

PART: I - SURVEY REPORT INCLUDING FEASIBILITY STUDY
Feasibility Study (Series 2 of 4)



Environment Impact Assessment (EIA)

Submitted To



**Chittagong University of Engineering
and Technology (CUET)**

Address: Kaptai, Highway Raozan Pahartali Rd, Chattogram 4349

www.cuet.ac.bd

Submitted By



**ONUSHANDHANI CREEDS LIMITED
(O.CREEDS)**

House: 135, Floor: 2nd, Road: 05, Mohakhali DOHS, Dhaka-1206

E-mail: ceo@ocreeds.com

www.ocreeds.com

EXECUTIVE SUMMARY

Bangladesh is blessed with natural beauty, ranging from mountains to rivers to beaches to bio-diversity. There is a great probability for the development of tourism industry if we are capable of ensuring infrastructural development, development of transportation and communication system and safety tourist spot for the tourists. In the south-eastern part, which is the Chittagong Division, there are natural and hilly areas like Chittagong Hill Tracts, along with sandy sea beaches. The most notable beach, in Cox's Bazar, is a contender for the title of longest unbroken sandy sea beach in the world.

Teknaf is an upazila of Cox's Bazar district under Chittagong division. It is the southern-most point in Bangladesh and it shares the border with Myanmar. The upazila is situated on the bank of Naf River and the hilly areas of Cox's Bazar. The scenic and enchanting beauty of Naf River, hills, forests and sea beach of Teknaf attract the tourists. Tourists can enjoy the river from the top of the hill which is the entrance of the town. Teknaf Sea Beach is one of the longest sandy beach ecosystems (80 km) in the world which is also very attractive for its blue and clear water.

One of the main attractions of Teknaf will be the Naf Tourism Park. The Naf Tourism Park is a proposed economic zone in the Jaliardwip, Cox's Bazar, and will be the first exclusive tourism park in Bangladesh. BEZA is developing this as part of its plan to develop 100 special economic zones throughout the country. Naf Tourism Park will be located in the Jaliardwip Island which is situated in the middle of the Naf River that divides Myanmar and Bangladesh. The island is diverse and multifaceted as it has both hill and river view.

Naf Tourism Park will be the first island-based tourism park in Bangladesh encompassing an area of 271 acres. Specialty of Naf Tourism Park will be Theme cruise for St. Martin Coral Reef Island, 5 star hotel, Restaurant, Honeymoon Park, Multi formatted Food Court & Themed Pavilions Jungle, jogging Tracks, Night Camps, Eco-Friendly Resorts, Mini Golf Course, Light & Sound Show, Entertainment Zone, Infant Swimming Pool, Cable Car, Sky Bridge, Oceanarium, Water Sports Complex, Game Parlors, Birds Watching and View Tower, Harbor Bridge, Cable Car Hanging, Hanging Bridge.

BEZA is responsible to execute this project Construction of Cable Car at Naf Tourism Park. At present, the route is Ne-Taung Hill to Naf Tourism Park (9.5km), after the construction of the Cable Car tourist attraction will increase in this area. As a result, this project will have a positive impact on overall economic development and at the same time, it will play an important role in promoting national tourism and improving the living standard of the locals. So the project is both economically and financially viable. It is, therefore recommended for implementation of the project.

The ONUSHANDHANI CREEDS LIMITED has carried out an EIA study for "Construction of Cable Car at Naf Tourism Park" project. Environmental impacts have been identified, and assessed, based on the baseline study undertaken as a part of EIA. The major impact identified is the change in the biodiversity of Naf River and at the top of the hill as the cable car will be connected among the three points. But the people within the project site will be economically benefited as it will be a tourist attraction. The purpose of this report is to investigate and provide an environmental baseline, determine the significance of residual impacts and delineation of Environmental Management Plan (EMP) & Biodiversity Management Pan (BMP) of the Project.

TABLE OF CONTENTS

EXECUTIVE SUMMARY	II
TABLE OF CONTENTS	III
LIST OF TABLES	VII
LIST OF FIGURES	IX
ACRONYMS AND ABBREVIATIONS.....	XI
1. INTRODUCTION	1
1.1 Project Background.....	1
1.2 Purpose of EIA Report.....	2
1.2.1 Scope of Work.....	2
1.3 Applicable Framework.....	2
1.4 Scope of EIA Study.....	3
1.5 Approach and Methodology	4
1.5.1 Screening	4
1.5.2 Scoping	4
1.5.3 Baseline Data Generation.....	5
1.6 EIA Team	7
1.7 Limitations	10
2. PROJECT DESCRIPTION	11
2.1 The Project.....	11
2.2 Project Location	11
2.2.1 Cable Car Project.....	11
2.2.2 Site Access	12
2.2.3 Key Feature of the Site and Surroundings	15
2.3 Description of Project Facilities, Components and Activities	19
2.3.1 Project Features.....	19
2.3.2 Project Components.....	19
2.3.3 Planning Phase	20
2.3.4 Construction Phase.....	20
2.3.5 Operation and Maintenance.....	21
2.4 Resources Requirement	21
2.4.1 Land.....	21
2.4.2 Water.....	22
2.4.3 Power.....	22
2.4.4 Manpower	22
2.4.5 Logistics During Construction Phase	22
2.4.6 Pollution Source, Characterization, and Control Measures	22
2.4.7 Fire Safety and Security.....	24
2.5 Project Schedule	24
2.6 Analysis of Alternatives	24
2.6.1 No Project Scenario	25
2.6.2 With Project Scenario.....	25
2.6.3 Conclusion	25
3. ADMINISTRATIVE FRAMEWORK	26
3.1 Environment-Related Policies in Bangladesh	26
3.1.1 National Environmental Policy, 1992	26
3.1.2 National Environment Management Action Plan, 1995.....	26

3.1.3	National Conservation Strategy, 1992	27
3.1.4	Other Policies Relevant to Environment	27
3.2	Environment and Social related Legislations in Bangladesh	28
3.2.1	The Environment Conservation Act, 1995 (subsequent amendments in 2000 and 2002).....	28
3.2.2	Environment Conservation Rules (ECR), 1997 (subsequent amendment in 2017)....	28
3.2.3	Environment Court Act, 2000 and subsequent amendments in 2002.....	29
3.2.4	Bangladesh Water Act, 2013	29
3.2.5	National Land Use Policy, 2001	30
3.2.6	Khas land (Agriculture) Management and Settlement Policy 1997.....	30
3.2.7	East Bengal State Acquisition and Tenancy Act, 1950.....	31
3.2.8	The Registration Act, 1908, amended in 2004.....	31
3.2.9	Transfer of Property Act, 1882.....	32
3.2.10	Land Holding Limitation Order, 1972, amended in 1982.....	32
3.2.11	Non-agricultural khas lands Management and Settlement Policy, 1995.....	32
3.2.12	Non-Agricultural Tenancy Act 1949	33
3.3	Relevant National Legal Instruments for the Project.....	33
3.3.1	Administrative Setup related to Environment in Bangladesh	37
3.3.2	Other Related Organization	37
3.3.3	Department of Environment (“DOE”).....	37
3.4	Environmental Clearance Process.....	38
3.5	Project Relevant International treaties and Conventions	40
3.6	International Safeguard Requirements	41
3.6.1	IFC Performance Standards	41
3.6.2	Equator Principles III (2013).....	48
3.6.3	FMO Sustainability Policy	49
3.7	Applicable Environmental Standards	50
4.	ENVIRONMENTAL AND SOCIAL SCREENING AND SCOPING	54
4.1	Screening	54
4.1.1	Project Categorisation as Per DoE, Ministry of Environment, Forest and Climate Change, Bangladesh.....	54
4.1.2	Project Categorization as Per FMO	54
4.1.3	Categorization of the Project.....	54
4.2	Scoping	55
4.2.1	Identification of Potential Environmental & Social Impacts	55
4.2.2	Scoping Matrix	56
4.3	Environmental and Social Impacts.....	59
5.	ENVIRONMENTAL AND SOCIAL BASELINE CONDITIONS.....	61
5.1	Introduction	61
5.2	Study Area	61
5.3	Project Influence Area.....	63
5.4	Approach and Methodology	63
5.4.1	Baseline Data Collection	64
5.4.2	Environmental Monitoring	64
5.4.3	Ecological Survey.....	69
5.4.4	Socio-economic Baseline.....	70
5.5	Physical Environment.....	70
5.5.1	Physiography	70
5.5.2	Topography	71
5.5.3	Climate and Meteorology	73
5.5.4	Temperature.....	74
5.5.5	Rainfall	75

5.5.6	Humidity	76
5.5.7	Wind Speed and Direction	77
5.5.8	Air Quality.....	78
5.5.9	Noise Quality.....	83
5.5.10	Geology.....	86
5.5.11	Land Use-Land Cover	88
5.5.12	Soil Quality	90
5.5.13	Hydrology	92
5.5.14	Surface Water Quality	93
5.5.15	Hydrogeology	94
5.5.16	Traffic & Transport	96
5.5.17	Natural Hazards	102
5.6	Ecological Environment.....	107
5.6.1	Study Area	107
5.6.2	Bio-ecological Zone.....	107
5.7	Ecological Classification of the Forests of Cox’s Bazar especially Teknaf Wildlife Sanctuary (TWS).....	108
5.7.1	Evergreen Forests.....	108
5.7.2	Deciduous	109
5.7.3	Bamboo Forests.....	109
5.7.4	Savannahs	109
5.8	Floral Records.....	109
5.8.1	Prior to the Independence of Bangladesh.....	109
5.8.2	Angladesh Period.....	109
5.9	Significance of Protected Areas for Biodiversity Conservation	110
5.9.1	Teknaf Wildlife Sanctuary	110
5.9.2	Homestead Plants.....	127
5.9.3	Vegetable Cultivation	129
5.9.4	Agricultural Crop Vegetation	130
5.9.5	Road Side Plants	131
5.10	Faunal Diversity	132
5.10.1	Invertebrates, fish and fisheries	132
5.10.2	Mammals.....	133
5.10.3	Birds	135
5.10.4	Reptiles	138
5.10.5	Amphibians	139
5.10.6	FGD, KII	140
5.10.7	Protected Areas	141
6.	STAKEHOLDER ENGAGEMENT	142
6.1	Scope and Specific Objectives.....	142
6.2	Identification of Stakeholders	142
6.2.1	Stakeholder Mapping	144
6.3	Summary of Engagement Activities	146
6.3.1	Engagement of Government officials	146
6.3.2	Engagement as part of the Land procurement process	147
6.3.3	Appointment of a Resettlement Manager.....	148
6.3.4	Establishing a Resettlement Committee	148
7.	IMPACT ASSESSMENT AND MITIGATION MEASURES	150
7.1	Introduction	150
7.2	Impact Assessment Methodology and Approach.....	150
7.2.1	Prediction of impacts.....	150
7.2.2	Evaluation of impacts	151

7.2.3	Identification of mitigation and enhancement measures	157
7.2.4	Management and monitoring	157
7.3	Environmental Impacts:.....	157
7.3.1	Impact on Land Use	157
7.3.2	Impact on Natural Resources.....	159
7.3.3	Impact on Topography and Drainage.....	160
7.3.4	Impact on Soil Quality	162
7.3.5	Impact on Ambient Air Quality.....	167
7.3.6	Impact on Ambient Noise Quality.....	169
7.3.7	Impact on Water Resource & Quality.....	171
7.3.8	Impact on Road & Traffic	174
7.3.9	Impact on Biological Environment.....	175
7.3.10	Occupational Health & Safety Related Impacts	182
7.3.11	Community Health & Safety Impacts	183
7.3.12	In-migration of workers.....	185
7.3.13	Employment Opportunities.....	186
7.3.14	Labour Welfare.....	188
7.3.15	Impacts of Gender and Social Inclusion.....	189
8.	ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN.....	191
8.1	CUET's Organizational Structure	191
8.1.1	CUET's Management.....	191
8.2	Environment, Health and Safety Department (HSE).....	191
8.2.1	Inspection, Monitoring and Audit.....	192
8.3	Reporting and Documentation	192
8.3.1	Documentation	192
8.3.2	Internal Reporting and Communication.....	193
8.3.3	External Reporting and Communication	193
8.3.4	EMP Review and Amendments	193
8.4	Training Programme and Capacity Building.....	193
8.5	Environmental Management Plan	193
8.6	Biodiversity Conservation & Wildlife Management Plan	210
8.6.1	Trees	211
8.6.2	Elephants	214
8.6.3	Birds	216
8.6.4	Another Biodiversity	218
8.7	Suggestions for Responsible Tourism Roles and Responsibilities	219
8.7.1	Tourism User Fees in Ecotourism Activities and Services.....	220
8.7.2	Facilities and Infrastructure Development.....	220
8.7.3	Tourism impact reduction.....	221
8.7.4	Ecotourism promotion and awareness.....	221
8.7.5	Tourism Safety	222
8.7.6	Education and Interpretation	222
9.	CONCLUSION.....	225
9.1	Impact Assessment Summary	225
9.2	Conclusion	227
	ANNEXURE.....	228

LIST OF TABLES

Table 1.1 Resources/Receptors and Impacts Considered In Scoping	4
Table 1.2 Layout of the Report.....	6
Table 1.3 EIA team and their roles.....	7
Table 2.1 Project Overview	11
Table 2.2 Salient Feature of the Site and Surroundings	15
Table 2.3 Typical design and drawings for cable car	19
Table 2.4 Key Components.....	19
Table 2.5 Sound power generated from equipment to be used in the proposed project	23
Table 3.1 Policies relevant to the Environment.....	27
Table 3.2 National Legal Instruments Relevant To The Project.....	33
Table 3.3 Project Relevant International Treaties and Conventions	40
Table 3.4 IFC Performance Standards	41
Table 3.5 Trigger of IFC PS	46
Table 3.6 FMO ESG risk categorization (following IFC's Environmental and Social Risk Categorization Framework):.....	49
Table 3.7 Ambient Air Quality Standards/ Guidelines	51
Table 3.8 Noise Level Standards/ Guidelines	52
Table 3.9 Effluent Standards/ Guidelines.....	52
Table 3.10 Standards for Sewage Discharge.....	53
Table 4.1 Scoping Matrix of Potential Interactions	57
Table 5.1 Sources of Information for the Baseline	64
Table 5.2 Environmental Monitoring Plan	65
Table 5.3 Ambient Air Quality Sampling Locations	79
Table 5.4 Ambient Air Quality Monitoring Results.....	83
Table 5.5 Details of Ambient Noise Monitoring Locations	84
Table 5.6 Noise Quality Monitoring Results	85
Table 5.7 Land use-land cover within the study area of Project Site.....	88
Table 5.8 Details of Soil Monitoring Locations	90
Table 5.9 Soil Monitoring Results	92
Table 5.10 Details of Surface Water Quality Monitoring Location	93
Table 5.11 Surface Water Monitoring Results.....	94
Table 5.12 Details of Ground Water Quality Monitoring Locations.....	95
Table 5.13 Ground Water Monitoring Results	96
Table 6.1 List of Key Stakeholders	142
Table 6.2 Stakeholder Mapping Matrix	144
Table 6.3 Stakeholder Mapping and Analysis	145
Table 6.4 Summary of Engagement Activities	148
Table 7.1 Magnitude Prediction Criteria	151
Table 7.2 Magnitude Definitions for Physical, Biological & Human Resources/ Receptors.....	152
Table 7.3 Sensitivity/Importance/ Vulnerability Criteria	153
Table 7.4 Definitions of Sensitivity/Importance /Vulnerability Biophysical and Human	153
Table 7.5 Assessing Significance of Impact due to Proposed Project	154
Table 7.6 Categorization of Impact Significance	155
Table 7.7 Categorization of Residual Impact	158
Table 7.8 Habitat-Impact Assessment Criteria.....	176
Table 7.9 Species-Impact Assessment Criteria	177
Table 8.1 Environmental Management Plan	195
Table 8.2 Project Activities and their effects on trees	211
Table 8.3 Management Plan for effects on trees	212
Table 8.4 Project Activities and their effects on elephants	214
Table 8.5 Consequence of anticipated effects	214

Table 8.6 Management Plan for effects on elephant.....	215
Table 8.7 Project Activities and their effects on birds.....	216
Table 8.8 Management Plan for effects on birds.....	217
Table 8.9 Management Plan for effects on other biodiversity	218
Table 9.1 Impact Assessment Summary	226

LIST OF FIGURES

Figure 1.1 Impact Assessment Process.....	3
Figure 1.2 Impact Assessment Approach	5
Figure 2.1 Regional Setting Map.....	12
Figure 2.2 Cable Car Installation Location Map	13
Figure 2.3 Project Accessibility Map	14
Figure 2.4 Pictures of Site and Surrounding Areas	17
Figure 2.5 Environmental Setting Map.....	18
Figure 3.1 DoE Environmental Clearance Applicability and Procedure	39
Figure 5.1 Project Study Area	62
Figure 5.2 Monitoring Location Map.....	68
Figure 5.3 Quadrat Layout for Floral Survey	69
Figure 5.4 Topography Map.....	72
Figure 5.5 Climatic Sub-regions of Bangladesh	74
Figure 5.6 Monthly Maximum, Minimum and Average Temperatures (2009-2020)	75
Figure 5.7 Total Rainfall (2008-2018)	76
Figure 5.8 Monthly Maximum, Minimum and Average Humidity (2010-2020).....	77
Figure 5.9 Monthly Variation of Wind Speed (2016-2017)	78
Figure 5.10 Ambient Air Quality Monitoring.....	79
Figure 5.11 SPM Values recorded in the study area.....	80
Figure 5.12 PM ₁₀ Values recorded in the study area	80
Figure 5.13 PM _{2.5} Values recorded in the study area.....	81
Figure 5.14 SO ₂ Values recorded in the study area	81
Figure 5.15 NO _x Values recorded in the study area	82
Figure 5.16 CO Values recorded in the study area	82
Figure 5.17 Ambient Noise Quality Monitoring.....	84
Figure 5.18 Geological map of Bangladesh	87
Figure 5.19 Land Use-Land Cover Map- Project Site	89
Figure 5.20 Soil Collection from the Project Site.....	91
Figure 5.21 Naf River	92
Figure 5.22 Surface Water Collection within the Project Site	93
Figure 5.23 Ground Water Collection.....	95
Figure 5.24 Traffic Data Collection.....	97
Figure 5.25 Vehicle Compositions of New Marine Drive Road.....	98
Figure 5.26 Vehicle Compositions of Old Marine Drive Road	99
Figure 5.27 Vehicle Composition of Teknaf-Cox's Bazar Road	100
Figure 5.28 Environmental Parametres Sample Collection Location	101
Figure 5.29 Earthquake Zone Map of Bangladesh.....	102
Figure 5.30 Cyclone Affected Area Map of Bangladesh	103
Figure 5.31 Flood Affected Areas of Bangladesh.....	105
Figure 5.32 Contour Map of Teknaf	106
Figure 5.33 Contour Point A and B of cable car will be in the TWS where forest and wildlife exist...	112
Figure 5.34 TWS supports remarkable number of flora and fauna in Teknaf peninsula	127
Figure 5.35 Plant species in different habitats within Study Area	130
Figure 5.36 Road side plantation within study area	131
Figure 5.37 Fish species found within the project area	133
Figure 5.38 Asian Elephant, the keystone mammals of Teknaf Wildlife Sanctuary.....	135
Figure 5.39 Avifauna found within the study area	137
Figure 5.40 Cosulation and FGD's with local stakeholder.....	140
Figure 5.41 Fish Species Found Within the Project Area.....	141
Figure 6.1 Kill with the AD (DOE).....	146
Figure 6.2 Kill with the AFO (DFO).....	147

Figure 8.1 Available biodiversity in the project area 210

ACRONYMS AND ABBREVIATIONS

Name	Description
AOI	Area of Influence
BFRI	Bangladesh Forest Research Institute
BMD	Bangladesh Meteorological Department
BPC	Bangladesh Parjatan Corporation
BWDB	Bangladesh Water Development Board
CCF	Chief Conservator of Forests
DEM	Digital Elevation Model
DFO	District Forest Office
DOE	Department of Environment
DUET	Dhaaka University of Engineering Technology
EC	Environmental Clearance
ECR	Environmental Conservation Rules
EHS	Health and Safety
EIA	Environmental Impact Assessment
EMP	Environmental management plans
EQS	Environmental Quality Standards
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
FD	Forest Department
FGD	Focus Group Discussion
FMO	Netherlands Development Finance Company
GRM	Grievance Redressal Mechanism
IEE	Initial Environmental Examination
IFC PS	International Finance Corporation's Performance Standards (2012)
IP	Indigenous Peoples
IPDP	Indigenous People's Development Plan
IUCN	International Union for the Conservation of Nature
KII	Key Informant Interview
LGED	Local Government Engineering Department
LRP	Livelihood Restoration Plan
O&M	Operations and Maintenance
PAH	Project Affected Household
PAP	Project Affected Person
RAP	Resettlement Action Plan (inclusive of a Livelihood Restoration Plan)
RoW	Right of Way

RPF	Resettlement Policy Framework
SEP	Stakeholder Engagement Plan
ToR	Terms of Reference

1. INTRODUCTION

The Government of Bangladesh has embarked on a program to develop new economic zones in the country, with the objective of inclusive economic growth and job creation through development of industries. The proposed project is planned on an area of 967 acres of which the Khas land constitutes of 935.88 acres and the rest 31.18 acres' land belongs to Bangladesh Water Development Board (BWDB). The project site is located at approximately 8 km from the center of Teknaf Upazila. The proposed zone will be connected with the Marine Drive at the northern periphery, which will be used for access to the economic zone. The Marine Drive is under construction. Highway Teknaf-Shahparirdwip Road (Z1099) runs parallel to the site at a distance of 5km. It connects the National Highway (N1). The site is about 210km from Chittagong Railway Station and around 96km from Cox's Bazar Domestic Airport.

The proposed construction enables dividends on multiple fronts including but not exclusively limited to: tourism, employment openings, public transport system, enabling ease of access in mixed traffic setting, local level environmental study to be used for future references etc. The proposed project has scope for major impact on the mass movement in mixed traffic setting of the Teknaf-Shahparirdwip Highway (Z1099) and the presently under construction Mirsharai-Teknaf Marine Drive. However, the primary beneficiary of the project are the future tourists of both tourism parks. With provisions for special considerations for the newly-weds and the family-on-board tourists, the cable car provides potential financial growth with its sightseeing and easy-to-commute facilities for the inter-facility movement.

The proposed site area does not have any railway connectivity. The nearest existing railway station is Chittagong Railway Station which is at a distance of 210 km from the site. A new railway station proposed at Gundun, which is 50km from the site. The proposal has already received approval from the Railway Ministry. The proposed Sabrang EZ is located about 96 km from the Cox's Bazar domestic airport. It takes around 2.5 hours travel time via road to reach Cox's Bazar airport.

O. Creeds Ltd has been commissioned by CUET to undertake an Environmental and Social Impact Assessment for the project. This report presents Environmental Impact Assessment (EIA) study focusing on environmental screening and scoping of the project, environmental baseline studies, assessment of environmental impacts, delineation of environmental management plans (EMP).

1.1 Project Background

The economic zone is proposed to be located in the Sabrang Mouza of Upazila Teknaf at Cox's Bazar district of Bangladesh, approximately 90km from Cox's Bazar. The total land area demarcated for the proposed economic zone is 967 acres, which includes Khas Land (878.26 acres), canals and ponds (57.62 acres) and land under Bangladesh Water Development Board (31.18 acres). The project site is located at approximately 8 kms from the center of Teknaf Upazila. The proposed EZ will be connected with the Marine Drive at the northern periphery, which will be used for access to the EZ. The Marine drive is under construction. Highway Teknaf-Shahparirdwip Road (Z1099) runs parallel to the site at a distance of 5 kilometers. The highway connects the National Highway N1. The site is abutted by Bay of Bengal on the southern side and Western side, private owned land on its north and Khas land on its east.

The proposed project area is bounded by Naf River on the eastern extremity and the Bay of Bengal in the western proximity. The Naf River is an international river marking the border of southeastern Bangladesh and western Myanmar. The average depth is 128 feet (39 m), and maximum depth is 400 feet (120 m). It flows into the Bay of Bengal in the Indian Ocean, between the Bangladeshi Cox's Bazar District of the Chittagong Division, and the Burmese

Rakhine State. The Bay of Bengal is the largest water region called a bay in the world. A number of rivers carry freshwater onto the Bay of Bengal including the Naf.

1.2 Purpose of EIA Report

The specific purpose of this EIA report is to provide environmental baseline assessment, assessment of impacts and delineation of Environmental Management Plan (EMP) of the Project and to fulfill the lenders viz. International Finance Corporation (IFC), Netherlands Development Finance Company (Dutch-Nederlandse Financierings-Maatschappij voor Ontwikkelingslanden N.V.-FMO), Japan International Cooperation Agency (JICA) etc requirements.

The objectives of this EIA are to:

- ✚ Facilitate an understanding of the elements of the existing baseline conditions that are relevant to resources/receptors that could be significantly impacted by the project.
- ✚ Identify the aspects of the Project likely to result in significant impacts to resources/receptors;
- ✚ Document how stakeholders have been engaged during the EIA process, and how stakeholder feedback has been considered in the EIA;
- ✚ Predict and evaluate the significance of the impacts of the Project;
- ✚ Identify the (environmental and health) aspects of the Project that need to be managed, and recommend appropriate and justified mitigation and enhancement measures;
- ✚ Determine the significance of residual impacts, taking into account the implementation of mitigation measures; and
- ✚ Generate plans for the management and monitoring of impacts, including plans for ongoing stakeholder engagement.

1.2.1 Scope of Work

The detailed scope of the EIA study is as outlined below:

- ✚ Screening of the Project based on applicable reference framework based on reconnaissance survey and desk-based review of Project documents;
- ✚ Scoping for the EIA study;
- ✚ Development of an integrated project description of the Project components including its sub-components, which are under the purview of the Project Proponent (PP);
- ✚ Development of a regulatory, policy and administrative framework relevant to the Project;
- ✚ Monitoring, analysis and reporting of the environmental baseline data of the study area including consultation with local communities and other stakeholders;
- ✚ Assessment of the environmental impacts of the Project in the study area;
- ✚ Formulation of an Environment Management Plan and associated/specific mitigation plans for identified impacts; and

1.3 Applicable Framework

The applicable reference framework for EIA study will follow the following standards/guidelines:

- ✚ The Environment Conservation Act, 1995 and The Environment Conservation Rules, 1997 and amendments thereof by the Ministry of Environment and Forest, GoB;

- ✚ Acquisition and Requisition of Immovable Property Ordinance, 1982 and ARIPA 2017;
- ✚ Other relevant Bangladesh Laws, Rules and Regulations for environment, health, safety and social aspects;
- ✚ The IFC Performance Standards for Environmental and Social Sustainability (2012);
- ✚ The IFC World Bank (WB) Environment, Health and Safety (EHS) guidelines of Power Transmission and Distribution;
- ✚ EHS guidelines of JICA and FMO
- ✚ The Equator Principles-III (2013).

1.4 Scope of EIA Study

The EIA has been undertaken following a systematic process that predicts and evaluates impacts the Project could have on aspects of the physical, biological, social/socio-economic and cultural environment. Further, identifies measures that the Project will take to avoid, minimise/reduce, mitigate, offset or compensate for adverse impacts; and to enhance positive impacts where practicable. The EIA methodology follows the overall impact assessment approach illustrated in **Figure 1.1**.

The approach and methodology adopted for screening and scoping of the project is discussed below, while the approach and methodology for baseline data collection and assessment has been described in the beginning of the respective chapters of this report.

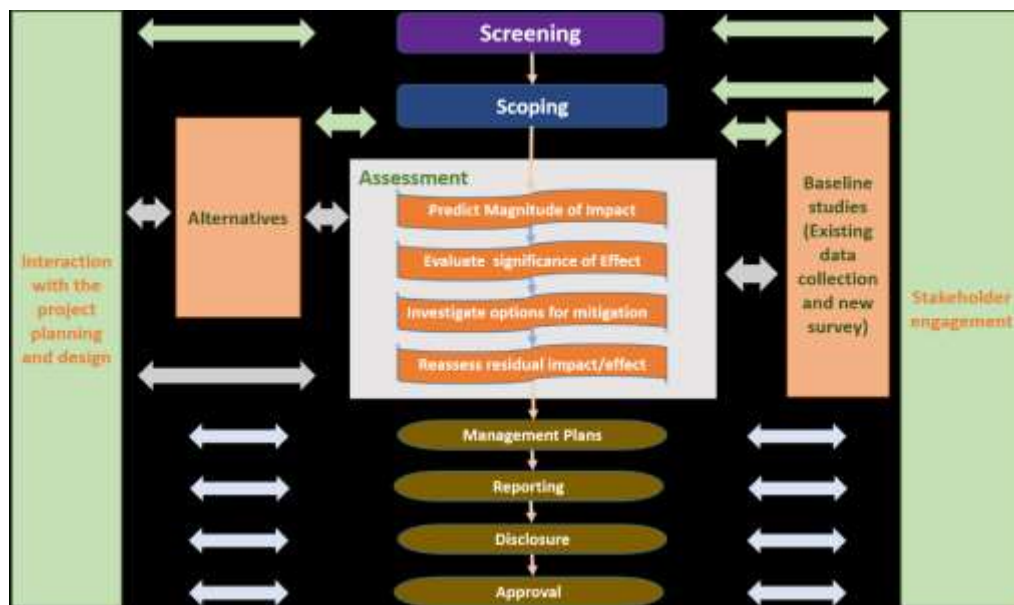


Figure 1.1 Impact Assessment Process

1.5 Approach and Methodology

Approach and methodology followed as part of the EIA study is presented below:

1.5.1 Screening

At the initial stage of the EIA, preliminary information was obtained and discussions held to aid in the determination of what legal and other requirements apply to the Project. This step was conducted utilizing a high-level description of the Project and its associated facilities.

1.5.2 Scoping

Scoping was undertaken to identify the potential Area of Influence (AOI) for the Project (and thus the appropriate Study Area), to identify potential interactions between the Project and resources/receptors in the Area of Influence and the impacts that could result from these interactions, and to prioritize these impacts in terms of their likely significance. Presents the resources/receptors considered in the scoping stage, together with the changes that could/might indicate a Project-related impact.

Table 1.1 Resources/Receptors and Impacts Considered In Scoping

Resources/Receptors	Impacts
Environmental	
Land Forms/Profile	Changes to Geology Topography
Soil Quality	Changes to Physical and chemical properties Erosion
Land use	Changes in Land use/land cover profile
Air Quality	Emissions of Gaseous pollutants (e.g. NO _x , SO _x); and Particulate matter (e.g. PM ₁₀ and PM _{2.5})
Drainage Pattern	Changes in the Drainage pattern, Submergence, Floods etc.
Surface Water Quantity and Quality	Changes to Physical, chemical or biological quality of surface water bodies Changes in surface water quantity Changes in habitat quality, abundance, diversity;
Ground water Quality	Contamination of shallow or deep groundwater resources, Change in ground water resource.
Ambient Noise Levels	Change in noise levels
Waste Solid Waste and liquid waste	Generation of wastes-hazardous and non-hazardous
Terrestrial Ecology	Impact on flora and fauna
Aquatic Ecology (Biodiversity)	Changes in fisheries productivity and impact on aquatic form of various activities
Health	

Resources/Receptors	Impacts
Community Health and Safety	Changes in the incidence and /or prevalence of sexually transmitted diseases and the factors that contribute to this (external workforce, transport routes etc. Changes in the incidence and or prevalence of vector borne diseases, the density of these vectors and their breeding grounds. Health and safety related impacts to Changes in availability of and access to health care, nutritional status, food security etc.

1.5.3 Baseline Data Generation

The primary objective of the environmental, ecological and socio-economic baseline study is to provide a baseline against which potential impacts from the construction, operation and decommissioning phases of the Project can be assessed. The methodologies of baseline data collection for the environmental, ecological and socio-economic baseline are presented in **Section 5** Impact assessment and management.

Impact identification and assessment starts with scoping and continues through the remainder of the IA Process. The principal IA steps are summarized in **Figure 1.2** and comprises of:

- ✚ **Impact prediction:** to determine what could potentially happen to resources/receptors as a consequence of the Project and its associated activities.
- ✚ **Impact evaluation:** to evaluate the significance of the predicted impacts by considering their magnitude and likelihood of occurrence, and the sensitivity, value and/or importance of the affected resource/receptor.
- ✚ **Mitigation and enhancement:** to identify appropriate and justified measures to mitigate negative impacts and enhance positive impacts.
- ✚ **Residual impact evaluation:** to evaluate the significance of impacts assuming effective implementation of mitigation and enhancement measures.

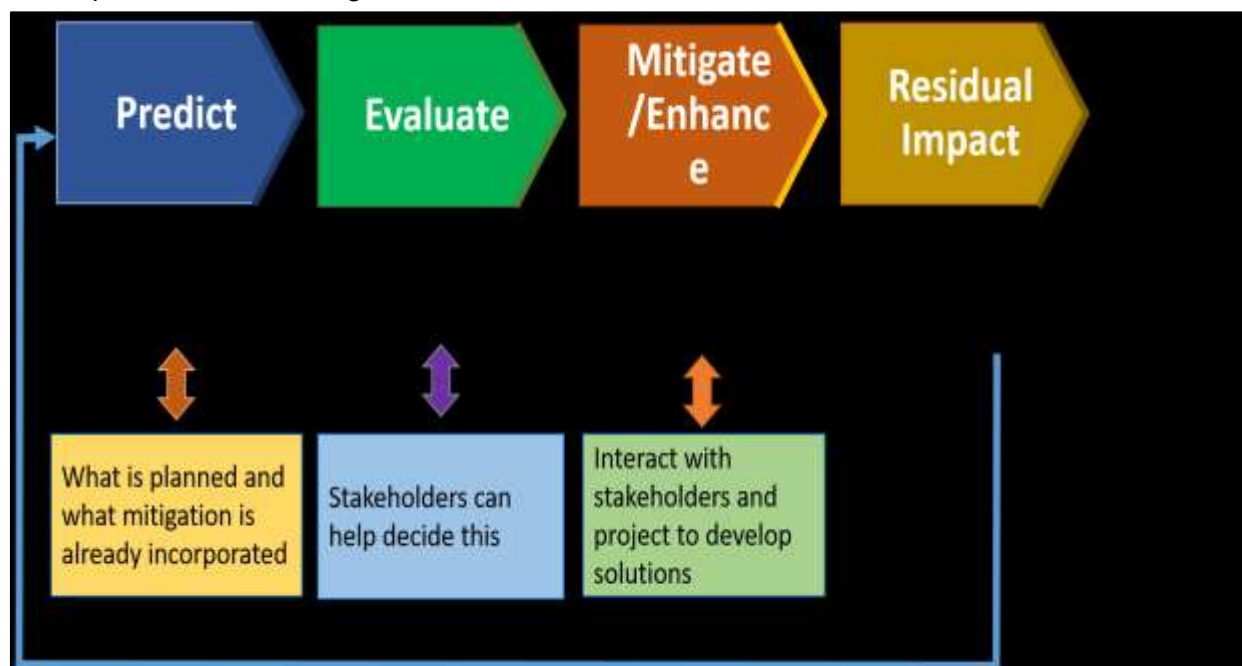


Figure 1.2 Impact Assessment Approach

The detailed impact assessment methodology is presented in **Section** Figure 1.3 Report Structure

The EIA report has been structured based on the scope of work shared by CUET to meet the applicable reference framework (refer to **Section 5**). The layout of the Report has been divided into 10 sections as *briefly* described in **Table 1.2**.

Table 1.2 Layout of the Report

No.	Chapter Title	Description
1	Introduction	This section includes <ol style="list-style-type: none"> 1. Introduction about the project, 2. Project background, 3. Brief description, 4. Scope of the EIA study 5. Approach and Methodology 6. EIA team
2	Project Description	This section describes <ol style="list-style-type: none"> 1. The proposed project; 2. Its major components; and 3. Its geographic, ecological, social, and temporal context. <p>This section also examines alternatives to the proposed project site, technology, design, and operation—including the no project alternative—in terms of their potential environmental and social impacts; the feasibility of mitigating these impacts; their suitability under local conditions; and their institutional, training, and monitoring requirements.</p>
3	Administrative Framework	This section discusses The national and local legal and institutional framework within which the environmental assessment is carried out. It also identifies project-relevant international environmental agreements to which the country is a party. It also covers the applicable reference framework being used for the EIA study in addition to the national regulatory requirements for project financing.
4	Environmental Screening and Scoping	This section discusses environmental screening of the project, categorisation and scoping for the impact assessment.
5	Environmental Baseline Conditions	This section: describes relevant physical and biological conditions within the study area
6	Stakeholder Engagement	This section describes the process undertaken during project design and preparation for engaging stakeholders, including information disclosure and consultation with affected people and other stakeholders; summarizes comments and concerns received from affected people and other stakeholders and how these comments have been addressed in project design and mitigation measures, with special attention paid to the needs and concerns of vulnerable groups; and

No.	Chapter Title	Description
		Describes the planned information disclosure measures and the process for carrying out consultation with affected people and facilitating their participation during project implementation.
7	Impact Assessment and Mitigation Measures	This section predicts and assesses the project's likely positive and negative direct and indirect impacts to physical, biological, socioeconomic (including occupational health and safety, community health and safety, vulnerable groups and gender issues, and impacts on livelihoods through environmental media, and physical cultural resources in the project's area of influence, in quantitative terms to the extent possible; identifies mitigation measures and any residual negative impacts that cannot be mitigated; explores opportunities for enhancement; identifies and estimates the extent and quality of available data, key data gaps, and uncertainties associated with predictions and specifies topics that do not require further attention; and examines global, transboundary, and cumulative impacts as appropriate.
8	Environmental Management Plan	This section deals with the set of mitigation and management measures to be taken during project implementation to avoid, reduce, mitigate, or compensate for adverse environmental and social impacts; describes the mitigation, monitoring, implementation arrangements and performance indicators for effective implementation of the EMP; and Framework management plans for construction phase of the project.
9	Conclusion and Recommendation	This section provides the conclusions drawn from the impact assessment; and Recommendations for environmental and social management during the project lifecycle.

1.6 EIA Team

O.Creeds constituted a team comprising of various experts to carry out the EIA study, as detailed out in the **Table 1.3**. The team was supported by CUET (Chittagong University of Engineering Technology) Team, Bangladesh for baseline data collection, TIA, social survey and consultations.

Table 1.3 EIA team and their roles

PROFESSIONAL STAFF				
Name of Staff	Firm/Organisation	Area of Expertise	Position Assigned	Task Assigned
Dr. Mohammed Nurul Islam, P. Engr.	O.CREEDS LIMITED	EIA and SIA guideline development,	Team Leader	The Team Leader will be responsible for team building and preparation of guidelines and

		Climate data analysis and trend analysis for climate variability.		study tools, overall supervision and communication functions in relation to feasibility study, liaison with CUET. He will also be responsible for river morphology assessment, river basin study, EIA and SIA guideline development, Climate data analysis and trend analysis for climate variability.
DR. TAREK	O.CREEDS LIMITED	Environmental Activities and Water Quality	Environmental Expert	EIA and SIA guideline line development, NRM, agriculture, disaster risk reduction, developing guiding principles related to the parameters, input support in guideline and study tools development, information collection through FGD & KII, data analysis and report preparation.
Dr. Zakir	O.CREEDS LIMITED	Surface Water & River Morphological expert	Hydrologist	Environmental perspective, developing guiding principles related to rivers course movement, input support in guideline and study tools development, information collection through FGD & KII, data analysis and report preparation
Dr. Ahsanul Kabir	O.CREEDS LIMITED	Transport Modeling and vehicle movement planning	Transport Modeling Expert	He will assess the existing and future road conditions, in particular at the tourism Street intersection that provides access to the tourism park beside Naf river. Also he will evaluate the potential impacts to the intersection, associated with the Project's construction and full capacity operation and consider of measures to mitigate traffic impacts.
Abdur Rahaman	O.CREEDS LIMITED	Climate Change Environment FGD	Disaster & Climate Change Specialist	EIA and SIA guideline line development, NRM, agriculture, disaster risk reduction, developing guiding principles related to the parameters, input support in guideline and study tools development, information collection through FGD & KII, data analysis and report preparation.

Shahadat Hossain	O.CREEDS LIMITED	Master Planning	Environmental & Water Specialist	Hydrological input support in guideline and study tools development.
Zahir Uddin Ahmed	O.CREEDS LIMITED	Financial Analysis	Financial & Transport Economist	Worked mainly for traffic Survey and cost- benefit analysis for proposed cable car. Will supervise the work of traffic survey farm and examined all the possible alternative routes for diverting traffic when construction works will start. Helped in preparing Traffic survey report and financial analysis of this cable car.
Mamun Ur Rashid	O.CREEDS LIMITED	Social Survey and research RAP & LAP	Social Expert	He will be responsible for all the procurement, including but not limited to lab equipment, logistics, transportation, field equipment, machinery, tools.
Abid Kamal	O.CREEDS LIMITED		RS & GIS Expert	He will be responsible for the overall land use and land cover studies including but not limited to preliminary research, literature review, satellite image processing, image analysis, map preparation, drainage map preparation, digital elevation map preparation, land use map preparation.
Prof. Dr. Asaduzzaman,	Dept. of CSE, CUET	Data Processing	Assistant Professor (CUET)	Data Processing
Prof. Dr. Sajal Chandra Banik,	Dept. of Mechanical Engineering, CUET	Stations Design	Assistant Professor (CUET)	Water, Soil, Air and Noise measurement
Prof. Dr. Asiful Hoque	Dept. of Civil Engineering, CUET	Environment	Assistant Professor (CUET)	EIA and SIA guideline line development
Dr. Farzana Rahman Zuthi	Dept. of Civil Engineering, CUET	Hydrology	Assistant Professor (CUET)	Hydrological input support in guideline and study tools development.
Prof. Dr. Swapan Kumar Palit	Dept. of Civil Engineering, CUET	Environment	Assistant Professor (CUET)	EIA and SIA guideline line development
Prof. Dr. Md. Moinul Islam	Dept. of Civil Engineering, CUET	Hydrology	Assistant Professor (CUET)	Hydrological, input support in guideline and study tools development.
Prof. Dr. Aysha Akter,	Dept. of Civil Engineering, CUET	Environment	Assistant Professor (CUET)	EIA and SIA guideline line development

Prof. Dr. Md. Reaz Akter Mullick,	Dept. of Civil Engineering, CUET	Hydrology	Assistant Professor (CUET)	Hydrological input support in guideline and study tools development.
Md. Atiqur Rahman Mollick	O.CREEDS LIMITED	Climate Change Environment FGD	Survey Assistant	EIA and SIA guideline line development, NRM, agriculture, disaster risk reduction, developing guiding principles related to the parameters
Md. Nazimuzzaman	O.CREEDS LIMITED	Social Survey and research RAP & LAP	Survey Assistant	He will be responsible for all the procurement, including but not limited to lab equipment, logistics, transportation, field equipment, machinery, tools.

1.7 Limitations

This report is based on the information available as of 9th September 2020.

2. PROJECT DESCRIPTION

2.1 The Project

The cable car is proposed to be located in the Sabrang Mouza of Upazila Teknaf at Cox’s Bazar district of Bangladesh, approximately 90km from Cox’s Bazar. The total land area demarcated for the proposed economic zone is 967 acres, which includes Khas Land (878.26 acres), canals and ponds (57.62 acres) and land under Bangladesh Water Development Board (31.18 acres). The project site is located at approximately 8 kms from the center of Teknaf Upazila. The proposed EZ will be connected with the Marine Drive at the northern periphery, which will be used for access to the EZ. The Marine drive is under construction. Highway Teknaf-Shahparirdwip Road (Z1099) runs parallel to the site at a distance of 5 kilometers. The highway connects the National Highway N1. The site is abutted by Bay of Bengal on the southern side and Western side, private owned land on its north and Khas land on its east.

The proposed project area is bounded by Naf River on the eastern extremity and the Bay of Bengal in the western proximity. The Naf River is an international river marking the border of southeastern Bangladesh and western Myanmar. The average depth is 128 feet (39 m), and maximum depth is 400 feet (120 m). It flows into the Bay of Bengal in the Indian Ocean, between the Bangladeshi Cox's Bazar District of the Chittagong Division, and the Burmese Rakhine State. The Bay of Bengal is the largest water region called a bay in the world. A number of rivers carry freshwater onto the Bay of Bengal including the Naf. Project overview is presented in Table 2.1.

The project has received approval from the Government of Bangladesh for setting up in Teknaf District. Project overview is presented in Error! Reference source not found..

Table 2.1 Project Overview

Particulars	Description
Location	The Sabrang Mouza of Upazila Teknaf at Cox’s Bazar district of Bangladesh, approximately 90km from Cox’s Bazar
Technical components	<ul style="list-style-type: none"> ✚ Review of existing study reports ✚ Topographical survey ✚ Geotechnical investigation ✚ Hydrological study
Access Route	The proposed project area is bounded by Naf River on the eastern extremity and the Bay of Bengal in the western proximity.

2.2 Project Location

2.2.1 Cable Car Project

It will be located in the Jaliardwip Island which is situated in the middle of the Naf River that divides Myanmar and Bangladesh. The island is diverse and multifaceted as it has both hill and river view.

Exact Project site boundary are not determined yet.

2.2.2 Site Access

Naf Tourism Park will be located in the Jaliardwip Island which is situated in the middle of the Naf River that divides Myanmar and Bangladesh.

The project site is located in proximity to the LGED Road. As the project site is in an island it is accessible by road and from Teknaf it is accessible by water ways. The cable car project will connect the three points (Point A, Point B and Point C). Point A is a commercial area which is accessible by road. Point B is in the Hatiarguna village of Teknaf which is a residential area and it is accessed through the existing earthen village road. Point C is on the top of a hill which is not accessible. The cable car will be 9.5 km which will connect these three points.



Figure 2.1 Regional Setting Map



Figure 2.2 Cable Car Installation Location Map

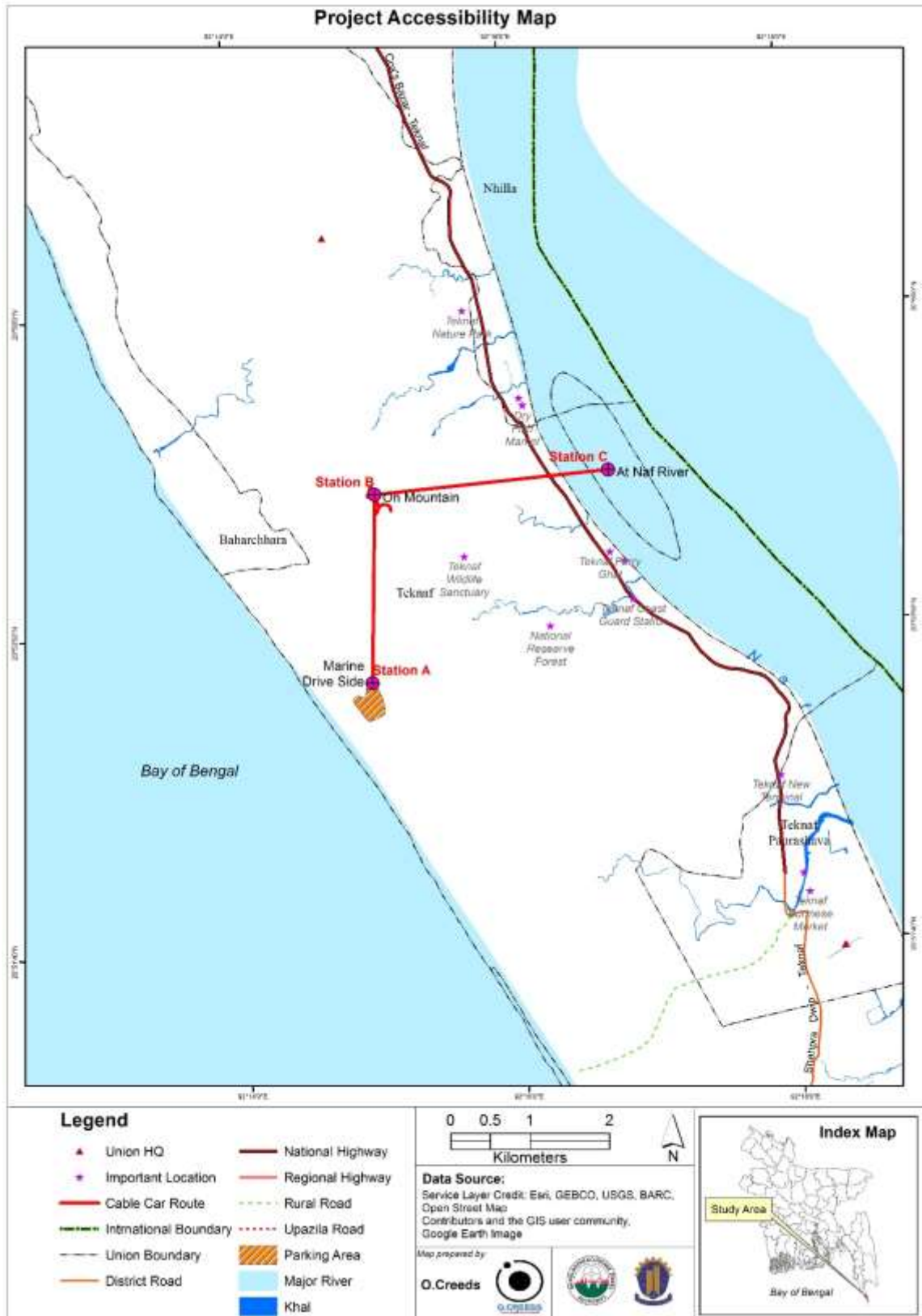


Figure 2.3 Project Accessibility Map

2.2.3 Key Feature of the Site and Surroundings

Salient features of the site and surroundings is presented in **Table 2.2**.

Table 2.2 Salient Feature of the Site and Surroundings

SI No.	Environmental Features	Details
		Teknaf
1.	Site location	Jaliardwip Island, Teknaf District: Cox's Bazar; Division: Chittagong
2.	Nearest highway	Dhaka-Chittagong Highway
3.	Nearest railway station	No Railway station near 10 km of the site
4.	Nearest airport	No airport near 10 km of the site
5.	Nearest waterbody	About 134 village ponds are present within the project site Naf River is surrounding of the project site:
6.	Site features	Site comprising of agricultural and non-agricultural barren lands, and settlement areas Settlements are associated with homestead plantation and village ponds Hilly area
7.	Site surroundings	Naf River is surrounded within the project site. There are a few settlements in point A
8.	Settlements	Only a few settlements were observed in Point A.
9.	Site land use (pre-project)	Site land use primarily include agricultural fields. Apart from that few areas with settlements, homestead plantations are village ponds are also present.
10.	Site Drainage	The site is located at the banks of Naf River. It is surrounded around the site. There is no major drainage channel within the site, there is a seasonal channel at the portion of the site. Also, there are few ponds within the site that receives the runoff from the site during monsoon.
11.	Cultural Heritage/ Archaeologically important sites	As per the information available from Department of Archaeology, Bangladesh (www.archaeology.gov.bd), there are reportedly no cultural heritage sites and archaeological monuments close to the project site. The nearest archaeologically important sites include the Dimla Shiva Mandir in Rangpur about 50 km from the site.
12.	Protected areas as per Wildlife (Conservation and Security) Act, 2012	None within 10 km radial zone
13.	Reserved and protected forests	None within 10 km radial zone
14.	Ecologically critical area	None within 10 km radial zone

SI No.	Environmental Features	Details
		Teknaf
15.	Seismicity	The project site and study area is located in Seismic Zone II

Pictures of site and surrounding areas are presented in **Figure 2.4**.

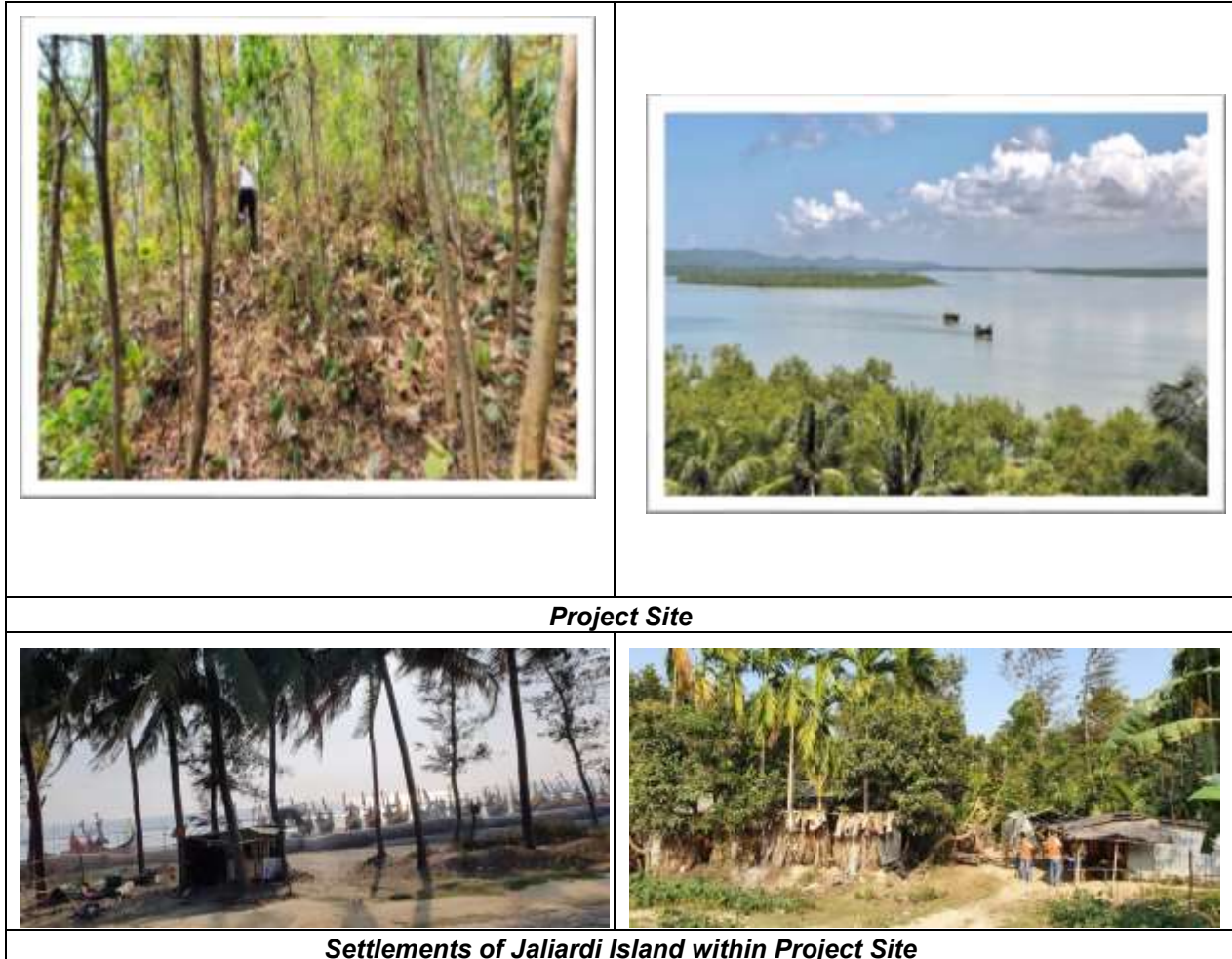




Figure 2.4 Pictures of Site and Surrounding Areas

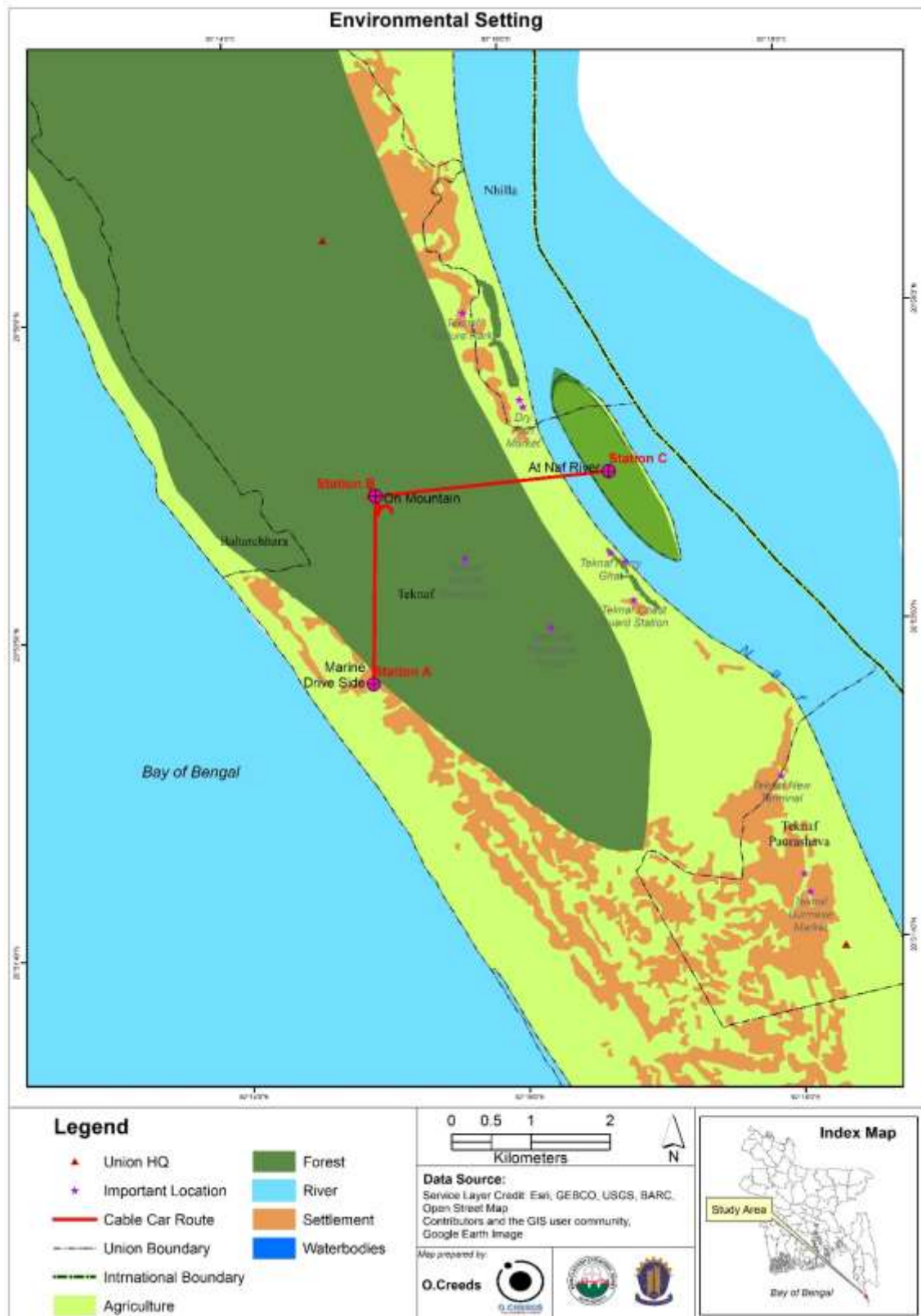


Figure 2.5 Environmental Setting Map

2.3 Description of Project Facilities, Components and Activities

2.3.1 Project Features

The type of designs and drawing systems used typically for a cable car project are presented in **Table 2.3**.

Table 2.3 Typical design and drawings for cable car

SL No.	Design and drawings	Description
1	Passenger Cabin	Detail drawing & design
2	Road pavement	Detail drawing & design
3	Access Road	Detail drawing & design
4	Station	Detail drawing & design
5	Environmental safeguards	Detail drawing & design

2.3.2 Project Components

Key Project Components of the project are presented below in **Table 2.4**.

Table 2.4 Key Components

Component	Application
Survey and Investigation	<ul style="list-style-type: none"> ✚ Review of the existing study reports ✚ Topographical survey ✚ Geotechnical investigation ✚ Hydrological study
Design and Drawing	Passenger Cabin Road pavement Access Road Station Environmental safeguards
DPP	<ul style="list-style-type: none"> ✚ Quantity estimate ✚ Unit price analysis ✚ Cost estimate

Project Activities

The activities for the Project can be divided into four phases, namely:

- a) Planning;
- b) Construction;
- c) Operations;
- d) Maintenance.

Key project activities during these phases of the Project have been summarized below:

2.3.3 Planning Phase

The planning phase includes the following components:

- Identification of land area and site;
- Site surveys as topographic, geo-technical investigations, and yield study, road studies, etc.
- Obtaining all necessary approvals/clearances; and
- Design and finalization of contractors.

The process of land procurement is in the process, the details of land procurement is given below in section 2.4.1. The site survey including topography survey geo-technical investigations, hydrological study, and yield study has been already carried out.

BEZA submitted a proposal to develop the project for 9.5 km long cable car route to Government of Bangladesh (GoB).

According to the Environmental Conservation Rules of Bangladesh (1997) and amendment dated 24.12.2017; cable car projects are included in the Red Category. Environmental Clearance for Red projects require Environmental Impact Assessment (EIA) and other documents viz. Form 3, EMP, NoC from Union Parishad, NoC from Deputy Commissioner, outline of relocation and rehabilitation plan (where applicable) etc. As the proposed project is a Red category project, a separate site clearance certificate will be required and then an Environmental Clearance will be provided.

2.3.4 Construction Phase

The construction is still in the planning phase, and the construction of the project has not started.

2.3.4.1 Access road

The project site is located in proximity to the Jaliwardip Island. The access route from Dhaka to Teknaf (Project Site) is through Marine drive Road, LGED Road and earthen village road.

2.3.4.2 Site Development

The proposed project site is located inside of the Naf floodplain area and is located approximately 1,300 m south and 750m west of Naf River. Site development work will include raising of the site for roads, buildings and MV Transformer platforms and sub-station between 1 to 2 meter and development of embankment (2 and 5 meters, depending on the topography) surrounding the site. It is estimated that 100 000 m³ of landfilling material will be required.

2.3.4.3 BEZA Works

The project has to engage the BEZA for providing the manpower and for the construction of the project site. The scope of work of the BEZA shall involve the following but not limited to:

- ✚ Erection of Cable car terminals on each of the three points;
- ✚ Building of Inverters and SCADA facilities;
- ✚ Construction of overhead electrical collection lines to connect the cable car terminals to the pooling substation;
- ✚ Building of other associated facilities (control room, office, workers' accommodation etc.)
- ✚ Construction of access road to the site; and
- ✚ Providing manpower and other financial supports

2.3.4.4 Construction Material and Waste Storage Area

The project will construct a designated construction material storage facility and the waste storage facility within the site.

2.3.4.5 Workforce and Labor Camp

The project will develop the workforce and the labor camp for the migrant workers, in taking into the consideration of national and international standards for labor camps.

2.3.5 Operation and Maintenance

The list of activities to be carried out in the operation and maintenance phase would be:

- ✚ Monthly cleaning and observation of the cable car terminals;
- ✚ Control of vegetation viz. weeds, bushes etc. within the site and those immediately surrounding it;
- ✚ Routine inspection of all machineries and the terminals and associated structures viz. cables, transformers, inverters, mounting structures etc.;
- ✚ Operation and maintenance of ancillary facilities such as power substation;
- ✚ Inspection and maintenance of cable car lines; and
- ✚ Inspection and maintenance of internal site pathways/access roads.

The project will be having a dedicated operations and maintenance (O&M) team comprising of technical staff to conduct the aforesaid maintenance activities. This will also require additional resources in the form of water (for module cleaning), consumable spares and insurance.

2.4 Resources Requirement

2.4.1 Land

The project is in the process of finalizing the design for the alignment of the proposed cable car terminals and access road. Based on the information presently available, the land requirement of the project is 271.93 acres. The actual requirement of land will be determined here after.

2.4.2 Water

Water will be required during the construction and as well as the operation phase of the road construction. Source of water will be tanker water supply from external source. However, if required water will be also be sourced from surface water or abstracted from groundwater after obtaining necessary.

2.4.3 Power

2.4.3.1 Construction Phase

For construction activity, the project has to install the Diesel Generator sets (of capacity 200 kVA) for providing the required power supply.

2.4.3.2 Operation Phase

Sourcing of power for operational phase will primarily be from grid supply. Additionally, DG sets will be employed for providing the power in case of emergency.

2.4.4 Manpower

The project requires the workforce for the construction and operation phases of the project. Manpower requirement during peak construction will be 700 nos. During operation manpower requirement will be 6 personnel. This will include the BEZA team and their contractors as well as semi-skilled and unskilled local laborers.

2.4.5 Logistics During Construction Phase

All the construction material, equipment and machinery will be transported to the site by using the highway and the access road.

2.4.6 Pollution Source, Characterization, and Control Measures

2.4.6.1 Air emission

Construction Phase

The likely emissions from the remaining construction activities would include the following:

- Generation of windblown dust from project site during site levelling and grading operations;
- Fugitive emission from construction of embankment
- Fugitive emissions from material handling, transportation, piling, use of construction machinery, etc.
- Fugitive dust emissions from unpaved internal roads;
- Vehicular emissions from increased traffic volume from vehicles used for transport accessories; and
- Exhaust emissions from operation of diesel generators.

Fugitive dust emission arising from various activities such as piling, transportation of material (loading and unloading), vehicular movement (on unpaved roads) should be minimized through sprinkling of water and maintaining vehicular speed to 10-15 km/hr. Vehicular emission should be controlled through proper maintenance of vehicles and vehicles operated at project site.

Operation Phase

Under normal operations, there will be no gaseous emissions from the operating areas. There will be gaseous and fugitive dust emissions owing to plying of maintenance vehicles. It will be ensured that well maintained vehicles will be used for maintenance purposes.

2.4.6.2 Noise emission

Construction Phase

Noise emission generated from piling, movement of vehicle and other construction machinery and operation of DG set. Noise from DG sets will be minimised through provision of acoustic enclosures. In addition, other noise generating activities will be restricted to daytime only.

Noise emission generated from piling, movement of vehicle and other construction machinery and operation of DG set. Noise during the site preparatory phase will primarily be contributed by heavy construction machinery operating on site and vehicular sources for constructing the site. Average noise emission ranges for different types of construction machinery are provided in **Table 2.5**.

Table 2.5 Sound power generated from equipment to be used in the proposed project

Equipments	Sound Level At Operator (in dB(A))
Earth Moving Equipment	
Front End Loader	85-91
Back Hoe	79-89
Bull Dozer	89-103
Roller	79-93
Truck	89-103
Material Handling Equipment	
Concrete Mixer	<85.0
Crane/Hydra	<85.0

Source: British Columbia, "Construction Noise," Workers Compensation Board of BC

2.4.6.3 Solid and Hazardous Waste

Construction Phase

The key solid waste that is expected to be generated during construction phase is the following:

- ✚ Domestic soil waste from temporary site office; hazardous waste like waste oil, lubricants, oil contaminated rags; electronic waste etc.;
- ✚ Hazardous wastes will be stored onsite at separate designated covered area provided with impervious flooring and secondary containment. The storage containers/ bins/ drum will be clearly marked and identified for their hazards. The hazardous waste materials will be disposed through authorized vendor;
- ✚ Broken stuffs if any, will be sent back to the vendor as part of buyback arrangement;
- ✚ Bio-degradable domestic solid waste will be disposed at compost pit within the project site.
- ✚ Recyclable waste will be disposed through local vendors.
- ✚ Transformer oil drums will be disposed through an authorized hazardous waste recycles.

Operation Phase

During operation phase, waste generated from the project will include domestic waste at site office, scrap materials like scrap tools, damaged PPEs etc.; hazardous waste like waste oil, lubricants, used transformer oil; damaged batteries; electronic waste etc. Following measure will be adopted for disposal of solid waste;

- ✚ Hazardous wastes will be stored temporarily onsite at separate designated covered area provided with impervious flooring and secondary containment and will be disposed in accordance with best practices;
- ✚ Broken things if any, will be sent back to the vendor as part of buyback arrangement; and
- ✚ Bio-degradable domestic solid waste will be disposed at compost pit within the project site.
- ✚ Recyclable waste will be disposed through local vendors.

2.4.6.4 Wastewater

Construction Phase

The liquid effluents generated during the construction phase will include domestic sewage from temporary site office and labour camp. Septic tank and soak pits or mobile Sewage Treatment Plant (STP) will be provided at the site office for treatment and disposal of sewage.

Operation Phase

The operational phase will have negligible wastewater generation at site office. Septic tank and soak pits or modular STP will be provided at the site office for treatment and disposal of sewage.

2.4.7 Fire Safety and Security

2.4.7.1 Construction Phase

Appropriate firefighting system has to install at the construction site. The fire extinguisher will place at strategic locations such as site office, storage yards, diesel storage facility etc.

2.4.7.2 Operation Phase

Suitable fire protection and fighting systems viz. portable fire extinguishers, fire buckets and automatic fire detection system to be made available at the entire project area, inverter stations, main control room and switchyard.

2.5 Project Schedule

The project is currently in the planning phase and as per project schedule BEZA works have already been started. The reconnaissance survey has already been concluded in March 2020. The Environment⁶ Survey team has collected all the necessary data of environmental parameters.

2.6 Analysis of Alternatives

The project has considered alternatives of design and technology options. An analysis of these alternatives has been undertaken for the proposed Project including consideration of a No-Project scenario.

2.6.1 No Project Scenario

Bangladesh is full of natural beauty. Rivers, coasts and beaches, archaeological sites, religious places, hills, forests, waterfalls, tea gardens surround it. To observe the beauty of nature, huge amount of domestic and foreign tourists visit the country and its tourist attraction sites. In 2012, around six-lakh (6 hundred thousand) tourists came Bangladesh to visit and enjoy its beauty. The total contribution of tourism to GDP was 4.4%, 3.8% to employment and 1.5% to investment in 2013.

Bangladesh Parjatan Corporation (BPC) looks after the tourism sector in Bangladesh under the ministry of Civil Aviation and Tourism. In Bangladesh, government-controlled tourism organization – Bangladesh Parjatan Corporation (BPC) is doing well in terms of profit. In 2009-2010, the profit was 23.41 lakh taka which has consistently increased to 612.33 lakh taka in 2012-2013. Travel and Tourism generated 1,328,500 jobs directly in 2013 and this is forecasted to grow by 4.0% in 2014. This includes employment by hotels, airlines, travel agents and other passenger transportation services. It will increase by 2.7% per annum on average over the next ten years. By 2024, travel and tourism are forecasted to support 4.2% of total employment.

Naf Tourism Park will be constructed in a prepossessing location. The cable car project in the Naf tourism Park is another addition to the tourism sector. This will create employment opportunity on the one hand and on the other hand it reduces the dependence of the country on some other specific sectors. Tourism can bring many economic, social and environmental benefits, particularly in rural areas and developing countries, yet mass tourism is also associated with negative effects. Tourism can only be sustainable if it is carefully managed so that probable negative effects on the host community and the environment are not permitted to outweigh the financial benefits.

2.6.2 With Project Scenario

2.6.2.1 Site Selection

CUET has conducted the siting study for setting up of the cable car. As per GoB requirement, any cable car project should be constructed on non-agricultural land. Based on the Government of Bangladesh's visit in 2017, the availability of non-agricultural category of land was assessed.

2.6.2.2 Technical

- + Access to road and transportation networks;
- + Existing site evacuation infrastructure;

2.6.2.3 Social and Environmental

- + No major sensitive environmental receptors (such as hospitals, schools, etc.) in close proximity;
- + No physical cultural resources on site and in close proximity.

2.6.3 Conclusion

The Cable Car project will create employment to the local people of Teknaf and will improve the economic structure of the locality. Again, it will be a recreation center for the inhabitants and also for foreign people. As tourists will visit the tourism park, the infrastructure of the area will be developed and the access road which already exists will be beautified. The site location is well suited for setting up of cable car with availability of adequate availability of land, access to road and without any disturbance to the local people of the area. Based on alternative analysis and selection of best-suited option.

3. ADMINISTRATIVE FRAMEWORK

3.1 Environment-Related Policies in Bangladesh

The GoB has developed a policy framework that requires environmental aspects that needs to be incorporated into the planning framework of any development project to be undertaken in Bangladesh. The key tenets of the various applicable environmental laws are explained in the following sub sections:

3.1.1 National Environmental Policy, 1992

The Bangladesh National Environmental Policy, drafted and approved in May 1992, sets out the basic framework for environmental action together with a set of broad sectoral action guidelines. The objectives of the Policy include:

- ✚ Maintaining ecological balance and ensuring sustainable development of the country through protection, conservation and improvement of the environment;
- ✚ Identifying and regulating all activities that pollute and destroy the environment;
- ✚ Ensuring environment-friendly development in all sectors;
- ✚ Ensuring sustainable and environmentally sound management of the natural resources; and
- ✚ Actively remain associated with all international environmental initiatives (MoEF, 1994)

The Environment Policy of 1992 requires specific actions to be undertaken for fifteen priority sectors, which includes industry. With respect to industry, the policy suggest:

- ✚ To adapt corrective measures to contain pollution
- ✚ To conduct EIA for all new industries
- ✚ To ban establishment of polluting industries
- ✚ To ensure sustainable use of raw materials to prevent wastage

The DoE is directed to review and approve all EIA for all new industries.

3.1.2 National Environment Management Action Plan, 1995

The National Environment Management Plan (NEMAP) is a national plan with a multi-sectoral approach. It builds on and extends the statements contained in the National Environment Policy (1992). The plan covers the period 1995-2005 with the aim of providing guidance to government and non-government organizations to make environmental plans and enforce better management practices. NEMAP was developed to achieve the following broad objectives:

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

For the purpose of management and implementation, all the actions contained in the NEMAP have been grouped under four heads, namely *institutional, sectoral, location-specific* and *long-term issues*.

The institutional aspects reflect the need to have inter-sectoral cooperation to tackle environmental problems. Sectoral head reflects the way in which government ministries and agencies are organized and hence making it easier to identify the agency to carry out the recommended action. Location specific head focuses on particularly local level governmental problems which need to be addressed on priority basis. Long term issues are those which can become more serious and threatening if they are not taken into cognizance early on.

3.1.3 National Conservation Strategy, 1992

The National Conservation Strategy, 1992, provides recommendations for sustainable development of the industrial sector. The key aspects of the strategy are as follows:

- ✚ All industries shall be subject to an EIA and the adoption of pollution prevention/control technologies shall be enforced;
- ✚ Hazardous or toxic materials/wastes shall not be imported as raw materials for industry;
- ✚ Import of appropriate and environmentally-sound technology shall be ensured;
- ✚ Dependence on imported technology and machinery should gradually be reduced in favour of sustainable local skills and resources.

3.1.4 Other Policies Relevant to Environment

Additional policies, their key features and their applicability to the Project are detailed in **Table 3.1**.

Table 3.1 Policies relevant to the Environment

Policy	Key Features	Applicability
The National Forest Policy, 1994	<ul style="list-style-type: none"> • Afforestation of 20% land • Bio-diversity of the existing degraded forests • Strengthening of the agricultural sector • Control of Global warming, desertification • Control of trade in wild birds and animals • Prevention of illegal occupation of the forested land, tree felling and hunting of wild animals 	Applicable when considering global warming and the protection of forests
National Land-use Policy, 2001	<ul style="list-style-type: none"> • Deals with several land uses including: agriculture (crop production, fishery and livestock), housing, forestry, industrialization, railways and roads, tea and rubber • Identifies land use constraints in all these sectors 	Applicable as land use changes from salt pans to industrial land
The National Water Policy, 1999	<ul style="list-style-type: none"> • Protection, restoration and enhancement of water resources • Protection of water quality, including strengthening regulations concerning agrochemicals and industrial effluent • Sanitation and potable water • Fish and fisheries • Participation of local communities in all water sector development 	Applicable for the preservation of surface water bodies, and flood plains in the surrounding area of the Project
The Energy Policy, 1996	<ul style="list-style-type: none"> • Provides for utilization of energy for sustainable economic growth, supply to different zones of the country, development of the indigenous energy 	Applicable. The project is for the development of energy generation.

Policy	Key Features	Applicability
	source and environmentally sound sustainable energy development programs <ul style="list-style-type: none"> Highlights the importance of EIA's for any new energy development project 	
The Power Policy, 1995	<ul style="list-style-type: none"> Is an integral part of the Energy Policy and deals with policy statement on demand forecast, long term planning and project implementation, investment terms, fuels and technologies, load management, institutional issues, private sector participation, technology transfer and research program, environmental policy and legal issues 	Applicable
Industrial Policy, 1999	<ul style="list-style-type: none"> Deals with industrial development, direct foreign investments, investment by public and private sector, introduction of new appropriate technology, women's participation, infrastructure development and environmentally sound industrial development 	Applicable as the Project is a private sector, industrial development

3.2 Environment and Social related Legislations in Bangladesh

The main Acts and Regulations guiding environmental and social protection and conservation in Bangladesh are outlined in the following subsections:

3.2.1 The Environment Conservation Act, 1995 (subsequent amendments in 2000 and 2002)

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

- ✚ Declaration of Ecologically Critical Areas;
- ✚ Obtaining Environmental Clearance Certificate;
- ✚ Regulation with respect to vehicles emitting smoke harmful for the environment;
- ✚ Regulation of development activities from environmental perspective;
- ✚ Promulgation of standards for quality of air, water, noise, and soils for 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 environment.

3.2.2 Environment Conservation Rules (ECR), 1997 (subsequent amendment in 2017)

The Environment Conservation Rules, 1997 are the first set of rules promulgated under the Environment Conservation Act, 1995. These Rules provide for, inter alia, the following:

- ✚ The National Environmental Quality Standards (EQS) for ambient air, surface water, groundwater, drinking water, industrial effluents, emissions, noise and vehicular exhaust;
- ✚ Categorization of industries, development projects and other activities on the basis of actual (for existing industries/development projects/activities) and anticipated (for proposed industries/development projects/activities) pollution load;

- ✚ Procedure for obtaining environmental clearance;
- ✚ Requirements for undertaking IEE and EIA's as well as formulating EMP's 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.

Depending upon the location, size and severity of pollution loads, projects/activities have been classified in ECR, 1997 into four categories: *Green*, *Orange A*, *Orange B* and *Red* respectively as nil, minor, medium and severe impacts on important environmental components (IECs).

As per the 2017 amendment, under the Environment Conservation Act, 1995, cable car have been included to the category of industrial units.

3.2.3 Environment Court Act, 2000 and subsequent amendments in 2002

An Act to provide for the establishment of environment courts and matters incidental thereto. The Act expedites the establishment of Environment Courts as and where necessary for the trial of offences relating to environmental pollution.

The GoB will establish one or more Environmental Court in each division, constituting of one judge. In consultation with the Supreme Court, the government shall-

Appoint an officer of the rank of Joint District Judge to dispose of cases only under Environmental laws; and

If considered necessary, appoint a judge of the rank of the rank of Joint District Judge for a Division, or a specific part of the same. The judge will, in addition to his ordinary functions, dispose cases that fall within the jurisdiction of Environmental Court.

The Environment Court shall be the competent authority to impose penalty for offences under Section 5A of the Act, and under any other Environmental law, and to pass order for compensation in appropriate cases.

If a person violates the court order under clause (a) of section 5(2) by repeating or continuing with the offence of which he has been fined, he shall be liable to sentenced with penalty prescribed for that offence, with the penalty not less than that imposed in the first instance of the order.

3.2.4 Bangladesh Water Act, 2013

This Act contains provisions for integrated development, management, abstraction, distribution, use, protection and conservation of water resources. The Act covers water resources such as surface water, ground water and rain water, and also includes flood-plain, wetland, natural or manmade River. According to the Act, all rights over the following water bodies within the state territory, on behalf of the people, is vested with the State-

- ✚ Surface water;
- ✚ Ground water;
- ✚ Sea water;
- ✚ Rain water, and
- ✚ Water in the atmosphere

Under the Act, a National Water Resources Council is constituted, which will have the following functions:

- ✦ to make policies, and provide instructions for integrated development, proper use, safe abstraction, proper distribution, protection and conservation of water resources;
- ✦ to give instructions in respect of making National Water Resources Plan and approval of thereof, for ensuring integrated development of water resources;
- ✦ to perform such functions as may be determined by the Council

In violation of any provision of the Act or of any prohibition/protection order or any clearance certificate, if any authority undertakes construction activities which creates impediments in the normal water course or changes the direction of such water course, the Executive committee may issue a removal order to such authority for removing infrastructure, or land filling materials within the time specified in that order.

3.2.5 National Land Use Policy, 2001

The current overarching policy guiding land use in the country is the National Land Use Policy (2001). The main objective of this policy is to define criteria on the basis of which land use will be determined and to provide guidelines for usage of land for the purpose of agriculture, housing, afforestation, commercial and industrial establishments, rail and highway, and for tea and rubber gardens (Hussain, 2015). The key objectives of the Policy are:

- ✦ Reforming the current land administration system by introduction of Certificate of Land Ownership (CLO);
- ✦ Preventing alarming loss of agricultural land, which is needed to meet the increasing food demand;
- ✦ Protecting state owned lands which can be used to meet the needs of developmental projects;
- ✦ Zoning of land for agriculture and other purposes;
- ✦ Establish a data bank of khas land, fallow land, acquired land, char land, etc.

The Policy lays emphasis on minimizing crop land loss, indiscriminate land use, rationalizing land acquisition, and synchronization of land use with natural environment (Ministry of Land, Input of the MoL for the 'Bangladesh Delta Plan 2100 Formulation Project'). The other key aspects are:

- ✦ Rehabilitation of landless people on newly reclaimed land (char land, coastal reclaimed land, etc);
- ✦ Reserving government khas land for future development projects;
- ✦ Increasing the opportunity of income generation through proper utilization of land resources;
- ✦ Protection of natural forest, Rivers and hill areas;
- ✦ Protecting land from pollution

3.2.6 Khas land (Agriculture) Management and Settlement Policy 1997

In 1997, the Government introduced the Agricultural Khas land Management and Settlement Ordinance to redefine the landless as anyone who owns less than 10 decimals of land. Only agriculture based landless families in which one or more members are involved in cultivation are entitled to khas land.

According to the ordinance, the following groups are to receive priority among landless in getting khasland:

- ✦ Households having no satisfactory living home

- ✦ Poor freedom fighter's family
- ✦ Households who lost all land due to River erosion
- ✦ Widow/abandoned women with adult son (as per GoB policy)
- ✦ Households which neither have agriculture land nor homestead land but fully dependent on agriculture
- ✦ Agro-dependent family having homestead land of 10 decimals with no cultivable land
- ✦ Households of no fixed address

There are certain types of khasland, which are exempted from distribution. This includes any land which is communally used, such as public roads and highways, River banks, khal, sewage systems, ponds, dighis, graveyards, and burning grounds.

The Ordinance considers two types of settlements: Permanent settlement, and Eksona settlement (also known as duplicate carbon receipt, DCR)

Only the landless agriculture-based families are entitled to permanent settlement, which is a 99-year lease settled with the government. In DCR, any family who is in control of a particular land is given control of khas land for one year. It can be converted into a 99-year lease only after it has been made suitable for cultivation.

3.2.7 East Bengal State Acquisition and Tenancy Act, 1950

East Bengal State Acquisition and Tenancy Act 1950 a law relating to tenancies to be held under the state and other matters connected therewith. This Act defined the rights and liabilities of the tenants in relation to their landlords.

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

This Act promotes the goal of retaining the agricultural character of the land by giving cultivators first right of purchase and prohibiting other use. In addition, this Act imposes a private land ceiling of 33.3 acres.

Under State Acquisition of Tenancy Act, khatiyan is prepared in the names of respective tenants directly under the government and the Act provides for a process of updating khatiyan in the names of the persons by transfer, inheritance, and settlement from government. That Act provides a process of pre-emption of land by a co-sharer of contiguous tenant if the transfer is made to any stranger.

The landowner has to establish ownership by producing record of rights, under this Act. This record of rights, prepared under Section 143 or 144 are not always updated and as a result, legal land owners have to face 'difficulties' in trying to prove ownership.

3.2.8 The Registration Act, 1908, amended in 2004

An Act to consolidate the enactments relating to registration of documents, and was aimed to document all immovable property in the country (Ministry of Law, The Registration Act, 1908, 2010). According to the Act, the following instruments (relating to immovable property) are to be registered, if the property to which the instrument relates to is situated in the district in which the Act is in force:

- ✦ Instruments of gift of immovable property;
- ✦ Declaration of heba under Muslim Personal Law (Shariat);
- ✦ Declaration of gift under the Hindu, Christian and Buddhist Personal Law;
- ✦ Instruments of mortgage referred to in section 59 of the Transfer of Property Act 1882;
- ✦ Leases of immovable property from year to year, or for any term extending more than one year;
- ✦ Instrument of partition of immovable property effected by persons upon inheritance according to their respective personal laws;

The law also specifies that any contract for sale of immovable property should be presented for registration within thirty days from the execution of the contract, and shall be executed legally by the parties thereto. In the original framework of the law, registration of land deeds is not compulsory.

Timeline for registration of documents: apart from will, no document of any instrument shall be presented later than three months from the date of execution of such document.

The latest amendment was passed in 2004, aiming to curb land related disputes as well cases of fault registration of land through compulsory registration of land related instruments. According to the amendment, the processes of making deeds, hebas (gift of immovable property) and registrations regarding mortgages, purchases and sale of the lands will be easy and transparent. Through this amendment, registration of land deed was made compulsory (New Land Registration Act comes into effect on July 1, 2005).

3.2.9 Transfer of Property Act, 1882

An Act to amend the law relating to the Transfer of Property by Act of Parties. It only deals with transfer of immovable property including certain incorporeal rights by one living person to another by voluntary act (The Transfer of Property Act, 1882, 2010).

The Act specifically deals with certain modes of transfer of properties by way of sale, mortgage, gift, exchanges or lease. Any transaction relating to immovable property is required to have a registered instrument under the sub-section (2) of section 30 of the Registration Act, 1908.

3.2.10 Land Holding Limitation Order, 1972, amended in 1982

This Order deals with the limitation of land property by providing a ceiling on the private land holding size. According to this order, the size of the private land holding must not exceed 100 bighas (33.3 acres) if the land is owned by families or individuals. The exceeding land must be returned to the Government. An exemption can be applied in case of land owned by religious organization, farmers' cooperatives or if tea, rubber, cocoa or coffee are being cultivated on that land; or when the land is being taken in account for industrial projects, considered beneficial to the public interest.

3.2.11 Non-agricultural khas lands Management and Settlement Policy, 1995

Under this Policy, the land ministry decided in principle to set up public-private partnership arrangement, for which a department or an agency will be constituted to distribute non-agricultural khas land. According to this policy, Non-agricultural khas land is defined as the khas land under government possession, cultivable or uncultivable, situated in Metropolitan areas, Municipality areas and Upazilla headquarter areas, and also includes uncultivable khas land situated outside Metropolitan, Municipality and Upazila headquarter areas.

Settlement to the public departments or Government agencies:

According to the policy, for any government purpose, the settlement of non-agricultural khas land can be made to any public department or government agencies if they apply and pay the appropriate amount, fixed according to the market price. The market price is to be determined based on the territory where the land is located, and the average market price of last 10 land sales, in that Upazilla.

Settlement to private individuals:

The land ministry will allow leaseholders or investors, including developers to build commercial establishments on the non-agricultural khas land, as leased from the Government, for a certain period.

The ownership will return to the Government once the leaseholders have recovered their investment costs plus net return on investment, according to the lease agreement.

3.2.12 Non-Agricultural Tenancy Act 1949

The NAT Act defines non-agricultural land as land, which is used for purposes not connected with agriculture or horticulture and includes any land which is held on lease for purposes not connected with horticulture. This is irrespective of whether it is used for any such purposes or not and a parcel of agricultural land converted into a tenancy by the order of the Collector. This does not include the following:

- ✦ (a) a homestead to which the provisions of Section 182 of the Bengal Tenancy Act 1885 (commonly known as the BT Act) apply
- ✦ (b) land which was originally leased for agriculture or horticultural purposes but is being used for purposes not connected with agriculture or horticulture without the consent either express or implied of the landlord, if the period for which such land has been so used is less than twelve years, and
- ✦ (c) land which held for purposes connected with cultivation or manufacture of tea.

Non-agricultural land does not include lease of structures with land but the cases of tenants of non-agricultural land, who have erected structures thereon, are governed by the provisions of the NAT Act 1949.

3.3 Relevant National Legal Instruments for the Project

Table 3.2 presents an outline of other National legal instruments that will have relevance to the proposed Project with respect to the social and environmental considerations.

Table 3.2 National Legal Instruments Relevant To The Project

Act / Rule / Law / Ordinance	Enforcement Agency – Ministry / Authority	Key Features	Applicability to the Project
The Environment Conservation Act, 1995 and subsequent amendments in 2000 and 2002	Department of Environment and Forests	<ul style="list-style-type: none"> ➤ Define applicability of environmental clearance certificate ➤ Regulation of development activities from environmental perspective 	Applicable as this act sets the rules for the process of Environment Clearance that is to be followed by CUET

Act / Rule / Law / Ordinance	Enforcement Agency – Ministry / Authority	Key Features	Applicability to the Project
		<ul style="list-style-type: none"> ➤ Framing applicable limits for emissions and effluents ➤ Framing of standards for air, water and noise quality ➤ Formulation of guidelines relating to control and mitigation of environmental pollution, conservation and improvement of environment ➤ Declaration of Ecologically critical areas 	
Environmental Conservation Rules, 1997 and subsequent amendments in 2002 and 2003, 2017	Department of Environment (DoE) Ministry of Environment and Forests	<ul style="list-style-type: none"> ➤ Declaration of Ecologically critical areas ➤ Requirement of environmental clearance certificate for various categories of projects ➤ Requirement of IEE/EIA as per the category ➤ Renewal of the environmental clearance certificate within 30 days after the expiry ➤ Provides standards for quality of air, water and sound and acceptable limits for emissions/discharges from vehicles and other sources 	Applicable as the Projects falls under Red Category (Park) and require environmental clearance from DoE
The Vehicle Act, 1927; The Motor Vehicles Ordinance, 1983; and The Bengal Motor Vehicle Rules, 1940	Bangladesh Road Transport Authority	<ul style="list-style-type: none"> ➤ Exhaust emissions ➤ Vehicular air and noise pollution ➤ Road/traffic safety ➤ Vehicle Licensing and Registration ➤ Fitness of Motor Vehicles ➤ Parking by-laws. 	Applicable for proposed Project in relation to road transport. All vehicles used in the project must have valid license; pollution testing to be conducted periodically. Project should follow the parking by-laws
The Forest Act, 1927 and subsequent amendments in 1982 and 1989	Ministry of Environment and Forests	<ul style="list-style-type: none"> ➤ Categorization of forests as reserve, protected and village forests ➤ Public liaison is required for use of forest land for any non-forest purposes 	Not applicable as proposed Project is not on forestland.

Act / Rule / Law / Ordinance	Enforcement Agency – Ministry / Authority	Key Features	Applicability to the Project
Wildlife (Conservation and Security) Act, 2012.	Ministry of Environment and Forest; Bangladesh Wildlife Advisory Board	<ul style="list-style-type: none"> ➤ Preservation of Wildlife Sanctuaries, Parks, and Reserves 	Not applicable as the Project study area does not have any wildlife areas
National Biodiversity Strategy and Action Plan (2004)	Ministry of Environment and Forest Bangladesh Wildlife Advisory Board	<ul style="list-style-type: none"> ➤ Conserve, and restore the biodiversity of the country ➤ Maintain and improve environmental stability for ecosystems ➤ Guarantee the safe passage and conservation of globally endangered migratory species, especially birds and mammals in the country 	Applicable for conservation of biodiversity. The proponent should conserve biodiversity in the surrounding area.
The Embankment and Drainage Act 1952	Ministry of Water Resources; Bangladesh Water Development Board (BWDB)	An Act to consolidate the laws relating to embankment and drainage and to make better provision for the construction, maintenance, management, removal and control of embankments and water courses for the better drainage of lands and for their protection from floods, erosion and other damage by water	Applicable due to the site location and presence of an existing earthen embankment within the study area. Public liaison to be obtained for constructing embankment surrounding the site and modifications of few drainage channels in the area.
Antiquities Act, 1968	Ministry of Cultural Affairs	This legislation governs preservation of the national cultural heritage, protects and controls ancient monuments, regulates antiquities as well as the maintenance, conservation and restoration of protected sites and monuments, controls planning, exploration and excavation of archaeological sites	Not applicable as the study area does not have any likely cultural heritage or ancient monuments of national or international significance. However, in case, any such evidence of archaeological findings arises, the Project will act in consonance to the Act
The Acquisition and Requisition of Immovable Property Ordinance 1982 and subsequent	Ministry of Land	The act and guidelines relate to procedures for acquisition and requisition of land	Not Applicable

Act / Rule / Law / Ordinance	Enforcement Agency – Ministry / Authority	Key Features	Applicability to the Project
amendments in 1994, 1995 and 2004			
Administrative and Regulatory Guidelines and Instructions for Land Acquisition	Ministry of Land	Regulation of land acquisition process by certain administrative instructions and procedural requirements	Not Applicable
The Building Construction Act 1952 and subsequent amendments	Ministry of Works	This act provides for prevention of haphazard construction of building and excavation of tanks which are likely to interfere with the planning of certain areas in Bangladesh	Applicable. The construction works for the project will have to be undertaken in keeping with the provisions of the act in terms of spatial planning, building codes and labour management
Bangladesh Labor Act, 2006. Bangladesh Labor Rules 2015.	Department of Labour	This Act pertains to the laws relating to employment of workers, relations between workers and employers, determination of minimum rates of wages, payment of wages, compensation for injuries to workers during working hours, raising and settlement of industrial disputes, health, safety, welfare and working conditions and environment of workers.	Applicable. The facility needs to be registered as per the provisions of Bangladesh Labor Rules, 2015 from Department of Labour. The provisions of this act need to be complied with.
Ozone Depleting Substances (Control) Rules, 2004	Ministry of Environment and Forests	<ul style="list-style-type: none"> ➤ Ban on the use of Ozone depleting substances ➤ Phasing out of Ozone depleting substances 	Applicable. No use of ozone depleting substance in the project.
Noise Pollution (Control) Rules 2006	Ministry of Environment and Forests	<ul style="list-style-type: none"> ➤ Prevention of Noise pollution ➤ Standards for noise levels 	Applicable. Monitoring of noise to be conducted to check compliance to the ECR, 1997 specified standards
NOC for abstraction of water under The Bangladesh Pani Bidhimala 2018	Bangladesh Water Development Board	Source of water will be tanker water supply from external source. However, if required water will be also be sourced from surface water or abstracted from groundwater after obtaining necessary □ Public liaison as per The Bangladesh Pani Bidhimala 2018.	Applicable; permission to be obtained from BWDB for sourcing of water during construction and operation phase

Act / Rule / Law / Ordinance	Enforcement Agency – Ministry / Authority	Key Features	Applicability to the Project
Permission from DC	DC Office, Nilphamari	Permission to be obtained from the Office of Deputy Commissioner, Nilphamari for landfilling	Applicable; NoC to be obtained from Deputy Commissioner for construction
NOC from Union Parishad	Union Parishad, Khalisa Chapani	NOC to be obtained from Khalisa Chapani Union Parishad for construction	Applicable. NoC to be obtained from Union Parishad for construction

Source: Websites of DOE, Legislative and Parliamentary Affairs Division: Bangladesh Laws and Bangladesh Board of Investment: Business laws

3.3.1 Administrative Setup related to Environment in Bangladesh

The Ministry of Environment & Forest (MoEF) 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 MoEF oversees the activities of the following technical/implementing agencies:

- ✚ Department of Environment (DOE);
- ✚ Forest Department (FD);
- ✚ Bangladesh Forest Industries Development Corporation (BFIDC);
- ✚ Bangladesh Forest Research Institute (BFRI); and
- ✚ Bangladesh National Herbarium (BNH).

3.3.2 Other Related Organization

There are several other organizations under the administrative framework which would govern social and environmental functions related to the proposed Project, namely:

- ✚ Ministry of Land: Land reform and land acquisition directorate;
- ✚ Ministry of water resources: Bangladesh Water Development Board; and
- ✚ Local Government Engineering Department (LGED).

3.3.3 Department of Environment (“DOE”)

The DOE has been placed under the MoEF as its technical wing and is statutorily responsible for the implementation of the *Environment Conservation Act, 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 pO.Creeds its - the latter being the legal requirement before the proposed Project can be implemented;
- ✚ Providing advice or taking direct action to prevent 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 Ecologically Critical Areas (ECAs), where the ecosystem has been degraded to a critical state; and
- ✚ Review and evaluation of Initial Environmental Examinations (IEEs) and EIAs prepared for projects in Bangladesh.

3.4 Environmental Clearance Process

As mentioned in Section 3.3.2, ECR has classified projects to be assessed by the DOE in four categories based on the severity of impacts:

- ✚ Green: Nil;
- ✚ Orange A: minor;
- ✚ Orange B: medium; and
- ✚ Red: severe.

As per the *ECR 1997* and amendment in 2017, Industrial Park is included under Red category.

The applicability of environmental clearance and the process of the same is described in

Figure 3.1.

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.

According to the Orange B category classification, the process for obtaining Environmental Clearance Certificate (ECC) for the proposed Project is presented below¹.

- ✚ Application through prescribed form-3 under Environment Conservation Rules 1997
- ✚ Prescribed fees under schedule-13 under Environment Conservation Rules 1997 (Amended 2002)
- ✚ Report on the feasibility of the industrial unit or project;
- ✚ Initial Environmental Examination Report;
- ✚ Environmental Management Plan (EMP);
- ✚ No objection certificate (NOC) from the local authority (Union Parishad);
- ✚ Permission from Deputy Commissioner, Nilphamari
- ✚ NOC for abstraction of water as per The Bangladesh Pani Bidhimala, 2018
- ✚ Outline of the relocation, rehabilitation plan;

¹ A Guide to Environmental Clearance Procedure, Department of Environment, Ministry of Environment and Forests August, 2010.

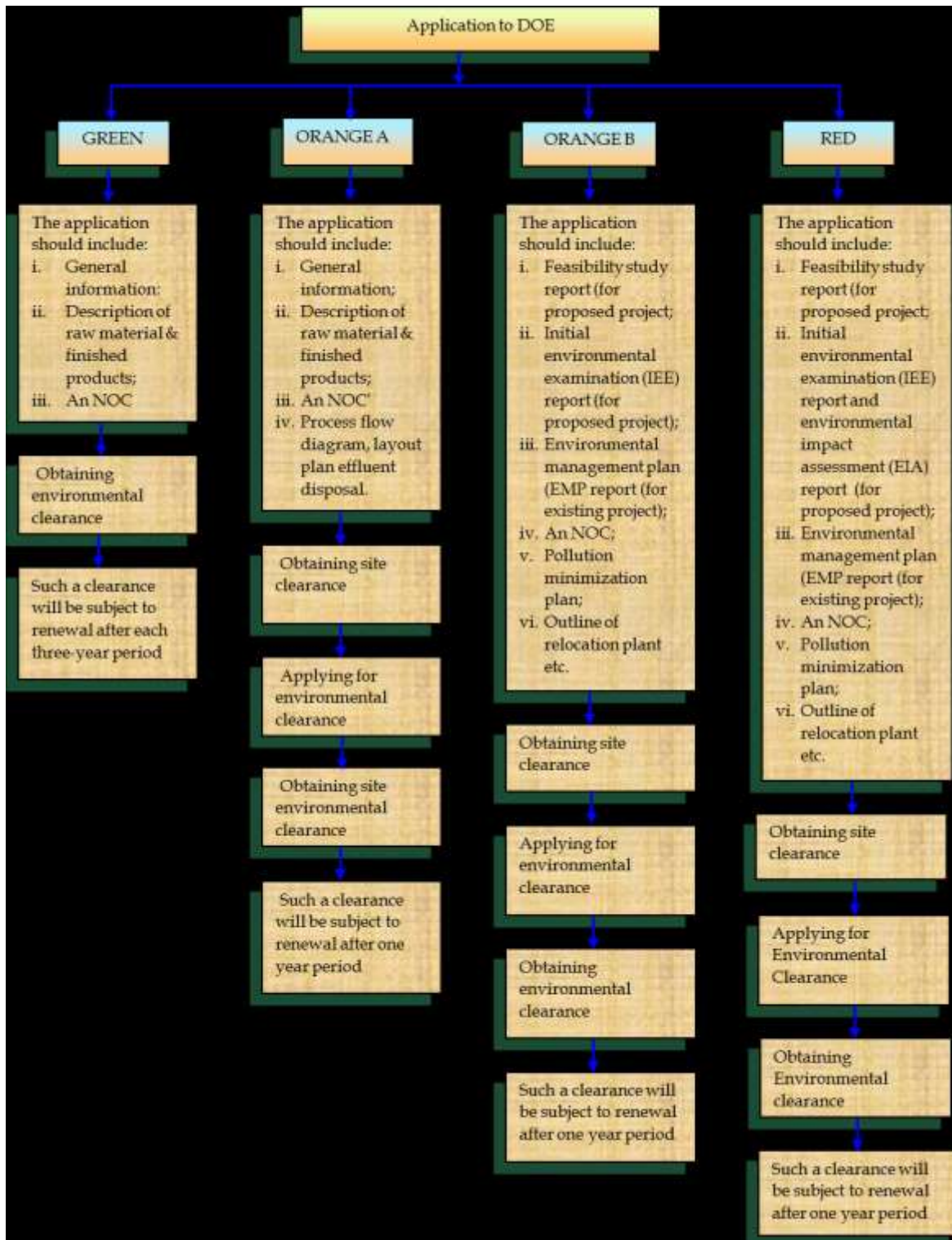


Figure 3.1 DoE Environmental Clearance Applicability and Procedure

3.5 Project Relevant International treaties and Conventions

Bangladesh is party to a number (30)² of international environmental conventions, treaties and agreements. The Project relevant international treaties and conventions relevant to the project signed, ratified and in the process of ratification by Bangladesh are detailed in **Table 3.3**.

Table 3.3 Project Relevant International Treaties and Conventions

Environment related International convention and Treaties	Status
International Plant Protection Convention (Rome, 1951.)	01.09.78 (ratified)
International Convention for the Prevention of Pollution of the Sea by Oil (London, 1954 (as amended on 11 April 1962 and 21 October 1969.))	28.12.81 (entry into force)
Plant Protection Agreement for the South East Asia and Pacific Region (as amended) (Rome, 1956.)	04.12.74 (accessed) (entry into force)
International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties (Brussels, 1969.)	04.02.82 (entry into force)
Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar, 1971) ("Ramsar Convention").	20.04.92 (ratified)
Convention Concerning the Protection of the World Cultural and natural Heritage (Paris, 1972.)	03.08.83 (accepted) 03.11.83 (ratified)
Convention on International Trade in Endangered Species of Wild Fauna and flora (Washington, 1973.) ("CITES Convention")	18.02.82 (ratified)
United Nations Convention on the Law of the Sea (Montego Bay, 1982.)	10.12.82 (ratified)
Vienna Convention for the Protection of the Ozone Layer (Vienna, 1985.)	02.08.90 (accessed) 31.10.90 (entry into force)
Montreal Protocol on Substances that Deplete the Ozone Layer (Montreal 1987.)	02.08.90 31.10.90 (accessed) (entry into force)
London Amendment to the Montreal Protocol on substances that Deplete the Ozone Layer (London, 1990)	18.03.94 (accessed) 16.06.94 (entry into force)
Copenhagen Amendment to the Montreal protocol on Substances that Deplete the Ozone Layer, Copenhagen, 1992	27.11.2000 (accepted) 26.2.2001 (entry into force)
Montreal Amendment of the Montreal Protocol on Substances that Deplete the Ozone Layer, Montreal, 1997	27.7.2001 (Accepted) 26.10.2001 (Entry into force)
Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal (Basel, 1989.)	01.04.93 (accessed)
International Convention on Oil Pollution Preparedness, Response and Cooperation (London, 1990.)	30.11.90 (signed) In the process of ratification
United Nations Framework Convention on Climate Change, (New York, 1992.)	09.06.92 (signed) 15.04.94 (ratified)
Convention on Biological Diversity, (Rio De Janeiro, 1992.)	05.06.92 (signed) 03.05.94 (ratified)
International Convention to Combat Desertification, (Paris 1994.)	14.10.94 (signed) 26.01.1996 (ratification) 26.12.1996 (entry into force)

² Department of Environment, Bangladesh

Environment related International convention and Treaties	Status
Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques, (Geneva, 1976.)	03.10.79 (accessed) (entry into force)
Agreement Relating to the Implementation of Part XI of the United Nations Convention on the Law of the Sea of 10 December 1982 (New York, 1994.)	28.07.96 (signed)
Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on their Destruction (Paris, 1993.)	14.01.93 (signed)
Convention on persistent Organic Pollutants, Stockholm	23.5.2001 (signed) 12.03.2007 (ratified)
Kyoto protocol to the United Nations Framework Convention on Climate Change	21.8.2001 (accessed)

Source: DOE, Bangladesh

3.6 International Safeguard Requirements

3.6.1 IFC Performance Standards

The Performance Standards (PS) (January 2012) established by IFC stipulates that the Project shall meet certain requirements throughout the life cycle of an investment by IFC or other relevant financial institution such as other Development Financial Institutions (DFI) (e.g. DEG, FMO) or commercial banks, which are signatory to the *Equator Principles, 2013*.

Table 3.4 IFC Performance Standards

Performance Standards	Specific Areas
Performance Standard 1:	Assessment and Management of Environmental and Social Risks and Impacts
Performance Standard 2	Labour and Working Conditions
Performance Standard 3	Resource Efficiency and Pollution Prevention
Performance Standard 4	Community Health, Safety and Security
Performance Standard 5	Land Acquisition and Involuntary Resettlement
Performance Standard 6	Biodiversity Conservation and Sustainable Management of Living Natural Resources
Performance Standard 7	Indigenous Peoples
Performance Standard 8	Cultural Heritage

IFC Performance Standards, January 2012

These PS and guidelines provide ways and means to identify impacts and affected stakeholders and lay down processes for management and mitigation of adverse impacts. A brief on the requirements as laid down in the performance standards is described in the following subsections.

Following sub-sections tries to provide the requirements of the specific PS, so as to set up the context for matching the requirements of these PS during the various stages of the life cycle of the Project.

3.6.1.1 PS 1: Assessment and Management of Environmental and Social Risks and Impacts

The PS 1 requires Social and Environmental Assessment and Management Systems for managing social and environmental performance throughout the life cycle of this Project and runs through all subsequent PSs. The main elements of PS 1 include:

- ✚ A Social and Environmental Assessment to understand the social and environmental impacts and risks;
- ✚ A Management Program for mitigating the impacts and minimizing the risks identified in the assessment;
- ✚ Establishing and ensuring organizational capacity and requisite trainings to the staff to implement the Management Programme;
- ✚ Identification and engagement with range of stakeholders that may be interested in their actions;
- ✚ Development and implementation of Stakeholder Engagement Plan that is scaled to the project risks and impacts and development stage and tailored to the characteristics and interests of the Affected Communities;
- ✚ Engagement and consultation with the affected communities, subject to identified risks and adverse impacts from a project;
- ✚ Informed Consultation and Participation (“ICP”) process for projects with potentially significant adverse impacts on affected communities;
- ✚ For projects with adverse impacts to Indigenous Peoples, requirement to engage them in a process of ICP and in certain circumstances requirement to obtain their Free, Prior, and Informed Consent (FPIC);
- ✚ Implementation and maintenance of procedure for external communications to receive and register external communications from the public, and their Redressal;
- ✚ Adequate monitoring and reporting systems to measure and report the effectiveness of the Management Programs.

The social and environmental performance is a continuous process to be initiated by the management and would involve communication between the organization, its workers and local communities directly affected by the Project. The PS requires that Project proponent initiate regular assessment of the potential social and environmental risks and impacts and consistently tries to mitigate and manage strategy on an ongoing basis.

3.6.1.2 PS 2: Labour and Working Conditions

The economic growth through employment creation and income generation is recognized and balanced protecting the basic rights of workers. PS 2 is guided by the various conventions of International Labour Organization (“ILO”) and outlines the minimum requirements of working conditions, protection to the workforce (including issues of child and forced labour) and ensuring occupational health and safety of both its ‘employees’ as well as ‘non employees’ working through contractors. The PS requires:

- ✚ Establishment of a sound worker-management relationship;
- ✚ Encouraging equal opportunity and fair treatment of workers;
- ✚ Promoting compliance with national labour and employment laws;
- ✚ Management of accommodation services with provision of basic services;
- ✚ Promoting healthy and safe working conditions for workers; and

- ✚ Analysis of alternatives for retrenchment prior to implementing any collective dismissals.

PS 2 requires project proponents to conduct its activities in a manner consistent with the four core labour standards (child labour, forced labour, non-discrimination, and freedom of association and collective bargaining). In addition, PS 2 also addresses other areas such as working conditions and terms of employment, retrenchment, and occupational health and safety issues.

Some of these requirements refer to the applicable national law. Whereas national law establishes standards that are less stringent than those in PS 2, or are silent, the project proponent is expected to meet the requirements of PS 2.

3.6.1.3 PS 3: Resource Efficiency and Pollution Prevention

PS 3 outline a project level approach to resource efficiency and pollution prevention and control in line with internationally disseminated technologies and practices with objectives to:

- ✚ avoid or minimize adverse impacts on human health and the environment by avoiding or minimizing pollution from activities;
- ✚ promote more sustainable use of resources, including energy and water; and
- ✚ reduce project-related greenhouse gas (“GHG”) emissions.

Key requirements of PS3 are to consider ambient conditions and apply technically and financially feasible resource efficiency and pollution prevention principles and techniques that are best suited to avoid or where avoidance is not possible, minimize adverse impacts on human health and the environment during the entire project life-cycle. In addition, a project needs to follow good international industry practice (“GIIP”), as reflected in various internationally recognized sources including the World Bank Group Environmental, Health and Safety Guidelines.

3.6.1.4 PS 4: Community, Health, Safety and Security

PS 4 concentrates on the responsibility that must be undertaken by the client to avoid or minimize the risks and impacts to the community’s health, safety and security that may arise from project activities. PS 4 requires a project to evaluate risks and impacts to the health and safety of the affected community during the Project life cycle and establish measures to avoid minimize and reduce risks and impacts from the Project.

A project needs to evaluate the risks and impacts to the health and safety of the Affected Communities during the project life-cycle and require establishing preventive and controlling measures consistent with good international industry practice (“GIIP”), such as in the World Bank Group Environmental, Health and Safety Guidelines (EHS Guidelines) or other internationally recognized sources.

PS 4 recognizes that project activities, equipment, and infrastructure often bring benefits to communities including employment, ecosystem services, and opportunities for economic development. However, projects can also increase the potential for community exposure to risks and impacts arising from equipment accidents, structural failures, and releases of hazardous materials.

The performance standard details out project proponents responsibility to avoid or minimize the possible risks and impacts to community health, safety and security that may arise from project activities.

3.6.1.5 PS 5: Land Acquisition and Involuntary Resettlement

The objectives of this PS are to:

- ✚ avoid, and when avoidance is not possible, minimize displacement by exploring alternative project designs;
- ✚ avoid forced eviction;
- ✚ anticipate and avoid, or where avoidance is not possible, minimize adverse social and economic impacts from land acquisition or restrictions on land use by (i) providing compensation for loss of assets at replacement cost, and (ii) ensuring that resettlement activities are implemented with appropriate disclosure of information, consultation and the informed participation of those affected;
- ✚ improve, or restore, the livelihoods and standards of living of displaced persons;
- ✚ improve living conditions among physically displaced persons through the provision of adequate housing with security of tenure at resettlement sites.

PS 5 require a project to consider various processes and systems to avoid /minimize social and economic impacts related to land acquisition and resettlement.

This PS applies to physical or economic displacement resulting from the following types of land transactions:

- ✚ Land rights or land use rights acquired through expropriation or other compulsory procedures in accordance with the legal system of the host country;
- ✚ Land rights or land use rights acquired through negotiated settlements with property owners or those with legal rights to the land if failure to reach settlement would have resulted in expropriation or other compulsory procedures;
- ✚ Project situations where involuntary restrictions on land use and access to natural resources cause a community or groups within a community to lose access to resource usage where they have traditional or recognizable usage rights;
- ✚ Certain project situations requiring evictions of people occupying land without formal, traditional, or recognizable usage rights;
- ✚ Restriction on access to land or use of other resources including communal property and natural resources such as marine and aquatic resources, timber and non-timber forest products, freshwater, medicinal plants, hunting and gathering grounds and grazing and cropping areas.

This PS does not apply to resettlement resulting from voluntary land transactions (i.e., market transactions in which the seller is not obliged to sell and the buyer cannot resort to expropriation or other compulsory procedures sanctioned by the legal system of the host country if negotiations fail). It also does not apply to impacts on livelihoods where the project is not changing the land use of the affected groups or communities.

3.6.1.6 PS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources

PS 6 aims at protecting and conserving biodiversity, maintaining ecosystem services, the variety of life in all its forms, including genetic, species and ecosystem diversity and its ability to change and evolve, is fundamental to sustainable development. The objectives of this PS are to:

- ✚ protect and conserve biodiversity;

- ✚ maintain the benefits from ecosystem services; and
- ✚ promote the sustainable management of living natural resources through the adoption of practices that integrate conservation needs and development priorities.

The components of biodiversity, as defined in the *Convention on Biological Diversity*, include ecosystems and habitats, species and communities, and genes and genomes, all of which have social, economic, cultural and scientific importance. This PS addresses how clients can avoid or mitigate threats to biodiversity arising from their operations as well as incorporate sustainable management of renewable natural resources.

PS 6 recognizes that protecting and conserving biodiversity—the variety of life in all its forms, including genetic, species and ecosystem diversity—and its ability to change and evolve, is fundamental to sustainable development. It reflects the objectives of the *Convention on Biological Diversity* to conserve biological diversity and promote use of renewable natural resources in a sustainable manner.

For the purposes of implementation of this PS, habitats are divided into modified, natural and critical. Critical habitats are a subset of modified or natural habitats. For the protection and conservation of biodiversity, the mitigation hierarchy includes biodiversity offsets, which may be considered only after appropriate avoidance, minimization, and restoration measures have been applied. A biodiversity offset should be designed and implemented to achieve measurable conservation outcomes that can reasonably be expected to result in no net loss and preferably a net gain of biodiversity; however, a net gain is required in critical habitats. The design of a biodiversity offset must adhere to the “like-for-like or better” principle and must be carried out in

3.6.1.7 PS 7: Indigenous Peoples

PS 7 acknowledges the possibility of vulnerability of indigenous people³ owing to their culture, beliefs, institutions and living standards, and that it may further get compromised by one or other project activity throughout the life cycle of the project. The PS underlines the requirement of avoiding / minimizing adverse impacts on indigenous people in a project area, respecting the local culture and customs, fostering good relationship and ensuring that development benefits are provided to improve their standard of living and livelihoods.

PS 7 recognizes that Indigenous Peoples, as social groups with identities that are distinct from dominant groups in national societies, are often among the most marginalized and vulnerable segments of the population. The term “indigenous people” is more clearly defined in the IFC Guidance Note for PS 7.

3.6.1.8 PS 8: Cultural Heritage

PS 8 aims to protect the irreplaceable cultural heritage and to guide clients on protecting cultural heritage in the course of their business operations.

PS 8 recognizes the importance of cultural heritage with an objective to:

³ There is no universally accepted definition of “Indigenous Peoples.” Indigenous Peoples may be referred to in different countries by such terms as “Indigenous ethnic minorities,” “aboriginals,” “hill tribes,” “minority nationalities,” “scheduled tribes,” “first nations,” or “tribal groups.” This Performance Standard applies to communities or groups of Indigenous Peoples who maintain a collective attachment, i.e., whose identity as a group or community is linked, to distinct habitats or ancestral territories and the natural resources therein. It may also apply to communities or groups that have lost collective attachment to distinct habitats or ancestral territories in the project area, occurring within the concerned group members’ lifetime, because of forced severance, conflict, government resettlement programs, dispossession of their lands, natural disasters, or incorporation of such territories into an urban area.

- ✚ Protect cultural heritage from the adverse impacts of project activities and support its preservation; and
- ✚ Promote the equitable sharing of benefits from the use of cultural heritage in business activities.

The PS requires the project proponent to comply with relevant national law on the protection of cultural heritage, including national law implementing the host country's obligations under the *Convention Concerning the Protection of the World Cultural and Natural Heritage* and other relevant international law.

Based on the available information, the following IFC Performance Standards (2012) are deemed applicable for the project:

Table 3.5 Trigger of IFC PS

Title	Applicability (Y/N)	Justification
Performance Standard 1: Assessment and Management of Environmental and Social Risks and Impacts	Y	Based on the review of the available information and the understanding developed as part of the site visits, it is understood that the project is likely to result in certain environmental and social risks and impacts. This Performance Standard shall guide the assessment and management of the impacts identified
Performance Standard 2: Labour and Working Conditions	Y	The project will direct employees and workers as well as contractual workers for the construction and operation phase. The management of these workers and the project's relationship with them, and risk of occupational health and safety will be guided by the requirements of this Performance Standard
Performance Standard 3: Resource Efficiency and Pollution Prevention	Y	Certain risks in terms of resource efficiency and environmental pollution have been identified for the project. The requirements of this performance Standard will guide the management of these impacts and minimization of adverse impacts due to the project
Performance Standard 4: Community Health, Safety, and Security	Y	The project is located in the Baish Pukur village, and is surrounded by agricultural and homestead land. Thus, a potential risk to community health and safety has been identified for the project and the same shall be managed in keeping with the requirements of this Performance Standard

Title	Applicability (Y/N)	Justification
Performance Standard 5: Land Acquisition and Involuntary Resettlement	Y	Based on the review of land procurement presented in Section 3.2, while the overall procurement process may have been planned through principles of willing buyer willing seller, the project will entail involuntary resettlement and potential livelihood impacts, which will require a RAP and LRP to be developed in conformance to IFC Performance Standard 5.
Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources	N	The project site, transmission line and access road is not passing through any natural habitats. There is no national ecological protected area within 10 km of the project footprint. There is no internationally recognized Key Biodiversity area, Important Bird Area within 10 km of the project area.
Performance Standard 7: Indigenous Peoples	N	Presently no Indigenous Peoples groups have been identified as project impacted. Thus, the Performance Standard is assessed as not applicable.
Performance Standard 8: Cultural Heritage	Y	Presently, a mosque and few burial sites are likely to be impacted as part of the project land take.

3.6.1.9 IFC Project Categorization

As part of its review of a project's expected social and environmental impacts, IFC uses a system of social and environmental categorization. This categorization is used to reflect the size of impacts understood as a result of the client's social and environmental assessment and to specify IFC's institutional requirements. The IFC categories are:

- ✚ Category A Projects: Projects with potential significant adverse social or environmental impacts that are diverse, irreversible or unprecedented;
- ✚ Category B Projects: Projects with potential limited adverse social or environmental impacts that are few in number, generally site-specific, largely reversible and readily addressed through mitigation measures;
- ✚ Category C Projects: Projects with minimal or no adverse social or environmental impacts, including certain financial intermediary (FI) projects with minimal or no adverse risks;
- ✚ Category FI Projects: All FI projects excluding those that are Category C projects.

IFC categorizes project primarily according to the significance and nature of impacts. IFC defines the project's area of influence as the primary project site(s) and related facilities that the client (including its contractors) develops or controls; associated facilities that are not funded as part of the project (funding may be provided separately by a client or a third party including the government), and whose viability and existence depend exclusively on the project and whose goods or services are essential for the successful operation of a project; areas potentially impacted by cumulative impacts from further planned development of a project; and areas potentially affected by impacts from unplanned but predictable developments caused by the project that may occur later or at a different location. The area

of influence does not include potential impacts that would occur without a project or independently of a project.

3.6.1.10 IFC EHS Guidelines, 2007

The *Environmental, Health, and Safety (EHS) General Guidelines*⁴ (April 30, 2007) will be applicable for this Project. In addition to that, IFC's Sector specific *EHS Guidelines for Electric Power Plants*⁵ (December 19, 2008) will also apply.

3.6.2 Equator Principles III (2013)

Equator Principles are set of voluntary guidelines adopted by private financial institutions to ensure that large-scale development or construction projects appropriately consider the associated potential impacts on the natural environment and the affected communities.

The Equator Principles Financial Institutions (EPFI) have their own environmental and social guidelines, which are compliant with the underlying IFC Performance Standards, and WB EHS Guidelines.

Based on the project categorization, the project proponent is expected to meet the requirements, as given below:

For category A and B projects, it is required to-

- ✚ Conduct an Environmental Impact Assessment (EIA). The assessment document should propose measures to mitigate, minimize, and offset adverse impacts appropriate to the nature and scale of the project.
- ✚ Conduct an alternative analysis (when GHG emission is more than 100,000 tons of CO₂ equivalent annually)
- ✚ Prepare an Action Plan (AP)
- ✚ Establish an environmental & social management system
- ✚ Conduct a stakeholder engagement with the project-affected communities
- ✚ Establish a grievance mechanism
- ✚ Disclose the environmental and social impact assessment report online
- ✚ Disclose the GHG emissions quantification (for projects emitting more than 100,000 tons of CO₂ equivalent annually)

For all projects, the project proponent will covenant in financial documentation to comply with all relevant host country environmental and social laws, regulations, and pO.Creeds its.

For Category A and B projects-

The financial documentation will have to comply with:

- ✚ The EMPs and EPAP (where applicable) during the construction and operation of the project in all material respects.

⁴ [http://www.ifc.org/ifcext/sustainability.nsf/AttachmentsByTitle/gui_EHSGuidelines2007_GeneralEHS/\\$FILE/Final+-General+EHS+Guidelines.pdf](http://www.ifc.org/ifcext/sustainability.nsf/AttachmentsByTitle/gui_EHSGuidelines2007_GeneralEHS/$FILE/Final+-General+EHS+Guidelines.pdf)

⁵ http://www1.ifc.org/wps/wcm/connect/dfb6a60048855a21852cd76a6515bb18/FINAL_ThO.Creedsal%2BPower.pdf?MOD=AJPERES&id=1323162579734

- ✚ Provide periodic reports prepared by in-house staff or third-party experts that document compliance with the AP and the host country's laws and regulations.
- ✚ Decommission the facilities in accordance with an agreed decommissioning plan.

3.6.3 FMO Sustainability Policy

The sustainability policy sets the FMO commitment for sustainable development, and is applicable for its clients. The policy is the foundation of FMO's Sustainability Management System and guides FMO's internal processes. The selection of clients by FMO is in line with the UN Guiding Principles on Business and Human Rights.

- ✚ Principles- FMO requires all clients to comply with applicable environmental, social and human rights laws in their home and host countries. In addition, FMO upholds the following international standards as a part of client operations, as applicable:
 - IFC Performance Standards/WB EHS Guidelines/Equator Principles
 - OECD Guidelines on Multinational Enterprises
 - ILO Declaration on Fundamental Principles and Rights to Work
 - UN Principles for Responsible Investment
 - EDFI Principles for Responsible Financing
 - G20 Principles of Corporate Governance

The IFC PS guide clients to assess the likelihood and severity of impact on human rights as part of their assessment of social and environmental impact.

- ✚ Exclusion list- FMO assesses potential investments for the following activities, which is classified as exclusion activities for investment.
 - Forced labour or child labour
 - Production or activity deemed illegal under host country laws or regulations
 - Cross border trade in waste and waste products
 - Destruction of High Conservation Value areas
 - Radioactive materials and unbounded asbestos fibres
 - Pornography/Prostitution
 - Racist and anti-democratic media
 - The client company's activity (10% of earnings) involves alcoholic beverages, tobacco, weapons and munitions, gambling

Table 3.6 FMO ESG risk categorization (following IFC's Environmental and Social Risk Categorization Framework):

Direct Investment	
Category A	Business activities with potential significant adverse environmental or social risks/impacts that are diverse, irreversible or unprecedented.
Category B	Business activities with potential adverse environmental or social risks/impacts that are beyond site boundaries, largely irreversible and

	can be addressed through relevant mitigation measures.
Category B+	Business activities with potential limited adverse environmental or social risks/impacts that are few in number, generally site-specific, reversible and readily addressed through mitigation measures.
Category C	Business activities with minimal or no environmental or social risks/impacts.

During due diligence FMO executes a thorough ESG assessment on its potential clients. This helps in identifying the main ESG risks and strengths that a client is exposed to, and assess the quality of the client's risk management and mitigation measures.

3.7 Applicable Environmental Standards

The Project shall have to comply with Bangladesh environmental, health and safety laws and World Bank Group Guidelines with special attention to comply with the Bangladesh (GOB Environmental Conservation Rule 1997) and World Bank Group Environmental, Health and Safety General Guidelines (WB EHS Guidelines).

Therefore, the EHS standards as stipulated in ECR 1997 and amendments thereof as well as in the IFC EHS guidelines (General and Electric Power Plant specific) for air quality, surface and ground water quality, ambient noise levels, emissions and effluent discharge will be applicable.

The relevant environmental standards (national as well as international) for project as applicable to the proposed Project are presented in the following tables:

Table 3.7 Ambient Air Quality Standards/ Guidelines

Parameter	Bangladesh**		WHO**			Suggested Criteria for the Project		
	24 hourly (µg/m ³)	Annual (µg/m ³)	1 hourly (µg/m ³)	24 hourly (µg/m ³)#	Annual (µg/m ³)#	1 hourly (µg/m ³)	24 hourly (µg/m ³)#	Annual (µg/m ³)#
SPM*	200	-	-	-	-	-	200 (8-hourly avg.)	-
PM ₁₀	150	50	-	150 (interim target – 1) 100 (interim target – 2) 75 (interim target – 3) 50 (guideline)	70 (interim target – 1) 50 (interim target – 2) 30 (interim target – 3) 20 (guideline)	-	100 (interim target – 2)	30 (interim target – 3)
PM _{2.5}	65	15	-	75 (interim target – 1) 50 (interim target – 2) 37.5 (interim target – 3) 25 (guideline)	35 (interim target – 1) 25 (interim target – 2) 15 (interim target – 3) 10 (guideline)	-	50 (interim target – 2)	15 (interim target – 3)
SO ₂	365	80	-	125 (Interim Target – 1) 50 (Interim Target – 2) 20 (guideline)	-	-	50 (Interim Target – 2)	-
NO _x	-	100	200 (guideline)	-	40 (guideline)	200	-	40 (guideline)
CO*	10,000	-	-	-	-	-	10,000 (Bangladesh)	-

Note:

* SPM and CO concentrations and standards are 8-hourly only.

** The Bangladesh National Ambient Air Quality Standards have been taken from the Environmental Conservation Rules, 1997 which was amended on 19th July 2005 vide S.R.O. No. 220-Law/2005.

*** WHO Ambient Air Quality Guideline Values (2005 and 2000), which are also being referred in the World Bank and IFC's General EHS Guidelines (2007)

Interim targets are provided in recognition of the need for a staged approach to achieving the recommended guidelines.

■ Represents the standard values that should be applicable to the Project based on comparison of National Standard and WHO guidelines.

Table 3.8 Noise Level Standards/ Guidelines

Category of Area/ Receptor	Bangladesh*		IFC-WHO**	
	Day (dB(A))	Night (dB(A))	Day (dB(A))	Night (dB(A))
Silent Zone	45	35	-	-
Residential Area	50	40	55	45
Mixed Area	60	50	-	-
Commercial Area	70	60	70	70
Industrial Area	75	70	70	70

Note:

* The Bangladesh National Ambient Noise Standards have been taken from Schedule 4 (Standards for Sound) of the Environmental Conservation Rules, 1997 amended September 7, 2006.

** Guidelines values are for noise levels measured out of doors. Source: Guidelines for Community Noise, World Health Organization (WHO), 1999.

*** As per IFC EHS noise level guidelines, Noise impacts should not exceed the levels presented in the above table or result in a maximum increase in background levels of 3 dB at the nearest receptor location off-site.

■ Represents the standard values applicable to the Project.

Table 3.9 Effluent Standards/ Guidelines

Parameter	Unit	Bangladesh*	WB/IFC**
pH	-	6-9	6-9
Total Suspended Solids (TSS)	mg/l	150	50 mg/l
Oil and grease	mg/l	10	10 mg/l
Total residual chlorine	mg/l	-	0.2 mg/l
Chromium (total)	mg/l	0.5	0.5 mg/l
Copper	mg/l	0.5	0.5 mg/l
Iron	mg/l	2.0	1.0 mg/l
Zinc	mg/l	5.0	1.0 mg/l
Lead	mg/l	0.1	0.5 mg/l
Cadmium	mg/l	0.5	0.1 mg/l
Mercury	mg/l	0.01	0.005 mg/l
Arsenic	mg/l	0.2	0.5 mg/l
Temperature increase at the edge of the mixing zone	°C	40 (summer) 45 (winter)	Site specific requirement to be established by the EA. Elevated temperature areas due to discharge of once-through cooling water (e.g., 1°C above, 2°C above, 3°C above ambient water temperature) should be minimized by adjusting intake and outfall design through the project specific EA depending on the sensitive aquatic ecosystems around the discharge point.

Note:

* Schedule 10 (Standards for Waste from Industrial Units or Projects Waste) of the Environmental Conservation Rules, 1997.

** Effluent Guidelines, WB/IFC EHS Guidelines for ThO.Creeds al Power Plants.

Table 3.10 Standards for Sewage Discharge

Parameter	Unit	Standard Limit (Bangladesh)*	WB Guideline Values
BOD	mg/l	40	30
Nitrate	mg/l	250	-
Phosphate	mg/l	35	-
Suspended Solid	mg/l	100	50
Temperature	°C	30	-
Coliform	No./100 ml	1000	400
pH		-	6-9
COD	mg/l	-	125
Oil & Grease	mg/l	-	10
Total Nitrogen	mg/l	-	10
Total Phosphorous	mg/l	-	2

Notes:

This limit shall be applicable to discharges into surface and inland waters bodies. Sewage shall be chlorinated before final discharge.

** Schedule 9 (Standards for Sewage Discharge) of the Environmental Conservation Rules, 1997*

■ Represents the standard values applicable to the Project.

4. ENVIRONMENTAL AND SOCIAL SCREENING AND SCOPING

4.1 Screening

4.1.1 Project Categorisation as Per DoE, Ministry of Environment, Forest and Climate Change, Bangladesh

Depending upon location, size and severity of pollution loads, projects/ activities have been classified in the ECR, 1997 into four categories: *Green*, *Orange A*, *Orange B* and *Red*, respectively, to nil, minor, medium and severe impacts on important environmental components (IECs).

As per the *Schedule-1* of the ECR 1997, corresponding category related to road cable car, falls under **Red** Project Categorization as per IFC Performance Standards.

IFC categorization is used to reflect the size of impacts understood as a result of the client's social and environmental assessment and to specify IFC's institutional requirements. The IFC categories are:

- + Category A Projects: Projects with potential significant adverse social or environmental impacts that are diverse, irreversible or unprecedented;
- + Category B Projects: Projects with potential limited adverse social or environmental impacts that are few in number, generally site-specific, largely reversible and readily addressed through mitigation measures;
- + Category C Projects: Projects with minimal or no adverse social or environmental impacts, including certain financial intermediary (FI) projects with minimal or no adverse risks;
- + Category FI Projects: All FI projects excluding those that are Category C projects.

4.1.2 Project Categorization as Per FMO

FMO distinguishes the following E&S risk-categories (following the IFC's Environmental and Social Risk Categorization Framework):

- + Category A: Business activities with potential significant adverse environmental or social risks and/or impacts that are diverse, irreversible, or unprecedented.
- + Category B+: Business activities with potential adverse environmental or social risks and/or impacts that are generally beyond the site boundaries, largely irreversible and can be addressed through relevant mitigation measures.
- + Category B: Business activities with potential limited adverse environmental or social risks and/or impacts that are few in number, generally site-specific, largely reversible, and readily addressed through mitigation measures.
- + Category C: Business activities with minimal or no adverse environmental or social risks and/or impacts.

4.1.3 Categorization of the Project

IFC (prospective lender to the project) and FMO (equity investor) consider projects or business activities with "*potential significant adverse social or environmental impacts that are diverse, irreversible or unprecedented*" as Category A.

FMO's Sustainable Policy (2016), also has an interim category of "High Risk B or Category B+", for business activities with potential adverse environmental or social risks and/or impacts that are

generally beyond the site boundaries, largely irreversible and can be addressed through relevant mitigation measures.

Based on O. CREEDS's understanding of the environmental and social impacts of the Teknaf Project, the project is categorised as Category A in keeping with IFC standards based on the following:

+ Diverse and Significant: the project is likely to result in significant adverse environmental and social impacts that are diverse and associated with various applicable Performance Standards. These relate to:

- Impacts on ambient conditions (air, soil and water) during the construction phase
- Risks of community health and safety due to included traffic, influx of labour and emissions including noise during construction phase
- Change in the natural drainage in the area due to the construction of a flood embankment at site, development of the project on a flood plain and filling of local village ponds (used for bathing, washing and for pisciculture) within the project site
- Land procurement and use change of 183 acres of land identified for the project area
- Physical and economic displacement of 71 PAHs (more than 300 PAPs) living within the project site
- The project will also result in the economic and livelihood impacts on approximately 299 households along the transmission line
- The project will impact at least one cultural site of local significance along with multiple burial sites within homestead areas;
- Impacts from associated facilities including transmission line and access road
- Impact to the modified ecological habitats (aquatic and terrestrial), flora and fauna within the project site and immediate surrounding areas

The significance of these impacts is assessed based on the likelihood of the impact and the severity of impact on the receptors resulting from such an occurrence. While the impacts from ambient conditions, community health and safety and natural drainage, flora and fauna are assessed as medium in O. Creeds s of significance, impacts related to land procurement, physical and economic displacement and impact on cultural sites is assessed as Major or high.

+ Largely Irreversible: Through the EIA and RAP & LRP specific mitigation measures will be identified and implemented. These mitigation measures, if implemented in keeping with the international good practices; will result in the reduction of severity & magnitude and thus overall significance of impacts. However, it is unlikely that these mitigation measures will reverse the impacts from the project completely; i.e. residual impacts for these receptors are likely to remain. the impacts on existing livelihood patterns are likely to be irreversible due to the lack of availability of natural resources such as agricultural land and a transition time of at least two or three years (to be confirmed further to completion of data analysis) before livelihoods are restored. The other largely irreversible impact is likely to be in the effects of the impacts on the cultural site and burial sites in the project footprint area.

4.2 Scoping

4.2.1 Identification of Potential Environmental & Social Impacts

Potential environmental and social impacts have been identified through a systematic process whereby the activities (both planned and unplanned) associated with the construction and operation of the Project have been considered with respect to their potential to interaction with

sensitive environmental and social resources or receptors. Scoping of potential impacts has been undertaken in two stages:

- ✚ Stage 1: Identification of potential interactions between project activities and environmental receptors; and
- ✚ Stage 2: Prioritization of these interactions in terms of their potential to cause significant impacts taking into consideration the current knowledge of project activities, and the existing condition/ sensitivities of environmental and social baseline.

The approach taken and outcomes for each stage are discussed in the subsequent section.

4.2.2 Scoping Matrix

The Scoping Matrix enables a methodical identification of the potential interactions each Project activity may have on the range of resources/receptors within the Area of Influence for the Project.

The matrix consists of a list of resources/receptors that could be affected by the Project activities, set against a list of Project activities. Entries in the matrix cells are coloured to indicate whether:

- ✚ An interaction is not reasonably expected (white);
- ✚ An interaction is reasonably possible but none of the resulting impacts are likely to lead to significant effects (grey); or
- ✚ The interaction is reasonably possible and at least one of the resulting impacts is likely to lead to an effect that is significant (black).

All potential interactions, regardless of probability of occurrence, are considered at this stage

Table 4.1 Scoping Matrix of Potential Interactions

Project Activity/ Hazards	Environmental Resources												
	Land Forms/ Profile	Soil/ Sediment Quality	Land Use	Air Quality	Climate Change	Drainage Pattern	Surface Water Quantity/Quality	Ground Water Resource & Quality	Noise Levels & vibration	Road & Traffic	Occupational Health & Safety	Terrestrial Ecology	Aquatic Flora / Fauna (Biodiversity)
Land acquisition/ purchase / lease	■		■										
Construction of Site Link Road		■	■	■		■							
Site development -filling, levelling & compaction		■		■		■					■		■
Transportation of construction materials				■					■				
Transportation of lime, bituminous materials, and cement, and miscellaneous materials and ancillary facilities				■					■				
Foundation excavation, piling and construction for mounts, site office, Transformer				■			■		■		■		
Electrical cable laying and installation of PV module		■											
Transmission tower installation and stringing of wire												■	
Storage, handling and disposal of waste		■					■	■					
Storage and handling of chemicals (unplanned release)		■					■	■					
Generation of sewage		■						■					
Influx of construction workers							■						
Sourcing of water								■					

Project Activity/ Hazards	Environmental Resources												
	Land Forms/ Profile	Soil/ Sediment Quality	Land Use	Air Quality	Climate Change	Drainage Pattern	Surface Water Quantity/Quality	Ground Water Resource & Quality	Noise Levels & vibration	Road & Traffic	Occupational Health & Safety	Terrestrial Ecology	Aquatic Flora / Fauna (Biodiversity)
Washing of modules													
Grass cutting													
Regular Inspection and Maintenance of equipment													
Decommissioning													
Removal of PV Module													
Removal of ground mounted structures, ancillary facilities													

= Represents “no” interactions are reasonably expected

= Represents interactions reasonably possible but none of the outcome will lead to significant impacts

= Represents interactions reasonably possible with one of the outcomes leading to potential significant impact

4.3 Environmental and Social Impacts

The interactions with resources/ receptor has been discussed in the following section.

- ✚ **Change in land use:** Only private double-cropped low laying agricultural land or waste land will be utilized for the project and therefore there will be a change in land use from agriculture to non-agricultural purpose. It should be noted that in the government records, the land is characterized as non-agricultural land, as it does not support triple cropping and more.
- ✚ **Alteration of Topography and drainage:** The site is located at a hilly area. Land owners in the neighbouring agricultural land parcels reported poor roads and poor drainage. Development at the Site (new pucca road) is likely to increase water inundation in the neighbouring agricultural land parcels.
- ✚ **Impact on Soil / Land Environment:** The project site was already developed. It was reported that there were no mature trees. Therefore, vegetation clearance was not required. The top soil has not been stripped prior to site development. Soil erosion and deposition of fill material in the adjacent agricultural land, improper waste disposal can contaminate soil.
- ✚ **Impact on Air Quality:** Operation of DG sets, vehicular movement and construction activities (filling of site, handling of construction material) can cause fugitive and point source emission. This may have adverse impact on local ambient air quality.
- ✚ **Increased Ambient Noise Levels:** Operation of construction equipment, machinery, piling, DG sets, and vehicular movement and maintenance activities would increase the ambient noise levels. Local communities may be disturbed due to higher than anticipated noise.
- ✚ **Impact on Water Environment:** Construction of the project will require water from local sources to carry out its activities. Further, road pitching and construction will require large quantity of water. Therefore, there can be impact on ground water resource. Surface and ground water quality can also be impacted due to improper waste disposal or leaks/spills and runoff.
- ✚ **Impact on terrestrial habitat:** Fugitive emission and noise related disturbance due to operation of machineries may have impact on terrestrial habitat of the nearby habitat.
- ✚ **Impact on Aquatic Habitat:** The surface runoff from project site during construction and operation phase of the project may increase the suspended solid in the receiving surface water body- this may have impact on primary productivity of the aquatic eco-system.
- ✚ **Occupational Health and Safety:** Occupational health and safety hazards can include construction machinery, handling of electrical instruments, noise pollution and dust pollution. In the case of spills/leaks there is a potential for fire hazards and some hazardous substances.
- ✚ **Local Economy and Employment:** The new road will generate employment opportunity for local people mostly during construction phase as well as for road cleaning, grass cutting and security related works during operation phase.
- ✚ **Land Based Livelihoods and Physical displacement:** the project will result in the physical and economic displacement of the land users residing in the area. The land owners and users along the new pucca route, the project is likely to impact the neighbouring settlements and bazar.
- ✚ **Community Health and Safety:** The community health and safety may arise due to changes in environmental quality, increased prevalence of disease and increase in traffic movement for transport of cement, cement mortar and cement concrete, machine and binders like lime, bituminous materials, and cement, and miscellaneous materials.

- ✚ **Cultural resources:** the project land take will result in an impact on several mosque and temples and few burial sites (within individual homesteads).
- ✚ **Vulnerable Groups:** the vulnerable land users who are below the poverty line, elderly or women headed household s are likely to be differentially impacted due to the project land take.

5. ENVIRONMENTAL AND SOCIAL BASELINE CONDITIONS

5.1 Introduction

This section describes the existing environmental and social baseline of the study area, which include the proposed Project site, and in a 5 km radial area around the proposed project site. This includes relevant components of physical, biological and socio-economic environment.

The purposes of describing the environmental settings of the study area are:

- ✚ To understand the project needs and environmental characteristics of the area; and
- ✚ To assess the quality of the existing environment, as well as the environmental impacts of the future developments being studied.

5.2 Study Area

The study area has been delineated based on the Area of Influence (AOI). The AOI of the Project comprises of the Project Site and the surrounding area, where influence of the Project activities is anticipated. The areas likely to be affected by the Project and its associated activities may 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, such as the road construction.
- ✚ Impacts from unplanned but predictable developments caused by the project that may 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' livelihoods are dependent.

Study area map is presented in **Figure 5.1**



Figure 5.1 Project Study Area

5.3 Project Influence Area

The Area of Influence (AOI) of the Project comprises of the project site and the surrounding area, where influence of the project activities is anticipated. The AOI with respect to the environmental and social resources was considered based on the following reach⁶ of impacts:

- ✚ **Air Quality:** Gaseous pollutants (e.g. NO_x and SO₂) and fine particulate matter (PM₁₀ and PM_{2.5})—typically up to 2-2.5 km from projects construction; and 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 from operations and 100 m from the access roads.
- ✚ **Water:** Ground water in 1-2 km radius of project footprint.
- ✚ **Flora and Fauna (Terrestrial and Aquatic):**
 - The direct footprint of the project comprising the project site.
 - The areas immediately adjacent to the project footprint within which a zone of ecological disturbance is created through increased dust, human presence and project related activities. This kind of disturbance has been estimated to occur within the project footprint and surrounding areas of about 500 m from the activity areas. In certain cases, if any significant impact is identified along the transmission line or access road, the study area will be extended upto 2 km.
- ✚ **Socio-economic:** The direct footprint of the project and its associated facilities, including access road
 - The areas within 2 km radius of the site and 500 m from the access roads and. This is based on the understanding that most of the interactions from the project will be limited to this area.

Based on the above the AOI for environmental and social studies is limited to 2-5 km from the Project site and 500 m, (extendable to 2km) for the access road.

Baseline environmental and social study was conducted during March-September 2020. In addition to this, additional socio-economic data was collected as part of the Resettlement Action Plan development in September 2020.

5.4 Approach and Methodology

The baseline data was collected through primary and secondary source of information with reference to the scope of work. This data is collected through a concerted effort of:

- ✚ Reconnaissance and field visits;
- ✚ Scoping study conducted by O. CREEDS;
- ✚ Primary monitoring of key environmental parameters like air, noise, traffic soil, surface water, ground water. The primary monitoring was conducted by O. CREEDS Limited, Bangladesh.

⁶ Distance based on O. CREEDS 's experience with similar projects

- Information about geology, hydrology, prevailing natural hazards like floods, earthquakes etc. have been collected from literature reviews and authenticated information made available by government departments.
- Surveys were carried out to understand and record the biological environment prevailing in the area and the same was verified against published information and literature.
- The socioeconomic environment has been studied through social surveys, consultations with various stakeholders in the villages within the study area.
- Additionally, socioeconomic data have been obtained from the Census of Bangladesh reports.

5.4.1 Baseline Data Collection

The following table summarizes the key sources of information pertaining to each aspect of the baseline:

Table 5.1 Sources of Information for the Baseline

Aspect	Source
Environmental Baseline	
Geology and topography	Geological Survey of Bangladesh
Hydrogeology and hydrology	Hydrological Study conducted for the project. Hydrogeology from relevant research papers
Drainage Pattern, water levels, flood history	Hydrological Study conducted for the project. Discussion with Engineer of 20 ECB. Bangladesh Water Development Board
Groundwater and surface water (quality)	Primary data (surface and groundwater monitoring)
Soils (quality)	Primary data (soil quality monitoring)
Ambient air quality	Primary data (ambient air quality monitoring)
Noise and vibrations	Primary data (ambient noise quality monitoring)
Meteorology	Bangladesh Meteorological Department
Natural hazards	Geological Survey of Bangladesh, Bangladesh Bureau of Statistics
Traffic	Visual observations, Primary data (traffic)
Visual amenity	Visual observations
Land rights and use patterns	Land use map based on satellite Imagery
Ecological Baseline	
Ecosystem services	Visual observations and stakeholder consultation
Flora & fauna, wildlife, biodiversity	Primary site surveys, discussion with local villagers and forest department officials

5.4.2 Environmental Monitoring

The first phase of primary data collection for the environmental parameters (ambient air quality, ambient noise, soil quality and ecology) was conducted during **27th- 30th March 2020**. The subsequent phase of primary data collection for environmental parameters (surface and ground water quality, traffic, terrestrial and aquatic ecology) was conducted on **2nd- 4th September 2020**. Details of primary environmental monitoring conducted at site is presented in **Table 5.2**.

Table 5.2 Environmental Monitoring Plan

Topic	Parameters	Sample per Site	Rationale
Air Quality	PM ₁₀ , PM _{2.5} , SO ₂ , NO ₂ , HC, CO	2	<p>To monitor the ambient air quality within the project site and at vicinity of the project site</p> <ul style="list-style-type: none"> ✚ Air 1: To understand baseline air quality within the project site ✚ Air 2: To understand the baseline air quality at the receptor at the vicinity of the project site at south western side.
Noise	Sound Level (L _{eq} in dB(A))	2	<p>To monitor noise condition at representative noise sensitive receiver in the vicinity of the site.</p> <ul style="list-style-type: none"> ✚ Noise 1: Within the project site to understand the baseline noise levels ✚ Noise 2: To understand the baseline noise levels at the nearest receptor (settlement) at the north eastern side.
Ground Water Quality	Colour, Odour, pH, Turbidity, TDS, Aluminium, Ammonia, Barium, Boron, Calcium, Chlorides, Copper, Fluoride, Free Residual Chlorine, Iron, Magnesium, Manganese, Mineral Oil, Nitrate, Phenolic Compounds, Sulphate, Sulphide, Total Alkalinity, Total Hardness, Zinc, Cadmium, Cyanide, Lead, Mercury, Polychlorinated biphenyls, Total chromium, Total Coliform, Faecal Coliform	2	<p>To monitor existing groundwater baseline condition.</p> <ul style="list-style-type: none"> ✚ Groundwater 1: Within the project site to understand the baseline groundwater quality ✚ Groundwater 2: To understand the baseline groundwater quality at the nearest receptor (settlement) at the south western side
Soil Quality	Particle size distribution, texture, %moisture, alkalinity, acidity,	2	<p>Soil 1, 2, -To understand baseline soil quality of the site</p>

Topic	Parameters	Sample per Site	Rationale
	specific gravity, bulk density, porosity, infiltration capacity, pH, electrical conductivity, nitrogen, phosphorus, potassium (NPK), calcium, magnesium, chloride, sulphate, carbonate, iron, copper, zinc, boron, sodium, cation exchange capacity, heavy metals (As, Hg, Cr+6, Pb, Cd, Fe, Cu, Zn), Sodium Absorption Ratio (SAR), pO.Creeds eability, water holding capacity		
Surface water quality	pH, temperature, turbidity, electrical conductivity, total hardness, total alkalinity, chloride, sulphate, nitrate, fluoride, sodium, potassium, salinity, total nitrogen, total phosphorus, DO, BOD, COD, phenol, heavy metals (As, Cd, Hg, Ni, Mn, Cr+6, Pb, Fe, Cu, Zn), total coliform and faecal coliform	2	<p>Surface water quality</p> <ul style="list-style-type: none"> ✚ Surface water 1- As the site is located within the watershed of Naf River; a sample was taken from Naf River to understand the baseline water quality ✚ Surface Water 2- Surface water quality of a local stream in proximity to the project site
Traffic	Traffic Volume Count	1	To monitor the traffic volume on the Marine Drive Road, LGED Road and Teknaf to Cox,s bazar Road.

Topic	Parameters	Sample per Site	Rationale
Aquatic Ecology	Plankton and benthos composition; fish species present	1	To monitor baseline biodiversity condition of the surface water bodies in the study area. Survey conducted at the same locations of surface water quality monitoring
Terrestrial Biodiversity	Listing of floral and faunal species, establish biodiversity indices and identification of threatened species for terrestrial habitat as per IFC PS6.		To monitor baseline biodiversity condition that may be affected by the Project.



Figure 5.2 Monitoring Location Map

5.4.3 Ecological Survey

Ecological survey was conducted for two (02) days (2nd – 4th September) at the study area. Land use of the study area include Naf River, Agricultural land, Road side vegetation's, ditches, and homesteads etc.

5.4.3.1 Floral Survey

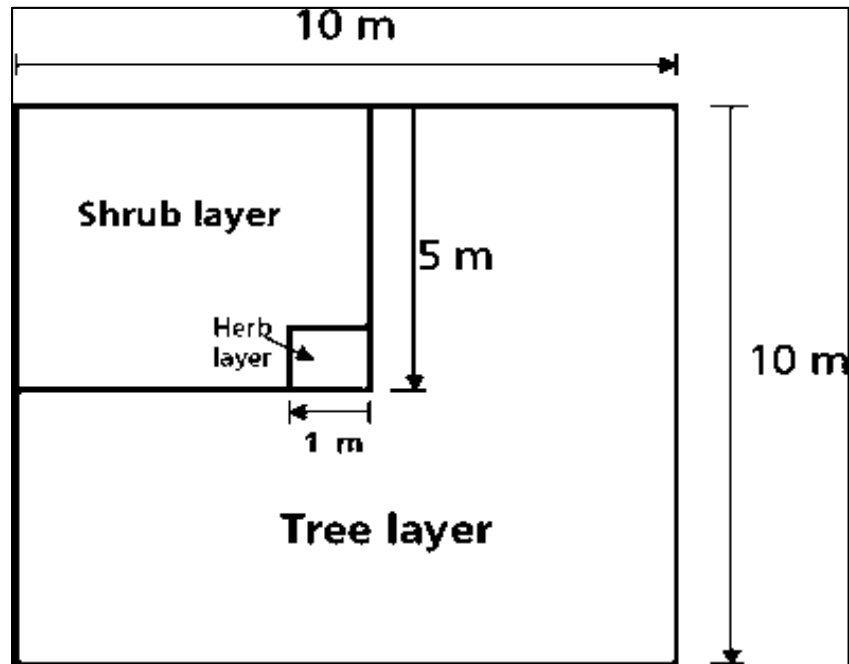


Figure 5.3 Quadrat Layout for Floral Survey

Quadrat sampling method has been used for the counting the vegetation structure in and around the study area. A quadrat is a frame that is laid down to mark out a specific area of the community to be sampled. Within the quadrat frame, the occurrence of plants is recorded using an appropriate measure of abundance. Different floral aspect within the study area was studied and categorized into different local availability status. Conservation significance of the floral diversity within the study area was studied according to the IUCN global Red list. Quadrat layout for floral survey is presented in Error! Reference source not found..

5.4.3.2 Faunal Survey

Faunal species from the study area were recorded based on direct sightings, indirect evidence such as dung, droppings, scats, pugmarks, scratch signs, burrows, nests etc. and consultation with Forest Department officials and local community. During consultation with communities, pictorial representations of species were used in form of field guides.

Sampling for reptiles was conducted during early morning hours and at night, while sampling for amphibians was conducted along edges of water bodies, primarily in the dusk hours. Standard, updated literature was used to identify the reptiles and amphibians in the field.

5.4.4 Socio-economic Baseline

The socio-economic baseline is based on a combination of quantitative and qualitative data. The socioeconomic baseline includes administrative profile, demographic profile, and social structure, livelihood, and infrastructure details. The socio-economic profile will present the socio-economic data in district, union and village level. In addition to the review of the census data, focus group discussions (FGD) and key informant interviews (KII) were undertaken with the following stakeholders:

- ✚ Local community
- ✚ Land owners and users impacted by the project
- ✚ District, Union Parishad and Mouza level offices.

5.5 Physical Environment

5.5.1 Physiography

In the context of physiography, Bangladesh may be classified into three distinct regions

(a) Floodplains,

(b) Terraces, and

(c) Bills; each having distinguishing characteristics of its own. The physiography of the country has been divided into 24 sub-regions and 54 units.

According to the physiography of Bangladesh, the proposed project area falls under the physiographic unit of **Northern Eastern Hills**. Low hill ranges occur between and outside the high hill ranges. They are mainly formed over unconsolidated sandstone and shale. Their summits generally are <300m above MSL. Most areas are strongly dissected, with short steep slopes, but there are some areas with rolling to early-level relief (eg in the best tea-growing areas of Sylhet region). In the Sylhet region, there are four main hillocks in the northern zone and six hill ranges project into the south of Sylhet district from the Indian state of Tripura. These six ranges, which project into the plains from the south, are, from east to west, Patharia, Harargaj, Rajkandi-Ita, Bhanugach, Tarap and Raghunandan.

In the Chittagong region, this unit includes the Sitakunda and Mara Tong ranges and the complex of hills to the south and east of Ramgarh, including the eastern part of the Middle Feni river valley. The Sitakunda range has 32-km long ridge in the middle, which reaches 352m at Sitakunda peak. To the north, the high peaks on this range are Rajbari Tila (274m) and Sajidhala (244m). To the south, there is an abrupt fall and Chittagong city heights are less than 92m. In the Mara Tong range a height of only 113m is reached. Further northeast the hills are higher. The topography is deeply eroded and rounded; the valleys are curved and almost isolated hillocks are common. At the Sitakunda peak, there are several hot springs. There are five broken ranges of hills between Karnafuli River and the southern tip of Bangladesh. South of Bakkhali River the hills reach the sea at Cox's Bazar. Thereafter the main mass of hills goes down the Teknaf peninsula as the Teknaf range. There is a slight break in the west along the Rejukhal valley. In its northern part, the Teknaf range is comparatively low (61 to 91m). From Whykong a high ridge runs south; its main peaks are Baragong (119m), Taunganga (268m), and Nytong (168m). The southwestern end of this range ends at a village called Noakhali where there are a series of impressive cliffs,

some 30m in height. The range ends at Teknaf Bazar. South of Gorjania (northeast of Teknaf peninsula) these hills continue into Myanmar. The Rejukhal valley is an important component of this broken-up landscape

5.5.2 Topography

The topography of the study area using the digital elevation model (DEM) is presented below. Topographic surveys have been conducted along the proposed transmission route at the project area using by RTK and Total Station. All of these transmission route cross sections have been taken by using Optical Level machine.

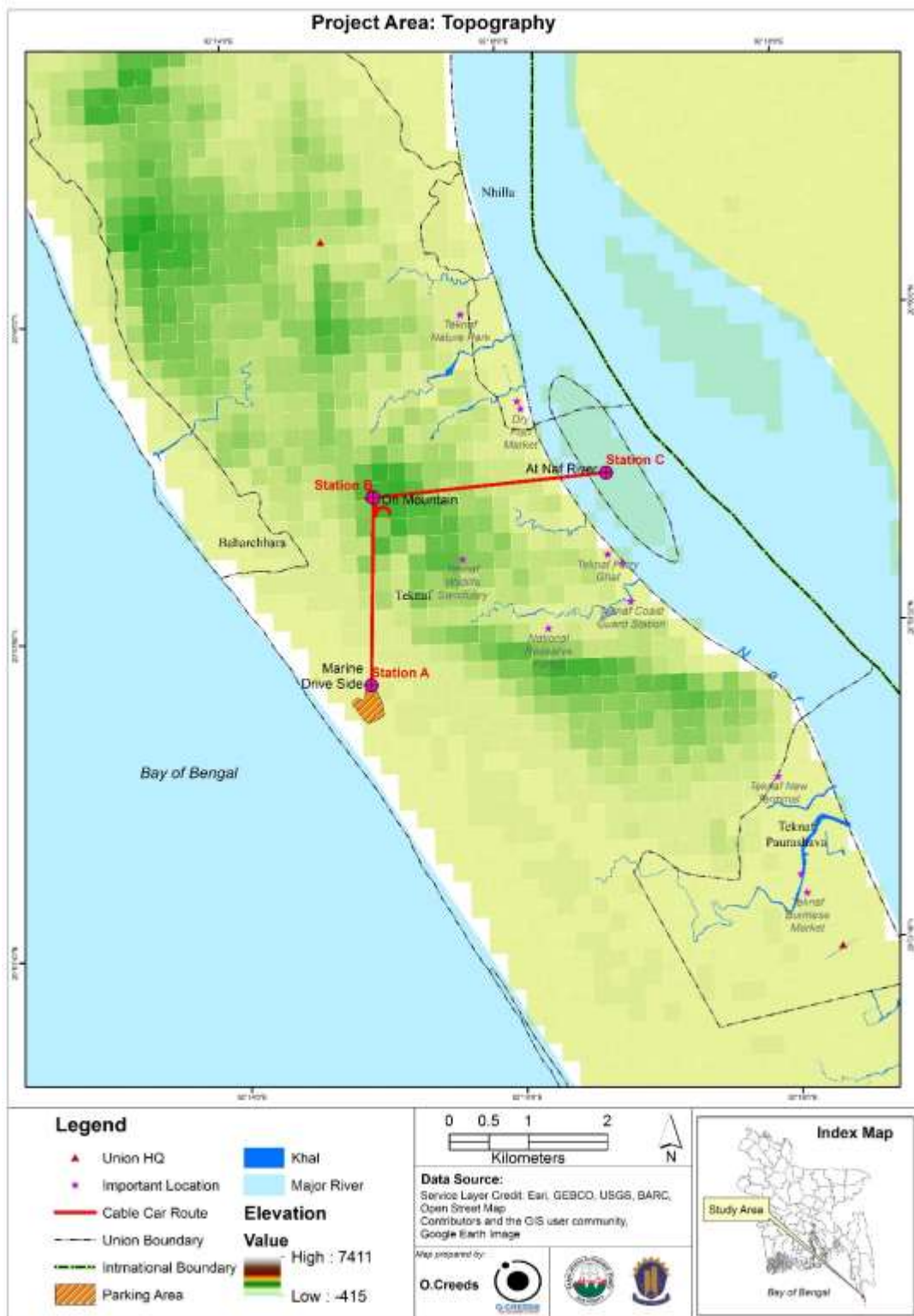


Figure 5.4 Topography Map

5.5.3 Climate and Meteorology

Bangladesh is located in sub-tropical monsoon climate zone. Based on the analysis of pressure, rainfall and temperature following four seasons are present in Bangladesh viz.

- ✚ Winter or Northeast Monsoon (December-February)
- ✚ Summer or Pre-Monsoon (March - May)
- ✚ Southwest Monsoon (June - September); and
- ✚ Autumn or Post-Monsoon (October - November)

Climatic sub-regions of Bangladesh are presented below

Teknaf Upazilla falls in the South Eastern Zone. To assess the climatic conditions of the area, climatology data has been obtained from Teknaf Station (at an aerial distance of 50 km from the site) of Bangladesh Meteorological Department (BMD) for the period 2008-2017.

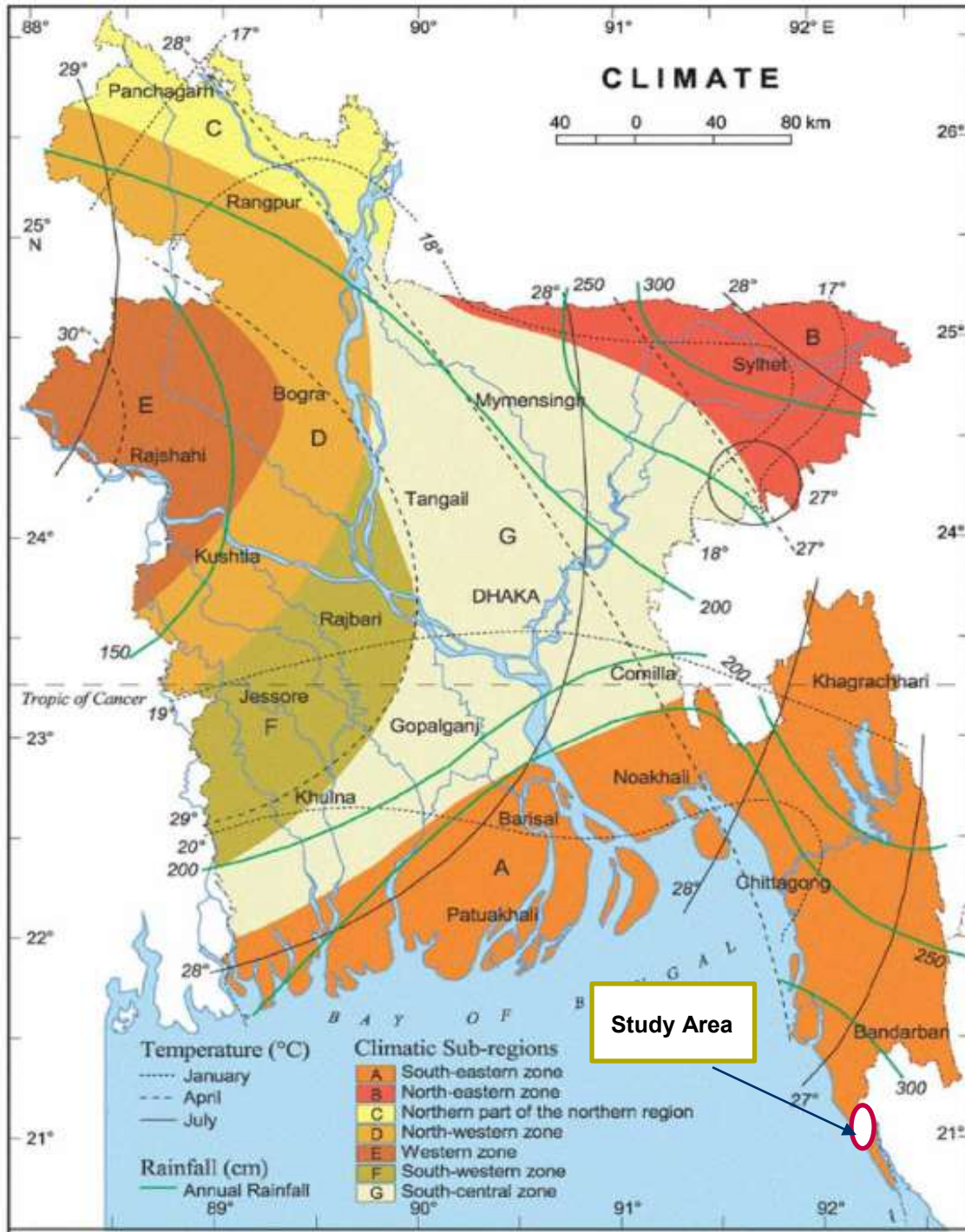


Figure 5.5 Climatic Sub-regions of Bangladesh

Source: <http://lib.pmo.gov.bd/maps/images/bangladesh/Climate.gif>

5.5.4 Temperature

The maximum, minimum and average temperatures recorded at the Teknaf station are presented below in Figure 5.6. The data analysis of 10 years (2009- 2020) shows that monthly maximum

temperature varies from 32°C to 25°C whereas monthly minimum temperature varies from 27°C to 16°C. The warmest month (with the highest average high temperature) is **April** (33°C). The month with the lowest average high temperature is **January** (16°C).

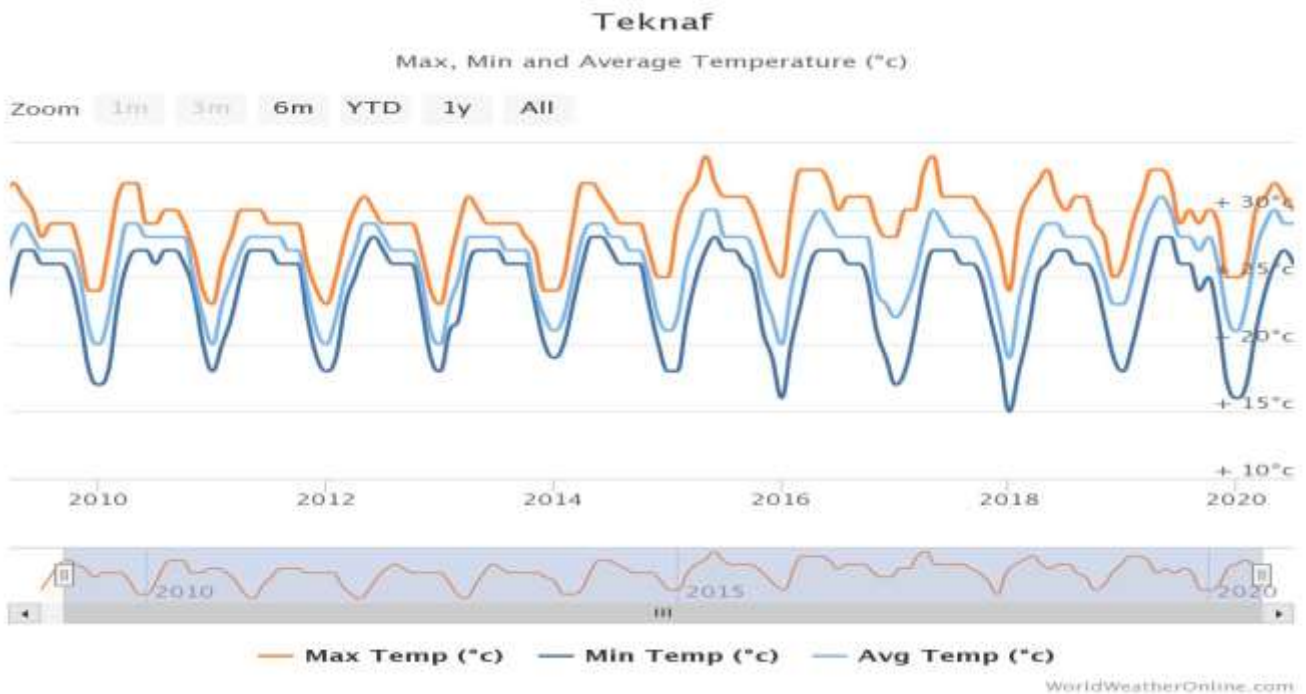


Figure 5.6 Monthly Maximum, Minimum and Average Temperatures (2009-2020)

Source: <https://www.worldweatheronline.com/teknaf-weather-averages/bd.aspx>

Max=Maximum Temperature recorded at a particular month across 10 years; Min= Minimum Temperature recorded at a particular month across 10 years; Avg Max- Average of maximum temperatures at a month; Avg min- Average of minimum temperatures at a month

5.5.5 Rainfall

Analysis of 10 years (2010-2020) rainfall data of Teknaf station indicate that about 90% of the rainfall occurs during monsoon months (July-September) with July and August receiving the maximum rains. Minimum rains are reported during the months of December to March. The last 10 years' rainfall data of Teknaf meteorological station shows that the annual average of total rainfall is recorded as 1966.08 mm. The wettest month (with the highest rainfall) is **July** (1017.2mm). The driest month (with the lowest rainfall) is **February** (0.5 mm). The total rainfall of the last 10 years (2008-2017) of Teknaf weather station which is nearest to the project location is shown below.

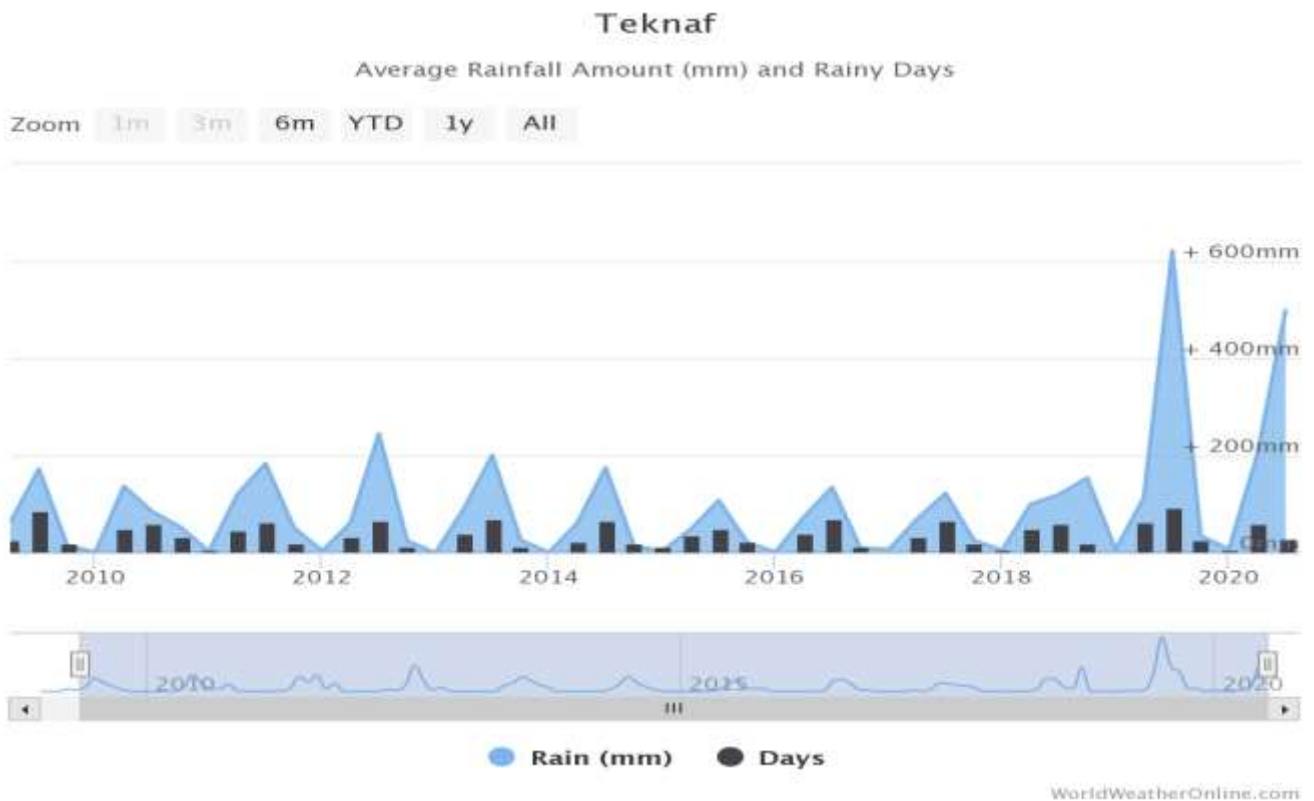


Figure 5.7 Total Rainfall (2008-2018)

Source: <https://www.worldweatheronline.com/teknaf-weather-averages/bd.aspx>

5.5.6 Humidity

Analysis of 10 years (2008-2017) relative humidity data of Teknaf station indicate that monthly average relative humidity was recorded above 80% during most of the months of the year. The monthly variation of normal humidity in Teknaf has been presented in **Figure 5.8**.

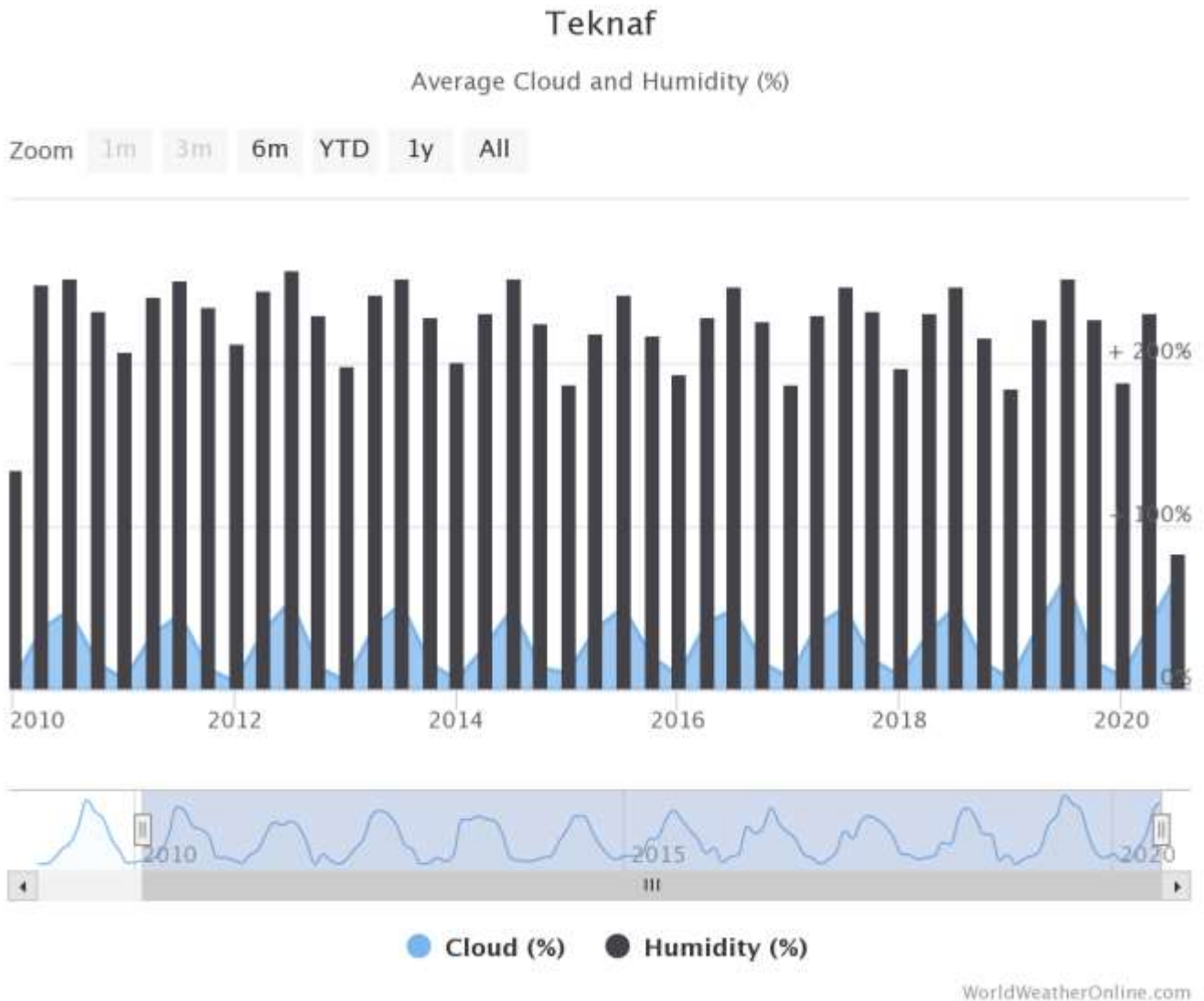


Figure 5.8 Monthly Maximum, Minimum and Average Humidity (2010-2020)

Source: <https://www.worldweatheronline.com/teknaf-weather-averages/bd.aspx>

5.5.7 Wind Speed and Direction

Wind speed data analyzed for 2 years (2016-2017) for the Cox's Bazar station of BMD. Wind speed varied from 0.00 m/s to 3.09 m/s. In general, the average wind speeds were found to be higher during pre-monsoon season (March-April) and lower during the winter season (Nov-January). Monthly variation of wind speeds is presented at the figure below.

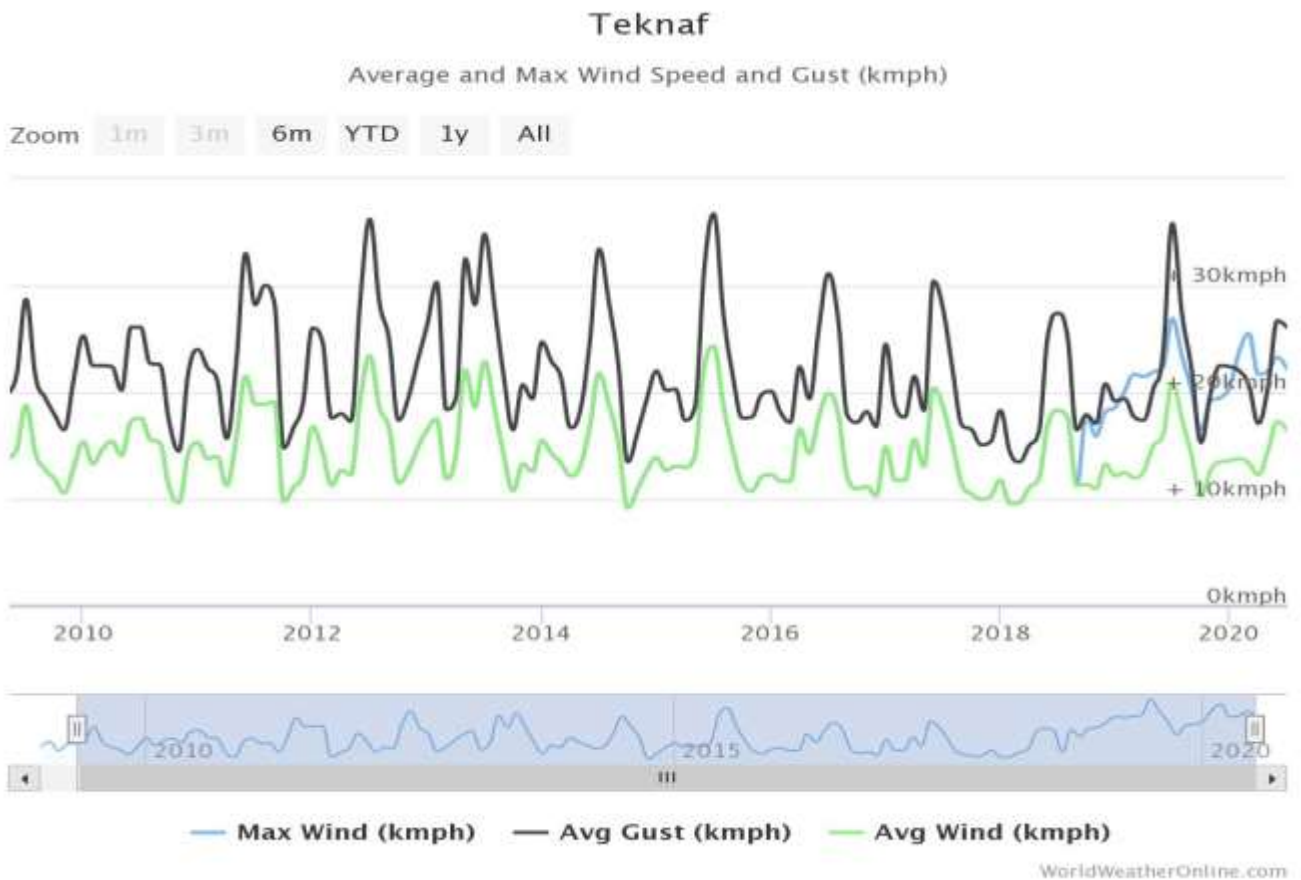


Figure 5.9 Monthly Variation of Wind Speed (2016-2017)

5.5.8 Air Quality

The objective of the ambient air quality-monitoring program was to establish the baseline ambient air quality in the study area. There is no major industrial activity is reported or observed in the study area. The air quality monitoring locations were selected based on the locations of settlements within the study area. Logistic factors such as consent of villagers, mainly the house owners, power connection, accessibility, security etc. were also taken into account in finalizing the monitoring stations.

5.5.8.1 Methodology of Air Quality Monitoring

The existing ambient air quality of the study area was monitored at three (2) locations during the monitoring period (September 2020) as part of the baseline study. Instrument used for air quality monitoring is Ambient air quality sampler Haz-Scanner- HIM 6000. The monitoring location details has been provided below.

Table 5.3 Ambient Air Quality Sampling Locations

Station Code	Monitoring Location	Geographic Coordinate	Location settings	Rationale for selection
AAQ-1	Domdomia	Lat: 20.917180 Long. : 92.267764	Commercial	To understand baseline air quality within the project site
AAQ-2	Hatiarguna Village	Lat: 20.88106 Long: 92.263841	Residential	To understand the baseline air quality at the receptor at the vicinity of the project site

The monitoring parameters included Particulate Matter (Suspended Particulate Matter (SPM), PM₁₀ and PM_{2.5}, Sulphur Dioxide (SO₂), Oxides of Nitrogen (NO_x) and Carbon Monoxide (CO). SPM and CO were monitored for eight hour whereas rest of the parameters were monitored on 24-hourly during the duration of the study. Ambient air quality monitoring pictures are presented below.



Figure 5.10 Ambient Air Quality Monitoring

5.5.8.2 Monitoring Results

Suspended Particulate Matter

The recorded concentration of SPM in the study area varies from 9 to 7 $\mu\text{g}/\text{m}^3$. The recorded concentrations were within the National Ambient Air Quality Standard for SPM (200 $\mu\text{g}/\text{m}^3$). The results are shown in the figure below.

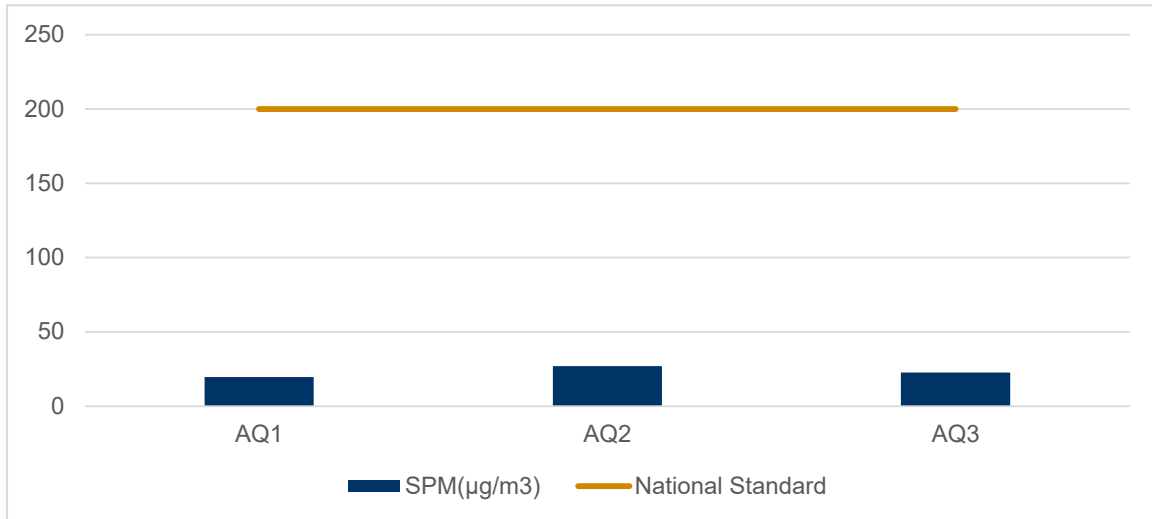


Figure 5.11 SPM Values recorded in the study area

Particulate Matter (PM_{10})

The recorded concentration of PM_{10} in both of the study area was 17 $\mu\text{g}/\text{m}^3$. The concentrations were within the National Ambient Air Quality Standard for PM_{10} (150 $\mu\text{g}/\text{m}^3$). The results are shown in the figure below.

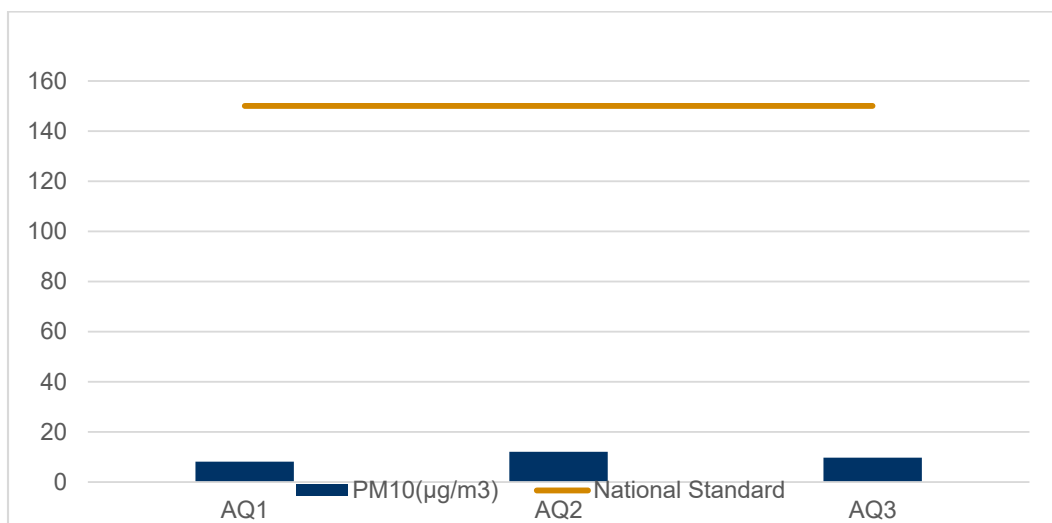


Figure 5.12 PM_{10} Values recorded in the study area

Particulate Matter (PM_{2.5})

The recorded concentration of PM_{2.5} in the study area varies from 14 to 17 µg/m³. The concentrations were within the National Ambient Air Quality Standard for PM_{2.5} (65 µg/m³). The results are shown in the figure below.

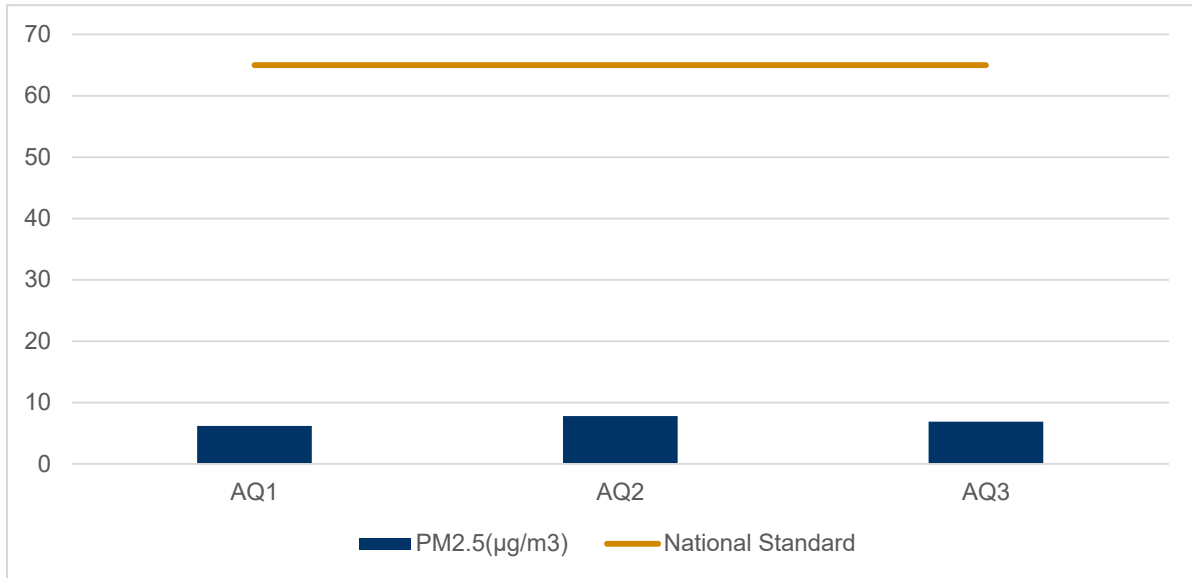


Figure 5.13 PM_{2.5} Values recorded in the study area

Sulphur Di Oxide (SO₂)

The concentration of SO₂ in the study area varies from 2.90 to 2.36 µg/m³. The concentrations were within the National Ambient Air Quality Standard for SO₂ (365 µg/m³). The results are shown in the figure below.

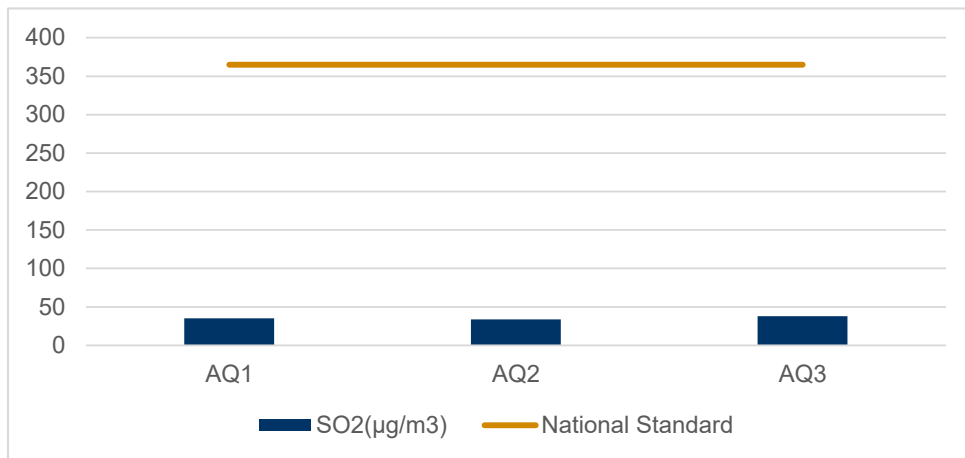


Figure 5.14 SO₂ Values recorded in the study area

Oxides of Nitrogen (NO_x)

The concentration of NO_x in the study area varies from 15.12 to 11.84 µg/m³. The concentrations were within the National Ambient Air Quality Standard for NO_x (100 µg/m³). The results are shown in the figure below.

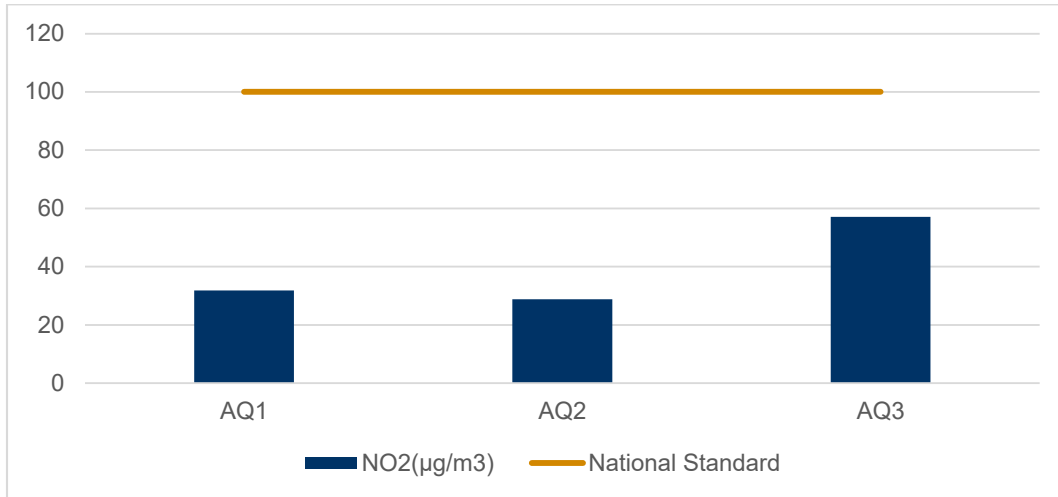


Figure 5.15 NO_x Values recorded in the study area

Carbon Mono-oxide (CO)

The concentration of CO in the study area varies from 0.27 to 0.10 ppm. The concentrations were within the National Ambient Air Quality Standard for CO (9 ppm). The results are shown in the figure below.

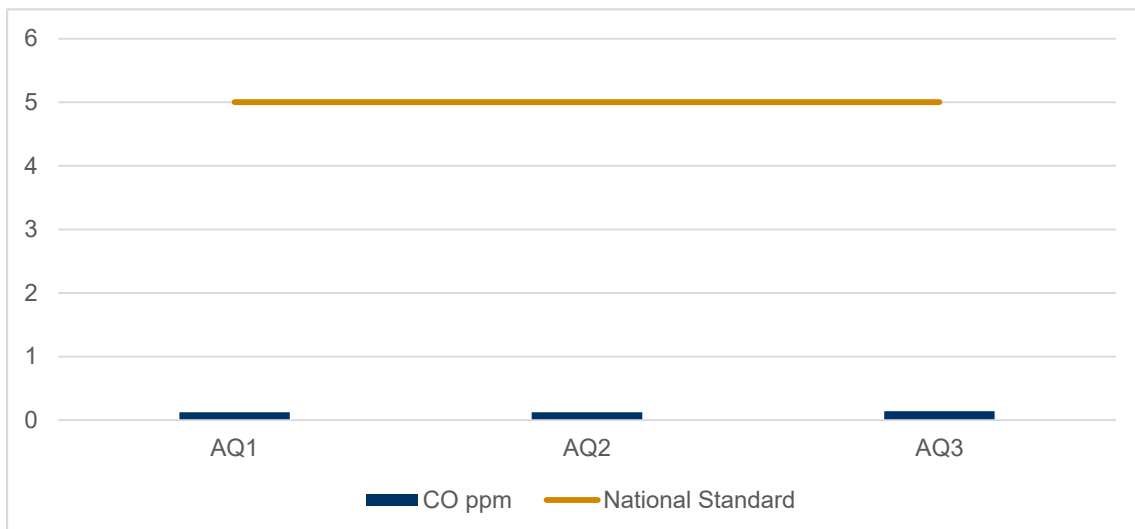


Figure 5.16 CO Values recorded in the study area

The monitored result of the particulate matters SPM, PM₁₀ and PM_{2.5} and CO were found to be in compliance to the WHO Ambient Air Quality Guideline Values (2005 and 2000) values. However, the concentration of SO₂ was higher than the WHO Guideline Value. The concentration of NOx in the study area was exceeding than the WHO guidelines value at AQ3. High NOx value could be primarily attributed to the use of wood as cooking medium in the area.

The monitored ambient air quality results are presented in **Table 5.4**.

Table 5.4 Ambient Air Quality Monitoring Results

Parameters	Location 1	Concentration
PM _{2.5}	Point A	017
PM ₁₀		017
PM ₁		009

Parameters	Location 2	Concentration
PM _{2.5}	Point C	014
PM ₁₀		017
PM ₁		007

5.5.9 Noise Quality

Noise levels were recorded at two (2) locations in the study area during the monitoring period September 2020. The purpose of ambient noise level measurement was to determine sound intensity at the monitoring locations located in proximity to the proposed project footprint areas. Noise levels were measured in the form of sound pressure levels with the help of a digital sound level meter. Noise levels were recorded in the form of A-weighted equivalent continuous sound pressure levels using Tekcoplus Data Logger SLM – 25 noise measuring instrument.

Noise level monitoring was carried out for 24 hours during monitoring period with 1-min equivalent sound pressure levels. At all the locations, measurement was taken at 1-min intervals over a 24 hour period. The equivalent noise levels have been converted to hourly equivalent noise levels. Finally, the measurements were carried out by dividing the 24 hours into two parts i.e. daytime, which is considered from 0600 to 2100 hours and night from 2100 to 0600 hours. At each location, day time Leq has been computed from the hourly sound pressure level values measured between 0600 to 2100 hours and night time Leq has been computed from the hourly sound pressure level values measured between 2100 to 0600 hours. The details of noise monitoring locations are given in **Table 5.5** and pictures of noise monitoring presented in Figure 5.17.

Table 5.5 Details of Ambient Noise Monitoring Locations

Location Code	Stations	Coordinate	Location Setting	Rationale for selection
NQ1	Domdomia	Lat: 20.917227 Long : 92.267692	Commercial Area	Within the project site to understand the baseline noise levels
NQ2	Hatiarguna Village	Lat: 20.888090 Long: 92.263717	Residential Area	To understand the baseline noise levels at the nearest receptor (settlement) at the south western side

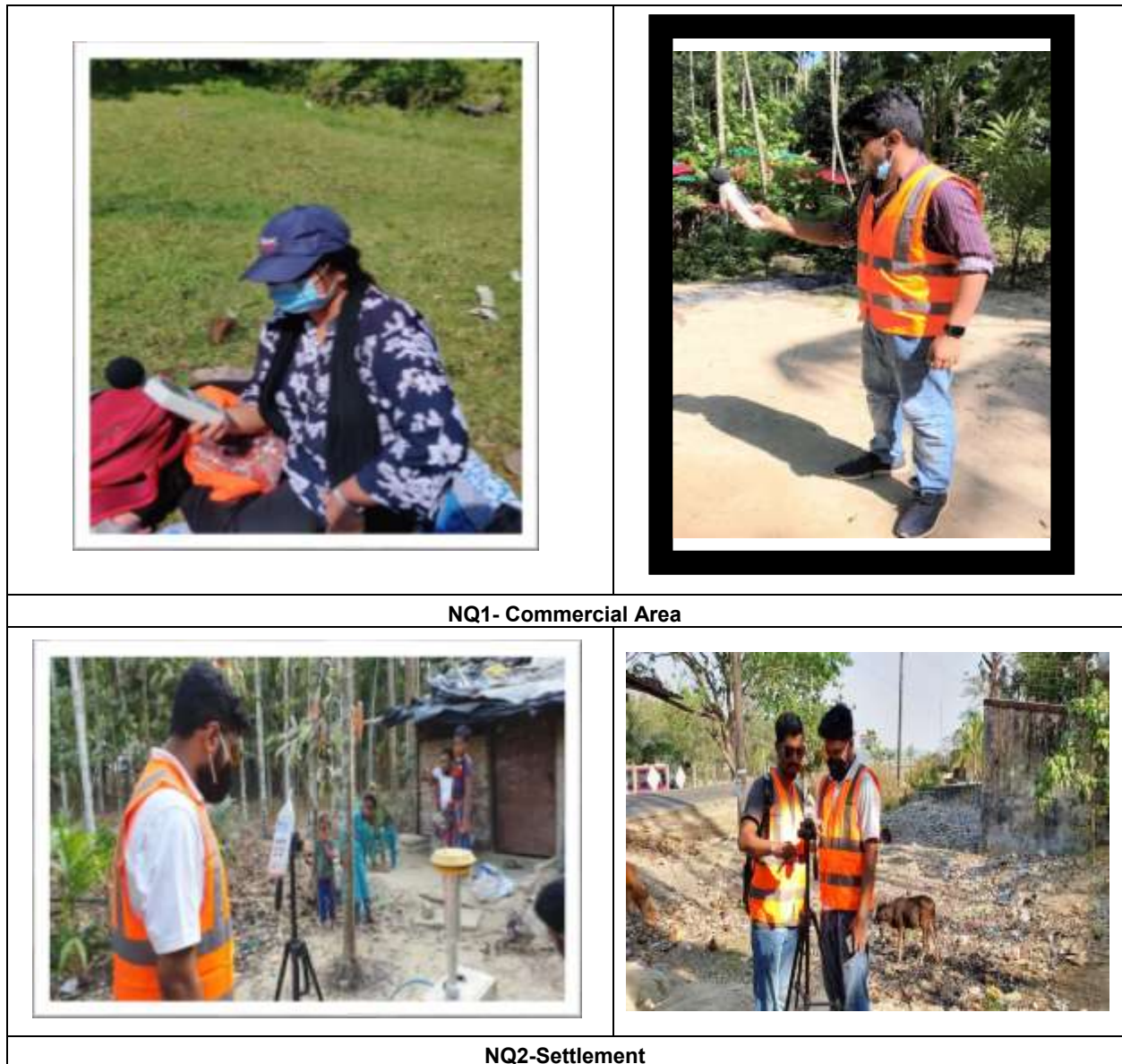


Figure 5.17 Ambient Noise Quality Monitoring

5.5.9.1 Monitoring Results

The recorded noise level in the project study area during the monitoring period is summarized below.

Table 5.6 Noise Quality Monitoring Results

Parameters	<u>Location</u>	Concentration
Existing Acoustic Environment in dB	Point A	Day: 83 , Night: 55 ;
Major Noise from Project (SDR)		

Parameters	<u>Location</u>	Concentration
Existing Acoustic Environment in dB	Point C	Day: 58.3 , Night: 51 ;
Major Noise from Project (SDR)		

5.5.9.2 Interpretation

The daytime equivalent noise levels observed at commercial area was 83 dB (A) in the study area and the night time equivalent noise level was 55 dB (A). Daytime and night time equivalent noise levels at most of the stations were found to be exceeding the day time (50 dbA) and night time noise standards (50 dbA) as per ECR, 1997.

The daytime equivalent noise levels observed at residential areas (near household) was 58.3 dB (A) in the study area and the night time equivalent noise level was 51 dB (A). Daytime and night time equivalent noise levels at both of the stations were found to be exceeding the day time (45 dbA) and night time noise standards (35 dbA) for residential areas as per ECR, 1997.

Higher daytime and night time noise levels at NQ1 could be attributed to movement of vehicles at the Teknaf-Cox's bazar road and the village road adjacent to the site. Higher nighttime noise levels could be due to noise of insects (viz. crickets) in the rural areas.

5.5.10 Geology

The study area is a part of Chittagong Hill tracts the geosynclinals basin in the southeast is characterised by the huge thickness (maximum of about 20 km near the basin centre) of clastic sedimentary rocks, mostly sandstone and shale of Tertiary age. It occupies areas of greater Dhaka, faridpur, noakhali, sylhet, comilla and Chittagong and the Bay of Bengal. The huge thickness of sediments in the basin is a result of tectonic mobility or instability of the areas causing rapid subsidence and sedimentation in a relatively short span of geologic time. The geosynclinals basin is subdivided into two parts, ie fold belt in the east and a fore deep to the west. The fold belt is characterised by folding of the sedimentary layers into a series of anticlines (upward folds) and synclines (downward fold). The anticlines form the hills and the synclines form valleys as seen in the topography of the eastern Chittagong-Comilla-Sylhet regions. The intensity of the folding is greater towards the east, causing higher topographic elevation in the eastern Chittagong hill tracts. As the intensity of folds decreases towards the west, the fold belts unit merges with the foredeep unit, which is characterised by only mild or no folding. So the sedimentary layers are mostly horizontal to sub-horizontal and are free from major tectonic deformation in the foredeep area covering the central part of the basin and this is expressed as River to delta plain topography of the land. The overall geology of the Bengal basin is given below.

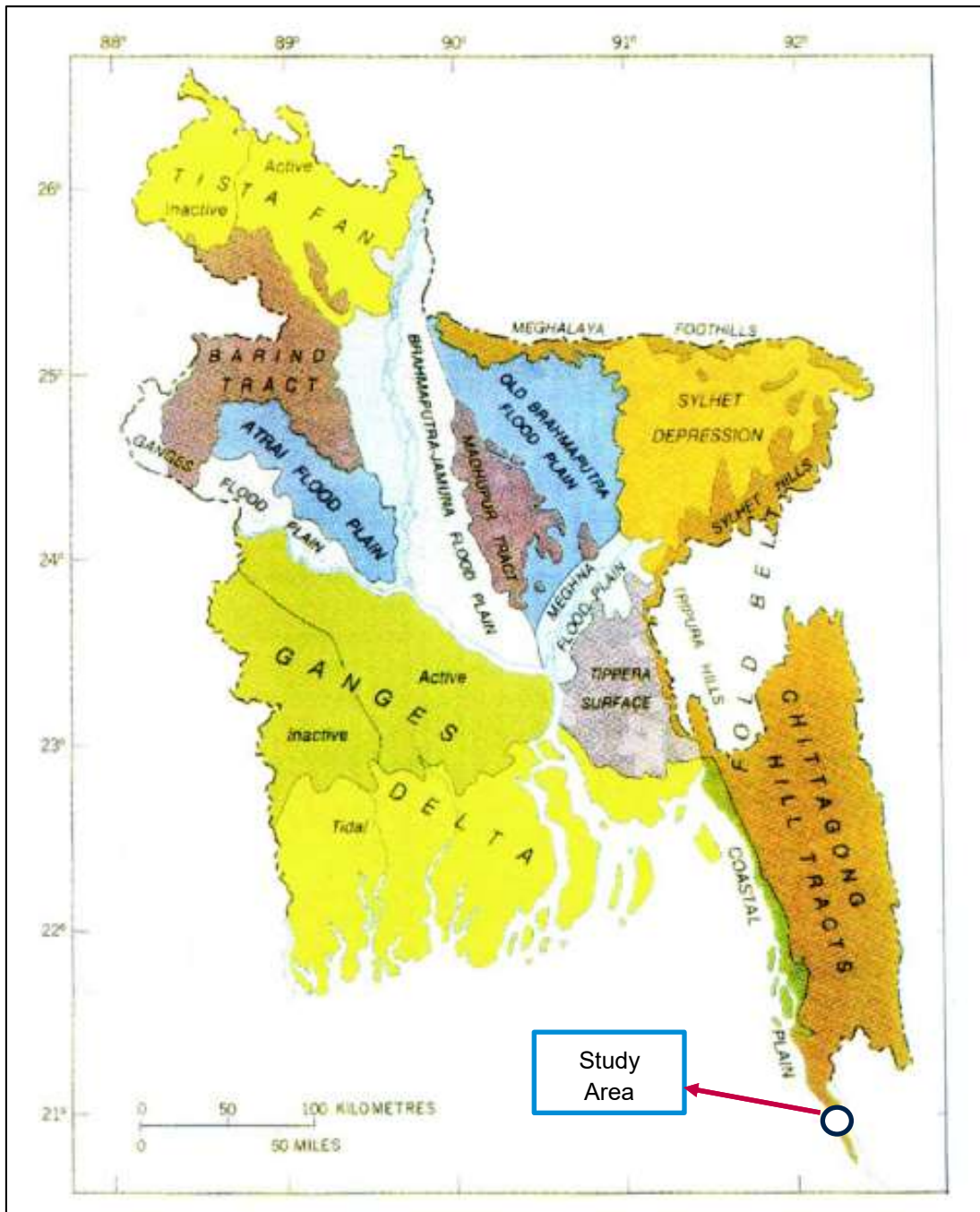


Figure 5.18 Geological map of Bangladesh

Source: Bdmaps

5.5.11 Land Use-Land Cover

Land use/cover studies are an essential component in land resource evaluation and environmental studies. Land use study/land cover study has been conducted through analysis of satellite imagery (USGS Landsat-8) and ground trothing during the site visit.

5.5.11.1 Land Use Land Cover of Study Area- Project site

The land use/land cover pattern shows that agricultural land (65.09%) occupies most of the area within the 5km study area. The River and River bed of Naf River occupies 27.77% of the land whereas settlement with homestead vegetation inhibits about 4.48%. Naf River canal occupies 1.02% of the study area and waterbodies cover 1.27% of the study area. Road network including the LGED road covers 0.12% of the study area. The land use percentage of the study area presented in **Table 5.7** and shown in **Figure 5.19**

Table 5.7 Land use-land cover within the study area of Project Site

Land use category	Area in Sq.km	Percentage
Agriculture	79.48	65.09
River and River Bed	33.91	27.77
Settlement	5.48	4.48
Waterbody	1.55	1.27
Canal	1.25	1.02
Road Network	0.14	0.12
Stream	0.30	0.24
Total	122.10	100.00

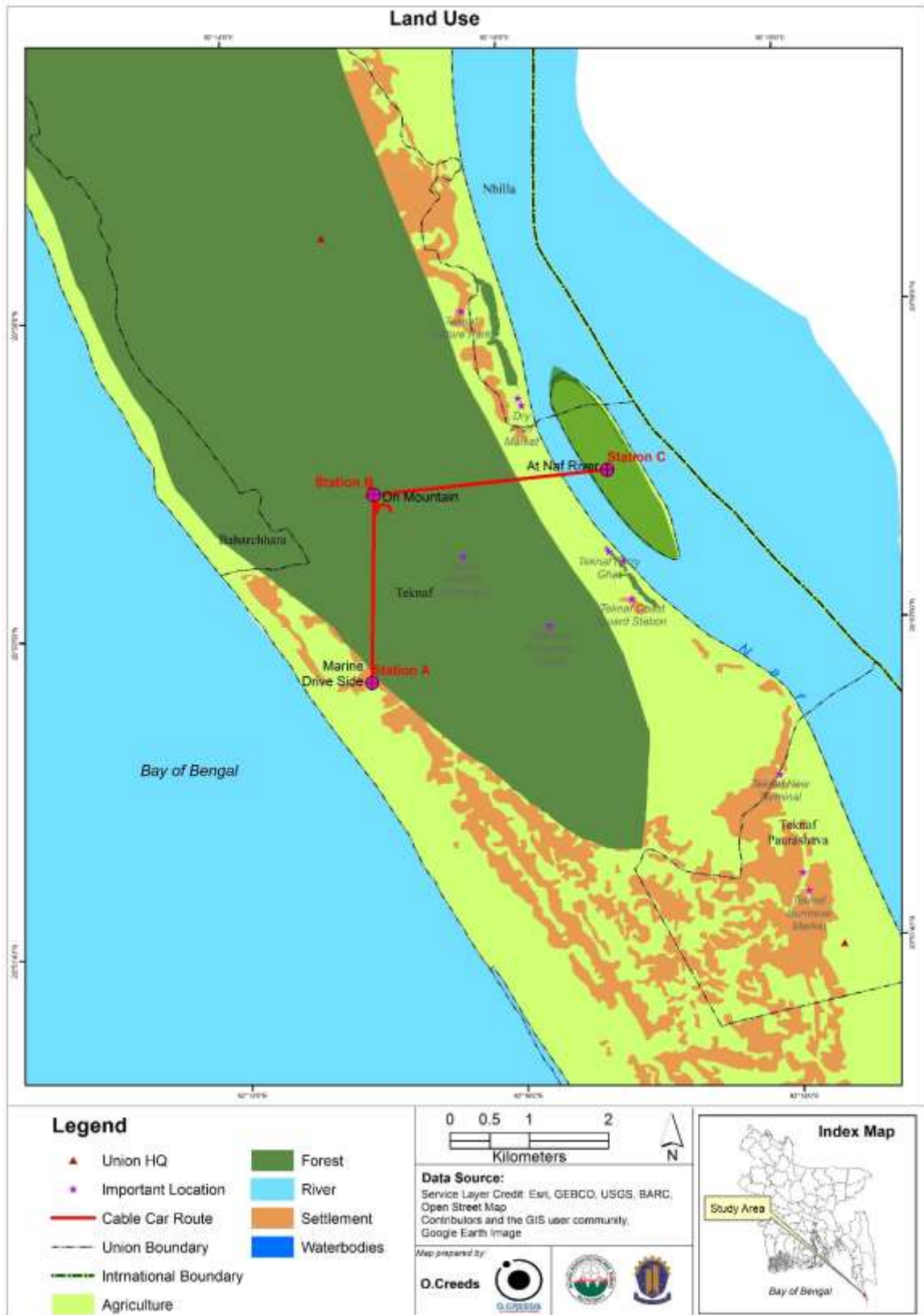


Figure 5.19 Land Use-Land Cover Map- Project Site

5.5.12 Soil Quality

The general type of soil found in the project area are:

Brown Hill Soil, a soil characterized by slight or no leaching of clay and iron. The profile is always decalcified, at least in the upper horizons. Alternatively, brown hill soils are drained soils with a yellow-brown to strong brown Dystric Cambisols. The texture is generally sandy loam or silty loam, but may be more clayey in eroded soils over shales. The organic matter contents range from low (<1.5%) under grassland to moderate (2-5%) under forest.

The agricultural potentiality of these soils is generally low or very low for field crops, but low to high for tree crops. Major limitations include very steep slopes, heavy monsoon rainfall, erodibility of most soils, and difficulty of making terrace, generally low soil fertility and rapid permeability. Usually more acidic as compared to Brown Floodplain soils and contains broken rock or little mottled sand in the substratum in comparison to Red-Brown Terrace soils. There are about 156,472 ha Brown Hill Soils occupying the gentle to very steep slopes in the Northern and Eastern Hills of Bangladesh i.e., in the Sylhet and Chittagong region

The soils consist of hard red clay with a mixture of fine sand of the same colour and nodules containing a large percentage of sesquioxides. The soils are moderately to strongly acidic. The soils are highly leached and have a low natural fertility. Hills are mainly under natural and plantation forests. Shifting cultivation is practiced in some places.

5.5.12.1 Primary Soil Monitoring

Soil samples were collected from three locations within the project site. Soil samples were collected from a depth of 3 feet with the help of a hand auger. Details of the locations are presented at **Table 5.8** and the soil collection locations are shown in **Figure 5.20**.

Table 5.8 Details of Soil Monitoring Locations

Location Code	Stations	Coordinate	Location Setting	Rationale for selection
SQ1	Domdomia Para (Point A)	Lat: 20.918421 Long: 92.268719	Waste land	To understand the baseline soil quality of the site
SQ2	Hatiarguna Village (Point C)	Lat: 20.88826246 Long: 92.26455119	Agricultural land	



SQ1- Domdomia Para (Point A)

SQ2- Hatiarguna Village (Point C)

Figure 5.20 Soil Collection from the Project Site

5.5.12.2 *Interpretation of soil monitoring results*

Texture: Soil texture is an important soil characteristic that could influence water retention capacity, aeration, drainage, and susceptibility to erosion which drive crop production and management. The texture of soil sample from **Point A** was found to be sandy soil (68%) and silty soil (23%) in nature. The texture of soil sample from **Point C** was found to be sandy soil (51%) and silty soil (41%) in nature. Soil monitoring results are presented in **Table 5.9**.

Table 5.9 Soil Monitoring Results

Parameter	Unit	SQ-1 (Point A)	SQ-2 (Point C)
Soil Texture		Sandy	Sandy & Silty

5.5.13 Hydrology

5.5.13.1 Drainage

The proposed project area is located in the flood plain of the Naf River. Naf River is a perennial River which is originated from Tso Lamho River of North Sikkim Himalaya. A number of tributaries meet the Naf River at the upstream direction of the project area and the main tributary of Naf River is Rangit River. Main course of Naf River flows within the study area from northwest to south east at a nearest distance of 0.7 km east of the project site. The Naf River (**Figure 5.21**) is located about 3.2 km north of the project site. The Naf River constructed from the Naf Barrage flows 2.2 km west of the project site.



Figure 5.21 Naf River

A natural stream (offshoot from the Naf River) passes through eastern portion of the Site. Per local residents, this stream is seasonal and carries water during rainy season intermittently for 3-4 months. However, only surface runoff within its catchment is carried in the Stream and not the water from Naf River, as an embankment has been constructed upstream of the Site (1,200 m from Site) across the stream disconnecting it from Naf River. According to local residents, up to 6 inches of water inundates the stream during rainy season which drains swiftly (from few hours to couple of days after rainfall event). Maximum water level observed in the stream was up to 1.5 m deep approximately 12 – 15 years ago (2005-06). Much of the stream has been encroached by local farmers for cultivation of crops.

Small pockets of water-logged areas were observed within the stream along the stretches within the Site and off-Site.

A second natural stream (offshoot from the Naf River) is located at approximately 300 m southeast from the Site. The stream mentioned above drains into this stream. About 4 years ago an embankment was constructed across this stream at the offshoot location. According to residents, this stream has not been observed to carry surface runoff >1 – 2 feet deep (0.3 – 0.6 m) which drains swiftly (into the ground and back into Naf River downstream approx. 4,400 m from embankment). Flooding and inundation due to this channel were not reported.

Another first order stream passes through the western portion of the Site. However, much of the stream has been encroached by farmers for crop cultivation and the stream is not recognizable. Local residents did not report any flooding and/or inundation within this channel.

5.5.14 Surface Water Quality

Surface water was monitored at three different locations from the study area. Samples were collected to understand the potential impact due to proposed project activities. The surface water quality monitoring details has been provided in **Table 5.10**

Table 5.10 Details of Surface Water Quality Monitoring Location

Location Code	Location	Geographic Coordinates	Selection Criteria
SW-1	Naf River	Lat: 20.919375 Long: 92.270126	Assess the existing water quality
SW-2	Local stream at the east of the site between Naf River and Project Boundary	Lat: 20.888840 Long: 92.262895	Assess the existing water quality



Figure 5.22 Surface Water Collection within the Project Site

5.5.14.1 Interpretation of Surface Water Quality Results

The surface water quality monitoring results has been provided in **Table 5.11**. The surface water quality has been compared with ECR, 97 Standard for inland surface Water.

- ✚ The pH of Naf River and local stream were found to be 7.9, 8.2 respectively; all the samples comply to the within the inland surface water standard for Category A use category (*source of drinking water for supply only after disinfecting*).
- ✚ The DO levels of Naf River and local stream were found to be 6.02 mg/l, 6.75 mg/l respectively, indicating favorable conditions for the growth and reproduction fish and other aquatic organisms in these water bodies, indicating water was fit for Category b (*Water usable for recreational activity*), c (*Source of drinking water for supply after conventional treatment*), d (*Water usable by fisheries*).

Biochemical Oxygen Demand (BOD) values of the samples collected from Naf River (Point A) and local stream (Point C) were found to be 4 mg/l and 3 mg/l, such low BOD values confirmed the presence of low concentrations of biologically oxidizable organic matter in the receiving water bodies; indicating the water was fit for b and c use category.

Table 5.11 Surface Water Monitoring Results

S.N.	Parameters	Unit	SW-1 (Point A)	SW-2 (Point C)
1	BOD	mg/l	4	3
2	COD	mg/l	12	8
3	Chloride	mg/l	230	8
4	DO	mg/l	6.02	6.75
5	EC	micromhos/cm	923	193.8
6	Iron	mg/l	1.47	0.15
7	Manganese	mg/l	0.05	0.04
8	pH	None	7.9	8.2
9	Temperature	°C	34.3	30.5
10	Total Hardness	mg/l	123	111
11	Turbidity	NTU	139	11.29
12	Arsenic	mg/l	.002	.001

5.5.15 Hydrogeology

The project area is situated at the floodplain of Naf River. The alluvial aquifers are very productive. These aquifers are characterized by thick deposits of Holocene sand. According to UNDP report 1982, the broad lithology of Naf fan comprised of Grey coarse sand, gravel and cobbles deposits of late Pleistocene and Holocene age.

5.5.15.1 Ground water quality

Primary monitoring of ground water quality was considered important in order to understand the probable impacts of the proposed project activities on the sub surface.

5.5.15.2 Groundwater Sampling Locations

Groundwater samples were collected from three (2) different locations. Groundwater was collected from shallow deep tube wells of the study area (Figure 5.2).

Table 5.12 Details of Ground Water Quality Monitoring Locations

Location Code	Location	Geographic Coordinates	Selection Criteria
GW-1	Domdomia Para	Lat: 20.919845 Long: 92.267179	Within the project site to understand the baseline groundwater quality
GW-2	Hatiarguna Village	Lat: 20.887571 Long: 92.264816	To understand the baseline groundwater quality at the nearest receptor (Settlement)

The samples were analyzed for physicochemical and bacteriological parameters and results were compared with ECR drinking water standard drinking water standards to identify and interpret any deviation in the statutory limits set for parameters under this standard. Ground water monitoring station details has been provided in.



Figure 5.23 Ground Water Collection

Analysis Results of Ground Water Quality

- ✚ pH of the groundwater samples was found **7.8** in Point A and **9.1** in Point C; were found to be higher than the drinking water standard (6.5-8.5) of ECR, 1997.
- ✚ With respect to drinking water standard of chloride is 150 mg/l (acceptable limit). The chloride concentration in the ground water sample of Point A was 33 mg/l and Point C was 27 mg/l were found to be in compliance to the ECR, 1997.
- ✚ Hardness of water is considered to be an important parameter in determining the suitability of water for domestic uses particularly washing. Total hardness of water is correlated to the presence of bivalent metallic ions *viz.* calcium and magnesium. Total hardness in the

groundwater sample of Point A was 87 mg/l and in Point C was 63 mg/l; were in compliance to the acceptable limit of 200 -500 mg/l.

- ✚ Total Dissolved Solids (TDS) values in Point A and Point C were sequentially 315 & 285 parts per thousand (ppt); which is within the limits of ECR, 1997 (1000 ppt)
- ✚ Iron is considered to be an important ground water parameter since at higher concentration it interferes with laundering operations and imparts objectionable stains. Concentration iron in ground water sample from Point A was 0.86 mg/l & from Point C was 0.25. Iron concentration in all the samples were in compliance with drinking water standard (0.3 to 1.0 mg/l).
- ✚ Mercury, cadmium, lead, nickel, arsenic, total chromium contents in all ground water samples were found to comply to the drinking water standard.
- ✚ Coliform are indicators of contamination from sewage and faecal matter. There were no total coliforms contents found in all the samples thus in compliance with the drinking water standard (0 /100 ml).

In summary the groundwater results indicate that all the parameters are in compliance to the limits of ECR, 1997. The groundwater levels do not indicate any chemical or biological contamination from any external source.

Groundwater monitoring results provided in **Table 5.13**.

Table 5.13 Ground Water Monitoring Results

S.N.	Parameters	Unit	GW-1	GW-2	Permissible Limit
1	Chloride	mg/l	33	27	150-600
2	Iron	mg/l	0.86	0.25	0.3-1.0
3	Manganese	mg/l	0.24	0.06	0.1
4	pH	None	7.8	9.1	6.5-8.5
5	TDS	ppt	315	285	1000
6	Total Hardness	mg/l	87	63	200-500
7	Turbidity	NTU	24.23	13.23	10

5.5.16 Traffic & Transport

The traffic survey is done in three location which is considered geographically important and maximum number of vehicle pass those point. Place 1 (Teknaf Bus Stand) which is the main entry in Teknaf town, Place 2 (Parjatan Bazar) is in the old marine drive road which is the main entry road for entering the Naf tourism park, Place 3 (Teknaf Beach Point) is the alternative entry to reach Teknaf town which is considered as the most busiest and dangerous road in Teknaf region.

Place 1: Teknaf Bus Stand Point (Route 1)

Place 2: Parjatan Bazar Point (Route 2)

Place 3: Teknaf Beach Point (Route 3)



Teknaf Bus Stand Point



Parjatan Bazar Point



Teknaf Beach Point

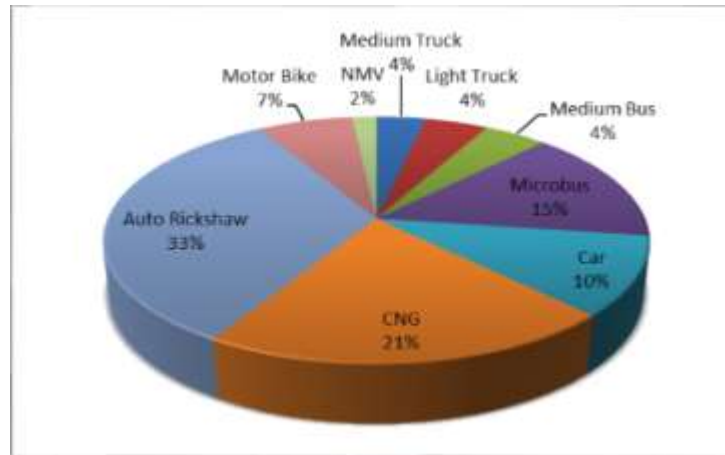
Figure 5.24 Traffic Data Collection

Vehicles plying in the concerned roads were categorized in the following categories during the traffic survey

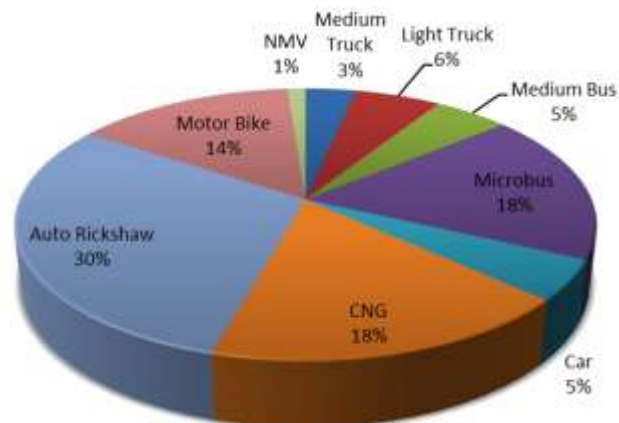
- ✚ Heavy Motor Vehicles (Truck, Bus, Dumper, Tanker, Trailer)
- ✚ Light Motor Vehicles (Car, Jeep, Van, Matador, Tractor, Tempo)
- ✚ Two/Three Wheelers (Scooter, motorcycle, Auto, Moped)
- ✚ Non Motorized Vehicles (Bicycle, Tricycle)

Vehicle Composition Analysis

New Marine Drive Road



Vehicle Compositions of New Marine Drive Road in Weekday



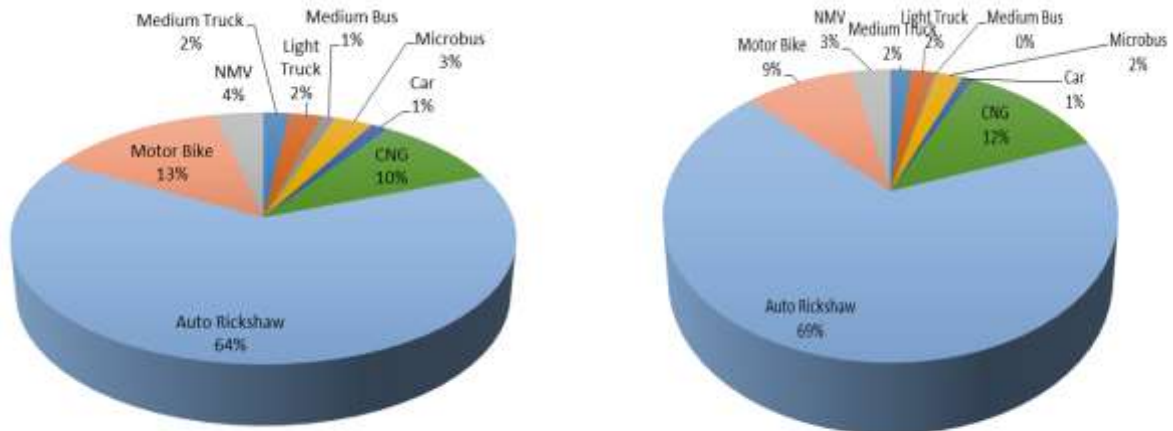
Vehicle Compositions of New Marine Drive Road in Weekend

Figure 5.25 Vehicle Compositions of New Marine Drive Road

It is shown that the most dominating vehicle in New Marine Drive road is auto rickshaw rather than other types of vehicles both weekend and weekday and their values are 33% and 30% respectively. . Auto rickshaw occupancy on road is higher because other public transports are not available in this road so that most of the people of this locality prefer auto rickshaw to go their destination. The CNG is the second type of vehicle which governs the maximum number in this road which contains 21% in weekday. Microbus, Motorbike, and car are medium governing vehicles both on weekdays and weekend days. The presence of trucks, buses, and NMT in this

road is less amount compared to other types of vehicles because public buses, heavy trucks are not allowed to travel through this road and maximum people travel by rickshaw and CNG.

Old Marine Drive Road



Vehicle Compositions of Old Marine Drive Road in Weekday

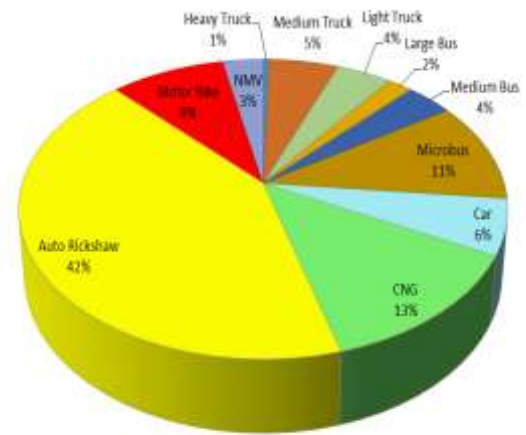
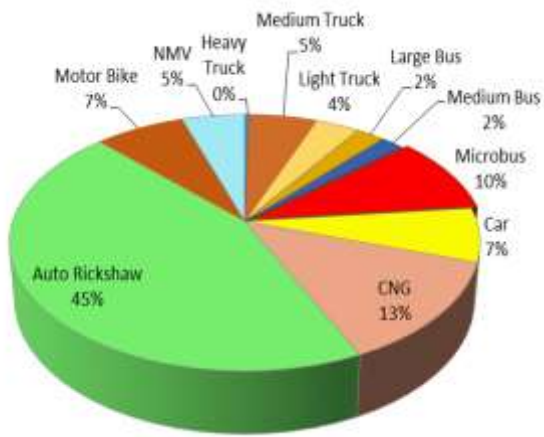
Vehicle Compositions of Old Marine Drive Road in Weekend

Figure 5.26 Vehicle Compositions of Old Marine Drive Road

The study has revealed that the most influencing vehicle is Auto Rickshaw in the Old Marine Drive road at weekday and weekend and their values are 64% and 69% respectively. This road also called Parjatan Bazar road and this road mainly passes through rural area, and public transports (Bus, laguna, etc) are not available to travel so that most of the people surrounding this road use auto rickshaw to travel their destination. From the survey, it is seen that motorbike and CNG are the moderate dominating vehicle both in weekday and weekday. However truck, microbus, car, and NMT are not significant in this road. This road contains the minimal volume of traffic compares to other two roads of our study area because of new connecting road of Teknaf- Cox’s Bazar road to Marine Drive road.

Teknaf- Cox’s Bazar Road

This road connects Teknaf with Cox’s Bazar, Chittagong, and Dhaka directly. In this road, the most dominant vehicle on weekdays and weekends is the auto rickshaw which contains 45% and 35% respectively.



Vehicle Compositions of Teknaf – Cox's Bazar Road in Weekday

Vehicle Compositions of Teknaf – Cox's Bazar Road in Weekend

Figure 5.27 Vehicle Composition of Teknaf-Cox's Bazar Road

The next influencing vehicle in this road is CNG on weekday which contains 13% and Microbus at weekend which contains 12% of the total traffic. Several percentages of bus travel through this road because this is the only road to travel Dhaka, Chittagong, and other parts of Bangladesh from Teknaf by bus. Heavy truck contains almost 0% on weekdays and 1% at weekends because Teknaf is a tourist area and there is no industry.

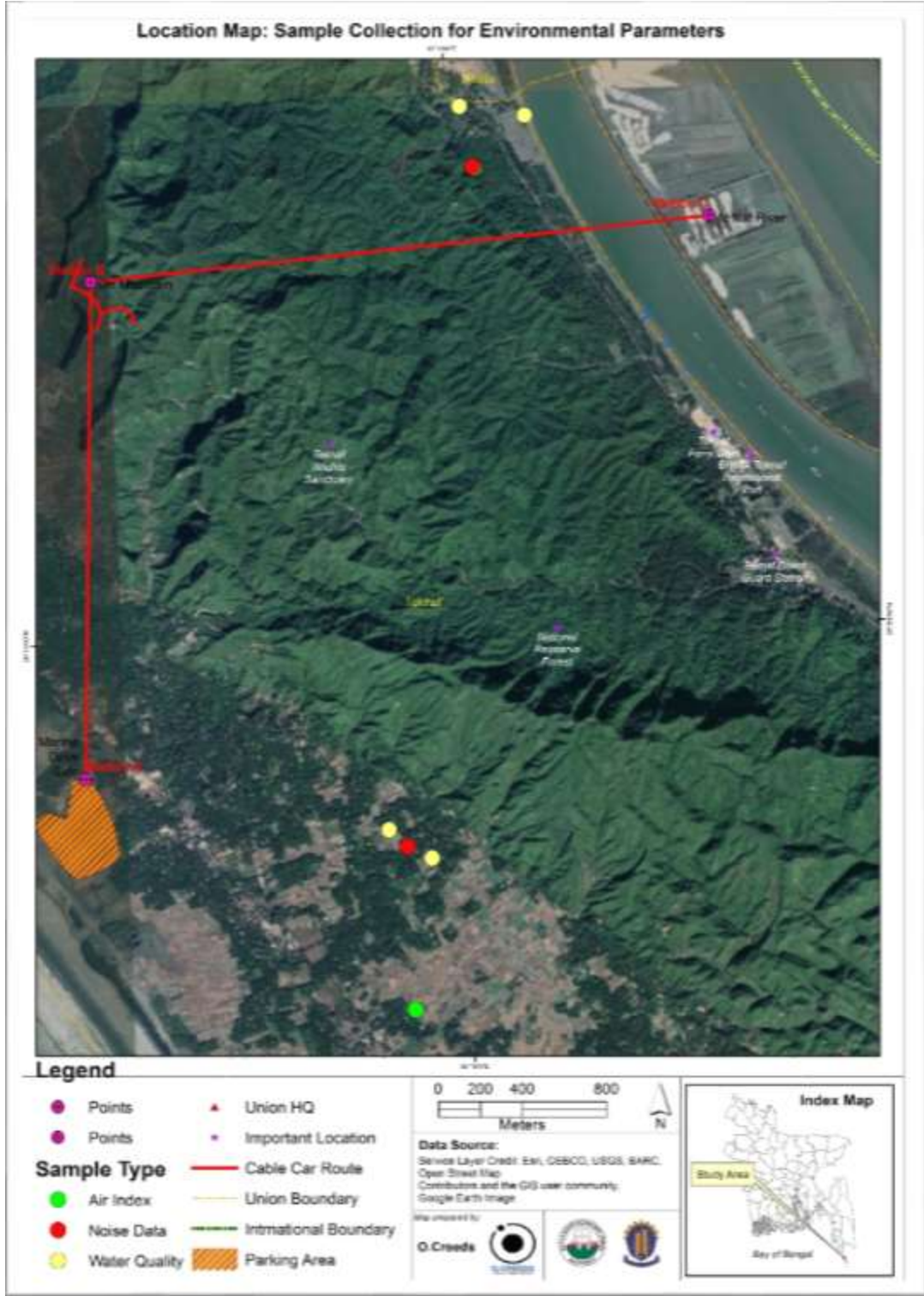


Figure 5.28 Environmental Parametres Sample Collection Location

5.5.17 Natural Hazards

5.5.17.1 Earthquakes

Per the Seismic Zoning Map of Bangladesh, the country is divided into four seismic zones and the design strength of buildings is stipulated in each seismic zone. The project site and study area is located in Seismic Zone II (**Figure 5.29**). The Zone-II includes the districts of Nilphamari, Thakurgaon, Dinajpur, Bogra, Dhaka, Narayanganj and Chittagong, where earthquake shock of maximum intensity of VIII of the Modified Mercalli Scale is possible and where building design of moderate levels will be necessary. Discussion with locals and district administration do not reveal any major seismic events in the area.



Figure 5.29 Earthquake Zone Map of Bangladesh

Source: Geological Survey of Bangladesh

5.5.17.2 Cyclones

Devastating 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. Because of the funnel shaped coast, Bangladesh repeatedly becomes the landing ground of cyclones formed in the Bay of Bengal. These cyclones occur in two seasons, April-May and October-November – i.e. before and after the monsoon. The following figure shows cyclone affected areas of Bangladesh. From the figure it is very clear that Teknaf Upazilla area has very high risk from cyclones.

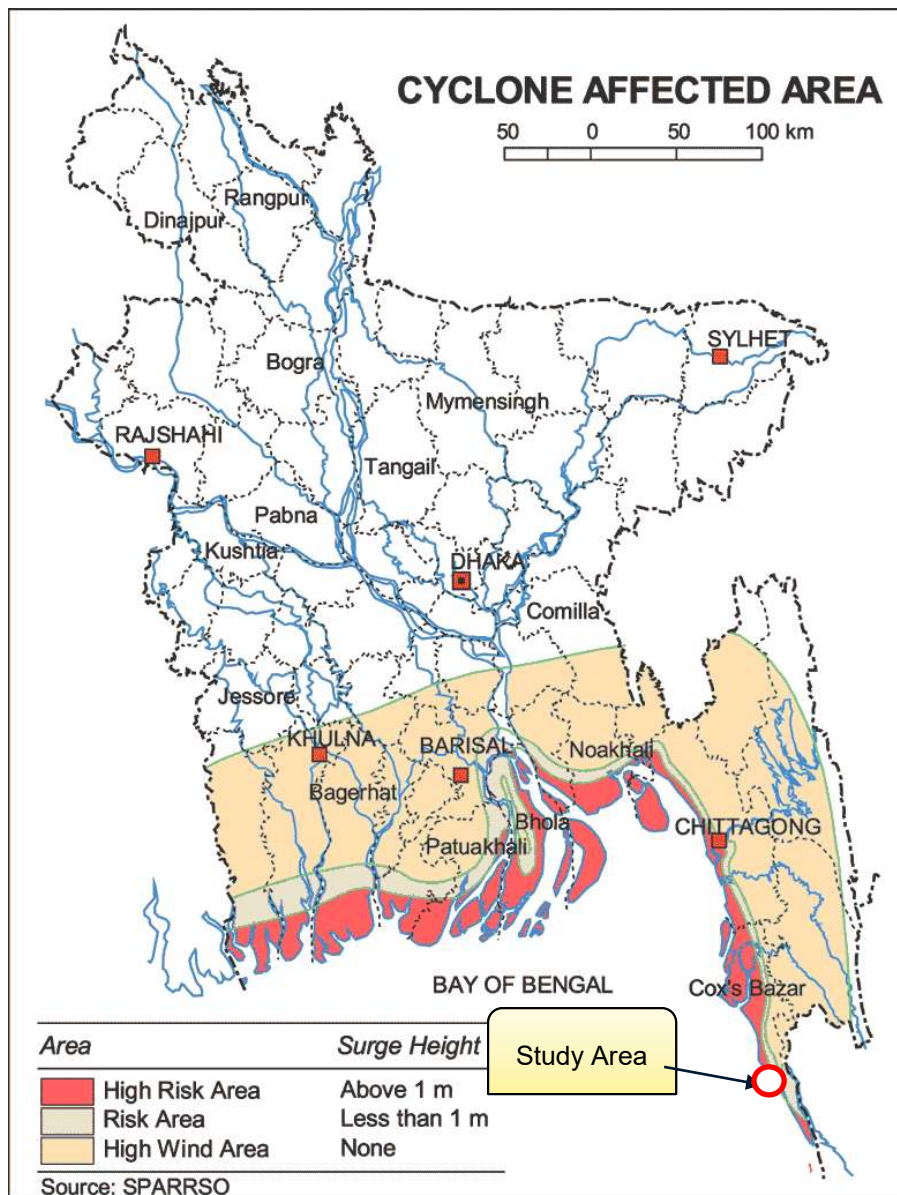


Figure 5.30 Cyclone Affected Area Map of Bangladesh

Source: Bangladesh Space Research and Remote Sensing Organization (SPARRSO)]

5.5.17.3 Floods

- ✦ Project Site is located approximately 1,300 m south and 710 m west of Naf River.
- ✦ According to local residents, flood water from Naf River does not reach the Site currently
- ✦ Naf barrage, a flood control / irrigation structure is located approx. 3,000 m north of the Site. It was constructed in 1997-98. Prior to its construction, Naf River is used to experience frequent flooding (yearly). However, as per barrage maintenance team, after its construction, flooding events have not been experienced downstream.
- ✦ Time series analysis of water level and discharge of Naf River from 1962 to 2018 revealed that the annual maximum water levels vary between 51.44 to 52.95 m PWD and annual maximum discharges vary between 1286 to 7960 m³/s. However, the maximum flood discharge in the last 12 years reported to have decreased significantly (approximately 2500 m³/s) compared to a long-run average of 4671 m³/s.
- ✦ 2D hydrodynamic modeling conducted as part of the hydrological study shows that the existing road along the right bank acts as an embankment and restricts the floodwater to enter the project area for 2500 m³/s flow. However, for the flow of 2700 m³/sec and above floodwater spills over the road and inundates the flood plain. Therefore, the proposed project area is vulnerable to flood. Moreover, in case of any breaching of the road the project area will be flooded even at 2500 m³/s of flow. To protect the project area from flooding of the Naf River, construction of an earthen dyke around the project area has been planned.

Five floods during the last fifty years were extensive and devastating and these are the floods of 1955, 1974, 1987, 1988, and 1998. The flood affected area of Bangladesh is presented in **Figure 5.30**.

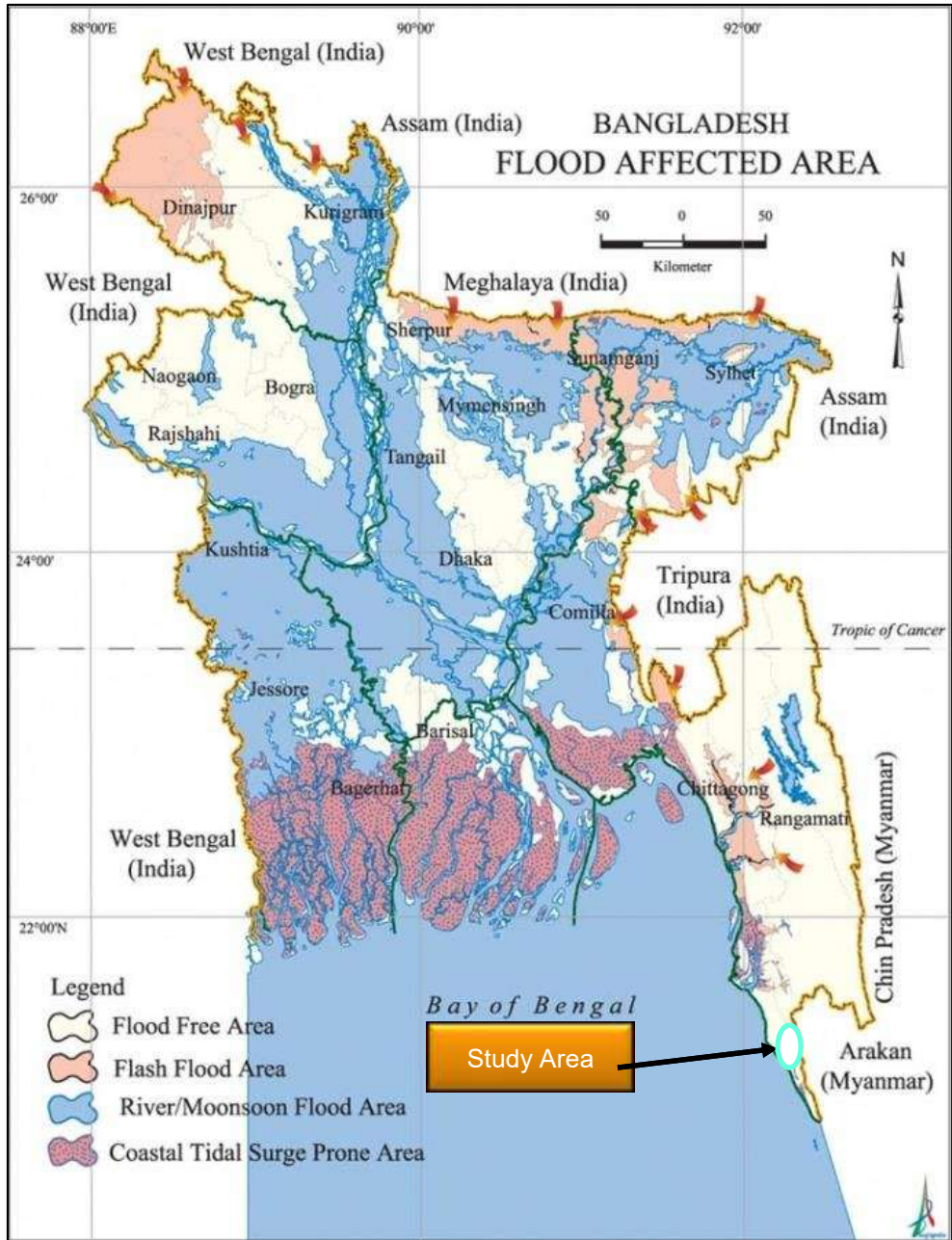


Figure 5.31 Flood Affected Areas of Bangladesh

Source: Bangladesh Water Development Board

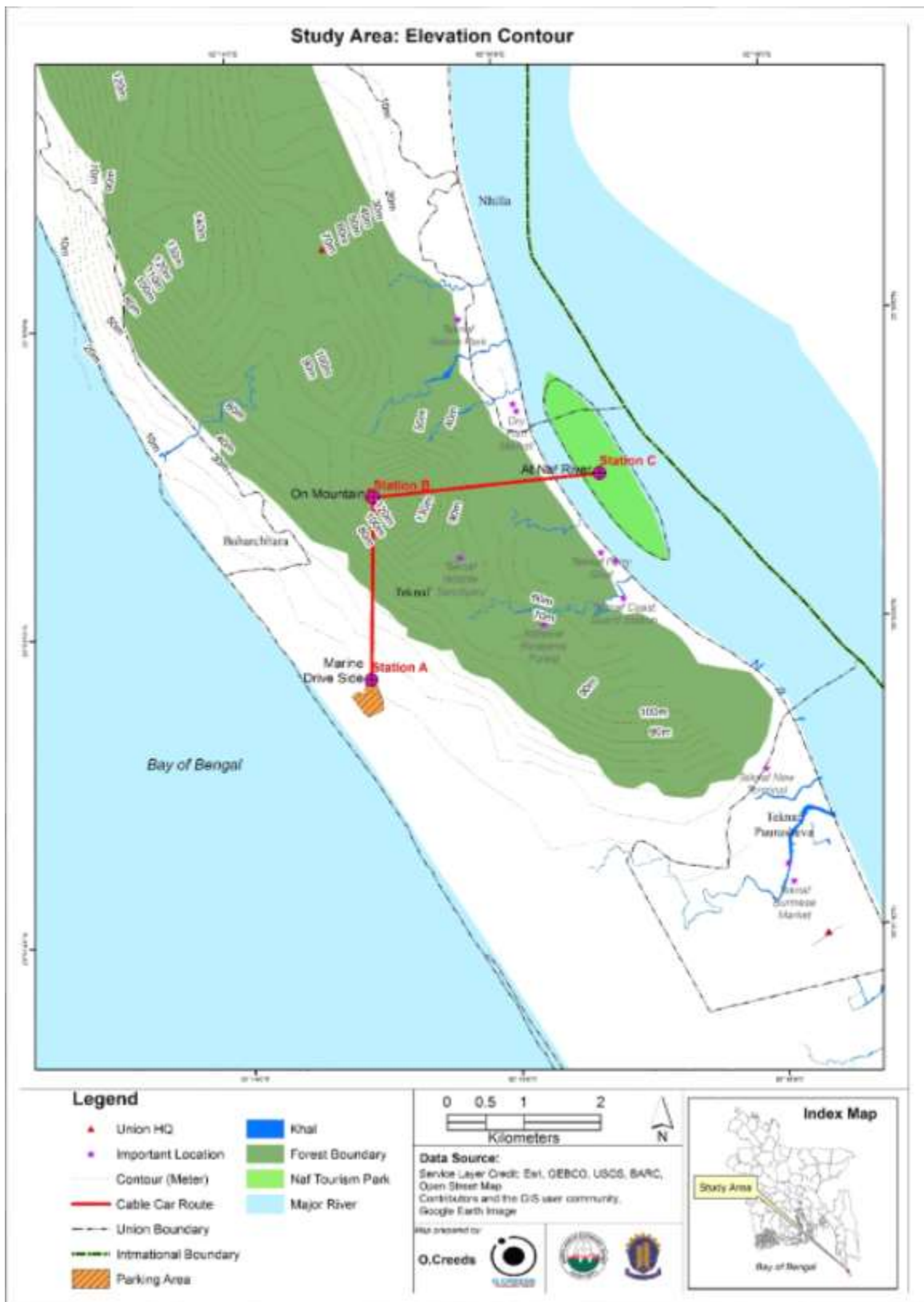


Figure 5.32 Contour Map of Teknaf

Flooding from Naf River

- ✚ Project Site is located approximately 1,300 m south and 710 m west of Naf River.
- ✚ According to local residents, flood water from Naf River does not reach the Site
- ✚ Naf barrage, a flood control / irrigation structure is located approx. 3,000 m north of the Site. It was constructed in 1997-98. Prior to its construction, Naf River is used to experience frequent flooding (yearly). However, as per barrage maintenance team, after its construction, flooding events have not been experienced downstream.

5.6 Ecological Environment

5.6.1 Study Area

Study area for the ecological study has been considered 5 km from the project boundary and 0.5 km on either side of the road construction.

5.6.2 Bio-ecological Zone

Study Area started from the Marine Drive point [E-421560 & N-2310084] and passed through top hill point [E-422019 & N-2312680] and ending with Jaliardwip [E-424964 & N-2312888]. Study area for the ecological study has been considered 5 km from the project boundary [2316 acres] and 0.5 km on either side of the Cabble car rought.

Bio-ecological Zone

As per IUCN classification (Nishat et al. 2002) based on physiographic and biological diversity, the study area falls under:

Bio-ecological Zone 8a: Coastal Plains

Bio-ecological Zone 8b: Offshore Islands

Bio-ecological Zone 8c: Narikel Jinjira Coral Island

Bio-ecological Zone 8e: Sandy Beach/ Sand Dunes

Bio-ecological Zone 9a: Chittagong Hills and the CHT

Northern – Eastern Hills. Basic information on the study site bio-ecological zone is summarized in Table 5.14.

Teknaf Union, Nila Union, Baharchhara Union, Sabrang Union, Whykong Union, St. Martins Dwip

Physiography Northern- Eastern Hills and Chittagong Hill Tracts

Soil Brown Hill Soils

Rainfall Average 2673 mm

Temperature maximum 36.5°C to minimum 12.5°C

Land use B Aman, L Aman, HYV Aus, HYV Aus, Potato, Wheat,

As per IUCN classification based on physiographic and biological diversity, the study area falls under Northern – Eastern Hills. Basic information on the study site bio-ecological zone is summarized in Error! Reference source not found..

5.7 Ecological Classification of the Forests of Cox's Bazar especially Teknaf Wildlife Sanctuary (TWS)

The Cox's Bazar Forest Division was first created on 1st April 1920 with a portion of the Chittagong Forest Division and Matamuhuri Reserve (FAO and IUCN 2022). In 1933 the divisions were merged as Chittagong Forest Division, which was again divided into Chittagong Forest Division and Cox's Bazar Forest Division in 1951. Finally, in 2001, Cox's Bazar Forest Division was divided into Cox's Bazar North and Cox's Bazar South Forest Divisions (Chowdhury, 2006). The forests of CBSFD were highly mixed in nature that created difficulties to discover a useful classification. Ecologically, the forest was classified as i) Evergreen, ii) Deciduous, iii) Bamboo jungle, and iv) Savannah (Cowan, 1923).

5.7.1 Evergreen Forests

5.7.1.1 Tidal Forests: Small patches of tidal forests were common in the vicinity of rivers and creeks, especially in the Matamuhuri delta extending to the offshore islands. There are only 20 tree species that occur with a height of not more than 13 meters. Among them, *Heritiera fomes*, *Avicennia alba*, *A. marina*, *A. officinalis*, *Bruguiera gymnorhiza*, *Cerops roxburghiana*, *Excoecaria agallocha*, *Sonneratia apetala* are the major species of the tidal forests.

5.7.1.2 Tropical Evergreen Forests: Tropical evergreen forests are found in deep valleys or areas shaded by high hills with sufficient moisture. The principal tallest species with a height of 30-35 meters include Chapalish, Telsur, Chundul, Narikeli etc. Under these, the commonest trees are Pitraj, Gutguita, Toon, Nageswar etc. Also, species such as *Micromelum*, *Maesa*, *Garcinia*, *Murraya*, *Clausena* and *Glochidion* are also found under this category (FAO and IUCN 2022).

5.7.1.3 Mixed Evergreen Forests: Mixed evergreen forests occupy in the largest area and contain a vast number of species. These forests are found both in the hills and on alluvial floodplains. The tallest trees are usually deciduous and scattered having a height of 55-60 meter. The most known species are Garjan, Chapalish, Simul, Koroi, Narikeli, Civit, Bandarhaura with a few Toons. Middle storey (15-25 meter) possess a great variety of predominating evergreen species, e.g., *Batna*, *Jam*, *Bhadi*, *Jarul*, *Pitraj*, *Pitali*, *Hargaza*, *Kusum*, *Haritaki*, *Bahera*, *Gamar*, *Kao*, *Borta*, *Udal*, *Moos*, *Gab*, *Assar*, *Bolas*, *Chatian*, *Ficus* etc. Lower storey trees possessing height ranging 8-16 meter are *Batna*, *Jam*, *Assar*, *Adaliya*, *Naricha*, *Bormala*, *Goda*, *Kestoma*, *Kechua*, *Bohal*, *Jalpai*, *Dakrom*, *Sheora*, *Madonmosta*, and *Asok* (Cowan, 1923).

5.7.1.4 Low Evergreen Forests: The low evergreen forests denote a stunted and poorer variety of mixed evergreen forests, found mostly along with the boundaries of the reserve high forests. These were originally mixed evergreen forest but reduced to coppices and scrubs by continual grazing and cutting. The species are those of the second and third storey of mixed evergreen forests.

5.7.2 Deciduous

5.7.2.1 Garjan Forests: The most common species are *Dipterocarpus turbinatus*, *D. gracilis*, *D. alatus*, and *D. costatus* throughout the Division. A north-east to east aspect is preferred and they are mostly found on the ridges. They are often 2-3 storey forests where the lower storey contain the species characteristic of the mixed evergreen forest.

5.7.2.2 Open Deciduous Forests: Open deciduous forests are found on exposed slopes, usually with a south-west aspect where the supply of water is scarce. Principal species are Bhadi, Koroi, Kanchan, Tula, Kurus, Bormala, Udal, Hargaza, Mandar, Amra, Bela, Pitali, Amlaki, Bahera, and Ficus species.

5.7.2.3 Dune Forests: The extensive stretch of the sand dune from the south of Bagkhali river to the mouth of Teknaf Peninsula, a long narrow strip of sandy beach has its own characteristics of flora. Some species are distinctly available at the sandy beach. Sinclair (1956) recorded 46 plant species and Rahman et al. (2001) recorded 128 species along the Cox's Bazar to Teknaf coast. The common pioneer species are *Ipomoea pescaprae* along with *Zoysia matrella*, *Fimbristylis cymosa*, *Eragrostis coarctata*, *Launaea asplenifolia*. However, the sand dune community plants are *Casuarina equisetifolia*, *Vitex trifolia*, *Alternanthera sessilis*, *Crotalaria pallida*, *Solanum nigrum*, *Clerodendrum viscosum*, *Leucas lavandulifolia*, *L. zeylanica* and other species of *Cyperus* and *Fimbristylis* (Uddin and Hassan, 2018c).

5.7.3 Bamboo Forests

Bamboo jungles are scarcely forming and often are undergrowth among various types. In the interior of the forests there are areas without trees but densely stocked with bamboos. The common species (75%) is Muli (*Melocanna baccifera*) followed by Mitinga. Other bamboos found are Kaliserri (*Oxytenanthera auriculata*), Dalu (*Schizostachyum dullooa*), and Orah (*Dendrocalamus longispathus*).

5.7.4 Savannahs

There are some areas practically devoid of trees and covered mostly with the sungrass (*Imperata cylindrica*). Along the river banks or in swampy localities, the most common species is Khagra (*Saccharum spontaneum*).

5.8 Floral Records

5.8.1 Prior to the Independence of Bangladesh

Cowan (1923) recorded the list of important timber yielding plants of the Teknaf Game Reserve in the Forest Management plan of Cox's Bazar. About 268 plant species were mentioned in the working plan of the Cox's Bazar Forest Division for the period from 1968-69 to 1977-78 (Choudhury, 1969). Beyond the management plan, there was a comprehensive floral assessment of 746 species by Sinclair (1956).

5.8.2 Bangladesh Period

Sporadic floral survey reports are available for the protected areas (PAs) (i.e., National Park and Wildlife Sanctuary) in CBSFD. Khan et al. (1994) reported 290 ecologically and economically important plant species from the Teknaf Game Reserve. A total of 547 angiosperms species belonging to 380 genera and 103 families were reported from Himchari National Park (Uddin and Rahman, 1999). Uddin et al. (2013) reported 538

plant species belong to the 370 genera and 102 families from the Teknaf Wildlife Sanctuary. Similarly, 443 plant species belong to the 93 families were recorded from the Inani Protected Forest (Feeroz, 2016; Hossen and Hossain, 2018).

5.9 Significance of Protected Areas for Biodiversity Conservation

The main benefits of establishing PAs are the conservation of biodiversity and unique habitats and the role of PAs in conserving biodiversity is well recognized. PAs contribute significantly to reduce tropical deforestation and forest degradation. Many PAs in the tropics are sheltering the threatened species and critical ecosystems with the rapid advancement of deforestation. The recreational and aesthetic values are other major benefits of their establishment and management. **Nature-based tourism** within the PAs is another major source of revenue from PAs worldwide.

According to the Bangladesh Forest Department (BFD), Bangladesh currently has 45 PAs including 18 National Parks, 20 Wildlife Sanctuaries, 2 Eco Parks, 2 Special Biodiversity Conservation Areas, a National Botanical Garden, an Ecopark and Wildlife Breeding Centre, and a Marine PA (<http://www.bforest.gov.bd/site/page/5430ce33-561e-44f6-9827-ea1ebaa2c00d/->). In Bangladesh, the total area covered by the 45 PAs is around 6 36 390.46 ha (4.31% of the total area of Bangladesh) among which the 38 PAs (18 National Parks and 20 Wildlife Sanctuaries) are 4 51 317.06 ha. In practice, these areas remain unprotected and both legal and illegal activities are continuing to diminish the quality of biodiversity of the PAs (Kabir and Muzaffar, 2002; Muzaffar et al., 2007). Functionally, most of the PAs are not protected from illegal activities. At present, one Wildlife Sanctuary, two National Parks, one Botanical Garden, and one Ecological Critical Area were declared within the jurisdiction of CBSFD for recreation and conservation of biological diversity (Table 5.14).

Table 5.14: Protected Areas (PAs) in Cox’s Bazar South Forest Division (CBSFD)

SN	Name of the Pas	Range(s)	Area (ha)
1.	Teknaf Wildlife Sanctuary	Teknaf, Whykeong and Silkhali Range	11 614.58
2.	Himchari National Park	Cox’s Bazar Sadar Range	1 729.21
3.	Sheikh Jamal National Park	Inani, Ukhiya	7 085.00
4.	Cox’s Bazar Botanical Garden Rajarkul		26.32
5.	Sea Front of Cox’s Bazar and Teknaf Peninsula (ECA)		10 465.00

5.9.1 Teknaf Wildlife Sanctuary

Teknaf Wildlife Sanctuary (TWS) was declared as Game Reserve in 1983 under the Bangladesh Wildlife (Preservation) (Amendment) Act 1974. Later the PA status was changed to Wildlife Sanctuary. TWS is located in the Teknaf and Ukhiya Upazila of Cox’s Bazar district. Geographically, it is located between 20°52’ - 21°09’ N latitude, and 92°08’ - 92°18’ E longitude (Rosario, 1997). The PA is bounded by the Bay of Bengal to the south and west, Monkhal and Thainkhali to the north, and the Naf River to the east. Its management is under the jurisdiction of CBSFD. It is locally managed by three Range offices (Teknaf, Whykhong, and Shilkhali Ranges) and ten forest beats. The total area of the sanctuary is about 11,615 ha (Table 5.15) (Feeroz, 2013).

Table 5.15: Areas under different Forest Ranges of Teknaf Wildlife Sanctuary

Forest Range	Beat	Area (ha)
Shilkhali	Mathabhanga	854.3
	Rajachara	1 352.4
	Shilkhali	749.8
Whykeong	Shaplapur	838.5
	Raikheong	1 771.7
	Whykeong	1 255.5
Teknaf	Modho Hnila	1 720.6
	Hnila	836.4
	Mochoni	1 031.5
	Teknaf	1 204.3

Teknaf Wildlife Sanctuary was originally supported with mixed evergreen and semi-evergreen forests which have been substantially altered due to heavy biotic pressures over time. The topography of the sanctuary is very undulating composed of a linear hill range (long in the north-south direction having an altitude up to 700 meters). The hills are gently sloping to the rugged hills and cliffs running down towards the central part of the peninsula. It is about 28 km long in the north-south and 3-5 km wide in the east-west direction. The hill range, interspersed by valleys, gullies, and streams, has several projections running towards east and west. The PA is crisscrossed by numerous streams flowing down to the Bay of Bengal in the west and the Naf River in the east. Most of the streams dry up during the off-monsoon season. The hills are composed of upper tertiary rocks (Pliocene and Miocene epoch) with Surma, Tipam, and Dhupitila geological series (Choudhury, 1969). On the plain ground, the soils vary from clay to clayey loam whereas it is sandy loam to coarse sand on hilly land (Choudhury, 1969). The sanctuary enjoys a moist tropical maritime climate with frequent and heavy rainfall during the monsoon season (May to October) ranging from 130-940 mm. Temperature ranges from 15° C to 32° C, whereas humidity ranges from 27% to 99% (<https://en.climate-data.org/asia>).





Figure 5.33 Contour Point A and B of cable car will be in the TWS where forest and wildlife exist

Floral Diversity of Teknaf Wildlife Sanctuary (TWS): The floral diversity of TWS recorded by Uddin et al. (2013) consists of climbers (86 species), Epiphyte (9), Herb (177), Parasite (1), Shrub (109) and Tree (155 species) are shown in Table 5.16.

Table 5.16. List of species recorded in Teknaf wildlife sanctuary (* means cultivated)

TWS Flora List according to Habit

No.	Scientific name	Family	Bangla name	Habit	Conservation status
Climber					
1	<i>Abrus precatorius</i> L.	Fabaceae	Ratti	Climber	
2	<i>Acacia concinna</i> (Willd.) DC.	Mimosaceae	Banrita	Climber	
3	<i>Adenia trilobata</i> (Roxb.) Engl.	Passifloraceae	Akandphul	Climber	
4	<i>Anodendron paniculatum</i> (Roxb.) A. DC.	Apocynaceae		Climber	
5	<i>Argyreia capitiformis</i> (Poir.) van Cheek Oostr.	Convolvulaceae	--	Climber	
6	<i>Argyreia roxburghii</i> Choisy	Convolvulaceae		Climber	
7	<i>Aristolochia tagala</i> Cham.	Aristolochiaceae	Ishwarmul	Climber	
8	<i>Bridelia stipularis</i> (L.) Blume	Euphorbiaceae	Pat khowi	Climber	
9	<i>Byttneria pilosa</i> Roxb.	Sterculiaceae	Harbanga lata	Climber	
10	<i>Caesalpinia bonduc</i> (L.) Roxb.	Caesalpinaceae	Nata	Climber	
11	<i>Caesalpinia crista</i> L.	Caesalpinaceae	Letkanta	Climber	
12	<i>Calamus longisetus</i> Griff.	Arecaceae	Udombet	Climber	
13	<i>Calycopteris floribunda</i> (Roxb.) Lamk.	Combretaceae	Guicha lata	Climber	
14	<i>Cayratia japonica</i> (Thunb.) Gagnep.	Vitaceae		Climber	
15	<i>Cissampelos pareira</i> L.	Menispermaceae	Tubaki-lata	Climber	
16	<i>Cissus adnata</i> Roxb.	Vitaceae	Aliangalata	Climber	
17	<i>Clitoria ternatea</i> L.	Fabaceae	Aparjita	Climber	
18	<i>Cnesmone javanica</i> Blume	Euphorbiaceae	Chutra	Climber	
19	<i>Combretum decandrum</i> Roxb.	Combretaceae	Sada guicha	Climber	
20	<i>Cuscuta reflexa</i> Roxb.	Cuscutaceae	Shornalata	Climber	
21	<i>Cyclea barbata</i> Miers	Menispermaceae	Patalpur	Climber	
22	<i>Dalbergia stipulacea</i> Roxb.	Fabaceae	Dadbari	Climber	

23	<i>Derris scandens</i> (Roxb.) Benth.	Fabaceae		Kalilata	Climber	
24	<i>Derris trifoliata</i> Lour.	Fabaceae		Melata	Climber	
25	<i>Dioscorea alata</i> L.	Dioscoreaceae		Suprialu	Climber	
26	<i>Dioscorea belophylla</i> (Prain) Voigt ex Haines	Dioscoreaceae			Climber	
27	<i>Dioscorea bulbifera</i> L. var. <i>bulbifera</i> L.	Dioscoreaceae		Ratal, Bon alu	Climber	
28	<i>Dioscorea kamoonsensis</i> Kunth	Dioscoreaceae			Climber	
29	<i>Dioscorea melanophyma</i> Prain & Burkill	Dioscoreaceae			Climber	
30	<i>Dioscorea oppositifolia</i> L.	Dioscoreaceae		Randrealeku	Climber	
31	<i>Dioscorea pentaphylla</i> L.	Dioscoreaceae			Climber	
32	<i>Dioscorea trinerva</i> Roxb.	Dioscoreaceae			Climber	
33	<i>Dysolobium dolichoides</i> (Roxb.) Prain	Fabaceae			Climber	
34	<i>Entada scandens</i> auct. non Benth.	Mimosaceae		Gila	Climber	
35	<i>Ficus pumila</i> L.	Moraceae		Dewall dumar	Climber	
36	<i>Ficus scandens</i> Buch.-Ham.	Moraceae			Climber	
37	<i>Fissistigma polyanthum</i> (Hook. f. & Thom.) Merr.	Annonaceae			Climber	
38	<i>Flagellaria indica</i> L.	Flagellariaceae			Climber	
39	<i>Gloriosa superba</i> L.	Liliaceae		Ulatchandal	Climber	
40	<i>Gnetum oblongum</i> L.	Gnetaceae			Climber	
41	<i>Gouania tiliaefolia</i> Lamk.	Rhamnaceae			Climber	
42	<i>Gymnopetalum cochinchinense</i> (Lour.) Kurz	Cucurbitaceae			Climber	
43	<i>Gynostemma pentaphylla</i> (Thumb.) Makino.	Vitaceae			Climber	
44	<i>Hemidesmus indicus</i> (L.) R. Br.	Asclepiadaceae		Anantamul	Climber	
45	<i>Hoya parasitica</i> (Roxb.) Wall. ex Wight	Asclepiadaceae		Pargacha	Climber	
46	<i>Ichnocarpus frutescens</i> (L.) R. Br.	Apocynaceae		Shamalata	Climber	
47	<i>Ipomoea aquatica</i> Forssk.	Convolvulaceae		Kalmi sak	Climber	
48	<i>Ipomoea mauritiana</i> Jacq.	Convolvulaceae		Huffta alu	Climber	
49	<i>Ipomoea pes-caprae</i> (L.) R. Br.	Convolvulaceae		Chagalkhuri	Climber	
50	<i>Ipomoea quamoclit</i> L.	Convolvulaceae		Gate phul	Climber	
51	<i>Jasminum auriculatum</i> Vahl*	Oleaceae		Jui	Climber	
52	<i>Jasminum grandiflorum</i> L.	Oleaceae		Wild jasmin	Climber	
53	<i>Luffa graveolens</i> Roxb.	Cucurbitaceae		Pahari dhundul	Climber	
54	<i>Melochia umbellata</i> (L.) Hallier f.	Convolvulaceae		Sadakalmi	Climber	
55	<i>Mikania cordata</i> (Burm. f.) Robinson	Asteraceae		Assamlata	Climber	
56	<i>Momordica dioica</i> Roxb. ex Willd.	Cucurbitaceae		Bonkorolla	Climber	
57	<i>Mucuna pruriens</i> (L.) DC.	Fabaceae		Alkushi	Climber	
58	<i>Oxyceros kunstleri</i> (King & Gamble) Tirveng.	Rubiaceae		Moishkanta	Climber	
59	<i>Passiflora foetida</i> L.	Passifloraceae		Jhumku lata	Climber	
60	<i>Pentatropis capensis</i> (L. f.) Bullock	Asclepiadaceae			Climber	

61	<i>Piper betle</i> L.	Piperaceae		Pan	Climber	
62	<i>Piper sylvaticum</i> Roxb.	Piperaceae		Ban pan	Climber	
63	<i>Pothos scandens</i> L.	Araceae		Batilata	Climber	
64	<i>Rhaphidophora grandis</i> Schott	Araceae			Climber	
65	<i>Sarcolobus carinatus</i> Wall.	Asclepiadaceae		Baoli lata	Climber	
66	<i>Schefflera bengalensis</i> Gamble	Araliaceae			Climber	
67	<i>Smilax ferox</i> Wall. ex Kunth	Smilacaceae		Kumari lata	Climber	
68	<i>Smilax laurifolia</i> L.	Smilacaceae		Kumari lata	Climber	
69	<i>Smilax ovalifoila</i> Roxb.	Smilacaceae		Kumari lata	Climber	
70	<i>Smilax perfoliata</i> Lour.	Smilacaceae		Kumari lata	Climber	
71	<i>Spatholobus acuminatus</i> Benth.	Fabaceae		Bean	Climber	
72	<i>Spatholobus roxburghii</i> Benth.	Fabaceae			Climber	
73	<i>Stemona tuberosa</i> Lour.	Stemonaceae		Lalgurania alu	Climber	
74	<i>Stephania glabra</i> (Roxb.) Miers	Menispermaceae		Thanda manik	Climber	
75	<i>Stephania japonica</i> (Thunb.) Miers	Menispermaceae		Muichanlata	Climber	
76	<i>Symplocos racemosa</i> Roxb.	Symplocaceae			Climber	
77	<i>Tetracera sarmentosa</i> (L.) Vahl subsp. andamanica (Hoogl.) Hoogl.	Dilleniaceae		Challalata	Climber	
78	<i>Tetrastigma angustifolium</i> (Roxb.) Planch.	Vitaceae		Nekung riubi	Climber	
79	<i>Thunbergia fragrans</i> Roxb.	Acanthaceae			Climber	
80	<i>Thunbergia grandiflora</i> (Roxb. ex Rottler) Roxb.	Acanthaceae		Nekung riubi	Climber	
81	<i>Tinospora cordifolia</i> (Willd.) Hook. f. & Thoms.	Menispermaceae		Ghora gulancha	Climber	
82	<i>Tinospora crispa</i> (L.) Hook. f. & Thoms.	Menispermaceae		Gulancha	Climber	
83	<i>Tylophora tenuissima</i> (Roxb.) Wight & Arn.	Asclepiadaceae			Climber	
84	<i>Uvaria hamiltonii</i> Hook. f. & Thom.	Annonaceae		Latkan	Climber	
85	<i>Vitis repens</i> (Lamk.) Wight & Arn.	Vitaceae		Marmaria puta	Climber	
86	<i>Ziziphus glabrata</i> Heyne ex Roth	Rhamnaceae		Jangli kul	Climber	
Epiphyte						
1	<i>Aerides multiflora</i> Roxb.	Orchidaceae		-	Epiphyte	
2	<i>Aerides odorata</i> Lour.	Orchidaceae		-	Epiphyte	
3	<i>Bulbophyllum lilacinum</i> Ridl.	Orchidaceae		Parchallow	Epiphyte	
4	<i>Cymbidium aloifolium</i> (L.) Sw.	Orchidaceae		Churi	Epiphyte	
5	<i>Dendrobium aphyllum</i> (Roxb.) Fischer	Orchidaceae			Epiphyte	
6	<i>Luisia zeylanica</i> Lindl.	Orchidaceae			Epiphyte	
7	<i>Papilionanthe teres</i> (Roxb.) Schltr.	Orchidaceae		Vanda	Epiphyte	
8	<i>Pholidota imbricata</i> Hook. f.	Orchidaceae			Epiphyte	

9	<i>Rhynchostylis retusa</i> (L.) Blume	Orchidaceae		Foxtail	Epiphyte	
Herb						
1	<i>Abelmoschus moschatus</i> Medic.	Malvaceae		Mushak dana	Herb	
2	<i>Achyranthes aspera</i> L.	Amaranthaceae		Apang	Herb	
3	<i>Aerua monsonia</i> Mart.	Amaranthaceae			Herb	
4	<i>Aerua sanguinolenta</i> (L.) Blume	Amaranthaceae			Herb	
5	<i>Ageratum conyzoides</i> L.	Asteraceae		Fulkuri	Herb	
6	<i>Aglaonema hookerianum</i> Schott	Araceae			Herb	
7	<i>Alocasia acuminata</i> Schott	Araceae			Herb	
8	<i>Alocasia macrorrhizos</i> (L.) G. Don	Araceae		Mankachu	Herb	
9	<i>Alternanthera philoxeroides</i> (Mart.) Griseb.	Amaranthaceae		Helench	Herb	
10	<i>Alternanthera sessilis</i> (L.) R. Br. ex Roem & Schult.	Amaranthaceae		Upathlenga	Herb	
11	<i>Amaranthus gangeticus</i> L.	Amaranthaceae		Shadamayishk	Herb	
12	<i>Amaranthus spinosus</i> L.	Amaranthaceae		Kanta-nutia	Herb	
13	<i>Amaranthus viridis</i> L.	Amaranthaceae		Notey Sak	Herb	
14	<i>Ammannia multiflora</i> Roxb.	Lythraceae		--	Herb	
15	<i>Amorphophallus bulbifer</i> (Roxb.) Blume	Araceae		Oil	Herb	
16	<i>Anisomeles heyneana</i> Wall. ex Benth.	Lamiaceae		--	Herb	
17	<i>Anisomeles indica</i> (L.) O. Kuntze	Lamiaceae		Gobura	Herb	
18	<i>Arundo donax</i> L.	Poaceae		Nal	Herb	
19	<i>Axonopus compressus</i> (Sw.) P. Beauv.	Poaceae		Dhakagash	Herb	
20	<i>Bacopa monieri</i> (L.) Pennell	Scrophulariaceae		Brammi	Herb	
21	<i>Begonia roxburghii</i> (Miq.) DC.	Begoniaceae			Herb	
22	<i>Blumea lacera</i> (Burm. f.) DC.	Asteraceae		Kukurmata	Herb	
23	<i>Blumea membranacea</i> Wall. ex DC.	Asteraceae		Shialmutra	Herb	
24	<i>Blumea virens</i> Wall. ex DC.	Asteraceae			Herb	
25	<i>Borreria articularis</i> (L. f.) Williams	Rubiaceae		Antharogia	Herb	
26	<i>Borreria latifolia</i> (Aublet) K. Schum.	Rubiaceae		Ghuiojhill sak	Herb	
27	<i>Campanumoea lancifolia</i> (Roxb.) Merr.	Campanulaceae			Herb	
28	<i>Carex indica</i> L.	Cyperaceae			Herb	
29	<i>Centella asiatica</i> (L.) Urban	Apiaceae		Thaimonshak	Herb	
30	<i>Chrysopogon aciculatus</i> (Retz.) Trin.	Poaceae		Premkanta	Herb	
31	<i>Cleome ruidosperma</i> DC.	Capparaceae			Herb	
32	<i>Cleome viscosa</i> L.	Capparaceae		Hurhuria	Herb	
33	<i>Colocasia esculenta</i> (L.) Schott	Araceae		Kachu	Herb	

34	<i>Colocasia heterochroma</i> H. Li et Z.X. Wei	Araceae			Herb	
35	<i>Colocasia oresbia</i> A. Hay	Araceae			Herb	
36	<i>Commelina benghalensis</i> L.	Commelinaceae		Kanchira	Herb	
37	<i>Commelina erecta</i> L.	Commelinaceae		Jata kanchira	Herb	
38	<i>Commelina longifolia</i> Lamk.	Commelinaceae		Pani kanchira	Herb	
39	<i>Costus speciosus</i> (Koenig ex Retz.) Smith	Costaceae		Keumul	Herb	
40	<i>Crinum amoenum</i> Roxb.	Liliaceae		Bopiaz	Herb	
41	<i>Crinum asiaticum</i> L.	Liliaceae		Gor-rosun	Herb	
42	<i>Crotalaria juncea</i> L.	Fabaceae		Junjuni	Herb	
43	<i>Crotalaria pallida</i> Ait.	Fabaceae		Jhunjhni	Herb	
44	<i>Curculigo orchiooides</i> Gaertn.	Liliaceae		Talmuli	Herb	
45	<i>Curculigo recurvata</i> Dryand.	Liliaceae		Satipata	Herb	
46	<i>Curcuma amada</i> Roxb.	Zingiberaceae		Shadi	Herb	
47	<i>Curcuma latifolia</i> Rosc.	Zingiberaceae		Amada	Herb	
48	<i>Curcuma zedoaria</i> (Christm.) Rosc.	Zingiberaceae		Shoti	Herb	
49	<i>Cynodon dactylon</i> (L.) Pers.	Poaceae		Durba	Herb	
50	<i>Cyperus cyperoides</i> (L.) O. Ktze.	Cyperaceae			Herb	
51	<i>Cyperus iria</i> L.	Cyperaceae			Herb	
52	<i>Cyperus kyllingia</i> Endl.	Cyperaceae			Herb	
53	<i>Cyperus laxus</i> Lamk. var. <i>laxus</i>	Cyperaceae			Herb	
54	<i>Cyperus pilosus</i> Vahl	Cyperaceae			Herb	
55	<i>Cyperus rotundus</i> L.	Cyperaceae			Herb	
56	<i>Desmodium heterocarpon</i> (L.) DC.	Fabaceae			Herb	
57	<i>Desmodium heterophyllum</i> (Willd.) DC.	Fabaceae			Herb	
58	<i>Desmodium styracifolium</i> (Osb.) Merr.	Fabaceae			Herb	
59	<i>Desmodium triflorum</i> (L.) DC.	Fabaceae		Kulalia	Herb	
60	<i>Desmodium triquetrum</i> (L.) DC.	Fabaceae			Herb	
61	<i>Desmodium triquetrum</i> (L.) DC. subsp. <i>alatum</i> (DC.) Prain	Fabaceae			Herb	
62	<i>Digitaria sanguinalis</i> (L.) Scop.	Poaceae		Makunjill	Herb	
63	<i>Digitaria violascens</i> Link	Poaceae			Herb	
64	<i>Echinochloa colonum</i> (L.) Link	Poaceae		Shama grass	Herb	
65	<i>Eclipta alba</i> (L.) Hassk.	Asteraceae		Keshoraj	Herb	
66	<i>Eichhornia crassipes</i> (Mart.) Solms	Pontederiaceae		Kachuripana	Herb	
67	<i>Elatostema sesquifolium</i> (Blume) Hassk.	Urticaceae			Herb	
68	<i>Eleocharis palustris</i> (L.) R. Br.	Cyperaceae			Herb	
69	<i>Elephantopus scaber</i> L.	Asteraceae			Herb	
70	<i>Eleusine indica</i> (L.) Gaertn.	Poaceae		Malan kuri	Herb	
71	<i>Enhydra fluctuans</i> Lour.	Asteraceae		Helench	Herb	

72	<i>Eragrostis tenella</i> (L.) P. Beauv. ex Roem. & Schult.	Poaceae		Koni grass	Herb	
73	<i>Eranthemum strictum</i> Coleb. ex Roxb.	Acanthaceae			Herb	
74	<i>Eryngium foetidum</i> L. *	Apiaceae		Katkatriabaho	Herb	
75	<i>Euphorbia hirta</i> L.	Euphorbiaceae		Dudhia	Herb	
76	<i>Euphorbia thymifolia</i> L.	Euphorbiaceae		Dudhiya	Herb	
77	<i>Evolvulus nummularius</i> (L.) L.	Convolvulaceae			Herb	
78	<i>Ficus hispida</i> L. f.	Moraceae		Dumur	Herb	
79	<i>Fimbristylis dichotoma</i> (L.) Vahl subsp. <i>dichotoma</i>	Cyperaceae			Herb	
80	<i>Fimbristylis miliacea</i> (L.) Vahl	Cyperaceae			Herb	
81	<i>Floscopa scandens</i> Lour.	Commelinaceae			Herb	
82	<i>Geissapsis cristata</i> Wight & Arn.	Fabaceae			Herb	
83	<i>Geodorum densiflorum</i> (Lamk.) Schltr.	Orchidaceae			Herb	
84	<i>Globba multiflora</i> Wall. ex Baker	Zingiberaceae			Herb	
85	<i>Hedyotis scandens</i> Roxb.	Rubiaceae		Bish lata	Herb	
86	<i>Heliotropium indicum</i> L.	Boraginaceae		Hatisun	Herb	
87	<i>Hemarthria protensa</i> Steud.	Poaceae		Chalia	Herb	
88	<i>Hemigraphis hirta</i> (Vahl) T. Anders.	Acanthaceae			Herb	
89	<i>Homalomena aromatica</i> (Roxb. ex Sim) Schott	Araceae			Herb	
90	<i>Hydrolea zeylanica</i> (L.) Vahl	Hydrophyllaceae			Herb	
91	<i>Hygrophila polysperma</i> (Roxb.) T. Anders.	Acanthaceae			Herb	
92	<i>Hyptis brevipes</i> Poit.	Lamiaceae			Herb	
93	<i>Hyptis suaveolens</i> (L.) Poit.	Lamiaceae		Tokma	Herb	
94	<i>Imperata cylindrica</i> (L.) P. Beauv. var. <i>latifolia</i> (Hook. f.) C. E. Hubb.	Poaceae		Ulu	Herb	
95	<i>Ischaemum indicum</i> (Houtt.) Merr.	Poaceae		Toto grass	Herb	
96	<i>Kaempferia galanga</i> L.	Zingiberaceae		Tiutara	Herb	
97	<i>Lagenaria siceraria</i> (Molina) Standl. *	Cucurbitaceae		Lau	Herb	
98	<i>Laportea interrupta</i> (L.) Chew	Urticaceae		Lal Bichuti	Herb	
99	<i>Lasia spinosa</i> (L.) Thw.	Araceae		Kantakachu	Herb	
100	<i>Lepidagathis incurva</i> Buch.-Ham. ex D. Don	Acanthaceae			Herb	
101	<i>Leucas aspera</i> (Willd.) Link	Lamiaceae		Dandakalash	Herb	
102	<i>Leucas lavandulaefolia</i> Smith	Lamiaceae		Gaochia	Herb	
103	<i>Limnophila indica</i> (L.) Druce	Scrophulariaceae		Pani karpur	Herb	
104	<i>Ludwigia adscendens</i> (L.) Hara	Onagraceae		Mulsi	Herb	
105	<i>Ludwigia hyssopifolia</i> (G. Don) Exell apud A. & R. Fernandes	Onagraceae			Herb	

106	<i>Mantisia radicalis</i> (Roxb.) D. P. Dam & N. Dam	Zingiberaceae			Herb	
107	<i>Mantisia spathulata</i> Schult.	Zingiberaceae			Herb	
108	<i>Maranta arundinacea</i> L.	Marantaceae		Ararot	Herb	
109	<i>Melochia corchorifolia</i> L.	Sterculiaceae		Tiki okra	Herb	
110	<i>Millettia cinerea</i> Benth.	Fabaceae			Herb	
111	<i>Mimosa invisa</i> Mart. ex Colla.	Mimosaceae		Bara lajjabati	Herb	
112	<i>Mimosa pudica</i> L.	Mimosaceae		Lajjabati	Herb	
113	<i>Molineria recurvata</i> (Dryand.) Herbert.	Liliaceae			Herb	
114	<i>Mollugo pentaphylla</i> L.	Moraceae		Khetpapra	Herb	
115	<i>Monochoria vaginalis</i> (Burm. f.) Presl	Pontederiaceae		Nukha	Herb	
116	<i>Musa acuminata</i> Colla	Musaceae			Herb	
117	<i>Nelsonia canescens</i> (Lamk.) Spreng.	Acanthaceae		Parmul	Herb	
118	<i>Nymphaea rubra</i> Roxb. ex Andr.	Nymphaeaceae		Lal Shaphla	Herb	
119	<i>Ocimum americanum</i> L.	Lamiaceae		Tulsi	Herb	
120	<i>Ocimum gratissimum</i> L. *	Lamiaceae		Ramtulsi	Herb	
121	<i>Oplismenus burmanii</i> (Retz.) P. Beauv.	Poaceae			Herb	
122	<i>Opuntia dillenii</i> Haw.	Cactaceae		Phanimansa	Herb	
123	<i>Panicum brevifolium</i> L.	Poaceae			Herb	
124	<i>Panicum notatum</i> Retz.	Poaceae			Herb	
125	<i>Paspalum scrobiculatum</i> L.	Poaceae		Kodoa phan	Herb	
126	<i>Peliosanthes teta</i> Andr.	Haemodoraceae		Napi gach	Herb	
127	<i>Persicaria flaccida</i> (Meissn.) H. Gross ex Loesen.	Polygonaceae		Lal-bishkatali	Herb	
128	<i>Persicaria hydropiper</i> (L.) Spach	Polygonaceae		Lal-kukri	Herb	
129	<i>Persicaria orientalis</i> (L.) Spach	Polygonaceae		Bara panimorich	Herb	
130	<i>Phaulopsis imbricata</i> (Forssk.) Sweet	Acanthaceae			Herb	
131	<i>Phyla nodiflora</i> (L.) Greene	Verbenaceae		Bakkumgula	Herb	
132	<i>Physalis minima</i> L.	Solanaceae		Fotka	Herb	
133	<i>Pogonatherum crinitum</i> (Thunb.) Kunth	Poaceae			Herb	
134	<i>Pogonatherum paniceum</i> (Lamk.) Hack.	Poaceae		Choto bush	Herb	
135	<i>Polygonum plebeium</i> R. Br.	Polygonaceae		Mechu sak	Herb	
136	<i>Pouzolzia zeylanica</i> (L.) Benn.	Urticaceae		Kulla kuri	Herb	
137	<i>Ricinus communis</i> L.	Euphorbiaceae		Reri	Herb	
138	<i>Rotala indica</i> (Willd.) Koehne	Lythraceae			Herb	
139	<i>Rotala rotundifolia</i> (Buch.-Ham. ex Roxb.) Koehne	Lythraceae			Herb	
140	<i>Rungia pectinata</i> (L.) Nees. in Wall.	Acanthaceae		Pindi	Herb	
141	<i>Saccharum</i> <i>arundinaceum</i> Retz.	Poaceae		Teng	Herb	
142	<i>Saccharum spontaneum</i> L.	Poaceae		Kash	Herb	
143	<i>Scoparia dulcis</i> L.	Scrophulariaceae		Bandhani	Herb	

144	<i>Senna obtusifolia</i> (L.) Irwin & Barneby	Caesalpiniaceae		Chakunda	Herb	
145	<i>Senna sophera</i> (L.) Roxb.	Caesalpiniaceae		Kalkesunde	Herb	
146	<i>Senna tora</i> (L.) Roxb.	Caesalpiniaceae		Chakunda	Herb	
147	<i>Setaria glauca</i> (L.) P. Beauv.	Poaceae		Bajra	Herb	
148	<i>Sida acuta</i> Burm. f.	Malvaceae		Nakphul	Herb	
149	<i>Sida cordata</i> (Burm. f.) Borss.	Malvaceae		Junka	Herb	
150	<i>Sida cordifolia</i> L.	Malvaceae		Berela	Herb	
151	<i>Sida rhombifolia</i> L.	Malvaceae		Lal-berela	Herb	
152	<i>Solanum nigrum</i> L.	Solanaceae		Puti begun	Herb	
153	<i>Sphaeranthus indicus</i> L.	Asteraceae		Chagalnadi	Herb	
154	<i>Spilanthes acmella</i> auct. non L. Thw.	Asteraceae		Mathamoriaguinshak	Herb	
155	<i>Sporobolus diander</i> (Retz.) P. Beauv.	Poaceae		Bina joni	Herb	
156	<i>Sporobolus indicus</i> R. Br.	Poaceae			Herb	
157	<i>Stachytarpheta jamaicensis</i> (L.) Vahl	Verbenaceae		Bina joni	Herb	
158	<i>Staurogyne argentea</i> Wall.	Acanthaceae			Herb	
159	<i>Steudnera colocasioides</i> Hook. f.	Araceae		Bishkachu	Herb	
160	<i>Strobilanthes polystachia</i> Nees.in Wall	Acanthaceae			Herb	
161	<i>Synedrella nodiflora</i> (L.) Gaertn.	Asteraceae			Herb	
162	<i>Tacca integrifolia</i> Ker- Gawl.	Taccaceae		Mati munda	Herb	
163	<i>Tapiria hirsuta</i> Hook. f	Anacardiaceae			Herb	
164	<i>Tephrosia purpurea</i> (L.) Pers.	Fabaceae		Bon-neel	Herb	
165	<i>Thysanolaena maxima</i> (Roxb.) O. Kuntze	Poaceae		Phuljharu	Herb	
166	<i>Torenia vegans</i> Roxb.	Scrophulariaceae			Herb	
167	<i>Triumfetta rhomboidea</i> Jacq.	Tiliaceae		Banokra	Herb	
168	<i>Uria lagopoides</i> DC.	Fabaceae			Herb	
169	<i>Urena lobata</i> L.	Malvaceae		Banokra	Herb	
170	<i>Urena sinuata</i> L.	Malvaceae			Herb	
171	<i>Urginea indica</i> (Roxb.) Kunth	Liliaceae		Sumudra pyaj	Herb	
172	<i>Vernonia patula</i> (Dry) Merr.	Asteraceae		Shial lata	Herb	
173	<i>Xanthium indicum</i> Koen. ex Roxb.	Asteraceae		Ghagra	Herb	
174	<i>Xanthosoma violaceum</i> Schott*	Araceae		Dud kachu	Herb	
175	<i>Zea mays</i> L. *	Poaceae			Herb	
176	<i>Zingiber montanum</i> (Koen.) Dietr.	Zingiberaceae		Paletara	Herb	
177	<i>Zingiber roseum</i> (Roxb.) Rosc.	Zingiberaceae		Laltara	Herb	
Parasite						
1	<i>Macrosolen cochinchinensis</i> (Lour.) Van Tiegh.	Loranthaceae		Porgasa	Parasite	
Shrub						
1	<i>Acanthus ilicifolius</i> L.	Acanthaceae		Hergoza	Shrub	

2	<i>Actephila excelsa</i> (Dalz.) Muell.-Arg.	Euphorbiaceae			Shrub	
3	<i>Aegialitis rotundifolia</i> Roxb.	Plumbaginaceae		Nuinna	Shrub	
4	<i>Aegiceras corniculata</i> (L.) Blanco	Primulaceae		Khoilsha	Shrub	
5	<i>Allophylus cobbe</i> (L.) Raeuschel	Sapindaceae		Chita	Shrub	
6	<i>Alpinia malaccensis</i> (Burm. f.) Rosc.	Zingiberaceae		Deotara	Shrub	
7	<i>Amomum aromaticum</i> Roxb.	Zingiberaceae		Tara	Shrub	
8	<i>Antidesma acuminatum</i> Wall.	Euphorbiaceae		Chukka	Shrub	
9	<i>Antidesma ghaesembilla</i> Gaertn.	Euphorbiaceae		Khudijam	Shrub	
10	<i>Antidesma roxburghii</i> Wall. ex Tulasne	Euphorbiaceae		--	Shrub	
11	<i>Ardisia elliptica</i> Thunb.	Myrsinaceae		--	Shrub	
12	<i>Ardisia paniculata</i> Roxb.	Myrsinaceae		--	Shrub	
13	<i>Ardisia solanacea</i> (Poir.) Roxb.	Myrsinaceae			Shrub	
14	<i>Bauhinia acuminata</i> L.	Caesalpiniaceae		Kanson	Shrub	LC
15	<i>Breynia retusa</i> (Dennst.) Alston	Euphorbiaceae		Silpati	Shrub	
16	<i>Breynia vitis-idaea</i> (Burm. f.) C. E. C. Fischer	Euphorbiaceae			Shrub	
17	<i>Bridelia retusa</i> (L.) A. Juss.	Euphorbiaceae		Kata koi	Shrub	
18	<i>Cajanus cajan</i> (L.) Millsp. *	Fabaceae		Orhor	Shrub	
19	<i>Calamus erectus</i> Roxb.	Arecaceae		Kadam bet	Shrub	
20	<i>Calliandra umbrosa</i> (Wall.) Benth.	Mimosaceae		Chotto betmar	Shrub	
21	<i>Calotropis procera</i> (Ait.) R. Br.	Asclepiadaceae		Akand	Shrub	
22	<i>Celtis timorensis</i> Span.	Ulmaceae		Datarchua	Shrub	
23	<i>Chromolaena odorata</i> (L.) King & Robinson	Asteraceae		Assamlata	Shrub	
24	<i>Citrus aurantium</i> L. *	Rutaceae		Komala	Shrub	
25	<i>Clausena heptaphylla</i> (Roxb.) Wight & Arn. ex Steud.	Rutaceae		Ponkarpur	Shrub	
26	<i>Clausena suffruticosa</i> (Roxb.) Wight & Arn.	Rutaceae		Panbilash	Shrub	
27	<i>Clerodendrum inerme</i> (L.) Gaertn.	Verbenaceae		Bamjui	Shrub	
28	<i>Clerodendrum viscosum</i> Vent.	Verbenaceae		Bhant	Shrub	
29	<i>Dalbergia rimosa</i> Roxb.	Fabaceae			Shrub	
30	<i>Dalbergia spinosa</i> Roxb.	Fabaceae			Shrub	
31	<i>Dalbergia tamarindifolia</i> Roxb.	Fabaceae			Shrub	
32	<i>Dalbergia volubilis</i> Roxb.	Fabaceae		Ankilata	Shrub	
33	<i>Datura metel</i> L.	Solanaceae		Dhatura	Shrub	
34	<i>Desmodium pulchellum</i> (L.) Benth.	Fabaceae		Juta salpani	Shrub	
35	<i>Dracaena spicata</i> Roxb.	Agavaceae		Dracaena	Shrub	
36	<i>Duranta repens</i> L.	Verbenaceae		Katamehedi	Shrub	
37	<i>Etlingera linguiformis</i> (Roxb.) R. M. Smith	Zingiberaceae			Shrub	

38	<i>Ficus fistulosa</i> Reinw. ex Blume	Moraceae			Shrub	
39	<i>Flacourtia indica</i> (Burm. f.) Merr.	Flacourtiaceae		Paniala	Shrub	
40	<i>Flacourtia inermis</i> Roxb.	Flacourtiaceae			Shrub	
41	<i>Flemingia macrophylla</i> (Willd.) O. Kuntze ex Merr.	Fabaceae		Bara shaphan	Shrub	
42	<i>Flemingia strobilifera</i> (L.) R. Br.	Fabaceae			Shrub	
43	<i>Glycosmis mauritiana</i> (Lamk.) Tanaka	Rutaceae			Shrub	
44	<i>Glycosmis pentaphylla</i> (Retz.) A. DC.	Rutaceae		Datmajan	Shrub	
45	<i>Goniothalamus sesquipedalis</i> (Wall.) Hook. F. & Thom.	Annonaceae			Shrub	
46	<i>Grewia microcos</i> L.	Tiliaceae		Assar	Shrub	
47	<i>Hibiscus rosa-sinensis</i> L. *	Malvaceae		Joba	Shrub	
48	<i>Hibiscus tiliaceus</i> L.	Malvaceae		Bolla	Shrub	
49	<i>Holarrhena antidysenterica</i> (L.) Wall. ex Decne.	Apocynaceae		Kurchi	Shrub	
50	<i>Ipomoea fistulosa</i> Mart. ex Choisy	Convolvulaceae		Dholkalmi	Shrub	
51	<i>Ixora acuminata</i> Roxb.	Rubiaceae			Shrub	
52	<i>Ixora javanica</i> DC.	Rubiaceae		Rangan	Shrub	
53	<i>Ixora pavetta</i> Andr.	Rubiaceae		Swet rangan	Shrub	
54	<i>Jasminum scandens</i> Vahl	Oleaceae			Shrub	
55	<i>Justicia gendarussa</i> Burm. f.	Acanthaceae		Nilnishinda	Shrub	
56	<i>Justicia simplex</i> D. Don.	Acanthaceae		Jogathmardan	Shrub	
57	<i>Lantana camara</i> L.	Verbenaceae		Lantana	Shrub	
58	<i>Lawsonia inermis</i> L. *	Lythraceae		Mehedi	Shrub	
59	<i>Leea acuminata</i> Wall.	Leeaceae		Phupharia	Shrub	
60	<i>Leea aequata</i> L.	Leeaceae			Shrub	
61	<i>Leea crispa</i> L.	Leeaceae		Banchilata	Shrub	
62	<i>Leea indica</i> Merr.	Leeaceae			Shrub	
63	<i>Lepisanthes rubiginosa</i> (Roxb.) Leenh.	Sapindaceae		Baraharina	Shrub	
64	<i>Macaranga peltata</i> (Roxb.) Muell.-Arg.	Euphorbiaceae		Bura	Shrub	
65	<i>Maesa indica</i> (Roxb.) A. DC.	Myrsinaceae		Ramjoni	Shrub	
66	<i>Maesa ramentacea</i> (Roxb.) A. DC.	Myrsinaceae		Maricha	Shrub	
67	<i>Mallotus philippensis</i> (Lamk.) Muell.-Arg.	Euphorbiaceae		Kamela	Shrub	
68	<i>Manihot esculenta</i> Crantz	Euphorbiaceae		Kasava	Shrub	
69	<i>Manilkara hexandra</i> (Roxb.) Dubard	Sapotaceae		Khirmi	Shrub	
70	<i>Melastoma malabathricum</i> L.	Melastomaceae		Futki	Shrub	
71	<i>Micromelum minutum</i> (G. Forster) Wight & Arn.	Rutaceae		Koroiphula	Shrub	
72	<i>Mussaenda frondosa</i> L.	Rubiaceae		Kalasonia	Shrub	
73	<i>Mussaenda roxburghii</i> Hook. f.	Rubiaceae		Silchuri	Shrub	
74	<i>Nypa fruticans</i> Wurmb.	Arecaceae		Golpata	Shrub	
75	<i>Oreocnide integrifolia</i> (Gaud.) Miq.	Urticaceae		Horhuta	Shrub	

76	<i>Osbeckia aspericaulis</i> Hook. f. ex Triana	Melastomaceae			Shrub	
77	<i>Pandanus foetidus</i> Roxb.	Pandanaceae		Keyakanta	Shrub	
78	<i>Pandanus odoratus</i> Ridl.	Pandanaceae		Keyakanta	Shrub	
79	<i>Phoebe lanceolata</i> (Nees) Nees	Lauraceae			Shrub	
80	<i>Phrynium imbricatum</i> Roxb.	Marantaceae		Pituli pata	Shrub	
81	<i>Phyllanthus reticulatus</i> Poir.	Euphorbiaceae		Chitki	Shrub	
82	<i>Pilea melastomoides</i> (Poir.) Wedd.	Urticaceae			Shrub	
83	<i>Premna esculenta</i> Roxb.	Verbenaceae		Lallong	Shrub	
84	<i>Psidium guajava</i> L.	Myrtaceae		Piara	Shrub	
85	<i>Randia dumetorum</i> Lamk.	Rubiaceae		Mankanta	Shrub	
86	<i>Rhynchosyche ellipticum</i> (Diet.) DC.	Gesneriaceae			Shrub	
87	<i>Saraca thaipingensis</i> Cantley ex Prain	Caesalpiniaceae		Ashok	Shrub	
88	<i>Sarcochlamys pulcherrima</i> Gaudich.	Urticaceae		Achila	Shrub	
89	<i>Senna alata</i> (L.) Roxb.	Caesalpiniaceae		Dadmordon	Shrub	
90	<i>Senna occidentalis</i> Roxb.	Caesalpiniaceae		Eski	Shrub	
91	<i>Sesbania grandiflora</i> (L.) Poir.	Fabaceae		Bokful	Shrub	
92	<i>Solanum barbisetum</i> Nees	Solanaceae			Shrub	
93	<i>Solanum capsicoides</i> All.	Solanaceae		Betbegun	Shrub	
94	<i>Solanum lasiocarpum</i> Dunal	Solanaceae		Beregul	Shrub	
95	<i>Solanum sisymbriifolium</i> Lamk.	Solanaceae			Shrub	
96	<i>Solanum torvum</i> Swartz	Solanaceae		Gota begun	Shrub	
97	<i>Solanum violaceum</i> Ortega	Solanaceae		Byakur	Shrub	
98	<i>Solanum virginianum</i> L.	Solanaceae		Kanta kari	Shrub	
99	<i>Streblus asper</i> Lour.	Moraceae		Sheora	Shrub	
100	<i>Strophanthus wallichii</i> Decne.	Apocynaceae			Shrub	
101	<i>Styrax serrulatus</i> Roxb.	Styraceae		Silver bell	Shrub	
102	<i>Tabernaemontana corymbosa</i> Roxb. ex Wall.	Apocynaceae		Tagar	Shrub	
103	<i>Tabernaemontana recurvata</i> Roxb.	Apocynaceae		Tagar	Shrub	
104	<i>Uraria rufesens</i> (DC.) Schind.	Fabaceae			Shrub	
105	<i>Vitex trifolia</i> L. f.	Verbenaceae		Chotonishinda	Shrub	
106	<i>Woodfordia fruticosa</i> (L.) Kurz	Lythraceae		Dhatri-phul	Shrub	
107	<i>Ziziphus funiculosa</i> Buch. -Ham. ex Lawson	Rhamnaceae			Shrub	
108	<i>Ziziphus oenoplia</i> (L.) Mill.	Rhamnaceae		Kankra	Shrub	
109	<i>Trevesia palmata</i> (Roxb.) Vis.	Araliaceae			Shrub	
Tree						
1	<i>Acacia auriculiformis</i> A. Cunn. ex Benth. & Hook. *	Mimosaceae		Akashmoni	Tree	LC
2	<i>Acacia mangium</i> Willd. *	Mimosaceae		Belgium	Tree	LC

3	<i>Haldina cordifolia</i> Hook. f. ex Brandis	Rubiaceae		Dakrum	Tree	CD
4	<i>Aegle marmelos</i> (L.) Corr. *	Rutaceae		Bel	Tree	LC
5	<i>Albizia lucidior</i> (Steud.) Nielsen	Mimosaceae		Sil-koroi	Tree	VU
6	<i>Albizia procera</i> (Roxb.) Benth.	Mimosaceae		Silkoroi	Tree	LC
7	<i>Alstonia scholaris</i> L.	Apocynaceae		Chatim	Tree	LC
8	<i>Anacardium occidentale</i> L. *	Anacardiaceae		Kaju badam	Tree	LC
9	<i>Anisoptera scaphula</i> (Roxb.) Pierre	Dipterocarpaceae		Boilum	Tree	CD
10	<i>Annona reticulata</i> L. *	Annonaceae		Ata	Tree	LC
11	<i>Anogeissus acuminata</i> (Roxb. ex DC.) Guill. & Perr.	Combretaceae		Itchri, Kasoi	Tree	DD
12	<i>Aphanamixis polystachya</i> (Wall.) R. N. Parker	Meliaceae		Pitraj	Tree	LC
13	<i>Aporosa dioica</i> (Roxb.) Muell.-Arg.	Euphorbiaceae		Patakharolla	Tree	NE
14	<i>Aquilaria agallocha</i> Roxb. *	Thymeliaceae		Agar	Tree	LC
15	<i>Areca catechu</i> L. *	Arecaceae		Supari	Tree	LC
16	<i>Artocarpus chaplasha</i> Roxb.	Moraceae		Chapalish	Tree	NE
17	<i>Artocarpus heterophyllus</i> Lamk. *	Moraceae		Kanthal	Tree	LC
18	<i>Averrhoa bilimbi</i> L. *	Oxalidaceae		Bilimbi	Tree	LC
19	<i>Averrhoa carambola</i> L. *	Oxalidaceae		Kamranga	Tree	LC
20	<i>Avicennia alba</i> Blume	Verbenaceae		Sada baen	Tree	LC
21	<i>Avicennia marima</i> (Forssk.) Vierh.	Verbenaceae		Moricha baen	Tree	LC
22	<i>Avicennia officinalis</i> L.	Verbenaceae		Kala baen	Tree	LC
23	<i>Azadirachta indica</i> A. Juss. *	Meliaceae		Neem	Tree	LC
24	<i>Bambusa balcooa</i> Roxb.	Poaceae		barak bash	Tree	LC
25	<i>Bambusa polymorpha</i> Munro	Poaceae		Parua bash	Tree	NE
26	<i>Bambusa tulda</i> Roxb.	Poaceae		Mitinga bash	Tree	LC
27	<i>Barringtonia acutangula</i> (L.) Gaertn.	Lecythidaceae		Hizol	Tree	LC
28	<i>Bombax ceiba</i> L.	Bombacaceae		Shimul	Tree	LC
29	<i>Bombax insigne</i> Wall.	Bombacaceae		Bonshimul	Tree	NE
30	<i>Borassus flabellifer</i> L. *	Arecaceae		Tal	Tree	LC
31	<i>Brownlowia elata</i> Roxb.	Tiliaceae		Moos, Massjot	Tree	VU
32	<i>Bruguiera gymnorhiza</i> (L.) Lamk.	Rhizophoraceae		Goran	Tree	LC
33	<i>Butea monosperma</i> (Lamk.) Taub.	Fabaceae		Polash	Tree	LC
34	<i>Caesalpinia pulcherrima</i> (L.) Swartz. *	Caesalpiniaceae		Radhachura	Tree	LC
35	<i>Callicarpa arborea</i> Roxb.	Verbenaceae		Bormala	Tree	LC
36	<i>Callicarpa macrophylla</i> Vahl	Verbenaceae		Bormala	Tree	DD
37	<i>Calophyllum polyanthum</i> Wall. ex Choisy	Clusiaceae		Keroli	Tree	VU
38	<i>Carica papaya</i> L. *	Caricaceae		Pepe	Tree	LC
39	<i>Cassia fistula</i> L.	Caesalpiniaceae		Sonalu	Tree	LC

40	<i>Castanopsis tribuloides</i> (Smith) A. DC.	Fagaceae		Hingra	Tree	VU
41	<i>Casuarina equisetifolia</i> Forst.	Casuarinaceae		Jau	Tree	LC
42	<i>Ceiba pentandra</i> (L.) Gaertn.	Bombacaceae		Tula	Tree	LC
43	<i>Ceriops decandra</i> (Griff.) Ding Hou	Rhizophoraceae		Khemo	Tree	
44	<i>Chukrasia tabularis</i> A. Juss.	Meliaceae		Chikrasi	Tree	
45	<i>Cinnamomum iners</i> Reinw. ex Blume	Lauraceae		Tejmul	Tree	
46	<i>Citrus grandis</i> (L.) Osbeck *	Rutaceae		Jambura	Tree	
47	<i>Cocos nucifera</i> L. *	Arecaceae		Narikel	Tree	
48	<i>Crateva magna</i> (Lour.) DC.	Capparaceae		Borun	Tree	
49	<i>Dalbergia sissoo</i> Roxb.	Fabaceae			Tree	
50	<i>Dehaasia kurzii</i> King ex Hook. f.	Lauraceae		Modonmosta	Tree	
51	<i>Delonix regia</i> Rafin. *	Caesalpiniaceae		Krishnachura	Tree	
52	<i>Dichopsis polyantha</i> Benth.	Sapotaceae		Tali	Tree	
53	<i>Dillenia indica</i> L.	Dilleniaceae		Chalta	Tree	
54	<i>Dillenia pentagyna</i> Roxb.	Dilleniaceae		Hargenza	Tree	
55	<i>Dillenia scabrella</i> Roxb. ex Wall.	Dilleniaceae		Ekuish	Tree	
56	<i>Dipterocarpus alatus</i> Roxb. ex G. Don	Dipterocarpaceae		Dholi garjan	Tree	
57	<i>Dipterocarpus costatus</i> Gaertn.	Dipterocarpaceae		Sil garjan	Tree	
58	<i>Dipterocarpus gracilis</i> Blume	Dipterocarpaceae			Tree	
59	<i>Dipterocarpus turbinatus</i> Gaertn.	Dipterocarpaceae		Kaligarjan	Tree	
60	<i>Elaeocarpus floribundus</i> Blume	Elaeocarpaceae		Belphoi	Tree	
61	<i>Elaeocarpus robustus</i> Roxb.	Elaeocarpaceae		Jalpai	Tree	
62	<i>Endospermum chinense</i> Benth.	Euphorbiaceae			Tree	
63	<i>Engelhardtia spicata</i> Lesch. ex Blume	Juglandaceae		Jumka bhadi	Tree	
64	<i>Erythrina fusca</i> Lour.	Fabaceae		Mandar	Tree	
65	<i>Erythrina indica</i> Lamk.	Fabaceae		Mandar	Tree	
66	<i>Erythrina ovalifolia</i> Roxb.	Fabaceae		Mandar	Tree	
67	<i>Excoecaria agallocha</i> L.	Euphorbiaceae		Gewa	Tree	
68	<i>Ficus altissima</i> Blume	Moraceae		Bot	Tree	
69	<i>Ficus benghalensis</i> L.	Moraceae		Bot	Tree	
70	<i>Ficus benjamina</i> L.	Moraceae		Jir	Tree	
71	<i>Ficus racemosa</i> L.	Moraceae		Jagya dumar	Tree	
72	<i>Ficus rumphii</i> Blume	Moraceae			Tree	
73	<i>Ficus semicordata</i> Buch.-Ham. ex Smith	Moraceae		Chotochorkigu	Tree	
74	<i>Ficus virens</i> Ait.	Moraceae		Pakur	Tree	
75	<i>Garcinia cowa</i> Roxb. ex DC.	Clusiaceae		Kau phal	Tree	
76	<i>Garcinia xanthochymus</i> Hook. f. ex T. Anders.	Clusiaceae		Dayphal	Tree	
77	<i>Garuga floribunda</i> Decne. var. <i>gamblei</i> (King ex Smith) Kalkman	Burseraceae		Jongli jiga	Tree	
78	<i>Garuga pinnata</i> Roxb.	Burseraceae		Jeolbhadi	Tree	
79	<i>Gmelina arborea</i> Roxb.	Verbenaceae		Gamari	Tree	

80	<i>Heritiera fomes</i> Buch.-Ham.	Sterculiaceae		Sundari	Tree	
81	<i>Heterophragma adenophylla</i> (Wall. ex G. Don) Benth.	Bignoniaceae		Dakrum	Tree	
82	<i>Holigarna longifolia</i> Roxb.	Anacardiaceae		Barala	Tree	
83	<i>Hopea odorata</i> Roxb.	Dipterocarpaceae		Telsur	Tree	
84	<i>Hymenodictyon excelsum</i> (Roxb.) Wall.	Rubiaceae		Bhuikadam	Tree	
85	<i>Jatropha curcas</i> L.	Euphorbiaceae		Sadajeol	Tree	
86	<i>Lagerstroemia speciosa</i> (L.) Pers.	Lythraceae		Jarul	Tree	
87	<i>Lannea coromandelica</i> (Houtt.) Merr.	Anacardiaceae		Jiga	Tree	
88	<i>Leucaena leucocephala</i> (Lamk.) de Wit. *	Mimosaceae		Ipli-ipil	Tree	
89	<i>Limonia acidissima</i> L.	Rutaceae		Koethbel	Tree	
90	<i>Lithocarpus elegans</i> var. <i>elegans</i> (Blume) Hatus. ex Soepad.	Fagaceae		Barabatna	Tree	
91	<i>Litsea glutinosa</i> (Lour.) Robinson	Lauraceae		Menda	Tree	
92	<i>Litsea monopetala</i> (Roxb.) Pers.	Lauraceae		Kukuchita	Tree	
93	<i>Lophopetalum wightianum</i> Arn.	Celastraceae		Rokton	Tree	
94	<i>Mangifera indica</i> L.	Anacardiaceae		Aam	Tree	
95	<i>Mangifera sylvatica</i> Roxb.	Anacardiaceae		Uriam	Tree	
96	<i>Melia azedarach</i> L. *	Meliaceae		Ghura neem	Tree	
97	<i>Melocanna baccifera</i> (Roxb.) Kurz	Poaceae		Moli bash	Tree	
98	<i>Michelia champaca</i> L.	Magnoliaceae		Champa	Tree	
99	<i>Milium globosa</i> (DC.) G. Panigr. & Mishra	Annonaceae		Tasbi	Tree	
100	<i>Mitragyna rotundifolia</i> (Roxb.) O. Kuntze	Rubiaceae		Rang kat	Tree	
101	<i>Murraya koenigii</i> (L.) Spreng.	Rutaceae		Kamini	Tree	
103	<i>Neolamarckia cadamba</i> (Roxb.) Bosser	Rubiaceae		Kadam	Tree	
104	<i>Ormosia robusta</i> (Roxb.) Baker	Fabaceae		Hokkanali	Tree	
105	<i>Oroxylum indicum</i> (L.) Kurz	Bignoniaceae		Thona	Tree	
106	<i>Phoenix sylvestris</i> Roxb.	Arecaceae		Khejur	Tree	
107	<i>Phyllanthus emblica</i> L.	Euphorbiaceae		Amlaki	Tree	
108	<i>Phyllanthus niruri</i> L.	Euphorbiaceae		Bhuiamla	Tree	
109	<i>Pithecellobium angulatum</i> Benth.	Mimosaceae		Kurmar	Tree	
110	<i>Pongamia pinnata</i> (L.) Pierre	Fabaceae			Tree	
111	<i>Protium serratum</i> (Wall. ex Coelbr.) EngL.	Burseraceae		Gutgutia	Tree	
112	<i>Pterospermum semisagittatum</i> Buch.-Ham. ex Roxb.	Sterculiaceae		Ban-assar	Tree	
113	<i>Quercus gomeziana</i> A. Camus	Fagaceae		Batna	Tree	
114	<i>Rhizophora mucronata</i> Poir.	Rhizophoraceae			Tree	
115	<i>Samanea saman</i> (Jacq.) Merr.	Mimosaceae		Randi korai	Tree	

116	<i>Sambucus canadensis</i> L.	Caprifoliaceae		Hoklati	Tree	
117	<i>Sapindus saponaria</i> L.	Sapindaceae		Ritha	Tree	
118	<i>Semecarpus anacardium</i> L.f.	Anacardiaceae		Bhela	Tree	
119	<i>Shorea robusta</i> Roxb. ex Gaertn. f.	Dipterocarpaceae		Sal	Tree	
120	<i>Sonneratia alba</i> J. Smith	Sonneratiaceae			Tree	
121	<i>Sonneratia apetala</i> Buch.-Ham.	Sonneratiaceae		Keora	Tree	
122	<i>Sonneratia caseolaris</i> (L.) Engl.	Solanaceae		Keora	Tree	
123	<i>Spondias pinnata</i> (L.f.) Kurz.	Anacardiaceae		Amra	Tree	
124	<i>Stephegyne parvifolia</i> Korth. auct. non Roxb.	Rubiaceae		Phulkadam	Tree	
125	<i>Sterculia foetida</i> L.	Sterculiaceae		Jongli badam	Tree	
126	<i>Sterculia villosa</i> Roxb. ex Smith	Sterculiaceae		Bsaket badam	Tree	
127	<i>Stereospermum personatum</i> (Hassk.) Chatterjee	Bignoniaceae			Tree	
128	<i>Suregada multiflora</i> (A. Juss.) Baill.	Euphorbiaceae		Maricha	Tree	
129	<i>Swietenia mahagoni</i> Jacq.	Meliaceae		Mehogoni	Tree	
130	<i>Swintonia floribunda</i> Griff.	Anacardiaceae		Civit	Tree	
131	<i>Syzygium balsameum</i> (Wight) Walp.	Myrtaceae		Bhutijam	Tree	
132	<i>Syzygium claviflorum</i> (Roxb.) A.M. Cowan & J.M. Cowan	Myrtaceae		Nalijam	Tree	
133	<i>Syzygium cumini</i> (L.) Skeels	Myrtaceae		Kalojam	Tree	
134	<i>Syzygium firmum</i> Thw.	Myrtaceae		Dhakijam	Tree	
135	<i>Syzygium formosum</i> (Wall.) Masamune	Myrtaceae		Panijam	Tree	
136	<i>Syzygium fruticosum</i> DC.	Myrtaceae		Bhutijam	Tree	
137	<i>Syzygium syzygioides</i> (Miq.) Merr. & L. M. Perry	Myrtaceae		Khaijam	Tree	
138	<i>Tamarindus indica</i> L.	Campanulaceae		Tentul	Tree	
139	<i>Tectona grandis</i> L. f. *	Verbenaceae		Segun	Tree	
140	<i>Terminalia arjuna</i> (Roxb. ex DC.) Wight & Arn. *	Combretaceae		Arjun	Tree	
141	<i>Terminalia bellirica</i> (Gaertn.) Roxb.	Combretaceae		Bohera	Tree	
142	<i>Terminalia catappa</i> L. *	Combretaceae		Katbadam	Tree	
143	<i>Terminalia chebula</i> Retz.	Combretaceae		Haritoki	Tree	
144	<i>Tetrameles nudiflora</i> R. Br.	Datisceae		Chundul	Tree	
145	<i>Toona ciliata</i> M. Roem.	Meliaceae		Toon	Tree	
146	<i>Trema orientalis</i> (L.) Blume	Ulmaceae		Gobar jiga	Tree	
147						
148	<i>Trewia nudiflora</i> L.	Euphorbiaceae		Pitali	Tree	
149	<i>Vitex altissima</i> L. f.	Verbenaceae		Monwal	Tree	
150	<i>Vitex glabrata</i> R. Br.	Verbenaceae		Ashal	Tree	
151	<i>Vitex peduncularis</i> Wall. ex Schauer	Verbenaceae		Horina	Tree	
152	<i>Walsura robusta</i> Roxb.	Meliaceae		Bonlichu	Tree	
153	<i>Xanthophyllum flavescens</i> Roxb.	Xanthophyllaceae		Gandi	Tree	
154	<i>Zanthoxylum rhesta</i> (Roxb.) DC.	Rutaceae		Bazna	Tree	

155	<i>Ziziphus mauritiana</i> Lamk. *	Rhamnaceae		Boroi	Tree	
-----	---------------------------------------	------------	--	-------	------	--



Figure 5.34 TWS supports remarkable number of flora and fauna in Teknaf peninsula

5.9.2 Homestead Plants

The presence of diversified tree species in the respondents' homestead around TWS was dominant with Aam, Narikel, Amra, Supari, Kanthal, Peyara, and Akashmoni. This indicated propensity towards fruit and cash crop as species for the home garden. But, the mean number of stems of these species per household was quite poor indicating the poor status of the homestead forest. About 52% of households had at least one tree species in their homesteads (Anon, 2020). Timber yielding and medicinal plants were found in the households (Table 5.17).

Table 5.17: Local and scientific name of plants recorded from the homesteads around TWS

SN	Local name	Scientific name
1	Aam	<i>Mangifera indica</i> L.
2	Akashmoni	<i>Acacia auriculiformis</i> A.Cunn ex Benth.
3	Amloki	<i>Phyllanthus emblica</i> L.
4	Amra	<i>Spondias pinnata</i> (L.f.) Kurz
5	Arjun	<i>Terminalia arjuna</i> (Roxb. ex DC.) Wight & Arn.
6	Arsol	<i>Vitex glabrata</i> R.Br.
7	Assargola	<i>Grewia nervosa</i> (Lour.) Panigrahi

SN	Local name	Scientific name
8	Ata	<i>Annona reticulata</i> L.
9	Baijja bansh	<i>Bambusa vulgaris</i> Schrad. ex Wendl.
10	Bakkumgola	<i>Garcinia lanceifolia</i> Roxb.
11	Bakul	<i>Mimusops elengi</i> L.
12	Bel	<i>Aegle marmelos</i> (L.) Corr.
13	Belumbo	<i>Averrhoa bilimbi</i> L.
14	Bet, Rattans	<i>Calamus</i> spp.
15	Bohera	<i>Terminalia bellirica</i> (Gaertn.) Roxb.
16	Booro Batna, Goorja Batna	<i>Lithocarpus elegans</i> var. <i>elegans</i> (Blume) Hatus. ex Soepad.
17	Boroi	<i>Ziziphus mauritiana</i> Lam.
18	Chalta	<i>Dillenia indica</i> L.
19	Chapalish	<i>Artocarpus chama</i> Buch.-Ham. ex Wall.
20	Dalim	<i>Punica granatum</i> L.
21	Gamar	<i>Gmelina arborea</i> Roxb.
22	Garjan	<i>Dipterocarpus alatus</i> Roxb. ex G. Don
23	Gutgutia	<i>Flacourtia jangomas</i> (Lour.) Raeusch.
24	Jalpai	<i>Elaeocarpus floribundus</i> Blume
25	Jambura	<i>Citrus maxima</i> (Burm.) Merr.
26	Jarul	<i>Lagerstroemia speciosa</i> (L.) Pers.
27	Kalajam	<i>Syzygium cumini</i> (L.) Skeels
28	Kanthal	<i>Artocarpus heterophyllus</i> Lamk.
29	Kola	<i>Musa paradisiaca</i> L.
30	Lebu	<i>Citrus aurantifolia</i> (Christm.) Swingle
31	Litchu	<i>Litchi chinensis</i> Sonn.
32	Mangium	<i>Acacia mangium</i> Willd.
33	Mehogoni	<i>Swietenia mahagoni</i> Jacq.
34	Minjiri	<i>Senna siamea</i> (Lam.) H.S. Irwin & Barneby
35	Muli bansh	<i>Melocanna baccifera</i> (Roxb.) Kurz
36	Narikel	<i>Cocos nucifera</i> L.
37	Neem	<i>Azadirachta indica</i> A. Juss.
38	Paan	<i>Piper betle</i> L.
39	Pepe	<i>Carica papaya</i> L.
40	Peyara	<i>Psidium guajava</i> L.
41	Putijam	<i>Syzygium fruticosum</i> (Roxb.) DC.
42	Raintree	<i>Samanea saman</i> (Jacq.) Merr.
43	Sada Koro	<i>Albizia procera</i> (Roxb.) Benth.
44	Sajna	<i>Moringa oleifera</i> Lam.
45	Supari	<i>Areca catechu</i> L.
46	Tal	<i>Borassus flabellifer</i> L.
47	Telsur	<i>Hopea odorata</i> Roxb.

5.9.3 Vegetable Cultivation

A total of 41% of households opined that they cultivated at least one vegetable in the last year while about 36% replied that they produce no vegetables (Table 5.18). A wide variety of vegetables had been produced in Nature and Life project area of CODEC in and around TWS (Anon 2020) by project beneficiaries. Major vegetables based on the percentage of cultivating households were bean, potato, sweet gourd, bottle gourd, lady's finger, red amaranth, tomato, green chili, eggplants, snake gourd, etc. (Table 5.18). Most of the vegetables are seasonal while some vegetables can grow year-round e.g. green chili, papaya, plantain, coriander, etc.

Table 5.18: List of vegetables cultivated by the beneficiary households

SN	Vegetable names	Scientific name	% of HH cultivating
1	Bean	<i>Lablab purpureus</i> (L.) Sweet	36.4
2	Potato	<i>Solanum tuberosum</i> L.	29.3
3	Sweet gourd	<i>Momordica cochinchinensis</i> (Lour.) Spreng.	28.3
4	Bottle gourd	<i>Lagenaria siceraria</i> (Molina) Standl.	25.6
5	Lady's finger	<i>Abelmoschus esculentus</i> (L.) Moench	25.3
6	Red amaranth	<i>Amaranthus cruentus</i> L.	23.9
7	Tomato	<i>Lycopersicon esculentum</i> Mill.	23.4
8	Year-round chili	<i>Capsicum annuum</i> L.	20.7
9	Egg plant	<i>Solanum melongena</i> L.	19
10	Snake gourd	<i>Trichosanthes anguina</i> L.	18.2
11	Indian spinach	<i>Basella alba</i> L.	15.7
12	Bitter gourd	<i>Momordica charantia</i> L.	13
13	Ridge Gourd	<i>Luffa acutangula</i> (L.) Roxb.	11.4
14	Spinach	<i>Spinacia oleracea</i> L.	10.3
15	Ash gourd	<i>Benincasa hispida</i> (Thunb.)	8.9
16	Gima kalmi	<i>Ipomoea aquatica</i> Forssk.	8.2
17	Stem amaranth	<i>Amaranthus cruentus</i> L.	8.1
18	Teasle gourd	<i>Momordica dioica</i> Roxb. ex Willd.	4.7
19	Papaya	<i>Carica papaya</i> L.	4.4
20	Cauliflower	<i>Brassica oleracea</i> var. <i>botrytis</i> L.	3.7
21	Plantain	<i>Musa paradisiaca</i> L.	3
22	Beet	<i>Beta vulgaris</i> L.	2.5
23	Coriander	<i>Coriandrum sativum</i> L.	2.5
24	Onion	<i>Allium cepa</i> L.	1.7
25	Cabbage	<i>Brassica oleracea</i> var. <i>capitata</i> L.	1.3
26	Pointed gourd	<i>Trichosanthes dioica</i> Roxb.	1
27	Carrot	<i>Daucus carota</i> subsp. <i>sativus</i> (Hoffm.) Arcang.	0.8
28	Turmeric	<i>Curcuma longa</i> L.	0.8
29	Garlic	<i>Allium sativum</i> L.	0.8
30	Elephant's foot	<i>Amorphophallus paeoniifolius</i> (Dennst.)	0.7
31	Mint leaves	<i>Mentha spicata</i> L.	0.7
32	Turnip	<i>Brassica rapa</i> L.	0.5

SN	Vegetable names	Scientific name	% of HH cultivating
33	Pulses	<i>Lens culinaris</i> Medik; <i>Pisum sativum</i> L.; <i>Lathyrus sativus</i> L.; <i>Cicer arietinum</i> L.	0.2
34	Other vegetables		2.9
35	Do not cultivate any vegetables		35.9







	
Bhutta (<i>Maize Spp.</i>) field after harvesting	Fallow Land with homestead plantation
	
Fallow Land beside Naf River	Fallow Land beside Naf River
	
<i>Eucalyptus</i> tree within homestead area	Bamboo (<i>Bambusa</i> sp.) species within homestead area

Figure 5.35 Plant species in different habitats within Study Area

5.9.4 Agricultural Crop Vegetation

The major agricultural crops of Teknaf district are rice, wheat, jute, pulse, vegetable, spice, etc. Among rice crops, *Aman* occupies the largest area followed by *Aus* and *Boro* varieties. The fruit crops are mango, jackfruit, banana and coconut. The crop which is very commonly grown and is very special of this district is betel nut. In field observation, the agricultural crops that are usually grown in the upazila include local aus, HYV rice, wheat, maize, vegetables, pulses, oilseeds, potato, tobacco, cotton, spices etc. Some horticultural crops like banana and mango are also grown.

The village homesteads are surrounded with a wide variety of trees, shrubs and thickets. Trees like haritaki (*Terminalia chebula*), kat badam (*Terminalia catappa*), arjuna (*Terminalia arjuna*), sheora (*Streblus asper*), teak (*Tectona grandis*), mahogany (*Swietenia macrophylla*) etc. are found along the roadside.

The common fruits found in Teknaf are coconut (*Cocos nucifera*), Papaya (*Carica papaya*) etc.

Cropping pattern in the area primarily includes rice during the monsoon season and maize/wheat during the dry season. The common cropping pattern in the area include B Aman, L. Aman, HYV Aman, L. Boro, HYV Boro, L Aus, HYV Aus, Potato, Wheat, Jute etc.

5.9.5 Road Side Plants

Strip Plantation program of Social Forest Department mainly coordinate the Highway roadside plantation. From the local consultation with the forest office it was indicated that a small scale of trees has been planted beside the roads.

Most common floral species within the project AOI are haritaki (*Terminalia chebula*), kat badam (*Terminalia catappa*), Arjuna (*Terminalia arjuna*),), teak (*Tectona grandis*), Akashmoni (*Acacia auriculiformis*) mahogany (*Swietenia macrophylla*) etc.



Figure 5.36 Road side plantation within study area

5.10 Faunal Diversity

5.10.1 Invertebrates, fish and fisheries

Invertebrates: Hot, humid evergreen forest environment with different habitat in the Teknaf Wildlife Sanctuary (TWS) make it a haven for the insect and butterflies. Butterfly diversity is very rich because of the large number of flowering plants along with dragonfly, damselfly, grasshopper, spider, beetle and bug. A total of 198 invertebrate species were recorded from TWS of which 70 species of butterfly, 25 species of dragon and damselflies fly and 10 species of grasshopper. Common butterflies are Jezebel, Yellow Pansy, Peacock Pansy, Grey Pansy, Striped Tiger, Common Leopard, Common Rose, Common Tit, Leopard Lacewing, Punchinello, Common Five Ring and Nigger (Nabi 2013). Very large sized, yellowish and sticky web of Giant wood spider are frequently found hanging inside the forest on the trail.

Fish Diversity at Teknaf peninsula: Fish resources at Teknaf peninsula are unique because of admixture of migratory and resident fish species. Forty-eight species of fin fish from three different habitats (estuarine, riverine and palustrine) were recorded (Nabi 2013) of which 60.4% are common and 10.4% are very rare. The inland fishes of Teknaf peninsula are represented as 28% from freshwater, 15.2% are esturine, 4.4% are marine and rest are found in all three habitats. Some of the important fishes in TWS are shown in Table 5.19.

Table 5.19 Fishes in TWS

No.	Local name	Scientific name	Status
1	Kukur jeeb	Paraplagusia bilineata	C*
2	Kukur jeeb	Cynoglossus cynoglossus	C
3	Kukur jeeb	Cynoglossus lingua	R
4	Kukur jeeb	Cynoglossus arel	C
5	Kumir khil	Microphis cunocalus	R
6	Kumir khil	Microphis chokderi	R
7	Kharu	Pisodonophis boro	VR
8	Kunche	Honopterus cuchia	VR
9	Shol	Channa striatus	C
10	Gajar, Gajal	Channa marulius	R
11	Taki, Chaitan	Channa punctatus	R
12	Gachua, Cheng	Channa orientalis	VR
13	Loitta, Nehari	Harpodon nehereus	VC
14	Fulchela	Salmostoma phulo	C
15	Darkina, Darka	Esomus danricus	C
16	Darkina	Rasbora daniconius	C
17	Anju	Danio rerio	VR
18	Phutani punti	Puntius phutunio	VR
19	Magur	Clarias batrachus	C
20	Boal	Wallago attu	C
21	Shingi, Shing	Heteropneustes fossilis	C
22	Shilong	Silonia silondia	C
23	Nuna-tengra, Guillya	Mystus gulio	VC
24	Kata	Arias nenga	VC
25	Gagla, Ghagra	Arias gagora	VC
26	Phasa	Setipinna phasa	C

27	Baim, Sal baim	Mastacembelus armatus	R
28	Guchi, Baim	Mastacembelus pancaalus	R
29	Rup chanda	Parastromateus niger	C
30	Rup chanda	Pampus chinensis	C
31	Tapasi, Rishi	Polynemus paradiseus	C
32	Bhangan bata	Mugil cephalus	C
33	Bata	Liza subviridis	C
34	Bata, Parse	Liza parsia	C
35	Chewa, Chiringi	Pseudapocryptes lanceolatus	C
36	Dahuk	Periophthalmus koelreuteri	C
37	Dahuk	Periophthalmodon schlosseri	VC
38	Bele, Bailla	Glossogobius giurus	VC
39	Mur bailla	Platycephalus indicus	C
40	Tular dandi	Sillaginopsis panijus	C
41	Poa	Acanthopagrus latus	C
42	Poma	Otolithoides pama	C
43	Cuja bola	Macrospinosa cuja	C
44	Koitor, poa	Johnius coitor	C
45	Taka chanda	Leiognathus equulus	C
46	Kamla chanda	Leiognathus bindus	C
47	bhetki, Korai	Lates calcarifer	VC
48	Sea Koi	Terapon jarbua	

*- C=Common, R=Rare, VR=Very Rare, VC= Very Common



Figure 5.37 Fish species found within the project area

5.10.2 Mammals

Teknaf Wildlife Sanctuary (TWS) is one of the largest and richest Protected Areas in the southeastern part of the country. The Sanctuary supports more than half of the mammalian species country till 1990s (Rashid et al. 1990). Some of the mammals (Asiatic Wild Dog, Binturong, Hoolock Gibbon, Goyal, Samber Deer, Leopard) are locally extinct from this sanctuary during the last three decades (Feeroz 2013). At present a total of 43

mammalian species are recorded in this sanctuary, of which 15 species are carnivores, 9 species of rodents, 6 species of bats and 4 species of primates (Table 5.20). Among these species, 30% are metaturnal, 26% are nocturnal, 23% are crepuscular, and 21% are diurnal.

Table 5.20. Mammals recorded from TWS areas (*- VC- Very Common, C- Common, R- Rare, VR- Very Rare, D- Diurnal, N- Nocturnal, Cre- Crepuscular, M- Metaturnal)

No.	Local name	Scientific name	Status & Active Period
1	Chika	<i>Suncus murinus</i>	R, N *
2	Gecho sucho	<i>Tupaia glis</i>	VR, D
3	Bocha Kola Badur	<i>Cynopterus sphinx</i>	R, N
4	Daini Badur	<i>Megaderma lyra</i>	R, N
5	Chamchika	<i>Rhinolophus lepidus</i>	R, N
6	Khudey Chamchika	<i>Pipistrellus coromandra</i>	C, N
7	Boro Rongila Chamchika	<i>Scotophilus heathii</i>	R, N
8	Lojjawati Banor	<i>Nycticebus bengalensis</i>	R, N
9	Banor	<i>Macaca mulatta</i>	VC, D
10	Lomba leji Banor	<i>Macaca fascicularis</i>	VR, D
11	Mukhpora Hanuman	<i>Trachypithecus pileatus</i>	VC, D
12	Pati Shial	<i>Canis aureus</i>	C, M
13	Ram Kutta	<i>Cuon alpinus</i>	R, M
14	Khek Shial	<i>Vulpes bengalensis</i>	R, M
15	Ban Biral	<i>Felis chaus</i>	R, Cr
16	Chita Biral	<i>Felis bengalensis</i>	R, Cre
17	Mechho Bagh	<i>Felis viverrina</i>	R, Cre
18	Sonali Biral	<i>Pardofelis temminckii</i>	R, Cre
19	Goaf-wala benji	<i>Herpestes urva</i>	R, Cre
20	Benji	<i>Herpestes auropunctatus</i>	C, D
21	Bara Beji	<i>Herpestes edwardsii</i>	C, D
22	Bhodor	<i>Lutra perspicillata</i>	R, M
23	Gor-khodok	<i>Arctonyx collaris</i>	R, N
24	Gandho Gokul	<i>Paradoxurus hermaphroditus</i>	VR, Cre
25	Bagdash	<i>Viverra zibetha</i>	C, Cre
26	Gandho Gokul	<i>Viverricula indica</i>	R, Cre
27	Gandho Gokul	<i>Paguma larvata</i>	R, Cre
28	Buno Shukar	<i>Sus scrofa</i>	R, M
29	Hati	<i>Elephas maximus</i>	R, M
30	Maya Harin	<i>Muntiacus muntjak</i>	R, D
31	Banrui	<i>Manis pentadactyla</i>	R, N
32	Badami Kathbirali	<i>Callosciurus pygerythrus</i>	VC, D
33	Kamlapet Katbirali	<i>Dremomys lokriah</i>	C,D

TWS was previously known as “Elephant Reserve” because of its luxurious elephant habitat, resident elephants’ population and was established as “Game Reserve” specially for their protection. Around hundred elephants including a migratory herd of 30 were recorded in Cox’s Bazar South Forest Division (Rashid et al. 1990). IUCN (2004) estimated 30-35 elephants in Cox’s Bazar South Forest Division. Three herds of elephant comprising a population of 20 individuals regularly forage between the different beat areas inside the Teknaf WS and raid nearby crop fields (Feeroz 2013). Netong hill and Baharchara are the famous sites for elephant sighting in TWS.



Figure 5.38 Asian Elephant, the keystone mammals of Teknaf Wildlife Sanctuary

5.10.3 Birds

Once TWS was very rich in avian diversity and density due its unique and diverse ecosystem where the hill forests meet the sea. The major avian habitats now exist in TWS include patches of mixed evergreen forests, bamboo groves, bush and grassy areas in hills, together with barren lands and sand dunes. A total of 243 species of bird was recorded from TWS which is about one-third of the total bird species of Bangladesh (Khan 2013). This includes a total of 183 (75%) resident and 60 (25%) migratory species, whereas 110 (45%) passerine and 133 (55%) non-passerine species.

The richness of bird species in the sanctuary is not only for the various types of vegetation and food, but also because of the altitudinal gradient that exist in the area. However, the sanctuary supports a total of nine nationally threatened species of bird (IUCN 2000), viz. Kalij Pheasant (*Lophura leucomelanos*), Oriental Pied Hornbill (*Anthracoceros albirostris*), Red-headed Trogon (*Harpactes erythrocephalus*), Dollarbird (*Eurystomus orientalis*), Spot-bellied Eagle Owl (*Bubo nipalensis*), Brown Fish Owl (*Ketupa zeylonensis*), White-bellied Sea Eagle (*Haliaeetus leucogaster*), Malayan Night Heron (*Gorsachius melanolophus*) and Streaked Spiderhunter (*Arachnothera magna*). Presence of these species needs conservation initiatives for protecting this sanctuary from further degradation, so that the threatened species that still exist in the area can get

enough food, shelter and nesting facilities. Some of the resident birds out of 183 species in TWS are shown in Table 5.21 (Khan 2013).

Table 5.21 Some resident birds available in TWS

No.	Local name	Scientific name	Status
1	Bon Morog/Murgi	<i>Gallus gallus</i>	C
2	Mothura	<i>Lophura leucomelanos</i>	VR
3	Pakra Kaththokra	<i>Dendrocopos macei</i>	C
4	Kaththokra	<i>Dinopium benghalense</i>	C
5	Basanta Bauri	<i>Megalaima asiatica</i>	C
6	Gurkhod/Beghbou	<i>Megalaima lineata</i>	C
7	Kao Dhanesh	<i>Anthracoceros albirostris</i>	VR
8	Hudhud/ Solaiman Pakhi	<i>Upupa epops</i>	C
9	Nilkantha	<i>Coracias benghalensis</i>	C
10	Choto Machh-ranga	<i>Alcedo atthis</i>	C
11	Pakra Machh-ranga	<i>Ceryle rudis</i>	
12	Suichora/Banspati	<i>Merops orientalis</i>	C
13	Neel-lej Suichora	<i>Merops Philippinus</i>	VR
14	Bau-kotha-kou	<i>Cuculus micropterus</i>	R
15	Kokil/Kuli	<i>Eudynamys scolopacea</i>	C
16	Fingey-Papiya	<i>Surniculus lugubris</i>	VR
17	Tia	<i>Psittacula krameri</i>	R
18	Ababil	<i>Apus affinis</i>	C
19	Laxmi Pencha	<i>Tyto alba</i>	R
20	Bhutum Pencha	<i>Ketupa zeylonensis</i>	R
21	Choto Nimpecha	<i>Otus sunia</i>	R
22	Sabuj Ghughu	<i>Chalcophaps indica</i>	R
23	Tila Ghughu	<i>Streptopelia chinensis</i>	VC
24	Lal Ghughu/Jongla Ghughu	<i>Streptopelia tranquebarica</i>	C
25	Horial/Horikol	<i>Treron bicincta</i>	VR
26	Horial/Botkol	<i>Treron phoenicoptera</i>	R
27	Dahuk	<i>Amaurornis phoenicurus</i>	C
28	Kura	<i>Gallicrex cinerea</i>	VR
29	Lal-lotika/Hot-ti-ti	<i>Vanellus indicus</i>	C
30	Tila Baj/Shapkheko Baj	<i>Spilornis cheela</i>	C
31	Bhubon Cheel	<i>Milvus migrans</i>	R
32	Pata Bulbuli	<i>Chloropsis aurifrons</i>	C
33	Holdey Pakhi	<i>Oriolus xanthornus</i>	C
34	Pata Bulbuli	<i>Chloropsis aurifrons</i>	C
35	Sabuj Bulbuli	<i>Chloropsis cochinchinensis</i>	R
36	Nil Pori	<i>Irena puella</i>	R
37	Panti Kak/ Kawa	<i>Corvus splendens</i>	C
38	Choto Fingey	<i>Dicrurus aeneus</i>	C
39	Jhuti Shalik	<i>Acridotheres fuscus</i>	VC
40	Moyna	<i>Gracula religiosa</i>	C



Figure 5.39 Avifauna found within the study area

In addition to resident birds, 60 migratory bird species are recorded from TWS. Some of the species are shown in Table 5.22.

Table 5.22 Migratory birds recorded from TWS (Khan 2013)

No.	Local name	Scientific name	Status
1	Metho Kaththokra	<i>Jynx torquilla</i>	VR
2	Kada-khucha/Chaga	<i>Gallinago gallinago</i>	C
3	Pati Batan	<i>Actitis hypoleucos</i>	C
4	Bon Batan	<i>Tringa glareola</i>	R
5	Shobuj Batan	<i>Tringa ochropus</i>	C
6	Terek Batan	<i>Xenus cinereus</i>	C
7	Lal Nuribatan	<i>Arenaria interpres</i>	C
8	Sonali Batan	<i>Pluvialis fulva</i>	C
9	Rupali Batan	<i>Pluvialis squatarola</i>	R
10	Choto Chaha	<i>Calidris minuta</i>	C
11	Balu Chaha	<i>Calidris alba</i>	C
12	Lal Noth	<i>Calidris canutus</i>	R
13	Choto Nothjiria	<i>Charadrius dubius</i>	C
14	Choto Gulinda	<i>Numenius phaeopus</i>	C
15	Lalpa	<i>Tringa totanus</i>	C
16	Sabujpa	<i>Tringa nebularia</i>	C
17	Kalomatha Gangchil	<i>Larus ridibundus</i>	VC
18	Pallaser Gangchil	<i>Larus ichthyaetus</i>	VC
19	Pati Panchil	<i>Sterna albifrons</i>	VC
20	Nodi Panchil	<i>Sterna aurantia</i>	C
21	Choto Bhimraj	<i>Dicrurus remifer</i>	R
22	Lalbook Chotok	<i>Ficedula albicilla</i>	C
23	Badami Koshai Pakhi	<i>Lanius cristatus</i>	VC
24	Jolpaipith Tulika	<i>Anthus hodgsoni</i>	C
25	Dhani Tulika	<i>Anthus hodgsoni</i>	C

5.10.4 Reptiles

A total of 54 species of reptiles are reported from TWS, of which 29 species are snakes, 20 species lizards and 5 species are turtles and tortoise (Hasan et al. 2013). Thirty species of reptiles (56%) are rare while 18 species (33%) are common. Preferred habitats of reptiles in TWS are, i) Forest floor and leaf litters, ii) Tree branches, tree holes and bushes, iii) Marshy grass lands, iv) Seasonal and permanent stagnant water bodies, v) Cultivated lands, and vi) Water creeks (chara). Status of reptiles in TWS are shown in Table 5.23 (Hasan et al. 2013).

Table 5.23 Reptiles recorded from TWS (*- VC-Very Common, C- Common, R- Rare)

No.	Local name	Scientific name	Status *
1	Halud Pahari Kasim	<i>Indotestudo elongata</i>	R
2	Shundi Kasim	<i>Lissemys punctata</i>	C
3	Pata Kachim	<i>Cyclermys oldhami</i>	R
4	Yellow turtle	<i>Morenia petersi</i>	R
5	Kori	<i>Pangshura tectum</i>	C
6	Tiktiki	<i>Hemidactylus frenatus</i>	VC
7	Tiktiki	<i>Hemidactylus brookii</i>	C
8	Tiktiki	<i>Hemidactylus brookii</i>	C
9	Chapta-leji Tiktiki	<i>Hemidactylus platyurus</i>	C
10	Tokkhak	<i>Gekko gekko</i>	VC
11	Gecko	<i>Cyrtodactylus ayeyarwadyensis</i>	R
12	Rokto-chusha	<i>Calotes versicolor</i>	VC
13	Rokto-chusha	<i>Calotes emma</i>	C
14	Nil-gola Girgiti	<i>Ptyctolaemus gularis</i>	R
15	Uranta Tiktiki	<i>Draco maculatus</i>	R
16	Anjon	<i>Mabuya multifasciata</i>	R
17	Anjoni/Anjon	<i>Eutropis macularia</i>	VC
18	Anjon	<i>Mabuya multifasciata</i>	R
19	Chiti-bon Anjoni	<i>Sphenomorphus maculatus</i>	C
20	Lizard	<i>Takydromus khasiensis</i>	R
21	Anjon	<i>Scincella reevesi</i>	R
22	Anjon	<i>Lygosoma punctata</i>	R
23	Anjon	<i>Lygosoma bowringii</i>	R
24	Gui Shap	<i>Varanus bengalensis</i>	C
25	Sona Gui	<i>Varanus flavescens</i>	R
26	Dumukha Shap	<i>Typhlops diardii</i>	R
27	Dumukha Shap	<i>Ramphotyphlops braminus</i>	C
28	Ajogar	<i>Python molurus</i>	R
29	Laodoga Shap	<i>Ahaetulla nasuta</i>	C
30	Laodoga Shap	<i>Ahaetulla prasina</i>	R
31	Khoiri Phonimonosha	<i>Boiga ochracea</i>	R
32	Sabuj Phonimonosha	<i>Boiga cyanea</i>	R
33	Dora Shap	<i>Amphiesma stolatum</i>	C
34	Kalnagini	<i>Chrysopelea ornata</i>	R
35	Rangila Gecho Shap	<i>Dendrelaphis pictus</i>	C
36	Badami Gechho Shap	<i>Dendrelaphis tristis</i>	R
37	Daraj	<i>Coluber mucosus</i>	C

38	Daraj	<i>Ptyas korros</i>	R
39	Dudhraj	<i>Coelognathus helenus</i>	R
40	Paina Shap	<i>Enhydris enhydris</i>	VC
41	--	<i>Oligodon dorsalis</i>	R
42	--	<i>Oligodon taeniolatus</i>	R
43	Gharginni Shap	<i>Lycodon aulicus</i>	C
44	Dhora Shap	<i>Xenochrophis piscator</i>	VC
45	Laldhora Shap	<i>Rhabdophis subminiatus</i>	R
46	--	<i>Psammodynastes pulverulentus</i>	R
47	Shankhini Shap	<i>Bungarus fasciatus</i>	C
48	Kal Keotey	<i>Bungarus caeruleus</i>	R
49	Kal Keotey	<i>Bungarus niger</i>	R
50	Khoia Gokhra Shap	<i>Naja naja</i>	C
51	Gokhra Shap	<i>Naja kaouthia</i>	C
52	Raj Gokhra	<i>Ophiophagus hannah</i>	R
53	Viper Shap	<i>Trimeresurus erythrurus</i>	R
54	Sobuj-bora	<i>Trimeresurus albolabris</i>	R

TWS supports a good number of reptiles, but destruction and alteration of their habitats and breeding grounds poses a huge threat to their survival. Most of the hills are barren and some are covered with bushy jungles without any big trees.

5.10.5 Amphibians

A total of 27 amphibian species were recorded from TWS, of which 12 were rare, 6 were common, and 9 were very common (Hasan and Akhtar, 2023). TWS provides diverse habitats for amphibians, e.g. i) Forest floor and leaf litters, ii) Tree branches and bushes, iii) Marshy grass land, iv) Seasonal and permanent stagnant water, v) Cultivated land, and vi) Water creek (chara). Local and scientific name and status of amphibians of TWS are shown in Table 5.24 (Hasan and Akhtar, 2013).

Table 5.24 Amphibians recorded from TWS (*- VC-Very Common, C- Common, R- Rare)

No.	Local name	Scientific name	Status *
1	Kuno Bang	<i>Duttaphrynus melanostictus</i>	VC
2	Jhi-jhi Bang	<i>Fejervarya pierrei</i>	VC
3	Jhi-jhi Bang	<i>Fejervarya asmatai</i>	VC
4	Jhi-jhi Bang	<i>Fejervarya frithi</i>	VC
5	Jhi-jhi Bang	<i>Fejervarya nepalensis</i>	VC
6	Jhi-jhi Bang	<i>Fejervarya syhadrensis</i>	VC
7	Kotkoti Bang	<i>Euphlyctis cyanophlyctis</i>	VC
8	--	<i>Occidozyga lima</i>	R
9	--	<i>Occidozyga borealis</i>	R
10	Sona Bang	<i>Hoplobatrachus tigerinus</i>	C
11	Murgi Daka Bang	<i>Hylarana leptoglossa</i>	C
12	Pana Bang	<i>Hylarana taipehensis</i>	C
13	--	<i>Humerana humeralis</i>	C
14	Soru-matha Bang	<i>Clinotarsus alticola</i>	R
15	Lal-laubichi Bang	<i>Microhyla rubra</i>	R

16	Laubichi Bang	<i>Microhyla ornata</i>	VC
17	Boro laubichi Bang	<i>Microhyla berdmorei</i>	VC
18	Venpu Bang	<i>Kaloula pulchra</i>	R
19	Holde Chokha Bang	<i>Leptobranchium smithi</i>	R
20	Mukut Bang	<i>Xenophrys parva</i>	R
21	Gechho Bang	<i>Polypedates maculatus</i>	R
22	Dorakata Gechho Bang	<i>Polypedates leucomystax</i>	VC
23	---	<i>Chiromantis vittatus</i>	C
24	Choto Gecho Bang	<i>Chiromantis simus</i>	R
25	---	<i>Philautus cf. parvulus</i>	R
26	---	<i>Philautus cf. silongensis</i>	R
27	---	<i>Rhacophorus bipunctata</i>	R

5.10.6 FGD, KII

FGD's, and KII's with the local people (Fig 5.38).



Figure 5.40 Consultation and FGD's with local stakeholder

Species were recorded from boat to boat survey, FGD's, and consultation with Upazila fisheries office. From them, one (1) species are categorized as Critically Endangered (*Bagarius bagarius*), seven (7) species are categorized as Endangered (*Clupisoma garua*, *Crossocheilus latius*, *Mastacembelus armatus*, *Notopterus chitala*, *Ompok pabda*, *Pangasius pangasius*, *Rita rita*) and four (4) (*Notopterus notopterus*, *Puntius ticto*, *Sperata aor*, *Wallago attu*) species are categorized as Vulnerable as per the Bangladesh Red List 2015. However, no Critically Endangered or endangered fish species were reported from the aquatic environments within the site.

The village ponds within the site are reportedly used for fish culture, which is consumed by the villagers. No commercial fish culture was identified at the village ponds. Common species reported from the fish ponds include *Labeo rohita*, *Clarias batrachus*, *Cyprinus carpio*, *Heteropneustes fossilis*, *Hypopthalmichthys molitrix* etc.



Gutum (*Lepidocephalichthys annandalei*)



Gutum (*Lepidocephalichthys guntea*)



Rui (*Labeo rohita*)



Carpio (*Cyprinus carpio*)



Figure 5.41 Fish Species Found Within the Project Area

5.10.7 Protected Areas

There is one protected area situated within the study area (TWS). An Ecologically Critical Area (ECA) is an environmental protection zone in Bangladesh. In 1995, specific areas in Bangladesh could be said Ecologically Critical Areas as a result of the Environmental Conservation Act. The proposed project area doesn't fall in any IBAs.

6. STAKEHOLDER ENGAGEMENT

A stakeholder is defined as “an individual, group, or organization, who may be affected by, or perceive itself to be affected by a decision, activity, or outcome of a project”.

“Stakeholder Analysis” is the process of sorting identified stakeholder groups according to their impact on the project and the impact the project will have on them. This information is then used to assess the manner in which the interests of the stakeholders or projects impact on them should be addressed in the project development plan or its operation. This section of the report describes the stakeholder engagement process undertaken as part of the EIA.

6.1 Scope and Specific Objectives

The broad objective of the stakeholder engagement and involvement process is to provide authorities, as well as interested and affected stakeholders with the opportunity to identify issues, concerns, and opportunities regarding the proposed project and to address key stakeholder concerns during the preparation of the EIA for the project. Specific objectives for stakeholder consultations are as follows;

- + To address relevant issues including those perceived as being important by other sectoral agencies, public bodies, local communities, affected groups and others;
- + To improve information flows between proponents and different stakeholders, improving understanding of a project;
- + To identify important environmental and social characteristics or mitigation opportunities;
- + To ensure that the magnitude and significance of impacts has been assessed properly; and
- + Improves the acceptability and quality of mitigation and monitoring process.

6.2 Identification of Stakeholders

The stakeholder identification is one of the most important processes throughout the project life cycle and documenting relevant information regarding their interests in the project, independencies, influence, and potential impact on the project. Stakeholder vary in O. Creeds’s of degree of interest, influence and control they have over the project. While those stakeholders who have a direct impact on, or are directly impacted by the project are known as **Primary Stakeholders**, those who have an indirect impact or are indirectly impacted are known as **Secondary Stakeholders**. Identification of stakeholder was carried out by O. CREEDS in discussion with CUET. Keeping in mind the nature of the project and its setting, the stakeholders have been identified and listed in the table presented below:

Table 6.1 List of Key Stakeholders

Sl. No.	Stakeholder Group/Category	Key Stakeholders	Description of the Stakeholder Profile
Primary Stakeholders			
1	Government Authority Responsible for Environmental and Forest Protection	<ul style="list-style-type: none"> + District Forest Office (DFO)Local Administration + Department of Environment (DOE) 	<ul style="list-style-type: none"> + Department of Environment is a government department responsible for the protection of the environment in Bangladesh. The department is headed by a director general. It is under the Ministry of Environment, Forest and Climate Change. + The Forest Department is a government agency responsible for the

Sl. No.	Stakeholder Group/Category	Key Stakeholders	Description of the Stakeholder Profile
			protection and maintenance of forests and wildlife in Bangladesh.
2	Project Affected Persons (PAPs)	<ul style="list-style-type: none"> ✚ Impacted Land Users ✚ Impacted Land Owners ✚ Impacted Rent Collector ✚ Vulnerable households 	<ul style="list-style-type: none"> ✚ This stakeholder group comprises of the Project Affected Households (PAHs) and Project Affected Persons (PAPs) who owned land inside the project footprint and those along the tower footprint. ✚ The PAPs also comprises of land users who are residing and carrying out cultivation inside the project footprint and the Right of Way (RoW) of tower.
3	Institutional Stakeholders	<ul style="list-style-type: none"> ✚ Religious Authorities associated with Mosque ✚ Local Administration- Union Parishad and Mouza ✚ Regulatory Authorities 	<ul style="list-style-type: none"> ✚ This stakeholder group includes the management authorities of the mosques located inside the project footprint. ✚ This stakeholder group comprises of regulatory authorities at the district, state and national level that are responsible for various pERM its and licenses pertaining to the Project.
4	Other Primary Stakeholders	<ul style="list-style-type: none"> ✚ EPC contractor 	<ul style="list-style-type: none"> ✚ This stakeholder group i.e. BSSE, is the Special Purpose Vehicle (SPV) that has been incorporated for the project. They are responsible for ensuring the effective implementation of the RAP and that the affected person are properly compensated and impacts are mitigated
Secondary Stakeholders			
5	Local Community	<ul style="list-style-type: none"> ✚ Local community residing near the project footprint ✚ Agricultural Labourers ✚ Vulnerable Community 	<ul style="list-style-type: none"> ✚ This stakeholder group comprises of the community residing near the vicinity of the project area. ✚ This group is expect to be indirectly impacted by the Project activities but may be indirectly impacted.
6	Institutional Stakeholders	<ul style="list-style-type: none"> ✚ Land and Revenue Department ✚ Survey Department ✚ Relief and Rehabilitation Department ✚ Irrigation Department ✚ Agriculture Department ✚ Fisheries Department ✚ Forest Department 	<ul style="list-style-type: none"> ✚ This stakeholder groups comprises of expert on different sector for providing inputs and information which are crucial for designing the resettlement site, and livelihood restoration measures ✚ These groups of stakeholders will serves as support system for technical guidance and collaborative agency while implementing the RAP
7	Other secondary stakeholder	<ul style="list-style-type: none"> ✚ Local NGOs ✚ Land Aggregators 	
8	Project Financing Agencies/ Institutions	<ul style="list-style-type: none"> ✚ Financers and Investors 	<ul style="list-style-type: none"> ✚ This stakeholder group includes International Finance Corporation (IFC) and other investors who are evaluating

Sl. No.	Stakeholder Group/Category	Key Stakeholders	Description of the Stakeholder Profile
			a potential investment opportunity into the Project.

6.2.1 Stakeholder Mapping

Stakeholder Mapping is a process of examining the relative influence that different individuals and groups have over a project as well as the influence of the project over them. The purpose of a stakeholder mapping is to:

- ✚ Study the profile of the stakeholders identified and the nature of the stakes;
- ✚ Understand each group's specific issues, concerns as well as expectations from the project that each group retains;
- ✚ Gauge their influence on the project.

Based on this understanding, the stakeholders are categorized into High Influence/ Priority, Medium Influence/ Priority and Low Influence/ Priority. The stakeholders who are categorized as high influence are those who have a high influence over the project or are likely to be heavily impacted by the project activities, and are thus high up on the project proponent's priority list for engagement and consultation.

Similarly, the stakeholders categorized as medium influence are those who have a moderate influence over the project or even though they are to be impacted by the project, it is unlikely to be substantial and these stakeholders are thus neither high nor low in the project proponent's list for engagement. On the other hand, the stakeholders with low influences are those who have a minimal influence on the decision-making process or are to be minimally impacted by the project and are thus low in the project proponent's engagement list.

6.2.1.1 Approach & Methodology for Stakeholder Mapping and Analysis

The approach adopted for mapping and analysing involves mapping of the key stakeholders (directly and indirectly) and assessing their significance, influence and impact on the project. The methodology adopted is described below:

The significance of a stakeholder group is categorized considering the magnitude of impact (type, extent, duration, scale, frequency) or degree of influence (power, proximity) of a stakeholder group and urgency/likelihood of the impact/influence associated with the particular stakeholder group in the project context. The magnitude of stakeholder impact/influence is assessed taking the power/responsibility of the stakeholder group and is categorized as negligible, small, medium and large. The urgency or likelihood of the impact on/influence by the stakeholder is assessed in a scale of low, medium and high. The overall significance of the stakeholder group is assessed as per the matrix provided in **Table 6.2** below:

Table 6.2 Stakeholder Mapping Matrix

		Sensitivity /Vulnerability / Important Resource / Receptor		
		Low	Medium	High
Magnitude of Impact	Negligible	Negligible	Negligible	Negligible
	Small	Negligible	Minor	Moderate
	Medium	Minor	Moderate	Urgent
	Large	Moderate	Urgent	Urgent

The following section provides brief profiles of the various stakeholders in the project as discussed in the previous sub section along with their degree of influence. The details are provided in **Table 6.3** below.

Table 6.3 Stakeholder Mapping and Analysis

Stakeholder Category	Stakeholder Group	Magnitude of Impact/ Influence	Stakeholder Significance
Primary Stakeholder			
Community	Project Affected Families and People	Impact of Project on Stakeholder: Large Influence of Stakeholder on Project: Medium	Urgent
	Vulnerable Groups including women, elderly	Impact of Project on Stakeholder: Large Influence of Stakeholder on Project: Low	Urgent
Government Bodies	Responsible for Environmental and Forest Protection	Impact of Project on Stakeholder: Small Influence of Stakeholder on Project: High	Urgent
Other Groups	EPC contractors and sub-contractors	Impact of Project on Stakeholder: Medium Influence of Stakeholder on Project: High	Urgent
Secondary Stakeholder			
Community	Local Community and Union Parishad	Impact of Project on Stakeholder: Large Influence of Stakeholder on Project: Medium	Urgent
Local Government Authorities	Relief and Rehabilitation Department	Impact of Project on Stakeholder: Small Influence of Stakeholder on Project: High	Moderate
	Irrigation Department	Impact of Project on Stakeholder: Small Influence of Stakeholder on Project: High	Moderate
	Agriculture Department	Impact of Project on Stakeholder: Small Influence of Stakeholder on Project: High	Moderate
	Fisheries Department	Impact of Project on Stakeholder: Small Influence of Stakeholder on Project: High	Moderate
	Power Grid Company of Bangladesh	Impact of Project on Stakeholder: Small Influence of Stakeholder on Project: High	Moderate
	Forest Department	Impact of Project on Stakeholder: Small Influence of Stakeholder on Project: High	Moderate
Institutional Stakeholders	Project Financing Agencies	Impact of Project on Stakeholder: Large Influence of Stakeholder on Project: High	Urgent
Other Groups	Local Political Groups	Impact of Project on Stakeholder: Medium Influence of Stakeholder on Project: High	Moderate
	Media	Impact of Project on Stakeholder: Small Influence of Stakeholder on Project: High	Moderate
	NGOs/CSOs operating in the area	Impact of Project on Stakeholder: Small Influence of Stakeholder on Project: High	Moderate

The stakeholder engagement plan prepared for the project, as part of the RAP provides an understanding of the engagement activities undertaken thus far and the key feedback received from the same.

6.3 Summary of Engagement Activities

6.3.1 Engagement of Government officials

O.CREEDS was carrying out a KII with Cox's Bazar's District Forest Office (DFO) and the Department of Environment (DOE). Both departments have opinions about the meeting point of the wild elephant and its century-old roads. For this reason, the officials demanded to visit the project site. They properly learned about the project and received a copy of the map. Their comments regarding the projects are given below:

Govt. Authority: DOE (Department of Environment)

Name of the Key Personnel: Azharul Islam (AD)

Comments:

- ▶ DOE representatives want to visit the project location.
- ▶ AD further stated that he would be unable to visit the site without a hard copy of the new and previous feasibility study and EIA report.
- ▶ A letter of authorization for a field visit from the DOE's Dhaka headquarters is needed.
- ▶ He desires that both the client team and the consultant team be present on the site during the site visit.



Figure 6.1 KII with the AD (DOE)

Govt. Authority: DFO (District Forest Office)

Name of the Key Personnel: Monirul Islam (Asst. Forest Officer)

Comments:

- ▶ Officials of DFO want to visit the site along with the consultant team and the client team.
- ▶ There is a location where wild elephants meet, as well as a corridor where other species unite, according to AFO.
- ▶ He stated that the client must send a letter to the CCF (Chief Conservator of Forests), who will instruct district officers to conduct a site inspection.
- ▶ A new feasibility study is required to determine whether the meeting point would be disrupted by the following development.



Figure 6.2 KII with the AFO (DFO)

CUET has undertaken various engagement activities with the key stakeholder groups identified. This section provides a summary of the key engagement activities undertaken as part of the following project stages:

- ✚ Project Land Take process
- ✚ Rapid Environmental and Social Screening for the project
- ✚ Engagement as part of the EIA and RAP process
- ✚ Ongoing Engagement as part of the larger resettlement process

The following subsections provide a summary of the engagement activities.

6.3.2 Engagement as part of the Land procurement process

The land procurement process involved iterative rounds of consultations and negotiations with the landowners on their willingness to sell the land, an option to consider land swap and the land price. These negotiations were undertaken in phases, as discussed in Table 2.3, starting June/July 2014. The process of engagement with the landowners for the tower footprint and RoW was undertaken in 2019. Once the engagement was completed, consent letters were signed with the landowners.

According to the information available, it is understood that as part of the negotiation process, the landowners were provided an overview of the proposed project and change in land use that would occur from the same. The engagement activities were primarily led by the local land aggregators and RREL representatives. From the side of the landowners, most of the negotiations are understood to have been carried out through their land managers. The land take process was undertaken through a willing buyer willing seller arrangement, with the involvement of the government departments restricted to the identification of the landowners in keeping with the land records and processing of the Baina agreement and sale agreements.

It is understood that the engagement at this stage of the project was primarily restricted to the negotiations with the landowners. While the land users and rent collectors were aware of a potential land transaction and project proposed, the details of the same were not available with them. 20 ECB did not undertake any specific engagement activities with the land users and rent collectors during this phase.

Some of the key engagement activities undertaken as part of the land procurement process is presented in Table 6.4 below.

Table 6.4 Summary of Engagement Activities

Date	Settlement	Purpose of Meeting
21/10/2019	Baish Pukur	✚ Introduction of New Resettlement Manager
23/10/2019	Baish Pukur	✚ Getting community's perception on the project, their future concerns and scope related to the project ✚ Concerns of the community regarding issues such as heat generation, uncertainty surrounding resettlement and livelihood
26/10/2019	Baish Pukur	✚ Discussion on the need for a resettlement committee ✚ Concerns regarding the resettlement issues ✚ Grievance Redressal mechanism
06/11/ 2019	Baish Pukur	✚ Establishing the resettlement committee Discussion on the following aspects ✚ Function of the committee ✚ Placement of suggestion boxes ✚ Preparatory works to be undertaken by CUET ✚ Issues surrounding construction of new structures post land purchase ✚ Presence of youth clubs in the area ✚ The ongoing Resettlement Planning

6.3.3 Appointment of a Resettlement Manager

CUET appointed a resettlement manager for the site in September 2019. The role of the resettlement manager is to undertake focused engagement activities with the local community and impacted land users, develop relations with the same, oversee, and facilitate the implementation of the Resettlement process. From the information available, it is understood that this resettlement manager has undertaken multiple rounds of meetings and discussions with the stakeholders involved and the same have been documented in the form of minutes of meetings. The resettlement manager originally appointed was replaced in October 2019. The present resettlement manager is undertaking meetings and discussions with each individual household in the project footprint area in order to develop a more direct relationship with these stakeholders.

6.3.4 Establishing a Resettlement Committee

As part of the ongoing resettlement planning, CUET established a Teknaf Resettlement Committee (RRC). The RRC is led by the local community under ECB's facilitation and/or overall participation and it comprises of the following members:

- ✚ CUET's representatives (including its local partner);
- ✚ Representatives from the Union Parishads;
- ✚ Representatives of project affected villages within the new pucca road; and
- ✚ Any other key informants and any community-based associations or organizations that may be recommended by project affected villages.

The Committee was formed at the Project site on October 26, 2019 in the presence of the known Project Affected Households (PAHs). The NRC will consist of a general committee that will

include representatives of all PAHs (one member selected from each households). A sub-committee of five PAHs representatives will be formed as the Execution Committee and a sub-committee that will comprise of six members where 3 of them are Local representatives (UP Chairman, ruling party members and businessman) and 3 from the PAHs will be formed as the Advisory Committee.

The five-member Execution Committee will have members that are nominated by the PAHs and will be responsible for overall coordination, communication, management and organization of all the activities associated to the resettlement. The six Advisory Committee members and the Committee will act as mediators if and when the general and executive committees will not be able to find amicable solutions.

Going forward CUET aims to broaden the RRC to ensure overall representation with regards to the aspects of gender, vulnerable groups, type of impacted entities. The RRC has already been asked to propose women candidates for inclusion in the committee. According to information from the executive committee members, there are two vulnerable households (a widow and an elderly headed households) who are connected with the other PAHs represented in the committee. The Resettlement Manager will finalize the strategy of representation after completion of his introductory household level consultations.

The RRC will thereafter be convened weekly (sometimes it may even without CUET's representatives) to discuss resettlement and livelihood restoration options and ongoing land access challenges and solutions. Each RRC meeting will be documented formally through minutes, signatures and photographs and a summary may also be printed and posted at every village. The records of meetings and next action points of RRC meetings will be maintained by the Resettlement Manager.

7. IMPACT ASSESSMENT AND MITIGATION MEASURES

7.1 Introduction

This section assesses the manner in which the project will interact with elements of the physical, ecological, social, cultural or human environment to produce impacts to resources/receptors. This has been organized as per the various stages of the project lifecycle to understand the risks and impacts associated with each of these individual stages.

The environmental and social impacts due to the project activities are considered in the two distinct stages of the project life cycle: (a) construction of the road (Construction Phase); and (b) operation and maintenance of the road (Operation Phase).

Impacts are identified and predicted based on the analysis of the information collected from the following:

- + Project information (as outlined in **Section** Section 2;
- + Baseline information (as outlined in Section Section 5.).

The identification of likely impacts during construction and operation phases has been carried out based on likely activities having their impact on environmental and socio-economic parameters, which are presented in **Section Error! Reference source not found.** The details of the activities and their impacts have been worked out in the following sections.

7.2 Impact Assessment Methodology and Approach

Impact identification and assessment starts with scoping and continues through the remainder of the impact assessment process (IAP). The principal impact assessment (IA) steps are summarized in **Section 0**.

7.2.1 Prediction of impacts

Prediction of impacts is essentially an objective exercise to O.Creeds in what could potentially happen to the environment as a consequence of the project and its associated activities. This is essentially a repeat of the process undertaken in scoping, whereby the potential interactions between the project and the baseline environment are identified. From these potential interactions, the potential impacts to the various resources/receptors are identified, and are elaborated to the extent possible. The diverse range of potential impacts considered in the IA process typically results in a wide range of prediction methods being used including quantitative, semi-quantitative and qualitative techniques. The nature and types of impacts that has been addressed in this EIA is defined in the **Box** below.

Box: Nature and types impacts considered for impact assessment

➤ Negative , when impact is considered to represent adverse change from the baseline or to have introduced a new undesirable factor; and
➤ Positive or beneficial , when impact is considered to represent improvement to baseline or to have introduced a new desirable factor.
➤ Direct , impacts that result from a direct interaction between the project and a resource/receptor
➤ Indirect , impacts that follow on from the direct interactions between the project and its environment as a result of subsequent interactions within the environment; and
➤ Induced , impacts that result from other activities (which are not part of the project) that happen as a consequence of the project

7.2.2 Evaluation of impacts

In assessing the significance of impact, the following impact characteristics are taken into consideration.

7.2.2.1 Determining magnitude of an impact

Magnitude, i.e. severity of an impact or degree of change caused by a project activity is a function of one or more of the following characteristics:

- ✚ **Scale:** Degree of damage that may be caused to the environmental components concerned.
- ✚ **Extent:** The extent refers to spatial or geographical extent of impact due to proposed project and related activities.
- ✚ **Duration:** The temporal scale of the impact in O. Creeds's of how long it is expected to last.

Criteria have been defined for each of these key elements and classified based on the level of impacts (low, medium and high) on the environmental component, presented in **Table 7.1** below:

Table 7.1 Magnitude Prediction Criteria

Impact Elements	Criteria	Ranking
Scale	Irreversible damage to natural environment and/or difficult or may not to revert back to earlier stage with mitigation; Major changes in comparison to baseline conditions and / or likely to regularly or continually exceed the standard;	High
	Reversible damage to natural environment but likely to easily revert back to earlier stage with mitigation; Perceptible change from baseline conditions but well within acceptable norms.	Medium
	Effect is within the normal range of natural variation; No perceptible or readily measurable change from baseline conditions;	Low
Extent	Study area and beyond study area	National
	Project site & study area (5.0 km from CUET site)	Regional
	Project site & its immediate vicinity (0.5 km from CUET site)	Local
Duration	Spread beyond the lifecycle of the project	Long
	Spread across several phases of the project lifecycle	Medium
	Only during particular activities or phase of the project lifecycle	Short

Definitions of magnitude for physical, biological and human environmental resources or receptors are defined subsequently:

Table 7.2 Magnitude Definitions for Physical, Biological & Human Resources/ Receptors

Magnitude Definitions	Biophysical and Environmental Receptors	Socio-economic, Cultural and Community Health Receptors
Negligible	Immeasurable, undetectable or within the range of normal natural variation	Change remains within the range commonly experienced within the household or community.
Small	Slight changes in background levels well within accepted norms. Emissions/ Discharges are well within benchmark discharge limits. The effected environmental conditions are expected to be recovered within a few months	Perceptible difference from baseline conditions. Tendency is that impact is local, rare and affects a small proportion of households and is of a short duration.
Medium	Temporary or localised change in physical or biological environment. The recovery of such changes returning to background levels thereafter and / or Occasional exceedance of benchmark emission/ discharge limits	Clearly evident difference from baseline conditions. Tendency is that impact affects a substantial area or number of people and/or is of medium duration. Frequency may be occasional and impact may be regional in scale.
Large	Change over a large area or ecological conditions that lasts over the course of several months with quality likely to cause secondary impacts; and / or routine exceedance of benchmark emission/ effluent discharge limits	Change dominates over baseline conditions. Affects the majority of the area or population in the Area of Influence and/or persists over many years. The impact may be experienced over a regional or national area.
Positive	In the case of positive impacts, no magnitude is assigned, unless there is ample data to support a more robust characterization. It is usually sufficient to indicate that the Project will result in a positive impact, without characterizing the exact degree of positive change likely to occur.	

Note: In the case of impacts resulting from unplanned events, the same resource/ receptor-specific approach to concluding a magnitude designation was followed, but the 'likelihood' factor was considered, together with the other impact characteristics, when assigning a magnitude designation.

7.2.2.2 Determining Sensitivity/ Importance/ Vulnerability of Receptor

In addition to characterising the magnitude of impact, the other principal step necessary to assign significance for an impact is to define the sensitivity/ vulnerability/ importance of the impacted resources/ receptor. There are a range of factors to be taken into account when defining the sensitivity/ vulnerability/ importance of the resource/ receptor, which may be physical, biological, cultural or human as per the following understanding:

- Where the resource is physical (for example, fresh water body) its quality, sensitivity to change and importance (on a local, regional, national importance) are considered.

- ✚ Where the resources/ receptor is biological or cultural (for example, wildlife habitat), its importance (for example local, regional or national importance) and its sensitivity to the specific type of impact are considered.
- ✚ Where the receptor is human, the vulnerability of the individual, community or wider societal group is considered.

Definition as defined in **Table 7.3** has been adopted to O.Creeds define sensitivity/ importance/ vulnerability of environmental resources or receptor.

Table 7.3 Sensitivity/Importance/ Vulnerability Criteria

Sensitivity Criteria	Contributing Criteria
High	Existing physical environment quality is already under stress; Ecologically sensitive/ protected area, provides habitat for globally protected species; Profound or multiple levels of vulnerability that under O.Creeds ability to adapt to changes brought by the project. Human receptors/ vulnerable community are located within the project footprint and directly affected by the project
Medium	Existing physical environment quality shows some sign of stress; which is sensitive to change in quality or physical disturbance; Natural habitat provides habitat for wildlife, which are protected under National regulations; Some, but few areas of vulnerability; still retaining an ability to at least in part adapt to change brought by the project. Human receptors/ vulnerable community are located adjacent the project site and likely to be affected by the project
Low	Existing physical environment quality is good; Modified habitat provides habitat for common species; Human receptors are located away and are not likely to be affected due to the project related activities

Determining sensitivity/importance/ vulnerability of environmental resource or receptor are defined as follows:

Table 7.4 Definitions of Sensitivity/Importance /Vulnerability Biophysical and Human

Sensitivity	Biophysical and Environmental Receptors	Socio-economic, Cultural and Community Health Receptors
Low	Existing physical environment quality is good and the ecological resources that it supports are not sensitive to disturbance	Minimal vulnerability; consequently with a high ability to adapt to changes brought by the Project and opportunities associated with it.
Medium	Existing physical environment quality shows some signs of stress and/ or supports ecological resources that could be sensitive to change in quality or physical disturbance.	Some, but few areas of vulnerability; still retaining an ability to at least in part adapt to change brought by the Project and opportunities associated with it.
High	Physical environment quality is already under stress and/ or the ecological resources it supports are very sensitive to change	Profound or multiple levels of vulnerability that undO.Creeds ine the ability to adapt to changes brought by the Project and opportunities associated with it.

Evaluating Significance of Impacts

Once magnitude of impact and sensitivity/ vulnerability/ importance of resource/ receptor have been characterized, the significance was assigned for each impact. Impact significance is designated using the matrix shown in *Error! Reference source not found.*

Table 7.5 Assessing Significance of Impact due to Proposed Project

		Sensitivity/Vulnerability/ Important Resource/Receptor		
		Low	Medium	High
Magnitude of Impact	Small	Negligible	Minor	Moderate
	Medium	Minor	Moderate	Major
	Large	Moderate	Major	Major

The matrix applies universally to all resources/receptors, and all impacts to these resources/receptors, as the resource/receptor-specific considerations are factored into the assignment of magnitude and sensitivity/vulnerability/ importance designations that enter into the matrix. **Table 7.6** provides a context for what the various impact significance ratings signify.

Table 7.6 Categorization of Impact Significance

Impact Category	Description of Impact Significance		
	Biophysical and Environmental Receptors	Social and Cultural Receptors	Community Health
Positive	Positive impacts provide resources or receptors, most often people, with positive benefits. The concepts of equity have been considered in assessing the overall positive nature of some impacts such as economic benefits, or opportunities for employment, improvement in infrastructure and overall development of region		
Negligible	An impact of negligible significance is one where a resource/ receptor (including people) will essentially not be affected in any way by a particular activity or the predicted effect is deemed to be 'imperceptible' or is indistinguishable from natural background variations	Inconvenience caused, but with no consequences to livelihoods, culture or quality of life.	Receptors may experience annoyance, minor irritation, or stress associated with change; minimal impact to perceived quality of life. Does not require treatment. No long-term consequences for the health of individuals and the community.
Minor	An impact of minor significance is one where a resource/ receptor will experience a noticeable effect, but the impact magnitude is sufficiently small and/or the resource/receptor is of low sensitivity/ vulnerability/ importance. In either case, the magnitude should be well within applicable standards/ guidelines	Impacts are short term and temporary and do not result in long term reductions in livelihood or quality of life.	Temporary reduction to health status of certain individuals that can be easily treated and does not result in long term consequences for community health. Impacts may lead to greater health inequalities in Project area.
Moderate	An impact of moderate significance has an impact magnitude that is within applicable standards/guidelines, but falls somewhere in the range from a threshold below which the impact is minor, up to a level that might be just short of breaching a legal limit. The emphasis for moderate impacts is on demonstrating that the impact has been reduced to a level that is as low as reasonably practicable (ALARP).	Adverse impacts that notably affect livelihood or quality of life at household and community level. Impacts can mainly be reversed but some households may suffer long-term effects.	High risk of diseases or injuries as well as exposure to Project operational risks to the local community. May result in long term but reversible community health impacts.
Major	An impact of major significance is one where an accepted limit or standard may be exceeded, or large magnitude impacts occur to highly valued/sensitive	Diverse primary and secondary impacts that will be impossible to reverse or	Loss of life, severe injuries or chronic illness requiring hospitalization. Exposure to and incidence of diseases not

Impact Category	Description of Impact Significance		
	Biophysical and Environmental Receptors	Social and Cultural Receptors	Community Health
	resource/receptors. An aim of Impact assessment is to get to a position where the Project does not have any major residual impacts, certainly not ones that would endure into the long or extend over a large area. However, for some aspects there may be major residual impacts after all practicable mitigation options have been exhausted (i.e. ALARP has been applied).	compensate for, possibly leading to long impoverishment, or societal breakdown.	commonly seen previously in the area. Likely to have long- consequences for community health.

7.2.2.3 Residual Impact Evaluation

Once mitigation and enhancement measures are declared, the next step in the IA Process is to assign residual impact significance. This is essentially a repeat of the impact assessment steps discussed above, considering the assumed implementation of the additional declared mitigation and enhancement measures.

7.2.3 Identification of mitigation and enhancement measures

Once the significance of an impact has been characterized, the next step is to evaluate what mitigation and enhancement measures are warranted. For the purposes of this IA, study team has adopted the following Mitigation Hierarchy:

- ✚ **Avoid at Source;** Reduce at Source: avoiding or reducing at source through the design of the project.
- ✚ **Abate on Site:** add something to the design to abate the impact.
- ✚ **Abate at Receptor:** if an impact cannot be abated on-site then control measures can be implemented off-site.
- ✚ **Repair or Remedy:** some impacts involve unavoidable damage to a resource and these impacts can be addressed through repair, restoration or reinstatement measures.
- ✚ **Compensate in Kind, compensate through other means:** where other mitigation approaches are not possible or fully effective, then compensation for loss, damage and disturbance might be appropriate.

The priority in mitigation is to first apply mitigation measures to the source of the impact (i.e., to avoid or reduce the magnitude of the impact from the associated Project activity), and then to address the resultant effect to the resource/receptor via abatement or compensatory measures or offsets (i.e., to reduce the significance of the effect once all reasonably practicable mitigations have been applied to reduce the impact magnitude).

7.2.4 Management and monitoring

The final stage in the IA Process is definition of the management and monitoring measures that are needed to identify whether:

- a) impacts or their associated project components remain in conformance with applicable standards; and
- b) Mitigation measures are effectively addressing impacts and compensatory measures and offsets are reducing effects to the extent predicted.

An Environmental Management Plan(EMP), which is a summary of all actions which the Project Proponent has committed to executing with respect to environmental/social/health performance for the project, is also included as part of the EIA report. The Environmental Management Plan (EMP) includes mitigation measures, compensatory measures and offsets and management and monitoring activities.

7.3 Environmental Impacts:

7.3.1 Impact on Land Use

For the assessment of land use change, the sensitivity and magnitude criteria outlined in **Table 7.1** and **Table 7.3** respectively has been used.

7.3.1.1 Additional Mitigation Measures

- ✚ In keeping with this assessment, the project has commissioned the development of a Resettlement Action Plan (RAP) and associated Resettlement Policy Framework (RPF). This RAP will provide a detailed assessment of the impacts of physical and economic displacement and identify suitable mitigation measures/entitlements for the same.
- ✚ In addition to the alternative housing and agricultural land, the project will provide allowances in terms of transition allowances, shifting allowances, food security allowances flood security allowance etc. as part of the RAP entitlements
- ✚ For those PAHs who elect to the option of self-relocation, provide compensation for the impacted immovable assets at replacement cost, without deducting the depreciation value, as provided in the RAP;
- ✚ The project will also provide additional livelihood restoration measures to mitigate the impacts due to reduction in land holdings through the Livelihood Restoration Plan for the project;
- ✚ Grant preference to the PAHs for direct/indirect project employment opportunities
- ✚ Identify and provide additional social and livelihood support to especially vulnerable families.
- ✚ The SEP and GRM for the project will be applicable to the land owners and users impacted

7.3.1.2 Residual Impact Significance

The residual impact significance will remain **major** as changes in land use will be for long term for majority of the project component (installation of cable car stations, access roads, central monitoring station etc.)

Table 7.7 Categorization of Residual Impact

Impact	Changes in Land use during construction					
	Impact Nature	Negative		Positive		Neutral
Impact Type	Direct		Indirect		Induced	
Impact Duration	Temporary	Short-term	Long-term		Permanent	
Impact Extent	Local		Regional		International	
Impact Scale	High		Medium		Low	
Impact Magnitude	Positive	Negligible	Small	Medium	Large	
Resource /Receptor Sensitivity	Low		Medium		High	
Impact Significance	Negligible		Minor		Moderate	Major
	Significance of impact is considered major .					
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large	
Residual Impact Significance	Negligible		Minor		Moderate	Major
	Significance of impact is considered major					

7.3.2 Impact on Natural Resources

7.3.2.1 Source of Impact

The project's land take will result in the loss of access to natural resources, such as water bodies associated with homestead area, timber trees, fodder and other non-timber trees, and common resources such as River and Stream

- As part of the resettlement site, the RPF and the LRP is considering the existing settlement profile in O. Creeds's of enabling access to alternative resources at the resettlement site. Based on the information to be obtained from the Land and Asset Inventory survey, the resettlement site will consider the option of minimum loss to natural resources, and/or partial access to current resource locations.

7.3.2.2 Embedded/In-built Controls

- ✚ As part of the resettlement site, the project proposes to consider all options at the resettlement site, including continued access to the current resources, partially, and proportionate replacement of few resources, which can be reproduced at the site.

7.3.2.3 Significance of Impact

The impact from the project to the natural resources will be is of the change in the land use of the area from agricultural to non-agricultural land use. Due to the nature of the project, the project development will require the clearing of the existing trees in the area and the filling of the existing water bodies. The project will also result in a change in the drainage patterns in the area; due to the creation of flood protection measures and limiting the water flow within the project area.

Many houses inside the project footprint have tress such as fruit trees like Mango, jackfruit, timber trees like Banana and Coconut are mainly used for consumption, as firewood and for house construction. Discussion with the affected community reported that each household has a backyard with a minimum a three to four trees, which is sufficient for family consumption. As per consultation on an average, every household inside the project footprint owned a minimum of 20-30 bamboo trees and is majorly used for making the cattle shed, bamboo baskets like "Kabu", paddy storage called "Dali", for making birds houses and fish traps etc. It has also been observed that bamboo is also used to make decorative house roofs. This skill set of using bamboo is traditional. However, the skill is not passed down to women. This type of skill set is restricted to men.

Dependence on River resources along the study area is mainly for fishing along the Naf River and extraction of sand mining. Fishing along the River is carried out during post winter and pre summer i.e falgun, *Chaitra* (Feb and March) summer season i.e *Boishakh* (April) season. These reported to be the good season for fishing. No fishing carried out during Monsoon season. Fishing carried out two times in a day from 10 PM to 7 AM and from 10 AM to 1 PM. The travel 3 -5 km from the shoreline towards the Naf River for fishing. Fishing along the Naf is mainly for income source.

Fishing by community in the project site are mainly done in small-scale in the pukur near to their households.

According to the households surveyed, the sand collected from Naf River is used in construction of houses. Consultation with the local community in Naturapara, Dolmundi, reported that the community extracts sand from the nearby River bodies mainly for house construction.

The sensitivity of the receptor is assessed as major. Thus, the overall significance of impact is assessed as **Major**.

7.3.2.4 Additional Mitigation Measures

The following additional mitigation measures have been identified for the project:

- ✚ The RAP will provide additional entitlements in terms of support during the transition phase to supplement the loss of access to natural resources for the first 1-2 years, while the new resources are generated and become productive.
- ✚ The project will also allow the land users and owners to harvest the standing crops and trees in the project land
- ✚ The crops, trees and pুকurs and other natural resources impacted will be compensated at replacement value

7.3.2.5 Residual Impact Significance

The residual impact significance will remain major.

Impact	Impact on Natural resources				
Impact Nature	Negative		Positive		Neutral
Impact Type	Direct		Indirect		Induced
Impact Duration	Temporary	Short-term	Long-term		Permanent
Impact Extent	Local		Regional		International
Impact Scale	High		Medium		Low
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource /Receptor Sensitivity	Low		Medium		High
Impact Significance	Negligible		Minor	Moderate	Major
	Significance of impact is considered Major				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible		Minor	Moderate	Major
	Significance of impact is considered Major				

7.3.3 Impact on Topography and Drainage

Criteria

For the purpose of assessment of impacts on topography and drainage of the area, sensitivity and magnitude criteria have been outlined in **Table 7.1** and **Table 7.3** respectively.

Source of Impact

Time series analysis of water level and discharge of Naf River from 1962 to 2018 revealed that the annual maximum discharges vary between 1286 to 7960 m³/s. The existing road along the right bank of the Naf River acts as an embankment and restricts the floodwater to enter the project area for 2500 m³/s flow. Modelling study conducted as part of the Hydrological study (June 2019) indicates that for the flow of 2700 m³/sec and above, floodwater spills over the road and inundates the flood plain. Therefore, the proposed project area is vulnerable to flood. Moreover, in case of any breaching of the road the project area will be flooded even at 2500 m³/s of flow.

Flood protection embankment of height 2 to 5 m (based on topography) will be built surrounding the site. Some portion of the site viz. roads, buildings, transformer platforms and substation areas will be raised by 1-2 metres which may impact the local drainage pattern in the area.

Receptor Sensitivity

The project area exhibits mostly hilly topography. Naf River passes close to the site (approximately 0.7 km at the eastern side) (refer **Section 5.6.2**). From discussion with local community it was understood that site (before site development) and the neighbouring agricultural land parcels reported poor drainage. The area is also reported to be landslide prone. Hence, receptor sensitivity has been assessed to be **medium**.

Impact Magnitude

The proposed project area is located in the flood area of the Naf River. Main course of Naf River flows within the study area from northwest to south east at a nearest distance of approximately 0.7 km east of the project site. A natural stream (offshoot from the Naf River) passes through eastern portion of the Site. This stream is seasonal and carries water during rainy season. Another first order stream passes through the western portion of the Site. However, much of the stream has been encroached by farmers for crop cultivation. Local residents did not report any flooding and/or inundation within this channel. There are about 20 village ponds within the project site. The surface runoff from the site and its adjacent area drains into the natural stream (offshoot from the Naf River) and finally into main Naf River. The site was within the active water channel of Naf River, however, due to shifting of the course of the River towards east the site is not within the active channel currently. As part of the project only roads, buildings and cable car stations and sub-station will be elevated between 1 to 2 meters. Flood Protection embankment will be built around the site with an elevation between 2 and 5 meters, depending on the topography.

Building of the embankment and raising of part of the site for site and road development may impact the microdrainage pattern in the area. There are local drainage channels passing through the eastern and western portions of the site. If the courses of the channels are blocked it may cause waterlogging at the eastern and western sides of the site. Moreover, there are about 20 village ponds within the proposed site. Site development during construction will result in filling of the ponds and levelling of the site. The village ponds receive the surface runoff from the site and store them. Filling of the ponds may result in waterlogging within the site and surrounding areas. The impact magnitude has therefore been assessed as **Medium**.

Embedded/In-built Control

The BEZA contractor will be instructed to avoid any unnecessary changes in the topography. Water bodies and micro drainage channel should be particularly avoided when constructing access roads or planning the transmission line pathway.

Proper cross drainage structures will be provided so that the embankment surrounding the site do not block the drainage channels.

Significance of Impact

Distributaries of Naf River passing through the Site along north-eastern portion of the Site. Eastern portion of the Site is particularly prone to water logging as observed during field visit. There is also a channel passing through the western portion of the site. Construction of embankment surrounding the site may impact the microdrainage pattern in the area. However, the microdrainage in the area could be maintained by building of cross drainage structures and the scale of the impact would be medium. The extent of the impact would be local i.e. within project site and immediate vicinity and duration is long term. Significance of impact is assessed to be **Moderate**.

Additional Mitigation Measures

- ✚ Measures to be taken to retain the courses of the streams at the eastern and western sides of the site

- ✚ A perimeter drain to be provided so that natural flow to the areas surrounding the site is maintained
- ✚ Appropriate cross drainage channels should be provided to maintain the drainage in the area.
- ✚ Cross drainage structures should be provided as necessary during widening and construction of access road to the site.
- ✚ It is assumed that there is no obstruction in the south side of the project area; and floodwater around the project area may flow back into the Naf River uninterruptedly. Therefore, it should be monitored that no road/obstruction is constructed in the south side of the project without proper provision for passing of flood water.
- ✚ Due to the construction of the embankment, there is a possibility of drainage congestion inside the project area, hence, adequate drainage facilities to be provided.
- ✚ Protect the proposed resettlement area and assets at the Site from potential surges in water level and changes in water course in main channel of Naf River ;
- ✚ Raise the ground level to prevent water logging/inundation, particularly in the north-eastern portion of Site.

Residual Impact Significance

The residual impact significance will be reduced to **moderate** after implementing above mentioned mitigation measures.

Impact	Topography & drainage due to site development activity				
Impact Nature	Negative		Positive		Neutral
Impact Type	Direct		Indirect		Induced
Impact Duration	Temporary	Short-term	Long-term		Permanent
Impact Extent	Local		Regional		International
Impact Scale	High		Medium		Low
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource/ Receptor Sensitivity	Low		Medium		High
Impact Significance	Negligible	Minor	Moderate		Major
	Significance of impact is considered major .				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate		Major
	Significance of impact is considered as Moderate				

7.3.4 Impact on Soil Quality

7.3.4.1 Criteria

For the assessment of soil quality, the sensitivity and magnitude criteria outlined in **Table 7.1** and **Table 7.3** respectively have been used.

7.3.4.2 Sources of impact

Construction Phase

The proposed project will be constructed within the land procured by CUET. The entire land of the site is land on the top of hill, agriculture land and settlement with homestead plantation and ponds. If the topsoil is not stripped prior to the site development the top soil already will be affected.

Other potential sources of impacts of project on soil quality include the following:

- ✚ Earthworks at the site including grading, filling and levelling
- ✚ Transportation of construction material, equipment and personnel;
- ✚ Storage of construction materials including hazardous material;
- ✚ Civil work activities;
- ✚ Storage, handling and disposal of wastes generated from site clearance, site excavation and formation, civil works and activities of construction workers (general waste and sewage);
- ✚ Spillage of fuel, lubricant and paints from storage site.

Operational Phase

- ✚ Spillage of oil & lubricant from storage and handling site
- ✚ Improper storage and disposal of municipal solid waste and wastewater from site office.

7.3.4.3 Receptors/ resource

The proposed project site and nearby area is agriculture land and settlement with homestead plantation and ponds. It is proposed that entire construction activity including laydown area will be within the procured land for proposed plant. Analysis of soil sampling in the Project area indicates that the soils are mainly sandy loam and silty loam in nature. Heavy metal concentrations were also found well below the intervention values. Therefore, the sensitivity of soil resources was considered **Low**.

7.3.4.4 Impact significance

Soil compaction

Within the Project site is roads, buildings and Transformer platforms, Cable Car Stations and sub-station will be elevated between 1 to 2 meters also flood Protection embankment will be built around the site, with an elevation of 2-5 meters, depending on the topography.

Laydown area, fabrication yard and construction camp are also planned within the Project area and hence, soil compaction will be limited to these areas within the proposed project site.

Movement of heavy vehicles and heavy construction machinery will also cause soil compaction; however, the proposed project site located adjacent to the existing site approach road and same will be utilised for this plant. Soil compaction and possible damage to the soil structure due to heavy vehicular movement will only be limited to the laydown areas and Project site. Based on the impact magnitude assessment criteria as given in **Table 7.1** Magnitude Prediction Criteria the impact significance was assessed as **minor**.

Impact	Soil Compaction				
Impact Nature	Negative		Positive		Neutral
Impact Type	Direct		Indirect		Induced
Impact Duration	Temporary	Short-term	Long-term		Permanent
Impact Extent	Local		Regional		National
Impact Scale	High		Medium		Low
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource/ Receptor Sensitivity	Low		Medium		High
Impact Significance	Negligible	Minor	Moderate	Major	
Residual Impact Significance	Significance of impact is considered minor .				

Soil erosion

The project AOI is prone to soil erosion due to nature of soil (sandy loam & silty loam) enhanced by heavy rains in the area. Average annual rainfall based on rainfall data recorded in Teknaf is 1966 mm. Of the annual rainfall, about 90% rainfall occurs during four monsoon months June to September) with the month of August getting the maximum rains. Soil erosion will typically be worse during the monsoon months during the initial site preparation and compaction works. Based on the impact magnitude assessment criteria as given in **Table 7.1** Magnitude Prediction Criteria the impact significance was assessed as **minor**.

Impact	Soil Erosion				
Impact Nature	Negative		Positive		Neutral
Impact Type	Direct		Indirect		Induced
Impact Duration	Temporary	Short-term	Long-term		Permanent
Impact Extent	Local		Regional		International
Impact Scale	High		Medium		Low
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource/ Receptor Sensitivity	Low		Medium		High
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered moderate				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance impact is considered Minor				

Soil contamination (spills and leaks)

Soil contamination during the construction phase and operation phase may result from leaks and spills of oil, lubricants, fuel from heavy equipment or leakage from chemical/fuel storage. While the risk of accidental spillage of potentially hazardous substances is low, proper handling and disposal of contaminated materials will further reduce the risk if such event does take place. The

following prevention and mitigation measures will be proposed in the Specification Manual for BEZA Contractors:

- ✚ The Contractor will prepare unloading and loading protocols and train staff to prevent spills and leaks;
- ✚ The Contractor will prepare guidelines and procedures for immediate clean-up actions following any spillages of oils, fuels or chemicals;
- ✚ A site specific Emergency Response Plan will be prepared by the Contractor for soil clean-up and decontamination

Soil samples analysis indicates that the soil at the Project site is not contaminated. Spill control measures such as storage and handling of chemicals and fuels on impervious areas (such as concrete surfaces) will be implemented to minimize impacts in case of spills. Liquid effluents arising from construction activities will be treated to the standards specified in *Schedule 9 and 10 of ECR, 1997 of the GOB*; prior to discharge. Therefore, the likelihood of unplanned events (i.e. spills and leaks) leading to soil and sediment contamination is considered likely. Based on the impact magnitude assessment criteria as given in **Table 7.1** Magnitude Prediction Criteria the impact significance has been considered as **moderate**.

Impact	Soil contamination from spills and leaks				
Impact Nature	Negative		Positive		Neutral
Impact Type	Direct		Indirect		Induced
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local		Regional		International
Impact Scale	High		Medium		Low
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource/ Receptor Sensitivity	Low		Medium		High
Impact Significance	Negligible		Minor		Moderate
	Significance of impact is considered moderate .				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible		Minor		Moderate
	Significance impact is considered as Minor				

Soil contamination from waste handling

Soil may become contaminated due to improper handling and storage of waste. The majority of the generated wastes will be non-hazardous. General construction waste will comprise of surplus or off-specification materials such as concrete, steel cuttings/filings, wooden planks, packaging paper or plastic, wood, plastic pipes, metals, etc. Domestic wastes consisting of food waste, plastic, glass, aluminium cans and waste packages will also be generated by the construction workforce.

A small proportion of the waste generated during construction will be hazardous and may include:

- ✚ Used paint, engine oils, hydraulic fluids and waste fuel;
- ✚ Spent solvents from equipment cleaning activities; and
- ✚ Spent batteries or spent acid/alkali from the maintenance of machinery on site.

If improperly managed, hazardous waste may create impacts on land. With reference to similar projects, it is anticipated that the quantity of hazardous waste (mainly waste lubricant oil and waste paints/solvents) will be less than 100 litres per month. The construction contractor will handle, store and dispose of all waste in accordance with applicable GoB guidelines. Concrete waste of inert nature will be stored near the concrete batching plant and will be reused under floors or internal roads. There is a potential for direct, long-term negative impacts to soil quality from improper waste handling; however, with the implementation of the embedded control measures discussed above the impacts to soil quality as discussed in **Table 7.1** Magnitude Prediction Criteria *the* impact significance is assessed to be **moderate**.

Impact	Soil Contamination from Waste Handling				
Impact Nature	Negative		Positive		Neutral
Impact Type	Direct		Indirect		Induced
Impact Duration	Temporary	Short-term	Long-term		Permanent
Impact Extent	Local		Regional		International
Impact Scale	High		Medium		Low
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource/ Receptor Sensitivity	Low		Medium		High
Impact Significance	Negligible		Minor		Major
	Significance of impact is considered moderate .				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible		Minor		Major
	Significance impact is considered as Minor				

7.3.4.5 Additional Mitigation Measures

Potential impacts to soil quality during the construction phase are attributed to soil compaction, erosion and soil contamination from spills, leaks, and wastes.

Following measures will be implemented to mitigate potential soil compaction and erosion:

- ✚ All areas of excavation shall be closed and compacted before the monsoon season to prevent soil erosion.
- ✚ Storm water shall be properly channelized to settling tanks for controlling soil erosion.
- ✚ Demarcating routes for movement of heavy vehicles;
- ✚ Building small bunds in areas with slope to prevent soil erosion.

The following measures will be implemented for the storage and handling of chemicals during construction, and operation phase and to minimise impacts to soil/sediment:

- ✚ Fuel tanks and chemical storage areas will be sited on sealed areas and provided with locks to prevent unauthorized entry;
- ✚ Use of spill or drip trays to contain spills and leaks;
- ✚ Use of spill control kits to contain and clean small spills and leaks.

- ✚ The storage areas of oil, fuel and chemicals will be surrounded by bunds or other containment device to prevent spilled oil, fuel and chemicals from percolating into the ground or reaching the receiving waters;
- ✚ The Contractor will prepare unloading and loading protocols for the and train staff to prevent spills and leaks
- ✚ The Contractor will prepare guidelines and procedures for immediate clean-up actions following any spillages of oils, fuels or chemicals;
- ✚ A site specific Emergency Response Plan will be prepared by the Contractor for soil clean-up and decontamination; and
- ✚ The contractor will implement a training program to familiarize staff with emergency procedures and practices related to contamination events.

The measures in place to properly manage waste and thereby minimize any impacts to soil quality are:

- ✚ Design processes to prevent/minimise quantities of wastes generated and hazards associated with the waste generated;
- ✚ Training labourers for waste disposal in designated areas and use of sanitation facilities;
- ✚ Proper storage of the construction materials and wastes to minimise the potential damage or contamination of the materials;
- ✚ Implementation of construction materials inventory management system to minimise over-supply of the construction materials, which may lead to disposal of the surplus materials at the end of the construction period.
- ✚ Segregation of hazardous and non-hazardous waste and provision of appropriate containers for the type of waste type (e.g. enclosed bins for putrescible materials to avoid attracting pests and vO.Creeds in and to minimise odour nuisance);
- ✚ Storage of wastes in closed containers away from direct sunlight, wind and rain;
- ✚ Storage of waste systematically to allow inspection between containers to monitor leaks or spills;
- ✚ Ensuring that storage areas have impO.Creeds eable floors and containment, of capacity to accommodate 110% of the volume of the largest waste container; and
- ✚ Disposal of waste by licensed contractors.

7.3.4.6 Residual impacts

With implementation of the precautionary and the mitigation measures mentioned for the storage and handling of chemicals and to avoid /minimise impacts to soil the residual impact would be **moderate**.

7.3.5 Impact on Ambient Air Quality

7.3.5.1 Criteria

The sensitivity criteria and impact magnitude criteria has been provided in **Table 7.1** and **Table 7.3** respectively.

7.3.5.2 Receptor Sensitivity

The receptor sensitivity has been assessed as medium for human receptors and major for ecological receptors. The receptor sensitivity is therefore **medium** based on the criteria provided in **Table 7.4**.

7.3.5.3 Source of Impact

Construction Phase

Air quality impacts in the remaining construction phase activities will be largely due to the following sources:

- ✚ Fugitive dust emissions from piling work, handling of construction materials, emission due to movement of vehicles on site.
- ✚ Vehicular emissions due to increased traffic movement on site and on the approach roads;
- ✚ Exhaust emissions from construction machinery and other equipment such as pile drivers; and
- ✚ Emissions from diesel generators (200 kVA) required to be run for construction power purposes and at construction camps.

Operational Phase

No significant air quality impact is envisaged during the operation phase. Minor change in air quality can be expected could be resulted due to limited vehicular movement, and operation of back-up DG sets, as required.

7.3.5.4 Embedded/In-built Controls

- ✚ Compaction of filled sand at site
- ✚ Dust suppression measures at site link road
- ✚ Vehicles, engines would be properly maintained.

7.3.5.5 Significance of Impact

The fugitive dust related impacts will be minimal as the site development activity is almost completed proposed (filling activity and compaction). The piling, civil construction activity and movement of vehicle and machinery in the site and handling of construction material would generate fugitive dust. The construction material will be stored in the covered storage area; generation of windblown dust is expected to be minimum.

The construction activity is only restricted during day time. The power requirement during construction phase is mainly for operation of machineries and power supply during night time at labour camp. The source of power during construction phase is DG sets. The operation of DG sets will generate the PM and NO₂. The operation of diesel driven machineries, equipment and vehicles used for transport of construction materials and manpower will also generated pollutants like PM, NO₂ and SO₂.

The baseline air quality monitoring results shows that concentration of PM, SO₂ and NO₂ were well within the NAAQS indicating that the environment is not stressed (refer to **Section**). It is evident from Table 7.10 that the incremental emissions (GLC) due to operation of DG set will not lead to exceedance of ambient air quality standards of Bangladesh (refer to **Table 3.7**) at the study area. Prediction results with maximum baseline monitoring results of each pollutant Table 7.10 (also indicate that the overall criteria pollutants concentrations will be well within the applicable standards.

The fugitive emissions are likely to be dispersed locally. The potential impact on air quality is assessed to be **moderate**.

7.3.5.6 Additional Mitigation Measures

- ✚ Speed of vehicles on site should be limited to 10-15 km/hr.
- ✚ Prevent idling of vehicles and equipment.
- ✚ Dust suppression measures at active working area.
- ✚ Compaction of entire site to minimise windblown dust generation from site.

7.3.5.7 Residual Impact

The significance of residual impact will be **minor** after implementing mitigation measures.

Impact	Ambient Air quality				
Impact Nature	Negative		Positive		Neutral
Impact Type	Direct		Indirect		Induced
Impact Duration	Temporary	Short-term	Long-term		Permanent
Impact Extent	Local		Regional		International
Impact Scale	High		Medium		Low
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity	Low		Medium		High
Impact Significance	Negligible	Minor	Moderate		Major
Residual Impact Magnitude	Significance of impact is considered moderate .				
Residual Impact Significance	Positive	Negligible	Small	Medium	Major
Residual Impact Significance	Negligible		Minor	Moderate	Major
Residual Impact Significance	Significance of impact is considered minor .				

7.3.6 Impact on Ambient Noise Quality

7.3.6.1 Criteria

It is planned that the Project will meet the noise emission criteria specified in the GOB ECR, 1997 and the WB/IFC EHS Guidelines (refer to **Table 3.8**). The above standards have been utilized to create a sensitivity criteria for ambient noise and criteria for impact magnitude for assessment of impact to ambient noise as presented in **Table 7.1** and **Table 7.3** respectively.

7.3.6.2 Receptors

Settlements of Hatiarguna, Domdomia etc are most likely to be affected by increasing noise levels because of proximity to the project site access road. Moreover, exceedances to the noise levels occurred at the monitoring locations in proximity to the site. The receptor sensitivity is therefore considered as **medium**.

7.3.6.3 Source of Impact

The sources of noise in the construction phase include construction activities, operation of DG sets and movement of vehicles. There will also be increased noise levels because of increased anthropogenic movement in the area. Source of impact during operation phase include operation of back up DG sets and movement of project vehicles.

7.3.6.4 Embedded/In-built control

Normal working hours of the contractor to be defined (preferable 8 am to 6 pm). If work needs to be undertaken outside these hours, it should be limited to activities which do not generate significant noise.

7.3.6.5 Significance of Impact

The construction activities such as transportation of construction materials for civil works, machineries and equipment, operation of heavy equipment and construction machinery are likely to cause increase in the ambient noise levels.

Residual Impacts

Significance of residual impact is assessed to be **minor** considering above mentioned mitigation measures.

Impact	Ambient Noise Levels				
Impact Nature	Negative		Positive	Neutral	
Impact Type	Direct		Indirect	Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local		Regional	International	
Impact Scale	High		Medium	Low	
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity	Low		Medium	High	
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered to be moderate .				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Major
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered minor .				

7.3.6.6 Additional Mitigation Measures

- ✚ Only well-maintained equipment should be operated on-site;
- ✚ If it is noticed that any particular equipment is generating too much noise then lubricating moving parts, tightening loose parts and replacing worn out components should be carried out to bring down the noise and placing such machinery far away from the households as possible;
- ✚ Machinery and construction equipment that may be in intermittent use should be shut down or throttled down during non-work periods; and
- ✚ Minimal use of vehicle horns and heavy engine braking in the area needs to be encouraged.

7.3.6.7 Residual Impacts

Significance of residual impact is assessed to be **minor** considering above mentioned mitigation measures.

Impact	Ambient Noise Levels				
Impact Nature	Negative		Positive		Neutral
Impact Type	Direct		Indirect		Induced
Impact Duration	Temporary	Short term	Long-term		Permanent
Impact Extent	Local		Regional		International
Impact Scale	High		Medium		Low
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity	Low		Medium		High
Impact Significance	Negligible		Minor		Moderate
	Significance of impact is considered to be moderate .				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Major
Residual Impact Significance	Negligible		Minor		Moderate
	Significance of impact is considered minor .				

7.3.7 Impact on Water Resource & Quality

7.3.7.1 Criteria

For the assessment of water resources and quality, the sensitivity and magnitude criteria outlined in **Table 7.1** and **Table 7.3** respectively.

7.3.7.2 Sources of impact

Construction Phase

The potential sources of impact to surface and ground water resources are:

- ✚ Filling and earth work at the Project site may increase the erosion, especially during rainfall, which may increase the suspended sediment concentrations and pollute water sources;
- ✚ Sewage generated from the construction workforce (toilets).
- ✚ Liquid effluents will be generated from washing of construction equipment and vehicles;
- ✚ Inappropriate storage of waste leading to water quality impacts from runoff entering the adjoining channel to the Project site or seepage to ground water.

Operational Phase

The potential sources of impact to surface and ground water resources during the operational phase include:

- ✚ The discharge of effluent and sewage from the office and canteen area that may have an impact on land or the quality of surface water; and

- The abstraction of ground water for the washing of instruments and drinking purposes for the employees of the project.

7.3.7.3 Embedded control measures:

The project embedded control measures are as follows:

- Storage of chemical, fuel in paved storage area.
- Septic tank and soak pit will be provided in construction site for treatment of domestic wastewater.

7.3.7.4 Receptors

The major surface water body adjacent to the Project site is Naf River, stream flow and local drainage channels. The primary receiving surface water body is local drainage channels, whereas ground water is the main source of domestic usage and irrigation requirements. Based on the sensitivity assessment criteria described in **Table 7.3**, both surface and ground water resource was found to be **large**.

7.3.7.5 Impact significance

Wastewater discharge

Wastewater will be generated from washing of equipment and machinery and pilling activity on site. This wastewater may contain suspended solids and traces of hydrocarbon. The contractor will be responsible for ensuring that any wastewater discharged meets the standards stipulated in *Schedule 10 of ECR, 1997* and the applicable *World Bank/ IFC General EHS Guidelines* prior to discharge of such wastewater. Sanitary facilities including toilets will be provided for the use of the construction and operation workforce both on-site and at the workers' accommodation. Such sewage streams are likely to be high in organic matter, suspended solids, coliform and other pollutants. Potential impacts are expected to be short-term and localised in nature. Based on the above discussion and referring to the magnitude criteria in **Table 7.1**, the impact to surface water from wastewater discharges during construction is assessed to be **major**.

Impact	Wastewater discharge				
Impact Nature	Negative		Positive		Neutral
Impact Type	Direct		Indirect		Induced
Impact Duration	Temporary	Short term	Long term		Permanent
Impact Extent	Local		Regional		International
Impact Scale	High		Medium		Low
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource/ Receptor Sensitivity	Low		Medium		High
Impact Significance	Negligible		Minor		Moderate
	Significance of impact is considered major				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Major
Residual Impact Significance	Negligible		Minor		Moderate
	Significance of impact is considered moderate .				

Groundwater contamination

Groundwater contamination during the construction phase may occur from unplanned events such as leaks and spills of oil, lubricants, fuel from heavy equipment, improper handling of sewage or chemical/fuel storage. The fill materials to be used for site development was River sand. The soil type of the adjacent land is mainly sandy loam to silty loam. The spillage of chemical and fuel may easily contaminate the subsoil, however, may take longer time to reach up to the ground water aquifer. While there is a potential for long-O. Creeds direct impacts to groundwater quality from construction, with the implementation of mitigation measures for proper handling of chemicals, waste and liquid effluents, and impact to ground water would be limited. Based on the above discussion and referring to the magnitude criteria in **Table 7.1**, the impact to groundwater from spills and leaks is assessed to be **moderate**.

Impact	Ground water contamination				
Impact Nature	Negative		Positive		Neutral
Impact Type	Direct		Indirect		Induced
Impact Duration	Temporary	Short term	Long-term		Permanent
Impact Extent	Local		Regional		International
Impact Scale	High		Medium		Low
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource/ Receptor Sensitivity	Low		Medium		High
Impact Significance	Negligible		Minor		Moderate
	Significance of impact is considered moderate				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Major
Residual Impact Significance	Negligible		Minor		Moderate
	Significance of impact is considered minor .				

7.3.7.6 Additional mitigation measures

The following measures will be implemented to reduce impacts to surface water and groundwater:

- ✚ Oil leakage or spillage will be contained and cleaned up immediately. Waste oil will be collected and stored for recycling or disposal;
- ✚ Oil and grease separator shall be used for wastewater generated from cleaning activities;
- ✚ Any surplus wastewater from the concrete batching will be treated to comply with discharge standards before it is discharged to the canal;
- ✚ For treatment of sewage septic tank with soak pit or mobile STP should be provided to treat the wastewater from the construction site.

7.3.7.7 Residual Impacts

Significance of residual impact is assessed to be **minor** considering above mentioned mitigation measures both for wastewater discharge and groundwater contamination.

7.3.8 Impact on Road & Traffic

7.3.8.1 Source of Impact:

The source of impact is additional traffic load due to proposed construction activities vehicles for transport, transformer and other machineries, equipment.

7.3.8.2 Assessment of Impact:

From the proposed project approximately, additional 250 trucks/trailers per day carrying construction material and plant and machineries and approximately 20 trucks carrying goods will be using the LGED road AND Marine drive road and site access road.

Based on the traffic survey conducted (*Refer Section 5.5.16*), it is noted that Teknaf - Cox's Bazar (N1) is the main road for transportation of construction material and plant and machineries. The average peak hourly traffic on this route was 204 PCU per hour and maximum traffic load was 404 PCU per hour. The average peak hourly traffic on the site access road was 8 PCU per hour and maximum traffic load was 21 PCU per hour. There is also a school abutting the road. Movement of heavy vehicles along the road and strengthening and widening of the access road has a potential to cause accidents or hazards.

The increase of traffic during construction phase will cause perceptible changes in the existing road traffic in site approach road. The increase of traffic load in the site access road will cause major changes the traffic load. However, operation of heavy vehicles during school hours or market time may cause community health and safety issues. The potential impact on road and traffic due to operational traffic is assessed to be **moderate**.

7.3.8.3 Mitigation Measures

Precautions as mentioned will be taken for transportation of raw material and finished products:

- ✚ CUET will prepare a traffic management plan,
- ✚ Traffic marshal will be deployed at important traffic junction and sensitive location (particularly near schools),
- ✚ CUET should avoid heavy vehicle traffic movement during school and market hours; preferably they can plan heavy vehicular traffic movement during night time
- ✚ No overloading is done will be ensured.
- ✚ Speed of heavy vehicles will be limited (<20 km /hr) near at the site access road
- ✚ Nighttime movement of vehicles will be restricted.

7.3.8.4 Residual impact

Considering the implementation of above mentioned mitigation measures, the residual impact disturbance/ discomfort to local people due to increase of traffic is assessed to be **minor**.

Impact	Road and traffic impacts			
Impact Nature	Negative		Positive	Neutral
Impact Type	Direct		Indirect	Induced
Impact Duration	Short Term		Medium Term	Long Term
Impact Extent	Local		Regional	National
Impact Scale	Low		Medium	High
Impact Magnitude	Positive	Small	Medium	Large
Resource/ Receptor Sensitivity	Low		Medium	High

Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered Moderate				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Minor				

7.3.9 Impact on Biological Environment

Impact Assessment Standards defines sensitivity of ecological receptors by det the significance of effects on species and habitats separately. The impact assessments were undertaken based on following impact assessment matrix as presented in **Table 7.8** and **Table 7.9** respectively

Table 7.8 Habitat-Impact Assessment Criteria

Habitat Sensitivity/ Value		Magnitude of Effect on Baseline Habitats			
		Negligible	Small	Medium	Large
Negligible	Habitats with negligible interest for biodiversity.	Not significant	Not significant	Not significant	Not significant
Low	Habitats with no, or only a local designation / recognition, habitats of significance for species listed as of Least Concern (LC) on IUCN Red List of Threatened Species, habitats which are common and widespread within the region, or with low conservation interest based on expert opinion.	Not significant	Not significant	Minor	Moderate
Medium	Habitats within nationally designated or recognised areas, habitats of significant importance to globally Vulnerable (VU) Near Threatened (NT), or Data Deficient (DD) species, habitats of significant importance for nationally restricted range species, habitats supporting nationally significant concentrations of migratory species and / or congregatory species, and low value habitats used by species of medium value.	Not significant	Minor	Moderate	Major
High	Habitats within internationally designated or recognised areas; habitats of significant importance to globally Critically Endangered (CR) or Endangered (EN) species, habitats of significant importance to endemic and/or globally restricted-range species, habitats supporting globally significant concentrations of migratory species and / or congregatory species, highly threatened and/or unique ecosystems, areas associated with key evolutionary species, and low or medium value habitats used by high value species.	Not significant	Moderate	Major	Critical
Negligible	Effect is within the normal range of natural variation				
Small	Affects only a small area of habitat, such that there is no loss of viability / function of the habitat				
Medium	Affects part of the habitat, but does not threaten the long-term viability / function of the habitat.				
Large	Affects the entire habitat, or a significant proportion of it, and the long-term viability / function of the habitat is threatened.				

Table 7.9 Species-Impact Assessment Criteria

Baseline Species Sensitivity/ Value		Magnitude of Effect on Baseline Habitats			
		Negligible	Small	Medium	Large
Negligible	Species with no specific value or importance attached to them.	Not significant	Not significant	Not significant	Not significant
Low	Species and sub-species of LC on the IUCN Red List, or not meeting criteria for medium or high value.	Not significant	Not significant	Minor	Moderate
Medium	Species on IUCN Red List as VU, NT, or DD, species protected under national legislation, nationally restricted range species, nationally important numbers of migratory, or congregatory species, species not meeting criteria for high value, and species vital to the survival of a medium value species.	Not significant	Minor	Moderate	Major
High	Species on IUCN Red List as CR, or EN. Species having a globally restricted range (i.e. plants endemic to a site, or found globally at fewer than 10 sites, fauna having a distribution range (or globally breeding range for bird species) less than 50,000 km ²), internationally important numbers of migratory, or congregatory species, key evolutionary species, and species vital to the survival of a high value species.	Not significant	Moderate	Major	Critical
Negligible	Effect is within the normal range of variation for the population of the species.				
Small	Effect does not cause a substantial change in the population of the species, or other species dependent on it.				
Medium	Effect causes a substantial change in abundance and / or reduction in distribution of a population over one, or more generations, but does not threaten the long term viability / function of that population, or any population dependent on it.				
Large	Affects entire population, or a significant part of it causing a substantial decline in abundance and / or change in and recovery of the population (or another dependent on it) is not possible either at all, or within several generations due to natural recruitment (reproduction, immigration from unaffected areas).				

7.3.9.1 Impact on Terrestrial Ecology

7.3.9.2 Source of impact

The proposed project site has few matured trees. The potential impact on terrestrial ecology may arise due to:

- ✚ Vegetation clearance, loss of habitat for terrestrial fauna
- ✚ Fugitive dust emission and deposition on plants;
- ✚ Noise & vibration.

7.3.9.3 Embedded control measures:

The control measures are as follows:

- ✚ Water sprinkling for dust suppression;
- ✚ Engineering control measures to minimise the noise level from construction machineries and equipment.

7.3.9.4 Impact assessment:

Vegetation Clearance

The proposed project site is forest road. However, homestead plantation (fruit bearing, timber, fuel wood, etc.) were recorded during site visit. Major tree species noted at the site include Akasmoni (*Acacia auriculiformis*), Kanthal (*Artocarpus heterophyllus*), Aam (*Mangifera indica*), Neem (*Azadirachta indica*), Supari (*Areca catechu*), and Tal (*Borassus flabellifer*). Apart from that bamboo (*Bambusa* spp.) bushes are also present within the site. This vegetation would be cleared during site preparation. None of these trees species within the site, along the site access road corridor is protected under national regulation or IUCN Red List.

Homestead plantation also provided habitats for mammals (Small Asian Mongoose, Golden Jackal, Northern Palm Squirrel, Little Indian Field Mouse and House Mouse etc.), birds (Red Turtle dove, Blue-throated Barbet, Black hooded Oriole, Common Iora, Baya Weaver, Little Cormorant, Black Drongo, Black hooded Oriole, Red-vented Bulbul, Rufous Treepie, White-throated Fantail, Long-tailed Shrike etc.), herpetofauna (Bengal Monitor Common Skink, Asian Common Toad, Common House Gecko, Indian Bull Frog, Indian Rat Snake, Russel's Viper). Vegetation clearance of the proposed project site will cause the damage of the habitat of the above-mentioned species. The faunal species likely to be present at site or near the site access road are common in the area. There are similar habitats adjacent to the site, access road and the species could easily relocate to that area. The species likely to be present are not threatened under national regulation or IUCN Red List.

Fugitive emission

The fugitive emissions are likely to be generated during construction phases. Due to relatively large particulate matter sizes associated with the fugitive emission from construction site and the relatively short release height of the pollutants, such negative impacts are usually confined in relatively small areas; estimated to be 100 to 200 m from construction activity site/s. The deposited particulate matter may block the plant leaf stomata hence inhibit gas exchange, or smother the plant leaf surfaces reducing photosynthesis levels. Within the 200 m from the proposed project site.

Noise & vibration

The operation of construction machineries and vehicles will generate noise and vibration. The increased level of noise and vibration in and around proposed project site may cause disturbance to local faunal species.

The habitat sensitivity is assessed as low with no, or only a local designation / recognition, habitats of significance for species listed as of Least Concern (LC) on IUCN Red List of Threatened Species, habitats which are common and widespread within the region, or with low conservation interest based on expert opinion. Habitat impact magnitude is assessed as large as the project will affect a large part of the habitat residing on the project site especially at the top of the hill and it might be the long-term viability / function of the habitat. Hence, significance of impact on habitat is considered as **major**.

The species sensitivity is assessed as low with species of LC on the IUCN Red List, or not meeting criteria for medium or high value. Species impact magnitude is assessed as low as the project will not cause a substantial change in the population of the species, or other species dependent on it. Hence, significance of impact on species is considered as **moderate**.

Impact	Terrestrial Ecology			
Impact Nature	Negative	Positive		Neutral
Impact Type	Direct	Indirect		Induced
Impact Duration	Short Term	Medium Term		Long Term
Impact Extent	Local	Regional		National
Impact Scale	Low	Medium		High
Impact Magnitude	Positive	Small	Medium	Large
Resource/ Receptor Sensitivity	Low		Medium	High
Impact Significance	Negligible	Minor	Moderate	Major
	Significance of impact is considered Major for habitats and moderate for species			
Residual Impact Magnitude (Habitat)	Positive	Negligible	Small	Medium Large
Residual Impact Significance	Negligible	Minor	Moderate	Major
	Will remain major for habitats			

7.3.9.5 Additional Mitigation measures

- ✚ Strict instruction should be given to the construction workers not to cut trees from the nearby areas for their fuel and timber use;
- ✚ Use of LPG/ Kerosene for cooking need to be provided/ encouraged in order to reduce the impacts on vegetation from the vicinity of the Project site.
- ✚ Water sprinkling for dust suppression;
- ✚ Engineering control measures to minimise the noise level from construction machineries and equipment.

7.3.9.6 Residual impact

Considering the implementation of above mentioned mitigation measures, the residual impact is still assessed to be **minor for habitats** as there will be some impact to the terrestrial ecology due to vegetation clearance and loss of faunal habitat.

7.3.9.7 Impact on Aquatic Ecology

7.3.9.8 Source of Impact

The Naf River is an important habitat for fishes and other aquatic fauna. Therefore, impact on River water quality due to proposed construction activity may have direct and indirect impact on aquatic habitat including fishes. The River water quality may impact, due to an increase of sediment loads, pollutants like oil & grease, etc.

Loss of Aquatic Ecosystem

There are about 50 village ponds within the project site. There is also a seasonal stream passing through the northeastern corner of the site. The village ponds are used by the locals for bathing, washing and the ponds represents aquatic habitats for fish and aquatic vegetation. The village ponds within the site are reportedly used for fish culture, which is consumed by the villagers. No commercial fish culture was identified at the village ponds. Common species reported from the fish ponds include *Labeo rohita*, *Catla catla*, *Clarias batrachus*, *Cyprinus carpio*, *Heteropneustes fossilis*, *Hypopthalmichthys molitrix* etc.

Site development operations will lead to filling of the village ponds and blockade of the local stream. Filling of village ponds will lead to loss of aquatic habitats. Fish species reported from the village ponds are common in the area and not threatened as per national regulation or IUCN Red List.

Pollution

The Naf River and local streams in the area are important habitat for fishes and other aquatic fauna. Therefore, impact on River water quality due to proposed construction activity may have direct and indirect impact on aquatic habitat including fishes. The River water quality may impact, due to an increase of sediment loads, pollutants like oil & grease etc.

Sedimentation: Sedimentation is likely to occur due to surface runoff from the construction site. The site will be developed with white River sand; again pilling activity will also be required for setting up the bed of the road. Surface runoff from the construction site may have adverse impact on receiving water body i.e. Naf River.

Contamination: During construction activities, construction machineries and vehicles will be utilized. Accidental spillage and leakage of fuel and lubricant is likely to get mixed up with runoff water. The discharge of oil and grease contaminated runoff water without treatment has likely impact on water quality of the receiving water body.

Organic Load: During construction activity, approximately 700 workforces (peak construction period) will be engaged. It is proposed to treat the wastewater through single chamber soak pit.

Discharge of surface runoff with high sediment load, spilled oil & lubricant and domestic wastewater at Naf River and local streams have the potential to affect the water quality of the River by increase in turbidity, organic content, etc. The increase of pollution (sediment, oil & grease, organic pollutant) has a direct impact on the physical and biological characteristics of the River basin.

The habitat sensitivity is assessed as low with no, or only a local designation / recognition, habitats of significance for species listed as of Least Concern (LC) on IUCN Red List of Threatened Species, habitats which are common and widespread within the region, or with low conservation interest based on expert opinion. Habitat impact magnitude is assessed as major as the project will affect part of the habitat and will also threaten the longterm viability / function of the habitat. Hence, significance of impact on habitat is considered as **major**.

The species sensitivity is assessed as low with species of LC on the IUCN Red List, or not meeting criteria for medium or high value. Species impact magnitude is assessed as high as the project will not cause a substantial change in the population of the species, or other species dependent on it. Hence, significance of impact on habitat is considered as **major**.

Impact	Aquatic Ecology			
Impact Nature	Negative		Positive	Neutral
Impact Type	Direct		Indirect	Induced
Impact Duration	Short Term		Medium Term	Long Term
Impact Extent	Local		Regional	National
Impact Scale	Low		Medium	High
Impact Magnitude	Positive	Small	Medium	Large
Resource/ Receptor Sensitivity	Low		Medium	High
Impact Significance	Negligible	Minor	Moderate	Major
	Significance of impact is considered Major for habitats and moderate for species			
Residual Impact Magnitude (Habitat)	Positive	Negligible	Small	Medium Large
Residual Impact Significance	Negligible	Minor	Moderate	Major
	Will remain Moderate for habitats			

7.3.9.9 Additional Mitigation Measures

- ✚ Construct drainage system with sedimentation tank with oil-water separator to treat the surface runoff from site;
- ✚ Oil leakage or spillage will be contained and cleaned up immediately. Waste oil will be collected and stored for recycling or disposal;
- ✚ Oil and grease separator shall be used for wastewater generated from cleaning activities;
- ✚ Any surplus wastewater from the concrete batching will be treated to comply with discharge standards before it is discharged to the canal.
- ✚ For treatment of sewage septic tank with soak pit or modular STP should be provided to treat the waste water from the construction site.

7.3.9.10 Residual impact

Considering the implementation of above-mentioned mitigation measures, the residual impact is still assessed to be **minor for habitats** as there will be some impact to the aquatic ecology due to loss of aquatic habitat (Naf River, Stream water, river pond).

7.3.10 Occupational Health & Safety Related Impacts

7.3.10.1 Source of Impact:

Occupational health and safety impacts during construction phase are anticipated primarily from operation of construction machineries/ equipment during site preparation and operation of labour camps for housing of onsite workers. Source of impacts during operation phase may happen from working in areas with high voltage,

7.3.10.2 Embedded Control Measures:

The project embedded control measures are as follows:

- ✚ Provision of drinking water facility, sanitation and cooking facilities;
- ✚ Provision of proper PPEs for the contractor workers onsite

7.3.10.3 Assessment of Impact:

Impact on occupational health and safety of construction workers is anticipated from exposure to high noise generated from operation of heavy machineries /equipment and fugitive dust generated from construction activity. It is estimated that approximately 700 workers will be deployed by the contractor. Continuous exposure of workers to high noise levels and fugitive dust may lead to adverse health impacts viz. headache, asthma, allergy, hearing loss etc. However, considering the temporary nature of the construction phase activities, operation of machineries/equipment and provision of proper PPEs for the workers, it may not cause any significant impact.

The outstation project workforce will be housed in labour camp located in the site. It is proposed to provide the adequate facilities in the labour camp like housing facility with proper ventilation, electricity, separate kitchen, solid waste collection facility, drinking water facility, sanitation facility, etc. Inadequate facilities and unhygienic condition may have impact on occupational health of the labourers.

The impact on occupation health and safety due to above mentioned construction activities is assessed to be **minor**.

7.3.10.4 Additional Mitigation Measures:

The mitigation measures are as follows:

- ✚ Adequate provision of healthy living conditions will be ensured in the contractor labour camp;
- ✚ Exposure of workers operating near high noise generating sources will be reduced to the extent possible;
- ✚ Use of adequate personal protection equipment (PPEs);
- ✚ Health surveillance of contractor workforce will be conducted
- ✚ Occupational health and safety of contractor workforce will be assured through the formulation of an "Occupational Health & Safety Management Plan.

7.3.10.5 Residual Impact:

Considering the implementation of above mentioned mitigation measures, impact on occupational health and safety is still assessed to be **minor**.

Impact	Impact on occupational health & safety			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect	Induced	
Impact Duration	Short Term	Medium Term	Long Term	
Impact Extent	Local	Regional	National	
Impact Scale	Low	Medium	High	
Impact Magnitude	Positive	Small	Medium	Large
Resource/ Receptor Sensitivity	Low	Medium	High	
Impact Significance	Negligible	Minor	Moderate	Major
	Significance of impact is considered minor			
Residual Impact Magnitude	Positive	Negligible	Small	Medium
Residual Impact Significance	Negligible	Minor	Moderate	Major
	Minor			

7.3.11 Community Health & Safety Impacts

7.3.11.1 Source of Impact:

The community health and safety may arise due to changes in environmental quality, health and safety impacts due to stringing of transmission lines, increased prevalence of disease and increase in traffic movement.

7.3.11.2 Embedded Controls:

The following control measures have been proposed:

- ✚ Proper collection, storage and disposal of MSW;
- ✚ Movement of heavy vehicles on approach road only during night time.

7.3.11.3 Assessment of Impact:

Dust and Noise Discomfort: Inhabitants residing close to access roads will be affected due to noise and dust generated from vehicular movement during construction phase. However, the access road is a curved road and the dust generation will be minimum.

Transmission of infectious diseases: Approximate 700 workers will be employed in the construction phase. Improper sanitation facility and disposal of municipal soil waste from the construction labour camp can cause vector borne diseases and other infectious diseases.

Traffic movement in site approach road: The construction activities are expected to increase traffic load in the site approach road which may create public safety issues for local residents and school children of nearby primary school. Potential impacts include pedestrian safety issues and safety aspects of slow moving vehicles. Considering project embedded control measures, the impact on community health & safety is assessed to be **moderate**.

7.3.11.4 Additional Mitigation measures:

The possible mitigation measures to address the aforesaid impacts include:

- ✚ Dust control measures will be taken along site approach road;

- ✚ Domestic waste generated from construction site will be disposed in the solid waste dumping site;
- ✚ Spread of communicable diseases from influx of contractor workforce will be mitigated;
- ✚ Speed of heavy vehicles will be limited (<20 km /hr) near at the site access road
- ✚ Prepare a traffic management plan for the project

It is understood that CUET's transmission line design contractor had identified these structures prior to the route finalization. The design contractor ascertained that these structures are low and that the transmission line design and clearance considerations (submitted to PGCB) takes the heights of these structures into account:

The technical contractor has ascertained that no relocation of these structures will be required and CUET has confirmed that the easement procurement process for these structures is already complete.

Based on a review of the applicable regulations to construct transmission lines (i.e. Bangladesh Telegraph Act, 1885 and the Electricity Act, 1910), there is no specific provision for removal of structures. Both regulations provide a basis for compensation in case of damages.

Implications of Project Construction and Operations

During the construction of transmission lines and stringing activities, there is a possibility for localised damage to structures (and its occupants) that will need to be considered as a part of the construction management safeguards.

With respect to the operations phase, very few studies have been able to identify any health risks from transmission line electromagnetic forces. This is especially true for high voltage lines, such as the Nilphamari Project's 220 KV lines, because the transmission lines are typically much higher off the ground and the RoW is wider (18 m for the project). The World Health Organization (WHO) references the standards established by the International Commission on Non-Ionizing Radiation Protection (ICNIRP), an international scientific group, which are based on a careful examination of the research data on the health effects of exposure to EMF.

Other than the height considerations, CUET is yet to evaluate the EMF from the proposed transmission line in order to ascertain and compare with the ICNIRP standards within and at the edge of the RoW. Such a study is recommended to ascertain if the RoW is safe to work, access and/or live or if any specific development restrictions may be required (e.g. prohibition of construction of any houses and/or relocation of existing structures).

Recommendations

- ✚ It is recommended that CUET's transmission line design/technical consultants undertake an assessment to evaluate the implications of EMF by comparing the electric field within the RoW to ICNIRP standards. These standards are also prescribed by the WBG/IFC's EHS Guidelines for Power Transmission and Distribution;
- ✚ Should the above EMF study ascertain that the results are significantly less than the ICNIRP standards, CUET (in consultation with PGCB), may consider that the 12 structures remain and from a longer-term perspective. Specific community health and safety safeguards will be put in place at the time of construction and if required, the occupants of the structure will be provided with temporary housing arrangements;

Should the above EMF study indicate an unacceptable risk based on a comparison of the ICNIRP standards, as the overall alignment has already been approved, CUET can explore the following two options:

- Rerouting the alignment around these specific locations/clusters through design alternatives and providing easement compensation for other land owners identified; or
- Applying the provisions of the proposed Entitlement Matrix and asking the structure owners to opt for resettlement housing and/or assisted self-relocation outside of the RoW. In addition, CUET will also need to impose development restrictions (e.g. prohibition on the construction of any houses or planting of trees above a certain height) on land within the RoW.

7.3.11.5 Residual Impact:

Considering the implementation of above mentioned mitigation measures, impact on community health and safety is assessed to be **minor**.

Impact	Impact on community health & safety				
	Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect	Induced		
Impact Duration	Short Term	Medium Term	Long Term		
Impact Extent	Local	Regional	National		
Impact Scale	Low	Medium	High		
Impact Magnitude	Positive	Small	Medium	Large	
Resource/ Receptor Sensitivity	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered moderate				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Minor				

7.3.12 In-migration of workers

Source of Impact

The peak man power requirement for the construction phase will require the project to recruit skilled, semi skilled and unskilled workers from outside the project area/district.

7.3.12.1 Embedded Controls:

No embedded control measures in place

7.3.12.2 Impact Significance:

The in-migration of workers from outside the area will result in increased risk of conflict and social unrest due to cultural differences between the labourers and local community.

Similarly, the in-migration may also lead to spread of communicable diseases due to contact and interaction among the labourer and the local community. Moreover, lack of proper sanitation or waste management facilities may also resulted in outbreak and transmission diseases. The in-migration will also have resulted in increased pressure on basic facility such as water etc. Such pressure and demand may lead to inflation and increased prices of food items and basic commodities. As this impact is restricted to the construction phase the impact, magnitude is assessed as **minor**.

Impact	Impact on In-migration				
Impact Nature	Negative		Positive	Neutral	
Impact Type	Direct		Indirect	Induced	
Impact Duration	Short Term		Medium Term	Long Term	
Impact Extent	Local		Regional	National	
Impact Scale	Low		Medium	High	
Impact Magnitude	Positive	Small	Medium	Large	
Resource/ Receptor Sensitivity	Low		Medium	High	
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered minor				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Negligible				

7.3.12.3 *Additional Mitigation measures:*

- ✚ Adequate monitoring should be undertaken to ensure the contractor's compliance to the applicable rules and regulations and provisions of the contractual agreement for the remaining duration of construction.
- ✚ Health screening of migrant workers,
- ✚ Undertaking health awareness among the local community,
- ✚ Providing the local community of an understanding of the project activities and the possible health and safety risks associated with the same;
- ✚ Avoiding presence of unsanitary conditions and better facilities in the campsite, such as safe drinking water, proper waste collection and disposal system, etc.
- ✚ A labour influx management plan should be put in place to check migrant labours.

7.3.13 *Employment Opportunities*

7.3.13.1 *Source of Impact*

The project is expected to create direct and indirect employment opportunities during the construction and operation phase of the project.

7.3.13.2 *Embedded/In-built Controls*

No embedded measures identified

7.3.13.3 *Significance of Impact*

During the construction phase, the project is expected to create economic opportunities for the engagement of local unskilled and semi-skilled workers. The wage earnings from the project will supplement their earnings from agriculture or other sources. Further, O. Creeds, the project development may also result in the creation of indirect economic opportunities such as for small businesses, contractual workers, structures or vehicles being provided on rent etc. the influx of workers (Semi skilled and skilled) is also likely to raise the wage levels and result in a localized inflation of prices for basic goods and supplies. There may also be a temporary period where demand of consumable may exceed supply.

The overall significance of the impact is likely to be positive.

7.3.13.4 *Enhancement Measures*

The following additional enhancement measures have been identified for the project

- ✚ The project will prioritize the engagement (along with their contractors and subcontractors) of local workers and suppliers for the project construction phase, as long as the required skill set is available;
- ✚ As part of the engagement and disclosure activities, the project will provide prior information regarding upcoming opportunities in O. Creeds s of employment or supplying products to the local community to allow them to take maximum benefits from the same
- ✚ The project shall consider establishing a database of the skill set in the local community and making the same available for the contractors and subcontractors for the project.

7.3.13.5 *Residual Impact Significance*

The residual impact will remain positive.

Impact	Impact on employment opportunities				
Impact Nature	Negative	Positive		Neutral	
Impact Type	Direct	Indirect		Induced	
Impact Duration	Short Term	Medium Term		Long Term	
Impact Extent	Local	Regional		National	
Impact Scale	Low	Medium		High	
Impact Magnitude	Positive	Small	Medium	Large	
Resource/ Receptor Sensitivity	Low	Medium		High	
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered positive				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate	Major	

7.3.14 Labour Welfare

7.3.14.1 Source of Impact

The projects will employ skilled, semi-skilled and unskilled workers, across the project lifecycle, which will include contractual and regular employees and local and migrant workers.

7.3.14.2 Embedded/In-built Controls

- ✚ As an internal policy, CUET requires each contractor to comply with the applicable regulatory provisions and labour laws.

7.3.14.3 Significance of Impact

The regular skilled workers are likely to be comprised of migrant workers, from different districts and states in the country, depending upon the need for technical expertise. The peak project labour requirement is likely to be 700 workers. Presently the decision pertaining to whether the workers will reside in a labour camp or rented accommodations in the local villages has not been made.

The scale of the impact is medium, extent is regional and duration is short term. The overall magnitude of the impact is assessed as small and the sensitivity is assessed as medium. The overall significance is assessed as **minor**.

7.3.14.4 Additional Mitigation Measures

The following additional mitigation measures are suggested in order to ensure compliance with labor laws/provisions as per the industry best practices:

- ✚ The labor camp and accommodation facility for regular employees should be constructed to meet the requirements of the applicable reference framework (IFC and EBRD Worker's Accommodation: Processes and Standards), in O.Creeds s of space per worker, water and sanitation facilities, first aid, lighting and ventilation etc. and regular monitoring should be undertaken to ensure compliance through the project lifecycle;
- ✚ The labor camp should be located at a certain safe distance from the local community settlements, to minimize impacts on the local community due to the daily activities of the laborers
- ✚ CUET should ensure a monthly monitoring and regular auditing mechanism for monitoring the sub-contractors and suppliers with respect to compliance to the applicable reference framework, in O. Creeds s of resources, migrant workers, child labor and forced labor, health and safety, payment of wages etc.
- ✚ Strengthen security personnel around labor camps in order to maintain adequate law and order and avoid any possible tensions between the migrant workforce and host community.
- ✚ Each worker and employee shall be provided a health and safety training as part of the induction process
- ✚ Create a labour management plan that will contain provisions to ensure non-discrimination and fair treatment for all workers. The labour influx management plan will also dictate the requirement of workers at different stages of construction cycle, thereby helping in management of employment issues.
- ✚ Establish an internal grievance redressal mechanism in place, to allow for the employees and workers to report any concern or grievance related to work activities

7.3.14.5 Residual Impact Significance

The residual impact significance will be reduced to negligible

Impact	Impact on Labour Welfare				
Impact Nature	Negative		Positive		Neutral
Impact Type	Direct		Indirect		Induced
Impact Duration	Short Term		Medium Term		Long Term
Impact Extent	Local		Regional		National
Impact Scale	Low		Medium		High
Impact Magnitude	Positive	Small	Medium	Large	
Resource/ Receptor Sensitivity	Low		Medium		High
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered minor				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Residual impact significance is negligible				

7.3.15 Impacts of Gender and Social Inclusion

7.3.15.1 Source of Impact

Project activities may result in disproportionate impacts on women and socially disadvantaged groups. These impacts are likely to result from the existing socio-cultural status of these groups, specifically in O. Creeds s of existing disparities in land and assets ownership, historical discrimination, literacy rates, livelihood profiles, access to and dependence on natural and other resources. These disparities make for impacts from the Project to be unequally borne by women and the socially disadvantaged groups.

7.3.15.2 Embedded/In-built Controls

✚ A Gender Action Plan is being developed for the project that will provide specific provisions for women and other socially disadvantaged.

7.3.15.3 Significance of Impact

While the overall impacts from land procurement and use restrictions have been discussed in **7.3.2**, the land acquisition process could put some women at a greater disadvantaged or increase their risk of landlessness and poverty (due to loss of wages or livelihood opportunities); especially for female-headed households. Where the land ownership is in the name of the male Head of Household or a male family member, women members of the household are also dependent upon the land for their livelihoods and sustenance.

Some women may also be put at risk if the compensation amount and entitlements as part of the resettlement and rehabilitation process are appropriated only by the male members of the households, who may independently decide how to use the money. The risk of abandonment may also increase for some women. Where financial literacy is low, this access to cash may result in an increase in impulsive spending, substance abuse, gambling and prostitution. In turn, these may have increase the risk of gender based violence within the community.

In addition to the general occupational and community health and safety concerns, women workers and women living in settlements near Project sites, may be at greater risk of physical or sexual harassment (when compared to males). An increase in interaction between non-local workers and the local community, especially young girls and women, may increase their

risk of harassment or even being trafficked. This risk is assessed as higher in cases where the workers are not accompanied by their families. Gender based violence risks may also increase following receipt of compensation payments, especially when combined with unequal decision-making and control over how payments are spent, as well as when payments are delayed, livelihoods related impacts are severe and unmitigated, and/or other financial or social stresses are increased.

Women are presently limited to agricultural and allied activities for their livelihoods. Therefore, local women are less likely to actively access employment opportunities for Project work. Frequently, local contractors will prefer male workers from the local communities, due to perceived notions of differential abilities to undertake work. Bangladesh also has a general acceptance of gender based differential wage rates for jobs. These aspects are likely to result in discriminatory practices by the Project in O. Creeds s of hiring of women (with the required skill set) and differences in wages paid for same quantity and nature of jobs, further disadvantaging women.

The scale of the impact is assessed as high, extent is local and duration is medium term. The overall magnitude of the impact is assessed as large and the sensitivity of the receptor is assessed as High. The overall significance of the impact is assessed as Major.

7.3.15.4 Additional Mitigation Measures

- ✚ The RAP; SEP-GRM, and EMP for the project will provide specific provisions for the women and other socially disadvantaged groups identified
- ✚ As part of the local employment, the project shall explore possibilities of proactively engaging women in the project activities; especially civil works and housekeeping
- ✚ Prepare a worker code of conduct for the workforce to be engaged by the project
- ✚ The Grievance Redressal Committee (GRC), set up as a part of the Stakeholder Engagement Plan (SEP) of CUET will look into the gender grievance issues, arising due to construction activities or otherwise, and ensure systematic disposal of such cases, with due reporting.

7.3.15.5 Residual Impact Significance

The residual significance is assessed as moderate

Impact	Impact on Gender and Social Inclusion			
Impact Nature	Negative	Positive		Neutral
Impact Type	Direct	Indirect		Induced
Impact Duration	Short Term	Medium Term		Long Term
Impact Extent	Local	Regional		National
Impact Scale	Low	Medium		High
Impact Magnitude	Positive	Small	Medium	Large
Resource/ Receptor Sensitivity	Low	Medium		High
Impact Significance	Negligible	Minor	Moderate	Major
Residual Impact Magnitude	Positive	Negligible	Small	Medium
Residual Impact Significance	Negligible	Minor	Moderate	Major
	Residual impact significance is moderate			

8. ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

This section presents the Environmental Management Plan (EMP) for the Project. The purpose of this EMP is to specify the standards and controls required to manage and monitor environmental and social impacts during construction and operation phase. To achieve this, the EMP identifies potential adverse impacts from the planned activities and outlines mitigation measures required to reduce the likely negative effects on the physical, natural and social environment.

8.1 CUET's Organizational Structure

To ensure the efficacy of Environmental and social management plan, certain institutional mechanism with well-defined roles and responsibilities is essential for effective implementation of identified mitigation measures both during construction and operation phases.

8.1.1 CUET's Management

CUET will have ultimate responsibility for implementing the provisions of the EMP during construction and operation phase of the project. This role will include the on-going management of environmental and social impacts, monitoring of contractor performance as well as development of mechanisms for dealing with environmental and social problems.

CUET will also ensure that the activities of its contractors are conducted in accordance with good practice measures, implementation of which will be required through contractual documentation.

Source: CUET

8.2 Environment, Health and Safety Department (HSE)

The HSE department take the overall responsibility for co-ordination of the actions required for environment and social management and mitigation and for monitoring the progress of the proposed EMP for the project. However, ultimate responsibility for implementing the provisions of the EMP will lie with CUET.

In general, the HSE department shall perform the following activities:

- ✚ Preparation of required documents on environmental and social management;
- ✚ Ensuring availability of resources and appropriate institutional arrangements for implementation of EMP;
- ✚ Implementation of the health and safety measures;
- ✚ Collection of the statistics of health of workers;
- ✚ Providing support during routine medical check-ups of workers;
- ✚ Awareness and implementing safety programs;
- ✚ Providing job specific induction training;
- ✚ Compliance of regulatory requirements;
- ✚ Carrying out environmental audits;
- ✚ Identify unsafe acts & conditions and suggest remedies;
- ✚ Develop safety culture and comply with company's HSE policy & standards requirements;
- ✚ Encourage and enforce the use of PPE's;

- ✚ Educate all employees for the use of PPE's & safe practices;
- ✚ Direct, coordinate and orient the safety activities;
- ✚ Promulgate the spread of policy, objectives, rules and/or regulations;
- ✚ Perform a thorough investigation of all accidents and review the recommendations to avoid any repetition;
- ✚ Monitoring the progress of implementation of EMP; and
- ✚ Reviewing and updating the EMP as and when required for its effective implementation.

8.2.1 Inspection, Monitoring and Audit

Inspection and monitoring of the environmental impacts of the Project activities will increase the effectiveness of EMP. Through the process of inspection and auditing, CUET will ensure that the conditions stipulated in various permits are complied. The inspection and audits will be done by the project identified HSE staff in coordination with O & M contractors and any other external agencies identified. The entire process of inspections and audits should be being documented. The inspection and audit findings are to be implemented by the site In-charge in their respective areas.

8.3 Reporting and Documentation

CUET will develop and implement a program of reporting through all stages of the project cycle. Delegated personnel shall require to fully complying with the reporting program in O. Creeds s of both timely submissions of reports as per acceptable level of detail. Reporting will be done in form of environmental check list, incident record register, environmental and social performance reports (weekly, monthly, quarterly, half yearly, yearly etc.).

8.3.1 Documentation

Documentation is an important step in implementing EMP. CUET will establish a documentation and record keeping system to ensure recording and updating of documents per the requirements specified in EMP. The documents should be kept as hardcopies as well as in electronic format. Responsibilities have to be assigned to relevant personnel for ensuring that the EMP documentation system is maintained and that document control is ensured through access by and distribution to, identified personnel in form of the following:

- ✚ Master Environment Management System document;
- ✚ Legal Register;
- ✚ Operation control procedures;
- ✚ Work instructions;
- ✚ Incident reports;
- ✚ Emergency preparedness and response procedures;
- ✚ Training records;
- ✚ Monitoring reports;
- ✚ Auditing reports; and
- ✚ Complaints register and issues attended/closed.

8.3.2 Internal Reporting and Communication

Inspection and audits finding along with their improvement program are to be regularly reported to the senior management for their consideration. The same are also to be communicated within the staff working on the project.

To maintain an open communication between the staff and management on HSE and social issues the followings are being used:

- ✚ Team Briefings,
- ✚ On-site work group meetings;
- ✚ Work Specific Instructions; and
- ✚ Meeting with stakeholders. Journey

8.3.3 External Reporting and Communication

HSE In-charge is the responsible person for ensuring that communication with regulatory agencies and stakeholders are maintained as per the requirement. All complaints and enquiries are to be appropriately dealt with and records be maintained in a Complaint/Enquiry Register by the delegated staff of HSE. All communications made to regulatory agencies should also be reported to CUET corporate HSE Head.

8.3.4 EMP Review and Amendments

The EMP act as an environment and social management tool which needs to be reviewed periodically to address changes in the organization, process or regulatory requirements.

Following a review, HSE In-charge will be responsible for making the amendments in the EMP and seeking approval from the senior management. The amended EMP will be communicated to all the staff.

8.4 Training Programme and Capacity Building

Training is needed for effective implementation of EMP. HSE In-charge of CUET as well as CUET Corporate HSE Head will ensure that Environmental health and safety induction training and job specific trainings are identified and given to the concerned personnel for construction activities and during operations of the project.

Also general environmental awareness will be increased among the projects' teams to encourage the implementation of environmentally sound practices and compliance requirements of the project activities. This will help in minimising adverse environmental impacts, compliance with the applicable regulations and standards, and achieving performance beyond compliance. The same level of awareness and commitment will be imparted to the contractors and sub-contractors involved in the project.

8.5 Environmental Management Plan

This section outlines the potential adverse impacts, mitigation measures, monitoring and management responsibilities during construction and operation phases of the Projects.

The purpose of EMP is to:

- ✚ Provide an institutional mechanism with well-defined roles and responsibilities for ensuring that measures identified in EIA are designed to mitigate potentially adverse impacts, are implemented;
- ✚ List all suggested mitigation measures and control technologies, safeguards identified through the EIA process;

- ✚ Assist in ensuring compliance with all relevant legislations at local, state and national level for the Projects.

In order to minimize adverse impacts during different phases of project lifecycles, mitigation measures, monitoring plan and responsibilities for its implementation are given in **Table 8.1**

Table 8.1 Environmental Management Plan

Project Activities	Impact/ Issue	Applicable Project Phase	Mitigation Measures	Responsibility for ensuring implementation of the suggested mitigation	Means of Verification that mitigation has been met	Timelines /frequency of Monitoring	Responsibility for implementation of monitoring	Supervision responsibility	Reporting Requirements
Land use									
<ul style="list-style-type: none"> • Construction of site access road • Construction of associate facility • Construction residential unit 	Permanent changes in land use	PreConstruction	<ul style="list-style-type: none"> ➤ The land use in and around permanent project facilities should not be disturbed. ➤ Construction activities should be restricted to designated area. ➤ A RAP and LRP for the affected person will be prepared who will be considered for resettlement, compensation, and other restoration measures. 	CUET	Site inspection	Monthly monitoring	Site HSE Officer of EPC Contractor	HSE In-charge of CUET	Report from HSE officer EPC Contractor to site HSE In-charge of CUET
Land Procurement									
<ul style="list-style-type: none"> • Procurement of land for the project 	Physical and economic displacement of impacted households	Preconstruction	<ul style="list-style-type: none"> ➤ Resettlement Policy Framework, Resettlement Action Plan and LRP. While the RPF will be a decision maker on the entitlement, the RAP to be developed will provide a detailed assessment of the impacts of physical and economic displacement and identify suitable mitigation measures/entitlements for the same Grant preference to the PAHs for direct/indirect 	CUET	<ul style="list-style-type: none"> ➤ Resettlement Action Plan ➤ Stakeholder Engagement Plan ➤ Grievance Redressal 	Prior to construction and in keeping with the RAP requirements	CUET resettlement manager	CUET HSE in-charge	As specified in the RAP, SEP and GRM document

Project Activities	Impact/ Issue	Applicable Project Phase	Mitigation Measures	Responsibility for ensuring implementation of the suggested mitigation	Means of Verification that mitigation has been met	Timelines /frequency of Monitoring	Responsibility for implementation of monitoring	Supervision responsibility	Reporting Requirements
			<p>project employment opportunities</p> <ul style="list-style-type: none"> ➤ Livelihood restoration for the affected person will be covered under the project. The plan will provide allowances in terms of transition allowances, shifting allowances, food security allowances flood security allowance etc. as part of the RAP entitlements ➤ For those PAHs who elect to the option of self-relocation, provide compensation for the impacted immovable assets at replacement cost, without deducting the depreciation value, as provided in the RAP ➤ Identify and provide additional social and livelihood support to especially vulnerable families 		Mechanism				
•	Other Livelihood Impacts	Preconstruction	<ul style="list-style-type: none"> ➤ Preparation of a Resettlement Action Plan for the project Consider employment opportunities for the local community both for men and for women as per their existing skills for construction and operation 	CUET	<ul style="list-style-type: none"> ✚ Resettlement Action Plan ✚ Stakeholder 	Prior to construction and in keeping with the RAP	CUET resettlement manager	CUET HSE in-charge	As specified in the RAP, SEP and GRM document

Project Activities	Impact/ Issue	Applicable Project Phase	Mitigation Measures	Responsibility for ensuring implementation of the suggested mitigation	Means of Verification that mitigation has been met	Timelines /frequency of Monitoring	Responsibility for implementation of monitoring	Supervision responsibility	Reporting Requirements
			<ul style="list-style-type: none"> ➤ Identify and provide additional social and livelihood support to especially vulnerable families. Land users carrying out cultivation in the area will be identified during the pegging and construction stage 		<ul style="list-style-type: none"> Engagement Plan Grievance Redressal Mechanism 	requirements			
	Impact on Natural Resource Impacts	Preconstruction	<ul style="list-style-type: none"> ➤ Preparation of a Resettlement Action Plan for the project ➤ Allow the land users and owners to harvest the standing crops and trees in the project land ➤ Compensate the crops, trees, pukurs and other natural resources 	CUET	Resettlement Action Plan	Prior to construction and in keeping with the RAP requirements	CUET resettlement manager	CUET HSE in-charge	As specified in the RAP document
Topography and Drainage									
<ul style="list-style-type: none"> Construction of site access roads; Site development 	Changes in Topography and Drainage	Construction	<ul style="list-style-type: none"> ➤ Measures to be taken to retain the course of the stream at the eastern portion of the site ➤ A perimeter drain to be provided so that natural flow to the areas surrounding the site is maintained ➤ Appropriate cross drainage channels should be provided to maintain the drainage in the area. 	CUET	Site inspection	Monthly monitoring	Site Officer of HSE of CUET	HSE In-charge of CUET	Report site HSE officer of to HSE In-charge of CUET

Project Activities	Impact/ Issue	Applicable Project Phase	Mitigation Measures	Responsibility for ensuring implementation of the suggested mitigation	Means of Verification that mitigation has been met	Timelines /frequency of Monitoring	Responsibility for implementation of monitoring	Supervision responsibility	Reporting Requirements
			<ul style="list-style-type: none"> ➤ Cross drainage structures should be provided as necessary during widening and construction of access road to the site ➤ It is assumed that there is no obstruction in the south side of the project area; and floodwater around the project area may flow back into the Naf River uninterrupted. Therefore, it should be monitored that no road/obstruction is constructed in the south side of the project without proper provision for passing of flood water. ➤ Due to the construction of the embankment, there is a possibility of drainage congestion inside the project area, hence, adequate drainage facilities to be provided. ➤ Protect the proposed resettlement area and assets at the Site from potential surges in water level and changes in water course in main channel of Naf River ; ➤ Raise the ground level to prevent water logging/inundation, 						

Project Activities	Impact/ Issue	Applicable Project Phase	Mitigation Measures	Responsibility for ensuring implementation of the suggested mitigation	Means of Verification that mitigation has been met	Timelines /frequency of Monitoring	Responsibility for implementation of monitoring	Supervision responsibility	Reporting Requirements
			particularly in the north-eastern portion of Site.						
Soil									
Piling and excavation work.	Soil erosion	Construction	<ul style="list-style-type: none"> ➤ Piling and excavation work will not be carried out during the monsoon season to minimize erosion and run-off. 	EPC contractor	Site inspection	Monthly monitoring	Site HSE Officer of EPC contractor	HSE In-charge of CUET	Report from HSE officer of EPC contractor to site HSE In-charge of CUET
Storage and transport of construction materials; Storage of oil and lubricants onsite; Storage of hazardous waste onsite; Storage of waste (MSW and construction/demolition) onsite from project site; and Sewage generated from the site office.	Soil contamination	Construction, Operation	<ul style="list-style-type: none"> ➤ No unauthorized dumping of used oil and other hazardous waste should be undertaken at site. ➤ Construction and Demolition Waste should be stored separately and be periodically collected by an authorized treatment and storage facility ➤ Hazardous waste should be properly labelled, stored onsite at a location provided with impervious surface and in a secondary containment system ➤ In case of accidental/unintended spillage on small area, the contaminated soil should be immediately collected and stored as hazardous waste. 	EPC contractor, O&M contractor	Site inspection	Monthly monitoring	Site HSE Officer of contractor, O&M contractor	HSE In-charge of CUET	Report from HSE officer of contractor, O&M contractor to site HSE In-charge of CUET

Project Activities	Impact/ Issue	Applicable Project Phase	Mitigation Measures	Responsibility for ensuring implementation of the suggested mitigation	Means of Verification that mitigation has been met	Timelines /frequency of Monitoring	Responsibility for implementation of monitoring	Supervision responsibility	Reporting Requirements
			<ul style="list-style-type: none"> ➤ Designated areas should be provided for Solid Municipal Waste and daily collection and period disposal should be ensured ➤ All waste should be stored in a shed that is protected from the elements (wind, rain, storms, etc.) and away from natural drainage channels 						
Air Quality									
<ul style="list-style-type: none"> • Fugitive emissions from site development work, material handling etc. • Fugitive emission from traffic movement; • Exhaust emission from operation of machineries like pile dRiver s, vehicles; • Point source emission from diesel generator. 	Fugitive and pint source emission	Construction, Operation	<ul style="list-style-type: none"> ➤ Water sprinkling for dust suppression at the site and access road; ➤ Speed of vehicles should be limited to 10-15 km/hr ➤ DG sets should be placed within enclosures and have an adequate stack height; ➤ Prevent idling of vehicles and equipment ➤ Vehicle engines need to be properly maintained and should have a valid pollution control certificate to ensure minimization in vehicular emissions 	BEZA contractor, O&M contractor	Site inspection Review of PUC documents of vehicles	Monthly monitoring	Site HSE Officer of contractor, O&M contractor	HSE In-charge of CUET	Report from HSE officer of contractor, O&M contractor to site HSE In-charge of CUET
Water Environment									

Project Activities	Impact/ Issue	Applicable Project Phase	Mitigation Measures	Responsibility for ensuring implementation of the suggested mitigation	Means of Verification that mitigation has been met	Timelines /frequency of Monitoring	Responsibility for implementation of monitoring	Supervision responsibility	Reporting Requirements
Water required for construction phase and operation phase of the project	Depletion of water resource	Construction, Operation	NOC for abstraction of ground water for operational phase under Bangladesh Pani Bidhimala 2018	CUET	Permission letter	At the start of operation	Site HSE Officer of CUET	HSE In-charge of CUET	Report from site HSE to corporate HSE
			Maintain logbook for water consumption	BEZA Team, CUET Team	Water consumption log book	Monthly monitoring	Site HSE Officer of EPC, site HSE In-charge of O&M Team	HSE In-charge of CUET	Report from HSE officer of O&M contractor to site HSE In-charge of CUET
Storage of hazardous substances onsite; and Storage of hazardous waste onsite.	Water Contamination	Construction, Operation	Prevent & mitigate spill of fuel within the storage area	BEZA Team, CUET Team	Site inspection	Regular monitoring	Site HSE Officer of EPC, site HSE In-charge of O&M Team	HSE In-charge of CUET	Report from HSE officer of EPC/O&M contractor to site HSE In-charge of CUET
			Septic tank and soak pit or modular Sewage Treatment Plant (STP) will be provided in construction site and labour accommodation area for treatment of domestic wastewater.	EPC Team; O&M Team	Site inspection	Regular monitoring	Site HSE Officer of EPC, site HSE In-charge of O&M Team	HSE In-charge of CUET	Report from HSE officer of EPC/O&M contractor to site HSE In-charge of CUET

Project Activities	Impact/ Issue	Applicable Project Phase	Mitigation Measures	Responsibility for ensuring implementation of the suggested mitigation	Means of Verification that mitigation has been met	Timelines /frequency of Monitoring	Responsibility for implementation of monitoring	Supervision responsibility	Reporting Requirements
			Storage of chemical, fuel in paved storage area;	BEZA Team; O&M Team	Site inspection	Regular monitoring	Site HSE Officer of EPC, site HSE In-charge of O&M Team	HSE In-charge of CUET	Report from HSE officer of EPC/O&M contractor to site HSE In-charge of CUET
			Oil and grease separator shall be used for wastewater generated from cleaning activities	BEZA Team; O&M Team	Site inspection	Regular monitoring	Site HSE Officer of EPC, site HSE In-charge of O&M Team	HSE In-charge of CUET	Report from HSE officer of EPC/O&M contractor to site HSE In-charge of CUET
			Wastewater from the concrete batching will be treated to comply with discharge standards before it is discharged.	BEZA Team,	Site inspection	Regular monitoring	Site HSE Officer of BEZA,	HSE In-charge of CUET	Report from HSE officer of EPC contractor to site HSE In-charge of CUET
			Regular monitoring the surface and ground water quality	BEZA Team; O&M Team	Site inspection	Six monthly monitoring	Site HSE Officer of EPC, site HSE In-charge of O&M Team	HSE In-charge of CUET	Report from HSE officer of EPC/O&M contractor to site HSE In-

Project Activities	Impact/ Issue	Applicable Project Phase	Mitigation Measures	Responsibility for ensuring implementation of the suggested mitigation	Means of Verification that mitigation has been met	Timelines /frequency of Monitoring	Responsibility for implementation of monitoring	Supervision responsibility	Reporting Requirements
									charge of CUET
Noise Quality									
Construction activities; Operation of DG sets; Cable car stations and Vehicular movement	Increase in noise level	Construction, operation	<ul style="list-style-type: none"> ➤ Normal working hours of the contractor to be defined (preferable 8 am to 6pm). If work needs to be undertaken outside these hours, it should be limited to activities which do not generate noise; ➤ Only well-maintained equipment should be operated on-site. ➤ Machinery and construction equipment that may be in intermittent use should be shut down or throttled down during non-work periods; and ➤ Minimal use of vehicle horns and heavy engine breaking in the area needs to be encouraged. ➤ Noise monitoring to be conducted during construction phase near the settlements ➤ Any noise generating activity near schools should be avoided during the school hours 	BEZA Team	Site inspection	Monthly monitoring	Site HSE Officer of BEZA	HSE In-charge of CUET	Report from HSE officer of EPC contractor to site HSE In-charge of CUET

Project Activities	Impact/ Issue	Applicable Project Phase	Mitigation Measures	Responsibility for ensuring implementation of the suggested mitigation	Means of Verification that mitigation has been met	Timelines /frequency of Monitoring	Responsibility for implementation of monitoring	Supervision responsibility	Reporting Requirements
Operational Health and Safety									
<ul style="list-style-type: none"> Working at heights; Working with live electrical components; and operation of cranes and other mechanical lifting equipment 	Injury, near-misses and fatalities for labour contracted on site.	Construction, Operation,	All workers (regular and contracted) should be provided with training on Health and Safety policies in place with appropriate refresher courses throughout the life cycle of the Project	BEZA Team, O&M Team	Training report	Monthly monitoring	Site HSE Officer of BEZA, site HSE In-charge of O&M Team	HSE In-charge of CUET	Report from HSE officer of EPC/O&M contractor to HSE officer of CUET
			Obtain and check safety method statements from contractors	BEZA Team, O&M Team	Site inspection	Monthly monitoring	Site HSE Officer of EPC, site HSE In-charge of O&M Team	HSE In-charge of CUET	Report from HSE officer of EPC/O&M contractor to HSE officer of CUET
			PO.Creeds itting system should be implemented to ensure that cranes and lifting equipment is operated by trained and authorized persons only	BEZA Team, O&M Team	Permitting document	Monthly monitoring	Site HSE Officer of EPC, site HSE In-charge of O&M Team	HSE In-charge of CUET	Report from HSE officer of EPC/O&M contractor to HSE officer of CUET
			Appropriate safety harnesses and lowering/raising tools should be used for working at heights	BEZA Team, O&M Team	Site inspection	Monthly monitoring	Site HSE Officer of EPC, site HSE In-charge of O&M Team	HSE In-charge of CUET	Report from HSE officer of EPC/O&M contractor to HSE officer of CUET

Project Activities	Impact/ Issue	Applicable Project Phase	Mitigation Measures	Responsibility for ensuring implementation of the suggested mitigation	Means of Verification that mitigation has been met	Timelines /frequency of Monitoring	Responsibility for implementation of monitoring	Supervision responsibility	Reporting Requirements
			A safety or emergency management plan should be in place to account for natural disasters, accidents and any emergency situations	BEZA Team, O&M Team	Site specific Emergency Management Plan	Monthly monitoring	Site HSE Officer of EPC, site HSE In-charge of O&M Team	HSE In-charge of CUET	Report from HSE officer of EPC/O&M contractor to HSE officer of CUET
			A safety or emergency management plan should be in place to account for natural disasters, accidents and any emergency situations. The nearest hospital, ambulance, fire station and police station should be identified in the implemented emergency management plan.	BEZA Team, O&M Team	Site inspection	Monthly monitoring	Site HSE Officer of EPC, site HSE In-charge of O&M Team	HSE In-charge of CUET	Report from HSE officer of EPC/O&M contractor to HSE officer of CUET
Ecology									

Project Activities	Impact/ Issue	Applicable Project Phase	Mitigation Measures	Responsibility for ensuring implementation of the suggested mitigation	Means of Verification that mitigation has been met	Timelines /frequency of Monitoring	Responsibility for implementation of monitoring	Supervision responsibility	Reporting Requirements
Construction of sites and access roads	Impact on local flora and fauna	Construction	<ul style="list-style-type: none"> ➤ Unnecessary disturbance of neighbouring vegetation due to off-road vehicular movement, fuel wood procurement and destruction of floral resources should be prohibited; ➤ Strict prohibition should be maintained on use of fuel wood and shrubs from nearby areas as kitchen fuel. ➤ Construction activities to be avoided during rainy season as far as possible; ➤ No water source/flow to be obstructed as a result of construction activities ➤ Hazardous materials should not be stored near natural drainage channels; ➤ Good housekeeping should be followed for construction activities, waste packaging material should be properly disposed; ➤ Speed limit of vehicles plying on these routes should be kept to 10-15 km/hr to avoid road kill of mammals and reptiles; ➤ Proper sanitation facilities should be provided at site offices; ➤ Anti-poaching, trapping and hunting policy among 	BEZA Team, O&M Team	<ul style="list-style-type: none"> • Site Inspection; • Training records; • Visual Assessment by experts 	Monthly monitoring	Site HSE Officer of EPC, site HSE In-charge of O&M Team	HSE In-charge of CUET	Report from HSE officer of EPC/O&M contractor to HSE officer of CUET

Project Activities	Impact/ Issue	Applicable Project Phase	Mitigation Measures	Responsibility for ensuring implementation of the suggested mitigation	Means of Verification that mitigation has been met	Timelines /frequency of Monitoring	Responsibility for implementation of monitoring	Supervision responsibility	Reporting Requirements
			employees and contractors should be strictly enforced.						
Labour Welfare									
Construction of sites and access roads	Impact on Labour Welfare and well being	Construction	<ul style="list-style-type: none"> ➤ The labour camp shall be developed in keeping with the EBRD guidelines and IFC PS requirements ➤ The labor camp should be located at a certain safe distance from the local community settlements, to minimize impacts on the local 	BEZA Team, O&M Team	<ul style="list-style-type: none"> • Labour management plan • Training records • Monitoring of labour camp 	Monthly monitoring	Site HSE Officer of EPC, site HSE In-charge of O&M Team	HSE In-charge of CUET	Report from HSE officer of EPC/O&M contractor to HSE officer of CUET

Project Activities	Impact/ Issue	Applicable Project Phase	Mitigation Measures	Responsibility for ensuring implementation of the suggested mitigation	Means of Verification that mitigation has been met	Timelines /frequency of Monitoring	Responsibility for implementation of monitoring	Supervision responsibility	Reporting Requirements
			<p>community due to the laborers and the risks of conflict or violence between the workers and local community</p> <ul style="list-style-type: none"> ➤ Each worker and employee shall be provided a health and safety training as part of the induction process ➤ The labour management plan shall have provisions to ensure non-discrimination and fair treatment for all workers ➤ CUET should ensure a monthly monitoring and regular auditing mechanism for monitoring the sub-contractors and suppliers with respect to compliance to the applicable reference framework, in terms of resources, migrant workers, child labor and forced labor, health and safety, payment of wages etc. ➤ Strengthen security personnel around labor camps in order to maintain adequate law and order and avoid any possible tensions between the migrant workforce and host community. 		<p>requirements against EBRD guidelines</p> <ul style="list-style-type: none"> • Visual Assessment by experts • Internal grievance Redressal system 				

Project Activities	Impact/ Issue	Applicable Project Phase	Mitigation Measures	Responsibility for ensuring implementation of the suggested mitigation	Means of Verification that mitigation has been met	Timelines /frequency of Monitoring	Responsibility for implementation of monitoring	Supervision responsibility	Reporting Requirements
			<ul style="list-style-type: none"> ➤ Establish an internal grievance redressal mechanism in place, to allow for the employees and workers to report any concern or grievance related to work activities 						
Occupational Health and Safety									
<ul style="list-style-type: none"> • Construction of sites and access roads • Operation of the plant 	Impact on occupational health and safety of construction workers	Construction, Operation	<ul style="list-style-type: none"> ➤ Develop an Occupational Health and Safety Management Plan ➤ Adequate provision of healthy living conditions will be ensured in the contractor labour camp; ➤ Exposure of workers operating near high noise generating sources will be reduced to the extent possible; ➤ Use of adequate personal protection equipment (PPEs); ➤ Health surveillance of contractor workforce will be conducted 	BEZA Team, O&M Team	<ul style="list-style-type: none"> • Occupational Health and Safety Management Plan • Noise Monitoring Records • Visual Observation of use of PPE • Health surveillance records • Monitoring of labour camp against EBRD guidelines 	Monthly monitoring	Site HSE Officer of EPC, site HSE In-charge of O&M Team	HSE In-charge of CUET	Report from HSE officer of EPC/O&M contractor to HSE officer of CUET

8.6 Biodiversity Conservation & Wildlife Management Plan

Biodiversity is part of our daily lives and livelihood and constitutes resources upon which families, communities, nations and future generations depend. Every organism and its variation are unique and have its own role to play in a particular ecological niche. During the last few decades, the pace of species extinction has increased dramatically as a result of human activities. Ecosystems are being fragmented or eliminated, and several species are in decline. The fragmentation, degradation, and loss of habitats pose serious threats to biological diversity. These losses are irreversible and pose a threat to our own well-being, considering our dependence on food crop medicines and other biological resources. The main objective of the Biodiversity Conservation and Management Plan is the sustainable use of natural resources, which involves scientific management of natural wealth developmental activities, which is likely to affect these resources. Therefore, a Biodiversity Conservation and management plan has been formulated for the conservation and management of the forest ecosystems Project area. The recommendations are designed to promote long-term high-level maintenance and recruitment of important structural attributes such as wildlife, diversity of species, special or unique habitats for floral and faunal wealth, and riparian areas diversity Biodiversity management is considered a difficult task as it refers to diversity at all levels like genetic, species and community. The formulation of a biodiversity management and wildlife conservation plan for a developmental Project is one of the steps toward environment conservation. Human activities like agricultural expansion, road construction, urbanization, and other developmental activities are supposed to be major threats to biodiversity and wildlife, therefore, the most effective and efficient mechanism for conserving biodiversity is to prevent further destruction or degradation of habitats.



Figure 8.1 Available biodiversity in the project area

In this project biodiversity management plan creates a great impact on the environment and wildlife. The Outlines actions and measures are necessary for the effective management of biodiversity along the route. The goal of this plan is to preserve the diversity of species, Sustainable utilization of species and ecosystem, to maintain life-supporting systems and essential ecological processes. Without a wide range of animals, plants, and microorganisms, we cannot have the healthy ecosystems that we rely on.

8.6.1 Trees

The research area primarily consists of homesteads, agricultural grounds, and vegetation along roads. The two main cultivars are paddy and maize. Major tree species include Chaplish, Garjan, Syzigium, Jarul Gamar, Koroi, Civit, and Toon, among others. The site's vegetation patches are dispersed and largely located near where people have been living, mostly in the western and central parts of the site. The site's major tree species include Eucalyptus, Akasmoni, Kanthal, Debdaru, Aam, Neem, and Supari Tal, among others. Additionally, there are bamboo bushes on the property. In order to preserve the health and operation of forests, which are complex ecosystems made up of many types of trees, plants, animals, and microbes, trees perform an essential and complicated role. Every element helps the forest maintain its overall balance and resilience.

Table 8.2 Project Activities and their effects on trees

PROJECT ACTIVITIES	IMPACT/ ISSUE	APPLICABLE PROJECT PHASE	EFFECTS
Procurement of land for the project	Trees/Plants	Construction	<ol style="list-style-type: none"> 1. The ecological balance will get disturbed, resulting in more frequent floods and droughts. 2. The topmost fertile layer will be lost, resulting in reduced fertility and desertification with time. 3. Wildlife will be affected, as the natural habitat provides shelter, food, and protection. 4. The most drastic effect will be global warming and climatic change.

Table 8.3 Management Plan for effects on trees

Management objective	1. Protect existing trees or stands	2. Plant new trees or woodland/forest restoration
1. Prevent net loss of tree canopy or forest type	If some trees are protected as a condition for removing other trees, net loss of canopy or forest type always occurs over the short term. If mitigation trees are mature, additional long term canopy loss is possible when the mitigation trees die. The degree of loss is a function of the mitigation ratio (e.g., 1 for 1 mitigation could lead to 50% loss)	Over the short term, canopy is normally reduced. Planting or afforestation has the potential to prevent long-term net loss if: (a) mitigation ratio is at least 1 successful new tree for each tree removed; (b) replacement species have similar mature canopy spread; (c) replanting or natural regeneration maintains the mitigation planting in perpetuity
2. Maintain mature tree canopy	Some mature canopy can be maintained over the short term. Long term maintenance depends on whether provisions have been made for natural regeneration and/or eventual replanting.	Loss of mature canopy is not mitigated over the short term (i.e., not until new plantings mature).
3. Maintain aesthetics associated with existing trees	Aesthetic impacts associated with loss of mature trees can be partially mitigated, depending on location of mitigation trees.	Aesthetic impacts associated with loss of mature trees are not mitigated over the short term.
4. Maintain habitat values	Habitat values associated with mature trees and existing woodlands/forests may be partially mitigated over the short term, depending on: (a) habitat elements provided by mitigation trees; (b) the location of the mitigation trees with respect to other trees or habitat elements; (c) level of disturbance (both initial and ongoing) in the mitigation area	Loss of habitat values associated with mature trees and existing woodlands/forests are not mitigated over the short term. New plantings do have habitat values, but these typically differ from those associated with mature trees and stands.

5. Maintain species diversity	The degree of mitigation provided depends on the species composition of protected areas. Locally uncommon or rare tree species can be conserved at least over the short term. Diversity of species other than trees (e.g., understory plants, animals) may also be conserved.	Depending on species used in planting, tree species diversity can be increased or decreased relative to preexisting tree or woodland/forest resources. The level of diversity among non-tree species depends strongly on the plant community and restoration / management practices used. Undesirable nonnative "weedy" species may be more prevalent in new plantings compared to existing woodlands/forests.
6. Maintain age diversity	The degree of mitigation provided depends on the species composition of protected areas. Locally uncommon or rare tree species can be conserved at least over the short term. Diversity of species other than trees (e.g., understory plants, animals) may also be conserved.	Depending on species used in planting, tree species diversity can be increased or decreased relative to preexisting tree or woodland/forest resources. The level of diversity among non-tree species depends strongly on the plant community and restoration / management practices used. Undesirable nonnative "weedy" species may be more prevalent in new plantings compared to existing woodlands/forests.
7. Conserve local tree genetic resources	Conservation of germplasm from local tree populations and populations of other woodland/forest organisms is possible if a sufficient number of individuals are protected. However, maintaining a few widely scattered individuals of outcrossing wind-pollinated species (e.g., many oaks) might not permit seed set and would effectively eliminate regeneration.	Local genetic resources (Annexure) may be conserved if seed or other propagules from local populations are used. Use of non-local planting stock in woodland/forest plantings may be a source of "genetic pollution" and may accelerate the loss of genetic traits associated with local adaptation

8.6.2 Elephants

Over the year construction period elephants will continue to use the crossing locations and there will be unavoidable interactions between the construction crews and elephants. To minimize this, an elephant awareness and construction period conflict minimization plan will be prepared as soon as the contractor is mobilized.

Table 8.4 Project Activities and their effects on elephants

PROJECT ACTIVITIES	IMPACTED BIODIVERSITY	APPLICABLE PROJECT PHASE	EFFECTS
Construction activities; Operation of DG sets; Cable car stations and Vehicular movement	ELEPHANT	Preconstruction, During Construction, Post Construction	<ol style="list-style-type: none"> 1. Their route will be changed due to this project 2. Due to disturbance, they can go to residential areas and can harm people. 3. Wildlife will be affected, as the natural habitat provides shelter, food, and protection. 4. Their Species can be losing day by day.

Table 8.5 Consequence of anticipated effects

Topic	Information
Elephant' s damaging area	Crop fields, houses, stored food, homestead gardens,commercially raised gardens.
Crops damaged by elephants	Paddy, Banana, Jackfruit, Bamboo, Guava, Coconut, Betelnut, Sugarcane, Melon, Mula, Brinjal, Mango, Potato.
Elephant's damaging/ raiding nature	<ol style="list-style-type: none"> 1) Generally, raid crops at night <p>Walk across the paddy fields and eat tender leaves or ripen paddy.</p> <ol style="list-style-type: none"> 2) Uproot coconut and betel nut trees <p>Come seasonally to nearby homesteads to eat Jackfruit,banana and stored paddy (if available).</p>
Frequent Elephant raiding months	Homestead gardens damage is comparatively higher in the months of May-June (Jackfruit fruiting season), and July-August (Guava fruiting season). Elephants damage homestead banana gardens around the year.

Table 8.6 Management Plan for effects on elephant

Management Objective	Details/ Management Plan
Monitoring Elephant	<ul style="list-style-type: none"> • Animal movement corridors will be identified with the help of local forest officials and all work will be carried out away from the same. • Monitor will Work at each crossing site will be completed as quickly as possible Immediately improve the guiding areas/structures by planting suitable plans and trees and constructing/maintaining the bollards • The project areas located close to the animal movement corridor will be adequately fenced with security guards to discourage animals coming close to the project location/ workers from entering the forests. The guard will be appointed to monitor the power evacuation lines, especially for bird strikes during the operation.
Elephant overpasses land requirements	<ul style="list-style-type: none"> • Based on a more detailed examination of the few crossing sites, overpasses are technically feasible at all sites but will require land for the structure as well as the guide all forest land, some of which is settled. The detailed update after conduction of the detailed study on elephant movement and behaviour by the Independent Monitor Wildlife Expert during the pre-construction stage.
Elephant Travel Route identified with imaging camera	<ul style="list-style-type: none"> • Can use the selected imaging camera option to detect the presence of elephants in the vicinity of their route. Conduct follow-up elephant awareness programs for Cable car staff as well as a program to place elephant crossing signs in strategic locations before the crossing points in both directions.

Elephant protection and avoiding disturbance	<ul style="list-style-type: none"> • Retain Environmental Specialist on Engineer's staff and draft to prepare construction period elephant impact avoidance plan. • All construction work and transportation of construction material to the site of the barrage and powerhouse, which are close to the forest path will be restricted between • Daytime and close it before sunset to avoid disturbance to the wild animals in the project area
Changing the route by giving food	<ul style="list-style-type: none"> • Local forest officials can make an alternative route by giving food in the expected route.

8.6.3 Birds


The project area (Teknaf) is a birdwatcher's paradise, with a wide range of avian species. The region is part of the East Asian-Australasian Flyway, and migratory birds pass through during the winter months. Variety of waterfowl, shorebirds, and forest-dwelling birds in Teknaf. A total of 32 species of avifauna from 23 families have been identified in the study region during the avifaunal survey. Red Turtle Dove, Blue-throated Barbet, Black-hooded Oriole, Common Iora, Baya Weaver, Little Cormorant, Black Drongo, Black-hooded Oriole, Red-vented Bulbul, Rufous Treepie, White-throated Fantail, Long-tailed Shrike, etc. are some of the more notable species that have been observed birds play a crucial role in maintaining the health and stability of forests and conserving and restoring these habitats is essential to ensure their survival. Birds are also important pollinators and seed dispersers, essential for the survival and growth of plant species. Many species of birds feed on fruits and berries and then excrete the seeds, which can later grow into new trees, plants, and flowers. This process is critical for maintaining the biodiversity of forests and supporting natural reforestation.

Table 8.7 Project Activities and their effects on birds

PROJECT ACTIVITIES	IMPACT/ ISSUE	APPLICABLE PROJECT PHASE	EFFECTS
<ul style="list-style-type: none"> • Construction activities; • Operation of DG sets; • Cable car stations and • Vehicular movement • Working at heights; • Working with live electrical components; and 	Trees/Plants	Preconstruction, Post Construction and During Construction	<ul style="list-style-type: none"> • birds help control the spread of invasive species, pests, and diseases that can harm the environment and the health of humans and other animals, keeping the ecosystem balance and climatic changed. • birds feed on insects that can cause

<ul style="list-style-type: none"> operation of cranes and other mechanical lifting equipment 			<p>damage to some species of trees, which ensures the health of the entire forest.</p>
--	--	--	--

Table 8.8 Management Plan for effects on birds

Management Objective	Details/ Management Plan
Afforestation	<ul style="list-style-type: none"> Afforestation is useful for protecting urban biodiversity including birds. As key components of forest biodiversity, birds are also important contributors to the forest community (e.g., as pollinators, dispersers, and pest controllers).
Specially designed decals	<ul style="list-style-type: none"> Can protect the lives of native birdlife with the installation of specially designed decals to prevent birds flying into the windows of its terminal. 

8.6.4 Another Biodiversity

The project area hosts diverse plant and animal species, including various species of mammals, reptiles, and birds. Some notable wildlife species found in the area are leopards, wild boars, and different types of deer, Capped Langur, waterfowl etc.

Table 8.9 Management Plan for effects on other biodiversity

Objective	Details about Management Plan
Afforestation and Enrichment plantation	<ul style="list-style-type: none"> • Afforestation and enrichment plantations will be carried out in the area. Plantation of indigenous species (Annexure) will be taken up in the stretch with an admixture of food and cover plants.
Bamboo Plantation	<ul style="list-style-type: none"> • To minimize their dependence on the forest, bamboo and cane cultivation is important. • Bamboo plantation will be done both in private land outside the protected area to maintain the local needs and also in the sanctuary to maintain the floral diversity and wildlife habitat. Plantation will be carried out on outer slopes protected area, and on private lands where bamboo clumps are comparatively less and stunted. Bamboo rhizomes with a tuft of one-year-old aerial roots will be planted for early establishment. Additional bamboo buffer resources need to be built up, as the species is the staple food of elephants and is also subject to gregarious flowering and death soon after around the planting area to prevent grazing. As bamboo is susceptible to root competition and fire, the plantation will be kept properly hoed, weeded, and protected from fire for optimum growth.
Awareness promotion	<ul style="list-style-type: none"> • The success of any conservation plan of this magnitude is entirely hinged on the active support and wholehearted co-operation of all stakeholders with the members of the public playing a major role: <ol style="list-style-type: none"> i. For this purpose, meetings and workshops will be organized from village to village on a regular basis to carry the people along with implementation. ii. Functions like Van Mahotsav, Wildlife Week, World Forestry Day, and World Environment Day will be organized in a befitting manner to which village heads, members of public representatives' system at GP level, local leaders, and members of NGO may be invited. The discussion may evolve around the deterioration of biodiversity, habitat loss, control of elephant damage and other human-wildlife conflicts, fire damage control, and how best the vegetation can be revamped etc. Members of the public will be encouraged to speak. The student community may also be sensitized to various conservation issues.
Safeguard Measures	<ul style="list-style-type: none"> • In addition to the various proposed plans, Project authorities are suggested to furnish appropriate guidelines to their workers as safeguard measures. Some of the measures to be followed are mentioned below:

	<ul style="list-style-type: none"> iii. Strict monitoring of laborers and associated workers for any activity related to endangering the life or habitat of wild animals and birds. iv. Strict restrictions will be imposed on the workers at Project sites to ensure that they do not harvest any produce from the natural forests and cause any danger or harm to the animals and birds in wild. v. The Project authorities will be bound by the rules and regulations of the Wildlife. vi. Protection Acts or any such agency of the State, which may exist or will be promulgated from time to time for the preservation of habitats and protection of wild animals. vii. It is to be ensured that the noise levels in no case go above 100-150 dB in the Project area. One of the measures that is proposed to be adopted is that the blasting is to be restricted during nights, early mornings and late afternoons, which are the feeding times of most of the fauna. Blasting will be resorted to only if necessary. For this strict blasting viii. Biodiversity & Wildlife Management Plan blasting under constant and strict surveillance is to be followed. The suggested methodologies aim at reducing and mitigating noise so as to cause as little disturbance to the animals as possible. ix. Each worker shall be provided with an identity card and will not be allowed access to forest areas without permission. x. The workers shall be discouraged for the plantation of nonnative species in the surroundings of labor colony. xi. Possession of firearms by Project workers shall be strictly prohibited, except for dedicated security personnel.
--	--

8.7 Sugesstions for Responsible Tourism Roles and Responsibilities

Ecotourism focuses on the conservation of nature and environmentally responsible behavior of tourists to avoid damage to the forest. The contexts of ecotourists behavior would be:

(a) Pre-trip: Before the site visit, the ecotourists are informed of the following issues:

- i. Commitment to green practice
- ii. The size of the group
- iii. Modes of transport
- iv. History of the place

(b) During the trip: Acting in a responsible manner with respect to:

1. Local Community:

- i. Respecting local customs and acting as a guest
- ii. Traveling with humility
- iii. Spending money in local enterprises

2. Local Environment:

- i. Avoiding any damage to trails, flora, and fauna
- ii. Minimizing personal impact on the environment

(c) Post-trip: Further developing an understanding and appreciation of the places visited; considering the impacts of the trip and providing feedback to the tour operator.

Rating from visitor's comments

On the basis of tourist satisfaction, there should be a rating system about the trip.

8.7.1 Tourism User Fees in Ecotourism Activities and Services

i. **Entrance fee:** The fees are charged by the respective authority to allow ecotourists in any ecotourism site. A minimum amount of entrance fees should be allowed under the supervision of authority. This will help to enhance the chance of earning revenue and this revenue can further be invested in the development of the site. The entrance fee may vary based on children, students, and adults. The authority will provide a receipt to the ecotourists before permitting the site and take the receipt before leaving the place.

iii. **Concession fee:** The fees that are charged or shared of revenue paid by the business entity within PAs or ecotourism sites that provide services to the visitors. For example, fees to operate restaurants, hotels, eco-lodge facilities, and souvenir shops. The revenue of concession fees can be utilized in infrastructure development. The major options include:

- Fees based on the number of people a concession serves during a given year
- Fees based on a percentage of the gross or net income of the concessionaire
- An annual fixed fee

iv. **Tourism-based taxes:** The taxes would be taken for some special kinds of activities like a hiking trail, backcountry camping, watchtower fee, etc. Those taxes or revenues are further channeled into PAs and ecotourism sites conservation and development by the existing authority.

8.7.2 Facilities and Infrastructure Development

Attraction is the key element to the tourism industry as it is the reason to visit any site; therefore, the authority should keep an eye on the infrastructural development of the site. Presently, there is a lacking of infrastructure facilities like resting houses, accommodation facilities at night, fixed waste management tools, and so on. While infrastructural development

will be carried on it should be kept in mind that it does not create any disturbances to the natural resources including soil, flora, fauna, and soil. Some facilities and infrastructural development need to be carried on:

- Zone creation for camping
- Enhance existing accommodation facilities with developed indoor facilities
- Creation of existing tourist spot information interpretation center
- Introducing nature and hiking trails
- Installing waste management tools
- Installation of proper drainage and sewerage system

8.7.3 Tourism impact reduction

Tourists create some disturbances on the environment, forest, society, and its local culture unknowingly when they come to visit these places. Sometimes it is happened due to authority unconsciousness or lack of existing laws and regulations.

Some steps should be taken in order to reduce the tourism impact on different site conditions. These are as follows:

- . Enforcement of strict laws with fines on disturbing the nature condition and its element.
- i. Provide skilled eco-guide with eco-tourist who will help in minimizing disturbances inside the forest by interpreting them.
- ii. Ensure some small bill-boards facility within the PAs or ecotourism site which contains the necessary code of conduct of the tourist while using these sites
- iii. Showing a short documentary on how nature and its components will be disturbed and how we can minimize them.
- iv. Provide dustbin facilities inside the forest so that the tourist will not able to throw waste inside the forest.
- v. Provide proper attention by the respective authority to keep the continuity of these managerial functions so that these processes will last as long as possible.

8.7.4 Ecotourism promotion and awareness

For the development of the tourist-spot and make it more attractive to the tourists some essential steps should be taken. These are as follows:

- i. Transportation and communication facilities should be improved so that they can easily move to these sites.
- ii. Proper information about the existing tourist site should be provided by the respective authority to the tourist and visitors by establishing an information interpretation center as well as making a website of proper geographical location with required transportation channel.

- iii. There should be introduced some nature and hiking trails for the movement of tourist into the forest so that they can enjoy the natural beauty of forest. In these trails the tourist can move on foot and cycle. The following types of trails
 - Short trail (1km, half an hour walking trail)
 - Medium trail (2km, 1-hour walking trail)
 - Long trail (5km, 2-3 hours walk)
- iv. For better tourism management, we have to involve the local poor community with regulating managerial functions as well as some other activities like eco guides, bird and animal identification, species identification, boatman, tourist guards, interpreter, selling commodities and handicrafts.
- v. Reframing the landscape pattern of these sites with well infrastructures.
- vi. Facilitate picnic facilities with sufficient spaces in addition to fixed camping sites under proper security could be introduced for tourism management.
- vii. Sufficient accommodation facilities with proper safety at night as well.
- viii. Taking a proper plan by the existing authority with proper monitoring, administrating services so that these activities will socially acceptable, economically feasible, and valuable, environmentally sustainable.

8.7.5 Tourism Safety

Tourist safety is very essential for any tourist spot. A tourist may not visit a place which is lacking safety precautions. Ensuring safety of the tourist should be the first and foremost duty of an authority that will enhance tourist view towards visiting any remote PAs or ecotourism site. Well roads/boat and communication system, night guard around the tourist lodge, information and interpretation center, electricity facilities around the tourist spot, eco-guide facility during entering the forest, etc. should have to provide by the respective authority so that the tourist feel safe to visit around there. It will help in enhancing the number of visitors to these sites.

8.7.6 Education and Interpretation

The educational tourism segment may thus be classified as tourism first or education first. Education tourism can take a variety of directions and serve a diversity of visitor interests, such as satisfying curiosity about other people and their language and culture; stimulating interest in architecture; inspiring concerns for natural environments, landscapes, flora and fauna or deepening the fascination of cultural heritage and historic places. Educational tourism goes beyond curiosity, interest, or fascination for a particular topic but includes an element of organized learning.

On the other hand, Interpretation is an explanation of the natural, cultural or historic values attached to respective places. It enables visitors to gain insight and understanding about reasons for conservations and ongoing protection of our heritage. Generally, these activities are done by local educated people or any persons of the belonging authority. These activities can be done either in the conference room by general speaking or by showing a short documentary to them which will contain about all the elements of the surrounding PAs or ecotourism site. In that case, the interpreter should have to conscious that, the communication process should be easy for the visitors, relevant to the subject, easily understandable, and

entertaining. It will be better for the visitor to cope with the surrounding environment with its components as well as its culture and reduce the risk of disturbances that can be occurred by the visitors or tourists.

References [These references were citing in Flora & Fauna chapter]

- Choudhury, M.U. 1969. Working Plan of Cox's Bazar Forest Division for the period from 1968- 69 to 1977-78. East Pakistan Government Press., Dhaka, Bangladesh.
- Chowdhury, J.A. 2006. Towards Better Forest Management. OITIJHYA.
- Cowan, J.M. 1923. Working Plans for Cox's Bazar Forest Division. Bengal Government Press, Calcutta.
- FAO and IUCN. 2022. Floral Diversity in Cox's Bazar South Forest Division, Bangladesh. Dhaka.
- Feeroz, M.M. (ed.). 2013. Biodiversity of Protected Areas of Bangladesh, Vol. III: Teknaf Wildlife Sanctuary. BioTrack, Arannayk Foundation. Dhaka, Bangladesh.
- Hasan, M.K. and Akhtar, S. 2013. Amphibians. **In:** M.M. Feeroz (ed.), Biodiversity of Protected Areas of Bangladesh Volume III: Teknaf Wildlife Sanctuary, pp- 113-1120.
- Hasan, M.K., Khalilullah, M.I. and Alam, S.M.R. 2013. Reptiles. **In:** M.M. Feeroz (ed.), Biodiversity of Protected Areas of Bangladesh Volume III: Teknaf Wildlife Sanctuary, pp- 121-132.
- Hossen, S., Hossain, M., 2018. Conservation status of tree species in Himchari National Park of Cox's Bazar, Bangladesh. *Journal of Biodiversity Conservation and Bioresource Management* 4, 1–10. <https://doi.org/10.3329/jbcm.v4i2.39842>
- Kabir, D.S., Muzaffar, S.B., 2002. The review of the present state of Protected Areas of Bangladesh, in: Ahmed, M.F., Tanveer, S.A., Badruzzaman, A.B.M. (Eds.), *Bangladesh Environment 2002*. Bangladesh Poribesh Rokha Andolon, Dhaka, Bangladesh, pp. 389–403.
- Khan, M.S., Rahman, M.M., Huq, A.M., Mia, M.M.K., Hassan, M.A., 1994. Assessment of biodiversity of Teknaf Game Reserve in Bangladesh focusing on economically and ecologically important plant species. *Bangladesh J. Plant Taxon.* 1, 21–33.
- Khan, M.M.H. 2013. Birds. **In:** M.M. Feeroz (ed.), Biodiversity of Protected Areas of Bangladesh, Volume III: Teknaf Wildlife Sanctuary, pp- 133-194.
- Muzaffar, S.B., Islam, M.A., Feeroz, M.M., Kabir, M., Begum, S., Mahmud, S., Chakma, S., 2007. Habitat characteristics of the endangered Hoolock Gibbons (*Hoolock hoolock*) of Bangladesh: the role of tree species richness. *Biotropica* 39, 539–545.
- Nabi, M.R. 2013. Aquatic ecosystem, invertebrates, fish and fisheries. **In:** M.M. Feeroz (ed.), Biodiversity of Protected Areas of Bangladesh Volume III: Teknaf Wildlife Sanctuary, pp- 93-111.
- Nishat, A., Huq, S.M. Imamul, Barua, Shuvashish, P., Reza, Ali, A.H.M., Khan, Moniruzzaman, A.S. (eds.). 2002. *Bio-ecological Zones of Bangladesh*. IUCN Bangladesh Country Office, Dhaka, Bangladesh, xii + 141 pp.
- Rahman, M.M., Rashid, M.H., Rashid, S.H., 2001. Assessment of plant biodiversity of Sand dune ecosystem along the Cox's Bazar to Teknaf coast. *Bangladesh J. Plant Taxon.* 8, 27–46.
- Rosario, E.A., 1997. The Conservation Management Plan of the Protected Areas Other than those in the Sundarbans Forests in Bangladesh (A Draft Plan). GOB/WB, Forest Resources Management Project, Technical Assistance Component. Dhaka, Bangladesh.
- Sinclair, J.B., 1956. The flora of Cox's Bazar, East Pakistan. *Bull. Bot. Soc. Beng.* 9, 84–116.
- Uddin, S.N., Hassan, M.A. (Eds.), 2018. *Vascular Flora of Chittagong and the Chittagong Hill Tracts*, Vol. 1 (Pteridophytes, Gymnosperms & Liliopsida). Bangladesh National Herbarium, Dhaka, Bangladesh.
- Uddin, S.B., Rahman, M.A., 1999. Angiospermic flora of Himchari National Park, Cox's Bazar. *Bangladesh J. Plant Taxon.* 6, 31–68.
- Uddin, M.Z., Alam, M.F., Rahman, M.A., Hassan, M.A., 2013. Diversity in angiosperm flora of Teknaf Wildlife Sanctuary, Bangladesh. *Bangladesh J. Plant Taxon.* 20, 145–162.

9. CONCLUSION

BEZA is planning to construct a 9.5 km long cable car in Naf Tourism Park Coxs Bazar district, Teknaf Chittagong Division in North Eastern Bangladesh.

This EIA has been carried out, to evaluate the potential environmental impacts which could arise due to the implementation of the road construction. Assessments of the impacts have been presented with mitigation measures to reduce the magnitude of the impacts. Alternatives to the Project and key design aspects have also taken in cognizance, as part of this Study.

The project may create some impacts on land use, air quality, noise quality, physiography & drainage, local ecology, community health and safety during the construction phase. Limited disturbance is envisaged on the neighboring community in Hatiarguna Village. Mitigation measures have been suggested to minimize adverse environmental and social impacts that have been identified as part of the assessment.

Similarly, environmental impacts have been identified, and assessed, based on the baseline study undertaken as a part of EIA. The results of the same will frame the RPF and the RAP. The major impact identified is the change in the biodiversity of Naf River and at the top of the hill as the cable car will be connected among the three points. But the people within the project site will be economically benefited as it will be a tourist attraction.

An overarching Environment Management Plan (EMP) has been developed to cover implementation mechanism for recommended mitigation measures to counter likely adverse environmental and social impacts arising due to the development of the road. In addition, there will be a Gender Action Plan (GAP) to address issues related to gender vulnerability during and post construction phase. A Labour Management Plan (LMP) for labour and employment during construction, and a SEP-GRM, which will be a live and dynamic document for the project, that will record, review and address all external grievances arising from the impacted households throughout the project cycle.

CUET will also ensure that the environmental and social performances of all the activities are monitored throughout execution of various Project components. CUET will continue to report E&S performance and submit monitoring reports regularly to statutory authorities as per National environmental norms.

9.1 Impact Assessment Summary

The table below presents the outcomes of the comprehensive assessment of identified impacts as a result of the various phases of the Project. Significance of impact has been presented here without mitigation (with embedded controls) and with mitigation.

Table 9.1 Impact Assessment Summary

Impact Description	Impact nature	Significance of Impact	
		Before Mitigation	With Mitigation
Pre-Construction Phase			
Change in land use	Negative	Major	Moderate
Physical and Economic Displacement	Negative	Minor	Minor
Other Livelihood Impacts	Negative	Minor	Minor
Natural Resources	Negative	Major	Major
Construction Phase			
Soil compaction	Negative	Negligible	Negligible
Soil erosion and compaction	Negative	Minor	Negligible
Soil & Sediment contamination	Negative	Major	Moderate
Change in Topography and Drainage	Negative	Moderate	Major
Road & Traffic	Negative	Moderate	Minor
Impact on ambient air quality	Negative	Moderate	Minor
Impact on noise quality	Negative	Moderate	minor
Water resource & quality	Negative	Major	Moderate
Terrestrial Ecology (Habitat)	Negative	Major	Moderate
Terrestrial Ecology (Species)	Negative	Major	Moderate
Aquatic ecology (Habitat)	Negative	Major	Moderate
Aquatic Ecology (Species)	Negative	Major	Moderate
Occupational Health and Safety	Negative	Minor	Negligible
Community Health and Safety	Negative	Minor	Minor
Employment Opportunities	Positive		
Labour Welfare	Negative	Minor	Negligible
Operation Phase			
Soil contamination due to waste generation, spillage and leakage	Negative	Major	Moderate
Depletion of water resources	Negative	Major	Moderate
Occupational Health and Safety	Negative	Minor	Negligible
Impact on Local Employment	Positive		

The Environmental Management Plan (EMP) describes mitigation measures for impacts specific to the Project activities and also discusses implementation mechanisms.

9.2 Conclusion

It has been noted from **Table 9.1** that most of the impacts are of moderate significance and can be addressed by using suggested mitigation measures and other guidelines detailed in the RAP. The impacts identified to physical, ecological, and social environment are to be addressed through the mitigation measures discussed in *Section 7*. To conclude, implementation of EMP, the RAP and RPF will help CUET to benchmark its management plans based on the national regulations as guidelines, as well as to meet the International Safeguard requirements.

ANNEXURE

ANNEXURE 1: AIR QUALITY STANDARDS

Density in microgram per cusec meter

Sl.No.	Categories of area	Suspended Particulate Matters (SPM)	Sulphur dioxide	Carbon Monoxide	Oxides Nitrogen
a.	Industrial and mixed	500	120	5000	100
b.	Commercial and mixed	400	100	5000	100
c.	Residential and rural	200	80	2000	80
d.	Sensitive	100	30	1000	30

Notes:

(1) At national level, sensitive area includes monuments, health centre, hospital, archeological site, educational institution, and government designated areas (if any).

(2) Industrial units located in areas not designated as industrial areas shall not discharge pollutants which may contribute to exceeding the standard for air surrounding the areas specified at Sl. No c and d above.

(3) Suspended Particular Matter means airborne particles of a diameter of 10 micron or less.

ANNEXURE 2: WATER QUALITY STANDARDS

(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 above	200 or less
c.	Source of drinking water for supply after conventional treatment :	6.5-8.5	6 or less	6 or more	5000 or less
d.	Water usable by fisheries:	6.5-8.5	6 or less	5 or more	---

e.	Water usable by various process and cooling industries:	6.5-8.5	10 or less	5 or more	5000 or less
f.	Water usable for irrigation:	6.5-8.5	10 or less	5 or more	1000 or less

Notes:

- (1) In water used for pisciculture, maximum limit of presence of ammonia as Nitrogen is 1.2 mg/l
- (2) Electricity conductivity for irrigation water -2250 $\mu\Omega/cm$ (at a temperature of 25°C): Sodium less than 0.2%.

(B)Standards for drinking water

Sl. No.	Parameter	Unit	Standards
1	2	3	4
1.	Aluminium	mg/l	0.2
2.	Ammonia(NH ₃)	..	0.5
3.	Arsenic	..	0.05
4.	Balium	..	0.01
5.	Benzene	..	0.01
6	BOD ₅ 20°C	..	0.2
7	Boron	..	1.0
8	Cadmium	..	0.005
9	Calcium	..	75
10	Chloride	..	150-600

1	2	3	4
40.	Phosphate	"	6
41.	Phosphorous	"	0
42.	Potassium	"	12
43.	Radioactive materials (gross alpha activity)	Bq/l	0.01
44.	Radioactive materials (gross beta activity)	Bq/l	0.1
45.	Selenium	Bq/l	0.01
46.	Silver	"	0.02
47.	Sodium	"	200
48.	Suspended particulate matters	"	10
49.	Sulfide	"	0
50.	Sulfate	"	400
51.	Total dissolved solids	"	1000
52.	Temperature	C	20-30
53.	Tin	Bq/l	2
54.	Turbidity	JTU	10
55.	Zinc	Bq/l	5

ANNEXURE 3: SOUND QUALITY STANDARDS

Sl No.	Category of areas	Standards determined at dB unit	
		Day	Night
a.	Silent zone	45	35
b.	Residential area	50	40
c.	Mixed area	60	50
e.	Commercial area	70	60
f.	Industrial area	75	70

Notes:

- (1) The time from 6am to 9pm is counted as daytime
- (2) The time from 9 pm to 6 am is counted as night time
- (3) Area up to a radius of 100 meters around hospitals or educational institutions or special institutions or special institutions/establishments identified /to be identified by the Government is designated as Silent Zones where use of horns of vehicles or other audio signals and loudspeakers are prohibited.

(A) Standards for sound originating from Motor Vehicles or Mechanized Vessels

Category of Vehicles	Unit	Standards	Remarks
Motor Vehicles(all types)	dB	85	As measured at a distance of 7.5 meters from exhaust pipe
		100	As measured at a distance of 0.5 meter from exhaust pipe
Mechanized Vessels	dB	85	As measured at a distance of 7.5 meter from the vessel which is not in motion not loaded and is at two third of its maximum rotating speed
		100	As measured at a distance of 0.5 meter from the vessel which is the same condition as above

*At the time of taking measurement, the motor vehicle shall not be in the motion and its engine condition shall be as follows

(a) Diesel engine- maximum rotating speed

(b) Gasoline engine- at two third of its maximum rotating speed and without any load

(c) Motorcycle -If maximum rotating speed is above 5000 rpm; two thirds of the speed is less than 5000 rpm; three fourth of the speed.

(B) Standards for Emission from Motor Vehicles

Parameter	Unit	Standard Limit
Black Smoke	Hartridge Smoke Unit(HSU)	65
Carbon Monoxide	gm/km	24
	percent area	04
Hydrocarbon	gm/km	02
	ppm	180
Oxides of Nitrogen	gm/km	02
	ppm	600

* As measured at two thirds of maximum rotating speed.

(C) Standards for Emission from Mechanized Vessels

Parameter	Unit	Standard Limit
Black Smoke	Hartridge Smoke Unit(HSU)	65

As measured at two thirds of maximum rotating speed.

ANNEXURE 4: ODOUR QUALITY STANDARDS

Parameter	Unit	Standard Limit
Acetaldehyde	ppm	0.5-5
Ammonia	''	1-5
Hydrogen Sulfide	''	0.02-0.2
Methyl Disulfide	''	0.009-0.1
Styrene	''	0.4-2.0
Trim ethylamine	''	0.005-0.07

Notes:

- (1) Following regulatory limit shall be generally applicable to emission/exhaust outlet pipe of above 5 meter height:

$$Q = 0.018 * He^2 * Cm \text{ (where } Q=\text{Gas Emission rate Nm}^3/\text{hour)}$$

He= Height of exhaust outlet pipe (m)

Cm= Above mentioned limit (ppm)

- (2) In case where a special parameter has been mentioned, the lower limit shall be applicable for warning purpose and the higher limit shall be applicable for prosecution purpose or punitive measure.

ANNEXURE 5: STANDARDS FOR SEWAGE DISCHARGE

Parameter	Unit	Standard Limit
BOD	mg/l	40
Nitrate	''	250
Phosphate	''	35
Suspended Solids(SS)	''	100
Temperature	°C	30
Coliform	Number/100ml	1000

Notes:

- (1) This limit shall be applicable to discharges into surface and inland water bodies
(2) Sewage shall be chlorinated before final discharge

ANNEXURE 6: STANDARDS FOR WASTE FROM INDUSTRIAL UNITS OR PROJECT WASTES

SI No	Parameter	Unit	Place for determination of standards		
			Inland Surface Water	Public Sewerage system connected to treatment at second stage	Irrigated Land
1	2	3	4	5	6
1	Ammonical Nitrogen (as elementary N)	mg/l	50	75	75
2	Ammonia(as free ammonia)	„	5	5	15
3	Arsenic(As)	„	0.2	0.05	0.2
4	BOD ₅ at 20°C	„	50	250	100
5	Boron	„	2	2	2
6	Cadmium(as CD)	„	0.05	0.05	0.05
7	Chloride	„	600	600	600
8	Chromium	„	0.5	1.0	1.0
9	COD	„	200	400	400
10	Chromium (as hexavalent Cr)	„	0.1	1.0	1.0
11	Copper (as Cu)	„	0.5	3.0	3.0
12	Dissolved Oxygen(DO)	„	4.5-8	4.5-8	4.5-8
13	Electro-conductivity(EC)	micro mho/cm	1200	1200	1200
14	Total Dissolved Solid	„	2,100	2100	2100
15	Fluoride(as F)	„	2	15	10
16	Sulfide (as S)	„	1	2	2
17	Iron(as Fe)	„	2	2	2
18	Total Kjeldahl Nitrogen (as N)	„	100	100	100
19	Lead (as Pb)	„	0.1	1.0	1.0
20	Manganese (as Mn)	„	5	5	5
21	Mercury(as Hg)	„	0.01	0.01	0.01
22	Nickel (as Ni)	„	1.0	2.0	1.0
23	Nitrate(as elementary N)	mg/l	10.0	Not yet Fixed	10
24	Oil and grease	„	10	20	10

1	2	3	4	5	6
25	Phenolic Compounds(as C6H5OH)	„	1.0	5	1
26	Dissolved Phosphorus (as P)	„	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)	Degree	5	10	10
1	2	3	4	5	6
31	Total Dissolved Solid	„	2100	2100	2100
32	Temperature	Centigrade	40	40	40-summer
			45	45	45-winter
33	Suspended Solid	mg/l	150	500	200
34	Cyanide (as Cn)	"	0.1	2.0	0.2

Notes:

- (1) This standards shall be applicable to all industries or projects other than those specified under the heading " Standards for sector wise industrial effluent or emission"
- (2) Compliance with these standards shall be ensured from the moment as industrial unit start trial production and in other case from the moment a projects starts operation.
- (3) These standards shall be inviolable even in case of any sample collected instantly at any point of time. These standards may be enforced in a more stringent manner if considered necessary in view of the environmental conditions of a particular situation.
- (4) Inland surface water means drains/ponds/tanks/water bodies/ditches, canals, rivers, springs and estuaries.
- (5) Public sewerage system means treatment facilities of the first and second stage and also the combined and complete treatment facilities.
- (6) Irrigable land means such land area which is sufficiently irrigated by waste water taking into consideration the quantity and quality of such water for cultivation of selected crops on that land.
- (7) Inland Surface Water shall apply to any discharge to a public sewerage system or to land if the discharge does not meet the requirements of the definitions in notes 6 and 6 above.

ANNEXURE 7: STANDARDS FOR GASEOUS EMISSION FROM INDUSTRIES OR PROJECTS


Sl. No.	Parameters	Standard present in a unit of mg/Nm ³
1	2	3
1.	(a) Power plant with capacity of 200 Megawatt or above.	150
		350
	(b) Power plant with capacity less than 200 Megawatt.	
2.	Chlorine	150
3.	Hydrochloric acid vapor and mist	350
4.	Total Fluoride F	25
5.	Sulfuric acid mist	50
6.	Lead particulate	10
7.	Mercury particulate	0.2
8.	Sulfur dioxide	kg/ton acid
	(a) Sulfuric acid production (DCDA Process)	4
	(b) Sulfuric acid production (SCSA process)	10
	(DCDA: Double Conversion, Double Absorption, SCSA: Single Conversion, Single Absorption)	
	Lowest height of stack for dispersion of sulfuric acid (in meter)	
(a)	Coal based power plant	
	(1) 500 Megawatt or above	275
	(2) 200 to 500 Megawatt	220
	(3) Less than Megawatt	14(Q) ^{0.3}
(b)	Boiler	
	(1) Steam per hour up to 15 tons	11
	(2) Steam per hour more than 15 tons	14(Q) ^{0.3}
	[Q = Emission of Sulfur dioxide (kg/hour)]	

1	2	3
9.	Oxides of Nitrogen	
	(a)Nitric acid production	3kg/ton acid
	(b)Gas fuel based power plant	50 ppm
	(1) 500 Megawatt or above	50 ppm
	(2) 200 to 500 Megawatt	40 ppm
	(3)Below 200 Megawatt	30 ppm
	(c)Metallurgical oven	200 ppm
10.	Kiln soot and dust	mg/Nm ³
	(a)Blast Furnace	500
	(b)Brick Kiln	1000
	(c)Coke oven	500
	(d)Lime Kiln	250

ANNEXURE 8: FOCUS GROUP DISCUSSION QUESTIONNAIRE

FGD 1

Location: Domdomia



O.CREEDS Ltd.

ONUSHANDHANI CREEDS LIMITED

Focus Group Discussion on Cable Car Installation and Preparation at Naf Tourism Park

Public representatives of Teknaf

Focus Group Discussion

Greetings!
My name is Simoon Mostafa, and I am working with 'Cable Car Installation and Preparation at Naf Tourism Park'. We are conducting a survey and would appreciate your participation. I would like to ask your views about the Naf Tourism Park. This information will help to install a cable car at the tourism Park. The discussion session usually takes 60 minutes to complete. Whatever information you provide will be kept strictly confidential and will not be shown to other persons. Personal information that identifies you or your house will be blackened out by the field teams after we have left the village.

Participation in this survey is voluntary and you can choose not to answer any individual question or all the question. You may terminate the interview at any time. However, we hope that you will participate in this survey since your views are important. Will you participate in this survey?

At this time, do you want to ask me anything about the survey?

Area:	<u>Hatiarguna, Karnchi para</u>
Number of participants:	
Union:	<u>Teknaf Sadar</u>
Latitude and Longitude:	<u>20.523825, 92.262536</u>
Date:	<u>03/09/2020</u>
FGD Conducted By:	<u>Ishraq, Simoon</u>
Venue:	<u>Madrasa</u>

Onushandhani Creeds Ltd.

Processing Team

	Start Time	End Time	Total Time (in minute)
Interview Duration (Start – End time)	<u>1:10</u>	<u>1:35</u>	<u>25</u>

House # 135, Road # 05, 2nd Floor, Mohakhali DOHS, Dhaka-1206
Contact: +8801712955908, E-mail: ceo@ocreeds.com www.ocreeds.com



FGD Checklist

A. Information Regarding Household:

SN	Questions	Answers
01	What is the main source of income of the families in your area?	Agriculture
02	What is the average monthly income of your area (per household)?	5000 - 10000 Tk
03	How much is the monthly expenditure of your area (per household)?	5000 - 10000 Tk
04	What is the literacy level of the area (%)?	10%
05	Occupation (%): Agriculture; Business; Service; Teacher; Physician; Laboure; Fishing; Others; Landlords	Agriculture - 90% Labour - 5% Fishes - 5%



O.CREEDS Ltd.

ONUSHANDHANI CREEDS LIMITED

B. General knowledge on Naf Tourism Park

SN	Questions	Answers
01	Do you know about Naf Tourism Park?	No
02	What do you know about the cable car project?	No
03	What are your views regarding the Tourism Park (TP)?	Positive (monthly)
04	Will the project impact your livelihood status of the area positively or negatively? (Especially project area)	Yes (positively)
05	Do you think you will be economically benefited from the project?	Yes (Majority)
06	Will this Naf Tourism Park serve as a recreational center for you?	Yes
07	Ethnic people and their living pattern in the project area. How they can contribute to the project	N/A

O.CREEDS
Onushandhani Creeds Ltd.

House # 135, Road # 05, 2nd Floor, Mohakhali DOHS, Dhaka-1206
Contact: +8801712955908, E-mail: ceo@ocreeds.com

www.ocreeds.com



O.CREEDS Ltd.

ONUSHANDHANI CREEDS LIMITED

C. Land Use:

SN	Questions	Answers
01	Is the land arable?	Yes
02	What is the land generally used for?	paan & Supari
03	What crops are mostly produced in surrounding area?	Paan & Supari
04	What is the main source of food in your community?	Fishes (Salt water)

D. Socio-economic impacts:

SN	Questions	Answers
01	Will the project have any socio-economic impact on your daily life?	Yes (positive)
02	Do you think the local culture will experience a shift to the economic and social changes after the implementation of the project?	Yes in a good way

O.CREEDS
Onushandhani Creeds Ltd.

House # 135, Road # 05, 2nd Floor, Mohakhali DOHS, Dhaka-1206
Contact: +8801712955908, E-mail: ceo@ocreeds.com

www.ocreeds.com



O.CREEDS
Onushandhani Creeds Ltd.

O.CREEDS Ltd.

ONUSHANDHANI CREEDS LIMITED

03

How can the socio-economic impacts be minimized?

Enhanced Security
& Keeping peace

FGD Co-Ordinator

Simoon Mustafa

Name: *Simoon Mustafa*

Date: *03/09/2020*

O.CREEDS
Onushandhani Creeds Ltd.

House # 135, Road # 05, 2nd Floor, Mohakhali DOHS, Dhaka-1206
Contact: +8801712955908, E-mail: ceo@ocreeds.com

www.ocreeds.com

Figure 1: FGD Questionnaire

ANNEXURE 9: FOCUS GROUP DISCUSSION ATTENDANCE SHEET

FGD 1

Area: Domdomia



O.CREEDS Ltd.

ONUSHANDHANI CREEDS LIMITED

Focus Group Discussion on Cable Car Installation and
Preparation at Naf Tourism Park

Teknaf

Participants of Teknaf

Attendance Sheet

Location: Teknaf

Latitude: 20.922919

Longitude: 92.266458

Total Number of Participants: 20

Date: 02/09/2020

Male Participants

SN	Name	Contact Number	Signature
1	Abdus Salam	01859998928	
2	Abdul Malek	01998169810	
3	Faridul Alam	01908210858	
4	Tajul Islam	01925346547	
5	Nurul Haque	01814414869	
6	Arif Ahmed	01865466155	
7	Obaidulla	01885002822	
8	Saidul Islam	01551073824	
9	Bashir Ahmed	01908209538	
10	Monir Ahmed	0183804986A	
11	Nur Islam	01875749950	
12	Laf Mia	-	
13	Md. Ismail	01720658143	
14	Rabiul Alam	01995009748	

House # 135, Road # 05, 2nd Floor, Mohakhali DOHS, Dhaka-1206
Contact: +8801712955908, E-mail: ceo@ocreeds.com

www.ocreeds.com



O.CREEDS Ltd.

ONUSHANDHANI CREEDS LIMITED

15	Todul Ahmed	01880194688	60500
16	Afaz Ahmed	01822344705	282432
17	Faridul Alam	018241467023	faridul Alam
18	Abul Basar	0 -	000
19	Saukat	01875124514	
20	Zafar Alam	01402076698	
21			
22			
23			
24			
25			

Female Participants

SN	Name	Contact Number	Signature
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

House # 135, Road # 05, 2nd Floor, Mohakhali DOHS, Dhaka-1206
Contact: +8801712955908, E-mail: ceo@ocreeds.com

www.ocreeds.com



O.CREEDS Ltd.

ONUSHANDHANI CREEDS LIMITED

11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			

Officials

Sl	Name	Contact Number	Signature
1	Schroque Bui Khut	01875390902	
2	Simran Mostafa	01756589954	
3	Reetika Ali	01799291249	
4	Md. Saifed Jaman	01877722852	
5	Sadia Mahafabin	01927074829	
6	Sourav Paul	01948128901	

House # 135, Road # 05, 2nd Floor, Mohakhali DOHS, Dhaka-1206
Contact: +8801712955908, E-mail: ceo@ocreeds.com

www.ocreeds.com



O.CREEDS Ltd.

ONUSHANDHANI CREEDS LIMITED

7			
8			
9			
10			

FGD Facilitator from O.CREEDS

Name: Simran Mostafa

Position: Junior Engineer

Signature:



O.CREEDS
Onushandhani Creeds Ltd.

House # 135, Road # 05, 2nd Floor, Mohakhali DOHS, Dhaka-1206
Contact: +8801712955908, E-mail: ceo@ocreeds.com

www.ocreeds.com

Figure 2: FGD Attendance Sheet

FGD 2

Location: Hatiarguna Village



O.CREEDS Ltd.

ONUSHANDHANI CREEDS LIMITED

Focus Group Discussion on Cable Car Installation and Preparation at Naf Tourism Park

Teknaf
Participants of Teknaf

Attendance Sheet

Location: Teknaf

Latitude: 20.888224

Longitude: 92.263636

Total Number of Participants:

Date: 02/09/2020

Male Participants

SN	Name	Contact Number	Signature
1	Md. Jounuc	01816200398	[Signature]
2	Abdur Rashid	01884154325	[Signature]
3	Md. Choudhury	01884154325	[Signature]
4	Ali Akbar	01881907009	[Signature]
5	Amin Ahmed	0184754855	[Signature]
6	Din Mohammad	01884154325	[Signature]
7	Md. Mokibul	01884154325	[Signature]
8	Md. Ovi Ahmed	01884154325	[Signature]
9	Rashid Ahmed	01884154325	[Signature]
10	Jawid Ahmed	01813786262	[Signature]
11	Azu Siddique	01867231388	[Signature]
12	Md. Jofon	01869504933	[Signature]
13			

House # 135, Road # 05, 2nd Floor, Mohakhali DOHS, Dhaka-1206
Contact: +8801712955908, E-mail: ceo@ocreeds.com

www.ocreeds.com



O.CREEDS Ltd.

ONUSHANDHANI CREEDS LIMITED

Officials

Sl	Name	Contact Number	Signature
1	Schroque Bin Khulik	01675390902	
2	Simoon Mostafa	01796584954	
3	Reetika Ali	01779291249	
4	Md. Sayed Smran	01877722852	
5	Sadia Mahajabin	01927074829	
6	Souran Paul	01948129301	

FGD Facilitator from O.CREEDS

Name: Simoon Mostafa
Position: Junior Engineer

Signature:

O.CREEDS
Onushandhani Creeds Ltd.

House # 135, Road # 05, 2nd Floor, Mohakhali DOHS, Dhaka-1206
Contact: +8801712955908, E-mail: ceo@ocreeds.com

www.ocreeds.com

Figure 2: FGD Attendance Sheet

ANNEXURE 10: ENVIRONMENT AND SOCIAL IMPACT CHECKLIST



O.CREEDS Ltd.

ONUSHANDHANI CREEDS LIMITED

Cable Car Installation and Preparation at Naf Tourism Park Teknaf, Cox's Bazar

ESIA Checklist

- Demographic Overview
- Geological Conditions
- Climate Conditions
- Socio-Economic Data
- Air Quality Index (AQI)
- Noise Data (Day & Night)
- Water Quality Data (Stagnant & Free flow water)
- Cultural Heritage (Reconnaissance Survey)

I. Climate Condition Parameters

Parameters	Maximum	Minimum
Temperature (Meteorological Data)		
Air Pressure (Meteorological Data)		
Humidity (Meteorological Data)		
Rainfall (Meteorological Data)		
Sunshine/Cloudiness (Meteorological Data)		
Evaporation (Meteorological Data)		
Wind Speed & Direction (Meteorological Data)		

O.CREEDS
Onushandhani Creeds Ltd.



House # 135, Road # 05, 2nd Floor, Mohakhali DOHS, Dhaka-1206
Contact: +8801712955908, E-mail: ceo@ocreeds.com

www.ocreeds.com



O.CREEDS Ltd.

ONUSHANDHANI CREEDS LIMITED

ii. Air Index

Date: 03/09/2020

Time: 08:15

Parameters	Location 1 (A)	Concentration
Particulate Matter (PM _{2.5})	Lat: 20.917180	017
Particulate Matter (PM ₁₀)	Long: 92.267764	017
Particulate Matter (PM ₁)		009
Humidity (%) RH		87.35
Parameters	Location 2	Concentration
Particulate Matter (PM _{2.5})	Lat: 20.88306	014
Particulate Matter (PM ₁₀)	Long: 92.263841	017
Particulate Matter (PM ₁)		007
Humidity (%) 70.89		70.89

iii. Noise Data (Day & Night)

Point A

Date: 03/09/2020

Lat: 20.917227

Long: 92.267692

Parameters	Concentration	
	Day: 83 (8:30)	Night: 55 (12:00)
Noise level (dB)		
Major Noise from Project (Note)		
Evaluation of Noise Emissions Levels (Note)		
Predicted Noise Impact (Note)		

Point C

Date: 03/09/2020

Lat: 20.888090

Long: 92.263717

Parameters	Concentration	
	Day: 58.3 (8:00)	Night: 51 (17:00)
Noise level (dB)		
Major Noise from Project (Plant)		
Evaluation of Noise Emissions Levels (Note)		
Predicted Noise Impact (Note)		

House # 135, Road # 05, 2nd Floor, Mohakhali DOHS, Dhaka-1206
 Contact: +8801712955908, E-mail: ceo@ocreeds.com

www.ocreeds.com

Figure 5: Onsite Air Quality Data



iv. Water Quality Data (Surface water)

Point A

Lat:	Long:
Parameters	Lab Report
Iron (DPHE Lab)	
Arsenic (DPHE Lab)	
Manganese (DPHE Lab)	
Chloride (DPHE Lab)	
BOD (DPHE Lab)	
COD (DPHE Lab)	

v. Water Quality Data (Ground water)

Point A

Lat:	Long:
Parameters	Lab Report
Iron (DPHE Lab)	
Arsenic (DPHE Lab)	
Manganese (DPHE Lab)	
Chloride (DPHE Lab)	

vi. Water Quality Data (Surface water)

Point C

Lat:	Long:
Parameters	Lab Report
Iron (DPHE Lab)	
Arsenic (DPHE Lab)	
Manganese (DPHE Lab)	
Chloride (DPHE Lab)	
BOD (DPHE Lab)	
COD (DPHE Lab)	

vii. **Water Quality Data (Ground water)** *160' Depth*

Point C

Lat:	Long:
Parameters	Lab Report
Iron (DPHE Lab)	
Arsenic (DPHE Lab)	
Manganese (DPHE Lab)	
Chloride (DPHE Lab)	
COB (DPHE Lab)	
COB (DPHE Lab)	

viii. **Onsite Water Quality Test (Free flow Water)** *NAF River*

Point A

Date: *03/09/2020*

Time: *08:35*

Lat: *20.919375*

Long: *92.270126*

Parameters	Concentration
Temperature (°C)	<i>34.3</i>
DO (mg/l)	<i>6.02</i>
Conductivity (µS/cm)	<i>923</i>
TDS (mg/l)	<i>429</i>
Turbidity (NTU)	<i>139</i>
Salinity in (%)	<i>0.45</i>
pH	<i>7.9</i>
Hardness	<i>123</i>

Figure 6: Onsite Surface Water Quality Test (Point A)



ix. Onsite Water Quality Test (Ground Water)

Point A

Date: 03/09/2020

Time: 9:20

Lat: 20.919845

Long: 92.267179

Parameters	Concentration
Temperature (°C)	32.9
DO (mg/l)	3.90
Conductivity (µS/cm)	649
TDS (mg/l)	315
Turbidity (NTU)	24.23
Salinity in (%)	0.31
pH	7.8
Hardness	87

x. Onsite Water Quality Test (Free flow Water)

Point C

Date: 3, 9, 2020

Time: 2.05 pm

Lat: 20.888840

Long: 92.262895

Parameters	Concentration
Temperature (°C)	30.5
DO (mg/l)	6.75
Conductivity (µS/cm)	196.8
TDS (mg/l)	92.1
Turbidity (NTU)	22.29
Salinity in (%)	0.09
pH	8.2
Hardness	211

Figure 7: Onsite Water Quality Test (Point A & Point C)



O.CREEDS Ltd.

ONUSHANDHANI CREEDS LIMITED

xi. Onsite Water Quality Test (Ground Water)

Point C

Date: 03/09/2020

Time: 01:40

Lat: 20.227571

Long: 92.264816

Parameters	Concentration
Temperature (°C)	28.4
DO (mg/l)	1.63
Conductivity (µS/cm)	525
TDS (mg/l)	285
Turbidity (NTU)	13.23
Salinity in (%)	0.28
pH	9.1
Hardness	63

xii. Geological Conditions (Soil Sample)

Point A

Date: 03/09/2020

Time: 9:15

Parameters	Location 1	
Soil Sample	Lat: 20.91421	Long: 92.268719

Point C

Date:

Time:

Parameters	Location 2	
Soil Sample	Lat: 20.227571	Long: 92.26455119

xiii. Land Use, Capacity & Tenure & Zoning (Local Administration):

Parameters	Note
Land Use	
Rural Land Capacity	
Land Tenure & Zoning	

House # 135, Road # 05, 2nd Floor, Mohakhali DOHS, Dhaka-1206
 Contact: +8801712955908, E-mail: ceo@ocreeds.com

www.ocreeds.com

Figure 8: Soil Collection Location

xiv. **Vegetation (Reconnaissance Survey)**

Parameters	Note
Inventory of Vegetation Species	
Open Wasteland & Wholly Cleared land	
Vegetation along Waterways	

xv. **Flora & Fauna (Secondary data review)**

Parameters	Note
Inventory of Species	
Birds, Bats	
Mammals	
Reptiles & Amphibians	

xvi. **Mapping**

Parameters	
Project Location Map	
Contour Map	
Regional Setting Map	
Cadastral map	
Accessibility Map	
Environmental Assessment Map	
DEM map of the district	
Physiographical map of Bangladesh	
Land Use Map (Drone Survey)	
The map described the noise concentration around 500m of the plant site	

xvii. **Cultural Heritage (Secondary Data Review)**

Parameters	Results
Local History	Natural Park, সফিয়ার গুফা
Archaeology	



xviii. Socio-Economic Conditions (FGD)

Parameters	Note
Impact Assessment (IA) on Economic Conditions	
Impact of Proposal on Environment	
Impact on Tourism	
Socio-Economic Impacts (If any)	

xix. GPS Coordinates for each location:

Important places	Latitude	Longitude
Mathiner KUP	20.864695	92.300587

****Note: Picture needs to be taken at the project site****



Water Quality Analyzer,
Simon Mochfa

Name: *Simon Mochfa*

Date: *03/09/2020*

Environmental Specialist
Atik Mollick

Name: *Atik Mollick*

Date: *03/09/2020*

Figure 9: EIA Checklist



Water Sample Testing



Air Quality Monitoring



Soil Sample Collection



Water Hardness testing



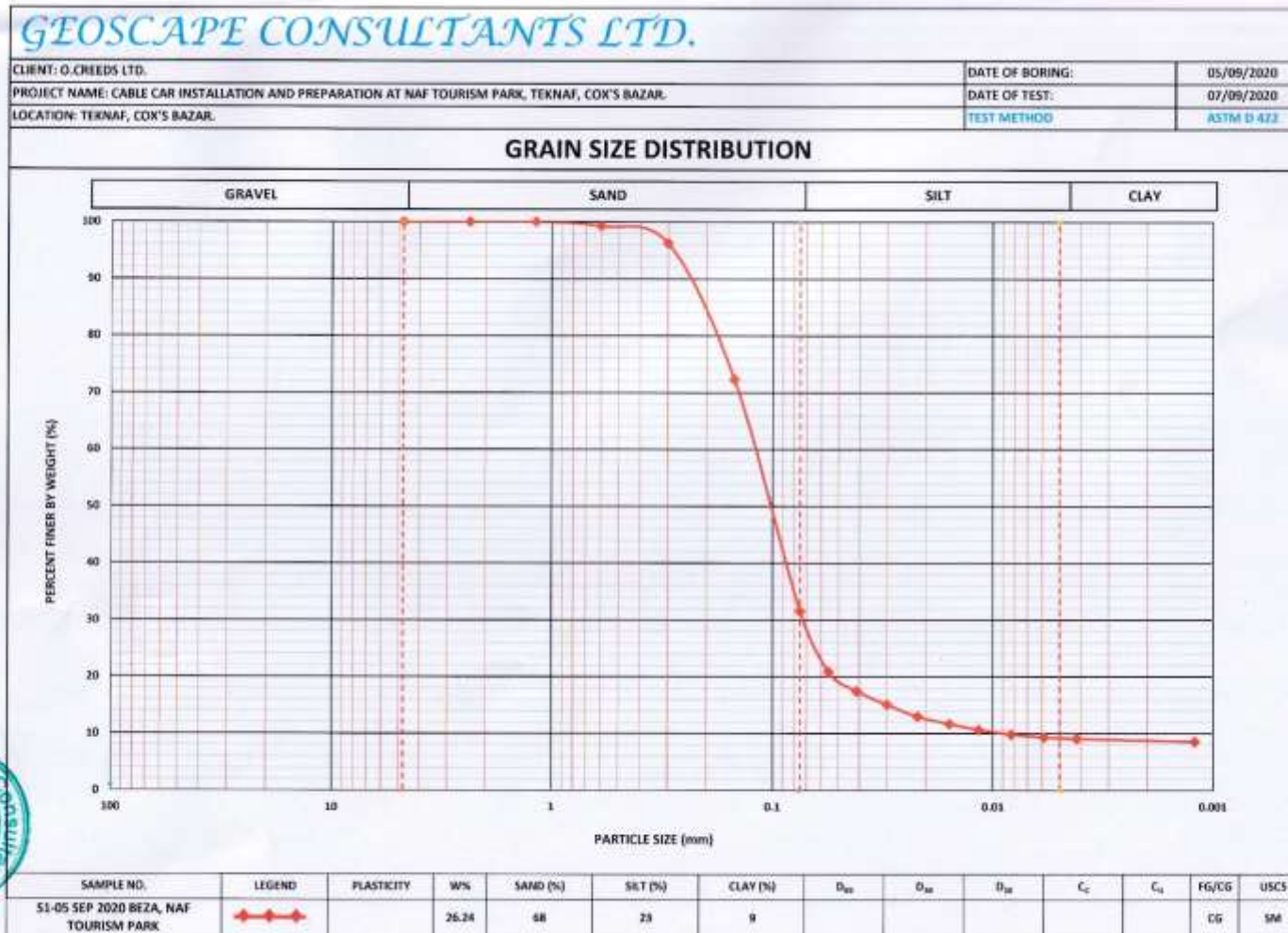
Noise Data Collection



Groundwater Sample Collection

Figure: Environmental Parameters (Air, Water, Soil, Noise) Testing

ANNEXURE 11: Soil Sample Test Result



GEOSCAPE CONSULTANTS LTD.

CLIENT: O.CREEDS LTD.

DATE OF BORING:

05/09/2020

PROJECT NAME: CABLE CAR INSTALLATION AND PREPARATION AT NAF TOURISM PARK, TEKNAF, COX'S BAZAR.

DATE OF TEST:

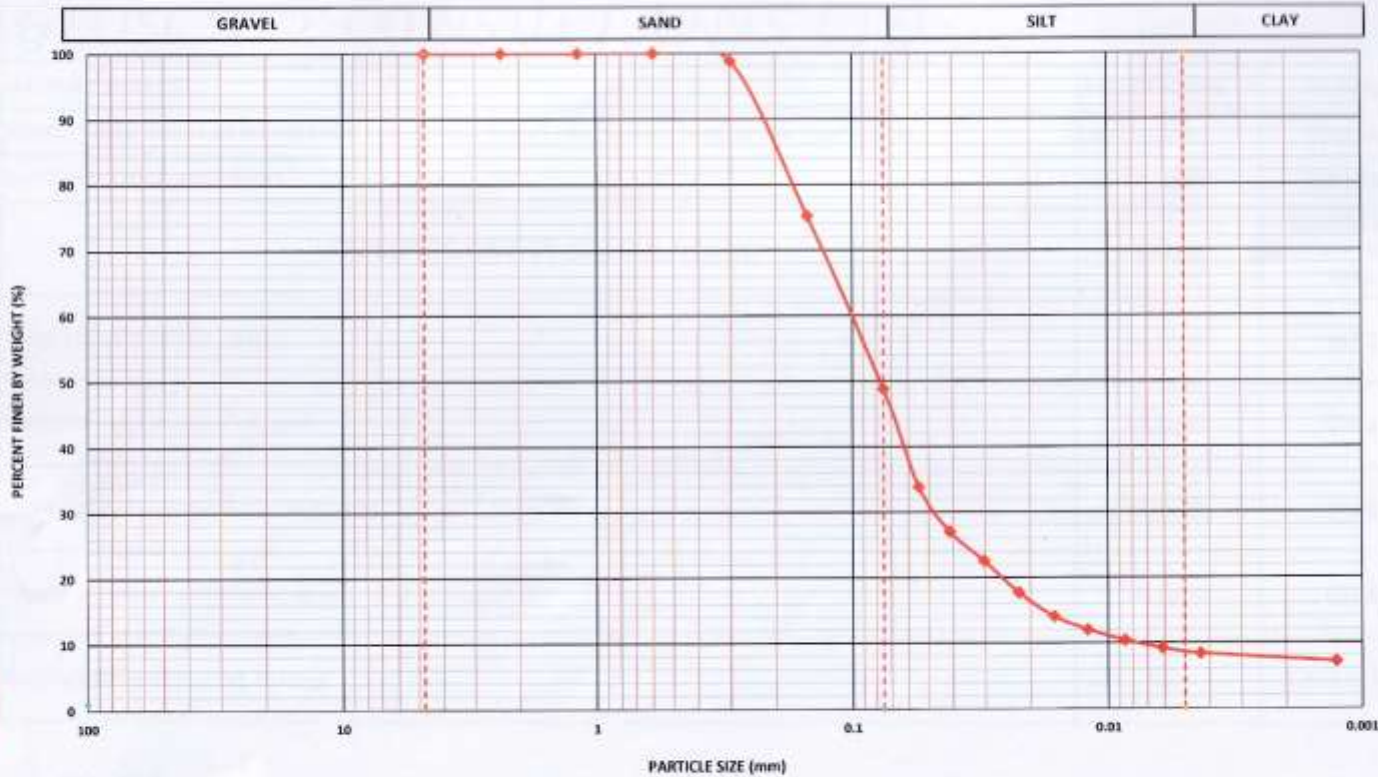
07/09/2020

LOCATION: TEKNAF, COX'S BAZAR.

TEST METHOD:

ASTM D 422

GRAIN SIZE DISTRIBUTION



SAMPLE NO.	LEGEND	PLASTICITY	W%	SAND (%)	SILT (%)	CLAY (%)	D ₁₀	D ₃₀	D ₆₀	C _c	C _u	FG/CG	USCS
S2-05 SEP 2020 BEZA, NAF TOURISM PARK	◆◆◆◆		26.5	51	41	8						CG	SM

<i>GEOSCAPE CONSULTANTS LTD.</i>		
CLIENT: O.CREEDS LTD.	DATE OF BORING:	05/09/2020
PROJECT NAME: CABLE CAR INSTALLATION AND PREPARATION AT NAF TOURISM PARK, TEKNAF, COX'S BAZAR.	DATE OF TEST:	09/09/2020
LOCATION: TEKNAF, COX'S BAZAR.	TEST METHOD:	ASTM D 854
SPECIFIC GRAVITY CALCULATION		SAMPLE
		S1-05 SEP 2020 BEZA, NAF TOURISM PARK
Weight of pycnometer, (gm)	M ₁ (gm)=	162.5
Weight of pycnometer+Soil, (gm)	M ₂ (gm)=	249.8
Weight of pycnometer+Soil+water, (gm)	M ₃ (gm)=	710.2
Weight of pycnometer+Water, (gm)	M ₄ (gm)=	655.4
Specific Gravity of Soil, (at 20 Deg)	G ₂₀ =	2.686153846



ANNEXURE 12: Water Sample Test Result



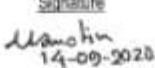
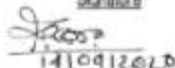


	<p>Government of the People's Republic of Bangladesh Office of the Chief Chemist Department of Public Health Engineering Central Lab, 38-39, Mohakhali C/A, Dhaka-1212 Phone: 88-02-9681927, Fax: 88-02-9882003, Email: wqmsc_central_lab@yahoo.com</p>					
Lab Memo: 188/CC, DPHE, CL, Dhaka		Date: 14-09-2020				
Physical /Chemical/ Bacteriological Analysis of Water Sample						
Sample ID: CEN2020090026	Sample Receiving date: 06-09-2020					
Ref. Memo No: O.Creeds/2020/NH & Dated: 06-09-2020	Sample Source: Ground Water					
Sent by: Md. Shahadat Hossain, Managing Director & CEO, O. Creeds, Mohakhali DOHS, Dhaka-1206.	Dist: Cox's Bazar, Ups: Teknaf					
Care Taker: O. Creeds (Sample :GW-06 Naf Tourism Park, A)	Union:, VII. BEZA, Naf Tourism Park					
Sample Collection date:	Date of Testing: 06/09/2020-13/09/2020					
LABORATORY TEST RESULTS:						
Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.002	mg/L	AAS	0.001
2	Chloride	150-600	33	mg/L	Titrimetic	-
3	Iron (Fe)	0.3-1	0.86	mg/L	AAS	0.05
4	Manganese (Mn)	0.1	0.24	mg/L	AAS	0.03
Comments: Sample was collected & supplied by client. N.B: AAS- Atomic Absorption Spectrophotometer, LOQ- Limit of Quantification.						
Test Performed by:			Countersigned/Approved by:			
1.) Name: Mahabuba Sabina Motin Designation: Sample Analyzer			1.) Name: Mita Sarker Designation: Senior Chemist			
2.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer			2.) Name: Md. Biplob Hossain Designation: Chief Chemist			
<i>Signature</i>  14-09-2020			<i>Signature</i>  14/09/2020 Mita Sarker Senior Chemist Department of Public Health Engineering Central Laboratory, Mohakhali, Dhaka.			

Figure: Groundwater Test Result (Point A)

	Government of the People's Republic of Bangladesh Office of the Chief Chemist Department of Public Health Engineering Central Lab, 38-39, Mohakhali C/A, Dhaka-1212 Phone: 88-02-9681927, Fax: 88-02-9682003, Email: wqmc_central_lab@yahoo.com	
---	---	---

Lab Memo: 185/ CC, DPHE, CL, Dhaka

Date: 14-09-2020

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2020090027	Sample Receiving date: 06-09-2020
Ref. Memo No: O.Creeds/2020/NH & Dated: 06-09-2020	Sample Source: Ground Water
Sent by: Md. Shahadat Hossain, Managing Director & CEO, O. Creeds, Mohakhali DOHS, Dhaka-1206.	Dist: Cox's Bazar, Upa Teknaf
Care Taker: O. Creeds (Sample :GW-06 Naf Tourism Park, C)	Union:, VIII. BEZA, Naf Tourism Park
Sample Collection date:	Date of Testing: 06/09/2020-13/09/2020

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.001	mg/L	AAS	0.001
2	Chloride	150-600	27	mg/L	Titrimetic	-
3	Iron (Fe)	0.3-1	0.25	mg/L	AAS	0.06
4	Manganese (Mn)	0.1	0.06	mg/L	AAS	0.03

Comments: Sample was collected & supplied by client.
 N.B: AAS- Atomic Absorption Spectrophotometer, LOQ- Limit of Quantitation.

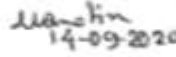
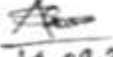




Test Performed by: 1.) Name: Mahabuba Sabina Motin Designation: Sample Analyzer 2.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	Signature  14-09-2020  14.09.2020	Countersigned/Approved by: 1.) Name: Mita Sarker Designation: Senior Chemist 2.) Name: Md. Biplob Hossain Designation: Chief Chemist	Signature  14/09/2020  14/09/2020
--	--	---	--

Figure: Ground Water Test Result (Point C)

	Government of the People's Republic of Bangladesh Office of the Chief Chemist Department of Public Health Engineering Central Lab, 38-39, Mohakhali C/A, Dhaka-1212 Phone: 88-02-9861927, Fax: 88-02-9862003, Email: wqmsc_central_lab@yahoo.com	
---	--	---

Lab Memo: 188/CC, DPHE, CL, Dhaka

Date: 14-09-2020

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2020090028	Sample Receiving date: 06-09-2020
Ref. Memo No: O.Creeds/2020/NII & Dated: 06-09-2020	Sample Source: Surface Water
Sent by: Md. Shahadat Hossain, Managing Director & CEO, O. Creeds, Mohakhali DOHS, Dhaka-1206.	Dist: Cox's Bazar, Upa: Teknaf
Care Taker: O. Creeds (Sample: SW-06 Naf Tourism Park, A)	Union: Vill: BEZA, Naf Tourism Park
Sample Collection date:	Date of Testing: 06/09/2020-13/09/2020

LABORATORY TEST RESULTS:



Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.002	mg/L	AAS	0.001
2	Biochemical Oxygen Demand (BOD)	0.2	4	mg/L	5 days incubation	0.1
3	Chemical Oxygen Demand (COD)	4.0	12	mg/L	CRM	-
4	Chloride	150-600	230	mg/L	Titrimetric	-
5	Iron (Fe)	0.3-1	1.47	mg/L	AAS	0.05
6	Manganese (Mn)	0.1	0.06	mg/L	AAS	0.03

Comments: Sample was collected & supplied by client.

N.B: AAS- Atomic Absorption Spectrophotometer, CRM-Closed Reflex Methods, LOQ- Limit of Quantitation.

<p>Test Performed by:</p> <p>1.) Name: Mahabuba Sabina Molin Designation: Sample Analyzer</p> <p>2.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer</p>	<p align="center"><u>Signature</u></p> <p align="center"><i>M. Sarker</i> 14-09-2020</p> <p align="center"><i>A. Hossain</i> 14.09.2020</p>	<p>Countersigned/Approved by:</p> <p>1.) Name: Mita Sarker Designation: Senior Chemist</p> <p>2.) Name: Md. Biplob Hossain Designation: Chief Chemist</p>	<p align="center"><u>Signature</u></p> <p align="center"><i>M. Sarker</i> 14/09/2020</p> <p align="center">Mita Sarker Senior Chemist</p> <p align="center">Department of Public Health Engineering Central Laboratory, Mohakhali, Dhaka.</p>
---	---	--	--

Figure: Surface Water Test Result (Point A)

	Government of the People's Republic of Bangladesh Office of the Chief Chemist Department of Public Health Engineering Central Lab, 38-39, Mohakhali C/A, Dhaka-1212 Phone: 88-02-9851927, Fax: 88-02-9852003, Email: wqmsc_central_lab@yahoo.com	
---	--	---

Lab Memo: 188/ CC, DPHE, CL, Dhaka

Date: 14-09-2020

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2020090629	Sample Receiving date: 05-09-2020
Ref. Memo No: O.Creeds/2020/NII & Dated: 06-09-2020	Sample Source: Surface Water
Sent by: Md. Shahadat Hossain, Managing Director & CEO, O. Creeds, Mohakhali DOHS, Dhaka-1206.	Dist: Cox's Bazar, Upa: Teknaf
Care Taker: O. Creeds (Sample :SW-06 Naf Tourism Park,C)	Union:, Vill.:BEZA, Naf Tourism Park
Sample Collection date:	Date of Testing: 05/09/2020-13/09/2020

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.001	mg/L	AAS	0.001
2	Biochemical Oxygen Demand (BOD)	0.2	3	mg/L	5 days incubation	0.1
3	Chemical Oxygen Demand (COD)	4.0	8	mg/L	CRM	-
4	Chloride	150-600	15	mg/L	Titrimetric	-
5	Iron (Fe)	0.3-1	0.15	mg/L	AAS	0.05
6	Manganese (Mn)	0.1	0.04	mg/L	AAS	0.03

Comments: Sample was collected & supplied by client.

N.B: AAS- Atomic Absorption Spectrophotometer, CRM-Closed Reflex Methods, LOQ- Limit of Quantitation.

<p>Test Performed by:</p> <p>1.) Name: Mahabuba Sabina Moth Designation: Sample Analyzer</p> <p>2.) Name: Md. Saiful Alam Khoseru Designation: Sample Analyzer</p>	<p align="center"><u>Signature</u></p> <p align="center"><i>M. Moth</i> 14-09-2020</p> <p align="center"><i>A. Khoseru</i> 14.09.2020</p>	<p>Countersigned/Approved by:</p> <p>1.) Name: Mita Sarker Designation: Senior Chemist</p> <p>2.) Name: Md. Biplob Hossain Designation: Chief Chemist</p>	<p align="center"><u>Signature</u></p> <p align="center"><i>M. Sarker</i> 14/09/2020</p> <p align="center">Mita Sarker Senior Chemist Department of Public Health Engineering Central Laboratory, Mohakhali, Dhaka.</p>
---	---	--	--

Figure: Surface Water Test Result (Point C)

ANNEXURE 13: Approval of Terms of Reference (TOR)

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: 22.02.0000.018.72.82.18 . 386 Date: 14/06/2018

Subject: Approval of Terms of Reference (ToR) for Environmental Impact Assessment (EIA) in favor of the Cable Car in Naf Tourism Park.

Ref: Your application dated 13 May 2018.

With reference to your letter dated 13.05.2018 for the subject mentioned above, the Department of Environment hereby gives approval of TOR in favor of the Cable Car in Naf Tourism Park 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 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 project.
 - 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 & 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

1/2

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 on the project on air, water, land, hydrology, vegetation-man made or natural, wildlife, socio-econom 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 the projects.
1. The project authority shall submit the EIA along with a filled-in application for Environmental Clearance in prescribed form, the applicable fee in a treasury Chalan, the applicable VAT on clearance fee in a separate treasury Chalan, the No Objection Certificates (NOC) from local authority, NOC from forest department (if it is required in case of cutting any forested plant, private or public), NOC in favor of Cutting/Dressing (if it is required) of Hill/Hillock from the concerned authority and NOCs from other relevant agencies for operational activity etc. to the Cox's Bazar District Office of DOE in Cox's Bazar with a copy to the Head Office of DoE in Dhaka.


14.06.2018

(Syed Nazmul Ahsan)
Director (Environmental Clearance)
Phone # 8181673

Executive Member (Additional Secretary)
Bangladesh Economic Zone Authority
Monem Business District (Level-12)
111 Bir Uttam C. R. Datta Road, Dhaka-1205.

Copy Forwarded to:

- 1) PS to Secretary, Ministry of Environment and Forests, Bangladesh Secretariat, Dhaka.
- 2) Director, Department of Environment, Chittagong Regional, Chittagong.
- 3) Deputy Director/Office In-charge, Department of Environment, Cox's Bazar District Office, Cox's Bazar.
- 4) Assistant Director, Office of the Director General, Department of Environment, Head Office, Dhaka.

ANNEXURE 14: KII with DoE & Forest

Annexure: Native tree species recommended for plantation/enrichment plantation in TWS

No.	Common name	Botanical name	Habit Form
1.	Amloki	<i>Phyllanthus emblica</i>	Medium sized deciduous tree
2.	Arjun	<i>Terminalia arjuna</i>	Medium-large sized evergreen tree
3.	Arshol/ Goda	<i>Vitex peduncularis</i>	A large tree
4.	Bahera	<i>Terminalia bellerica</i>	A large deciduous tree
5.	Baittya garjan	<i>Dipterocarpus costatus</i>	A large evergreen tree
6.	Ban lichi	<i>Walsura robusta</i>	A medium-sized tree
7.	Bandarhula	<i>Duabunga grandiflora</i>	A large evergreen tree
8.	Banspata	<i>Podocarpus nerifolia</i>	Evergreen medium-large sized tree
9.	Barapatta	<i>Fernandoa adenophylla</i>	A medium-sized tree
10.	Bazna	<i>Zanthoxylum rhetsa</i>	Medium-sized deciduous tree
11.	Bohal/Bole-gota	<i>Cordia dichotoma</i>	Medium-sized deciduous tree
12.	Boilam	<i>Anisoptera scaphula</i>	A large evergreen tree
13.	Borta/ Dewa	<i>Artocarpus lacucha</i>	A medium-sized deciduous tree
14.	Buddha narikel	<i>Pterygota alata</i>	A large deciduous tree
15.	Burma-simul	<i>Ceiba pentandra</i>	Medium sized tree
16.	Chakua koro	<i>Albizia chinensis</i>	A large deciduous tree
17.	Chalmugra	<i>Hydnocarpus kurzii</i>	A medium-sized evergreen tree
18.	Chalta	<i>Dillenia indica</i>	A large evergreen tree
19.	Champa phul	<i>Michelia champaca</i>	Medium-large sized deciduous tree
20.	Chandul	<i>Tetrameles nudiflora</i>	A large deciduous tree
21.	Chapalish	<i>Artocarpus chama</i>	A large deciduous tree
22.	Chatian	<i>Alstonia scholaris</i>	A large tree
23.	Chickrassi	<i>Chukrasia tabularis</i>	A large deciduous tree
24.	Civit	<i>Swintonia floribunda</i>	A large semi-deciduous tree
25.	Dhakijam	<i>Syzygium firmum</i>	Medium-large sized tree
26.	Dharmara	<i>Stereospermum colais</i>	A large evergreen tree
27.	Dholi batna	<i>Lithocarpus acuminata</i>	A large evergreen tree
28.	Dhullya garjan	<i>Dipterocarpus alatus</i>	A large tree with long straight bole
29.	Dumur	<i>Ficus spp.</i>	Medium sized tree
30.	Echri/Sheori	<i>Anogeissus acuminata</i>	A large evergreen tree
31.	Faisa udal	<i>Firmiana colorata</i>	A large tree
32.	Fashya udal	<i>Sterculia villosa</i>	Medium-sized deciduous tree
33.	Gurjabatna/Khami/Sil batna	<i>Castanopsis tribuloides</i>	Medium-sized evergreen tree
34.	Gutguttya	<i>Protium serratum</i>	Medium-large sized tree
35.	Haldu	<i>Haldina cordifolia</i>	A large deciduous tree
36.	Hargaza	<i>Dillenia pentagyna</i>	A large deciduous tree
37.	Haritaki	<i>Terminalia chebula</i>	Medium-sized deciduous tree
38.	Horina	<i>Vitex glabrata</i>	A large deciduous tree
39.	Hukka nali	<i>Ormosia robusta</i>	A large evergreen tree
40.	Jalpai	<i>Elaeocarpus floribundus</i>	A medium sized tree

No.	Common name	Botanical name	Habit Form
41.	Jam/Kalo jam	<i>Syzygium cumini</i>	A large evergreen tree
42.	Jarul	<i>Lagerstroemia speciosa</i>	A medium-sized deciduous tree
43.	Jhumka bhadi	<i>Engelhardtia spicata</i>	A large deciduous tree
44.	Kadam	<i>Neolamarckia cadamba</i>	Medium-large sized deciduous tree
45.	Kainjal bhadi	<i>Bischofia javanica</i>	A large tree
46.	Kamdev	<i>Calophyllum polyanthum</i>	Medium-large sized evergreen tree
47.	Kanaidinga	<i>Oroxylum indicum</i>	Medium-sized tree
48.	Kanak / Bonak	<i>Schima wallichii</i>	A large tree
49.	Kannyari	<i>Gardenia coronaria</i>	Small –medium sized tree
50.	Kanta batna	<i>Castanopsis armata</i>	A medium-sized tree
51.	Kau/Kaogula	<i>Garcinia cowa</i>	Small-medium sized tree
52.	Khooisa batna	<i>Quercus gomeziana</i>	A large tree
53.	Kiabang	<i>Carallia brachiata</i>	Medium-sized evergreen tree
54.	Lana assar	<i>Pterospermum semisagittatum</i>	A medium-sized deciduous tree
55.	Lohakat	<i>Xylia xylocarpa</i>	A medium-sized deciduous tree
56.	Lotkon	<i>Baccaurea ramiflora</i>	A medium-sized tree
57.	Mahua	<i>Madhuca longifolia</i>	A medium-sized tree
58.	Manda/Sukurja	<i>Litsea monopetala</i>	A medium-sized tree
59.	Modon mosto	<i>Dehaasia kurzii</i>	A medium-sized evergreen tree
60.	Moos	<i>Brownlowia elata</i>	A large evergreen tree
61.	Muchighandha/Moos	<i>Pterospermum acerifolium</i>	A large tree
62.	Nageshwar	<i>Mesua ferrea</i>	Small-medium sized evergreen tree
63.	Nalijam	<i>Syzygium claviflorum</i>	Small-medium sized tree
64.	Padauk	<i>Pterocarpus indicus</i>	A medium-large sized tree
65.	Paina gola	<i>Flacourtia jangomas</i>	A small evergreen tree
66.	Pannya jam	<i>Syzygium formosum</i>	Small evergreen tree
67.	Parul	<i>Stereospermum suaveolens</i>	A large deciduous tree
68.	Pitali	<i>Trewia nudiflora</i>	A medium-sized deciduous tree
69.	Pitraj	<i>Aphanamixis polystachya</i>	A medium-sized evergreen tree
70.	Polash	<i>Butea monosperma</i>	A medium-sized deciduous tree
71.	Raktan	<i>Lophopetalum wightianum</i>	A large tree
72.	Silbhadi	<i>Garuga pinnata</i>	Medium-sized deciduous tree
73.	Simul	<i>Bombax ceiba</i>	A large deciduous tree
74.	Sonalu	<i>Cassia fistula</i>	Small-medium sized deciduous tree
75.	Tali	<i>Palaquium polyanthum</i>	A large tree
76.	Tejbahal	<i>Cinnamomum iners</i>	A medium-sized tree
77.	Telia/Kali garjan	<i>Dipterocarpus turbinatus</i>	A lofty tree with a long cylindrical bole
78.	Telsur	<i>Hopea odorata</i>	A large evergreen tree
79.	Tentul	<i>Tamarindus indica</i>	Large semi-deciduous tree
80.	Toon/surujbed	<i>Toona ciliata</i>	A medium-sized tree
81.	Ujja gach/Sal kachra	<i>Bhesa robusta</i>	A large evergreen tree
82.	Uriaam	<i>Mangifera sylvatica</i>	Large evergreen tree