to the NNW area. During monitoring period, wind was blowing almost 57.14% time of the monitoring day and rest of the time wind was calm.

Figure 4-7: Wind Direction over Dohazari during Monitoring Day (Monsoon Period)

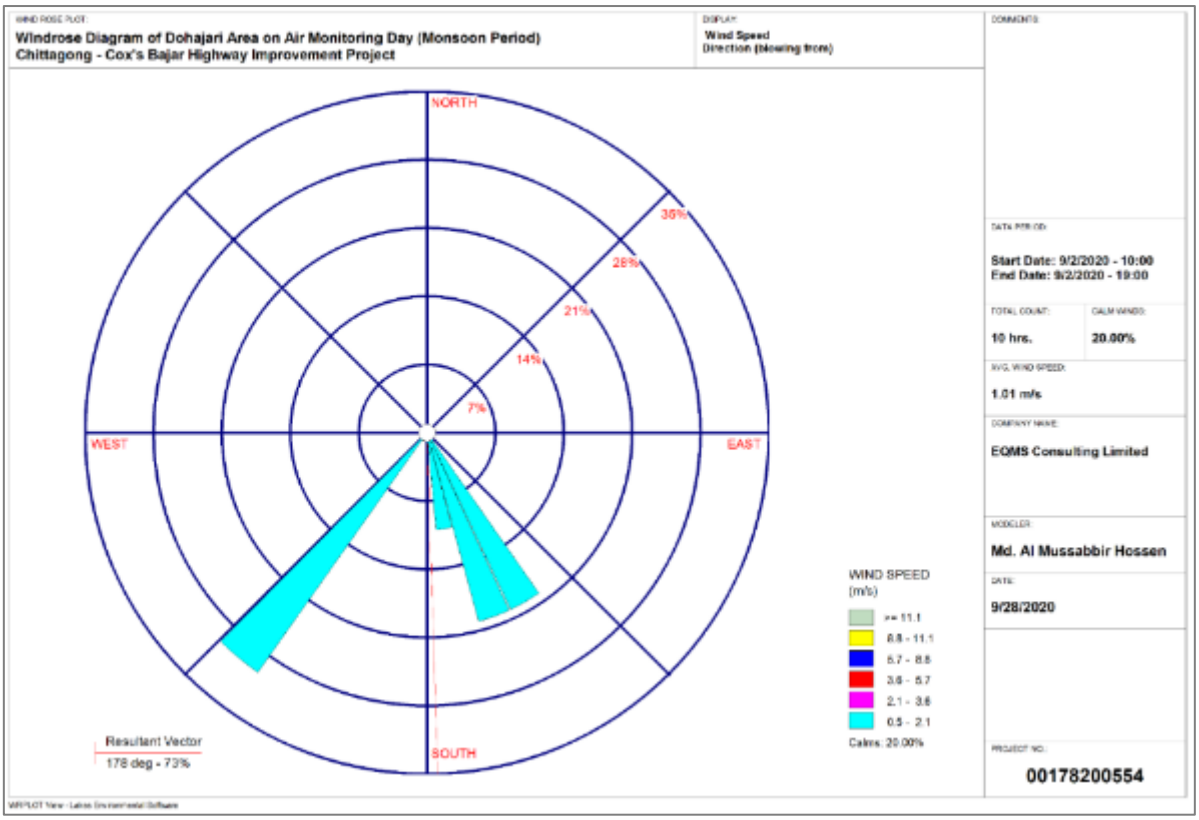
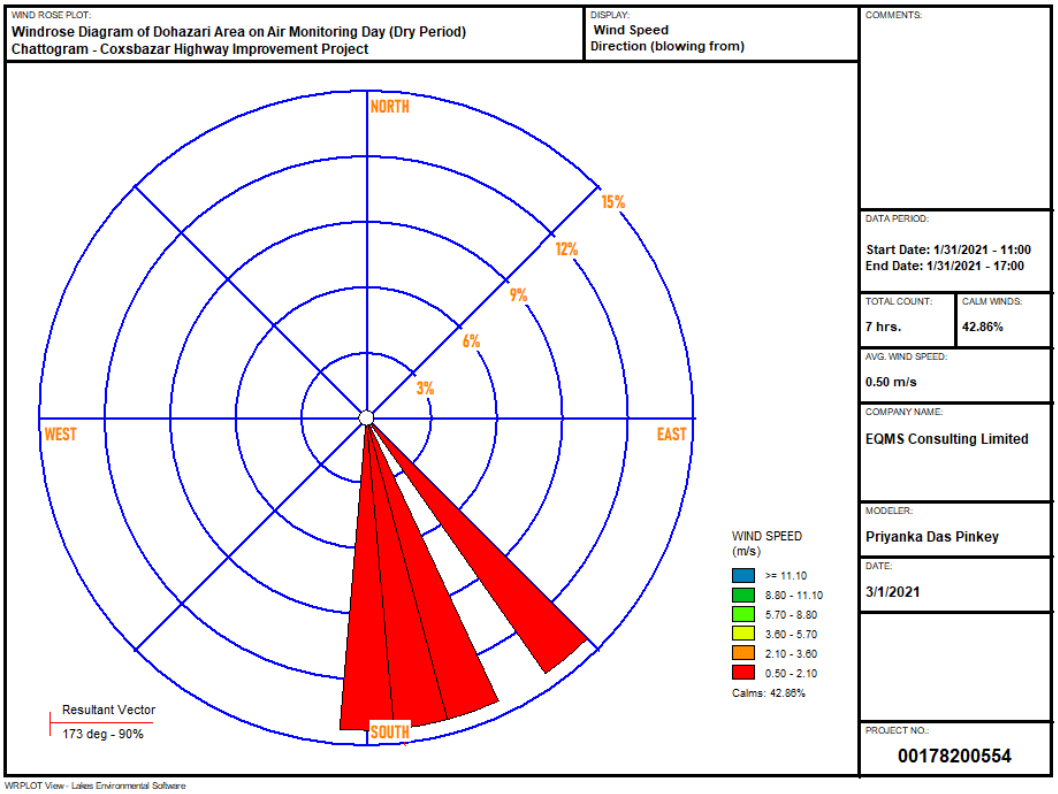


Figure 4-8: Wind Direction over Dohazari during Monitoring Day (Dry Period)



4.2.3.3 WR Plot of Keranihat (Flyover)

Average wind speed of Keranihat FOB area during monsoon period was 0.79 m/s and the wind was blowing whole day from the SSW to the NNE (**Figure 4-9**). During dry period, the average wind speed was 0.35 m/s and wind was blowing mostly from the WNW to ESE and rest of the time are from the WSW to the ENE directions (**Figure 4-10**). During this period, wind was blowing almost 37.5% time of the monitoring day and rest of the time wind was calm.

Figure 4-9: Wind Direction over Keranihat (flyover) Area during Air Quality Monitoring Day (Monsoon Period)

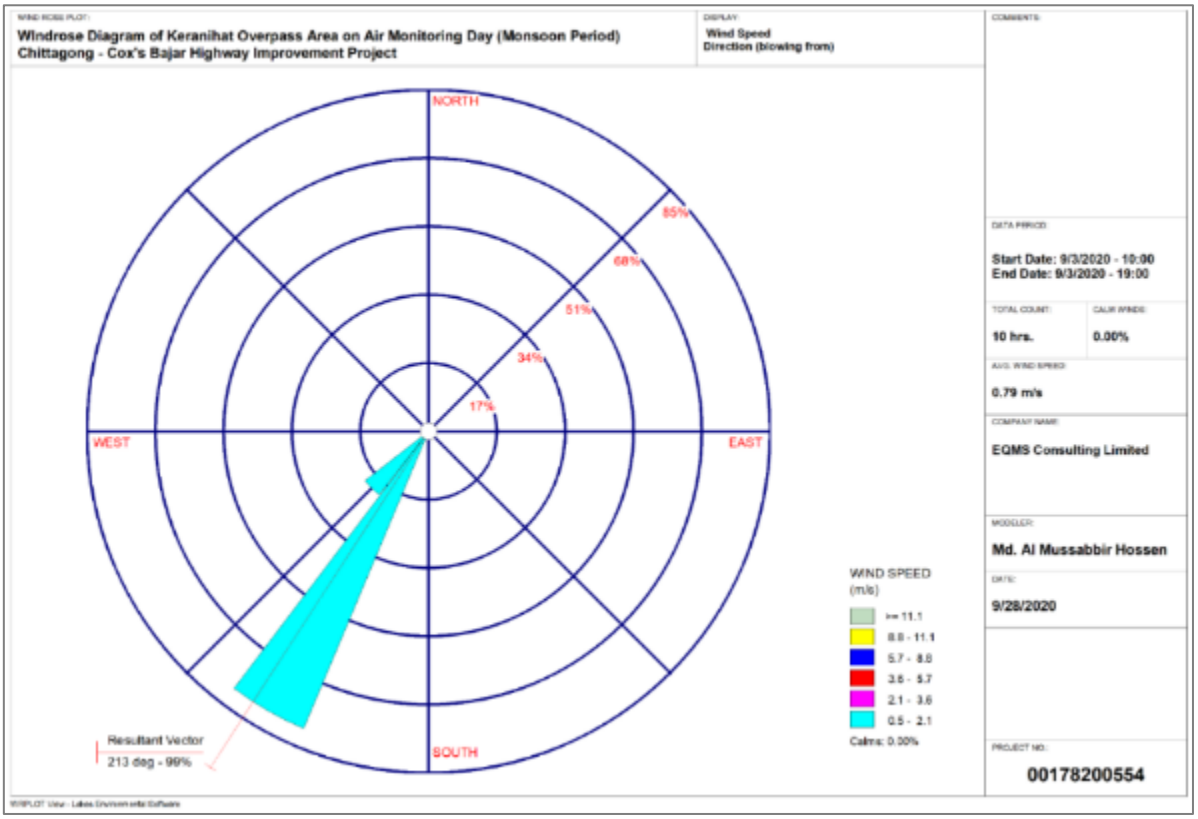
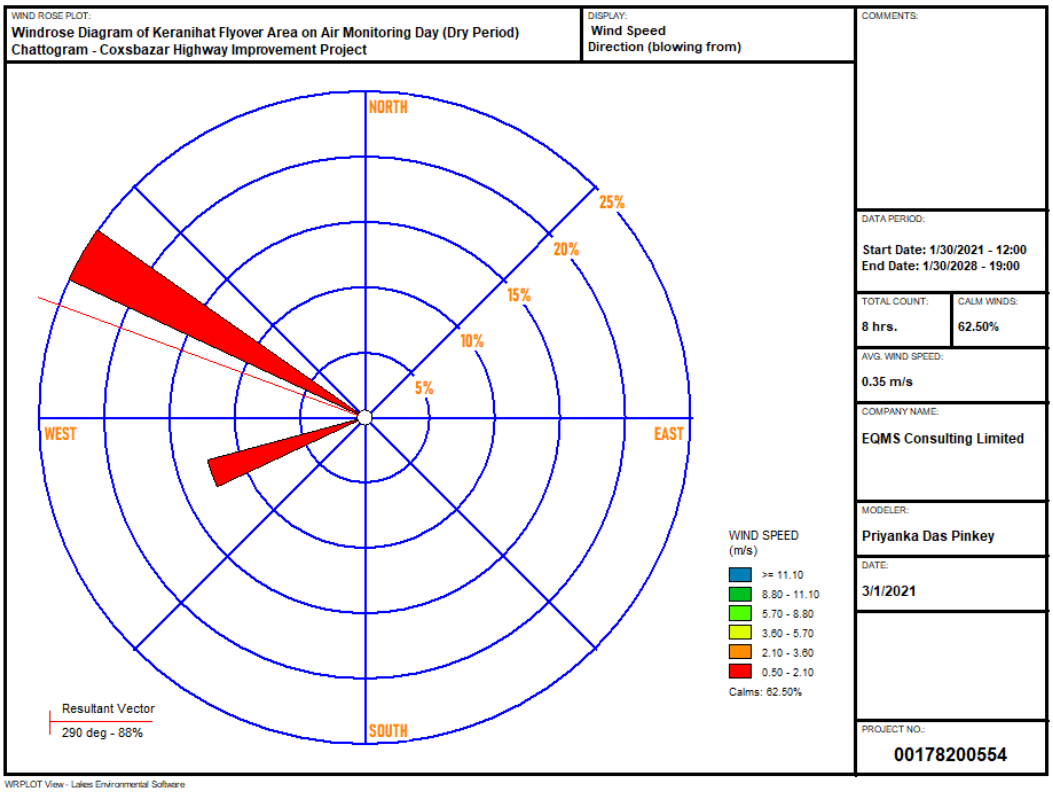


Figure 4-10: Wind Direction over Keranihat Flyover Area (Dry Period)



4.2.3.4 WR Plot of Keranihat (Bypass)

The average wind speed at Keranihat Bypass area during the monsoon period monitoring was about 0.07 m/s and the wind was blowing from the WNW to the ESE area (**Figure 4-11**). Most of the time there was no wind blowing at the area. During this period, wind was blowing almost 9.09% time of the monitoring day and rest of the time wind was calm. In this time the monitoring location was near Keranihat Bypass area which is a bit far from the FOB area and on the Bandarban route. But the pollution sources were same as it is for the FOB area. Though there was drizzling in the morning period. But as the sun rises up, the surfaces were dried up and started to contribute the pollutants in the air. Also, the development work of the Bandarban route was also a big source of pollutants in the air. During dry period monitoring, wind was blowing almost all the day and the average wind speed was about 3.76 m/s. Wind was blowing mostly from the WNW to the ESE direction. Rest of the time, it was blowing from the WSW, SSW and NNW to the ENE, NNE and SSE directions respectively (**Figure 4-12**).

Figure 4-11: Wind Direction over Keranihat Bypass Area (Monsoon Period)

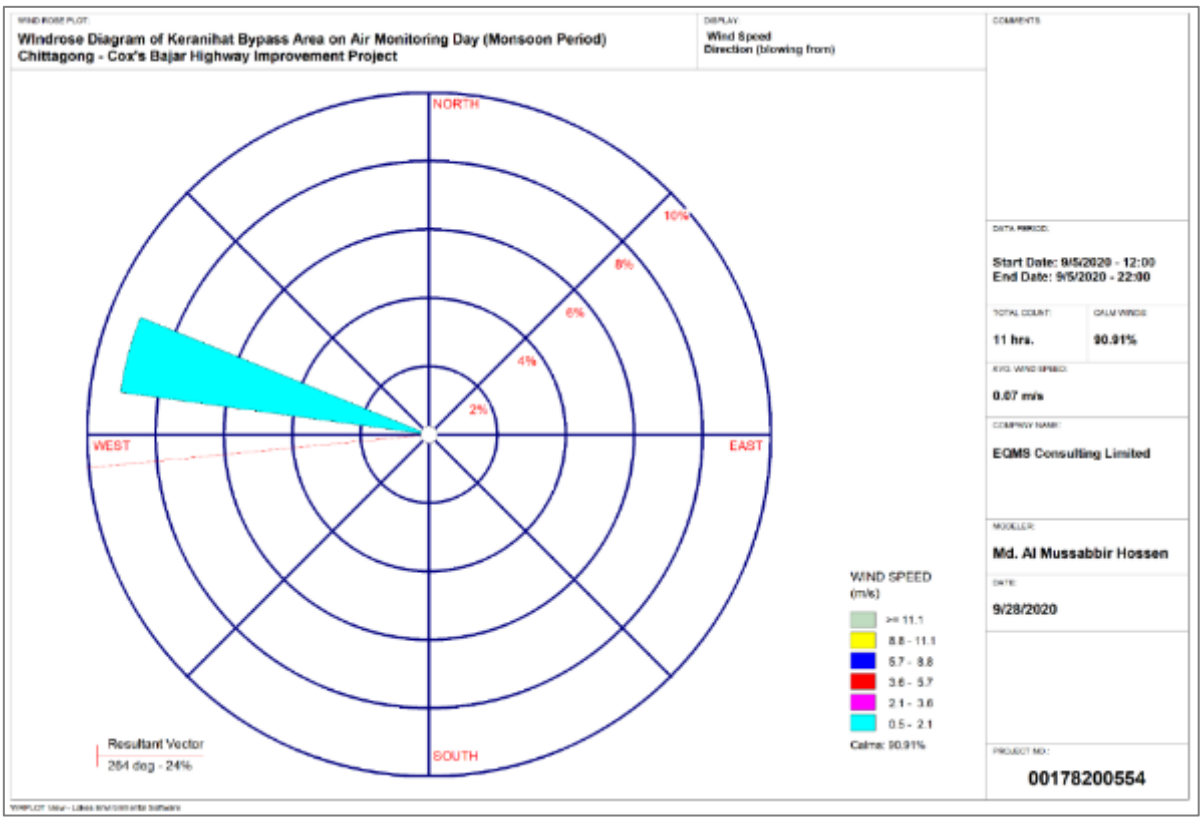
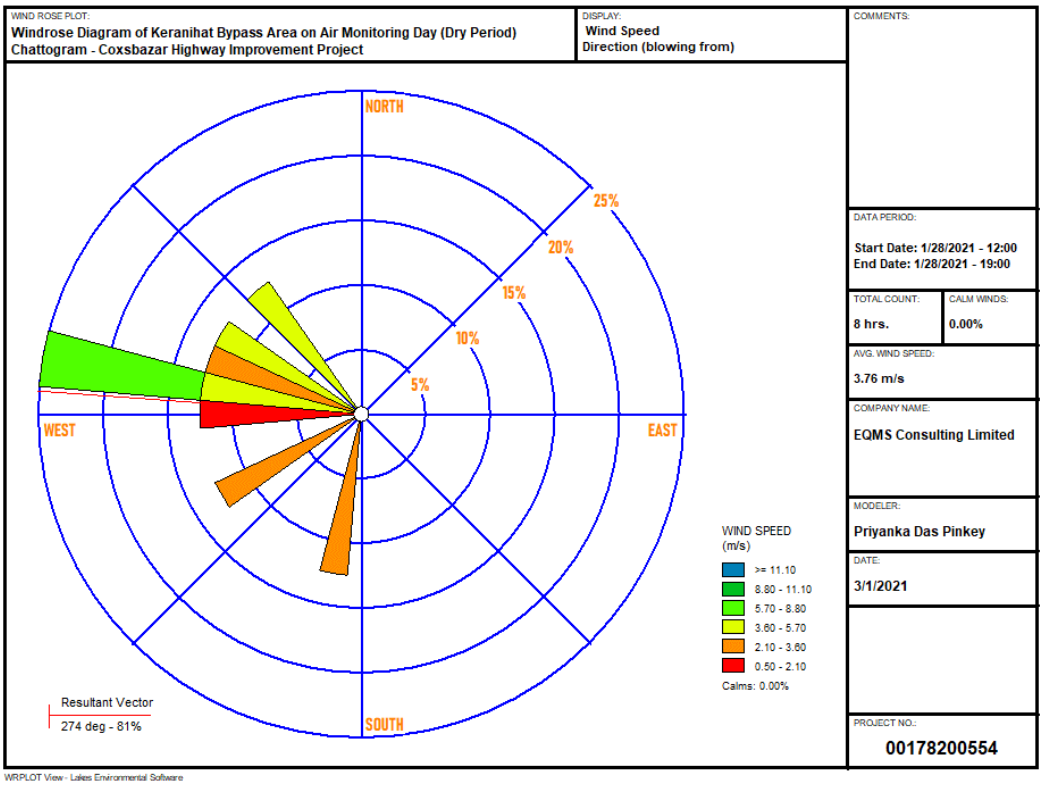


Figure 4-12: Wind Direction over Keranihat Bypass Area (Dry Period Monitoring)



4.2.3.5 WR Plot of Lohagara Bottleneck

During monsoon period, the average wind speed in Lohagara area was about 0.79 m/s. **Figure 4-13** shows that, wind was mostly blowing from the SSW to the NNE direction. Rest of the time wind was blowing from the WSW to the ENE direction. During the monitoring period, most of the time was windy with 66.67% wind blow and rest of the time wind was calm.

During dry period, the average wind speed in Lohagara area was about 0.8 m/s. **Figure 4-14** shows that, most of the time wind was blowing from the SSW to the NNE direction. Rest of the time wind was blowing from the WSW and WNW to the ENE and ESE directions. In the evening, wind was blowing from the ESE to the WNW direction. During monitoring period, most of the time was windy with 87.5% wind blow and rest of the time wind was calm.

Figure 4-13: Wind Direction over Lohagara Area during Monitoring Day (Monsoon Period)

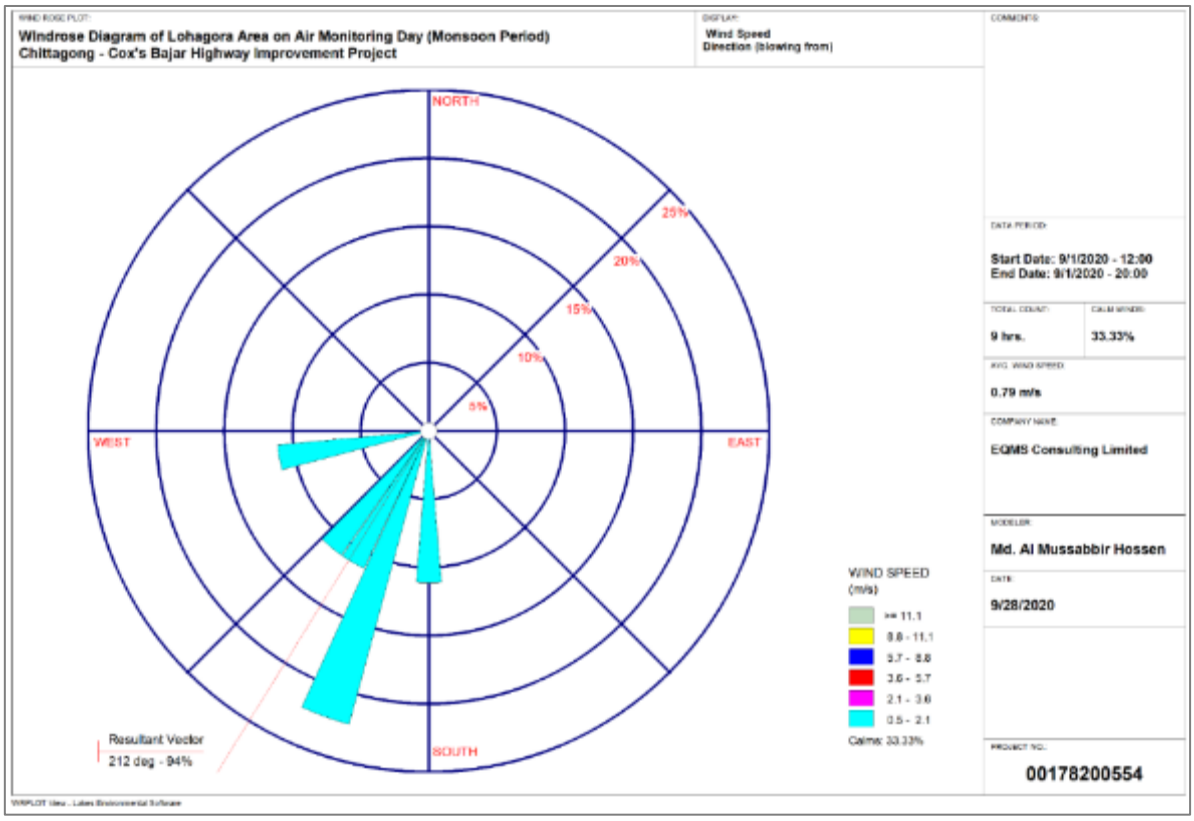
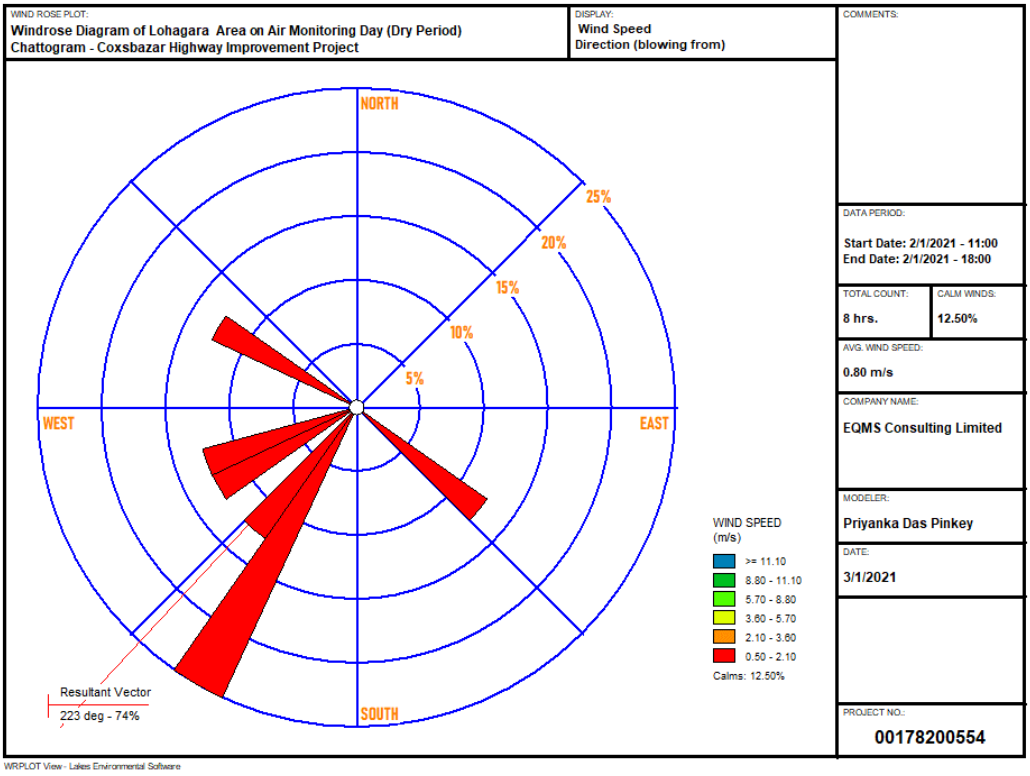


Figure 4-14: Wind Direction over Lohagara Area during Monitoring Day (Dry Period)



4.2.3.6 WR Plot of Chakaria Bottleneck

Average wind speed in Chakaria during the monsoon period was about 0.98 m/s. **Figure 4-15** shows that, wind was mostly blowing from the SSW to the NNE direction. Rest of the time, wind was blowing from the WNW to the ESE direction. During monitoring period, wind was blowing for the 60.00% time of the day and rest of the time wind was calm.

Figure 4-16 shows that, the average wind speed during dry period was 1.51 m/s and wind was mostly blowing from the WNW to the ESE direction. Rest of the wind was blowing from the WSW to the ENE direction. During monitoring period, wind was blowing for the 87.5% time of the day and rest of the time wind was calm. The main sources of the pollutant in this area are the existing commercial settings in Chakaria main town, existing national highway and traffic movement through this, construction activities of the Cross-Border Road Network Improvement Project, Dohazari – Cox's Bazar Railway Line Project, So, all of these sources on the existing national highway were the main sources of the pollutants during the monitoring period.

Figure 4-15: Wind Direction over Chakaria Area during Monitoring Day (Monsoon Period)

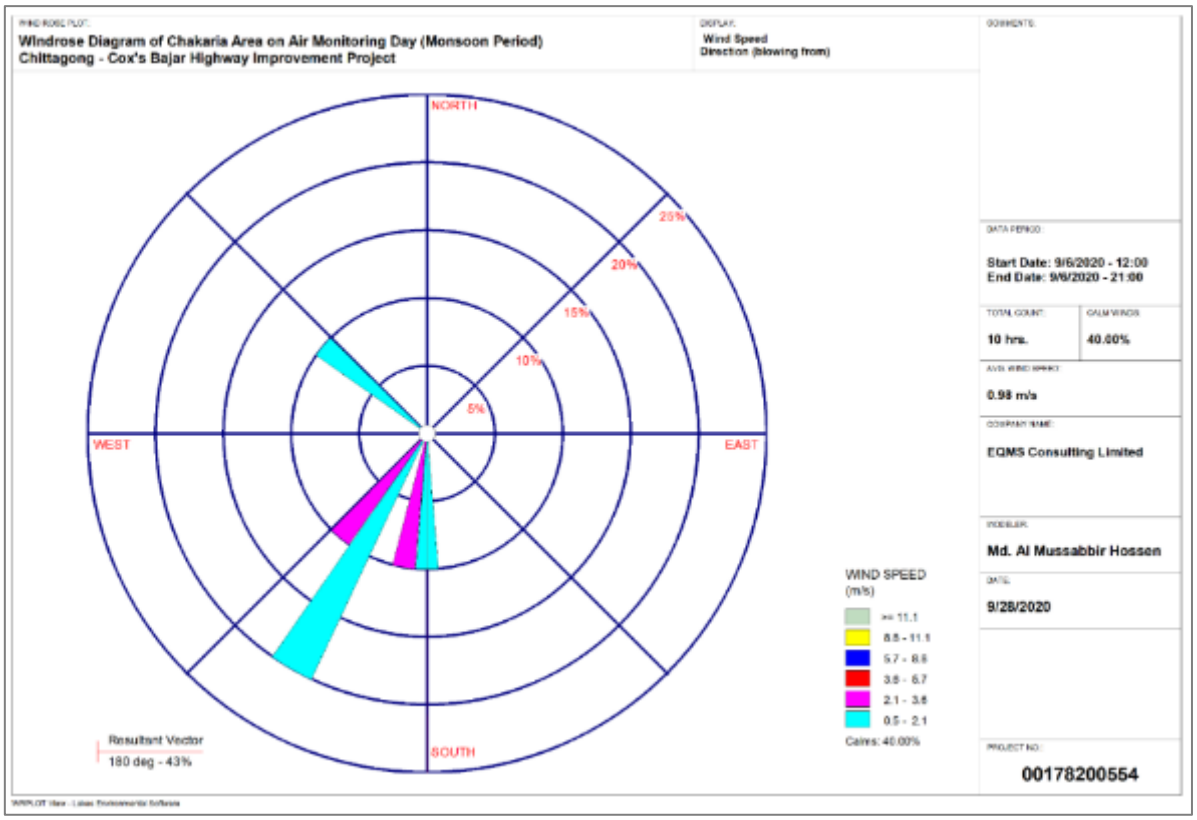
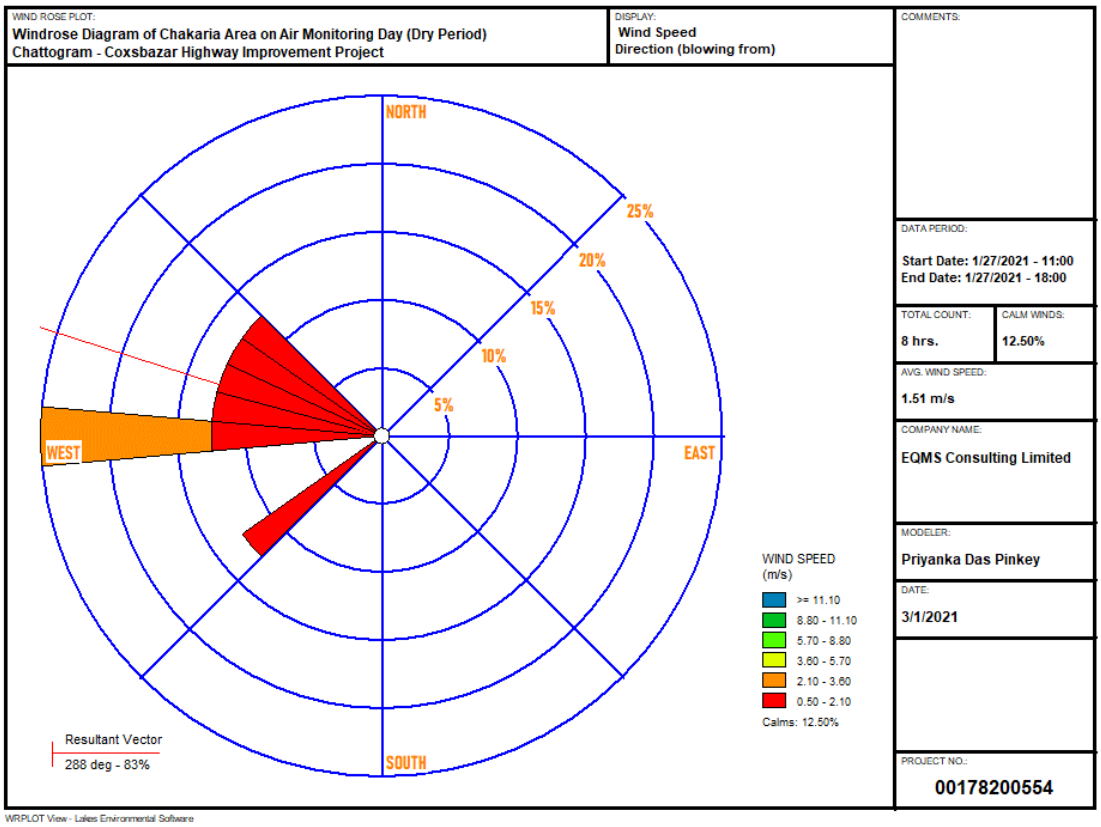


Figure 4-16: Wind Direction over Chakaria Area during Monitoring Day (Dry Period)



Overall WR plot of the CCHIP alignment during monsoon period and dry period are presented in **Figure 4-17** and **Figure 4-18.** It shows that, the average wind speed during the monsoon period and dry period was about 0.69 m/s and 1.24 m/s respectively. During monsoon period, wind was blowing almost 60.66% time of the monitoring day and during the dry period wind was blowing 72.34% time of the monitoring day. Rest of the day wind was calm.

Figure 4-17: Wind Direction over CCHIP during Air Quality Monitoring Days (Monsoon Period)

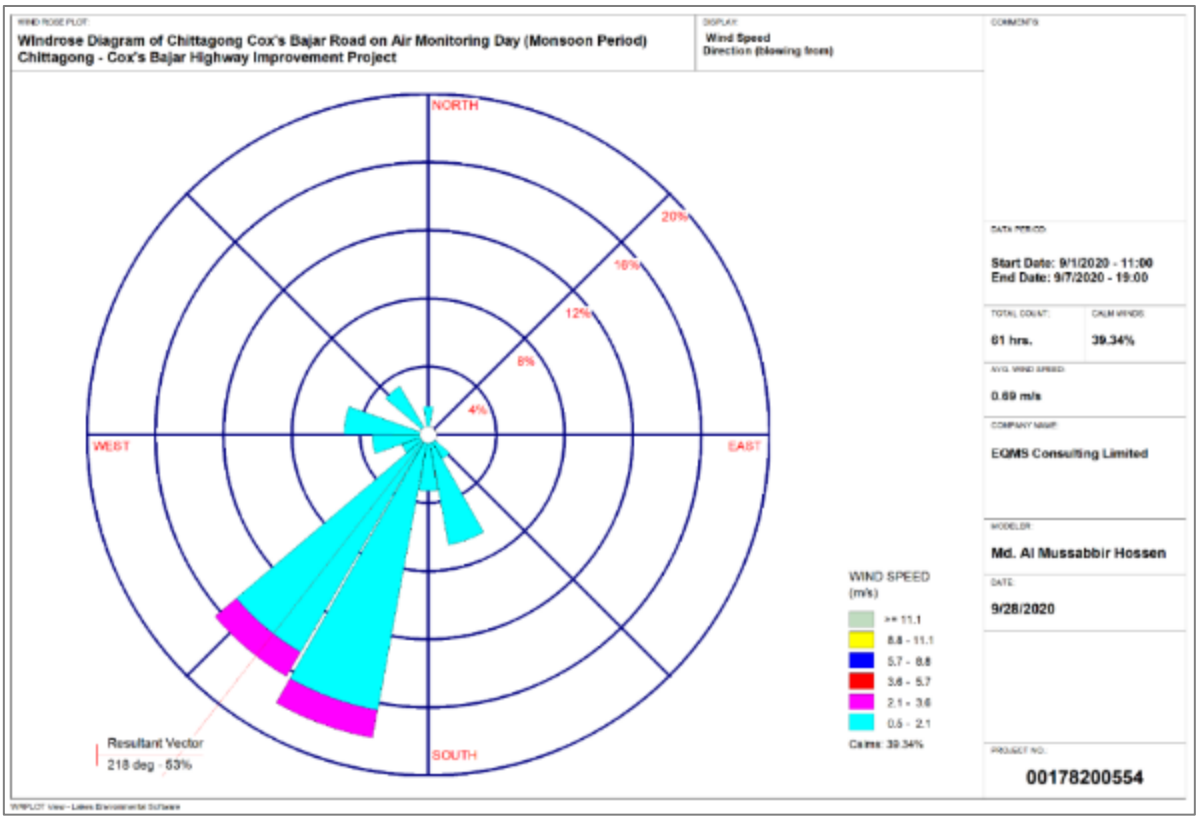
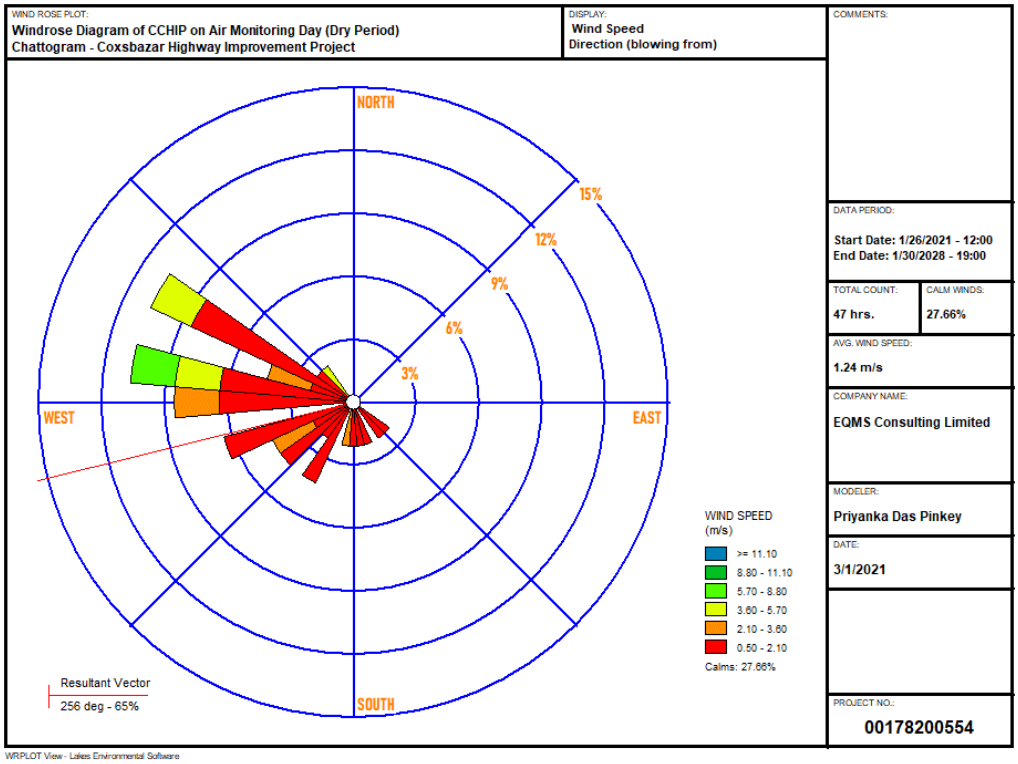


Figure 4-18: Wind Direction over CCHIP during Air Quality Monitoring Days



4.3 Environmental Quality

Environmental quality refers to the existing characteristics of the components of natural environment, e.g., air, water, noise, soil, etc. that have significant impacts on health and standard of living of human. This section intends to present the findings of environmental baseline survey, such as ambient air quality, water quality, and noise level to portray the existing environmental quality of the project areas. The following sub-sections contain the methods, location, and results of baseline monitoring, which was conducted in both wet and dry seasons.

4.3.1 Identification and Mapping of Sensitive Receptors

For EIA, it is important to identify the sensitive receptors in and around the project surroundings. Based on site visit and consultations, following potential sensitive receptors have been identified in the major bottleneck area. A detailed list of sensitive receptors in both major and minor bottleneck area is provided in **Appendix B. Figure 4-19** to **Figure 4-23** shows the sensitive receptors in the major bottleneck area.

Figure 4-19: Sensitive Receptors at Patiya Major Bottleneck

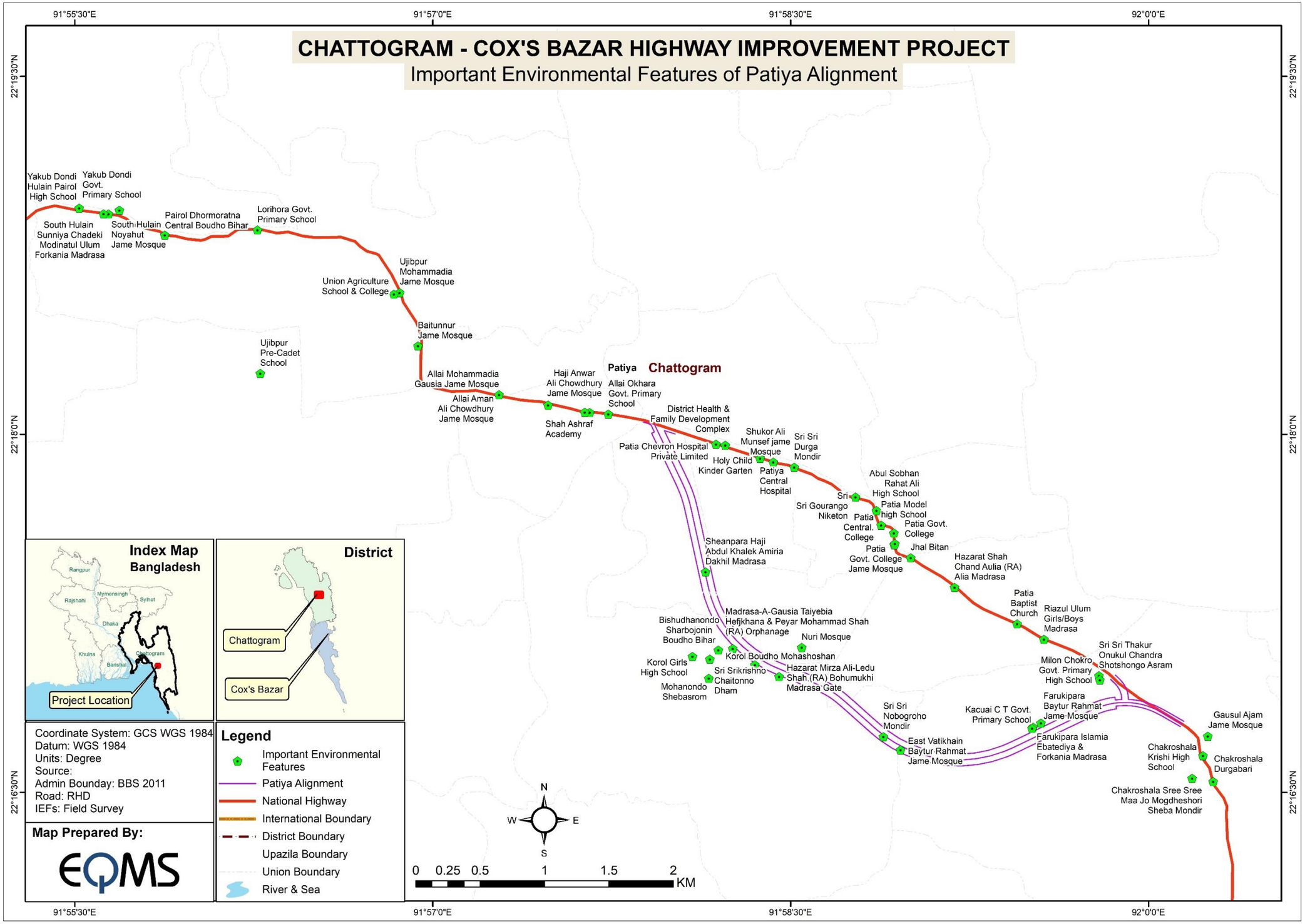


Figure 4-20: Sensitive Receptors at Dohazari Major Bottleneck

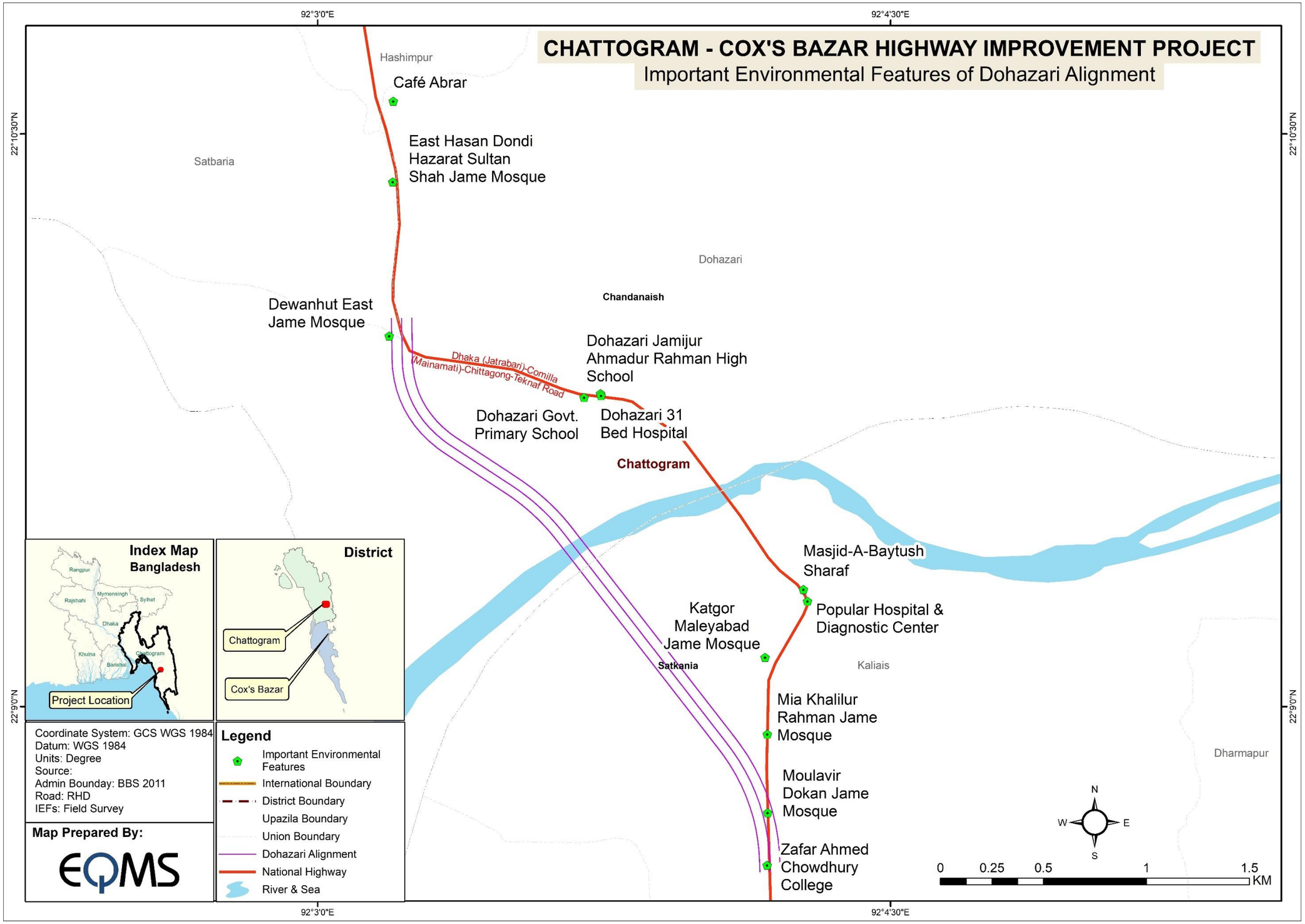


Figure 4-21: Sensitive Receptors at Keranihat Major Bottleneck

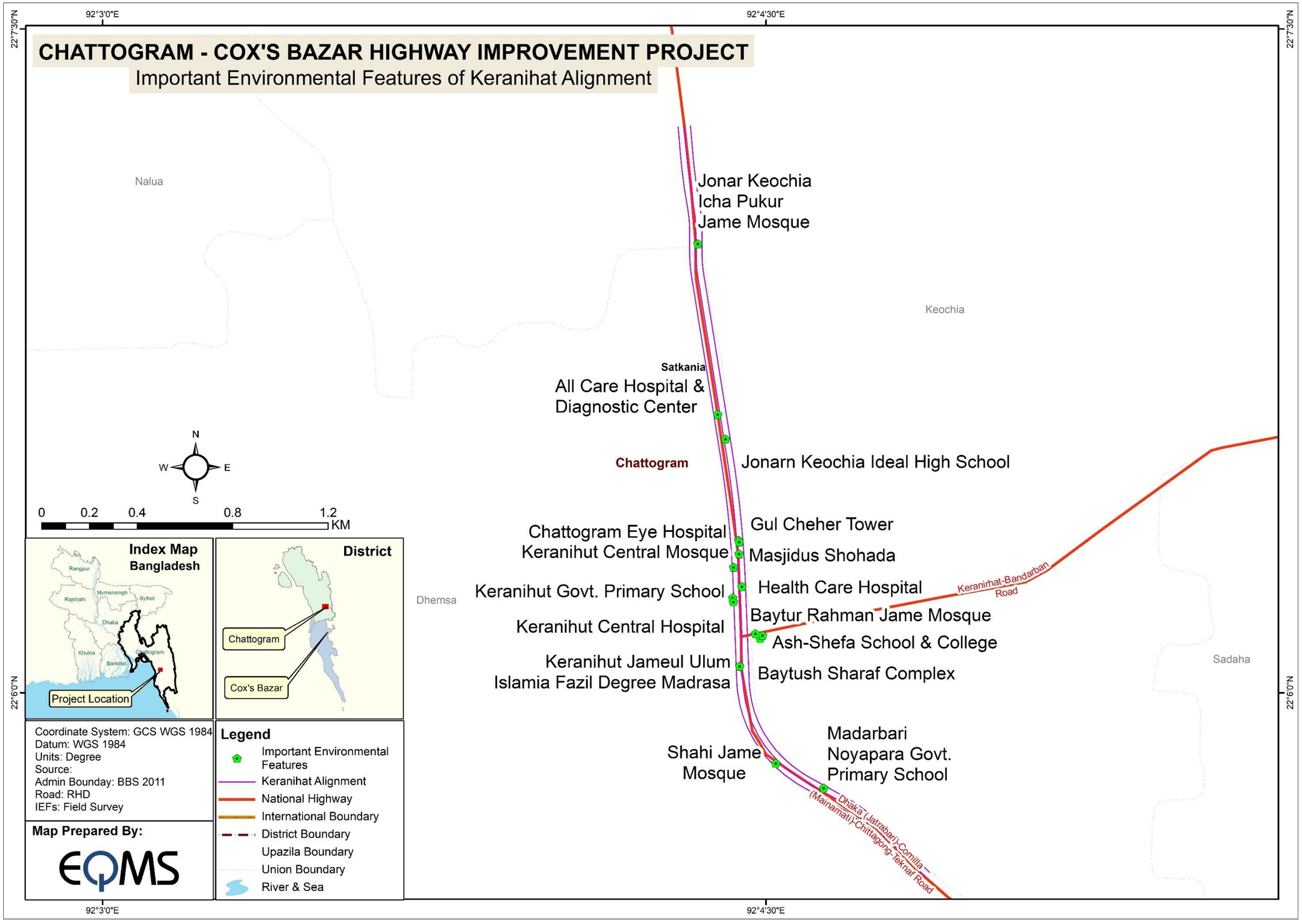


Figure 4-22: Sensitive Receptors at Lohagara Major Bottleneck

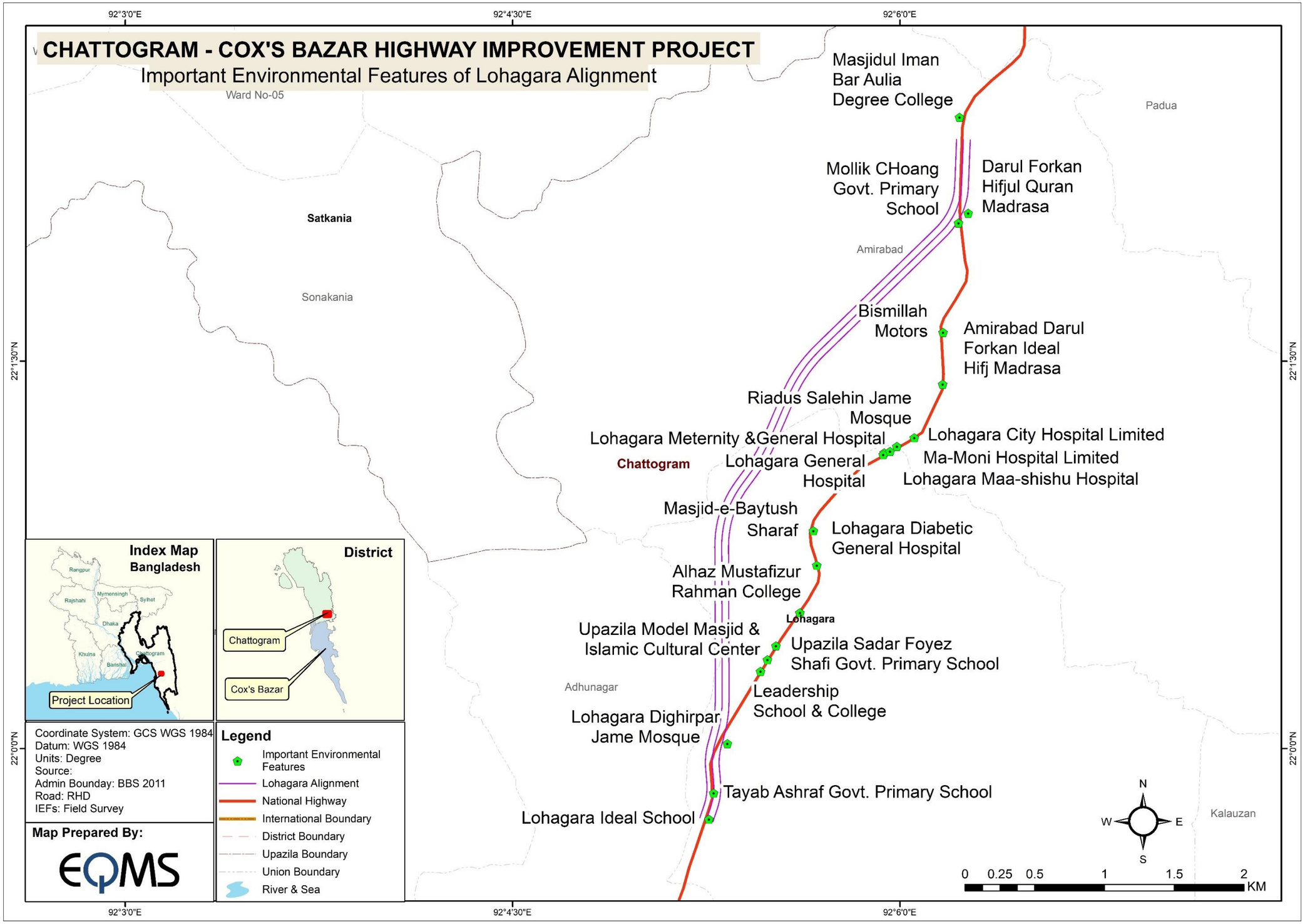
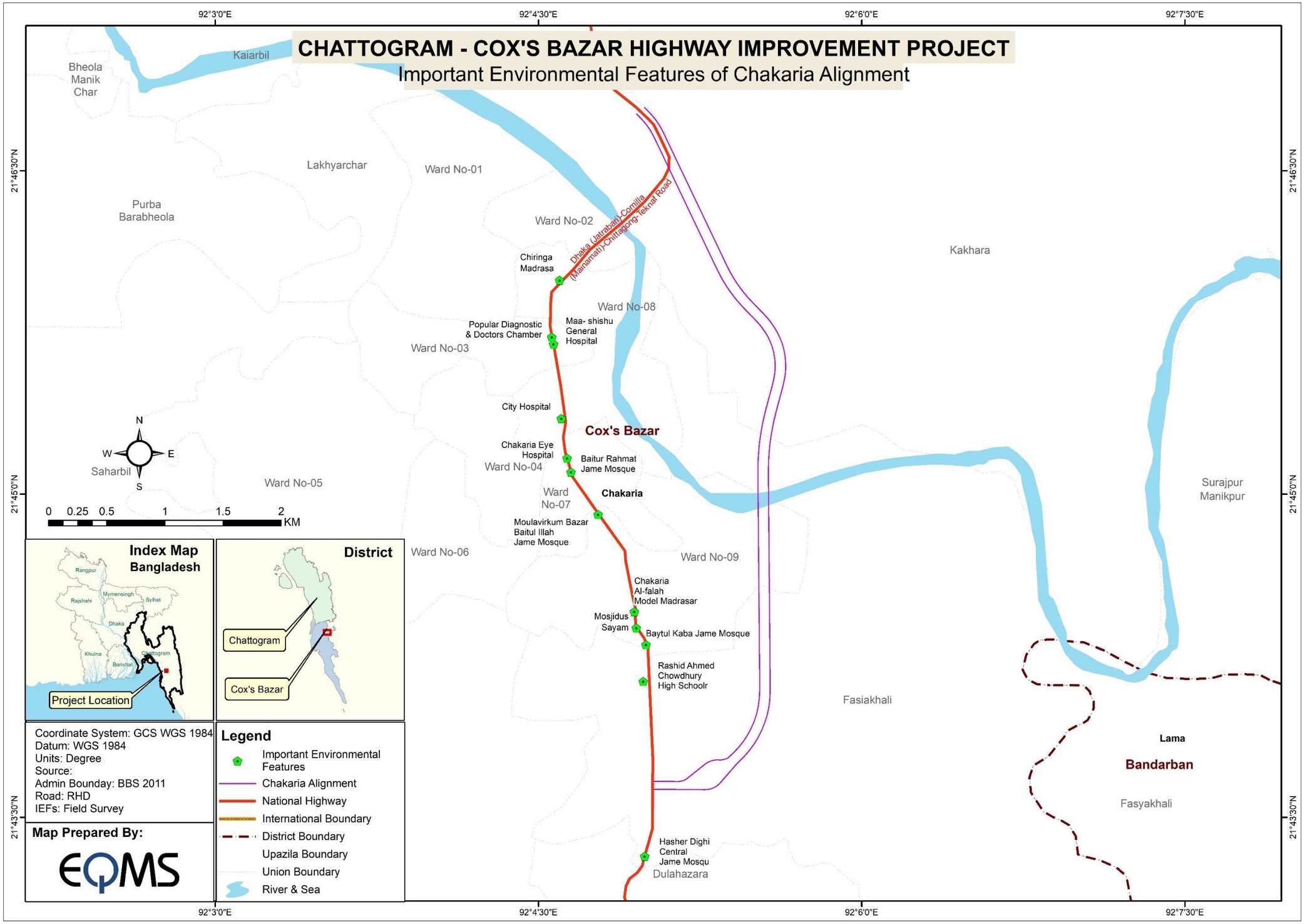


Figure 4-23: Sensitive Receptors at Chakaria Major Bottleneck



4.3.2 Ambient Air Quality

The objective of the ambient air quality monitoring program was to establish the baseline ambient air quality in the study area. Air quality was monitored in both Monsoon season and Winter season.

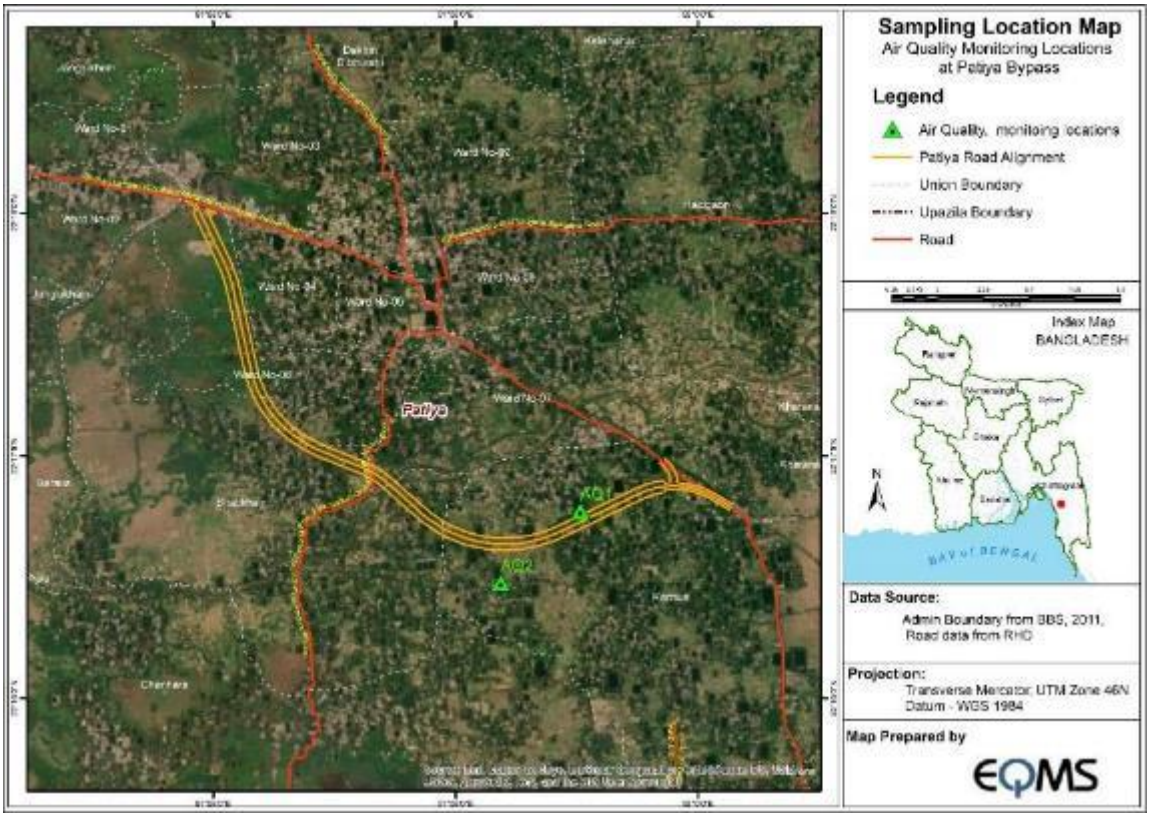
4.3.2.1 Ambient Air Quality Monitoring Locations

Ambient air quality has been monitored in two locations for every bottleneck point. One sampling location has been selected besides existing road alignment to understand the current condition. And another point was selected at 01 km away from the proposed alignment, which was planned to be a rural area. However, it was not always possible to select exact plan wise location for monitoring due to presence of vegetation as air quality sampling requires an open place without tree shade. Therefore, considering the on-field situations an open place was selected nearer to local LGED road for second monitoring location. In total, 12 monitoring locations have been selected for air quality sampling at five outer road alignments in Patiya, Dohazari, Keranihat, Lohagara, and Chakaria as well as one flyover alignment in Keranihat. **Table 4-5** shows the details of air quality sampling locations. **Figure 4-24** to **Figure 4-28** shows the monitoring locations map of ambient air quality. Photographs of the air quality monitoring area given in **Appendix C-1** and **Appendix C-2**.

Table 4-5: Air quality sampling locations

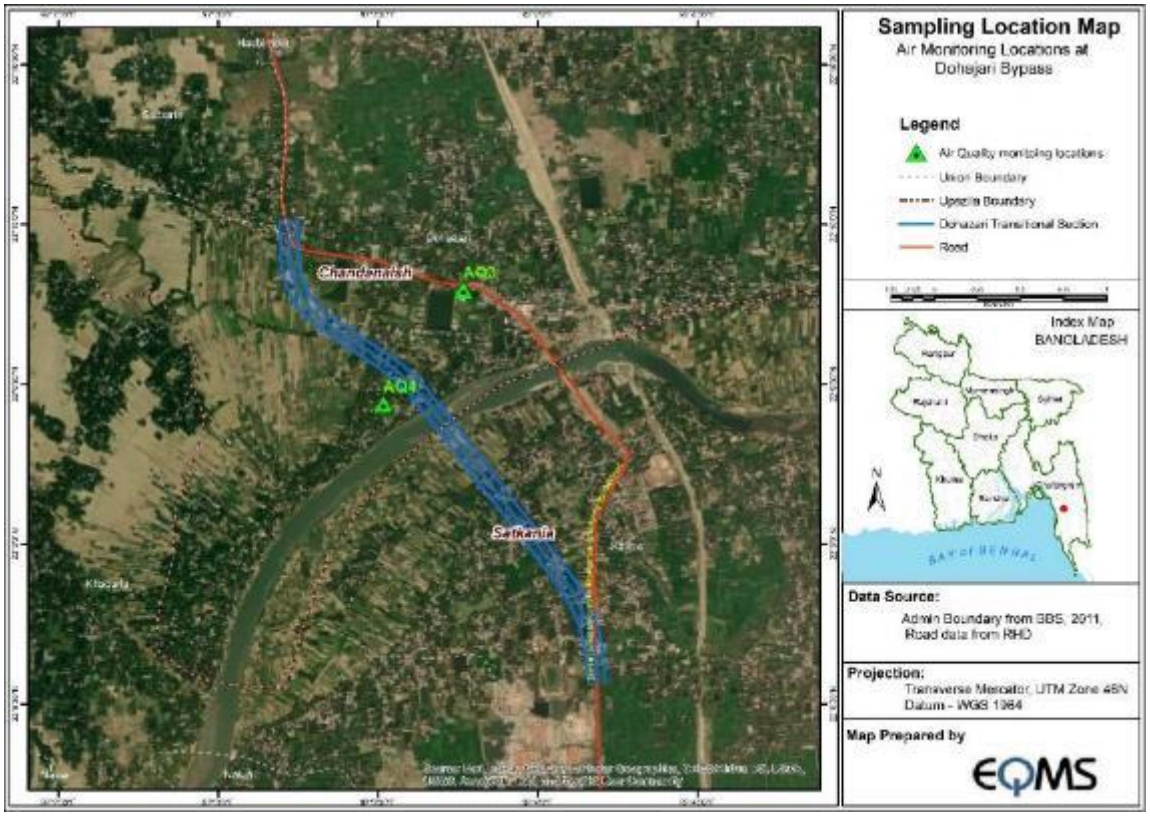
Sl.	Monitoring Locations	Monitoring ID	Coordinates
1.	Air quality monitoring beside existing highway in Patiya	AQ1	22°16'46.33"N 91°59'30.86"E
2.	Air quality monitoring near residential/commercial area of the proposed bypass in Patiya	AQ2	22°16'28.64"N 91°59'11.18"E
3.	Air quality monitoring beside existing highway in Dohazari	AQ3	22° 9'48.58"N 92° 3'44.89"E
4.	Air quality monitoring near the proposed bypass area in Dohazari	AQ4	22° 9'26.24"N 92° 3'31.67"E
5.	Air quality monitoring beside existing highway at proposed FOB area in Keranihat	AQ5	22° 6'18.36"N 92° 4'25.98"E
6.	Air quality monitoring near residential/commercial area at proposed FOB area in Keranihat	AQ6	22° 5'48.06"N 92° 4'8.93"E
7.	Air quality monitoring near the proposed bypass area in Keranihat	AQ7	22° 6'8.34"N 92° 4'32.77"E
8.	Air quality monitoring near the proposed bypass area in Keranihat	AQ8	22° 6'9.89"N 92° 4'39.78"E
9.	Air quality monitoring beside existing highway in Lohagara	AQ9	22° 1'11.97"N 92° 6'3.51"E
10.	Air quality monitoring near the proposed bypass area in Lohagara	AQ10	22° 1'20.52"N 92° 5'37.81"E
11.	Air quality monitoring near the proposed bypass area in Chakaria	AQ11	21°46'42.88"N 92° 5'1.13"E
12.	Air quality monitoring near existing highway in Chakaria	AQ12	21°44'6.09"N 92° 5'1.35"E

Figure 4-24: Air quality monitoring locations in Patiya



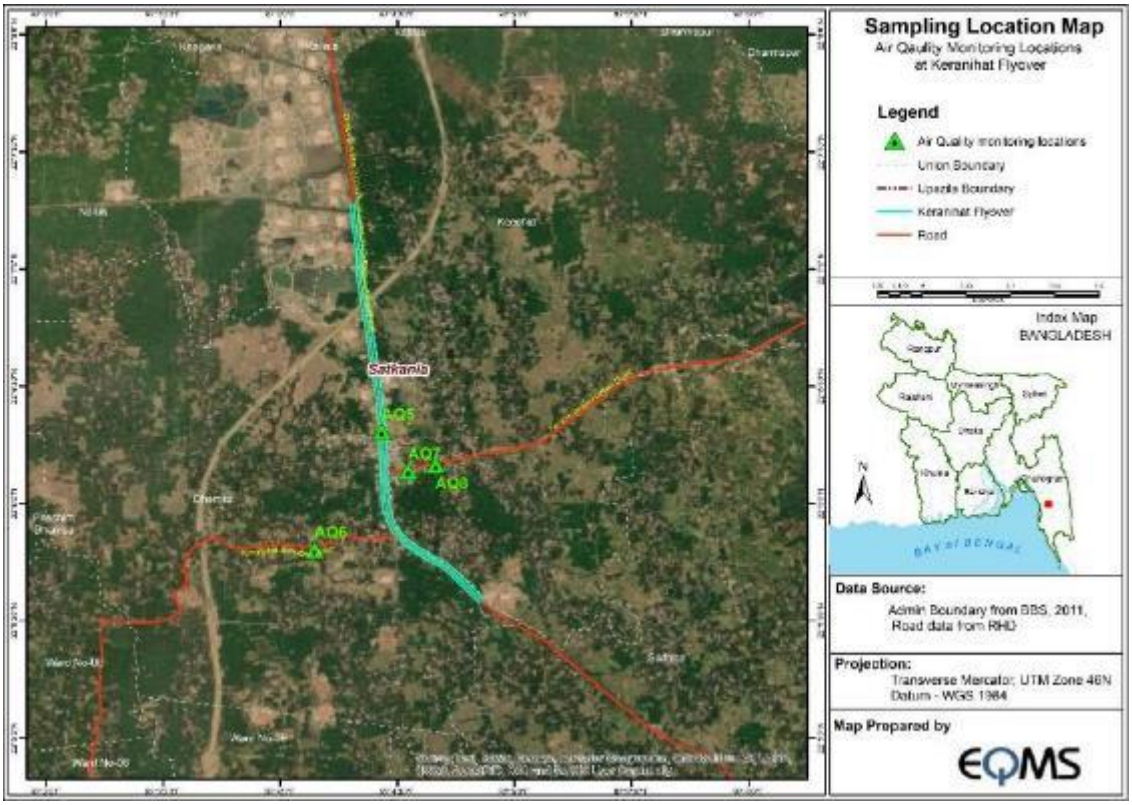
Source: Field Survey by EQMS, September 2020

Figure 4-25: Air quality monitoring locations in Dohazari



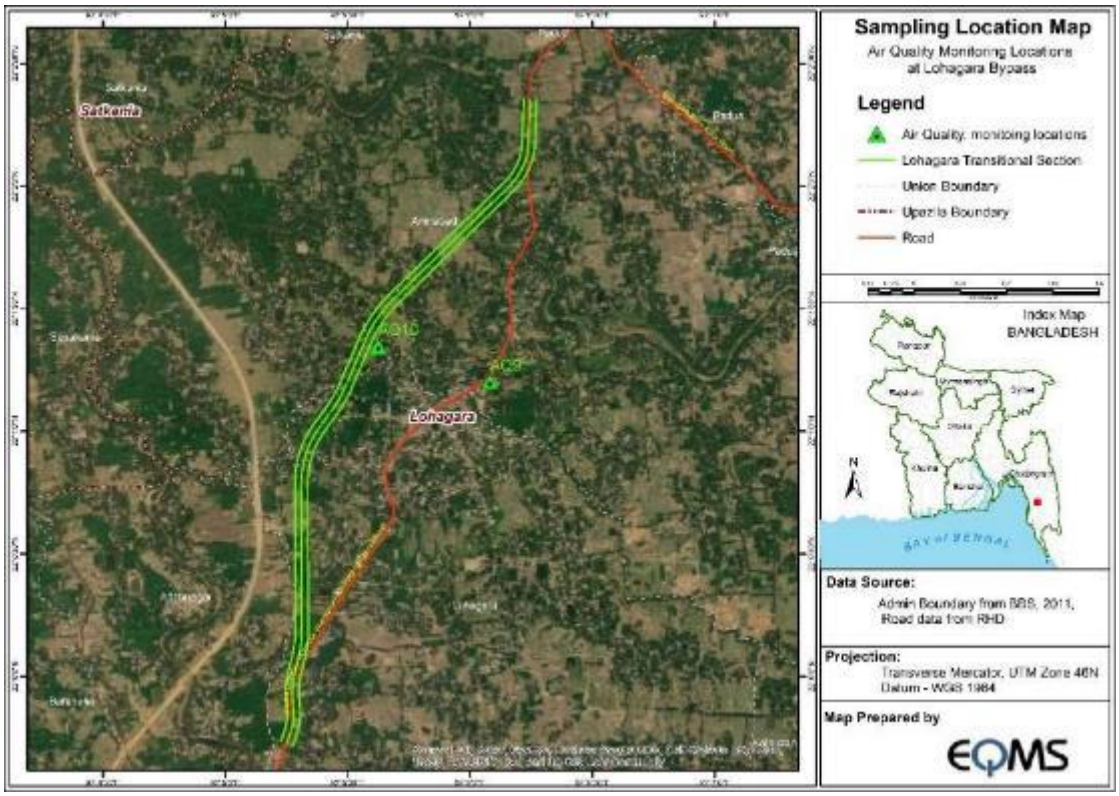
Source: Field Survey by EQMS, September 2020

Figure 4-26: Air quality monitoring locations in Keranihat



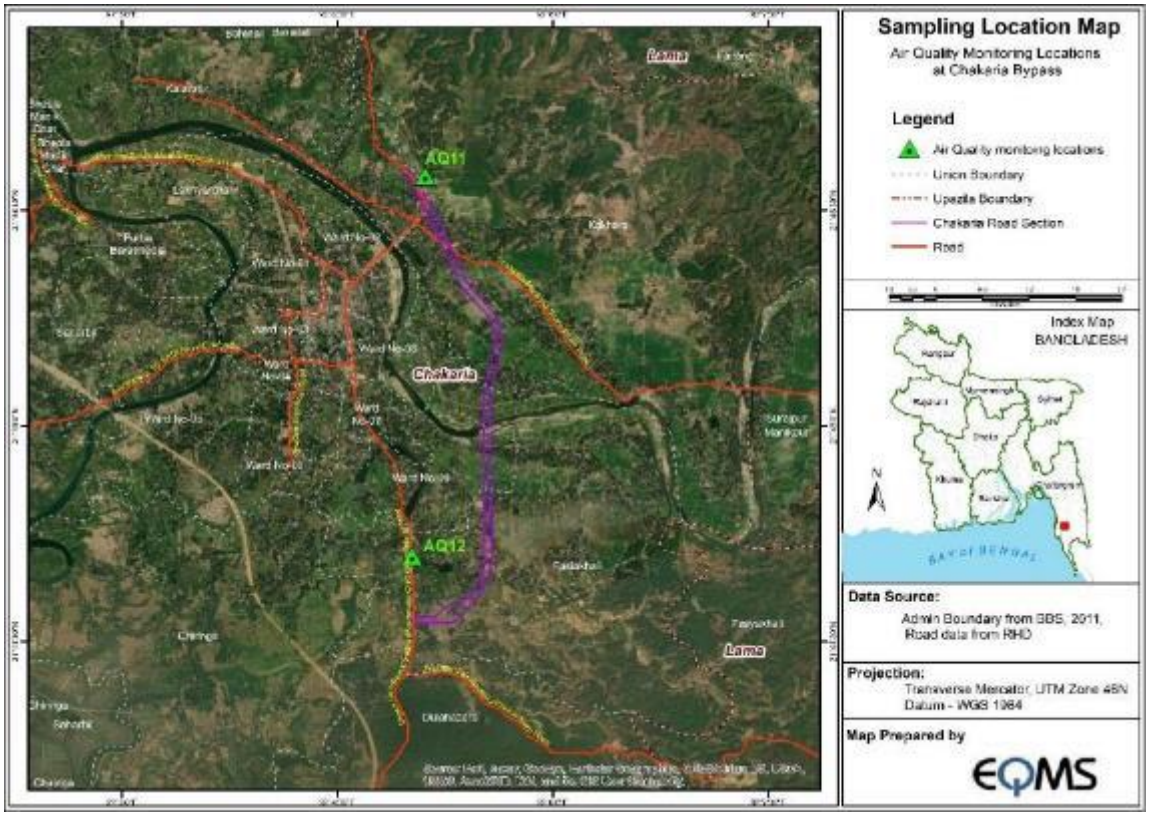
Source: Field Survey by EQMS, September 2020

Figure 4-27: Air quality monitoring locations in Lohagara



Source: Field Survey by EQMS, September 2020

Figure 4-28: Air quality monitoring locations in Chakaria



Source: Field Survey by EQMS, September 2020

4.3.2.2 Methods

The ambient air quality was monitored for 08 hours at every location during day time. The portable wireless HAZ-SCANNER™ HIM-6000 Hazardous Incident Monitor was used to scan, measure, and document criteria pollutants, including nitrogen dioxide, carbon monoxide, sulfur dioxide, ozone, carbon dioxide, and particulate matter. On the other hand, temperature, wind speed, and wind direction have been measured by AcuRite Weather Station, a portable weather monitoring device. Sampling and analysis of ambient air quality was conducted by following the recommendation of the United States Environmental Protection Agency (USEPA). The Haz-Scanner Environmental Perimeter Air Station (EPAS) have been used to collect ambient air monitoring data. The air quality monitoring device records one reading in every five minutes as well as stores automatically in its memory, which is retrievable later. Several sensing instruments are integrated in the machine, including Particulates 90° Infrared Light Scattering for particulate matter (SPM, PM_{10}, and $PM_{2.5}$) and electrochemical sensors for toxic gaseous substances (CO, NO_2, and SO_2) (**Table 4-6**). Monitoring and analysis of ambient air quality was conducted by referring to the recommendation of the United States Environmental Protection Agency (USEPA).

Table 4-6: Particulars of air quality and weather monitoring system

Parameter	Machine	Methods of Testing	Sensors
$PM_{2.5}$	Hazz Scanner HIM 6000	On Site Recording	Light Scattering Nephotometer
PM_{10}	Hazz Scanner HIM 6000	On Site Recording	Light Scattering Nephotometer

Parameter	Machine	Methods of Testing	Sensors
Nitrogen-di-oxide	Hazz Scanner HIM 6000	On Site Recording	High Sensitivity Electrochemical
Sulfur dioxide (SO_2)	Hazz Scanner HIM 6000	On Site Recording	High Sensitivity Electrochemical
Carbon monoxide (CO)	Hazz Scanner HIM 6000	On Site Recording	High Sensitivity Electrochemical
Temperature	Acurite Weather Station	On Site Recording	Solar Panel Powers for an accurate temperature measurement
Wind Speed	Acurite Weather Station	On Site Recording	High Speed Anemometer with Dual Precision Bearing
Wind Direction	Acurite Weather Station	On Site Recording	Optical Sensors for Tracking the Wind Direction

As per the national standard, CO was monitored for 8 hours to compare with the national standard. For PM10, PM2.5 and SO_2, the standard duration is 24-hour data whereas the standard duration for NOx is annual. The Hazz scanner HIM 6000 was operated for 8 hours in peak traffic time in week day (mostly from 10.00 am to 6.00 pm) and a conversion equation (given below) was used to convert the data from specific time period to expected time period. Many agencies (e.g. New York State Dept. of Environmental Conservation, California Office of Environmental Health Hazards Assessment, USEPA, Ontario Ministry of Environment) used a conversion process by applying Pasqual's (1961) air mass dispersion tables defining six air mass stability classes (**Table 4-7**) and a set of meteorological conditions (**Table 4-8**). Using the simple power law principle Schroeder and Jugloff (2012) described the steps for converting eight-hour readings to 24-hour/annual values (Schroeder & Jugloff, 2012). The stability classes (**Table 4-7**) are related to average wind speed, daytime solar radiation and night-time cloud cover (**Table 4-8**), refining these relationships, was also developed by Pasquill.

Table 4-7: Pasquill-Gifford Air Dispersion Stability Classes and Associated Dispersion Exponents[3]

Stability Class	P	Definition
A	0.5	Very Unstable
B	0.5	Unstable
C	0.333	Slightly Unstable
D	0.2	Neutral
E	0.167	Slightly Stable
F	0.167	Stable

[3] Julie Schroeder and Denis Jugloff (2012), Interpretation of 24-hour sampling data: Development of 24-hour ambient air quality criteria and their use in Ontario, Human Toxicology & Air Standards Section, Standards Development Branch, Ontario Ministry of the Environment, Toronto, ON, Canada

Table 4-8: Meteorological Condition define the P-G Stability Classes

Surface Wind Speed	Day Time Incoming Solar Radiation	Night time Cloud Cover	Surface Wind Speed	Day Time Incoming Solar Radiation	Night time Cloud Cover
m/s	Strong	Moderate	Slight	>50%	<50%
<2	A	A-B	B	E	F
2-3	A-B	B	C	E	F
3-5	B	B-C	C	D	E
5-6	C	C-D	D	D	D
>6	C	D	D	D	D
m/s	Strong	Moderate	Slight	>50%	<50%

Weather data was not recorded during the monitoring period. So, from Bangladesh context, the annual average wind speed in Dhaka area is about <2 m/s. Considering the wind speed, from **Table 4-8** (1st row as the average wind speed in all the area is <2 m/s), the project stability class was calculated as 0.39 (see below):

$$P = \frac{0.5+0.5+0.167}{3}$$

$$= 0.389 \approx 0.39$$

The value of exponential factor is calculated based on the stability class of study area (**Table 4-7**). According to the wind speed and the stability class of the study area is A, B, E, and F. Hence, the value of P will be the average of the respected P values of these stability classes. This suggests a somewhat unstable air mass, resulting in considerable dilution of an eight-hour sample when spread out over a 24-hour period. In order to provide 24-hour averages for the five parameters, the following power-law equation as defined in Schroeder and Jugloff 2012 was applied:

$$\mathbf{C_{long} = C_{short}\ (t_{short}/t_{long})^{p}}$$

Where,

C_{long} = Expected output in specific time period

C_{short} = Outcome during Monitoring Period

t_{short} = Specific time period during monitoring (in minutes)

t_{long} = Expected time period (in minutes)

p = Exponential factor where the value is 0.39

This generalized approach was applied to all data, and the 24-hour/annual averages generated in order to be able to compare Project results to the GoB standards. The equation has been used in many approved EIA report in Bangladesh.

4.3.2.3 Ambient Air Quality Monitoring Results

Ambient air quality has been monitored in two different seasons. Monitoring results of the both seasons are described below:

4.3.2.3.1 Wet/Monsoon Season (2020)

Table 4-9 shows the summary findings of the baseline monitoring of ambient air quality during monsoon season. The study found that the average concentration of PM_{10} in every location varies from 29.63 to 70.05 µg/m^3 with a mean value of 48.5 µg/m^3. The standard deviation (15.5 µg/m^3) suggests that the concentration of PM_{10} along Chattogram-Cox's Bazar Highway varies moderately among the monitoring locations. The lowest concentration is found in Patiya, while the highest concentration is detected in Keranihat (flyover option). The monitoring location of Patiya was a rural area with less concentration of vehicles, whereas the monitoring location of Keranihat was an urban area with more traffic movement. In case of fine particulate matter ($PM_{2.5}$), the average concentration varies from 14.22 µg/m^3 in Patiya to 61.82 µg/m^3 in Keranihat (flyover option). The mean and standard deviation of $PM_{2.5}$ in all locations are 34.2 and 16.1 µg/m^3, respectively, which suggest that the concentration of $PM_{2.5}$ varies moderately among all locations. Both the concentration of PM_{10} and $PM_{2.5}$ did not exceed standard limit in any locations (**Figure 4-29**). The correlation coefficient between the concentration of PM_{10} and $PM_{2.5}$ suggests a strong positive relation (r = 0.96). The findings also suggest that the concentration of particulate matter is comparatively higher in urban locations compared to the values of other locations which are in rural or semi-urban areas. The main sources of particulate matter in study areas includes vehicular emission, traffic movements, burning of solid waste in open space, unpaved road surface, and household combustion. There is no notable industrial emission in and around the study areas.

In addition to particulate matter, the concentration of gaseous substances, e.g., NO_2, SO_2, and CO have also been measured during baseline monitoring of ambient air quality. The results suggest that the level of SO_2 and CO did not exceed national standard level in any locations. On the other hand, there is no standard for NO_2 in Bangladesh legislation. The highest amount of NO_2, SO_2, and CO have been found in Keranihat (flyover option), while the lowest concentration of these gases is found in Dohazari, Patiya, and Dohazari, respectively.

The overall findings indicate that the concentration of air pollutants is higher in Keranihat (flyover option) than any other locations, however, not any pollutants have exceeded the standard limits of Bangladesh ECR-97. The concentration of PM10 at AQ1, AQ2, AQ3, AQ8 and AQ10, along with the concentration of PM2.5 at AQ1 and AQ10 were found within the WHO standard. The concentration of CO was found within the WHO standard at all the location. However, the concentration of NO_2 and SO_2 were exceeded the WHO standard at AQ12 and AQ4, AQ7 & 12 respectively.

Table 4-9: Summary results of ambient air quality testing in monsoon (wet) and winter (dry) season

Monitoring Code	PM_{10}	$PM_{2.5}$	NO_2	SO_2	CO	Temperature (°C)			Average Wind Speed	Wind Direction
	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	PPM	Avg.	Max	Min	m/s	Degree
AQ1 (Wet Season)	29.6	14.2	5.01	23.2	0.02	28.6	32.3	24.8	0.55	281
AQ1 (Dry Season)	31.1	21.0	10.9	30.3	0.08	25.5	29.2	18.0	0.43	255.4
AQ2 (Wet Season)	31.8	21.3	17.0	8.7	0.08	28.6	32.3	24.8	0.55	281
AQ2 (Dry Season)	35.5	24.5	34.1	10.3	0.15	25.5	29.2	18.0	0.43	255.4
AQ3 (Wet Season)	40.0	34.0	2.0	21.0	0.01	30.3	34.3	25.7	1.01	178
AQ3 (Dry Season)	52.6	42.4	26.3	3.8	0.03	24.2	28.7	16.2	0.63	174.9
AQ4 (Wet Season)	69.8	58.8	14.9	45.3	0.06	30.3	34.3	25.7	1.01	178
AQ4 (Dry Season)	72.9	62.1	24.8	51.2	0.25	24.2	28.7	16.2	0.63	174.9
AQ5 (Wet Season)	63.3	47.8	7.2	28.3	0.12	35.1	35.4	29.9	0.79	213
AQ5 (Dry Season)	71.1	50.5	11.9	58.8	0.27	25.3	28.5	19.3	0.47	288
AQ6 (Wet Season)	35.1	20.6	4.9	29.8	0.19	35.1	35.4	29.9	0.79	213
AQ6 (Dry Season)	47.6	32.9	19.3	8.4	0.04	25.3	28.5	19.3	0.47	288
AQ7 (Wet Season)	70.0	61.8	16.8	46.7	0.55	29.9	33.7	24.8	0.07	264
AQ7 (Dry Season)	79.8	64.7	15.5	29.8	0.14	25.7	28.6	19.8	3.75	272.3
AQ8 (Wet Season)	42.8	28.6	8.8	33.6	0.08	29.9	33.7	24.8	0.07	264
AQ8 (Dry Season)	54.1	33.6	17.9	3.6	0.04	25.7	28.6	19.8	3.75	272.3
AQ9 (Wet Season)	61.1	40.3	8.0	19.1	0.17	32.8	36.5	28.2	0.79	212
AQ9 (Dry Season)	73.0	52.3	10.4	36.3	0.18	22.2	26.9	15.1	0.82	221.1
AQ10 (Wet Season)	29.9	12.4	2.4	33.0	0.39	32.8	36.5	28.2	0.79	212
AQ10 (Dry Season)	31.3	23.4	16.5	3.1	0.05	22.2	26.9	15.1	0.82	221.1
AQ11 (Wet Season)	52.8	35.8	4.0	17.9	0.14	30.2	32.5	26.9	0.98	180

Monitoring Code	PM_{10}	$PM_{2.5}$	NO_2	SO_2	CO	Temperature (°C)			Average Wind Speed	Wind Direction
	µg/m³	µg/m³	µg/m³	µg/m³	PPM	Avg.	Max	Min	m/s	Degree
AQ11 (Dry Season)	61.4	41.3	9.1	39.9	0.01	23.0	27.4	14.8	1.5	288
AQ12 (Wet Season)	56.2	34.8	25.3	43.4	0.25	30.2	32.5	26.9	0.98	180
AQ12 (Dry Season)	69.5	44.7	10.1	13.2	0.01	23.0	27.4	14.8	1.5	288
Duration (hours)	24	24	24	24	8	8	8	8	8	8
Weather	Sunny									
Bangladesh Standard[4]	150	65	-	365	9	-	-	-	-	-
WHO Standard	45	15	25	40	10	-	-	-	-	-

[4] The Environment Conservation Rules, 1997 and amendment 2005 (Schedule-2).

4.3.2.3.2 Dry/Winter Season (2020-21)

A second-round air quality monitoring was conducted in winter (dry) season to understand the seasonal variation of ambient air quality in the project areas. **Table 4-9** shows the summary findings of air quality measurement in winter season. The study found that the concentration level of PM_{10} and $PM_{2.5}$ remains within the ECR,97 standard limits in all study locations. But the PM_{10} concentration at AQ1, AQ2 and AQ10 has exceeded the WHO standard. The average concentration of PM_{10} in all locations varies from 31.1 µg/m^3 in Patiya to 79.8 µg/m^3 in Keranihat (flyover option). The mean (56.7 µg/m^3) and standard deviation value (17.6) of the concentration of PM_{10} suggest that the values vary moderately among the monitoring locations. In case of the average concentration of fine particulate matter ($PM_{2.5}$), the value ranges from 21.0 µg/m^3 in Patiya to 64.7 µg/m^3 in Keranihat (flyover option). Although not any values of the concentration of PM2.5 of any locations did not exceed standard limit of ECR'97, but it exceeded the WHO standard at all the locations. The mean (41.1 µg/m^3) and standard deviation (14.6) of $PM_{2.5}$ indicates that there is a moderate fluctuation in the concentrations of $PM_{2.5}$ among all sampling locations. The concentration of PM_{10} and $PM_{2.5}$ is comparatively higher in the monitoring locations situated in urban or semi-urban areas compared to rural locations. The correlation coefficient reveals a very strong positive relations between the concentrations of PM_{10} and $PM_{2.5}$ in all locations (r = 0.95). This validates the testing and results as higher positive correlation between PM_{10} and $PM_{2.5}$ has also been found in many previous studies also[5].

The concentration of SO_2 were found within the standard limit of ECR'97 in all monitoring locations. But it exceeded the WHO standard in AQ4 and AQ5. For NO_2, there is no standard limit in Bangladesh legislation. The concentration of NO2 was found within the WHO standard at all locations except AQ2 and AQ3. The concentration of CO was found within the standards of both ECR'97 and WHO. The highest concentration of NO_2, SO_2, and CO were found in Patiya (34.1 µg/m^3), Keranihat (58.8 µg/m^3), and Keranihat (0.27 ppm), respectively. On the other hand, the lowest concentration NO_2, SO_2, and CO are found in Chakaria (9.1 µg/m^3), Lohagara (3.1), and Chakaria (0.1 ppm), respectively.

4.3.2.3.3 Comparison Between Air Quality in Wet and Dry Season

Ambient air quality has been monitored in two seasons to get a better understanding about the baseline environmental conditions of project areas as the weather pattern influences the level of air quality. **Figure 4-29** shows a graphical presentation of the comparison between the concentration of PM10 and PM2.5 in wet and dry season. The analysis found that the concentration of PM10 has increased in dry season than wet season by 17.1% on average. The highest amount of increment of PM10 has occurred in Keranihat (35.5%) followed by Dohazari (31.5%) than the concentration in wet season. On the other hand, the lowest amount of increment took place in Lohagara (4.8%). In case of PM2.5, the concentration has increased in dry season by 28.5% on average than wet season. The maximum amount of increment has occurred in Lohagara (41.3%) followed by Keranihat (59.7%) than the concentration in wet season. On the other hand, the minimum amount of increment has occurred in Keranihat (flyover option) (4.7%) than wet season. The difference between the concentrations of PM2.5 in Keranihat (AQ7, flyover option) is very less compared to the differences in other locations. This implies that there is a homogeneity of the emission of fine particulate matter in Keranihat all year round.

[5] Munir, S., Habeebullah, T.M., Mohammed, A.M., Morsy, E.A., Rehan, M. and Ali, K. (2017). Analysing PM2.5 and its Association with PM10 and Meteorology in the Arid Climate of Makkah, Saudi Arabia. *Aerosol Air Qual. Res.* 17: 453-464. https://doi.org/10.4209/aaqr.2016.03.0117

Figure 4-29: Comparison between the concentration of PM10 & PM2.5 in wet and dry season

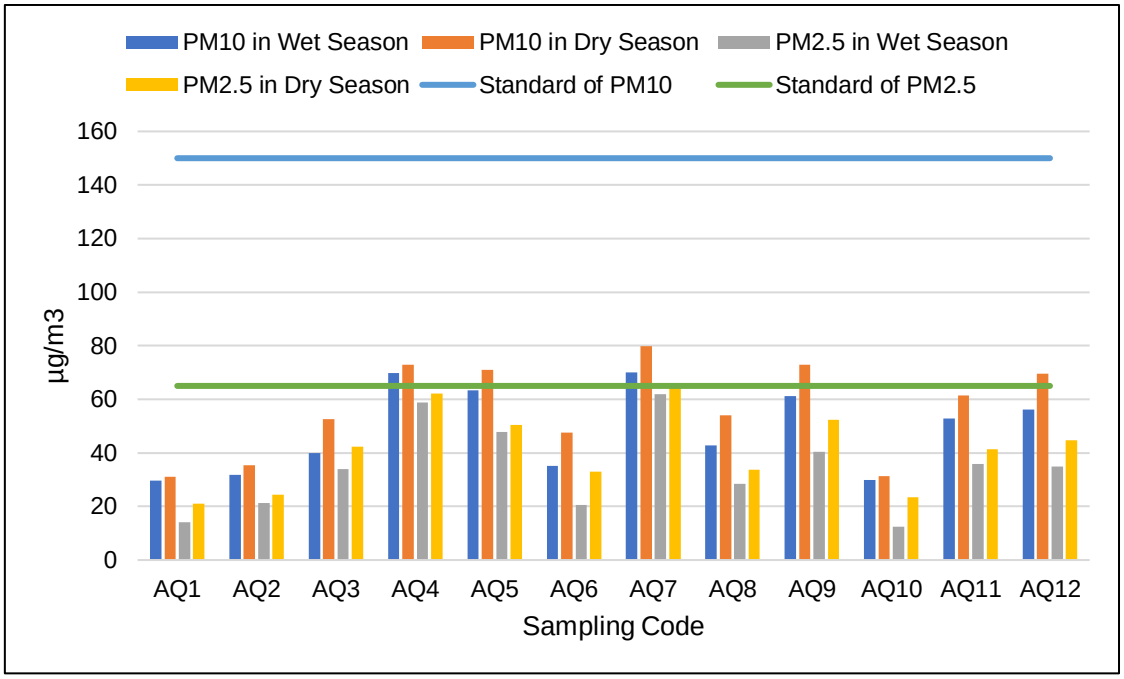


Figure 4-30 shows the comparison between the concentration of NO_2 in wet and dry season. The study found that, unlike the concentration of particulate matter, the concentration of NO_2 in dry season has not increased in all locations, but in most of the locations compared to the concentration in wet season. The highest amount of increment occurred in Dohazari followed by Patiya and Keranihat. On the other hand, in Keranihat (flyover option) and Chakaria (02nd sample of Chakaria), the concentration of NO_2 in dry season has decreased than wet season.

Figure 4-30: Comparison between the concentration of NO_2 in wet and dry season

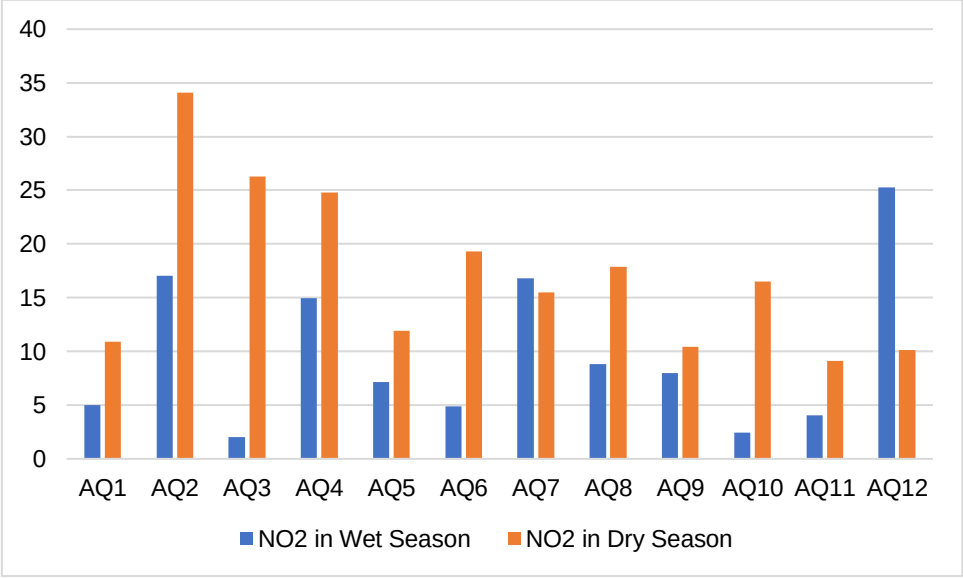


Figure 4-31 shows the comparison between the concentration of SO_2 in wet and dry season in all locations. The findings reveal that in half of the monitoring stations, the concentration of SO2 in dry season has been increased than wet season, whereas the concentration in dry season has been decreased in other locations. **Figure 4-32** shows the comparison between the concentration of CO in wet and dry season in all monitoring stations. Like the concentration of SO2, the concentration of CO in dry season has also been increased in six monitoring locations, while it has been decreased in other

six stations. However, the monitoring location wise increasing and decreasing patter is not similar for both gases. In short, unlike the concentration of particulate matter, the concentration of gaseous substances showed a mixed variations in both seasons.

Figure 4-31: Comparison between the concentration of SO_2 in wet and dry season

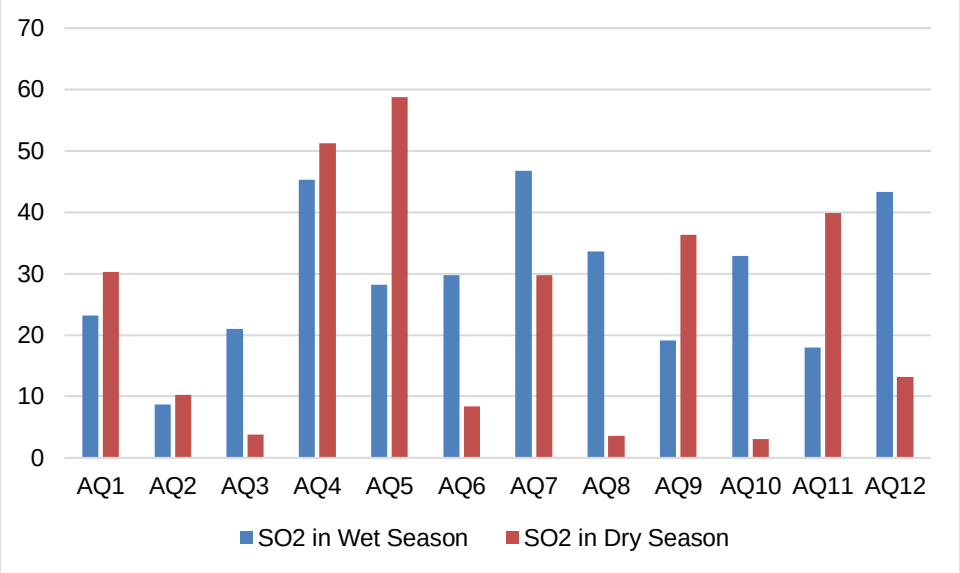
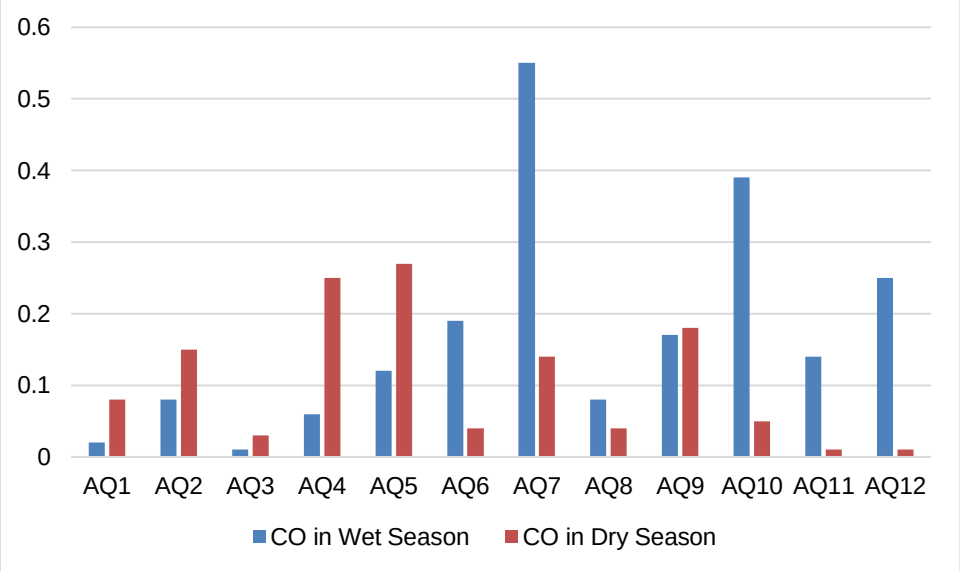


Figure 4-32: Comparison between the concentration of CO in wet and dry season



4.3.3 Noise Level

The objective of the ambient noise level monitoring was to establish the baseline ambient noise level in the project alignment.

4.3.3.1 Noise level Monitoring Location

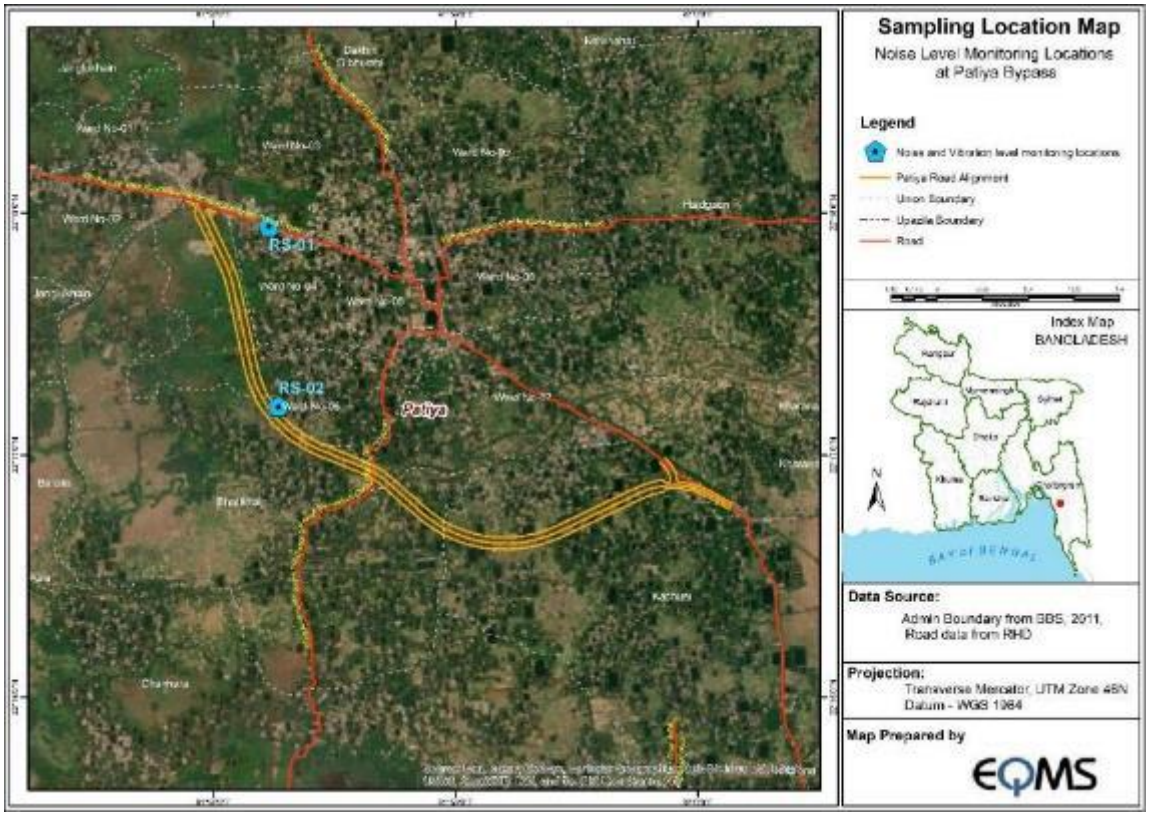
Noise level was monitored at 12 locations including nine locations from the alignment of existing Chattogram-Cox's Bazar Highway and three locations from the proposed roads (future road) alignment. Details of the monitoring is given in the **Table 4-10**. In addition, **Figure 4-33** to **Figure 4-40** shows the monitoring locations map of ambient noise level. Photographs of the noise level monitoring are given in Appendix C-3.

Table 4-10: Noise Level Monitoring locations

Sl.	Monitoring Locations	Monitoring ID	Monitoring Coordinates	Monitoring Date	Monitoring Time
1.	In front of Upazila Health Complex, Patiya	RS-01	22°17'56.99"N 91°58'13.67"E	23.03.2021-24.03.2021	11:00-01:35
2.	In front of Dakshin Gata Nuri Jame Mosque, Patiya	RS-02	22°17'12.15"N 91°58'16.02"E	24.03.2021-25.03.2021	12:00-23:00 24:00-12:00
3.	In front of BGC Trust Medical College, Chandanaish	RS-03	22°14'42.15"N 92° 1'9.25"E	27.03.2021-28.03.2021	08:00-19:00 20:00-08:00
4.	In front of Dohazari Jamijuri A. Rahman High School, Dohazari	RS-04	22° 9'49.25"N 92° 3'41.32"E	29.03.2021-30.03.2021	08:00-19:00 20:00-08:00
5.	Near Chagachar Jame Mosque, Dohazari	FR-01	22° 9'34.11"N 92° 3'34.15"E	30.03.2021-31.03.2021	09:00-20:00 21:00-09:00
6.	In front of Shahi Jame Mosque, Keranihat	RS-05	22° 5'50.14"N 92° 4'31.40"E	01.04.2021-02.04.2021	10:00-21:00 22:00-10:00
7.	In front of Noyapara Baitul Mamur Jame Mosque, Padua	RS-06	22° 3'42.71"N 92° 6'26.17"E	03.04.2021-04.04.2021	08:00-19:00 20:00-08:00
8.	In front of Citizen Park Community Center, Lohagara	RS-07	22° 1'10.17"N 92° 6'0.56"E	01.06.2021-02.06.2021	11:00-21:00 22:00-11:00
9.	In front of Maulana Sultan Hossain Jame Mosque, Lohagara	FR-02	22° 1'34.34"N 92° 5'42.26"E	02.06.2021-03.06.2021	13:00-24:00 01:00-13:00
10.	In front of Adhunagar Gul-E-Jar Girls High School, Aziz Nagar, Chakaria	RS-08	21°58'51.49"N 92° 4'47.75"E	05.06.2021-06.06.2021	09:00-20:00 21:00-09:00
11.	In front of Dakshin Lotonee Central Jame Mosque, Chakaria	FR-03	21°45'21.92"N 92° 5'39.48"E	06.06.2021-07.06.2021	11:00-22:00 23:00-11:00
12.	In front of Fashiakhali Govt. Primary School, Chakaria	RS-09	21°44'7.61"N 92° 5'0.74"E	07.06.2021-08.06.2021	12:00-23:00 24:00-12:00

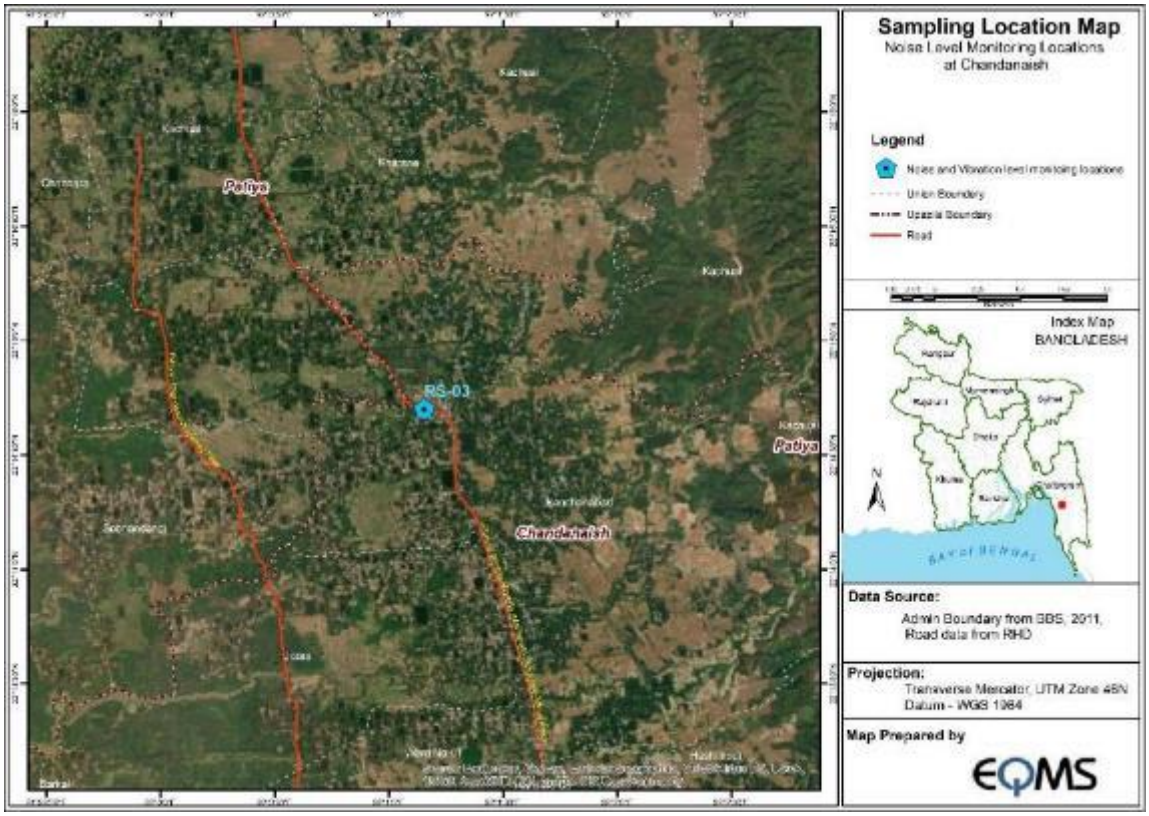
Source: Field Survey by EQMS, March-June 2021

Figure 4-33: Noise Level Monitoring locations in Patiya



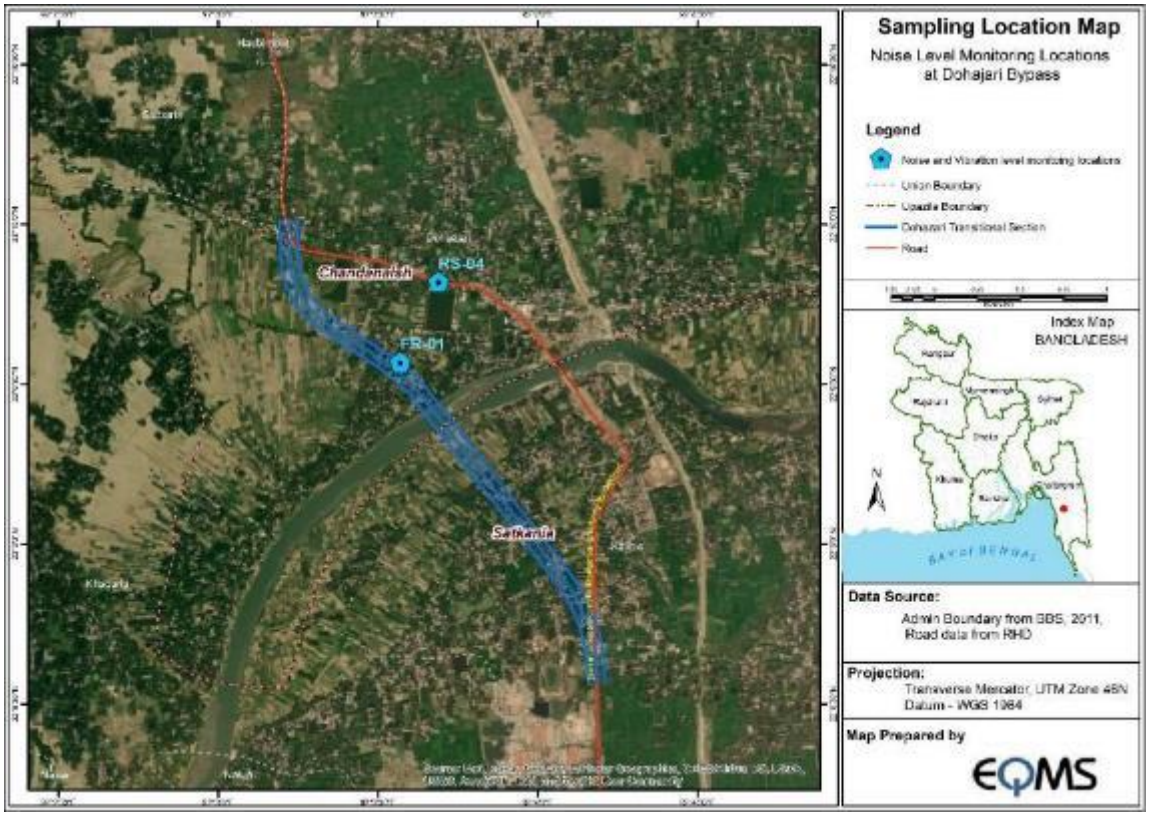
Source: Field Survey by EQMS, March-June 2021

Figure 4-34: Noise Level Monitoring locations in Chandanaish



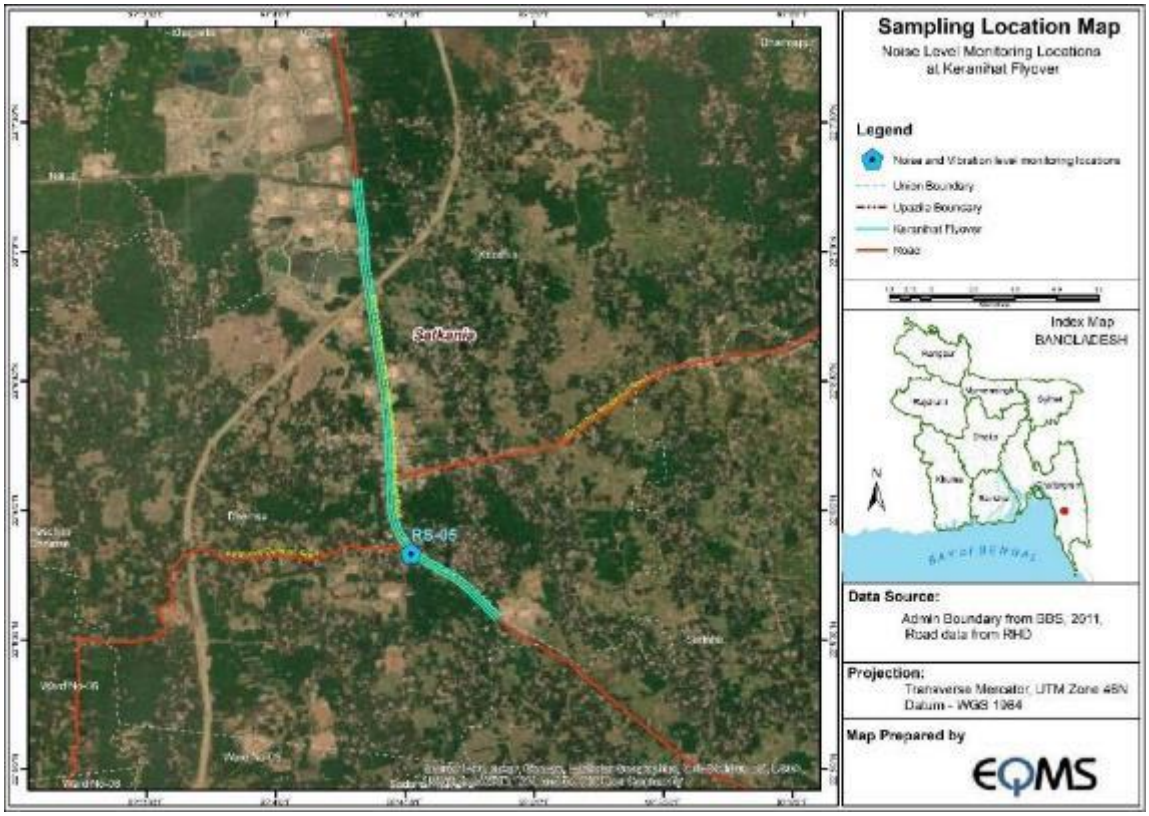
Source: Field Survey by EQMS, March-June 2021

Figure 4-35: Noise Level Monitoring locations in Dohazari



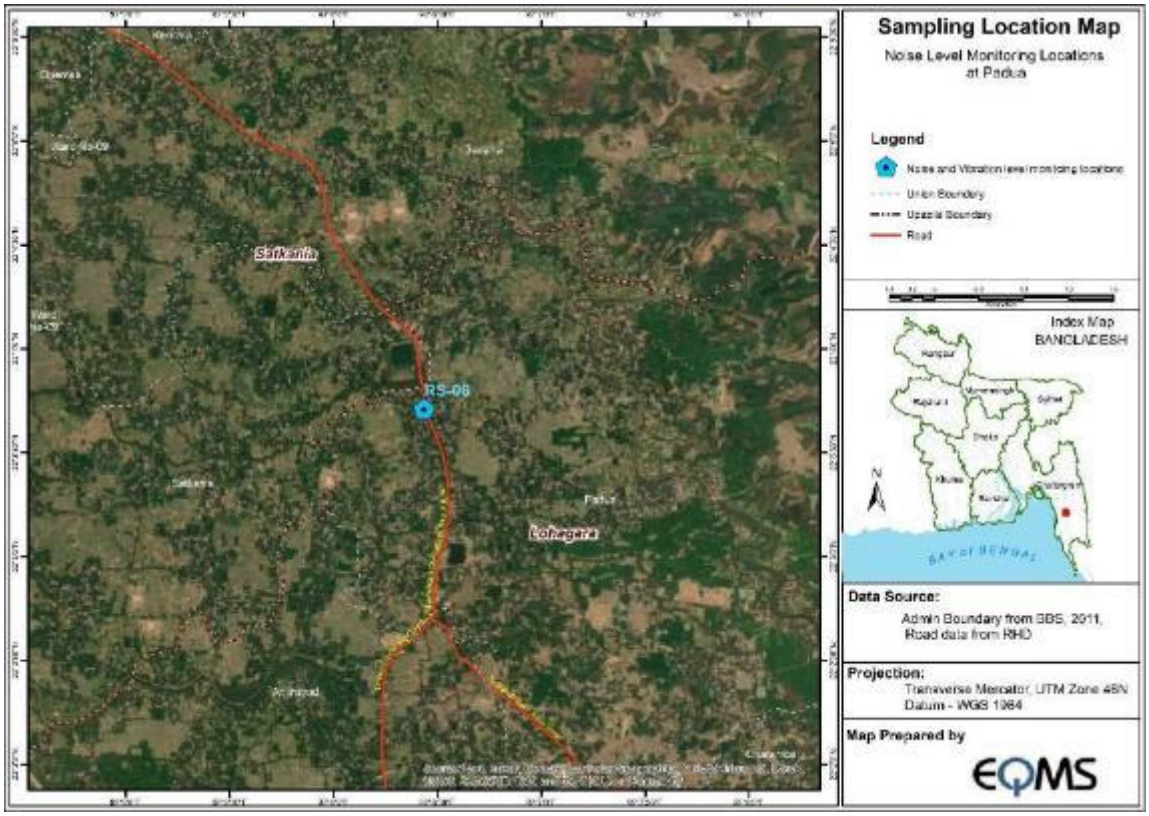
Source: Field Survey by EQMS, March-June 2021

Figure 4-36: Noise Level Monitoring locations in Keranihat



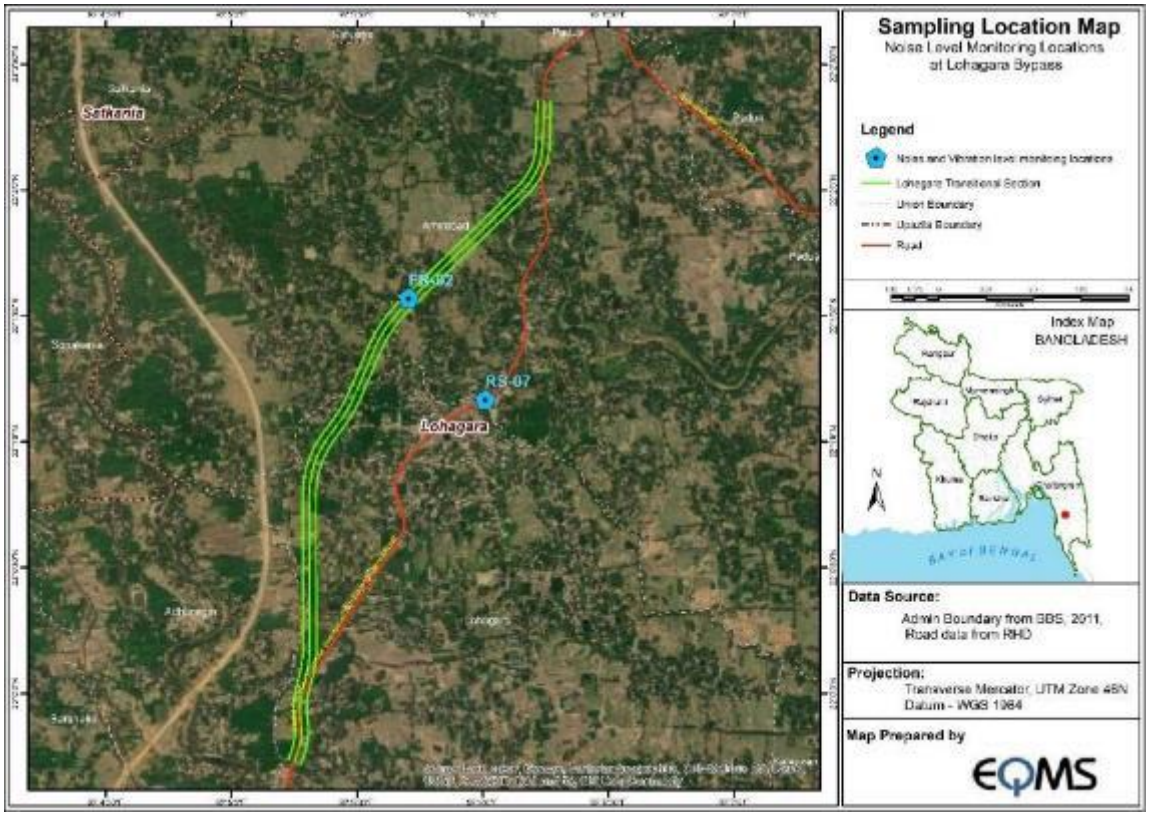
Source: Field Survey by EQMS, March-June 2021

Figure 4-37: Noise Level Monitoring locations in Padua



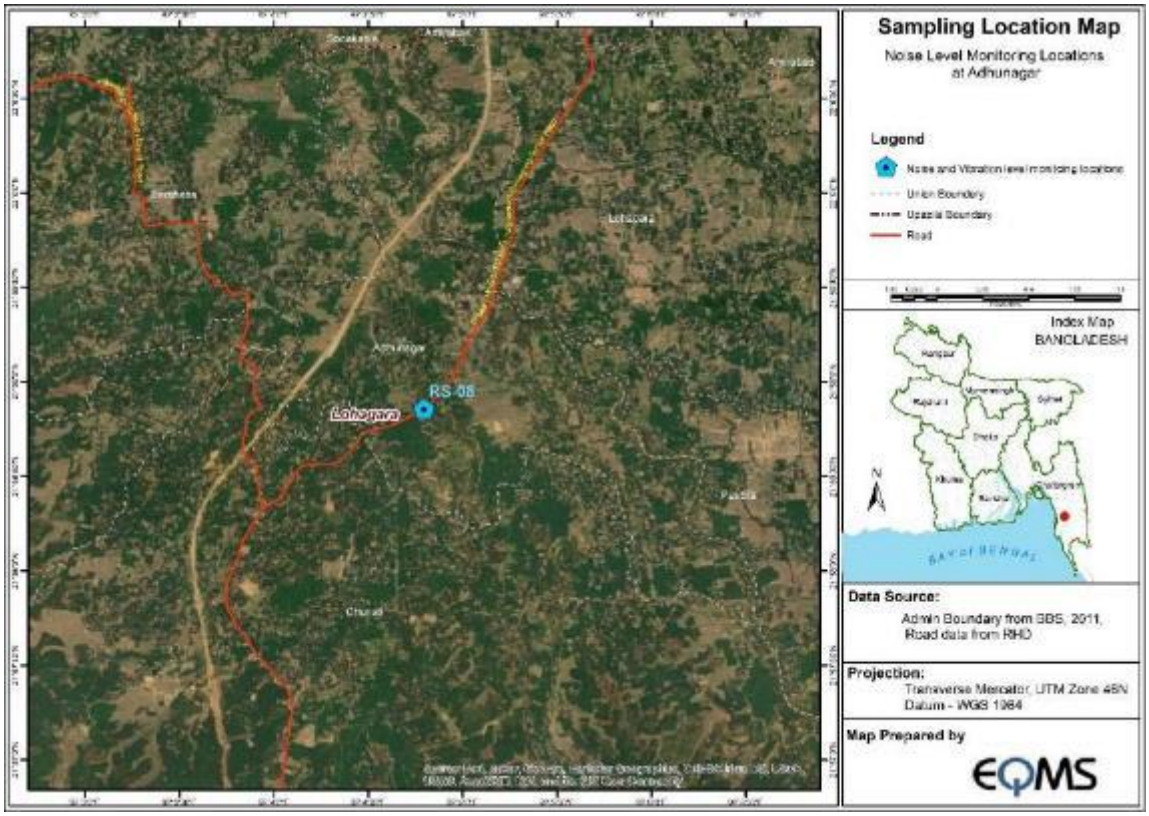
Source: Field Survey by EQMS, March-June 2021

Figure 4-38: Noise Level Monitoring locations in Lohagara



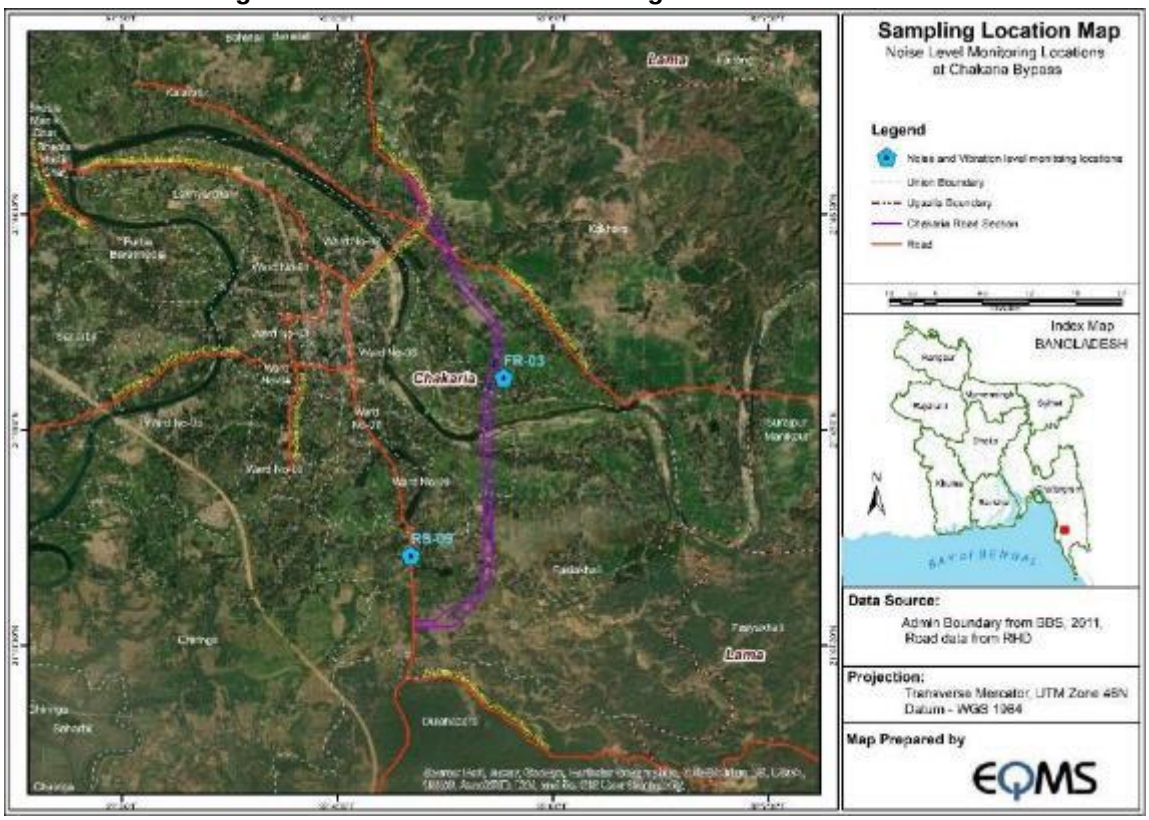
Source: Field Survey by EQMS, March-June 2021

Figure 4-39: Noise Level Monitoring locations in Adhunagar



Source: Field Survey by EQMS, March-June 2021

Figure 4-40: Noise Level Monitoring locations in Chakaria

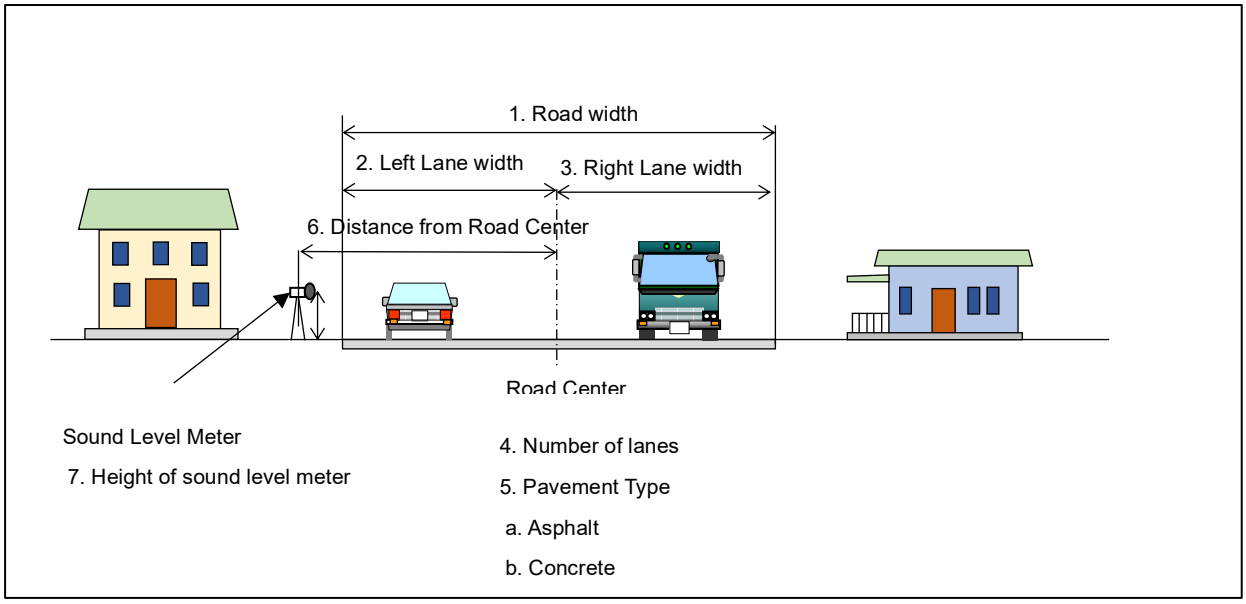


Source: Field Survey by EQMS, March-June 2021

4.3.3.2 Methods

The Leq (equivalent continuous sound level) is the sound level in decibels, having the same total sound energy as the fluctuating level measured. The Leq is common metric for assessing noise environment in today's world. To measure the ambient noise level in the alignment of CCHIP, continuous noise level data of every 0.1 seconds was collected for 24 hours using Orion NL-42 Type-A noise level meter. Unusual noise event (Vehicle horn, motorcade, rain etc.) was also recorded in separate sheet to avoid interference in the Leq. In addition, traffic volume, road width and road condition were also recorded in separate sheet for further forecasting during construction and operation phase. A schematic diagram for noise level survey is shown in **Figure 4-41**.

Figure 4-41: Noise Level Monitoring along with road section



Source: Nippon-Koei, March 2021

Sound events more than 80 dB were eliminated during data processing. Eventually, Leq (Day) and Leq (Night) has been calculated from the processed data. A summary of the monitoring items is given in **Table 4-11**.

Table 4-11: Summary of the monitoring item for ambient Noise level

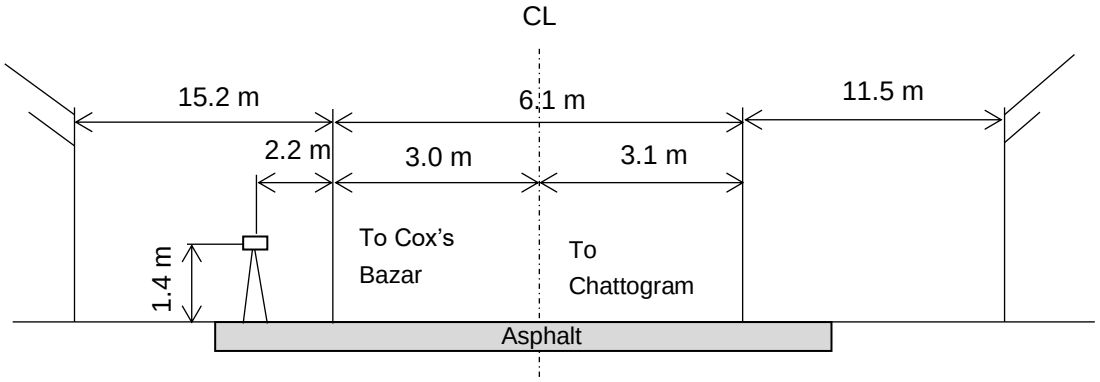
Sl	Item	Monitoring Method		Monitoring Point	
				Roadside of N1 RS-1 to 9	Future roadside FR-1 to 3
1.	Noise Level	Noise level meter	Collected continuous noise level data of every 0.1 seconds for 24 hours	✓	✓
2.	Sound Events during monitoring	Site observation & recoding	Observation	✓	✓
3.	Traffic volume	Site counting & recoding	Counted traffic volume of the monitoring point for 24 hours. (Type of vehicles, direction)	✓	NA

Sl	Item	Monitoring Method		Monitoring Point	
				Roadside of N1 RS-1 to 9	Future roadside FR-1 to 3
4.	Road width	Site measurement	Measured road width	✓	NA
5.	Road Condition	Site observation & recoding	Observation	✓	NA

Source: Field Survey by EQMS, March-June 2021

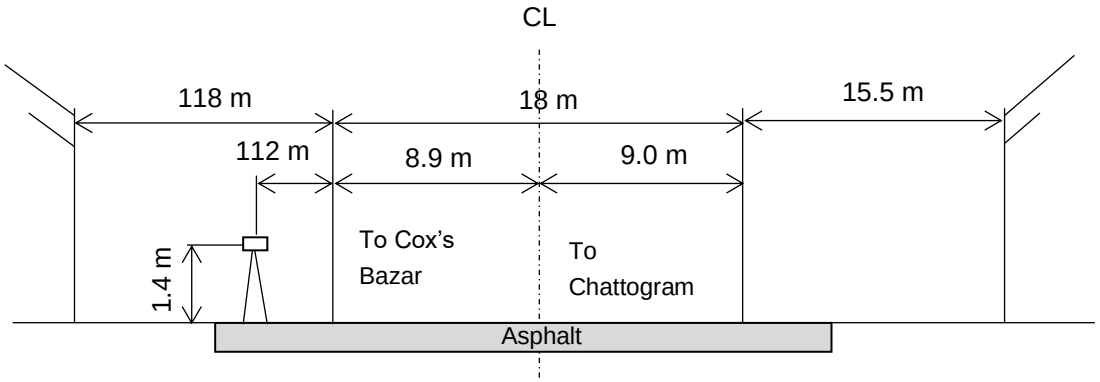
Details of the surveyed road sections in the alignment of existing Chattogram-Cox's Bazar highway are shown in **Figure 4-42** to **Figure 4-50**.

Figure 4-42: Road section and Receptor location at RS-01, Patiya



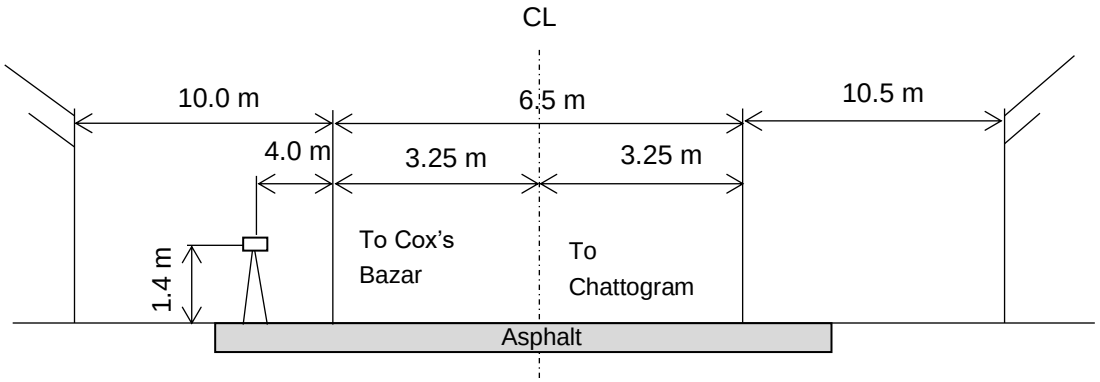
Source: Field Survey by EQMS, March-June 2021

Figure 4-43: Road section and Receptor location at RS-02, Patiya



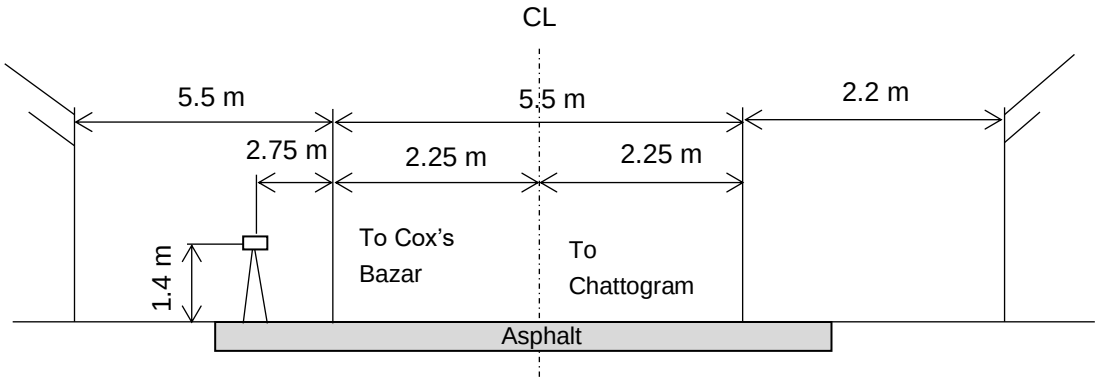
Source: Field Survey by EQMS, March-June 2021

Figure 4-44: Road section and Receptor location at RS-03, Patiya



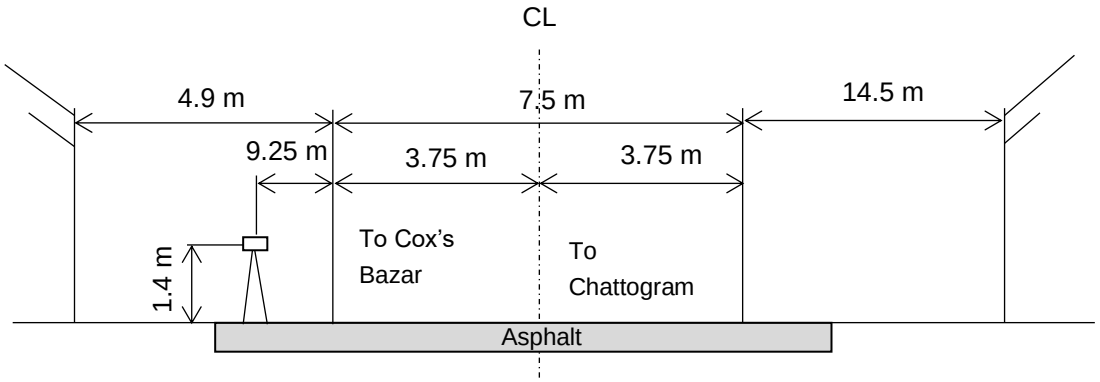
Source: Field Survey by EQMS, March-June 2021

Figure 4-45: Road section and Receptor location at RS-04, Dohazari



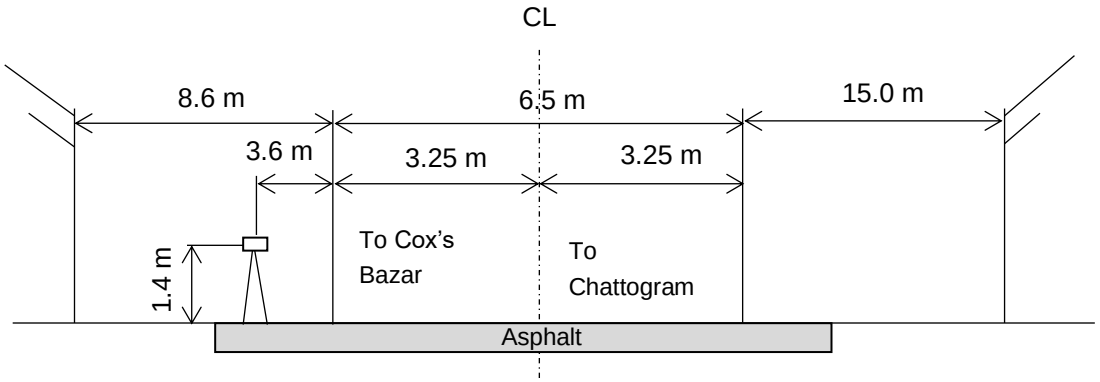
Source: Field Survey by EQMS, March-June 2021

Figure 4-46: Road section and Receptor location at RS-05, Keranihat



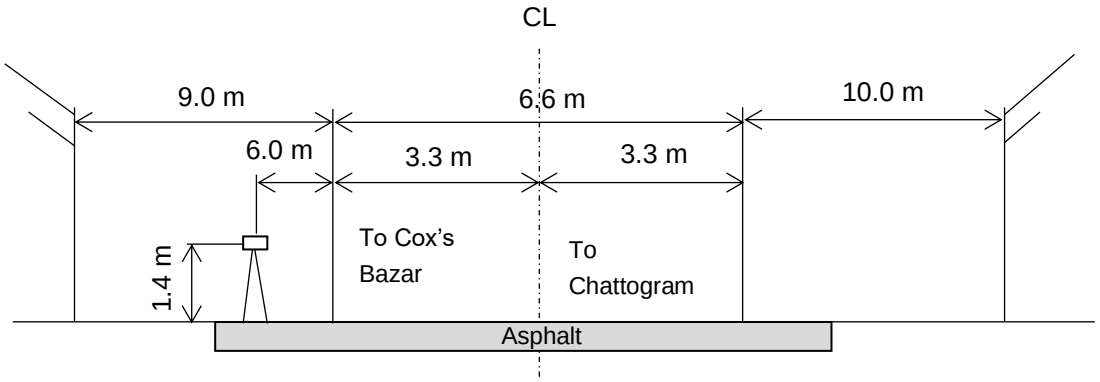
Source: Field Survey by EQMS, March-June 2021

Figure 4-47: Road section and Receptor location at RS-06, Padua



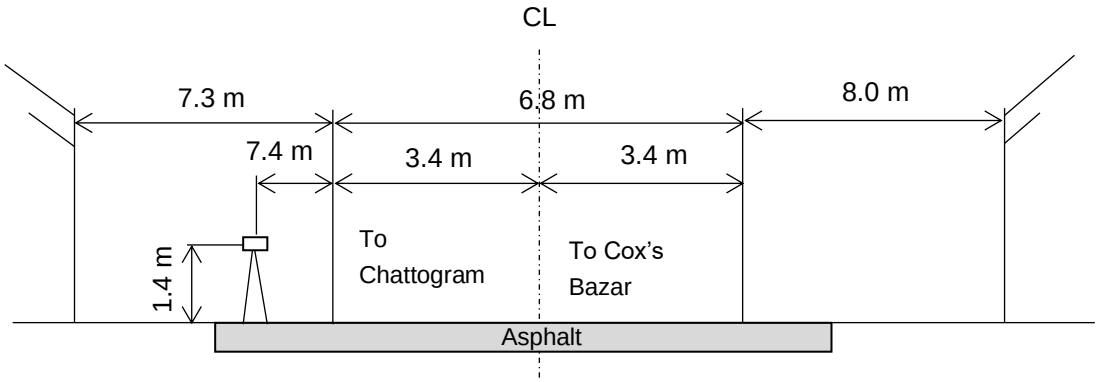
Source: Field Survey by EQMS, March-June 2021

Figure 4-48: Road section and Receptor location at RS-07, Lohagara



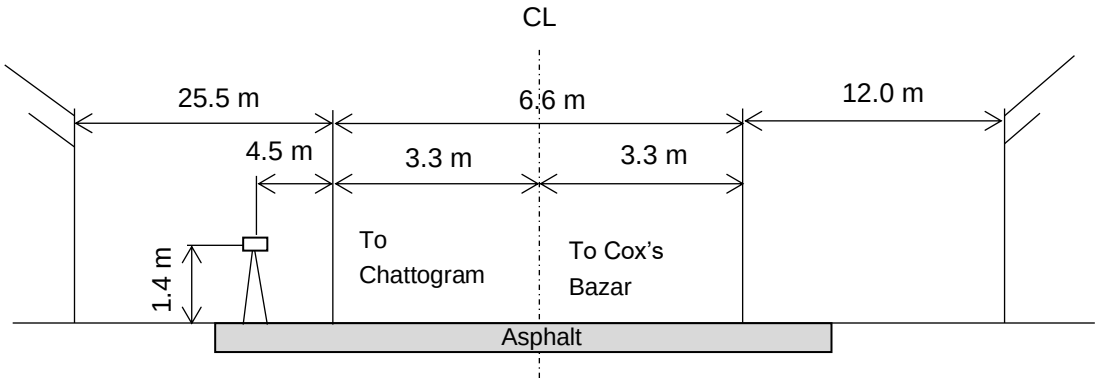
Source: Field Survey by EQMS, March-June 2021

Figure 4-49: Road section and Receptor location at RS-08, Adhunagar



Source: Field Survey by EQMS, March-June 2021

Figure 4-50: Road section and Receptor location at RS-09, Chakaria



Source: Field Survey by EQMS, March-June 2021

4.3.3.3 Ambient Noise Level Monitoring Results

Ambient noise level monitoring results are given in the following **Table 4-12**. Monitoring results have been compared with both Bangladesh and Japanese noise standards. Details of the noise level calculation are provided in the **Appendix C-4.**

Table 4-12: Baseline level of the traffic noise

Monitoring ID	Area Category*	LAeq in dB(A)		Bangladesh Standard*		Japanese Standard**	
		Day	Night	Day	Night	Day	Night
RS-01	Mixed	72.6	69.6	60	50	70	65
RS-02	Residential	59.7	60.9	55	45		
RS-03	Mixed	70.9	70.4	60	50		
RS-04	Mixed	72.7	69.3	60	50		
FR-01	Residential	63.1	57.9	55	45		
RS-05	Commercial	70.5	69.4	70	60		
RS-06	Commercial	70.1	67.8	70	60		
RS-07	Commercial	69.6	67.8	70	60		
FR-02	Residential	61.9	58.4	55	45		
RS-08	Commercial	71.1	67.7	70	60		
FR-03	Residential	64.9	57.5	55	45		
RS-09	Commercial	71.1	66.6	70	60		

***** *Noise Pollution (Control) Rules, 2006*

Note: Orange colure indicate exceedance of national noise level standard of Noise Pollution (Control) Rules, 2006

***Japanese standard value is referred the noise value in roadside space of trunk road*

Source: Field Survey by EQMS, March-June 2021

Noise Level at Mixed Zone

As per the Noise Pollution (Control) Rules, 2006, RS-01, RS-03 and RS-04 are characterized as mixed zone of hospital, educational institution, commercial place and residential area. Noise level in these three locations during both day and night was found higher than the Bangladesh and Japanese standard. Frequent horn and vehicular movement were the main source of noise in these location.

Noise Level at Residential Zone

RS-02, FR-01, FR-02 and FR-03 are characterized as residential zone as per the Noise Pollution (Control) Rules, 2006. Noise level in these four locations during both day and night was found higher than the Bangladesh standard but within the permissible limit of Japanese standard. Vehicular movement in the nearby highway was the main source of noise at RS-02. Vehicular movement in the local street was main source of noise at FR-01, FR-02 and FR-03. In addition, raining for longer period also contributed to the noise level at FR-03.

Noise Level at Commercial Zone

As per the Noise Pollution (Control) Rules, RS-05, RS-06, RS-07, RS-08 and RS-09 are characterized as commercial zone. Day time noise level in RS-05, RS-06, RS-08 and RS-09 were found slightly higher than the Bangladesh and Japanese standard. Day time noise level at was found within the both standards. However, night time noise level in all of these five locations were found higher than the both standards. Vehicular movement and horn in the existing Chattogram-Cox's Bazar highway is the main source of noise in these locations.

4.3.4 Vibration Level

The objective of the vibration level monitoring was to establish the baseline vibration level in the project alignment.

4.3.4.1 Vibration level Monitoring Location

Vibration level was monitored at 12 locations including nine locations from the alignment of existing Chattogram-Cox's Bazar Highway and three locations from the proposed roads (future road) alignment. Details of the monitoring is given in the **Table 4-13.** Vibration level monitoring locations are same as the noise level monitoring locations. Photographs of the vibration level monitoring are given in **Appendix C-3.**

Table 4-13: Vibration Level Monitoring locations

Sl.	Monitoring Locations	Monitoring ID	Monitoring Coordinates	Monitoring Date	Monitoring Time
1.	In front Upazila Health Complex, Patiya	RS-01	22°17'56.99"N 91°58'13.67"E	23.03.2021-24.03.2021	11:00-02:10
2.	In front of Dakshin Gata Nuri Jame Mosque, Patiya	RS-02	22°17'12.15"N 91°58'16.02"E	24.03.2021-25.03.2021	12:00-22:10 23:00-11:10
3.	In front of BGC Trust Medical College, Chandanaish	RS-03	22°14'42.15"N 92° 1'9.25"E	27.03.2021-28.03.2021	08:00-18:10 19:00-07:10
4.	In front of Dohazari Jamijuri A. Rahman High School, Dohazari	RS-04	22° 9'49.25"N 92° 3'41.32"E	29.03.2021-30.03.2021	08:00-18:10 19:00-07:10
5.	Near Chagachar Jame Mosque, Dohazari	FR-01	22° 9'34.11"N 92° 3'34.15"E	30.03.2021-31.03.2021	09:00-19:10 20:00-08:10
6.	In front of Shahi Jame Mosque, Keranihat	RS-05	22° 5'50.14"N 92° 4'31.40"E	01.04.2021-02.04.2021	10:00-21:10 22:00-09:10
7.	In front of Noyapara Baitul Mamur Jame	RS-06	22° 3'42.71"N 92° 6'26.17"E	03.04.2021-04.04.2021	08:00-18:10 19:00-07:10

Sl.	Monitoring Locations	Monitoring ID	Monitoring Coordinates	Monitoring Date	Monitoring Time
	Mosque, Padua				
8.	In front of Citizen Park Community Center, Lohagara	RS-07	22° 1'10.17"N 92° 6'0.56"E	01.06.2021-02.06.2021	11:00-20:10 22:00-10:10
9.	In front of Maulana Sultan Hossain Jame Mosque, Lohagara	FR-02	22° 1'34.34"N 92° 5'42.26"E	02.06.2021-03.06.2021	13:00-23:10 01:00-12:10
10.	In front of Adhunagar Gul-E-Jar Girls High School, Aziz Nagar, Chakaria	RS-08	21°58'51.49"N 92° 4'47.75"E	05.06.2021-06.06.2021	09:00-19:10 20:00-08:10
11.	In front of Dakshin Lotonee Central Jame Mosque, Chakaria	FR-03	21°45'21.92"N 92° 5'39.48"E	06.06.2021-07.06.2021	11:00-21:10 22:00-10:10
12.	In front of Fashiakhali Govt. Primary School, Chakaria	RS-09	21°44'7.61"N 92° 5'0.74"E	07.06.2021-08.06.2021	12:00-22:10 23:00-11:10

Source: Field Survey by EQMS, March-June 2021

4.3.4.2 Methods

The Lv (Vibration level) is commonly used parameter in Japan. There is no common metric for the vibration in the world as of today. So, Lv used for the vibration level monitoring since the project is being financed by JICA. To measure the vibration level in the alignment of CCHIP, vibration level data for the first 10 minutes of the hour was collected for 24 hours using Orion VM-53 Vibration level meter. Unusual data were carefully ignored during the vibration level calculation. A summary of the monitoring items for vibration level measurement is given in **Table 4-14**.

Table 4-14: Summary of the monitoring item for Vibration level

Sl	Item	Monitoring Method		Monitoring Point	
				Roadside of N1 RS-1 to 9	Future roadside FR-1 to 3
1.	Traffic volume	Site counting & recoding	Counted traffic volume of the monitoring point for 24 hours. (Type of vehicles, direction)	✓	NA
2.	Vibration Level	Vibration Level Meter	Measured vibration level	✓	✓

Source: Field Survey by EQMS, March-June 2021

4.3.4.3 Vibration Level Monitoring Results

Vibration level monitoring results are given in the following **Table 4-15**. There is no stipulated standard for vibration level in Bangladesh. Hence, monitoring results have been compared with Japanese vibration standards. Details of the noise level calculation are provided in the **Appendix C-5.**

Table 4-15: Baseline level of the vibration

Monitoring ID	L10 (dB)		Japanese Standard of Traffic Vibration (dB)	
	Day	Night	Day	Night
RS-01	47.5	50.4	65	60
RS-02	38.1	39.0		
RS-03	51.2	52.6		
RS-04	47.6	48.7		
FR-01	35.3	30.2		
RS-05	45.6	47.9		
RS-06	48.2	49.5		
RS-07	49.9	53.2		
FR-02	28.4	20.9		
RS-08	41.2	42.7		
FR-03	27.4	23.2		
RS-09	46.9	45.4		

Source: Field Survey by EQMS, March-June 2021

RS-01 to RS-09 locations are within the alignment of existing highway and FR-01, FR-02 and FR-03 are within the alignment of future road. That's why vibration level at the existing highway alignment is comparatively higher than the future road due to road traffic. However, vibration level during day and night at all the locations were found within the Japanese Standards of Traffic Vibration.

4.3.5 Water Quality

4.3.5.1 Surface Water Sampling Locations

Surface water samples were collected from 10 locations, including 02 locations from each bottleneck point in two seasons, e.g., wet (monsoon) and dry (winter) season. The samples were collected mainly nearby river, canal or other types of water bodies, which have potentiality to be affected by construction works. **Table 4-16** shows the detailed information about surface water sampling locations, including their latitude and longitude values. The outer road alignments in Dohazari, Lohagara, and Chakaria will go through Sangu River, Tangkabati Canal, and Matamuhuri River, respectively. Therefore, two water samples from these streams were collected, including one sample from both upstream and downstream locations. There is also a narrow river, which intercepts with the alignment of Patiya and a sample was collected from this water body. In Keranihat, two water samples were collected from nearby water bodies of flyover alignment. **Figure 4-51** to **Figure 4-55** shows the surface water sampling locations map. Photographs of the surface water sampling are given in **Appendix C-6** and **Appendix C-7**.

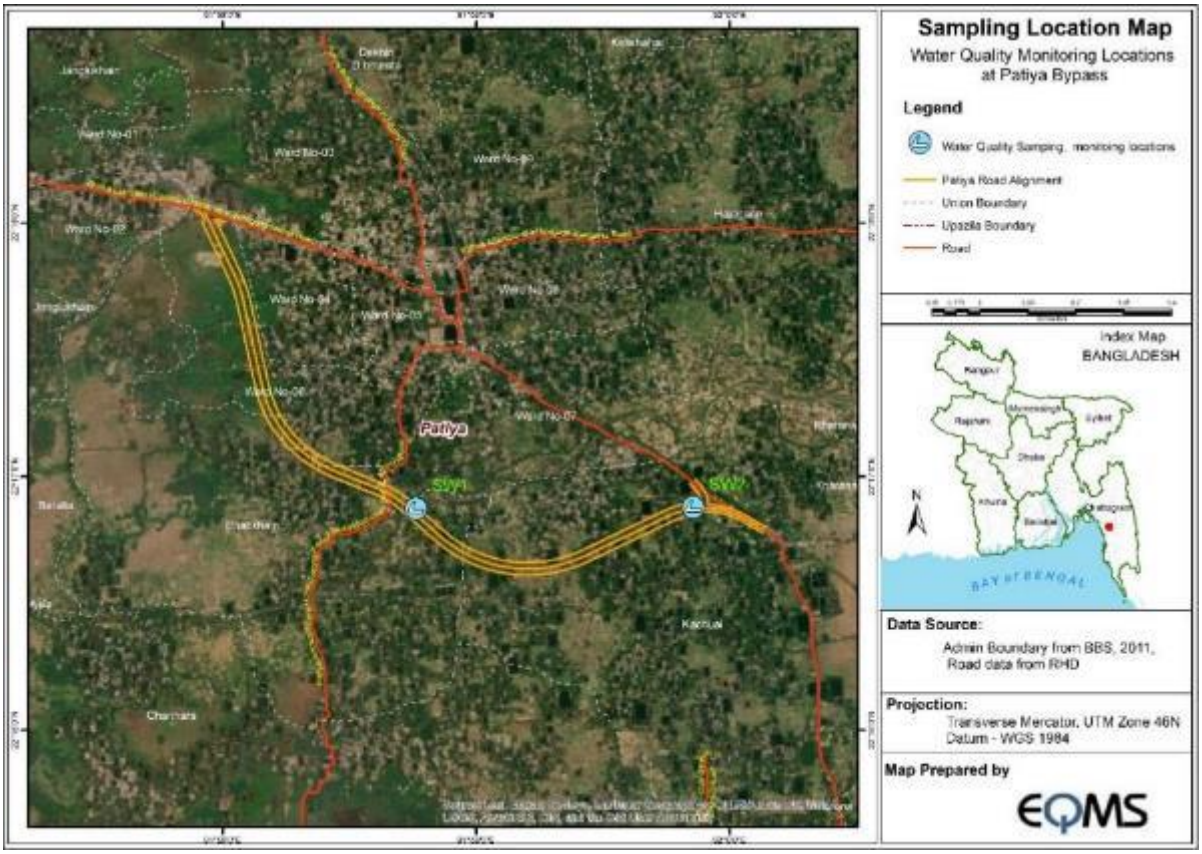
Table 4-16: Surface Water Sampling Location

SL#	Sampling Location	Sampling ID	Coordinates
1.	Surface Water sample from Chimnar Khal, Patiya	SW1	22°16'52.39"N 91°58'45.74"E
2.	Surface Water sample from nearby pond, Patiya	SW2	22°16'52.69"N 91°59'51.38"E
3.	Surface Water sample from upstream of the Sangu River, Dohazari	SW3	22° 9'28.71"N 92° 3'50.29"E

SL#	Sampling Location	Sampling ID	Coordinates
4.	Surface Water sample from downstream of the Sangu River, Dohazari	SW4	22° 9'16.53"N 92° 3'30.76"E
5.	Surface water sample from nearby pond of Keranihat FOB	SW5	22° 7'8.13"N 92° 4'17.97"E
6.	Surface water sample from nearby water body of Keranihat FOB	SW6	22° 6'49.16"N 92° 4'17.71"E
7.	Surface water sample from upstream of the Tangkabati River, Lohagara	SW7	22° 1'43.98"N 92° 6'11.50"
8.	Surface water sample from downstream of the Tangkabati River, Lohagara	SW8	22° 1'48.04"N 92° 6'5.59"E
9.	Surface Water sample from upstream of the Matamuhuri River, Chakaria	SW9	21°45'1.00"N 92° 5'40.18"E
10.	Surface Water sample from downstream of the Matamuhuri River, Chakaria	SW10	21°44'58.39"N 92° 5'18.93"E

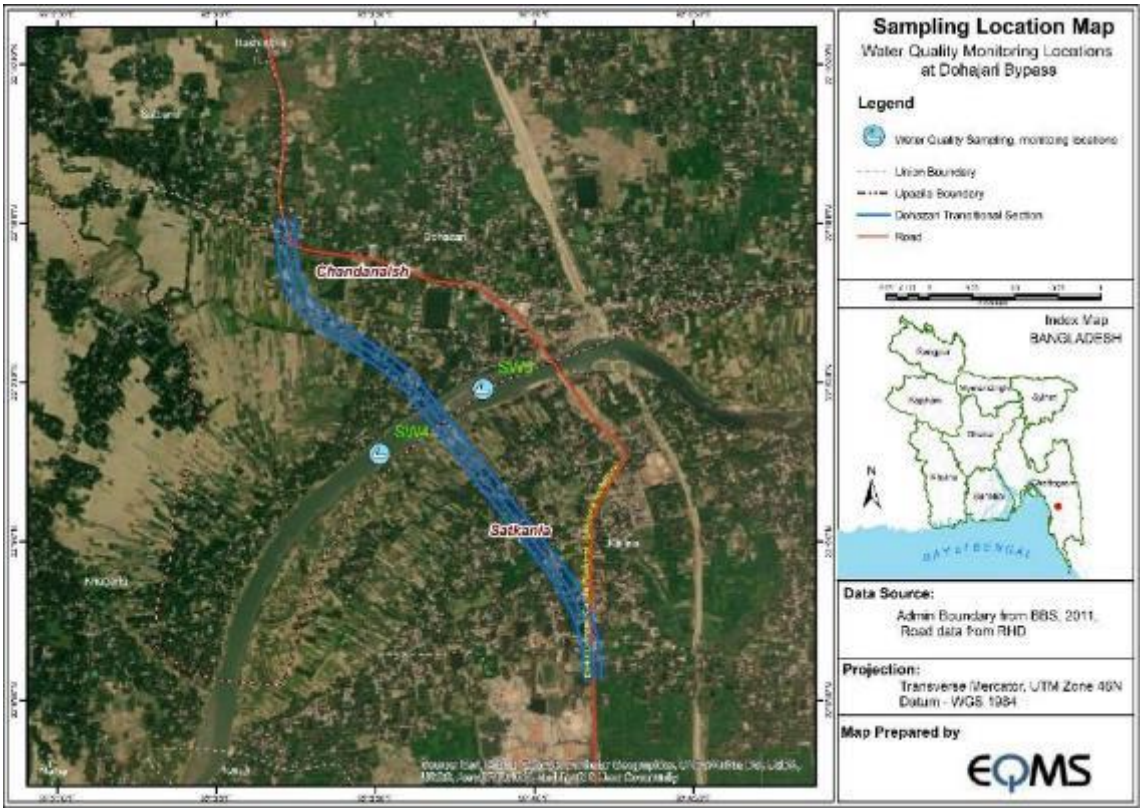
Source: Field Survey by EQMS, June and November 2020

Figure 4-51: Surface water sampling locations in Patiya



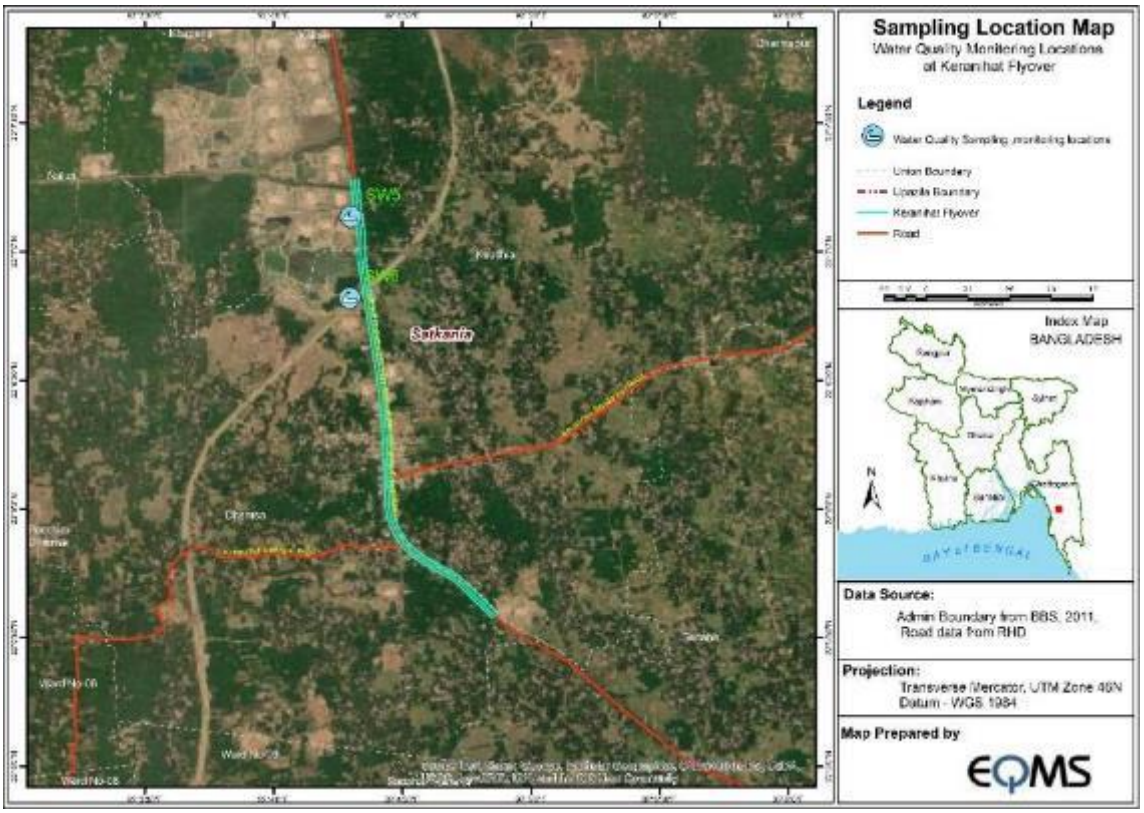
Source: Field Survey by EQMS, June and November 2020

Figure 4-52: Surface water sampling locations in Dohazari



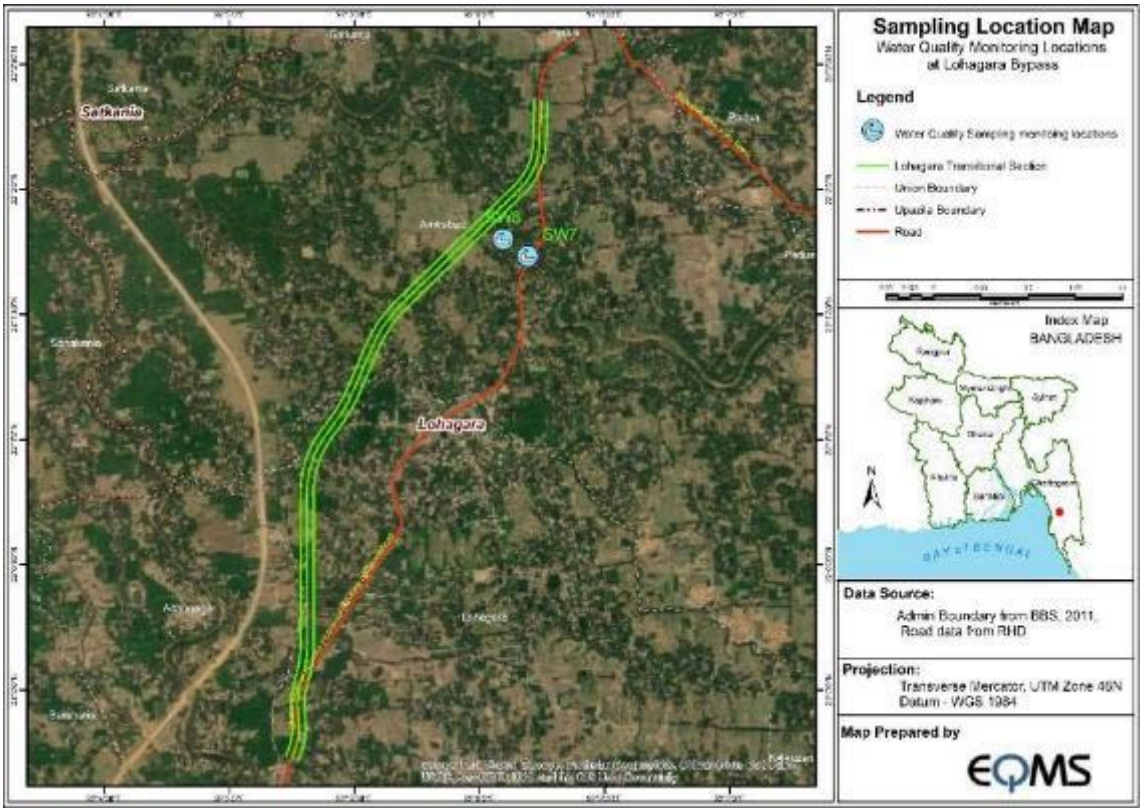
Source: Field Survey by EQMS, June and November 2020

Figure 4-53: Surface water sampling locations in Keranihat



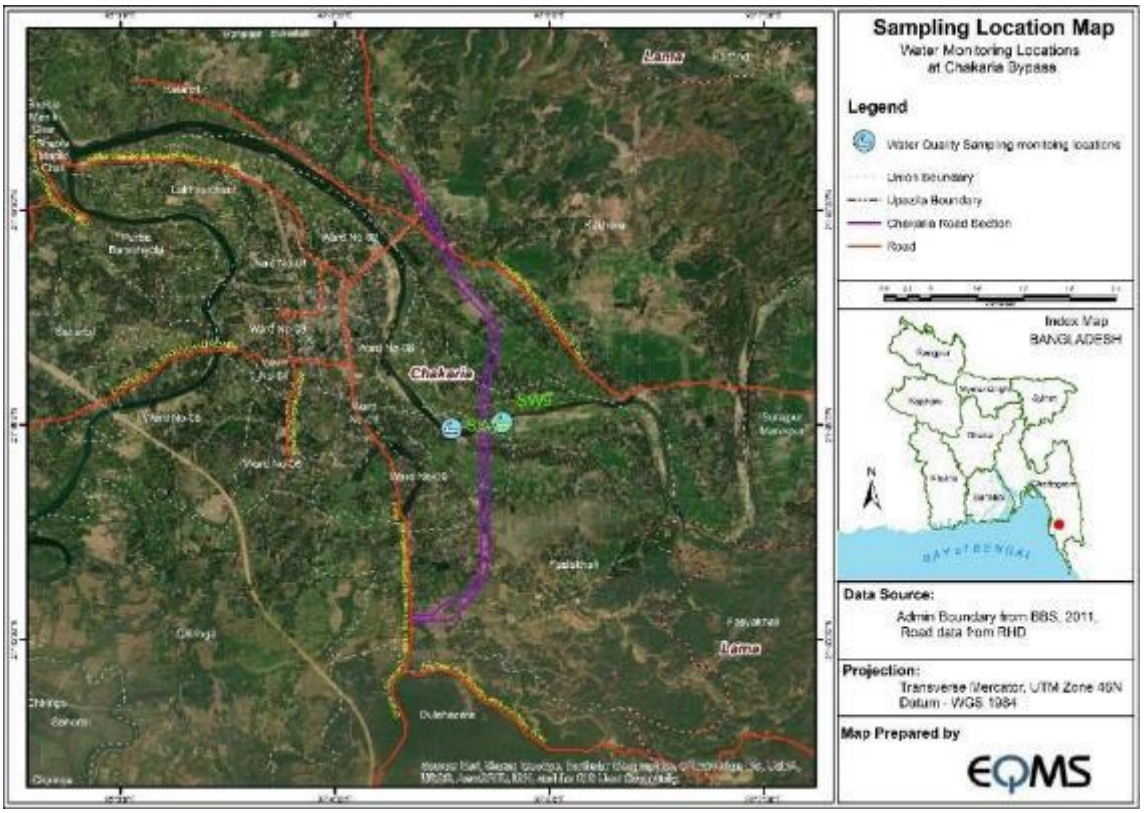
Source: Field Survey by EQMS, June and November 2020

Figure 4-54: Surface water sampling locations in Lohagara



Source: Field Survey by EQMS, June and November 2020

Figure 4-55: Surface water sampling locations in Patiya



Source: Field Survey by EQMS, June and November 2020

4.3.5.2 Methods

The water samples were collected following standard sample collection procedures. Firstly, one liter of water sample was taken into a plastic bottle without any air bubbles inside and air tighten. This bottle was preserved for laboratory testing. Then, another sample was taken from same location for onsite testing. Finally, the preserved and air tighten sample bottle was sent for the laboratory testing. Some parameters, e.g., temperature, pH, and Dissolved Oxygen (DO) were tested onsite as their reading may change in a different environment other than the sampling point. On the other hand, other parameters, e.g., Color, Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Total Suspended Solid (TSS), Turbidity, Total Coliforms, Arsenic, Oil and Grease have been tested in recognized laboratories. **Table 4-17** shows the list of parameters along with their testing methods.

Table 4-17: Parameters of surface water and their testing methods

Parameter	Laboratory	Method/Instrument used for Testing
Color	DPHE Laboratory	APHA 22nd Edition-2012, 2120B
Water Temperature	On Site Testing	Ion Electrode Method
pH	On Site Testing	Ion Electrode Method
DO	On Site Testing	DO Meter
BOD	DPHE Laboratory	5 days incubation
COD	DPHE Laboratory	CRM/APHA 22nd Edition-2012, 5220B
TSS	DPHE Laboratory	APHA 22nd Edition-2012, 2540D
Turbidity	DPHE Laboratory	Turbidity Meter
Total Coliforms	DPHE Laboratory	Membrane Filtration Procedure
Arsenic	DPHE Laboratory	Atomic Absorption Spectrophotometer
Oil and Grease	BCSIR Laboratory	Gravimetric Method

4.3.5.3 Results Analysis

The analyzed results for surface water were compared to Bangladesh Standards (ECR, 1997). Testing results of surface water samples collected in two seasons, (wet and dry season) are presented in Table 4-18. The results found that most of the parameters comply with the national standard, while some parameters in some locations don't comply with the standard limits. The level of pH varies from 6.8 (SW8) to 7.4 (SW1) in wet season and 5.5 (SW6) to 6.6 (SW9) in dry season. During winter season, the level of pH is found below standard range in most of the sampling locations, i.e., SW1, SW2, SW3, SW5, SW6, SW7, and SW8. It is also evident from the results that the level of pH has slightly decreased in winter season than monsoon season in all locations. The temperature of water extends from 28.7 (SW7) to 32.4°C (SW1) in wet season and 27.9 (SW2) to 29.7°C (SW10) in dry season. There is no standard in Bangladesh legislation related to surface water temperature. One of the most important parameters of surface water quality is dissolved oxygen. The findings show that, in case of wet season, the highest concentration of DO has been found in Dohazari (SW3) and Lohagara (SW8), whereas the lowest concentration is found in Patiya (SW1). On the other hand, during dry season, the highest concentration of DO is found Keranihat (SW6) and lowest concentration is found in Lohagara (SW7). Overall, the concentration of DO is found below standard range in three locations, such as Patiya (SW2) and Keranihat (SW5 & SW6) in wet season. In contrast, no under- or over-standard concentration of DO is found in winter season. The lower concentration of DO indicates higher amount of organic waste materials present in the water. During monsoon season, the surface runoff can discharge excessive amount of phosphorus and nitrogen into the surface water, which cause algae bloom those ultimate leads to lower amount of dissolved oxygen as algae consumes higher amount of oxygen to be decomposed. This situation is harmful for aquatic organisms. BOD is another important parameter,

which represents the amount of oxygen needed to breakdown the organic matter in water. The concentration of BOD is found within standard range in all locations except Chakaria (SW10) in wet season. On the other hand, the concentration of BOD is found higher than standard range in Patiya (SW1), Dohazari (SW4) and Lohagara (SW8) in winter season considering standard for disinfected and treated potable water and water usable for recreation and fisheries).

Some other physical and chemical properties of water, e.g., turbidity, chemical oxygen demand, total suspended solid, arsenic, color, and oil and grease have been tested for which no national standard is established. The turbidity is a measure of the cloudiness of water, which represents the degree to which the water loses its transparency due to the presence of suspended particulates. The more total suspended solids in the water, the murkier it seems and the higher the turbidity. Turbidity is considered as a good measure of the quality of water. Unlike BOD, the COD indicates the amount of water required for oxidization of total organic matter in water. Arsenic is a highly toxic (in inorganic form) chemical element that enter water mainly through erosion of rocks and minerals as well as industrial and agricultural pollution. Oil and grease can get into waterways when storm water runs off any site with heavy vehicular activity such as a transportation hub, vehicle washing and repair facility or automotive recycling facility. The concentration of these substances can be used as reference value during construction and operation period.

In addition to physical and chemical properties of water, the microbiological characteristics, e.g., total coliform bacteria have also been tested. The coliform bacteria, including fecal coliform can mix with water by surface runoff, particularly from human and animal waste. The test results reveal that the numbers of the coliform bacteria count have exceeded the standard for drinking water in all sampling locations during monsoon season. On the other hand, three out of ten samples (SW4, SW6, and SW8) showed higher number of coliform bacteria during winter season.

Table 4-18: Surface Water Quality Testing Result in Wet (Monsoon) and Dry (Winter) Season

Parameters	Unit	Concentration Present										Bangladesh Standard[6] (ECR-1997: Schedule 3(A)-d)						WHO[7]
		SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8	SW9	SW10	a	b	c	d	e	f	
pH (Wet Season)	---	7.38	6.9	7.11	6.81	7.1	6.74	6.92	6.8	6.99	7.08	6.5-8.5	6.5-8.5	6.5-8.5	6.5-8.5	6.5-8.5	6.5-8.5	6.0-8.5
pH (Dry Season)	---	5.8	5.9	6.2	6.5	6.4	5.5	5.9	5.9	6.6	6.5	6.5-8.5	6.5-8.5	6.5-8.5	6.5-8.5	6.5-8.5	6.5-8.5	6.0-8.5
Temperature (Wet Season)	(^{0}C)	32.4	31.8	29.8	30.0	30.4	31.2	28.7	29.3	30.3	29.8	-	-	-	-	-	-	-
Temperature (Dry Season)	(^{0}C)	28.5	27.9	28.2	28.3	29.1	29.5	28.2	28.5	29.4	29.7	-	-	-	-	-	-	-
DO (Wet Season)	mg/l	7.5	4.4	7.6	7.3	4.5	4.5	7.5	7.6	6.9	7.4	≥ 6	≥ 5	≥ 6	≥ 5	≥ 5	≥ 5	-
DO (Dry Season)	mg/l	7.5	6.9	9.3	8.7	11.1	11.3	6.2	7.6	6.8	6.7	≥ 6	≥ 5	≥ 6	≥ 5	≥ 5	≥ 5	-
BOD (Wet Season)	mg/l	2	1	1	1	2	3	3	4	4	7	≤ 2	≤ 3	≤ 6	≤ 6	≤ 10	≤ 10	-

[6] Bangladesh Environment Conservation Rules, 1997- Schedule 3 (Standards for Inland Surface Water).

[7] WHO Standards for Surface Water Quality

Parameters	Unit	Concentration Present										Bangladesh Standard[6] (ECR-1997: Schedule 3(A)-d)						WHO[7]
		SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8	SW9	SW10	a	b	c	d	e	f	
BOD (Dry Season)	mg/l	26	4	2	8	5	4	1	22	1	2	≤ 2	≤ 3	≤ 6	≤ 6	≤ 10	≤ 10	-
COD (Wet Season)	mg/l	8	4	4	8	8	12	16	12	16	24	-	-	-	-	-	-	-
COD (Dry Season)	mg/l	104	16	4	36	16	12	4	80	4	8	-	-	-	-	-	-	-
TSS (Wet Season)	mg/l	7	6	18	42	5	23	31	36	25	22	-	-	-	-	-	-	-
TSS (Dry Season)	mg/l	4	5	2	3	2	2	4	3	2	3	-	-	-	-	-	-	-
Color (Wet Season)	Hazen	1.6	1.1	2.7	3.9	1	1.1	4.1	3.8	2.3	1.8	-	-	-	-	-	-	-
Color (Dry Season)	Hazen	1.3	2.1	0.90	1.2	1.0	0.98	1.7	0.96	0.90	0.93	-	-	-	-	-	-	-
TC (Wet Season)	N/100 ml	360	410	280	390	180	120	280	310	418	440	≤ 50	≤ 200	≤5000	-	≤5000	≤1000	-

Parameters	Unit	Concentration Present										Bangladesh Standard[6] (ECR-1997: Schedule 3(A)-d)						WHO[7]
		SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8	SW9	SW10	a	b	c	d	e	f	
TC (Dry Season)	N/100 ml	48	12	36	56	16	112	48	76	48	12	≤ 50	≤ 200	≤5000	-	≤5000	≤1000	-
Turbidity (Wet Season)	NTU	26.4	5.9	153	365	8.1	96	282	305	215	141	-	-	-	-	-	-	-
Turbidity (Dry Season)	NTU	4.1	8.2	2.3	2.7	2.0	1.3	7.4	2.8	1.7	2.8	-	-	-	-	-	-	-
Arsenic (Wet Season)	mg/l	0.003	0.004	0.001	0.003	0.003	0.005	0.003	0.003	0.003	0.003	-	-	-	-	-	-	-
Arsenic (Dry Season)	mg/l	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	-	-	-	-	-	-	-
Oil & Grease (Wet Season)	mg/l	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.41	<0.2	-	-	-	-	-	-	-
Oil & Grease (Dry Season)	mg/l	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	1.09	<0.2	1.31	0.65	-	-	-	-	-	-	-
Lead*	mg/l	-	-	<0.01	<0.01	-	-	-	-	<0.01	<0.01	-	-	-	-	-	-	0.5
Chromium*	mg/l	-	-	<0.01	<0.01	-	-	-	-	<0.01	<0.01	-	-	-	-	-	-	0.5

Source: Laboratory Analysis by DPHE and EQMS Laboratory, 2021

Note:
a = Source of drinking water for supply only after disinfecting
b = Water usable for recreational activity
c = Source of drinking water for supply after conventional treatment
d = Water usable by fisheries
e = Water usable by various process and cooling industries
f = Water usable by irrigation

4.4 Natural Environment

Natural environment is the part of the environment surrounding humans that contains only physical elements, such as the water, soil, air, and so on. These are elements that are tangible and that people can touch. In this section, a brief description of the natural environmental conditions, including geology, topography, soil, and hydrological profile of study area with necessary maps are provided.

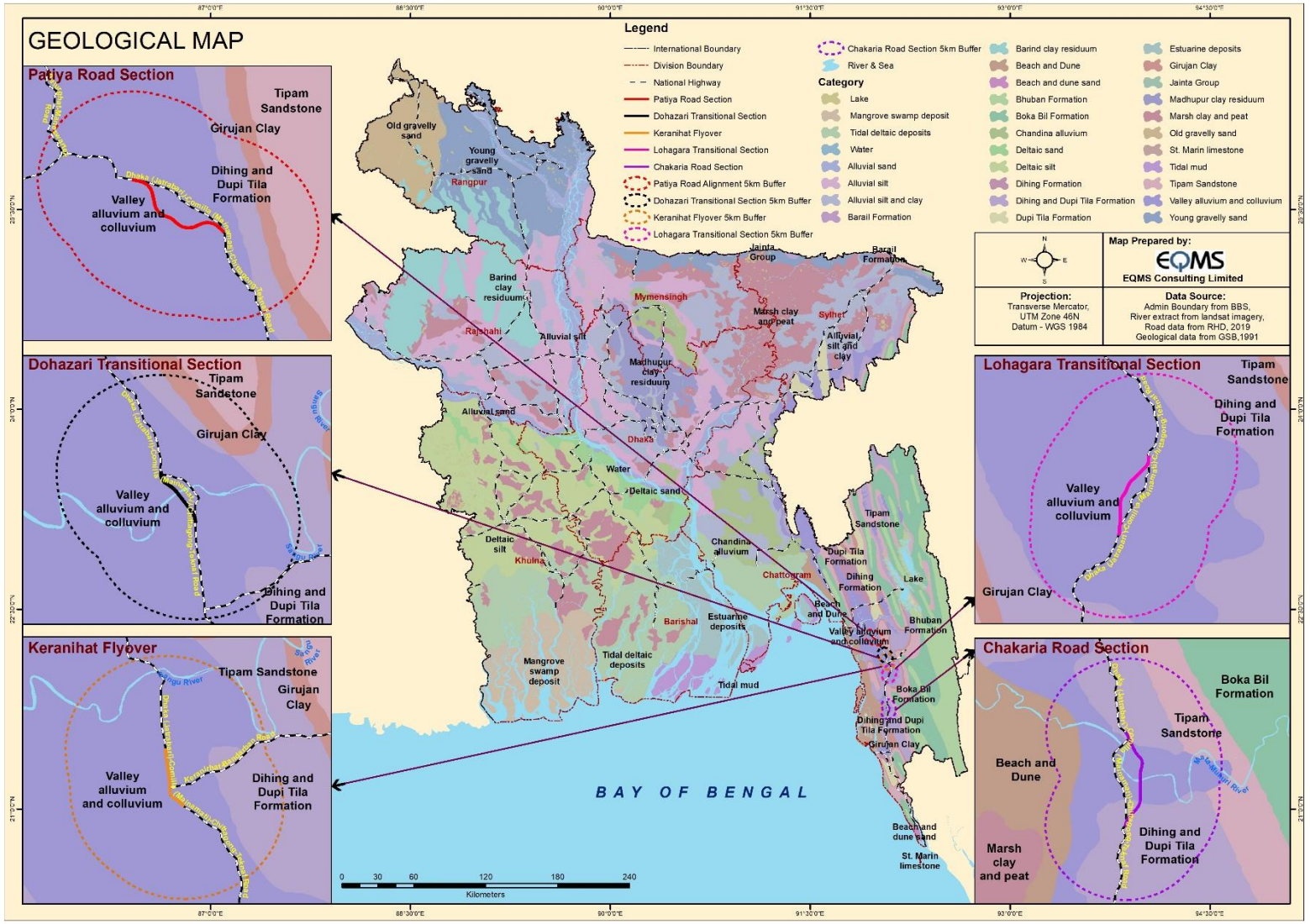
4.4.1 Geology

Chattogram area is situated within the tertiary hill region of folded flank of Bengal fore deep[8]. The folded part is composed of the Tipam sandstone formation and Girujan clay formation of Pliocene age at the bottom and Dupi Tila formation of Plio-Pleistocene age at the top. Tipam sandstone formation is hard and compact while other sandstones are mostly moderate to loosely compacted and consisted of medium to fine grained with minor amount of silt and clay. The Girujan clay formation consists of mottled clay with intercalations of sand bands and occasional coal streaks. The Dupi Tila formation comprises of sandstone and shale. Cox's Bazar is predominantly composed of Valley Alluvium and Colluvium and Dihing formation of Pliocene Pleistocene age[9]. Rocks of the Pleistocene, Pliocene and Neogene ages are also exposed in the area. The exposed rock units are mostly composed of sandstone and claystone. Six Lithostratigraphic units have been observed from the Geological Map of Bangladesh. To the west of the Municipal Boundary, the strand of coastal deposit, beach and dune sand, lies extending towards south. To the east of beach and sandstone, there lies another narrow zone of Boka Bil formation of Neogene age. A slight narrow zone Tipam sandstone of Neogene age forms the eastern side of Boka Bil zone. Along the east of Tipam sandstone zone, another formation of bedrock from Tipam group that is Girujan clay of Pleistocene and Neogene age lines. The northeastern boundary of the town consists of alluvial deposits of Valley Alluvium and Colluvium. The southeastern part of the town has basically Dihing formation bedrock which is characterized as yellow to yellowish-grey, massive, fine to medium grained poorly consolidated sandstone and clayey sandstone. Dupi Tila formation of Pleistocene and Pliocene age lies to the south of Dihing Formation which might have a slight influence in the surface geology of the city. Dupi Tila is characterized as yellow to ochre, pink, light-brown, light-grey to grayish-white or bluish-grey sandstone, siltstone and conglomerate. **Figure 4-56** shows the map of geological divisions of Bangladesh containing the alignments of the sub-projects.

[8] Islam, M.S., Islam, M.S., Ahmed, A.S.D., Karim, S.U., Hosain, M. and Hoque, F., Seismic Induced Landslide Vulnerability in the Chittagong City, Bangladesh. STM Journals 2015.
https://www.researchgate.net/publication/271198923_Seismic_induced_Landslide_vulnerability_in_the_Chittagong_City_Bangladesh

[9] Imtiaz, A., Barua, A., Sakib, M. and Ansary, M., 2018. Seismic Microzonation of Cox's Bazar Municipal Area Bangladesh. GEOTECHNICAL ENGINEERING, 49(3), pp.11-17.
https://www.researchgate.net/publication/327121431_Seismic_Microzonation_of_Cox's_Bazar_Municipal_Area_Bangladesh

Figure 4-56: Geological units of Bangladesh, including the project location



4.4.2 Topography

Chattogram district is located in the south-eastern region of Bangladesh, on the banks of Karnaphuli River between Chittagong Hills Tracks and Bay of Bengali. It borders Tripura State of India on the north, Khagrachari, Rangamati and Bandarban districts on the east, Cox's Bazar district on the south and Bay of Bengal, Feni and Noakhali districts on the west. It is part of Chittagong division. The port city of Chattogram, the second largest city in Bangladesh is in this district. The district lies between latitudes[10] 21º54' and 22º59' north and longitudes 91º17' and 92º13' east and has a total area of 5282.92 sq. km. (2039.74 sq. miles) of which 1,700 sq. km. (456.37 sq. miles) including coastal area.

Cox's Bazar is a coastal district located at the fringe of the Bay of Bengal with an unbroken sea beach which is probably the longest beach in the world. The district borders the Chattogram district on the north, Bay of Bengal on the south, Bandarban district, Myanmar and the Naf River on the east and the Bay of Bengal on the west. It lies between latitudes[11] 20º43' and 21º56' north and longitudes 91º50' and 92º23' east with a total area of2,491.85 sq. km. (962.10 sq. miles) out of which 940.58 sq. km is under forest.

Figure 4-57 shows the altitude distribution of the project areas with reference to the altitude distribution of whole country. Although altitudes up to 105 metres (344 ft) above sea level occur in the northern part of the plain, most elevations are less than 10 metres (33 ft) above sea level; elevations decrease in the coastal south, where the terrain is generally at sea level. With such low elevations and numerous rivers, water—and concomitant flooding—is a predominant physical feature.

The only exceptions to Bangladesh's low elevations are the Chittagong Hills in the southeast, the Low Hills of Sylhet in the northeast, and highlands in the north and northwest. The Chittagong Hills constitute the only significant hill system in the country and, in effect, are the western fringe of the north–south mountain ranges of Burma and eastern India. The Chittagong Hills rise steeply to narrow ridge lines, generally no wider than 36 metres (118 ft), with altitudes from 600 to 900 metres (2,000 to 3,000 ft) above sea level. At 1,052 metres (3,451 ft) altitude, the highest elevation in Bangladesh is found at Saka Haphong, in the southeastern part of the hills. Fertile valleys lie between the hills lines, which generally run north–south. West of the Chittagong Hills is a broad plain, cut by rivers draining into the Bay of Bengal that rises to a final chain of low coastal hills, mostly below 200 metres (660 ft), which attain a maximum elevation of 350 metres (1,150 ft). West of these hills is a narrow, wet coastal plain located between the cities of Chittagong in the north and Cox's Bazar in the south.

The map shows that the elevation of project areas is not homogenous, but varies within a short extent of the area. The Keranihat, Lohagara and Chakaria project area lies on an altitude range from 54 to 105 m from sea level. On the other hand, Patiya and Dohazari project areas are located on an elevation range from 20 to 54 m. Although the greater Chittagong region is highly undulating and comparatively higher than other parts of the country, the project locations are situated on western side of the area which is a foothill area with relatively plain topography.

4.4.3 Soil

The soils of greater Chittagong region consist of hard red clay with a mixture of fine brown sand. The soils are slightly to strongly acidic, and sometimes shallow over shale or sandstone bedrocks on very steep high hills.

Figure 4-58 shows the map of the type of soil in project areas with reference to the soil types of other parts of the country. The map shows that Patiya, Dohazari, and Keranihat project areas are situated on

[10] Bangladesh Bureau of Statistic (BBS). District Statistics 2011. Chittagong District. (Dec. 2013), http://203.112.218.65:8008/WebTestApplication/userfiles/Image/District%20Statistics/Chittagong.pdf

[11] BBS. District Statistics 2011. Cox's Bazar District. (Dec. 2013), http://203.112.218.65:8008/WebTestApplication/userfiles/Image/District%20Statistics/Cox%60s%20Bazar.pdf

Grey Piedmont Soils. On the other hand, Lohagara and Chakaria project areas are partly located on Grey Piedmont Soils and partly on Acidic Sulphate Soils and Deep and Shallow Brown Soils.

4.4.3.1 Grey Piedmont Soil

These soils occur on alluvial outwash fans at the foot of the northern and eastern hills and locally on the Chittagong coastal plain. Seasonal flooding is shallow, but they are severely affected by occasional flash floods by heavy rainfall. The topsoil has a 5-10 cm thick cultivated layer. They are grey to pale brown when dry and grey to olive-grey when wet. These layers are strongly to extremely acidic when dry, but neutral in reduced condition. The subsoil varies from 15 cm to more than 60 cm in thickness. They are grey with yellow-brown, brown, or red mottles. The structure is prismatic and blocky. The substratum comprises stratified material. Most soils are loamy in texture. They usually are more sandy close to hills, and more silty and clayey on the lower parts of the piedmont slopes. The topsoil usually lighter in texture than that of the subsoil. The agricultural productivity of these soils is mainly moderate to low. Most soils except sandy ridge soil are much better suited for paddy cultivation than dryland crops. These soils are classified as dystric or eutric gleysols.

4.4.3.2 Acidic Sulphate Soil

Acidic sulphate soils are formed in the tidal alluvium and are actually or potentially extremely acidic (pH < 3.5) within 124 cm of the surface. These soils occur in the Khulna and Chakaria Sundarbans, where former mangrove forest has been cleared for cultivation. Two types of soils are included in this type. One is tidally flooded with saline water throughout the year and is under mangrove forest and contains soft, finely stratified, muddy sediment layers. The other kind of soil occurs on land that has been cleared and brought under cultivation. Under field conditions, these soils are slightly acidic, but the pH decreases when dried. These extremely acidic soils are locally known as *Kosh* soils in the south of Chittagong region. The agricultural productivity of acidic sulphate soils is severely limited due to the extreme acidity of these soils. Shrimp culture is more economic than agricultural use because of the high cost for reclamation. The soils are classified as either thionic fluvisols of thionic gleysols.

Figure 4-57: Distribution of elevation from mean sea level (altitude) in project areas

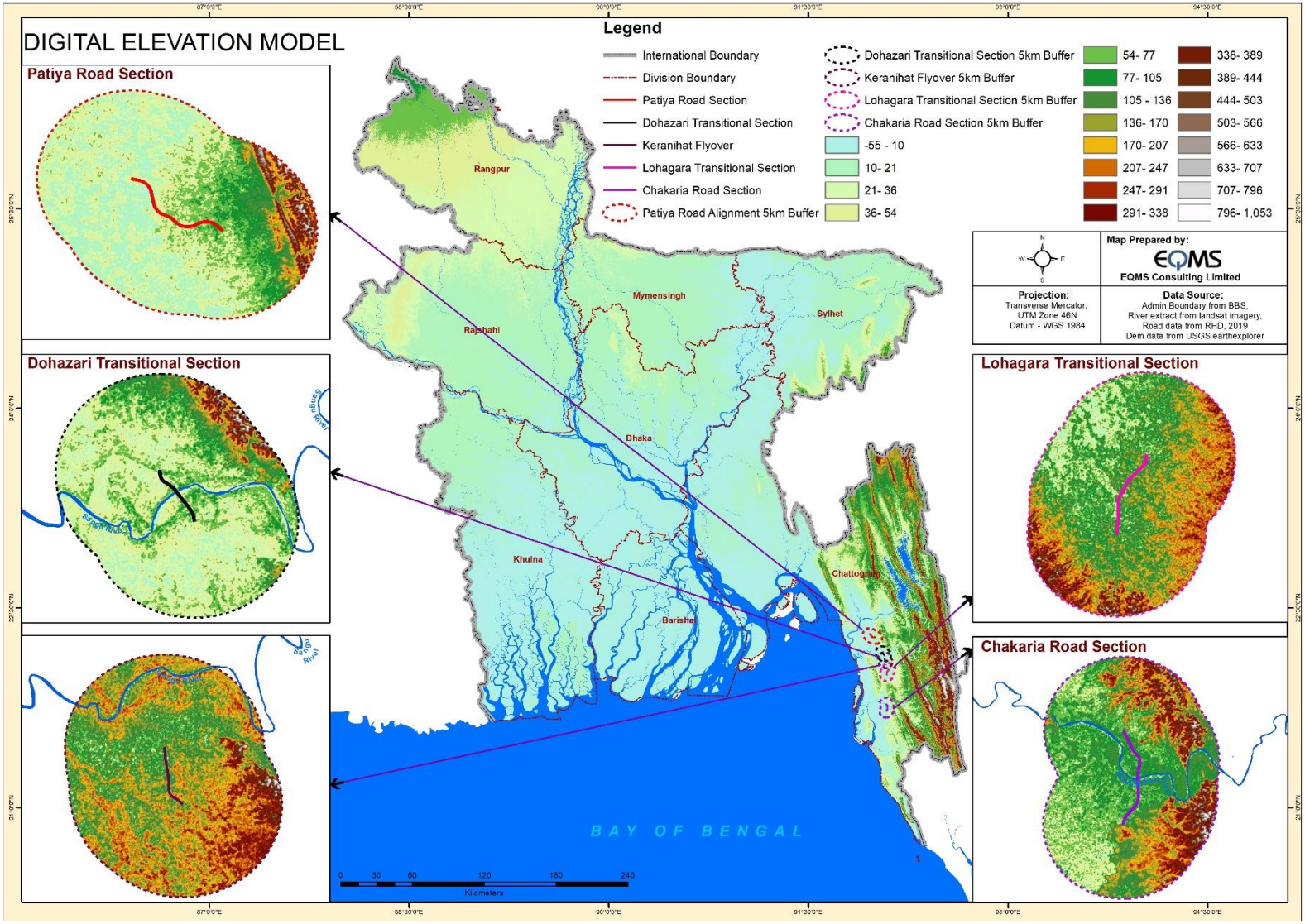
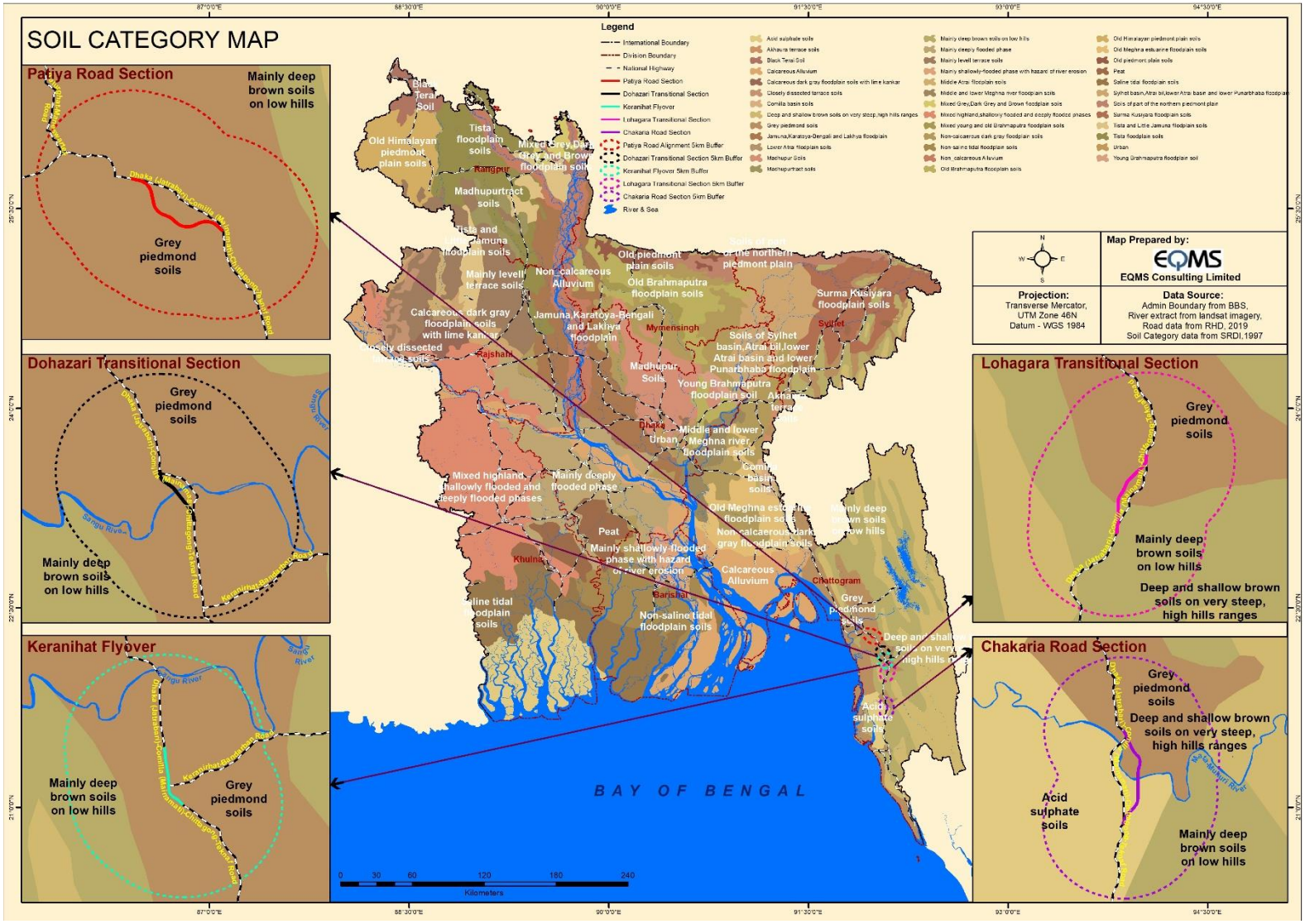


Figure 4-58: Soil map showing the types of soil in project areas



4.4.4 Flood and Water Resources

4.4.4.1 Flood Occurrence

The World Risk Report of 2016, on 173 countries, revealed that Bangladesh is the fifth most disaster-prone country in the world, particularly susceptible to devastating natural disasters such as flooding. Although the country and its people have adapted to regular flooding that maintain the equilibrium of a range of ecological systems, in extreme years, up to 68% of the country have been inundated with devastating effect. Floods in Bangladesh are annual phenomena, with the most severe occurrence during the months of July and August. Regular river floods affect nearly 20% of the country on an average, increasing up to 68% in extreme years. In Bangladesh, floods are commonly classified as flash flood, river flooding, and water logging. A brief description these flood types are given below.

Flash floods: these are caused by heavy or excessive rainfall in a short period over a relatively small area. During flash flooding, water levels rise and fall rapidly with little or no advance warning. Typically, they occur in areas where the upstream basin topography is relatively steep, and the time needed for the water to flow from the most remote point in a watershed to the watershed outlet is relatively short. The most affected areas are in the Haor Basin of the northern belt of Bangladesh, as well as the southeast in Chattogram, Cox's Bazar and Bandarban districts. Flash floods are most common from April to July and from September to October. Flash floods carry sediment that has eroded from hilly catchment areas. During heavy rainfall in the hilly regions, massive erosion occurs on exposed surfaces of the hills. When there is high rainfall, coarser sediment erodes and moves along the rivers. During a flash flood, sediment transport rates increase significantly resulting in a disproportionate distribution of sediment and changes in channel sizes, shapes, and even location.

River flooding: This type of flood is also known as monsoon flooding (June to September), which is the most common type of flooding in Bangladesh. It refers to, both, "normal" inundation of up to 25% of the country as well as extreme flooding which can inundate up to 70% of the country.

Water logging: It refers to stagnant river floodwaters that are unable to recede. This has become an increasingly concerning issue in urban areas like Dhaka and Chattogram districts due to rapid urbanization and poor waste management. Waterlogging can be particularly problematic at the end of the monsoon period (August/September).

According to **Figure 4-59**, the location of Patiya and Dohazari bypass are fully exposed to moderate flash flood prone areas, whereas the location of Chakaria bypass is partially exposed to moderate flash flood prone areas. On the other hand, the location of Keranihat flyover and Lohagara bypass are not exposed to any flood prone areas.

4.4.4.2 Water Resources

The main rivers of the Chattogram region originate in the hills. They are now increasingly subject to sedimentation due to unceasing deforestation and hilly cultivation practices (e.g., Jhum, shifting cultivation practiced by some countries in Asia). The major rivers of the region are: Karnafuli and its tributaries (e.g., Rainkhiang, Kasalong, Halda, Ichamati, etc.); Bakkhali, Sangu, Matamuhuri, Naf, and Feni. Kutubdia and Maheshkhali channels are the coastal channels of the region.

Karnafuli is the principal river of the region. It originates in the Lushai Hills of Mizoram (India), flows through Rangamati and the port city of Chattogram and discharges into the Bay of Bengal near Patenga. The river is flashy, and its length is about 131 km.

Several small streams originating in the southeastern hills of Mizoram meets the Naikhongchhari of Bandarban district to form the Bakkhali. Bakkhali flows through Naikhongchhari and Ramu of Cox's Bazar district and falls into Maheshkhali channel. This is also a flashy river and has a length of about 67 km.

Sangu River originates in the Arakan Hills of Myanmar and enters Bangladesh near Remarki (Thanchi

upazila of Bandarban district). It flows north through Thanchi, Rowangchhari and Bandarban upazilas of Bandarban district. Then it flows west through Satkania and Banshkhali upazilas of Chattogram district to meet the Bay of Bengal near Khankhanabad (Chittagong). The length of the river is 295 km.

Matamuhuri is a flashy river that originates in the Moyvar hills of Alikadam (Bandarban). It flows northwest through Alikadam and Lama upazilas of Bandarban and Chakaria of Cox's Bazar. The river discharges into Maheshkhali channel near Saplapur (Chakaria, Cox's Bazar). The length of the river is 148 km.

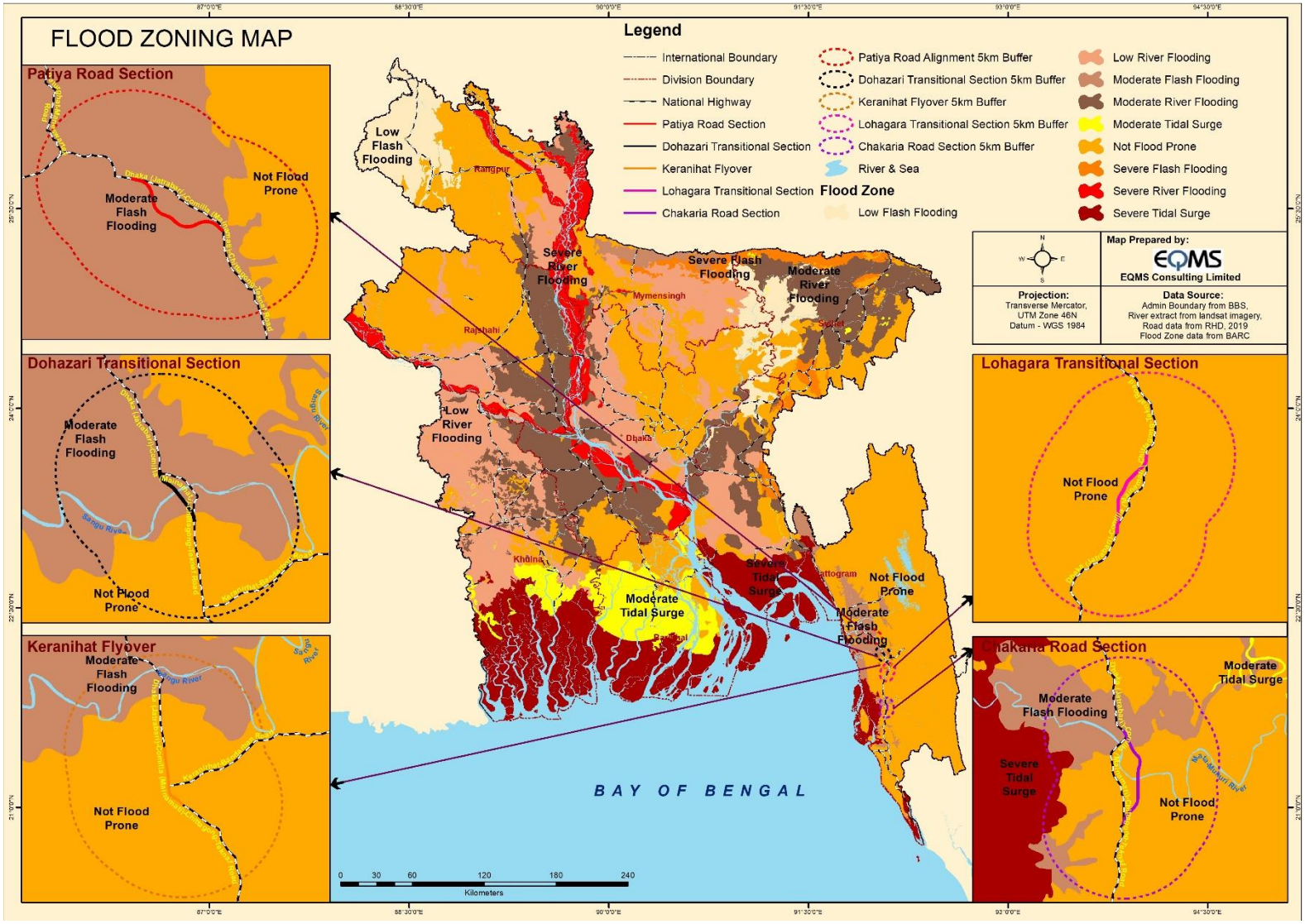
Naf River flows along the southernmost border line of the country. It originates in the northern hills of Myanmar and enters Bangladesh near Palong Khali of Ukhia upazila of Cox's Bazar district. The river flows through Ukhia and Teknaf and discharges into the Bay of Bengal near Sabrang (Teknaf upazila, Cox's Bazar). Most of the downstream reach of the river demarcates the Myanmar-Bangladesh border. The river is 62 km long.

Feni River originates in the eastern hills of Tripura and enters Bangladesh at Belchhari of Matiranga upazila of Khagrachhari district. If flows through Ramgarh (Khagrachhari), Fatikchhari (Chattogram) and then flows along the border of Chittagong (Mirsharai upazila) and Feni (Chhagalnaiya, Feni, Sonagazi upazilas) districts and discharges into the Bay of Bengal near Sonagazi. The length of the river is 108 km.

Kutubdia Channel lies in-between the mainland of the country (Cox's Bazar) and Kutubdia Island. The length of the channel is 24 km. The channel is connected with the Bay of Bengal at its both ends.

Maheshkhali Channel lies between the mainland of Bangladesh (Cox's Bazar district) and Maheshkhali Island. The channel carries the combined flow of the Matamuhuri and its tributaries and of other rivers such as Bharuakhali khal, Bura Matamuhuri, Mangla Khal, Manikchhari khal, etc. The length of the channel is 35 km. The channel is connected with the Bay of Bengal.

Figure 4-59: Flood zoning map showing the exposure of project locations to different flood prone areas



Additionally, Bagakain Lake, a true natural deep-water lake about 1.25 km long and covering an area of 21.21 ha, lies to the east of the region. Another true natural lake, Rainkhiangkine, 1.55 km long and covering an area of 32.66 ha, also lies in Chittagong Hill Tracts (CHT). The country's largest artificial water reservoir, Kaptai Lake, with a surface area of about 77 sq. km, also lies in this region on the Karnafuli River.

4.5 Biological Environment

Biological diversity or Biodiversity is the term given for the variety of life on Earth and the natural patterns it forms (CBD 2000[12]). It encompasses the variety of life, at all levels of organization, including evolutionary (phylogenetic) and ecological (functional). Biodiversity is the result of billions of years of evolution determined by natural processes and increasingly by the influence of humans. The diversity includes the wide variety of plants, animals and microorganisms. Scientists estimate that there are actually about 13 million species, though estimates range from 3 to 100 million (CBD 2000). However, biodiversity is not just the number of species in a particular area. It is the total variety of genetic strains, species and ecosystems that are found in nature. In principle, biodiversity is sub-divided into three major hierarchical categories, e.g.: variation at the genetic level within a particular species; species diversity or the number and proportion of different species in a particular area; and ecosystem diversity that describes the variation in the assemblages of species and their habitats (ITTO 1993[13]).

Bangladesh is situated between the Indo-Himalayas and Indo-Chinese sub-regions with distinct physiographic characteristics, variations in hydrological and climatological conditions, and differences in the soil properties contribute in developing diverse forms of ecosystems with rich flora and fauna. The country acts as an important merging and sharing habitat, land making bridge and biological corridors of the flora and fauna. Though small in size, Bangladesh is a biodiversity rich country. The people of the country have traditionally been using and conserving biodiversity generation after generations. Maintaining the sustainable use of these rich biodiversity is very important for a huge population of the country. However, the current status of biodiversity in Bangladesh is under stress. Population pressure, reckless pollution, monoculture, habitat destruction through land use change, introduction and rapid spread of invasive alien species along with the recent climate change is becoming a serious threat on our biodiversity (NBSAP 2005[14]).

4.5.1 Value of Biodiversity

The world community is now conscious about the intrinsic value of biodiversity and ecological, genetic, social, economic, scientific, educational, cultural, recreational and aesthetic values of biodiversity and its components (MoEF, 2007[15]). Some of the major values of biodiversity are i) Environmental value, ii) Social value, iii) Ecosystem services, iv) Economic value, v) Consumptive use value, vi) Productive use value, vii) Ethical and moral value, and viii) Aesthetic value. Biodiversity is the most precious gift of nature and mankind is blessed with it. As all the organisms in an ecosystem are interlinked and interdependent, the value of biodiversity in the life of all the organisms including humans is enormous. Direct use values (goods) are food, medicine, building material, fiber, fuel etc. Indirect use values (services) are atmospheric and climate regulation, pollination, nutrient recycling, cultural, spiritual and aesthetic etc. Non-use values include potential or option value (future value either as a good or service), existence value (value of knowing something exists), and bequest value, i.e., value of knowing that something will be there for future generations. In fact, most of the environmental or ecological services are non-marketed and hence does not have a market price. Even if a market price for a resource exists, market complexity structure often does not reflect the true 'opportunity cost' of resources (Haque and

[12] https://legal.un.org/avl/ha/cpbcbd/cpbcbd.html

[13] ITTO Guidelines on The Conservation Of Biological Diversity In Tropical Production Forests. 1993.

[14] http://www.poribesh.com/wp-content/uploads/2015/08/National-Biodiversity-Strategy-and-Action-Plan-2005.pdf

[15] http://old.moef.gov.bd/index.php

Aich, 2014)[16]. MEA (2005)[17] defined the ecosystem services conceptually based on four pillars, e.g., support, regulatory, provisional and cultural services.

4.5.2 Plant and Wildlife Diversity in Bangladesh

About 2,260 species of plant reported alone from the Chittagong Hill Tracts, which falls between two major floristic regions of Asia (MoEF, 1993[18]). Until now, an estimated 5,700 species of angiosperms alone, including 68 woody legumes, 130 fiber yielding plants, 500 medicinal plants, 29 orchids, 3 gymnosperms and 1,700 pteridophytes have been recorded from the country (Firoz et al., 2004[19]). The country also possesses a rich faunal diversity. Bangladesh is home of about 138 mammal species, more than 700 species of birds (passerine and non-passerine), 167 species of reptiles, 49 species of amphibians (IUCN, 2015). In addition to that, at least 253 species of fish (inland freshwater), 305 species of butterflies, 305 species of shrimp/prawn, 2,493 species of insects, 362 species of mollusks, 66 species of corals, 15 species of crabs, 19 species of mites, 164 species of algae, 4 species of echinoderms are believed to be exist in the country (IUCN 2015[20] and Islam et al., 2003[21]).

4.5.3 General Description of the Project Area

The study area is extended to Patiya, Chandanish, and Lohagara Upazila under Chattogram district and Chakaria Upazila under the Cox's Bazar district. Generally, wildlife habitats of Chattogram and Cox's Bazar district is covered by hill forest, massive coastal belt, river system, wetland, and homestead vegetation. Garjan (*Dipterocarpus* spp.), Bailam (*Anisoptera scaphula*) and Civit (*Swintonia floribunda*) are the major tree species of this forest belt. Most of these tree species have been exterminated but a few trees are still found at the periphery of the forest. Other important tree species are Shegun (*Tectona grandis*), Loha kath (*Xylia dolabiformis*), Hargoza *(Dillenia pentagyna*), Chalta (*Dillenia indica*), Chickrassi (*Chickrassia tabularis*), Jam (*Syzyzium* spp.), Uri-am (*Mangifera longipes*), Figs (*Ficus* spp.), Jarul (*Lagerstoemia speciosa)*, Bahera (*Terminalia bellirica*), Pitraj (*Ammora wallichi)*, Batna (*Quercus sp.),* Gutgutia (*Protium serratum*), Koroi (*Albizia* spp*.)*, Moase (*Brownlowia elata*), Chapalish (*Artocarpus chama*), Kanchon vadi (*Aldrovanda vesiculosa*) and Shimul (*Salmalia malabarica*).

Vegetation of Cox's Bazar district is mixed evergreen. The upper canopy ranges from 30 to 50 m high and is usually composed of Garjan (*Dipterocarpus* spp.), Chapalish (*Artocarpus chama*), Chundul (*Tetrameles nudiflora*), Civit (*Swintonia floribunda*), Telsur (*Hopea odorata*), Shimul (*Bombax ceiba*), Pitraj (*Aphanamixis polystachya*), Koroi (*Albizia* spp.), Bandorholla (*Duabhanga grandiflora*), *Acacia* spp., and so forth. The middle canopy is 15 to 25 m high and major tree species are Jam (*Syzygium* spp.), Rata (*Amoora wallchi*), Nageshwar (*Mesua ferrea*), Raktan (*Lophopetalum wightianum*), Uri-am (*Mangifera longipes*), Bhadi/Giol (*Lannea coromandelica*), Jarul (*Lagerstroemia* spp.), Gamar (*Gmelia arborea*), Figs (*Ficus* spp.), and Ajuli (*Dillenia pentagyna*). The lower canopy ranges from 7 to 15 m composed of saplings of species in the upper two canopies.

The composition of undergrowth, including the bamboo forests, varies considerably from place to place. The commonest species are Muli (*Melocanna bambusoides*), Mitinga (*Bambusa tulda*), Ground Orchard (*Geodorum* sp.), Galla Bet (*Daemonorops jenkinsianus*), Bet (*Calamus* spp.). There are

[16] Haque, A.K.E. and Aich, D. 2014. Economic valuation of ecosystem services in Bangladesh Sundarban Delta Vision 2050–a first step in its formulation.

[17] https://www.millenniumassessment.org/en/index.html

[18] http://old.moef.gov.bd/index.php

[19] Firoz R, Mobasher SM, Waliuzzaman M, Alam MK (eds). 2004. Proceedings of the Regional Workshops on National Biodiversity Strategy and Action Plan. Dhaka: IUCN Bangladesh Country Office.

[20] IUCN Bangladesh. 2015. Red List of Bangladesh Volume 1: Summary. IUCN, International Union for Conservation of Nature, Bangladesh Country Office, Dhaka, Bangladesh, pp. xvi+122.

[21] Islam, S.S. 2003. State of forest genetic resources conservation and management in Bangladesh. Forest Genetic Resources Working Papers, Working Paper FGR/68E. Forest Resources Development Service, Forest Resources Division. FAO, Rome, 31 pp

abundant creepers, lianas, and epiphytes, which include *Tinospora cordifolia*, *Vitis* spp., *Spatholobus roxburghii*, *Entada pursaetha, Derris* spp., *Ipomoea* sp., *Passiflora* spp., *Oberonia* spp., and so forth.

Paddy, Pulses, Ground Nut, Potato (Sweet and Round), Watermelon, Onion, Garlic, and winter vegetables are common crops cultivated at the Cox's Bazar district while Jackfruit, Mango, Banana, Papaya, Black Berry, Olive, Velvet Apple and Guava are the most common horticultural or fruit crops. The region has an irregular relief of broad and narrow ridges and depressions, interrupted by cut off channels and active channels. **Figure 4-60** shows the map of bio-ecological zones containing the locations of project areas.

4.5.4 Description of Project AOI

4.5.4.1 Bottleneck of Patiya (BP)

Patia Bottleneck is situated at Patia Upazila under the Chattogram district (previously known as Chittagong). Total length is about 5.23 km and closely lies on the existing bypass. Both side of the bottleneck area is identified as marshy areas which was inundated during the monsoon. Chandkhali khal flows on western part of the bottleneck. Human settlement and homestead vegetation were seen at the eastern part of the project. Chimnar khal is originated from hill range of Patiya Reserved Forest and Criss cross the habitat.

4.5.4.2 Bottleneck of Dohazari (BD)

Dohazari Bottleneck is situated at Chandanaish Upazila under the Chattogram district. Approximate length of this bottleneck is 3.51 km. This area is dominated by homestead vegetation and agricultural field. The Sangu River is originated from the hill of Bandarban and cross the bottleneck. This river is sources of various type of fishes and wildlife. Highly productive floodplain has the ample amount different type of vegetation. Urban wildlife species were observed around the bottleneck areas. Floristic composition includes the common homestead vegetation, shrub, herbs and timber yield plants species.

4.5.4.3 Bottleneck of Keranihat (BK)

Keranihat Bottleneck area is situated at Satkania Upazila under Chittagong district, covering the length of 3.79 km. Easter and western site of the northern part is dominated by marshy land large waterbodies. A small canal is also crossing the bottleneck in the northern part. Wetland vegetation are dominated at the northern end whereas human settlement, homestead vegetation, paddy field were found at the southern part. Variety of fishes, carnivores, waterbirds were known to be occur in Bangladesh.

4.5.4.4 Bottleneck of Lohagara (BL)

Lohagara Bottleneck is situated at Lohagara Upazila under Chattogram district. Lohagara bottleneck area is dominated by homestead vegetation, human settlements, agricultural field, and pond. The Tonkaboti crisscross the bottleneck. It is a small hill river originated from the nearby Tonkaboti hill range. Local community people cultivate vegetables and paddy on the bank of the river. This area is devoid of any forested area.

4.5.4.5 Bottleneck of Chakaria (BC)

Chakaria Bottleneck is the longest and significant bottleneck among the project sites. This area is dominated by forest species, homestead vegetation, river and wetlands. Fashiakhali Wildlife Sanctuary and Kakara Reserved Forest is situated at the close proximity of Chakaria Bottleneck. Forest dwelling wildlife species including mammals, birds, and reptiles were observed at near of the project site. Small patch of natural *Dipterocarpus* vegetation were observed at Kakara Forest Office. **Figure 4-61** shows the photographs of different types of habitats in the project areas.

Figure 4-60: Map of bio-ecological zones showing the locations of project areas

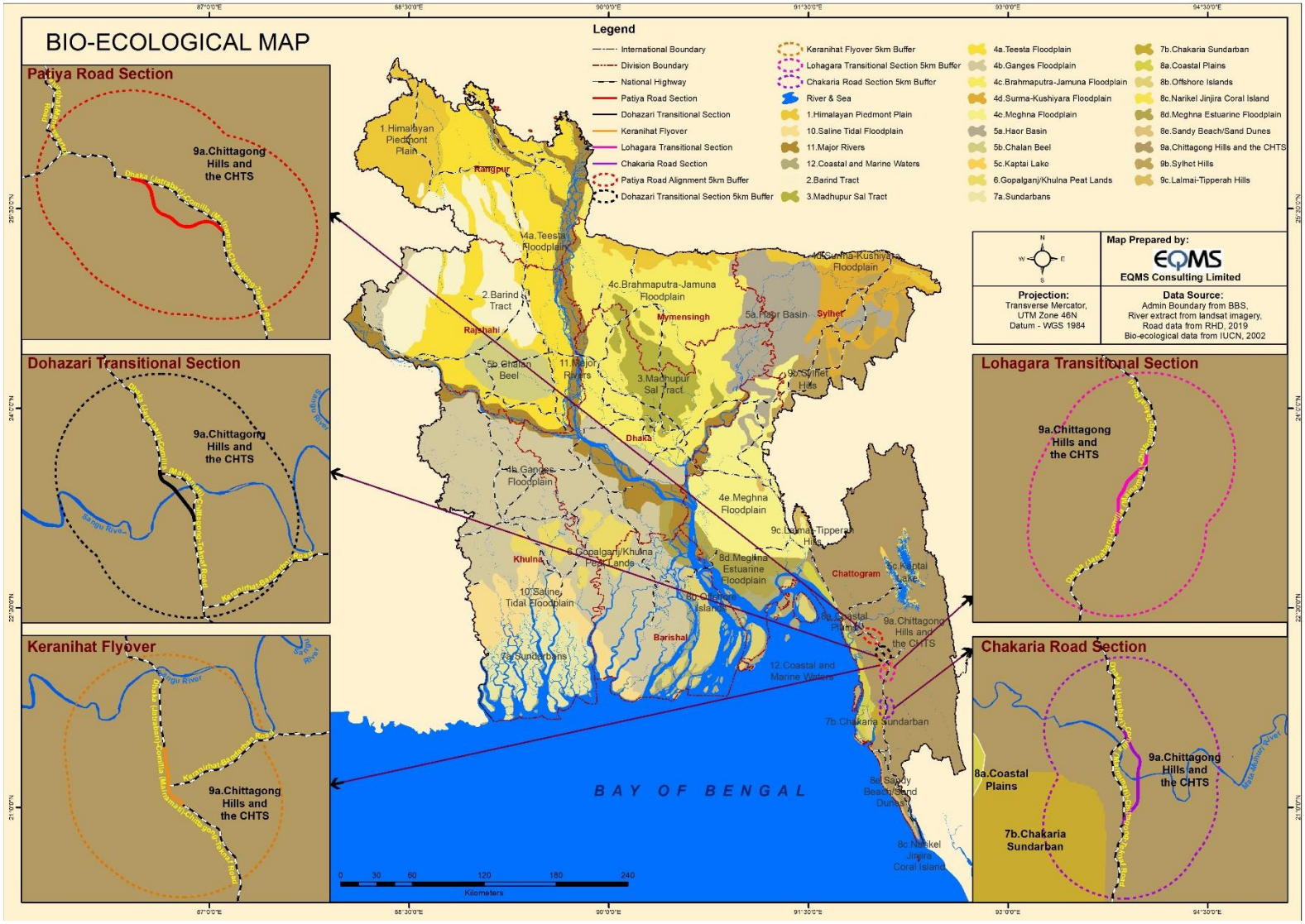


Figure 4-61: Different types of habitats in the project AOI

	
Chimnar khal at Patiya bottleneck	Homestead vegetation and crop field
	
Various habitat	Different types wildlife habitat
	
Pond water habitat	Wetland habitat


Different Types of Habitats at Patiya Bottleneck

Sangu river

Crop land

Crop land

Vegetable field


Different Types of Habitats at Dohazari Bottleneck



Different types habitats at Keranihat Bottleneck

Terrestrial habitat

Terrestrial habitat

Different types of habitats at Lohagara bottleneck

Matamuhuri river

Dipterocarpus forest

	
Hill stream near Fasiakhali Wildlife Sanctuary	Elephant prone area of Fasiakhali Wildlife Sanctuary
Different Types Habitat at Chakaria Bottleneck	

Source: Field Survey by EQMS, June and November 2020

4.5.5 Approach and Methodology

The main objectives of the Ecological Study are to conduct the baseline information of terrestrial flora and fauna and aquatic flora and fauna, assessing possible impact and providing effective mitigation measures.

Specific objectives of the proposed project are-

- Determining the aquatic floral and faunal composition at around the project AOI;
- Assessing the terrestrial floral and faunal composition at around the project area at the project AOI;
- Assessing the habitat connectivity of significant wildlife species at the project site; and
- Identifying the elephant corridor around the project site.

The methods of the ecological study are described below.

4.5.5.1 Secondary Information Collection

Secondary information was reviewed to know the occurrence of birds and bats fauna at project site and other ecological issues from published and unpublished literatures. Potential impact and mitigation measures were also suggested according to available literatures.

Occurrence and status of any significant species at the project area, identification of the possible impact and providing the suggested mitigation measure, fish migration, and use of project area by important wildlife species were supported by the discussion with the Forest Range Officers of Chunati Reserve Forest, Chunati Wildlife Sanctuary and Fashiakhali Wildlife Sanctuary and local community people.

4.5.5.2 Floral Survey

Project area is dominated by homestead vegetation. Small patches forest vegetation touches the Chakaria bottleneck area. Floral species were assessed by direct visual observation, consultation with Forest Department and local community people. Generally, this bottleneck area is devoid any forest areas which is dominated by homestead vegetation and exotic species. So, quadrate sampling would not suitably approach to assess the vegetation attribute at the project AOI.

4.5.5.3 Faunal Survey

4.5.5.3.1 Fish Survey

Fish composition assessment was conducted by direct visual observation, boat to boat survey, consultation with local fishermen and local community people. Local fisheries offices were also a source to understand the presence of any threatened fish species. Use of project AOI as migration route and breeding ground was identified. Fishes were identified by direct visual observations, consultation with local fishermen and community people.

4.5.5.3.2 Herpetofauna Survey

The Herpetofauna includes amphibian and reptiles. Area Search Method in the forest floor as well as human-dominated landscape for generating a more complete herpetofauna inventory of the region as well as assessing the effectiveness of area searches in general through estimation of detection probabilities obtained during surveys. Detection probabilities were relatively low for most groups, reaffirming that reptiles and amphibians are extremely secretive animals that are difficult to sample.

Area searches are more suitable method for reptile inventory. Herpetofauna survey was conducted at the appropriate habitats of the project AOI during night time. Identification of reptiles and amphibian species were identified by field guide and help from photograph. Species were reported from consultation of local community people and forest department. Opportunist observation were also be noted.

4.5.5.3.3 Birds Survey

Transect survey is the best way to estimate the wildlife population in an area with specific time. Birds' observations were undertaken to follow the transect method by direct visual observation and call. Relative frequency was calculated from 2 km fixed transect at the core zone of the project location. It was conducted on 1-hour study which was started from 8.00 AM and ended on 9.00 AM on 19 December 2019. This survey was repeated in next consecutive morning. Observer (s) visited the transect area at a steady pace with a scan of birds by visual observation and call and recorded the sightings in prepared data sheet. The relative frequency of the presence of the species has been assessed as very common (VC): seen during 80–100 % of the field visits; common (C): during 50–79 % of the field visits; uncommon (UC): observed during 20–49% of the field visits; few (F): met less than 19% field visits and rare (R): found occasionally[22]. Opportunistic observations, scanning of the important bird habitats (scattered trees and homestead vegetation) were considered during transect survey.

4.5.5.3.4 Mammals Survey

Mammals were survey by direct search method at appropriate habitats and opportunistic observation. Dawn and dusk were emphasized for nocturnal and crepuscular mammal species. Ecologist team also conducted survey during night for nocturnal species. Sign survey is another best technique to know the presence of any species in particular area[23]. Faeces, footprint was used as sign of an animal. Photograph were also used for identification of the species.

4.5.6 Observation and Analysis

4.5.6.1 Floral Composition

4.5.6.1.1 Aquatic Vegetation

Aquatic composition was dependent on the presence of the waterbodies type and quality. Common aquatic vegetation is Swamp Morning Glory (*Ipomoea aquatica*), Common Water Hyacinth (*Eichhornia*

[22] Khan, M.A.R. 1982. Wildlife of Bangladesh: A Checklist. The University of Dhaka, Dhaka.

[23] Gopal, R. 2012. Fundamental of Wildlife Management Technique. Natraj Publishers

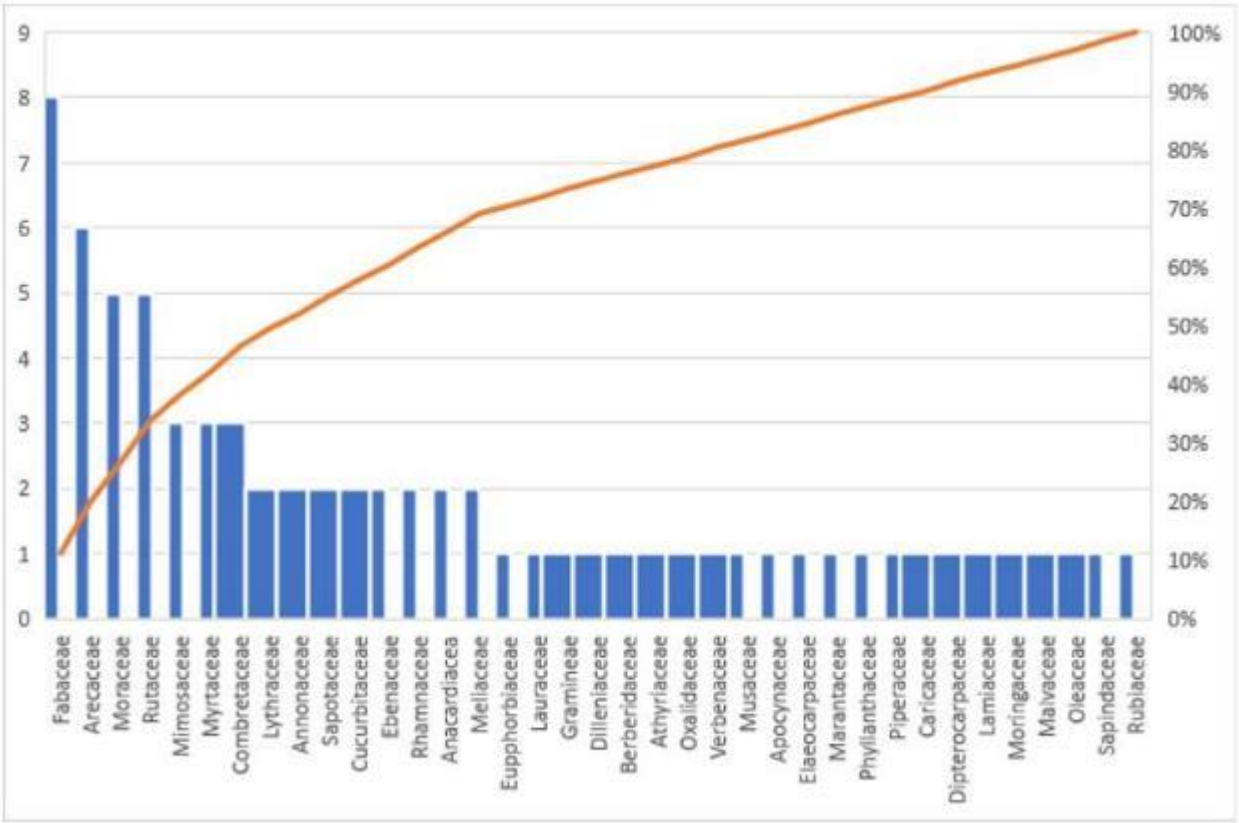
crassipes), Water Lettuce (*Pistia stratiotes*), Greater Duckweed (*Spirodela polyrhiza*), Kochu (*Colocasia esculenta*), Kalmi (*Ipomoea aquatica*) and Dhol Kalmi (*Ipomea fistulosa*) (**Appendix E-1**). About 13 species of aquatic vegetation were observed at Patiya bottleneck whereas 10, 8, 8 and 9 species were recorded at Dohazari, Keranihat, lohagara and Chakaria bottleneck respectively.

4.5.6.1.2 Terrestrial Vegetation

Homestead Vegetation: 68 species of homestead plant species are identified from project AOI under 38 family. Family Fabaceae supports the highest species which is followed by Arecaceae, Moraceae, Rutaceae respectively (**Figure 4-62**). None of them are considered as threatened species on the basis of IUCN Red List. However, Mahagoni (*Swietennia mahagoni*) is considered as Near Threatened species globally. Mahagoni is exotic species in Bangladesh and mainly use this tree as timber. It is native in North America and Caribbean Island. **Appendix E-2:** lists the available homestead vegetation found in the study area.

Hill Side Forest Vegetation: A small portion of Kakara Reserved Forest and Fashiakhali Wildlife Sanctuary cross the proposed Chakaria bottleneck. Portion of Fashiakhali Wildlife Sanctuary is devoid of any natural forest vegetation while a small patch Garjan (*Dipterocarpus* sp.) were present at Kakara area beside the Kakara Forest Beat office. All the Grajan tree species were completely mature and cover the upper canopy. Other forest species are Telshur (*Hopea odorata*), Jam (*Syzygium* sp), Shimul (*Bombax ceiba*), Kathbadam (*Terminalia catappa)*, Mandar (*Erythrina indica*), Vadi (*Lannea coromandelica),* Bot (*Ficus bengalensis*) and Ziri bot (*Ficus benjamina*) (**Appendix E-3:**).

Figure 4-62: Family wise distribution of the homestead vegetation



4.5.6.2 Faunal Composition

4.5.6.2.1 Amphibian Diversity

About 12 species of amphibian were reported from the project AOI (**Appendix E-4:**). All the identified amphibian species are considered as Least Concern according to IUCN Red List of Bangladesh (2015).

AOI of Chakaria bottleneck support the highest 12 species which were followed by Patiya, Dohazari, Keranihat and Lohagara. None of the species are considered as conservation significant species.

4.5.6.2.2 Reptiles Diversity

About 25 species of reptiles were recorded from the project AOI by the direct visual observations, consultation with local community people and Bangladesh Forest Department (**Appendix E-5**). Chakaria bottleneck supported the highest reptilian species composition (22 species) which was followed Dohazari, Keranihat, Lohagara and Patiya bottle. There is no conservation significant species of reptiles at the project AOI. All the species are Least Concern with two monitors (Varanus sp.) as Near Threatened. Peacock Softshell Turtle (*Nillsonia hurum*) which is considered as Least Concern Species in Bangladesh and Vulnerable species globally.

4.5.6.2.3 Mammals Diversity

About 19 species of mammals were reported from the project AOI (**Appendix E-6**). Among them, Chakaria bottleneck supported the highest species composition, which was followed Dohazari, Patiya, Keranihat and Lohagara. Ganges River Dolphin was only reported from the Sangu River at Dohazari bottleneck by the consultation with local community people and Local Forest Department. Asian Elephant (*Elephas maximus*), Barking Deer (*Muntiacus muntjac*), Wild Boar (*Sus scrofa*) and Rhesus Macaque (*Macaca mulatta*) were only very rarely reported at and around the area of Fasiakhali Wildlife Sanctuary and Kakara Reserved Forest. However, there are no habitats for these species and no active migration route of Asian Elephant in the bottleneck site of Chakaria.

4.5.6.2.4 Birds Diversity

A total of 86 species of birds were recorded from the project AOI. **Appendix E-7:** shows a list of bird species found in the study area during ecological survey. The study found that many of the birds that are commonly available in Bangladesh are also present in project area. All the species are Least Concern according to IUCN Bangladesh 2015.

4.5.6.2.5 Fish Diversity

A fish survey was conducted to identify the fish diversity in study area. **Figure 4-63** shows the scientific names and pictures of fishes found in the project area during ecological survey. The identified fishes are: *Channa punctata*, *Clarias batrachus, Anodontostoma chacunda, Anabas testudineus, Channa striatas, Labeo angra, Ilisha megaloptera, Salmophasia bacaila, Amblypharyngodon microlepis, Pseudambassis lala, Heteropneustes nani, Pethia conchonius*, etc. A checklist has been provided in **Appendix E-8**.

Among these fish species, eleven are Least Concern and one is Data Deficient according to IUCN Bangladesh 2015. Also, these species are not enlisted in Schedule I and Schedule II (protected wild animal) of Wildlife Conservation & Security Act, 2012.

Figure 4-63: Fish species found at the study area

	
Channa punctata	*Clarias batrachus*
	
Anodontostoma chacunda	*Anabas testudineus*
	
Channa striatas	*Labeo angra*

	
Ilisha megaloptera	*Salmophasia bacaila*
	
Amblypharyngodon microlepis	*Pseudambassis lala*
	
Heteropneustes nani	*Pethia conchonius*

CHAPTER 5

Socio-Economic Environment

5 SOCIO-ECONOMIC ENVIRONMENT

The present socio-economic conditions of the people of the project area will provide sound reference and assess probable socio-economic impact of the proposed interventions. This will enable us to compare the changes and impacts of the project interventions in future. The socio-economic baseline scenario describes the socio-economic characteristics of project area on the basis of primary and secondary data. The socio-economic characteristics include administrative area, demographic, household size, education, occupation, settlement and housing, employment opportunity, access to public utilities, water and sanitation status etc.

5.1 Administrative Area and Location

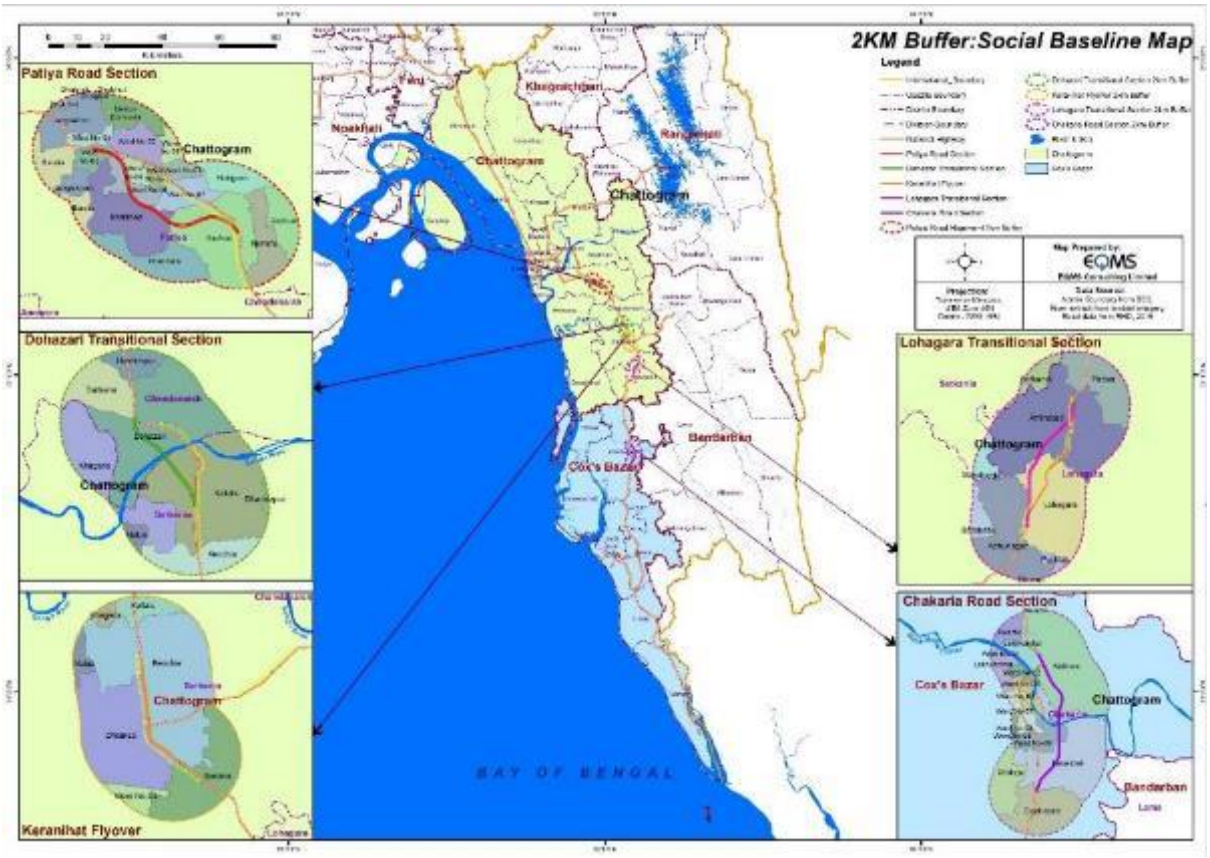
The proposed project is located over the two districts titled Chattogram and Cox-Bazar and five Upazillas are Patiya, Chandanaish, Satkania, Lohagara and Chakaria. Based on the assessment of the project, its surroundings and its environmental & social influence, RoW of proposed road considered as the study area for the social study. **Table 5-1** and **Figure 5-1** shows the study area of the project across Unions/ Paurashava, Upazila and District. The socio-economic features of the study area are discussed in this section.

As the project intend to construct four bypasses road and one flyover in five major bottlenecks of Chattogram-Cox's Bazar highways to reduce traffic congestion and to enhance a smooth traffic operation. The bottleneck locations where a bypass is planned to construct are Patiya, Dohazari, Lohagara, and Chakaria. On the other hand, a flyover will be built in Keranihat to avoid the conflict with nearby Chattogram-Cox's Bazar Railway.

Table 5-1: Study Area

District	Upazila	Union
Chattogram	Patiya	Bhatikhain
		Kachuai
		Ward No-06
		Ward No-07
	Chandanaish	Dohazari
		Satbaria
	Satkania	Kaliais
		Keonchia
		Dhemsa
		Sadaha
	Lohagara	Amirabad
		Lohagara
Cox's Bazar	Chakaria	Fasiakhali
		Kakara
		Lakhyarchar
		Ward No-09

Figure 5-1: Social Baseline Map of Study Area



5.2 Demographic Profile

In the proposed study area 13 unions and 3 wards, there are about 62095 households (HHs) with a total population of 336010 that will be influenced by the implementation of the proposed project. The average sex ratio is 106 and the average household size 5.35. The demography of the study area is shown in the following **Table 5-2.**

Table 5-2: Demography of the Study Area

Upazila	Union	Total Pop	Total HHs	Avg. HH Size	Sex Ratio
Patiya	Bhatikhain	7624	1433	5.3	100
	Kachuai	24344	4704	5.2	101
	Ward No-06	4849	928	5.2	100
	Ward No-07	7357	1218	4.7	175
Chandanaish	Dohazari	40147	7601	5.3	103
	Satbaria	24327	4652	5.2	94
Satkania	Kaliais	20563	3665	5.5	102
	Keonchia	25031	4338	5.5	108
	Dhemsa	16015	2822	5.5	104
	Sadaha	30896	5390	5.7	99
Lohagara	Amirabad	37303	7342	5	93
	Lohagara	35010	6707	5.2	103

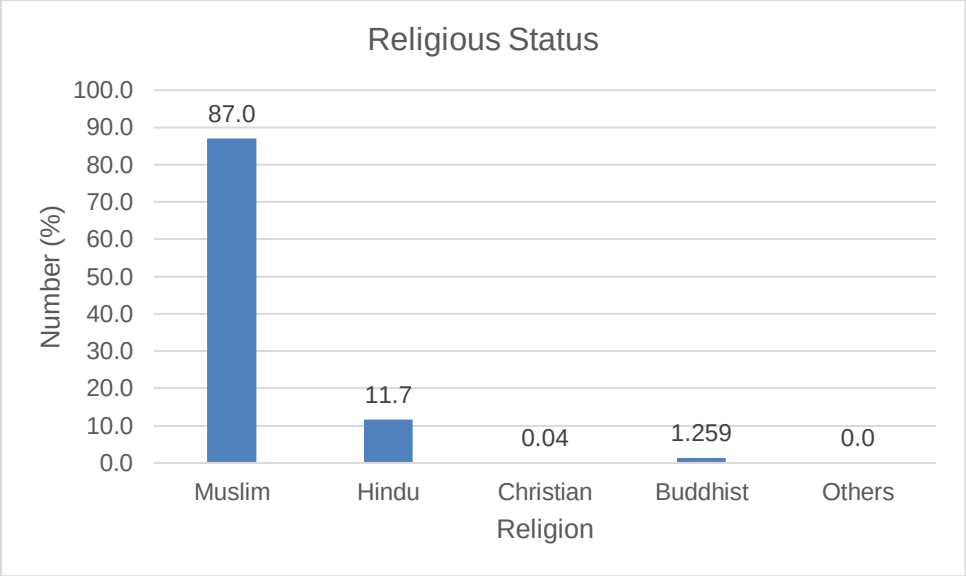
Upazila	Union	Total Pop	Total HHs	Avg. HH Size	Sex Ratio
Chakaria	Fasiakhali	25137	4528	5.5	100
	Kakara	22829	4177	5.5	100
	Lakhyarchar	8069	1480	5.4	100
	Ward No-09	6509	1110	5.9	107
Study Area		**336010**	**62095**	**5.35**	**106**

Source: Population and Housing Census, BBS, 2011

5.3 Religion

According to the population and housing census (2011), the population of the study areas is dominated by the Muslim community constituting almost 87% of the total population. The remaining 11.7% is primarily constituted by Hindus. Whereas, the composition of other religion like 1.26% is Buddhist, Christians are negligible. The following **Figure 5-2** indicates the various religious profile of the project study area.

Figure 5-2: Religious Status



Source: Population and Housing Census, BBS, 2011

5.4 Ethnic Composition

According to the population and housing census (2011) ethnic population in is very much less in the proposed study area. Total 53 number of ethnic households reside in the area. Whereas, 34 are Chakma, 13 are Marma and others are 165 persons. The ethnic composition depicted in the below **Table 5-3.**

Table 5-3: Ethnic Composition

Upazila	Union	Number of Households	Ethnic Population			Ethnic Population in main groups			
			Total	Male	Female	Tripura	Chakma	Marma	Others
Patiya	Bhatikhain	1	3	3	0	0	0	3	0
	Kachuai	3	9	9	0	1	8	0	0
	Ward No-06	0	0	0	0	0	0	0	0
	Ward No-07	2	2	1	1	0	1	1	0
Chandanaish	Dohazari	3	11	6	5	0	4	0	7
	Satbaria	0	0	0	0	0	0	0	0
Satkania	Kaliais	2	6	2	4	0	0	2	4
	Keochia	1	3	1	2	0	0	3	0
	Dhemsa	1	3	2	1	0	3	0	0
	Sadaha	0	0	0	0	0	0	0	0
Lohagara	Amirabad	3	15	6	9	0	15	0	0
	Lohagara	1	4	1	3	0	0	4	0
Chakaria	Fasiakhali	35	154	71	83	0	0	0	154
	Kakhara	0	0	0	0	0	0	0	0
	Lakhyarchar	0	0	0	0	0	0	0	0
	Ward No-09	1	3	1	2	0	3	0	0
Total		**53**	**213**	**103**	**110**	**1**	**34**	**13**	**165**

Source: Population and Housing Census, BBS, 2011

A brief profile of the two ethnic groups is provided in below Box[24]:

Chakmas: The Chakmas or Changmas are considered to be the largest ethnic group in Bangladesh, mainly residing in the central and northern parts of the Chittagong Hill Tracts, mainly in Rangamati and Khagrachhari districts. The Chakma community also reside in various northeast Indian states. The Chakma language has Indo-Aryan roots, whichis closely related to Chittagonian Bengali, and majority practice Theravada Buddhism as their faith, with their major festival being the *Bizu*festival. Traditionally, the Chakma people practice shifting (jhum) agriculture.

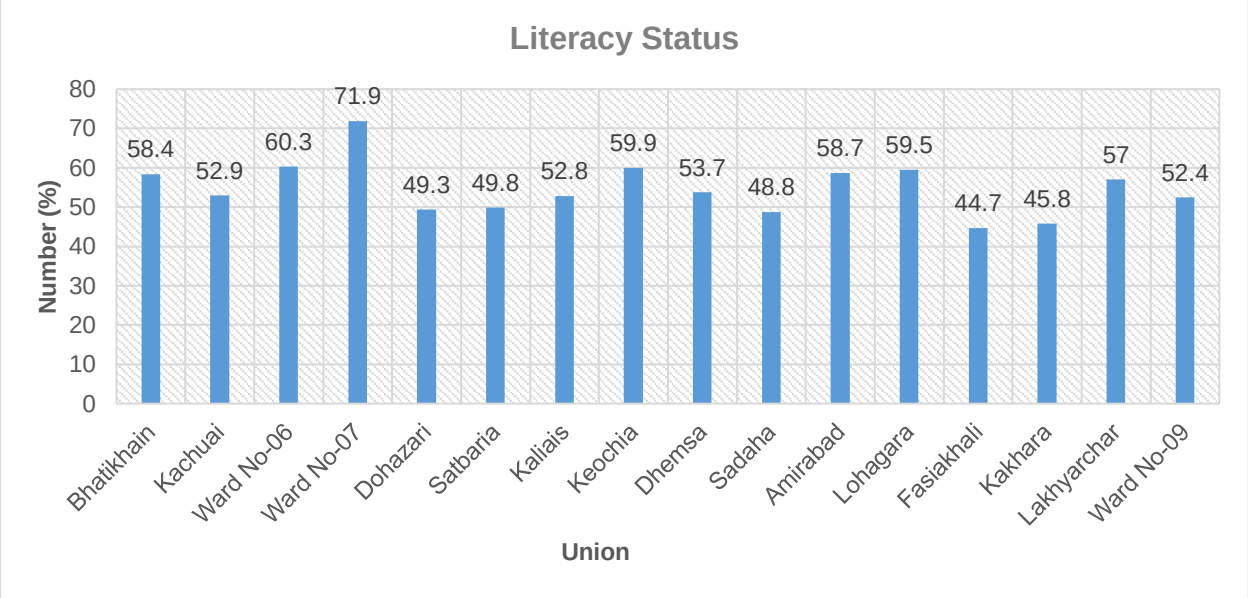
Marmas: The Marmas are an ethnic group mainly residing in Rangamati, Bandarban and Khagrachhari districts of Bangladesh, who refer to themselves as Rakhain. The Marma language belongs to the Burma- Arakan group. The Marmas too mainly practice shifting agriculture as well as wage labour and basketry for their economic activities. The Marma community mainly practice Buddhism as their faith, while animism is also practiced.

[24] Willem van Schendel (ed), Francis Buchanan in South-east Bengal (1798): His Journey to Chittagong, Chittagong Hill Tracts, Noakhali and Comilla; Meshbah Kamal et al, Cultural Survey of Bangladesh Series-5, Indigenous Communities, Asiatic Society of Bangladesh 2007; Sirajul Islam (ed), History of Bangladesh, vol. 1 (2007), chapter Five

5.5 Level of Education

According to the population and housing census (2011), it shows that the concentration of literate people in thirteen unions and three ward of selected upazilas. The average literacy rate in the study area is 54.7% which is significantly higher than the national average of 47.68%. The following **Figure 5-3** shows the literacy rate of the project study area.

Figure 5-3: Literacy Status of Study Area



Source: Population and Housing Census, BBS, 2011

5.6 Settlement and Housing

According to the population and housing census (2011), total households of the project study area is 62095. The types of structures have been categorized into *kutcha* (temporary) *semi-pucca* (semi-permanent), *pucca* (permanent) and *Jhupri* (huts).[25] The predominant structure of this study area is Kutcha (57.3%) followed by Semi-pucka (16.7%), Pucka (15.6%) and Jhupri (10.4%). Housing tenancy of the study area is owned by (89%), rented (9.6%) and rent free (1.4%). The following **Table 5-4** shows the type of structure and housing tenancy in the project study area.

Table 5-4: Housing and Settlement

Upazila	Union	Type of Structure (%)				Housing Tenancy (%)		
		Pucka	Semi-pucka	Kutcha	Jhupri	Owned	Rented	Rent free
Patiya	Bhatikhain	13.1	17.5	66.1	3.3	96.4	2	1.6
	Kachuai	9.1	14.1	73.7	3.1	91.9	7	1.1
	Ward No-06	22.3	25.3	52.2	0.2	80.8	18.3	0.9
	Ward No-07	34.9	31.0	31.4	2.7	46.7	48.9	4.5
Chandanaish	Dohazari	10.8	11.2	62.2	15.7	78.5	17.8	3.7

[25] *Kutcha* (temporary) structures are made out of mud brick, bamboo, sun-grass, wood and are occasionally corrugated iron sheets as roofs. *Semi-pucca* (semi-permanent) structures have walls made partially of bricks, cemented floors and corrugated iron sheet roof. *Pucca* structures have bricks walls and concrete roof, while Jhupri structures are temporary huts.

Upazila	Union	Type of Structure (%)				Housing Tenancy (%)		
		Pucka	Semi-pucka	Kutcha	Jhupri	Owned	Rented	Rent free
	Satbaria	15.7	9.1	62.2	12.9	97.6	1.2	1.2
Satkania	Kaliais	14.5	13.3	62.9	9.3	94.2	5	0.8
	Keochia	20.2	17.4	50.3	12.1	89.7	9.1	1.2
	Dhemsa	17.1	15.6	24.9	42.4	92.3	6.5	1.1
	Sadaha	15.5	12.3	67.3	4.9	98.1	1.2	0.7
Lohagara	Amirabad	17.1	16.9	59.3	6.8	93.3	5.6	1.1
	Lohagara	30.4	15.9	50.2	3.5	78.6	20	1.4
Chakaria	Fasiakhali	2.9	13.4	63.4	20.3	97.4	1.3	1.2
	Kakhara	4.1	14.1	76.1	5.7	97.7	1	1.2
	Lakhyarchar	12.0	23.5	58.5	6.0	93.8	5.1	1.1
	Ward No-09	9.5	16.8	56.2	17.5	96.9	2.8	0.3
Total		**15.6**	**16.7**	**57.3**	**10.4**	**89.0**	**9.6**	**1.4**

Source: Population and Housing Census, BBS, 2011

5.7 Traffic and Transport

As per District Statics 2013, it has been found that, among the selected Upazillas there are 396.65 KM metalled road, 617 KM semi metalled road and 2523 KM unmetalled kutcha road. Among these Upazillas Satkania have highest 106 KM metalled road, and Lohagara have 917 KM unmetalled kutcha road. Below **Table 5-5** shows the road condition of study area.

Table 5-5: Traffic and Transport

Upazilla	Road Length			
	Metalled road (KM)	Semi metalled (KM)	Unmetalled Kutcha Road (KM)	Total
Patiya	86	52	490	628
Chandanaish	81	141	202	424
Satkania	106	106	482	694
Lohagara	83	114	917	1115
Chakaria	40.65	204	432.02	676.67
Total	**396.65**	**617**	**2523.02**	**3537.7**

Source: District Statistics 2013

5.8 Public Utilities

5.8.1 Water Supply

At the project study area, the major source of drinking water is tube-well where about 92.7% population use tube-wells water. Studied Unions have 3.1% access to tap water. On the other hand, 3.9% people have access neither tube-well nor tap water. An overview is depicted in **Table 5-6.**

Table 5-6: Status of Water Supply

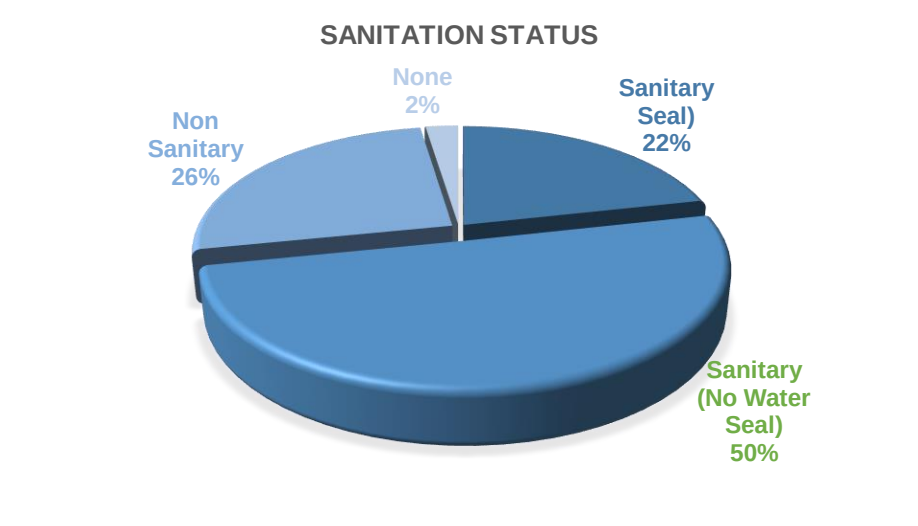
Upazila	Union	Tap (%)	Tube-well (%)	Other (%)
Patiya	Bhatikhain	0.1	98.7	1.3
	Kachuai	0.4	97	2.6
	Ward No-06	1.8	98.2	0
	Ward No-07	13.2	86	0.8
Chandanaish	Dohazari	0.9	94	5.1
	Satbaria	0.3	92	7.7
Satkania	Kaliais	1.6	96.1	2.3
	Keochia	6.6	84.9	8.5
	Dhemsa	1.5	94.7	3.8
	Sadaha	0.4	94.7	4.9
Lohagara	Amirabad	5.5	89.9	4.6
	Lohagara	13.6	81.6	4.8
Chakaria	Fasiakhali	0.4	90.7	8.9
	Kakhara	0.3	93.4	6.3
	Lakhyarchar	2.6	97.3	0.1
	Ward No-09	0.1	94.2	5.7
Total of Study Area		**3.1**	**92.7**	**4.2**

Source: Population and Housing Census, BBS, 2011

5.8.2 Sanitation

In the study area, about 22% and 50% of the households use non-water sealed and water-sealed sanitary latrine facility respectively, whereas about 26% households use non-sanitary facilities. On the contrary, only 2% households defecate in open places with no access to hygienic latrine facilities. The following **Figure 5-4** shows sanitation facility of the project area.

Figure 5-4: Sanitation Status



Source: Population and Housing Census, BBS, 2011

5.8.3 Solid Waste

Uncontrolled waste generation coupled with inadequate collection and disposal systems have the potentiality to give rise to pollution and environmental degradation as well as disease. While no specific data on local waste management was collected from the study area, it is likely that – as with many other parts of rural Bangladesh – the villages within the study area have no formal waste management facilities, and that in general people dispose of their waste in landfills or in fallow land.

5.9 Economy and Employment

5.9.1 Employment Structure

According to the Population and Housing Census (2011), there are approximately 66847 people in the study area out of which 22408 male and 2326 female are employed. Moreover, a significant number of the population; 1266 male and 25702 female of the study area are involved in household work. Also, 399 male and 149 female are looking for work and 6322 male and 8275 female are not involved in any kind of employment. The following **Table 5-7** shows the employment status of the project area.

5.9.2 Cultural Issues in Employment

According to the Population and Housing Census (2011), service is the dominant source of employment in the study area. A significant number of male 46% and 61% female involved in service sector. Study finds that, 41.4% male and 31% female involved in the agricultural activities including crops cultivation, fishing, direct farming, sharecropping, agricultural laborers etc. Only 13% male and 9% female involved in industry sector. The following **Table 5-8** shows the employment status of the project area.

Table 5-7: Employment Structure of the Study Area

Upazilla	Union	Population Aged 7+, not attending school but employed			Employment Status							
					Employed		Looking for work		Household work		Do not work	
		Total	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Patiya	Bhatikhain	1266	548	718	406	30	4.0	1.0	21	540	117	147
	Kachuai	4737	2167	2570	1690	139	15.0	3.0	43	1842	419	586
	Ward No-06	555	238	317	179	7	0.0	1.0	7	232	52	77
	Ward No-07	619	304	315	203	32	2.0	0.0	7	197	92	86
Chandanaish	Dohazari	11233	5251	5982	4268	483	86.0	36.0	115	4419	782	1044
	Satbaria	5261	2301	2960	1737	118	44.0	10.0	87	2396	433	436
Satkania	Kaliais	3656	1619	2037	1207	141	10.0	4.0	144	1486	258	406
	Keochia	4491	2010	2481	1511	87	10.0	4.0	74	1750	415	640
	Dhemsa	2946	1368	1578	1092	36	9.0	6.0	23	1139	244	397
	Sadaha	5932	2615	3317	1904	155	30.0	11.0	42	2289	639	862
Lohagara	Amirabad	5150	2083	3067	1381	89	18.0	3.0	49	2180	635	795
	Lohagara	5404	2434	2970	1759	147	14.0	17.0	39	1830	622	976
Chakaria	Fasiakhali	7093	3380	3713	2104	624	50.0	17.0	487	2261	739	811
	Kakhara	5375	2608	2767	1935	181	94.0	30.0	96	1894	483	662
	Lakhyarchar	1419	650	769	427	13	11.0	5.0	9	574	203	177
	Ward No-09	1710	819	891	605	44	2.0	1.0	23	673	189	173
Study Area		**66847**	**30395**	**36452**	**22408**	**2326**	**399**	**149**	**1266**	**25702**	**6322**	**8275**

Source: Population and Housing Census, BBS, 2011

Table 5-8: Cultural Issues in Employment

Upazila	Union	Population Aged 7+, not attending school but employed			Field of Activity											
					Agriculture				Industry				Service			
		Total	Male	Female	Male	%	Female	%	Male	%	Female	%	Male	%	Female	%
Patiya	Bhatikhain	436	406	30	167	41.1	6	20.0	68	16.7	7	23.3	171	42.1	17	56.7
	Kachuai	1829	1690	139	763	45.1	19	13.7	79	4.7	28	20.1	848	50.2	92	66.2
	Ward No-06	186	179	7	35	19.6	1	14.3	10	5.6	0	0.0	134	74.9	6	85.7
	Ward No-07	235	203	32	32	15.8	11	34.4	11	5.4	1	3.1	160	78.8	20	62.5
Chandanaish	Dohazari	4751	4268	483	2181	51.1	206	42.7	254	6.0	40	8.3	1833	42.9	237	49.1
	Satbaria	1855	1737	118	909	52.3	31	26.3	202	11.6	20	16.9	626	36.0	67	56.8
Satkania	Kaliais	1348	1207	141	534	44.2	18	12.8	233	19.3	10	7.1	440	36.5	113	80.1
	Keochia	1598	1511	87	638	42.2	20	23.0	266	17.6	5	5.7	607	40.2	62	71.3
	Dhemsa	1128	1092	36	414	37.9	12	33.3	306	28.0	5	13.9	372	34.1	19	52.8
	Sadaha	2059	1904	155	1169	61.4	63	40.6	197	10.3	15	9.7	538	28.3	77	49.7
Lohagara	Amirabad	1470	1381	89	239	17.3	2	2.2	285	20.6	6	6.7	857	62.1	81	91.0
	Lohagara	1906	1759	147	221	12.6	10	6.8	121	6.9	12	8.2	1417	80.6	125	85.0
Chakaria	Fasiakhali	2728	2104	624	1652	78.5	586	93.9	164	7.8	10	1.6	288	13.7	28	4.5
	Kakhara	2116	1935	181	1336	69.0	103	56.9	134	6.9	3	1.7	465	24.0	75	41.4
	Lakhyarchar	440	427	13	243	56.9	7	53.8	88	20.6	1	7.7	96	22.5	5	38.5
	Ward No-09	649	605	44	100	16.5	8	18.2	100	16.5	1	2.3	405	66.9	35	79.5
Total in Study Area		**24734**	**22408**	**2326**	**10633**	**41.4**	**1103**	**31**	**2518**	**13**	**164**	**9**	**9257**	**46**	**1059**	**61**

Source: Population and Housing Census, BBS, 2011

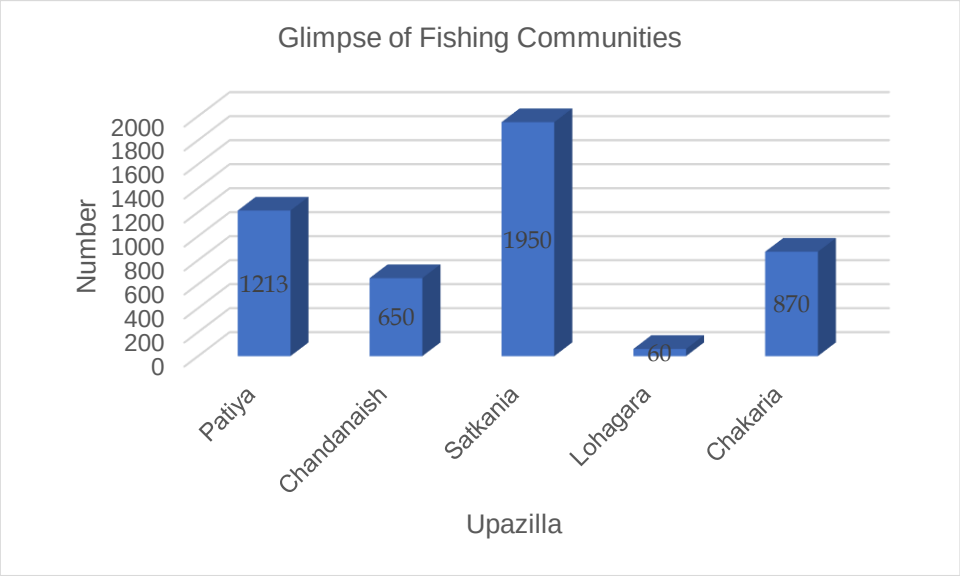
5.10 Fisheries

In Bangladesh, fish provides 60 percent of the national animal protein and this sub-sector contributes about 5 percent to the national GDP and approximately 9 percent to the total foreign exchange earnings. Nearly, 1.2 million people directly employed in this sub-sector and another 11 million are indirectly engaged in activities related to this sub-sector.

5.10.1 Fishing Activities and Fishing Communities

As per BBS District Statistics 2013, There are total 4743 fisherman in the selected Upazillas. Among them Patiya has 1213, Chandanaish has 650, Satkania has 1950, Lohagara has 60 and Chakaria has 870 fishermen. A glimpse on the fishing community of the study area is given in **Figure 5-5**.

Figure 5-5: Fishing Communities of the Study Area



Source: District Statistics 2013

5.10.2 Commercial Factors

In the study area, most of the fisherman are commercial in nature. Fishing activity is mainly pond based. They are using traditional fishing gears for the fishing purpose. Use of fish feed increased in commercial fishing.

5.11 Socio-Economic Status of the Affected Person in Major Bottleneck Area

During the study period a Census & Socioeconomic Survey and Inventory of Losses (IOL) survey has been conducted by Resettlement Action Plan (RAP) team with a view to collect a details socio-demographic profile of the Project Affected Population (PAPs) and evaluated the level of impacts on them due to the project intervention. Project Affected Units (PAUs) including residential households, plain landowners, shops, and community properties were identified through the census and inventory of losses survey. Based on the collected data and information, necessary mitigation measures have been formatted based on the magnitude of impacts on the affected people. This chapter describes the demographic information, age, sex, occupation, income, marital status, and other socio-economic issues of the project-affected peoples. Census & Socioeconomic Survey and Inventory of Losses (IOL) survey were carried out in the five bottleneck sections through an online data collection method using electronic devices, e.g tablet.

5.11.1 Demographic Profile of PAPs

A total of 2552 entity have been identified as project affected unit by losing residential households, plain land owners, and shops will be affected in five bottleneck sections of the project area. Survey found that ,a total 2508 HHs will be partially affected in the project area where 2289 nos. Male headed and 219 nos. Female headed HHs comprising a total of 11,413 population. Among them Male 6044 (52.96%) and Female 5369 (47.04). The male-female ratio is 100:89. The average household size among the affected people is 4.55 which is much higher than the national average household size as per HIES 2016 is 4.06. Below **Table 5-9** shows the demographic profiles of the households.

Table 5-9: Demographic Information of Project Affected Persons (PAPs) in MB area

Location	Households	Male HH	Female HH	Male No	Female No	Total Population	HH Size
Patiya	343	321	22	816	731	1547	4.51
Dohazari	414	384	30	1074	1016	2090	5.05
Lohagara	664	595	69	1583	1384	2967	4.47
Keranirhat	252	247	5	644	569	1213	4.81
Chakaria	835	742	93	1927	1669	3596	4.31
Total	2508	2289	219	6044	5369	11413	4.55

Source: Census, SES, IoL Survey August 2020-June 2021

5.11.2 Age distribution, Marital and Health Status of PAPs

Census and SES survey found that, age distribution of the population, about 26.37% are up to 14 years of age, and about 3.90 % are more than 65+ while elderly population (more than 65+). About 47.50 % are married, 48.28% are unmarried 4.13% divorced/widow and 0.10% identified as Separated. Health status of the population shows that about 98.83% people say they do not have any chronic disease. Details of the age group, marital status and health status are given in **Table 5-10.**

Table 5-10: Age Distribution, Marital status and health status in MB area

Demographic Information	Details	Patiya	Dohazari	Lohagara	Keranihat	Chakaria	Total	%
Age Group	Up to 14	341	605	783	357	924	3010	26.37
	15 to 18	130	167	257	116	381	1051	9.21
	19 to 20	63	79	103	43	124	412	3.61
	21 to 30	288	406	517	192	602	2005	17.57
	31 to 40	214	320	436	159	531	1660	14.54
	41 to 50	212	227	387	168	465	1459	12.78
	51 to 65	231	217	357	137	429	1371	12.01
	>65 Years	68	69	127	41	140	445	3.9
	Total	**1547**	**2090**	**2967**	**1213**	**3596**	**11413**	**100**
	Married	780	949	1427	553	1712	5421	47.5

Demographic Information	Details	Patiya	Dohazari	Lohagara	Keranihat	Chakaria	Total	%
Marital Status	Unmarried	688	1036	1403	625	1758	5510	48.28
	Divorced/Widow	76	103	136	34	122	471	4.13
	Separated	3	2	1	1	4	11	0.1
	Total	**1547**	**2090**	**2967**	**1213**	**3596**	**11413**	**100**
Health Status	Chronic illness	14	15	2	3	7	41	0.36
	Disabled	15	21	13	6	17	72	0.63
	Mental disorder	2	4	9	2	4	21	0.18
	Without disability or chronic illness	1516	2050	2943	1202	3568	11279	98.83
	Total	**1547**	**2090**	**2967**	**1213**	**3596**	**11413**	**100**

Source: Census, SES, IoL Survey August 2020-June 2021

5.11.3 Status of Religion and Ethnicity

From the census and SES it has been identified that, The project area is dominated by Muslim, where about 92.30% (2,315) of the affected Households religious are found Islam while 7.70% (193) are identified as Hindu by faith. There are no other religious people in the project area. Below Table shows the religious status of project area. Moreover, no indigenous community has been identified during survey. Details of the religious status is given in **Table 5-11.**

Table 5-11: Religious status of the PAPs in MB area

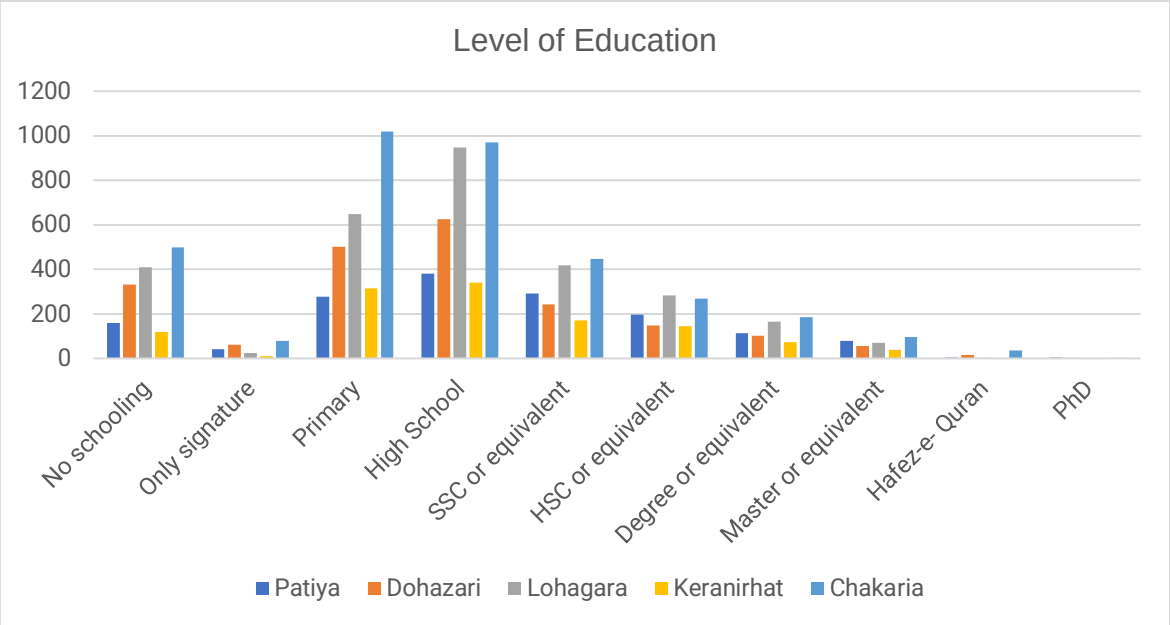
Religion	Patiya	Dohazari	Lohagara	Keranihat	Chakaria	Total	%
Islam	283	377	664	239	752	2315	92.3
Hindu	60	37	0	13	83	193	7.7
Total	343	414	664	252	835	2508	100

Source: Census, SES, IoL Survey August 2020-June 2021

5.11.4 Level of Education

According to the census and SES it has been revealed that, the average literacy rate in the project area it is about 84.79% which is significantly higher than the national average literacy rate 74.68%. The literacy status of the project area has been depicted hereunder in the **Figure 5-6**.

Figure 5-6: Educational status of the PAPs in MB area



5.11.5 Occupational Pattern

A diverse occupational pattern found through SES and census in the project area. The below table shows that among various types of occupation business (11.07%), housewives (24.46%), and students (32.29%) are found mostly affected in the project areas. Livelihood restoration programs can enhance the capacity of the people particularly female and vulnerable people for doing more income-generating activities. Details of the occupational pattern of the PAPs is given in **Table 5-12.**

Table 5-12: Occupational Pattern of the PAPs in MB area

Main Occupation	Patiya	Dohazari	Lohagara	Keranirhat	Chakaria	Total	%
Business	168	233	349	229	284	1263	11.07
Service	137	96	143	23	159	558	4.89
Expatriate	47	88	186	33	116	470	4.12
Agriculture	13	56	39	8	225	341	2.99
Day labor	41	61	53	4	115	274	2.4
Professional	44	17	36	10	98	205	1.8
Motor driver	16	35	39	8	33	131	1.15
Rickshaw puller	0	0	0	0	6	6	0.05
Child	100	200	259	83	264	906	7.94
Housewife	398	500	742	278	874	2792	24.46
Retired	75	90	136	40	103	444	3.89
Student	473	663	914	466	1169	3685	32.29
Unemployed	35	51	71	31	150	338	2.96
Total	**1547**	**2090**	**2967**	**1213**	**3596**	**11413**	**100**

Source: Census, SES, IoL Survey August 2020-June 2021

5.11.6 Income and Property Status

According to the census, SES survey, it is found that nearly half (47.41%) of the population of the affected area are living below poverty line. Their maximum income range is below 24,000 taka which comparatively much lower than population whose income is more than 50,000 taka. The table shows that only 11.44% people income is more than 50,000 while a great percentage of population (41.15) live under a lower middle class whose income level is up to BDT 50,000. Details of the income level of the PAPs is given in **Table 5-13.**

Table 5-13: Income level of the PAPs in MB area

Income Range (in taka)							
per month/HH	Patiya	Dohazari	Lohagara	Keranihat	Chakaria	Total	%
1-24000	149	147	326	58	509	1189	47.41
24001-30000	86	84	147	60	191	568	22.65
30001-40000	25	52	83	31	67	258	10.29
40001-50000	38	43	52	36	37	206	8.21
50001-60000	12	26	15	8	11	72	2.87
More Than 60000	33	62	41	59	20	215	8.57

Source: Census, SES, IoL Survey August 2020-June 2021

CHAPTER 6

SCREENING AND SCOPING

6 SCREENING AND SCOPING

Assessment of potential impacts are based on activities that will be involved in the implementation of the project, nature and extent of the proposed activities, and present environmental setting of the project area.

6.1 Screening

Screening is the step to categorize projects/activities based on degree of environmental impacts caused by the project.

According to Environment Conservation Rules, 1997 (ECR, 97) the proposed project (CCHIP) makes reference to the 'RED' category list of DoE and category "A" according to the JICA Guidelines for Environmental and Social Considerations, and thus EIA is necessary to be conducted.

6.2 Scoping Matrix

In order to assess the likely significant environmental and social impacts, potential environmental and social impacts of the Project were preliminarily identified based on the project description and overall environmental and social conditions in and around CCHIP project. The impacts of pollution, natural and social environments, health and safety, emergency risk, and others were classified as A to D in accordance with the following criteria, assuming no specific measures toward the impacts are taken. Several areas of impacts have been forecasted during preparation of the scoping report based on the findings of a reconnaissance survey conducted in March 2020. Then, the forecasted items of impact were assigned a score based on the nature of the consequence (positive or negative) and severity or magnitude of the impacts. The scale of the score is defined as per the guideline of JICA as follows:

- A = Significant impact is assumed
- B = Impact is assumed but less than A
- C = Impact is not clear because the design is not finished and further survey is needed to confirm
- D = No impact is assumed

As the project will be constructed both in urban and rural area, so there might be some significant environmental impacts due to the construction and operation period of the project. To find out the significant environmental impacts of the environmental components, four environmental standpoints have been considered for finding out the significant impact. These are:

- Physical Environment
- Biological Environment
- Social Environment and
- Others

6.3 Results of Scoping for Environmental Impact Assessment

Results of the scoping for environmental impact assessment are shown in **Table 6-1**. These impacts were evaluated in each of the three phases namely pre-construction, construction and operation. The '+' and '-' sign suggest positive and negative impacts, respectively.

Table 6-1: Scoping Matrix for the Proposed Project

No.	Items of Impact	Forecasted Impact		Reason of Assessment
		Before/During Construction Stage	Operation Stage	
Anti-Pollution Measures				
1	Air pollution	B-	B-	**During construction:** Operation of construction machine and vehicle may cause air pollution. **Operation:** Increase number of vehicles may increase air pollution.
2	Water pollution	B-	D	**During construction:** Turbid water by construction work may deteriorate water quality of nearest water bodies. **Operation:** Insignificant
3	Soil pollution	B-	D	**During construction:** Oil leak from poor machine and vehicle may cause soil pollution. **Operation:** Insignificant
4	Waste	B-	B-	**During construction:** Waste containing hazardous materials will be generated by construction work. **Operation:** Waste may increase with the increase in traffic throughout the alignment of future road.
5	Noise and vibration	B-	B-	**During construction:** Construction machinery and vehicles will be caused regularly. **Operation:** Increase of vehicles can create more noise and vibration.
6	Ground subsidence	C	D	**During construction:** Excavation and displacement of soil may cause ground subsidence but farther study needed **Operation:** No impact expected
7	Offensive Odor	D	D	**During construction:** Construction work with odors is not expected. **Operation:** No odor expected
8	Bottom sediment	B-	D	**During construction:** Turbid water by construction work may cause bottom sediment of rivers around the project site during bridge and road construction. Oil leak from poor maintenance machine and vehicle may also deteriorate bottom sediment.

No.	Items of Impact	Forecasted Impact		Reason of Assessment
		Before/During Construction Stage	Operation Stage	
				Operation: No significant impact expected
Natural Environment				
9	Protected area	B-	C	**During construction:** There is a wildlife sanctuary near the study area. **Operation:** Further study needed
10	Biota and ecosystem	B-	C	**During construction:** Construction work may create excessive noise and dust which can affect the biota and ecosystem **Operation:** Loss of fauna may occur through disturbance to habitat
11	Fisheries and aquatic biology	B-	D	**During construction:** Construction work may affect migration of fish and health of fish at the bridge section **Operation:** No impact expected
12	Hydrology	B-	B-	**During construction:** Potential for some flooding site, existing road and adjacent areas during rainy season **Operation:** Water-logging due to blockage of natural drainage
13	Ground water	B-	D	**During construction:** Excavation may affect water level and quality of ground water. **Operation:** no significant impact expected
14	Topography and geology	B-	D	**During construction:** Potential disfigurement of topography due to borrow pits and construction activities **Operation:** Loss and destruction of soil and subsoil may cause erosion near road alignment

No.	Items of Impact	Forecasted Impact		Reason of Assessment
		Before/During Construction Stage	Operation Stage	
Social Environment				
15	Involuntary resettlement	A-	B-	**During Construction:** Significant amount of resettlement needed. All PAPs will be resettled prior to start the construction activity **Operation:** There is a possibility of negative impact without livelihood restoration support.
16	Poor	C	D	**Before/During Construction:** Further study required **Operation:** No impact expected
17	Indigenous or ethnic minority people	C	C	**Before/During Construction:** There might be indigenous people's use of land. **Operation:** No impact expected
18	Local economies such as employment, livelihood, etc.	B-/B+	C	**During Construction:** Livelihood are assumed to be affected due to their displacement; however, the job opportunity will be increased at the same time. **Operation:** It is not clear at this stage.
19	Land use and utilization of local resources	B-/B+	D	**During Construction:** It is assumed that impact due to the acquisition will change the present aspect from negative and positive points of view. **Operation:** No impact expected
20	Disruption of agricultural activities	B-	B-	**During Construction:** Disturbances to farmers access and activities **Operation:** Some disturbance to farmers activities where road passes through land used by them
21	Water use	C	D	**During Construction:** Impact is not clear at this stage. **Operation:**

No.	Items of Impact	Forecasted Impact		Reason of Assessment
		Before/During Construction Stage	Operation Stage	
				No impact expected
22	Social service facilities	B-	B-	**Before/During Construction:** Regional traffic and transportation service will be disturbed by the construction work and vehicles **Operation:** There is a concern that the impact may occur as the traffic volume increases
23	Social institutions and local decision-making institutions	C	C	**Before/During Construction:** Magnitude of impact is not clear at this stage. **Operation:** Ditto
24	Local conflicts of interest	B-	B-	**During Construction:** The gaps between those who shall be displaced and non-displaced are assumed. **Operation:** Conflict of interest may arise among PAPs at the relocation site since they are supposed to find a relocation site on their own with monetary compensation.
25	Cultural heritages	C	C	**Before/During Construction:** Cultural heritages concerned are not clear at this moment. **Operation:** Ditto
26	Gender	C	C	**During Construction:** Magnitude of impact is not clear at this stage. **Operation:** Ditto
27	Children's rights	C	C	**During Construction:** Not clear at this stage **Operation:** Not clear at this stage
28	Infectious disease such as HIV/AIDS	B-	D	**During Construction:** Influx of workers may increase the risk of infectious diseases. **Operation:** Not significant risk

No.	Items of Impact	Forecasted Impact		Reason of Assessment
		Before/During Construction Stage	Operation Stage	
29	Occupational health and safety	B-	D	**During Construction:** The construction workers may be at risk for occupational health hazards due to the materials handled and working condition **Operation:** Not significant risk
30	Working conditions	B-	D	**During Construction:** Insufficient management by the contractor may worsen the workers' working condition. **Operation:** No impact expected
Others				
31	Global warming/Climate change	B-	B-	**During construction:** The operation of construction machine and vehicle will produce greenhouse gas (CO_2). **Operation:** CO_2 emission will increase in some areas due to the increase in traffic volume
32	Accident	B-	B-/B+	**During Construction:** Inappropriate traffic control or increase of traffic may induce the accident. **Operation:** Due to higher traffic speed, accident may increase on the improved road without public awareness raising for the drivers and residents

CHAPTER 7

IDENTIFICATION, FORECASTING AND EVALUATION OF POTENTIAL IMPACTS

7 IDENTIFICATION, FORECASTING AND EVALUATION OF POTENTIAL IMPACTS

This section provides a detailed description of identified impacts during construction and operation phases. The mitigation measures have also been given for both construction and operation stages based the nature and significance of the impacts. The impact assessment takes the current baseline environmental conditions into account for understanding and describing the effects.

7.1 Impacts on Physical Environment

7.1.1 Air Pollution

7.1.1.1 Construction Phase

The ambient air quality can be affected during construction phase by several means. The construction works involve the exploitation of several natural resources, including soil and sand. There will be engagement of different types of machineries and vehicles, which will be used for excavation, compaction, rolling, generating electricity, transportation, piling, hammering, etc.

The major sources of impacts on ambient air quality are given below:

- Earth works, including soil excavation, soil levelling and rolling, soil compaction, sand dumping and levelling can release dust particles (coarse particulate matter) into air;
- Vehicle hauling for transportation of construction materials generate dust particle due to friction between loose soil/unpaved surface and vehicle wheels;
- The stockpiles of construction and spoil materials like soil, sand, stones, aggregate, etc. can also pollute ambient air by releasing particulate matter;
- Different types of machineries like excavator, dozer, pile driver, crane, roller, vibro hammer, diesel generator, welding machine, boom truck, etc. and transportation vehicles like truck, dump truck, pickup, car, lorry, ship, etc. will emit different kinds of gaseous pollutants, such as CO, SO_2, NO_2, Lead, Hydrocarbons as well as fine particulate matter, such as $PM_{2.5}$ and PM_{10}.
- Gaseous substances, particulate matter, and fly ash will also be emitted from batching plant and asphalt mixing plant;
- Demolition of buildings and other dismantling and demolition of bridges, culverts, existing roadways will also generate air pollutants;
- Household combustion (fire wood, gas, petroleum, etc.) in labor accommodation and service area may generate air pollutants, including both particulate matter and gaseous pollutants;
- Burning of solid waste e, especially in labor accommodation and service area may also pollute the ambient air;
- Earth works, especially removing topsoil of agricultural land may release methane into air.

The environmental baseline study suggest that the existing air shed of the project locations are not polluted with reference to the national air quality standards of Bangladesh. Therefore, this large-scale construction project along with its subsequent impacts pose significant hazard to the ambient air quality in and around project areas.

Mitigation Measures during Construction Phase

Since the anticipated impacts on ambient air quality during construction phase are significant, following mitigation measures are suggested to reduce the impacts:

- There should be an Air Quality Management Plan in the Contractor's Environment Management Plan (CEMP), which will be prepared by contractor and submitted to the Consultant and Employer prior to commencement of civil works;

- A dust suppression program should be established and maintained by contractor throughout the construction period. This program will include: water spray on road and construction site from movable water truck with sprinklers as well as stationary sprinklers or hose pipe; water down of material stockpiles; covering of material stockpile using tarpaulin; covering of hauling vehicles using tarpaulin during transportation of spoiled soil, sand, cement, aggregate, brick, and other loose materials that may generate particulate matter due to wind friction and dropping of loose soil and sand; regular sweeping of construction site, office premise, and construction yard; etc.;
- A soil dumping plan shall be prepared by contractor to dispose spoil soil, which may include location of disposal site, hauling route, pickup and dumping schedule, etc. Spoil soil should not remain onsite for more than 12 hours after generation/excavation. They should be covered before removal.
- The hauling vehicles transporting construction materials should strictly follow selected route causing less dust pollution to adjacent exposures. The hauling roads should avoid sensitive land use (residential, market, religious, etc.) completely or use only watered hard surfaced road;
- Use of temporary walls and enclosures near sensitive land uses like residential and commercial areas, mosque, temple, etc.;
- Cover stockpiles during dry and windy weather and cover vehicles/ trucks carrying construction materials when passing through market areas and urban and residential areas;
- All machineries and vehicles should be inspected by independent inspection body for checking and certifying the competence of exhaust filter and other compliance standards (HEPA Standards) before starting operation for first time in the project and in every six months onwards; The inspection certificate should be submitted to the consultant;
- The construction machineries and vehicles should be maintained properly on regular basis and use air pollution prevention measure, e.g., diesel particulate filter; the machineries and vehicles should bear inspection and maintenance sticker.

7.1.1.2 Operation Phase

It is expected that after completion of the project the efficiency of transport facilities will be enhanced. Therefore, there will be increment in the volume of vehicle movement as per the forecasting. This will increase the vehicular emission. The increased number of vehicles may also generate dust during dry weather. On the other hand, traffic congestion and slow-moving vehicle will be decreased that may reduce the vehicular emission also. In addition, the general use of newer and better maintained vehicles will have the effect of reducing overall emission. Hence, the cumulative impacts on air pollution is less significant compared to the impacts during construction period.

Mitigation Measures during Operation Phase

- The road/flyover should be a good quality paved surface during operational period through proper and effective cleaning, maintenance, and repair;
- Tree plantation and landscaping along the alignments.
- All existing vehicle emissions standards and controls to limit harmful emissions should be enforced. All vehicles should be maintained in accordance with vehicle emission regulations of the Government of Bangladesh. (Note: Implementation of this measure is not the responsibility of project owner but DOE and BRTA).

7.1.2 Water Pollution

7.1.2.1 Construction Phase

7.1.2.1.1 Surface Water

There are some rivers, canals, and ponds in and around the proposed alignments of outer roads and flyover. The project has potentials to deteriorate nearby surface water resource from many aspects.

Since surface runoff can transport pollutants from project sites to nearby water bodies and there are provision of constructing bridge and culverts on the rivers and canals, the possibility of surface water pollution seems significant. Besides, associate facilities and infrastructure can also cause water pollution.

Regarding possibility of the surface and ground water pollution by using the ground improvement materials and cement solidification materials in the construction, the sand compaction pile method (SCP method, a method to create sand piles in soft ground to prevent ground subsidence, arc slides, etc.) is planned to use in this project to improve the ground in part of the embankment. However, the cement solidifiers or other materials for ground improvement will not be used. In addition, in the case of using locally generated soil (clay with high natural water content) as fill material, lime will be added to adjust the water content and it will not cause negative impact on the surrounding environment.

The major source of impacts on surface water are given below:

- Surface runoff may discharge turbid water from construction site with soil and sand particles that may generate from loose soil; this will increase the suspended sediment load and turbidity of the rivers and canals posing a potential threat to aquatic organisms downstream; increased turbidity in water reduces light penetration, thereby interfering with the photosynthetic process.
- Disposal of solid waste into river and the discharge of wastewater from kitchen of nearby workers accommodation may increase the organic matter in the water that leads to lower concentration of DO and higher BOD;
- Discharge of effluents from offices and workers accommodation;
- Spilling and washing out of oil and grease and other liquids used in the use of machineries and vehicles;
- The piling works for bridge construction may disturbed bottom sediment layer of the rivers that will increase suspended particles in water; this can also increase the values of BOD and COD by removing un-oxidized sediment layer of river bed;
- The excavation during bridge construction may release sediments due to spilling and erosion; erosion can also be occurred from soil stockpile during rainfall.

Mitigation Measures for Surface Water during Construction Phase

- A sediment fence should be erected on the bank of concerned rivers, canals, and ponds to prevent sedimentation in the water;
- During road construction, loose soil and sand should be compacted properly to prevent erosion;
- Drip pan should be placed under generators and other machineries to collect leaked oil. Spilled oil should be absorbed by sponge absorber during/after maintenance works of machineries and vehicles;
- Direct disposal and discharge of solid waste and effluent, originated from project works, into river or other water bodies should be strictly prohibited. Instead, solid waste should be disposed in designated disposal sites of nearby municipality. If no municipal waste dumping site is located nearby, the organic solid waste should be landfilled and recyclable solid waste should be sold to recycling companies; for effluent, sanitary pit toilet should be used and they will be emptied after proper disinfection.
- Slurry mixed wastewater from batching plant should be stored in a settling tank. Then, the accumulated slurry at bottom of the tank will be scrapped and dried up for using in temporary road repairing and ground support works. On the other hand, the water should be reused instead of releasing in environment.
- In construction yard, waste water should be settled to allow sedimentation (using check dam) at the bottom of the drains. Then, the water could be discharged through sediment

screen or filter. And the bottom sediment layer in the drains will be scrapped manually and dried up for reuse.

- There should be and oil water separator installed in the outflow from mechanical works of construction yard to prevent the releasing of oil and grease into surface water. The collected oil and lubricant will be stored securely for selling them to refinery.

7.1.2.1.2 Ground Water

The nature of the project does not pose any significant threat to ground water resource or aquifer. The road construction does not require piling, except the construction of bridges, therefore, there is no chance of penetrating the aquifer. The surface area of project confinement is not very large, so it will not change the infiltration characteristics of concerned region. However, there is a rare chance of penetration of toxic chemicals such as fuel, lubricants, thinner, and solvents (accidentally spilled from machineries and vehicles) into aquifer through infiltration. Also, leachate generated at the solid waste disposal site may contaminate the ground water system. As mentioned earlier in Section 7.1.2.1.1, cement solidifiers or other materials for ground improvement will not be used. In addition, in the case of using locally generated soil (clay with high natural water content) as fill material, lime will be added to adjust the water content and it will not cause negative impact on the surrounding environment, including groundwater. The rare possibility of contamination will not have a significant impact on groundwater if appropriate mitigation measures taken in the project.

Mitigation Measures for Ground Water during Construction Phase

- Drip pan should be placed under generators and other machineries to collect leaked oil. Spilled oil should be absorbed by sponge absorber during/after maintenance works of machineries and vehicles;
- All solid waste from project offices and labour camps should be disposed of at approved off site locations in accordance with existing waste disposal regulations.

7.1.2.2 Operation Phase

7.1.2.2.1 Surface Water

There is very limited scope of surface water pollution during operation phase. Soil erosion may occur from slope of the road if remained uncovered that will end up in water body and will increase sediment load and turbidity. There might be an indirect impact by spilling and washing out of oil and grease from repairing and maintenance facilities of newly added vehicle fleet due to implementation of this project. The broken road surface may cause erosion of bitumen and other construction materials that may wash out into water bodies.

Mitigation Measures for Surface Water during Operation Phase

- The slope and footpath of road should be turfed with grass or paved to prevent or reduce soil erosion induced water pollution;
- The road surface should be maintained and repaired properly on regular basis to prevent or reduce erosion of bitumen and aggregate.

7.1.2.2.2 Ground Water

It is expected that in operational phase there will be no scope for deterioration of groundwater quality provided spillage from accidents are managed properly and that an effective waste disposal plan is implemented by RHD and local government.

7.1.3 Topography and Soil Pollution

7.1.3.1 Construction Phase

The implementation of this project will require alteration of existing topography and landscape. Several features like vegetation, water body, arable land, settlement will be affected. The construction works have also potentiality to affect soil resource in adverse manner. A huge amount of soil will be needed to construct the roads which may affect the soil in several way.

The major sources of impacts on topography and landscape are given below.

- The setting and appearance of landscape will be changed as many trees need to be felled and many settlements need to be demolished.
- Land use in the alignment will be changed by converting agricultural land, fisheries, homestead vegetation and settlement into wide paved and impervious road surface;
- The elevation in the alignment will be increased as the road will be higher than existing ground level. However, this change will not bring any big change in the distribution of altitude in concerned regions. Moreover, this change will also not change the slope and aspect of the region.
- The landscape in and around the alignment will be disfigured through excavation of spoil materials for the road construction.

The major sources of impacts on soil are given below:

- Spilling of oil and lubricants from poorly maintained machines and vehicles can contaminate soil;
- If bentonite is used as a drilling fluid to stabilize the boreholes/piles, the improper disposal of bentonite slurry may pollute the soil quality;
- Improperly managed sewage and solid wastes generated from the project activities can pollute soil.

Mitigation Measures during Construction Phase

- A tree plantation and landscaping program should be implemented after completion of the project to mitigate the vegetation loss and to increase the aesthetic view;
- Oil and lubricant spilled from machines and vehicles need to be absorbed using sponge. Drip pan/bucket should be used under the machines and vehicles (during maintenance) to collect the leaked and spilled oil;
- The collected/absorbed oil and lubricants should be disposed following appropriate procedures set by the "Hazardous Waste and Ship Breaking Waste Management Rules 2011" of the Government of Bangladesh;
- Open toilet without sanitary pit is strictly prohibited in this project, including work site, office, residential areas, construction yards, and other associated facilities.

7.1.3.2 Operation Phase

There are no major chances of soil pollution during operation phase. However, improper disposal of hazardous wastes, i.e., oil, lubricant and solid waste can contaminate soil. The magnitude of this impact is not significant.

Mitigation Measures during Operation Phase

- Hazardous waste like oil and lubricant leaked and spilled from vehicles need to be collected using drip pan and absorber. The collected/absorbed oil and lubricant should be disposed following appropriate procedures set by the "Hazardous Waste and Ship Breaking Waste Management Rules 2011" of the Government of Bangladesh;

- Solid waste from vehicles and other facilities, especially generated due to implementation of this project, should not be dumped in open place to prevent soil pollution.

7.1.4 Waste

7.1.4.1 Construction Phase

A road construction project can generate multiple types of wastes. Primarily, waste can be classified into two types: solid waste and hazardous waste. Furthermore, the solid waste can be classified into organic and inorganic waste. The examples of organic waste include food waste, paper, wood, sewage sludge, yard waste, etc., whereas inorganic waste includes plastic, polythene, glass, aluminum can, scrap waste, etc. The solid waste can also be classified into recyclable (paper, plastic, aluminum can, tin, glass, scrap, etc.) and non-recyclable waste (mostly food waste and spoil). On the other hand, the hazardous waste is waste that has substantial or potential threats to public health or the environment. This can include oil, lubricant/grease, medical waste, sharp materials, bentonite slurry, chemical mixed slurry from batching plant, paint and adhesive chemicals, etc.

Improper management of both solid waste and hazardous waste can pose a significant threat to environment (lithosphere, hydrosphere, biosphere, and atmosphere) and public health. It can also be harmful for workers and other people who will be exposed in the project. Since there is agricultural land, fisheries, rivers, and homesteads nearby the project, impacts of waste generated from this project is significant.

An estimation of waste generation during construction phase has been conducted by JICA Study Team. Estimated amount of asphalt waste and concrete waste as main construction wastes generated during construction from the construction site in the major bottleneck section are shown in the following table.

Table 7-1: Major Construction Waste Generation in MJB Sites

Type of Construction Waste	Amount of Waste Generated	Remarks
Asphalt Waste	approx. 25,000 ton	(1) Patiya: 59,500 m^2 (2) Dohazari: 5,490 m^2 (3) Keranihat: 29,456 m^2 (4) Lohagara: 9,040 m^2 (5) Chakaria: 4,500 m^2 Total area: 107,986 m^2, Thickness: 0.1 m Total volume: 10,799 m^3 X Unit weight: 2.3 t/m^3 = 24,837.7 ton
Concrete Waste	approx. 3,000 ton	-

Source: Estimated by JICA Study Team

Existing dumping site of Patiya, Dohazari, Satkania, Lohagara and Chakaria Pourashava could be used as disposal sites for waste concrete and solid wastes. Hence, no additional sites are required for this purpose. Some other development projects along the same alignment are also using the same dumping sites for waste disposal. Respective municipalities need to be contacted by proper authority for waste disposal purpose prior to the construction phase of the project.

Major sources of impacts related to solid waste are given below:

- Construction sites, offices, and residential quarters will produce different types of inorganic waste like paper, plastic, polythene, can, etc.;

- Kitchen of workers accommodation, canteen, eating and resting place in work sites will generate organic solid waste like food waste, paper, etc.;
- Toilets installed in the project areas, including stationary and mobile toilet will produce sewage sludge;
- Improper management of these waste (Serial I-III above) will cause environmental pollution, including water and soil pollution, bad odor as well as public health problems;
- Earth works and piling (including pile cap breaking) will generate spoil soil;
- Several types of scrap waste like rebar, steel plate, formworks, electric cable, etc. will be generated mostly from flyover, bridge, and culvert construction;
- Organic waste could be released through drainage discharge from kitchen and canteen of workers accommodation, construction yards, and offices;

Major sources of impacts related to hazardous waste are given below:

- Burned oil, especially lubricant (Mobil) will be produced from machineries and vehicles;
- There will be a huge number of empty containers of adhesive chemicals and epoxy;
- A little amount of medical waste, including sharp materials will be generated from medical center of the project;
- Oil and lubricant mixed water will be released from construction yard;
- There will be a big number of expired or used lithium-ion battery likely to be generated in the project;
- Leakage and spillage of oil and lubricant from machines and vehicles;
- Bentonite slurry from piling work, chemical mixed slurry from concrete mixing plant or batching plant, etc.;
- There will be sharp metal and non-metal materials in scrap waste.

Mitigation Measures for Solid Waste Related Impacts during Construction Phase

- A Waste Management Plan should be incorporated in the Contractor's Environmental Management Plan (CEMP), including detailed management plan for municipal solid waste and hazardous waste;
- The solid waste should be segregated at source. For this purpose, different colored waste bins should be provided with appropriate labelling and instructions in all project sites. The colors of the waste bins could be: green (for recyclable waste), yellow (for non-recyclable waste), and red/brown (for hazardous and sharp waste);
- The non-recyclable solid waste like food waste will be disposed in designated dumping zone of nearby municipality. If the distance of municipality waste dumping site is not affordable, then a sanitary landfill could be established beside project sites following appropriate procedures.
- The recyclable waste like paper, plastic, glass, aluminum can, etc. should be sold to recycle plants or their local suppliers;
- The spoil soil will be dumped in designated place with approval of consultant and employer within 12 hours of their generation.

Mitigation Measures for Hazardous Waste Related Impacts during Construction Phase

- Burned oil and lubricant (Mobil), empty containers of adhesive and epoxy, expired and used lithium-ion battery should be sold to refinery or their vendors;
- Medical waste should be disposed following appropriate procedures set by the "Medical Waste Management Rules 2008" of the Government of Bangladesh and Waste Management Plan of CEMP.
- There will be an oil water separator installed in drain to collect oil and grease from wastewater released from construction yard before their final discharge in environment;
- The disposal and handling of hazardous waste like oil and greased collected/absorbed from machines, vehicles, wastewater drain of construction yard should be managed in accordance

with the appropriate procedure set by the "Hazardous Waste and Ship Breaking Waste Management Rules 2011" of the Government of Bangladesh and Waste Management Plan of CEMP.

7.1.4.2 Operation Phase

There is a very little chance of waste generation during operation period of the project. Oil and grease can be leaked and spilled from vehicles. Solid waste like food waste, plastic, glass, paper can be produced from the operating and maintaining facilities of the project. Same mitigation measures like the measures for construction phase can be applied during operation phase also.

7.1.5 Noise

Noise impact due to the project construction and operation which will be more or less same to the receptor level as the existing ambient noise level. Hence, noise level forecasting has been conducted for this project considering the existing noise level and future construction activities.

7.1.5.1 Construction Phase

Noise and vibration is very common outcomes from any development project. It is expected that, due to nature of this project, this project will also produce noise and vibration during construction phase. This project includes bypass or outer road in four places and flyover in one place. The bypasses will mostly go through agricultural land and rural residential area. On the other hand, the flyover will go through an urban area with commercial and residential settlements on both sides. Therefore, it is perceived that, the impact of noise and vibration generated from the construction of bypass roads will be moderately significant. On the other hand, the impacts will be significant in case of flyover construction.

Source of Construction Noise

The major sources of impacts of construction noise are given below:

- Noise will be produced during pile driving or bore poling for bridge and flyover construction. The crawler crane-mounted rotary boring unit or a purpose-built hydraulic drilling machine will generate higher noise;
- The operation of different types of construction machines and vehicles like excavator, roller, diesel generator, lifting crane, bulldozer, boom truck, vibro hammer, truck, dump truck, lorry, car, etc. will produce noise with moderate magnitude;
- Higher noise will be produced during rebar cutting and binding in construction yards as well as during welding;
- Higher noise will also be produced during pile cap breaking using hammer, jackhammer, concrete chipper, steel rod cutting saw, etc.
- This project may require some demolition works, especially where the alignment goes through residential and commercial areas. Hence, moderate to higher noise will be generated during demolition operation;
- The batching plant and asphalt mixing plant will also generate noise;
- The transportation of different types of construction and waste materials, formwork setting and dismantling, rebar grid framework installing, scaffolding setting and dismantling, concreting will produce noise with lower to moderate magnitude.

Anticipated Noise Level from Construction Equipment

It is expected that the major source of the noise during construction period would be the operations of construction equipment. The construction equipment can be classified into two categories, such as stationary and mobile equipment.

- **Stationary Equipment:** Stationary equipment consists of equipment that generates noise from one general area and includes items such as pumps, generators, compressors, etc. These types of equipment operate at a constant noise level under normal operation and are classified as non-impact equipment. Other types of stationary equipment such as pile drivers, jackhammers, pavement breakers, blasting operations, etc., produce variable and sporadic noise levels and often produce impact-type noises. Impact equipment is equipment that generates impulsive noise, where impulsive noise is defined as noise of short duration (generally less than one second), high intensity, abrupt onset, rapid decay, and often rapidly changing spectral composition. For impact equipment, the noise is produced by the impact of a mass on a surface, typically repeating over time.

- **Mobile Equipment:** Mobile equipment such as dozers, scrapers, graders, etc., may operate in a cyclic fashion in which a period of full power is followed by a period of reduced power. Other equipment such as compressors, although generally considered to be stationary when operating, can be readily relocated to another location for the next operation.

The noise level emitted from different construction equipment have been estimated in different previous studies. A standard practice of measuring the noise level emitted from construction equipment is considering a 50 ft receptor distance. **Table 7-2** below shows an estimation of noise (L_{max}) produced from different construction equipment conducted by U.S. Department of Transport, considering a receptor distance of 50 ft from the source. Apart from these reference values of maximum noise generated from the mentioned vehicles and machines, the manufacturer also provides factory standard noise level produced by that vehicle or machine. However, for old machines and vehicles, the actual noise can be differed from the factory standard. Therefore, it is recommended that a baseline noise measurement should be conducted before starting of the machine or vehicle in the project following appropriate procedures of ECR 1997 (Schedule-5). During construction works, the ambient noise in the construction site will be a mixture of the noise generated from machines and vehicles and other noise from different sources, i.e., traffic, rebar cutting, rolling, hammering, etc.

Table 7-2: Typical noise emission from different construction equipment

No.	Equipment Name	L_{max} at 50 ft (dBA, slow)
1	Auger Drill Rig	85
2	Ground Compactor	80
3	Compressor (Air)	80
4	Concrete Batch Plant	83
5	Concrete Mixer Truck	85
6	Concrete Pump Truck	82
7	Crane	85
8	Dozer	85
9	Drill Rig Truck	84
10	Dump Truck	84
11	Excavator	85
12	Generator	82
13	Generator (<25KVA)	70
14	Pile Driver	95
15	Jack Hammer	85

No.	Equipment Name	L_{max} at 50 ft (dBA, slow)
16	Mounted Impact Hammer	90
17	Pickup Truck	55
18	Pumps	77
19	Chipping Gun/Concrete Chipper	85
20	Roller	85
21	Vibratory Pile Driver	95
22	Welder/Torch	73
23	Tractor	84

Source: Federal Highway Administration, U.S. Department of Transportation

7.1.5.1.1 Construction Noise Analysis

This section addresses noise levels expected from various combinations of equipment required to perform construction tasks. The main sources of noise level during the construction phase are:

- Different types of equipment used for the sand compaction and vibratory compaction used to stabilize the future road area.
- Operation of the heavy equipment during infilling and construction.
- Construction vehicles.

For existing highway noise level will be increased due to the operation of construction vehicles mainly. This section addresses noise levels expected due to construction of CCHIP project.

Approach

The forecasting of construction noise on receptor points has been carried out based on sound power levels of equipment required to perform the work. Point of impact on the receptors are taken to be 3.325 – 16.7m based on the receptor distance. The nearest receptor from the existing road center is situated at the RS-04 (Dohazari). Forecasted values are compared with ambient noise levels. Ambient and forecasted noise levels are superimposed; comparisons are made with the DOE's ambient noise standards and Japanese standards.

Applicable standard

The ECR 1997, the only legislation of Bangladesh that set different environmental quality standards, did not establish any noise standard for construction project. There is a generalized zone wise noise standard, which is often not applicable for a construction project (**Table 7-3**). The ambient noise level along the alignment have already exceeded most of the monitoring locations.

Table 7-3: Zone wise noise standard in Bangladesh (Schedule-4 of ECR 1997)

Sl. No.	Category of areas	Day (dBA)	Night (DBA)
1	Silent zone	45	35
2	Residential zone	50	40
3	Mixed area	60	50
4	Commercial area	70	60
5	Industrial area	75	70

Note: Day: 06 AM – 09 PM, Night: 09 PM – 06 AM

In addition to zone wise noise standard for normal situations, the ECR set another standard for motor vehicles (**Table 7-4**). However, the construction noise does not only represent the noise originated from vehicles or machines, but a combined noise mixed with other ambient noise like traffic, rebar cutting, hammering, loading and unloading, etc.

Table 7-4: Standard for sound originated from motor vehicles (Schedule 5 of ECR 1997)

Category of Vehicles	Unit	Standard	Remarks
Motor Vehicles (all types)	dBA	85	As measured at a distance of 7.5 m from exhaust pipe
		100	As measures at a distance of 0.5 m from exhaust pipe

Note: At the time of taking measurement, the motor vehicle shall not be in motion and its engine conditions shall be as follows:

Diesel engine: maximum rotating speed

Gasoline engine: at two thirds of its maximum rotating speed and without any load

Since no standard is established for construction project in the legislations of Bangladesh, the study reviewed the applicable standards of other countries set for same cause. Table 7-5 compiles the noise standard for construction works established in New Zealand, Japan, Singapore, United Kingdom, and United States of America. The Table shows that there is a variation among the construction noise standards of different countries. The standards set by Singapore is stricter than Japan, UK, and USA, whereas close to the standards of New Zealand. The standard of USA is 80 and 85 dB in residential and commercial area during day time, while 70 and 85 dB during night time, respectively. In addition, USA set another standard for urban area, which adds 10 dB to the baseline ambient noise level (if found more than 65 dB). The sub-project areas of this project are a combination of urban and rural areas with presence of both residential and commercial land use. Particularly, the alignment of flyover in Keranihat will go through a semi-urban area, whereas the alignment of other bypass roads will go through mostly rural and residential areas. Therefore, in reference to the standards set by USA, a generalized construction noise standard is proposed for all five sub-project areas (see **Table 7-6**).

Table 7-5: Noise standard and criteria for construction works in different countries

Countries	Standard or Criteria	Day Time Leq	Night Time Leq
New Zealand	Residential (less than 14 hr. per weekday)	65 dB (6.30 -7.30 am) 80 dB (7.30 am-6 pm)	75 dB (6-8 pm) 45 dB (8 pm-6.30 am)
	Residential (less than 20 hr. per weekday)	60 dB (6.30 -7.30 am) 75 dB (7.30 am-6 pm)	70 dB (6-8 pm) 45 dB (8 pm-6.30 am)
	Residential (more than 20 hr. per weekday)	55 dB (6.30 -7.30 am) 70 dB (7.30 am-6 pm)	65 dB (6-8 pm) 45 dB (8 pm-6.30 am)
	Commercial/industrial area (less than 14 days)	80 dB (7.30 am – 6pm)	85 dB (6 pm-7.30 am)
	Commercial/industrial area (less than 20 weeks)	75 dB (7.30 am -6pm)	80 dB (6 pm-7.30 am)
	Commercial/industrial area (more than 20 weeks)	70 dB	75 dB

Countries	Standard or Criteria	Day Time Leq	Night Time Leq
Japan	Using heavy equipment with high noise level (piling, excavating etc.)	85 dB (Maximum)	
Singapore	Hospitals, schools, institutions of higher learning, homes for the aged sick, etc.	60dB (7 am-7pm, 12 hrs)	50 dB (7 pm-7am, 12 hrs)
	Residential buildings located less than 150m from the construction site where the noise is being emitted	75 dB (7 am-7 pm, 12 hrs)	60dB (7- 10 pm, 55dB)
	Other Buildings	75 dB (7 am-7 pm, 12 hrs)	
UK	In rural, suburban and urban areas away from main road traffic and industrial noise	70 dB (8.00-18:00)	
	Urban Areas near main roads	72 dB (8.00-18:00)	
USA	Residential	80 dB (8 hrs)	70 dB (8 hrs)
	Commercial	85 dB (8 hrs)	85 dB (8 hrs)
	Urban Area with high ambient noise level (>65 dB)	Ambient Noise Level +10 dB	

Note: New Zealand Standard NZS 6803:1999 Acoustics-Construction Noise
Noise Regulation Act, Japan (law no 98, 1968, Amended No 33, 2006)
Environmental Protection and management Act in Singapore (Chap. 94 A, Section 77, revised in 2008)
British standard 5228:1997 "Noise and vibration control on open and construction sites"
Transit Noise and Vibration Impact Assessment, U.S. Department of Transportation in USA, 1995

Table 7-6: Recommended noise standard for CCHIP project

Sl. No.	Location Code	Location Name	Baseline Noise Level		Project Standard (Either Existing Noise Level + 10 dBA or 85 dB, whichever is lower)	
			Leq_{day}	Leq_{night}	Day (dB)	Night (dB)
1.	RS-01	In front Upazila Health Complex, Patiya	72.6	69.6	82.6	79.6
2.	RS-02	In front of Dakshin Gata Nuri Jame Mosque, Patiya	59.7	60.9	69.7	70.9

Sl. No.	Location Code	Location Name	Baseline Noise Level		Project Standard (Either Existing Noise Level + 10 dBA or 85 dB, whichever is lower)	
			Leq_{day}	Leq_{night}	Day (dB)	Night (dB)
3.	RS-03	In front of BGC Trust Medical College, Chandanaish	70.9	70.4	80.9	80.4
4.	RS-04	In front of Dohazari Jamijuri A. Rahman High School, Dohazari	72.7	69.3	82.7	79.3
5.	FR-01	Near Chagachar Jame Mosque, Dohazari	63.1	57.9	73.1	67.9
6.	RS-05	In front of Shahi Jame Mosque, Keranihat	70.5	69.4	80.5	79.4
7.	RS-06	In front of Noyapara Baitul Mamur Jame Mosque, Padua	70.1	67.8	80.1	77.8
8.	RS-07	In front of Citizen Park Community Center, Lohagara	69.6	67.8	79.6	77.8
9.	FR-02	In front of Maulana Sultan Hossain Jame Mosque, Lohagara	61.9	58.4	71.9	68.4
10.	RS-08	In front of Adhunagar Gul-E-Jar Girls High School, Aziz Nagar, Chakaria	71.1	67.7	81.1	77.7
11.	FR-03	In front of Dakshin Lotonee Central Jame Mosque, Chakaria	64.9	57.5	74.9	67.5
12.	RS-09	In front of Fashiakhali Govt. Primary School, Chakaria	71.1	66.6	81.1	76.6

Note: Orange colure indicate exceedance of national noise level standard of Noise Pollution (Control) Rules, 2006
Source: Field Survey by EQMS, March-June 2021

7.1.5.1.2 Construction Noise Impact Forecasting

ASJ RTN-Model 2018 has been used for noise level impact forecasting during construction and operation period. A general outline for the considerations of ASJ-RTN Model are given below.

Types of Roads: General roads (flat, bank, cut and viaduct) and special road sections (interchanges, junctions, signalized intersections, road tunnels, depressed/semi-underground roads, flat roads with overhead viaducts and double-deck viaducts).

Traffic volume: No limitation.

Running speed of vehicles: 40 to 140 km/h for sections of a steady traffic flow on expressways and general roads, 0 to 60 km/h for sections of non-steady traffic flow on general roads, 0 to 80 km/h for

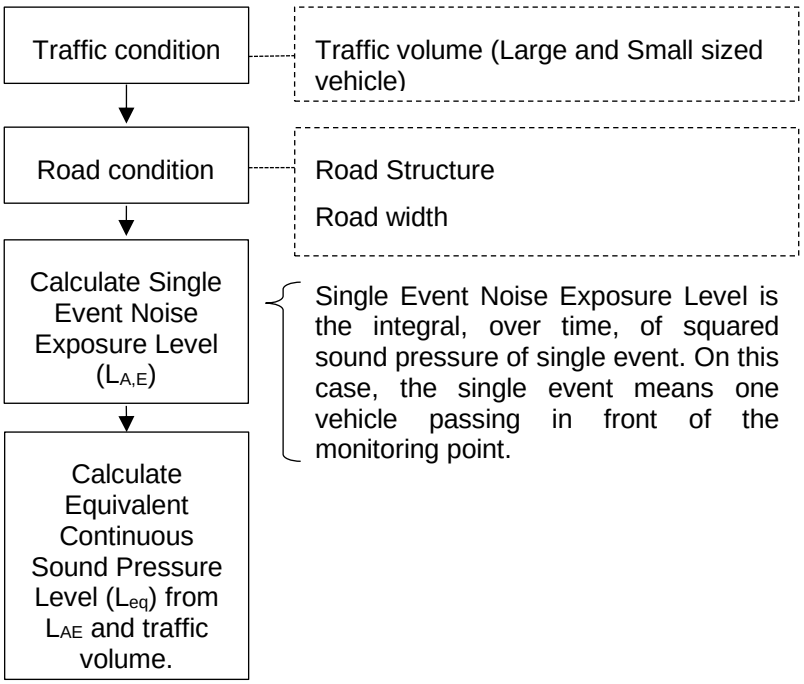
acceleration/deceleration sections on expressways such as interchanges, 0 to 60 km/h for acceleration/deceleration sections on general roads such as in the vicinity of signalized intersections.

Forecasting range: Up to a horizontal distance of 200m from the road under consideration and up to a height of 12m above the ground.

Meteorological conditions: No wind or strong temperature profile is assumed as the standard condition

The road traffic noise forecasting model of Acoustical Society of Japan (ASJ RTN-Model) shows that LAeq of the traffic(vehicle) is based on the car size, traffic volume and road condition. For the calculation of LAeq on road traffic is calculated by following diagram.

Figure 7-1: Flow Diagram of the ASJ RTN-Model



According to the construction plan, the number of construction vehicles will reach its maximum 6 months after the start of construction. Following table shows the number of daily trips of construction vehicle at maximum month. Those trips for construction will be generated during daytime.

Table 7-7: Daily Trip Estimate of Construction Vehicles

SL No.	Town	Monitoring Point	The number of Construction Vehicle at peak month (trip/day)*
1.	Patiya	RS-1	151 trip/day
2.	Patiya	RS-3	151 trip/day
3.	Dohazari	RS-4	1,204 trip/day
4.	Keranihat	RS-5	1,955 trip/day
5.	Padua	RS-6	1,955 trip/day
6.	Lohagara	RS-7	1,654 trip/day
7.	Adhunagar	RS-8	0 trip/day
8.	Chakaria	RS-9	1,654 trip/day

Source: JICA Study Team, 2021

Note: Both direction traffic

Operation time: 8:00AM～16:00PM

Methodology for Noise Impact Forecasting

According to Environmental Impact Assessment Technique for Road Project, on traffic noise forecasting caused by operation of the construction vehicles, ASJ-RTN Model which was developed by Acoustical Society of Japan (ASJ) is applicable. In general, the impact from construction vehicle is generated in the area along the existing road. The construction vehicle will use existing road which are used by general traffic for transport construction machineries and materials. As a result of construction vehicle passing, the traffic flow will be increased from the traffic as usual. From the scenario above, the impact of the traffic noise can be calculated from the increment of the traffic flow of construction vehicles with using ASJ-RTN Model.

The forecasting theorem is a same as the forecasting method for traffic noise in operational stage of newly constructed bypassing road. On the actual calculation process, the baseline noise level and traffic volume which is measured at the assessment point is required. The equivalent continuous noise level L_{Aeq} is given by:

$$L_{Aeq} = L_{Aeq^*} + \Delta L,$$

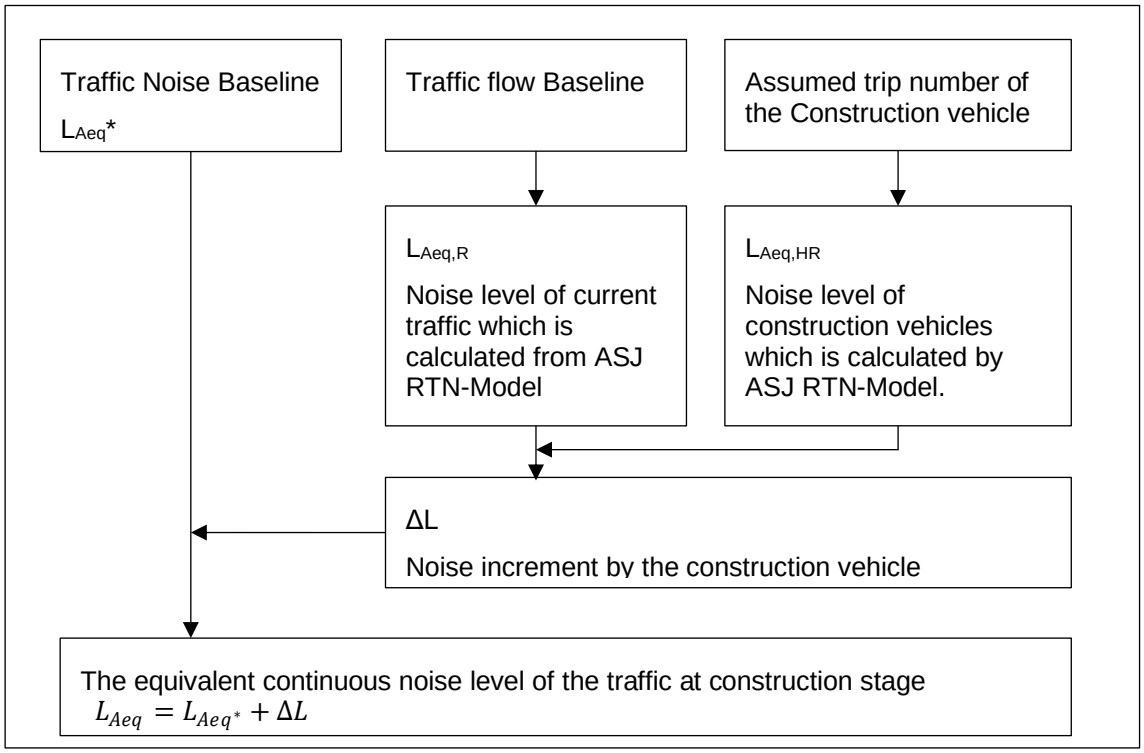
$$\Delta L = 10lg\{(10^{L_{Aeq,R}/10} + 10^{L_{Aeq,HC}/10})/10^{L_{Aeq,R}/10}\},$$

where: L_{Aeq}* is noise level of the baseline;

$L_{Aeq,R}$ is noise level of current traffic which is calculated by ASJ RTN-Model;

and $L_{Aeq,HR}$ is noise level of construction vehicles which is calculated by ASJ RTN-Model

Figure 7-2: Flow Diagram of the ASJ RTN Method



Source: Technical Note of PWRI No.4254, March 2013, Public Works Research Institute, Japan

Impact Forecasting at Source Point

Noise level impact at the source point due to construction vehicles has been forecasted for 8 locations using existing traffic volume and daily traffic estimate during the construction period. Forecasting for rest of the 4-monitoring location has not been conducted since no road traffic available on those locations. Summary of the forecasting is given in **Table 7-8.**

Table 7-8: Impact Forecasting at Source Point

Sl. No.	Location Code	Location Name	Baseline Noise Level (Leq_{day})	Noise Level Increment ΔL	Road Noise Level at peak month (Leq_{day})	Bangladesh Standard
1.	RS-01	In front Upazila Health Complex, Patiya	72.6	0.1	72.7	60
2.	RS-03	In front of BGC Trust Medical College, Chandanaish	70.9	0.1	71.0	60
3.	RS-04	In front of Dohazari Jamijuri A. Rahman High School, Dohazari	72.7	0.6	73.3	60
4.	RS-05	In front of Shahi Jame Mosque, Keranihat	70.5	1.0	71.5	70
5.	RS-06	In front of Noyapara Baitul Mamur Jame Mosque, Padua	70.1	1.2	71.3	70
6.	RS-07	In front of Citizen Park Community Center, Lohagara	69.6	1.5	71.1	70
7.	RS-08	In front of Adhunagar Gul-E-Jar Girls High School, Aziz Nagar, Chakaria	71.1	0.0	71.1	70
8.	RS-09	In front of Fashiakhali Govt. Primary School, Chakaria	71.1	1.2	72.3	70

Note: Orange colure indicate exceedance of national standard of Noise Pollution (Control) Rules, 2006
Source: Field Survey by EQMS, March-June 2021 and ASJ-RTN Model

Results shows that, noise level at all monitoring locations will exceed the Bangladesh noise standards during the construction period. However, the construction vehicles will have less impact on the existing

noise level of the source point. Noise level at RS-08 won't be impacted by construction activities since no construction vehicles will be there.

Impact Forecasting at Receptor Point

Noise level impact at the receptor point due to construction vehicles has been forecasted for eight locations using existing traffic volume and daily traffic estimate during the construction period. Forecasting for rest of the four-monitoring location has not been conducted since no road traffic available on those locations. Summary of the forecasting is given in **Table 7-9.** Results shows that, night noise level at all receptor point during pre-construction and construction period will exceed the Bangladesh noise standards. However, day time noise level in seven out of sixteen receptor point will exceed during the pre-construction period. During the construction period, day time noise level in nine out of sixteen receptor point will exceed during the pre-construction period. Overall, the construction vehicles will have less impact on the existing noise level at the receptor point.

Table 7-9: Impact Forecasting at Receptor Point

Monitoring Location	Forecasting Point	Distance from the Road Center (m)	Baseline Noise Level		Forecasted Noise at Receptor (Pre-Construction Period)		Forecasted Noise at Receptor (Construction Period)		Bangladesh Standards	
			Daytime	Nighttime	Daytime	Nighttime	Daytime	Nighttime	Daytime	Nighttime
RS-01	1	16.7	72.6	69.6	63.6	62.6	64.0	62.6	60	50
	2	13.1			64.7	63.6	65.2	63.6		
RS-03	1	11.6	70.9	70.4	69.8	69.2	70.0	69.2	60	50
	2	12.1			69.7	68.7	69.8	68.7		
RS-04	1	6.6	72.7	69.3	72.4	72.1	73.5	72.1	60	50
	2	3.3			78.0	77.3	79.0	77.3		
RS-05	1	6.8	70.5	69.4	74.0	73.5	75.5	73.5	70	60
	2	16.4			68.5	67.4	70.1	67.4		
RS-06	1	10.2	70.1	67.8	70.2	69.3	72.0	69.3	70	60
	2	16.6			67.7	66.2	69.5	66.2		
RS-07	1	10.7	69.6	67.8	67.2	67.7	69.8	67.7	70	60
	2	11.7			67.1	67.0	69.5	67.0		
RS-08	1	9.0	71.1	67.7	69.2	68.4	69.3	68.5	70	60
	2	9.7			69.1	68.0	69.1	68.0		
RS-09	1	16.6	71.1	66.6	66.6	64.9	68.5	64.9	70	60
	2	13.6			67.7	65.6	69.5	65.6		

Note: Orange colure indicate exceedance of national standard of Noise Pollution (Control) Rules, 2006
Source: Field Survey by EQMS, March-June 2021 and ASJ-RTN Model

Mitigation Measures for Noise Pollution during Construction Phase

- The location of sensitive receptors should be considered during selection of road alignment;
- Necessary evacuation, resettlement, and compensation plan should be prepared for sensitive noise receptors, if seems necessary.
- A Noise and Vibration Management Plan shall be formulated in the Contractor's Environmental Management Plan (CEMP);
- A baseline noise study by measuring the noise produced by different types of machines and vehicles should be conducted by contractor following appropriate method before starting the civil works;
- The machineries and vehicles should be maintained regularly to reduce their operation noise. A third-party inspection and certification of machineries and vehicles should be conducted by contractor before starting of works and in every six months onward; Over standard noise producing machines and vehicles shall not be allowed to operate in the project;
- Noise barrier should be erected around construction site, especially for flyover and bridge construction; in case of road construction, noise barrier should be erected where any residential and commercial settlement and sensitive receptors like school, mosque, temple, hospital are present beside work site;
- The machineries and vehicles should be equipped with muffler, silencer, foam, rubber and other sound soundproofing materials, whatever necessary, to reduce operation noise; the diesel generators should be covered with canopy;
- On Friday and other national holidays, nor works shall be permitted; during working days, any noisy works shall not be conducted during night shift and prayer times;
- All mixing and other plants like batching plant and asphalt plant should be operated in accordance with manufacturers recommendations, including sound proofing and to be located at a minimum distance of 200 m from sensitive receptors; the storage site, laydown area, construction camp shall be built maintain this distance criterion;
- Stationary units, e.g., aggregate breaker, compressor should be placed in sound-absorbing areas or tents, which can reduce the noise level by up to 70%.

7.1.5.2 Operation Phase

During the operational phase, the main source of noise pollution is traffic on the road. Noise levels are anticipated to increase due to pressure horns. It can be estimated that ambient noise level will increase due to the increased traffic. However, the better road condition and less congestion on roads will reduce the net noise levels at market and other crowded places. The Noise levels are likely to reach the acceptable levels at a distance of 500 m from the road. Some sensitive locations within 500m of the road may be affected due to higher noise levels than the stipulated 45 dB(A).

7.1.5.2.1 Operation Noise Impact Forecasting

ASJ RTN-Model 2018 has been used for noise level impact forecasting during operation period. A general outline for the considerations of ASJ-RTN Model are given below.

Types of Roads: General roads (flat, bank, cut and viaduct) and special road sections (interchanges, junctions, signalized intersections, road tunnels, depressed/semi-underground roads, flat roads with overhead viaducts and double-deck viaducts).

Traffic volume: No limitation.

Running speed of vehicles: During the operation period, design speed for Main Road is 80 km/h and for Side Road is 65 km/h.

Forecasting range: Forecasting for operation period noise at future road has been made up to a horizontal distance of 1.2m from the road and up to a height of 12m above the ground.

Meteorological conditions: No wind or strong temperature profile is assumed as the standard condition

A tentative distribution of vehicles is given in Table 7-10 according to the traffic plan (FY 2040) for EIA Study.

Table 7-10: Traffic Demand (FY2040) for future road during operation phase

Area	Road	Large	Small	MC	CNG	Total
Patiya	Main	8,269	6,684	0	0	14,953
	Side	1,839	1,486	8,203	11,960	23,488
Dohazari	Main	12,749	10,618	0	0	23,367
	Side	3,315	2,821	5,957	10,355	22,448
Keranihat	Main	14,220	11,522	0	0	25,742
	Side	-	-	-	-	-
Lohagara	Main	12,399	10,645	0	0	23,044
	Side	1,715	1,484	5,049	13,799	22,047
Chakaria	Main	10,526	8,818	0	0	19,344
	Side	917	776	6,599	18,577	26,869

Source: JICA Study Team, 2021

Cross section of the route alignment and details of the embankment height is given in **Figure 3-6**, **Figure 3-7**, **Figure 3-8**, **Table 3-3**, **Table 3-4** and **Table 3-5**.

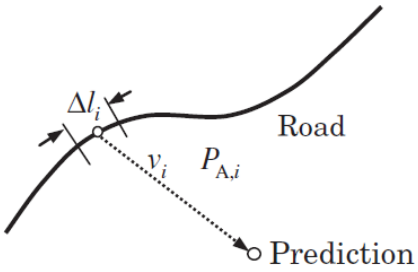
Methodology for Traffic Noise Impact Forecasting during Operation of New Road

According to Environmental Impact Assessment Technique for Road Project, on traffic noise prediction during operation of newly constructed road is shown in ASJ-RTN Model which was developed by Acoustical Society of Japan (ASJ).

In the calculation of road traffic noise using $L_{Aeq,T}$, the basic procedure is to obtain the time history of L_A observed at a prediction point (the unit pattern) for a single vehicle that is considered to be an omni-directional point source passing along the road under consideration, and to calculate its time-integrated value over the duration of its passage. By taking account of the traffic conditions (traffic volume, vehicle type composition, etc.) in the above results, the time-averaged value of the noise at a prediction point in terms of energy is calculated.

First, the objective road (lane) is divided into several sections (see **Figure 7-3**). Here, the running speed vi [m/s] and the A-weighted sound power level $L_{WA,i}$ of the running vehicle at the i^{th} divided section should be regarded as constant. One of the sections is selected, and a representative point (source point) is set at the center point of the section, and the A-weighted sound power level $L_{WA,I}$ is set.

Figure 7-3: Sound Propagation from a sound source to a prediction point



Next, the A-weighted sound pressure level $L_{A,i}$ at the prediction point is calculated according to calculation method of sound propagation. The sound exposure level for the i[th] section $L_{EA,Ti,i}$ during the interval Ti, in which the vehicle exists in the i[th] section, is calculated as follows (see **Figure 7-4**).

$$L_{EA,Ti,i} = L_{A,i} + 10 \cdot log_{10} \frac{T_i}{T_0}$$

where T_0 = 1 s (the reference time).
The above calculation is performed for every section. Then, the single-event sound exposure level L_{EA} [dB] at the prediction point when a vehicle travels along the entire road (lane) is calculated as

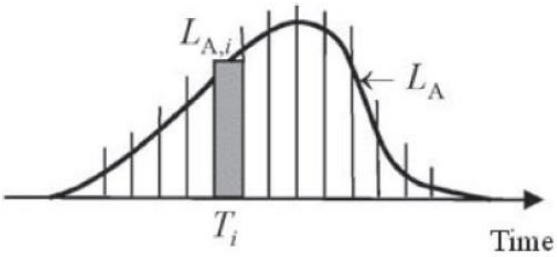
$$L_{EA} = 10 \cdot log_{10} \sum_i 10^{\frac{L_{EA,Ti,i}}{10}}.$$

The sound power level is dependent on the vehicle type. Therefore, L_{EA} is calculated for each vehicle type, and the equivalent continuous A-weighted sound pressure level $L_{Aeq;T}$ is calculated by taking into consideration the traffic volume for the vehicle type,

$$L_{Aeq,T} = 10log_{10} \frac{\sum_j N_{T,j} 10^{\frac{L_{EA,j}}{10}}}{T},$$

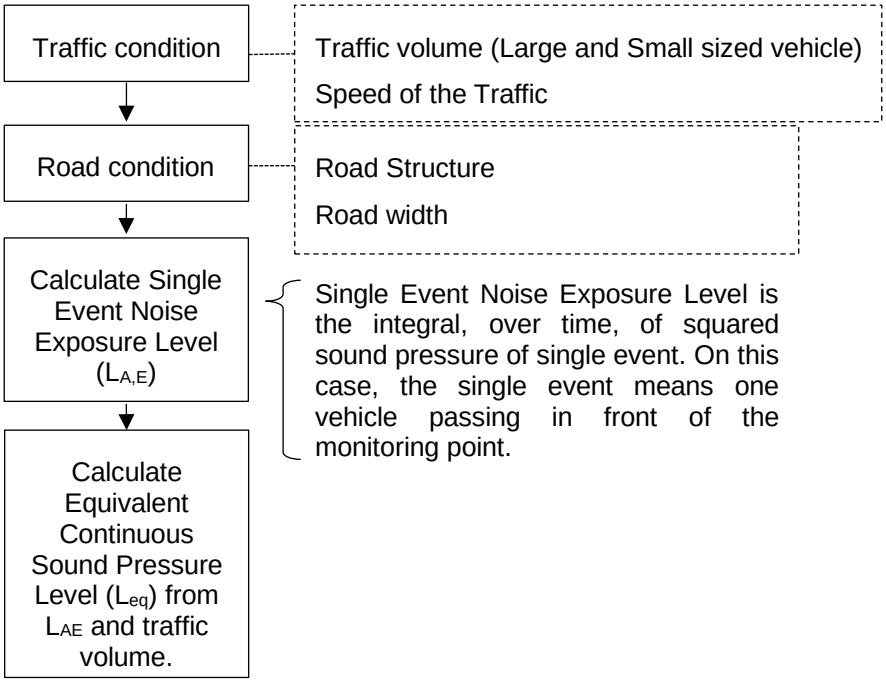
where T [s] is the total time interval, $L_{EA,j}$ [dB] is the single-event sound exposure level for vehicle type j, and $N_{T,j}$ is the traffic volume (number of vehicles) of vehicle type j during the time interval T.

Figure 7-4: Unit Pattern



The road traffic noise forecasting model of Acoustical Society of Japan (ASJ RTN-Model) shows that LAeq of the traffic(vehicle) is based on the car size, traffic volume and road condition. For the calculation of LAeq on road traffic is calculated by following diagram.

Figure 7-5: Flow Diagram of the ASJ RTN-Model



The Leq is calculated from traffic volume and L_{AE}. The formula of calculation is;

$$L_{eq} = 10log_{10}\frac{N \cdot 10^{\frac{L_{AE}}{10}}}{T} = L_{AE} + 10 \cdot log_{10}\frac{N}{T}$$

where

N is traffic volume,

L_{AE} is Single Event Noise Exposure Level and

T is the time of considered time zone (15(hours for daytime) x 3,600(sec) = 54,000(sec)).

Impact Forecasting at Receptor Point

Noise level impact at the receptor point due to operation of the vehicles has been forecasted for five locations using daily traffic estimate during the operation period. Summary of the forecasting is given in Table 7-11**.** Results shows that, noise level at all receptors point except daytime noise in Keranihat will exceed the Bangladesh noise standards during operation period.

Table 7-11: Impact Forecasting at Receptor Point

Monitoring Location	Forecasting Point	Distance from the Roadside (m)	Baseline Noise Level		Forecasted Noise at Receptor (Operation Period)		Bangladesh Standards	
			Daytime	Nighttime	Daytime	Nighttime	Daytime	Nighttime
Patiya	Right Side Receptor	1.2	59.7	60.9	67.4	70.5	55.0	45.0
	Left Side Receptor	1.2			67.7	70.3		
Dohazari	Right Side Receptor	1.2	63.1	57.9	61.9	65.1	55.0	45.0
	Left Side Receptor	1.2			62.2	64.8		
Keranihat	Right Side Receptor	1.2	70.5	69.4	64.1	67.4	70.0	60.0
	Left Side Receptor	1.2			64.5	67.1		
Lohagara	Right Side Receptor	1.2	61.9	58.4	62.2	65.4	55.0	45.0
	Left Side Receptor	1.2			62.5	65.1		
Chakaria	Right Side Receptor	1.2	64.9	57.5	61.7	64.9	55.0	45.0
	Left Side Receptor	1.2			62.0	64.6		

Note: Orange colure indicate exceedance of national standard of Noise Pollution (Control) Rules, 2006
Source: Field Survey by EQMS, March-June 2021 and ASJ-RTN Model

Mitigation Measures for Noise Pollution during Operation Phase

Mitigation measures will include:

- It is suggested that suitable engineering measures such as sound barriers, road pavement design should be adopted to minimize the noise generation.
- It is also suggested that surface roughness of the roads are maintained as per the design characteristics and honking should be discouraged through signboard displays.
- Signs for sensitive zones (health centres / educational institutions etc.) to disallow the use of pressure horns;
- Enforcement and penalties against traffic rules violators;
- Tree plantation along the road side should carried out and
- Noise monitoring shall be carried out as per the suggested monitoring plan.

7.1.6 Vibration

7.1.6.1 Construction Phase

Vibration is very common outcomes from any development project. It is expected that, due to nature of this project, this project will also produce vibration during construction phase. This project includes bypass or outer road in four places and flyover in one place. The bypasses will mostly go through agricultural land and rural residential area. On the other hand, the flyover will go through an urban area with commercial and residential settlements on both sides. Therefore, it is perceived that, the impact of vibration generated from the construction of bypass roads will be less significant. On the other hand, the impacts will be significant in case of flyover construction, especially during piling works.

7.1.6.1.1 Source of Vibration during Construction Works

Major sources of impacts related to vibration are given below:

I. Vibration will be generated during pile driving or bore piling, especially during construction of bridges and flyover;
II. The construction activities using heavy machineries during soil compacting and rolling, lifting crane, etc. will generate moderate to high vibration;
III. Substantial extent of vibration will be produced during sheet pile driving and dismantling using vibro hammer;
IV. Ground vibration may be generated during the operation of heavy vehicles, i.e., lorry carrying viaduct segment, I-girder, and other heavyweight materials with moderate extent.

7.1.6.1.2 Anticipated Vibration from Construction Works

The vibration level is characterized by the maximum velocity or peak particle velocity (PPV) in the vertical direction because it is less influenced by the alignment of the geophone than the longitudinal or transversal components. This project will use several construction equipment that may generate vibration during operation of those machines, especially during bridge and flyover construction. The extent of vibration depends on the characteristics of both origin and receptors. Several factors related to the source of vibration like the age of machine and parts, workload, etc. can differ the vibration it generates. On the other hand, the characteristics of soil and structures can influence then magnitude of vibration felt in the receiving end. **Table 7-12** presents some typical figure of vibration originated from different construction equipment at various distances. However, these values are only for understanding their potential impacts. The original values in construction site may differ due to the characteristics of machines and soil.

Table 7-12: Typical vibration generated from different construction equipment

Sl. No.	Construction Equipment	Receptor Distance	Vibration (mm/s)
1	Excavator (V Bucket)	2.5	1.36
		5	1.33
		6	0.66
		6.6	0.51
		10	0.215
2	Excavator (Ripper)	4	1.36
		10	0.38
		11	0.095
3	Vibrating Ripper	2	4.31
		10	1.85
		15	1.39
4	Hydraulic Hammer	2	3.33
		3.5	1.99
		5	1.36
		8.5	0.90
		10	0.40
5	Bulldozer	3	2.5
		5	1.77
		7	1.58
		8.5	0.45
		11	1.36
6	Vibrating Roller	1.5	3.33
		3	15.76
		5	4.54
		7	5.44
		8.5	4.31
		10.5	1.27

Source: Rodriguez and Bascompta (2000)[26]

7.1.6.1.3 Applicable Standards for Construction Vibration

There is no vibration standard established in the legislations of Bangladesh. Therefore, the standards of other countries have been reviewed to suggest a standard for this project. **Table 7-13** shows the vibration standards for construction works in different countries. The table shows that the vibration standards in different countries vary with the characteristics of receptors like historical building, domestic site development, industrial site development, residential development, commercial development, concrete structure, timber, etc. The standard of Japan set for construction work (75 VdB or 1.4 mm/s PPV) seems stricter that the standards set by other countries. While the standards in other countries are vary for different types of receptors, the Japanese standard is applicable for all kinds of receptors. In case of Australia standard, the reference values are set for historical building, residential area, and commercial areas. On the other hand, the USA standards are classified into four classes based on the building materials of the receptor and structures and their structural strength. The types of receptors for USA standards are reinforced cement concrete (RCC), cement concrete (CC), timber/mason, and extremely susceptible to vibration. In case of India, there are three types of receptors

[26] Rodriguez R and Bascompta M (2000) Vibration Analysis and Empirical Law Definition for Different Equipment in a Civil Construction. *Applied Sciences* 10: 4689

like historical buildings, residential, and industrial site. Reviewing the vibration standard for construction works in different countries, the Japanese standard can be recommended for this project.

Table 7-13: Vibration Standards for Construction in Different Countries

Country	Criteria	Standard
India (CMRI)	Historical buildings Domestic site development Industrial site development	2 mm/sec PPV 5 mm/sec PPV 12.5 mm/sec PPV
Australia	Historical buildings Residential development Commercial development	2 mm/sec PPV 10 mm/sec PPV 25 mm/sec PPV
USA	RCC CC Timber/ Mason Extremely susceptible to vibration	0.5 in/sec (12.7 mm/s, 102 VdB) 0.3 in/sec (7.6 mm/s, 98 VdB) 0.2 in/sec (5 mm/s, 94 VdB) 0.12 in/sec (3 mm/s, 90 VdB)
Indonesia	Jakarta Metro (During Construction)	85 VdB
Japan	During Construction	75 VdB

7.1.6.1.4 Impact Forecasting

Vibration impact in the alignment of existing highway has been forecasted using current traffic volume and construction vehicles trip per day during construction period. Details of the vibration impact forecasting are discussed below.

Vibration Impact Forecasting Methodology

Public Works Research Institute (PWRI) of Japan developed traffic vibration model for EIA study. That model can estimate traffic vibration around road based on the traffic volume. This forecasting method can calculate ten (10) percentile value of the traffic vibration level which can compare with vibration standard value of Japan. This forecasting method is based on the statistical data of road vibration from a lot of experiment result. The ten-percentile traffic vibration level L_{10} is given by:

$$L_{10} = L_{10^*} + \Delta L,$$

$$\Delta L = a \cdot lg(lgQ') - a \cdot lg(lgQ),$$

where
L_{10}^* is the Baseline of 10-percentile value of vibration level;
Q is the Equivalent traffic volume (Baseline) per lane and 500 seconds;
Q' is the Equivalent traffic volume (construction period) per lane and 500 seconds;
and a is constant. (a=47)

Q and Q' are given by

$$Q = \frac{500}{3{,}600} \times \frac{1}{M} \times \{N_L + K \times N_H\} \text{ and } Q' = \frac{500}{3{,}600} \times \frac{1}{M} \times \{N_L + K(N_H + N_{HC})\},$$

where
N_L is the Baseline traffic flow of small vehicles per hour;
N_H is the Baseline traffic flow of large vehicles per hour;
N_{HC} is the Assumed trip number of the Construction vehicle(large) per hour;
and K is constant. (K=13).

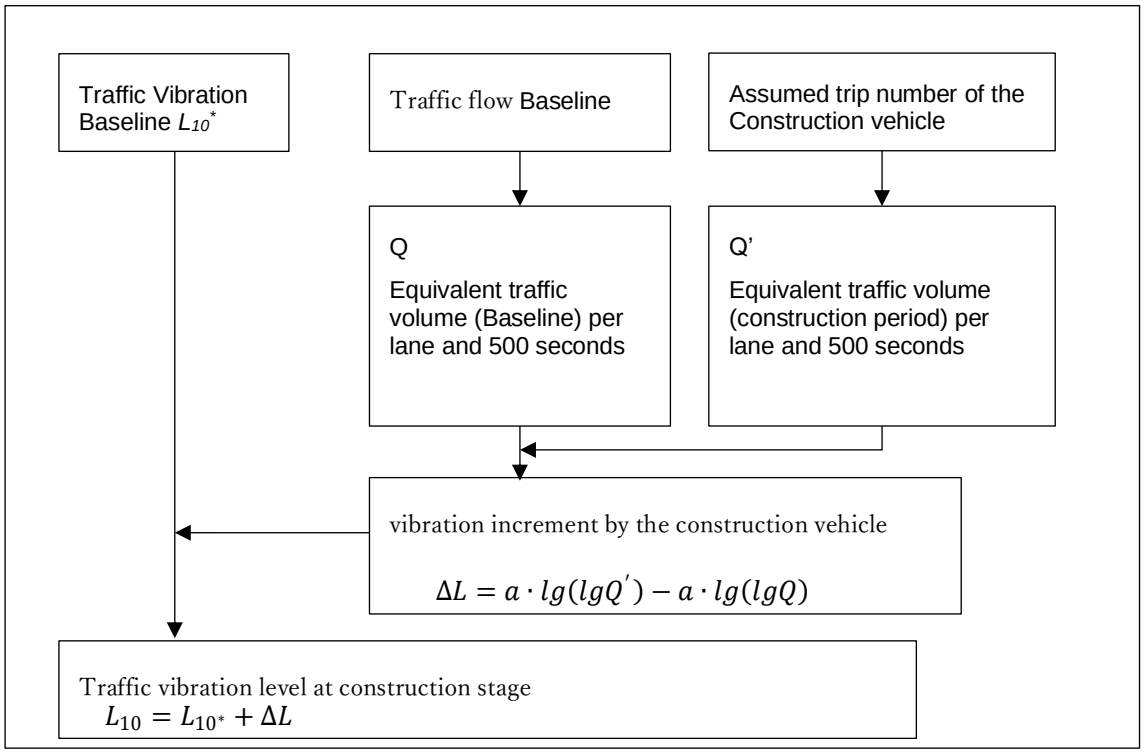


Figure: The flow diagram of vibration level for construction vehicles on existing road (Technical Note of PWRI No.4254, March 2013, Public Works Research Institute, Japan).

Construction Vibration Impact Forecasting

Vibration level impact at the at the alignment of the existing highway due to construction vehicles has been forecasted for 8 locations using existing traffic volume and daily traffic estimate during the construction period. Forecasting for rest of the 4-monitoring location has not been conducted since no road traffic available on those locations. Summary of the forecasting is given in **Table 7-14**.

Table 7-14: Construction Vibration Impact Forecasting

Sl. No.	Location Code	Location Name	Baseline Vibration Level (dB)	Vibration Level Increment ΔL	Traffic Vibration Level of Construction period (dB)	Japanese Standard
9.	RS-01	In front Upazila Health Complex, Patiya	47.5	1.3	48.8	65
10.	RS-03	In front of BGC Trust Medical College, Chandanaish	51.2	0.3	51.5	65
11.	RS-04	In front of Dohazari Jamijuri A. Rahman High School, Dohazari	47.6	1.9	49.5	65

Sl. No.	Location Code	Location Name	Baseline Vibration Level (dB)	Vibration Level Increment ΔL	Traffic Vibration Level of Construction period (dB)	Japanese Standard
12.	RS-05	In front of Shahi Jame Mosque, Keranihat	45.6	3.2	48.8	65
13.	RS-06	In front of Noyapara Baitul Mamur Jame Mosque, Padua	48.2	3.7	51.9	65
14.	RS-07	In front of Citizen Park Community Center, Lohagara	49.9	5.1	55.0	65
15.	RS-08	In front of Adhunagar Gul-E-Jar Girls High School, Aziz Nagar, Chakaria	41.2	0.0	41.2	65
16.	RS-09	In front of Fashiakhali Govt. Primary School, Chakaria	46.9	4.7	51.6	65

Note: There is no vibration standard in Bangladesh, since the project is JICA financed project, Japanese standard is used for this project
Source: Field Survey by EQMS, March-June 2021 and ASJ-RTN Model

Results shows that, vibration level at all the prediction point are within the Japanese vibration standards during the baseline and construction period. However, the construction vehicles will have less impact on the existing vibration level. Vibration level at RS-08 won't be impacted by construction activities since no construction vehicles will be there.

Mitigation Measures for Vibration during Construction Period

- The route alignments and design and construction specifications should be determined considering the vulnerable receptors of vibration;
- The design and construction specifications should consider less vibration generation.
- Concurrent works that produce vibration should be avoided. Instead, vibration producing works will be conducted with intervals of work place and time;
- An assessment should be conducted to estimate the vibration tolerance level of adjacent infrastructures in flyover and bridge construction areas before starting of civil works. If found vulnerable, then necessary measures like cut-off trench; temporary evacuation, resettlement, and compensation should be implemented;
- The demolition works should not be conducted concurrently, but with intervals of time and buildings.

7.1.6.2 Operation Phase

During the operation phase, the main source of vibration is traffic on the road. It can be estimated that vibration level will increase in future road area due to the increased traffic. However, the vibration levels

are likely to be within the acceptable levels. In general, road traffic vibration has a significant impact when the distance between the traffic lane of a vehicle and the point of receptor is closer. Specifically, the effect is greater when traffic lanes and residential houses are closely located. Since the distance from the main and service road lanes is large from the residential area in the proposed project with bypassing road, the impact of road traffic vibration is expected very small. The most important vibration impact that must be considered in this construction vehicles using the existing narrow road during construction phase, the quantitative impact of which is mentioned in the previous section.

Mitigation Measures for Vibration during Operation Period

- No additional mitigations are required.

7.1.7 Ground Subsidence/Landslide

7.1.7.1 Construction Phase

The occurrence of ground subsidence and landslide mostly depends on the geologic characteristics of the concerned area, including the lithology of aquifer underneath and condition of water table. These matters should be considered during design of the project.

There will be requirement of soil for road construction. For this reason and for foundation of bridges and flyover, soil excavation is required. Therefore, there would be a nominal chance of landslide during and after the excavation of pile foundation and borrow pit. Landslide typically occurs in monsoon season due to excessive rainfall induced erosion and loosening of soil. The Chittagong Hill Tracts, the hilly region on the eastern side of the project, is a landslide prone area. However, the project location is situated in comparatively plain land that reduces the susceptibility of landslide significantly. Landslide in pile foundation and borrow pit may cause minor injury to fatal accidents, if happened. Despite their low chance to occur, some mitigation measures need to be implemented.

Mitigation Measures for Landslide Hazard during Construction Phase

- A lithological study should conduct to assess the formation of aquifer underneath, including water table for predicting any future subsidence;
- The findings of the study should be considered during design of the roads and flyover.
- Pile foundation and borrow pit area should be enclosed with hard barrier during excavation to prevent public exposure;
- During pile cap breaking and foundation works, shore piling/shoring using steel sheet and/or shoring beam shall be installed to prevent bank collapse or ground subsidence due to erosion, loosening of soil, and overweight materials on bankside.
- There should be first aid box and ambulance (during heavy works) onsite for emergency response to the affected workers, if any landslide happened.

7.1.7.2 Operation Phase

The chance of occurring ground/road subsidence is very minimal, but still, it can happen. The roads will be constructed by filling and compaction of soil and sand. The subsidence may be caused by natural processes or by human activities. The former type may include earthquake, slope failure and erosion, loosening of soil and slope due to infiltration and percolation of water during heavy rainfall, etc. On the other hand, the human factors may involve construction faults, for instance, improper compaction of soil and sand, using of low-quality materials; excessive withdrawal of groundwater from aquifer underneath; operation of overweight vehicles, etc. This occurrence can cause damage to the property and life. However, this impact is less significant as happening of this incident is rare.

Mitigation Measures for Subsidence Hazard during Operation Phase

- The soil and sand should be tightly compacted reducing porous space well during construction of the roads;

- The slope could be paved to prevent infiltration and percolation of water and erosion;
- Drainage system should be sufficient to discharge water from road surface after rainfall;
- Operation of overweight vehicles should be prohibited and strictly monitored. For this purpose, weigh station can be installed to monitor the weight of the vehicles.

7.1.8 Offensive Odors

7.1.8.1 Construction Phase

The implementation of this project involves several types of construction works that may generate substances with bad odors. For example, land preparation and clearing work, sewage from mobile and stationary toilets, solid waste, slurry, etc. However, considering the possibility of producing such bad odor and its public exposure level, the impact is seemed less significant.

Mitigation Measures for Offensive Odors during Construction Phase

- The sewage sludge generated from stationary toilets in offices, workers accommodation, and construction yards should be managed with sanitary pit and shall not be released in open environment;
- The solid wastes and slurry from batching plant shall not be disposed in open place without following the instruction given in waste management plan.

7.1.8.2 Operation Phase

Any impact related to offensive odors is not expected during operation phase of the project.

7.1.9 Bottom Sediments

7.1.9.1 Construction Phase

This project requires large scale earth works, including removing of topsoil and site clearance, excavation, filling with soil and sand, rolling and compacting soil and sand, piling, etc. These works will generate sediments that may discharged into water body by surface runoff and wind erosion and transportation. Moreover, oil and grease can also be reached nearby water body. These sediments generated from the construction site may deteriorate the bottom sediments of nearby rivers and other streams. This will also be a threat for aquatic organisms. Since there are rivers and streams in and around the alignments of the project, the potential impact from bottom sediments is significant.

Mitigation Measures for Bottom Sediments during Construction Phase

- Sediment fence/silt fence should be installed on the bank of rivers, canals, and ponds nearby the project to prevent sediment discharge into the water;
- Slurry from batching plant should be dried up in a location away from water body. During monsoon season, a sediment fence should be installed around this site to prevent rainfall induced runoff carrying sediments from this site;
- No oil and lubricant shall be disposed or discharged into water body. Oil water separator should be used in the drainage outflow of construction yard;
- The sediment mixed water should be settled in drain by check dam to allow sedimentation. Later, the sediments will be scrapped and dried up in designated place (as per serial II).

7.1.9.2 Operation Phase

The chance of releasing sediments by water and wind into water body from the project will decrease significantly. However, the sediments still can be generated from slope erosion of the roads, if remained unpaved or uncovered with grass. In case of flyover, the impact is not expected.

Mitigation Measures for Bottom Sediments during Operation Phase

- The footpath and slope should not remain uncovered. Instead, they should be paved or covered with grass. This will reduce soil erosion and sediment production.

7.1.10 Flood and Drainage

7.1.10.1 Construction Phase

Flooding and drainage are two of the most significant and obvious impacts in Bangladesh, especially in the case of road embankment construction. It is because it may create water logging by blocking surface drainage. It can also interrupt irrigation and natural water courses. Within the project area flooding is a significant problem during the rainy season. Flooding or drainage congestion and water logging will occur in the Project Area during severe rainfalls in the monsoon reason. The construction of a wide road embankment may have impacts on the roadways corridor. Unless adequate drainage is allowed in the embankment the potential exists for it to act as a dam, impounding rainwater may occur in the vicinity of the roadsides and settlement areas. It can be seen from **Figure 4-59** that the alignments of Patiya, Dohazari, and Lohagara Bypass are located in moderate flash flood prone areas. Hence, the alignments may create blockage of flood induced water making the inundation to stay for longer times. On the other hand, the location of Keranihat and Chakaria sub-projects are not situated in flood prone area. However, this flood zoning is conducted considering wide scale of area, while local scale flood or inundation could be occurred for short or longer times due the development works. The design of the road should ensure that no flooding is worsened within the vicinity of the area and preferably is reduced through good design.

The major earthworks may interrupt the existing surface water hydrology, ground water flow, and water management practices in project areas. The project will require several types of permanent and temporary infrastructures and facilities like construction yard, workers camps, project office, stack-yards, materials stockpiles, etc. These works could potentially disrupt the natural cross drainage and might be the cause of flooding, which may have localized or regional impacts. Furthermore, the excavation of fill materials for construction of road embankment will result in an increased extent of open water during monsoon.

Mitigation Measures for Flood and Drainage during Construction Phase

- A catchment level surface drainage/hydrological study should be conducted as part of feasibility study to determine the drainage slope and direction;
- The height of the road embankments and bridges should be determined after analyzing the historic flood depth data;
- Provide adequate number of cross drainages opening for facilitating irrigation on adjacent agricultural land;
- Provide appropriate pipe culverts, box culverts and bridges on the road with adequate opening for cross drainage of the catchment area, so that they can safely handle a 20-year frequency of flood;
- All drains need to be designed so that runoff resulting from storms to a specified frequency of occurrence can be drained off immediately without overflowing or not being impounded in lower level of the Project Area;
- In case of bridge construction, the river morphology should be examined to determine effects on river bed and banks erosion during flooding.
- Temporary drains should be constructed in and around the construction sites to ensure water flow (by gravity or pumping) to the river or nearest water course for preventing water logging;
- All rainwater and construction induced stagnant water/inundation should be drained immediately by pumping or drains so that they do not cause disturbance and hazard to the local community, farmers, and road users.

- Temporary cross drainage facilities should be arranged for water flow and irrigation purpose of nearby agricultural lands.

7.1.10.2 Operation Phase

Any major impacts related to flooding and drainage are not expected during operation phase provided that the mitigation measures are perfectly implemented during pre-construction and construction period. However, some minor impacts related to inundation or drainage congestion may occur for short period, if any design error occurred.

Mitigation Measures for Flooding and Drainage during Operation Phase

- Stagnant water from temporary inundation should be pumped out on emergency basis to reduce public disturbance;
- The cross-drainage infrastructures should be maintained by cleaning and dredging regularly to keep them operational, especially during monsoon season.

7.1.11 Source of Materials and Haul Routes, and Disposal Sites

7.1.11.1 Construction Phase

The required fill materials will be sourced by dredging. There will be some disposal sites for spoil, slurry, waste concrete, and solid waste.

At this stage it is not possible to carry out an environmental review of the sources of all material. The precise location can only be determined once the contractors have been selected and they have made their own decisions on sources and availability. Nevertheless, it is essential that all contractors follow good environmental standards for selection and extraction in accordance with national environmental regulations.

Major sources of impacts are given below:

- The borrow pits, haul route, and disposal sites may cause land use change and loss of agricultural land;
- The waste disposal site may cause land degradation and contamination;
- The borrow pits will increase open water, which may cause mosquito breeding;
- Danger to other roads users, in particular pedestrians and non-motorized and farm vehicles.

Mitigation Measures during Construction Phase

- The borrow pits and disposal sites should be constructed avoiding arable lands (three-cycle per year) and away from settlement area;
- Minimize the use of earth/topsoil as filling materials for road embankment. Instead, maximize the use of dredged materials as filling materials;
- The waste disposal sites should be away from water body; the spoil disposal site should be levelled and compacted regularly;
- Larvicide and adulticide should be applied for controlling mosquito;
- The haul route and schedule should be selected causing least disturbance to local community and traffic.

7.1.11.2 Operation Phase

No further borrow pit and waste disposal site will be required during operation phase. However, if the previously constructed pit and disposal site remains abandoned as like before, they may cause some problems in environment. The waste disposal sites can spread contamination through leaching and surface runoff. The borrow pits will be polluted and will harm surrounding environment.

Mitigation Measures during Operation Period

- The solid waste disposal sites should be temporary. The land of disposal site should be reclaimed following appropriate procedure after completion of the project;
- The abandoned borrow pits can be usable for fishing and recreational activities. Some borrow pits can be refilled with sand, if found feasible.

7.2 Impacts on Ecological Resources

7.2.1 Protected Area

There are eight Protected Areas (PAs) nearby to the Chattogram-Cox's Bazar Highway which are Dudpukuria-Dhopachari Wildlife Sanctuary, Chunati Wildlife Sanctuary, Fashiakhali Wildlife Sanctuary, Medhakacchapia National Park, Sangu Wildlife Sanctuary, Himchari National Park, Sheikh Jamal Inani National Park and Teknaf Wildlife Sanctuary. Considering the nature (Linear Road) of the project, up to 2.0 km on both sides of the alignment has been considered as the project AOI for primary data collection purpose. Within the project AOI, only Fashiakhali Wildlife Sanctuary is located at Chakaria Bottleneck. However, this bottleneck is not intersecting the Fashiakhali Wildlife Sanctuary. Also, there is no gazetted buffer zone available for any of the PAs concerned for this project.

Fashiakhali Wildlife Sanctuary is enriched with biodiversity and managed by Forest Department. According to the Wildlife (Conservation and Security) Act (2012), a set of activities including disturbing or threatening any wildlife, dumping any materials detrimental to wildlife and entering or residing in a sanctuary are prohibited. **Figure 7-6** shows the map of nearby protected areas of the project locations.

7.2.1.1 Construction Phase

The construction activities relating to workers' movement, improper waste disposal, and lack of training and proper awareness of workers may pose potential threat for PAs within the project AOI.

Mitigation Measures during Construction Phase

- No access for any construction activities allowed into the PAs.
- No disposal of construction and other wastes allowed into the PAs.
- No construction of labor camps will be allowed within 2 kilometers of the boundary of the PAs.
- No poaching will be done.
- Workers will be trained not to disturb or threatening any wildlife and natural resources of the PAs.

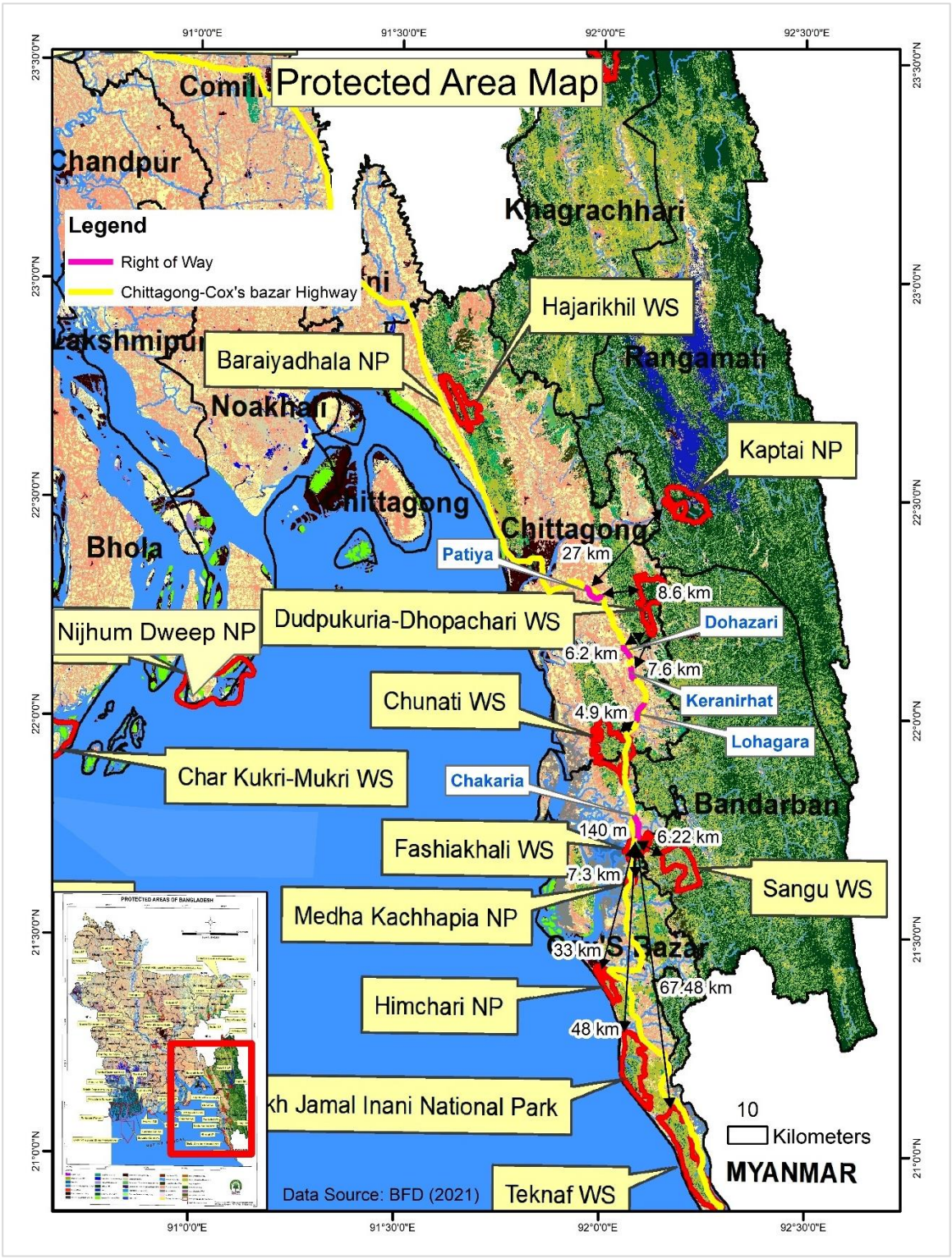
7.2.1.2 Operation Phase

During the operation phase, workers will not be employed anymore. However, minor impacts from speedy driving and improper use of horns may impact the wildlife of the PAs.

Mitigation Measures during Operation Phase

- Proper signage for skipping horns and speed limit to be installed near the PAs.

Figure 7-6: Nearby protected areas of the project locations



7.2.2 Biota and Ecosystem

7.2.2.1 Construction Phase

In the project AOI, 13 species of aquatic plants and 68 species of terrestrial flora from homestead vegetation and 44 species of terrestrial flora from hillside forest were recorded. Also, 12 species of amphibians, 25 species of reptiles, 19 species of mammals, 86 species of birds and 12 species of fishes were recorded in this study. No threatened species were observed expect four mammals and few trees.

Garjan (*Dipterocarpus turbinatus*) is considered as Vulnerable (VU) following The IUCN Red List of Threatened Species; Version 2021-2. But this species is very common in the forested habitat and hillside vegetation. Ganges River Dolphin was only reported from the Sangu River at Dohazari bottleneck by the consultation with local community people and Local Forest Department. Asian Elephant (*Elephas maximus*), Barking Deer (*Muntiacus muntjac*), Wild Boar (*Sus scrofa*) and Rhesus Macaque (*Macaca mulatta*) were only be very rarely reported at and around the area of Fasiakhali Wildlife Sanctuary and Kakara Reserved Forest. However, there are no habitats for these species and no active migration route of Asian Elephant in the bottleneck site of Chakaria. Therefore, these threatened species are unlikely to be impacted due to the project activities.

Before and during the construction phase, vegetation removal along with tree felling will be done on the ROW and the areas where trees might create a safety hazard to the future operation of the road. A total of 85,402 nos of trees (18,353 trees from Patiya Bottleneck, 10,639 trees from Dohazari Bottleneck, 30,785 trees from Lohagara Bottleneck, 2,741 trees from Keranihat Bottleneck and 22,884 trees from Chakaria Bottleneck) will be affected. This will lead to loss of habitat and habitat quality degradation for wildlife particularly birds and mammals that rely on trees for their habitat and food source.

The above-mentioned trees have been categorized as fruit bearing, timber type, firewood, medicinal, bamboo, cane bush, papaya, and banana. Size and species will be finally assessed by the Forest Department during the land acquisition process, and compensation will be paid adding 100% premium as per ARIPA 2017. The owners of fruit trees (large and medium sizes) will get fruit compensation at 30% of the timber value. Details of the area of logging expected in the MJB sections of the project are given in Appendix G-01.

During the construction phase, dust will be produced due to vehicle movement and construction-related activity. Dust, as well as exhaust from construction material carrying vehicles, will settle down to surrounding vegetation which will lead to hinder the physiochemical process of plants i.e., photosynthesis, respiration, etc. This will result in to decrease in plant growth and future germination. In addition, pollution of surface water caused by construction of culverts and bridges, spillage of chemicals, run off the wastewater, disposal of solid and liquid waste into the water body may impact aquatic vegetation. Excavation of borrow pits, vehicle movement and other construction activities may cause soil erosion, soil compaction, destruction of terrestrial vegetation and injury of fauna. To compensate this impact, a greenbelt plantation plan will be implemented for replantation of saplings after assessing the trees to be felled with the support of the Forest Department.

Major sources of impacts are given below:

- Removal of vegetation and/ or loss of trees in the ROW and areas where trees might create a safety hazard to the future operation of road
- Dust and exhausts produced from vehicle movement and construction-related activity
- Pollution of surface water caused by constriction of culverts and bridges, spillage of chemicals, run off the wastewater, disposal of solid and liquid waste into the water body resulting to impact on aquatic vegetation
- Hunting of wildlife and birds during construction.

Mitigation Measures during Construction Phase

- No trees shall be felled unless they are directly in the ROW and clearly defined, or unless they created a safety hazard to the future operation of the road.
- Secure permit from Forestry Department prior to tree cutting /removal.
- Cutting of large trees that harbor and encourage wildlife must be kept to a minimum.
- No trees shall be felled unless they are directly in the ROW and clearly defined, or unless they created a safety hazard to the future operation of the road.
- Cutting of large trees that harbor and encourage wildlife must be kept to a minimum.
- Vegetation adjacent to the ROW should not be used as fuelwood for heating bitumen during construction activities.
- Restrict and enforce dumping and storage of spoil and other materials close to trees to ensure that trees and plants are not damaged.
- Hunting the birds and other animals by construction workers should be prohibited at the construction sites.
- Topsoil in the vicinity of tree felled should be reused for new planting.
- Avoid major construction activities during night hours.
- Advise and educate contractors and workers to ensure the conservation of natural resources.
- Upon completion of embankment works turfing and planting should be done on embankment and slopes. Dense and well-rooted growth of permanent grasses should be planted to eliminate dust and erosion.
- Camp sites and asphalt plants to be established on waste/barren land rather than on forested or agriculturally productive land.
- Borrow pits (if any) to be fenced to protect animals.
- In accordance with the normal practice of the Forest Department, 2 new trees should be planted for each tree felled. Replanting along the roadway should consist of a multi-species mix of local vegetation including fruit trees, fast-growing (fuel) trees and timber trees.
- Replanting along the roadway and all other areas should consist of a multi-species mix of local vegetation including fruit trees, fast-growing (fuel) trees and timber trees.
- Replanting of trees along the roadsides and all other areas will be done through the implementation of the Social Afforestation Program by FD and NGO/RHD. It will offer a significant opportunity to bring benefits to the local community and Project Affected Persons (PAP's), vulnerable groups, particularly women by direct involvement in the program.
- Forestation programme should be initiated, covering the road ROW, any embankments, and land near bridges and culverts to compensate for the loss of vegetation, to reduce the risk of erosion of the banks, and finally as a noise-reducing wall.
- Mitigation measures for other pollution control stated in the EMP are applicable.

7.2.2.2 Operation Phase

During operation phase, tree plantation programme will be continued for its proper establishment to offset the impacts caused by vegetation removal during construction phase. (see **Appendix G** for specific details of the planting plan). Dust produced from vehicle movement and disturbances caused by domestic and wild animals may impact the newly planted saplings. Therefore, it is necessary to ensure proper implementation of the greenbelt plantation plan. Impacts during operation phase are likely to be as follows:

- The survival rate and growth of newly planted saplings may be impacted.
- Killing of animals in road accidents

Mitigation Measures during Operation Phase

- Proper care to be taken for newly planted saplings.

- Provide mulching and fencing for these saplings as necessary.
- Low width under passes with the provision of small net on both side of the road shall be made where the animal movement is frequent.

7.2.3 Fisheries and Aquatic Biology

7.2.3.1 During Construction Phase

Construction activities at bridges/ culverts may affect fish health and fish migration of the water bodies. Commercial fishing pond and large water bodies may be impacted due to improper waste disposal. In addition, bottom sediments generated from construction sites are potential threat to aquatic organisms. Oil and grease produced from construction sites will also deteriorate the aquatic ecosystem of nearby rivers and other water bodies. In addition, Ganges River Dolphin was reported from the Sangu River at Dohazari bottleneck by the consultation with local community people and Local Forest Department. Due to aforementioned impacts on waterbodies during bridge construction may lead to affect the migration and behavioral responses of them.

Mitigation Measures during Construction Phase

- Fish migration routes need to be considered during the construction period.
- Ensure no disposal of construction materials or wastes in any nearby commercial fishing areas.
- Disposal of dredged materials will be taken place in the deepest parts of rivers.
- Proper implementation of Section 10: Bottom Sediments to be followed.
- Manage all liquid waste disposal and ensure no accidental spills of liquid waste into the river.
- Construction not to be undertaken during high flood.
- Bridge construction activities in the river must be avoided during the fish breeding season (July to September)
- Consider avoiding fish ponds during land acquisition.
- Ensure to have no adverse impact on fishing projects and fishing ponds in the project AOI.
- Waterbodies shouldn't get disrupted and natural water flow should be ensured during construction.
- All activities in the land and river should be done within the designated areas.
- Follow the below mitigation measures for the protection of Ganges River Dolphin during bridge construction activities in the Sangu River
    a. Check for dolphins at a radius of 500 meter before starting dredging and piling activities
    b. Avoid monsoon season for dredging and piling activities
    c. Piling should be paused if dolphins are found nearby and let them leave the area
    d. Acoustic enclosures will be placed to reduce air noise during the piling operation

7.2.3.2 Operation Phase

The newly constructed bridge/ culvert may affect water flow and therefore hamper fish migration. In addition, Construction of road and bridge may impact on fish production.

Mitigation Measures during Operation Phase

- Ensure sufficient water flow and fish migration facilities.
- Consult with the local fisheries department to enrich the fisheries resources;

7.3 Impacts on Social Environment

The assessment of socio-economic impacts has been undertaken with respect to the receptors across natural capital, human capital, social capital, economic capital and physical capital to have a significant interaction with the activities linked to the project across its lifecycle. For assessment of impacts, the

project lifecycle has been divided in to two phases – (i) Construction phase (this includes the pre-construction phase also); and (ii) Operation phase.

7.3.1 Involuntary Resettlement

7.3.1.1 Before/During Construction Phase

The construction phase of the project will involve the pre-construction preparatory phase and intense construction activities which require site preparation, transportation of construction material, rapid mobilization of labour force etc. The significant impacts which are expected for involuntary Resettlement during construction phase include:

- Loss of Land
- Loss of structure
- Loss of Livelihood

As per RAP study, A total of 405.1965 acres private land will need to be acquired for five major bottleneck sections. More than 2500 PAUs including residential HHs and shops, plain land owners have been affected by the project interventions. Besides, 31 community properties and 13 offices/institutions are also affected among which 20 CPRs and 10 offices will be relocated elsewhere. Apart from the HHs and shops, 573 tenants, 641 wage laborers and 206 vendors are also affected within the proposed ROW.

Major impacts on project-affected units (PAUs) were identified at Chattogram district (520 PAUs), followed by Cox's Bazar district (224 PAUs) and Bandarban district (7 PAUs). Among the total affected PAUs, there are 33 community property resources (CPRs) and office/institutions, out of which 27 CPRs/offices are at Chittagong, six at Cox's Bazar, and no CPR at Bandarban. Apart from the CPRs, many business premises are affected in the project area. Total 3123 persons in 715 households (excluding CPRs) are affected. The details of involuntary resettlement have been described in Resettlement Action Plan report.

The impact magnitude is high therefore the impact is significant.

Mitigation Measure during Construction Phase

- A detailed assessment will be carried out during the detail measurement survey to determine the extent of impact and usage of land;
- Where procuring of private land cannot be avoided and it will be done through land acquisition process through the enforcement of Acquisition and Requisition of Immovable Property Act, 2017 (ARIPA), the land owner will be duly compensated as per the provisions mentioned in the Entitlement Matrix of Resettlement Action Plan;
- Compensation will be provided to the affected as per Cash Compensation Law (CCL) as specified in ARIPA, 2017 or replacement cost, whichever is greater;
- In the case of leaseholder, the affected persons will be assisted in identifying alternative location.
- Stakeholder Engagement Plan and Grievance Redressal Mechanism should be implemented;
- Compensation for loss of income and other investments related loss for the affected households will be assessed, determined and paid based on the entitlements specified in the entitlement matrix of Resettlement Action Plan (RAP);
- The Concessionaire has to establish an effective grievance redress mechanism, which should be properly communicated to all the affected persons and stakeholders; this will be a platform to raise their concerns and complaints;
- In case the affected person is not satisfied with the compensation, he/she has the right to express concern through formal application to the grievance process;
- It should be ensured that compensation for the income loss is paid to the affected persons before the start of any physical work;

- The contractor should ensure that the construction work takes place during lean business hours and during the night to avoid major disruption;
- The contractor should inform all the stakeholders well in advance (at least 30 days) before the start of the construction work, to enable shop owners to stock up and remain unaffected if vehicles delivering goods are unable to reach them during construction;
- At Keranirhat Flyover area it should be ensure that the temporary road side small vendor who don't have any specific location to continue their business, during construction phase a suitable location require for them to continue their business.
- Contractor during construction should ensure that some commercial structures like restaurants and shops near the RoW at Keranirhat are not affected and excavation should be carried out to the possible extent to avoid any damages to the commercial structures.

Operation Phase

No impact will be expected regarding involuntary resettlement during Operation phase.

Mitigation Measure during Operation Phase

All sorts or resettlement assistant will be ensured prior to operation phase, so no impact will be assumed regarding involuntary resettlement.

7.3.2 Poor Group

Before/During Construction Phase

Sources of Impact

According to the census, SES and IoL survey of RAP study, it is found that nearly half (47.41%) of the population of the affected area lives below poverty line. Their maximum income range is below 24,000 taka which comparatively much lower than population whose income is more than 50,000 takas. Due to acquisition of the property these poor people will be affected adversely.

Mitigation Measure during Construction Phase

Prepare RAP involving the following measures

- Define the displaced persons and criteria for determining their eligibility for compensation
- Establish external monitoring committee consists of the third party

7.3.3 Indigenous or Ethnic Minority People

Before/During Construction Phase

Sources of Impact

As per survey conducted during RAP preparation in the proposed project area there is no indigenous or ethnic minority available. So, the impact on indigenous or ethnic minority is negligible. So, no mitigation measure will be required.

7.3.4 Loss of Livelihood

7.3.4.1 Construction Phase

Sources of Impact

As per RAP reports, three categories of business have been identified based on nature and capital investment i.e. large (having TIN certificate and capital investment is more than BDT 500,000), medium (have no TIN certificate and capital investment is BDT 200,000 to 500,000 and small (have no TIN certificate and capital investment is less than BDT 200,000). In the five major bottleneck sections, a total of 712 business entity comprising of 59.13% of total business have been found small, 22.47% is medium and 18.40% business is large will be directly impacted.

A total of 641 wage laborers have been identified during census and IOL survey at five major bottleneck sections. Most of them are male wage laborers (625) and remaining are female (16). The female wage laborers are mainly engaged in the restaurant as assistant to the cook, supplying of drinking water, etc. On the other hand, male wage laborers are mostly engaged in restaurant, grocery shop, whole sale market, etc. Major impacts on wage laborers are found at Keranihat (289) followed by Dohazari (256).

Apart from the squatter and tenants there are some vendors 27 at Lohagara (15) and Keranihat (191) section. No vendors are found in other bottleneck sections. These vendors are selling their good on the RHD land without rent or tax. Major number of vendors are found as fruit seller (61) and cloth seller (40) at Keranihat. The vendors sell their goods on the RHD land without rent or tax. Many vendors are found as fruit sellers (44) and vegetable sellers (26). No vendors are found in other bottleneck sections. The numbers of vendors are always changeable, and new vendors may come to the site, or someone may leave at any time.

Most of the fishermen in the project upazilas (i.e., around 80% in Patiya Upazila, around 65% in Chandanaish Upazila) are commercial in nature. Local fishermen use traditional fishing gears for their low scale fishing activities in the river. But, the primary purpose of these fishing activities is self-consumption. In addition, there is no designated fishing area in the rivers within the project AOI.

Fishing activity within AoI was observed only in Sangu River Bridge area during the field survey. Around 10-12 artisanal fishermen are involved in low scale fishing with traditional fishing gears for self-consumption in this area. Due to bridge construction, the availability of fishes in bridge construction site might be lower. However, it is unlikely to impact on the livelihood of these fishermen residing near Sangu River Bridge area as there are available fishing area in the downstream of the river.

Mitigation Measures during Construction Phase

- All direct income lost should be properly compensated as per RAP;
- Livelihood Restoration Plan should be initiated who have loss their existing opportunity;
- Ensure employment opportunity for street vendors who are located at the RoW of Lohagara and Keranirhat section;
- Project Affected Persons should be prioritized during employment opportunities related to this project;
- Female wage labour should be well trained in compliance with another profession as they loss their existing jobs employed in different sectors;
- Affected vendors may get resettlement benefits to restore their business elsewhere.
- Vendors without permanent structures but doing business in the same place almost every day should be considered entitled vendors for this project as it was considered in the past international projects (e.g., MRT Line 6 project of JICA, Bus Rapid Transit Project of ADB) in Bangladesh.
- Ensure to have no adverse impact on rivers, fishing projects and fishing ponds in the project AOI.
- Consider avoiding fish ponds during land acquisition.
- Waterbodies shouldn't get disrupted and natural water flow should be ensured during construction.
- Inform nearby fishermen before starting any bridge construction activities in the river.
- Ensure that fisherman shouldn't be affected during construction.
- Ensure proper implementation of mitigation measures related to surface water quality, waste management, bottom sediments and protection of fisheries and aquatic ecosystem.

[27] Petty businessmen who do their business on small structure on wheel or sit on the ground without structure. They sit on a particular location everyday and sale their goods. Mobile vendors who sale goods (betel leaf, nuts, cigarette, etc.) on foot are not included in this category.

7.3.4.2 During Operation Phase

No impact is expected during operation phase, so no mitigation measure is required.

7.3.5 Land Use and Utilization of Local Resources

7.3.5.1 Construction Phase

Sources of Impact

According to the RAP report, a total of 405.1965 acres (164.047 ha) of private land at five major bottlenecks sections will need to be acquired out of which 147 acres (36.30%) at Chakaria followed by Lohagara 116.43 acre (28.77%), Patiya 78.45 acre (19.37%), Dohazari 65.50 acres (16.17%) and Keranirhat 1.20 acres (0.30%). Most of the affected land is Null 322(79.47%) followed by homestead 45.79 Acre (11.30%), Pond 15.43 Acres (3.81%) and Vita (high land) 13.09 Acre (3.23%).

A large number of trees of various species have been found affected in the proposed right of way of five bottleneck sections since the alignment is passing through villages in at least four bottleneck sections except Keranihat. A total of 85,402 trees of various sizes; Large 13,691, Medium 20,611, Small 34,727 and plant (sapling) 16,373 are affected. Out of the total 30,785 trees in Lohagara, 10,639 trees in Dohazari and 2,741 trees in Keranihat, 18,353 trees in Patiya and 22,884 trees in Chakaria have been identified during the field survey.

As mentioned above the land use will be changed for the construction of proposed project and will have a significant impact on the project area.

Mitigation Measures during Construction Phase

- Proper design of project should also minimize the impact on land;
- Land used for labor and worker accommodation should be revamp as per previous condition after the completion of construction period;
- Tree plantation program for 170,804 number of saplings should be initiated as compensation for the demolition of 85,402 number trees following **Appendix G:**;

7.3.5.2 Operation Phase

No impact is expected during operation phase of the project, so no mitigation measure is required.

7.3.6 Disruption of Agricultural Activities

7.3.6.1 Construction Phase

Sources of Impact

As per RAP report, most of the affected land is Null 322(79.47%) of total 405.196 Acres. So, the existing agricultural pattern of project area will be disrupted. Land owners as well as cultivators, wage earners, sharecroppers will be impacted due to the implementation of the project.

Mitigation Measures during Construction Phase

- Ensure adequate compensation for land owner as well as cultivator;
- Sharecropper should be compensated as per RAP;
- Consideration of alternative design to minimize the impact on the agricultural land

7.3.6.2 Operation Phase

No impact is expected during operation phase of the project, so no mitigation measure is required.

7.3.7 Water Use

7.3.7.1 Construction Phase

Sources of Impact

Huge amount of water will be required during construction phase for labour and accommodation and others purposes. Excessive withdrawal of ground water may lead to depletion of aquifers. Measures should be taken to minimize the water extraction by reducing water consumption and wastage.

Mitigation Measures during Construction Phase

- Rain water harvesting ponds should be constructed so as to store rain water for construction activities;
- Water for curing can be saved by carrying out curing in early morning or late evening and covering structures with gunny bag so as the moisture can be restored for longer time;
- Regular inspections at site to monitor leakages in water storage tanks;
- Creating awareness among construction workers about the importance of water conservation;
- Adoption of the advance technologies and machinery which helps in minimizing water requirement for construction;
- Storing the curing run-off and waste from other construction activity and using the same for sprinkling;
- Covering the water storage tanks at site to prevent evaporation losses.

7.3.7.2 Operation Phase

No impact is expected during operation phase of the project, so no mitigation measure is required.

7.3.8 Social Service Facilities

7.3.8.1 Construction Phase

Sources of Impact

During the construction period due to blockage and restriction on road people may have faces problem to access the existing facilities of social services.

Mitigation Measures during Construction Phase

- Restriction on access to social services should not be implied;
- Creation of awareness among the people about the alternative way of accessing social services;
- Find out better alternative option by consultation with relevant stakeholders

7.3.8.2 Operation Phase

Sources of Impact

People living in the project area will be benefited by the proposed project as the travel time will be reduced. And it will create a positive impact over the community people by getting the services.

7.3.9 Social Institutions and Local Decision-making Institutions

7.3.9.1 Construction Phase

Sources of Impact

According to RAP report, there are total 31 Community property resources (CPR) such as Mosque, Mazar, Graveyard, non-government school, Temple and Madrasah are affected in the project right of

way of Major bottleneck section. Some of the CPRs are fully affected and require relocation in new location while some are partially affected and not require relocation.

Apart from the CPRs, some 13 government and non-government offices/institutions are also affected. The Offices/institutions include Government school, health clinic, political party club, government office, passenger shed of a bus stop, etc also be impacted in major bottleneck section. Moreover, A total of 33 Community property resources (CPR) such as Mosques, Mazar, Graveyards, Schools, Monuments, and Ansar Camps are affected in the project right of way. Some of the CPRs are fully affected and require relocation to the new location, while some are partially affected and do not require relocation.

7.3.9.2 Construction Phase

- Proper compensation as per RAP,
- Alternative access facilities should be incorporated consultation with the communities;
- Proper signage and fencing during demolition of these institutions;
- Implement swift alternative means regarding displacement or demolition of religious institutions e.g., mosque, temple etc.

7.3.10 Local Conflict of Interest

7.3.10.1 Construction Phase

Sources of Impact

The gaps between those who shall be displaced and non-displaced are assumed. As employment opportunity will be increased in construction period, construction workers may have conflicts with the community. Based on previous similar scale of the projects, approx. 300 to 500 persons/day of the workers will engage during the construction. Throughout the whole construction period, approx. 2,000 persons are expected in total , including those who worked on construction projects for a short period of time to those who were employed for a long period of time.

Mitigation Measures during Construction Phase

- Job opportunities should be provided in fair way;
- Clear information about the needs of labor (number and qualification) should be provided with local people;
- The job skills and the priority for the affected people shall be taken into account and the workers can be chosen.

7.3.10.2 Operation Phase

Sources of Impact

Due to the implementation of proposed project community people will get the opportunity to access to these social institutions by reducing the travel time. It will create a positive vibe to the communities.

7.3.11 Cultural Heritage

7.3.11.1 Construction Phase

Sources of Impact

Nothing found in the development area would be affectedly the development. Therefore, no impact is expected on cultural heritage due to proposed project implementation.

7.3.11.2 Operation Phase

No impact is expected

7.3.12 Gender

7.3.12.1 Construction Phase

Sources of Impact

Despite cultural practices, no gender specific issues are observed and expected in the project area. The fact is that the participation of women in society is limited from a religious perspective, which has been observed during the first-round consultation meeting and second-round information disclosure meeting. However, during construction phase female labour will be engaged not only for catering services but also for various construction work. The wage discrimination between male and female workers shall be arises.

Mitigation Measure during Construction Phase

The wage discrimination between male and female workers should be minimized through proper monitoring system.

7.3.12.2 Operation Phase

No impact is expected.

7.3.13 Children's Rights

7.3.13.1 Construction Phase

There are some primary and high schools near the alignment of the major bottleneck areas. There is a possibility of disruption to PAHs and local community children's commuting to school during construction as a result of project implementation specially in Major Bottleneck areas. Also, there is a risk of child labor during construction period.

Mitigation Measure during Construction Phase

- Traffic signal man should be appointed at every potential crossing of school commuting children;
- Safety signage should be placed properly so that school commuting children can easily access the route;
- Child labor at the construction site during the project implementation shall be strictly prohibited since both Bangladesh laws and JICA guidelines ban such practices.

7.3.13.2 Operation Phase

No impact is expected.

7.3.14 Infectious Disease, such as HIV/AIDS

7.3.14.1 Construction Phase

Sources of Impact

The entire construction phase will require labour of unskilled, semi-skilled, skilled and highly skilled nature. However, it is envisaged that outsourced personnel will comprise mostly of skilled labours and workers. During Construction, in general, a lot of migrant workers flow into the sites, who may have the possibility with HIV/AID and the disease can spread among local people.

Mitigation Measure during Construction Phase

In order to minimize the impact, preventive measures against such diseases, which is stipulated in the Environment, Health, and Safety (EHS) Guidelines of the International Finance Corporation (IFC), should be considered and implemented by construction contractor.

- To provide surveillance for worker's health;
- Prevention of illness among workers by undertaking health awareness and education initiatives and by conducting immunization programs for workers;
- To provide treatment through standard case management in on-site and community health care facilities as necessary;
- Educating project personnel and area residents on risks, prevention, and available treatment;
- Promoting collaboration with local authorities to enhance access of worker's families and the community to public health services and promote immunization as necessary;
- Promoting use of repellents, clothing, netting, and other barriers to prevent insect bites;
- Prevention of larval and adult propagation through sanitary improvements and elimination of breeding habitats close to human settlements;
- Elimination of unusable impounded water;

7.3.14.2 Operation Phase

No impact is expected.

7.3.15 Occupational Health and Safety

7.3.15.1 Construction Phase

Sources of Impact

There would be a possibility to occur accidents and incident during construction works for the implementation of the Project. Physical trouble, Noise, vibration, lighting, electrical, heat and cold, nuisance dust, fire/explosion, machine grinding, working space, Chemical, Gases, dusts, fumes, vapors, liquids are the major hazards which are harmful for workers health. In order to prevent accidents and incidents, the project proponent regulates to install security and maintain safety prevention measures and devices suitable for using in each plot for construction in the internal regulation. Therefore, construction contractor based on the international guidelines should manage the working condition during the construction.

Mitigation Measure during Construction Phase

- Provide adequate health care facilities and first aid within construction sites;
- Provide OHS training program and information of basic site rules of work, basic hazard awareness, site specific hazards, safe work practices, and emergency procedure;
- Provide adequate lavatory facilities for the number of people expected to work in the facility;
- Provide adequate supplies and easy access of drinking water with a sanitary
- Provide temporary shelters to protect against heat stroke during working activities or for use as rest areas as needed;
- Arrange for provision of clean eating areas where workers are not exposed to the hazardous or noxious substances where there is potential for exposure to substances poisonous by ingestion of food as necessary;
- Promote the use of repellents, clothing, netting, and other barriers to prevent insect bites and snake bite;
- Adequate preventive measures from negative factors such as fire precautions, lighting, safe access, work environment temperature, area signage, labelling of equipment, communicate Hazard codes, electrical;
- Establish rights-of-way, site speed limits, vehicle inspection requirements, operating rules and procedures, and control of traffic patterns or direction;
- Identify and provide appropriate PPE that offers adequate protection to the worker, co-workers, and occasional visitors;
- Proper maintenance of PPE and the instruction of proper use;

7.3.15.2 Operation Phase

No impact is expected.

7.3.16 Working Conditions

7.3.16.1 Construction Phase

Sources of Impact

Working conditions are at the core of paid work and employment relationships. Working conditions cover a broad range of topics and issues, from working time (hours of work, rest periods, and work schedules) to remuneration, as well as the physical conditions and mental demands that exist in the workplace. Occupational safety and health (OSH), also commonly referred to as occupational health and safety (OHS), occupational health, or workplace health and safety (WHS), Community Health & Safety is a multidisciplinary field concerned with the safety, health, and welfare of people at work.

Mitigation Measure during Construction Phase

- Maintain general guidelines of worker accommodation;
- To provide and maintain general OHS guideline;
- Maintain safe housekeeping practices that reduce the risk of fire danger;
- Implement a program that includes preparation, prevention, and recognition of fire Risk;
- Proper handling of combustible and flammable material;
- Keep all fires and heaters well-guarded, especially open fires;
- Keep portable heaters and candles away from furniture and curtains;
- Proper handling of wastes

7.3.16.2 Operation Phase

No impact is expected.

7.4 Impacts on Other Sectors

7.4.1 Temporary Construction Yards with Workers' Accommodations

7.4.1.1 Before/During Construction Phase

The sites for the temporary construction yard, including the site office and accommodation facilities, are assumed to be leased land (approximately 2 ha in area) such as cultivated land adjacent to the planned road construction site (the major bottleneck section included in each construction package). The locations of the proposed temporary construction yard are shown in **Figure 7-7** to **Figure 7-11**. The access roads are planned to be constructed within the planned road construction area, and the soil extraction area is planned to be purchased from a soil extraction site that has already obtained a permit. Since this project is mainly embankment construction, a dedicated soil dumping site is not required, but waste materials such as waste from existing structures are planned to be disposed of at designated waste disposal sites.

Source: Prepared by JICA Study Team, 2022

Figure 7-7: Location of Temporary Construction Yard (Patiya)

Source: Prepared by JICA Study Team, 2022

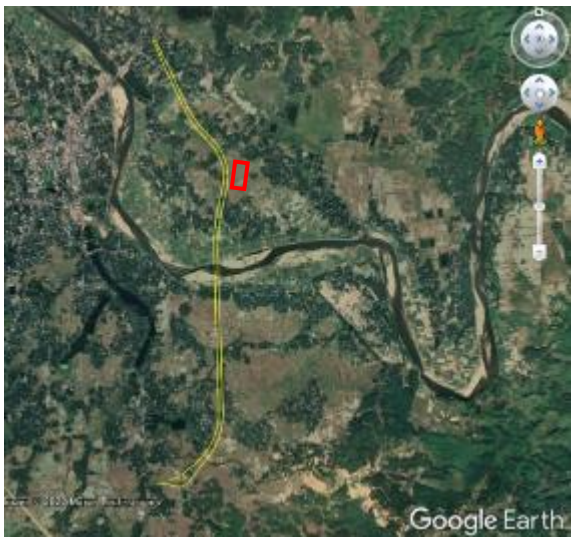
Figure 7-8: Location of Temporary Construction Yard (Dohazari)

Source: Prepared by JICA Study Team, 2022

Figure 7-9: Location of Temporary Construction Yard (Keranihat)

Source: Prepared by JICA Study Team, 2022

Figure 7-10: Location of Temporary Construction Yard (Lohagara)



Source: Prepared by JICA Study Team, 2022

Figure 7-11: Location of Temporary Construction Yard (Chakaria)

Mitigation Measure during Construction Phase

- Proper compensation should be provided as per ARIPA 2017 for the leased land.
- Agricultural land should be avoided if possible.
- Waste generated from the temporary yard and workers' accommodation should be collected using separate waste bin.
- All types of solid waste should be disposed in the dedicated dumping zone of the nearby municipality.
- Wastewater from batching plant and other sources should be discharged through settling pond and sediment fence.

7.4.1.2 During Operation Phase

No impact is anticipated since the leased land will be returned to the landowner upon restoration to its original condition and will not be used for business purposes in the operation phase.

Mitigation Measure during Operation Phase

- No additional mitigations measures are required.

7.4.2 Global Warming/Climate Change

7.4.2.1 Construction Phase

Sources of Impact

Climate change may refer to a change in average weather conditions, or in the time variation of weather within the context of longer-term average conditions. Climate change is caused by factors such as biotic processes, variations in solar radiation received by Earth, plate tectonics, and volcanic eruptions. Certain human activities have been identified as primary causes of ongoing climate change, often referred to as global warming.

GHG will be released from vehicles and machineries during construction phase. But the impact is not so significant considering the overall traffic numbers in the city area. Regular maintenance of heavy vehicles, implementation of the mitigation measures under the Air pollution part will reduce the GHG emission as much as possible during the construction phase.

Mitigation Measure during Construction Phase

- Control of GHGs emission in the construction period;

7.4.2.2 Operation Phase

Due to increase in vehicular traffic during operation phase, CO_2 emission will be increased in many of the areas throughout the alignment. The GHG emission has been calculated considering the number of different types of vehicles on the horizon year, average trip distance and CO_2 emission factor of different vehicles. CO_2 emission factors and other considerations taken from the Traffic Demand Estimate (TDE) report and published sources from the web, including Department for Environment, Food and Rural Affairs (DEFRA), Government of United Kingdom and United States Environmental Protection Agency (US EPA). Other simplifying assumptions were used in the analysis are as follows:

- Methane and Nitrous Oxide are not counted in the calculations
- Leakage is ignored (reduced load factor of buses, minis and cars in baseline emissions)
- Rebound effect is ignored (reduced congestion on bottleneck areas, provoking higher average vehicle speed)
- Indirect project emissions are not counted due to lack of survey data

Table 7-15 summarizes results of GHG emission considering both with and without project scenario in 2040. Details of the calculation is given in **Appendix F**.

Table 7-15: GHG Emission Calculation

Year	CO_2 Emission (ton/year)									
	Patiya		Dohazari		Keranihat		Lohagara		Chakaria	
	With Project	Without Project	With Project	Without Project	With Project	Without Project	With Project	Without Project	With Project	Without Project
2040	61748	61748	38094	41280	38368	36709	49654	45908	58364	50495

7.4.3 Accidents

7.4.3.1 Construction Phase

Construction accidents and road accidents around the project site are expected due to the construction activities. Construction workers can have harmful and critical troubles.

During construction period, contractor will appoint many workers for civil work and there are some possibilities to occur accidents. Moreover, due to movement of heavy vehicles, drum truck and other heavy construction equipment will enhance the accident rate of proposed project area. Improper traffic management and safety issue can increase this problem significant.

Mitigation Measure during Construction Phase

- Follow Health and Safety Management Plan (HSMP) rules and regulations designated by contractors;
- Provision of traffic sings, road mark, bump, zebra mark, guard rail and pole, and curb stones etc;
- Recommendation to use late night period for the mobility of heavy construction vehicles and equipment's.

7.4.3.2 Operation Phase

No impact is expected

7.4.4 Enhancement of Local Economy

7.4.4.1 Construction Phase

Sources of Impact

During construction period people from various part of the country as well as global will be employed for long days. During this time all kinds of commodities relevant with the livelihoods of workers and engineers will be supplied from local community. As a result, local business opportunity and enhancement of economy will create a positive impact for the community.

Mitigation Measure during Construction Phase

As the impact is considered as positive so no mitigation measure is required.

7.4.4.2 Operation Phase

Sources of Impact

The proposed project will have significant beneficial impact over the community by creating new business opportunity. Business opportunity will be boosted up through the implementation of this project by reducing the travel time of commodity. Proposed project will also reduce the distance between the Chattogram and Coxbazar so people can easily transport their goods in a short moment. Moreover, the tourism sector will be enhanced by implementation of this project.

7.5 Summary of the Identified Impacts

Summary of the identified impacts are shown in the following Table 7-16.

Table 7-16: Summary of the Identified Impacts

No.	Area of Impact	Evaluation in Scoping		Evaluation based on EIA		Identified Impacts
		C[1)]	O[1)]	C[1)]	O[1)]	
A. Physical Environment						
1	Air Pollution	**B-**		**B-**		**Pre-Construction/Construction Phase** (1) Earth works, including soil excavation, soil levelling and rolling, soil compaction, sand dumping and levelling can release dust particles (coarse particulate matter) into air; (2) Vehicle hauling for transportation of construction materials generate dust particle due to friction between loose soil/unpaved surface and vehicle wheels; (3) The stockpiles of construction and spoil materials like soil, sand, stones, aggregate, etc. can also pollute ambient air by releasing particulate matter; (4) Different types of machineries like excavator, dozer, pile driver, crane, roller, vibro hammer, diesel generator, welding machine, boom truck, etc. and transportation vehicles like truck, dump truck, pickup, car, lorry, ship, etc. will emit different kinds of gaseous pollutants, such as CO, SO_2, NO_2, Lead, Hydrocarbons as well as fine particulate matter, such as $PM_{2.5}$ and PM_{10}. (5) Gaseous substances, particulate matter, and fly ash will also be emitted from batching plant and asphalt mixing plant; (6) Demolition of buildings and other dismantling and demolition of bridges, culverts, existing roadways will also generate air pollutants; (7) Household combustion (fire wood, gas, petroleum, etc.) in labor accommodation and service area may generate air pollutants, including both particulate matter and gaseous pollutants; (8) Burning of solid waste, especially in labor accommodation and service area may also pollute the ambient air; (9) Earth works, especially removing topsoil of agricultural land may release methane into air.
			B-		**B-**	**Operation Phase** There will be increment in the volume of vehicle movement as per the forecasting. This will increase the vehicular emission. The increased number of vehicles may also generate dust during dry weather. On the other hand, traffic congestion and slow-moving vehicle will be decreased that may reduce the vehicular emission also. In addition, the general use of newer and better maintained vehicles will have the effect of reducing overall emission.
2	Surface Water	**B-**		**B-**		**Construction Phase** (1) Surface runoff may discharge turbid water from construction site with soil and sand particles that may generate from loose soil; this will increase the suspended sediment load and turbidity of the rivers and canals posing a potential threat to aquatic organisms downstream; increased turbidity in water reduces

No.	Area of Impact	Evaluation in Scoping		Evaluation based on EIA		Identified Impacts
		C[1)]	O[1)]	C[1)]	O[1)]	
						light penetration, thereby interfering with the photosynthetic process. (2) Disposal of solid waste into river and the discharge of wastewater from kitchen of nearby workers accommodation may increase the organic matter in the water that leads to lower concentration of DO and higher BOD; (3) Discharge of effluents from offices and workers accommodation; (4) Spilling and washing out of oil and grease and other liquids used in the use of machineries and vehicles; (5) The piling works for bridge construction may disturbed bottom sediment layer of the rivers that will increase suspended particles in water; this can also increase the values of BOD and COD by removing un-oxidized sediment layer of river bed; (6) The excavation during bridge construction may release sediments due to spilling and erosion; erosion can also be occurred from soil stockpile during rainfall.
			D		**B-**	**Operation Phase** (1) Soil erosion from slope of the road if remained uncovered that will end up in water body; (2) There might be an indirect impact by spilling and washing out of oil and grease from repairing and maintenance facilities of vehicles (3) The broken road surface may cause erosion of bitumen and other construction materials that may wash out into water bodies.
3	Ground Water	**B-**		**B-**		**Construction Phase** (1) There is a rare chance of penetration of toxic chemicals such as fuel, lubricants, thinner, and solvents into aquifer through infiltration. (2) Leachate generated at the solid waste disposal site may contaminate the ground water system.
			D		**B-**	**Operation Phase** Leaching from waste disposal site, if not reclaimed.
4	Topography and Soil Erosion	**B-**		**B-**		**Construction Phase** **A. Topography:** (1) The setting and appearance of landscape will be changed as many trees need to be felled and many settlements need to be demolished. (2) Land use in the alignment will be changed by converting agricultural land, fisheries, homestead vegetation and settlement into wide paved and impervious road surface; (3) The elevation in the alignment will be increased as the road will be higher than existing ground level. However, this change will not bring any big change in the distribution of altitude in concerned regions. Moreover, this change will also not change the slope and aspect of the region. (4) The landscape in and around the alignment will be disfigured through excavation of spoil materials for

No.	Area of Impact	Evaluation in Scoping		Evaluation based on EIA		Identified Impacts
		C[1)]	O[1)]	C[1)]	O[1)]	
						the road construction. **B. Soil:** (1) Spilling of oil and lubricants from poorly maintained machines and vehicles can contaminate soil; (2) If bentonite is used as a drilling fluid to stabilize the boreholes/piles, the improper disposal of bentonite slurry may pollute the soil quality; (3) Improperly managed sewage and solid wastes generated from the project activities can pollute soil.
			D		**B-**	**Operation Phase** There is no major chances of soil pollution during construction phase. However, improper disposal of hazardous wastes, i.e. oil, lubricant and solid waste can contaminate soil.
5	Solid Waste	**B-**		**B-**		**Construction Phase** (1) Construction sites, offices, and residential quarters will produce different types of inorganic waste like paper, plastic, polythene, can, etc.; (2) Kitchen of workers accommodation, canteen, eating and resting place in work sites will generate organic solid waste like food waste, paper, etc.; (3) Toilets installed in the project areas, including stationary and mobile toilet will produce sewage sludge; (4) Improper management of these waste (Serial I-III above) will cause environmental pollution, including water and soil pollution, bad odor as well as public health problems; (5) Earth works and piling (including pile cap breaking) will generate spoil soil; (6) Several types of scrap waste like rebar, steel plate, formworks, electric cable, etc. will be generated mostly from flyover, bridge, and culvert construction; (7) Organic waste could be released through drainage discharge from kitchen and canteen of workers accommodation, construction yards, and offices;
			D		**B-**	**Operation Phase** (1) Solid waste like food waste, plastic, glass, paper can be produced from the operating and maintaining facilities of the project.
6	Hazardous Waste	**B-**		**B-**		**Construction Phase** (1) Burned oil, especially lubricant (Mobil) will be produced from machineries and vehicles; (2) There will be a huge number of empty containers of adhesive chemicals and epoxy; (3) A little amount of medical waste, including sharp materials will be generated from medical center of the project; (4) Oil and lubricant mixed water will be released from construction yard; (5) There will be a big number of expired or used lithium-ion battery likely to be generated in the project; (6) Leakage and spillage of oil and lubricant from machines and vehicles;

No.	Area of Impact	Evaluation in Scoping		Evaluation based on EIA		Identified Impacts
		C[1)]	O[1)]	C[1)]	O[1)]	
						(7) Bentonite slurry from piling work, chemical mixed slurry from concrete mixing plant or batching plant, etc.; (8) There will be sharp metal and non-metal materials in scrap waste.
			D		**B-**	**Operation Phase** (1) There is a very little chance of waste generation during operation period of the project. Oil and grease can be leaked and spilled from vehicles.
7	Noise	**B-**		**B-**		**Before/During Construction Phase** (1) Noise will be produced during pile driving or bore poling for bridge and flyover construction. The crawler crane-mounted rotary boring unit or a purpose-built hydraulic drilling machine will generate higher noise; (2) The operation of different types of construction machines and vehicles like excavator, roller, diesel generator, lifting crane, bulldozer, boom truck, vibro hammer, truck, dump truck, lorry, car, etc. will produce noise with moderate magnitude; (3) Higher noise will be produced during rebar cutting and binding in construction yards as well as during welding; (4) Higher noise will also be produced during pile cap breaking using hammer, jackhammer, concrete chipper, steel rod cutting saw, etc. (5) This project may require some demolition works, especially where the alignment goes through residential and commercial areas. Hence, moderate to higher noise will be generated during demolition operation; (6) The batching plant and asphalt mixing plant will also generate noise; (7) The transportation of different types of construction and waste materials, formwork setting and dismantling, rebar grid framework installing, scaffolding setting and dismantling, concreting will produce noise with lower to moderate magnitude.
			B-		**B-**	**Operation Phase** (1) The main source of noise during operation phase would be the vehicles using the roads and flyover and the maintenance and repairing works. To predict the noise generation from vehicles during operation period, a noise modelling is performed based on the existing noise level, traffic volume, and forecasted traffic volume.
8	Vibration	**B-**		**B-**		**During Construction Phase** (1) Vibration will be generated during pile driving or bore piling, especially during construction of bridges and flyover; (2) The construction activities using heavy machineries during soil compacting and rolling, lifting crane,

No.	Area of Impact	Evaluation in Scoping		Evaluation based on EIA		Identified Impacts
		C[1)]	O[1)]	C[1)]	O[1)]	
						etc. will generate moderate to high vibration; (3) Substantial extent of vibration will be produced during sheet pile driving and dismantling using vibro hammer; (4) Ground vibration may be generated during the operation of heavy vehicles, i.e., lorry carrying viaduct segment, I-girder, and other heavyweight materials with moderate extent.
			B-		**D**	**Operation Phase** Vibration level will increase in future road area due to the increased traffic. However, the vibration levels are likely to be within the acceptable levels.
9	Ground Subsidence	**C**		**B-**		**Before/During Construction Phase** (1) There would be a nominal chance of landslide during and after the excavation of pile foundation and borrow pit. (2) Landslide in pile foundation and borrow pit may occur and cause minor injury or fatal accident.
			D		**B-**	**Operation Phase** (1) Subsidence or landslide may occur due to earthquake, slope failure and erosion, loosening of soil and slope due to infiltration and percolation of water during heavy rainfall, etc. (2) This also can occur due to construction faults (improper compaction of soil and sand), use of low-quality materials; excessive withdrawal of groundwater from aquifer underneath; operation of overweight vehicles, etc.
10	Offensive Odors	**D**		**B-**		**Construction Phase** Land preparation and clearing work, sewage from mobile and stationary toilets, solid waste, slurry, etc. can generate bad odor.
			D		**D**	**Operation Phase** Any impact related to offensive odors is not expected during operation phase of the project.
11	Bottom Sediments	**B-**		**B-**		**Construction Phase** (1) Earth works will generate sediments that may discharged into water body by surface runoff and wind erosion and transportation. (2) Moreover, oil and grease can also be reached nearby water body. These sediments generated from the construction site may deteriorate the bottom sediments of nearby rivers and other streams. (3) This will also be a threat for aquatic organisms.
			D		**B-**	**Operation Phase** The sediments still can be generated from slope erosion of the roads, if remained unpaved or uncovered with grass. In case of flyover, the impact is not expected.

No.	Area of Impact	Evaluation in Scoping		Evaluation based on EIA		Identified Impacts
		C[1)]	O[1)]	C[1)]	O[1)]	
12	Flood and Drainage	B-		B-		**Before/During Construction Phase** (1) Road embankment may create water logging by blocking surface drainage. It can also interrupt irrigation and natural water courses. (2) Flooding or Drainage congestion and water logging will occur in the Project Area during severe rainfalls in the monsoon reason. (3) The major earthworks may interrupt the existing surface and ground water system. (4) These temporary construction infrastructures could potentially disrupt the natural cross drainage and might be the cause of flooding. (5) The excavation of fill materials for construction of road embankment will result in an increased extent of open water during monsoon.
			B-		B-	**Operation Phase** (1) Any major impacts related to flooding and drainage are not expected during operation phase provided that the mitigation measures are perfectly implemented during pre-construction and construction period. (2) However, some minor impacts related to inundation or drainage congestion may occur for short period, if any design error occurred.
13	Source of Materials, Haul Routes, and Disposal Sites	B-		B-		**Construction Phase** (1) Haul route, and disposal sites will not cause land use change and loss of agricultural land; (2) The waste disposal site may cause land degradation and contamination; (3) Danger to other roads users, in particular pedestrians and non-motorized and farm vehicles.
			D		B-	**Operation Phase** The waste disposal sites can spread contamination through leaching and surface runoff.
B. Ecological Resources						
14	Protected Area	B-		D		**Construction Phase** Workers' movement, improper waste disposal, and lack of training and proper awareness of workers may pose potential threat for PAs i. e. Fashiakhali Wildlife Sanctuary.
			C		B-	**Operation Phase** Minor impacts from speedy driving and improper use of horns may impact on the wildlife of the PAs i. e. Fashiakhali Wildlife Sanctuary.
15		B-		B-		**Before/During Construction Phase**

No.	Area of Impact	Evaluation in Scoping		Evaluation based on EIA		Identified Impacts
		C[1)]	O[1)]	C[1)]	O[1)]	
	Biota and Ecosystem	**B-**		**B-**		(1) Removal of vegetation and/ or loss of trees will impact floral diversity and its ecosystem and may affect wildlife, particularly birds and mammals that rely on trees for their habitat and food source. (2) Loss of vegetation cover may increase soil erosion from rain and wind. (3) Excavation of borrow pits might add physical destruction of terrestrial flora and/ or injury of fauna. (4) Dust produced from vehicle movement and construction related activity may impact on the physiochemical process of plants i.e. photosynthesis, respiration, etc. (5) Pollution of surface water caused by constriction of culverts and bridges, spillage of chemicals, run off the wastewater, disposal of solid and liquid waste into the water body may impact aquatic vegetation (6) Hunting of wildlife and birds during construction
			C		**B-**	**Operation Phase** (1) The survival rate and growth of newly planted saplings may be impacted. (2) Killing of animals in road accidents
16	Fisheries and Aquatic Biology	**B-**		**B-**		**Construction Phase** (1) Construction activities at bridges/ culverts may affect fish health and fish migration. (2) Commercial fishing may be impacted (3) Bottom sediments generated from construction sites are potential threat to aquatic organisms. (4) Oil and grease produced from construction sites may deteriorate the aquatic ecosystem of nearby rivers and other waterbodies. (5) Dredging and piling activities during Sangu River Bridge Construction might impact on the migration and behavioral changes of Ganges River Dolphin in the Sangu River.
			D		**B-**	**Operation Phase** (1) Bridge/ culvert construction may affect fish migration. (2) Construction of road and bridge may impact on fish production
D. Social Environment						
19	Involuntary Resettlement	**A-**		**A-**		**Before/During Construction Phase** (1) A total of 405.1965 acres private land will need to be acquired for five major bottleneck sections. (2) 2500 PAUs including residential HHs and shops, plain land owners have been affected by the project interventions. (3) 31 community properties and 13 offices/institutions are also affected among which 20 CPRs and 10 offices will be relocated elsewhere. Apart from the HHs and shops, 573 tenants, 641 wage laborers and 206 vendors are also affected within the proposed ROW. (4) 17.50 decimal land will be acquired for the Minor Bottleneck sections, out of which 9.50 decimal in Chittagong and 8 decimals in Cox's Bazar district

No.	Area of Impact	Evaluation in Scoping		Evaluation based on EIA		Identified Impacts
		C[1)]	O[1)]	C[1)]	O[1)]	
						(5) Major impacts on project-affected units (PAUs) were identified at Chattogram district (520 PAUs), followed by Cox's Bazar district (224 PAUs) and Bandarban district (7 PAUs).
			D		D	**During Operation** No impact is expected
20	Poor	C	D	B-	B-	47.4% of the population of the affected area lives below poverty line
21	Loss of Livelihood	B-/B+	C	B-	D	(1) In the five major bottleneck sections, a total of 712 business entity comprising of 59.13% of total business have been found small, 22.47% is medium and 18.40% business is large will be directly impacted. (2) In the minor bottleneck sections, a total of 1012 business entity comprising 67.19% of businesses have been found small, 18.08% are medium, and 14.72% are large will be directly impacted. (3) A total of 641 wage laborers will be impacted in major bottleneck section (4) A total of 727 wage laborers will be impacted in minor bottleneck section (5) Significant numbers of vendors will be impacted in both major and minor bottleneck sections (6) Commercial fishing activities might be impacted. (7) Change in the livelihood of some marginal local fishermen residing near Sangu River Bridge area may occur if they are unable to access to nearby river. **During Operation** No impact is expected
22	Disruption of Agricultural Activities	**B-**	**C**	**B-**	**D**	**Before/During Construction Phase** (1) Most of the affected land is Null 322(79.47%) of total 405.196 Acres. So, the existing agricultural pattern of project area will be disrupted.
23	Land Use and Utilization of Local Resources	**B-**	**C**	**B-**	**D**	(1) a total of 405.1965 acres (164.047 ha) of private land at five major bottlenecks sections will need to be acquired out of which 147 acres (36.30%) at Chakaria followed by Lohagara 116.43 acre (28.77%), Patiya 78.45 acre (19.37%), Dohazari 65.50 acres (16.17%) and Keranirhat 1.20 acres (0.30%). Most of the affected land is Null 322(79.47%) followed by homestead 45.79 Acre (11.30%), Pond 15.43 Acres (3.81%) and Vita (high land) 13.09 Acre (3.23%). (2) A total of 85,402 trees of various sizes; Large 13,691, Medium 20,611, Small 34,727 and plant (sapling) 16,373 are affected. Out of the total 30,785 trees in Lohagara, 10,639 trees in Dohazari and 2,741 trees in Keranihat, 18,353 trees in Patiya and 22,884 trees in Chakaria

No.	Area of Impact	Evaluation in Scoping		Evaluation based on EIA		Identified Impacts
		C[1)]	O[1)]	C[1)]	O[1)]	
24	Social Institutions and Local Decision-making Institutions	**B-**	**C**	**B-**	**D**	(1) Total 31 Community property resources (CPR) such as Mosque, Mazar, Graveyard, non-government school, Temple and Madrasah are affected in the project right of way of Major bottleneck section. Some of the CPRs are fully affected and require relocation in new location while some are partially affected and not require relocation. (2) Apart from the CPRs, some 13 government and non-government offices/institutions are also affected. The Offices/institutions include Government school, health clinic, political party club, government office, passenger shed of a bus stop, etc also be impacted in major bottleneck section. Moreover, A total of 33 Community property resources (CPR) such as Mosques, Mazar, Graveyards, Schools, Monuments, and Ansar Camps are affected in the project right of way. Some of the CPRs are fully affected and require relocation to the new location, while some are partially affected and do not require relocation.
25	Local Conflict of Interest	**B-**	**C**	**B-**	**D**	**During Construction** Conflict between migrant labor and local community **During Operation** No impact is expected
26	Gender	**B-**	**C**	**B-**	**D**	**During Construction** Wage discrimination between male and female worker **During Operation** No impact is expected
27	Children Rights	**B-**	**C**	**B-**	**D**	**During Construction** (1) May impact on educational opportunity of school going children in PAHs of the Project (2) Disruption of children's commuting to school (3) Impact of the project on increase of child labor **During Operation** No impact is expected
28	Infectious Disease, such as HIV/AIDS	**B-**	**C**	**B-**	**D**	**During Construction** Spreading of infectious disease **During Operation** No impact is expected
29	Working Conditions	**B-**	**C**	**B-**	**D**	**During Construction** (1) There would be a possibility to occur accidents and incident during construction works; (2) Physical trouble, noise, vibration, lighting, electrical, heat and cold, nuisance dust, fire/explosion,

No.	Area of Impact	Evaluation in Scoping		Evaluation based on EIA		Identified Impacts
		C[1)]	O[1)]	C[1)]	O[1)]	
	including Occupational Health & Safety					machine grinding, working space, Chemical, Gases, dusts, fumes, vapors, liquids are the major hazards which are harmful for workers health; (3) May insect and snake bite in the labour camp; (4) Road Accident **During Operation** No impact is expected
30	Water Use	**B-**	**C**	**B-**	**D**	**During Construction** (1) Use of ground water for construction purpose (2) Use of water at labour and employer accommodation (3) Excessive withdrawal of ground water may lead to depletion of aquifers. **During Operation** No impact is expected
E. Others						
31	Temporary construction Yard and Workers' accommodation	**-**	**-**	**B-**	**D**	**During Construction** Land requisition for temporary construction yard and workers' accommodation. **During Operation** No impact is anticipated.
32	Accidents	**-**	**-**	**B-**	**D**	**During Construction** Due to movement of heavy construction vehicle accident would be increased. **During Operation** As bottlenecks point and accident occurs zone will have straightened, the accident rate on the highway will be minimized

Note: A+/-: Significant positive/negative impact is expected.
B+/-: Positive/negative impact is expected to some extent.
C: Extent of impact is unknown. (A further examination is needed, and the impact could be clarified as the study progresses)
D: No impact is expected.
N/A: Impact assessment is not conducted because the item was categorized into D in scoping phase.

CHAPTER 8

Environmental and Social Management and Monitoring Plan

8 ENVIRONMENTAL AND SOCIAL MANAGEMENT AND MONITORING PLAN

8.1 Introduction

The main purpose of the Environmental Management Plan (EMP) is to identify project-specific actions that will be undertaken by the project authority for mitigation of the specific impacts identified in the proposed project. These actions will be incorporated into the project management system and integrated into the implementation at various stages of project development. The EMP describes both generic good practice measures and site-specific measures, the implementation of which is aimed at mitigating the potential impact associated with the project activity.

The EMP provides details of the environmental and social impacts, environmental and social mitigation measures, environment monitoring parameters and frequency, and environmental supervision responsibilities. The project implementation authority will ensure that the EMP is made part of the contract documents. The Contractor will be responsible for preparing a specific Environmental Management Plan (Contractor's Environmental Management Plan - CEMP) based on this EMP, prior to the commencement of construction activities. The supervising consultant will be responsible for reviewing and approving the CEMP as well as ensuring that contractors comply with its mandates. Public complaints regarding adverse environmental impacts arising from inadequate implementation of the EMP will be captured and settled by Grievance Redress Mechanism. Contract documents shall explicitly indicate the requirement of these plans and also state that all environmental protection measures should be included in the bid price.

While the contractor will include an Environmental Management Officer in the contractor's staff responsible for implementing the EMP the supervising engineer's staff will also include an Environmental Supervision Specialist for monitoring the implementation of the EMP and managing other unforeseen environmental impacts.

8.2 Objectives of the Environmental Management Plan

The main objective of the EMP is to warrant that the development in an identified particular study area needs to be entangled with judicious utilization of non-renewable resources and to ensure that the stress/load on the ecosystem is within its permissible assimilative capacity i.e., its' carrying capacity. In the above context assimilative capacity refers to the maximum amount of pollution load that can be discharged into the environment without affecting the designated use of various environmental attributes and is governed by dilution, dispersion, and removal due to physicochemical and biological processes. An effective EMP ensures that these environmental requirements and objectives are satisfied during all phases of the project. The long-term objectives of the EMP for all the environmental and social attributes are as under:

- To comply with all the regulations/applicable laws stipulated by the DOE;
- To create good working conditions for employees;
- To encourage and achieve the highest performance and response from individual employees and contractors;
- To plan out the complete strategy to take care of stakeholder engagement;
- Budgeting and allocation of funds for environmental management;
- Continuous development and search for innovative technologies for a cleaner and better future environment; and
- To contribute significantly to sustainable development.

8.3 Management and Monitoring Plan

An Environmental and Social Management and Monitoring Program is formulated incorporated the impacts, mitigation measures, implementing and responsible authority, monitoring parameters and frequency, and expenditure. Table 8-1 shows the EMP, which includes the plan for physical environment, ecological resources, and social environment during pre-construction, construction, and operation period. This plan provides a clear framework for implementing the mitigation measures, following which the contractor should prepare its CEMP.

Table 8-1: Environmental and Social Management and Monitoring plan

No.	Area of Impact	Identified Impacts	Mitigation Measures	Monitoring Parameters
A. Physical Environment				
1	Air Pollution	**Pre-Construction/Construction Phase** (1) Earth works, including soil excavation, soil levelling and rolling, soil compaction, sand dumping and levelling can release dust particles (coarse particulate matter) into air; (2) Vehicle hauling for transportation of construction materials generate dust particle due to friction between loose soil/unpaved surface and vehicle wheels; (3) The stockpiles of construction and spoil materials like soil, sand, stones, aggregate, etc. can also pollute ambient air by releasing particulate matter; (4) Different types of machineries like excavator, dozer, pile driver, crane, roller, vibro hammer, diesel generator, welding machine, boom truck, etc. and transportation vehicles like truck, dump truck, pickup, car, lorry, ship, etc. will emit different kinds of gaseous pollutants, such as CO, SO_2, NO_2, Lead, Hydrocarbons as well as fine particulate matter, such as $PM_{2.5}$ and PM_{10}. (5) Gaseous substances, particulate matter, and fly ash will also be emitted from batching plant and asphalt mixing plant; (6) Demolition of buildings and other dismantling and demolition of bridges, culverts, existing roadways will also generate air pollutants; (7) Household combustion (fire wood, gas, petroleum, etc.) in labor accommodation and service area may generate air pollutants, including both particulate matter and gaseous	(1) There should be an Air Quality Management Plan in the Contractor's Environment Management Plan (CEMP), which will be prepared by contractor and submitted to the Consultant and Employer prior to commencement of civil works; (2) A dust suppression program should be established and maintained by contractor throughout the construction period. This program will include: water spray on road and construction site from movable water truck with sprinklers as well as stationary sprinklers or hose pipe; water down of material stockpiles; covering of material stockpile using tarpaulin; covering of hauling vehicles using tarpaulin during transportation of spoiled soil, sand, cement, aggregate, brick, and other loose materials that may generate particulate matter due to wind friction and dropping of loose soil and sand; regular sweeping of construction site, office premise, and construction yard; etc.; (3) A soil dumping plan shall be prepared by contractor to dispose spoil soil, which may include location of disposal site, hauling route, pickup and dumping schedule, etc. Spoil soil should not remain onsite for more than 12 hours after generation/excavation. They should be covered before removal. (4) The hauling vehicles transporting construction materials should strictly follow selected route causing less dust pollution to adjacent exposures. The hauling roads should avoid sensitive land use (residential, market, religious,	**Monitoring Parameters** PM_{10}, $PM_{2.5}$, SO_2, NO_2, CO **Monitoring Frequency** Quarterly, but can be changed as per consultant's requirement **Monitoring Location** Hot mix plant, concrete mixing plant/stone crushers at construction sites and sensitive locations near the site **Implementing Organization** Contractor **Supervision Organization** Consultant and RHD **Budget** Contractor's scope

No.	Area of Impact	Identified Impacts	Mitigation Measures	Monitoring Parameters
		pollutants; (8) Burning of solid waste, especially in labor accommodation and service area may also pollute the ambient air; (9) Earth works, especially removing topsoil of agricultural land may release methane into air.	etc.) completely or use only watered hard surfaced road; (5) Use of temporary walls and enclosures near sensitive land uses like residential and commercial areas, mosque, temple, etc.; (6) Cover stockpiles during dry and windy weather and cover vehicles/ trucks carrying construction materials when passing through market areas and urban and residential areas; (7) All machineries and vehicles should be inspected by independent inspection body for checking and certifying the competence of exhaust filter and other compliance standards (HEPA Standards) before starting operation for first time in the project and in every six months onwards; The inspection certificate should be submitted to the consultant; (8) The construction machineries and vehicles should be maintained properly on regular basis and use air pollution prevention measure, e.g., diesel particulate filter; the machineries and vehicles should bear inspection and maintenance sticker.	
		Operation Phase There will be increment in the volume of vehicle movement as per the forecasting. This will increase the vehicular emission. The increased number of vehicles may also generate dust during dry weather. On the other hand, traffic congestion and slow-moving vehicle will be decreased that may reduce the vehicular emission also. In addition, the general use of newer and better maintained vehicles will have the effect of reducing overall emission.	(1) The road/flyover should be a good quality paved surface during operational period through proper and effective cleaning, maintenance, and repair; (2) Tree plantation and landscaping along the alignments. (3) All existing vehicle emissions standards and controls to limit harmful emissions should be enforced. All vehicles should be maintained in accordance with vehicle emission regulations of the Government of Bangladesh. (Note: Implementation of this measure is not the responsibility of project owner but DOE and	**Monitoring Parameters** PM_{10}, $PM_{2.5}$, SO_2, NO_2, CO **Monitoring Frequency** 1 site/year for 3 years **Monitoring Locations** One sample for each major road **Implementing Organization** RHD **Supervision Organization** RHD, DOE **Budget**

No.	Area of Impact	Identified Impacts	Mitigation Measures	Monitoring Parameters
			BRTA).	RHD's scope
2	Surface Water	**Construction Phase** (1) Surface runoff may discharge turbid water from construction site with soil and sand particles that may generate from loose soil; this will increase the suspended sediment load and turbidity of the rivers and canals posing a potential threat to aquatic organisms downstream; increased turbidity in water reduces light penetration, thereby interfering with the photosynthetic process. (2) Disposal of solid waste into river and the discharge of wastewater from kitchen of nearby workers accommodation may increase the organic matter in the water that leads to lower concentration of DO and higher BOD; (3) Discharge of effluents from offices and workers accommodation; (4) Spilling and washing out of oil and grease and other liquids used in the use of machineries and vehicles; (5) The piling works for bridge construction may disturbed bottom sediment layer of the rivers that will increase suspended particles in water; this can also increase the values of BOD and COD by removing un-oxidized sediment layer of river bed; (6) The excavation during bridge construction may release sediments due to spilling and erosion; erosion can also be occurred from soil stockpile during rainfall.	(1) A sediment fence should be erected on the bank of concerned rivers, canals, and ponds to prevent sedimentation in the water; (2) During road construction, loose soil and sand should be compacted properly to prevent erosion; (3) Drip pan should be placed under generators and other machineries to collect leaked oil. Spilled oil should be absorbed by sponge absorber during/after maintenance works of machineries and vehicles; (4) Direct disposal and discharge of solid waste and effluent, originated from project works, into river or other water bodies should be strictly prohibited. Instead, solid waste should be disposed in designated disposal sites of nearby municipality. If no municipal waste dumping site is located nearby, the organic solid waste should be landfilled and recyclable solid waste should be sold to recycling companies; for effluent, sanitary pit toilet should be used and they will be emptied after proper disinfection. (5) Slurry mixed wastewater from batching plant should be stored in a settling tank. Then, the accumulated slurry at bottom of the tank will be scrapped and dried up for using in temporary road repairing and ground support works. On the other hand, the water should be reused instead of releasing in environment. (6) In construction yard, waste water should be settled to allow sedimentation (using check dam) at the bottom of the drains. Then, the water could be discharged through sediment screen or filter. And the bottom sediment layer in the drains will	**Monitoring Parameters** pH, Temp., DO, BOD, COD, TSS, Color, TC, Turbidity, As, Oil & Grease **Monitoring Frequency** Quarterly or as per requirement of consultant **Location** River and Major water body **Implementing Organization** Contractor **Supervision Organization** Consultant, RHD **Budget** Contractor's scope

No.	Area of Impact	Identified Impacts	Mitigation Measures	Monitoring Parameters
			be scrapped manually and dried up for reuse. (7) There should be and oil water separator installed in the outflow from mechanical works of construction yard to prevent the releasing of oil and grease into surface water. The collected oil and lubricant will be stored securely for selling them to refinery. (8) Cement solidifiers or other materials for ground improvement will not be used. In the case of using locally generated soil (clay with high natural water content) as fill material, lime will be added to adjust the water content.	
		Operation Phase (1) Soil erosion from slope of the road if remained uncovered that will end up in water body; (2) There might be an indirect impact by spilling and washing out of oil and grease from repairing and maintenance facilities of vehicles (3) The broken road surface may cause erosion of bitumen and other construction materials that may wash out into water bodies.	(1) The slope and footpath of road should be turfed with grass or paved to prevent or reduce soil erosion induced water pollution; (2) The road surface should be maintained and repaired properly on regular basis to prevent or reduce erosion of bitumen and aggregate.	**Monitoring Parameters** pH, Temp., DO, BOD, COD, TSS, Color, TC, Turbidity, As, Oil & Grease **Monitoring Frequency** 1/year for 3 years **Location** Surface water near project site **Implementing Organization** RHD **Supervision Organization** RHD, DOE **Budget** RHD's scope
3	Ground Water	**Construction Phase** (1) There is a rare chance of penetration of toxic chemicals such as fuel, lubricants, thinner, and solvents into aquifer through infiltration. (2) Leachate generated at the solid waste disposal site may contaminate the ground water system.	(1) Drip pan should be placed under generators and other machineries to collect leaked oil. Spilled oil should be absorbed by sponge absorber during/after maintenance works of machineries and vehicles; (2) All solid waste from project offices and labour camps should be disposed of at approved off site	**Monitoring Parameters** pH, TDS, EC, Oil & Grease, Turbidity **Monitoring Frequency** Quarterly **Location** Drinking water for construction camps and

No.	Area of Impact	Identified Impacts	Mitigation Measures	Monitoring Parameters
			locations in accordance with existing waste disposal regulations. (3) Cement solidifiers or other materials for ground improvement will not be used. In the case of using locally generated soil (clay with high natural water content) as fill material, lime will be added to adjust the water content.	ground water near project site **Implementing Organization** Contractor **Supervision Organization** RHD **Budget** Contractor's scope
		Operation Phase Leaching from waste disposal site, if not reclaimed.	Reclamation of waste disposal site after completion of construction period.	**Monitoring Parameters** Not required **Monitoring Frequency** Not applicable **Implementing Organization** RHD **Supervision Organization** RHD, DOE **Budget** RHD's scope
4	Topography and Soil Erosion	**Construction Phase** **A. Topography:** (1) The setting and appearance of landscape will be changed as many trees need to be felled and many settlements need to be demolished. (2) Land use in the alignment will be changed by converting agricultural land, fisheries, homestead vegetation and settlement into wide paved and impervious road surface; (3) The elevation in the alignment will be increased as the road will be higher than existing ground level. However, this change will not bring any big change in the distribution of altitude in concerned regions. Moreover, this change will also not change the slope and aspect of the region. (4) The landscape in and around the alignment will	(1) A tree plantation and landscaping program should be implemented after completion of the project to mitigate the vegetation loss and to increase the aesthetic view; (2) Oil and lubricant spilled from machines and vehicles need to be absorbed using sponge. Drip pan/bucket should be used under the machines and vehicles (during maintenance) to collect the leaked and spilled oil; (3) The collected/absorbed oil and lubricants should be disposed following appropriate procedures set by the "Hazardous Waste and Ship Breaking Waste Management Rules 2011" of the Government of Bangladesh; (4) Open toilet without sanitary pit is strictly prohibited in this project, including work site, office, residential areas, construction yards, and	**Monitoring Parameters** Visual check for Soil erosion and siltation **Monitoring Frequency** Monthly **Location** All major water bodies **Implementing Organization** Contractors **Supervision Organization** Consultant, RHD **Budget**

No.	Area of Impact	Identified Impacts	Mitigation Measures	Monitoring Parameters
		be disfigured through excavation of spoil materials for the road construction. **B. Soil:** (4) Spilling of oil and lubricants from poorly maintained machines and vehicles can contaminate soil; (5) If bentonite is used as a drilling fluid to stabilize the boreholes/piles, the improper disposal of bentonite slurry may pollute the soil quality; (6) Improperly managed sewage and solid wastes generated from the project activities can pollute soil.	other associated facilities.	Contractor's scope
		Operation Phase There is no major chances of soil pollution during construction phase. However, improper disposal of hazardous wastes, i.e. oil, lubricant and solid waste can contaminate soil.	(1) Hazardous waste like oil and lubricant leaked and spilled from vehicles need to be collected using drip pan and absorber. The collected/absorbed oil and lubricant should be disposed following appropriate procedures set by the Hazardous Waste and Ship Breaking Waste Management Rules 2011 (2) Solid waste from vehicles and other facilities, especially generated due to implementation of this project, should not be dumped in open place to prevent soil pollution.	**Monitoring Parameters** Visual check for soil erosion and siltation **Monitoring Frequency** After first precipitation **Location** All major water bodies **Implementing Organization** RHD **Supervision Organization** RHD, DOE **Budget** RHD's scope
5	Solid Waste	**Construction Phase** (1) Construction sites, offices, and residential quarters will produce different types of inorganic waste like paper, plastic, polythene, can, etc.; (2) Kitchen of workers accommodation, canteen, eating and resting place in work sites will generate organic solid waste like food waste, paper, etc.; (3) Toilets installed in the project areas, including	(1) A Waste Management Plan should be incorporated in the Contractor's Environmental Management Plan (CEMP), including detailed management plan for municipal solid waste and hazardous waste; (2) The solid waste should be segregated at source. For this purpose, different colored waste bins should be provided with appropriate labelling and instructions in all project sites. The colors of the waste bins could be: green (for	**Monitoring Parameters** Inspection and record keeping during site visit **Monitoring Frequency** Weekly **Location** Construction Yard, dumping site

No.	Area of Impact	Identified Impacts	Mitigation Measures	Monitoring Parameters
		stationary and mobile toilet will produce sewage sludge; (4) Improper management of these waste (Serial I-III above) will cause environmental pollution, including water and soil pollution, bad odor as well as public health problems; (5) Earth works and piling (including pile cap breaking) will generate spoil soil; (6) Several types of scrap waste like rebar, steel plate, formworks, electric cable, etc. will be generated mostly from flyover, bridge, and culvert construction; (7) Organic waste could be released through drainage discharge from kitchen and canteen of workers accommodation, construction yards, and offices;	recyclable waste), yellow (for non-recyclable waste), and red/brown (for hazardous and sharp waste); (3) The non-recyclable solid waste like food waste will be disposed in designated dumping zone of nearby municipality. If the distance of municipality waste dumping site is not affordable, then a sanitary landfill could be established beside project sites following appropriate procedures. (4) The recyclable waste like paper, plastic, glass, aluminum can, etc. should be sold to recycle plants or their local suppliers; (5) The spoil soil will be dumped in designated place with approval of consultant and employer within 12 hours of their generation.	**Implementing Organization** Contractor **Supervision Organization** Consultant, RHD **Budget** Contractor's scope
		Operation Phase (1) Solid waste like food waste, plastic, glass, paper can be produced from the operating and maintaining facilities of the project.	(1) Same mitigation measures like the measures for construction phase can be applied during operation phase also.	**Monitoring Parameters** No specific parameters **Monitoring Frequency** During maintenance work **Implementing Organization** RHD **Supervision Organization** RHD, DOE **Budget** RHD's scope
6	Hazardous Waste	**Construction Phase** (1) Burned oil, especially lubricant (Mobil) will be produced from machineries and vehicles; (2) There will be a huge number of empty containers of adhesive chemicals and epoxy; (3) A little amount of medical waste, including sharp materials will be generated from medical center of the project; (4) Oil and lubricant mixed water will be released	(1) Burned oil and lubricant (Mobil), empty containers of adhesive and epoxy, expired and used lithium-ion battery should be sold to refinery or their vendors; (2) Medical waste should be disposed following appropriate procedures set by the "Medical Waste Management Rules 2008" of the Government of Bangladesh and Waste Management Plan of CEMP.	**Monitoring Parameters** No specific parameters. Inspection and record keeping during site visit. **Monitoring Frequency** Weekly **Location**

No.	Area of Impact	Identified Impacts	Mitigation Measures	Monitoring Parameters
		from construction yard; (5) There will be a big number of expired or used lithium-ion battery likely to be generated in the project; (6) Leakage and spillage of oil and lubricant from machines and vehicles; (7) Bentonite slurry from piling work, chemical mixed slurry from concrete mixing plant or batching plant, etc.; (8) There will be sharp metal and non-metal materials in scrap waste.	(3) There will be an oil water separator installed in drain to collect oil and grease from wastewater released from construction yard before their final discharge in environment; (4) The disposal and handling of hazardous waste like oil and greased collected/absorbed from machines, vehicles, wastewater drain of construction yard should be managed in accordance with the appropriate procedure set by the "Hazardous Waste and Ship Breaking Waste Management Rules 2011" of the Government of Bangladesh and Waste Management Plan of CEMP.	Fuel storage area and construction site **Implementing Organization** Contractor **Supervision Organization** Consultant, RHD **Budget** Contractor's scope
		Operation Phase (1) There is a very little chance of waste generation during operation period of the project. Oil and grease can be leaked and spilled from vehicles.	(1) Same mitigation measures like the measures for construction phase can be applied during operation phase also.	**Monitoring Parameters** No specific parameter **Monitoring Frequency** Not applicable **Implementing Organization** RHD **Supervision Organization** RHD, DOE **Budget** RHD's scope
7	Noise	**Before/During Construction Phase** (1) Noise will be produced during pile driving or bore poling for bridge and flyover construction. The crawler crane-mounted rotary boring unit or a purpose-built hydraulic drilling machine will generate higher noise; (2) The operation of different types of construction machines and vehicles like excavator, roller, diesel generator, lifting crane, bulldozer, boom truck, vibro hammer, truck, dump truck, lorry, car, etc. will produce noise with moderate magnitude;	**Pre-construction Phase** (1) The location of sensitive receptors should be considered during selection of road alignment; (2) Necessary evacuation, resettlement, and compensation plan should be prepared for sensitive noise receptors, if seems necessary. **Construction Phase** (1) A Noise and Vibration Management Plan shall be formulated in the Contractor's Environmental Management Plan (CEMP); (2) A baseline noise study by measuring the noise produced by different types of machines and	**Monitoring Parameters** Noise level dB(A) **Monitoring Frequency** Monthly or as per consultant's requirement **Monitoring Location** Construction sites and inhabited locations and sensitive areas

No.	Area of Impact	Identified Impacts	Mitigation Measures	Monitoring Parameters
		(3) Higher noise will be produced during rebar cutting and binding in construction yards as well as during welding; (4) Higher noise will also be produced during pile cap breaking using hammer, jackhammer, concrete chipper, steel rod cutting saw, etc. (5) This project may require some demolition works, especially where the alignment goes through residential and commercial areas. Hence, moderate to higher noise will be generated during demolition operation; (6) The batching plant and asphalt mixing plant will also generate noise; (7) The transportation of different types of construction and waste materials, formwork setting and dismantling, rebar grid framework installing, scaffolding setting and dismantling, concreting will produce noise with lower to moderate magnitude.	vehicles should be conducted by contractor following appropriate method before starting the civil works; (3) The machineries and vehicles should be maintained regularly to reduce their operation noise. A third-party inspection and certification of machineries and vehicles should be conducted by contractor before starting of works and in every six months onward; Over standard noise producing machines and vehicles shall not be allowed to operate in the project; (4) Noise barrier should be erected around construction site, especially for flyover and bridge construction; in case of road construction, noise barrier should be erected where any residential and commercial settlement and sensitive receptors like school, mosque, temple, hospital are present beside work site; (5) The machineries and vehicles should be equipped with muffler, silencer, foam, rubber and other sound soundproofing materials, whatever necessary, to reduce operation noise; the diesel generators should be covered with canopy; (6) On Friday and other national holidays, nor works shall be permitted; during working days, any noisy works shall not be conducted during night shift and prayer times; (7) All mixing and other plants like batching plant and asphalt plant should be operated in accordance with manufacturers recommendations, including sound proofing and to be located at a minimum distance of 200 m from sensitive receptors; the storage site, laydown area, construction camp shall be built maintain this distance criterion; (8) Stationary units, e.g., aggregate breaker,	**Implementing Organization** Consultant (design stage), contractor (construction phase) **Supervision Organization** Consultant, RHD **Budget** Consultant's scope (design stage), contractor's scope (construction phase)

No.	Area of Impact	Identified Impacts	Mitigation Measures	Monitoring Parameters
			compressor should be placed in sound-absorbing areas or tents, which can reduce the noise level by up to 70%.	
		Operation Phase (1) The main source of noise during operation phase would be the vehicles using the roads and flyover and the maintenance and repairing works. To predict the noise generation from vehicles during operation period, a noise modelling is performed based on the existing noise level, traffic volume, and forecasted traffic volume.	(1) Signs for sensitive zones (health centres / educational institutions etc.) to disallow the use of pressure horns; (2) Enforcement and penalties against traffic rules violators;	**Monitoring Parameters** Noise level dB(A) **Monitoring Frequency** 1 site/year for 3 years **Monitoring Location** Inhabited locations and sensitive areas **Implementing Organization** RHD **Supervision Organization** RHD, DoE **Budget** RHD's scope
8	Vibration	**During Construction Phase** (5) Vibration will be generated during pile driving or bore piling, especially during construction of bridges and flyover; (6) The construction activities using heavy machineries during soil compacting and rolling, lifting crane, etc. will generate moderate to high vibration; (7) Substantial extent of vibration will be produced during sheet pile driving and dismantling using vibro hammer; (8) Ground vibration may be generated during the operation of heavy vehicles, i.e., lorry carrying viaduct segment, I-girder, and other heavyweight materials with moderate extent.	**During Construction Phase** (1) The route alignments and design and construction specifications should be determined considering the vulnerable receptors of vibration; (2) The design and construction specifications should consider less vibration generation. (3) Concurrent works that produce vibration should be avoided. Instead, vibration producing works will be conducted with intervals of work place and time; (4) An assessment should be conducted to estimate the vibration tolerance level of adjacent infrastructures in flyover and bridge construction areas before starting of civil works. If found vulnerable, then necessary measures like cut-off trench; temporary evacuation, resettlement, and compensation should be implemented; (5) The demolition works should not be conducted concurrently, but with intervals of time and	**Monitoring Parameters** Vibration level **Monitoring Frequency** Monthly or as per consultant's requirement **Monitoring Location** Construction sites and inhabited locations and sensitive areas **Implementing Organization** Consultant (design stage), contractor (construction phase) **Supervision Organization** Consultant, RHD **Budget**

No.	Area of Impact	Identified Impacts	Mitigation Measures	Monitoring Parameters
			buildings.	Consultant's scope (design stage), contractor's scope (construction phase)
		Operation Phase Vibration level will increase in future road area due to the increased traffic. However, the vibration levels are likely to be within the acceptable levels.	**Operation Phase** No additional mitigations are required.	**Monitoring Parameters** Vibration level **Monitoring Frequency** 1 site/year for 3 years **Monitoring Location** Inhabited locations and sensitive areas **Implementing Organization** RHD **Supervision Organization** RHD, DoE **Budget** RHD's scope
9	Ground Subsidence	**Before/During Construction Phase** (1) There would be a nominal chance of landslide during and after the excavation of pile foundation and borrow pit. (2) Landslide in pile foundation and borrow pit may occur and cause minor injury or fatal accident.	**Pre-construction Phase** (1) A lithological study should conduct to assess the formation of aquifer underneath, including water table for predicting any future subsidence; (2) The findings of the study should be considered during design of the roads and flyover. **Construction Phase** (1) Pile foundation and borrow pit area should be enclosed with hard barrier during excavation to prevent public exposure; (2) During pile cap breaking and foundation works, shore piling/shoring using steel sheet and/or shoring beam shall be installed to prevent bank collapse or ground subsidence due to erosion, loosening of soil, and overweight materials on bankside. (3) There should be first aid box and ambulance (during heavy works) onsite for emergency response to the affected workers, if any landslide	**Monitoring Parameters** No specific parameter. Safety measures will be inspected during site visit **Monitoring Frequency** Not applicable **Implementing Organization** Consultant (design stage), contractor (construction phase) **Supervision Organization** Consultant, RHD **Budget** Consultant's scope (design stage), contractor's scope (construction phase)

No.	Area of Impact	Identified Impacts	Mitigation Measures	Monitoring Parameters
			happened.	
		Operation Phase (3) Subsidence or landslide may occur due to earthquake, slope failure and erosion, loosening of soil and slope due to infiltration and percolation of water during heavy rainfall, etc. (4) This also can occur due to construction faults (improper compaction of soil and sand), use of low-quality materials; excessive withdrawal of groundwater from aquifer underneath; operation of overweight vehicles, etc.	(1) The soil and sand should be tightly compacted reducing porous space well during construction of the roads; (2) The slope could be paved to prevent infiltration and percolation of water and erosion; (3) Drainage system should be sufficient to discharge water from road surface after rainfall; (4) Operation of overweight vehicles should be prohibited and strictly monitored. For this purpose, weigh station can be installed to monitor the weight of the vehicles.	**Monitoring Parameters** No specific parameter **Monitoring Frequency** Not applicable **Implementing Organization** RHD **Supervision Organization** RHD **Budget** RHD's scope
10	Offensive Odors	**Construction Phase** Land preparation and clearing work, sewage from mobile and stationary toilets, solid waste, slurry, etc. can generate bad odor.	(1) The sewage sludge generated from stationary toilets in offices, workers accommodation, and construction yards should be managed with sanitary pit and shall not be released in open environment; (2) The solid wastes and slurry from batching plant shall not be disposed in open place without following the instruction given in waste management plan.	**Monitoring Parameters** No specific parameter. Monitoring will be conducted during site visit **Monitoring Frequency** Weekly **Implementing Organization** Contractor **Supervision Organization** Consultant, RHD **Budget** Contractor's scope
		Operation Phase Any impact related to offensive odors is not expected during operation phase of the project.	No mitigation measures required	**Monitoring Parameters** N/A **Monitoring Frequency** N/A **Implementing Organization** N/A **Supervision Organization** N/A **Budget** N/A

No.	Area of Impact	Identified Impacts	Mitigation Measures	Monitoring Parameters
11	Bottom Sediments	**Construction Phase** (1) Earth works will generate sediments that may discharged into water body by surface runoff and wind erosion and transportation. (2) Moreover, oil and grease can also be reached nearby water body. These sediments generated from the construction site may deteriorate the bottom sediments of nearby rivers and other streams. (3) This will also be a threat for aquatic organisms.	(1) Sediment fence/silt fence should be installed on the bank of rivers, canals, and ponds nearby the project to prevent sediment discharge into the water; (2) Slurry from batching plant should be dried up in a location away from water body. During monsoon season, a sediment fence should be installed around this site to prevent rainfall induced runoff carrying sediments from this site; (3) No oil and lubricant shall be disposed or discharged into water body. Oil water separator should be used in the drainage outflow of construction yard; (4) The sediment mixed water should be settled in drain by check dam to allow sedimentation. Later, the sediments will be scrapped and dried up in designated place (as per serial II).	**Monitoring Parameters** TSS, TDS, Turbidity, EC, Oil and Grease in water **Monitoring Frequency** Quarterly or as per consultant's demand **Location** River and Major water body **Implementing Organization** Contractor **Supervision Organization** Consultant, RHD **Budget** Contractor's scope
		Operation Phase The sediments still can be generated from slope erosion of the roads, if remained unpaved or uncovered with grass. In case of flyover, the impact is not expected.	The footpath and slope should not remain uncovered. Instead, they should be paved or covered with grass. This will reduce soil erosion and sediment production.	**Monitoring Parameters** TSS, TDS, Turbidity, EC, Oil and Grease in water **Monitoring Frequency** 1/year for 3 years **Location** Water body near to the road **Implementing Organization** RHD **Supervision Organization** RHD, DOE **Budget** RHD's scope
12	Flood and Drainage	**Before/During Construction Phase** (1) Road embankment may create water logging by blocking surface drainage. It can also interrupt irrigation and natural water courses. (2) Flooding or Drainage congestion and water	**Pre-construction Period** (1) A catchment level surface drainage/hydrological study should be conducted as part of feasibility study to determine the drainage slope and direction;	**Monitoring Parameters** Check drainage plan implemented correctly and conduct regular inspection **Monitoring Frequency**

No.	Area of Impact	Identified Impacts	Mitigation Measures	Monitoring Parameters
		logging will occur in the Project Area during severe rainfalls in the monsoon reason. (3) The major earthworks may interrupt the existing surface and ground water system. (4) These temporary construction infrastructures could potentially disrupt the natural cross drainage and might be the cause of flooding. (5) The excavation of fill materials for construction of road embankment will result in an increased extent of open water during monsoon.	(2) The height of the road embankments and bridges should be determined after analyzing the historic flood depth data; (3) Provide adequate number of cross drainages opening for facilitating irrigation on adjacent agricultural land; (4) Provide appropriate pipe culverts, box culverts and bridges on the road with adequate opening for cross drainage of the catchment area, so that they can safely handle a 20-year frequency of flood; (5) All drains need to be designed so that runoff resulting from storms to a specified frequency of occurrence can be drained off immediately without overflowing or not being impounded in lower level of the Project Area; (6) In case of bridge construction, the river morphology should be examined to determine effects on river bed and banks erosion during flooding. **Construction Phase** (1) Temporary drains should be constructed in and around the construction sites to ensure water flow (by gravity or pumping) to the river or nearest water course for preventing water logging; (2) All rainwater and construction induced stagnant water/inundation should be drained immediately by pumping or drains so that they do not cause disturbance and hazard to the local community, farmers, and road users. (3) Temporary cross drainage facilities should be arranged for water flow and irrigation purpose of nearby agricultural lands;	Weekly during monsoon **Location** Construction Site **Implementing Organization** Consultant (design stage), contractor (construction phase) **Supervision Organization** Consultant, RHD **Budget** Consultant's scope (design stage), contractor's scope (construction phase)
		Operation Phase	(1) Stagnant water from temporary inundation	**Monitoring Parameters**

No.	Area of Impact	Identified Impacts	Mitigation Measures	Monitoring Parameters
		(1) Any major impacts related to flooding and drainage are not expected during operation phase provided that the mitigation measures are perfectly implemented during pre-construction and construction period. (2) However, some minor impacts related to inundation or drainage congestion may occur for short period, if any design error occurred.	should be pumped out on emergency basis to reduce public disturbance; (2) The cross-drainage infrastructures should be maintained by cleaning and dredging regularly to keep them operational, especially during monsoon season.	Water logging **Monitoring Frequency** During monsoon season **Location** Near inhabitant of the road and cross drainage **Implementing Organization** RHD **Supervision Organization** RHD **Budget:** RHD's scope
13	Source of Materials, Haul Routes, and Disposal Sites	**Construction Phase** (1) Haul route, and disposal sites will not cause land use change and loss of agricultural land; (2) The waste disposal site may cause land degradation and contamination; (3) Danger to other roads users, in particular pedestrians and non-motorized and farm vehicles.	(1) Disposal sites should be constructed avoiding arable lands (three-cycle per year) and away from settlement area; (2) Dredged materials should be used as filling materials; (3) The waste disposal sites should be away from water body; the spoil disposal site should be levelled and compacted regularly; (4) The haul route and schedule should be selected causing least disturbance to local community and traffic.	**Monitoring Parameters** No specific parameter. Monitoring will be conducted during site visit. **Monitoring Frequency** Monthly **Location** Waste disposal sites **Implementing Organization** Contractor **Supervision Organization** Consultant, RHD **Budget** Contractor's scope
		Operation Phase The waste disposal sites can spread contamination through leaching and surface runoff.	(1) The solid waste disposal sites should be temporary. The land of disposal site should be reclaimed following appropriate procedure after completion of the project; (2) The abandoned borrow pits can be usable for fishing and recreational activities. Some borrow pits can be refilled with sand, if found feasible.	**Monitoring Parameters** Inspect whether disposal site is reclaimed **Monitoring Frequency** **After completion of construction** **Implementing Organization** Contractor **Supervision Organization** RHD, Consultant

No.	Area of Impact	Identified Impacts	Mitigation Measures	Monitoring Parameters
				Budget RHD's scope
B. Ecological Resources				
14	Protected Area	**Construction Phase** Workers' movement, improper waste disposal, and lack of training and proper awareness of workers may pose potential threat for PAs i. e. Fashiakhali Wildlife Sanctuary.	(1) No access for any construction activities allowed into the PAs. (2) No disposal of construction and other wastes allowed into the PAs. (3) No construction of labor camps will be allowed within 2 kilometers of the boundary of the PAs. (4) No poaching will be done. (5) Workers will be trained for not disturbing or threating any wildlife and natural resources of the PAs.	**Monitoring Parameters** Regular monitoring will be conducted during site visit. **Monitoring Frequency** Daily **Location** Project site near protected area **Implementing Organization** Contractor **Supervision Organization** Consultant, RHD **Budget** Contractor's scope
		Operation Phase Minor impacts from speedy driving and improper use of horns may impact on the wildlife of the PAs i. e. Fashiakhali Wildlife Sanctuary.	Proper signage for skipping horns and speed limit to be installed near the PAs.	**Monitoring Parameters** Noise level and checking of signage **Monitoring Frequency** Noise level: 1/year/road for 3 years and regular inspection for signage **Implementing Organization** RHD **Supervision Organization** RHD **Budget** RHD's scope
15	Biota and Ecosystem	**Before/During Construction Phase** (1) Removal of vegetation and/ or loss of trees will impact floral diversity and its ecosystem and may affect wildlife, particularly birds and	**Before Construction Phase** (1) No trees shall be felled unless they are directly in the ROW and clearly defined, or unless they created a safety hazard	**Before Construction Phase** **Monitoring Parameters** • Visual confirmation of

No.	Area of Impact	Identified Impacts	Mitigation Measures	Monitoring Parameters
		mammals that rely on trees for their habitat and food source. (2) Loss of vegetation cover may increase soil erosion from rain and wind. (3) Excavation of borrow pits might add physical destruction of terrestrial flora and/ or injury of fauna. (4) Dust produced from vehicle movement and construction related activity may impact on the physiochemical process of plants i.e. photosynthesis, respiration, etc. (5) Pollution of surface water caused by constriction of culverts and bridges, spillage of chemicals, run off the wastewater, disposal of solid and liquid waste into the water body may impact aquatic vegetation (6) Hunting of wildlife and birds during construction	(2) Secure permit from Forestry Department prior to tree cutting /removal **During Construction Phase** (1) No trees shall be felled unless they are directly in the ROW and clearly defined, or unless they created a safety hazard to the future operation of the road. (2) Cutting of large trees that harbor and encourage wildlife must be kept to a minimum. (3) Vegetation adjacent to the ROW should not be used as fuelwood for heating bitumen during construction activities. (4) Restrict and enforce dumping and storage of spoil and other materials close to trees to ensure that trees and plants are not damaged. (5) Hunting the birds and other animals by construction workers should be prohibited at the construction sites. (6) Topsoil in the vicinity of tree felled should be reused for new planting. (7) Avoid major construction activities during night hours. (8) Advise and educate contractors and workers to ensure the conservation of natural resources. (9) Upon completion of embankment works turfing and planting should be done on embankment and slopes. Dense and well-rooted growth of permanent grasses should be planted to eliminate dust and erosion. (10) Camp sites and asphalt plants to be established on waste/barren land rather than on forested or agriculturally productive land	wildlife including valuable species (monitoring method will be established in close consultation with the Forest Department). **Monitoring Frequency** During tree felling and site clearing operations **Implementing Organization** Contractor **Supervision Organization** Consultant, RHD **Budget** Contractor's scope **During Construction Phase** **Monitoring Parameters** Number of trees planted and survival rate (at least 75%) during tree plantation programme Visual confirmation of wildlife (including valuable species) **Monitoring Frequency** Quarterly for tree plantation program and Monthly for visual inspection **Implementing Organization** Contractor **Supervision Organization** Consultant, RHD **Budget** Contractor's scope

No.	Area of Impact	Identified Impacts	Mitigation Measures	Monitoring Parameters
			(11) Borrow pits to be fenced to protect animals. (12) In accordance with normal practice of Forest Department, two saplings should be planted for each tree felled. The replantation should be done along the road way and embankments, in lands near bridges and culverts, private and govt. land under social forestry program, and through community distribution. The replantation should consist of a multi-species mix of local vegetation including fruit trees, fast-growing (fuel) trees and timber trees. (13) Replanting along the roadsides and all other areas should consist of a multi-species mix of local vegetation including fruit trees, fast-growing (fuel) trees and timber trees. (14) Replanting of trees along the roadsides and all other areas will be done through the implementation of Social Afforestation Program by FD and NGO/RHD. It will offer a significant opportunity to bring benefits to the local community and Project Affected Persons (PAP's), vulnerable groups, particularly women by direct involvement in the program. (15) Forestation programmes should be initiated to compensate for the loss of vegetation, to reduce the risk of erosion of the banks, and finally as a noise-reducing wall. Implement the Tree Plantation Plan as described in (**Appendix G**). (16) Mitigation measures for other pollution control stated in the EMP are applicable	
		Operation Phase (1) The survival rate and growth of newly planted	(1) Proper care to be taken for newly planted saplings.	**Monitoring Parameters** Tree survival rate

No.	Area of Impact	Identified Impacts	Mitigation Measures	Monitoring Parameters
		saplings may be impacted. (2) Killing of animals in road accidents	(2) Provide mulching and fencing for these saplings as necessary. (3) Low width under passes with the provision of small net on both side of the road shall be made where the animal movement is frequent	**Monitoring Frequency** Monthly **Location** Tree plantation area and areas alongside the road alignment for wildlife **Implementing Organization** RHD with support from Forest Department **Supervision Organization** RHD **Budget** RHD's scope
16	Fisheries and Aquatic Biology	**Construction Phase** (1) Construction activities at bridges/ culverts may affect fish health and fish migration. (2) Commercial fishing may be impacted (3) Bottom sediments generated from construction sites are potential threat to aquatic organisms. (4) Oil and grease produced from construction sites may deteriorate the aquatic ecosystem of nearby rivers and other waterbodies. (5) Dredging and piling activities during Sangu River Bridge Construction might impact on the migration and behavioral changes of Ganges River Dolphin in the Sangu River.	(1) Fish migration routes need to be considered during the construction period. (2) Ensure no disposal of construction materials or wastes in any nearby commercial fishing areas. (3) Disposal of dredged materials will be taken place in the deepest parts of rivers. (4) Proper implementation of Section 10: Bottom Sediments to be followed. (5) Manage all liquid waste disposal and ensure no accidental spills of liquid waste into the river. (6) Construction not to be undertaken during high flood. (7) Bridge construction activities in the river must be avoided during the fish breeding season (July to September) (8) Consider avoiding fish ponds during land acquisition. (9) Ensure to have no adverse impact on fishing projects and fishing ponds in the project AOI. (10) Waterbodies shouldn't get disrupted and natural water flow should be ensured during construction.	**Monitoring Parameters** Mitigation measures will be inspected regularly during the site visit **Monitoring Frequency** Monthly **Location** All major water bodies **Implementing Organization** Contractor **Supervision Organization** Consultant, RHD **Budget** Contractor's scope

No.	Area of Impact	Identified Impacts	Mitigation Measures	Monitoring Parameters
			(11) All activities in the land and river should be done within the designated areas. (12) Follow the below mitigation measures for the protection of Ganges River Dolphin during bridge construction activities in the Sangu River a. Check for dolphins at a radius of 500 meter before starting dredging and piling activities b. Avoid monsoon season for dredging and piling activities c. Piling should be paused if dolphins are found nearby and let them leave the area d. Acoustic enclosures will be placed to reduce air noise during the piling operation	
		Operation Phase (1) Bridge/ culvert construction may affect fish migration. (2) Construction of road and bridge may impact on fish production	(1) Ensure fish migration facilities and sufficient water flow. (2) Consult with the local fisheries department to enrich the fisheries resources;	**Monitoring Parameters** Impact on fish productivity, breeding and spawning **Monitoring Frequency** End of first year of operation **Location** All major water bodies **Implementing Organization** RHD **Supervision Organization** RHD/Fisheries Department **Budget** RHD's scope
D. Social Environment				
19	Involuntary Resettlement	**Before/During Construction Phase** (1) A total of 405.1965 acres private land will need to be acquired for five major bottleneck sections. (2) 2500 PAUs including residential HHs and shops, plain landowners have been affected by the project interventions.	(1) A detailed assessment will be carried out during the detail measurement survey to determine the extent of impact and usage of land; (2) Where procuring of private land cannot be avoided and it will be done through land acquisition process through the enforcement of Acquisition and Requisition of Immovable	**Monitoring Parameters** Numbers of PAPs got compensation

No.	Area of Impact	Identified Impacts	Mitigation Measures	Monitoring Parameters
		(3) 31 community properties and 13 offices/institutions are also affected among which 20 CPRs and 10 offices will be relocated elsewhere. Apart from the HHs and shops, 573 tenants, 641 wage laborers and 206 vendors are also affected within the proposed ROW. (4) Major impacts on project-affected units (PAUs) were identified at Chattogram district (520 PAUs), followed by Cox's Bazar district (224 PAUs) and Bandarban district (7 PAUs).	Property Act, 2017 (ARIPA), the landowner will be duly compensated as per the provisions mentioned in the Entitlement Matrix of Resettlement Action Plan; (3) Compensation will be provided to the affected as per Cash Compensation Law (CCL) as specified in ARIPA, 2017 or replacement cost, whichever is greater; (4) In the case of leaseholder, the affected persons will be assisted in identifying alternative location. (5) The contractor should ensure that the construction work takes place during lean business hours and during the night to avoid major disruption; (6) The contractor should inform all the stakeholders well in advance (at least 30 days) before the start of the construction work, to enable shop owners to stock up and remain unaffected if vehicles delivering goods are unable to reach them during construction; (7) At Keranirhat Flyover area it should be ensure that the temporary road side small vendor who don't have any specific location to continue their business, during construction phase a suitable location require for them to continue their business. (8) Contractor during construction should ensure that some commercial structures like restaurants and shops near the RoW at Keranirhat are not affected and excavation should be carried out to the possible extent to avoid any damages to the commercial structures.	**Monitoring Frequency** Proper disbursement of compensation as per RAP **Implementing Organization** DC office/ NGO **Supervision Organization** RHD/CSE **Budget** Land acquisition and Resettlement cost

No.	Area of Impact	Identified Impacts	Mitigation Measures	Monitoring Parameters
20	Poor	47.4% of the population of the affected area lives below poverty line	(1) Define the displaced persons and criteria for determining their eligibility for compensation (2) Establish external monitoring committee consists of the third party	**Monitoring Parameters** Proper disbursement of compensation as per RAP **Monitoring Frequency** Quarterly **Implementing Organization** NGO **Supervision Organization** RHD/ Supervision Consultant **Budget** Land acquisition and Resettlement cost
21	Loss of Livelihood	(1) In the five major bottleneck sections, a total of 712 business entity comprising of 59.13% of total business have been found small, 22.47% is medium and 18.40% business is large will be directly impacted. (2) A total of 641 wage laborers will be impacted in major bottleneck section (3) Significant numbers of vendors will be impacted in major bottleneck sections (4) Commercial fishing activities might be impacted. (5) Change in the livelihood of some marginal local fishermen residing near Sangu River Bridge area may occur if they are unable to access to nearby river. **During Operation** No impact is expected	(1) All direct income lost should be properly compensated as per RAP; (2) Livelihood Restoration Plan should be initiated who have loss their existing opportunity (3) Ensure employment opportunity for street vendors who are located at the RoW of Lohagara and Keranirhat section; (4) Project Affected Persons should be prioritized during employment opportunities related to this project; (5) Female wage labour should be well trained in compliance with another profession as they loss their existing jobs employed in different sectors; (6) Affected vendors may get resettlement benefits to restore their business elsewhere. (7) Vendors without permanent structures but doing business in the same place almost every day should be considered entitled vendors for this project as it was considered in the past international projects (e.g., MRT Line 6 project	**Monitoring Parameters** Proper disbursement of compensation as per RAP **Monitoring Frequency** Quarterly **Implementing Organization** NGO **Supervision Organization** RHD/ Supervision Consultant **Budget** Land acquisition and Resettlement cost

No.	Area of Impact	Identified Impacts	Mitigation Measures	Monitoring Parameters
			of JICA, Bus Rapid Transit Project of ADB) in Bangladesh. (8) Ensure to have no adverse impact on rivers, fishing projects and fishing ponds in the project AOI. (9) Consider avoiding fishponds during land acquisition. (10) Waterbodies shouldn't get disrupted and natural water flow should be ensured during construction. (11) Inform nearby fishermen before starting any bridge construction activities in the river. (12) Ensure that fisherman shouldn't be affected during construction. (13) Proper compensation should be provided to fisherman in case of any livelihood loss. (14) Ensure proper implementation of mitigation measures related to surface water quality, waste management, bottom sediments and protection of fisheries and aquatic ecosystem.	
22	Disruption of Agricultural Activities	**Before/During Construction Phase** (1) Most of the affected land is Null 322(79.47%) of total 405.196 Acres. So, the existing agricultural pattern of project area will be disrupted.	(1) Ensure adequate compensation for landowner as well as cultivator; (2) Sharecropper should be compensated as per RAP; (3) Consideration of alternative design to minimize	**Monitoring Parameters** Proper disbursement of compensation as per RAP **Monitoring Frequency** Quarterly **Implementing Organization** Contractor **Supervision Organization** RHD/ Supervision Consultant **Budget** Land acquisition and Resettlement cost
23	Land Use and	(1) a total of 405.1965 acres (164.047 ha) of private land at five major bottlenecks sections will need to be acquired out of which 147	(1) Proper design of project should also minimize the impact on land; (2) Land used for labor and worker accommodation	**Monitoring Parameters** Number of employment opportunities for local

No.	Area of Impact	Identified Impacts	Mitigation Measures	Monitoring Parameters
	Utilization of Local Resources	acres (36.30%) at Chakaria followed by Lohagara 116.43 acre (28.77%), Patiya 78.45 acre (19.37%), Dohazari 65.50 acres (16.17%) and Keranirhat 1.20 acres (0.30%). Most of the affected land is Null 322(79.47%) followed by homestead 45.79 Acre (11.30%), Pond 15.43 Acres (3.81%) and Vita (high land) 13.09 Acre (3.23%). (2) A total of 85,402 trees of various sizes; Large 13,691, Medium 20,611, Small 34,727 and plant (sapling) 16,373 are affected. Out of the total 30,785 trees in Lohagara, 10,639 trees in Dohazari and 2,741 trees in Keranihat, 18,353 trees in Patiya and 22,884 trees in Chakaria	should be revamp as per previous condition after the completion of construction period; (3) Tree plantation program should be initiated as compensation for the demolition of huge number trees;	residents and number of businesses around the construction area **Monitoring Frequency** Quarterly **Implementing Organization** Contractor **Supervision Organization** RHD/ Supervision Consultant **Budget** Land acquisition and Resettlement cost
24	Social Institutions and Local Decision-making Institutions	(1) Total 31 Community property resources (CPR) such as Mosque, Mazar, Graveyard, non-government school, Temple and Madrasah are affected in the project right of way of Major bottleneck section. Some of the CPRs are fully affected and require relocation in new location while some are partially affected and not require relocation. (2) Apart from the CPRs, some 13 government and non-government offices/institutions are also affected. The Offices/institutions include Government school, health clinic, political party club, government office, passenger shed of a bus stop, etc also be impacted in major bottleneck section. Moreover, A total of 33 Community property resources (CPR) such as Mosques, Mazar, Graveyards, Schools, Monuments, and Ansar Camps are affected in the project right of way. Some of	(1) Proper compensation as per RAP, (2) Alternative access facilities should be incorporated consultation with the communities; (3) Proper signage and fencing during demolition of these institutions; (4) Implement swift alternative means regarding displacement or demolition of religious institutions e.g., mosque, temple etc.	**Monitoring Parameters** Proper disbursement of compensation as per RAP **Monitoring Frequency** Quarterly **Implementing Organization** Contractor **Supervision Organization** RHD/ Supervision Consultant **Budget** Land acquisition and Resettlement cost

No.	Area of Impact	Identified Impacts	Mitigation Measures	Monitoring Parameters
		the CPRs are fully affected and require relocation to the new location, while some are partially affected and do not require relocation.		
25	Local Conflict of Interest	**During Construction** Conflict between migrant labor and local community **During Operation** No impact is expected	**During Construction** (1) Job opportunities should be provided in fair way; (2) Clear information about the needs of labor (number and qualification) should be provided with local people; (3) The job skills and the priority for the affected people shall be taken into account and the workers can be chosen;	**Monitoring Parameters** Number of grievance record in terms of conflict **Monitoring Frequency** Based on occurrence **Implementing Organization** Contractor **Supervision Organization** RHD/ Supervision Consultant **Budget** Contractor's Scope
26	Gender	**During Construction** Wage discrimination between male and female worker **During Operation** No impact is expected	**During Construction** Proper monitoring to minimize the wage gap between male and female	**Monitoring Parameters** Gender among those who are to be recruited **Monitoring Frequency** Quarterly **Implementing Organization** Contractor **Supervision Organization** RHD/ Supervision Consultant **Budget** Contractor's Scope
27	Children Rights	**During Construction** (1) May impact on educational opportunity of school going children in PAHs of the Project (2) Disruption of children's commuting to school (3) Impact of the project on increase of child labor **During Operation** No impact is expected	**During Construction** (1) Support of sending children to school (2) Signal man should be appointed, and safety signage should be placed near school. (3) Child labour should be strictly prohibited	**Monitoring Parameters** Check logbook of labour recruitment to verify child labour **Monitoring Frequency** Quarterly/ Daily (Child Labor) **Implementing Organization** Contractor

No.	Area of Impact	Identified Impacts	Mitigation Measures	Monitoring Parameters
				Supervision Organization RHD/ Supervision Consultant **Budget:** Contractor's Scope
28	Infectious Disease, such as HIV/AIDS	**During Construction** Spreading of infectious disease **During Operation** No impact is expected	**Mitigation Measure during Construction** (1) To provide surveillance for worker's health; (2) Prevention of illness among workers by undertaking health awareness and education initiatives and by conducting immunization programs for workers; (3) To provide treatment through standard case management in on-site and community health care facilities as necessary; (4) Educating project personnel and area residents on risks, prevention, and available treatment; (5) Promoting collaboration with local authorities to enhance access of worker's families and the community to public health services and promote immunization as necessary; (6) Promoting use of repellents, clothing, netting, and other barriers to prevent insect bites; (7) Prevention of larval and adult propagation through sanitary improvements and elimination of breeding habitats close to human settlements; (8) Elimination of unusable impounded water;	**Monitoring Parameters** Labor health records **Monitoring Frequency** Quarterly **Implementing Organization** Contractor **Supervision Organization** RHD/ Supervision Consultant **Budget** Contractor's Scope
29	Working Conditions including Occupational Health & Safety	**During Construction** (1) There would be a possibility to occur accidents and incident during construction works; (2) Physical trouble, noise, vibration, lighting, electrical, heat and cold, nuisance dust, fire/explosion, machine grinding, working space, Chemical, Gases, dusts, fumes, vapors, liquids are the major hazards which are harmful for workers health; (3) May insect and snake bite in the labour camp; (4) Road Accident	**Mitigation Measure during Construction** (1) To provide adequate health care facilities and first aid within construction sites; (2) To provide OHS training program and information of basic site rules of work, basic hazard awareness, site specific hazards, safe work practices, and emergency procedure; (3) To provide adequate lavatory facilities for the number of people expected to work in the facility; (4) To provide adequate supplies and easy access of drinking water with a sanitary;	**Monitoring Parameters** As per Occupational Health and Safety Plan **Monitoring Frequency** Based on occurrence **Implementing Organization** Contractor

No.	Area of Impact	Identified Impacts	Mitigation Measures	Monitoring Parameters
		During Operation No impact is expected	(5) To provide temporary shelters to protect against heat stroke during working activities or for use as rest areas as needed; (6) To arrange for provision of clean eating areas where workers are not exposed to the hazardous or noxious substances where there is potential for exposure to substances poisonous by ingestion of food as necessary; (7) To promote the use of repellents, clothing, netting, and other barriers to prevent insect bites and snake bite; (8) Adequate preventive measures from negative factors such as fire precautions, lighting, safe access, work environment temperature, area signage, labelling of equipment, communicate Hazard codes, electrical; (9) To establish rights-of-way, site speed limits, vehicle inspection requirements, operating rules and procedures, and control of traffic patterns or direction; (10) To identify and provide appropriate PPE that offers adequate protection to the worker, co-workers, and occasional visitors;	**Supervision Organization** RHD/ Supervision Consultant **Budget:** Contractor's Scope
30	Water Use	**During Construction** (1) Use of ground water for construction purpose (2) Use of water at labour and employer accommodation (3) Excessive withdrawal of ground water may lead to depletion of aquifers. **During Operation** No impact is expected	**Mitigation Measure during Construction** (1) Rainwater harvesting ponds should be constructed so as to store rain water for construction activities; (2) Water for curing can be saved by carrying out curing in early morning or late evening and covering structures with gunny bag so as the moisture can be restored for longer time; (3) Regular inspections at site to monitor leakages in water storage tanks; (4) Creating awareness among construction workers about the importance of water	**Monitoring Parameters** Check logbook of water use Water quality testing report **Monitoring Frequency** Monthly **Implementing Organization** Contractor **Supervision Organization** RHD

No.	Area of Impact	Identified Impacts	Mitigation Measures	Monitoring Parameters
			conservation; (5) Adoption of the advance technologies and machinery which helps in minimizing water requirement for construction; (6) Storing the curing run-off and waste from other construction activity and using the same for sprinkling; (7) Covering the water storage tanks at site to prevent evaporation losses;	**Budget** Contractor
E. Others				
31	Temporary construction Yard and Workers' accommodation	**During Construction** Land requisition for temporary construction yard and workers' accommodation. **During Operation** No impact is anticipated.	**Mitigation Measure during Construction** (1) Proper compensation should be provided as per ARIPA 2017 for the leased land. (2) Agricultural land should be avoided if possible. **Mitigation Measure during Operation** No additional mitigations are required.	**Monitoring Parameters** Proper disbursement of compensation as per RAP **Monitoring Frequency** Bi-annually **Implementing Organization** Contractor **Supervision Organization** RHD/ Supervision Consultant **Budget** Land acquisition, requisition and resettlement cost
32	Accidents	**During Construction** Due to movement of heavy construction vehicle accident would be increased. **During Operation** As bottlenecks point and accident occurs zone will have straightened, the accident rate on the highway will be minimized	**Mitigation Measure during Construction** (1) Follow Health and Safety Management Plan (HSMP) rules and regulations designated by contractors; (2) Provision of traffic sings, road mark, bump, zebra mark, guard rail and pole, and curb stones etc.	**Monitoring Parameters** Traffic Movement **Monitoring Frequency** Continuous records **Implementing Organization** Contractor **Supervision Organization** RHD/ Supervision Consultant **Budget:** Contractor's Scope

8.4 Environmental Monitoring Plan

Physical, biological and social environmental components monitoring of particular significance are identified as performance indicators. Therefore, it is important to monitor selected parameters to assess the performance of the projects. A comprehensive monitoring plan for each performance indicator has been prepared for all phases of the Project and is presented in **Table 8-1** including management plan. This includes parameters to be measured, methods to be used, sampling locations, frequency of measurements, cost and responsibilities for implementation and supervision.

8.4.1 Objectives

The environmental monitoring programme has been devised with the following objectives:

- To evaluate the effectiveness of the proposed mitigation measures and the protection of the ambient environment as per prescribed/ applicable standards for the Project;
- To identify the need for improvements in the management plans;
- To verify compliance with statutory and community obligations; and
- To allow comparison against baseline conditions and assess the changes in environmental quality in the Project AOI

8.4.2 Components to be Monitored

Monitoring has two components:

- Compliance monitoring, which checks whether prescribed actions have been carried out, usually by visual observation and by the use of checklists.
- Effects monitoring which records the beneficial and adverse consequences of activities on the biophysical and social environment. This is often by repeat measurements of a set of objectively verifiable indicators.

Monitoring for this project will concentrate on compliance monitoring to ensure that measures are being implemented on time and according to sound environmental principles.

8.4.2.1 Pre-Construction stage compliance monitoring

Compliance monitoring during the pre-construction stage has three components:

- Checking that the project's design incorporates appropriate measures to avoid or minimize negative environmental impacts.
- Incorporation of appropriate protective clauses in the contract documents that are to be complied with by the contractors.
- Acquisition of land issue and damages to properties are dealt with as per the Land Acquisition and Resettlement Plan (LARP) and compensated accordingly.

The detailed program of monitoring of various components is given in **Table 8-1.**

8.4.2.2 Construction stage compliance monitoring

Compliance monitoring during the construction stage comprises:

- EMP which addresses the environmental issues in details to provide environmental protection.
- Contractors' compliance to the environmental clauses in their day-to-day activities.
- Implementation of tree planting and site clearance activities after completion of work.

The environmental impacts during construction are highly dependent on (i) the contractors' work practices, especially those related to the storage of construction materials and cleanliness of the work sites; (ii) cooperation by the local authorities with the contractor in terms of traffic management and use

of public space and utilities; (iii) project management's strict enforcement of the correct construction practices and standards; and (iv) the incorporation of the mitigating measures identified in the EIA into bid documents and specifications.

Direct monitoring during the construction phase will involve the following activities:

- Review of Contractor's proposed designs and working methods including a review at project start-up to ensure that the designs and working methods proposed by the contractors have taken account of the environmental constraints specified in the tender documents (geotechnical, ecological, social, safety).
- Site- specific review of contractors' temporary facilities; involving the inspection of contractor's worksites and work camps to ensure that the contractor's arrangements regarding temporary facilities are satisfactory.
- Regular site inspection during the construction period, involving scheduled and unannounced inspections to ensure that the stipulated procedures as defined in the EMP are being followed by the contractor(s). This monitoring will require the completion of systematic observations of site activities using checklists to be developed by RHD or its supervising consultants.
- Inspection of the certification of site clearance and restoration, to ensure that actual restoration has taken place, e.g., the temporary sewage works have been adequately disposed of.

8.4.2.3 Operation stage monitoring

The contractor will compile and maintain the environmental data and records gathered during the construction phase for reference during the operation phase. The contractor will coordinate with government departments and agencies, RHD in particular, for monitoring with respect to air quality, water, noise and traffic.

- The contractor in collaboration with the concerned department will organize monitoring of air quality and effects of the exhausts along the road project. Sensitive parameters including NO_2, SO_2 and particulate matters will be monitored and necessary measures will be taken to keep them within the limits set by government.
- The noise levels will be monitored to see whether they are within the limits. When they are found to exceed these limits and disturb the nearby settlements, noise abatement measures, like plantation of trees and construction of sound barriers will be taken.
- Monitoring will be done to ensure that surface quality will up to the standards.
- The contractor will monitor that flora and fauna of the area is not disturbed by the increase of population and other activities in the area of influence. Tree plantation will be done. Any activity of the nearby residents (such as disposal of waste, land use change, etc.), which affects the environment, will be brought to the knowledge of the competent authority for necessary action.

The above monitoring system will be fully controlled by the project proponent i.e. RHD. A monitoring schedule has been included as guideline for the stakeholders (**Table 8-1**).

8.4.3 Monitoring Program

Monitoring points have been selected based on the sensitivity of the location with respect to sensitive receptors. The schedule has been developed based on the possible occurrence of adverse impacts and required mitigation actions. However, this schedule is subject to change depending on the analysis results obtained. The protocol for changing the monitoring schedule is given below.

8.4.3.1 Tree Plantation

The 75% survival rate of re-plantation shall be monitored on the first year of the operation phase. If the survival rate is found below 75%, survival rate monitoring shall be again taken up after 3 years. This cycle should continue until the 75% survival rate is achieved.

8.4.3.2 Terrestrial and Aquatic Fauna including Fisheries

The fish productivity monitoring are important and sensitive issues. In case, any significant decline in terms of fish productivity in the khals/canals or ponds is noticed, the monitoring frequency shall be increased until the effectiveness of mitigation measures is established.

8.4.3.3 Soil Erosion and Drainage Congestion

No significant soil erosion problem is anticipated due to the project either in the construction phase or in the operation phase. However, in the construction phase, some localized soil erosion may be noticed owing to construction activities. However, if soil erosion is noticed during construction and operation phase, the corrective action shall be initiated and frequency of check be increased to assess the tendency of occurrence.

8.4.3.4 Air and Noise Quality

Due to the variability of the construction activities, type of construction activity and other anthropogenic influences, the ambient air quality of the project area may change. If the air quality with respect to any parameter exceeds by more than 25% of its last monitored value, the monitoring frequency shall be doubled and cause of the increase investigated. If the construction activities are found to be the reason for this increase, suitable measures should be adopted.

Similarly, due to the variability in traffic movement, namely changes in traffic volume, traffic compositions and other anthropogenic influences, the noise quality in the project area is likely to change. If the noise quality exceeds by 20% of the applicable ambient noise quality standard or 5% of its last monitored value, the monitoring frequency shall be increased and the cause of the increase investigated. If the construction activities are found to be the reason for this increase, suitable measures should be adopted.

8.4.3.5 Water Quality

In the construction phase, the monitored values for pH, BOD, COD, TDS, DO and Oil and Grease might change owing to construction activities. Hence, it is suggested that if the monitored value for any water quality parameter exceeds by more than 20% of its last monitored status the monitoring frequency shall be increased. If the construction activities are found to be the reason for this increase, suitable measures should be adopted.

8.5 EMP Implementation Schedule

An implementation schedule has been prepared based on the environmental components that may be affected during the construction and operation of the project. Since project is likely to have impact on various components of environment, a comprehensive EMP implementation schedule covering terrestrial and aquatic ecology, soil erosion, drainage congestion, tree plantation, air quality, noise, and vibration are provided in **Table 8-2**. Monitoring Plan has been suggested for pre-construction, construction and operation phase in **Table 8-1.**

Table 8-2: EMP Implementation Schedule

Environmental Issue	EMP	Timeline		
		Pre-Const'n (6-months)	Construction Phase (42 months)	Operation Phase (36 months)
Technical Support	Updating of environmental guidelines and performance indicators			
Flora	Tree cutting along the RoW			
	Compensatory afforestation (Minimum 1:2)			
Fauna	Monitoring of impacts on terrestrial fauna			
	Monitoring of impacts on fishes and aquatic mammals			
Establishments	Construction Stage			
Drainage Congestion	Provision of adequate opening			
	Monitoring analysis of drainage congestion			
Erosion, Sedimentation and Soil	Bank protection measures			
	Soil conservation			
	Monitoring of soil erosion			
Land	Compensation against land acquisition			
	Landscaping on approach road and service areas			
Slope/ Embankment protection at approach Road	Turfing of embankment with grasses and herbs			
	Embankment protection of the approach road			
Water and	Monitoring of Surface Water Quality			

Environmental Issue	EMP	Timeline		
		Pre-Const'n (6-months)	Construction Phase (42 months)	Operation Phase (36 months)
Drinking Water Supply	Monitoring of Ground Water Quality and Levels			
	Installation of oil and grease traps at construction sites			
	Construction of soak pits at construction and rehabilitation sites			
	Ensuring arsenic free drinking water for construction camps			
Air Quality and Dust Management	Monitoring of Ambient Air Quality			
	Water Spraying/ Watering			
Construction Safety	Provision of PPEs			
Health Issues	Health Check-up Camps			
Noise Level and Barriers	Monitoring of Noise and Vibration			
	Provision of Noise Barriers			
Tree cutting and Plantation	Monitoring of Tree Felling and Plantation			
	Maintenance of tree			
Training	Environmental training and Awareness			
Management Information System				

8.6 Environmental Budget

The Contractor will allocate a separate budget for environmental management plan implementation, training, environmental monitoring, analysis and reporting, verification monitoring and capacity building. It should be noted that cost for many in-built mitigation measures, such as drainage network, bank protection, embankment, dust management, traffic management and construction safety etc., are already included in the construction cost estimate and/or operating cost estimates. The environmental monitoring budget estimates for the construction and operation phase of the project has been provided in **Table 8-3**. The overall costs of the EMP will comprise:

- Environmental monitoring through sample collection and analysis;
- Any remedial measures necessary to reduce or avoid environmental damage;
- Designing and implementing all mitigating and enhancement measures;
- Supervision staff from RHD and consultants including direct costs and travel subsistence.

The total budget is estimated as BDT. 97.69 million or 1.15 million USD.

Table 8-3: Environmental Budget for CCHIP

Component	Item	Unit	Quantity	Unit Rate (in BDT)	Total Rate (in BDT)	Amount (million BDT)
Pre-Construction Stage						
Technical Support	Updating of Environmental guidelines and performance indicators	Lump sum	-	-	600,000	0.60
Air Quality	Measuring air quality	No.	5	20,000	100,000	0.10
Noise	Measuring ambient noise level	No.	10	2,000	20,000	0.02
Vibration	Measuring Vibration Level	No.	10	4,000	40,000	0.04
Flora	Clearing of Roadside plantation	No. of trees	-	Covered in Eng. cost		-
Water Quality	Surface water quality measurement	No.	3	10,000	30,000	0.03
	Groundwater quality measurement	No.	3	10,000	30,000	0.03
Land acquisition and resettlement	Compensation against land acquisition	Covered under Resettlement Implementation budget			-	-
	Sub-Total (Pre-Construction Stage)				**820,000**	**0.82**
Construction Stage						
Air Quality	Measuring air quality (2 locations per site x 5 sites x quarterly x 3.5 years)	No.	140	20,000	2,800,000	2.8

Component	Item	Unit	Quantity	Unit Rate (in BDT)	Total Rate (in BDT)	Amount (million BDT)
Noise	Measuring ambient noise level (2 locations per site x 5 sites x quarterly x 3.5 years)	No.	140	2,000	280,000	0.28
Vibration	Measuring vibration level (2 locations per site x 5 sites x quarterly x 3.5 years)	No.	140	4,000	560,000	0.56
Flora / tree plantation	Clearing of roadside plantation	No.	Covered under Engineering cost			-
	Compensatory afforestation (Minimum 1:2) (Plantation and maintenance for two year)	No.	171,000	300/tree	51, 300, 000	51.30
Water Quality	Surface water quality measurement (2 locations per site x 5 sites x quarterly x 3.5 years)	No.	140	10,000	1,400,000	1.4
	Groundwater quality measurement (1 location per site x 5 sites x quarterly x 3.5 years)	No.	70	10,000	700,000	0.7
	Installation of oil and grease traps at construction sites @ 1 per site	No.	5	80,000	400,000	0.4
	Construction of soak pits at construction sites @ 2 per construction camp	No.	10	50,000	500,000	0.5
Drainage Congestion	Provision of adequate opening	Covered in Engineering Cost			-	-
Erosion and Sedimentation	Riverbank protection measures	Covered in Engineering Cost			-	-
Soil	Maintenance cost in soil conservation	Covered in Engineering Cost			-	-
Slope /Embankment protection at	Turfing of embankment with grasses and herbs	Covered in Engineering Cost			-	-

Component	Item	Unit	Quantity	Unit Rate (in BDT)	Total Rate (in BDT)	Amount (million BDT)
approach Road						
Dust Management	Water sprayer / watering	Covered in Engineering Cost			-	-
Waste disposal and management	Disposal and management of construction waste	Lump sum	-	-	5,000,000	5.0
Construction Safety	Accident risks in construction activity	Covered in Engineering Cost/Insurance				
	General Safety (provision of PPE like earmuffs, gloves etc.)	Lump sum	-	-	500,000	0.5
Health	Health check-up camps for construction workers	Camps	Lump sum	-	1,000,000	1.0
Ecological Monitoring	Monitoring Tree Felling and Plantation	Lump sum	Lump sum	-	1,200,000	1.2
	Terrestrial and aquatic Fauna Fisheries	Lump sum	Lump sum	-	1,500,000	1.5
	Sub-Total (Construction Stage)				**67,140,000**	**67**
Operation Stage						
Air Quality	Monitoring air quality (1 per year/site for 3 years)	No.	15	20,000	300,000	0.3
Noise	Monitoring ambient noise level (1 per year/site for 3 years)	No.	15	2,000	30,000	0.03
Vibration	Monitoring Vibration level (1 per year/site for 3 years)	No.	15	4,000	60,000	0.06
Water	Monitoring surface water quality (1 per year/site for 3 years)	No.	12	10,000	120,000	0.12
Tree survival	Provision of additional tree plantation (Plantation and maintenance for two year)	No. of trees	171,000	100/tree	17,100,000	17.10
Fisheries	Fish productivity, breeding and spawning	Lump sum	-	-	1,000,000	1.0

Component	Item	Unit	Quantity	Unit Rate (in BDT)	Total Rate (in BDT)	Amount (million BDT)
Monitoring of performance indicators	Monitoring tree felling and plantation	Lump sum	-	-	500,000	0.5
	Monitoring of waste disposal and management	Lump sum	-	-	500,000	0.5
	Sub-Total (Operation Stage)				**17,100,000**	**17**
Training						
Training	Environmental training and awareness	Lump sum	-	-	15,00,000	1.5
Management Information System		Lump sum	-	-	500,000	0.5
Sub-Total (Establishment and Training)					**20,00,000**	**2.0**
Sub-Total (Pre-construction, Construction, Operation and training)					**87,060,000**	**87**
Contingencies@ 10 % on total Environmental Costs					**8,706,000**	**8.7**
Grand Total (in BDT)					**95,766,000**	**95.76**
Grand Total (in US$) @ US$= 85.0 BDT					**1.126 million USD**	

8.7 Institutional Arrangement, Capacity Building and Grievance Redress Mechanism

8.7.1 Institutional Arrangement

The effective implementation and operation of the EMP depend on the regular monitoring of environmental and social components in the proposed project area. The Environmental Management Plan (EMP) implementation requires an organization support structure in the form of organizational requirements, training needs and plan, and information management system. The following section captures these institutional arrangements for EMP implementation by concerned officials of RHD, their consultants and working contractors.

The organizational structure of RHD is given in **Figure 8-1**. However, an organizational structure shall be developed at the corporate, regional and site level to aid effective implementation of the EMP document. Various departments will be involved during implementation of the project as shown in **Figure 8-2**. Contractor is responsible for implementation of EMP during works and Construction Supervision Consultant (CSC) is primarily responsible for supervision of monitoring of the implementation of the EMP. RHD will be supported by a Management Consultant (MC) to advise and assist RHD in quality and capacity enhancement and independent quality monitoring. Contractor will be responsible for implementation of EMP during work activities stage. Relevant departments responsible for implementation and supervision of proposed mitigation and monitoring measures are given in the EMP.

CSC will be responsible to monitor all activities of all contractors procured under the project. As several contractors will be working simultaneously for timely and speedy implementation of the project, it is important that CSC has an environmental unit to effectively supervise and monitor the environmental activities being implemented in the field. The CSC is also responsible to update or make necessary changes to the EMP if required based on the revised designs and locations. A combined grievance redress committee is proposed to address grievances in both social and environmental issues. In addition, there will be NGOs working for plantation program and environmental awareness.

Figure 8-1: Organization Structure of RHD

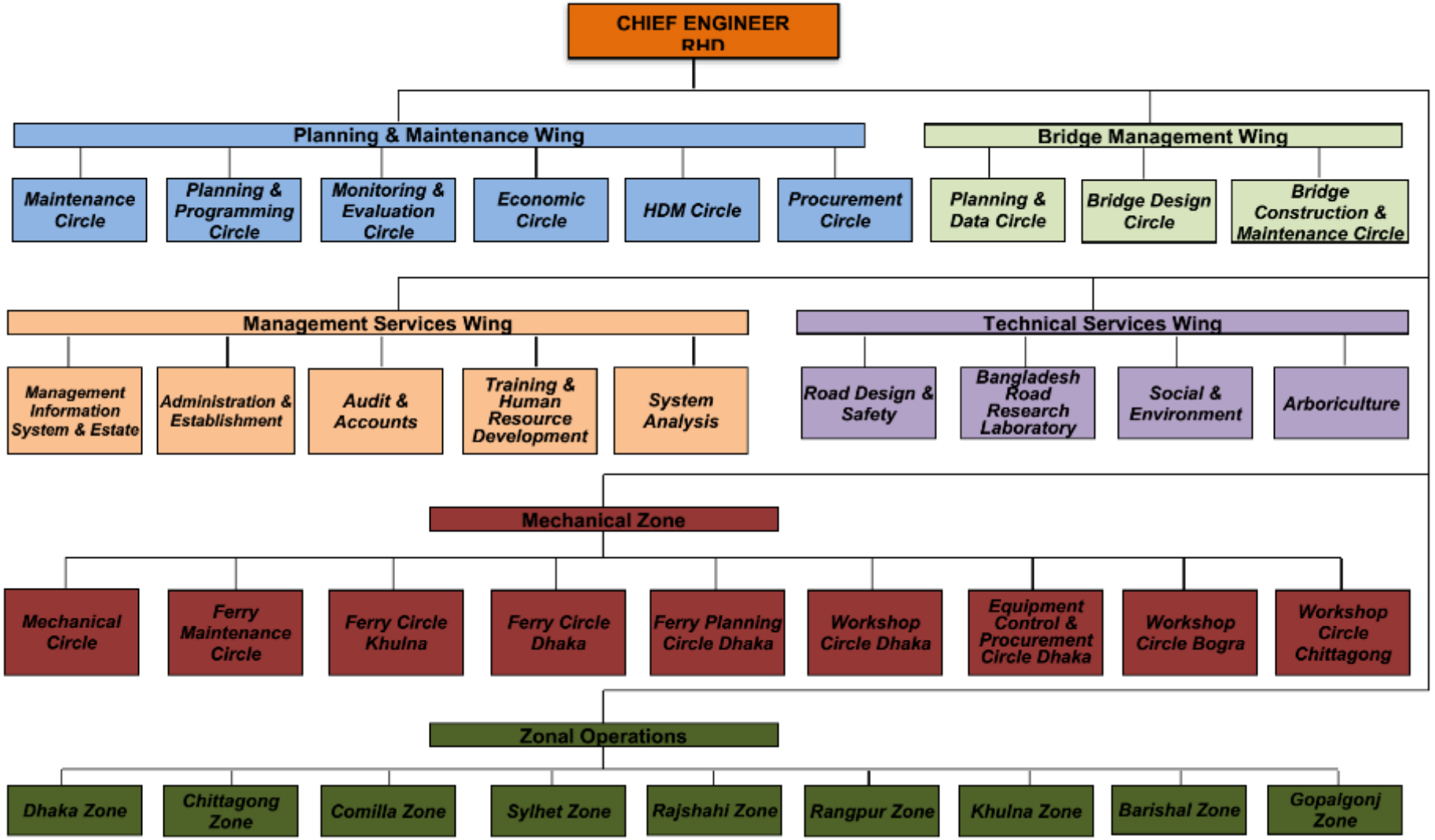
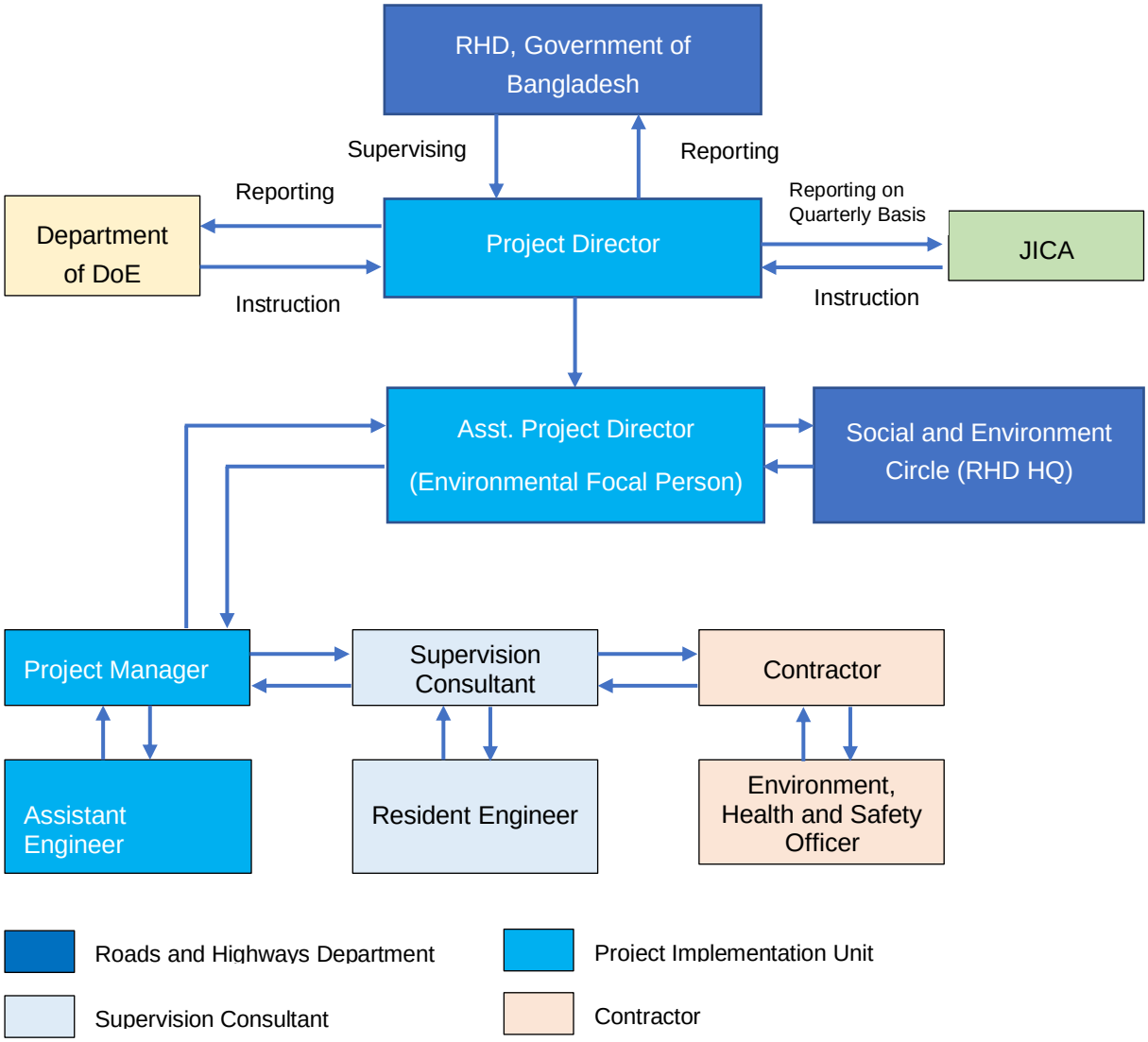


Figure 8-2: Proposed Organisation Structure for CCHIP Project



8.7.2 Institutional Roles and Responsibilities

As the project developer, the RHD has the responsibility to ensure that the project follows the legal requirements for environmental assessment. The RHD has an Environmental and Social Circle (ESC) headed by the Superintending Engineer who is supported by the Executive Engineer, Subdivision Engineer, Assistant Engineer and Sub-assistant Engineer.

Project Implementation Units (PIU) will be responsible for implementing the project. PIU is headed by a Project Director (PD) who is supported by Additional Project Directors (APD). At the site level there will be a Project Managers (PM). PM will be further supported by Deputy PM, Assistant Engineers and Sub Assistant Engineers.

The APD will serve as the environmental focal persons under the PIU. One of Assistant Engineers serve as the environmental focal person at the site level and support the APD on environment safeguard matters. Further the Supervision Consultant (SC) responsible for supervising the civil works contractor will provide support to the respective PIU for day to day monitoring and reporting on environment safeguards. The following **Table 8-4** elaborates the detailed responsibilities on environment safeguards of the project.

Table 8-4: Functions and Responsibilities of different Agencies on Environmental Safeguard of the CCHIP Project

Department/Agency/ Consultant	Duties and Responsibility
Roads and Highways Department (RHD)	As the Executing Agency, RHD will be responsible for ensuring that all the environment safeguard requirements as provided in the Framework Financing Agreement (FFA), and the respective EMP are complied with.
RHD (Environment and Social Cell)	The RHD Environment and Social Cell (ESC) is responsible for managing environment and social safeguards including safeguards related capacity building for all RHD projects. They will not be involved in the day to day implementation of safeguards for specific projects such as this investment program. The respective PIU will seek their support and advise on an as needed basis. Their overall responsibilities are: • Ensure that all RHD works and projects are executed in accordance with appropriate environmental and social standards and practices. • Liaise with GoB organizations and other line agencies to ensure effective interagency cooperation on relevant projects. • Ensure the provision or procurement of the necessary services for carrying out Environmental Assessment, Land acquisition and Resettlement studies. • Disseminate the need for high social and environmental standards throughout RHD and to the concerned public through research, publicity, seminars and training. • Coordination the preparation and implementation of environmental and resettlement management plans for RHD projects as needed. • Monitor long-term, cumulative environmental impacts and ensure mitigation measures for project sustainability. • Conduct site inspections on selected RHD projects as needed • Provide feedback on all environmental issues of existing and ongoing RHD projects and works. • Review and preparation of Request for Proposal (RFP) and tender documents for procurement of Environmental Services (IEE, EIA and EMP) for RHD projects. • Assist the Director of RHD Training Centre in providing training to RHD officers in Environmental and Resettlement issues. • Review and approve the Environmental Assessment reports and Environmental Monitoring reports produced by consultants/experts under RHD projects as needed. • Establish and maintain environmental standards, guidelines and manuals in RHD. • Identify environmental issues and constraints at project planning stage, suggest alternatives, options. • Establish a reference library, containing relevant environmental documents (hard and soft copies) of domestic and overseas sources.

Department/Agency/ Consultant	Duties and Responsibility
	• Monitor long term environmental impacts on relevant RHD Projects • Liaise with Road Safety Circle, Arboriculture Head and maintain intra-departmental co-ordination.
PIU (Environmental Focal Persons at Project Head Quarter and Site level)	• Prepare or engage consultants to prepare environmental assessment reports (IEE, EIA, EMP) for project components as necessary • Review and comment on the environmental assessment reports and environmental monitoring reports prepared by consultants and ensure they are prepared in accordance with requirements of RHD, DOE and JICA • Ensure that the consultants while carrying out work at site follow the environmental standards, guidelines and manual of RHD. • Take necessary steps to ensure timely receipt of DoE Environmental Clearance • Ensure that the EMP and relevant environmental clauses are included in the contractors bidding documents • Conduct spot checks on-site to monitor contractor's compliance with the EMP • Review and endorse quarterly monitoring reports prepared by the SC • Review and endorse annual environmental monitoring reports prepared by the SC for further submission to JICA • If there are any non-compliance issues or unanticipated environmental impacts ensure that necessary corrective actions are taken and IEE and/or EMP is updated as necessary • Ensure that all grievances and complaints received are addressed in a timely manner and properly documented • Carry out all other activities on environment safeguards on behalf of the PIU as needed
Supervision Consultant (Environment Safeguards Team)	The proposed framework for implementation of the project shall utilize consultancy services from both international and national companies for the overall management and supervision of construction work on behalf of the EA. In addition to supervising the construction work of the contractor their role will be to check on conformity with the relevant clauses in construction contracts and national legislation and regulations. The following are the detailed responsibilities of the SC. • Review the EMPs of project to understand the context and environmental issues of the project • Establish monitoring and reporting protocols within the environment safeguards team at the site level and project headquarter level • Require the civil works contractor to prepare sub-plans on environment safeguards such as camp layout plan, borrow area management plan, construction debris management plan, traffic management plan etc. as needed

Department/Agency/ Consultant	Duties and Responsibility
	• Review and approve all sub-plans on environment safeguards submitted by the civil works contractor • Conduct regular (minimum of weekly) onsite inspections on implementation of the EMP by the contractor • Ensure the contractor obtains all clearances, permits etc. related to environment safeguards on a timely basis • Ensure the contract collects required environmental monitoring data (air, water, noise) as stipulated in the EIA report • Provide on-site technical advice and training to the contractor as needed • Organize training workshops on implementation of environment safeguards for the project team including PIU, RHD site offices, members of the SC and civil works contractor • Facilitate proper functioning of the grievance redress mechanism and maintain records of all complaints received and actions taken for inclusion in the environmental monitoring reports • If there are any non-compliance issues or unanticipated environmental impacts ensure that necessary corrective actions are taken and update the EIA and/or EMP as necessary • Review and approve the monthly progress reports submitted by the contractor • Based on monthly progress reports submitted by the contractor and site inspections prepare quarterly environmental monitoring reports for review and approval by the PIU • Based on the quarterly monitoring reports prepare annual environmental monitoring reports for review and approval by the PIU and further submission to JICA • Provide necessary technical support to the PIU on implementation of environment safeguards
Contractor (Environment Safeguards Team)	The tender for the construction of the project would be national/international competitive bidding contractors. The Contractor is legally mandated to implement the EMP and EMoP and obtain all environment related permits and clearances required for construction. The detailed responsibilities of the contractor on environment safeguards are the following: • Recruit and appoint environmental focal persons and/or environmental health and safety officers on the construction site • The contractor shall comply with all statutes and regulations concerning the execution of works as mentioned in DoE and RHD environmental guidelines. • The contractor shall be responsible for familiarizing himself with all legislation elating to environmental protection that is relevant to his activities. Reference to rational environmental quality guidelines should be made. • Implement the EMP approved by the SC

Department/Agency/ Consultant	Duties and Responsibility
	• Prepare all sub-plans related environment safeguards such as camp layout plan, borrow area management plan, construction debris management plan, traffic management plan etc. as needed and submit for approval by the SC • Obtain all statutory clearances and permits on environment safeguards in a timely manner • Conduct environmental quality monitoring (air, noise, water) as stipulated in the Environmental Monitoring Plan of the EIA report • Take necessary measures to immediately address any complaints or grievances raised by local community or other stakeholders • Prepare monthly progress reports on implementation of the EMP for approval by the SC • The contractor shall be responsible for the costs of cleaning up any environmental pollution resulting from his activities if methods for doing so are available and effective.
Japan International Cooperation Agency (JICA)	As a funding agency JICA is responsible for monitoring implementation of environment safeguards, providing technical guidance to the EA as necessary. Specific responsibilities entail the following: • Review EIA report including EMP provide feedback and disclose the report on the RHD website as required by the JICA; • Provide assistance to RHD, if required, in carrying out its responsibilities and for building capacity for safeguard compliance; • Monitor overall compliance of the project through review missions; • Review all environmental monitoring reports submitted by RHD, provide feedback and disclose the reports • Provide guidance to the RHD and the PIU on issues related to inclusion of new components, changes in component design, occurrence of unanticipated environmental impacts during component implementation, emergency situations and others as necessary.
Department of Environment (DoE)	The designated institution for overseeing environmental management in Bangladesh is the Department of Environment (DoE). The DoE is responsible for ensuring that EIA is carried out following the requirements of the Environmental Conservation Act (1995) and Rules (1997). DoE will ensure that project work abides by the environmental laws, rules and procedures, with overall direction given by them.
Forest Department (FD)	The Forest Department (FD) sometimes requires authorization for the cutting of trees, especially if they are in specially planted areas and forest area under their jurisdiction. The proposed project will require both forest and planted tree cutting. To obtain the correct clearance documentation can be time consuming, although with the proposed project tree planting programs there will be far more tree cover as a result of the project. It is thus vital to ensure that adequate time is made available to obtain the required clearance. As for the FD, it is vital to ensure that adequate time is

Department/Agency/ Consultant	Duties and Responsibility
	made available in the program for obtaining any such clearance that may be required.

8.7.3 Reporting Requirements

Three types of environmental reports will be submitted to the Client (RHD) and funding agency (JICA) in English, containing air, noise, and water quality data, maps, diagrams, plans, tables, etc. All environmental data should be reflected in the Reports. The following reports are required to prepare during the construction stage of the project.

- Monthly Environmental Report
- Quarterly Environmental Report
- Annual Environmental Report

a. Monthly Environmental Inspection Report

During the construction period, environmental reporting will be required monthly, which will be prepared by the contractor. The monthly reports will consist of a completed environmental compliance checklist developed using the EMP and approved by the SC such that actions necessary for each relevant mitigative action are identified and a summary of all actions recorded. Where a monthly report is coincident with a quarterly and annual report, such monthly report shall be required but may be included with the respective quarterly and annual report.

b. Quarterly Environmental Compliance Report

During the construction period, environmental inspections and reporting will be prepared quarterly by the contractor. The quarterly report shall consist of a completed environmental compliance checklist developed using the EMP and approved by the SC together with a summary of significant items from the current and previous two monthly reports with an indication of trends, either positively or negatively. The EIA contains mandatory sampling specifications that the contractor will be required to adhere to. Quarterly report is coincident with the annual report, such quarterly report shall be required but may be included with the respective annual report.

c. Annual Monitoring Report

During the construction period, the Contractor will prepare an Annual Report to include details of all environment related activities together with a summary of all tests and monitoring activities and conclusions to include assessment of effectiveness of current monitoring activities, possible changes in construction methodologies and any other thing(s) which may contribute to a reduction in environmental impact. This report is mandatory and must be submitted to RHD.

8.7.4 Capacity Building

In Bangladesh, the environmental assessment process is established, but environmental awareness and capability for implementation of EMP in infrastructure projects are still developing. The project implementation unit (PIU) of RHD had some officers in the environmental and social circle department (ESC) that are delegated environmental duties. The delegated officers have responsibility to bring environmental issues to the notice of senior management. Typically, the delegated officers have been moved to different departments due to promotions and operational needs after about every 3 years, and they move on to other engineering departments in RHD. The status quo is that ESC engineering officers are delegated to check environmental assessments prepared by consultants. The EIA and EMP are referred to the DoE in the Ministry of Environment Forests and Climate Change (MOEFCC) for approval. The ESC in RHD is not directly involved with project implementation but has more administrative responsibility to ensure environmental compliance and a general role to increase

environmental awareness for RHD. It is therefore not clear if RHD/ESC has the capacity to check the adequacy of the developed EMP for this project.

The most significant challenge for environmental management on this project is the lack of human and financial resources and necessary infrastructure in PIU. To enhance the capacity of the RHD Environmental and Social Circle and PIU for effective implementation of proposed mitigation measures and monitoring the resultant effect, some training programs and awareness workshop are proposed. The detailed training plan is provided at **Table 8-5**.

Table 8-5: Training Plan

Target Group	Subject(s)	Method	Time Frame
Planning and Construction Stage			
All concerned PIU/RHD project staff	**Environmental Overview:** Environmental regulations, and national standards, process of impact assessment and identification of mitigation measures, importance of EMP and monitoring, and monitoring methodology	Presentation and Lectures	Before beginning of the implementation of the project
Environmental engineers, field officers, contractors, supervision consultants	**Implementation of EMPs:** Basic features of an EMP, Planning, designing and execution of environmental mitigation and enhancement measures, monitoring and evaluation of environmental conditions during construction and operation	Workshops and Seminars	Before the construction begins
Environmental Engineers, field officers, contractors, supervision consultants	**Environmentally Sound Construction Practices:** Waste management and minimization in construction, pollution control devices and methods for construction sites and equipment, Environmental clauses in contract documents and their implications, Environmental monitoring during construction	Seminars, Lectures and Site visits	Before the construction
Project staff dealing in social/lands matters	**Social awareness:** Monitoring consultants/organizations specializing in social management and monitoring can provide training on social awareness and land acquisition and resettlement issues	Lectures, Workshops and Seminars	Before the construction begins
Environmental engineers, field officers, contractors, supervision consultants	**Monitoring Environmental Performance during Construction:** Monitoring Air, Water, Soil Erosion, Noise, and effect on wildlife and fisheries, Evaluation and Review of results, Performance indicators and	Lectures, Workshop and site visits	During initial phases of construction

Target Group	Subject(s)	Method	Time Frame
	their applicability, possible corrective actions, reporting requirements and mechanisms		
Contractor's staff, construction labourers	**Occupational Safety and Health:** Monitoring consultants/ organizations specializing in occupational, health and safety issues can provide training on this issue	Workshops and seminars	During initial phases of construction
Construction labourers	Waste handling and sanitation at construction sites/construction camps	Workshops and signage	During initial phases of construction
During Operation Phase			
General public, road and bridge users	Wildlife protection and environmental protection awareness Programme	Signage, workshops,	Construction and operation stage

8.8 Grievance Redress Mechanism

To facilitate the resolution of affected people's concerns, complaints, and grievances about the social and environmental performance of the project, a Grievance Redress Mechanism (GRM) is established which aims to provide a time bound and transparent mechanism to voice and resolve social and environmental concerns.

Grievances related to the implementation of the project, particularly regarding the environmental management plan will be acknowledged, evaluated, and responded to the complainant with corrective actions proposed using understandable and transparent processes that are gender responsive, culturally appropriate, and readily accessible to all segments of the affected people. The responsibility for addressing the grievances along with proper timelines will be clearly indicated. Records of grievances received, corrective actions taken and their outcomes will be properly maintained and form part of the environmental monitoring report for submission to JICA.

The Project Implementation Unit (PIU) of RHD shall make the public aware of the GRM with the support of SC through methods such as public awareness campaigns. Grievances can be filed in writing or by phone with any member of the PIU or SC. The following steps procedures will be followed under the GRM.

First tier of GRM: The Site Project Manager (PM) under the PIU shall be the designated officer for grievance redress at the first tier. Resolution of complaints will be done within 7 working days. Investigation of grievances will involve site visits and consultations with relevant parties (e.g., affected persons, contractors, traffic police, etc.) Grievances will be documented and personal details (name, address, date of complaint, etc.) will be included, unless anonymity is requested. A tracking number shall be assigned for each grievance, including the following elements:

- initial grievance sheet (including the description of the grievance), with an acknowledgement of receipt handed back to the complainant when the complaint is registered;
- grievance monitoring sheet, mentioning actions taken (investigation, corrective measures); and
- closure sheet, one copy of which will be handed to the complainant after he/she has agreed to the resolution and signed off.

The updated register of grievances and complaints will be available to the public at the PM office, construction site, and other key public offices along the project area. Should the grievance remain unresolved within 7 working days, it will be elevated to the second tier.

Second tier of GRM: The site level PM will activate the second tier of GRM by referring the unresolved issue (with written documentation). The GRC shall be established by the PIU before commencement of site works. The GRC will consist of the following persons: (i) project director; (ii) representative of city/union ward; (iii) representative of the affected persons; (iv) representative of the local deputy commissioner's office (land); and (v) representative of the Department of Environment (DoE) for environmental related grievances. A hearing will be called with the GRC, if necessary, where the affected person can present his or her concerns and issues. The process will facilitate resolution through mediation. The local GRC will meet as necessary when there are grievances to be addressed. The local GRC will suggest corrective measures at the field level and assign clear responsibilities for implementing its decision within 15 working days.

The contractor will have observer status on the committee. If unsatisfied with the decision, the existence of the GRC shall not impede the complainant's access to the government's judicial or administrative remedies.

The functions of the local GRC are as follows: (i) resolve problems and provide support to affected persons arising from various environmental issues, including dust, noise, utilities, power and water supply, waste disposal, traffic interference, and public safety, as well as social issues such as land acquisition, asset acquisition, and eligibility for entitlements, compensation, and assistance; (ii) reconfirm grievances of displaced persons, categorize and prioritize them, and aim to provide solutions within a month; and (iii) report to the aggrieved parties about developments regarding their grievances and decisions of the GRC.

The respective APD and PM will be responsible for processing and placing all papers before the GRC, maintaining database of complaints, recording decisions, issuing minutes of the meetings, and monitoring to see that formal orders are issued and the decisions carried out.

Third tier of GRM: In the event that a grievance cannot be resolved directly by the Project Implementation Unit (PIU) (first tier) or GRC (second tier), the affected person can seek alternative redress through the city ward committees or in appropriate courts. The PIU or GRC will be kept informed by the city mayor/union authority.

The monitoring reports of the EMP and the resettlement plan implementation shall include the following aspects pertaining to progress on grievances: (i) number of cases registered with the GRC, level of jurisdiction (first, second, and third tiers), number of hearings held, decisions made, and the status of pending cases; and (ii) lists of cases in process and already decided upon, which may be prepared with details such as name, identification (I.D.) with unique serial number, date of notice, date of application, date of hearing, decisions, remarks, actions taken to resolve issues, and status of grievance (i.e., open, closed, or pending).

CHAPTER 9

Public Consultation and Disclosure

9 PUBLIC CONSULTATION AND DISCLOSURE

9.1 Introduction

Any development project has its involvement with community people who are going to be affected either in positive or negative way. It is inevitable that there will be some adverse impacts on local people. On the other hand, proper mitigation measures can reduce those impacts and can turn the project beneficial for the affected people. Therefore, it is necessary that community can fully understand the project, have the opportunity to express their views and to become directly involved in the project's overall decision-making process.

The JICA Guidelines for Environmental and Social Considerations require that consultation with interested parties and the general public will take place and their views taken into account in the planning and execution of the project. The Bangladesh legislations also requires consultation with affected parties. Overall, the objectives of public consultation and disclosure include:

- To explain the proposed development project to the local community;
- Obtaining reliable local information of conditions and issues that may affect the proposal;
- To reduce conflicts amongst all stakeholders by disclosing information and giving opportunity to express their opinions;
- Increase local confidence in the proposal and to give a sense of ownership.
- To distribute the information about the baseline conditions of proposed project area;
- To disseminate the information on predicted impacts and mitigation measure for those impacts regarding the proposed project during draft report preparation stage;
- To publicize the proposed Environmental Management Plan (EMP);
- To inform about the Grievance Redress Mechanism (GRM);
- To eliminate conflict among all stakeholders by disseminating information and allowing them to express their perspectives and
- To Increase local confidence in the proposal and to give a sense of ownership.

9.2 Approach and Methodology for Consultation

Several types of consultations, including Public Consultation Meeting (PCM), Focus Group Discussion (FGD), and Key Informant Interview (KII) have been conducted in participation of project affected people, local residents, beneficiaries, government and non-government officials, vulnerable groups like women, senior citizen, representatives of local governments, public representatives, etc. The PCM was conducted in two stages, i.e. (i) during impact assessment stage to inform about project and to obtain their views; (ii) after completion of baseline study and impacts assessment to disclose the findings.

9.3 Stakeholder Mapping

A stakeholder is defined as "a person, group, or organization that has direct or indirect stake in a project/organization because it can affect or be affected by the Project or its Proponent's actions, objectives, and policies". Stakeholders vary in terms of degree of interest, influence and control they have over the Project or the proponent. In the present study, all the stakeholders have been primarily categorized into two categories that have been identified as:

- **Primary Stakeholders:** include people, groups, institutions that either have a direct influence on the project or are directly impacted (positively or adversely) by the project and its activities; and
- **Secondary Stakeholders:** are those who have a bearing on the project and its activities by the virtue of them being closely linked or associated with the primary stakeholders and due to the influence they have on the primary stakeholder groups.

Apart from categorization, the stakeholders have also been classified in accordance with the level of influence they have over the project as well as their priority to the project proponent in terms of importance. The influence and priority have both been primarily rates as:

- **High Influence/Priority (Manage Closely):** People who have high power and interest are grouped in this category. They always must be managed closely. This implies a high degree of influence of the stakeholder on the project in terms of participation and decision making or high priority for project proponent to engage that stakeholder.
- **Medium Influence/Priority (Keep Satisfied/ keep informed):** People who have high power but low interest as well as who have high interest, but low power should be kept satisfied or informed. This implies a moderate level of influence and participation of the stakeholder in the project as well as a priority level for project proponent to engage the stakeholder who are neither highly critical nor are insignificant in terms of influence.
- **Low Influence/Priority (Monitor with minimum effort):** This implies a low degree of influence or interest of the stakeholder on the project in terms of participation and decision making or low priority for project proponent to engage that stakeholder.

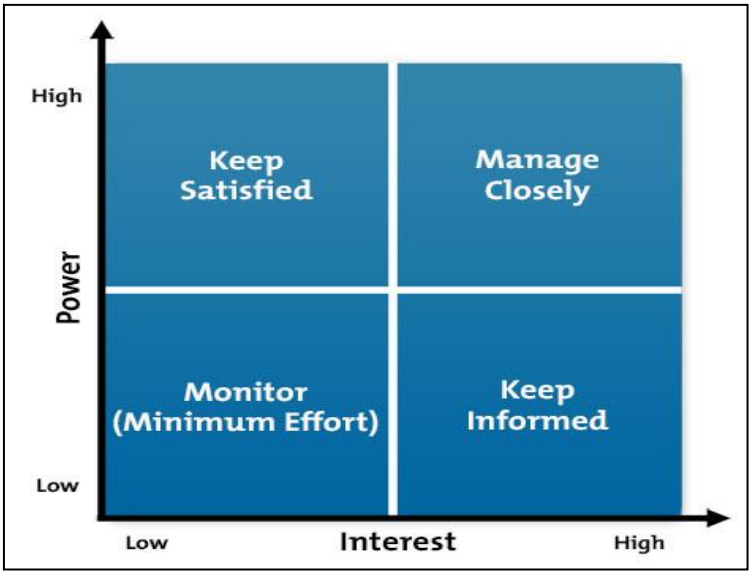


Figure 9-1: Interest Grid for Stakeholder Prioritization

How they are likely to feel about and react to the project, how best to engage them in the project and how best to communicate with them, are measured by getting answers to the following questions:

- What financial or emotional interest do they have in the outcome of the project? Is it positive or negative?
- What motivates them most of all?
- What information do they want from the project?
- How do they want to receive information? What is the best way of communication?
- What is their present opinion? Is it based on sufficient information?
- Who influences their opinions generally?
- If they are not likely to be positive, what will win them around to support the project?
- What should be done to manage stakeholders' opposition?
- Who else might be influenced by stakeholders' opinions?

Summary of the stakeholder mapping for the proposed project are given in **Table 9-1.**

Table 9-1: Stakeholder Mapping for the Project

Stakeholders	Category of Stakeholder	Brief Profile	Overall Influence on the Project	Basis of Influence Rating
Project Management				
Roads and Highways Division (RHD)	Primary	• RHD is the primary project proponent who owns a controlling stake of 100% in the project.	High	- The primary project proponents; - Responsible for all the project related risks and impact liabilities; - Primary beneficiaries; - Responsible for the entire project-related risks and impact liabilities.
Project Financiers	Primary	• Financiers at the corporate and project level of JICA for the project • May include local and regional bank, national and international banks as well as development agency	High	- Engagement is high at the corporate management level; - Key participants in the decision-making process - Compliance to funding agencies' safeguard and other policies
EPC Contractor/ Developers	Primary	• Construct to deliver a functioning facility or asset to their clients	High	- Carry out the detailed engineering design of the project - Procure all the equipment and materials necessary - Carry out the works in accordance with the guidelines
Community				
Local Community	Primary	• Primarily includes the adjacent community to the project site.	High	- They will lose their land due to land acquisition - The project will bring development to the area; - Improvement in infrastructure in the area; - Increase transport facilities, trade and commerce; - Business or economic conditions, access to health facilities, and education will be improved.
Vulnerable Groups (poor, old aged, and destitute)	Primary	• The marginal groups within the project area primarily comprise landless households as	High	- Employment opportunity during the pre-construction and construction phase; - Compensation should not be subjected to gender or any kind of discrimination;

Stakeholders	Category of Stakeholder	Brief Profile	Overall Influence on the Project	Basis of Influence Rating
		a result of the land loss, households below the poverty threshold, women-headed households, old aged and destitute.		- Prioritization for getting further assistance if any.
Fishermen	Secondary	• Fishermen in the area are primarily engaging in small-scale fishing in the river.	Low	- Low scale for self-consumption and selling;
Local and Migrant workers/ laborers	Primary	• Laborers and workers were recruited from inside and outside of the area of influence during the pre-construction and construction phase of the project.	Medium	- Responsible for undertaking mostly un-skill and semiskilled based work during the pre-construction and construction phase of the project; - Engagement level primary in the civil construction part of the work.
Regulatory/Administrative Authorities and Agencies				
Department of Environment (DOE), Bangladesh	Primary	• The Department of Environment (DOE) is the primary government regulatory authority for environmental protection in Bangladesh.	High	- Government Regulatory agency to provide Environmental Clearance (EC) to the project based on evaluation and approval of the Environmental Impact Assessment (EIA) study; - Responsible for monitoring the project's Environmental compliance throughout the project lifecycle; - High influence and high interest.
Department of Agriculture Extension (DAE)	Secondary	• DAE is responsible for agricultural development.	High	- High influence and high interest.

Stakeholders	Category of Stakeholder	Brief Profile	Overall Influence on the Project	Basis of Influence Rating
Department of Fisheries (DoF)	Secondary	• DoF is responsible for fisheries development, conservation, maintenance of the fish sanctuary.	Low	- Minor influence on project-related activities;
Department of Social Welfare	Secondary	• The local governmental agency is responsible for the implementation of government social welfare schemes.	Low	- Minor influence on project-related activities; - However, participation level and influence may increase in case community welfare activities proposed by the project proponent are implemented in coordination with this agency.
Upazila Bit/Range Office of Forest	Secondary	• Local government agency responsible for the protection and maintenance of forests and wildlife	High	- High influence and high interest regarding protection and maintenance of forests and wildlife
Other Regulatory and Permitting Authorities	Primary	-	High	- Primary involvement during the pre-construction, construction, and operation phases.
Political Administration				
Thana/Upazila Political Administration	Secondary	• Elected representative of people at Thana/Upazila level for a fixed tenure.	Medium	- The key linkage between the community and the project proponent; - Low interest with high influence.
Ward leaders and local representatives	Primary	• An elected representative at ward level for a fixed tenure.	Medium	- Issuance of no objection certificate as the representative of the local level representative; - Plays an important role in providing public opinion and sentiment on the project; - Empowered to provide consent and authorization for the establishment of the project on behalf of the community.

Stakeholders	Category of Stakeholder	Brief Profile	Overall Influence on the Project	Basis of Influence Rating
Other Institutional Stakeholders Groups				
Non-government Organization (NGO)	Primary	• Appointed for compensation disbursement and resettlement implementation	High	- Major involvement in the project during Resettlement implementation. - High influence with high interest
Printed and Electronic Media	Secondary	• National and Local Newspaper, Online portals, TV Channels	Medium	- Public watchdog on the project-related activities; - Minor influence on the project.

9.4 Information Disclosure and Consultation

Numbers of consultation were conducted during the field visit, baseline data collection and disclosure stage for EIA study. The stakeholders were consulted including local people, the community in the vicinity of the project area, local elected representatives and government officials. The details of consultations held with issues raised or discussed and suggestions provided by the respective stakeholders are presented in the following sub-sections.

A combination of mixed methods of information disclosure and consultation process was adopted at this stage of EIA preparation. The method selected for consultation was designed keeping in mind the profile of the stakeholders, types of information desired, and the level of engagement required. In each consultation session during disclosure, the consultant introduced themselves, introduced the project as well as the predicted impacts, mitigation measure, and management plan and the purpose of engagement with the respective stakeholder. The primary methods followed in the consultation process are:

- Key Informant Interview (KII);
- Focus Group Discussion (FGD); and
- Public Consultation.

9.4.1 First Round Public Consultation Meetings

The objective of the meeting was to inform and obtain opinions of the community about the proposed Chattogram-Cox's Bazar Highway Improvement Project (CCHIP), particularly about Chakaria Bypass and the ongoing Environmental Impact Assessment (EIA) study.

9.4.1.1 Details of the Meeting

A total of five PCMs have been conducted in first round stage of the meeting, including one meeting in each bottleneck point. **Table 9-2** shows the details of the meetings, including their venues, time, date, and types of participants. All meetings were conducted in participation of project affected people, beneficiaries, local residents, representative of local governments, public leaders, government and non-government officials, etc. List of invitees, invitation letter, participants list, photographs and presentation materials of the PCMs are given in **Appendix H-1** to **Appendix H-10**.

Table 9-2: Details of first round public consultation meetings

No.	Date	Venue	Time	Types of Participants
1	January 27, 2021	Chakaria Pourasova, Cox's Bazar	10:00 AM–01:00 PM	• MP, local leaders, project affected people, local residents, businessmen, shop owners, teachers, farmers, housewives, service holders, remittance earners, politicians, imams, students, hawkers, rickshaw pullers, drivers, etc.
2	January 27, 2021	Amirabad UP Auditorium, Lohagara, Chattogram	03:00 PM-05:00 PM	• Representatives of local government, public leaders, project affected people, local residents, women, elderly people, government and non-government employees, etc.
3	January 28, 2021	Keochia UP Auditorium, Satkania, Chattogram	10:00 AM-12:00 PM	• Representatives of local government, public leaders, project affected people, project beneficiaries, local residents, women, elderly people, government and non-government employees, etc.

No.	Date	Venue	Time	Types of Participants
4	January 28, 2021	Kaliais UP Auditorium, Satkania, Chattogram	03:00 PM-05:00 PM	• Representatives of local government, public leaders, project affected people, project beneficiaries, local residents, women, elderly people, government and non-government employees, etc.
5	January 31, 2021	Four Star Convention Hall, Patiya, Chattogram	10:00 AM-01:30 PM	• Representatives of local government, public leaders, project affected people, project beneficiaries, local residents, women, elderly people, government and non-government employees, etc.

9.4.1.2 Overview of the Meetings

At first, a presentation was showed describing the objectives and particulars of the project. The presentation includes the maps of the route alignments of all four bypasses and one flyover, locations of environmental baseline survey, scope of EIA study, deadline of the study, and scope of the study related to land acquisition and resettlement by other consultants. In the presentation, the importance of the project and ongoing studies were described by the EQMS consultants. The detail information about the EIA study, its scope and objectives, deadline were also described. The presentation explained that this meeting is being conducted to inform about the study and obtained opinions and questions from public regarding potential environmental and social impacts. The presentation also informed that a second stage consultation meeting (probably in March 2021) will be conducted to disclose the findings of the study as well as environmental management plan. After the presentation, a question-and-answer session was held, which is summarized in Table 5 below. A range of questions and opinions were raised from participants and all of their questions were answered properly. The questions were answered by EQMS consultants, and in some case, by Nippon Koei representative (in Keranihat, Dohazari, and Patiya) and KMC representative (in Patiya) who were present in the meeting.

9.4.1.3 Questions and Opinions of the Stakeholders

In every PCM, there was a session to obtain opinion and questions from the participants of the meetings, especially from the project affected people. A wide range of opinions and questions were expressed from the stakeholders, including the route alignment, compensation of land and property loss, environmental impacts, social impacts, etc. **Table 9-3** presents the summary of questions and answer sessions, including the questions and opinions as well as their responses in all consultation meetings.

Table 9-3: Summary of question-and-answer sessions in all consultation meetings

No.	Name	Question/Opinion	Response
1. Public Consultation Meeting in Chakaria			
1)		He opined that the bypass is necessary to reduce traffic congestion and carrying time. However, the said that current route alignment, especially the beginning part that goes through Kakara UP will displace many families. Then he urged to reconsider the current route and change to further eastward to save their land and settlement.	Present alignment proposed after considering many technical issues for greater benefit. Projected affected persons will be properly compensated. However, we will convey your opinion to our employer. Local Member of Parliament (MP) said that "current government is implementing this project to boost up the local and national economy. The

No.	Name	Question/Opinion	Response
			affected families who will loss lands and houses will be compensated".
2)		He expressed concern regarding the social impacts that they are going to suffer due to probable loss of their lands and homes. Then he suggested to redesign the alignment to alleviate these social impacts.	The alignment is proposed after careful consideration of loss and benefits. The affected persons will be compensated according to the laws and rules of Bangladesh and JICA guidelines. A Resettlement Action Plan (RAP) will be prepared to mitigate the impacts. Special measures will be taken for those who are vulnerable".
3)		The mouza rate of land is very lower than current market price. How the amount of compensation will be determined?	Compensation will be provided as per existing laws of Bangladesh. Acquisition and Requisition of Immovable Property Act-2017 will be applicable for the compensation of lands and structures.
4)		He opined that the route alignment should be selected with consultation of local MP, Mayor, Chairman (Upazila and concerned UPs), and UNO. He proposed to hold meeting in presence of these key leaders/officials to select the route. Proper mitigation measure requires to reduce the construction phase environmental impacts.	Explained the objectives of the meeting that we intend to obtain the opinions of stakeholders regarding environmental and social impacts. And about the selection and change of route alignment, we will convey your opinion to the authorities. Mitigation measure to reduce environmental impacts will be incorporated in the EIA reports.
5)		He pointed out the social impacts of the project. Then he said that "there is open land without human settlement in further eastward location. The bypass could be gone through those area that will save land and houses of local residents. Moreover, it will shorten the length also. He also pointed out that there is a hundred years old graveyard in proposed bypass alignment".	Opinion regarding this issue will be shared with authority.
2. Public Consultation Meeting in Lohagara			
1)		a) If a part of my land is acquired, will I get compensation for whole land? b) Will all successors of the land be compensated?	Compensation will be provided as per existing law of Bangladesh. All the successors who have legal documents will be entitled for receiving the compensation.
2)		There is a graveyard in the proposed alignment. What will happen to this?	Existing laws will be implemented regarding these issues.

No.	Name	Question/Opinion	Response
3)		We suggest to change the route. We don't want to lose our ancestral lands and homes.	Opinions regarding changes of alignment will be shared with authorities.
4)		Will we get proper compensation for our property? Where will we go if there any problem regarding the paperwork of the land? How can be the environmental pollution will be mitigated during construction phase?	Compensations will be provided as per existing laws of Bangladesh. Local AC land office will help them about the problematic paperwork of the land. Proper mitigation plan regarding environmental issues will be incorporated in the Environment and Social Management Plan.
5)		There are Mazar, mosque, and graveyard in the proposed alignment? What will happen to them? Is there any plan to reduce the air and noise pollution as well as vibration during construction phase of the project?	Responses regarding Common property resources will be addressed in the EIA report (from RAP report). Government generally avoids this type of locations unless it is inevitable to demolish and relocate them. Mitigation measure regarding air, noise pollution and vibration will be incorporated in the EIA report.
6)		Welcomed the project and this consultation meeting with the local people. Already there is a railway project under construction nearby. Many farmers suffered due to that project as it caused water logging and obstacle for irrigation. My concern is that will this project cause similar impact? Necessary culverts should be built to facilitate water flow under the road during construction and operation stage for irrigation of nearby agricultural lands.	EQMS replied that "sustainability of natural water flow will be considered during construction and operation stage so that the farmers don't get affected". Opinions regarding construction of necessary culverts to facilitate the irrigation will be shared with authority.
3. Public Consultation Meeting in Keranihat			
1)		Will there be any further land acquisition? What is the measurement of the flyover? How the affected business will be compensated?	In response of this questions, it is expected that the provable flyover will be constructed on the land that have already been acquired. The flyover will be 3.44 km long and 48 m wide. The affected business, although most of them are on acquired (Khas) land, will be compensated as per existing law.
2)		What is the location of flyover as per presented RoW alignment?	The flyover will be built along the existing highway (starting and ending point is mentioned)

No.	Name	Question/Opinion	Response
3)		How the affected businessman will be compensated?	Affected businesses will be compensated. An independent consulting firm is working for this purpose and they will conduct survey to identify the affected businessman and to estimate the compensation.
4)		It will be good for us if government build a bypass instead of the flyover. For this flyover, hundreds of business institutions will be affected. And around a few hundred people will lose livelihood (at this point most of the participants started giving slogan demanding a bypass instead of flyover).	Several options, such as bypass or flyover, have been considered. But it seemed that this flyover would be most feasible as there is a rail line under construction nearby which is an obstacle for bypass. Besides, a flyover has to be built due to that rail line. The affected businessman, including those who sell products on footpath and roadside will compensated as per existing laws of Bangladesh
5)		Hundreds of businessmen will be benefitted if a bypass is constructed instead of the flyover. We are worried about our livelihood.	Responses regarding this question mentioned above.
6)		I am in favor of flyover as there will be severe social impacts like loss of land, house, agriculture, fisheries, and vegetation if a bypass is constructed.	Your opinion will be shared with the project implementation authorities.
7)		Exactly how much damage we will suffer from this project?	The amount of loss has not finalized yet. The survey is ongoing. The findings will be disclosed once the survey is completed.
8)		In my opinion, a bypass would be better option considering the amount of loss of business and livelihood that will be caused by the flyover.	Both options will cause some damage. But the extent of loss will be higher in case of bypass. Besides, bypass construction is difficult due to nearby railway. This is why this flyover option will be considered rather than bypass
9)		It is seen in previous time that development work creates water logging? Will there be such kind of problem in this project?	There will be plan to prevent water logging and drainage congestion. The contractor has to follow this plan. The consultant and employer will monitor this issue.
10)		How many lanes will be under the flyover? It is important to keep drainage system functional and to prevent water logging during construction and operation phase. I	Mr. Mehedi from NK replied: "There will be 2 lanes beneath the flyover. Bandarban road will be kept functional".

No.	Name	Question/Opinion	Response
		request the authority to implement the project causing least damage to the businessman.	EQMS replied: "There will be an environmental management plan in EIA report. In this plan drainage and water logging issues will be addressed. The project implementation authority will try to cause least damage of business. The affected businesses will be compensated as per existing laws of Bangladesh".
4. Public Consultation Meeting in Dohazari			
1)		It would be better to construct a flyover instead of bypass as the bypass will cause loss of lands and homes.	Present option of bypass has been selected after considering the feasibility of several options. This option seems most feasible. Affected persons will be compensated as per existing laws of Bangladesh
2)		I am in favor of this bypass option	Opinion will be shared with our technical team.
3)		How the compensation for land acquisition will be provided?	The compensation will be determined according to the laws of Bangladesh. A separate consulting firm is working in this regard. The affected persons will be contacted when necessary.
4)		The mouza rate of land is lower than current market price. How will this dispute be resolved? How will you determine heirs of the land?	The compensation for land acquisition will be provided as per Acquisition and Requisition of Immoveable Property Act 2017. The successors of the land will be issued the local Union Parishad office.
5)		What will happen to community clinic? There is a community clinic in the proposed alignment. Are there any plan to reduce the impact related with noise, water and vibration?	If any community clinic is affected, necessary and proper actions will be addressed in the resettlement action plan. Proper management plan will be incorporated in the EIA report regarding the impact related with noise, water and vibration.
5. Public Consultation Meeting in Patiya			
1)		What will be the measurement of proposed bypass?	According to proposed plan, the width of the bypass will be 300 feet,

No.	Name	Question/Opinion	Response
			including 4-lane main road and 2-lane side road at both sides.
2)		There is already a bypass in Patiya? Why it is necessary to expand this bypass?	Responses given by explaining the necessity of expanding the existing bypass, which has already been described during presentation session.
3)		When will the survey be started? What will be the probable amount of compensation?	A separate consulting firm is working this regard. Survey for land acquisition and resettlement purpose will be started soon. The final amount will be determined by authority who is conducting resettlement study."
4)		Will this new project straighten the curvatures of present bypass?	This is one of the objectives of this project. The curvatures will be straightened as much as possible.
5)		Will the proposed bypass be on the existing bypass?	It was tried to design the new alignment by keeping it on the existing alignment as much as possible. However, to straighten the curvatures, there might be distortion in some places.
6)		If the existing bypass is expanded maintaining a parallel expansion from the median, then we have no objections. But we have objections if the new alignment become distorted from existing bypass alignment.	It was tried to design the new alignment by keeping it on the existing alignment as much as possible. However, to straighten the curvatures, there might be distortion (on right or left side) in some places. This is for smooth traffic operations and for reducing the chance of accidents."
7)		My family graveyard is in the proposed alignment. What will happen to it?	Generally, project authority intends to avoid such kind of culturally sensitive establishment. However, if it seems inevitable for greater benefit, then government may take initiative to relocate the graveyard. The whole procedure will be carried out as per the established laws. We will convey your concern to the project technical team."
8)		Why the proposed alignment distorted at entirely one side instead of remaining on the existing bypass alignment?	It was tried to design the new alignment by keeping it on the existing alignment as much as possible. However, to straighten the curvatures, there might be distortion (on right or left side) in some places.

No.	Name	Question/Opinion	Response
			This is for smooth traffic operations and for reducing the chance of accidents."
9)		During the construction of existing bypass, the project implementation authority did not take our consultation. How will we be assured that our consultation will be valued this time?	As this project will be financed by international landers so opinion of the stakeholder will take into consideration.
10)		Previously, during the construction of old bypass, there was corruption and we did not get compensation of acquired land properly. What will happen this time?	Fair compensation will be provided as per existing laws of Bangladesh.
11)		If the existing bypass is expanded maintaining a parallel expansion from the median, then we have no objections. But we have objections if the new alignment become distorted from existing bypass alignment.	It was tried to design the new alignment by keeping it on the existing alignment as much as possible. However, to straighten the curvatures, there might be distortion (on right or left side) in some places. This is for smooth traffic operations and for reducing the chance of accidents.
12)		During the construction of old bypass, the land acquisition procedure did not follow rules and regulations properly. There was corruption. Therefore, the project affected persons are worried that they will not get compensation properly this time also. If the existing bypass is expanded maintaining a parallel expansion from the median, then we have no objections. But we have objections if the new alignment become distorted from existing bypass alignment.	Responses regarding these issues mentioned earlier.
13)		We want the new alignment to be constructed by expanding existing bypass maintaining parallel expansion.	It was tried to design the new alignment by keeping it on the existing alignment as much as possible. However, to straighten the curvatures, there might be distortion (on right or left side) in some places. This is for smooth traffic operations and for reducing the chance of accidents.

9.4.2 Information Disclosure Meeting

It is deemed necessary to disclose the findings of the EIA study to the PAPs, local residents and other relevant stakeholders. Hence, a total of eleven Information Disclosure Meeting was organized throughout the alignment of the CCHIP.

9.4.2.1 Details of the Meeting

A total of five IDMs were conducted in the second stage of the meeting, including one meeting in each major and minor bottleneck point. **Table 9-4** shows the details of the meetings, including their venues, time, date, types of participants with number and ratio of male and female. All meetings were conducted in participation of project affected people, beneficiaries, residents, representative of local governments, public leaders, government and non-government officials, etc. A copy of invitation letter, participants list, photographs and presentation materials of the IDMs are given in **Appendix H-11** to **Appendix H-19**. A copy of non-technical summary of the draft EIA report is given in **Appendix H-20**.

Table 9-4: Details of the Information Disclosure Meetings (IDMs)

No.	Date	Venue	Time	Number of Participants			Types of Participants
				Male	Female	Total	
1	March 23, 2022	Kaliaish Union Parishad Auditorium, Satkania, Chattogram	10:00 AM-12:00 PM	31	4	35	• Local elected representative including Chairman and ward members, project affected people, local residents, businessmen, shop owners, teachers, farmers, female representative, service holders, remittance earners, politicians, imams, students, hawkers, rickshaw pullers, drivers, etc.
2	March 27, 2022	Kochuaai Union Parishad Auditorium, Patiya, Chattogram	10:00 AM–12:00 PM	37	4	41	• Local elected representative including Chairman and ward members local leaders, project affected people, local residents, businessmen, shop owners, teachers, farmers, housewives, service holders, remittance earners, politicians, imams, students, hawkers, rickshaw pullers, drivers, etc.
3	March 29, 2022	Amirabad Union Parishad Auditorium, Lohagara, Chattogram.	10:00 AM–12:00 PM	40	1	41	• Representatives of RHD, Local elected representative including Chairman and ward members, public leaders, project affected people, project beneficiaries, local residents, women, elderly people, government and non-government employees, etc.

No.	Date	Venue	Time	Number of Participants			Types of Participants
				Male	Female	Total	
4	March 30, 2022	Keonchia Union Parishad Auditorium, Lohagara, Chattogram	04:00 PM–06:00 PM	31	1	32	• Representatives of RHD, Local elected representative including Chairman and ward members, public leaders, project affected people, project beneficiaries, local residents, women, elderly people, government and non-government employees, etc.
5	March 31, 2022	Shah Omrabad High School Auditorium, Chakaria, Coxsbazar.	10:00 AM–12:00 PM	61	0	61	• Representatives of RHD, Local elected representative including Chairman and ward members public leaders, project affected people, project beneficiaries, local residents, women, elderly people, government and non-government employees, etc.

9.4.2.2 Overview of the Meetings

At first, a presentation was given describing the objectives and particulars of the project. The presentation includes the maps of the route alignment of all four bypasses and a flyover, locations of environmental baseline survey, scope of EIA study, predicted environmental and social impact, proposed mitigation measure and Environment and Social Management Plan (EMP), etc. In the presentation, the importance of the project and findings of the studies were described by the EQMS consultants. The detail information about the EIA study, its scope and objectives, findings of draft report preparation stage were also described. The presentation explained that this meeting is being conducted to inform about the study and obtained opinions and questions from public regarding potential environmental and social impacts. After the presentation, a question-and-answer session was held, which is summarized in **Table 9-5** below. A range of questions and opinions were raised from participants and all their questions were answered properly. The questions were answered by the RHD representative, EQMS consultants, and in some case, by national representative of JICA Study Team who presented in the meeting. During the meetings, no specific objections were raised to the project itself.

9.4.2.3 Questions and Opinions of the Stakeholders

In every IDM, there was a session to obtain opinion and questions from the participants of the meetings, especially from the project affected people. A wide range of opinions and questions were expressed from the stakeholders, including the route alignment, compensation of land and property loss, environmental impacts, social impacts, etc. **Table 9-5** presents the summary of questions and answer sessions, including the questions and opinions as well as their responses in all the disclosure meetings.

Table 9-5: Summary of question-and-answer sessions in IDMs

No.	Name	Question/Opinion	Response
A) IDM in Kochuaai, Patiya, Chattogram			

No.	Name	Question/Opinion	Response
1)		• When the Land acquisition notice will be provided? • As the existing road is too busy, will there be any foot over bridge Infront of school/college/mosque?	• A separate consulting firm is working on land acquisition. After their completion of survey or other activities government will go for noticing for Land Acquisition. • According to representative from the JICA Study Team, there will be foot over bridge/underpasses in sensitive areas.
2)		• People are getting confused about the alignment of the road. They want to get assurance how much land will be acquired from both sides of the proposed road, because they think marking is not fixed by the survey team. • What will be the notice period and when they will get compensated?	• According to representative from the JICA Study Team, tentative road alignment is just proposed, but final decision will be taken by the Government and relative authorities. Therefore, last land marking is almost right. • After the completion of survey government will declare when the land acquisition will be occurred.
3)		• Is there any chance to getting change of land marking? • Any possibility of air pollution? If yes, what will be the mitigation measure?	• Last marking is almost final, and the previous marking will be eliminated/removed by the RAP consultants. • During construction period there will be the possibility of air pollution due to lack of proper mitigation measure like as Water spray and covering of material stockpile; Maintenance of vehicles and machines to control exhaust emission. • Moreover, a detail management plan regarding air pollution has been incorporated in the Draft EIA report.
4)		• Several accidents are getting occurred regularly due to damaged and broken dividers. • Due to the existing road, water logging has been occurred. • They want the solution of water logging problem and building/enhancing the size of culverts in several locations.	• Opinion regarding this issue will be shared with authority. • Proper drainage system will be incorporated to prevent the water logging in the project area.

No.	Name	Question/Opinion	Response
B) IDM in Kaliaish Union, Satkania, Chattogram			
1)		• When the construction activity will be started? • What impacts of environment will be occurred?	• Construction activity will be started in 2025. • Air, Noise and Soil Pollution will be occurred.
2)		• Why is bypass needed if 6-lane road will be constructed?	• To prevent accident and control the heavy load of traffic bypass is needed.
3)		• I do not live in Bangladesh. How will I get the compensation?	• Compensation will be provided as per approved entitle matrix followed by national and international laws, policies and guidelines.
4)		• If we do not get compensation, we will not let them (RHD) to construct the road. JICA Survey Team must pay compensation by their own responsibility.	• Compensation will be provided as per approved entitle matrix followed by national and international laws, policies and guidelines.
5)		• People are poor. They need the opportunity of employment. • How the water pollution should be mitigated?	• Both skilled and non-skilled people will get opportunity of employment during construction period. • Management plan has been incorporated to control predicted water pollution which includes; o Sediment fence and soil compaction; o Drip pan for containing hazardous waste; o Settling tank and oil-water separator;
C) IDM in Keonchia Union Parishad, Satkania, Chattogram			
1)		• He asked, "Four outer roads will be constructed in Patiya, Dohazari, Lohagara and Chakaria. But why a flyover will be constructed in Keranirhat? He also added that people want bypass instead of flyover.	• Representative from the JICA Study Team replied that according to the feasibility study government choose the option of flyover instead of bypass.
2)		• He opined, "We want 4-lane road instead of 6 lanes otherwise transportation problem will be emerged in future."	• This opinion will be shared to the authority.

No.	Name	Question/Opinion	Response
3)		• He said that it would be better to construct 6-lane bypass instead of flyover.	• Representative from JICA Study Team already replied this in previous question.
4)		• According to Mr. Musa, Keranirhat has huge area to construct 6-lane road why RHD/Government is going to build flyover. He also added that people of Keranirhat will protest when the flyover construction will be started.	• Representative from JICA Study Team already replied this in previous question.
5)		• Mr. Sarwar said that mosque, madrasa, school and graveyard will be demolished by the activity of RHD and What will be the solution.	• Representative from JICA Study Team replied, "Generally, project authority intends to avoid such kind of sensitive establishment. However, if it seems inevitable for greater benefit, then government may take initiative to relocate these structures. The whole procedure will be carried out as per the established laws."
D) IDM in Amirabad Union Parishad, Lohagara, Chattogram.			
1)		• Is there any provision of employment opportunity for local unskilled people during construction period? • Is there any possibility to create noise pollution during construction period?	• According to representative from JICA Study Team, local people both skilled and unskilled will get opportunity for employment. • Management plan to mitigate the noise pollution has been incorporated in the EIA report briefly it consists, ○ Noise barrier between residential and commercial area and the project. ○ Maintenance of vehicle and machines; canopy, muffler, silencer in machines;
2)		• Is it true that the project will be implemented? • They are not sure about the land acquisition. They want to make buildings or structures in the proposed acquired area.	• RHD representative confirmed that the project will be implemented. • After the survey and the declaration of Cut-off date anyone can't build anything in the proposed area.
3)		• How the compensation of land will be provided? • Who do business in the government property,	• Compensation will be provided as per approved entitle matrix followed by national and international laws, policies and guidelines.

No.	Name	Question/Opinion	Response
		will they get any compensation?	
E) IDM in Shah Omrabad High School, Kakara Union, Chakaria, Coxsbazar			
1)		• They will be in problem. Their land will be acquired, and they will have nothing left. They are poor and day labour. So, alternative way should be chosen.	• Representative from RHD said, "This opinion will be shared to the authority."
2)		• According to Mr. Farhadul, if the proposed alignment will be constructed low environmental effect will be occurred but social impact will be seen in a big scale. Maximum people want alternative alignment of road.	• This opinion will be shared to the authority.
3)		• There is a syndicate that made corruption for fixing the alignment. And huge area of settlement, mosque and madrasa will be demolished. • There has water logging due to flood and inadequate drainage. What will be the solution regarding this issue?	• To reduce the waterlogging a management plan has been incorporated in the EIA report briefly which includes; ○ Pumping and discharge of stagnant water ○ Construction of adequate number of cross drainage channel.
4)		• Significant number of HHs will lose their land. They need proper compensation. • Due to existing road, they are facing flood during rainy season. Elevated expressway could be another option.	• Compensation will be provided as per approved entitle matrix followed by national and international laws, policies and guidelines. • This opinion will be delivered to the authority.
5)		• People don't have legal papers of land and they think they will not get compensation. So, they want alternative road.	• Representative from JICA Study Team: If people do not have legal papers of land or they are living in government land, they will not get compensation indeed.

9.4.3 First Round Focus Group Discussion (FGD)

Generally, a process to collect information through a set of questions from group of people defined as Focus Group Discussion (FGD). The aim of FGD is to collect information from the group of people about their perceptions, attitude and experience on predetermined topics. To collect information from the different group of people, including community people, land owners, land dependents, business owners, women group in five bottleneck points (including both bypass and flyover) of Chattogram-Cox's Bazar Highway Improvement Project, several FGDs were conducted. To disseminate and collect the information from the specific group of people, the target participants of the FGDs were the group of people who were absentees in the Public Consultation Meetings. Moreover, individual consultation conducted with visually vulnerable people, such as differently able, elderly etc**.**

9.4.3.1 Details of the FGD

The discussion was held with different group of people at different locations. The locations and group descriptions of the focus group discussions are depicted in the **Table 9-6**. Photographs of FGD are given in **Appendix H-27.**

Table 9-6: Location and Target Group of Respondent

SL	Date	Place	Target Group	No. of Participant		
				Male	Female	Total
1.	29/01/2020	Chakaria	Land Owners	6	0	6
2.	29/01/2020	Chakaria	Community People	16	0	16
3.	29/01/2020	Chakaria	Land Dependents	8	0	8
4.	29/01/2020	Chakaria	Women Group	3	18	21
5.	30/1/2020	Lohagara	Land Owners	8	0	8
6.	30/1/2020	Lohagara	Community People	7	0	7
7.	30/1/2020	Lohagara	Women Group	0	9	9
8.	30/1/2020	Keranihat	Business Group	6	0	6
9.	30/1/2020	Keranihat	Local Community	8	0	8
10.	30/1/2020	Dohazari	Land Owners	8	0	8
11.	30/1/2020	Dohazari	Land dependents	7	0	7
12.	31/1/2020	Patiya	Land Owners	9	0	9
13.	31/1/2020	Patiya	Local Community	12	0	12

9.4.3.2 Findings of the FGD

The issues of discussion and participants' opinions, comments and suggestions are summarized in **Table 9-7**, **Table 9-8**, **Table 9-9**, **Table 9-10**, and **Table 9-11**.

Table 9-7: FGD with Local Community

Issues Discussed	Participants Opinion, Suggestions				
	Patiya	Dohazari	Lohagara	Chakaria	Keranihat
General information of local community including location,	General information has been gathered about local community, village, mouza etc. Whereas, Patiya Widening of existing Bypass Road includes the following unions Bhatikhain, Kachuai, Patiya Paurashava (Word No-06, 07), Dohajari (New Bypass Road) includes Satbaria, Dohazari union. Keranihat (Flyover over the Existing Road) includes Dhemsa, Keochia, Sadaha. Lohagara (New				

Issues Discussed	Participants Opinion, Suggestions				
	Patiya	**Dohazari**	**Lohagara**	**Chakaria**	**Keranihat**
village, Mouza, upazila etc;	Bypass Road) contains Amirabad, Lohagara unions. Chakaria (New Bypass Road) contains Fasiakhali, Kakhara, Lakhyarchar, Chakaria Paurashava (Word No-09) etc.				
Information about the project;	Local people have been informed about the proposed project through survey for resettlement study, people who were attended the PCM of EIA study also informed the respondents. Most of the respondents had the curiosity about the final alignment and price of the land.				
Settlement pattern of the local community;	Apart from Keranihat, settlement pattern of the proposed alignment is diversified.				
What is the key occupation/source of livelihood for the community in the village?	Mostly agricultural				Mostly businessman
Illegal/legal settlers' information about people who are residing with the RoW of highway;	No responses regarding illegal/ legal settlers' information about who are residing with the RoW of highway.				
Is there any scope for Loss of agricultural land for borrow pits or stock piling?	Most of the respondent opined that, they will lose their agricultural land due to borrow pits or stock piling.				Agricultural land will not be impacted
What are the problems that the community faces (for example infrastructure, job, and education)?	Generally, community faces problem relevant with employment.				
Is there any ethnic community available?	No ethnic community available.				
Number/ frequency of accident in the bottleneck point over the year?	Frequent accident occurs in Patiya area.				
What will be the impacts of the project on the community's	Due to the proposed alignment of bypass and flyover people's livelihood will be impacted.				

Issues Discussed	Participants Opinion, Suggestions				
	Patiya	Dohazari	Lohagara	Chakaria	Keranihat
livelihood and culture?					

Table 9-8: FGD with Land Owners

Issues Discussed	Participants Opinion, Suggestions				
	Patiya	Dohazari	Lohagara	Chakaria	Keranihat
What is the current use of acquired land?	Apart from Keranihat most of the acquired land is agricultural.				
What is the land use pattern of road side land?	Land use pattern of road side area is mostly agricultural.				
What are the main crops grown in the area?	Double crops Agricultural and monsoon land.	Double crops agricultural land and winter vegetables at river side	Double crops Agricultural land.	Kakara union has triple crops land.	No agricultural land.
Production of land per acre?	Paddy production per acre is on average 220 Mound.				
What is the difference between current market price and mouza rate of land?	There is a significant difference between current market price and mouza rate of the land. Generally, the mouza rate has been determined through the average price of land sold last year. Customarily, it is common practice in Bangladesh that land buyer-seller undervalued land in registration process to pay lower stamp duty, VAT & TAX and other applicable registration fees. As a result, land price remains lower than actual market price. To bridge the gap of registered and actual market price of land, the government of Bangladesh makes the provision for 200% additional of registered/assessed price.				
Do you know how to raise a complaint?	No idea about the grievance process.				
What will be the impacts of this project (both positive and negative impacts)?	Traffic congestion will be mitigated, however, most of the respondents will lose their land and settlement due to acquisition.				
Production of land per acre?	Paddy production per acre is on average 220 Mound.				

Table 9-9: FGD with Women Group

Issues Discussed	Participants Opinion, Suggestions	
	Lohagara	Chakaria
Informed about the project	Local people have been informed about the proposed project through survey for resettlement study, people who were attended the PCM of EIA study also informed the respondents.	
What is the main livelihood-related activities (or work) undertaken by women? (e.g., Cultivation, livestock rearing, fuel wood collection etc.)	Basically, most of the respondents involved with household activities.	
Are there any restrictions to the type of work women can perform?	No such types of restrictions	
What is the average minimum age of marriage for girls and boys in the community?	20 is the average minimum age of marriage for girls and 25 is the average minimum age of marriage for boys in the community.	
Average age of mother at childbirth (first child)	Average first childbirth age is 22.	
Is there any preference for boy or girl child?	As like as others practice of rural life there is a preference for boy child.	
What is the highest level of education that women attain?	Highest level of education of women generally High School Certificate (college level).	
Do girls attend school regularly or take leaves if they are required to work at home?	Such types of activities occur in a very low frequency.	
Is there any special preference for sending boys for higher studies instead of girls?	Yes, there is a preference for sending boys for higher studies instead of girls.	
Who is the primary decision-maker in the house?	Father has the dominancy over decision making in the family.	
Can women independently take decisions on certain topics?	Have this opportunity but in very marginal level.	
Do women participate in decision-making at the village-level?	In a very low frequency.	
Are there any traditional or customary practices related to ownership of land and asset or access to property?	Particularly ownership of land and asset or access to property determine upon the existing laws.	
Are you aware of the proposed project? if yes, get details on the level of information available and provide an understanding of the proposed project and its potential impacts on the community	Most of the respondents have the awareness of the project, however, most of them are very much concerned about the land and structure which are going to be acquired.	

Table 9-10: FGD with Land Dependents

Issues Discussed	Participants Opinion, Suggestions					
	Patiya	Dohazari	Lohagara	Chakaria	Keranihat	Patiya

What are the uses of the land acquired (sharecropper, agricultural laborers, for storage, as access road/area)?	Apart from Keranihat most of the acquired land is agricultural. In Keranihat business owner will be affected and the ownership of the land is government.	
On an average for how long have you been using this land?	Most of the respondent using this land more than 20 years.	
Do you earn from this land? If yes, for which activities (for example agriculture or any other) and how much?	By agriculture most of the respondents earn from this land.	No land acquisition required.
Is there any business structure affected due to acquisition?	Some business structure will be affected at Chakaria, Dohazari and Keranihat area.	
Types of business has been affected?	Both permanent and temporary business will be affected.	
Any alternative income source apart from business?	Most of the respondents have no alternative income source apart from business.	

Table 9-11: FGD with Market Committee at Keranihat

Issues Discussed	Participants Opinion, Suggestions
What are the roles and activities of Market committee?	Market committee is responsible to work for businessman interest. Member of the Keranihat Progotishil Bebshayek Somity is 2100 businessman. All the members duly paid 40 taka per month for their membership subscription fees.
Perception about the project?	Most of the respondent demanded to change the alignment, they prefer bypass rather flyover.
Is there any physical and economic displacement due to project implementation?	Both economic and physical displacements will be occurred due to the proposed flyover alignment.
How the existing Bazar besides highway will be impacted?	Business man who are doing their business adjacent to the road side will be severely impacted due to the flyover construction.
How many Numbers of persons will be impacted due to project implementation?	Not identified yet.
Business pattern of people besides bottleneck?	Both permanent and temporary businesses comprise of stationary, grocery, fruits and vegetables are available at bottleneck area.
Have any kind of illegal occupants doing their business besides highway?	No information available regarding this question.

Issues Discussed	Participants Opinion, Suggestions
What is the renting procedure of shop/ business structure?	Business man rent their business facilities from the owner of infrastructures.
Suggestions and recommendations during construction period mitigation measure.	Proper compensation packages for the businessman who will lose their livelihood for the proposed project.

9.4.4 Second Round Focus Group Discussion (FGD)

During the disclosure stage of draft EIA, the aim of FGDs is to disseminate the information to the group of people of project area residing major and minor bottleneck sections. The target participants of the FGDs were the group of people who were absentees in the Information Disclosure Meetings held at different locations of major and minor bottleneck sections. Moreover, individual consultation conducted with visually vulnerable people, such as differently able, elderly, etc. of the project area. During FGDs following topics were disseminated with the participants and collected their concern, perceptions and further recommendations.

- Status of proposed development project to the local community;
- To distribute the information about the baseline conditions of proposed project area;
- The information regarding predicted impacts and mitigation measure for those impacts regarding the proposed project during draft report preparation stage;
- Publicize the proposed Environmental Management Plan (EMP);
- To inform about the Grievance Redress Mechanism (GRM);
- To eliminate conflict among all stakeholders by disseminating information and allowing them to express their perspectives.
- Increase local confidence in the proposal and to give a sense of ownership.

During conducting FGDs with different groups of the major and minor bottleneck sections, responses were also provided by consultants as per participants concerns and recommendations.

9.4.4.1 Details of the FGD

The discussion was held with different groups of people at different locations of the major and minor bottleneck sections. The locations and group descriptions of the focus group discussions are depicted as follows. **Table 9-12** indicates the details of the FGDs. Photographs of the FGDs are given in **Appendix H-22**.

Table 9-12: Details of the FGDs

No.	Date	Place	Number of Participants			Types of Participants
			Male	Female	Total	
1	March 27, 2022	Patiya	4	1	5	• Land owners, land dependents, local community people
2	April 01. 2022	Patiya	6	0	6	• Land owners, land dependents, local community people, Businessmen
3	March 24, 2022	Dohazari	6	0	6	• Land owners, land dependents, local community people
4	April 01. 2022	Dohazari	6	1	7	• Land owners, land dependents, local community people, Businessmen
5	March 31, 2022	Keranirhat	6	0	6	• Community people, Business owner
6	March 29, 2022	Lohagara	7	0	7	• Land owners, land dependents, local community people, Businessmen
7	March 28, 2022	Chakaria	0	5	5	• Female group including housewife of affected HHs, students of local area.
8	March 29, 2022	Chakaria	8	0	8	• Land owners, land dependents, local community people, Businessmen

9.4.4.2 Findings of the FGD

The issues of discussion and participants' opinions, comments and suggestions are summarized in **Table 9-13**.

Table 9-13: Summary of the FGDs

Issues Discussed	Participant opinion/ questions/ Recommendation	Responses
Brief description about the project	• People are very much confused about the proposed final RoW alignment	• Most of the RoW alignments has been finalized as per Feasibility study report.
Status of land acquisition and Resettlement	• Most of the people from major bottleneck sections were very much concerned of land acquisition status including process, entitlement matrix, compensations, etc.	• Land acquisition and Resettlement Action Plan has been carried out by another firm. Compensations and other benefits will also be provided as per national and international laws, policies and guidelines.

Issues Discussed	Participant opinion/ questions/ Recommendation	Responses
Predicted Impact on Environmental and Social aspects	• Should take proper initiative to mitigate the predicted impact on Air. Water, soil and others.	• An Environmental Management Plan (EMP) including monitoring schedule and budget has been incorporated in the draft EIA report. Moreover, during consultation it has been explained to the participants about the predictive impact, proposed mitigation measures and management plan regarding the environmental elements such as air, water,soil etc. The participants were convinced with the proposed mitigation measures and management plan and they expect the proper implementation of the plans.
Beneficial aspect for the local community	• How the local people will be benefited for this project?	• Local people will be benefited during both construction and operation phases by creating the employment opportunity, enhancement of local economy, accident prevention and others available service provisions.
Status of Community Property Resources during construction	• What will be the process of land acquisition if any Community Property Resources lies into RoW	• Will take proper mitigation measure for the CPR.
Conflict of interest between project employee, workers and community people	• If any kind of conflict of interest arise, how it will be resolved?	• During construction period both migrant and non-migrant worker will be available at the project area, thus the conflict might be arising between workers and local community people. An external grievance redress mechanism channel will be developed that ensure the local people have the access to raise any grievance to the authority.

Issues Discussed	Participant opinion/ questions/ Recommendation	Responses
Disruption or enhancement of existing social service	• Is there any possibility to the disruption of existing social service providing status?	• During construction period some service facilities might be disrupted due to lack of accessibility. Project proponent will create alternative provision to smooth accessibility of local people for getting the services.
Flood and drainage condition of project area	• How the proposed project has impact on flood and drainage condition?	• Flood assessment has been carried out during study period so mitigation measure has also been developed regarding flooding and drainage condition.
Overall perception about the project	• Perhaps, most of the participants who will be going to lose their land and livelihood due to project implementation have similar perception for alternative analysis. Unlikely, they demand proper compensation.	• Compensation will be provided as per national and international, laws and guidelines.

9.4.5 Key Informant Interview (KII)

Key informant interviews (KII) are qualitative in-depth interviews with people who know what is going on in the community. The purpose of key informant interviews is to collect information from a wide range of people—including community leaders, professionals, or officials—who have first-hand knowledge about the project areas. A total of 26 KIIs have been conducted with the Upazila level offices, including the Department of Fisheries, Department of Agriculture, Department of Education, Department of Public Health Engineering, Executive Engineer of Roads and Highways Division, Dohazari, Chattogram, Sub Divisional Engineer of Chakaria, Cox's Bazar, Range Officers of Chunati Range, Chunati Wildlife Sanctuary and Fashiakhali Range, Forest Department and Department of Environment, Chattogram Divisional Office. The summary of the findings of the KII are presented in **Table 9-14** (Department of Fisheries), **Table 9-15** (Department of Agriculture), **Table 9-16**(Department of Education), **Table 9-17** (Department of Public Health Engineering), **Table 9-18** (Roads and Highways Department), and **Table 9-19: KII with Department of Forest**

Sl	Key Issues Discussed	Response		
		Chunati Range	**Chunati Wildlife Sanctuary**	**Fashiakhali Range**
01	Forest Division	Chittagong South Forest Division	Wildlife Management and Nature Conservation Division, Chittagong	Cox's Bazar North Forest Division
02	Administrative Area	Lohagara Upazila	Lohagara Upazila	Chakaria Upazila

Sl	Key Issues Discussed	Response		
		Chunati Range	**Chunati Wildlife Sanctuary**	**Fashiakhali Range**
		Chakaria Upazila Banshkhali Upazila	Chakaria Upazila Banshkhali Upazila	
03	Important/Notable Wildlife Species	Asian Elephant, Hog Badger, Brown Fish Eagle, Resus Macaque, White-crested Laughing Thrush	Asian Elephant, Rhesus Macaque, Barking Deer, Fishing Cat, Crested Porcupine, Indian Pangolin, Great Slaty Woodpecker, White-crested Laughingthrush, Common Hill Myna	Asian Elephant, Northern Pig-tailed Macaque, Slow Loris, Jungle Cat, Fishing Cat and White-crested Laughing Thrush
04	Important Plant Species	Naturally growing tree species - Baitta garjan, Teliya garjan, Duliya garjan, Goda, Bonchalta, Chapalish, Amloki, Bohera, Dumur, Gotguttya, Bazna, Khudijam, Bot, different species of bamboo and cane.	Naturally growing tree species - Baitta garjan, Teliya garjan, Duliya garjan, Goda, Bonchalta, Chapalish, Amloki, Bohera, Dumur, Gotguttya, Bazna, Khudijam, Bot, different species of bamboo and cane. Planted species - Garjan, Jam, Akashmoni, Mehogony, Shegun, Chikrassi, Chapalish, Chatian Jolpai, Dumor, Bohera, Gamar, Sheora, Kat badam, Amloki, Horotoki, Kathal, Lotkon, Bell, Jambura, and Kotbel.	Dominant species - Garjan, Telshur, Chapalish and Jam. Plantation species - Teak and Akashmoni, Agar, Bamboo, Bet, Chickrassi, Arjun, Bohera, etc.
05	Wildlife/Elephant Corridor and movement in Project AoI	Asian Elephant movement is present in the Forest Range. All the bottleneck sites are outside of the Forest Range.	Corridor of Asian Elephant is present in Chunati Wildlife Sanctuary. All the bottleneck sites are outside of the Wildlife Sanctuary.	Asian Elephant, Barking Deer, Wild Boar and Rhesus Macaque movement occurs through existing highway. There are no habitat of the above species and no active migration route of Asian Elephant present in

Sl	Key Issues Discussed	Response		
		Chunati Range	**Chunati Wildlife Sanctuary**	**Fashiakhali Range**
				the Chakaria bottleneck.
06	Perception about the project	This project will improve the local transportation system. But vegetation clearance will degrade habitats of wild animals.	Tree felling will reduce tree cover. In addition, generation of noise and light will impact wildlife movement.	Improved transportation will be ensured. Wild animal movement will be hampered due to the operation of vehicles and heavy machinery.
07	Expectations, suggestions and recommendations for the proposed project	Plantation along with roadside should be done. Killing or harming wildlife should be prohibited at construction sites.	Tree plantation should be done. Less noise-generating equipment should be used. Use of light should be minimum at night.	Speed limit should be maintained, and horn/ siren should be omitted near forest area.

Table 9-20 (Department of Environment). All the interviews were held in the respective department's office in January 2021 in parallel to the first-round stakeholder meeting. Photographs of KII is given in **Appendix H-23** and detailed list of KII participants is given in **Appendix H-24**.

Table 9-14: KII with the Department of Fisheries

Sl.	Key Issues Discussed	Response				
		Patiya Bottleneck	**Dohazari Bottleneck**	**Keranihat Bottleneck**	**Lohagara Bottleneck**	**Chakaria Bottleneck**
01	Administrative Area	Patiya Upazila	Chandanaish Upazila	Satkania Upazila	Lohagara Upazila	Chakaria Upazila
02	Understanding of fishing activities in the administrative area in terms of key areas, sources of fishing, nature of fishing (artisanal, commercial etc.), tools and equipment's used for fishing and any key villages or communities involved;	Most (around 80%) of the fisherman are commercial in nature. Fishing activity is mainly pond based. There is no designated natural fishing area/sanctuary. They are using traditional fishing gears for the fishing purpose. Around 600 household from Polagaon anf Sungargand areas are involved in fishing.	Most (around 65%) of the fisherman are commercial in nature. Fishing activity is mainly pond based. There is some artisanal fisherman as well. They have their fishing activity at nearby Sangu river. There is no designated natural fishing area/sanctuary. They are using traditional fishing gears for the fishing purpose. Around 400 household are involved in fishing.	Fishing activities are mainly pond based commercial fishing. There is no designated fishing area. People are using traditional gears for fishing.	Mainly pond based fishing. Near about 15~20 households from north Amirabad are involved with fishing. Traditional fishing gears are being used by the fisherman.	Most of the fisherman are Artisanal in nature. There is no designated natural fishing area/sanctuary. They are using traditional fishing gears for the fishing purpose
03	Importance of fishing commercially and for the local community;	Very important	Very important	Important	Important	Important
04	Changes in fishing patterns (if any) over the last 2-3 decades in the area;	Use of fish feed increased in commercial fishing.	Use of fish feed increased in commercial fishing. Use of technology facilitates the marketing procedure.	Betterment of transportation facilitates the business and use of fish feed increased the fish production.	Use of fish feed for commercial fishing and fish culture.	Availability of fish in natural waterbodies decreased.
05	Understand the provisions for fishing in the nearest river,	There is no designated fishing zone. Mostly pond based fishing. So, no	There is no designated fishing zone. Mostly pond based fishing. So, no	People are less aware about the provisions since	People aren't that much aware about provisions since	People aren't aware about the provisions since there is no

Sl.	Key Issues Discussed	Response				
		Patiya Bottleneck	Dohazari Bottleneck	Keranihat Bottleneck	Lohagara Bottleneck	Chakaria Bottleneck
	prohibited activities, role of the fishermen association, members of the association, etc.	association is there and people are less aware about the provisions for fishing.	association is there and people aren't aware about the provisions for fishing.	there is no restricted zone for fishing.	there is no sanctuary or restricted fishing zone.	restricted fishing zone.
06	Are there any months where fishing activities are restricted or prohibited?	During February to July, Fishing activities at Sankhali Khal and Karnaphuli River area are restricted.	No restriction	No restriction	No restriction	No restriction
07	Suggestions and recommendations for construction period mitigation measure of proposed project.	Need to make sure that no adverse impact on fishing pond.	Need to avoid fish pond during land acquisition.	Need to make sure that fisherman shouldn't be affected during construction.	Need to avoid fish pond or fishing project during construction.	Water body shouldn't get disrupted and natural water flow should be ensured during construction.

Table 9-15: KII with the Department of Agriculture

Sl	Key Issues Discussed	Response				
		Patiya Bottleneck	Dohazari Bottleneck	Keranihat Bottleneck	Lohagara Bottleneck	Chakaria Bottleneck
01	Administrative Area	Patiya Upazila	Chandanaish Upazila	Satkania Upazila	Lohagara Upazila	Chakaria Upazila
02	Ranking based list of major crops produced in the area	Boro> Aush> T. Aman > Winter vegetables	Boro> Aush> T. Aman> Winter Vegetables> Summer Vegetables	Boro> T. Aman> Winter Vegetables> Winter Vegetables	Boro> Aush> T. Aman> Summer Vegetables> Winter Vegetables	Boro> F. Aman> Winter Vegetables> Summer Vegetables> T. Aman> Summer Vegetables> Aman

Sl	Key Issues Discussed	Response				
		Patiya Bottleneck	**Dohazari Bottleneck**	**Keranihat Bottleneck**	**Lohagara Bottleneck**	**Chakaria Bottleneck**
03	Production data according to major crops produced	Average 4.5 Metric Tons (MT)/Hectare Boro, 04 MT/Hectare Aush, 03 MT/Hectare T. Aman and 15 MT/Hectare winter vegetables	Average 5.5 Metric Tons (MT)/Hectare Boro, 04 MT/Hectare Aush, 3.5 MT/Hectare T. Aman, 20 MT/Hectare winter vegetables and 10 MT/Hectare summer Vegetables	Average 4.5 Metric Tons (MT)/Hectare Boro, 3.5 MT/Hectare T. Aman and 12 MT/Hectare winter vegetables	Average 06 Metric Tons (MT)/Hectare Boro, 05 MT/Hectare Aush, 4.5 MT/Hectare T. Aman, 20 MT/Hectare Summer vegetables and 25 MT/Hectare Winter Vegetables	Average 09 Metric Tons (MT)/Hectare Boro, 07 MT/Hectare Aush, 5.5 MT/Hectare T. Aman and 20 MT/Hectare Summer vegetables and 35 MT/Hectare Winter Vegetables
04	Irrigation requirements and availability	Required mostly for Boro and are managed by the available Surface Water and Ground Water	Required mostly for Boro and are managed by the available Surface Water and Ground Water	Required mostly for Boro and are managed by the available Surface Water and Ground Water	Required mostly for Boro and are managed by the available Surface Water and Ground Water	Required mostly for Boro and are managed by the available Surface Water and Ground Water
05	Agricultural schemes, policies in place	None	None	None	05 (1 Regional, 4 Local)	05 (1 Regional, 4 Local)
06	Sources of inputs and market place for the produce in the area	Local Market and Chattogram	Local Market and Chattogram	Local Market and Chattogram	Local Market, Chattogram and Cox's Bazar	Local Market, Chattogram and Cox's Bazar
07	Impact of industrialization on agriculture in the area	Loss of agricultural land due to industrialization	No impact so far	Loss of agricultural land due to brick kiln	No impact so far	No impact so far
08	Wage rate of the area	BDT 600/Day/Person	BDT 600/Day/Person	BDT 600/Day/Person	BDT 500~700/Day/Person	BDT 600~700/Day/Person

Sl	Key Issues Discussed	Response				
		Patiya Bottleneck	**Dohazari Bottleneck**	**Keranihat Bottleneck**	**Lohagara Bottleneck**	**Chakaria Bottleneck**
09	Perception about the project	Farmers will be affected if crop land acquisition take place for this project. Gross impact won't be significant	Project will have overall positive impact through the betterment of transportation	Influx of migrant labor for agriculture and transport facility will facilitate agricultural system	Project will beneficial to the community and farmers as well through the increase of transport facility	This project will have overall positive impact as a means of communication. Farmers will be benefited from this project as a means of transportation
10	Expectations, suggestions and recommendations for the proposed project	It would be better if the whole Chattogram-Cox's Bazar highway is considered for the extension except the bottleneck's areas only. Apart from this, sufficient time should be provided to harvest the crop once the land is selected for acquisition.	Firstly, Farmers shouldn't be deprived. Secondly, rapid industrialization shouldn't be promoted with the improvement of highway and finally, proper measures should be taken to safeguard the environment.	Farmers should be paid with proper compensation	Adjacent land that aren't considered for acquisition should also be considered for compensation since their crop production are likely to get decreased. Moreover, the natural flow of water shouldn't be disrupted due to the construction of highway. It would be better to consider culvert after e certain distance to make sure the natural flow of water.	First of all, Agricultural land shouldn't be damaged for the highway construction. Secondly, Proper drainage should be ensured in the adjacent area. Thirdly, dust pollution should be managed properly during the construction phase and finally migrant labor for construction work should be managed properly.

Table 9-16: KII with the Department of Education

Sl	Key Issues Discussed	Response					
		Patiya Bottleneck	**Dohazari Bottleneck**		**Keranihat Bottleneck**	**Lohagara Bottleneck**	**Chakaria Bottleneck**
01	Administrative Area	Patiya Upazila	Chandanaish Upazila	Satkania Upazila	Satkania Upazila	Lohagara Upazila	Chakaria Upazila

Sl	Key Issues Discussed	Response					
		Patiya Bottleneck	Dohazari Bottleneck		Keranihat Bottleneck	Lohagara Bottleneck	Chakaria Bottleneck
02	Number of Educational Institutions in the project area	Primary School: 02	Primary School: 03 High School: 01 Dakhil Madrasa: 01 College: 01	None	Primary School: 02	Primary School: 06	Primary School: 02 High School: 01 Dakhil Madrasa: 01 College: 01
03	Any educational institution besides the proposed highway?	Kochuai C.T. Government Primary School	Dohazari Govt. Primary School and Chagachar Hazi Khalil Badiuzzaman Govt. Primary School	None	Keranihat Govt. Primary School	None	Lotonee Govt. Primary School and Shah Omarabad High School
04	How will this project impact the education sector of this area?	Disrupt road traffic for the school going children during the construction. After the completion of the project, it will develop the communication facilities.	Positive impact through better communication	N/A	Betterment of communication will have positive impact on education	Overall positive impact on education through the betterment of communication	Better communication will facilitate better access to the opportunity
05	Suggestions and recommendations for construction period mitigation measure of proposed project	Need to ensure that school going children won't be affected during the project construction	Location of the above mentioned two primary school need to be shifted for better access	N/A	Need to ensure that the adjacent Keranihat Govt. primary school won't be affected due to the construction	Need to maintain road traffic properly specially for the pedestrians and school going children	Need to make sure that educational institution won't be affected due to the construction of the project

Table 9-17: KII with the Department of Public Health Engineering

Sl	Key Issues Discussed	Response				
		Patiya Bottleneck	**Dohazari Bottleneck**	**Keranihat Bottleneck**	**Lohagara Bottleneck**	**Chakaria Bottleneck**
01	Administrative Area	Patiya Upazila	Chandanaish Upazila	Satkania Upazila	Lohagara Upazila	Chakaria Upazila
02	Number of deep tube-well and shallow tube-well in the project area	DTW-04 STW-50 (Approx.)	DTW-03 STW-40 (Approx.)	DTW-03 STW-40 (Approx.)	DTW-04 STW-50 (Approx.)	DTW-04 STW-50 (Approx.)
03	Arsenic and Iron concentration of the project located union and upazila	As-0.001 mg/L Fe-0.07 mg/L	As-Nil Fe-Exceed the limit	As-Nil Fe-Exceed the limit	As-Nil Fe-Exceed the limit	As-Nil Fe-Exceed the limit
04	Sources of water for drinking and agriculture	Ground Water (GW) used as Drinking water. Both Surface Water (SW) and GW used in agriculture	Ground Water (GW) used as Drinking water. Both Surface Water (SW) and GW used in agriculture	Ground Water (GW) used as Drinking water. Both Surface Water (SW) and GW used in agriculture	Ground Water (GW) used as Drinking water. Both Surface Water (SW) and GW used in agriculture	Ground Water (GW) used as Drinking water. Both Surface Water (SW) and GW used in agriculture
05	Testing water quality when installed the tube-well	Yes	Yes	Yes	Yes	Yes
06	Suggestions and recommendations for construction period mitigation measure of proposed project	Surface water quality should be monitored properly to prevent pollution during construction period	Need to prevent surface water pollution during project construction phase	Need to maintain specific area for wastewater during the project construction phase	Surface water pollution shouldn't be taking place due to project construction	Need to make sure that surface body won't be polluted due to the construction of the project

Table 9-18: KII with the Department of Roads and Highways

Sl	Key Issues Discussed	Response	
		Dohazari Road Division	**Chakaria Sub Division (Cox's Bazar Road Division)**
01	Area of Influence	Patiya, Dohazari, Keranihat and Lohagara Bottleneck	Chakaria Bottleneck
02	Understand the compensation payment for the project for the various categories of impacts and the reasoning for the same.	Yes	Yes
03	In case of existence of land users on the site, what is the nature of agreement with them and the compensation paid to them?	Proper compensation will be paid to the land owners through a formal land acquisition process where necessary	Proper compensation will be paid to the land owners through a formal land acquisition process where necessary
04	Understand the compensation for illegal occupants	Yes	Yes
05	Understand the compensation for small scale business owner	Yes	Yes
06	Understand the compensation for structure owner	Yes	Yes
07	Suggestions and recommendations for construction period mitigation measure of proposed project	Dust, water and noise pollution should be minimizing during the construction phase.	Environmental safeguards, utilization of resources and occupational health and safety should be ensured during the construction phase.

Table 9-19: KII with Department of Forest

Sl	Key Issues Discussed	Response		
		Chunati Range	**Chunati Wildlife Sanctuary**	**Fashiakhali Range**
01	Forest Division	Chittagong South Forest Division	Wildlife Management and Nature Conservation Division, Chittagong	Cox's Bazar North Forest Division
02	Administrative Area	Lohagara Upazila	Lohagara Upazila	Chakaria Upazila

Sl	Key Issues Discussed	Response		
		Chunati Range	**Chunati Wildlife Sanctuary**	**Fashiakhali Range**
		Chakaria Upazila Banshkhali Upazila	Chakaria Upazila Banshkhali Upazila	
03	Important/Notable Wildlife Species	Asian Elephant, Hog Badger, Brown Fish Eagle, Resus Macaque, White-crested Laughing Thrush	Asian Elephant, Rhesus Macaque, Barking Deer, Fishing Cat, Crested Porcupine, Indian Pangolin, Great Slaty Woodpecker, White-crested Laughingthrush, Common Hill Myna	Asian Elephant, Northern Pig-tailed Macaque, Slow Loris, Jungle Cat, Fishing Cat and White-crested Laughing Thrush
04	Important Plant Species	Naturally growing tree species - Baitta garjan, Teliya garjan, Duliya garjan, Goda, Bonchalta, Chapalish, Amloki, Bohera, Dumur, Gotguttya, Bazna, Khudijam, Bot, different species of bamboo and cane.	Naturally growing tree species - Baitta garjan, Teliya garjan, Duliya garjan, Goda, Bonchalta, Chapalish, Amloki, Bohera, Dumur, Gotguttya, Bazna, Khudijam, Bot, different species of bamboo and cane. Planted species - Garjan, Jam, Akashmoni, Mehogony, Shegun, Chikrassi, Chapalish, Chatian Jolpai, Dumor, Bohera, Gamar, Sheora, Kat badam, Amloki, Horotoki, Kathal, Lotkon, Bell, Jambura, and Kotbel.	Dominant species - Garjan, Telshur, Chapalish and Jam. Plantation species - Teak and Akashmoni, Agar, Bamboo, Bet, Chickrassi, Arjun, Bohera, etc.
05	Wildlife/Elephant Corridor and movement in Project AoI	Asian Elephant movement is present in the Forest Range. All the bottleneck sites are outside of the Forest Range.	Corridor of Asian Elephant is present in Chunati Wildlife Sanctuary. All the bottleneck sites are outside of the Wildlife Sanctuary.	Asian Elephant, Barking Deer, Wild Boar and Rhesus Macaque movement occurs through existing highway. There are no habitat of the above species and no active migration route of Asian

Sl	Key Issues Discussed	Response		
		Chunati Range	Chunati Wildlife Sanctuary	Fashiakhali Range
				Elephant present in the Chakaria bottleneck.
06	Perception about the project	This project will improve the local transportation system. But vegetation clearance will degrade habitats of wild animals.	Tree felling will reduce tree cover. In addition, generation of noise and light will impact wildlife movement.	Improved transportation will be ensured. Wild animal movement will be hampered due to the operation of vehicles and heavy machinery.
07	Expectations, suggestions and recommendations for the proposed project	Plantation along with roadside should be done. Killing or harming wildlife should be prohibited at construction sites.	Tree plantation should be done. Less noise-generating equipment should be used. Use of light should be minimum at night.	Speed limit should be maintained, and horn/ siren should be omitted near forest area.

Table 9-20: KII with the Department of Environment

Sl	Key Issues Discussed	Response
01	Area of Influence	Patiya, Dohazari, Keranihat, Lohagara Bottleneck and adjacent area.
02	Perception and viewpoint about the project	Overall positive perception inters of better communication facilities. At the same time, it is a matter of concern regarding environmental safeguards.
03	What has been the experience or observation of DoE on compliance with environment regulations by this kind of Projects?	In some cases, DoE observed the violation of the existing rules and regulations by this kind of project and proper provision of punishment are in practice for such kind of violation.
04	What are some of the major issues with road development projects on the environment that have been observed in the past in Bangladesh?	Dust pollution, noise pollution and surface water pollution are the major concern for road construction project in Bangladesh. Apart from these, soil requirement for the road construction is another important concern for this kind of project.
05	Nearest forest/ecologically sensitive area (if available):	Chunati Wildlife Sanctuary
06	Surround culturally sensitive area (type and distance)	N/A
07	Any Future development planning in this district?	Aligned with the plan of the ministry.

Sl	Key Issues Discussed	Response
08	Any comments or Suggestions	Need to make sure that, required soil for the road construction will be collected through proper measures. Hill cutting for the required soil for road construction is subject to national law and such kind of activity during the construction is punishable by law.

CHAPTER 10

Emergency Response Plan

10 EMERGENCY RESPONSE PLAN AND DISASTER IMPACT ASSESSMENT

10.1 Introduction

The Emergency Response Plan (ERP) is a set of written procedures for dealing with emergencies that minimize the impact of the even and facilities recovery from the event. It is an outline of the procedures to be followed by all workers, employees, contractors and visitors at the Site in the event of an emergency.

10.1.1 Purpose of the Plan

The purpose of the plan includes:

- Control or limit the effect of a range of potential emergency incidents that may occur within the site;
- Ensure safe, efficient and orderly evacuation of all persons if deemed necessary;
- Ensure the safety and well-being of all personnel on the premises at the time of an emergency incident which will include assigning responsibilities for specific actions;
- Outline the procedures to be followed including communication protocols to ensure all vital information is communicated to relevant stakeholders as soon as possible;
- Contain and control an emergency incident, so as to minimize the effects on people, property and the natural environment so that normal operations can be resumed;
- Define and record emergency training requirements and emergency plan review.

This response plan is applicable in the project site that may include construction site, project office, construction yard, materials stockpiles, workers accommodation as well as off-site which has direct and indirect correlation with the project activity.

10.1.2 Scope of the Plan

This emergency response plan is mostly applicable during construction period. However, the plan is also applicable during operation period. All site personnel, subcontractors, and all third parties possibly on site are required to read and comply with this plan. It is to be noted that this is a framework plan only and shall be further developed during the project implementation.

10.2 Legislative Requirements

The relevant legal requirements and regulations for this emergency response plan are established in following laws and regulations.

- Bangladesh Labour Act 2006
- Bangladesh Labour Rules 2015
- IFC Environmental, Health, and Safety (EHS) Guidelines, General EHS Guidelines: Community Health and Safety
- Emergency Preparedness and Response sections in:
  - Performance Standard 1: Assessment and Management of Environmental and Social Risks and Impacts
  - Performance Standard 2: Labour and Working Conditions
  - Performance Standard 4: Community Health, Safety, and Security
- EIA Report of Chattogram-Cox's Bazar Highway Improvement Project

10.3 Organizational and Managerial Structure

There should be adequate personnel to implement this plan, including managerial and executive personnel with clearly defined roles and responsibilities. An Emergency Rescue Leading Group will be

formed for effective implementation of this plan at Site level. This group will be headed by Project Manager (or equivalent) accompanied by the HSE Manager (or equivalent) as the second-in-command of this group. The major roles and responsibilities of the each of personnel is given below.

10.3.1 The Role of the Project Manager/Site In-charge:

i. Proclaim the emergency and activate the Emergency Response Team (ERT) and confirming the ERP is operational.
ii. Communicate and provide incident updates to Senior Management.
iii. Coordinate/execute additional internal and external notices.
iv. Communicate with the HSE Manager and Emergency Response Team as per the demands of the situations.

10.3.2 The Roles and Responsibilities of the HSE Manager:

i. Take control of emergency situation and liaise with external emergency services like fire service and civil defense, medical services, police, etc.
ii. Assess the magnitude, potential impact, safety concerns, and action requirements based on the primary information given by the first reporting person onsite.
iii. Confirm safety aspects at site, including need for PPE, sources of incident, and possible need for evacuation.
iv. Conducting regular training and exercise, including readiness of all emergencies, evacuation drill, firefighting equipment, and training of new workers in ERP and their specific duties.
v. Ensuring the evacuation alarm/siren/call is activated during an emergency and liaise with H&S Leader.
vi. Having detailed information of available firefighting equipment and their stations.
vii. Assisting in the investigation into the emergency, if required.
viii. Preparing a detailed summary of the emergency and submit to the Consultant as soon as possible.

10.3.3 Emergency Rescue Leading Team:

Project Manager and HSE Manager will form an Emergency Rescue Leading Team. The responsibilities of this team will include:

i. Provide immediate response
ii. Assess the alert level
iii. Make the initial notifications
iv. Secure and contain the site
v. Coordinate with the site engineer and arriving of external emergency response personnel like fire service and civil defense team
vi. Response to distress calls and assist in rescue and evacuation
vii. Administer first aid as required and arrange for medical evacuation and ambulance
viii. Maintain the response until the situation is resolved

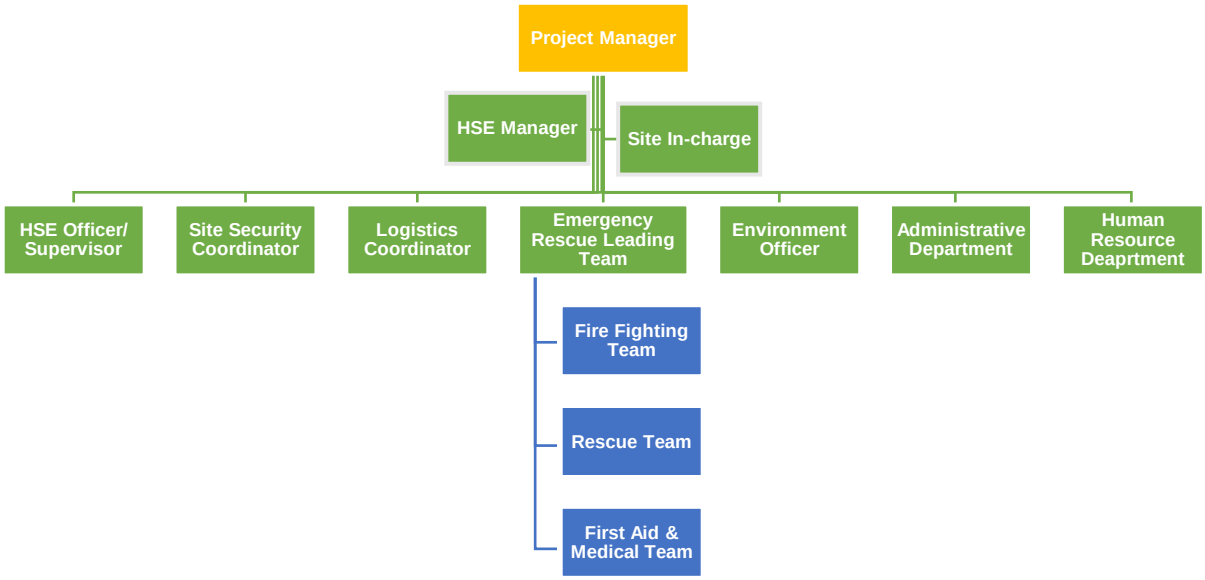
The members of this team will be:

- Trained in firefighting
- Trained in first aid service
- And trained in rescue and evacuation

An emergency management office will be established at site. The Emergency Rescue Leading Team also include EHS Supervisors, Personnel from Security Department, Personnel from Administrative and Logistic Management Department, and Personnel from Human Resource Department. An organogram

is suggested in **Figure 10-1** for constituting organizational structure to implement the emergency response plan.

Figure 10-1: The organization chart for emergency management



10.4 Potential Sources of Emergencies

This section identifies the potential sources of emergencies from various aspects, which are relevant for any construction project. The emergency can happen onsite as well as off-site project activities.

10.4.1 System, Equipment and Engineering Failure

The system, equipment, and engineering failures include several types of hazards originated from fire, fuel from gas cylinders, leakage from gas cylinders, medical emergency, toppling of heavy equipment, earthmovers, and ground vehicles, onsite and offsite road accident, and fall of person from height.

10.4.1.1 Fire

Following table shows potential sources of fire associated with construction yard and construction offices. The construction yard seems more vulnerable to any fire related incidents. Besides, fire can also occur in office and construction site as well.

Sl.	Source	Potential Risks	Exposure
1	Diesel storage area	Overfill ground fires or dike fires result from piping or tank leakage or from the error caused by the operator. Vent fire caused by the fire in the fugitive vapour; Unobstructed full liquid surface fires that can be caused by the explosion triggered by the internal vapour pressure of the tank.	Construction yard, refuelling pump
2	Fire from LPG Cylinders	LPG cylinders are used for hot work activity and at on-site canteen area. The fire from the use of LPG cylinders can be occurred due to:	Construction yard and site, kitchen at office, workers camps

Sl.	Source	Potential Risks	Exposure
		i. Leakage from faulty gas regulators and damaged hoses. Over pressure in the LPG cylinder that may cause explosion	
3	Fire at raw material storage area	Electrical fire triggered from the: i. Damaged component of the electrical panel and breaker box. ii. Over loading of the electrical panel and fuse box during hot work and other activity. iii. Defective and faulty wiring. iv. Loose fitting of the fuse or wire that can generate sparks. v. Fire in the combustible materials such as jute bag, plastic bags and other packing materials.	Construction yard and site, office and camps

10.4.1.2 Fuel and Chemical Spillage

The project will use different types of chemicals, including oil, lubricant, paint and thinner, polymer, adhesive like epoxy, etc. These chemicals will be stored at designated places in construction yard. Fire may ignite if these chemicals fall and spill accidentally and find any fire source. Also, toppling of the vehicles that carries the chemicals to the site can also cause spillage of the chemicals.

10.4.1.3 Leakage from Gas Cylinders

The project will use different types of gas cylinders like LPG Cylinder, Acetylene Cylinders, and Clean Air and Oxygen Cylinders for hot work purpose and cooking purpose. The leakage from the gas cylinder can occur due to various reasons. For example: malfunction of cylinder regulator, de-function and malfunction of the safety valve, leakage of gas transfer pipeline, welding torch fuel gas leakage, manual handling of the gas cylinder which includes toppling, falling of gas cylinders and horizontal positioning of the gas cylinders.

10.4.1.4 Medical Emergency

Medical emergencies can occur for several types of accidents like major injuries caused by traffic accident, fall from height, burn injury from electrocution, fire, exposure to lightening, exposure to gas and other chemical, etc. In addition to these emergencies, some health crisis can also be happened, for example, difficulty and shortness of breathing, fainting, chest pain or and high/fluctuation in blood pressure, uncontrolled bleeding after injury, sudden severe pain, etc.

10.4.1.5 Toppling of Heavy Equipment, Earth Movers, and Ground Vehicles

Accidents can also happen due to toppling of heavyweight equipment, earth movers, and ground vehicles. The main reasons of this type of accidents may include over-speeding of vehicles, loading more materials than the capacity of the vehicles, toppling of heavy earth movers due to not maintaining proper slope of the ramp at excavation area, not maintaining proper turning radius that may cause toppling of the vehicle, etc. Besides, onsite and offsite road accidents can be occurred due to over-speeding of vehicles, not properly following traffic instructions, not maintain speed limits at/near sensitive receptors like mosque, schools, hospitals, madrasa, etc., operating poorly maintained vehicles, and unskilled driver.

10.4.2 Anthropogenic Activities

Apart from above mentioned risks related to mostly project based activities, some anthropogenic activities can also create emergence situation. These types of activities can include both onsite and offsite incidents. For example, workers agitation, community agitation, socio-political unrest, malicious act such as theft and vandalism, etc.

10.4.3 Natural Calamities

Bangladesh is prone to several types of natural hazard and disasters due to its distinct geographical characteristics. The most recurrent natural disasters include cyclone, flood, river bank erosion, drought, storm, etc. These types of hazards can disrupt project works and create emergency situations. They main risks related to natural calamities include-

I. **Earthquake:** Earthquake is an unpredictable natural disaster with short duration but the consequences can be severe. The project area is located in Seismic Zone-3 of Bangladesh where seismic coefficient is 0.28. However, there is no devastating earthquake occurred in Bangladesh in recent history.
II. **Flood:** Flash flood risk may arise in case of unusually heavy rain. There is also risk of monsoon flood, the most dominant flood type in Bangladesh. Among five bottleneck points, Patiya, Dohazari, and Chakaria (Partial) bypass locations are situated in Moderate Flash Flood Zone, whereas Keranihat and Lohagara is situated in Not Flood Prone Area.
III. **Cyclones:** Cyclones hit the coastal areas of Bangladesh almost every year usually accompanied by high-speed winds, sometimes reaching 250 km/hr or more and 3-10m high waves, causing extensive damage to life, property and livestock. According to the cyclone risk zoning of Bangladesh, all bottleneck points are located in High Wind Area with possible storm surge height 01 m.

10.4.4 Emergency Classification

Based on the magnitude, exposure, risk, and type of the emergencies, the emergency situations can be categorized into three levels. They are:

I. Level 1: The emergency is confined to the area of occurrence and can be effectively and safely managed by the emergency equipment and available resources.
II. Level 2: The emergency has occurred and has spread to a small area but can be managed by the emergency equipment and resources available at site.
III. Level 3: This is an emergency or an incident which cannot be effectively and safely managed or contained at the location of occurrence by available resource and emergency equipment. Additional external support is required from Fire Service and Civil Defense Station/District and Upazila Administration/Hospitals/Police, etc. as it has the potential to exert effect beyond the site boundary.

10.5 Emergency Notification and Evacuation

10.5.1 Emergency Notification

Any emergency at the site shall be notified by sounding the alarm by activating the siren system or public address system. The personnel from the Emergency Rescue Leading Team will take active leadership in communicating the emergency event to the Site personnel.

10.5.2 Evacuation

If evacuation is needed, either partially or completely for short or longer time, following procedures will be followed:

I. Regardless of the situation if the emergency alarm is activated, evacuation must take place. However, personnel involve in managing the emergency situation will decide if complete evacuation or area specific evacuation is required.
II. All personnel and workers shall act in accordance with directions given by Emergency Rescue Leading Team personnel to evacuate the construction site immediately.
III. All shall move calmly to the nominated assembly area shall not leave the said area until the all clear has been given by the Site Manager or HSE Manager and Emergency Rescue Leading Team.
IV. If the danger persists, emergency services will be called by the Site Manager or HSE Manager.
V. Emergency Rescue Leading Team members may reassess the situation for immediate actions to take place.
VI. If the designated assembly point becomes endangered, or the evacuees need to remain outside the premises for an extended period, personnel will be relocated to a suitable point at the direction of the Emergency Rescue Leading Team.
VII. The emergency evacuation route map and location of the nearest assembly point must be provided at conspicuous locations.

10.5.3 Head Count

After evacuation, all persons on site, including visitors shall assemble at the assembly point. The Emergency Rescue Leading Team will conduct a roll call to ensure all persons are accounted for, including visitors and workers. This roll call will be done by using the muster rolls and visitor register. Therefore, the muster roll and visitor register need to be maintained regularly by the Site and these will be made readily available to Emergency Rescue Leading Team after an emergency. Missing persons shall be advised to the Site In-charge and HSE Manager, who will then advise the Emergency services. No personnel shall undertake search and rescue for missing persons in endangered areas except for the specialized and trained personnel along with external emergency services, if required.

10.5.4 Re-Entry

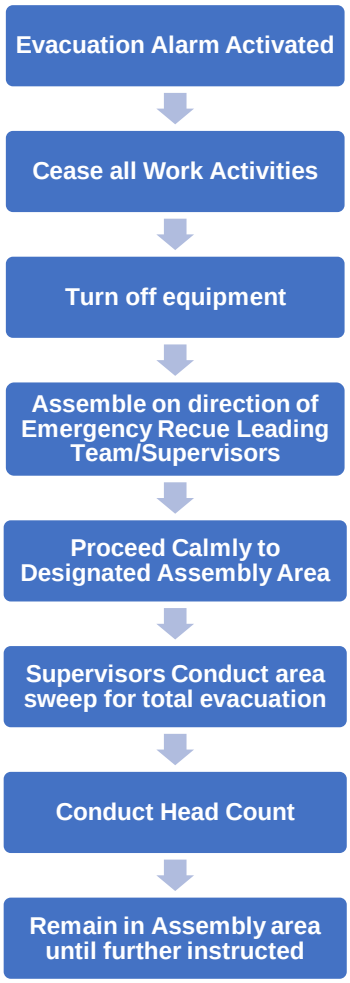
After evacuation, resolving the emergency, and head count, re-entry shall not take place until the permission is given by Project Manager and or HSE Manager. The emergency evacuation process flow is presented in **Figure 10-2**.

10.5.5 Emergency Assembly/Muster Point

There shall be a designated and identified assembly or muster point and it will be notified to all workers. During an emergency, the site personnel and visitors will be assembled at this muster point. The following safety precautions will be taken with respect to the emergency muster point:

I. The entry of goods vehicles to the Site will be stopped during an emergency to minimise exposure to the secondary emergency scenario such as accident owing to traffic movement near emergency muster point.
II. The Site will use physical road barriers to separate this area from any internal traffic movement during an emergency.
III. The Emergency Rescue Leading Team will assist the Site personnel (which includes visitors) to reach at the emergency muster point.
IV. The security guard at the main entrance of the Site will manage the movement of traffic on the access road during emergency to prevent traffic congestion that may occur by the goods vehicle plying in and out of Site.

Figure 10-2: The procedures of emergency evacuation process



10.5.6 Public Communication during Emergency

Since, there are human settlement nearby the project locations, there is a chance that the community people might be affected by the emergencies occurred in the project site. Emergency Rescue Leading Team will monitor any emergency situation and continuously monitor its impact both on internal asset and external public involvement and will take decisions on controlling emergencies accordingly. This information related to public will be shared with the general public by distribution of printed materials like banner, festoon, leaflet, signboard, etc. and meeting with community leaders as well as to the Union Parishad and Pourasova Officials.

If any emergency occurs, following safety measures will be taken to protect the public:

I. Immediately block the public road and allow emergency vehicle only;
II. Continuously announce by mike in the nearest community for evacuation if necessary;
III. Call external emergency support like Fire Service and Civil Defense, Police, Local Leaders, etc. to take control on the community according to government protocol.

10.6 Emergency Response

The former two sections described about the source of emergencies and their necessary preparedness. This section intends to describe the emergency response procedure that needs to be followed and implemented during an emergency situation.

10.6.1 Response for Emergencies caused by System, Equipment, Engineering Failure

10.6.1.1 Fire

Following procedures and steps will be followed if any fire occurred in the project site and creates emergency situations:

I. The person who recognizes the fire for the first time must inform the nearest supervisor or any personnel from the Emergency Rescue Leading Team.
II. The Site In-charge will declare the emergency and based on the level of the emergency will activate the Emergency Response Procedure. Based on the magnitude and potential harm that may cause due to fire emergency, he will seek the help of the external agencies, if required.
III. The area Supervisors will initiate the evacuation of the workers from the incident scene through safe exit in a disciplined manner. Workers will be instructed to calm and not to be panicked.
IV. The on-site Emergency Rescue Leading Team will assess the alert level and co-ordinate with the Site management and off-Site emergency response personnel if their requirement is triggered by the site manager.
V. Apart from the trained fire fighters, no other personnel will be allowed at the place of incident. The fire fighters must ensure that they have wear essential PPEs such as safety suit, safety helmet, self-containing breathing apparatus (SCBA) based on the requirement and magnitude of the fire.
VI. Disconnect utilities and equipment unless doing so jeopardizes site safety.
VII. The fire will be isolated by removing the surrounding inflammable material. This will be done without compromising safety of the fire fighters to the extent possible.
VIII. The small fires will be extinguished by using appropriate fire extinguisher (based on the class of the fire);
IX. The fire hydrant system and fire tenders will be used for the extinguishing the big fires. The site must ensure that the firewater generated during the fire suppression activity must not reach to the nearby river;
X. Rescue and attend the injured personnel and call medical emergency number to send them to hospital, if required.

The fire extinguishers to be used based on the types of fire: has been enumerated in the **Table 10-1** below:

Table 10-1: Fire Extinguishers to be kept in project site

Sl. No	Causing agent	Classification of Fire	Type of Extinguisher
1	Combustible Packing Material	Class "A" Fires	Water Type (Water and CO_2)
2	Diesel	Class "B" Fires	Foam Type
3	Paint and Paint Solvent	Class "B" Fires	Foam Type
4	Electrical Panel	Class "C" Fires	Dry Chemical powder
5	LPG Cylinder	Class "C" Fires	

10.6.1.2 Fuel and Chemical Spillage

If any large-scale fuel and chemical spillage occurred, following procedures will be followed**:**

I. Immediately notify the designated Site Supervisor/Engineer;
II. The site manager will declare the emergency and activate the Emergency Rescue Leading Team;

III. The Emergency Rescue Leading Team member must wear adequate PPEs prior staring of the spill management procedure;
IV. Secure the area and alert other site personnel. If required initiate an emergency evacuation process;
V. No person will be allowed to involve in spill containing activity unless they are trained to do so;
VI. Contain the spill with available equipment (e.g., pads, booms, absorbent powder, etc.). In case of oil spillage try to stop its flow, close the main valve of the storage tank or isolate the pipeline (in case of leakage from flanges) by blinding. Collect the spilled chemical in container by use of PPE. The Site must consider the Safety Data Sheet (SDS) of the spilled chemicals prior applying water or any other chemicals on the spilled chemicals;
VII. Do not allow the flow of spilled chemicals in the natural drainage channel;
VIII. Attend the injured personnel and call the medical emergency number, if required;
IX. Dispose of the spilled chemicals in environment friendly manner. If require, consult to the Department of Environment (DoE) Bangladesh in this regard;

If any small-scale fuel and chemical spillage occurred, following procedures will be followed:

I. Immediately notify the Site Engineer/Supervisor;
II. If toxic fumes are present, secure the area (with caution tapes or cones) to prevent other personnel from entering;
III. Deal with the spill in accordance with the instructions described in the SDS.
IV. Small spills must not be handled without wearing the proper PPEs as included in the SDS.

10.6.1.3 Leakage from Gas Cylinders

The following procedure will be followed in case of leakage of gas:

I. The person who smells the gas odor or identify the gas leak immediately inform the Site Engineer/Supervisor or directly to Site In-charge/HSE Manager.
II. An emergency will be declared.
III. The Site Supervisors will initiate the evacuation of the workers from the incident scene through safe exit in a disciplined manner. Workers will be instructed to calm and not to be panicked;
IV. The Emergency Rescue Leading Team will assess the level of emergency and co-ordinate with the Site In-charge/HSE manager for making communication with the off-site emergency response personnel.
V. Any LPG cylinder which develops a leak should be promptly removed to an isolated open place away from any source of ignition.
VI. Cylinder with valve leakage must be capped immediately and tagged by mentioning the defect.
VII. Use adequate PPEs.
VIII. Do not use naked lights to detect the leak.
IX. In case of outbreak of fire, trigger the firefighting procedures as specified in the Fire section above.
X. Give first aid to whoever required and get medical attention as quickly as possible.

10.6.1.4 Medical Emergency

Following procedures will be followed if any medical emergency happens:

I. Call the emergency phone number for ambulance and assistant. Inform Site In-charge/ HSE Manager / Site supervisor/ Site Engineer.
II. Provide the following information:
    - Nature of medical emergency.
    - Location of the emergency (area).
    - Name of the person, department.
III. Do not move victim unless absolutely necessary.

IV. Call the personnel trained in CPR and First Aid to provide the required assistance prior to the arrival of the ambulance
V. In case of rendering assistance to personnel exposed to hazardous materials, consult the SDS and wear the appropriate personal protective equipment. Attempt first aid ONLY if trained and qualified
VI. The following information must be remembered and followed for burn accident:
- In case of first and second-degree burn, exposed the affected area under cold water for 15-20 minutes. Do not put any chemical such as toothpaste etc. on the affected area and do not apply synthetic clothing on the burnt surface;
- Do not use water in case the person is exposed to water reactive chemical;

VII. In case of electrocution please follow the following steps to revive the person suffered from electrical shock:
- Ensure that the source of electrocution is de-energized if the victim is still in contact with the source of electrocution. Do not touch the victim until the source has been removed or disconnected.
- Apart from the trained first-aiders, do not allow any other person to go near to the victim.
- Conduct a head-to-toe physical examination of the victim, which will include identification of the different contact points and thermal burn.
- Check if the victim is able to communicate and is able to talk then ask for if the victim is experiencing any pain or able to move.
- Assess for any fractures and neurological deficits caused by the shock. Do not move victim in case of any neurologic deficit such as spinal injury; keep the person in lying position unless medical help arrives.
- In case victim is not able to communicate, then monitor victim's cardiac rhythm. Provide respiratory support to the victim if he/she is not able to breathe properly (asphyxiation).
- Monitor the cardiac rhythm of the victim and if required start cardiopulmonary resuscitation (CPR) to the victim. The CPR must be given by trained first-aider.
- Based on the impact of the injury transfer the person to the nearest hospital on priority basis.

10.6.1.5 Toppling of Heavy Equipment, Earth Movers and Ground Vehicles

The toppling of heavy earth movers, or heavy vehicles is one of the common phenomena in the construction phase. For prevention of toppling of vehicles, following measures will be taken:

I. Provide signed direction and coordination related to vehicle movement at site.
II. Ensure that the vehicle is fit and able to be operated and is driven by the authorized personnel only.
III. Ensure that loads are tied and securely transported.
IV. The turning radius must be maintained based on the length of the fleet.

In case of any toppling happens, the following measures to be taken by the responsible person onsite:

I. Only the authorised and trained personnel will initiate the rescue of the driver and the area will be cordoned for preventing any unauthorized entry.
II. Any naked flame or hot work activity nearby to be stopped as it may cause fire in the fuel/ diesel tanker of the toppled vehicles.
III. Traffic de-routing will be done to prevent on-site traffic congestion.
IV. The toppled vehicles will be placed at upright position by using crane with adequate load bearing capacity.
V. The Site In-charge/ HSE Manager / Site Supervisor/ Site Engineer will initiate the medical emergency based on the magnitude of the injury and illness.

10.6.1.6 Onsite and Offsite Road Accident

Following measures and procedures will be taken in case any onsite road accident occurs in the project site:

I. Only the authorised and trained personnel will initiate the rescue of the driver and victim.
II. The area will be cordoned for preventing any unauthorized entry.
III. Traffic de-routing will be done to prevent on-site traffic congestion.
IV. The emergency rescue team shall rescue the materials that was being carried by the vehicles.
V. The Site In-charge/ HSE Manager / Site Supervisor will initiate the medical emergency based on the magnitude of the injury and illness. Injured person will be shifted to the nearest health centre/ hospital and if required, to Chattogram or Dhaka.

In case any offsite road accident occurs, the following measures will be taken:

I. The driver of the vehicle will communicate the event and nature of the accident to the Site In-charge/HSE Manager/Site Engineer/Transport Engineer. Under no circumstance, the driver will start communication with the local community and must surrender at the nearest police station.
II. In case the driver suffers from the injury, he will park the vehicle at roadside and take out the vehicle key and inform the project management personnel regarding his condition. If required, he will be admitted to the nearest hospital. The Site management team will send a team of personnel for rescue operation and communicate the issue to the nearest police station (from the place of accident) as well as to the external agency that provides vehicles.

10.6.2 Response for Emergencies Caused by Anthropogenic Act and Malicious Practices

10.6.2.1 Workers and Local Community Agitation

Following procedures will be followed if any agitation of workers and local people occur in and around the project site:

I. The person who discovers the unrest should dial the emergency contact number and notify the Site In-charge/Site Engineer/Site Supervisor/HSE Manager.
II. Site In-charge must warn the site personnel of the unrest and mobilize Emergency Rescue Leading Team.
III. The team will ensure the safety of labour and site personnel in the immediate vicinity.
IV. Site Manager will instruct to seal off the affected area, if possible.
V. The Site Manager will instruct the site security personal to isolate the agitated workers.
VI. In case the agitation caused by the local community, the security will close all the entry gates and prevent entry of outsiders inside the site.
VII. Based on the magnitude of the issue, HSE Manager/Project Manager will call the Local Police Station for help.
VIII. The Emergency Rescue Leading Team will try to rescue any personnel trapped in the mob.

10.6.2.2 Socio-political Unrest

I. The Workers especially the expat workers will not be allowed to move outside the Site in case of any political unrest in the country.
II. If require, the 'Stop Work' will be declared at Site and workers will stay inside their accommodation only.
III. The Site personnel especially expats will be taken to Shah Amanat International Airport, Chattogram and or Cox's Bazar Airport in case they need to evacuate the country.

10.6.2.3 Malicious Acts, such as Theft and Vandalism

If the Site receives any information on the malicious act or vandalism caused by the worker (s) then:

I. The worker (s) involve in such activity will be identified and the site security, area supervisor and respective contractor agency must be informed.
II. The designated department will issue a show cause notice.
III. A formal hearing process inclusive of self-pleading will be conducted in presence of Site In-charge and other designated personal.

If a person is suspected of carrying a weapon to site:

I. The person who believes someone has a weapon should immediately dial emergency number;
II. The person who believes someone has a weapon should immediately notify the Site Engineer and/or Supervisor and nearest security person;
III. If suspect threatens other person with a weapon, do not engage to disarm them and remain calm;
IV. The security person will dis-weapon the worker in case they are carrying any weapons if possible;

In case of any fight among workers:

I. The person who witnesses an assault or fight should dial emergency contact;
II. Notify the incident to Site manager;
III. Site In-charge will initiate emergency response and security and Emergency Rescue Leading Team will be deployed to diffuse the situation;
IV. The security and Emergency Rescue Leading Team should seal off area where assault/fight took place, if possible;
V. The Emergency Rescue Leading Team will document all activities and ask victim(s)/witness(s) for their account of incident, including details such as weapon use, physical injury causing substantial pain or impairment of physical condition.

Based on the magnitude of the issue the local police station will be involved and involved person may be handed over to them.

10.6.3 Response for Emergencies Caused by Natural Calamities

10.6.3.1 Earthquake

Although the earthquake risk is not significant, the following procedures and measures can be followed and implemented if any occurrence take place:

I. Stay calm and await instructions from the Safety Supervisor/Site Engineer/HSE Manager or designated official.
II. Keep away from overhead fixtures, windows, filing cabinets, and electrical power.
III. Protect your head.
IV. Evacuate as instructed by the HSE Manager/Emergency Rescue Leading team.

The following procedures should be followed after the earthquake event:

I. Visually inspect the structures such as buildings, storage tanks for any visible cracks. Identify critical and weak areas of the building and organize to support them adequately to prevent collapse.
II. Isolate electrical supply if required.
III. Isolate all pipelines of steam, natural gas etc. in case of any leakage.
IV. Empty such tanks, which are found in relatively unstable conditions.
V. Take a review of material storage and ensure that stored materials are kept in safe manner.
VI. Ensure that LPG cylinders are removed from manufacturing areas and stored in the designated shed in safest manner. Also identify leaked cylinders if any

VII. Immediate ready to use all Emergency equipment like stretchers, breathing equipment, PPEs, Dewatering, portable welding gas cutting equipment, Spill kits, emergency lights, Battery-operated public-address equipment, ropes, lifting tackles, trolleys, emergency medical equipment, etc.
VIII. Inspect the firefighting equipment provided at site.
IX. Inspect if the electrical panel and other sources of ignition for any fault and damage
X. Ensure that flammable liquids i.e., Diesel and other petroleum products are stored under secondary containment with due precautions.

After such inspection notify the top management about the damage that has been identified.

10.6.3.2 Flood

If any flood/inundation occurred due to natural cause or project induced factor, following procedures will be followed:

I. Coordinate with the Emergency Rescue Leading Team and take action as per their guideline.
II. Evacuate the people from flooded area and send them to a safe area.
III. Switch off the power supply from effected area.
IV. Remove obstructions from the drain.
V. Initiate protection of raw materials, critical equipment, records and electronic equipment as best as possible
VI. Evacuate all affected spaces immediately;
VII. Relocate to a safe place on the upper floors of the building;
VIII. Prevent personnel to wade through flood waters of any depth;
IX. In case anyone needs to evacuate, he/ she must wear life-jackets or similar flotation devices.

Based on the magnitude of the flood incident the Project Manager/HSE Manager will decide to involve outside agencies during flood phenomenon based on the emergency classification as mentioned in this plan.

10.6.4 Emergency Equipment

The following equipment should be available in the project (onsite whatever necessary) for emergency use in case of necessity:

I. Firefighting Equipment:
   - Fire extinguishers;
   - Hose pipe/hose reel and fire hydrant boxes;
   - Fire water tank;
   - Fire pumps;
   - Fire tenders;
II. Personal Protective Equipment (PPE):
   - Fire retardant suits;
   - Self-Containing breathing apparatus;
   - Safety helmet, safety goggles, safety vest.
   - Life Jacket, Life Buoy
III. Medical Aids:
   - Ambulance;
   - First aid boxes;
   - Medical rooms are set up and provided with medical staff;
IV. Spill Control kit.
V. Relief supplies (including supplies for emergency work, living supplies, etc.)
VI. Vehicles for emergency work.

10.6.5 Emergency Response Training

The aim of emergency response training is to build the capacity of Site staff, to improve preparedness and response at all levels before, during, and after the potential emergencies. The focus of emergency response training will generally be on the improving the technical skills of the participants, but also on personnel and team management. It also aims to improve coordination of emergency response and the quality and availability of emergency management tools/equipment.

In accordance to the relevant provision of the *Bangladesh Labour Act, 2006* and *Bangladesh Labour Rules, 2015* all workers or at least 18% of the workers employed shall be trained on the following emergency response aspects:

- Fire-fighting;
- Emergency rescue operation;
- First aid; and
- Portable fire-fighting equipment usage.

10.6.6 Emergency Drills or Exercise

Fire drills and emergency evacuation drills shall be arranged at least once in every six months period and records of such drills shall be maintained. In addition, the concerned Inspector and nearby Fire Service Station shall be informed minimum 15 days before such drills are held. The workers shall be briefed about safety and emergency measures during Toolbox Meeting (TBM) on regular basis.

10.7 Emergency Communication

A clear communication is essential for proper response to an emergency. Therefore, multiple approaches need to be implemented during an emergency as one single method of communication may not be sufficient to communicate the emergency to the designated site personnel and off-site agencies in a timely manner. The emergency communications are made by the site personnel through emergency signage and direct communication.

10.7.1 Emergency Signage

The project will provide emergency and warning signage at conspicuous locations to make site personnel aware about the risk that cannot be avoided or controlled by other means, such as engineering controls and safety systems provided at workplace. The emergency signage are provided at site to make site personnel, including workers and visitors, aware about the:

I. Emergency escape route and location of the nearest muster point;
II. Location of the nearest emergency response equipment such as fire extinguishers, spill kits, etc.;
III. Potential hazards and risks pertaining to their operation and activities;
IV. Potential risks and hazards pertaining to a particular area such as chemical and explosive storage area, electric panel, generator, etc.

The following types of emergency signage will be provided in areas such as fuel and raw material storage area, parking area etc.:

I. Prohibition Signs: These signs will be provided to convey any 'Do Not' type of commands such as 'No Smoking'. In the workplace, they are used to reinforce instructions prohibiting dangerous activities.
II. Warning Signs: These signs are provided at site to make Site personnel aware of the nearby danger. For example, electric danger, fall danger, slope danger, slip danger, etc.
III. Mandatory Signs: The project will use these signs in order to provide instructions which needs to be complied on high priority basis. For example, the Site will provide signage on usage of PPE at Site.

IV. Safe Condition and Exit Signs: The Site will provide signage indicating escape routes, muster points, location of first aid equipment, emergency showers, etc.
V. Contact Information: The project must show emergency contact information and flow chart in every working location with high visibility.
VI. Awareness Building: The project should show signage like billboard and standby festoon containing awareness and inspirational message regarding compliance with health and safety measures.

10.7.2 Direct Communication

In case of an emergency, the emergency declaration and emergency communication procedure will be initiated. The emergency communication:

I. Must be made in simple language;
II. No code word should be used;
III. The methods of communication at site to notify all personnel during an emergency include:
    i. Emergency siren;
    ii. Manual Call Point;
    iii. Public address system;
    iv. Mobile phone, land line and intercom;
    v. Two-way radio or wireless system;

The Site Supervisor/In-charge will evaluate the emergency and determine the best method to notify the site personnel of the emergency.

10.7.3 End of the Response

After the on-site accident is handled, the project emergency rescue leading team confirms that the accident is completely controlled, and the injured persons are treated or sent to hospital; after the dangerous state has been cleared, the leader of the emergency rescue leading group decides to give an instruction to end the emergency work. The Emergency Management Office (HSE Office) notifies all departments of the project, contractor and various personnel, and the emergency operation is completed. After the emergency work is completed, check the amount of emergency supplies and supplement to the normal quantity

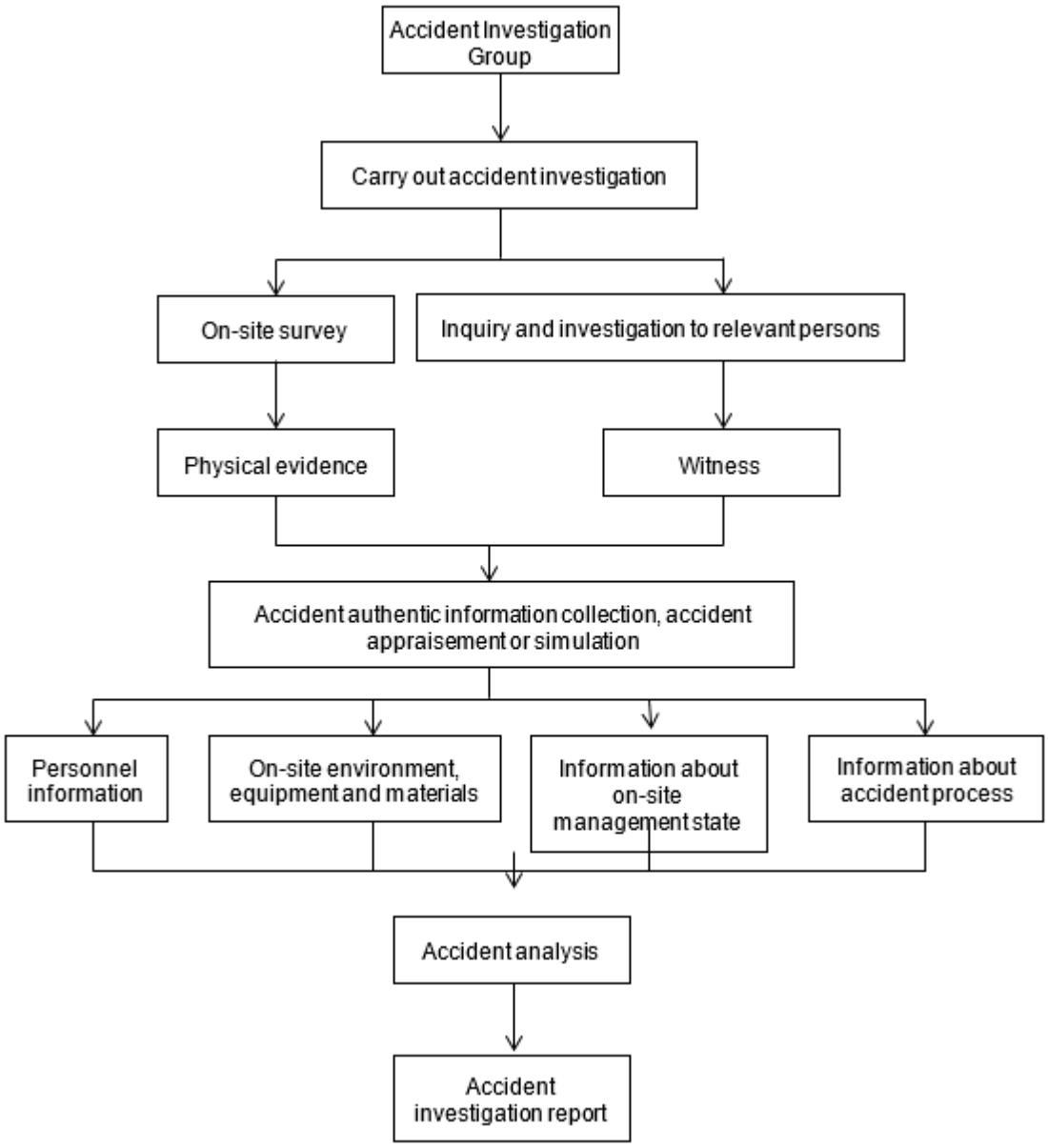
10.7.4 Accident Investigation

After the on-site accident is handled, the accident investigation personnel will carry out the following work regarding the accident:

I. Identify the cause, process, casualties and economic losses of the accident.
II. Determine the nature and responsibility of the accident.
III. Propose accident handling advises and preventive measures.
IV. Issue an accident investigation report.

The accident investigation procedure is illustrated in the following **Figure 10-3**.

Figure 10-3: Accident investigation procedures



10.8 Emergency Response Plan Review

The Project Manager and HSE Manager along with contractor's other representatives (members of the Emergency Rescue Leading Group) will annually review this plan. In addition, the Employer and the Consultant will also be involved in monitoring and review the following performance indicators to assess the effective implementation of the procedure:

I. Emergency drill records; and
II. Training records.

CHAPTER 11

Conclusion and Recommendations

11 CONCLUSION AND RECOMMENDATIONS

11.1 Conclusion

The conclusions are, in fact, summary of findings of the EIA study, which provide valuable input to the decision-makers to take informed decisions. This Environmental Impact Assessment (EIA) concludes that the environmental impacts will be manageable if the mitigation measures are implemented thoroughly. The EMP is based on the type, extent, and duration of the identified environmental impacts. The EMP has been prepared with close reference to best practices and in line with the JICA's guideline of environmental and social consideration and DoE environmental guidelines.

The project is classified 'A' in accordance with JICA's environmental and social consideration 2010 requiring preparation of an Environmental Impact Assessment Report. As per the Environmental Conservation Act, 1995 of Bangladesh, the project falls under Red category and requires preparation of an EIA. This report is prepared following the JICA and GOB environmental requirements.

Essentially primary data was used to assess the environmental impacts in a comprehensive manner. Site survey for environmental data collection, public consultation and specific studies (flora, fauna, land use,) were carried out to complete the environmental impact assessments and recommend suitable mitigation measures.

The potential environmental impacts were assessed in a comprehensive manner. The EIA report assesses the potential environmental impacts associated with the Chattogram-Cox's Bazar highway improvement project, and suitable mitigation measures have been recommended. In case any design details of the project are changed, the EIA and EMP shall be reviewed and revised accordingly and submitted to DoE & JICA for acceptance.

11.2 Recommendations

The EMP, its mitigation and monitoring programs, contained herewith shall be included within the Bidding documents for project works. The Bid documents state that the contractor shall be responsible for the implementation of the requirements of the EMP through his own Site-Specific Environmental Management Plan which will adopt all the conditions of the EMP and add site specific elements that are not currently known, such as the Contractors borrow pit locations. This ensures that all potential bidders are aware of the environmental requirements of the project and its associated environmental costs.

The EMP and all its requirements shall then be added to the contractor's contract, thereby making implementation of the EMP a legal requirement according to the contract. Contractor shall then prepare the CEMP which will be approved and monitored by the Engineer/Environmental Specialist. To ensure compliance with the CEMP the contractor should employ a national environmental specialist to monitor and report project activities throughout the project construction phase.

APPENDIX

Appendix A: Approved TOR for the EIA Study

Government of the People's Republic of Bangladesh
Department of Environment
Head Office, Paribesh Bhaban
E-16 Agargaon, Dhaka-1207
www.doe.gov.bd

Memo No: 22.02.0000.18.72.040.20 ·135 Date: 29 /06/2020

Subject: Exemption of IEE and Approval of Terms of Reference for Environmental Impact Assessment (EIA) in favour of Chattogram – Cox's Bazar Highway Improvement Project, Roads and Highways Department, Shetu Bhaban, Banani, Dhaka.

Ref: Your application dated 04/03/2020.

With reference to your letter dated 04/03/2020 for the subject mentioned above, the Department of Environment hereby gives exemption of IEE and approval of TOR for Environmental Impact Assessment (EIA) in favour of Chattogram – Cox's Bazar Highway Improvement Project, Roads and Highways Department, Shetu Bhaban, Banani, Dhaka subject to fulfilling the following terms and conditions.

1. The Project Authority shall conduct a comprehensive Environmental Impact Assessment (EIA) study considering the overall activity of each component under package-1 of the said Project in accordance with the TOR submitted to the DOE and additional suggestions provided herein.
2. The EIA report should be prepared in accordance with following indicative outlines:

1. Executive summary
2. Introduction: (Background, brief description, scope of study, methodology, limitation, EIA team, references)
3. Legislative, regulation and policy consideration (covering the potential legal, administrative, planning and policy framework within which the EIA will be prepared)

4a. Project activities: A list of the main project activities to be undertaken during site clearing, construction as well as operation.

4b. Project schedule: The phase and timing for development of the PMBP

4c. Resources and utilities demand: Resources required to develop the project, such as soil and construction material and demand for utilities (water, electricity, sewerage, waste disposal and others), as well as infrastructure (road, drains, and others) to support the project.

4d. Map and survey information
Location map, Cadastral map showing land plots (project and adjacent area), Geological map showing geological units, fault zone, and other natural features.

5. Baseline Environmental Condition should include, inter alia, following:
   - Physical Environment : Geology, Topology, Geomorphology, Soils, Meteorology, and Hydrology.
   - Biological Environment : Habitats, Aquatic life and fisheries, Terrestrial Habitats and Flora and Fauna
   - Environment Quality : Air, Water, Soil and Sediment Quality.

6. Socio-economic environment should include, inter alia, following:
   - Population: Demographic profile and ethnic composition
   - Settlement and housing
   - Traffic and transport
   - Public utilities: water supply, sanitation and solid waste
   - Economy and employment: employment structure and cultural issues in employment
   - Fisheries: fishing activities, fishing communities, commercial important species, fishing resources, commercial factors.

7. Identification, Prediction and Evaluation of Potential Impacts (identification, prediction and assessment of positive and negative impacts likely to result from the proposed project).

In identification and analysis of potential impacts'-the 'Analysis' part shall include the analysis of relevant spatial and non-spatial data. The outcome of the analysis shall be presented with the scenarios, maps, graphics etc. for the cases of anticipated impacts on baseline. Description of the impacts of the project on air, water, land, hydrology, vegetation-man maid or natural, wildlife, socio-economic aspect shall be incorporated in detail.

8. Management Plan/Procedures:

   For each significant major impact, proposed mitigation measures will be set out for incorporation into project design or procedures, impacts, which are not capable of mitigation, will be identified as residual impacts Both technical and financial plans shall be incorporated for proposed mitigation measures..
   An outline of the Environmental Management Plan shall be developed for the project. .
   In Environmental Monitoring Plan, a detail technical and financial proposal shall be included for developing an in-house environmental monitoring system to be operated by the proponent's own resources (equipments and expertise).

9. Consultation with Stakeholders/Public Consultation (ensures that consultation with interested parties and the general public will take place and their views taken into account in the planning and execution of the project)

   Beneficial Impacts (summarize the benefits of the project to the Bangladesh nation, people and local community and the enhancement potentials)

10. Emergency Response Plan and Disaster Impact Assessment

11. Conclusion and Recommendations

3. Without approval of EIA report by the Department of Environment, The Project Authority shall not be able to open L/C in favor of importable machineries.
4. Without obtaining Environmental Clearance, The Project Authority shall not start operation of each component under package-1 of this project.
5. The Project Authority shall submit the EIA report along with the filled-in application for Environmental Clearance in prescribed form, the feasibility study report, the applicable Environmental Clearance fee in a treasury chalan, the applicable VAT on clearance fee in a separate treasury chalan, the No Objection Certificate (NOC) from local authority, NOC from Forest Department (if it is required in case of cutting any forested plant, private or public) and NOC from relevant agencies for operational activity etc. to the Chattogram Regional Office of DOE at Chattogram with a copy to the Head Office of DoE in Dhaka.

29.10.2020

(Syed Nazmul Ahsan)
Director (Environmental Clearance)
Phone # 02-8181673

Project Director
Chattogram – Cox's Bazar Highway Improvement Project
Roads and Highways Department
Shetu Bhaban, Banani, Dhaka.

Copy Forwarded to :

1) PS to Secretary, Ministry of Environment, Forest and Climate Change, Bangladesh Secretariat, Dhaka.
2) Director, Department of Environment, Chattogram Regional Office, Chattogram.
3) Deputy Director, Department of Environment, Chattogram District Office, Chattogram.
4) Deputy Director, Department of Environment, Cox's Bazar District Office, Cox's Bazar.
5) Assistant Director, Office of the Director General, Department of Environment, Head Office, Dhaka.

Appendix B: List of Sensitive Receptors

Sl. No.	Name	Location
1.	Malumghat Ideal School, Malumghat, Chakaria, Cox's Bazar	21°40'47.636"N, 92°4'39.209"E
2.	Malumghat Central Jame Mosque, Malumghat, Chakaria, Cox's Bazar	21°40'49.619"N, 92°4'39.758"E
3.	Memorial Christian Hospital	21°40'55.685"N, 92°4'41.37"E
4.	Ringvong Rahmania Dakhil Madrasa, Malumghat, Chakaria, Cox's Bazar	21°40'57.915"N, 92°4'43.595"E
5.	Ringvong Dargah Gate Baytur Rahmat Jame Mosque, Cox's Bazar	21°42'1.081"N, 92°4'42.318"E
6.	Shah Majidia Rashidiatalimul Quran Madrasa, Cox's Bazar	21°42'35.142"N, 92°4'48.945"E
7.	Hasher Dighi Central Jame Mosque, Hasher Dighi Bazar, Fashiakhali, Chakaria, Cox's Bazar	21°43'19.161"N, 92°4'59.524"E
8.	Moulavirkum Bazar Baitul Illah Jame Mosque, Moulavirkum Bazar, Chakaria, Cox's Bazar	21°44'54.391"N, 92°4'46.546"E
9.	Baitur Rahmat Jame Mosque, Nijpan Khali, Chakaria, Cox's Bazar	21°45'6.163"N, 92°4'39.057"E
10.	Chakaria Eye Hospital, Vangarmukh, Chakaria Pourashava, Cox's Bazar	21°45'9.975"N, 92°4'37.902"E
11.	Rashid Ahmed Chowdhury High School, Chakaria Pourashava, Cox's Bazar	21°44'7.834"N, 92°4'59.124"E
12.	Baytul Kaba Jame Mosque, Vendibazar, Chakaria Pourashava, Cox's Bazar	21°44'18.162"N, 92°4'59.89"E
13.	Mosjidus Sayam, Lathi Moulavikum, Fashiakhali, Chakaria Pourashava, Cox's Bazar	21°44'22.731"N, 92°4'57.186"E
14.	Chakaria Al-falah Model Madrasa, Pukpukuria, Chakaria Pourashava, Cox's Bazar	21°44'27.274"N, 92°4'56.662"E
15.	City Hospital, Chakaria Pourashava, Cox's Bazar	21°45'21.117"N, 92°4'36.307"E
16.	Maa- shishu General Hospital, Chakaria Pourashava, Cox's Bazar	21°45'41.728"N, 92°4'34.171"E
17.	Popular Diagnostic & Doctors Chamber, Chakaria Pourashava, Cox's Bazar	21°45'43.857"N, 92°4'33.634"E
18.	Chiringa Madrasa, Chakaria Pourashava, Cox's Bazar	21°45'59.582"N, 92°4'35.863"E
19.	Tayab Ashraf Govt. Primary School, Lohagara, Chattogram	21°59'43.561"N, 92°5'15.599"E
20.	Lohagara Ideal School, Lohagara, Chattogram	21°59'49.634"N, 92°5'16.682"E
21.	Lohagara Dighirpar Jame Mosque, Lohagara, Chattogram	22°0'1.138"N, 92°5'19.89"E

Sl. No.	Name	Location
22.	Upazila Sadar Foyez Shafi Govt. Primary School, Lohagara, Chattogram	22°0'17.932"N, 92°5'27.586"E
23.	Upazila Model Masjid & Islamic Cultural Center, Lohagara, Chattogram	22°0'20.669"N, 92°5'29.143"E
24.	Leadership School & College, Hashem Park, Lohagara, Chattogram	22°0'23.866"N, 92°5'31.179"E
25.	Alhaz Mustafizur Rahman College, Lohagara, Chattogram	22°0'31.555"N, 92°5'36.744"E
26.	Lohagara Diabetic General Hospital, Lohagara, Chattogram	22°0'42.544"N, 92°5'40.659"E
27.	Masjid-e-Baytush Sharaf, Lohagara, Chattogram	22°0'50.588"N, 92°5'39.869"E
28.	Lohagara City Hospital Limited, Lohagara, Chattogram	22°1'8.692"N, 92°5'56.301"E
29.	Lohagara Meternity &General Hospital, Lohagara, Chattogram	22°1'8.33"N, 92°5'56.081"E
30.	Lohagara Maa-shishu Hospital, Lohagara, Bangladesh	22°1'9.05"N, 92°5'57.677"E
31.	Lohagara General Hospital, Lohagara, Chattogram	22°1'10.182"N, 92°5'59.253"E
32.	Riadus Salehin Jame Mosque, Amirabad, Jhakoabirpara, Main Road, Lohagara, Chattogram	22°1'10.182"N, 92°5'59.253"E
33.	Ma-Moni Hospital Limited, Lohagara, Chattogram	22°1'12.201"N, 92°6'3.305"E
34.	Amirabad Darul Forkan Ideal Hifj Madrasa, Lohagara, Chattogram	22°1'24.637"N, 92°6'9.896"E
35.	Bismillah Motors, Lohagara, Chattogram	22°1'36.669"N, 92°6'10.013"E
36.	Darul Forkan Hifjul Quran Madrasa, Lohagara, Chattogram	22°2'2.081"N, 92°6'13.596"E
37.	Mollik CHoang Govt. Primary School, Lohagara, Chattogram	22°2'4.376"N, 92°6'15.841"E
38.	Masjidul Iman Bar Aulia Degree College, Lohagara, Chattogram	22°2'26.68"N, 92°6'13.818"E
39.	Tahfijul Quran Academy, Podua, Lohagara, Chattogram	22°2'50.468"N, 92°6'29.093"E
40.	Podua Jamiatul Anwar Hemaytul Islam Madrasa & Orphanage, Podua, Lohagara, Chattogram	22°3'58.414"N, 92°6'24.494"E
41.	Podua Al-Jameul Anwar Central Jame Mosque, Mirzarkhal, Satkania, Chattogram	22°4'1.594"N, 92°6'26.551"E
42.	Madarbari Noyapara Govt. Primary School, Satkania, Chattogram	22°5'47.076"N, 92°4'37.807"E
43.	Shahi Jame Mosque, Rastarmatha, Satkania, Chattogram	22°5'50.434"N, 92°4'31.309"E

Sl. No.	Name	Location
44.	Baytur Rahman Jame Mosque, Keranihut, Satkania, Chattogram	22°6'3.613"N, 92°4'26.417"E
45.	Middle Hasimpur Kharajirpara Jame Mosque, Chandanaish, Chattogram	22°11'56.274"N, 92°2'36.455"E
46.	Talimul Islam Madrasa, Khanjirpara, Chattogram	22°11'55.035"N, 92°2'35.664"E
47.	Masjid-A-Baitul Huda, Chattogram	22°11'41.868"N, 92°2'39.328"E
48.	Khan Jame Mosque, Hashimpur, Bagichahut, Chandanaish, Chattogram	22°11'29.915"N, 92°2'43.772"E
49.	South Hashimpur Boropara Central Jame Mosque, Hashimpur, Chandanaish, Chattogram	22°10'50.636"N, 92°3'6.71"E
50.	South Hashimpur Govt. Primary School, Hashimpur, Chandanaish, Chattogram	22°10'49.816"N, 92°3'6.969"E
51.	Café Abrar, Chandanaish, Chattogram	22°10'35.139"N, 92°3'11.848"E
52.	East Hasan Dondi Hazarat Sultan Shah Jame Mosque, Chandanaish, Chattogram	22°10'22.457"N, 92°3'11.773"E
53.	Dewanhut East Jame Mosque, Chandanaish, Chattogram	22°9'58.255"N, 92°3'11.212"E
54.	Dohazari Jamijuri Ahmadur Rahman High School, Chandanaish, Chattogram	22°9'48.59"N, 92°3'41.842"E
55.	Dohazari 31 Bed Hospital, Chandanaish, Chattogram	22°9'49.231"N, 92°3'44.451"E
56.	Dohazari Govt. Primary School, Chandanaish, Chattogram	22°9'48.87"N, 92°3'44.5"E
57.	Masjid-A-Baytush Sharaf, Katgor, Satkania, Chattogram	22°9'18.418"N, 92°4'16.298"E
58.	Popular Hospital & Diagnostic Center, Katgor, Satkania, Chattogram	22°9'16.578"N, 92°4'16.938"E
59.	Katgor Maleyabad Jame Mosque, Katgor, Satkania, Chattogram	22°9'7.752"N, 92°4'10.268"E
60.	Mia Khalilur Rahman Jame Mosque, Satkania, Chattogram	22°8'55.67"N, 92°4'10.63"E
61.	Moulavir Dokan Jame Mosque, Rasulabad, Satkania, Chattogram	22°8'43.339"N, 92°4'10.693"E
62.	Zafar Ahmed Chowdhury College, North Satkania, Chattogram.	22°8'35.089"N, 92°4'10.611"E
63.	Jonar Keochia Icha Pukur Jame Mosque, Satkania, Chattogram.	22°7'0.895"N, 92°4'20.748"E
64.	All Care Hospital & Diagnostic Center, Satkania, Chattogram.	22°6'37.73"N, 92°4'23.438"E
65.	Jonar Keochia Ideal High School, Keranihut, Satkania, Chattogram.	22°6'34.404"N, 92°4'24.496"E
66.	Gul Cheher Tower, Keranihut, Satkania, Chattogram	22°6'20.686"N, 92°4'26.262"E

Sl. No.	Name	Location
67.	Chattogram Eye Hospital, Pahartoli, Satkania, Chattogram	22°6'20.686"N, 92°4'26.262"E
68.	Masjidus Shohada, Keranihut, Satkania, Chattogram	22°6'18.837"N, 92°4'26.324"E
69.	Keranihut Govt. Primary School, Satkania, Chattogram	22°6'17.038"N, 92°4'25.591"E
70.	Health Care Hospital, Keranihut, Satkania, Chattogram	22°6'14.412"N, 92°4'26.733"E
71.	Keranihut Central Hospital, Keranihut, Satkania, Chattogram	22°6'12.919"N, 92°4'25.557"E
72.	Keranihut Central Mosque, Keranihut, Satkania, Chattogram	22°6'12.328"N, 92°4'25.565"E
73.	Baytush Sharaf Complex, Keranihut, Satkania, Chattogram	22°6'7.343"N, 92°4'29.195"E
74.	Ash-Shefa School & College, Keranihut, Satkania, Chattogram	22°6'7.918"N, 92°4'29.588"E
75.	Keranihut Jameul Ulum Islamia Fazil Degree Madrasa, Keranihut, Satkania, Chattogram	22°6'8.055"N, 92°4'28.55"E
76.	Gachbaria Nittanondo Gourichandra Govt. Model High School, Chandanaish, Chattogram	22°12'47.767"N, 92°1'49.253"E
77.	Gausul- Azam Jame Mosque, Chandanaish, Chattogram	22°12'48.625"N, 92°1'50.335"E
78.	Khanhut Bazar Central jame Mosque, Chandanaish, Chattogram	22°12'58.057"N, 92°1'41.949"E
79.	Gachbaria Govt. College Mosque, Chandanaish, Chattogram	22°13'0.775"N, 92°1'40.438"E
80.	Hashimpur Moqbulia Fazil Madrasa, Chandanaish, Chattogram	22°13'0.933"N, 92°1'41.516"E
81.	Kanchonabad High School, Chandanaish, Chattogram	22°14'11.026"N, 92°1'24.026"E
82.	Munshi Keramot Ali Chowdhury Jame Mosque, Kanchon Nagar, Chandanaish, Chattogram	22°14'11.099"N, 92°1'23.984"E
83.	Jahangiria Aulia Jame Mosque, Chandanaish, Chattogram	22°14'20.174"N, 92°1'17.983"E
84.	Hazarat Shah Sufi Momtajia Mohammadia Hefjkhana & Orphanage, Chandanaish, Chattogram	22°14'19.881"N, 92°1'17.863"E
85.	Rowshonhut Jame Mosque, Chandanaish, Chattogram	22°14'33.21"N, 92°1'17.858"E
86.	Tojumbul Ali Pandit Jame Mosque, North Kanchon Nagar, Chandanaish, Chattogram	22°14'39.106"N, 92°1'19.634"E
87.	Ibrahim Iqbal Memorial Hospital, Chandanaish, Chattogram	22°14'41.768"N, 92°1'10.947"E
88.	B.G.C Trust University, Chandanaish, Chattogram	22°14'50.867"N, 92°1'1.486"E

Sl. No.	Name	Location
89.	Chakroshala Durgabari, Patia, Chattogram	22°16'33.521"N, 92°0'10.907"E
90.	Chakroshala Sree Sree Maa Jo Mogdheshori Sheba Mondir, Patia, Chattogram	22°16'32.717"N, 92°0'16.162"E
91.	Chakroshala Krishi High School, Patia, Chattogram	22°16'39.222"N, 92°0'13.63"E
92.	Gausul Ajam Jame Mosque, Komol Munshirhut, Patia, Chattogram	22°16'44.123"N, 92°0'14.859"E
93.	Sri Sri Thakur Onukul Chandra Shotshongo Asram, Milon Chokro, Chakroshala, Patia, Chattogram	22°16'59.329"N, 91°59'47.488"E
94.	Milon Chokro Govt. Primary High School, Chakroshala, Patia, Chattogram	22°16'58.275"N, 91°59'47.695"E
95.	Riazul Ulum Girls/Boys Madrasa, Patia, Chattogram	22°17'8.483"N, 91°59'33.664"E
96.	Patia Baptist Church, Sreemai Bridge, Patia, Chattogram	22°17'12.355"N, 91°59'26.915"E
97.	Hazarat Shah Chand Aulia (RA) Alia Madrasa, Bahuli, Patia, Chattogram	22°17'21.537"N, 91°59'11.194"E
98.	Jhal Bitan, Masjid Market Bus Station, Patia, Chattogram	22°17'28.974"N, 91°59'0.167"E
99.	Patia Govt. College, Patia, Chattogram	22°17'32.354"N, 91°58'56.009"E
100.	Patia Central. College, Patia, Chattogram	22°17'32.514"N, 91°58'56.167"E
101.	Patia Govt. College Jame Mosque, Patia, Chattogram	22°17'35.199"N, 91°58'55.901"E
102.	Patia Model high School, Patia, Chattogram	22°17'37.167"N, 91°58'52.734"E
103.	Abul Sobhan Rahat Ali High School, Patia, Chattogram	22°17'40.837"N, 91°58'51.534"E
104.	Sri Sri Gourango Niketon, Patia, Chattogram	22°17'44.251"N, 91°58'46.28"E
105.	Sri Sri Durga Mondir, Munsef Bazar, Patia Pourashova, Chattogram	22°17'51.736"N, 91°58'30.884"E
106.	Shukor Ali Munsef jame Mosque, Patia, Chattogram	22°17'53.015"N, 91°58'25.623"E
107.	Patiya Central Hospital, Patia, Chattogram	22°17'54.181"N, 91°58'22.239"E
108.	Holy Child Kinder Garten, Patia, Chattogram	22°17'54.066"N, 91°58'22.335"E
109.	District Health & Family Development Complex, Patia, Chattogram	22°17'57.266"N, 91°58'13.537"E
110.	Patia Chevron Hospital Private Limited, Patia, Chattogram	22°17'57.524"N, 91°58'11.202"E
111.	Sheanpara Haji Abdul Khalek Amiria Dakhil Madrasa, Patia, Chattogram	22°17'25.405"N, 91°58'8.571"E

Sl. No.	Name	Location
112.	Nuri Mosque, South Ghata, Patia, Chattogram	22°17'6.44"N, 91°58'32.763"E
113.	Bishudhanondo Sharbojonin Boudho Bihar, Patia, Chattogram	22°17'4.179"N, 91°58'5.271"E
114.	Sri Srikrishno Chaitonno Dham, Vatikhain, Patia, Chattogram	22°16'58.666"N, 91°58'9.391"E
115.	Korol Girls High School, Patia, Chattogram	22°17'3.565"N, 91°58'9.664"E
116.	Korol Boudho Mohashoshan, Patia, Chattogram	22°17'5.785"N, 91°58'11.801"E
117.	Madrasa-A-Gausia Taiyebia Hefjkhana & Peyar Mohammad Shah (RA) Orphanage, Patia, Chattogram	22°17'6.169"N, 91°58'15.406"E
118.	Mohanondo Shebasrom, Patia, Chattogram	22°17'2.068"N, 91°58'20.984"E
119.	Hazarat Mirza Ali-Ledu Shah (RA) Bohumukhi Madrasa Gate, Vatikhain, Patia, Chattogram	22°16'59.086"N, 91°58'27.074"E
120.	Sri Sri Nobogroho Mondir, Patia, Chattogram	22°16'44.006"N, 91°58'53.274"E
121.	East Vatikhain Baytur Rahmat Jame Mosque, Vatikhain, Patia, Chattogram	22°16'40.662"N, 91°58'57.582"E
122.	Farukipara Baytur Rahmat Jame Mosque, Kachuai, Patia, Chattogram	22°16'46.395"N, 91°59'30.91"E
123.	Kacuai C T Govt. Primary School, Kachuai, Patia, Chattogram	22°16'46.395"N, 91°59'30.91"E
124.	Farukipara Islamia Ebatediya & Forkania Madrasa, Kachuai, Patia, Chattogram	22°16'47.426"N, 91°59'32.897"E
125.	Allai Okhara Govt. Primary School, Patia, Chattogram	22°18'5.098"N, 91°57'44.136"E
126.	Haji Anwar Ali Chowdhury Jame Mosque, Patia, Chattogram	22°18'5.513"N, 91°57'39.432"E
127.	Shah Ashraf Academy, Patia, Chattogram	22°18'5.587"N, 91°57'38.231"E
128.	Allai Aman Ali Chowdhury Jame Mosque, Patia, Chattogram	22°18'7.357"N, 91°57'28.968"E
129.	Allai Mohammadia Gausia Jame Mosque, Patia, Chattogram	22°18'9.982"N, 91°57'16.636"E
130.	Ujibpur Pre-Cadet School, Ujibpur, Patia, Chattogram	22°18'15.332"N, 91°56'16.636"E
131.	Baitunnur Jame Mosque, Ujibpur, Patia, Chattogram	22°18'22.237"N, 91°56'56.267"E
132.	Ujibpur Mohammadia Jame Mosque, Ujibpur, Patia, Chattogram	22°18'35.631"N, 91°56'51.686"E
133.	Union Agriculture School & College, Ujibpur, Patia, Chattogram	22°18'35.24"N, 91°56'50.208"E
134.	Lorihora Govt. Primary School, Patia, Chattogram	22°18'51.393"N, 91°56'15.913"E

Sl. No.	Name	Location
135.	Pairol Dhormoratna Central Boudho Bihar, Patia, Chattogram	22°18'50.114"N, 91°55'52.596"E
136.	South Hulain Noyahut Jame Mosque, Patia,Chattogram	22°18'56.373"N, 91°55'41.203"E
137.	Yakub Dondi Hulain Pairol High School, Patia,Chattogram	22°18'55.414"N, 91°55'38.457"E
138.	Yakub Dondi Govt. Primary School, Patia,Chattogram	22°18'55.403"N, 91°55'37.348"E
139.	South Hulain Sunniya Chadeki Modinatul Ulum Forkania Madrasa, Patia, Chattogram	22°18'56.909"N, 91°55'31.084"E

Appendix C: Monitoring Location Photographs

Appendix C-1: Monsoon Period Air Quality Monitoring Photographs

AQ-01: Air quality monitoring beside existing highway in Patiya

AQ-02: Air quality monitoring near residential/commercial area of the proposed bypass in Patiya

Weather Monitoring at Patiya

AQ-03: Air quality monitoring beside existing highway in Dohazari

AQ-04: Air quality monitoring near the proposed bypass area in Dohazari

Weather monitoring at Dohajari Area

AQ-05: Air quality monitoring beside existing highway at proposed FOB area in Keranihat

AQ-06: Air quality monitoring near residential/commercial area at proposed FOB area in Keranihat

Weather monitoring at proposed FOB area in Keranihat

AQ-07: Air quality monitoring near the proposed bypass area in Keranihat


AQ-08: Air quality monitoring near the proposed bypass area in Keranihat

Weather monitoring at proposed Bypass Area, Keranihat


AQ-09: Air quality monitoring beside existing highway in Lohagara


AQ-10: Air quality monitoring near the proposed bypass area in Lohagara

Weather monitoring at proposed Lohagara Area

AQ-11: Air quality monitoring near the proposed bypass area in Chakaria

AQ-12: Air quality monitoring near existing highway in Chakaria

Weather monitoring at proposed Chakaria Area

Appendix C-2: Winter Period Air Quality Monitoring Photographs


AQ-01: Air quality monitoring beside existing highway in Patiya


AQ-02: Air quality monitoring near residential/commercial area of the proposed bypass in Patiya

Weather Monitoring at Patiya


AQ-03: Air quality monitoring beside existing highway in Dohazari

AQ-04: Air quality monitoring near the proposed bypass area in Dohazari

Weather monitoring at Dohajari Area


AQ-05: Air quality monitoring beside existing highway at proposed FOB area in Keranihat


AQ-06: Air quality monitoring near residential/commercial area at proposed FOB area in Keranihat

Weather monitoring at proposed FOB area in Keranihat

AQ-07: Air quality monitoring near the proposed bypass area in Keranihat

AQ-08: Air quality monitoring near the proposed bypass area in Keranihat

Weather monitoring at proposed Keranihat Bypass Area


AQ-09: Air quality monitoring beside existing highway in Lohagara


AQ-10: Air quality monitoring near the proposed bypass area in Lohagara

Weather monitoring at proposed Lohagara Area


AQ-11: Air quality monitoring near the proposed bypass area in Chakaria

AQ-12: Air quality monitoring near existing highway in Chakaria

Weather monitoring at proposed Chakaria Area

Appendix C-3: Noise Level, Vibration Level and Road Traffic Survey Photographs

RS-01: In front of Upazila Health Complex, Patiya

RS-02: In front of Dakshin Gata Nuri Jame Mosque, Patiya

RS-03: In front of BGC Trust Medical College, Patiya


RS-04: In front of Dohazari Jamijuri A. Rahman High School, Dohazari


FR-01: Near Chagachar Jame Mosque, Dohazari


RS-05: In front of Shahi Jame Mosque, Keranihat


RS-06: In front of Noyapara Baitul Mamur Jame Mosque, Padua, Lohagara


RS-07: In front of Citizen Park Community Center, Lohagara


FR-02: In front of Maulana Sultan Hossain Jame Mosque, Lohagara


RS-08: In front of Adhunagar Gul-E-Jar Girls High School, Aziz Nagar, Chakaria


FR-03: In front of Dakshin Lotonee Central Jame Mosque, Chakaria


RS-09: In front of Fashiakhali Government Primary School, Chakaria

Appendix C-4: Noise Level Calculation from hourly LAeq

Monitoring Location	Time Zone	Hour	LAeq (dB), Hour	LAeq, Time Zone
RS-01: Patiya	Day	6	Not Monitored	72.6
		7	Not Monitored	
		8	Not Monitored	
		9	Not Monitored	
		10	Not Monitored	
		11	76.9	
		12	72.9	
		13	71.4	
		14	72.7	
		15	70.7	
		16	70.8	
		17	71.4	
		18	71.4	
		19	72.3	
		20	71.2	
	Night	21	71.1	69.6
		22	69.7	
		23	68.7	
		24	68.8	
		1	69	
		2	Not Monitored	
		3	Not Monitored	
		4	Not Monitored	
		5	Not Monitored	

Monitoring Location	Time Zone	Hour	LAeq (dB), Hour	LAeq, Time Zone
RS-02: Patiya	Day	6	59.9	59.7
		7	63.6	
		8	62.3	
		9	61.1	
		10	61.3	
		11	57.3	
		12	59.8	
		13	56.5	

Monitoring Location	Time Zone	Hour	LAeq (dB), Hour	LAeq, Time Zone
		14	55.7	
		15	57.2	
		16	58.7	
		17	60.1	
		18	58.2	
		19	58.6	
		20	56	
	Night	21	61.9	60.9
		22	62.4	
		23	Installation Break	
		24	61	
		1	62.4	
		2	61.3	
		3	59.3	
		4	57.7	
		5	59.3	

Monitoring Location	Time Zone	Hour	LAeq (dB), Hour	LAeq, Time Zone
RS-03: Patiya	Day	6	69.2	70.9
		7	69.9	
		8	73	
		9	70.5	
		10	70.8	
		11	71.2	
		12	70.5	
		13	70.7	
		14	70.5	
		15	70.3	
		16	71.3	
		17	70.9	
		18	71.4	
		19	Installation Break	
		20	71.7	
	Night	21	71.2	70.4
		22	69.8	

Monitoring Location	Time Zone	Hour	LAeq (dB), Hour	LAeq, Time Zone
		23	71.5	
		24	70.8	
		1	70.9	
		2	70.3	
		3	70.2	
		4	69.6	
		5	68.4	

Monitoring Location	Time Zone	Hour	LAeq (dB), Hour	LAeq, Time Zone
RS-04: Dohazari	Day	6	67.6	72.7
		7	70.3	
		8	74.1	
		9	77.6	
		10	73.2	
		11	72.6	
		12	72.5	
		13	70.9	
		14	71.7	
		15	71.5	
		16	72.6	
		17	71.4	
		18	71.9	
		19	Installation Break	
		20	71.5	
	Night	21	70.1	69.3
		22	71.5	
		23	70.4	
		24	69.4	
		1	68.9	
		2	69.4	
		3	67.1	
		4	67.1	
		5	67	

Monitoring Location	Time Zone	Hour	LAeq (dB), Hour	LAeq, Time Zone
FR-01: Dohazari	Day	6	60	63.1
		7	60.8	
		8	64.4	
		9	63.6	
		10	62.8	
		11	64.1	
		12	61.3	
		13	62.3	
		14	61.9	
		15	63.5	
		16	64.9	
		17	64.8	
		18	63	
		19	63	
		20	Installation Break	
	Night	21	61.2	57.9
		22	62.7	
		23	59.1	
		24	55.2	
		1	52	
		2	49.7	
		3	48.3	
		4	52.3	
		5	58.8	

Monitoring Location	Time Zone	Hour	LAeq (dB), Hour	LAeq, Time Zone
RS-05: Keranihat	Day	6	68.9	70.5
		7	70.7	
		8	71.3	
		9	71.1	
		10	71.1	
		11	71.3	
		12	70.1	
		13	69.9	
		14	69	

Monitoring Location	Time Zone	Hour	LAeq (dB), Hour	LAeq, Time Zone
		15	69.6	
		16	70.3	
		17	70.5	
		18	71.1	
		19	71.3	
		20	70.6	
	Night	21	Installation Break	69.4
		22	71.1	
		23	69.9	
		24	71.3	
		1	68.9	
		2	67.9	
		3	68.1	
		4	68.4	
		5	68.3	

Monitoring Location	Time Zone	Hour	LAeq (dB), Hour	LAeq, Time Zone
RS-06: Padua	Day	6	68.9	70.1
		7	69.3	
		8	69.2	
		9	69.8	
		10	70.4	
		11	70.9	
		12	70.7	
		13	70.1	
		14	69.8	
		15	70.3	
		16	70.4	
		17	70.2	
		18	70.7	
		19	Installation Break	
		20	70	
	Night	21	70.4	67.8
		22	69.6	
		23	68	

Monitoring Location	Time Zone	Hour	LAeq (dB), Hour	LAeq, Time Zone
		24	67.6	
		1	67.2	
		2	66.5	
		3	65.1	
		4	65.5	
		5	67	

Monitoring Location	Time Zone	Hour	LAeq (dB), Hour	LAeq, Time Zone
RS-07: Lohagara	Day	6	66.1	69.6
		7	67.8	
		8	68.2	
		9	69.1	
		10	69.8	
		11	71.1	
		12	70.8	
		13	70.2	
		14	70.2	
		15	70.3	
		16	70.8	
		17	70.6	
		18	69.4	
		19	69	
		20	68.5	
	Night	21	Installation Break	67.8
		22	68.6	
		23	67.5	
		24	67.3	
		1	68.2	
		2	66.5	
		3	66.6	
		4	65.5	
		5	70.3	

Monitoring Location	Time Zone	Hour	LAeq (dB), Hour	LAeq, Time Zone
FR-02: Lohagara	Day	6	51.7	61.9
		7	55.6	
		8	56.9	
		9	55.7	
		10	58.4	
		11	57.8	
		12	59.4	
		13	62.3	
		14	68.7	
		15	66.5	
		16	60.6	
		17	59.8	
		18	60.3	
		19	61.5	
		20	61.7	
	Night	21	63.1	58.4
		22	60.5	
		23	60.1	
		24	Installation Break	
		1	55.6	
		2	54	
		3	53.8	
		4	54.8	
		5	53.6	

Monitoring Location	Time Zone	Hour	LAeq (dB), Hour	LAeq, Time Zone
RS-08: Adhunagar	Day	6	66.5	71.1
		7	67.3	
		8	68.4	
		9	71.4	
		10	71	
		11	70.9	
		12	71.4	
		13	71.2	
		14	75.1	

Monitoring Location	Time Zone	Hour	LAeq (dB), Hour	LAeq, Time Zone
		15	71	
		16	71.8	
		17	70.5	
		18	72.7	
		19	68.9	
		20	Installation Break	
	Night	21	70.4	67.7
		22	68.9	
		23	68.4	
		24	67.3	
		1	66.8	
		2	66.1	
		3	65.5	
		4	66.7	
		5	67	

Monitoring Location	Time Zone	Hour	LAeq (dB), Hour	LAeq, Time Zone
FR-03: Chakaria	Day	6	58.7	64.9
		7	60.9	
		8	61.2	
		9	65.7	
		10	67.8	
		11	68.9	
		12	68.8	
		13	65.3	
		14	69.5	
		15	60.7	
		16	59.6	
		17	60.4	
		18	62.1	
		19	59.1	
		20	57.2	
	Night	21	60.3	57.5
		22	Installation Break	
		23	58.3	

Monitoring Location	Time Zone	Hour	LAeq (dB), Hour	LAeq, Time Zone
		24	59.6	
		1	56.2	
		2	56.3	
		3	56.3	
		4	53.8	
		5	54.6	

Monitoring Location	Time Zone	Hour	LAeq (dB), Hour	LAeq, Time Zone
RS-09: Chakaria	Day	6	67.4	71.1
		7	68.5	
		8	69.7	
		9	72.2	
		10	71.1	
		11	71.8	
		12	71.3	
		13	72.6	
		14	71.4	
		15	70.9	
		16	71.8	
		17	71.7	
		18	72.5	
		19	71.4	
		20	69.3	
	Night	21	67.9	66.6
		22	69	
		23	Installation Break	
		24	66.8	
		1	65.6	
		2	64.1	
		3	65.9	
		4	65.4	
		5	66.3	

Appendix C-5: Vibration Level Calculation

Location: RS-01					
Time Zone	**Hour**	**L10 (dB)**	**L50 (dB)**	**L90 (dB)**	**L10(dB), Time Zone**
Day	8	Not computed	Not computed	Not computed	47.5
	9	Not computed	Not computed	Not computed	
	10	Not computed	Not computed	Not computed	
	11	48	39.8	35.5	
	12	49.6	40.7	36.3	
	13	48	38.3	34.5	
	14	47.6	38.2	32.1	
	15	48.9	38.8	34.1	
	16	45.8	37.1	32.7	
	17	46	37.5	32.4	
	18	46.3	38.2	34	
Night	19	47.1	38.2	33.3	50.4
	20	49.7	37.5	31.9	
	21	47.3	36.5	31.4	
	22	47.6	36.8	30.1	
	23	51	37.7	29	
	24	56.5	38.2	28.9	
	1	51.1	32.7	25.5	
	2	53.2	32.5	21	
	3	Not computed	Not computed	Not computed	
	4	Not computed	Not computed	Not computed	
	5	Not computed	Not computed	Not computed	
	6	Not computed	Not computed	Not computed	
	7	Not computed	Not computed	Not computed	

Location: RS-02					
Time Zone	**Hour**	**L10 (dB)**	**L50 (dB)**	**L90 (dB)**	**L10(dB), Time Zone**
Day	8	37.4	31.6	26.3	38.1
	9	36.5	30.7	26.3	
	10	37.6	31.1	25.2	
	11	37.2	30.9	26.5	
	12	39.3	32.9	26.3	
	13	38.3	31.6	24.9	

Location: RS-02					
Time Zone	**Hour**	**L10 (dB)**	**L50 (dB)**	**L90 (dB)**	**L10(dB), Time Zone**
	14	41.1	33	25.7	
	15	37.4	30.8	23.3	
	16	37.5	32.1	24.7	
	17	39.8	32.9	28.3	
	18	36.6	32.5	26.8	
Night	19	37.6	31	23.5	39.0
	20	39.3	34.9	30.3	
	21	42.2	36.5	30.2	
	22	40.9	36.5	30.5	
	23	41.9	37	30.5	
	24	39.5	32.2	24.4	
	1	38.3	32.2	22.1	
	2	38	28.8	17.6	
	3	37.2	30.9	17.8	
	4	36.8	31	22.9	
	5	36.1	27.6	18.9	
	6	38.7	32.7	24.2	
	7	40.6	32.2	24.2	

Location: RS-03					
Time Zone	**Hour**	**L10 (dB)**	**L50 (dB)**	**L90 (dB)**	**L10(dB), Time Zone**
Day	8	54.1	44.9	38.7	51.2
	9	50.5	42.6	36.5	
	10	51.5	44.3	39.5	
	11	50.4	41.9	36.3	
	12	50.5	41.3	35.4	
	13	50.9	45.4	34.9	
	14	50.2	44.3	38.6	
	15	50.5	44.3	38.3	
	16	51.2	43.1	36	
	17	51.1	44.8	37	
	18	52.3	45.7	37.8	
Night	19	52	46.2	38.9	52.6
	20	51.8	47	41.8	

Location: RS-03					
Time Zone	**Hour**	**L10 (dB)**	**L50 (dB)**	**L90 (dB)**	**L10(dB), Time Zone**
	21	51.8	45.3	34.3	
	22	53.1	48	42.2	
	23	53	46.8	37.1	
	24	54.4	47.6	37.4	
	1	54.3	46.9	40.7	
	2	56.5	47.9	37.9	
	3	51.7	42	33.3	
	4	53.3	45.3	34.5	
	5	52.3	40.8	23.2	
	6	50.3	42.4	32.3	
	7	48.8	40.2	33.2	

Location: RS-04					
Time Zone	**Hour**	**L10 (dB)**	**L50 (dB)**	**L90 (dB)**	**L10(dB), Time Zone**
Day	8	46.6	35.7	27.5	47.6
	9	47.5	39.1	30.5	
	10	45.7	37.9	30.2	
	11	46	37.7	31.1	
	12	49.3	41.7	35.2	
	13	48	40	31.8	
	14	47.8	39.4	31	
	15	48.2	40.9	31.4	
	16	47.7	40	33.5	
	17	48.2	38.8	31.1	
	18	48.1	39.8	31.4	
Night	19	48.1	41.9	35.6	48.7
	20	46.6	38.4	30.3	
	21	50	42	31	
	22	49.2	40.7	31.7	
	23	48.4	39.9	28.1	
	24	49.4	40.4	28.1	
	1	47	31.9	20.7	
	2	50.3	40.5	27.4	
	3	49.9	38.5	27.6	

Location: RS-04					
Time Zone	**Hour**	**L10 (dB)**	**L50 (dB)**	**L90 (dB)**	**L10(dB), Time Zone**
	4	48.3	36.2	23.2	
	5	47.8	30.8	19	
	6	49.3	36.6	24.9	
	7	48.3	37.7	27.2	

Location: FR-01					
Time Zone	**Hour**	**L10 (dB)**	**L50 (dB)**	**L90 (dB)**	**L10(dB), Time Zone**
Day	8	34	26.5	22	35.3
	9	35.9	29.4	23.3	
	10	37	29.8	24.5	
	11	35.8	27.6	21.3	
	12	35.1	27.3	21.2	
	13	35.1	26.7	21.4	
	14	35	26.4	20.1	
	15	33.9	25.6	21.5	
	16	35.9	27.8	22.6	
	17	35.8	28.5	22.7	
	18	34.6	27.3	21.7	
Night	19	35.6	27.9	23.3	30.2
	20	36.5	29.8	25.3	
	21	36	27.6	23.7	
	22	35.9	26.7	21.8	
	23	32.7	25.4	21.8	
	24	27.7	23	19.6	
	1	26.9	23.4	20	
	2	27.5	23.8	20.5	
	3	24.4	20.5	17.3	
	4	24.9	20.4	16.8	
	5	24.7	20.4	17.2	
	6	25.9	22.6	19.5	
	7	34.2	24.7	20.9	

Location: RS-05					
Time Zone	**Hour**	**L10 (dB)**	**L50 (dB)**	**L90 (dB)**	**L10(dB), Time Zone**
Day	8	46.6	38.5	34.1	45.6
	9	41.8	37.4	33.5	
	10	43.9	39.2	36.1	
	11	43.7	38.8	33.6	
	12	45.7	38.8	33.4	
	13	42.8	35.8	32.1	
	14	46.6	41.6	34.5	
	15	48.9	40.6	33.2	
	16	47.4	38.9	32.9	
	17	47.1	40.7	33.9	
	18	47.2	38.1	32.9	
Night	19	45	39.2	34.6	47.9
	20	49.8	42.7	36.9	
	21	47.5	40.2	34	
	22	47.8	40.2	34	
	23	49.5	41.7	36.1	
	24	48.1	40.8	33	
	1	49.3	41.9	34.6	
	2	49.6	42.7	34.4	
	3	48	40.8	34.8	
	4	46.3	38.1	33.1	
	5	48.1	39.3	33.3	
	6	47.8	37.4	32.2	
	7	46.3	37.4	32	

Location: RS-06					
Time Zone	**Hour**	**L10 (dB)**	**L50 (dB)**	**L90 (dB)**	**L10(dB), Time Zone**
Day	8	49.2	35.8	26.4	48.2
	9	47.6	34.1	25.4	
	10	46.4	34.1	25.3	
	11	48.6	36.3	27.5	
	12	47.7	35.9	27.4	
	13	46.2	33.5	24	
	14	48.4	35.7	26.2	

Location: RS-06					
Time Zone	**Hour**	**L10 (dB)**	**L50 (dB)**	**L90 (dB)**	**L10(dB), Time Zone**
	15	49.1	37.8	29.7	
	16	48.5	36.6	25.6	
	17	50.2	39	29.5	
	18	48.4	39	30.2	
Night	19	49.4	39.8	29.1	49.5
	20	48.7	38.3	26.9	
	21	48.4	38.6	28.4	
	22	49.9	36.9	24.9	
	23	49.8	35.7	23.5	
	24	48.9	30.4	18.4	
	1	49.8	34.6	21.9	
	2	49.8	35.5	20.1	
	3	49.3	35.5	22.4	
	4	48.7	30.1	16.2	
	5	50.7	33.4	19.7	
	6	50.5	35.6	23.9	
	7	49.6	35.1	22	

Location: RS-07					
Time Zone	**Hour**	**L10 (dB)**	**L50 (dB)**	**L90 (dB)**	**L10(dB), Time Zone**
Day	8	50.9	35.8	26.5	49.9
	9	50.2	37	28.8	
	10	47.9	38.7	32.2	
	11	53.2	41.5	34.4	
	12	45	37.1	32.4	
	13	48.7	37.7	31.4	
	14	52.9	41.8	33.7	
	15	52.5	39.7	33.2	
	16	47.2	38.1	29.3	
	17	51.7	40.2	32.3	
	18	48.9	39.2	32.9	
Night	19	47.4	37.5	31.2	53.2
	20	49.7	40	32.9	
	21	Not computed	Not computed	Not computed	

Location: RS-07					
Time Zone	**Hour**	**L10 (dB)**	**L50 (dB)**	**L90 (dB)**	**L10(dB), Time Zone**
	22	51.7	39.6	29.6	
	23	52	36.9	25.6	
	24	53.6	39.1	27.5	
	1	55.1	38.8	28.8	
	2	54.6	41.8	30.6	
	3	53.5	35.2	26.3	
	4	53.5	31.7	19.4	
	5	52.7	36.5	24	
	6	53.4	35.1	23.5	
	7	51.6	36.2	27.1	

Location: FR-02					
Time Zone	**Hour**	**L10 (dB)**	**L50 (dB)**	**L90 (dB)**	**L10(dB), Time Zone**
Day	8	23.9	17.9	15.4	28.4
	9	25.2	19.2	15.6	
	10	34.5	21.7	16.3	
	11	28.8	20.2	16.6	
	12	28.3	20.4	17.1	
	13	28.3	21	17.2	
	14	28.7	20.4	17.1	
	15	25.6	18.7	16.1	
	16	32.2	19.9	16	
	17	29	22.4	19.1	
	18	27.7	21.1	17.9	
Night	19	24.1	19.5	17.7	20.9
	20	30.2	18.5	16.3	
	21	29.1	20.1	16	
	22	22.4	18.6	16.3	
	23	25.2	18.4	15.2	
	24	Not computed	Not computed	Not computed	
	1	23.9	18.1	15.9	
	2	19.9	16.6	14.7	
	3	19.3	16.9	15	
	4	19.9	17.3	15.2	

Location: FR-02					
Time Zone	**Hour**	**L10 (dB)**	**L50 (dB)**	**L90 (dB)**	**L10(dB), Time Zone**
	5	19.3	16.6	14.9	
	6	20.4	17.1	15.2	
	7	23.5	16.6	14.4	

Location: RS-08					
Time Zone	**Hour**	**L10 (dB)**	**L50 (dB)**	**L90 (dB)**	**L10(dB), Time Zone**
Day	8	40	27.8	19.7	41.2
	9	39.6	29.5	22.6	
	10	41.1	30.8	23.8	
	11	39.2	28.9	20.8	
	12	40.5	31.5	24.4	
	13	43.1	31.2	23.2	
	14	37.9	26.8	19.5	
	15	43.3	32	24.5	
	16	44.5	33.9	24.6	
	17	42.1	32.2	22.8	
	18	41.6	32.6	23.4	
Night	19	44.9	33.9	25.4	42.7
	20	43.2	33.7	26.7	
	21	Not computed	Not computed	Not computed	
	22	44.9	40.7	40	
	23	42.9	31.6	20.9	
	24	41.1	29.8	17.8	
	1	45.4	33.7	22.4	
	2	41.5	28.5	16.3	
	3	44.2	32.1	21.2	
	4	40.3	29.2	19.8	
	5	40.6	26.6	16.7	
	6	41.2	27.1	16.8	
	7	41.9	27.9	18.5	

Location: FR-03					
Time Zone	**Hour**	**L10 (dB)**	**L50 (dB)**	**L90 (dB)**	**L10(dB), Time Zone**
Day	8	27.9	22.5	19.6	27.4
	9	26.3	22.1	19.5	
	10	28	21	18.5	
	11	31.1	23.8	21.2	
	12	27.2	24.5	22.9	
	13	24.2	20.8	18.6	
	14	28.2	23.5	21.6	
	15	23.3	20	18.2	
	16	28.2	22.3	20.7	
	17	27.6	23.4	21	
	18	29.6	25	23	
Night	19	30.1	24.6	22.3	23.2
	20	30.2	23.3	21.5	
	21	27.6	22.7	20.4	
	22	37.4	28.1	22.7	
	23	28	20.1	16.4	
	24	17.7	15	14	
	1	16.4	14.4	14	
	2	17.8	15.4	14	
	3	18.2	15.3	14	
	4	18.1	15.6	14.2	
	5	18.6	16.8	15.4	
	6	20.6	17.6	15.9	
	7	21.2	18.5	16.7	

Location: RS-09					
Time Zone	**Hour**	**L10 (dB)**	**L50 (dB)**	**L90 (dB)**	**L10(dB), Time Zone**
Day	8	46	36.1	29.2	46.9
	9	47	37.3	30.5	
	10	48.6	37.8	29.4	
	11	47.5	39.1	33	
	12	53	39.1	30.8	
	13	46.4	35.4	29.2	
	14	45.5	34.8	29.9	

Location: RS-09					
Time Zone	**Hour**	**L10 (dB)**	**L50 (dB)**	**L90 (dB)**	**L10(dB), Time Zone**
	15	44.5	33.2	26.5	
	16	44	33.4	27.4	
	17	47.3	41.8	40.6	
	18	46.2	37.3	32.3	
Night	19	45.2	36.5	30	45.4
	20	47.6	36.8	28.7	
	21	45.3	35.2	26.8	
	22	45.7	33.8	27.9	
	23	46.9	33.9	25.3	
	24	44.3	32.8	25.6	
	1	44.9	30	20.4	
	2	44.2	31.6	23.6	
	3	43.3	33.1	24.1	
	4	46.4	32.9	21.1	
	5	42.8	29.4	18.2	
	6	45.6	31.2	22.8	
	7	48.3	36.4	26.1	

Appendix C-6: Monsoon Period Water Sampling Photographs

SW-01: Surface Water sample from Chimnar Khal, Patiya

SW-02: Surface Water sample from nearby pond, Patiya

SW-03: Surface Water sample from upstream of the Sangu River, Dohazari


SW-04: Surface Water sample from downstream of the Sangu River, Dohazari


SW-05: Surface water sample from nearby pond of Keranihat FOB


SW-06: Surface water sample from nearby water body of Keranihat FOB


SW-07: Surface water sample from upstream of the Tangkabati River, Lohagara


SW-08: Surface water sample from downstream of the Tangkabati River, Lohagara


SW-09: Surface Water sample from upstream of the Matamuhuri River, Chakaria


SW-10: Surface Water sample from downstream of the Matamuhuri River, Chakaria

Appendix C-7: Winter Period Water Sampling Photographs


SW-01: Surface Water sample from Chimnar Khal, Patiya


SW-02: Surface Water sample from nearby pond, Patiya


SW-03: Surface Water sample from upstream of the Sangu River, Dohazari

SW-04: Surface Water sample from downstream of the Sangu River, Dohazari


SW-05: Surface water sample from nearby pond of Keranihat FOB


SW-06: Surface water sample from nearby water body of Keranihat FOB


SW-07: Surface water sample from upstream of the Tangkabati River, Lohagara


SW-08: Surface water sample from downstream of the Tangkabati River, Lohagara


SW-09: Surface Water sample from upstream of the Matamuhuri River, Chakaria


SW-10: Surface Water sample from downstream of the Matamuhuri River, Chakaria

Appendix D: Applicable Standards of DOE

Appendix D-1: Standards for Ambient Air Quality in Bangladesh

Air Pollutant	Bangladesh Standard ($\mu g/m^3$)	Average Time
Carbon Monoxide (CO)	10,000 (9 ppm)	8 hours
	40,000 (35 ppm)	1 hour
Lead (Pb)	0.5	Annual
Oxides of Nitrogen (NO_X)	100 (0.053 ppm)	Annual
Suspended Particulate Matters (SPM)	200	8 hours
Coarse Particulates (PM_{10})	50	Annual
	150	24 hours
Fine Particulates ($PM_{2.5}$)	15	Annual
	65	24 hours
Ozone (O_3)	235 (0.12 ppm)	1 hour
	157 (0.08 ppm)	8 hours
Sulfur Dioxide (SO_2)	80 (0.03 ppm)	Annual
	365 (0.14 ppm)	24 hours

Source: The Environment Conservation Rules, 1997 and amendment 2005 (Schedule-2)

Appendix D-2: Standards for Water Quality in Bangladesh

A. Standards for Inland Surface Water

Best Practice-Based Classification		Parameter			
		pH	BOD mg/L	DO mg/L	Total Coliform Number/100
a.	Source of drinking water for supply only after disinfecting	6.5-8.5	2 or less	6 or above	50 or less
b.	Water usable for recreational activity	6.5–8.5	3 or less	5 or more	200 or less
c.	Source of drinking water for supply after conventional treatment	6.5–8.5	3 or less	6 or more	5,000 or less
d.	Water usable by fisheries	6.5–8.5	6 or less	5 or more	5,000 or less
e.	Water usable by various process and cooling industries	6.5–8.5	10 or less	5 or more	–
f.	Water usable for irrigation	6.5–8.5	10 or less	5 or more	1,000 or less

Notes:

1. In water used for pisciculture, maximum limit of presence of ammonia as Nitrogen is 1.2 mg/L.
2. Electrical conductivity for irrigation water is 2250 micromho/cm (at a temperature of 25°C); Sodium is less than 26%; boron is less than 0.2%.

Source: The Environment Conservation Rules, 1997 (Schedule-3)

B. Standards for Drinking Water

S/N	Parameter	Unit	Standards
1.	Aluminum	mg/L	0.2
2.	Ammonia (NH_3)	mg/L	0.5
3.	Arsenic	mg/L	0.05
4.	Balium	mg/L	0.01
5.	Benzene	mg/L	0.01
6.	BOD_5 (at 20°C)	mg/L	0.2
7.	Boron	mg/L	1.0
8.	Cadmium	mg/L	0.005
9.	Calcium	mg/L	75
10.	Chloride	mg/L	150–600*
11.	Chlorinated Alkanes		
	Carbon Tetrachloride	mg/L	0.01
	1.1 Dichloroethylene	mg/L	0.001
	1.2 Dichloroethylene	mg/L	0.03
	Tetrachloroethylene	mg/L	0.03
	Trichloroethylene	mg/L	0.09
12.	Chlorinated Phenols		
	Pentachlorophenol	mg/L	0.03
	2.4.6 Trichlorophenol	mg/L	0.03
13.	Chlorine (Residual)	mg/L	0.2
14.	Chloroform	mg/L	0.09
15.	Chromium (Hexavalent)	mg/L	0.05
16.	Chromium (Total)	mg/L	0.05
17.	COD	mg/L	4
18.	Coliform (Fecal)	n/100 mL	0
19.	Coliform (Total)	n/100 mL	0
20.	Color	Hazen unit	15
21.	Copper	mg/L	1
22.	Cyanide	mg/L	0.1
23.	Detergents	mg/L	0.2
24.	DO	mg/L	6
25.	Fluoride	mg/L	1
26.	Hardness (as $CaCO_3$)	mg/L	200–500
27.	Iron	mg/L	0.3–1.0
28.	Kjeldhl Nitrogen (Total)	mg/L	1
29.	Lead	mg/L	0.05

S/N	Parameter	Unit	Standards
30.	Magnesium	mg/L	30–35
31.	Manganese	mg/L	0.1
32.	Mercury	mg/L	0.001
33.	Nickel	mg/L	0.1
34.	Nitrate	mg/L	10
35.	Nitrite	mg/L	<1
36.	Odor	mg/L	Odorless
37.	Oil and Grease	mg/L	0.01
38.	pH	mg/L	6.5–8.5
39.	Phenolic Compounds	mg/L	0.002
40.	Phosphate	mg/L	6
41.	Phosphorus	mg/L	0
42.	Potassium	mg/L	12
43.	Radioactive Materials (Gross Alpha Activity)	Bq/l	0.01
44.	Radioactive Materials (Gross Beta Activity)	Bq/l	0.1
45.	Selenium	mg/L	0.01
46.	Silver	mg/L	0.02
47.	Sodium	mg/L	200
48.	Suspended Particulate Matters	mg/L	10
49.	Sulfide	mg/L	0
50.	Sulfate	mg/L	400
51.	Total Dissolved Solids	mg/L	1,000
52.	Temperature	^{0}C	20–30
53.	Tin	mg/L	2
54.	Turbidity	JTU	10
55.	Zinc	mg/L	5

Source: The Environment Conservation Rules, 1997 (Schedule-3)

Appendix D-3: Standards for Sound in Bangladesh

S/N	Category of Area/Zone	Limit in dB(A) Leq*	
		Day Time	Night Time
1.	Silent zone	50	40
2.	Residential area	55	45
3.	Mixed area	60	50
4.	Commercial area	70	60
5.	Industrial area	75	70

Notes:

1. The time from 6 am to 9 pm is counted as day time.

S/N	Category of Area/Zone	Limit in dB(A) Leq*	
		Day Time	Night Time
2. The time from 9 pm to 6 am is counted as night time.			
* The time-weighted average of sounds related to the human ear for a certain period is expressed by dB(A) Leq which is indicated in dB(A) scale.			

Source: Noise Pollution (Control) Rules, 2006

Appendix D-4: Standards for Odor in Bangladesh

S/N	Parameter	Unit	Standard Limit
1.	Acetaldehyde	ppm	0.5–5
2.	Ammonia	ppm	1–5
3.	Hydrogen Sulfide	ppm	0.02–0.2
4.	Methyl Disulfide	ppm	0.009–0.1
5.	Methyl Sulfide	ppm	0.01–0.2
6.	Styrene	ppm	0.4–2.0
7.	Trim ethylamine	ppm	0.005–0.07

Source: The Environment Conservation Rules, 1997 (Schedule-8)

Appendix D-5: Standards for Sewage Discharge in Bangladesh

S/N	Parameter	Unit	Standard Limit
1.	BOD	mg/L	40
2.	Nitrate	mg/L	250
3.	Phosphate	mg/L	35
4.	Suspended Solids (SS)	mg/L	100
5.	Temperature	Degree Centigrade	30
6.	Coliform	Number per 100mL	1,000

Source: The Environment Conservation Rules, 1997 (Schedule-9)

Appendix D-6: Standards for Waste from Industrial Units or Projects Waste in Bangladesh

S/N	Parameter	Unit	Places for Determination of Standards		
			Inland Surface Water	Public Sewerage System Connected to Treatment at Second Stage	Irrigated Land
1	Ammoniacal Nitrogen (as elementary N)	mg/L	50	75	75
2	Ammonia (as free ammonia)	mg/L	5	5	15
3	Arsenic (As)	mg/L	0.2	0.05	0.2
4	BOD_5 at 20°C	mg/L	50	250	100
5	Boron	mg/L	2	2	2
6	Cadmium (as CD)	mg/L	0.50	0.05	0.05

S/N	Parameter	Unit	Places for Determination of Standards		
			Inland Surface Water	Public Sewerage System Connected to Treatment at Second Stage	Irrigated Land
7	Chloride	mg/L	600	600	600
8	Chromium (as total Cr)	mg/L	0.5	1.0	1.0
9	COD	mg/L	200	400	400
10	Chromium (as hexavalent Cr)	mg/L	0.1	1.0	1.0
11	Copper (as Cu)	mg/L	0.5	3.0	3.0
12	Dissolved Oxygen (DO)	mg/L	4.5–8	4.5–8	4.5–8
13	Electro-conductivity (EC)	micromho/ cm	1,200	1,200	1,200
14	Total Dissolved Solids	mg/L	2,100	2,100	2,100
15	Fluoride (as F)	mg/L	2	15	10
16	Sulfide (as S)	mg/L	1	2	2
17	Iran (as Fe)	mg/L	2	2	2
18	Total Kjeldahl Nitrogen (as N)	mg/L	100	100	100
19	Lead (as Pb)	mg/L	0.1	1.0	0.1
20	Manganese (as Mn)	mg/L	5	5	5
21	Mercury (as Hg)	mg/L	0.01	0.01	0.01
22	Nickel (as Ni)	mg/L	1.0	2.0	1.0
23	Nitrate (as elementary N)	mg/L	10.0	Not yet Fixed	10
24	Oil and Grease	mg/L	10	20	10
25	Phenolic Compounds (as C_6H_5OH)	mg/L	1.0	5	1
26	Dissolved Phosphorus (as P)	mg/L	8	8	15
27	Radioactive substance	To be specified by Bangladesh Atomic Energy Commission			
28	pH		6–9	6–9	6–9
29	Selenium (as Se)	mg/L	0.05	0.05	0.05
30	Zinc (as Zn)	mg/L	5	10	10
31	Total Dissolved Solids	mg/L	2,100	2,100	2,100
32	Temperature	^{0}C	40	40	40-Summer
			45	45	45-Winter
33	Suspended Solids (SS)	mg/L	150	500	200
34	Cyanide (as Cn)	mg/L	0.1	2.0	0.2

Source: The Environment Conservation Rules, 1997 (Schedule-10)

Appendix E: Checklists for Flora and Fauna

Appendix E-1: Aquatic vegetation found at the project AOI

Sl#	Family	Scientific Name	Common Name	BP	BD	BK	BL	BC	IUCN Global Status	Wildlife Conservation & Security Act, 2012	Rare Species
1.	Convolvulaceae	*Ipomoea aquatica*	Swamp Morning Glory	√	√	√	√	√	LC	-	-
2.	Asteraceae	*Enhydra fluctuans*	Four-Leaf Clover	√	√	-	-	√	-	-	-
3.	Pontaderiaceae	*Monochoria hastata*	Arrow Leaf Pondweed	√	-	-		-	LC	-	-
4.		*Eichhornia crassipes*	Common Water Hyacinth	√	√	√	√	√	-	-	-
5.	Cyperaceae	*Cyperus articulatus*	Jointed Flatsedge	√	-	-	-	-	LC	-	-
6.		*Cyperus distans*	Slender Cyperus	√	√	√	√	√	LC	-	-
7.	Nymphaeaceae	*Nymphaea nouchali*	Blue Lotus	√	-	-	-	-	LC	-	-
8.	Araceae	*Pistia stratiotes*	Water Lettuce	√	√	√	√	√	LC	-	-
9.		*Spirodela polyrhiza*	Greater Duckweed	√	√	√	√	√	LC	-	-
10.		*Colocasia esculenta*	Kochu	√	√	√	√	√	LC	-	-
11.	Convolvulaceae	*Ipomoea aquatica*	Kolmi	√	√	√	√	√	LC	-	-
12.		*Ipomea fistulosa*	Dhol Kolmi	√	√	√	√	√	-	-	-
13.	Hydrocharitaceae	*Hydrilla verticillata*	Esthwaite Waterweed	√	√	-	-	√	LC	-	-

Appendix E-2: List of floral species observed in the homestead ecosystem

SL#	Family	Scientific Name	Common Name	Type
1.	Anacardiaceae	*Mangifera indica*	Aam	Tree
2.	Fabaceae	*Acacia auriculiformis*	Akashmoni	Tree
3.	Euphorbiaceae	*Phyllanthus embelica.*	Amloki	Tree
4.	Anacardiaceae	*Spondias mombin*	Amra	Tree
5.	Combretaceae	*Terminalia arjuna*	Arjun	Tree
6.	Moraceae	*Ficus religiosa*	Ashwath	Tree
7.	Annonaceae	*Annona squamosa*	Atafol, Sharifa	Tree
8.	Fabaceae	*Acacia nilotica*	Babla	Tree
9.	Rutaceae	*Aegle marmelos*	Bel	Tree
10.	Sapotaceae	*Mimusops elengi.*	Bakul	Tree
11.	Lauraceae	*Litsea monopetala.*	Bara kukurchita	Tree
12.	Gramineae	*Bambusa balcooa*	Bash	Shrub
13.	Arecaceae	*Calamus tenuis*	Bet	Shrub
14.	Rhamnaceae	*Ziziphus mauritiana*	Boroi	Tree
15.	Moraceae	*Ficus benghalensis*	Bot	Tree
16.	Dilleniaceae	*Dillenia indica*	Chalta	Tree
17.	Berberidaceae	*Berberis aristata*	Chutro	Tree
18.	Lythraceae	*Punica granatum*	Dalim, Bedana, Anar	Shrub
19.	Moraceae	*Artocarpus lacucha*	Deaua	Tree
20.	Athyriaceae	*Diplazium esculentum*	Dheki Shak	Shrub
21.	Moraceae	*Ficus racemosa*	Dumur	Tree
22.	Myrtaceae	*Eucalyptus citriodora.*	Eucalyptus	Tree
23.	Ebenaceae	*Diospyros discolor*	Gaab (Bilati)	Tree

24.	Ebenaceae	*Diospyros malabarica*	Gaab (Deshi)	Tree
25.	Mimosaceae	*Melaleuca leucadendron.*	Ipil-Ipil	Tree
26.	Myrtaceae	*Syzygium cumini*	Jam	Tree
27.	Rutaceae	*Citrus grandis*	Jambura, Batabilebu	Tree
28.	Lythraceae	*Lagerstroemia speciose.*	Jarul	Tree
29.	Elaeocarpaceae	*Elaeocarpus serratus*	Jolpai	Tree
30.	Rubiaceae	*Neolamarckia cadamba*	Kadam	Tree
31.	Rutaceae	*Feronia lemonia*	Kadbel	Tree
32.	Oxalidaceae	*Averrhoa carambola*	Kamranga	Tree
33.	Moraceae	*Artocarpus heterophyllus*	Kanthal	Tree
34.	Verbenaceae	*Duranta erecta*	Kata mehedi	Shrub
35.	Arecaceae	*Phoenix dactylifera*	Khejur	Tree
36.	Musaceae	*Musa acuminata*	Kola	Shrub
37.	Apocynaceae	*Carissa carandas*	Koromca	Shrub
38.	Fabaceae	*Albizia lebbeck*	Koroy	Tree
39.	Fabaceae	*Delonix regia*	Krisnochura	Tree
40.	Rhamnaceae	*Ziziphus mauritiana*	Kul, Boroi	Tree
41.	Combretaceae	*Terminalia catappa*	Katbadam	Tree
42.	Rutaceae	*Citrus aurantifolia*	Lebu	Shrub
43.	Rutaceae	*Citrus limon*	Lebu	Shrub
44.	Sapindaceae	*Litchi chinensis*	Lichu	Tree
45.	Meliaceae	*Swietenia mahagoni*	Mahogany	Tree
46.	Cucurbitaceae	*Trichosanthes tricuspidata*	Makal	Tree
47.	Fabaceae	*Erythrina variegata*	Mandar	Tree
48.	Marantaceae	*Schumannianthus dichotomus*	Murta, Pati bet	Shrub

49.	Arecaceae	*Cocos nucifera*	Narikel	Tree
50.	Meliaceae	*Azadirachta indica.*	Neem	Tree
51.	Phyllanthaceae	*Phyllanthus acidus*	Nora	Tree
52.	Piperaceae	*Piper betle*	Paan	Climber
53.	Caricaceae	*Carica papaya*	Pepe	Tree
54.	Myrtaceae	*Psidium guajava*	Peyara	Tree
55.	Fabaceae	*Butea Monosperma*	Polash	Tree
56.	Mimosaceae	*Samanea saman*	Megh Shirish	Tree
57.	Rubiaceae	*Ixora chinesis*	Rangan	Shrub
58.	Meliaceae	*Aphanamixis polystachya*	Royna	Tree
59.	Fabaceae	*Albizia procera*	Silkoroi	Tree
60.	Dipterocarpaceae	*Shorea robusta*	Sal	Tree
61.	Lamiaceae	*Tectona grandis*	Segun	Tree
62.	Moringaceae	*Moringa oleifera*	Shajna	Tree
63.	Malvaceae	*Bombax ceiba*	Shimul	Tree
64.	Fabaceae	*Dalbergia sissoo*	Shishu	Tree
65.	Oleaceae	*Nyctanthes arbor-tristis*	Shiuli ful	Shrub
66.	Sapotaceae	*Manilkara zapota*	Sofeda	Tree
67.	Arecaceae	*Areca catechu*	Supari	Tree
68.	Arecaceae	*Borassus flabellifer*	Taal	Tree

Note: All the floral species in homestead ecosystem are planted.

Appendix E-3: Hillside Forest vegetation at the Chakaria bottleneck area

SL#	Family	Scientific Name	Common Name	Type	IUCN Global Status	Wildlife Conservation & Security Act, 2012	Rare Species
1.	Aristolochiaceae	*Aristolochia tagala*	Ishwarmul	Climber	-	-	-
2.	Araceae	*Pothos scandens*	Batilata	Climber	-	-	-
3.	Arecaceae	*Calamus longisetus*	Udombet	Climber	-	-	-
4.	Fabaceae	*Spatholobus acuminatus*	Bean	Climber	-	-	-
5.	Liliaceae	*Gloriosa superba*	Ulatchandal	Climber	LC	-	-
6.	Cucurbitaceae	*Momordica dioica*	Bonkorolla	Climber	-	-	-
7.	Cuscutaceae	*Cuscuta reflexa*	Shornalata	Climber	LC	-	-
8.	Rhamnaceae	*Ziziphus glabrata*	Jangli kul	Climber	-	-	-
9.	Menispermaceae	*Tinospora cordifolia*	Ghora gulancha	Climber	-	-	-
10.	Menispermaceae	*Tinospora crispa*	Gulancha	Climber	-	-	-
11.	Asclepiadaceae	*Hemidesmus indicus*	Anantamul	Climber	-	-	-
12.	Caesalpiniaceae	*Senna alata*	Dadmordon	Shrub	LC	-	-
13.	Rutaceae	*Glycosmis pentaphylla*	Datmajan	Shrub	LC	-	-
14.	Apocynaceae	*Holarrhena antidysenterica*	Kurchi	Shrub	LC	-	-
15.	Caesalpiniaceae	*Cassia fistula*	Sonalu	Tree	LC	-	-
16.	Fabaceae	*Butea monosperma*	Polash	Tree	LC	-	-
17.	Fabaceae	*Erythrina indica*	Mandar	Tree	LC	-	-
18.	Meliaceae	*Azadirachta indica*	Neem	Tree	LC	-	-
19.	Meliaceae	*Chukrasia tabularis*	Chikrasi	Tree	LC	-	-
20.	Meliaceae	*Melia azedarach*	Ghura neem	Tree	LC	-	-
21.	Meliaceae	*Toona ciliata*	Toon	Tree	LC	-	-

22.	Mimosaceae	*Albizia procera*	Silkoroi	Tree	LC	-	-
23.	Moraceae	*Artocarpus chaplasha*	Chapalish	Tree	-	-	-
24.	Moraceae	*Ficus benjamina*	Jiri Bot	Tree	LC	-	-
25.	Moraceae	*Ficus bengalensis*	Bot	Tree	-	-	-
26.	Anacardiaceae	*Lannea coromandelica*	Jiga/Vadi	Tree	LC	-	-
27.	Bignoniaceae	*Heterophragma adenophylla*	Dakrum	Tree	-	-	-
28.	Bombacaceae	*Bombax ceiba*	Shimul	Tree	LC	-	-
29.	Clusiaceae	*Garcinia cowa*	Kau phal	Tree	LC	-	-
30.	Combretaceae	*Terminalia arjuna*	Arjun	Tree	-	-	-
31.	Dipterocarpaceae	*Dipterocarpus* spp.	Garjan	Tree	VU	-	Very Common in the Project area
32.	Dipterocarpaceae	*Hopea odorata*	Telsur	Tree	LC	-	-
33.	Combretaceae	*Terminalia catappa*	Katbadam	Tree	LC	-	-
34.	Combretaceae	*Terminalia bellirica*	Bohera	Tree	LC	-	-
35.	Campanulaceae	*Tamarindus indica*	Tentul	Tree	LC	-	-
36.	Elaeocarpaceae	*Elaeocarpus robustus*	Jalpai	Tree	LC	-	-
37.	Verbenaceae	*Gmelina arborea*	Gamari	Tree	LC	-	-
38.	Verbenaceae	*Tectona grandis*	Segun	Tree	-	-	-
39.	Myrtaceae	*Syzygium balsameum*	Bhutijam	Tree	-	-	-
40.	Myrtaceae	*Syzygium cumini*	Kalojam	Tree	LC	-	-
41.	Lythraceae	*Lagerstroemia speciosa*	Jarul	Tree	-	-	-
42.	Magnoliaceae	*Michelia champaca*	Champa	Tree	LC	-	-
43.	Mimosaceae	*Acacia auriculiformis*	Akashmoni	Tree	LC	-	-
44.	Euphorbiaceae	*Phyllanthus emblica*	Amlaki	Tree	LC	-	-

* LC=Least Concern, VU=Vulnerable; (IUCN Red List of Threatened Species. Version 2021-2)

Appendix E-4: List of Amphibians species recorded in the study area

Sl#	Family	Common Name	Local Name	Scientific Name	BP	BD	BK	BL	BC	IUCN Local Status*	Wildlife Conservation & Security Act, 2012	Rare Species
1.	Bufonidae	Asian Common Toad	Kuno Bang	*Duttaphrynus melanostictus*	√	√	√	√	√	LC	SCH II	-
2.	Dicroglossidae	Indian Bull Frog	Kola Bang	*Hoplobatrachus tigerinus*	√	√	√	√	√	LC	SCH I	-
3.		Asmat's Cricket Frog	Asmater Jhi-jhi Bang	*Fejervarya asmat*	√	√	√	√	√	LC	SCH II	-
4.		Green Frog	Shobuj Bang	*Euphlyctis hexadactylus*	-	-	-	-	√	LC	SCH I	-
5.		Bombay Wart Frog	Dakshinatter Jhi-Jhi Bang	*Fejervarya syhadrensis*	√	√	√	√	√	LC	SCH II	-
6.		Nepal Wart Frog	Nepali Jhi-Jhi Bang	*Fejervarya nepalensis*	√	√	√	√	√	LC	SCH II	-
7.		Terai Wart Frog,	Torai Jhi-Jhi Bang	*Fejervarya teraiensis*	√	√	√	√	√	LC	SCH II	-
8.		Skipper frog	Katkati Bang	*Euphlyctis cyanophlyctis*	√	√	√	√	√	LC	SCH II	-
9.	Rhacophoridae	Common Tree Frog	Gecho Bang	*Polypedates leucomystax*	-	-	-	-	√	LC	SCH II	-
10.	Microhylidae	Ornate Microhylid Frog	Cheena Bang	*Microhyla ornata*	√	√	√	√	√	LC	SCH II	-

Sl#	Family	Common Name	Local Name	Scientific Name	BP	BD	BK	BL	BC	IUCN Local Status*	Wildlife Conservation & Security Act, 2012	Rare Species
11.		Red Microhylid Frog	Lal Laubichi Bang	*Microhyla rubra*	-	-	-	-	√	LC	SCH II	-
12.		Painted Bullfrog	Venpu Bang	*Kaloula pulchra*	-	-	-	-	√	LC	SCH I	-

*LC=Least Concern; (IUCN Red List Bangladesh 2015)

Appendix E-5: List of Reptiles species recorded in the study area

Sl#	Family	Common Name	Local Name	Scientific Name	BP	BD	BK	BL	BC	IUCN Local Status*	Wildlife Conservation & Security Act, 2012	Rare Species
1.	Gekkonidae	Tokay Gecko	Tokkhak	*Gekko gecko*	√	√	√	√	√	LC	SCH II	-
2.		House gecko	Tiktiki	*Hemidactylus frenatus*	√	√	√	√	√	LC	SCH II	-
3.		Brook's House Gecko	Khoskhoshey Tiktiki	*Hemidactylus brookii*	√	√	√	√	√	LC	SCH II	-
4.		House lizard	Choto Tiktiki	*Hemidactylus bowringii*	-	-	-	√	√	LC	SCH II	-
5.		Garden lizard	Rokto chosa	*Calotes versicolor*	√	√	√	√	√	LC	SCH II	-
6.	Scincidae	Keeled grass skink	Angina	*Eutropis carinata*	√	√	√	√	√	LC	SCH II	-
7.		Bronze Grass Skink	Tamatey Anjon	*Eutropis macularia*	-	-	-	-	√	LC	SCH II	-
8.		Bowring's Supple Skink	Bowringer Anjan	*Lygosoma bowringii*	-	-	-	-	√	LC	SCH II	-

Sl#	Family	Common Name	Local Name	Scientific Name	BP	BD	BK	BL	BC	IUCN Local Status*	Wildlife Conservation & Security Act, 2012	Rare Species
9.	Varanidae	Bengal Monitor Lizard	Gui shap	*Varanus bengalensis*	√	√	√	√	√	NT	SCH II	-
10.		Monitor Lizard	Gui Shap	*Varanus salvator*	-	-	-	-	√	NT	SCH I	-
11.	Colubridae	Indian Rat Snake	Daraj shaap	*Ptyas mucosa*	√	√	√	√	√	LC	SCH I	-
12.		Asian Vine Snake	Laodoga Shap	*Ahaetulla prasina*	√	√	√	√	√	LC	SCH I	-
13.		Copper-headed Trincate Snake	Dudraj Shap	*Coelognathus radiatus*	√	√	√	√	√	LC	SCH I	-
14.		Common Wolf Snake	Gharginni Shap	*Lycodon aulicus*	√	√	√	√	√	LC	SCH I	-
15.		Common Smooth Water Snake	Painna Shap	*Enhydris enhydris*	√	√	√	√	√	LC	SCH I	-
16.		Indian Rock Python	Ajogar	*Python molurus*	-	-	-	-	√	LC	SCH I	-
17.		Diard's Blindsnake	Dumukha Shap	*Argyrophis diardii*	√	√	√	√	-	LC	-	-
18.	Natricidae	Checkered Keelback	Dora shaap	*Xenochrophis piscator*	√	√	√	√	√	LC	SCH I	-

Sl#	Family	Common Name	Local Name	Scientific Name	BP	BD	BK	BL	BC	IUCN Local Status*	Wildlife Conservation & Security Act, 2012	Rare Species
19.		Striped Keelback	Dora Shap	*Amphiesma stolatum*	√	√	√	√	√	LC	SCH I	-
20.		Red-necked Keelback	Ladhora Shap	*Rahabdophis subminiatus susubmin*	-	-	--	-	√	NT	SCH I	-
21.	Elapidae	Banded Krait	Shangkhini	*Bungarus fasciatus*	√	√	√	√	√	LC	SCH II	-
22.		Green Pit Viper	Shabuj Bora	*Trimeresurus albolabris*	-	-	-	-	√	LC	SCH II	-
23.	Trionychidae	Indian Roofed turtle	Kori kaitta	*Pangshura tecta*	-	√	√	-	-	LC	SCH I	-
24.		Spotted Flapshel	Sundi Kachim	*Lissemys punctat*	-	√	√	-	-	LC	SCH II	-
25.		Peacock soft shell turtle	Dhum Kachchim	*Nilssonia hurum*	-	√	-	-	-	LC	SCH I	-

* NT= Near threatened, LC=Least Concern; (IUCN Red List Bangladesh 2015)

Appendix E-6: List of Mammal species recorded in the study area

Sl#	Family	Common Name	Local Name	Scientific Name	BP	BD	BK	BL	BC	IUCN Local Status*	Wildlife Conservation & Security Act, 2012	Rare Species
1.	Cercopithecidae	Rhesus Macaque	Banor	*Macaca mulatta*	-	-	-	-	√	VU	SCH I	√
2.	Elephantidae	Asian Elephant	Hati	*Elephas maximus*	-	-	-	-	√	EN	SCH I	√

Sl#	Family	Common Name	Local Name	Scientific Name	BP	BD	BK	BL	BC	IUCN Local Status*	Wildlife Conservation & Security Act, 2012	Rare Species
3.	Sciuridae	Irrawaddy Squirrel	Kathbirali	*Callosciurus pygerythrus*	√	√	√	√	√	LC	SCH I	-
4.	Hystricidae	Indian Crested Porcupine	Sojaru	*Hystrix indica*	-	-	-	-	√	LC	SCH I	-
5.	Muridae	Common Indian Field Mouse	Metho Idur	*Mus boodug*	√	√	√	√	√	LC	SCH III	-
6.	Pteropidae	Indian Flying Fox	Badur	*Pteropus giganteus*	√	√	√	√	√	LC	SCH I	-
7.		Greater Short-nosed Fruit Bat	Bucha Kolabadur	*Cynopterus sphinx*	√	√	√	√	√	LC	SCH I	-
8.	Vespertilionidae	Indian Pipis trelle	Khudey Chamchika	*Pipistrellus cormandra*	√	√	√	√	√	LC	SCH I	-
9.	Herpestidae	Small Indian Mongoose	Boro beji	*Herpestes auropunctatus*	√	√	√	√	√	LC	SCH I	-
10.		Crab-eating Mongoose	Kakra-bhuk Beiji	*Herpestes urva*	-	-	-	-	√	LC	SCH I	-
11.	Viverridae	Common Palm Civet	Gandhagakul	*Paradoxurus hermaphroditus*	-	-	-	-	√	NT	SCH I	-
12.		Large Indian Civet	Baghdas	*Viverra zibetha*	√	√	√	√	√	NT	SCH I	-
13.		Small Indian Civet	Khatash	*Viverricula indica*	√	√	√	√	√	NT	SCH I	-
14.	Canidae	Golden Jackal	Pati-Siyal	*Canis aureus*	√	√	√	√	√	LC	SCH I	-

Sl#	Family	Common Name	Local Name	Scientific Name	BP	BD	BK	BL	BC	IUCN Local Status*	Wildlife Conservation & Security Act, 2012	Rare Species
15.	Felidae	Jungle Cat	Choto Ban Biral	*Felis chaus*	√	√	√	√	√	LC	SCH I	-
16.		Leopard Cat	Chita Biral	*Prionailurus bengalensis*	√		√		√	NT	SCH I	-
17.	Suidae	Wild Boar	Shukar	*Sus scrofa*	-	-	-	-	√	LC	SCH II	-
18.	Cervidae	Barking Deer	Maya Horin	*Muntiacus muntjak*	√	√	√	√	√	EN	SCH I	√
19.	Platanistidae	Ganges River Dolphin	Shushuk	*Platanista gangetica*	-	√	-	-	-	VU	SCH I	√

* VU=Vulnerable, NT= Near Threatened, DD=Data Deficient, LC=Least Concern; (IUCN Red List Bangladesh 2015)

Appendix E-7: List of Bird species recorded in the study area

SL#	Family	Common Name	Scientific Name	Local Name	BP	BD	BK	BL	BC	IUCN Local Status*	Wildlife Conservation & Security Act, 2012	Rare Species
1.	Phasianidae	Red Junglefowl	*Gallus gallus*	Bonmurgi	-	-	-	-	√	LC	SCH I	-
2.	Piciformes	Fulvous-breasted Woodpecker	*Dendrocopos macei*	Batabi Kathkurali	√	√	√	√	√	LC	SCH II	-
3.		Black-rumped Flameback	*Dinopium benghalense*	Sonali kaththokra	√	√	√	√	√	LC	SCH II	-
4.		Rufous Woodpecker	*Celeus brachyurus*	Khoira Khathkurali	-	-	-	-	√	LC	SCH I	-
5.		Lesser Yellownape	*Picus chlorolophus*	Choto Holdekurali	-	-	-	-	√	LC	SCH I	-
6.		Black-naped Woodpecker	*Picus guerini*	Metematha Kathkurali	√	√	√	√	√	LC	SCH I	-

SL#	Family	Common Name	Scientific Name	Local Name	BP	BD	BK	BL	BC	IUCN Local Status*	Wildlife Conservation & Security Act, 2012	Rare Species
7.		Streak-throated Woodpecker	*Picus xanthopygaeus*	Dagigola Kathkurali	√	√	√	√	√	LC	SCH I	-
8.	Upupidae	Common Hoopoe	*Upupa epops*	Hudhud	√	√	√	√	√	LC	SCH I	-
9.	Alcedinidae	Common King Fisher	*Alcedo atthis*	Chhoto Maachranga	√	√	√	√	√	LC	SCH II	-
10.		Pied Kingfisher	*Ceryle rudis*	Pakra Machranga	√	-	-	-	-	LC	SCH II	-
11.		White-breasted Kingfisher	*Halcyon smyrnensis*	Dhola gola Machranga	√	√	√	√	√	LC	SCH II	-
12.	Megalaimidae	Blue-throated Barbet	*Psilopogon asiaticus*	Nil-gola Basonti Baori	√	√	√	√	√	LC	SCH I	-
13.		Lineated Barbet	*Psilopogon lineatus*	Dagi Boshonto	√	√	√	√	√	LC	SCH I	-
14.		Coppersmith Barbet	*Psilopogon haemacephalus*	Chhoto Basanta Bauri	√	√	√	√	√	LC	SCH II	-
15.	Meropidae	Asian Green bee-eater	*Merops orientalis*	Suichora	√	√	√	√	√	LC	SCH II	-
16.	Meropidae	Chestnut-headed Bee-eater	*Merops leschenaulti*	Khoyramatha Shuichora	√	√	√	√	√	LC	SCH I	-
17.		Blue-tailed Bee-eater	*Merops Philippinus*	Neel-lej Suichora	√	√	√	√	√	LC	SCH I	-
18.	Cuculidae	Asian Koel	*Eudynamys scolopaces*	Kokil, koel	√	√	√	√	√	LC	SCH II	-

SL#	Family	Common Name	Scientific Name	Local Name	BP	BD	BK	BL	BC	IUCN Local Status*	Wildlife Conservation & Security Act, 2012	Rare Species
19.		Plaintive Cuckoo	*Cacomantis merulinus*	Koroon Papia	√	√	√	√	√	LC	SCH II	-
20.		Common hawk-cuckoo	*Hierococcyx varius*	Pati Chokh-gelo	√	√	√	√	√	LC	SCH II	-
21.	Centropodidae	Greater Coucal	*Centropus sinensis*	Boro kubo	√	√	√	√	√	LC	SCH I	-
22.		Lesser Coucal	*Centropus bengalensi*	Kukka	-	-	-	-	√	LC	SCH I	-
23.	Psittaculidae	Rose-ringed Parakeet	*Psittacula krameria*	Sobuj Tia		√			√	LC	SCH I	-
24.		Red-breasted Parakeet	*Psittacula alexandri*	Modna Tia	√	√	√	√	√	LC	SCH I	-
25.	Apodidae	Asian Palm swift	*Cypsiurus balasiensis*	Ashio Talbatashi	√	√	√	√	√	LC	SCH I	-
26.		House Swift	*Apus affinis*	Ghor Batashi	√	√	√	√	√	LC	SCH I	-
27.	Strigidae	Spotted Owlet	*Athene brama*	Khurley pecha	√	√	√	√	√	LC	SCH I	-
28.		Oriental Scops Owl	*Otus sunia*	Udoi Nimpecha	-	-	-	-	√	LC	SCH I	-
29.		Brown Fish Owl	*Ketupa zelonensis*	Bhootoom Pecha	√	-	-	-	-	LC	SCH I	-
30.	Tytonidae	Barn Owl	*Tyto alba*	Lokkhi pecha	-	-	-	√	-	LC	SCH I	-
31.	Columbidae	Spotted Dove	*Streptopelia chinensis*	Tila Ghughu	√	√	√	√	√	LC	SCH I	-

SL#	Family	Common Name	Scientific Name	Local Name	BP	BD	BK	BL	BC	IUCN Local Status*	Wildlife Conservation & Security Act, 2012	Rare Species
32.		Rock Pigeon	*Columba livia*	Gola Paira	√	√	√	√	√	LC	SCH I	-
33.		Eurasian Collard Dove	*Streptopelia decaocta*	Eurasian Konthi Ghugu	√	√	√	√	√	LC	SCH I	-
34.		Red Turtle Dove	*Streptopelia tranquebarica*	Lal Ghugu	√	-	-	-	-	LC	SCH I	-
35.		Yellow -footed Green Pigeon	*Treron Phoenicopterus*	Horial	-	-	-	-	√	LC	SCH I	-
36.	Rallidae	White-breasted Waterhen	*Amaurornis phoenicurus*	Dahuk	√	√	√		√	LC	SCH I	-
37.	Jacanidae	Bronze winged Jacana	*Metopidius indicus*	Dolpipi	√		√		√	LC	SCH I	-
38.	Charadriidae	Red Wattled Lapwing	*Vanellus indicus*	Hot Titi	√	√	√	√	√	LC	SCH I	-
39.	Accipitridae	Black kite	*Milvus migrans*	Bhubon Chil	√	√	√	√	√	LC	SCH II	-
40.		Brahminy Kite	*Haliastur indus*	Shonkho Chil	√	√	√	√	√	LC	SCH II	-
41.		Crested serpent eagle	*Spilornis cheela*	Tila Nag Eagle	-	√			√	LC	SCH I	-
42.		Black-winged Kite	*Elanus caeruleus*	Katua Cheel	-	-	√			LC	SCH I	-
43.	Phalacrocoracidae	Little Cormorant	*Microcarbo niger*	Choto Pankowri	√	√	√	√	√	LC	SCH II	-
44.	Rhipiduridae	White-throated Fantail	*Rhipidura albicollis*	Dholagola Chatagurani	√	√	√	√	√	LC	SCH I	-

SL#	Family	Common Name	Scientific Name	Local Name	BP	BD	BK	BL	BC	IUCN Local Status*	Wildlife Conservation & Security Act, 2012	Rare Species
45.	Dicruridiae	Black Drongo	*Dicrurus macrocercus*	Kala Fingey	√	√	√	√	√	LC	SCH I	-
46.		Bronzed Drongo	*Dicrurus aeneus*	Fingey	√	√	√	√	√	LC	SCH I	-
47.		Ashy Drongo	*Dicrurus leucophaeus*	Kalche Fingey	-	-	-	-	√	LC	SCH I	-
48.		Hair-crested Drongo	*Dicrurus hottentottus*	Keshori Fingey	-	-	-	-	√	LC	SCH I	-
49.	Sturnidae	Common Myna	*Acridotheres tristis*	Salik/Bhat Salik	√	√	√	√	√	LC	SCH II	-
50.		Asian Pied Starling	*Sturnus contra*	Go shalik	√	√	√	√	√	LC	SCH II	-
51.		Jungle Myna	*Acridotheres fuscus*	Juti shalik	√	√	√	√	√	LC	SCH II	-
52.		Chestnut-tailed Starling	*Sturnia malabarica*	Kath Shalik	√	√	√	√	√	LC	SCH II	-
53.	Paridae	Great Tit	*Parus major*	Titpokh	√	√	√	√	√	LC		-
54.	Ardeidae	Little Egret	*Egretta garzetta*	Choto boga	√	√	√	√	√	LC	SCH II	-
55.		Indian pond heron	*Ardeola grayii*	Kani Bok	√	√	√	√	√	LC	SCH I	-
56.		Intermediate Egret	*Ardea intermedia*	Majhari Bok	√					LC	SCH I	-
57.		Green Backed Heron	*Butorides striata*	Shobuj Bok	√		√		√	LC	SCH I	-
58.		Cattle Egret	*Bubulcus ibis*	Go Boga	√	√	√	√	√	LC	SCH II	-

SL#	Family	Common Name	Scientific Name	Local Name	BP	BD	BK	BL	BC	IUCN Local Status*	Wildlife Conservation & Security Act, 2012	Rare Species
59.	Ciconiidae	Asian Openbill Stork	*Anastomus oscitans*	Shamukkhol	√					LC	SCH I	-
60.	Irenidae	Golden-fronted Leafbird	*Chloropsis aurifrons*	Horbola					√	LC	SCH I	-
61.	Corvidae	Rufous Treepie	*Dendrocitta vagabunda*	Harichacha, Khoira Harichacha	√	√	√	√	√	LC	SCH I	-
62.		Large-billed Crow/Jungle Crow	*Corvus macrorhynchos*	Dar kak	√	√	√	√	√	LC	SCH I	-
63.		House Crow	*Corvus splendens*	Pati Kak	√	√	√	√	√	LC	-	-
64.	Campephagidae	Small Minivet	*Pericrocotus cinnamomeus*	Choto Sat Soheli				√	√	LC	SCH I	-
65.		Common Woodshrike	*Tephrodornis pondicerianus*	Pati Bonlatora				√	√	LC	SCH I	-
66.		Large Cuckooshrike	*Corcina macei*	Boro kabashi	√	√	√	√	√	LC	SCH I	-
67.	Oriolidae	Black hooded Oriole	*Oriolus xanthornus*	Halde Pakhi	√	√	√	√	√	LC	SCH II	-
68.	Artamidae	Ashy Wood swallow	*Artamus fuscus*	Mete Bon ababil	√	√	√	√	√	LC	SCH II	-
69.	Laniidae	Long-tailed Shrike	*Lanius schach*	Kosai, Lenja Latora	√	√	√	√	√	LC	SCH II	-

SL#	Family	Common Name	Scientific Name	Local Name	BP	BD	BK	BL	BC	IUCN Local Status*	Wildlife Conservation & Security Act, 2012	Rare Species
70.	Monarchidae	Black-naped Monarch	*Hypothymis azurea*	Kalagarh Rajon	√	√	√	√	√	LC	SCH I	-
71.	Aegithinidae	Common Iora	*Aegithina tiphia*	Fotikjol	√	√	√	√	√	LC	SCH II	-
72.	Muscicapidae	Oriental Magpie Robin	*Copsychus saularis*	Doel	√	√	√	√	√	LC	SCH II	-
73.		White-rumped Shama	*Copsychus malabaricus*	Shama	√	√	√	√	√	LC	SCH I	-
74.	Pycnonotidae	Red-vented Bulbul	*Pycnonotus cafer*	Bangla bulbul	√	√	√	√	√	LC	SCH II	-
75.		Red-whiskered Bulbul	*Pycnonotus jocosus*	Shipahi Bulbul	√	√	√	√	√	LC	SCH I	-
76.	Cisticolidae	Common Tailor Bird	*Orthotomus sutorius*	Tuntuni	√	√	√	√	√	LC	SCH II	-
77.	Timalidae	Striated Babbler	*Turtoides straita*	Dagi Chatare	-	-	-	-	√	LC	SCH I	-
78.	Pellorneidae	Puff-throated Babbler	*Pellorneum ruficeps*	Golafola Cchatare	-	-	-	-	√	LC	SCH I	-
79.	Leiothrichidae	Rufous-necked Laughingthrush	*Garrulax ruficolis*	Lalghar Penga	-	-	-	-	√	LC	SCH I	-
80.		Lesser Necklaced Laughingthrush	*Garrulax monileger*	Choto Malapenga	-	-	-	-	√	LC	SCH I	-
81.	Nectarinidae	Purple-rumped Sunbird	*Leptocoma zeylonica*	Moutusi	√	√	√	√	√	LC	SCH I	-
82.		Purple Sunbird	*Cinnyris asiaticus*	Niltunit	√	√	√	√	√	LC	SCH I	-

SL#	Family	Common Name	Scientific Name	Local Name	BP	BD	BK	BL	BC	IUCN Local Status*	Wildlife Conservation & Security Act, 2012	Rare Species
83.	Estrildidae	Scaly-breasted Munia	*Lonchura punctulata*	Tila munia	√	√	√	√	√	LC	SCH I	-
84.		Indian silverbill	*Euodice malabarica*	Deshi Chadithota	√	-	√	-	-	LC	SCH I	-
85.	Passeridae	House sparrow	*Passer domesticus*	Pati choroi	√	√	√	√	√	LC	SCH II	-
86.	Motacillidae	Paddyfield Pipit	*Anthus rufulus*	Dhani Tulika	-	-	-	√	-	LC	SCH II	-

* LC=Least Concern; (IUCN Red List Bangladesh 2015)

Appendix E-8: List of Fish species recorded in the study area

SL#	Family	Common Name	Scientific Name	Local Name	IUCN Local Status*	Wildlife Conservation & Security Act, 2012	Rare Species
1.	Ambassidae	Lal Chanda	*Pseudambassis lala*	Mola punti	LC	-	-
2.	Anabantidae	Climbing Perch	*Anabas testudineus*	Koi	LC	-	-
3.	Channidae	Spotted Snahehead	*Channa punctata*	Taki	LC	-	-
4.		Snakehed Murrel	*Channa striatas*	Shol	LC	-	-
5.	Clariidae	Walking Catfish	*Clarias batrachus*	Magur	LC	-	-
6.	Cyprinidae	Angra labeo	*Labeo angra*	Kharsa	LC	-	-
7.		Large Razorbelly Minnow	*Salmophasia bacaila*	Chela	LC	-	-
8.		Mola carplet	*Amblypharyngodon microlepis*	Mola	LC	-	-

SL#	Family	Common Name	Scientific Name	Local Name	IUCN Local Status*	Wildlife Conservation & Security Act, 2012	Rare Species
9.		Red Barb	*Pethia conchonius*	Kanchan Punti	LC	-	-
10.	Heteropneustidae	Stinging catfish	*Heteropneustes nani*		DD	-	-
11.	Osphronemidae	Thick-lipped Gourami	*Trichogaster labiosus*	Khalisha	LC	-	-
12.	Pristigasteridae	Bigeye Ilisha	*Ilisha megaloptera*	Chapila	LC	-	-

* LC=Least Concern, DD=Data Deficit; (IUCN Red List Bangladesh 2015)

Appendix F: GHG Emission Calculation

Appendix F-1: Number of Vehicles with and without project

Component		Patiya		Dohazari		Keranihat		Lohagara		Chakaria	
		FR	N1	FR	N1	FR	N1	FR	N1	FR	N1
Trip Length		5.4	5.4	3.3	3.9	3.5	3.5	5.1	5.2	6.8	6.3
Number of vehicles (with project) in transport mode	Bus+Truck	10108	5846	16064	1143	14220	2234	14114	306	11443	1864
	Car	16373	9234	19396	6506	11522	13535	17178	3758	16193	2742
	CNG	11960	7020	10355	9828	0	22236	13799	8551	18577	3308
Number of vehicles (without project) in transport mode	Bus+Truck	10108	5846	-	15618	-	15165	-	12505	-	11578
	Car	16373	9,234	-	25410	-	24864	-	19812	-	17209
	CNG	11960	7020	-	21621	-	23787	-	23091	-	20531

Appendix F-2: Emission Factor for vehicle type

Sl. No.	Vehicle	gm/veh/km	Remarks
1.	Bus+Truck[28]	1200	HCV diesel bus and truck> 3000 CC
2.	Car[29]	242	Average petrol car
3.	CNG[29]	190	Average CNG autorickshaw

[28] DEFRA (2013). Government GHG Conversion Factors for Company Reporting: Methodology Paper for Emission Factors, Department for Environment, Food and Rural Affairs, Government of United Kingdom

[29] DEFRA (2012). Government GHG Conversion Factors for Company Reporting: Methodology Paper for Emission Factors, Department for Environment, Food and Rural Affairs, Government of United Kingdom

Appendix G: Tree Plantation Plan

Proposed Chattogram-Cox's Bazar Highway Improvement Project in Bangladesh will be implemented in 5 (five) major bottleneck sites – Patiya, Dohazari, Lohagara, Keranihat, Chakaria. A total of 85,402 number of trees has been estimated to be affected in Bottleneck sites due to this project. Details of the area of logging expected in the MJB sections of the project are given in Appendix G-01.

In accordance with the normal practice of the Forest Department, 2 new trees should be planted for each tree felled or as advised by the Forest Department for forest trees. However, considering the footprint of this project in a larger area, plantation of saplings should be at least two times of plant felled. Therefore, a Tree Plantation Program has been prepared for planting 170,804 saplings to compensate the loss of 85,402 trees/plants as well as to build additional carbon stock in the project area to make the project more environment friendly.

The objective of the Tree Plantation Program is to compensate for the loss of trees due to the proposed implementation of the Chattogram-Cox's Bazar Highway Improvement Project. Other major objectives of the program are to protect the affected cultural/sensitive areas and also to enhance the health of the existing ecosystem.

Selection of Tree Species

Considering different physiographic situations at different locations of the alignment, habitat-wise species will be selected for plantation those are categorized into four groups. These groups are (i) Timber, (ii) Fruit-bearing, (iii) Medicinal, and (iv) Fuelwood. The category, groups, quantity will vary in each location due to ecological condition of the site. For instance, the category and groups of species in River side will differ from that of forested area due to species survival tolerance and adaptability. The species for the proposed tree plantation will be selected based on the statistics of the lost vegetation and suitability for the intended purpose. This will be done in consultation with Forest Department, Ecologist of the project and local communities during stakeholder consultation. The main consideration for selection of species is to protect the highway from erosion and habitat for biotic species, minimize visual impacts, improved aesthetics and ecological conservation as well as commercial benefits.

However, the following characteristics will be taken into consideration while selecting plant species for green belt development and tree plantation.

- Plants should be fast-growing;
- They should be perennial and evergreen;
- They should have thick canopy cover;
- The trees should maintain regional ecological balance and conform to soil and hydrological conditions. Indigenous species should be preferred.

The following trees species can be selected for tree plantation program –

Table 11-1: Tree Species Selection for Plantation Program

Category of Trees	Local Name	Common Name	Scientific Name	Number of Sapling to be planted
Timber (50%)	Raintree/ Siris	Raintree	*Samanea saman*	85,402
	Silkorai	White Siris	*Albizia procera*	
	Kala Koroi	Lebbek Tree	*Albizia lebbeck*	
	Mahogani	Mahogany	*Swietenia mahagoni*	
	Shisu	North Indian Rosewood	*Dalbergia sissoo*	

Category of Trees	Local Name	Common Name	Scientific Name	Number of Sapling to be planted
	Chapalish	Monkey Jack	*Artocarpus chaplasha*	
	Garjan	Dipterocarpus	*Dipterocarpus* spp.	
	Gamar	White Teak	*Gmelina arborea*	
	Lohakath	Burma Ironwood	*Xylia xylocarpa*	
	Chikrasi	Indian Mahagony	*Chukrasia tabularis*	
	Bailam	-	*Anisoptera scaphula*	
	Telsur	Ironwood	*Hopea odorata*	
	Katbadam	Indian Almond	*Terminalia catappa*	
Fruit-bearing (30%)	Aam	Mango	*Mangifera indica*	51,241
	Kathal	Jackfruit	*Artocarpus heterophyllus*	
	Jalpai	Indian Olive	*Elaeocarpus floribundus*	
	Tetul	Tamarind	*Tamarindus indica*	
	Bel	Wood Apple	*Aegle marmelos*	
	Boroi	Indian jujube	*Ziziphus mauritiana*	
	Bhutijam	Wild Plum	*Syzygium balsameum*	
	Kalojam	Black Plum	*Syzygium cumini*	
Medicinal (10%)	Neem	Neem	*Azadirachta indica*	17,080
	Ghura neem	Chinaberry Tree	*Melia azedarach*	
	Arjun	Arjun	*Terminalia arjuna*	
	Bohera	Bohera	*Terminalia bellirica*	
	Horitoki	Black Myrobalan	*Terminalia chebula*	
	Amloki	Indian gooseberry/ Amla	*Phyllanthus emblica*	
Fuelwood (10%)	Jarul	Pride of India	*Lagerstroemia speciosa*	17,080
	Sonalu	Golden Shower	*Cassia fistula*	
	Polash	Sacred Tree	*Butea monosperma*	
	Kadam	Burflower Tree	*Neolamarckia cadamba*	
	Mandar	Indian Coral Tree	*Erythrina indica*	
	Krishnochura	Royal Poinciana	*Delonix regia*	
	Bokul	Spanish cherry	*Mimusops elengi*	

Category of Trees	Local Name	Common Name	Scientific Name	Number of Sapling to be planted
	Bot	Banyan	*Ficus bengalensis*	
			Total Sapling to be planted	170,804

Plantation Area and Tree Plantation Program

The proposed plantation locations/ ways are as follows –

- Right of Way,
- Any embankments, and
- Lands near bridges and culverts
- Community distribution
- Private and Govt. land under social forestry program

Guidelines for Tree Plantation Program

The following guidelines should be implemented from Nursery development to tending operations (planting, thinning, pruning, etc.)

- Saplings of deep-rooted trees to be planted
- Trees having profuse branching pattern will be planted in mixed combination comprising of timber, fruit-bearing, medicinal and fuelwood trees
- Nursery to be developed based on selected trees
- Nursery will be developed from locally available good quality seeds to ensure well adaptation of planted saplings
- Man height saplings to be planted
- Saplings will be planted from June to August
- According to Forest Department, one guard is required for the protection of 2 km long strip plantation or 50 acres of block plantation
- Mulching and regular watering will be done in the dry season
- For block plantation, fences to be installed surrounding the plantation area and for strip plantation, each planted sapling to be protected with tree cages
- Pruning and thinning operations to be performed after 4 years of plantation

Institutional Arrangement

Roads and Highways Department (RHD)

On behalf of RHD, the Contractor will plant the trees during construction period of the project. The participation of Forest Department (FD) and local community is recommended as RHD/contractor may utilize their skills and knowledge on Tree Plantation Program. The Forest Department has the capacity to provide all technical and other supports in planning and developing the plantations.

The tasks of the RHD are as follows:

- Training of the local RHD staff on tree maintenance
- Preparation of the Tree Plantation Programs in accordance with this plan and get them approved by the Forest Department, if necessary
- Coordination of sapling procurement process of approved species prescribed above
- Supervision of nurseries for raising saplings

Forest Department (FD)

Nurseries of the FD can be used for raising the suitable saplings of the tree species for the plantation areas in the project area.

There are a number of private sector nurseries in the project district which may be also contacted for raising saplings as well. The FD will also involve local community in developing homestead gardens surrounding their houses in all possible ways. It is recommended that RHD should start dialogue with the FD for the tree plantation development program in the pre-construction stage, so that setting up of nurseries for making 170,804 saplings available for planting in the early stage of the project.

Construction Contractor

The Construction Contractor will be responsible for planting trees throughout the alignment and other areas as prescribed above. The Contractor will need to procure and raise saplings until they survive for 18 months after plantation. They can set up nurseries in consultation with RHD and the Engineer at the early stage of the Project. Alternatively, the Contractor can purchase saplings from the local nursery.

Monitoring Measures for Tree Plantation Program

The monitoring plan focuses on the successful implementation of Tree Plantation Program by continuously checking parameters of monitoring in certain locations to ensure the proper implementation of program activities by the responsible parties. “14. Biota and Ecosystem” under Section 8.3 includes the monitoring measures required for successful tree implementation of this plantation program.

Appendix G-1: Impact on Trees in Major Bottleneck Sites

Types of Trees		Size of Trees				Total
		Large	Medium	Small	Plant	
Patiya	Fruit bearing	298	962	1,397	729	3,386
	Timber	491	1,065	5,887	814	8,257
	Timber & fruit	227	484	1,129	625	2,465
	Firewood	0	57	394	10	461
	Medicinal	1	2	56	14	73
	Bamboo	523	649	302	30	1,504
	Banana	335	468	770	81	1,654
	Papaya	64	85	76	19	244
	Cane bush	110	50	149	0	309
	Sub-total	**2,049**	**3,822**	**10,160**	**2,322**	**18,353**
Dohazari	Fruit bearing	358	933	1,027	337	2,655
	Timber	414	827	2,825	442	4,508
	Timber & fruit	203	202	510	280	1,195
	Firewood	0	8	33	19	60
	Medicinal	0	0	8	4	12
	Bamboo	123	153	281	0	557
	Banana	325	481	602	151	1,559
	Papaya	13	16	47	0	76
	Cane bush	2	0	15	0	17
	Sub-total	**1,438**	**2,620**	**5,348**	**1,233**	**10,639**
Lohagara	Fruit bearing	775	1,159	1,329	5,562	8,825
	Timber	1,374	3,305	3,635	1,772	10,086
	Timber & fruit	472	1,691	2,081	1,138	5,382
	Firewood	122	103	117	0	342
	Medicinal	2	25	0	4	31
	Bamboo	979	863	258	10	2,110
	Banana	1,611	571	669	67	2,918
	Papaya	122	129	78	600	929
	Cane bush	70	0	92	0	162
	Sub-total	**5,527**	**7,846**	**8,259**	**9,153**	**30,785**
Keranihat	Fruit bearing	1	2	21	0	36
	Timber	282	629	755	116	1,782
	Timber & fruit	39	112	140	7	298
	Firewood	**0**	**0**	**0**	**0**	**0**
	Medicinal	**0**	**0**	**0**	**0**	**0**
	Bamboo	0	0	32	0	32
	Banana	150	135	226	37	548
	Papaya	20	10	10	5	45
	Cane bush	0	0	0	0	0

Types of Trees		Size of Trees				Total
		Large	Medium	Small	Plant	
	Sub-total	**494**	**891**	**1,191**	**165**	**2,741**
Chakaria	Fruit bearing	1,335	1,163	1,563	507	4,568
	Timber	437	1,426	3,691	675	6,229
	Timber & fruit	273	1,678	2,754	1,789	6,494
	Firewood	70	167	325	237	799
	Medicinal	2	52	306	236	596
	Bamboo	1,043	204	524	3	1,774
	Banana	657	531	441	50	1,679
	Papaya	41	70	23	3	137
	Cane bush	325	141	142	0	608
	Sub-total	**4,183**	**5,432**	**9,769**	**3,500**	**22,884**
	Total	**13,691**	**20,611**	**34,727**	**16,373**	**85,402**

Source: RAP Study Results, 2022

Note: Large = Height 16+ feet & encirclement 30-40+ inch; Medium = Height 11-15 feet & encirclement 20-30 inch; Small = Height 6-10 feet & encirclement 10-20 inch; Sapling = Height 1-5 feet & encirclement 1-10 inch;

Appendix H: Invitation letter, Participant list, Photographs and Presentation Materials of Stakeholder Consultations

Appendix H-2: Copy of Invitation Letter of first round PCM

Government of the Peoples Republic of Bangladesh
Roads and Highways Department
Chattogram-Cox's Bazar Highway Improvement Project
RHD Foreign Aided Projects Office Building (Level-2)
Road-27, Block-A, Banani, Dhaka-1213
www.rhd.gov.bd
Email: pdmatarbari@rhd.gov.bd, Phone: 02-41080771

Memo No.: 35.01.2607.068.44.002.19-4211 Date: 21 January 2021

Subject: Public Consultation Meeting for the Environmental and Social Impact Assessment (ESIA) of the Chattogram-Cox's Bazar Highway Improvement Project.

With reference to the above-mentioned subject, this is to inform that Roads and Highway Department under the Road Transport and Highway Division, Ministry of Road Transport and Bridges has planned to take up Chattogram-Cox's Bazar Highway Improvement Project with the financial aid from Japan International Cooperation Agency (JICA). Four outer roads at Patiya, Dohazari, Lohagara, Chakaria and a flyover at Keranihat will be constructed under this project.

At present, Environmental and Social Impact Assessment for the project and mitigation measures establishment for the assessed impacts are in progress. To get public perception regarding this project, first stage of public consultation meeting with the respective stakeholders will be held as per following schedule. Your kind presence at the meeting is highly expected.

Site	Date and Time	Venue
Chakaria	27 January 2021 10:00 AM	Chakaria Pourashava Auditorium, Chakaria, Cox's Bazar
Lohagara	27 January 2021 03:00 PM	02 No. Amirabad Union Parishad Auditorium, Lohagara, Chattogram
Keranihat	28 January 2021 10:00 AM	10 No. Keonchia Union Parishad Auditorium, Satkania, Chattogram
Dohazari	28 January 2021 03:00 PM	11 No. Kaliaish Union Parishad Auditorium, Satkania, Chattogram
Patiya	31 January 2021 10:00 AM	Four Star Community Center, Patiya, Chattogram

21/01/2021
(Shyamal Kumar Bhattacharyya)
ID NO: 001035
Interim Project Director
Chattogram-Cox's Bazar Highway Improvement Project

Copy Distributed for Kind Presence (Not According to Seniority):

1. Divisional Forest Officer, Chattogram South Forest Division, Chattogram
2. Divisional Forest Officer, Wildlife Management & Nature Conservation Division, Chattogram South Forest Division, Chattogram
3. Director, Chattogram Regional Office, Department of Environment, Chattogram
4. Deputy Director, Cox's Bazar District Office, Department of Environment, Cox's Bazar
5. Executive Engineer, RHD, Road Division, Chattogram/Dohazari/Cox's Bazar
6. Upazilla Nirbahi Officer (UNO)..... Upazilla
7. Mayor..... Pourashava
8. Chairman..... Upazilla Parishad
9. Chairman..... Union Parishad
10. Councilor..... no. Ward.....Pourashava
11. Member..... no. Ward.....Union Parishad
12. Upazilla Agriculture Officer, Patiya/Chandanaish/Satkania/Lohagara/Chakaria
13. Upazilla Fisheries Officer, Patiya/Chandanaish/Satkania/Lohagara/Chakaria
14. Upazilla Education Officer, Patiya/Chandanaish/Satkania/Lohagara/Chakaria
15. Sub-Assistant Engineer, DPHE, Patiya/Chandanaish/Satkania/Lohagara/Chakaria Upazilla

Copy to (Not According to Seniority):

1. Mr. Takayasu Nagai, Team Leader of the JICA Study Team, The Preparatory Survey for Chattogram-Cox's Bazar Highway Improvement Project in Bangladesh.
2. Mr. Masatomo Toyoda, JICA Bangladesh Office, 3rd Floor, Bay's Galleria, 57 Gulshan Avenue (CWS-A19), Gulshan-1, Dhaka-1212.
3. Mr. Suman Dasgupta, Senior Programme Officer, JICA Bangladesh Office, 3rd Floor, Bay's Galleria, 57 Gulshan Avenue (CWS-A19), Gulshan-1, Dhaka-1212.

Appendix H-3: Copy of first rounf PCM Advertisement in Newspaper

Name of Newspaper: The Daily Azadi (Page-07)

Date: January 22, 2021

বিজ্ঞপ্তি

চট্টগ্রাম-কক্সবাজার হাইওয়ে ইমপ্রুভমেন্ট প্রজেক্ট এর পরিবেশগত ও সামাজিক প্রভাব নিরূপণ বিষয়ক অংশীজন সভা

গণপ্রজাতন্ত্রী বাংলাদেশ সরকারের সড়ক পরিবহন ও সেতু মন্ত্রণালয়ের সড়ক পরিবহন ও মহাসড়ক বিভাগের আওতাধীন সড়ক ও জনপথ অধিদফতর এর উদ্যোগে এবং জাপান আন্তর্জাতিক সহযোগিতা সংস্থা (জাইকা)- এর আর্থিক সহায়তায় চট্টগ্রাম-কক্সবাজার হাইওয়ে ইমপ্রুভমেন্ট প্রজেক্ট এর পরিকল্পনা গ্রহণ করা হয়েছে। উক্ত প্রকল্পের আওতায় পটিয়া, দোহাজারী, লোহাগাড়া ও চকোরিয়া এলাকায় একটি করে বাইপাস এবং কেরানিহাট এলাকায় একটি ফ্লাইওভার নির্মাণ করা হবে।

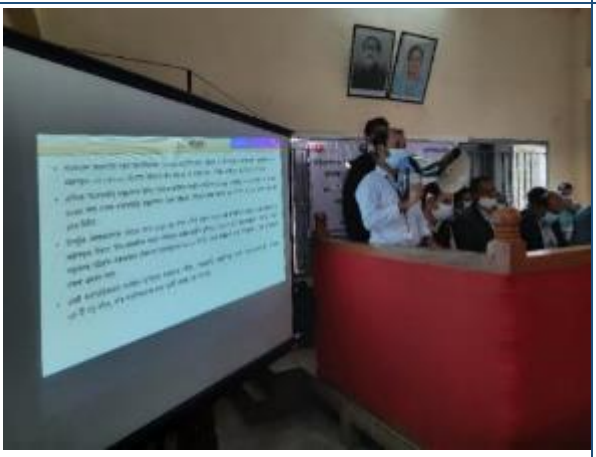
বর্তমানে উক্ত প্রকল্পের পরিবেশগত ও সামাজিক প্রভাব নিরূপণ করা হচ্ছে এবং নিরূপণকৃত প্রভাব প্রশমনের ব্যবস্থা প্রণয়ন করা হচ্ছে। এ সংশ্লিষ্ট বিষয়ে সর্বসাধারণের মতামত জানার লক্ষ্যে নিম্নোক্ত সময় ও স্থানে স্বাস্থ্যবিধি মেনে ও সামাজিক দূরত্ব বজায় রেখে প্রথম দফা অংশীজন সভা অনুষ্ঠিত হবে। উক্ত সভায় উপস্থিত থাকার জন্য আপনাকে বিশেষভাবে অনুরোধ করা হল।

সংশ্লিষ্ট এলাকা	তারিখ ও সময়	স্থান
চকোরিয়া	২৭ জানুয়ারি ২০২১, সকাল ১০.০০ ঘটিকা	চকোরিয়া পৌরসভা মিলনায়তন, চকোরিয়া, কক্সবাজার।
লোহাগাড়া	২৭ জানুয়ারি ২০২১, বিকেল ০৩.০০ ঘটিকা	০২ নং আমিরাবাদ ইউনিয়ন পরিষদ মিলনায়তন, লোহাগাড়া, চট্টগ্রাম।
কেরানিহাট	২৮ জানুয়ারি ২০২১, সকাল ১০.০০ ঘটিকা	১০ নং কেঁওচিয়া ইউনিয়ন পরিষদ মিলনায়তন, সাতকানিয়া, চট্টগ্রাম।
দোহাজারী	২৮ জানুয়ারি ২০২১, বিকেল ০৩.০০ ঘটিকা	১১ নং কালিয়াইশ ইউনিয়ন পরিষদ মিলনায়তন, সাতকানিয়া, চট্টগ্রাম।
পটিয়া	৩১ জানুয়ারি ২০২১, সকাল ১০.০০ ঘটিকা	ফোর স্টার কমিউনিটি সেন্টার, পটিয়া, চট্টগ্রাম।

অনুরোধক্রমে
অন্তর্বর্তীকালীন প্রকল্প পরিচালকের কার্যালয়
চট্টগ্রাম-কক্সবাজার হাইওয়ে ইমপ্রুভমেন্ট প্রজেক্ট
আরএইচডি বৈদেশিক সাহায্যপুষ্ট প্রকল্পসমূহের কার্যালয় (লেভেল-২)
রোড-২৭, ব্লক-এ, বনানী, ঢাকা-১২১৩

নং-বি ২৬৫১/০১

Appendix H-9: Photographs of the first round PCM

	
Local MP Zafar Alam delivering speech at PCM1, Chakaria	Participants at the PCM1, Chakaria
	
Presentation by EQMS in the PCM1, Chakaria	Participants listening presentation at PCM1, Chakaria
	
Presentation by EQMS at PCM2, Lohagara	Participants at PCM2, Lohagara

	
Responding to the questions of stakeholders at PCM2, Lohagara	Member of Amirabad UP delivering speech at PCM2, Lohagara
	
Participants at the PCM3, Keranihat	Presentation by EQMS at the PCM3, Keranihat
	
Chairman of Keochia UP delivering speech at the PCM3, Keranihat	Question/opinion from stakeholder at the PCM3, Keranihat

	
Participants at the PCM4, Dohazari	Presentation and responding to stakeholder's question by EQMS at the PCM4, Dohazari
	
Question/opinion from stakeholders at the PCM4, Dohazari	Question/opinion from stakeholders at the PCM4, Dohazari
	
Question/opinion from stakeholder at the PCM5, Patiya	Responding to stakeholder's question by Nippon Koei at the PCM5, Patiya

	
Presentation and responding to stakeholder's question by EQMS at the PCM5, Patiya	Providing face mask to participants for COVID-19 protection at the PCM5, Patiya

Appendix H-10: Presentation Materials of first round PCM

পরিবেশগত এবং সামাজিক প্রভাব নিরূপণ (ইএসআইএ)
"চট্টগ্রাম-কক্সবাজার হাইওয়ে ইমপ্রুভমেন্ট প্রজেক্ট"

সড়ক পরিবহন ও মহাসড়ক বিভাগ (আরএইচডি)

আরএইচডি এর সহায়তাপুষ্ট জাইকা সমীক্ষা দল/ ইকিউএমএস কনসালটিং লিমিটেড

তারিখঃ ৩১ জানুয়ারী ২০২১

1

সূচীপত্র

3

১। পটভূমি

- বাংলাদেশ সরকারের সড়ক মহাপরিকল্পনা (২০০৯) অনুসারে ঢাকা, চট্টগ্রাম ও কক্সবাজারকে সংযোগকারী সড়ককে জাতীয় মহাসড়ক -০১ (এন-০১) হিসেবে বিবেচনা করা হয়েছে, যা একই সাথে এশিয়ান হাইওয়ে -৪১ হিসেবেও বিবেচ্য।
- এদিকে "মাতারবাড়ি সমুদ্রবন্দর উন্নয়ন বিষয়ক জাইকার প্রাথমিক সমীক্ষা (২০১৮)" অনুযায়ী, এন-০১ উন্নয়ন করা না হলে ২০৩৫ সাল নাগাদ মাতারবাড়ি সমুদ্রবন্দর থেকে চট্টগ্রাম পৌঁছাতে সময় লাগবে ৪৩৮ মিনিট, যা ২০১৭ সাল নাগাদ ছিল ১২৩ মিনিট।
- উপর্যুক্ত বিষয়গুলোকে সামনে রেখে ২০১৩-১৪ সালে এশীয় উন্নয়ন ব্যাংক-এর কারিগরি সহায়তায় সড়ক পরিবহন ও মহাসড়ক বিভাগ "উপ-আঞ্চলিক সড়ক পরিবহন প্রকল্প প্রস্তুতি সুবিধা-২" এর আওতায় কক্সবাজারের ৫ কি.মি. সংযোগ সড়কসহ চট্টগ্রাম-কক্সবাজার-টেকনাফ মহাসড়কের ২০৮.৮ কি.মি. সড়ক উন্নয়নের জন্য উপযোগিতা যাচাই ও বিস্তারিত নকশা প্রনয়ন করে।
- এরই ধারাবাহিকতায় বর্তমানে জাইকার সহায়তায় পটিয়া, দোহাজারী, কেরানীহাট, লোহাগাড়া এবং চকোরিয়া এলাকায় ০৫ টি বড় বাঁকে, বাঁক সরলীকরণের জন্য একটি প্রকল্প নেয়া হয়েছে।

১। পটভূমি

জাইকা প্রকল্পের জন্য আরএইচডির দায়িত্ব

- নেতিবাচক প্রভাব কমানোর জন্য ESIA এবং RAP রিপোর্ট প্রস্তুত করা;
- স্বচ্ছতার জন্য জনগণের সাথে পরামর্শ ও তথ্য প্রকাশ করা;
- নির্মাণকালীন ও চালু অবস্থায় ইএসআইএ রিপোর্ট এ প্রস্তাবিত পরিবেশগত ও সামাজিক প্রভাব প্রশমনের ব্যবস্থা বাস্তবায়ন করা;
- আরএইচডি কর্তৃক প্রকল্প নির্মাণকালীন ও চালু অবস্থায় পরিবেশগত ও সামাজিক অবস্থা নিরীক্ষা করা।

১। পটভূমি

অংশীজন সভার উদ্দেশ্য

(ইএসআইএ) এর জন্য অংশীজন সভা ২ ধাপে অনুষ্ঠিত হবে,

- প্রাথমিক ধাপ (উক্ত সভা)
- চূড়ান্ত ধাপ হবে খসড়া ইএসআইএ রিপোর্ট প্রস্তুত হবার পর জনসাধারণের নিকট ফলাফল প্রকাশ এবং তাদের মতামত গ্রহনের জন্য।

২। প্রকল্পের বৈশিষ্ট্য

প্রকল্পের অবস্থান

চট্টগ্রাম-কক্সবাজার মহাসড়ক সংলগ্ন পটিয়া, চন্দনাইশ, সাতকানিয়া, লোহাগাড়া ও চকোরিয়া উপজেলার অধীনে অবস্থিত।

২। প্রকল্পের বৈশিষ্ট্য (অবস্থানঃ পটিয়া বাইপাস)

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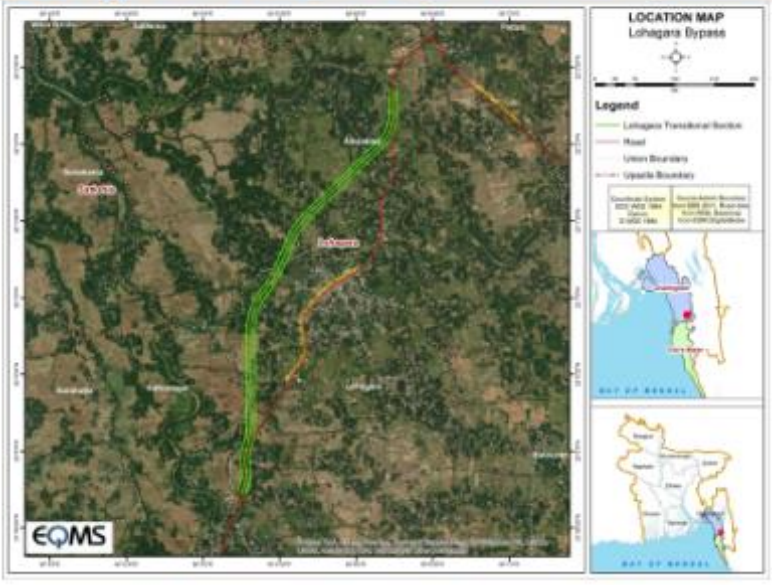
২। প্রকল্পের বৈশিষ্ট্য (অবস্থানঃ দোহাজারী বাইপাস)

15

২। প্রকল্পের বৈশিষ্ট্য (অবস্থানঃ কেরানিহাট উড়াল সড়ক)

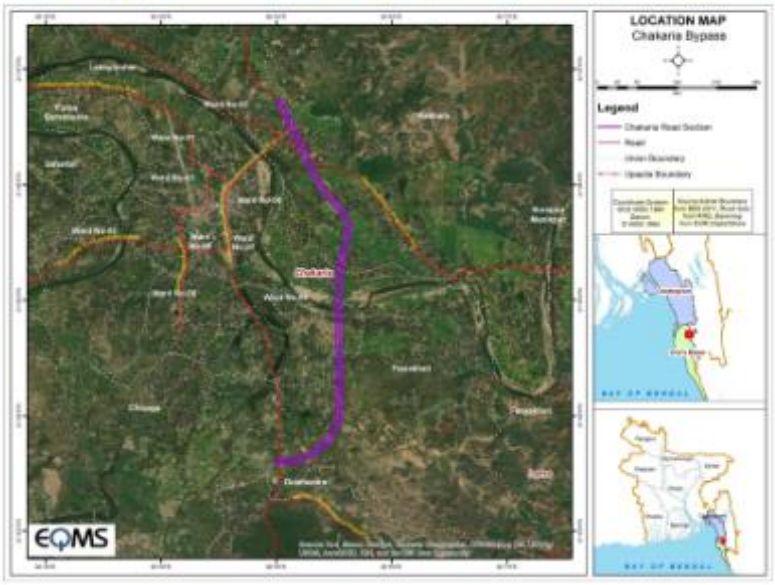
17

২। প্রকল্পের বৈশিষ্ট্য (অবস্থানঃ লোহাগাড়া বাইপাস)



19

২। প্রকল্পের বৈশিষ্ট্য (অবস্থানঃ চকোরিয়া বাইপাস)



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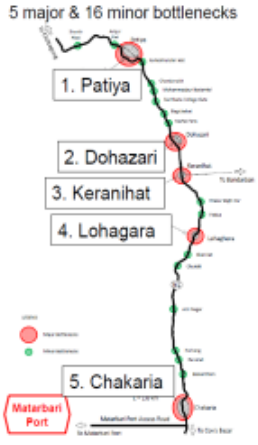
২. প্রকল্পের বৈশিষ্ট্য (প্রকল্পের অন্তর্ভুক্ত বিষয়)

➢ ০৫ টি বড় বাঁক ও ১১৪ টি ছোট বাঁকসহ মোট ২৫.৫ কি.মি. মহাসড়ক উক্ত প্রকল্পের অধীনে উন্নয়ন করা হবে।

অবস্থান	প্রস্তাবিত অপশন	দৈর্ঘ্য (কি.মি.)	প্রস্থ (মি.)	বড় স্থাপনা
পটিয়া	বাইপাস	৬.৬০ (সম্ভাব্য)	৯১.৫	নাই
দোহাজারী	বাইপাস	৩.২৬	৯১.৫	• সাঙ্গু নদী অতিক্রমকারী সেতু
কেরানিহাট	ফ্লাইওভার	৩.৪৪	৪৮.০	• রেলওয়ে ওভারপাস
লোহাগাড়া	বাইপাস	৫.২৭	৯১.৫	• টংকাবতী খাল অতিক্রমকারী সেতু
চকোরিয়া	বাইপাস	৬.৯৬ (সম্ভাব্য)	৮৪.২	• মাতামুহুরি নদী অতিক্রমকারী সেতু



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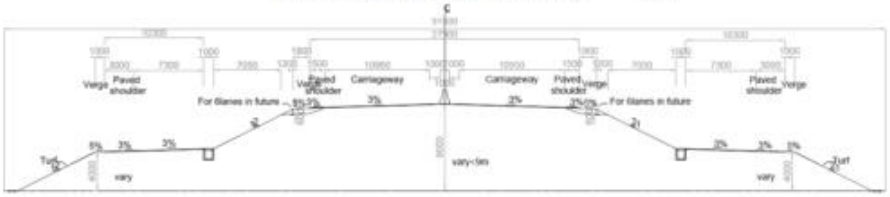
২. প্রকল্পের বৈশিষ্ট্য (সাধারন প্রস্থচ্ছেদঃ প্রাথমিক)

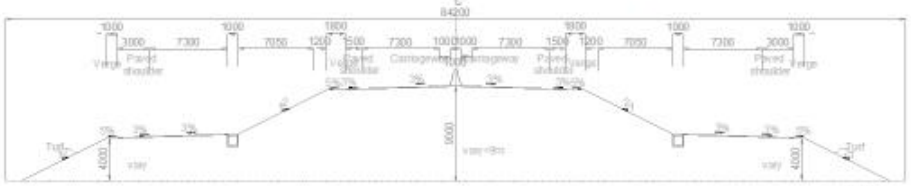
বহিঃস্থ সড়কের বাঁধের অংশ (মূল সড়কঃ ৬ লেন, পার্শ্ব সড়কঃ ৪ লেন)

নির্মাণ প্রয়োজনীয় প্রস্থঃ ৯১.৫ মি. (৩০০ ফুট)



বহিঃস্থ সড়কের বাঁধের অংশ (মূল সড়কঃ ৪ লেন, পার্শ্ব সড়কঃ ৪ লেন), চকোরিয়া

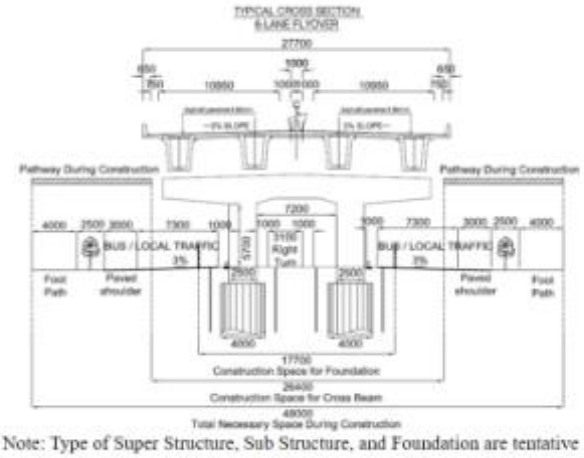
নির্মাণ প্রয়োজনীয় প্রস্থঃ ৮৪.২ মি. (২৮০ ফুট)



২. প্রকল্পের বৈশিষ্ট্য (সাধারন প্রস্থচ্ছেদঃ প্রাথমিক)

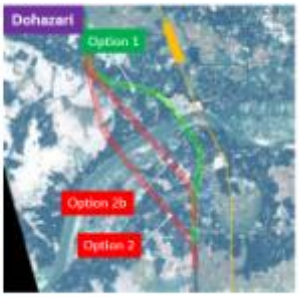
উড়ালসড়ক অংশ (মূল সড়কঃ ৬ লেন, পার্শ্ব সড়কঃ ৪ লেন), কেরানিহাট

নির্মাণ প্রয়োজনীয় প্রস্থঃ ৪৮ মি. (১৬০ ফুট)



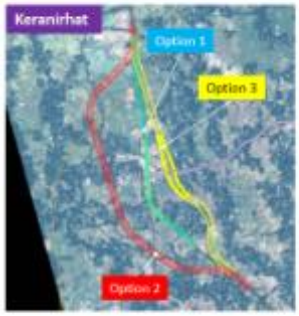
Note: Type of Super Structure, Sub Structure, and Foundation are tentative

৩. বিকল্প সড়ক পর্যালোচনা (দোহাজারী)



Item	Development Option		
	Option 1	Option 2b	Option 3
Concept	**Utilize Existing ROW & New Sangu Bridge**	**Outer Road on West Side Minimize river-related risk**	**Combined Outer Road for both Dohazari & Keranihat on East Side**
Scope of Works	✓ Align Improvement ✓ Widening **Large-scale structures:** ✓ None	✓ New Outer Road ✓ Service Road **Large-scale structures:** ✓ Sangu River Crossing	✓ New Outer Road ✓ Service Road **Large-scale structures:** ✓ Sangu River Crossing ✓ Railway Crossing ✓ N108 Crossing
Design Control	**Approach**		
City Center (Built-up area)	Pass through	Bypass	Pass through
Sangu River	Utilize the bridge to be built under another project	Construct a new bridge with large crossing angle	Construct a new bridge with large crossing angle
Railway (under const.)	No impact	No impact	Construct Railway-Over-Bridge with large crossing angle
N108	No impact	No impact	Grade Separation by Interchange

৩. বিকল্প সড়ক পর্যালোচনা (কেরানিহাট)

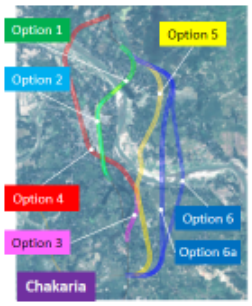


Item	Development Option		
	Option 1	Option 2	Option 3
Concept	**Utilize Existing ROW Construct Flyover**	**Outer Road on West Side**	**Outer Road on East Side**
Scope of Works	✓ Align Improvement ✓ Flyover ✓ Approach Road ✓ Service Road **Large-scale structures:** ✓ Flyover	✓ New Outer Road ✓ Service Road **Large-scale structures:** ✓ Railway Crossing	✓ New Outer Road ✓ Service Road **Large-scale structures:** ✓ Railway Crossing ✓ N108 Crossing
Design Control	**Approach**		
City Center (Built-up area)	Pass through	Bypass	Bypass
Railway (under const.)	Flyover needs to be extended to cross over the railway	Construct Railway-Over-Bridge with large crossing angle	Construct Railway-Over-Bridge with large crossing angle
N108	Grade Separation by Flyover	No impact	Grade Separation by Interchange
High Voltage Line	No impact	Secure offset distance	No impact

৩. বিকল্প সড়ক পর্যালোচনা (লোহাগড়া)

Item	Development Option		
	Option 1	Option 2	Option 3
Concept	**Utilize Existing ROW** **Construct Flyover**	**Outer Road on West Side**	**Outer Road on East Side**
Scope of Works	✓ Align Improvement ✓ Flyover ✓ Approach Road ✓ Service Road **Large-scale structures:** ✓ Flyover	✓ New Outer Road ✓ Service Road **Large-scale structures:** ✓ Tonkaboti Canal Crossing	✓ New Outer Road ✓ Service Road **Large-scale structures:** ✓ Tonkaboti Canal Crossing
Design Control	**Approach**		
City Center (Built-up area)	Pass through	Bypass	Bypass
Railway (under const.)	No impact	No impact	No impact
Tonkaboti Canal	No impact	Construct a new bridge with large crossing angle	Construct a new bridge with large crossing angle

৩. বিকল্প সড়ক পর্যালোচনা (চকোরিয়া)



Item	Development Option		
	Option 1	Option 2	Option 3
Concept	**Utilize Existing ROW & New Mathamuhuri Bridge**	**Utilize Existing ROW** **Construct Flyover**	**Outer Road on East Side**
Scope of Works	✓ Align Improvement ✓ Widening **Large-scale structures:** ✓ Flyover	✓ Align Improvement ✓ Flyover ✓ Approach Road ✓ Service Road **Large-scale structures:** ✓ Flyover	✓ New Outer Road ✓ Service Road **Large-scale structures:** ✓ Mathamufuri River Crossing
Design Control	**Approach**		
City Center (Built-up area)	Pass through	Pass through	Bypass
Mathamufuri River	Utilize the bridge to be built under another project	Utilize the bridge to be built under another project	Construct a new bridge with large crossing angle
Railway (under const.)	No impact	No impact	No impact
N1	To be improved under the Project	To be improved under the Project	To be connected smoothly
Matarbari Access Road	To be improved separately	To be improved separately	To be improved separately

৩. বিকল্প সড়ক পর্যালোচনা (চকোরিয়া)

Item	Development Option	
	Option 4	Option 5
Concept	Outer Road on West Side -> East Side Connect to Matarbari Access Road	Outer Road on East Side Connect to Matarbari Access Road
Scope of Works	✓ New Outer Road ✓ Service Road Large-scale structures: ✓ Mathamufuri River Crossing ✓ N1 Crossing ✓ Matarbari Access Road Crossing	✓ New Outer Road ✓ Service Road Large-scale structures: ✓ Mathamufuri River Crossing ✓ Matarbari Access Road Crossing
Design Control	**Approach**	
City Center (Built-up area)	Bypass Impact on Army property	Bypass
Mathamufuri River	Construct a new bridge with large crossing angle	Construct a new bridge with large crossing angle
Railway (under const.)	No impact	No impact
N1	Grade Separation by Interchange	To be connected smoothly
Matarbari Access Road	Grade Separation by Interchange	Grade Separation by Interchange

৩. বিকল্প সড়ক পর্যালোচনা (চকোরিয়া)

Item	Development Option	
	Option 6	Option 6a
Concept	Avoid impact on Urban Area to be Developed Outer Road on East Side Connect to Matarbari Access Road	Avoid impact on Urban Area to be Developed Outer Road on East Side Connect to Matarbari Access Road Minimize river-related risk
Scope of Works	✓ New Outer Road ✓ Service Road Large-scale structures: ✓ Mathamufuri River Crossing ✓ Matarbari Access Road Crossing	✓ New Outer Road ✓ Service Road Large-scale structures: ✓ Mathamufuri River Crossing ✓ Matarbari Access Road Crossing
Design Control	**Approach**	
City Center (Built-up area)	Bypass	Bypass
Mathamufuri River	Construct a new bridge with large crossing angle	Construct a new bridge with large crossing angle
Railway (under const.)	No impact	No impact
N1	To be connected smoothly	To be connected smoothly
Matarbari Access Road	Grade Separation by Interchange	Grade Separation by Interchange

৪। পরিবেশের গুণমান নিরীক্ষা

- বর্ষা ও শুষ্ক মওসুমের ভূপৃষ্ঠ পানির নমুনা যথাক্রমে ২০২০ সালের জুন এবং ডিসেম্বর মাসে সংগ্রহ করা হয়েছে।
- প্রথম দফা বায়ুর মান ২০২০ সালের সেপ্টেম্বর মাসে নিরীক্ষা করা হয়েছে। দ্বিতীয় দফা বায়ুর মান নিরীক্ষা ২০২১ সালের জানুয়ারি মাসে শুরু হয়েছে।
- উদ্ভিদ ও প্রানী বৈচিত্র্য এবং বন্য হাতি চলাচলের রাস্তা অনুসন্ধানের জন্য প্রথম ও দ্বিতীয় দফা প্রতিবেশগত সমীক্ষা যথাক্রমে ২০২০ সালের জুন এবং ডিসেম্বর মাসে করা হয়েছে।
- শব্দ এবং কম্পনের মাত্রা পরিমাপের জন্য নিরীক্ষা ২০২১ সালের ফেব্রুয়ারি মাসে শুরু হবে।

৪। পরিবেশের গুণমান নিরীক্ষা

বায়ুর মান, শব্দের মাত্রা ও কম্পনের মাত্রা পরিমাপ এবং ভূপৃষ্ঠ পানির নমুনা সংগ্রহের অবস্থান: পটিয়া

৪। পরিবেশের গুণমান নিরীক্ষা

বায়ুর মান, শব্দের মাত্রা ও কম্পনের মাত্রা পরিমাপ এবং ভূপৃষ্ঠ পানির নমুনা সংগ্রহের স্থানসমহঃ দোহাজারী

৪। পরিবেশের গুণমান নিরীক্ষা

বায়ুর মান, শব্দের মাত্রা ও কম্পনের মাত্রা পরিমাপ এবং ভূপৃষ্ঠ পানির নমুনা সংগ্রহের স্থানসমহঃ কেরানিহাট উড়াল সড়ক

৪। পরিবেশের গুণমান নিরীক্ষা

বায়ুর মান, শব্দের মাত্রা ও কম্পনের মাত্রা পরিমাপ এবং ভূপৃষ্ঠ পানির নমুনা সংগ্রহের স্থানসমূহঃ লোহাগাড়া

৪। পরিবেশের গুণমান নিরীক্ষা

বায়ুর মান, শব্দের মাত্রা ও কম্পনের মাত্রা পরিমাপ এবং ভূপৃষ্ঠ পানির নমুনা সংগ্রহের স্থানসমূহঃ চকোরিয়া

৫। পরিবেশগত ও সামাজিক প্রভাব নিরূপণ এর জন্য সামাজিক জরিপ

ইকিউএমএস কর্তৃক সামাজিক জরিপ

- স্থানীয় অধিবাসী ও জনগোষ্ঠীর উপর প্রায় সব ধরনের (ইতিবাচক ও নেতিবাচক) সামাজিক প্রভাব নিরূপণের জন্য সামাজিক জরিপ ও পরামর্শ করা হবে।
- কয়েকটি প্রত্যাশিত সামাজিক প্রভাব হতে পারে যানজট নিরসন, যোগাযোগ ব্যবস্থা উন্নয়ন, নির্মাণকালীন সময়ে যাতায়াতে সাময়িক অসুবিধা, ভুমি অধিগ্রহণ ও পুনর্বাসন। ঠিক কি ধরনের প্রভাব পড়বে তা নির্ধারণ করা হবে সাক্ষাৎকার, ফোকাস গ্রুপ ডিসকাশন এবং অংশীজন সভার মতো বিভিন্ন সামাজিক জরিপ ও পরামর্শ করার মধ্য দিয়ে।
- উপর্যুক্ত সমীক্ষা থেকে প্রাপ্ত তথ্য-উপাত্ত সরাসরি ইএসআইএ প্রতিবেদনে অন্তর্ভুক্ত হবে।

৫। পরিবেশগত ও সামাজিক প্রভাব নিরূপণ এর জন্য সামাজিক জরিপ

নলেজ ম্যানেজমেন্ট কনসালটেন্ট (কে এম সি) কর্তৃক পুনর্বাসন বিষয়ক সমীক্ষা

- ভূমি অধিগ্রহন, ক্ষতিপূরণ ও পুনর্বাসনের জন্য কে এম সি কর্তৃক আলাদা করে RAP সমীক্ষা করা হবে।
- RAP সমীক্ষার অংশ হিসেবে আলাদা অংশীজন সভা ও সামাজিক জরিপ কাজ পরিচালনা করা হবে।
- অগাস্ট ২০২০ থেকে প্রাথমিক জরিপ শুরু হয়েছে এবং ডিসেম্বর ২০২০ থেকে জরিপ কাজ পুনরায় শুরু হয়েছে।
- উপর্যুক্ত জরিপসমূহ থেকে প্রাপ্ত তথ্য-উপাত্ত RAP সমীক্ষার অংশ হিসেবে মূল ইএসআইএ প্রতিবেদনে অন্তর্ভুক্ত হবে।

৬। পরিবেশগত ও সামাজিক প্রভাব মূল্যায়ন

পরিবেশগত প্রভাব

- বায়ু দূষণ
- শব্দ ও কম্পন
- পানি দূষণ
- মাটি দূষণ
- মাটি ক্ষয়
- জীববৈচিত্র্য
- কৃষি
- মৎস্য
- বৈশ্বিক উষ্ণতা

পরিবেশ অধিদপ্তর (ডিওই) থেকে অনুমোদন প্রাপ্ত

সামাজিক প্রভাব

- অনৈচ্ছিক পুনর্বাসন (কেএমসি জরিপ কাজ পরিচালনা করবে এবং RAP সমীক্ষার সারাংশ প্রভাব নিরুপনের কাজে ব্যবহার করা হবে)।
- জীবন ও জীবিকা
- ঝুঁকিপূর্ণ শ্রেণী
- স্থানীয় সংঘাত
- শিশু অধিকার
- এইডস/এইচআইভি ঝুঁকি
- পেশাগত স্বাস্থ্য ও নিরাপত্তা
- সামাজিক স্বাস্থ্য ও নিরাপত্তা
- আপদকালীন ঝুঁকি

৬। অনুশীলন পরিকল্পনা

সম্ভাব্য তারিখ	বিষয়	উদ্দেশ্য
২৭-৩১ জানুয়ারি ২০২১	প্রথম দফা "ইএসআইএ মতবিনিময় সভা"	কাজের পরিধি, এলাইনেমেন্ট এবং বিস্তারিত নকশা সম্পর্কে জনসাধারণকে জানানো
মার্চ ২০২১	দ্বিতীয় দফা "ইএসআইএ মতবিনিময় সভা"	ইএসআইএ সমীক্ষার সারাংশ প্রকাশ করা
মে ২০২১	দ্বিতীয় দফা "ইএসআইএ মতবিনিময় সভা" হবার পর সংশোধিত ইএসআইএ প্রতিবেদন প্রস্তুত করা হবে	দ্বিতীয় দফা "ইএসআইএ মতবিনিময় সভা" থেকে প্রাপ্ত তথ্য-উপাত্তের ভিত্তিতে সংশোধিত ইএসআইএ প্রতিবেদন প্রস্তুত করে আরএইচডি এবং জাইকা সমীক্ষা দলের নিকট জমা দেয়া

জনসাধারণের মতামত ও আলোচনা

15

ধন্যবাদ

16

Appendix H-11: Copy of Invitation Letter of IDM

Government of the People's Republic of Bangladesh
Office of the Project Director (ACE), RHD
Cross Border Road Network Improvement Project (Bangladesh)
RHD Foreign Aided Office Building (1st Floor)
Road No.27, Block-A, Banani, Dhaka-1213
E-mail: cbrniprhd@gmail.com, pdcrossborder@gmail.com
pdcbrnip@rhd.gov.bd, Phone No. 02-41080627

Memo No. 35.01.2607.057.03.22-179 **Date:** 16/03/2022

Subject: Information Disclosure Meeting for the Environmental and Social Impact Assessment (ESIA) of the Chattogram-Cox's bazar Highway Improvement Project.

With reference to the above-mentioned subject, this is to inform that Roads and Highway Department under the Road Transport and Highway Division, Ministry of Road Transport and Bridges has planned to take up Chattogram-Cox's Bazar Highway Improvement Project with the financial aid from Japan International Cooperation Agency (JICA). Four outer roads at Patiya, Dohazari, Lohagara, Chakaria and a flyover at Keranihat will be constructed under this project. Besides, some minor bottleneck areas throughout the alignment will also be improved under this project.

Meanwhile, draft ESIA report including mitigation measures for the assessed impacts of the project has been prepared. Information DisclosureMeeting with respective stakeholders will be held to disclose the findings of the ESIA study and to get public feedback. Your kind presence at the meeting is highly expected.

Site	Date and Time	Venue
Patiya	27/03/2022, 10:00 AM	Kochuaai Union Parishad Auditorium, Patiya, Chattogram
Patiya	27/03/2022, 04:00 PM	Jungolkhain Union Parishad Auditorium, Patiya, Chattogram
Dohazari	23/03/2022, 10:00 AM	Kaliaish Union Parishad Auditorium, Satkania, Chattogram
Dohazari	28/03/2022, 04:00 PM	Hashimpur Union Parishad, Chandanaish, Chattogram
Keranihat	28/03/2022, 10:00 AM	Padua Hedayetul Islam Madrasa, Thakur Dighir Bazar, Chattogram
Keranihat	30/03/2022, 04:00 PM	Keonchia Union Parishad Auditorium, Satkania, Chattogram
Lohagara	30/03/2022, 10:00 AM	Chunati Union Parishad Auditorium, Lohagara, Chattogram
Lohagara	29/03/2022, 10:00 AM	Amirabad Union Parishad Auditorium, Lohagara, Chattogram
Chakaria	29/03/2022, 03:00 PM	Boroitoli Union Parishad Auditorium, Chakaria, Coxsbazar
Chakaria	31/03/2022, 10:00 AM	Shah Omrabad High School Auditorium, Chakaria, Coxsbazar
Ramu	31/03/2022, 04:00 PM	Rashidnagar Union Parishad Auditorium, Ramu, Coxsbazar

16/03/2022

(Shyamal Kumar Bhattacharyya)
ID No. 001035
Interim Project Director, CCHIP
and
Project Director (ACE, CC, RHD)
Cross Border Road Network Improvement Project
(Bangladesh), Banani, Dhaka

Copy Distributed for Kind Presence (Not According to Seniority)

1. Divisional Forest Officer, Chattogram South Forest Division, Chattogram
2. Divisional Forest Officer, Wildlife Management & Nature Conservation Division, Chattogram South Forest Division, Chattogram
3. Director, Chattogram Regional Office, Department of Environment, Chattogram

E:\CBRNIP_New_Correspondence\CCHIP_Letter\PD Letter_English.docx

4. Deputy Director, Cox's Bazar District Office, Department of Environment, Cox's Bazar
5. Executive Engineer, RHD, Road Division, Chattogram/Dohazari/Cox's Bazar
6. Chairman, Patiya/Chandanaish/Satkania/Lohagara/ChakariaUpazilla Parishad
7. UpazillaNirbahi Officer, Patiya/Chandanaish/Satkania/Lohagara/Chakaria
8. Mayor…… Pourashava
9. Chairman…….. Union Parishad
10. Councilor…….. no. Ward……Pourashava
11. Upazilla Agriculture Officer, Patiya/Chandanaish/Satkania/Lohagara/Chakaria
12. Upazilla Fisheries Officer, Patiya/Chandanaish/Satkania/Lohagara/Chakaria
13. Upazilla Education Officer, Patiya/Chandanaish/Satkania/Lohagara/Chakaria
14. Sub-Assistant Engineer, DPHE, Patiya/Chandanaish/Satkania/Lohagara/Chakaria

Copy to (Not According to Seniority)

1. Mr. Takayasu Nagai, Team Leader of the JICA Study Team, The Preparatory Survey for Chattogram-Cox's Bazar Highway Improvement Project in Bangladesh.
2. Mr. Masatomo Toyoda, JICA Bangladesh Office, 3rd Floor, Bay's Galleria, 57 Gulshan Avenue (CWS-A19), Gulshan-1, Dhaka-1212.
3. Mr. Suman Dasgupta, Senior Programme Officer, JICA Bangladesh Office, 3rd Floor, Bay's Galleria, 57 Gulshan Avenue (CWS-A19), Gulshan-1, Dhaka-1212.

Appendix H-12: Copy of IDM Advertisement in Newspaper

Name of Newspaper: The Daily Azadi (Page-08)

Date: March 25, 2022

বিজ্ঞপ্তি

চট্টগ্রাম-কক্সবাজার হাইওয়ে ইমপ্রুভমেন্ট প্রজেক্ট এর পরিবেশগত ও সামাজিক প্রভাব নিরূপণ বিষয়ক তথ্য উন্মুক্তকরণ সভা

গণপ্রজাতন্ত্রী বাংলাদেশ সরকারের সড়ক পরিবহন ও সেতু মন্ত্রণালয়ের, সড়ক পরিবহন ও মহাসড়ক বিভাগের আওতাধীন সড়ক ও জনপথ অধিদফতর এর উদ্যোগে এবং জাপান আন্তর্জাতিক সহযোগিতা সংস্থা (জাইকা)-এর আর্থিক সহায়তায় চট্টগ্রাম-কক্সবাজার হাইওয়ে ইমপ্রুভমেন্ট প্রজেক্ট এর পরিকল্পনা গ্রহণ করা হয়েছে। উক্ত প্রকল্পের আওতায় পটিয়া, দোহাজারী, লোহাগাড়া ও চকোরিয়া এলাকায় একটি করে বাইপাস এবং কেরানিহাট এলাকায় একটি ফ্লাইওভার নির্মাণ করা হবে। এছাড়াও উক্ত প্রকল্পের আওতায় কিছু এলাকায় বাঁক সরলীকরণের মাধ্যমে বিদ্যমান মহাসড়কের উন্নয়ন করা হবে।

উক্ত প্রকল্পের পরিবেশগত ও সামাজিক প্রভাব নিরূপণ এবং নিরূপণকৃত প্রভাব প্রশমনের ব্যবস্থা বিষয়ক তথ্য উন্মুক্ত করতে এবং এ সংশ্লিষ্ট বিষয়ে সর্বসাধারণের মতামত জানার লক্ষ্যে নিম্নোক্ত সময় ও স্থানে স্বাস্থ্যবিধি মেনে ও সামাজিক দূরত্ব বজায় রেখে তথ্য উন্মুক্তকরণ সভা অনুষ্ঠিত হবে। উক্ত সভায় উপস্থিত থাকার জন্য আপনাকে বিশেষভাবে অনুরোধ করা হল।

সংশ্লিষ্ট এলাকা	তারিখ ও সময়	স্থান
পটিয়া	২৭/০৩/২০২২, সকাল ১০.০০ ঘটিকা	কচুয়াই ইউনিয়ন পরিষদ মিলনায়তন, পটিয়া, চট্টগ্রাম।
	২৭/০৩/২০২২, বিকেল ০৪.০০ ঘটিকা	জঙ্গলখাইন ইউনিয়ন পরিষদ মিলনায়তন, পটিয়া, চট্টগ্রাম।
দোহাজারী	২৩/০৩/২০২২, সকাল ১০.০০ ঘটিকা	কালিয়াইশ ইউনিয়ন পরিষদ মিলনায়তন, সাতকানিয়া, চট্টগ্রাম।
	২৮/০৩/২০২২, বিকেল ০৪.০০ ঘটিকা	হাশিমপুর ইউনিয়ন পরিষদ মিলনায়তন, চন্দনাইশ, চট্টগ্রাম।
কেরানিহাট	২৮/০৩/২০২২, সকাল ১০.০০ ঘটিকা	পদুয়া হেমায়েতুল ইসলাম মাদরাসা, ঠাকুর দিঘীর বাজার, চট্টগ্রাম।
	৩০/০৩/২০২২, বিকেল ০৪.০০ ঘটিকা	কেঁওচিয়া ইউনিয়ন পরিষদ মিলনায়তন, সাতকানিয়া, চট্টগ্রাম।
লোহাগাড়া	৩০/০৩/২০২২, সকাল ১০.০০ ঘটিকা	চুনতী ইউনিয়ন পরিষদ মিলনায়তন, লোহাগাড়া, চট্টগ্রাম।
	২৯/০৩/২০২২, সকাল ১০.০০ ঘটিকা	আমিরাবাদ ইউনিয়ন পরিষদ মিলনায়তন, লোহাগাড়া, চট্টগ্রাম।
চকোরিয়া	২৯/০৩/২০২২, বিকেল ০৩.০০ ঘটিকা	বরইতলী ইউনিয়ন পরিষদ মিলনায়তন, চকোরিয়া, কক্সবাজার।
	৩১/০৩/২০২২, সকাল ১০.০০ ঘটিকা	শাহ ওমরাবাদ উচ্চ বিদ্যালয় মিলনায়তন, চকোরিয়া, কক্সবাজার।
রামু	৩১/০৩/২০২২, বিকেল ০৪.০০ ঘটিকা	রশিদনগর ইউনিয়ন পরিষদ মিলনায়তন, রামু, কক্সবাজার।

অনুরোধক্রমে

অন্তর্বর্তীকালীন প্রকল্প পরিচালকের কার্যালয়
চট্টগ্রাম-কক্সবাজার হাইওয়ে ইমপ্রুভমেন্ট প্রজেক্ট
আরএইচডি বৈদেশিক সাহায্যপুষ্ট প্রকল্পসমূহের কার্যালয় (লেভেল-২)
রোড-২৭, ব্লক-এ, বনানী, ঢাকা-১২১৩

নং-২৬৭৫/০৩

Appendix H-18: Photographs of the IDM

	
Question and Answer Session at IDM1, Kaliaish, Satkania	Presentation given in IDM1, Kaliaish, Satkania
	
Participant of the IDM1, Kaliaish, Satkania	Participant of the IDM1, Kaliaish, Satkania
	
Presentation by EQMS at IDM2, Kochuaai, Patiya, Chattogram	Participants at IDM2, Kochuaai, Patiya, Chattogram

	
Responding to the questions of stakeholders at IDM2, Kochuaai, Patiya, Chattogram	Chairman of Kochuaai Union delivering speech at IDM2, Kochuaai, Patiya, Chattogram
	
Participants at the IDM6, Amirabad, Lohagara, Chattogram	Responding to stakeholder's question by RHD at the IDM6, Amirabad, Lohagara, Chattogram
	
Presentation and responding to stakeholder's question by EQMS at the IDM6, Amirabad, Lohagara, Chattogram	Question/opinion from stakeholders at the IDM6, Amirabad, Lohagara, Chattogram

	
Participants at IDM9, Keonchia, Satkania, Chattogram	Presentation by EQMS at IDM9, Keonchia, Satkania, Chattogram
	
Responding to stakeholders by EQMS at IDM9, Keonchia, Satkania, Chattogram	Responding to stakeholders by RHD at IDM9, Keonchia, Satkania, Chattogram
	
Participants at IDM10, Shah Omrabad High School, Chakaria, Cox's Bazar	Opinion/Question from stakeholders at IDM10, Shah Omrabad High School, Chakaria, Cox's Bazar

	
Responding to the stakeholders by representative of JICA Study Team at IDM10, Shah Omrabad High School, Chakaria, Cox's Bazar	Responding to the stakeholders by EQMS at IDM10, Shah Omrabad High School, Chakaria, Cox's Bazar

Appendix H-19: Presentation Materials of IDM

Presentation on ESIA Study of the Preparatory Study for Chattogram-Cox's Bazar Highway Improvement Project (CCHIP) in Bangladesh

ROADS AND HIGHWAYS DEPARTMENT (RHD)

RHD assisted JICA Study Team/ EQMS Consulting Limited
Date: 20 March 2022

1

Outline

The presentation will have the following contents

- Introduction
- Policy and legislative consideration
- Project description
- Environmental Baseline Study
- Screening and Scoping
- Anticipated Environmental Impact and mitigation measures
- Effectiveness of mitigation measures
- Environmental Management plan
- Environmental monitoring plan
- Stakeholder consultation
- ESIA Implementation
- Conclusion and recommendation

2

Introduction

- CCHIP falls under the "Red" category according to ECR 1997, the implication of which is to conduct a full EIA, and requiring ECC from DoE for project implementation;
- As per the JICA's Environmental and Social Consideration guidelines 2010, the project falls under Category A;
- In 2013-2014, a feasibility study and detailed engineering design were carried out for the Chittagong - Cox's Bazar - Teknaf Road (208.8 km) including Cox's Bazar access road (5 km) under the road component of SRTPPF-II of the RHD with the technical assistance of ADB;
- Now a JICA aided project has been taken to debottlenecking of five major bottlenecks at Patiya, Dohazari, Keranihat, Lohagara and Chakaria.

3

Introduction

RHD's Responsibility for JICA Project

- ESIA and RAP will be prepared by RHD to minimize negative impacts;
- Public consultation and information disclosure will be done for better transparency by RHD;
- Environmental and social mitigation measures proposed in the ESIA will be implemented during construction and operation;
- Environmental and social monitoring will be conducted by RHD during construction and operation.

4

Policy and Legislative Consideration

- The ESIA has taken into account the laws and policies of GoB and equal attention have been paid to the JICA's rules and regulations.
- The study has identified and addressed the differences between these laws/policies in the best possible ways.
- The followings are the important policies related to the project:
  - Environment Conservation Rules, 1997 and its subsequent amendment
  - JICA Environmental and Social Consideration guidelines 2010 and
  - Other relevant laws

5

Project Description

Project Location

The project will be implemented in the adjacent area of the Chattogram-Cox's Bazar highway under Patiya, Chandanaish, Satkania, Lohagara and Chakaria upazila.

6

Project At a Glance

Name of the project	Chattogram-Cox's Bazar Highway Improvement Project (CCHIP)
Implementation and management	Roads and Highways Department (RHD)
Ministries responsible	Road Transport and Highway Division Ministry of Road Transport and Bridges
Finance	GoB and JICA
Type of Infrastructure (Super Structure)	Patiya Outer Road - 5.419 km, 4 lanes (space allocated for 6 lanes) Dohazari Outer Road - 3.266 km, 4 lanes (space allocated for 6 lanes) Keranihat Flyover - 3.448 km, 6 lanes Lohagara Outer Road - 5.397 km, 4 lanes (space allocated for 6 lanes) Chakaria Outer Road, 6.840 km, 4 lanes Each outer road will have service lanes on both sides of the road for slow moving vehicles
Type of Infrastructure (Sub Structure)	In addition to the four outer roads and a flyover, the project covers the improvement of minor bottlenecks including 15.13 km in the Chittagong section, 670 m in the Bandarban section and 12.60 km in Cox's Bazar part of the Chittagong-Cox's Bazar highway.
Type of infrastructure	Bridge construction over the river/canal of Sangu, Tangkabati and Matamuhuri
Construction Period	2025-2028

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Route Alignment of CCHIP (Patiya Outer Road)

8

Route Alignment of CCHIP (Dohazari Outer Road)

9

Route Alignment of CCHIP (Keranihat Flyover)

10

Route Alignment of CCHIP (Lohagara Outer Road)

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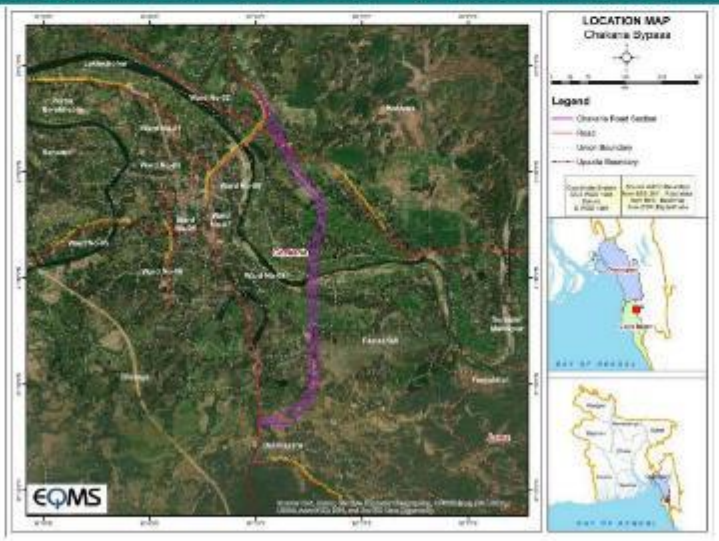
Route Alignment of CCHIP (Chakaria Outer Road)



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Environmental Baseline Study

For the purpose of the EIA the following aspects were studied

- **Physical:** soil properties, geological characteristics, topography, watershed.;
- **Physio-chemical:** water, air, noise level, vibration level etc.;
- **Biological:** habitats, aquatic life, fisheries, flora and fauna;
- **Socioeconomic:** demography, social structure, economic conditions, developmental capabilities, etc.;

- The baseline environmental study was conducted during the 2020-21 period.

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Air Quality Monitoring

- In 2020-21, Total **5** parameters ($PM_{2.5}$, PM_{10}, NO_2, SO_2 and CO) were monitored at **12** locations.
- During both Wet and Dry Season, concentration of the above-mentioned parameters were found within the National Ambient Air Quality Standard.
- The concentration of PM10 has increased in dry season than wet season by 17.1% on average.
- In case of PM2.5, the concentration has increased in dry season by 28.5% on average than wet season.
- The concentration of NO2 in dry season has increased in most of the locations than wet season.
- In 6 locations, the concentration of SO2 in dry season has been increased than wet season, whereas the concentration in dry season has been decreased in other locations.

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Air Quality Monitoring Locations

Monitoring ID	Monitoring Locations
AQ1	Beside existing highway in Patiya
AQ2	Near residential/commercial area of the proposed bypass in Patiya
AQ3	Beside existing highway in Dohazari
AQ4	Near the proposed bypass area in Dohazari
AQ5	Beside existing highway at proposed FOB area in Keranihat
AQ6	Near residential/commercial area at proposed FOB area in Keranihat
AQ7	Near the proposed bypass area in Keranihat
AQ8	Near the proposed bypass area in Keranihat
AQ9	Beside existing highway in Lohagara
AQ10	Near the proposed bypass area in Lohagara
AQ11	Near the proposed bypass area in Chakaria
AQ12	Near existing highway in Chakaria

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Air Quality Monitoring Photographs

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Noise and Vibration Level Monitoring

- In 2021, Noise level and Vibration level monitoring was conducted in **12** locations.
- During the study, the noise level was higher than the DoE prescribed limit in almost all the locations.
- There is no standards for vibration in Bangladesh.
- During the study, the vibration level was within the prescribed limit of Japanese standards in all the locations.

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Noise & Vibration Level Monitoring Locations

Monitoring ID	Monitoring Locations
RS-01	In front of Upazila Health Complex, Patiya
RS-02	In front of Dakshin Gata Nuri Jame Mosque, Patiya
RS-03	In front of BGC Trust Medical College, Chandanaish
RS-04	In front of Dohazari Jamijuri A. Rahman High School, Dohazari
FR-01	Near Chagachar Jame Mosque, Dohazari
RS-05	In front of Shahi Jame Mosque, Keranihat
RS-06	In front of Noyapara Baitul Mamur Jame Mosque, Padua
RS-07	In front of Citizen Park Community Center, Lohagara
FR-02	In front of Maulana Sultan Hossain Jame Mosque, Lohagara
RS-08	In front of Adhunagar Gul-E-Jar Girls High School, Aziz Nagar, Chakaria
FR-03	In front of Dakshin Lotonee Central Jame Mosque, Chakaria
RS-09	In front of Fashiakhali Govt. Primary School, Chakaria

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Noise and Vibration Level Monitoring Photographs






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Surface Water Quality

- In 2020, surface water samples were collected from **ten** locations along the alignment.
- A total of 11 parameters (pH, Temperature, DO, BOD, COD, TSS, Color, TC, Turbidity, Arsenic, Oil and Grease) were tested during both Wet and Dry season.
- During the study, concentration of most of the parameters were found to comply with the national standard.
- The concentration of BOD was exceeded in Chakaria (SW10) in wet season. However, it exceeded in Patiya (SW1), Dohazari (SW4) and Lohagara (SW8) in winter season.

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Surface Water Sampling Locations

Sampling ID	Sampling Locations
SW1	Chimnar Khal, Patiya
SW2	Nearby pond, Patiya
SW3	Upstream of the Sangu River, Dohazari
SW4	Downstream of the Sangu River, Dohazari
SW5	Pond of Keranihat FOB
SW6	Nearby water body of Keranihat FOB
SW7	Upstream of the Tangkabati River, Lohagara
SW8	Downstream of the Tangkabati River, Lohagara
SW9	Upstream of the Matamuhuri River, Chakaria
SW10	Downstream of the Matamuhuri River, Chakaria

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Surface Water Sampling Photographs






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Screening and Scoping

- To assess the likely significant impact of the potential environmental and social impacts of the Project, which were preliminarily identified based on the project description and overall environmental and social conditions in and around CCHIP project.
- The impacts of pollution, natural and social environments, health and safety, emergency risk, and others were classified as A to D in accordance with the following criteria, assuming **no specific measures toward the impacts are taken**:
  - A-/A+: Significant negative/positive impact
  - B-/B+: Some negative/positive impact
  - C-/C+: Impacts are not clear, require more investigation
  - D: Impacts are negligible, no further study required

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Scoping Matrix

No.	Items of Impact	Predicted Impact		Description of Rating
		Before/During Construction Stage	Operation Stage	
Physical Environment				
1.	Air Pollution	B-	B-	During construction: Operation of construction machineries and vehicle may cause air pollution. Operation: Increase number of vehicles may cause air pollution.
2.	Water Pollution	B-	D	During construction: Turbid water by construction work may deteriorate water quality of nearest water bodies. Operation: Insignificant
3.	Noise and Vibration	B-	B-	During construction: Construction machinery and vehicles will be caused regularly. Operation: Increase of vehicles can create more noise and vibration.

This is an extract of the scoping Matrix shown as sample.

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Anticipated Environmental Impacts and Their Mitigation Measures

The major impacts of CCHIP are as follows:

- Noise
- Vibration
- Air pollution
- Surface water pollution
- Topography and Soil pollution
- Waste
- Ground subsidence/Landslide
- Offensive Odors
- Bottom Sediments
- Flood and Drainage
- Borrow Pits, Source of Materials and Haul Routes, and Disposal Sites
- Protected Area
- Biota and Ecosystem
- Fisheries and Aquatic Biology
- Involuntary Resettlement
- Poor group
- Indigenous and Ethnic Minority People
- Local Economy
- Land Use and Utilization of Local Resources
- Disruption of Agricultural activities
- Water Use
- Social Service Facilities
- Social Institutions and Local Decision-Making Institutions
- Local Conflict of Interest
- Cultural Heritage
- Gender
- Children's Rights
- Infectious Disease, such as HIV/AIDS
- Occupational Health and Safety
- Working Conditions
- Global Warming/Climate Change
- Accidents

High Impact
Medium Impact
Low Impact
Positive Impact

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Noise Level

Impact	Mitigation measure
Construction Stage Operations of the heavy equipment at the construction sites, movement of heavy machineries and transportation of vehicles may cause noise.	• Use low noise generating equipment; • Regular maintenance of machineries and vehicles; • Use heavy equipment with built in noise abatement; • Construct temporary noise barriers (flyover and bridge construction); • Batching plant and asphalt plant, at least 200m from sensitive receptors; • Construct walled enclosures; • Avoid construction activities during night time and holidays in sensitive places;
Operation Stage Vehicle movement in the outer road will create noise	• Noise barrier around the sensitive receptors

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Vibration Level

Impact	Mitigation measure
Construction Stage Construction activities and operation of equipment may cause vibration.	• Concurrent works that produce vibration should be avoided; • Use low-vibration generating equipment and machineries; • Cut-off trench; • Temporary evacuation, resettlement, and compensation; • Vibration level and condition monitoring;
Operation Stage Vibration will be minimal.	• No additional mitigation measure is needed.

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Air Quality

Impact	Mitigation measure
Construction Stage Transport of construction materials, heavy equipment operation and earthworks will generate dust and exhaust gas, temporarily.	• Equip all the machineries with the appropriate exhaust system; • Operate the vehicles in a fuel-efficient manner; • Cover haul vehicles carrying dusty materials moving outside the construction site; • Dust suppression system should be established and maintained; • Impose speed limits on all vehicle movement; • Removal of mud from the wheel at entry and exit point; • Service all vehicles regularly to minimize emissions; • Machinery causing excess pollution will be temporarily banned; • Provide filtering systems, to the concrete batching and mixing plant.
Operation Stage The project will decrease road congestion, air pollution will be reduced.	• No additional mitigation measure is needed

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Surface Water (Construction Stage)

Impact	Mitigation measure
Turbid water by construction work may deteriorate water quality.	• Temporary drainage line to capture sediment-laden run-off from site; • Sediment fence on the banks of concerned rivers, canals and ponds; • Divert runoff from undisturbed areas; • Restrict direct discharge of solid waste and effluent; • Stockpile materials away from drainage lines; • Slurry mixed wastewater from batching plant into settling tank; • Wash out ready-mix concrete agitators and concrete handling equipment; • Minimize the generation of sediment, oil and grease, excess nutrients, organic matter, litter, debris, and any form of waste.

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Surface Water (Operation Stage)

Impact	Mitigation measure
Soil erosion from the newly constructed roads may increase sediment load and turbidity in nearby waterbody.	• Slope and footpath of road should be turfed with grass or paved; • Maintain Road surface properly and regularly.

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Soil Pollution

Impact	Mitigation measure
Construction Stage Hazardous material like lubricant and bentonite/polymer slurry may cause soil pollution.	• Before site works commence, a Spill Management Plan needed; • Fuel and hazardous substances in paved areas with embankment; • Availability of spill clean-up materials; • All storage containers in good condition with proper labeling; • Regular check of container for leakage; • Hazardous materials stored above flood level; • Prohibit open toilet without sanitary pit.
Operation Stage No significant impact expected	• No additional mitigations measures required

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Waste

Impact	Mitigation Measures
Construction Stage Burned oil, lubricants, lithium-ion battery, leakage and spillage, empty containers, slurry, fragments of construction materials and garbage.	• Proper segregation of solid wastes; • Solid waste disposal in an environmentally acceptable manner; • Third party for collection and disposal of solid wastes; • Waste Recycling; • Spoil soil dumping in designated place within 12 hours of generation.
Operation Stage Oil and grease can be leaked and spilled from vehicles	• Impact will be insignificant. Hence, no additional mitigation measures required.

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Ground Subsidence/Landslide

Impact	Mitigation measure
During Construction Landslide during and after the excavation of pile foundation and borrow pit.	• Enclosed Pile foundation and borrow pit area; • Shore piling/shoring using steel sheet and/or shoring beam;
During Operation Ground/road subsidence is very minimal.	• Paved Slope; • Sufficient drainage system; • Prohibit overweight vehicles operation.

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Offensive Odors

Impact	Mitigation measure
During Construction Land preparation and clearing work, sewage from mobile and stationary toilets, solid waste, slurry, etc may create odor (less significant).	• Sewage sludge should be managed with sanitary pit; • Prohibit open dispose of Solid wastes and slurry from batching plant.
During Operation No significant impact expected	• No additional mitigation measures required

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Bottom Sediments

Impact	Mitigation measure
During Construction Earthwork sediment discharge into waterbody may deteriorate the bottom sediments of adjacent rivers and streams.	• Sediment fence/silt fence/Check dam should be installed for sediment mixed water settling; • Slurry from batching plant should be dried up away from water body; • Prohibit oil and lubricant discharge into water body.
During Operation Sedimentation form the slope erosion of uncovered outer road.	• Grass paved footpath and slope.

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Flood and Drainage

Impact	Mitigation measure
Construction stage Rainfall induced Flooding/drainage congestion/water logging in the monsoon reason. Embankment road may affects the roadways corridor.	• Temporary drains at construction sites; • Immediate drain out of stagnant water; • Temporary cross drainage facilities.
Operation stage No major impact expected.	• Pumping out stagnant water; • Cross-drainage infrastructures maintenance.

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Borrow Pits, Source of Materials & Haul Routes

Impact	Mitigation measure
Construction stage Borrow pits, haul route, and disposal sites may cause land use change, land degradation and loss of agricultural land;	• Avoid arable lands for Borrow pits and disposal sites; • Minimize use of earth/topsoil as filling materials; • Waste disposal sites away from water body; • Larvicide and adulticide for controlling mosquito; • Haul route and schedule selection keeping least disturbance.
Operation stage No further borrow pits or disposal site.	• Reclaim disposal site land after project completion.

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Protected Area

Impact	Mitigation measure
Construction stage Construction activities may pose potential threat for PAs within the project AOI	• No construction activities into the PAs. • No waste disposal into the PAs. • No labor camps within 2 kilometers of the boundary of the PAs.
Operation stage Minor impacts from speedy driving and improper use of horns may impact the wildlife of the PAs	• Proper signage for skipping horns and speed limit.

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Biota and Ecosystem

Impact	Mitigation measure
Construction stage Construction induced dust, exhausts and spillage may deteriorate plant growth and aquatic ecosystem	• No tree cutdown unless necessary. • Cutting of large trees must be kept to a minimum. • Vegetation should not be used as fuelwood. • Restrict and enforce dumping and storage of spoil and other materials close to trees. • Avoid major construction activities during night hours. • 2 new trees should be planted for each tree felled. • Afforestation.
Operation stage Vehicle movement induced dust may affect the newly planted saplings.	• Proper care for newly planted saplings; • Provide mulching and fencing for newly planted sapling.

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Fisheries and Aquatic Biology

Impact	Mitigation measure
Construction stage Construction activities may affect fish health and fish migration of the water bodies.	• Fish migration routes need to be considered. • Ensure no disposal of construction materials or wastes in fishing areas. • Proper implementation of Section 10: Bottom Sediments needs to be followed.
Operation stage Newly constructed bridge/ culvert may affect water flow and therefore hamper fish migration.	• Ensure sufficient water flow and fish migration facilities.

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Involuntary Resettlement

Impact	Mitigation measure
Land required for future road construction. Detail **RAP study is under preparation by KMC**. The exact information and amount related to impact and loss of property will be known once the RAP study is completed.	Proper compensation will be paid to all the project affected people as per the RAP study.

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Water Use

Impact	Mitigation measure
Construction stage Both surface and ground water will be required for construction activities.	• Construct Rainwater harvesting ponds; • Regular inspections of water storage tanks; • Awareness raising among construction workers; • Adoption of the advance technologies; • Covering the water storage tanks at site.
Operation stage No impact expected	• No additional mitigation measures required.

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Local Conflict of Interest

Impact	Mitigation measure
Construction stage Conflict of interest may arise regarding working opportunities.	• Fair job opportunities should be provided; • Clear information about the needs of labor; • Job skills and the priority for the affected people.
Operation stage No impact expected	• No additional mitigation measures required.

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Gender

Impact	Mitigation measure
Construction stage Wage discrimination between male and female workers shall be arises.	• Wage discrimination should be checked.
Operation stage No impact expected	• No additional mitigation measures required.

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Children's Rights

Impact	Mitigation measure
Construction stage May affect the opportunity of the school going children and increase child labour.	• Child labor should be strictly prohibited.
Operation stage No impact expected	• No additional mitigation measures required.

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Infectious Disease

Impact	Mitigation measure
Construction stage Influx of migrant workers may have the possibility of disease spread.	• Provide surveillance for worker's health; • Prevention of illness among workers; • Provide treatment through case management; • Educating project personnel and local residents; • Promoting collaboration with local authorities; • Promoting use of repellents, clothing, netting etc; • Prevention of larval and adult propagation; • Elimination of unusable impounded water;
Operation stage No impact expected	• No additional mitigation measures required.

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Occupational Health and Safety

Impact	Mitigation measure
Construction stage Possibility to occur accidents and incident during construction works	• Provide adequate health care facilities and first aid; • Provide OHS training program; • Provide adequate clean water and lavatory facilities; • Arrangement of clean eating areas • Temporary shelters for resting; • Measures for fire precautions, lighting, safe access, temperature, area signage, labelling of equipment, Hazard codes, ROW, site speed limits, vehicle inspection requirements, SOP, and management; • Ensure appropriate PPE;
Operation stage No impact expected	• No additional mitigation measures required.

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Other Social Impacts

Impacts will be finalized upon RAP completion,

- Poor Group
- Indigenous or Ethnic Minority People
- Local Economy
- Land use and utilization of Local Resources
- Disruption of Agricultural Activities
- Social Service Facilities
- Social Institutions and Local Decision-Making Institutions
- Cultural Heritage

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Global Warming/Climate Change

Impact	Mitigation Measures
Construction Stage GHG emission for construction sites	• Operation time management for construction machineries; • Avoidance excessive loading operation; • Educating construction workers/drivers about the idling stop practice.
Operation Stage No impact expected	• No additional mitigation measures are required.

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Accidents

Impact	Mitigation Measures
Construction Stage Construction accidents and road accidents around the project site	• Implement Health and Safety Management Plan (HSMP) rules and regulations; • Provision of traffic sings, road mark, bump, zebra mark, guard rail and pole, and curb stones etc.
Operation Stage No impact expected	• Traffic signs, road marks, speed limit control sign boards should be put up; • Drivers need to be trained to raise awareness.

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Positive impacts

Impacts on Local Economies	• Employment generation; • New business opportunity;
Traffic Congestion Reduction	• Road traffic in the major bottleneck will be reduced after project completion;
Mobility and Safety	• Reduction of the journey time; • Improved safety and lower number of passenger's accidental deaths and injuries.
Gender	• Women empowerment by creating opportunity of employment.

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Environmental Management Plan

- Environmental Management Plan-provided for pre-construction, construction, and operation stage including,
  - Possible impacts, mitigation measures and authority responsible;
  - Budget allocation indicated in the EMP.
  - Provided Environmental monitoring plan.

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Environmental Management Plan (Construction Stage)

Project Activity	Environmental Impacts	Proposed Mitigation Measures	Budget	Responsibility
Bridge and Flyover Construction	Waste disposal, dust and noise	• Waste disposal at designated site; • Water spray and dust suppression; • Noise barrier and noise-dampen equipments.	Included in contractor's scope	**Implementation:** Contractor **Supervision:** General Consultant, RHD
Embankment Road Construction	Drainage and waterlogging	• Cross-drainage infrastructures maintenance.	Included in contractor's scope	**Implementation:** Contractor **Supervision:** General Consultant, RHD
Air quality during construction	Air quality impacts due to gaseous and dust emissions	• Strictly implement approved dust control plan; • Suppress of dust by spraying water at required interval.	Included in contractor's scope	**Implementation:** Contractor **Supervision:** General Consultant, RHD

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Environmental Monitoring Plan

Parameters	Locations	Means of Monitoring	Frequency	Budget BTD	Responsible Agency	
					Implemented by	Supervised by
DURING CONSTRUCTION						
A. Environmental Monitoring Plan for Embankment Road and Bridge Construction						
Air quality (PM_{10}, $PM_{2.5}$, SO_2, NO_2, CO)	As per construction activity and consultant's requirement	• Sample collection and laboratory analysis	Monthly or as per consultant's requirements	Included in contractor's scope	Contractor	General Consultant, RHD
Noise Level	As per construction activity and consultant's requirement	• Noise level collection and analysis	Monthly or as per consultant's requirements	Included in contractor's scope	Contractor	General Consultant, RHD
Surface Water quality (pH, Temp., DO, BOD, COD, TSS, Color, TC, Turbidity, As, Oil & Grease).	As per construction activity and consultant's requirement	• Sample collection and laboratory analysis	Monthly or as per consultant's requirements	Included in contractor's scope	Contractor	General Consultant, RHD

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Public Consultation and Disclosure

- JICA requires **public disclosure** in the form of KII, FGD and PCM etc.
- Main purpose of this (disclosure) meeting is to inform people about the potential environmental and social impacts and mitigation measures.
- Another purpose is to obtain their opinions regarding the implementation of the project.
- Earlier in January 2021, same has been conducted to inform people about the project and to receive feedback during scoping stage.

Date	Venue	Time	Types of Participants
January 27, 2021	Chakaria Pourasava, Cox's Bazar	10:30 AM-01:00 PM	• MP, local leaders, project affected people, local residents, businessmen, shop owners, teachers, farmers, housewives, service holders, remittance owners, politicians, imams, students, hawkers, rickshaw pullers, drivers, etc.
January 27, 2021	Amirabad UP Auditorium, Lohagara, Chattogram	03:00 PM-05:00 PM	• Representatives of local government, public leaders, project affected people, local residents, women, elderly people, government and non-government employees, etc.
January 28, 2021	Kachia UP Auditorium, Satkania, Chattogram	10:00 AM-12:00 PM	• Representatives of local government, public leaders, project affected people, project beneficiaries, local residents, women, elderly people, government and non-government employees, etc.
January 28, 2021	Kaliais UP Auditorium, Satkania, Chattogram	03:00 PM-05:00 PM	• Representatives of local government, public leaders, project affected people, project beneficiaries, local residents, women, elderly people, government and non-government employees, etc.
January 31, 2021	Four Star Convention Hall, Patiya, Chattogram	10:00 AM-01:30 PM	• Representatives of local government, public leaders, project affected people, project beneficiaries, local residents, women, elderly people, government and non-government employees, etc.

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Public Consultation and Disclosure

The PCM included

- Project implementing authorities
- Representatives of administrative authorities
- Project Beneficiaries
- Affected people

A total of 13 FGD and 23 KII has been conducted for the project

- The FGD included community people, landowners, land dependents, business owners, and women group;
- Local Government Administration (Fisheries, Agriculture, Education, Public Health Engineering) RHD and DoE.

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Public Consultation Meeting (Scoping Stage)

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KII and FGD with Stakeholders

KII with Executive Engineer, RHD, Dohazari Road Division

KII with Agriculture Officer, Lohagara Upazila

FGD with Landowners, Chakaria Upazila

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ESIA Implementation

- Environmental Contract Specification (ECS) will be developed based on the EMP and EMoP;
- The ECS will be an integral part of bid document, making the Contractor responsible to maintain the safeguard aspect during construction stage;
- Contractors will prepare CEMP and take approval from supervision consultant prior to start construction;
- During construction stage, contractors will monitor the environmental parameter as stipulated in the CEMP and will generate report;
- Periodic Monitoring report shall be submitted to the JICA and DoE for concurrence.

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Conclusion and Recommendation

Potential adverse impacts	Positive impacts	Mitigation and Monitoring Plan
• Air pollution, land acquisition, involuntary resettlement, loss of livelihood, noise and vibration pollution, loss of vegetation, water pollution, etc.	• Infrastructural development, development of local economy, reduction in traffic congestion and travel time, employment opportunities.	• Proper mitigation measures have been suggested to reduce the impacts during construction stage and operation stage. • A monitoring plan has been prepared mentioning the monitoring parameters, frequency, implementing and supervision agency, and budget information.

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Public Opinion and Discussion

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Thank you

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"চট্টগ্রাম - কক্সবাজার হাইওয়ে ইমপ্রুভমেন্ট প্রজেক্ট" এর পরিবেশগত ও সামাজিক প্রভাব নিরূপণ (ইএসআইএ) বিষয়ক উপস্থাপনা

সড়ক ও জনপথ বিভাগ (আরএইচডি)

আরএইচডি এর সহায়তাপুষ্ট জাইকা সমীক্ষা দল/ইকিউএমএস কনসালটিং লিমিটেড
তারিখঃ ২০ মার্চ ২০২২

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আলোচ্য বিষয়

- সূচনা
- বিবেচ্য আইন ও বিধিমালা
- প্রকল্পের বৈশিষ্ট্য
- প্রকল্পের প্রারম্ভিক অবস্থার পরিবেশগত সমীক্ষা
- স্ক্রিনিং এবং স্কোপিং
- প্রত্যাশিত পরিবেশগত প্রভাব এবং প্রশমন ব্যবস্থা
- প্রশমন ব্যবস্থার কার্যকারিতা
- পরিবেশগত ব্যবস্থাপনা পরিকল্পনা
- পরিবেশগত পর্যবেক্ষণ পরিকল্পনা
- অংশীজনদের সাথে পরামর্শ
- ইএসআইএ বাস্তবায়ন
- উপসংহার এবং সুপারিশ

2

সূচনা

- যেহেতু পরিবেশ সংরক্ষন বিধিমালা ১৯৯৭ অনুসারে আলোচ্য প্রকল্পটি লাল তালিকাভুক্ত, সেহেতু প্রকল্পটি বাস্তবায়নের জন্য পূর্ণাঙ্গ পরিবেশগত প্রভাব নিরুপন এবং পরিবেশ অধিদপ্তর থেকে প্রকল্পের অনুকূলে পরিবেশগত ছাড়পত্র গ্রহন প্রয়োজন;
- জাইকা "পরিবেশ ও সামাজিক বিবেচনা নির্দেশিকা ২০১০" অনুসারে আলোচ্য প্রকল্পটি এ - ক্যাটাগরি এর অন্তর্ভুক্ত;
- ২০১৩-১৪ সালে এশীয় উন্নয়ন ব্যাংক এর কারিগরি সহায়তায় সড়ক ও জনপথ বিভাগ 'উপ - আঞ্চলিক সড়ক পরিবহন প্রকল্প প্রস্তুতি সুবিধা-২" এর আওতায় কক্সবাজারের ৫ কি.মি. সংযোগ সড়কসহ চট্টগ্রাম - কক্সবাজার - টেকনাফ মহাসড়কের ২০৮.৮ কি.মি. সড়ক উন্নয়নের জন্য সম্ভাব্যতা যাচাই ও বিস্তারিত নকশা প্রনয়ন করে;
- এরই ধারাবাহিকতায় বর্তমানে জাইকার অর্থ -সহায়তায় পটিয়া, দোহাজারী, কেরানীহাট, লোহাগাড়া এবং চকোরিয়া এলাকায় ০৫ টি বড় বাঁকসহ অনেকগুলো ছোট বাঁক সরলীকরণের জন্য আলোচ্য প্রকল্পটি নেয়া হয়েছে।

3

সূচনা

জাইকা প্রকল্পের জন্য আরএইচডির দায়িত্ব

- নেতিবাচক প্রভাব কমানোর জন্য ESIA এবং RAP রিপোর্ট প্রস্তুত করা;
- স্বচ্ছতার জন্য জনগণের সাথে পরামর্শ ও তথ্য প্রকাশ করা;
- নির্মাণকালীন ও চালু হবার পরবর্তী সময়ে ইএসআইএ প্রতিবেদনে প্রস্তাবিত পরিবেশগত ও সামাজিক প্রভাব প্রশমনের ব্যবস্থা বাস্তবায়ন করা;
- আরএইচডি কর্তৃক প্রকল্প নির্মাণকালীন ও চালু হবার পরবর্তী সময়ে পরিবেশগত ও সামাজিক অবস্থা পর্যবেক্ষণ করা।

4

বিবেচ্য আইন ও বিধিমালা

- ইএসআইএ প্রতিবেদনে বাংলাদেশ সরকারের প্রযোজ্য আইন ও বিধিমালার পাশাপাশি জাইকার প্রযোজ্য নির্দেশিকা সমান গুরুত্ব সহকারে বিবেচনা করা হয়েছে;
- প্রযোজ্য আইন ও বিধিমালার পার্থক্যগুলো সমীক্ষায় যথাযথভাবে চিহ্নিত ও সমাধান করা হয়েছে;
- বিবেচ্য উল্লেখযোগ্য বিধিমালাগুলো নিম্নরূপঃ
  - পরিবেশ সংরক্ষন বিধিমালা ১৯৯৭
  - জাইকা পরিবেশ ও সামাজিক বিবেচনা নির্দেশিকা ২০১০
  - অন্যান্য প্রাসঙ্গিক আইন ও বিধিমালা।

5

প্রকল্পের বৈশিষ্ট্য

প্রকল্পের অবস্থান

- চট্টগ্রাম-কক্সবাজার মহাসড়ক সংলগ্ন পটিয়া, চন্দনাইশ, সাতকানিয়া, লোহাগাড়া, চকোরিয়া, রামু এবং কক্সবাজার সদর উপজেলার অধীনে অবস্থিত।

6

এক নজরে প্রকল্পের বৈশিষ্ট্য

প্রকল্পের নাম	চট্টগ্রাম - কক্সবাজার হাইওয়ে ইমপ্রুভমেন্ট প্রজেক্ট
বাস্তবায়ন ও ব্যবস্থাপনা	সড়ক ও জনপথ বিভাগ (আরএইচডি)
সংশ্লিষ্ট মন্ত্রণালয়	সড়ক পরিবহন ও মহাসড়ক বিভাগ, সড়ক পরিবহন ও সেতু মন্ত্রণালয়
প্রাক্কলিত ব্যয়	**** কোটি টাকা (ডিপিপি অনুসারে)
অর্থায়নে	গণপ্রজাতন্ত্রী বাংলাদেশ সরকার এবং জাইকা
অবকাঠামোর ধরন (প্রধান অবকাঠামো)	পটিয়া আউটার রোড- ৫.৪১৯ কি.মি., ৪ লেন (৬ লেনের জন্য জায়গা রাখা হয়েছে) সোহাজারি আউটার রোড- ৩.২৬৬ কি.মি., ৪ লেন (৬ লেনের জন্য জায়গা রাখা হয়েছে) কেরানিহাট ফ্লাইওভার- ৩.৪৪৮ কি.মি., ৬ লেন লোহাগাড়া আউটার রোড- ৫.৩৯৭ কি.মি., ৪ লেন (৬ লেনের জন্য জায়গা রাখা হয়েছে) চকোরিয়া আউটার রোড, ৬.৮৪০ কি.মি., ৪ লেন প্রতিটি আউটার রোডে ধীরগতির গাড়ী চলাচলের জন্য রাস্তার উভয় পাশে সার্ভিস লেন থাকবে
(উপ অবকাঠামো)	চারটি আউটার রোড ও একটি ফ্লাইওভার ছাড়াও এই প্রকল্পের অধীনে চট্টগ্রাম-কক্সবাজার মহাসড়কের চট্টগ্রাম অংশে ১৫.১৩ কি.মি., বান্দরবান অংশে ৬৭০ মি. এবং কক্সবাজার অংশে ১২.৬০ কি.মি. ছোটোখাটো বাঁক সরলীকরণ ও রাস্তা উন্নয়ন করা হবে।
অবকাঠামোর ধরন	সাঙ্গু, উংকাবতি, মতামুহুরি নদী/খালের উপর সেতু নির্মাণ
নির্মাণকাল	২০২৫-২০২৮

7

পটিয়া আউটার রোড এলাইনমেন্ট

8

দোহাজারি আউটার রোড এলাইনমেন্ট

9

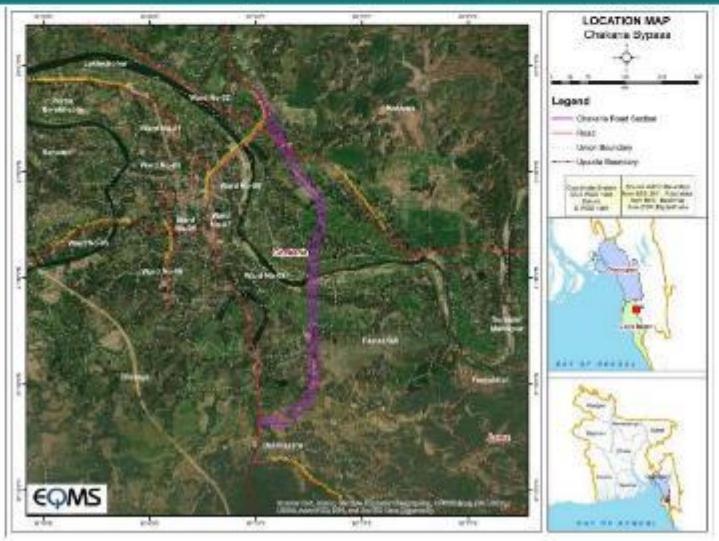
কেরানিহাট ফ্লাইওভার এলাইনমেন্ট

10

লোহাগাড়া আউটার রোড এলাইনমেন্ট

11

চকোরিয়া আউটার রোড এলাইনমেন্ট



12

প্রারম্ভিক অবস্থার পরিবেশগত সমীক্ষা

পরিবেশগত প্রভাব মূল্যায়নের জন্য নিম্নের বিষয়গুলো সমীক্ষা করা হয়েছে;

- **ভৌতঃ** মৃত্তিকার বৈশিষ্ট্য, ভূতাত্ত্বিক বৈশিষ্ট্য, ভূসংস্থান, জল বিভাজিকা;
- **ভৌত - রাসায়নিকঃ** পানি, বায়ু, শব্দের মাত্রা, কম্পনের মাত্রা;
- **জৈবিকঃ** আবাস, জলজ প্রাণ, মৎস্য, উদ্ভিদ, প্রানি;
- **আর্থসামাজিকঃ** জনসংখ্যা, সামাজিক গঠন, অর্থনৈতিক অবস্থা, উন্নয়ন সক্ষমতা ইত্যাদি।

প্রারম্ভিক অবস্থার পরিবেশগত সমীক্ষাটি ২০২০-২১ সময়ে করা হয়েছে।

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বায়ুর মান পর্যবেক্ষণ

- ২০২০-২১ সালে ১২ টি স্থানে মোট ৫ প্যারামিটার ($PM_{2.5}$, PM_{10}, NO_2, SO_2 and CO) পর্যবেক্ষণ করা হয়েছে।
- আর্দ্র এবং শুষ্ক উভয় মৌসুমে উপরে উল্লিখিত প্যারামিটারগুলোর ঘনত্ব ন্যাশনাল অ্যাম্বিয়েন্ট এয়ার কোয়ালিটি স্ট্যান্ডার্ডের মধ্যে পাওয়া গেছে।
- PM10 এর ঘনত্ব আর্দ্র মৌসুমের তুলনায় শুষ্ক মৌসুমে গড়ে ১৭.১% বৃদ্ধি পেয়েছে।
- PM2.5 এর ক্ষেত্রে, শুষ্ক মৌসুমে ঘনত্ব আর্দ্র মৌসুমের তুলনায় গড়ে ২৮.৫% বৃদ্ধি পেয়েছে।
- শুষ্ক মৌসুমে NO_2 এর ঘনত্ব বেশির ভাগ স্থানে আর্দ্র মৌসুমের তুলনায় বেড়েছে।
- শুষ্ক মৌসুমে ৬ টি স্থানে SO_2 এর ঘনত্ব আর্দ্র মৌসুমের তুলনায় বৃদ্ধি পেয়েছে, যেখানে শুষ্ক মৌসুমে ঘনত্ব অন্যান্য স্থানে হ্রাস পেয়েছে।

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বায়ুর মান পর্যবেক্ষণের স্থান

পর্যবেক্ষণের আইডি	পর্যবেক্ষণের স্থান
AQ1	পটিয়ায় বিদ্যমান মহাসড়কের পাশে
AQ2	পটিয়ায় প্রস্তাবিত বাইপাসের পার্শ্ববর্তী আবাসিক/বাণিজ্যিক এলাকায়
AQ3	দোহাজারীতে বিদ্যমান মহাসড়কের পাশে
AQ4	দোহাজারীতে প্রস্তাবিত বাইপাস এলাকার পাশে
AQ5	কেরানীহাটে প্রস্তাবিত FOB এলাকায় বিদ্যমান হাইওয়ের পাশে
AQ6	কেরানীহাটের প্রস্তাবিত FOB এলাকায় আবাসিক/বাণিজ্যিক এলাকার পাশে
AQ7	কেরানীহাটে প্রস্তাবিত বাইপাস এলাকার পাশে
AQ8	কেরানীহাটে প্রস্তাবিত বাইপাস এলাকার পাশে
AQ9	লোহাগাড়ায় বিদ্যমান মহাসড়কের পাশে
AQ10	লোহাগাড়ায় প্রস্তাবিত বাইপাস এলাকার পাশে
AQ11	চকোরিয়ায় প্রস্তাবিত বাইপাস এলাকার পাশে
AQ12	চকোরিয়ায় বিদ্যমান মহাসড়কের পাশে

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বায়ুমান পর্যবেক্ষণের আলোকচিত্র

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16

শব্দ ও কম্পনের মাত্রা পর্যবেক্ষণ

- ২০২১ সালে ১২ টি স্থানে শব্দ ও কম্পনের মাত্রা পর্যবেক্ষণ করা হয়েছে।
- সমীক্ষার সময় প্রায় সব জায়গায় শব্দের মাত্রা পরিবেশ অধিদপ্তর নির্ধারিত সীমার চেয়ে বেশি ছিল।
- বাংলাদেশে কম্পনের কোনো মানদণ্ড নেই।
- সমীক্ষার সময় সব জায়গায় কম্পনের মাত্রা জাপানের মানদণ্ডের নির্ধারিত সীমার মধ্যে ছিল।

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শব্দ ও কম্পনের মাত্রা পর্যবেক্ষণের স্থান

পর্যবেক্ষণের আইডি	পর্যবেক্ষণের স্থান
RS-01	পটিয়া উপজেলা স্বাস্থ্য কমপ্লেক্সের সামনে (পটিয়া)
RS-02	দক্ষিণঘাটা নূরী জামে মসজিদের সামনে (পটিয়া)
RS-03	বিজিসি ট্রাস্ট মেডিকেল কলেজের সামনে (চন্দনাইশ)
RS-04	দোহাজারী জামিয়ুরী এ রহমান উচ্চ বিদ্যালয়ের সামনে (দোহাজারী)
FR-01	চাগাচর জামে মসজিদের কাছে (দোহাজারী)
RS-05	শাহী জামে মসজিদের সামনে (কেরানিহাট)
RS-06	নয়াপাড়া বায়তুল মামুর জামে মসজিদের সামনে (পদুয়া)
RS-07	সিটিজেন পার্ক কমিউনিটি সেন্টারের সামনে (লোহাগাড়া)
FR-02	মাওলানা সুলতান হোসেন জামে মসজিদের সামনে (লোহাগাড়া)
RS-08	আধুনগর গুল-ই-জার বালিকা উচ্চ বিদ্যালয়ের সামনে (আজিজ নগর, চকোরিয়া)
FR-03	দক্ষিণ লোটোনী কেন্দ্রীয় জামে মসজিদের সামনে (চকোরিয়া)
RS-09	ফাসিয়াখালী সরকারি প্রাথমিক বিদ্যালয়ের সামনে (চকোরিয়া)

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শব্দ ও কম্পনের মাত্রা পর্যবেক্ষণের আলোকচিত্র






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ভূপৃষ্ঠস্থ পানির মান পরীক্ষা

- ২০২০ সালে দশটি স্থান থেকে ভূপৃষ্ঠস্থ পানির নমুনা সংগ্রহ করা হয়েছে।
- আর্দ্র এবং শুষ্ক উভয় মৌসুমে মোট ১১ টি প্যারামিটার (pH, Temperature, DO, BOD, COD, TSS, Color, TC, Turbidity, Arsenic, Oil and Grease) পরীক্ষা করা হয়েছে।
- সমীক্ষার সময়, বেশিরভাগ প্যারামিটারের ঘনত্ব জাতীয় মান মাত্রার মধ্যে পাওয়া গেছে।
- চকোরিয়ায় (SW10) আর্দ্র মৌসুমে BOD এর ঘনত্ব মান মাত্রা অতিক্রম করে। তবে শীত মৌসুমে পটিয়া (SW1), দোহাজারী (SW4) এবং লোহাগাড়া (SW8) তে প্রাপ্ত ঘনত্ব মান মাত্রা ছাড়িয়ে গেছে।

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ভূপৃষ্ঠস্থ পানির নমুনা সংগ্রহের স্থান

নমুনার আইডি	নমুনা সংগ্রহের স্থান
SW1	চিমনার খাল, পটিয়া
SW2	বাইপাসের পার্শ্ববর্তী পুকুর, পটিয়া
SW3	সাঙ্গু নদীর উজানে, দোহাজারী
SW4	সাঙ্গু নদীর ভাটিতে, দোহাজারী
SW5	কেরানীহাট এফওবি এর পার্শ্ববর্তী পুকুর
SW6	কেরানীহাট এফওবি এর পার্শ্ববর্তী জলাশয়
SW7	টংকাবতী নদীর উজানে, লোহাগাড়া
SW8	টংকাবতী নদীর ভাটিতে, লোহাগাড়া
SW9	মাতামুহুরী নদীর উজানে, চকরিয়া
SW10	মাতামুহুরী নদীর ভাটিতে, চকরিয়া

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ভূপৃষ্ঠস্থ পানির নমুনা সংগ্রহের আলোকচিত্র

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স্ক্রীনিং এবং স্কোপিং

- প্রকল্পটি বাংলাদেশের পরিবেশ সংরক্ষণ বিধিমালা ১৯৯৭ অনুসারে "লাল" শ্রেণী ও জাইকার পরিবেশ নির্দেশিকা অনুসারে "এ" শ্রেণীর অন্তর্ভুক্ত, এবং এই পরিপ্রেক্ষিতে ইআইএ বাধ্যতামূলক।
- উক্ত প্রকল্পের বিবরণ এবং তার আশেপাশের সামগ্রিক পরিবেশ ও সামাজিক অবস্থার উপর ভিত্তি করে প্রাথমিকভাবে সম্ভাব্য পরিবেশগত ও সামাজিক প্রভাব চিহ্নিত করা হয়েছে (এ পর্যায়ে প্রভাবগুলোর প্রশমনের জন্য কোন নির্দিষ্ট ব্যবস্থা বিবেচনায় আনা হয়নি)। দূষণের প্রভাব, প্রাকৃতিক ও সামাজিক পরিবেশ, স্বাস্থ্য ও নিরাপত্তা, ঝুঁকি, এবং অন্যান্য নিম্নলিখিত মানদণ্ড অনুসারে এ থেকে ডি হিসেবে শ্রেণীবদ্ধ করা হয়েছে:
  ১) এ-/ এ+: উল্লেখযোগ্য নেতিবাচক/ইতিবাচক প্রভাব
  ২) বি-/ বি+: কিছু নেতিবাচক/ইতিবাচক প্রভাব
  ৩) সি-/ সি+: প্রভাবগুলো স্পষ্ট নয়, আরও পর্যালোচনা প্রয়োজন
  ৪) ডি: প্রভাবগুলি নগণ্য, আর পর্যালোচনা প্রয়োজন

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বিস্তৃতি (স্কোপিং) ম্যাট্রিক্স

নং	প্রভাবের বিষয়	অনুমিত প্রভাব		রেটিং এর বর্ণনা
		নির্মাণ পর্যায়ের আগে/সময়	অপারেশনের সময়	
ভৌত পরিবেশ				
১.	বায়ু দূষণ	বি-	বি-	**নির্মাণ পর্যায়ের সময়ঃ** নির্মাণ যন্ত্রপাতি এবং যানবাহন পরিচালনা বায়ু দূষণের কারণ হতে পারে। **অপারেশনের সময়ঃ** যানবাহনের সংখ্যা বৃদ্ধি বায়ু দূষণের কারণ হতে পারে।
২.	পানি দূষণ	বি-	ডি	**নির্মাণ পর্যায়ের সময়ঃ** নির্মাণ কাজের মাধ্যমে ঘোলা পানি নিকটবর্তী জলাশয়ের পানির মান নষ্ট করতে পারে। **অপারেশনের সময়ঃ** নগণ্য
৩.	শব্দ এবং কম্পন	বি-	বি-	**নির্মাণ পর্যায়ের সময়ঃ** নির্মাণ যন্ত্রপাতি এবং যানবাহন নিয়মিত শব্দের কারণ হবে। **অপারেশনের সময়ঃ** যানবাহন বৃদ্ধি আরও শব্দ এবং কম্পন সৃষ্টি করতে পারে।

এটি নমুনা হিসাবে দেখানো স্কোপিং ম্যাট্রিক্সের একটি নির্যাস

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প্রত্যাশিত পরিবেশগত প্রভাব এবং তাদের প্রশমন ব্যবস্থা

- শব্দ
- কম্পন
- বায়ু দূষণ
- ভূপৃষ্ঠস্থ পানি দূষণ
- ভূসংস্থান ও মাটি দূষণ
- বর্জ্য
- ভূমিধস
- দুর্গন্ধ
- তলানির পলি
- বন্যা এবং নিষ্কাশন
- উপকরণের উৎস এবং ঢালাই রুট, এবং নিষ্পত্তি সাইট
- সংরক্ষিত এলাকা
- বায়োটা এবং ইকোসিস্টেম
- মৎস্য ও জলজ জীববিজ্ঞান
- অনিচ্ছাকৃত পুনর্বসন
- দরিদ্র জনগোষ্ঠী
- আদিবাসী ও জাতিগত সংখ্যালঘু মানুষ
- স্থানীয় অর্থনীতি
- ভূমি ব্যবহার এবং স্থানীয় সম্পদের ব্যবহার
- ব্যাহত কৃষি কার্যক্রম
- জল ব্যবহার
- সামাজিক সেবা সুবিধা
- সামাজিক প্রতিষ্ঠান এবং স্থানীয় সিদ্ধান্ত গ্রহণকারী প্রতিষ্ঠান
- স্থানীয় স্বার্থের দ্বন্দ্ব
- সাংস্কৃতিক ঐতিহ্য
- লিঙ্গ
- শিশুদের অধিকার
- সংক্রামক রোগ, যেমন এইচআইভি/এইডস
- পেশাগত স্বাস্থ্য ও নিরাপত্তা
- কাজের পরিবেশ
- বৈশ্বিক উষ্ণতা/জলবায়ু পরিবর্তন
- দুর্ঘটনা

উচ্চ প্রভাব	
মাঝারি প্রভাব	
কম প্রভাব	
ইতিবাচক প্রভাব	

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শব্দের মাত্রা

প্রভাব	প্রশমন ব্যবস্থা
নির্মাণ পর্যায় নির্মাণস্থলে ভারী যন্ত্রপাতি চালানো এবং যানবাহন চলাচলের কারণে শব্দ হতে পারে।	• কম শব্দ উৎপন্নকারী সরঞ্জাম ব্যবহার; • যন্ত্রপাতি এবং যানবাহন নিয়মিত রক্ষণাবেক্ষণ; • অভ্যন্তরীণ শব্দ প্রতিরোধক ব্যবস্থা সম্পন্ন ভারী যন্ত্রপাতি ব্যবহার; • অস্থায়ী শব্দ বাধা নির্মাণ (ফ্লাইওভার এবং সেতু নির্মাণ এলাকায়); • ব্যাচিং প্ল্যান্ট এবং অ্যাসফাল্ট প্ল্যান্ট সংবেদনশীল রিসেপ্টর থেকে কমপক্ষে ২০০ মি. দূরবর্তী স্থানে নির্মাণ করা; • প্রাচীর ঘেরা নির্মাণকাজ পরিচালনা; • সংবেদনশীল স্থানে রাতের সময় এবং ছুটির দিনে নির্মাণ কার্যক্রম এড়িয়ে চলা।
অপারেশন পর্যায় বাইপাস সড়কে যানবাহন চলাচলে শব্দ সৃষ্টি হবে	• সংবেদনশীল রিসেপ্টরগুলির চারপাশে শব্দ বাধা নির্মাণ করা।

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কম্পনের মাত্রা

প্রভাব	প্রশমন ব্যবস্থা
নির্মাণ পর্যায় নির্মাণ কার্যক্রম এবং যন্ত্রপাতি পরিচালনার কারণে কম্পন হতে পারে।	• কম্পন সৃষ্টিকারী সমসাময়িক কাজগুলি এড়ানো উচিত; • কম কম্পন তৈরির সরঞ্জাম এবং যন্ত্রপাতি ব্যবহার করা; • পরিখা খনন পদ্ধতি ব্যবহার করা; • অস্থায়ী উচ্ছেদ, পুনর্বাসন, এবং ক্ষতিপূরণ প্রদান; • কম্পন স্তর এবং অবস্থা পর্যবেক্ষণ;
অপারেশন পর্যায় অল্প কম্পন হবে।	• কোন অতিরিক্ত প্রশমন ব্যবস্থা প্রয়োজন নাই।

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বায়ুর মান

প্রভাব	প্রশমন ব্যবস্থা
নির্মাণ পর্যায় নির্মাণ সামগ্রী পরিবহন, ভারী যন্ত্রপাতির অপারেশন এবং মাটির কাজ সামগ্রিকভাবে ধুলো এবং নিষ্কাশন গ্যাস উৎপন্ন করবে।	• উপযুক্ত নির্গমন নিয়ন্ত্রণ ব্যবস্থা সম্পন্ন যন্ত্রপাতি ব্যবহার; • জ্বালানী-সাশ্রয়ী পদ্ধতিতে যানবাহন পরিচালনা; • নির্মাণ এলাকায় নিয়মিত পানি ছিটানো; • নির্মাণ সাইটের বাইরে চলাচলকারী মাটি বহনকারী যানবাহন ঢেকে নেয়া; • সকল যানবাহন চলাচলের উপর গতিসীমা আরোপ করুন; • প্রবেশ এবং প্রস্থানের সময় চাকা থেকে কাদা অপসারণ; • নির্গমন কমানোর জন্য নিয়মিতভাবে সমস্ত যানবাহন মেরামত করা; • অতিরিক্ত দূষণ সৃষ্টিকারী যন্ত্রপাতি সাময়িকভাবে ব্যবহার না করা; • কংক্রিট ব্যাচিং এবং মিক্সিং প্ল্যান্টে ফিল্টারিং সিস্টেম ব্যবহার করা।
অপারেশন পর্যায় প্রকল্পের ফলে সড়কের যানজট কমবে, বায়ু দূষণও কমবে।	• কোন অতিরিক্ত প্রশমন ব্যবস্থা প্রয়োজন নাই।

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ভূপৃষ্ঠস্থ পানি (নির্মাণ পর্যায়)

প্রভাব	প্রশমন ব্যবস্থা
নির্মাণ কাজের দ্বারা সৃষ্ট ঘোলা পানি, নিকটবর্তী ভূপৃষ্ঠস্থ পানি দূষণের কারন হতে পারে।	• নির্মাণ এলাকা থেকে পলি-মিশ্রিত পানি প্রবাহ বন্ধ করতে অস্থায়ী নিষ্কাশন ব্যবস্থা করা; • সংশ্লিষ্ট নদী, খাল ও পুকুরের তীরে পলি আটকানোর ব্যবস্থা রাখা; • দূষণমুক্ত এলাকা থেকে প্রবাহকে সরিয়ে দেওয়া; • কঠিন বর্জ্য এবং তরল বর্জ্য সরাসরি নিষ্কাশন না করা; • নিষ্কাশন লাইন থেকে দূরে উপকরণ মজুদ রাখা; • ব্যাচিং প্লান্ট থেকে গ্রারি মিশ্রিত বর্জ্য সেটলিং ট্যাঙ্কে রাখা; • রেডি-মিক্স কংক্রিট মেশানোর এবং কংক্রিট হ্যান্ডলিং সরঞ্জাম ধুয়ে ফেলা; • পলি, তেল ও গ্রীজ, অতিরিক্ত পুষ্টি, জৈব পদার্থ, আবর্জনা, ধ্বংসাবশেষ এবং যেকোন প্রকার বর্জ্যের উৎপাদন কমানো।

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ভূপৃষ্ঠস্থ পানি (অপারেশন পর্যায়)

প্রভাব	প্রশমন ব্যবস্থা
নবনির্মিত রাস্তার মাটির ক্ষয় কাছাকাছি জলাশয়ে পলির স্তর এবং দূষণ বাড়াতে পারে।	• রাস্তার ঢাল এবং ফুটপাথে ঘাস লাগানো বা পাকা করা যেতে পারে; • রাস্তার উপরিভাগ সঠিকভাবে এবং নিয়মিত রক্ষণাবেক্ষণ করতে হবে।

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মাটি দূষণ

প্রভাব	প্রশমন ব্যবস্থা
নির্মাণ পর্যায় লুব্রিকেন্ট এবং বেনটোনাইট/পলিমার স্লারির মতো বিপজ্জনক উপাদান মাটি দূষণের কারণ হতে পারে।	• সাইটের কাজ শুরু করার আগে, একটি স্পিল ম্যানেজমেন্ট প্ল্যান প্রয়োজন; • জ্বালানী এবং বিপজ্জনক পদার্থ বাঁধ সহ পাকা জায়গায় রাখতে হবে; • পরিষ্কার করার উপকরণের মজুদ রাখতে হবে; • সঠিক লেবেল সহ ভাল পাত্রে সব উপকরণ মজুদ রাখতে হবে; • চুইয়ে পড়া প্রতিরোধ করার জন্য নিয়মিত পরিদর্শন করতে হবে; • বন্যা স্তরের উপরে বিপজ্জনক উপকরণ সংরক্ষণ করতে হবে; • স্যানিটারি পিট ছাড়া খোলা পায়খানা নিষিদ্ধ করতে হবে।
অপারেশন পর্যায় কোন উল্লেখযোগ্য প্রভাব প্রত্যাশিত নয়	• কোন অতিরিক্ত প্রশমন ব্যবস্থা প্রয়োজন নাই

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বর্জ্য

প্রভাব	প্রশমন ব্যবস্থা
নির্মাণ পর্যায় পোড়া তেল, লুব্রিকেন্ট, লিথিয়াম-আয়ন ব্যাটারি এবং স্পিলেজ, খালি পাত্র, স্লারি, নির্মাণ সামগ্রীর টুকরো এবং আবর্জনা।	• কঠিন বর্জ্য সঠিকভাবে পৃথকীকরণ করতে হবে; • একটি পরিবেশগতভাবে গ্রহণযোগ্য পদ্ধতিতে কঠিন বর্জ্য নিষ্পত্তি করতে হবে; • কঠিন বর্জ্য সংগ্রহ ও নিষ্পত্তির জন্য তৃতীয় পক্ষকে নিয়োজিত রাখতে হবে; • বর্জ্য পুনঃপ্রক্রিয়াজাতকরণ করতে হবে; • উৎপন্ন হওয়ার ১২ ঘন্টার মধ্যে নির্ধারিত স্থানে অব্যবহৃত মাটি ডাম্পিং করতে হবে।
অপারেশন পর্যায় যানবাহন থেকে তেল এবং গ্রীস ছড়িয়ে পড়তে পারে	• প্রভাব নগণ্য হবে। অতএব, কোন অতিরিক্ত প্রশমন ব্যবস্থা প্রয়োজন নেই।

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ভূমিধ্বস

প্রভাব	প্রশমন ব্যবস্থা
নির্মাণ পর্যায় পাইল ফাউন্ডেশনের সময় এবং পরে ভূমিধস হতে পারে	• পাইল ফাউন্ডেশন এলাকা আবদ্ধ করতে হবে; • স্টিল শীট এবং/অথবা শোরিং বিম ব্যবহার করে শোর পাইলিং/শোরিং এর কাজ করতে হবে।
অপারেশন পর্যায় সড়ক সাময়িকভাবে দেবে যেতে পারে	• পাকা ঢাল নির্মাণ করতে হবে; • পর্যাপ্ত পানি নিষ্কাশন ব্যবস্থা রাখতে হবে; • অতিরিক্ত ওজনের যানবাহন চলাচল নিষিদ্ধ করতে হবে।

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দুর্গন্ধ

প্রভাব	প্রশমন ব্যবস্থা
নির্মাণ পর্যায় জমি তৈরি ও পরিষ্কার করার কাজ, ভ্রাম্যমাণ ও স্থির টয়লেটের পয়ঃনিষ্কাশন, কঠিন বর্জ্য, স্লারি ইত্যাদি সাময়িক দুর্গন্ধ সৃষ্টি করতে পারে	• সুয়ারেজ স্লাজ স্যানিটারি পিট দিয়ে ব্যবস্থা করতে হবে; • ব্যাচিং প্ল্যান্ট থেকে কঠিন বর্জ্য এবং স্লারি খোলা জায়গায় নিষ্পত্তি বন্ধ করতে হবে।
অপারেশন পর্যায় কোন উল্লেখযোগ্য প্রভাব প্রত্যাশিত নয়	• কোন অতিরিক্ত প্রশমন ব্যবস্থা প্রয়োজন নেই

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পলি স্তরায়ন

প্রভাব	প্রশমন ব্যবস্থা
নির্মাণ পর্যায় ভূমির কাজে সৃষ্ট পলি নিঃসরণ সংলগ্ন নদী এবং জলধারার নীচের পলির অবনতি ঘটাতে পারে।	• পলি মিশ্রিত পানি নিষ্পত্তির জন্য পলিরোধক বেড়া স্থাপন করতে হবে; • ব্যাচিং প্ল্যান্টের লারি জলাশয় থেকে দূরে শুকাতে হবে; • পানিতে তেল এবং লুব্রিকেন্ট ফেলা যাবে না।
অপারেশন পর্যায় অনাবৃত রাস্তার ঢাল ক্ষয় থেকে সৃষ্ট পলি সংলগ্ন নদী এবং জলধারার নীচের পলির অবনতি ঘটাতে পারে।	• পাকা ফুটপাথ নির্মাণ এবং রাস্তার ঢাল বরাবর ঘাস লাগানোর মাধ্যমে পলি রোধ করা যেতে পারে।

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বন্যা ও নিষ্কাশন

প্রভাব	প্রশমন ব্যবস্থা
নির্মাণ পর্যায় বাঁধের রাস্তা বৃষ্টিপাতের কারণে বন্যা/নিষ্কাশন জটিলতা/ বর্ষায় জলাবদ্ধতা ইত্যাদিকে প্রভাবিত করতে পারে।	• নির্মাণ সাইটে অস্থায়ী নিষ্কাশন ব্যবস্থা নির্মাণ করতে হবে; • অবিলম্বে জলাবদ্ধতা নিষ্কাশন করতে হবে; • অস্থায়ী ক্রস-ড্রেনেজ সুবিধা নির্মাণ করতে হবে।
অপারেশন পর্যায় কোন বড় প্রভাব প্রত্যাশিত নয়	• জলাবদ্ধতা নিষ্কাশনের জন্য তাৎক্ষনিক পাম্প করতে হবে। • ক্রস-ড্রেনেজ অবকাঠামো রক্ষণাবেক্ষণ করতে হবে।

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মালামালের উৎস এবং পরিবহন পথ

প্রভাব	প্রশমন ব্যবস্থা
নির্মাণ পর্যায় মালামাল পরিবহনের রাস্তা এবং নিষ্পত্তির স্থানগুলিতে ভূমি ব্যবহারের পরিবর্তন, জমির অবক্ষয় এবং কৃষি জমির ক্ষতির কারণ হতে পারে	• বর্জ্য নিষ্পত্তি সাইটের জন্য আবাদি জমি এড়িয়ে চলতে হবে; • ভরাট উপকরণ হিসাবে মাটি/উপরের মাটির ব্যবহার কমাতে হবে; • জলাশয় থেকে দূরে বর্জ্য নিষ্পত্তি সাইট নির্বাচন করতে হবে; • মশা নিয়ন্ত্রণের জন্য লার্ভিসাইড এবং অ্যাডাল্টিসাইডব্যবহার করতে হবে; • চলাচলের রুট এবং সময়সূচী এমনভাবে নির্বাচন করতে হবে যাতে সর্বনিম্ন অসুবিধা হয়।
অপারেশন পর্যায় কোন প্রভাব প্রত্যাশিত নয়	• প্রকল্প সমাপ্তির পরে বর্জ্য নিষ্পত্তি স্থান পুনরুদ্ধার করতে হবে

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সংরক্ষিত এলাকা

প্রভাব	প্রশমন ব্যবস্থা
নির্মাণ পর্যায় নির্মাণ কার্যক্রম প্রকল্পের প্রভাব এলাকার মধ্যে সংরক্ষিত এলাকার জন্য সম্ভাব্য হুমকি সৃষ্টি করতে পারে	• সংরক্ষিত এলাকাতে কোনো নির্মাণ কার্যক্রম করা যাবে না; • সংরক্ষিত এলাকার মধ্যে কোন বর্জ্য নিষ্পত্তি করা যাবে না; • সংরক্ষিত এলাকার সীমানার ২ কিলোমিটারের মধ্যে কোন শ্রমিক আবাসন ক্যাম্প করা যাবে না।
অপারেশন পর্যায় দ্রুত ড্রাইভিং এবং হর্নের অনুপযুক্ত ব্যবহার থেকে সৃষ্ট সামান্য প্রভাব সংরক্ষিত এলাকার বন্যজীবনকে প্রভাবিত করতে পারে	• হর্ন এবং গতিসীমা মানার জন্য সঠিক সংকেত ব্যবহার করতে হবে।

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জীব এবং বাস্তুসংস্থান

প্রভাব	প্রশমন ব্যবস্থা
নির্মাণ পর্যায় নির্মাণ জনিত ধূলিকণা, নিষ্কাশন এবং স্পিলেজ গাছের বৃদ্ধি এবং জলজ বাস্তুতন্ত্রের ক্ষতি করতে পারে	• আবশ্যক প্রয়োজন ছাড়া গাছ কাটা যাবে না; • বড় গাছ কাটা সীমিত পরিসরে রাখতে হবে; • প্রকল্পের জ্বালানী হিসাবে গাছপালা ব্যবহার করা যাবে না; • নির্মাণ সামগ্রীর ডাম্পিং এবং মজুদ গাছপালা ঘেরা এলাকায় করা যাবে না; • রাতের সময় বড় নির্মাণ কার্যক্রম এড়িয়ে চলতে হবে; • কাটা প্রতিটি গাছের জন্য 2টি নতুন গাছ লাগাতে হবে; • বনায়ন করতে হবে।
অপারেশন পর্যায় যানবাহন চলাচলের কারনে সৃষ্ট ধুলা নতুন রোপণ করা চারার বৃদ্ধি প্রভাবিত করতে পারে।	• সদ্য রোপিত চারার সঠিক পরিচর্যা করতে হবে; • সদ্য রোপিত চারার জন্য বেড়া প্রদান করতে হবে।

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মৎস্য এবং জলজ জীববৈচিত্র্য

প্রভাব	প্রশমন ব্যবস্থা
নির্মাণ পর্যায় নির্মাণ কার্যক্রম মাছের স্বাস্থ্য এবং জলাশয়ে মাছের স্থানান্তরকে প্রভাবিত করতে পারে।	• মাছের অভিবাসন রুট বিবেচনা করা প্রয়োজন; • মাছ ধরার এলাকায় নির্মাণ সামগ্রী বা বর্জ্য নিষ্পত্তি নিয়ন্ত্রণ করতে হবে; • তলানীর পলির জন্য Section 10 এর যথাযথ বাস্তবায়ন করতে হবে।
অপারেশন পর্যায় নবনির্মিত সেতু/কালভার্ট পানির প্রবাহকে প্রভাবিত করতে পারে এবং মাছের স্বাভাবিক স্থানান্তরকে বাধাগ্রস্ত করতে পারে।	• পর্যাপ্ত পানি প্রবাহ এবং মাছের স্থানান্তর সুবিধা নিশ্চিত করুন।

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অনিচ্ছাকৃত পুনর্বাসন

প্রভাব	প্রশমন ব্যবস্থা
ভবিষ্যতে রাস্তা নির্মাণের জন্য জমি প্রয়োজন। বিস্তারিত RAP প্রতিবেদন কেএমসি দ্বারা প্রস্তুত করা হচ্ছে। প্রকল্পের সামাজিক প্রভাব এবং সম্পত্তির ক্ষতি সম্পর্কিত সঠিক তথ্য এবং পরিমাণ RAP প্রতিবেদন থেকে জানা যাবে।	RAP সমীক্ষা অনুযায়ী প্রকল্প সংশ্লিষ্ট সকল ক্ষতিগ্রস্তদের যথাযথ ক্ষতিপূরণ প্রদান করা হবে।

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পানির ব্যবহার

প্রভাব	প্রশমন ব্যবস্থা
নির্মাণ পর্যায় নির্মাণ কার্যক্রমের জন্য ভূপৃষ্ঠ ও ভূগর্ভস্থ পানি উভয়ই প্রয়োজন হবে।	• বৃষ্টির পানি সংগ্রহের পুকুর নির্মাণ; • পানি সঞ্চয় ট্যাংক নিয়মিত পরিদর্শন; • নির্মাণ শ্রমিকদের মধ্যে সচেতনতা বৃদ্ধি; • উন্নত প্রযুক্তি গ্রহণ; • সাইটে পানি সঞ্চয় ট্যাংকে আবরণ দিয়ে ঢেকে রাখা।
অপারেশন পর্যায় কোন প্রভাব প্রত্যাশিত নয়	• কোন অতিরিক্ত প্রশমন ব্যবস্থা প্রয়োজন নেই

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স্থানীয় স্বার্থের সংঘাত

প্রভাব	প্রশমন ব্যবস্থা
নির্মাণ পর্যায় কাজের সুযোগ নিয়ে স্বার্থের দ্বন্দ্ব দেখা দিতে পারে	• ন্যায্য চাকরির সুযোগ প্রদান করতে হবে; • শ্রমের চাহিদা সম্পর্কে পরিষ্কার তথ্য প্রদান করতে হবে; • কাজের দক্ষতা বিবেচনা এবং ক্ষতিগ্রস্ত ব্যক্তিদের অগ্রাধিকার প্রদান করতে হবে।
অপারেশন পর্যায় কোন প্রভাব প্রত্যাশিত নয়	• কোন অতিরিক্ত প্রশমন ব্যবস্থা প্রয়োজন নেই

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লিঙ্গ

প্রভাব	প্রশমন ব্যবস্থা
নির্মাণ পর্যায় পুরুষ ও মহিলা শ্রমিকদের মধ্যে মজুরি বৈষম্য সৃষ্টি হতে পারে	• মজুরি বৈষম্য পরীক্ষা কঠোরভাবে রোধ করা উচিত।
অপারেশন পর্যায় কোন প্রভাব প্রত্যাশিত নয়	• কোন অতিরিক্ত প্রশমন ব্যবস্থা প্রয়োজন নেই

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শিশুদের অধিকার

প্রভাব	প্রশমন ব্যবস্থা
নির্মাণ পর্যায় স্কুলগামী শিশুদের সুযোগকে প্রভাবিত করতে পারে এবং শিশুশ্রম বৃদ্ধি করতে পারে।	• শিশুশ্রম কঠোরভাবে নিষিদ্ধ করা উচিত।
অপারেশন পর্যায় কোন প্রভাব প্রত্যাশিত নয়	• কোন অতিরিক্ত প্রশমন ব্যবস্থা প্রয়োজন নেই

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সংক্রামক ব্যাধি

প্রভাব	প্রশমন ব্যবস্থা
নির্মাণ পর্যায় অভিবাসী শ্রমিকদের আগমনে রোগ ছড়ানোর সম্ভাবনা থাকতে পারে।	• সবার স্বাস্থ্যের বিষয়ে নজরদারি করা; • শ্রমিকদের মধ্যে অসুস্থতা প্রতিরোধ; • কেস ম্যানেজমেন্টের মাধ্যমে চিকিৎসা প্রদান; • প্রকল্প কর্মীদের এবং স্থানীয় বাসিন্দাদের শিক্ষিত করা; • স্থানীয় কর্তৃপক্ষের সাথে সহযোগিতা বৃদ্ধি; • প্রতিরোধক, পোশাক, মশারী ইত্যাদির ব্যবহার প্রচার করা; • মশার লার্ভা বংশবৃদ্ধি প্রতিরোধ; • অব্যবহারযোগ্য আবদ্ধ পানি নিষ্কাশন করা।
অপারেশন পর্যায় কোন প্রভাব প্রত্যাশিত নয়	• কোন অতিরিক্ত প্রশমন ব্যবস্থা প্রয়োজন নেই

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পেশাগত স্বাস্থ্য এবং নিরাপত্তা

প্রভাব	প্রশমন ব্যবস্থা
নির্মাণ পর্যায় নির্মাণ কাজের সময় দুর্ঘটনা ও ঘটনা ঘটার সম্ভাবনা	• পর্যাপ্ত স্বাস্থ্যসেবা সুবিধা এবং প্রাথমিক চিকিৎসা প্রদান; • OHS প্রশিক্ষণ প্রদান; • পর্যাপ্ত বিশুদ্ধ পানি ও শৌচাগার সুবিধা প্রদান; • পরিষ্কার খাওয়ার জায়গার ব্যবস্থা করা • বিশ্রামের জন্য অস্থায়ী আশ্রয়; • অগ্নি সতর্কতা, আলো, নিরাপদ প্রবেশাধিকার, তাপমাত্রা, সতর্ক সংকেত, সরঞ্জামের লেবেল, বিপদ কোড, চলাচলের পথ, সাইটের গতি সীমা, যানবাহন পরিদর্শনের ব্যবস্থা এবং SOP • উপযুক্ত পিপিই নিশ্চিত করা।
অপারেশন পর্যায় কোন প্রভাব প্রত্যাশিত নয়	• কোন অতিরিক্ত প্রশমন ব্যবস্থা প্রয়োজন নেই

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অন্যান্য সামাজিক প্রভাব

RAP সমাপ্তির পরে প্রভাবগুলি চূড়ান্ত করা হবে,

- দরিদ্র জনগোষ্ঠী
- আদিবাসী বা জাতিগত সংখ্যালঘু মানুষ
- আঞ্চলিক অর্থনীতি
- ভূমি ব্যবহার এবং স্থানীয় সম্পদের ব্যবহার
- ব্যহত কৃষি কার্যক্রম
- সামাজিক সেবা সুবিধা
- সামাজিক প্রতিষ্ঠান এবং স্থানীয় সিদ্ধান্ত গ্রহণকারী প্রতিষ্ঠান
- সাংস্কৃতিক ঐতিহ্য

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বৈশ্বিক উষ্ণায়ন/জলবায়ু পরিবর্তন

প্রভাব	প্রশমন ব্যবস্থা
নির্মাণ পর্যায় নির্মাণ সাইটের জন্য GHG নির্গমন	• নির্মাণ যন্ত্রপাতির জন্য অপারেশন সময় ব্যবস্থাপনা; • অত্যধিক লোডিং অপারেশন পরিহার করা; • অলস সময়ে যানবাহন বন্ধ রাখার অনুশীলন সম্পর্কে নির্মাণ শ্রমিক/চালকদের শিক্ষিত করা।
অপারেশন পর্যায় কোন প্রভাব প্রত্যাশিত	• কোনো অতিরিক্ত প্রশমন ব্যবস্থার প্রয়োজন নেই।

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দুর্ঘটনা

প্রভাব	প্রশমন ব্যবস্থা
নির্মাণ পর্যায় প্রকল্প স্থানের আশপাশে নির্মাণ জনিত দুর্ঘটনা ও সড়ক দুর্ঘটনা	• স্বাস্থ্য ও নিরাপত্তা ব্যবস্থাপনা পরিকল্পনা (HSMP) প্রণয়ন ও প্রবিধান বাস্তবায়ন; • ট্রাফিক সংকেত, রোড মার্ক, বাম্প, জেব্রা মার্ক, গার্ড রেল ও পোল এবং কার্ব স্টোন ইত্যাদির ব্যবস্থা।
অপারেশন পর্যায় গাড়ীর বেপরোয়া গতির কারনে দুর্ঘটনা ঘটতে পারে	• ট্রাফিক সংকেত, রোড মার্ক, গতি সীমা নিয়ন্ত্রণের সাইন বোর্ড লাগাতে হবে। • গাড়ীর চালকদের সচেতনতা বাড়াতে প্রশিক্ষণ দিতে হবে।

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ইতিবাচক প্রভাব

স্থানীয় অর্থনীতির উপর প্রভাব	• কর্মসংস্থান সৃষ্টি; • নতুন ব্যবসার সুযোগ।
যানজট হ্রাস	• প্রকল্পের কাজ শেষ হলে সড়কে যানজট কমে যাবে।
গতিশীলতা এবং নিরাপত্তা	• ভ্রমণের সময় হ্রাস; • উন্নত নিরাপত্তা এবং যাত্রীদের দুর্ঘটনাজনিত মৃত্যু ও আহতের সংখ্যা কমবে।
লিঙ্গ	• কর্মসংস্থানের সুযোগ সৃষ্টি করে নারীর ক্ষমতায়ন।

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পরিবেশগত ব্যবস্থাপনা পরিকল্পনা

প্রাক-নির্মাণ, নির্মাণ, এবং অপারেশন পর্যায়ের জন্য নিম্নোক্ত বিষয়গুলো অন্তর্ভুক্ত করে পরিবেশগত ব্যবস্থাপনা পরিকল্পনা প্রণয়ন করা হয়েছে,

- সম্ভাব্য প্রভাব, প্রশমন ব্যবস্থা এবং দায়িত্বশীল কর্তৃপক্ষ;
- EMP নির্দেশিত বাজেট বরাদ্দ;
- পরিবেশগত মনিটরিং পরিকল্পনা প্রণয়ন।

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পরিবেশগত ব্যবস্থাপনা পরিকল্পনা (নির্মাণকালীন সময়)

প্রকল্পের কার্যকলাপ	পরিবেশগত প্রভাব	প্রস্তাবিত প্রশমন ব্যবস্থা	বাজেট	দায়িত্ব
সেতু ও ফ্লাইওভার নির্মাণ	বর্জ্য নিষ্পত্তি, ধুলাবালি এবং শব্দ	• নির্ধারিত স্থানে বর্জ্য নিষ্পত্তি; • পানি ছিটানো এবং ধুলাবালি দমন; • শব্দ বাধা এবং শব্দ-নিরোধক সরঞ্জাম ব্যবহার।	ঠিকাদারের কাজের তালিকায় অন্তর্ভুক্ত	**বাস্তবায়ন:** ঠিকাদার **তত্ত্বাবধান:**জেনারেল কনসালটেন্ট, আরএইচডি
বেড়িবাঁধ সড়ক নির্মাণ	নিষ্কাশন ও জলাবদ্ধতা	• ক্রস-ড্রেনেজ অবকাঠামো রক্ষণাবেক্ষণ	ঠিকাদারের কাজের তালিকায় অন্তর্ভুক্ত	**বাস্তবায়ন:** ঠিকাদার **তত্ত্বাবধান:**জেনারেল কনসালটেন্ট, আরএইচডি
নির্মাণের সময় বায়ুর মান	গ্যাসীয় এবং ধূলিকণা নির্গমনের কারণে বায়ুর গুণমান প্রভাবিত হয়	• অনুমোদিত ধুলা নিয়ন্ত্রণ পরিকল্পনা কঠোরভাবে বাস্তবায়ন; • প্রয়োজনীয় বিরতিতে পানি ছিটিয়ে ধুলা দমন করতে হবে।	ঠিকাদারের কাজের তালিকায় অন্তর্ভুক্ত	**বাস্তবায়ন:** ঠিকাদার **তত্ত্বাবধান:**জেনারেল কনসালটেন্ট, আরএইচডি

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পরিবেশগত মনিটরিং পরিকল্পনা

প্যারামিটার	অবস্থানসমূহ	মনিটরিং এর মাধ্যম	হার	বাজেট (বাংলাদেশি টাকা)	দায়িত্বশীল সংস্থা	
					বাস্তবায়নে	তত্ত্বাবধানে
নির্মাণের সময়						
A. বাঁধের রাস্তা এবং সেতু নির্মাণের জন্য পরিবেশগত মনিটরিং পরিকল্পনা						
বায়ুর মান (PM_{10}, $PM_{2.5}$, SO_2, NO_2, CO)	নির্মাণ কাজ এবং পরামর্শিতার প্রয়োজন অনুযায়ী	• বায়ুর মান পরিমাপ এবং বিশ্লেষণ	মাসিক বা পরামর্শদাতার চাহিদা অনুযায়ী	ঠিকাদারের কাজের তালিকায় অন্তর্ভুক্ত	ঠিকাদার	জেনারেল কনসালটেন্ট, আরএইচডি
শব্দের মাত্রা	নির্মাণ কাজ এবং পরামর্শিতার প্রয়োজন অনুযায়ী	• শব্দের মাত্রা পরিমাপ এবং বিশ্লেষণ	মাসিক বা পরামর্শদাতার চাহিদা অনুযায়ী	ঠিকাদারের কাজের তালিকায় অন্তর্ভুক্ত	ঠিকাদার	জেনারেল কনসালটেন্ট, আরএইচডি
ভূপৃষ্ঠস্থ পানির মান (pH, Temp., DO, BOD, COD, TSS, Color, TC, Turbidity, As, Oil & Grease).	নির্মাণ কাজ এবং পরামর্শিতার প্রয়োজন অনুযায়ী	• নমুনা সংগ্রহ এবং পরীক্ষাগার বিশ্লেষণ	মাসিক বা পরামর্শদাতার চাহিদা অনুযায়ী	ঠিকাদারের কাজের তালিকায় অন্তর্ভুক্ত	ঠিকাদার	জেনারেল কনসালটেন্ট, আরএইচডি

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জনগণের সাথে পরামর্শ এবং ফলাফল প্রকাশ

- JICA চায় KII, FGD এবং PCM ইত্যাদি আকারে জনসাধারণের মধ্যে তথ্য প্রকাশ করতে।
- এই (প্রকাশ) সভার মূল উদ্দেশ্য হল সম্ভাব্য পরিবেশগত এবং সামাজিক প্রভাব এবং প্রশমন ব্যবস্থা সম্পর্কে জনগণকে অবহিত করা।
- আরেকটি উদ্দেশ্য হল প্রকল্প বাস্তবায়নের বিষয়ে তাদের মতামত নেয়া।
- এর আগে ২০২১ সালের জানুয়ারিতে, প্রকল্পটি সম্পর্কে অবহিত করার জন্য এবং স্কোপিং পর্যায়ে প্রতিক্রিয়া পাওয়ার জন্য পরামর্শ সভা করা হয়েছিল।

Date	Venue	Time	Types of Participants
January 27, 2021	Chakaria Pourasava, Cox's Bazar	10:30 AM-01:00 PM	• MP, local leaders, project affected people, local residents, businessmen, shop owners, teachers, farmers, housewives, service holders, remittance corners, politicians, imams, students, hawkers, rickshaw pullers, drivers, etc.
January 27, 2021	Amirabad UP Auditorium, Lohagara, Chattogram	03:00 PM-05:00 PM	• Representatives of local government, public leaders, project affected people, local residents, women, elderly people, government and non-government employees, etc.
January 28, 2021	Kerchia UP Auditorium, Satkania, Chattogram	10:00 AM-12:00 PM	• Representatives of local government, public leaders, project affected people, project beneficiaries, local residents, women, elderly people, government and non-government employees, etc.
January 28, 2021	Kaliais UP Auditorium, Satkania, Chattogram	03:00 PM-05:00 PM	• Representatives of local government, public leaders, project affected people, project beneficiaries, local residents, women, elderly people, government and non-government employees, etc.
January 31, 2021	Four Star Convention Hall, Patiya, Chattogram	10:00 AM-01:30 PM	• Representatives of local government, public leaders, project affected people, project beneficiaries, local residents, women, elderly people, government and non-government employees, etc.

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জনগণের সাথে পরামর্শ এবং ফলাফল প্রকাশ

পরামর্শ সভায় অন্তর্ভুক্ত ছিল,

- প্রকল্প বাস্তবায়নকারী কর্তৃপক্ষ
- প্রশাসনিক কর্তৃপক্ষের প্রতিনিধিরা
- প্রকল্পের সুবিধাভোগী
- ক্ষতিগ্রস্ত মানুষ

প্রকল্পের জন্য মোট ১৩ টি FGD এবং ২৩ টি KII করা হয়েছে,

- এফজিডিতে স্থানীয় সম্প্রদায়ের মানুষ, ভূমির মালিক, ভূমির উপর নির্ভরশীল, ব্যবসায়ী এবং মহিলা গোষ্ঠী অন্তর্ভুক্ত ছিল;
- স্থানীয় সরকার প্রশাসন (মৎস্য, কৃষি, শিক্ষা, জনস্বাস্থ্য প্রকৌশল), সড়ক ও জনপথ এবং পরিবেশ অধিদপ্তর।

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জনগণের সাথে পরামর্শ সভা (স্কোপিং স্টেজ)

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অংশীজনদের সাথে KII এবং FGD

নির্বাহী প্রকৌশলীর সাথে KII, আরএইচডি, দোহাজারী সড়ক বিভাগ

লোহাগাড়া উপজেলা কৃষি কর্মকর্তার সাথে KII

ভূমির মালিকদের সাথে FGD, চকরিয়া উপজেলা

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ESIA বাস্তবায়ন

- EMP এবং EMOP এর উপর ভিত্তি করে এনভায়রনমেন্টাল কন্ট্রাক্ট স্পেসিফিকেশন (ECS) তৈরি করা হবে;
- ECS হবে বিড ডকুমেন্টের একটি অবিচ্ছেদ্য অংশ, যা নির্মাণ পর্যায়ে সুরক্ষার দিকটি বজায় রাখার জন্য ঠিকাদারকে বাধ্য করবে;
- ঠিকাদাররা CEMP প্রস্তুত করবে এবং নির্মাণ কাজ শুরু করার আগে নির্মাণ কাজ তদারকি পরামর্শকের কাছ থেকে অনুমোদন নেবেন;
- নির্মাণ পর্যায়ে, ঠিকাদাররা CEMP-তে নির্ধারিত পরিবেশগত প্যারামিটার পর্যবেক্ষণ করবেন এবং প্রতিবেদন তৈরি করবেন;
- পিরিওডিকাল পর্যবেক্ষণ প্রতিবেদন অনুমোদনের জন্য জাইকা এবং পরিবেশ অধিদপ্তরে জমা দেওয়া হবে।

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উপসংহার এবং সুপারিশ

সম্ভাব্য প্রতিকূল প্রভাব	ইতিবাচক প্রভাব	প্রশমন এবং পর্যবেক্ষণ পরিকল্পনা
• বায়ু দূষণ, ভূমি অধিগ্রহণ, অনিচ্ছাকৃত পুনর্বাসন, জীবিকার ক্ষতি, শব্দ ও কম্পন দূষণ, গাছপালা নষ্ট হওয়া, পানি দূষণ ইত্যাদি।	• অবকাঠামোগত উন্নয়ন, স্থানীয় অর্থনীতির উন্নয়ন, যানজট এবং ভ্রমণের সময় হ্রাস, কর্মসংস্থানের সুযোগ।	• নির্মাণ পর্যায় এবং অপারেশন পর্যায়ে প্রভাব কমাতে যথাযথ প্রশমন ব্যবস্থার পরামর্শ দেওয়া হয়েছে। • প্যারামিটার, ফ্রিকোয়েন্সি, বাস্তবায়ন ও তত্ত্বাবধানকারী সংস্থা এবং বাজেটের তথ্য উল্লেখ করে একটি পর্যবেক্ষণ পরিকল্পনা তৈরি করা হয়েছে।

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জনগণের মতামত এবং আলোচনা

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ধন্যবাদ

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Appendix H-20: Non-Technical Summary of the EIA Report

Non-Technical Summary: ESIA Report

Project Name: The Preparatory Study for Chattogram-Cox's bazar Highway Improvement Project in Bangladesh

1. Introduction

1.1 Background of the Study

Chattogram-Cox's Bazar Road is currently two lanes. The existing road condition is not good to operate smooth communication. According to the Matarbari Port Development Project (2017), the necessary travel time from Matarbari Port to Chattogram (approx. 130 km) is estimated to increase from 123 minutes in 2017 to 438 minutes in 2035. So, Roads and Highway Department has intended to debottleneck of five major bottlenecks under the Preparatory study for Chattogram-Cox's Bazar Highway Improvement Project with the assistance of JICA. Anticipating the opening of Matarbari Port, the Chattogram - Cox's Bazar Highway Improvement Project (CCHIP) will contribute to the smooth and safe transport of passengers and freight through the construction of one flyover at Keranihat and four bypass roads at Patiya, Dohazari, Lohagara, and Chakaria of the major transport route N1 between Chattogram and Cox's Bazar.

1.2 Objective of the ESIA Study

An EIA is a systematic process that predicts and evaluates the potential impacts of a project. It also documents the mitigation measures to be implemented to reduce/mitigate these adverse impacts. A comprehensive ESIA study has been carried out for the CCHIP project to identify the potential impact and suggest subsequent mitigation measures following the below method. Another objective of the assessment is to get Environmental Clearance Certificate from the Department of Environment (DoE) and to get approval from the lender, JICA.

1.3 Method of the ESIA Study

Methods undertaken for this ESIA study is as follows:

- Study of relevant documents related to policies, laws and administrative structures and their review, especially environmental aspects and waste disposal limits, health and safety requirements, identification of sensitive areas and endangered species, etc.;
- Conducting surveys for baseline data collection in a planned format and determining the qualitative level of environmental measurement and analysis of collected data;
- Environmental observation of the project area and Baseline status monitoring through sampling.
- Mathematical analysis has been done to determine the future noise levels generated by the project construction work and the movement of vehicles at different distances;
- Identification of major project activities at both construction and operation phases;
- Identifying and predicting the environmental impact of project activities on the surrounding environment;
- Identifying the most significant environmental and social impacts and advising mitigation measures to reduce the negative impact and increase the positive impact;
- Consultation meetings and information disclosure arrangements to consult with potential PAPs as well as local people;
- Preparation of Environmental Management Plan (EMP) for construction phase as well as operation phase.

2. Policy, Law and Administrative Framework

There are several policies, laws, and rules related to environmental protection and safeguard established in Bangladesh. All policies, laws and rules have been reviewed and applicability has been incorporated in the report. Besides the national law, policy and rules, JICA guidelines for Environmental and Social consideration also followed to report preparation.

No project shall be taken except the issuance of environmental clearance by the Director General of the Department of Environment in the manner prescribed by the Environmental Conservation Rules 1997 framed in the light of Article 12 of the Environmental Protection Act, 1995. Therefore, it is mandatory to obtain site and environmental clearance from the Department of Environment in favor of each development project / industry prescribed under Schedule-I of Environmental Conservation Rules, 1997. According to the Rule 7(1) of the Environmental Conservation Rules, 1997, all projects are classified into four categories, namely, Green, Orange A, Orange B, and Red, considering the location of the project and its impact on the environment. The Chittagong-Cox's Bazar Highway Improvement Project is classified as "Red". EIA survey is mandatory for this project as it is a red category project.

In addition to the ECC, other laws and ordinances relating to resettlement, land acquisition, and compensation are relevant to the project. Acquisition and Requisition of Immovable Property Act (ARIPA) 2017 is the main legal framework for land acquisition in Bangladesh.

3. Project Description

Brief description of the project is given below:

Name of the project	Chattogram-Cox's Bazar Highway Improvement Project (CCHIP)
Implementation and management	Roads and Highways Department (RHD)
Ministries responsible	Road Transport and Highway Division, Ministry of Road Transport and Bridges
Financed By	GoB and JICA
Type of Infrastructure (Super Structure)	Patiya Outer Road - 5.419 km, 4 lanes (space allocated for 6 lanes) Dohazari Outer Road - 3.266 km, 4 lanes (space allocated for 6 lanes) Keranihat Flyover - 3.448 km, 6 lanes Lohagara Outer Road - 5.397 km, 4 lanes (space allocated for 6 lanes) Chakaria Outer Road, 6.840 km, 4 lanes Each outer road will have service lanes on both sides of the road for slow moving vehicles
Type of Infrastructure (Sub Structure)	In addition to the four outer roads and a flyover, the project covers the improvement of minor bottlenecks including 15.13 km in the Chittagong section, 670 m in the Bandarban section and 12.60 km in Cox's Bazar part of the Chittagong-Cox's Bazar highway.
Type of Infrastructure	Bridge construction over the river/canal of Sangu, Tangkabati and Matamuhuri
Construction Period	2025-2028

4. Baseline Environmental Condition

During environmental and social baseline study, physical environment, biological environment, socio-economic status and environmental quality were surveyed and analyzed.

Physical Environment: The project area is situated in south-eastern climatic sub-zone, which covers both Chattogram and Cox's Bazar District. The mean temperature varies from 13 to 32°C and the average rainfall is 254 cm on an annual basis.

Biological Environment: Detailed survey has been conducted for the type of plants, animals and birds found in the project area and recorded in the report. The Chakaria bottleneck is located nearby

Fasiakhali wildlife sanctuary and Kakra reserved forest. Some minor bottlenecks are intersecting Chunati WS, Fasiakhali WS, Medhakacchapia NP, Chunati reserved forest, Fasiakhali reserved forest and Fulchari reserved forest.

Socio-Economic Status: According to BBS, the average family size in the project area is 5.35. Muslims outnumber other religions (87%). The literacy rate in the project area is 54.7% which is lower than the national literacy rate of 56.7%. In the 5 km study area, service sector is the main source of employment. Moreover, 41.4% males and 31% females are involved in agriculture.

Environmental Quality: Ambient air quality has been monitored in 12 locations during monsoon and winter season. Two air quality monitoring locations were selected from each alignment option. Different parameters of air quality, including PM_{10}, $PM_{2.5}$, NO_2, SO_2, and CO have been measured during the monitoring. The results shows that no over standard concentration of any pollutants was found during both monsoon and winter season.

The surface water samples were collected from 10 locations, including two locations from each bottleneck point. The overall condition of surface water is good, except some out of standard range level of pH, DO, and BOD in few sampling locations.

In addition, ambient noise level and vibration level has also been monitored in and around the alignment. Noise level has exceeded the permissible limits in most of the monitoring locations. However, vibration level has been found within the permissible limit of Japanese standards at all the monitoring locations.

5. Environmental Screening and Scoping

According to Environment Conservation Rules, 1997 (ECR, 97) the proposed project (CCHIP) makes reference to the 'RED' category list of DoE and category "A" according to the JICA Guidelines for Environmental and Social Considerations, and thus EIA is necessary to be conducted.

In this chapter, the potential environmental and social effects are initially identified based on the project description and the overall environmental and social conditions in the vicinity (no specific measures for mitigation of the effects are considered at this stage). As per the pollution effects, natural and social environment, health and safety, risk, and others are classified as A to D according to the following criteria:

- A-/A+: Significant negative/positive impact is assumed
- B-/B+: Negative/positive impact is assumed but less than A
- C-/C+: Impact is not clear, need more assessment
- D = Insignificant impact assumed; no further assessment needed

6. Anticipated Environmental Impacts and Mitigation Measures

The probable impacts of construction and operation of Chittagong-Cox's Bazar Highway Improvement Project are presented below.

Component	Impact	Mitigation Measures
Noise and Vibration Level	**Construction Stage** Operations of the heavy equipment at the construction sites, movement of heavy machineries and transportation of vehicles may cause noise and vibration.	• Use low noise generating equipment; • Regular maintenance of machineries and vehicles; • Use heavy equipment with built in noise abatement; • Construct temporary noise barriers (flyover and bridge construction); • Batching plant and asphalt plant, at least 200m from sensitive receptors; • Construct walled enclosures;

Component	Impact	Mitigation Measures
		• Avoid construction activities during night time and holidays in sensitive places; • Provide noise-dampened equipment;
	Operation Stage Vehicle movement in the outer road will create noise and vibration	• Noise barrier around the sensitive receptors • Speed control for vehicles
Air Quality	**Construction Stage** Transport of construction materials, heavy equipment operation and earthworks will generate dust and exhaust gas, temporarily	• Equip all the machineries with appropriate exhaust system; • Operate the vehicles in a fuel-efficient manner; • Cover haul vehicles carrying dusty materials moving outside the construction site; • Impose speed limits on all vehicle movement; • Removal of mud from the wheel at entry and exit point; • Regular water spraying in the construction site; • Machinery causing excess pollution will be temporarily banned;
	Operation Stage The project will decrease road congestion, air pollution will be reduced.	• No additional mitigation measure is needed
Surface Water	**Construction Stage** Turbid water by construction work may deteriorate water quality.	• Temporary drainage line to capture sediment-laden run-off from site; • Sediment fence on the banks of concerned rivers, canals and ponds; • Restrict direct discharge of solid waste and effluent; • Stockpile materials away from drainage lines; • Slurry mixed wastewater from batching plant into settling tank;
	Operation Stage Soil erosion from the newly constructed roads may increase sediment load and turbidity in nearby waterbody.	• Slope and footpath of road should be turfed with grass or paved; • Maintain Road surface properly and regularly.
Soil Pollution	**Construction Stage** Hazardous material like lubricant and bentonite/polymer slurry may cause soil pollution.	• Before site works commence, a Spill Management Plan needed; • Fuel and hazardous substances in paved areas with embankment; • All storage containers in good condition with proper labeling; • Regular check of container for leakage; • Hazardous materials stored above flood level;

Component	Impact	Mitigation Measures
		• Prohibit open toilet without sanitary pit.
Waste	**Construction Stage** Burned oil, lubricants, lithium-ion battery, leakage and spillage, empty containers, slurry, fragments of construction materials and garbage.	• Proper segregation of solid wastes; • Solid waste disposal in an environmentally acceptable manner; • Third party for collection and disposal of solid wastes; • Waste Recycling; • Spoil soil dumping in designated place within 12 hours of generation.
Protected Area	**Construction stage** Construction activities may pose potential threat for PAs within the project AOI	• No construction activities into the PAs. • No waste disposal into the PAs. • No labor camps within 2 kilometers of the boundary of the PAs.
	Operation stage Minor impacts from speedy driving and improper use of horns may impact the wildlife of the PAs	• Proper signage for skipping horns and speed limit.
Biota and Ecosystem	**Construction stage** Construction induced dust, exhausts and spillage may deteriorate plant growth and aquatic ecosystem	• No tree cutdown unless necessary. • Cutting of large trees must be kept to a minimum. • Vegetation should not be used as fuelwood. • Restrict and enforce dumping and storage of spoil and other materials close to trees. • Avoid major construction activities during night hours. • 2 new trees should be planted for each tree felled. • Afforestation.
	Operation stage Vehicle movement induced dust may affect the newly planted saplings.	• Proper care for newly planted saplings; • Provide mulching and fencing for newly planted sapling.
Occupational Health and Safety	**Construction stage** Possibility to occur accidents and incident during construction works	• Provide adequate health care facilities and first aid; • Provide OHS training program; • Provide adequate clean water and lavatory facilities; • Arrangement of clean eating areas • Temporary shelters for resting; • Measures for fire precautions, lighting, safe access, temperature, area signage, labelling of equipment, Hazard codes, ROW, site speed limits, vehicle inspection requirements, SOP, and management; • Ensure appropriate PPE;

Component	Impact	Mitigation Measures
Accidents	**Construction Stage** Construction accidents and road accidents around the project site	• Implement Health and Safety Management Plan (HSMP) rules and regulations; • Provision of traffic sings, road mark, bump, zebra mark, guard rail and pole, and curb stones etc.
	Operation Stage No impact expected	• Traffic signs, road marks, speed limit control sign boards should be put up. • Drivers need to be trained to raise awareness.
Positive Impacts	Impacts on Local Economies	• Employment generation; • New business opportunity;
	Traffic Congestion Reduction	• Road traffic in the major bottleneck will be reduced after project completion;
	Mobility and Safety	• Employment generation; • New business opportunity;

7. Environmental Management Plan

Environmental Management Plan-provided for pre-construction, construction, and operation stage including,

- Possible impacts, mitigation measures and authority responsible.
- Budget allocation indicated in the EMP.
- Provided Environmental monitoring plan.

8. Stakeholder Consultation

Public consultation was conducted during the Environmental Baseline Survey as part of the preparation of the ESIA report. Five public consultation meetings have been organized in five areas to assess the environmental impact targeting interested groups. After the detailed presentation of the project a question-and-answer session was held where questions and opinions of the attendees were taken. The key points raised by the stakeholders are included in the ESIA report.

In addition to public consultation meetings, Key Informant Interviews with experts were conducted during the Environmental Baseline Survey and were included in the ESIA report accordingly.

9. Information Disclosure

The meeting is being held to disclose the information to the public as part of the process of finalizing the ESIA report. It will be published to the public at later stage on RHD's web site.

10. Conclusion and Recommendations

The ESIA report is prepared by identifying potential impacts, evaluating them, and recommending possible mitigation measures for adverse impacts. Potential adverse environmental impacts of the project include air pollution, noise and vibration, plant damage, water pollution, land acquisition, involuntary resettlement and loss of livelihood. On the other hand, the project has some positive impacts which include infrastructural development, development of local economy, reduction of traffic congestion and travel time, employment opportunities etc. Positively, the project will have a negligible impact on the environment and will contribute to the development of sustainable transportation after the implementation of the environmental management and monitoring plan.

পরিবেশগত এবং সামাজিক প্রভাব মূল্যায়ন প্রতিবেদনের সারাংশ

প্রকল্পের নাম: চট্টগ্রাম-কক্সবাজার মহাসড়ক উন্নয়ন প্রকল্প

১. ভূমিকা

১.১ পটভূমি

চট্টগ্রাম-কক্সবাজার সড়ক বর্তমানে দুই লেনের। বিদ্যমান সড়ক মসৃণ যোগাযোগ পরিচালনার জন্য ভালো নয়। মাতারবাড়ী বন্দর উন্নয়ন প্রকল্প (২০১৭) অনুসারে, মাতারবাড়ী বন্দর থেকে চট্টগ্রাম (প্রায় ১৩০ কিমি) ভ্রমণের সময় ২০১৭ সালের ১২৩ মিনিট থেকে ২০৩৫ সালে ৪৩৮ মিনিটে উন্নীত হবে বলে অনুমান করা হয়েছে। ফলশ্রুতিতে, সড়ক ও জনপথ বিভাগ জাইকার সহায়তায় চট্টগ্রাম-কক্সবাজার মহাসড়ক উন্নয়ন প্রকল্পের প্রস্তুতিমূলক সমীক্ষার অধীনে পাঁচটি বড় বাঁক সরলীকরণের জন্য প্রকল্প গ্রহনের সিদ্ধান্ত নিয়েছে। চট্টগ্রাম কক্সবাজার হাইওয়ে ইমপ্রুভমেন্ট প্রজেক্ট (সিসিএইচআইপি) এর অধীনে কেরানীহাটে একটি ফ্লাইওভার এবং পটিয়া, দোহাজারী, লোহাগাড়া এবং চকরিয়ায় চারটি বাইপাস সড়ক নির্মাণের মাধ্যমে যাত্রী ও মালামাল মসৃণ ও নিরাপদ পরিবহনে অবদান রাখবে।

১.২ সমীক্ষার উদ্দেশ্য

পরিবেশগত এবং সামাজিক প্রভাব মূল্যায়ন (ইএসআইএ) অধ্যয়নের মূল উদ্দেশ্য হল পরিবেশগত এবং আর্থ-সামাজিক প্রভাব চিহ্নিত করা, মূল্যায়ন করা এবং প্রতিবেদন প্রস্তুত করা। এই প্রক্রিয়ার মধ্যে রয়েছে প্রশমনমূলক ব্যবস্থাগুলি চিহ্নিত করা যা সম্ভাব্য নেতিবাচক পরিবেশগত ও সামাজিক প্রভাব কমাতে বা দূর করতে ব্যবহার করা হয়। ইএসআইএ প্রতিবেদন প্রস্তুত করার আরেকটি মূল উদ্দেশ্য হল পরিবেশ অধিদপ্তর (ডিওই) হতে উক্ত প্রকল্পের অধীনে ছাড়পত্র গ্রহন ও আর্থিক সহায়তাকারী প্রতিষ্ঠান জাইকা হতে প্রতিবেদন অনুমোদন করা।

১.৩ সমীক্ষা পরিচালনার পদ্ধতি

এই ইএসআইএ প্রতিবেদন তৈরির জন্য গৃহীত পদ্ধতি নিম্নরূপ:

- নীতি, আইন ও প্রশাসনিক কাঠামো এবং তাদের পর্যালোচনা সম্পর্কিত প্রাসঙ্গিক নথি অধ্যয়ন, বিশেষ করে পরিবেশগত দিক এবং বর্জ্য নিষ্কাশন সীমা, স্বাস্থ্য ও নিরাপত্তার প্রয়োজনীয়তা, সংবেদনশীল এলাকা ও বিপন্ন প্রজাতি চিহ্নিতকরণ ইত্যাদি;
- পরিকল্পিত বিন্যাসে বেসলাইন উপাত্ত সংগ্রহের জন্য জরিপ পরিচালনা এবং পরিবেশগত পরিমাপকের গুনগত মাত্রা নির্ণয় ও সংগৃহীত উপাত্ত বিশ্লেষণ;
- প্রকল্প এলাকার পরিবেশগত পর্যবেক্ষণ এবং নমুনার মাধ্যমে বেসলাইন অবস্থা লিপিবদ্ধকরণ;
- প্রকল্পের নির্মাণ কাজ ও গাড়ী চলাচলের ফলে ভবিষ্যতে উৎপন্ন শব্দের মাত্রা বিভিন্ন দূরত্বে নির্ণয়ের জন্য গাণিতিক বিশ্লেষণ করা হয়েছে;
- প্রকল্পের নির্মাণ ও নির্মাণ পরবর্তী/পরিচালন উভয় পর্যায়ে প্রধান প্রকল্প কার্যক্রম চিহ্নিতকরণ;
- পারিপার্শ্বিক পরিবেশের উপর প্রকল্প কার্যক্রমের পরিবেশগত প্রভাব চিহ্নিতকরণ এবং পূর্বাভাস;
- সবচেয়ে উল্লেখযোগ্য পরিবেশগত এবং সামাজিক প্রভাব চিহ্নিতকরণ এবং নেতিবাচক প্রভাব হ্রাস ও ইতিবাচক প্রভাব বৃদ্ধির জন্য প্রশমন ব্যবস্থার পরামর্শ প্রদান;
- সম্ভাব্য ক্ষতিগ্রস্ত ব্যক্তিদের পাশাপাশি স্থানীয় জনগণের সাথে পরামর্শ করার জন্য মতবিনিময় সভা এবং তথ্য উন্মুক্তকরণ ব্যবস্থা; এবং
- প্রকল্পের নির্মাণ পর্যায়ের পাশাপাশি নির্মাণ পরবর্তী/পরিচালন পর্যায়ের জন্য পরিবেশ ব্যবস্থাপনা পরিকল্পনা (ইএমপি) প্রণয়ন।

২ নীতি, আইন, এবং প্রশাসনিক কাঠামো

পরিবেশ সংরক্ষণ আইন ১৯৯৫ এর অনুচ্ছেদ ১২ এর আলোকে প্রণীত পরিবেশ সংরক্ষণ বিধিমালা ১৯৯৭ দ্বারা নির্ধারিত পদ্ধতিতে পরিবেশ অধিদপ্তরের মহাপরিচালক কর্তৃক পরিবেশগত ছাড়পত্র প্রদান ব্যাতিত কোন প্রকল্প গৃহীত হবে না। সুতরাং, পরিবেশ সংরক্ষণ বিধিমালা ১৯৯৭ এর তফসিল ১ এর অধীনে নির্ধারিত প্রতিটি উন্নয়ন প্রকল্প/শিল্পের অনুকূলে পরিবেশ অধিদপ্তর থেকে অবস্থানগত ও পরিবেশগত ছাড়পত্র নেওয়া বাধ্যতামূলক। পরিবেশ সংরক্ষণ বিধিমালা ১৯৯৭ এর বিধি ৭(১) অনুযায়ী পরিবেশগত ছাড়পত্র প্রদানের উদ্দেশ্যে প্রকল্পের অবস্থান ও পরিবেশের উপর প্রভাব বিবেচনা করে সকল প্রকল্পকে চারটি ক্যাটাগরিতে ভাগ করা হয়েছে, যথা- সবুজ, কমলা ক, কমলা খ, এবং লাল। চট্টগ্রাম-কক্সবাজার হাইওয়ে ইমপ্রুভমেন্ট প্রকল্পটি "লাল" শ্রেণীভুক্ত। লাল শ্রেণীভুক্ত হওয়ার কারণে এই প্রকল্পের জন্য ইআইএ সমীক্ষা করা বাধ্যতামূলক।

ইসিসি ছাড়াও পুনর্বসন, ভূমি অধিগ্রহণ, এবং ক্ষতিপূরণ সংক্রান্ত অন্যান্য আইন ও অধ্যাদেশ প্রকল্পের জন্য প্রাসঙ্গিক। স্থাবর সম্পত্তি অধিগ্রহণ ও হুকুম দখল আইন ২০১৭ বাংলাদেশে ভূমি অধিগ্রহণ পরিচালনার প্রধান আইনি কাঠামো।

৩ প্রকল্পের বিবরণ

প্রকল্পের সংক্ষিপ্ত বিবরন নিম্নে দেওয়া হল

প্রকল্পের নাম	চট্টগ্রাম - কক্সবাজার হাইওয়ে ইমপ্রুভমেন্ট প্রজেক্ট
বাস্তবায়ন ও ব্যবস্থাপনা	সড়ক ও জনপথ বিভাগ (আরএইচডি)
সংশ্লিষ্ট মন্ত্রণালয়	সড়ক পরিবহন ও মহাসড়ক বিভাগ, সড়ক পরিবহন ও সেতু মন্ত্রণালয়
অর্থায়নে	গণপ্রজাতন্ত্রী বাংলাদেশ সরকার এবং জাইকা
অবকাঠামোর ধরন (প্রধান অবকাঠামো)	পটিয়া বাউটার রোড- ৫.২৩ কি.মি., ৪ লেন (৬ লেনের জন্য জায়গা রাখা হয়েছে) দোহাজারি আউটার রোড- ৩.৫১ কি.মি., ৪ লেন (৬ লেনের জন্য জায়গা রাখা হয়েছে) কেরানিহাট ফ্লাইওভার- ৩.৩০ কি.মি., ৬ লেন লোহাগাড়া আউটার রোড- ৪.২৭ কি.মি., ৪ লেন (৬ লেনের জন্য জায়গা রাখা হয়েছে) চকোরিয়া আউটার রোড, ৭.৯২ কি.মি., ৪ লেন প্রতিটি আউটার রোডে ধীরগতির গাড়ী চলাচলের জন্য রাস্তার উভয় পাশে সার্ভিস লেন থাকবে
(উপ অবকাঠামো)	চারটি আউটার রোড ও একটি ফ্লাইওভার ছাড়াও এই প্রকল্পের অধীনে পটিয়াতে প্রায় ৪,৪৫৭ কিমি, দোহাজারীতে ৫.৭৮৯ কিমি, লোহাগাড়ায় ০.৫১৩ কিমি, চকরিয়াতে ৭.৩০৯ কিমি এবং চকরিয়া থেকে কক্সবাজার পর্যন্ত ১৬.৯২১ কিমি হোটোখাটো বাঁক সরলীকরণ ও রাস্তা উন্নয়ন করা হবে।
অবকাঠামোর ধরন	সাঙ্গু, টংকাবতি, মাতামুহুরি নদী/খালের উপর সেতু নির্মাণ
নির্মাণকাল	২০২৫-২০২৮

৪ পরিবেশগত ভিত্তি উপাত্ত (বেসলাইন)

পরিবেশগত এবং সামাজিক বেসলাইন অধ্যয়নের সময়, ভৌত পরিবেশ, জৈবিক পরিবেশ, আর্থ-সামাজিক অবস্থা এবং পরিবেশগত মান জরিপ ও বিশ্লেষণ করা হয়েছে।

ভৌত পরিবেশঃ প্রকল্প এলাকাটি দক্ষিণ-পূর্ব জলবায়ু উপ-জোনে অবস্থিত। গড় তাপমাত্রা ১৩ থেকে ৩২ ডিগ্রি সেলসিয়াসের মধ্যে পরিবর্তিত হয় এবং বার্ষিক ভিত্তিতে গড় বৃষ্টিপাত ২৫৪ সেমি।

জৈবিক পরিবেশঃ প্রকল্প এলাকায় কি ধরনের গাছপালা, পশু-পাখি পাওয়া যায় তার জন্য বিস্তারিত জরিপ করা হয়েছে ও প্রতিবেদনে লিপিবদ্ধ করা হয়েছে। চকরিয়া আউটার রোডটি ঘাসিয়াখালী বন্যপ্রাণী অভয়ারণ্য এবং কাকাড়া সংরক্ষিত বনের কাছাকাছি অবস্থিত।

বিদ্যমান রাস্তার প্রস্তাবিত উন্নয়নের কিছু অংশ চুনতি ও ফাসিয়াখালী বন্যপ্রাণী অভয়ারণ্য, মেধাকচ্ছপিয়া জাতীয় উদ্যান, চুনতি, ফাসিয়াখালী এবং ফুলছড়ি সংরক্ষিত বনের মধ্য অবস্থিত।

আর্থ-সামাজিক অবস্থাঃ বিবিএস এর তথ্য মতে প্রকল্প এলাকার ৭৬ পরিবারের আকার ৫.৩৫। অন্যান্য ধর্মের তুলনায় মুসলিমরা সংখ্যায় প্রধান (৮৭%) । প্রকল্প এলাকার মধ্যে শিক্ষিত লোকের হার ৫৪.৭% যা জাতীয় সাক্ষরতার হার ৫৬.৭% থেকে কম। ৫ কিমি অধ্যয়ন এলাকায়, চাকুরি হচ্ছে কর্মসংস্থানের প্রধান উৎস। তাছাড়া ৪১.৪% পুরুষ এবং ৩১% মহিলা কৃষিকাজে জড়িত।

পরিবেশের গুনগত মানঃ বর্ষা ও শীত মৌসুমে ১২ টি স্থানে পরিবেষ্টিত বায়ুর গুণমান পর্যবেক্ষণ করা হয়েছে। প্রতিটি আউটার ও ফ্লাইওভার প্রকল্প এলাকা থেকে দুটি করে বায়ুর গুণমান পর্যবেক্ষণ করা হয়েছে। উক্ত বায়ু পর্যবেক্ষণের সময় সাতটি পরিমাপক পর্যবেক্ষণ করা হয়েছিল, যথা- পিএম$_{১০}$, পিএম$_{২.৫}$, নাইট্রোজেন ডাই অক্সাইড, সালফার ডাই অক্সাইড ও কার্বন মনোক্সাইড। ফলাফলগুলি দেখায় যে বর্ষা এবং শীত উভয় ঋতুতে সব কয়টি পরিমাপক বাংলাদেশের বায়ুর মানমাত্রার মধ্যে ছিল।

পরিবেশগত ভিত্তি জরিপের সময় প্রতিটি প্রকল্প এলাকা থেকে মোট দশটি ভূ-উপরস্থ পানির নমুনা নেওয়া হয়েছে। এই জরিপে দেখা যায় কয়েকটি নমুনায় পি এইচ, দ্রবীভূত অক্সিজেন এবং বিওডি এর ঘনত্ব অনুমোদিত মানদণ্ডের বাইরে। অন্যান্য পরিমাপকগুলো অনুমোদিত মানদণ্ডের মধ্যে রয়েছে।

প্রকল্প এলাকায় বেশিরভাগ জরিপ এলাকায় শব্দের মাত্রা অনুমোদিত সীমা ছাড়িয়ে গেছে। অন্যদিকে, সমস্ত জরিপ এলাকায় কম্পনের মাত্রা জাপানি মানদণ্ডের অনুমোদিত সীমার মধ্যে পাওয়া গেছে।

৫ পরিবেশগত প্রভাব বাছাইকরণ (স্ক্রিনিং) ও বিস্তৃতি (স্কোপিং) পর্যালোচনা

প্রকল্পটি বাংলাদেশের পরিবেশ সংরক্ষণ বিধিমালা ১৯৯৭ অনুসারে "লাল" শ্রেণী ও জাইকার পরিবেশ নির্দেশিকা অনুসারে 'এ' শ্রেণীর অন্তর্ভুক্ত, এবং এই পরিপ্রেক্ষিতে ইআইএ বাধ্যতামূলক।

এই অধ্যায়ে, উক্ত প্রকল্পের বিবরণ এবং তার আশেপাশের সামগ্রিক পরিবেশ ও সামাজিক অবস্থার উপর ভিত্তি করে প্রাথমিকভাবে সম্ভাব্য পরিবেশগত ও সামাজিক প্রভাব চিহ্নিত করা হয়েছে (এ পর্যায়ে প্রভাবগুলোর প্রশমনের জন্য কোন নির্দিষ্ট ব্যবস্থা বিবেচনায় আনা হয়নি)। দূষণের প্রভাব, প্রাকৃতিক ও সামাজিক পরিবেশ, স্বাস্থ্য ও নিরাপত্তা, ঝুঁকি, এবং অন্যান্য নিম্নলিখিত মানদণ্ড অনুসারে এ থেকে ডি হিসেবে শ্রেণীবদ্ধ করা হয়েছে:

১) এ-/ এ+: উল্লেখযোগ্য নেতিবাচক/ইতিবাচক প্রভাব

২) বি-/ বি+: কিছু নেতিবাচক/ইতিবাচক প্রভাব

৩) সি-/ সি+: প্রভাবগুলো স্পষ্ট নয়, আরও পর্যালোচনা প্রয়োজন

৪) ডি: প্রভাবগুলি নগণ্য, আর পর্যালোচনা প্রয়োজন নেই

৬ প্রত্যাশিত পরিবেশগত প্রভাব এবং তাদের প্রশমন ব্যবস্থা

চট্টগ্রাম-কক্সবাজার মহাসড়ক উন্নয়ন প্রকল্প নির্মাণ ও পরিচালনার কারণে সম্ভাব্য প্রভাবগুলো নিম্নে উপস্থাপন করা হয়েছে।

উপাদান	প্রভাব	প্রশমন ব্যবস্থা
শব্দ ও কম্পন মাত্রা	**নির্মাণ পর্যায়** নির্মাণস্থলে ভারী যন্ত্রপাতি চলাচল, এবং যানবাহন চলাচলের কারণে শব্দ ও কম্পন হতে পারে।	• কম শব্দ উৎপন্নকারী সরঞ্জাম ব্যবহার; • যন্ত্রপাতি এবং যানবাহন নিয়মিত রক্ষণাবেক্ষণ; • অভ্যন্তরীণ শব্দ প্রতিরোধক ব্যবস্থা সম্পন্ন ভারী যন্ত্রপাতি ব্যবহার; • অস্থায়ী শব্দ বাধা নির্মাণ (ফ্লাইওভার এবং সেতু নির্মাণ এলাকায়);

উপাদান	প্রভাব	প্রশমন ব্যবস্থা
		• সংবেদনশীল স্থানে রাতের সময় এবং ছুটির দিনে নির্মাণ কার্যক্রম এড়িয়ে চলা।
	অপারেশন পর্যায় বাইপাস সড়কে যানবাহন চলাচলে শব্দ ও কম্পন সৃষ্টি হবে	• সংবেদনশীল রিসেপ্টরগুলির চারপাশে শব্দ বাধা নির্মাণ করা। • গাড়ির গতি নিয়ন্ত্রণ করা
বায়ুর মান	**নির্মাণ পর্যায়** নির্মাণ সামগ্রী পরিবহন, ভারী যন্ত্রপাতির অপারেশন এবং মাটির কাজ সাময়িকভাবে ধুলো এবং নিষ্কাশন গ্যাস উৎপন্ন করবে।	• উপযুক্ত নির্গমন নিয়ন্ত্রণ ব্যবস্থা সম্পন্ন যন্ত্রপাতি ব্যবহার; • জ্বালানী-সাশ্রয়ী পদ্ধতিতে যানবাহন পরিচালনা; • নির্মাণ সাইটের বাইরে চলাচলকারী মাটি বহনকারী যানবাহন ঢেকে রাখা; • সকল যানবাহন চলাচলের উপর গতিসীমা আরোপ করা; • প্রবেশ এবং প্রস্থানের সময় চাকা থেকে কাদা অপসারণ; • নির্মাণ এলাকায় নিয়মিত পানি ছিটানো; • অতিরিক্ত দূষণ সৃষ্টিকারী যন্ত্রপাতি সাময়িকভাবে ব্যবহার না করা;
	অপারেশন পর্যায় প্রকল্পের ফলে সড়কের যানজট কমবে, বায়ু দূষণও কমবে।	• কোন অতিরিক্ত প্রশমন ব্যবস্থা প্রয়োজন নাই।
ভূ-উপরস্থ পানি	**নির্মাণ পর্যায়** নির্মাণ কাজের দ্বারা সৃষ্ট ঘোলা পানি, নিকটবর্তী ভূ-উপরস্থ পানি দূষণের কারন হতে পারে।	• নির্মাণ এলাকা থেকে পলি-মিশ্রিত পানি প্রবাহ বন্ধ করতে অস্থায়ী নিষ্কাশন ব্যবস্থা করা; • সংশ্লিষ্ট নদী, খাল ও পুকুরের তীরে পলি আটকানোর ব্যবস্থা রাখা; • কঠিন বর্জ্য এবং তরল বর্জ্য সরাসরি নিষ্কাশন না করা; • নিষ্কাশন লাইন থেকে দূরে উপকরণ মজুদ রাখা; • ব্যাচিং প্লান্ট থেকে ক্ষারি মিশ্রিত বর্জ্য সেটলিং ট্যাঙ্কে রাখা;
	অপারেশন পর্যায় নবনির্মিত রাস্তার মাটির ক্ষয় কাছাকাছি জলাশয়ে পলির স্তর এবং দূষণ বাড়াতে পারে।	• রাস্তার ঢাল এবং ফুটপাথে ঘাস লাগানো বা পাকা করা যেতে পারে; • রাস্তার উপরিভাগ সঠিকভাবে এবং নিয়মিত রক্ষণাবেক্ষণ করতে হবে।
মাটি দূষণ	**নির্মাণ পর্যায়** লুব্রিকেন্ট এবং বেনটোনাইট/পলিমার স্লারির মতো বিপজ্জনক উপাদান মাটি দূষণের কারণ হতে পারে।	• সাইটের কাজ শুরু করার আগে, একটি স্পিল ম্যানেজমেন্ট প্লান করতে হবে; • জ্বালানী এবং বিপজ্জনক পদার্থ বাঁধ সহ পাকা জায়গায় রাখতে হবে; • সঠিক লেবেল সহ ভাল পাত্রে সব উপকরণ মজুদ রাখতে হবে; • চুইয়ে পড়া প্রতিরোধ করার জন্য নিয়মিত পরিদর্শন করতে হবে; • বন্যা স্তরের উপরে বিপজ্জনক উপকরণ সংরক্ষণ করতে হবে; • স্যানিটারি পিট ছাড়া খোলা পায়খানা নিষিদ্ধ করতে হবে।
বর্জ্য	**নির্মাণ পর্যায়**	• কঠিন বর্জ্য সঠিকভাবে পৃথকীকরণ করতে হবে; • একটি পরিবেশগতভাবে গ্রহণযোগ্য পদ্ধতিতে কঠিন বর্জ্য নিষ্পত্তি করতে হবে;

উপাদান	প্রভাব	প্রশমন ব্যবস্থা
	পোড়া তেল, লুব্রিকেন্ট, লিথিয়াম-আয়ন ব্যাটারি এবং স্পিলেজ, খালি পাত্র, ড্রাম, নির্মাণ সামগ্রীর টুকরো এবং আবর্জনা।	• কঠিন বর্জ্য সংগ্রহ ও নিষ্পত্তির জন্য তৃতীয় পক্ষকে নিয়োজিত রাখতে হবে; • বর্জ্য পুনঃপ্রক্রিয়াজাতকরণ করতে হবে; • উৎপন্ন হওয়ার ১২ ঘন্টার মধ্যে নির্ধারিত স্থানে অব্যবহৃত মাটি ডাম্পিং করতে হবে।
সংরক্ষিত এলাকা	**নির্মাণ পর্যায়** নির্মাণ কার্যক্রম প্রকল্পের প্রভাব এলাকার মধ্যে সংরক্ষিত এলাকার জন্য সম্ভাব্য হুমকি সৃষ্টি করতে পারে	• সংরক্ষিত এলাকাতে কোনো নির্মাণ কার্যক্রম করা যাবে না; • সংরক্ষিত এলাকার মধ্যে কোন বর্জ্য নিষ্পত্তি করা যাবে না; • সংরক্ষিত এলাকার সীমানার ২ কিলোমিটারের মধ্যে কোন শ্রমিক আবাসন ক্যাম্প করা যাবে না।
	অপারেশন পর্যায় দ্রুত ড্রাইভিং এবং হর্নের অনুপযুক্ত ব্যবহার থেকে সৃষ্ট প্রভাব সংরক্ষিত এলাকার বন্যজীবনকে প্রভাবিত করতে পারে	• হর্ন এবং গতিসীমা মানার জন্য সঠিক সংকেত ব্যবহার করতে হবে।
জীব এবং বাস্তুসংস্থান	**নির্মাণ পর্যায়** নির্মাণ জনিত ধূলিকণা, নিষ্কাশন এবং স্পিলেজ গাছের বৃদ্ধি এবং জলজ বাস্তুতন্ত্রের ক্ষতি করতে পারে	• আবশ্যক প্রয়োজন ছাড়া গাছ কাটা যাবে না; • বড় গাছ কাটা সীমিত পরিসরে রাখতে হবে; • প্রকল্পের জ্বালানী হিসাবে গাছপালা ব্যবহার করা যাবে না; • নির্মাণ সামগ্রীর ডাম্পিং এবং মজুদ গাছপালা ঘেরা এলাকায় করা যাবে না; • রাতের সময় বড় নির্মাণ কার্যক্রম এড়িয়ে চলতে হবে; • বনায়ন করতে হবে।
	অপারেশন পর্যায় যানবাহন চলাচলের কারনে সৃষ্ট ধূলা নতুন রোপণ করা চারার বৃদ্ধি প্রভাবিত করতে পারে।	• সদ্য রোপিত চারার সঠিক পরিচর্যা করতে হবে; • সদ্য রোপিত চারার জন্য বেড়া প্রদান করতে হবে।
পেশাগত স্বাস্থ্য এবং নিরাপত্তা	**নির্মাণ পর্যায়** নির্মাণ কাজের সময় দুর্ঘটনা ঘটার সম্ভাবনা আছে	• পর্যাপ্ত স্বাস্থ্যসেবা সুবিধা এবং প্রাথমিক চিকিৎসা প্রদান; • প্রশিক্ষণ প্রদান; • পর্যাপ্ত বিশুদ্ধ পানি ও শৌচাগার সুবিধা প্রদান; • পরিষ্কার খাওয়ার জায়গার ব্যবস্থা করা • বিশ্রামের জন্য অস্থায়ী আশ্রয়; • অগ্নি সতর্কতা, আলো, নিরাপদ প্রবেশাধিকার, তাপমাত্রা, সতর্ক সংকেত, সরঞ্জামের লেবেল, বিপদ কোড, চলাচলের পথ, সাইটের গতি সীমা, যানবাহন পরিদর্শনের ব্যবস্থা • উপযুক্ত স্বাস্থ্য সুরক্ষার সরঞ্জাম নিশ্চিত করা।
দুর্ঘটনা	**নির্মাণ পর্যায়** প্রকল্প স্থানের আশপাশে নির্মাণ জনিত দুর্ঘটনা ও সড়ক দুর্ঘটনা	• স্বাস্থ্য ও নিরাপত্তা ব্যবস্থাপনা পরিকল্পনা প্রণয়ন ও প্রবিধান বাস্তবায়ন; • ট্রাফিক সংকেত, রোড মার্ক, বাম্প, জেব্রা মার্ক, গার্ড রেল ও পোল এবং কার্ব স্টোন ইত্যাদির ব্যবস্থা।
	অপারেশন পর্যায় গাড়ীর বেপরোয়া গতির কারনে দুর্ঘটনা ঘটতে পারে	• ট্রাফিক সংকেত, রোড মার্ক, গতি সীমা নিয়ন্ত্রণের সাইন বোর্ড লাগাতে হবে। • গাড়ীর চালকদের সচেতনতা বাড়াতে প্রশিক্ষণ দিতে হবে

ইতিবাচক প্রভাব	স্থানীয় অর্থনীতির উপর প্রভাব	• কর্মসংস্থান সৃষ্টি; • নতুন ব্যবসার সুযোগ।
	যানজট হ্রাস	• প্রকল্পের কাজ শেষ হলে সড়কে যানজট কমে যাবে।
	গতিশীলতা এবং নিরাপত্তা	• ভ্রমণের সময় হ্রাস; • উন্নত নিরাপত্তা এবং যাত্রীদের দুর্ঘটনাজনিত মৃত্যু ও আহতের সংখ্যা কমবে।

৭ পরিবেশ ব্যবস্থাপনা পরিকল্পনা

প্রাক-নির্মাণ, নির্মাণ, এবং অপারেশন পর্যায়ের জন্য নিম্নোক্ত বিষয়গুলো অন্তর্ভুক্ত করে পরিবেশগত ব্যবস্থাপনা পরিকল্পনা প্রণয়ন করা হয়েছে,

- সম্ভাব্য প্রভাব, প্রশমন ব্যবস্থা এবং দায়িত্বশীল কর্তৃপক্ষ;
- পরিবেশ ব্যবস্থাপনা পরিকল্পনা নির্দেশিত বাজেট বরাদ্দ;
- পরিবেশগত মনিটরিং পরিকল্পনা প্রণয়ন।

৮ জনসাধারণের সাথে মতবিনিময়

ইএসআইএ প্রতিবেদন প্রস্তুতির অংশ হিসেবে পরিবেশগত ভিত্তি জরিপ চলাকালীন সময় জনসাধারণের পরামর্শ গ্রহণ করা হয়েছে। পাঁচটি এলাকায় আগ্রহী গোষ্ঠীকে লক্ষ্য করে পরিবেশগত প্রভাব নিরূপণের জন্য পাঁচটি মতবিনিময় সভা অনুষ্ঠিত হয়েছে। প্রকল্পের বিস্তারিত উপস্থাপনার পরে একটি প্রশ্নোত্তর পর্ব রাখা হয় যেখানে উপস্থিতিদের প্রশ্ন ও মতামত গ্রহণ করা হয়। অংশীজনদের উপস্থাপিত গুরুত্বপূর্ণ মূল বিষয়সমূহ ইআইএ প্রতিবেদনে অন্তর্ভুক্ত করা হয়েছে।

জনসাধারণের সাথে মতবিনিময় সভার পাশাপাশি পরিবেশগত ভিত্তি জরিপের সময় বিশেষজ্ঞদের একক সাক্ষাৎকারও নেওয়া হয়েছে এবং ইএসআইএ প্রতিবেদনে অন্তর্ভুক্ত করা হয়েছে।

৯.২ তথ্য প্রকাশ

এই ইএসআইএ রিপোর্ট চূড়ান্ত করণ প্রক্রিয়ার অংশ হিসেবে জনগনের কাছে তথ্য উন্মুক্তের জন্য এই মতবিনিময় সভা হচ্ছে। পরবর্তীতে আরএইচডি এর ওয়েব সাইটে সর্বসাধারণের জন্য প্রকাশ করা হবে।

১০ উপসংহার এবং সুপারিশমালা

ইএসআইএ প্রতিবেদনটি সম্ভাব্য প্রভাবগুলো চিহ্নিতকরণ, তাদের মূল্যায়ন এবং প্রতিকূল প্রভাবগুলোর জন্য সম্ভাব্য প্রশমন ব্যবস্থার সুপারিশের মাধ্যমে প্রস্তুত করা হয়েছে। প্রকল্পের সম্ভাব্য বিরূপ পরিবেশগত প্রভাবগুলোর মধ্যে রয়েছে বায়ু দূষণ, শব্দ ও কম্পন, গাছপালার ক্ষতি, পানি দুষণ, ভূমি অধিগ্রহণ, অনৈচ্ছিক পুনর্বাসন ও জীবিকার ক্ষতি ইত্যাদি। অন্যদিকে প্রকল্পের কিছু ইতিবাচক প্রভাব আছে যার মধ্যে রয়েছে অবকাঠামোগত উন্নয়ন, স্থানীয় অর্থনীতির উন্নয়ন, যানজট এবং ভ্রমণের সময় হ্রাস, কর্মসংস্থানের সুযোগ ইত্যাদি। ইতিবাচকভাবে উপসংহারে হিসাবে বলা যায় যে পরিবেশ ব্যবস্থাপনা এবং পর্যবেক্ষণ পরিকল্পনা বাস্তবায়নের পর প্রকল্পটি পরিবেশের উপর নগণ্য প্রভাব ফেলবে এবং টেকসই পরিবহন উন্নয়নে সহায়তা করবে।

Appendix H-21: First round FGD Photographs

	
FGD with Land Owner	FGD with local community
	
FGD with Community People	FGD with Land Dependents
	
FGD with Women Group	FGD with Community people

	
FGD with local community	FGD with land owner
	
FGD with Business Owner	FGD with Business Owner
	
FGD with women group	FGD with women group

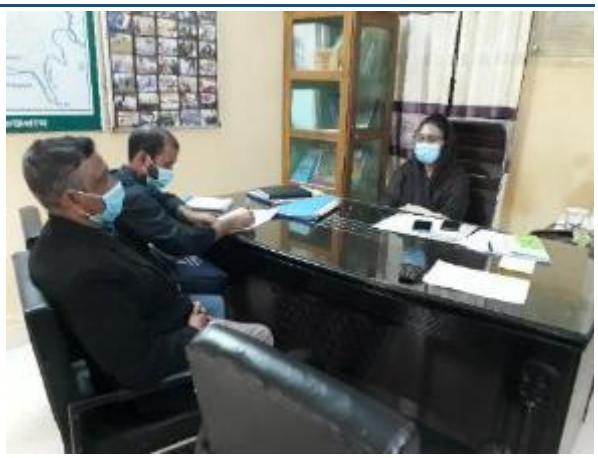
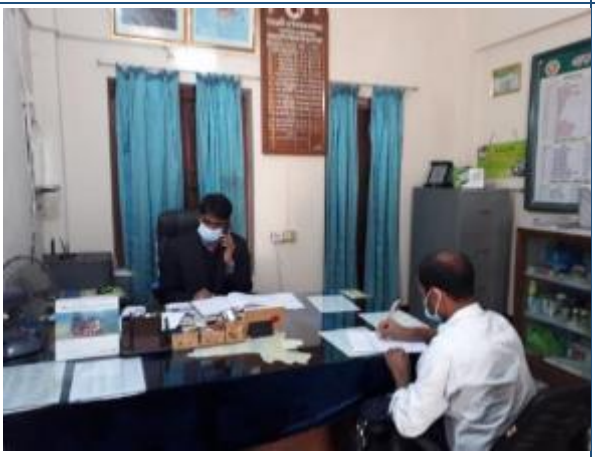
	
FGD with land owner	FGD with Local Community

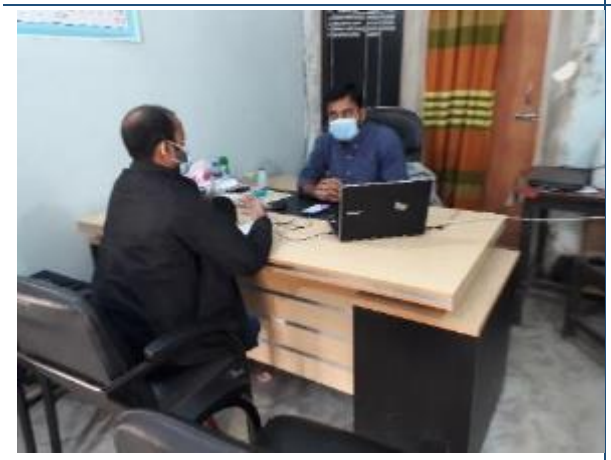
Appendix H-22: Second round FGD Photographs

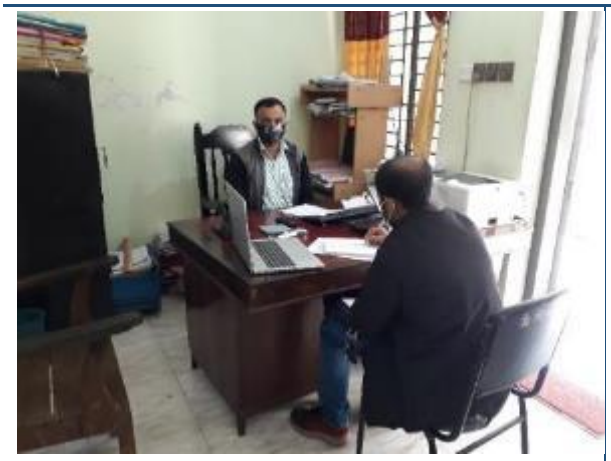
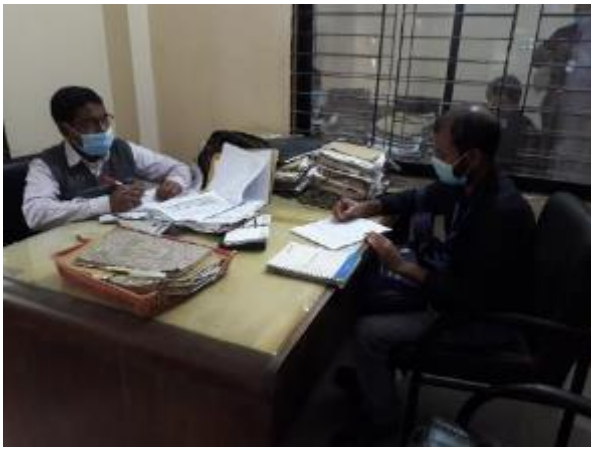
	
FGD with Landowner	FGD with local community
	
FGD with Community People	FGD with Land Dependents
	
FGD with Women Group	FGD with Land Owner

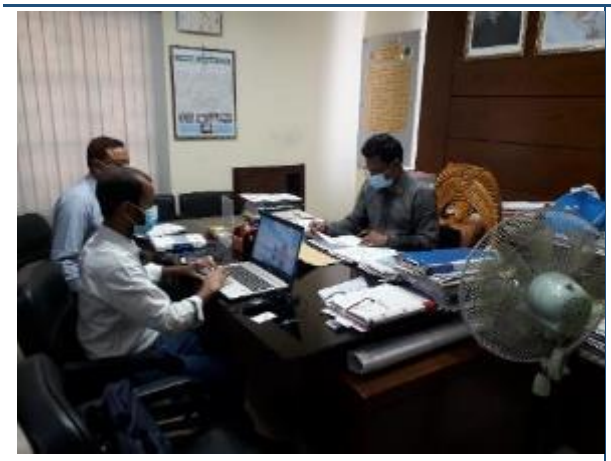
	
FGD with local community	FGD with Women Group
	
FGD with Landowner	FGD with Land Dependence

Appendix H-23: KII Photographs

	
KII with Agriculture Officer, Patiya Upazila	KII with Agriculture Officer, Chandanaish Upazila
	
KII at Agriculture Office, Satkania Upazila	KII with Agriculture Officer, Lohagara Upazila
	
KII with Agriculture Officer, Chakaria Upazila	KII with Senior Fisheries Officer, Patiya Upazila

	
KII at Upazila Fisheries Office, Chandanaish Upazila	KII at Upazila Fisheries Office, Satkania Upazila
	
KII with Fisheries Officer, Lohagara Upazila	KII with Senior Fisheries Officer, Chakaria Upazila
	
KII with Education Officer, Chandanaish Upazila	KII with Education Officer, Satkania Upazila

	
KII at Upazila Education Office, Lohagara Upazila	KII with Education Officer, Chakaria Upazila
	
KII at DPHE Office, Patiya Upazila	KII at DPHE Office, Chandanaish Upazila
	
KII with Sub-Assistant Engineer of DPHE, Satkania Upazila	KII at DPHE Office, Chakaria Upazila

	
KII with the Executive Engineer, RHD, Dohazari Road Division	KII with Forest Range Officer, Fashiakhali Range
	
KII with Forest Range Officer, Chunati Range	KII with Forest Range Officer, Chunati Wildlife Sanctuary

Appendix I: Sample Monitoring Form to be submitted by Project Proponent to JICA

MONITORING FORM

-If environmental reviews indicate the need of monitoring by JICA, JICA undertakes monitoring for necessary items that are decided by environmental reviews. JICA undertakes monitoring based on regular reports including measured data submitted by the project proponent. When necessary, the project proponent should refer to the following monitoring form for submitting reports.

-When monitoring plans including monitoring items, frequencies and methods are decided, project phase or project life cycle (such as construction phase and operation phase) should be considered.

1. **Responses/Actions to Comments and Guidance from Government Authorities and the Public**

Monitoring Item	Monitoring Results during Report Period

2. **Mitigation Measures**

-Proposed Monitoring Sites of Ambient Air Quality

- Patiya construction yard
- Construction site of Patiya (future road)
- Near residential area of Patiya (future road)
- Dohazari construction yard
- Construction site of Dohazari (future road)
- Near residential area of Dohazari (future road)
- Keranihat construction yard
- Construction site of Keranihat flyover
- Near residential area of Keranihat flyover
- Lohagara construction yard
- Construction site of Lohagara (future road)
- Near residential area of Lohagara (future road)
- Chakaria construction yard
- Construction site of Chakaria (future road)
- Near residential area of Chakaria (future road)

Item	Unit	Measured Value (Mean)	Measured Value (Max.)	Bangladesh Standards	Referred International Standards	Remarks (Measurement Point, Frequency, Method, etc.)
$PM_{2.5}$						
PM_{10}						
Nitrogen-di-oxide						

Sulfur dioxide (SO_2)						
Carbon monoxide (CO)						

Proposed monitoring locations of Surface Water Quality

- Chimnar Khal, Patiya
- Pond near Patiya future road
- Upstream of Sangu River, Dohazari
- Downstream of Sangu River, Dohazari
- Pond near Keranihat FOB
- Waterbody nearby Keranihat FOB
- Upstream of Tonkaboti River, Lohagara
- Downstream of Tonkaboti River, Lohagara
- Upstream of Matamuhuri River, Chakaria
- Downstream of Matamuhuri River, Chakaria

Item	Unit	Measured Value (Mean)	Measured Value (Max.)	Bangladesh Standards	Referred International Standards	Remarks (Measurement Point, Frequency, Method, etc.)
pH						
Temperature						
DO						
BOD						
COD						
TSS						
Color						
TC						
Turbidity						
Arsenic						
Oil and Grease						

Proposed monitoring locations of Drinking Water Quality

- Workers' accommodation site, Patiya
- Office building of Patiya construction site
- Workers' accommodation site, Dohazari
- Office building of Dohazari construction site
- Workers' accommodation site, Keranihat
- Office building of Keranihat construction site
- Workers' accommodation site, Lohagara
- Office building of Lohagara construction site
- Workers' accommodation site, Chakaria

- Office building of Chakaria construction site

Item	Unit	Measured Value (Mean)	Measured Value (Max.)	Bangladesh Standards	Referred International Standards	Remarks (Measurement Point, Frequency, Method, etc.)
pH						
Temperature						
TSS						
Iron						
Manganese						
Arsenic						
Phosphate						
Nitrate						
Ammonia						
Copper						
Chloride						
Total Coliform						
Total Coliform						

Waste

Monitoring Item	Monitoring Results during Report Period

Proposed Monitoring Sites of Noise and Vibration level

- Patiya construction yard
- Construction site of Patiya (future road)
- Near residential area of Patiya (future road)
- Dohazari construction yard
- Construction site of Dohazari (future road)
- Near residential area of Dohazari (future road)
- Keranihat construction yard
- Construction site of Keranihat flyover
- Near residential area of Keranihat flyover
- Lohagara construction yard
- Construction site of Lohagara (future road)
- Near residential area of Lohagara (future road)
- Chakaria construction yard
- Construction site of Chakaria (future road)
- Near residential area of Chakaria (future road)

Item	Unit	LAeq (Day)	LAeq (Night)	Bangladesh Standards	Referred International Standards	Remarks (Measurement Point, Frequency, Method, etc.)
Noise Level						
Vibration Level						

Odor

Monitoring Item	Monitoring Results during Report Period

3. Natural Environment

- Ecosystem

Monitoring Item	Monitoring Results during Report Period

4. Social Environment

- Resettlement

Monitoring Item	Monitoring Results during Report Period

- Living / Livelihood

Monitoring Item	Monitoring Results during Report Period

Appendix J: No Objection Certificate (NOC) from Local Authority

বিস্‌মিল্লাহির রাহমানির রাহিম

পটিয়া পৌরসভা
PATIYA POURASHAVA

"শেখ হাসিনার মূলনীতি
গ্রাম শহরের উন্নতি"

পটিয়া, চট্টগ্রাম-৪৩৭০। ঃ ০৩০৩৫৫৬১৬০

Website: www.patiyapourashava.gov.bd, e-mail:patiyapourashava@yahoo.com

স্মারক নং- ০০ ০০ ১৫৬১ ০৩৩ -০১ -২০২২-৫৮১

তারিখ : ২২/০১/২০২২

অবস্থানগত/পরিবেশগত অনাপত্তিপত্র

১। আবেদনকারীর নামঃ সড়ক ও জনপথ অধিদপ্তর

২। পিতা/স্বামী/স্ত্রীর নামঃ প্রযোজ্য নয়

৩। আবেদনকারীর ঠিকানাঃ অন্তর্বর্তীকালীন প্রকল্প পরিচালকের কার্যালয়, চট্টগ্রাম-কক্সবাজার হাইওয়ে ইমপ্রুভমেন্ট প্রজেক্ট, আরএইচডি বৈদেশিক সাহায্যপুষ্ট প্রকল্পসমূহের কার্যালয় রোড-২৭, ব্লক-এ, বনানী, ঢাকা-১২১৩

৪। কারখানা/ প্রকল্পের অবস্থানগত ঠিকানাঃ পটিয়া পৌরসভা, পটিয়া উপজেলা, চট্রগ্রাম জেলা

৫। কারখানা/ প্রকল্পের তফসিলঃ

জেলার নাম	উপজেলা	মৌজার নাম	দাগ নং	জমির ধরন	মোট জমির পরিমান
সংযুক্ত	সংযুক্ত	সংযুক্ত	সংযুক্ত	সংযুক্ত	সংযুক্ত

৬। কারখানা/ প্রকল্পের উৎপাদিত পন্যের নামঃ

উপরোক্ত তথ্যাদির আলোকে চট্টগ্রাম-কক্সবাজার হাইওয়ে ইমপ্রুভমেন্ট প্রকল্পকে নিম্নে বর্ণিত শর্তসাপেক্ষে অনাপত্তিপত্র প্রদান করা হলো।

১। প্রকল্প/ কারখানা স্থাপন ও পরিচালনার ক্ষেত্রে পরিবেশ সংরক্ষণ আইন ও বিধি যথাযথভাবে অনুসরন করতে হবে।

২। পরিবেশ অধিদপ্তর হতে বিধি দ্বারা নির্ধারিত পদ্ধতিতে ছাড়পত্র গ্রহন করতে হবে।

৩। কর্মরত শ্রমিকদের পেশাগত স্বাস্থ্য ও নিরাপত্তা নিশ্চিত করতে হবে।

৪। উপযুক্ত অগ্নি নির্বাপক ব্যবস্থা রাখতে হবে এবং অগ্নিকান্ড কিংবা অন্য কোন দূর্ঘটনার সময় জরুরি নির্গমন ব্যবস্থা থাকতে হবে।

৫। বায়ু ও শব্দ দূষণ করা যাবে না।

৬। কারখানা/ প্রকল্প সৃষ্ট তরল বর্জ্য অপরিশোধিত অবস্থায় বাইরে নির্গমন করা যাবে না।

উল্লিখিত যে কোন শর্ত লঙ্ঘন করলে যথোপযুক্ত কতৃপক্ষ কতৃক কারখানা/ প্রকল্পের বিরুদ্ধে আইনানুগ ব্যবস্থা নেওয়া যাবে।

MD. AYUB BABUL
MAYOR
PATIYA POURASHAVA

২২/০১/২০২২

নিয়মিত পৌরকর পরিশোধ করুন। জন্ম-মৃত্যু তালিকা লিপিবদ্ধ করুন। আপনার শহর পরিচ্ছন্ন রাখুন।

জেলার নাম	উপজেলা	মৌজার নাম	দাগ নং	জমির ধরন	মোট জমির পরিমান
চট্টগ্রাম	পটিয়া পৌরসভা	পটিয়া	৭, ৮, ৯, ১০, ১১, ১৩, ১৩, ১৪, ১০৪, ১০৫, ১০৮, ১০৯, ১১০, ১১১, ১১২, ১১৬, ১১৭, ১১৮, ১২৫, ১৯৭, ১৯৮, ১৮৬, ১৯৯, ২০০, ২০১, ২০৩, ২০৪, ২০৫, ২০৬, ২৩৮, ২২০, ২২৩, ২২৪, ২২৫, ২১৫, ২১৭, ২১৯, ২১৮, ২৪০, ২২৪২, ২২৪০, ২১৪৮, ২১৪৬, ২১৪০, ২১৩৯, ২১৪২, ২১৪৩, ২১৪৪, ২১৪৫, ২১৪৬, ২১৪৭, ২১৩৬, ২১৩৭, ২১৩৮, ২১৩৪, ২১৩৫, ২১৩২, ২১৩৩, ২১২১, ১৮৪৮, ১৮৪৬, ১৮৪৭, ১৮৪৫, ১৮৪৪, ১৮৪৩, ১৮৪২, ১৮৪১, ১৮০২, ১৮৫২, ১৮৫৩, ১৮০১, ১৮৬৯, ১৮০, ১৭৯৯, ১৮০৩, ১৮৯৫, ১৮৯৮, ১৭৯৭, ১৭৯৬, ১৬৪৫, ১৬৪৪, ১৬৪৩, ১৬৪৭, ১৬৪৮, ১৬৪০, ১৬৪২, ১৬৩৬, ১৬৩৪, ১৬৩৫, ১৬৩২, ১৬৩০, ১৬২৯, ১৬১৫, ১৬১৬, ১৬১৭, ১৬০০, ১৫৯৯, ১৫৯৭, ১৫৯৬, ১৫৯৪, ১৫৯৫, ১৫৯৩, ১৬০১, ১৬০২, ১৪৯৭, ১৪৯৮, ১৪৯৯, ১৫০২, ১৫০৫, ১৪৯১, ১৫০৭, ১৫০৮, ১৫০৯, ১৫১০, ১৫১১, ১৫১২, ১৫১৪, ১৫১৬, ১২৩০, ১২৩৭, ১২২৮, ১২২৯, ১২৪২, ১২৩৩, ১২৩৬, ১২৪০, ১২৪১, ১২৪২, ১২২১, ১২৪৩, ১২৪৪, ১২৪৫, ১২৪৬, ১২৪৭, ১২১৬, ১২১৭, ১২০৪, ১২৫০, ১২৪৮, ১৩৭৯, ১৩৮০, ১৩৭৮, ১৩৭৫, ১৩৭৬, ১৩৭৭, ১২৬১, ১২৬২, ১২৬৪, ১২৬৫, ১২৬৬, ১২৬৭, ১৩৫৮, ১৩৬০, ১৩৫৫, ১৩৫৬, ১৩৩৮, ১৩৩৯, ১৩৪৫, ১৩৪৪, ১৩৪৩, ১৩৪২, ১৩৪১,	নাল, বিটি, ডোবা	১১.৩৬ একর

MD. AYUB BABUL
MAYOR
PATIYA POURASHAVA

জেলার নাম	উপজেলা	মৌজার নাম	দাগ নং	জমির ধরন	মোট জমির পরিমান
			১৩২৪, ১৩২৫, ১৩২৬, ১৩২৭, ৩২৮, ১৩২৯, ১৩৩০, ৪৫৫২, ৪৫৫৩, ৪৫৫৪, ৪৫৫৫, ৪৫৫৬, ৪৫৫৭, ৪৫৮১, ৪৫৮০, ৪৫৭৯, ৪৫৮২, ৪৫৮৪, ৪৫৮৫, ৪৫৮৪, ৪৫৮৫, ৪৫৮৬, ৪৫৯৮, ৪৫৯৮, ৪৫৯৫, ৪৫৯৬, ৪৫৯৫, ৪৬০২, ৪৬০৩, ৪৬০৪, ৪৬০১, ৪৬১১, ৪৬১২, ৪৬১৬, ৪৬১৪, ৪৬১৫, ৪৬৯৬, ৪৬৯৫, ৪৬৯১, ৪৬৯৭, ৪৬৯৯, ৪৬৯৮, ৪৭০০, ৪৭০১, ৪৭০২, ৪৭০৩		
মোট					২১.৩৬ একর

MD. AYUB BABUL
MAYOR
PATIYA POURASHAVA

স্মারক নং-

তারিখ- ২২/০১/২০২২

অবস্থানগত/পরিবেশগত ছাড়পত্রের জন্য স্থানীয় কতৃপক্ষ কতৃক প্রদেয় অনাপত্তিপত্রের ছক

১। আবেদনকারীর নামঃ সড়ক ও জনপথ অধিদপ্তর

২। পিতা/স্বামী/স্ত্রীর নামঃ প্রযোজ্য নয়

৩। আবেদনকারীর ঠিকানাঃ অন্তর্বর্তীকালীন প্রকল্প পরিচালকের কার্যালয়, চট্টগ্রাম-কক্সবাজার হাইওয়ে ইমপ্রুভমেন্ট প্রজেক্ট, আরএইচডি বৈদেশিক সাহায্যপুষ্ট প্রকল্পসমূহের কার্যালয় রোড-২৭, ব্লক-এ, বনানী, ঢাকা-১২১৩

৪। কারখানা/ প্রকল্পের অবস্থানগত ঠিকানাঃ ভাটীখাইন ইউনিয়ন, পটিয়া উপজেলা, চট্টগ্রাম জেলা

৫। কারখানা/ প্রকল্পের তফসিলঃ

জেলার নাম	উপজেলা	মৌজার নাম	দাগ নং	জমির ধরন	মোট জমির পরিমান
সংযুক্ত	সংযুক্ত	সংযুক্ত	সংযুক্ত	সংযুক্ত	সংযুক্ত

৬। কারখানা/ প্রকল্পের উৎপাদিত পন্যের নামঃ

উপরোক্ত তথ্যাদির আলোকে চট্টগ্রাম-কক্সবাজার হাইওয়ে ইমপ্রুভমেন্ট প্রকল্পকে নিম্নে বর্ণিত শর্তসাপেক্ষে অনাপত্তিপত্র প্রদান করা হলো ।

১। প্রকল্প/ কারখানা স্থাপন ও পরিচালনার ক্ষেত্রে পরিবেশ সংরক্ষণ আইন ও বিধি যথাযথভাবে অনুসরন করতে হবে ।

২। পরিবেশ অধিদপ্তর হতে বিধি দ্বারা নির্ধারিত পদ্ধতিতে ছাড়পত্র গ্রহন করতে হবে ।

৩। কর্মরত শ্রমিকদের পেশাগত স্বাস্থ্য ও নিরাপত্তা নিশ্চিত করতে হবে ।

৪। উপযুক্ত অগ্নি নির্বাপক ব্যবস্থা রাখতে হবে এবং অগ্নিকান্ড কিংবা অন্য কোন দূর্ঘটনার সময় জরুরি নির্গমন ব্যবস্থা থাকতে হবে।

৫। বায়ু ও শব্দ দূষণ করা যাবে না।

৬। কারখানা/ প্রকল্প সৃষ্ট তরল বর্জ্য অপরিশোধিত অবস্থায় বাইরে নির্গমন করা যাবে না।

উল্লিখিত যে কোন শর্ত লঙ্ঘন করলে যথোপযুক্ত কতৃপক্ষ কতৃক কারখানা/ প্রকল্পের বিরুদ্ধে আইনানুগ ব্যবস্থা নেওয়া যাবে।

তারিখ-

স্থানীয় কতৃপক্ষের স্বাক্ষর ও সীল

২২/১/২২ ই.

জেলার নাম	উপজেলা	মৌজার নাম	দাগ নং	জমির ধরন	মোট জমির পরিমান
চট্রগ্রাম	পটীয়া	ভাটীখাইন	৭, ৮, ৯, ১০, ১১, ২৯৬, ২৯৭, ২৯৮, ২৯৯, ৩০০, ৩০১, ৩০২, ৩১৪, ৩১৬, ৩১৭, ৩১৮, ৩২৭, ৩৫৩, ৩৫১, ৩৫০, ৩৫৮, ৩৫৯, ৩৬০, ৩৬২, ৩৬৩, ৩৬৪ ৩৬৬, ৩৬৭, ৩৪৪, ৪৫২, ৪৫০, ৪৫৩, ৩৫৫, ৩৫৬, ৩৫৭, ৩৫৮, ৩৫৯, ৩৬০, ৪৬১, ৪৬২, ৪৬৩, ৪৮৯, ৫৪১, ৫৩৪, ৫৩৫, ৫২০, ৫০৯, ৫১৬, ৫১৭, ৫১৮, ৫৫৯, ৫৬০, ১২৩২, ১২৩৩, ১২৩৫, ১২৩৯, ১২৪০, ১২৪১, ১২৪২, ১২৪৩, ১২৪৪, ১২৬১, ১২৬২, ১২৬৩, ১২৬৫, ১২৬৬, ১২৬৭, ১২৬৮, ১২৬৯, ১২৭০, ১২৭১, ১২৭২, ১২৭৩, ১২৭৪, ১২৭৫, ১২৭৬, ১২৭৭, ১২৭৮, ১২৭৯, ১২৮১, ১৩১৬, ১৩১৭, ১২৯০, ১২৯১, ১২৯২, ১২৯৩, ১২৯৪, ১২৯৮, ১২৯৯, ১৩০০, ১৪৯৮, ১৫০০, ১৫০১, ১৫০২, ১৫২৬, ১৫২৭, ১৫০৪, ১৫০৫, ১৫০৭, ১৫২৮, ১৫২৯, ১৫৩১, ১৫৩২, ১৫৩০, ১৫৪৩, ১৫৪৪, ১৫৪৫, ১৫৪৬	নাল, ভিটি, ডোবা	১২.৬১ একর
চট্রগ্রাম	পটীয়া	করল	১০০৭, ১০০৮, ১০০৯, ১০১০, ১০১১, ১০১২, ১০১৩, ১০১৪, ১০১৫, ১০১৬, ১০১৭, ১০১৮, ১০১৯, ১০২১, ১০২২, ১০৪৭, ২০৮৮, ২০৮৯, ২০৯০, ২০৯১, ২০৮৭, ২০৯৪, ২০৭৯, ২০৮০, ২০৮১, ২০৮২, ২০৮৩, ২০৮৪, ২০৪৭	নাল, ভিটি	২.৭৫ একর
মোট					**১৫.৩৬ একর**

22/11/22

১৬নং কচুয়াই ইউনিয়ন পরিষদ

চেয়ারম্যান ঃ এস এম ইনজামুল হক (জসীম)

ডাকঘর ঃ চক্রশালা, উপজেলা ঃ পটিয়া, জেলা ঃ চট্টগ্রাম। মোবাইল: ০১৮১৫-৫৫৩৪২৫

স্মারক নং- ৪৬.০০.৬১৫৮.০০০.৯৯.০০১.২২ ৪২৫৫ তারিখ- ২১/০৯/২০২২ ইং

অবস্থানগত/পরিবেশগত ছাড়পত্রের জন্য স্থানীয় কর্তৃপক্ষ কর্তৃক প্রদেয় অনাপত্তিপত্রের ছক

১। আবেদনকারীরনামঃ সড়ক ও জনপথ অধিদপ্তর

২। পিতা/স্বামী/স্ত্রীর নামঃ প্রযোজ্য নয়

৩। আবেদনকারীরঠিকানাঃ অন্তর্বর্তীকালীন প্রকল্পপরিচালকেরকার্যালয়, চট্টগ্রাম-কক্সবাজারহাইওয়েইমপ্রুভমেন্টপ্রজেক্ট, আরএইচডিবৈদেশিকসাহায্যপুষ্টপ্রকল্পসমূহেরকার্যালয়রোড-২৭, ব্লক-এ, বনানী, ঢাকা-১২১৩

৪। কারখানা/ প্রকল্পের অবস্থানগত ঠিকানাঃকচুয়াই ইউনিয়ন, পটিয়া উপজেলা, চট্টগ্রামজেলা

৫। কারখানা/ প্রকল্পের তফসিলঃ

জেলার নাম	উপজেলা	মৌজার নাম	দাগ নং	জমির ধরন	মোট জমির পরিমান
সংযুক্ত	সংযুক্ত	সংযুক্ত	সংযুক্ত	সংযুক্ত	সংযুক্ত

৬। কারখানা/ প্রকল্পের উৎপাদিত পন্যের নামঃ

উপরোক্ত তথ্যাদির আলোকে চট্টগ্রাম-কক্সবাজারহাইওয়েইমপ্রুভমেন্টপ্রকল্পকে নিম্নে বর্ণিত শর্তসাপেক্ষে অনাপত্তিপত্র প্রদান করা হলো ।

১। প্রকল্প/ কারখানা স্থাপন ও পরিচালনার ক্ষেত্রে পরিবেশ সংরক্ষণ আইন ও বিধি যথাযথভাবে অনুসরন করতে হবে ।

২। পরিবেশ অধিদপ্তর হতে বিধি দ্বারা নির্ধারিত পদ্ধতিতে ছাড়পত্র গ্রহন করতে হবে ।

৩। কর্মরত শ্রমিকদের পেশাগত স্বাস্থ্য ও নিরাপত্তা নিশ্চিত করতে হবে ।

৪। উপযুক্ত অগ্নি নির্বাপক ব্যবস্থা রাখতে হবে এবং অগ্নিকান্ড কিংবা অন্য কোন দূর্ঘটনার সময় জরুরি নির্গমন ব্যবস্থা থাকতে হবে।

৫। বায়ু ও শব্দ দূষণ করা যাবে না।

৬। কারখানা/ প্রকল্প সৃষ্ট তরল বর্জ্য অপরিশোধিত অবস্থায় বাইরে নির্গমন করা যাবে না।

উল্লিখিত যে কোন শর্ত লঙ্ঘন করলে যথোপযুক্ত কর্তৃপক্ষ কর্তৃক কারখানা/ প্রকল্পের বিরুদ্ধে আইনানুগ ব্যবস্থা নেওয়া যাবে।

এস এম ইনজামুল হক
চেয়ারম্যান
১৬নং কচুয়াই ইউনিয়ন পরিষদ
পটিয়া, চট্টগ্রাম।

জেলার নাম	উপজেলা	মৌজার নাম	দাগ নং	জমির ধরন	মোট জমির পরিমান
চট্টগ্রাম	পটীয়া	কচুয়াই	৩২১, ৩২২, ৩২৩, ৩২৪, ৩২৫, ৩৪৬, ৩৪৭, ৩৪৮, ৩৪৯, ৩৫৫, ৩৫৬, ৩৫৭, ৩৫৮, ৩৫৯, ৩৬০, ৩৬২, ৩৬৩, ৩৬৫, ৩৬৬, ৩৬৮, ৩৭০, ৩৭৭, ৩৭৮, ৩৭৯, ৩৭৪, ৩৭৫, ৩৭৯, ৩৮০, ৩৮১, ১১৩৬, ১১৩৭, ১১৩৮, ১১৩৯, ১১৪০, ১১৩৫, ১১৩৪, ১১৪৩, ১১৪৪, ১১৪৩, ১১৪৮, ১১৪২, ১১১৯। ১১২০, ১১২২, ১১৩৮, ১১১৮, ১১৬২, ১১৬৪, ১১৬৭, ১১৬৯, ১১৫৪, ১১৫৬, ১১৬৯, ১১৭০, ১০৫৪, ১০৫৫, ১০৫৬, ১০৫৭, ১০৫৮, ১০৪৯, ১০৫০, ৯৭২, ৯৭৩, ৯৭৪, ১০২৫, ৪৭৬৩, ৯৭৭, ৯৭৮, ৯৭৯, ৯৮০, ৯৮১, ৯৮২, ৪৭৬২, ১০২৪, ৯৯৮, ৯৯৯, ১০০০, ১০০১, ১০০২, ১০০৩, ১০০৯, ১০১০, ১০১১, ৯০৬, ৯০৩, ৯০৪, ৯০২, ৯০০, ২৫৮৮, ২৫৯০, ২৫৯২, ২৫৯৩, ২৫৯৪, ২৫৯৫, ২৬৭২, ২৬৭৩, ২৭৭৪, ২৬৭৫, ২৬৭৬, ২৬৭৭, ২৬৭৮, ২৬৭৯, ২৬৮০, ২৬৮১, ২৬৬৭, ২৬৬৮, ২৬৬৬, ২৬৮৩, ২৬৩৫, ২৬৮৪, ২৬৫৮, ২৬৬০, ২৬৫৯, ২৭০৪, ২৭০৫, ২৭০৬, ২৭০৭, ২৭০৮, ২৭০৯, ২৭১০, ২৭১১, ২৭১২, ২৭০৩, ২৭২২, ২৭২৩, ২৭২৪, ২৭১৭, ২৭১৮, ২৭১৯, ২৭২০, ২৮১০, ২৮১১, ২৮১২, ২৮১৩, ২৮১৪, ২৮৯৩, ২৮০৯, ২৮৪৭, ২৮৪৮, ২৮৫১, ২৮৪৪, ২৮৪০, ২৮৭০, ২৮৭১, ২৮৭২, ২৮৭৩, ২৮৭৪, ২৮৩৮, ২৮৩৯, ২৮৭৫, ২৮৭৬, ২৮৭৯, ২৮৭৮, ২৮৩৫, ২৮৯৮, ২৮৯৯, ২৮৯৭, ২৯১৪, ২৯১৫, ২৯১৬,	নাল, ভিটি, ডোবা	২১.৬৫ একর

এস এম ইনজামুল হক
চেয়ারম্যান
১৬নং কচুয়াই ইউনিয়ন পরিষদ
পটিয়া, চট্টগ্রাম।

জেলার নাম	উপজেলা	মৌজার নাম	দাগ নং	জমির ধরন	মোট জমির পরিমান
			২৯১৭, ২৯১১, ২৯১২, ২৯১৩, ২৯১৪, ২৯১৮, ২৯১৯, ২৯২০, ২৯২১, ২৯২২, ২৯২৩, ২৯২৪, ২৯২৭, ২৯২৮, ২৯৬০, ২৬৬৯, ২৯৭১, ২৯৯৩, ৩০১৩, ৩০১৭		
মোট					২১.৬৫ একর

এস এম ইনজামুল হক
চেয়ারম্যান
১৬নং কুয়াইশ ইউনিয়ন পরিষদ
পটিয়া, চট্টগ্রাম।

জয় বাংলা

বিসমিল্লাহির রাহমানির রাহিম

বাংলাদেশ চিরজীবি হউক

২নং আমিরাবাদ ইউনিয়ন পরিষদ

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ডাকঘর ঃ মাষ্টার হাট, উপজেলা ঃ লোহাগাড়া, জেলা ঃ চট্টগ্রাম, বাংলাদেশ।
P.O : Masterhat, Amirabad, Upazilla : Lohagara, Chattogram. Bangladesh.

সূত্র ঃ

তারিখ ঃ ২১ ০৭ ২০২২

অবস্থানগত/পরিবেশগত ছাড়পত্রের জন্য স্থানীয় কর্তৃপক্ষ কর্তৃক প্রদেয় অনাপত্তিপত্রের ছক

১। আবেদনকারীর নামঃ সড়ক ও জনপথ অধিদপ্তর

২। পিতা/স্বামী/স্ত্রীর নামঃ প্রযোজ্য নয়

৩। আবেদনকারীর ঠিকানাঃ অন্তর্বর্তীকালীন প্রকল্প পরিচালকের কার্যালয়, চট্টগ্রাম-কক্সবাজার হাইওয়ে ইমপ্রুভমেন্ট প্রজেক্ট, আরএইচডি বৈদেশিক সাহায্যপুষ্ট প্রকল্পসমূহের কার্যালয় রোড-২৭, ব্লক-এ, বনানী, ঢাকা-১২১৩

৪। কারখানা/ প্রকল্পের অবস্থানগত ঠিকানাঃ আমিরাবাদ ইউনিয়ন, লোহাগাড়া উপজেলা, চট্টগ্রাম জেলা

৫। কারখানা/ প্রকল্পের তফসিলঃ

জেলার নাম	উপজেলা	মৌজার নাম	দাগ নং	জমির ধরন	মোট জমির পরিমান
সংযুক্ত	সংযুক্ত	সংযুক্ত	সংযুক্ত	সংযুক্ত	সংযুক্ত

৬। কারখানা/ প্রকল্পের উৎপাদিত পন্যের নামঃ

উপরোক্ত তথ্যাদির আলোকে চট্টগ্রাম-কক্সবাজার হাইওয়ে ইমপ্রুভমেন্ট প্রকল্পকে নিম্নে বর্ণিত শর্তসাপেক্ষে অনাপত্তিপত্র প্রদান করা হলো।

১। প্রকল্প/ কারখানা স্থাপন ও পরিচালনার ক্ষেত্রে পরিবেশ সংরক্ষণ আইন ও বিধি যথাযথভাবে অনুসরন করতে হবে।
২। পরিবেশ অধিদপ্তর হতে বিধি দ্বারা নির্ধারিত পদ্ধতিতে ছাড়পত্র গ্রহন করতে হবে।
৩। কর্মরত শ্রমিকদের পেশাগত স্বাস্থ্য ও নিরাপত্তা নিশ্চিত করতে হবে।
৪। উপযুক্ত অগ্নি নির্বাপক ব্যবস্থা রাখতে হবে এবং অগ্নিকান্ড কিংবা অন্য কোন দূর্ঘটনার সময় জরুরি নির্গমন ব্যবস্থা থাকতে হবে।
৫। বায়ু ও শব্দ দূষণ করা যাবে না।
৬। কারখানা/ প্রকল্প সৃষ্ট তরল বর্জ্য অপরিশোধিত অবস্থায় বাইরে নির্গমন করা যাবে না।

উল্লিখিত যে কোন শর্ত লঙ্ঘন করলে যথোপযুক্ত কর্তৃপক্ষ কর্তৃক কারখানা/ প্রকল্পের বিরুদ্ধে আইনানুগ ব্যবস্থা নেওয়া যাবে।

২১/০৭/২০২২

এস.এম ইউনুছ
চেয়ারম্যান
২নং আমিরাবাদ ইউনিয়ন পরিষদ
লোহাগাড়া, চট্টগ্রাম।

জেলার নাম	উপজেলা	মৌজার নাম	দাগ নং	জমির ধরন	মোট জমির পরিমান (একর)
চট্টগ্রাম	লোহাগাড়া	মল্লিক ছোয়াং	৪, ২৯৭, ৩১০, ৩১১, ৩১২, ১৩০৪, ১৩০৫, ১৩০৬, ১৩০৭, ১৩০৮, ১৩০৯, ১৩১০, ১৩১২, ১৩১৩, ১৩১৪, ১৩১৫, ১৩১৬, ১৩১৭, ১৩১৮, ১৩১৯, ১৩২০, ১৩৩১, ১৩৩২, ১৩৩৩, ১৩৩৪, ১৩৩৫, ১৩৩৬, ১৩৫৮, ১৩৬২, ১৩৬৫, ১৩৬৬, ১৩৬৭, ১৩৬৮, ১৩৬৯, ১৩৭০, ১৩৭১, ১৩৮৬, ১৩৮৭, ২৯৯২, ২৯৯৩, ২৯৯৯	রাস্তা, ভিটি, নাল	১০.৬১
চট্টগ্রাম	লোহাগাড়া	আমিরাবাদ সিট নং ২	২৩৭০, ২৩৭১, ২৩৭২, ২৩৭৩, ২৩৭৪, ২৩৭৫, ২৩৭৬, ২৩৮৪, ২৩৮৫, ৪২২২, ৪২২৩, ৪২২৪, ৪২২৫, ৪২২৬, ৪২২৭, ৪২২৮, ৪২২৯, ৪২৩০, ৪২৩১, ৪২৩২, ৪২৩৩, ৪২৩৪, ৪২৩৫, ৪২৩৬, ৪২৩৭, ৪২৩৮, ৪২৩৯, ৪২৪০, ৪২৪১, ৪২৪৩, ৪২৪৪, ৪২৪৫, ৪২৪৬, ৪২৪৮, ৪৯৮৩, ৪৯৮৪, ৪৯৮৫, ৪৯৮৮, ৪৯৯২, ৪৯৯৩, ৫১১৬, ৫১১৮, ৫১১৯, ৫১২০, ৫১২১, ৫১২২, ৫১২৩, ৫১২৪, ৫১২৫, ৫১২৬, ৫১২৭, ৫১২৮, ৫১২৯, ৫১৩০, ৫১৩১, ৫১৩২, ৫১৩৩, ৫১৩৪, ৫১৩৫, ৫১৩৬, ৫১৩৭, ৫১৩৮, ৫১৩৯, ৫১৪০, ৫১৪১, ৫১৪২, ৫১৪৩, ৫১৪৪, ৫১৪৪৫, ৫১৪৬, ৫১৪৭, ৫১৪৮, ৫১৪৯, ৫১৫০, ৫১৫১, ৫১৫২, ৫১৫৩, ৫১৫৪, ৫১৫৫, ৫১৫৬, ৫১৫৭, ৫১৫৮, ৫১৫৯, ৫১৬০, ৫১৬১, ৫২৩৫, ৫২৩৬, ৫২৩৭, ৫২৩৮, ৫২৩৯, ৫২৪০, ৫২৪১, ৫২৪২, ৫২৪৩, ৫২৪৪, ৫২৪৫, ৫২৪৬, ৫২৪৭, ৫২৪৮, ৫২৪৯, ৫২৫০, ৫২৫১, ৫২৫২, ৫২৬৭, ৫২৬৯, ৫২৭০, ৫২৭১, ৫২৭২, ৫২৭৩, ৫২৭৪, ৫২৭৫, ৫২৭৬, ৫২৭৭, ৫২৮৩, ৫২৮৪, ৫২৮৫, ৫২৮৬, ৫২৮৭, ৫২৮৮, ৫২৮৯, ৫২৯০, ৫২৯১, ৫২৯২, ৫২৯৩, ৫২৯৪, ৫২৯৫, ৫২৯৬, ৫২৯৭, ৫২৯৮, ৫৩০০, ৫৩০১, ৫৩০২, ৫৩০৩, ৫৩০৪, ৫৩০৫, ৫৩০৬, ৫৩০৭, ৫৩০৮, ৫৩০৯, ৫৩১০, ৫৩১২, ৫৩১৩, ৫৩১৪, ৫৩১৫, ৫৩১৬, ৫৩১৭, ৫৩১৮, ৫৩১৯, ৫৩২০, ৫৩২১, ৫৩২২, ৫৩২৩, ৫৩২৪, ৫৩২৫, ৫৩২৬, ৫৩২৭, ৫৩২৮, ৫৩২৯, ৫৩৩০,	খাল, রাস্তা, ভিটি, নাল	৬৩.১২

জেলার নাম	উপজেলা	মৌজার নাম	দাগ নং	জমির ধরন	মোট জমির পরিমান (একর)
			৫৩৩১, ৫৩৩২, ৫৩৩৩, ৫৩৩৪, ৫৩৩৫, ৫৩৩৬, ৫৩৩৭, ৫৩৩৮, ৫৩৩৯, ৫৩৪০, ৫৩৪১, ৫৪৩৭, ৫৪৫১, ৫৪৫২, ৫৪৫৩, ৫৪৫৪, ৫৪৫৫, ৫৪৫৬, ৫৪৫৭, ৫৪৫৮, ৫৪৫৯, ৫৪৬০, ৫৪৬১, ৫৪৬২, ৫৪৬৩, ৫৪৬৪, ৫৪৬৫, ৫৪৭০, ৫৪৭১, ৫৪৭২, ৫৪৭৩, ৫৪৭৪, ৫৪৭৫, ৫৪৭৬, ৫৪৭৭, ৫৪৮১, ৫৪৮২, ৫৪৮৫, ৫৬৮৪, ৫৬৮৯, ৫৬৯৪, ৫৬৯৫, ৫৬৯৬, ৫৬৯৭, ৫৬৯৮, ৫৬৯৯, ৫৭০০, ৫৭০১, ৫৭০২, ৫৭০৩, ৫৭০৪, ৫৭০৫, ৫৭০৬, ৫৭০৭, ৫৭০৮, ৫৭০৯, ৫৭১০, ৫৭১১, ৫৭১২, ৫৭১৩, ৫৭১৪, ৫৭১৫, ৫৭১৫, ৫৭১৬, ৫৭১৭, ৫৭১৮, ৫৭১৯, ৫৭২০, ৫৭২১, ৫৭২৭, ৫৭২৮, ৫৭৬১, ৫৭৬২, ৫৭৬৩, ৫৭৬৪, ৫৭৬৫, ৫৭৬৬, ৫৭৬৭, ৫৭৬৮, ৫৭৬৯, ৫৭৭০, ৫৭৭১, ৫৭৭২, ৫৭৭৩, ৫৭৭৪, ৫৭৭৫, ৫৭৭৬, ৫৭৭৭, ৫৭৭৮, ৫৭৭৯, ৫৭৮০, ৫৭৮১, ৫৭৮২, ৫৭৮৩, ৫৭৮৭, ৫৭৮৮, ৫৭৮৯, ৫৭৯০, ৫৭৯১, ৫৭৯২, ৫৭৯৩, ৫৭৯৪, ৫৭৯৫, ৫৭৯৬, ৫৭৯৭, ৫৭৯৮, ৫৭৯৯, ৫৮০০, ৫৮০১, ৫৮০২, ৫৮০৩, ৫৮০৪, ৫৮০৫, ৫৮০৬, ৫৮০৭, ৫৮০৮, ৫৮০৯, ৫৮১০, ৫৮১১, ৫৮১২, ৫৮১৩, ৫৮১৪, ৫৮১৫, ৫৮১৬, ৫৮১৭, ৫৮২০, ৫৮২১, ৫৮২২, ৫৮২৩, ৫৮২৪, ৫৮২৫, ৫৮২৬, ৫৮২৭, ৫৮২৯, ৬১৪০, ৬২৩৩, ৬২৩২, ৬২৩৪, ৬২৩৫, ৬২৩৬, ৬২৩৭, ৬২৩৮, ৬২৩৯, ৬২৪০, ৬২৪১, ৬২৪২, ৬২৫১, ৬২৬৫, ৬২৬৬, ৬২৬৭, ৬২৬৮, ৬২৬৯, ৬২৭০, ৬২৭১, ৬২৭২, ৬২৭৩, ৬২৭৪, ৬২৭৮, ৬২৭৯, ৬২৮০, ৬২৮১, ৬২৮২, ৬২৮৩, ৬২৮৪, ৬২৮৫, ৬২৮৬, ৬২৮৭, ৬২৮৮, ৬২৮৯, ৬২৯০, ৬২৯১, ৬২৯২, ৬২৯৩, ৬২৯৪, ৬২৯৫, ৬২৯৬, ৬২৯৭, ৬২৯৮, ৬২৯৯, ৬৩০০, ৬৩১৭, ৬৪৪৪, ৬৪৪৫, ৬৪৪৬,		

জেলার নাম	উপজেলা	মৌজার নাম	দাগ নং	জমির ধরন	মোট জমির পরিমান (একর)
			৬৪৪৭, ৬৪৪৮, ৬৪৬৪, ৬৪৬৫, ৬৪৬৬, ৬৪৬৭, ৬৪৬৮, ৬৪৬৯, ৬৪৭০, ৬৪৭১, ৬৪৭২, ৬৪৭৩, ৬৪৭৪, ৬৪৭৫, ৬৪৭৬, ৬৪৭৭, ৬৪৭৮, ৬৪৭৯, ৬৪৮০, ৬৪৮১, ৬৪৮২, ৬৪৮৩, ৬৪৮৫, ৬৪৮৬, ৬৪৮৭, ৬৪৮৮, ৬৪৮৯, ৬৪৯০, ৬৪৯১, ৬৪৯২, ৬৪৯৩, ৬৪৯৫, ৬৪৯৬, ৬৪৯৭, ৬৪৯৮, ৬৪৯৯, ৬৫০০, ৬৫০১, ৬৫০২, ৬৫০৩, ৬৫০৪, ৬৫০৬, ৬৫০৭, ৬৫০৮, ৬৫০৯, ৬৫১০, ৬৫১১, ৬৫১২, ৬৫১৩, ৬৫১৪, ৬৫১৫, ৬৫১৬, ৫৬১৭, ৬৫১৮, ৫৬১৯, ৬৫২০, ৬৫২১, ৬৫২২, ৬৫২৩, ৬৫২৪, ৬৫২৫, ৬৫২৬, ৬৫২৭, ৬৫২৮, ৬৫৪০, ৬৫৪১, ৬৫৪২, ৬৫৪৩, ৬৫৪৪, ৬৫৪৫, ৬৫৪৬, ৬৫৪৭		
চট্টগ্রাম	লোহাগাড়া	আমিরাবাদ সিট নং ৫	২০১১০, ২০১১১, ২০১১২, ২০১১৩, ২০১১৪, ২০১১৫, ২০১১৬, ২০১১৭, ২০১১৮, ২০১১৯, ২০১২০, ২০১২১, ২০১২২, ২০১২৩, ২০১২৪, ২০১২৫, ২০১২৬, ২০১২৭, ২০১২৮, ২০১২৯, ২০১৩০, ২০১৩৫, ২০১৩৬, ২০১৩৭, ২০১৩৮, ২০১৩৯, ২০১৪০, ২০১৪১, ২০১৪২, ২০১৪৩, ২০১৪৪, ২০১৪৫, ২০১৪৬, ২০১৪৭, ২০১৪৮, ২০১৪৯, ২০১৫০, ২০১৫১, ২০১৫২, ২০১৫৩, ২০১৫৪, ২০১৫৫, ২০১৫৬, ২০১৫৭, ২০১৫৮, ২০১৫৯, ২০১৬০, ২০১৬২, ২০১৬৩, ২০১৬৪, ২০১৬৫, ২০১৬৭, ২০১৬৮, ২০১৬৯, ২০১৭০, ২০১৭১, ২০১৭২, ২০১৭৩, ২০১৭৪, ২০১৭৫, ২০১৭৬, ২০১৭৭, ২০২০৬, ২০২০৭, ২০২০৮, ২০২০৯, ২০২১০, ২০২১১, ২০২১২, ২০২১৩, ২০২১৪, ২০২১৫, ২০২১৬, ২০২১৭, ২০২২৩, ২০২২৪, ২০২২৫, ২০২৩৫, ২০২৩৬, ২০২৩৭, ২০২৩৮, ২০২৩৯, ২০২৪০, ২০২৪১, ২০২৪২, ২০২৪৩, ২০২৪৪, ২০২৪৫, ২০২৪৬, ২০২৪৭, ২০২৪৮, ২০২৪৯, ২০২৫০, ২০৪৯৯, ২০৫০০, ২০৫০১, ২০৫০২, ২০৫০৩, ২০৫০৪, ২০৫০৫,	রাস্তা, ভিটি, নাল	২৫.৬২

জেলার নাম	উপজেলা	মৌজার নাম	দাগ নং	জমির ধরন	মোট জমির পরিমান (একর)
			২০৫০৬, ২০৫০৭, ২০৫০৮, ২০৫০৯, ২০৫১০, ২০৫১১, ২০৫১২, ২০৫১৩, ২০৫১৪, ২০৫১৭, ২০৫১৮, ২০৫১৯, ২০৫৪৫, ২০৫৪৬, ২০৫৪৭, ২০৫৪৮, ২০৫৪৯, ২০৫৫০, ২০৫৫১, ২০৫৫২, ২০৫৫৩, ২০৫৫৪, ২০৫৫৫, ২০৫৫৬, ২০৫৫৮, ২০৫৮৬, ২০৫৮৮৮, ২০৫৮৯, ২০৫৯০, ২০৫৯১, ২০৫৯২, ২০৫৯৩, ২০৫৯৪, ২০৫৯৫, ২০৫৯৬, ২০৫৯৭, ২০৫৯৮, ২০৫৯৯, ২০৬০০, ২০৬০১, ২০৬০২, ২০৬০৩, ২০৬০৪, ২০৬০৫, ২০৬০৬, ২০৬০৭, ২০৬০৮, ২০৬০৯, ২০৬১০, ২০৬১১, ২০৬১২, ২০৬১৩, ২০৬১৪, ২০৬১৫, ২০৬১৬, ২০৬১৭, ২০৬১৮, ২০৬১৯, ২০৬২০, ২০৬২১, ২০৬২২, ২০৬২৩, ২০৬২৯, ২০৬৩০, ২০৬৩৬, ২০৭০৩, ২০৭০৪, ২০৭০৬, ২০৭০৭, ২০৭০৮, ২০৭১৬, ২০৭১৭, ২০৭১৮, ২০৭১৯, ২০৭২০, ২০৭২১, ২০৭২২, ২০৭২৩, ২০৭২৪, ২০৭২৫, ২০৭২৬, ২০৭২৭, ২০৭২৮, ২০৭২৯, ২০৭৩০, ২০৭৩১, ২০৭৩২, ২০৭৩৩, ২০৭৩৪, ২০৭৩৫, ২০৭৩৬, ২০৭৩৭, ২০৭৩৮, ২০৭৩৯, ২০৭৪২, ২১৭৩১		
মোট					৯৯.৩৫

এস.এম ইউনুচ
চেয়ারম্যান

বাংলাদেশ

বিছমিল্লাহির রাহমানির রাহিম

চিরজীবি হউক

৬নং লোহাগাড়া ইউনিয়ন পরিষদ

উপজেলা ঃ লোহাগাড়া, জেলা ঃ চট্টগ্রাম, বাংলাদেশ।

চেয়ারম্যান ঃ আলহাজ্ব নুরুচ্ছাফা চৌধুরী, 01818-685738

6 No Lohagara Union Parishad

Upazila : Lohagara, District : Chattogram, Bangladesh.

ইউপি চেয়ারম্যান/ সদস্যের নাম

আলহাজ্ব নুরুচ্ছাফা চৌধুরী
চেয়ারম্যান
০১৮১৮-৬৮৫৭৩৮

রেহেনা আক্তার
সংরক্ষিত মহিলা সদস্য (১, ২, ৩)
০১৮১৫-৯৫৮৫১২

জাফর আহমেদ
সদস্য, ০১নং ওয়ার্ড
০১৮৩৪-৫৬৬৮৮২

আব্দুল মন্নান
সদস্য, ০২নং ওয়ার্ড
০১৯৫২-৪২৩৭৩৪

শাহ আলম লিটন
সদস্য, ০৩নং ওয়ার্ড
০১৮১২-১৩৫৬৩৪

লুৎফুন্নিছা বিউটি
সংরক্ষিত মহিলা সদস্য (৪, ৫, ৬)
০১৮১৫-৮০৫৪৫২

মো: বেলাল
সদস্য, ০৪নং ওয়ার্ড
০১৮৭৪-৭৫৭০৫

মো: হামিদ
সদস্য, ০৫নং ওয়ার্ড
০১৮৭৪-৪৭৯৮০৩

এনামুল হক
সদস্য, ০৬নং ওয়ার্ড
০১৮৮১-৯৩৭৮৮১

জিনাত রেহেনা রওশন
সংরক্ষিত মহিলা সদস্য (৭,৮,৯)
০১৮৬৫৩৯৪৭৯৯

আব্দুল মালেক
সদস্য, ০ নং ওয়ার্ড
০১৮১৭-২০০২৬৬

আব্দুস সবুর
সদস্য, ০ নং ওয়ার্ড
০১৮১৭-২৪৬৪৮৮

নুরুল কবির
সদস্য, ০৯নং ওয়ার্ড
০১৬১৭-৩৮৩৮৪০

সূত্র : ২৭/২২ তারিখ : 21 SEP 2022

স্মারক নং- তারিখ-

অবস্থানগত/পরিবেশগত ছাড়পত্রের জন্য স্থানীয় কতৃপক্ষ কতৃক প্রদেয় অনাপত্তিপত্রের ছক

১। **আবেদনকারীর নামঃ** সড়ক ও জনপথ অধিদপ্তর

২। **পিতা/স্বামী/স্ত্রীর নামঃ** প্রযোজ্য নয়

৩। আবেদনকারীর ঠিকানাঃ অন্তর্বর্তীকালীন প্রকল্প পরিচালকের কার্যালয়, চট্টগ্রাম-কক্সবাজার হাইওয়ে ইমপ্রুভমেন্ট **প্রজেক্ট**, আরএইচডি বৈদেশিক সাহায্যপুষ্ট **প্রকল্পসমূহের** কার্যালয় **রোড-২৭**, ব্লক-এ, **বনানী**, ঢাকা-১২১৩

৪। কারখানা/ প্রকল্পের অবস্থানগত ঠিকানাঃ লোহাগাড়া ইউনিয়ন, লোহাগাড়া উপজেলা, চট্টগ্রাম জেলা

৫। কারখানা/ প্রকল্পের তফসিলঃ

জেলার নাম	উপজেলা	মৌজার নাম	দাগ নং	জমির ধরন	মোট জমির পরিমান
সংযুক্ত	সংযুক্ত	সংযুক্ত	সংযুক্ত	সংযুক্ত	সংযুক্ত

৬। কারখানা/ প্রকল্পের উৎপাদিত পন্যের নামঃ

উপরোক্ত তথ্যাদির আলোকে চট্টগ্রাম-কক্সবাজার হাইওয়ে ইমপ্রুভমেন্ট প্রকল্পকে নিম্নে বর্ণিত শর্তসাপেক্ষে অনাপত্তিপত্র প্রদান করা হলো ।

১। প্রকল্প/ কারখানা স্থাপন ও পরিচালনার ক্ষেত্রে পরিবেশ সংরক্ষণ আইন ও বিধি যথাযথভাবে অনুসরন করতে হবে ।

২। পরিবেশ অধিদপ্তর হতে বিধি দ্বারা নির্ধারিত পদ্ধতিতে ছাড়পত্র গ্রহন করতে হবে ।

৩। কর্মরত শ্রমিকদের পেশাগত স্বাস্থ্য ও নিরাপত্তা নিশ্চিত করতে হবে ।

৪। উপযুক্ত অগ্নি নির্বাপক ব্যবস্থা রাখতে হবে এবং অগ্নিকান্ড কিংবা অন্য কোন দূর্ঘটনার সময় জরুরি নির্গমন ব্যবস্থা থাকতে হবে।

৫। বায়ু ও শব্দ দূষণ করা যাবে না।

৬। কারখানা/ প্রকল্প সৃষ্ট তরল বর্জ্য অপরিশোধিত অবস্থায় বাইরে নির্গমন করা যাবে না।

উল্লিখিত যে কোন শর্ত লঙ্ঘন করলে যথোপযুক্ত কতৃপক্ষ কতৃক কারখানা/ প্রকল্পের বিরুদ্ধে আইনানুগ ব্যবস্থা নেওয়া যাবে।

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৬নং লোহাগাড়া ইউনিয়ন পরিষদ

জেলার নাম	উপজেলা	মৌজার নাম	দাগ নং	জমির ধরন	মোট জমির পরিমান (একর)
চট্টগ্রাম	লোহাগাড়া	লোহাগাড়া সিট নং ১	১৫, ২৯, ৩০, ৩১, ৩২, ৩৩, ৩৪, ৩৫, ৩৬, ৩৭, ৩৮, ৩৯, ৪০, ৪১, ৪২, ৪৩, ৪৪, ৪৫, ৪৬, ৪৪৭, ৪৮, ৪৯, ৫০, ৫১, ৫২, ৫৩, ৫৪, ৫৫, ৫৬, ৫৭, ৫৮, ৫৯, ৬০, ৬১, ৬৪, ৬৫, ৬৬, ৬৭, ৬৮, ৬৯, ৭০, ৭৩, ৭৪, ৭৫, ২২৯, ৩১৭, ৩১৮, ৩১৯, ৩২৩, ৩২৪, ৩২৫, ৩২৬, ৩২৭, ৩২৮, ৩২৯, ৩৩০, ৩৩১, ৩৩২, ৩৩৩, ৩৩৪, ৩৩৫, ৩৩৬, ৩৩৭, ৩৩৮, ৩৩৯, ৩৪০, ৩৪১, ৩৪২, ৩৪৩, ৩৪৪, ৩৪৫, ৩৪৬, ৩৪৭, ৩৪৮, ৩৪৯, ৩৫০, ৩৫১, ৩৫২, ৩৫৩, ৩৫৪, ৩৫৫, ৩৫৬, ৩৫৭, ৩৫৮, ৩৫৯, ৩৬০, ৩৬১, ৩৬২, ৩৬৩, ৩৬৪, ৩৬৫, ৩৬৬, ৩৬৭, ৩৭১, ৩৭৭, ৩৭৮, ৩৮৭, ৩৮৮, ৩৮৯, ৩৯০, ৩৯১, ৩৯২, ৩৯৩, ৩৯৪, ৩৯৫, ৩৯৬, ৩৯৮, ৩৯৯, ৪০০, ৪০১, ৪০২, ৪০৩, ৪০৪, ৪০৫, ৪০৬, ৪০৭, ৪০৮, ৪০৯, ৪১০, ৪১১, ৪১২, ৪১৩, ৪১৪, ৪১৫, ৪১৬, ৪১৭, ৪১৮, ৪১৯, ৪২০, ৪২১, ৪২২, ৪২৩, ৪২৪, ৪২৫, ৪২৬, ৪২৭, ৪২৮, ৪২৯, ৪৩০, ৪৩১, ৪৩২, ৪৩৩, ৪৩৪, ৪৩৫, ৪৩৬, ১১৩৮, ১১৪৬, ১১৫৪, ১১৫৬	রাস্তা, ভিটি, নাল	২৪.৭৪
চট্টগ্রাম	লোহাগাড়া	লোহাগাড়া সিট নং ২	১৬৬৪, ১৬৬৫, ১৬৬৬, ১৬৬৭, ১৬৬৮, ১৬৬৯, ১৬৭০, ১৬৭১, ১৬৭২, ১৬৭৩, ১৬৭৪, ১৬৭৫, ১৬৭৬, ১৬৭৭, ১৬৭৮, ১৬৭৯, ১৬৮০, ১৬৮১, ১৬৮২, ১৬৮৩, ১৬৮৪, ১৬৮৫, ১৬৮৬, ১৬৮৭, ১৬৮৮, ১৬৮৯, ১৬৯০, ১৬৯১, ১৬৯২, ১৬৯৩, ১৬৯৪, ১৬৯৫, ১৬৯৬, ১৬৯৭, ১৬৯৮, ১৬৯৯, ১৭০০, ১৭০১, ১৭০২, ১৭০৫, ১৭০৭, ১৭০৮, ১৭০৯, ১৭১০, ১৭১১, ১৭১২, ১৭১৩, ১৭১৪, ১৭১৫, ১৭১৬, ১৭১৭, ১৭১৮, ১৭১৯, ১৭২০, ১৭২১, ১৭২২, ১৭২৩, ১৭২৪, ১৭২৫, ১৭২৬, ১৭২৮, ১৭২৯, ১৭৩০, ১৭৩১, ১৭৩২, ১৭৩৩, ১৭৩৪, ১৭৩৫, ১৭৩৯, ১৭৪০, ১৭৪১, ১৭৪২, ১৭৪৩, ১৭৪৪, ১৭৪৫, ১৭৪৬, ১৭৪৭, ১৭৪৮, ১৭৫০, ১৭৫২, ১৭৫৩, ১৭৫৪, ১৭৫৫, ১৭৫৬, ১৭৫৭, ১৭৫৮, ১৭৫৯, ১৭৬০, ১৭৬১, ১৭৬২,	রাস্তা, ভিটি, খাল, নাল,	৬৮.৫১

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০৬নং লোহাগাড়া ইউনিয়ন পরিষদ
লোহাগাড়া, চট্টগ্রাম।

জেলার নাম	উপজেলা	মৌজার নাম	দাগ নং	জমির ধরন	মোট জমির পরিমান (একর)
			১৭৬৩, ১৭৮৬, ১৭৮৭, ১৭৮৯, ১৭৯০, ১৭৯১, ১৭৯২, ১৭৯৩, ১৭৯৪, ১৭৯৫, ১৭৯৬, ১৭৯৭, ১৭৯৮, ১৭৯৯, ১৮০০, ১৮০১, ১৮০২, ১৮১০, ১৮১১, ১৮১২, ১৮১৩, ১৮১৪, ১৮১৫, ১৮১৬, ১৮১৬৭, ১৮১৮, ১৮১৯, ১৮২০, ১৮২৬, ১৮২৮, ১৮২৯, ১৮৩০, ১৮৩১, ১৮৩২, ১৮৩৩, ১৮৩৪, ১৮৩৫, ১৮৩৬, ১৮৩৭, ১৮৩৮, ১৮৩৯, ১৮৪০, ১৮৪১, ১৮৪২, ১৮৪৩, ১৮৪৫, ১৮৪৬, ১৮৪৭, ১৮৯৯, ১৯০১, ১৯০২, ১৯০৩, ১৯০৪, ১৯০৫, ১৯০৬, ১৯০৭, ১৯০৮, ১৯০৯, ১৯১০, ১৯১১, ১৯১২, ১৯১৩, ১৯১৪, ১৯১৫, ১৯১৬, ১৯১৭, ১৯১৮, ১৯১৯, ১৯২০, ১৯২১, ১৯২২, ১৯২৩, ১৯২৪, ১৯২৫, ১৯২৬, ১৯২৭, ১৯২৮, ১৯২৯, ১৯৩০, ১৯৩১, ১৯৩৫, ১৯৩৬, ১৯৩৯, ১৯৪০, ১৯৪১, ১৯৪২, ১৯৪৩, ১৯৪৪, ১৯৪৫, ১৯৪৬, ১৯৪৭, ১৯৪৮, ১৯৪৯, ১৯৫০, ১৯৫১, ১৯৫২, ১৯৫৩, ১৯৫৪, ১৯৫৫, ১৯৫৬, ২৪১৩, ২৪১৫, ২৪১৬, ২৪১৭, ২৪১৮, ২৪১৯, ২৪২০, ২৪২১, ২৪২২, ২৪২৩, ২৪২৪, ২৪২৫, ২৪২৬, ২৪২৭, ২৪২৮, ২৪২৯, ২৪৩০, ২৪৩১, ২৪৩২, ২৪৩৩, ২৪৪৫, ২৪৪৭, ২৪৪৮, ২৪৪৯, ২৪৫০, ২৪৫১, ২৪৫২, ২৪৫৩, ২৪৫৪, ২৪৫৫, ২৪৫৬, ২৪৬০, ২৪৬১, ২৪৬২, ২৪৮২, ২৪৮৩, ২৪৮৪, ২৪৮৫, ২৪৮৬, ২৪৮৭, ২৪৮৮, ২৪৮৯, ২৪৯০, ২৪৯১, ২৪৯২, ২৪৯৮, ২৫১২, ২৫১৪, ২৫১৫, ২৫১৬, ২৫১৭, ২৫১৮, ২৫১৯, ২৫২০, ২৫২১, ২৫২২, ২৫২৩, ২৫২৪, ২৫২৫, ২৫২৬, ২৫২৭, ২৫২৮, ২৫২৯, ২৫৩০, ২৫৩১, ২৫৩২, ২৫৩৩, ২৫৩৪, ২৫৩৫, ২৫৩৬, ২৫৩৭, ২৫৩৮, ২৫৩৯, ২৫৪০, ২৫৪১, ২৫৪২, ২৫৪৩, ২৫৪৪, ২৫৪৪০, ২৫৪৫, ২৫৪৬, ২৫৪৭, ২৫৪৯, ২৫৫০, ২৫৫১, ২৫৫৫, ২৫৫৬, ২৫৫৭, ২৫৫৮, ২৫৫৯, ২৫৬০, ২৫৬১, ২৫৬৩, ২৫৬৪, ২৫৬৫, ২৫৬৬, ২৫৬৭, ২৫৬৮, ২৫৬৯, ২৫৭০, ২৫৭১, ২৫৭২, ২৫৭৩,		

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আলহাজ্ব নুরুচ্ছাফা চৌধুরী
চেয়ারম্যান
০৬নং লোহাগাড়া ইউনিয়ন পরিষদ
লোহাগাড়া, চট্টগ্রাম

জেলার নাম	উপজেলা	মৌজার নাম	দাগ নং	জমির ধরন	মোট জমির পরিমান (একর)
			২৫৭৪, ২৫৭৫, ২৫৭৬, ২৫৭৭, ২৫৭৮, ২৫৭৯, ২৫৮০, ২৫৮১, ২৫৮২, ২৫৮৩, ২৫৮৪, ২৫৮৫, ২৫৮৬, ২৫৮৭, ২৫৯২, ২৫৯৭, ২৫৯৮, ২৫৯৯, ২৬০০, ২৬০১, ২৬০২, ২৬০৩, ২৬০৪, ২৬০৫, ২৬০৬, ২৬০৭, ২৬০৮, ২৬০৯, ২৬১০, ২৬১১, ২৬১২, ২৬১৩, ২৬১৬, ২৬১৬, ২৬১৮, ২৬১৯, ২৬২০, ২৬২১, ২৬২২, ২৬২৩, ২৬২৪, ২৬২৫, ২৬২৬, ২৬২৭, ২৬২৮, ২৬২৯, ২৬৩০, ২৬৩১, ২৬৩৩, ২৬৩৪, ২৬৩৫, ২৬৩৬, ২৬৩৭, ২৬৩৮, ২৬৩৯, ২৬৪০, ২৬৪১, ২৬৪২, ২৬৫১, ২৬৫২, ২৬৫৩, ২৬৫৪, ৪৯৩৭		
চট্টগ্রাম	লোহাগাড়া	লোহাগাড়া সিট নং ২	১৪০০৩, ১৪০০৪, ১৪০১১, ১৪০১২, ১৪০১৩, ১৪০১৪, ১৪০১৫, ১৪০১৬, ১৪০৫০, ১৪০৮৪, ১৪০৮৫, ১৫০৬৭, ১৬৬৯০	রাস্তা, ভিটি, নাল	১.০৬
মোট					৯৪.৩১

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চেয়ারম্যান
০৬নং লোহাগাড়া ইউনিয়ন পরিষদ
লোহাগাড়া, চট্টগ্রাম

স্মারক নং- ইউপি-১০২/২০২২- তাং ২১।০৯।২২
তারিখ-

অবস্থানগত/পরিবেশগত ছাড়পত্রের জন্য স্থানীয় কতৃপক্ষ কতৃক প্রদেয় অনাপত্তিপত্রের ছক

১। আবেদনকারীর নামঃ সড়ক ও জনপথ অধিদপ্তর

২। পিতা/স্বামী/স্ত্রীর নামঃ প্রযোজ্য নয়

৩। আবেদনকারীর ঠিকানাঃ অন্তর্বর্তীকালীন প্রকল্প পরিচালকের কার্যালয়, চট্টগ্রাম-কক্সবাজার হাইওয়ে ইমপ্রুভমেন্ট প্রজেক্ট, আরএইচডি বৈদেশিক সাহায্যপুষ্ট প্রকল্পসমূহের কার্যালয় রোড-২৭, ব্লক-এ, বনানী, ঢাকা-১২১৩

৪। কারখানা/ প্রকল্পের অবস্থানগত ঠিকানাঃ ফাসিয়াখালি ইউনিয়ন, চকরিয়া উপজেলা, কক্সবাজার জেলা

৫। কারখানা/ প্রকল্পের তফসিলঃ

জেলার নাম	উপজেলা	মৌজার নাম	দাগ নং	জমির ধরন	মোট জমির পরিমান
সংযুক্ত	সংযুক্ত	সংযুক্ত	সংযুক্ত	সংযুক্ত	সংযুক্ত

৬। কারখানা/ প্রকল্পের উৎপাদিত পন্যের নামঃ

উপরোক্ত তথ্যাদির আলোকে চট্টগ্রাম-কক্সবাজার হাইওয়ে ইমপ্রুভমেন্ট প্রকল্পকে নিম্নে বর্ণিত শর্তসাপেক্ষে অনাপত্তিপত্র প্রদান করা হলো ।

১। প্রকল্প/ কারখানা স্থাপন ও পরিচালনার ক্ষেত্রে পরিবেশ সংরক্ষণ আইন ও বিধি যথাযথভাবে অনুসরন করতে হবে ।

২। পরিবেশ অধিদপ্তর হতে বিধি দ্বারা নির্ধারিত পদ্ধতিতে ছাড়পত্র গ্রহন করতে হবে ।

৩। কর্মরত শ্রমিকদের পেশাগত স্বাস্থ্য ও নিরাপত্তা নিশ্চিত করতে হবে ।

৪। উপযুক্ত অগ্নি নির্বাপক ব্যবস্থা রাখতে হবে এবং অগ্নিকান্ড কিংবা অন্য কোন দূর্ঘটনার সময় জরুরি নির্গমন ব্যবস্থা থাকতে হবে।

৫। বায়ু ও শব্দ দূষণ করা যাবে না।

৬। কারখানা/ প্রকল্প সৃষ্ট তরল বর্জ্য অপরিশোধিত অবস্থায় বাইরে নির্গমন করা যাবে না।

উল্লিখিত যে কোন শর্ত লঙ্ঘন করলে যথোপযুক্ত কতৃপক্ষ কতৃক কারখানা/ প্রকল্পের বিরুদ্ধে আইনানুগ ব্যবস্থা নেওয়া যাবে।

২১/০৯/২০২২

তারিখ-

স্থানীয় কতৃপক্ষের স্বাক্ষর ও সীল
হেলাল উদ্দিন
চেয়ারম্যান
৮নং ফাঁসিয়াখালী ইউনিয়ন পরিষদ
চকরিয়া, কক্সবাজার

জেলার নাম	উপজেলা	মৌজার নাম	দাগ নং	জমির ধরন	মোট জমির পরিমান
কক্সবাজার	চকরিয়া	দিগরপানখালী	২১৯, ২২৪, ২২৫, ২২৬, ২২৭, ২২৮, ২২৯, ২৩০, ২৩৮, ২৩৯, ২১৮, ২২০, ২২১, ২২২, ২২৭, ৭২৮, ৭৩০, ৭৩১, ৭২৬, ৭২৭, ৭২৯, ৭৩৩, ৭৪৭, ৭৫৭, ৭৫৮, ৭৪৬, ৭৪৯, ৭৫০, ৭৫৫, ৭৫৬, ৭৪৮, ৭৫১, ৭৫২, ৭৪০, ৭৫৪, ৮৮৮, ৮৯০, ৮৯১, ৮৯২, ৮৯৪, ৮৯৫, ৮৯৬, ৮৯৭, ৮৯৮, ৮৯৯, ৯০০, ৯০৪, ৯০৫	নাল, ভিটি	৯.২৩ একর
কক্সবাজার	চকরিয়া	পোক পোখরিয়া পানখালী	১১৯৫, ১১৯৬, ১১৯৭, ১২০০, ১২০১, ১২১৯, ১২২০, ১২৩৮, ১২৩৯, ১২৪০, ১২৪২, ১২৪৯, ১২৫১, ১২৫২, ১২৫৩, ১২৫৭, ১২৫৮, ১২৬০, ১২৬১, ১২৬৩, ১২৬৪	নাল, ভিটি	৫.২৪ একর
কক্সবাজার	চকরিয়া	রাজার বিল	১৭৭, ১৭৮, ১৭৯, ১৮০, ১৮১, ১৮২, ১৮৩, ১৮৬, ১৮৭, ১৮৮, ১৮৯, ১৯৫, ১৯৬, ১৯৭, ১৯৮	নাল	৩.১৬ একর
কক্সবাজার	চকরিয়া	উচিতার বিল	১২২, ১২৩, ১২৪, ১২৫, ১২৬, ১২৭, ১২৮, ১৩২, ১৫৪, ১৫৭, ১৫৮, ১৫৯, ১৬৪, ১৬৫, ১৬৮, ১৬৯, ১৭০, ১৭৩, ১৭৪, ১১৮, ১১৯, ১১৫, ১৮০, ১৮৫, ১৮৬, ১৮৭, ১৮৮, ১৯০, ২১৫, ২১৬, ২১৭, ২১৮, ২১৯, ২২০, ২২৬, ২২৭, ২৩১, ২৩২, ২৩৩, ২৩৪, ২৩৬, ২৩৭, ২৩৮, ২৪০, ২৫৩, ২৫৪, ২৫৭, ২৫৮,	নাল, ভিটি, খাল	৯.৫৯ একর
কক্সবাজার	চকরিয়া	ফাসিয়াখালি	১০২৬, ১০২৮, ১০২৯, ১০৪৪	নাল, খাল	১.০৯ একর
মোট					**২৮.৩১ একর**

১৩/০৩/২০২২

হেলাল উদ্দিন
চেয়ারমান
৮নং ফাঁসিয়াখালী ইউনিয়ন পরিষদ
চকরিয়া, কক্সবাজার

স্মারক নং-

তারিখ- ২২/৪৯/২২

অবস্থানগত/পরিবেশগত ছাড়পত্রের জন্য স্থানীয় কতৃপক্ষ কতৃক প্রদেয় অনাপত্তিপত্রের ছক

১। আবেদনকারীর নামঃ সড়ক ও জনপথ অধিদপ্তর

২। পিতা/স্বামী/স্ত্রীর নামঃ প্রযোজ্য নয়

৩। আবেদনকারীর ঠিকানাঃ অন্তর্বর্তীকালীন প্রকল্প পরিচালকের কার্যালয়, চট্টগ্রাম-কক্সবাজার হাইওয়ে ইমপ্রুভমেন্ট প্রজেক্ট, আরএইচডি বৈদেশিক সাহায্যপুষ্ট প্রকল্পসমূহের কার্যালয় রোড-২৭, ব্লক-এ, বনানী, ঢাকা-১২১৩

৪। কারখানা/ প্রকল্পের অবস্থানগত ঠিকানাঃ কাকারা ইউনিয়ন, চকরিয়া উপজেলা, কক্সবাজার জেলা

৫। কারখানা/ প্রকল্পের তফসিলঃ

জেলার নাম	উপজেলা	মৌজার নাম	দাগ নং	জমির ধরন	মোট জমির পরিমান
সংযুক্ত	সংযুক্ত	সংযুক্ত	সংযুক্ত	সংযুক্ত	সংযুক্ত

৬। কারখানা/ প্রকল্পের উৎপাদিত পন্যের নামঃ

উপরোক্ত তথ্যাদির আলোকে চট্টগ্রাম-কক্সবাজার হাইওয়ে ইমপ্রুভমেন্ট প্রকল্পকে নিম্নে বর্ণিত শর্তসাপেক্ষে অনাপত্তিপত্র প্রদান করা হলো ।

১। প্রকল্প/ কারখানা স্থাপন ও পরিচালনার ক্ষেত্রে পরিবেশ সংরক্ষণ আইন ও বিধি যথাযথভাবে অনুসরন করতে হবে ।

২। পরিবেশ অধিদপ্তর হতে বিধি দ্বারা নির্ধারিত পদ্ধতিতে ছাড়পত্র গ্রহন করতে হবে ।

৩। কর্মরত শ্রমিকদেও পেশাগত স্বাস্থ্য ও নিরাপত্তা নিশ্চিত করতে হবে ।

৪। উপযুক্ত অগ্নি নির্বাপক ব্যবস্থা রাখতে হবে এবং অগ্নিকান্ড কিংবা অন্য কোন দূর্ঘটনার সময় জরুরি নির্গমন ব্যবস্থা থাকতে হবে।

৫। বায়ু ও শব্দ দূষণ করা যাবে না।

৬। কারখানা/ প্রকল্প সৃষ্ট তরল বর্জ্য অপরিশোধিত অবস্থায় বাইরে নির্গমন করা যাবে না।

উল্লিখিত যে কোন শর্ত লঙ্ঘন করলে যথোপযুক্ত কতৃপক্ষ কতৃক কারখানা/ প্রকল্পের বিরুদ্ধে আইনানুগ ব্যবস্থা নেওয়া যাবে।

তারিখ-

স্থানীয় কতৃপক্ষের স্বাক্ষর ও সীল

(মোহাম্মদ হাফেজ হারুন)
প্যানেল চেয়ারম্যান
৭নং কাকারা ইউনিয়ন
চকরিয়া, কক্সবাজার

জেলার নাম	উপজেলা	মৌজার নাম	দাগ নং	জমির ধরন	মোট জমির পরিমান
কক্সবাজার	চকরিয়া	কাকারা	১৫০২, ১৫০৩, ১৫০৪, ১৫০৫, ১৫০৬, ১৫০৭, ১৫০৮, ১৫০৯, ১৬১৩, ১৬১৪, ১৬২১, ১৬১৮, ১৬১৭, ১৬২১, ১৬২২, ১৬১৫, ১৬২৯, ১৬৩৬, ১৬৩০, ১৬৩৫, ১৬৩৪, ১৬৩৭, ১৬৪০, ১৬৪১, ১৬৪২, ১৬৪৩, ১৬৪৪, ১৬৬৫, ১৭৫৭, ১৭৫৮, ১৭৬০, ১৭৬১, ১৭৬২, ১৭৬৩, ১৭৬৪, ১৭৬৫, ১৭৬৬, ১৭৬৭, ১৭৬৮, ১৭৬৯, ১৭৭০, ১৮২০, ১৮২১, ১৮২২, ১৮২৩, ১৮২৪, ৩৫১১, ৩৫১২, ৩৫১৩, ৩৫১৪, ৩৫১৫, ৩৫১৬, ৩৫২১, ৩৫২২, ৩৫২৬, ৩৫২৭	নাল, ভিটি	৭.৪ একর
কক্সবাজার	চকরিয়া	লোটনি	১১৬, ১২১, ১২২, ১২৩, ১২৪, ১২৯, ১৫৩, ১৫৪, ১৫৫, ১৫৬, ১৫৭, ১৫৮, ১৬০, ১৬১, ১৬২, ১৬৩, ১৬৪, ১৯৭, ১৯৮, ১৯৯, ২০০, ২০২, ২০৩, ২০৪, ২০৫, ২০৬, ২০৭, ২০৮, ২০৯, ২১০, ২১১, ২১২, ২১৮, ২১৫, ২৭২, ২৭৩, ২৭৪, ২৭৫, ২৭৬, ২৭৭, ৩২১, ৩২২, ৩২৩, ৩৩৫, ৩৩৬, ৩৩৭, ৩৪৪, ৩৪৫, ৩৪৬, ৩৪৭, ৩৬৫, ৩৬৬, ৩৬৭, ৩৮৪, ৩৮৫, ৩৯৮, ৩৯৯, ৪০০, ৪০১, ৪০৩, ৪০৫, ৪০৭, ৪০৮, ৪১৪, ৪১৫, ৪১৭, ৪১৮, ৪১৯, ৫০১, ৫০৭, ৫০৮, ৫১০, ৫১১, ৫১২, ৫১৩, ৫১৪, ৫১৫, ৫১৬, ৫১৭, ৫৩৫, ৫৪২, ৫৪৩, ৫৪৪, ৫৪৫, ৫৫৪, ৫৫৭, ৫৫৮, ৫৫৯, ৫৬০, ৫৬১, ৮০৫, ৮০৬, ৮০৭, ৮০৮, ৮০৮, ৮০৯, ৮১০, ৮৪১, ৮৪২, ৮৪৩, ৮৪৪, ৮৪৬, ৮৪৭, ৮৪৮, ৮৫১, ৮৫২, ৮৫৩, ৮৫৪, ৮৬৪, ৮৬৫, ৮৬৬, ৮৬৭, ৮৬৮, ৮৬৯, ৬৭০, ৬৭১, ৬৭২, ৬৭৩, ৬৭৪, ৮৭৯,	নাল, ভিটি	২০.৬২ একর

22/07/22

(মোহাম্মদ মোরশেদ)
প্যানেল মেয়র
৩নং কাকারা ইউনিয়ন পরিষদ
চকরিয়া, কক্সবাজার।

জেলার নাম	উপজেলা	মৌজার নাম	দাগ নং	জমির ধরন	মোট জমির পরিমান
			৮৮০, ৯৬২, ৯৬৮, ৯৬৯, ৯৭০, ৯৭২, ৯৭৩, ৯৭৪,		
কক্সবাজার	চকরিয়া	হাজিয়ান	৪৫৮, ৪৮৫, ৪৮৬, ৪৮৭, ৪৮৮	ভিটি	০.২২ একর
মোট					**২৮.২৪ একর**

২২/০৯/২২

স্মারক নং- ৪০/২২ তারিখ- ২৭/০১/২০২২

অবস্থানগত/পরিবেশগত ছাড়পত্রের জন্য স্থানীয় কতৃপক্ষ কতৃক প্রদেয় অনাপত্তিপত্রের ছক

১। আবেদনকারীর নামঃ সড়ক ও জনপথ অধিদপ্তর

২। পিতা/স্বামী/স্ত্রীর নামঃ প্রযোজ্য নয়

৩। আবেদনকারীর ঠিকানাঃ অন্তর্বর্তীকালীন প্রকল্প পরিচালকের কার্যালয়, চট্টগ্রাম-কক্সবাজার হাইওয়ে ইমপ্রুভমেন্ট প্রজেক্ট, আরএইচডি বৈদেশিক সাহায্যপুষ্ট প্রকল্পসমূহের কার্যালয় রোড-২৭, ব্লক-এ, বনানী, ঢাকা-১২১৩

৪। কারখানা/ প্রকল্পের অবস্থানগত ঠিকানাঃ লক্ষ্যারচর ইউনিয়ন, চকরিয়া উপজেলা, কক্সবাজার জেলা

৫। কারখানা/ প্রকল্পের তফসিলঃ

জেলার নাম	উপজেলা	মৌজার নাম	দাগ নং	জমির ধরন	মোট জমির পরিমান
সংযুক্ত	সংযুক্ত	সংযুক্ত	সংযুক্ত	সংযুক্ত	সংযুক্ত

৬। কারখানা/ প্রকল্পের উৎপাদিত পন্যের নামঃ প্রযোজ্য নয়

উপরোক্ত তথ্যাদির আলোকে চট্টগ্রাম-কক্সবাজার হাইওয়ে ইমপ্রুভমেন্ট প্রকল্পকে নিম্নে বর্ণিত শর্তসাপেক্ষে অনাপত্তিপত্র প্রদান করা হলো ।

১। প্রকল্প/ কারখানা স্থাপন ও পরিচালনার ক্ষেত্রে পরিবেশ সংরক্ষণ আইন ও বিধি যথাযথভাবে অনুসরন করতে হবে ।

২। পরিবেশ অধিদপ্তর হতে বিধি দ্বারা নির্ধারিত পদ্ধতিতে ছাড়পত্র গ্রহন করতে হবে ।

৩। কর্মরত শ্রমিকদের পেশাগত স্বাস্থ্য ও নিরাপত্তা নিশ্চিত করতে হবে ।

৪। উপযুক্ত অগ্নি নির্বাপক ব্যবস্থা রাখতে হবে এবং অগ্নিকান্ড কিংবা অন্য কোন দুর্ঘটনার সময় জরুরি নির্গমন ব্যবস্থা থাকতে হবে।

৫। বায়ু ও শব্দ দূষণ করা যাবে না।

৬। কারখানা/ প্রকল্প সৃষ্ট তরল বর্জ্য অপরিশোধিত অবস্থায় বাইরে নির্গমন করা যাবে না।

উল্লিখিত যে কোন শর্ত লঙ্ঘন করলে যথোপযুক্ত কতৃপক্ষ কতৃক কারখানা/ প্রকল্পের বিরুদ্ধে আইনানুগ ব্যবস্থা নেওয়া যাবে।

তারিখ-

স্থানীয় কতৃপক্ষের স্বাক্ষর ও সীল

মহি উদ্দিন মোঃ আওরঙ্গজেব
চেয়ারম্যান
৯নং লক্ষ্যারচর ইউনিয়ন পরিষদ
চকরিয়া, কক্সবাজার।

জেলার নাম	উপজেলা	মৌজার নাম	দাগ নং	জমির ধরন	মোট জমির পরিমান
কক্সবাজার	চকরিয়া	লক্ষ্যারচর	২৪৯২, ২৪৯৫, ২৪৯৬, ১৫২০, ১৫২১, ২৪৫৬, ২৪৫৭, ২৪৫৮, ২৪৫৯, ২৪৬০, ২৪৬১, ২৪৬২, ২৪৬৩, ২৪৬৪,২৪৬৫, ২৪৬৬, ২৪৬৭, ২৭০৯, ২৭১০, ২৭১১, ২৭১২, ২৭১৩, ২৭১৪, ২৭৭৪, ২৭৭৫, ২৭৭৬, ২৭৭৭, ২৭৫২, ২৭৫৩, ২৭৫৪, ২৭৫৫, ২৭৮১, ২৭৮২, ২৭৮৩, ২৭৮৬, ২৭৪৭, ২৭৮৯, ২৭৯০, ২৭৯১, ২৭৯২, ২৭৯৯, ২৮০৫, ২৮০৬, ২৮০৬, ২৮০৭, ২৮১৯,২৮২০, ২৮২১, ২৮২৪, ২৮২৫, ২৮২৬, ২৮২৭, ২৮৪৬, ২৮৪৭, ২৮৪৮, ২৮৪৯, ২৮৫০, ২৮৫১, ২৮৫২, ২৮৮৫, ২৮৮৮, ২৮৮৯, ২৮৯০, ২৮৯১, ২৮৯২, ২৮৯৩, ২৮৯৪, ২৯০২, ২৯০৭, ২৯০৭, ২৯০৮, ২৯০৯, ৩২৩২	নাল, ভিটি	৮.৩৯ একর
মোট					৮.৩৯ একর

মহি উদ্দিন মোঃ আওরঙ্গজেব
চেয়ারম্যান
৯নং লক্ষ্যারচর ইউনিয়ন পরিষদ
চকরিয়া, কক্সবাজার।

Appendix K: Received Copy of Tree Cutting Permission Letter Submitted to Forest Department

Government of the People's Republic of Bangladesh
Office of the Project Manager (EE), RHD
Cross Border Road Network Improvement Project (Bangladesh)
Sarak Bhaban, Block-B, Agrabad, Chattogram
e-mail: *pmeastcbrnip@gmail.com*

Memo no: PM (East)/433

Date: 20/09/2022

Subject: Tree Cutting Permission for the "Chattogram-Cox's Bazar Highway Improvement Project."

With reference to the above-mentioned subject, this is to inform that Roads and Highways Department under the Road Transport and Highways Division, Ministry of Road Transport and Bridges has planned to take up Chattogram-Cox's Bazar Highway Improvement Project with the financial aid from Japan International Cooperation Agency (JICA). Four outer roads at Patiya, Dohazari, Lohagara, Chakaria and a flyover at Keranihat will be constructed under this project. This project will play an important role for the traffic of Matarbari Port and Chattogram-Cox's Bazar region. It is for your kind information that some number of private trees will be required to be felled for construction of this project.

In this context, you are kindly requested to provide the tree cutting permission for the afore-mentioned project. Below mentioned person has been appointed as focal person for these purposes.

Focal person
S. M. Tanvir Hassan
Assistant Consultant
Mobile: 01676250500
EQMS Consulting Limited.

Attachment:

1. Tree Inventory
2. Land Information
3. Road alignment on Mauza Map

Zulfiquar Ahmed
ID No: 602138
Project Manager (EE), RHD
Cross Border Road Network Improvement
Project (Bangladesh)

(Zulfiquar Ahmed)
ID No: 602138
Project Manager (East)
Executive Engineer (R&D)
Cross Border Road Network
Improvement Project (Bangladesh)

Divisional Forest Officer
Chattogram South Forest Division
Department of Forest, Chattogram

Copy Sent for Kind information and cooperation to (Not According to Seniority)

1. Additional Chief Engineer, RHD, Chattogram Zone, Chattogram.
2. Superintending Engineer, RHD, Road Circle, Chattogram.
3. Executive Engineer, RHD, Road Division, Chattogram/Dohazari.

Received
22/9/2022

Pm sir/enlish letter/forwarding/F