SIRAJGANJ ECONOMIC ZONE



Final Environmental and Social Impact Assessment Report
Main Report



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SIRAJGANJ
ECONOMIC ZONE
NESTING INNOVATION AND INVESTMENT

EQMS

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Sirajganj Economic Zone Limited

Environmental and Social Impact Assessment Study for the Proposed Sirajganj Economic Zone, Saidabad, Sirajganj Sadar, Sirajganj

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Abbreviations

AAS	Atomic Absorption Spectrometer
ADB	Asian Development Bank
AMSL	Average Mean Sea Level
ANSI	American National Standard Institute
AOI	Area of Influence
APHA	American Public Health Association
AQ	Air Quality
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Material
BBS	Bangladesh Bureau of Statistics
BEZA	Bangladesh Economic Zones Authority
BIWTA	Bangladesh Inland Water Transport Authority
BMD	Bangladesh Meteorological Department
BOD	Biochemical Oxygen Demand
BS	British Standards
BWDB	Bangladesh Water Development Board
CBD	Convention on Biological Diversity
CBO	Community-based Organization
CCL	Cash Compensation under Law
CCPP	Combined Cycle Power Plant
CEGIS	Center for Environmental and Geographic Information Services
CETP	Common Effluent Treatment Plant
CITES	Convention on International Trade in Endangered Species of Wild Fauna and flora
CO	Carbon Monoxide
CO_2	Carbon Di-Oxide
COD	Chemical Oxygen Demand
CRM	Certified Reference Material

DC	Deputy Commissioner
DEM	Digital Elevation Model
DO	Dissolved Oxygen
DoE	Department of Environment
EC	Electric Conductivity
ECA	Environmental Conservation Act
ECC	Environmental Clearance Certificate
ECR	Environment Conservation Rules
EHS	Environmental Health and Safety
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EPC	Engineering, Procurement and Construction
EPFIs	Equator Principles Financial Institutions
EPZ	Export Processing Zone
EQMS	Environmental Quality Management System
EQS	Environmental Quality Standards
ESDD	Environmental and Social Due Diligence
ESF	Environmental and Social Framework
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
ESRM	Environmental and Social Risk Management
ESSF	Environmental and Social Safeguards Framework
ETP	Effluent Treatment Plant
EZ	Economic Zone
FDI	Foreign Direct Investment
FGD	Focus Group Discussion
FI	Financial Intermediary
FPIC	Free Prior Informed Consent
GDP	Gross Domestic Product
GoB	Government of Bangladesh

GRC	Grievance Redress Mechanism
HSC	Higher Secondary Certificate
ICT	Inland Container Terminal
IDCOL	Infrastructure Development Company Limited
IEE	Initial Environmental Examination
IEF	Important Environmental Feature
IFC	International Finance Corporation
ILO	International Labor Organization
IPCC	Intergovernmental Panel on Climate Change
IPFF II	Investment Promotion and Financing Facility II
IUCN	International Union for Conservation of Nature
KII	Key Informant Interview
MBR	Membrane Bio Reactor
MLD	Millions of Litters Per Day
MoL	Ministry of Land
MPO	Master Plan Organization
MSL	Mean Sea Level
N_2O	Nitrous Oxide
NAAQS	National Ambient Air Quality Standard
NEMAP	National Environmental Management Action Plan
NGO	Non-governmental Organization
NOC	No Objection Certificate
NOx	Oxides of Nitrogen
NWPGCL	North West Power Generation Company Limited
OP	Operational Manual
PCB	Polychlorinated Biphenyls
PET	Polyethylene Terephthalate
PET	Potential Evapo-Transpiration
PGCL	Poschimanchol Gas Company Limited
PHC	Population and Housing Census

PM	Particulate Matter
PPA	Pollution Prevention and Abatement
PPP	Public Private Partnership
PS	Performance Standards
RAP	Resettlement Action Plan
RBC	Rotating Biological Contactors
RMG	Ready-Made Garments
RV	Replacement Value
SASEC	South Asia Sub Regional Economic Cooperation Road
SBR	Sequencing Batch Reactor
SEZ	Sirajganj Economic Zone
SEZL	Sirajganj Economic Zone Limited
SO_2	Sulphur Di Oxide
SOP	Standard Operating Procedure
SSC	Secondary School Certificate
SST	Sea Surface Temperature
STP	Sewage Treatment Plant
TAPM	The Air Pollution Model
TDS	Total Dissolved Solid
ToR	Terms of Reference
UASB	Up-flow Anaerobic Sludge Blanket
UNFCC	United Nations Framework Convention on Climate Change
USEPA	United States Environmental Protection Agency
UVS	Ultraviolet Spectrograph
WB	World Bank
WBG	World Bank Group
WR	Wind Rose

CHAPTER 1

1 INTRODUCTION

1.1 Overview of the Project

The Government of Bangladesh (hereinafter referred to as Gob) has declared in its vision 2021 development plan that; Bangladesh would become a middle-income nation by 2021, and is promoting its industrialization policy with medium to long term goals. By identifying the policy for attracting FDI as one of its chief priorities, the Gob has been working on the development of an Economic Zone (EZ) at Sirajganj. These efforts have been coupled with the further promotion and diversification of exports, as well as the improvement of infrastructure such as electricity, ports, roads, and railroads. In 2010, the Bangladesh Economic Zone Act was enacted and the direction of EZ development in Bangladesh was outlined, while at the same time the Bangladesh Economic Zone Authority (BEZA) was established. Although BEZA has been promoting EZ development with the support of the World Bank and other institutions since 2012, under these circumstances, the government of Bangladesh has requested the private industries or group to come forward for the investment in economic zones. Responding to the offer of the government, a consortium of nine renowned business group and 2 renowned business personality has formed in the name of Sirajganj Economic Zone Limited (SEZL) to develop the largest private economic zone in Sirajganj.

The proposed Sirajganj Economic Zone (SEZ) site is located at Saidabad & Rajapur Union, under Sirajganj Sadar and Belkuchi Upazila which is adjacent to the Elenga-Nalka-Hatikumrul highway. The total land of SEZ is approximately 415 acres for 1st phase. Upon completion, SEZ is envisaged to create approximately 50,000 jobs when fully occupied by

investors. The location of the project site is shown in

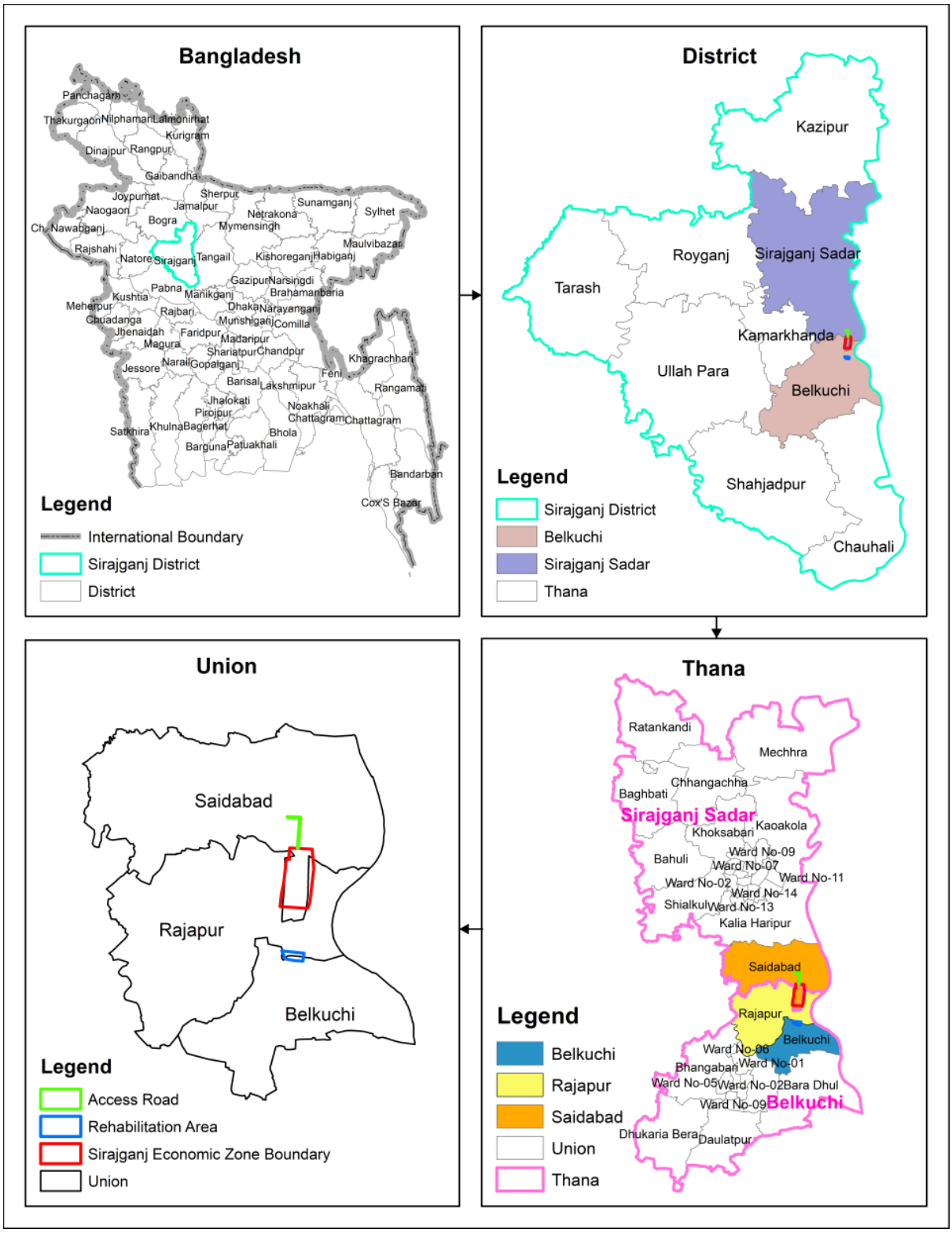


Figure 1-1. The Elenga-Nalka-Hatikamrul Road (N405) which would serve as the primary trunk connectivity for accessing the project site. The project area is mainly covering agricultural low land. The area formed by the siltation of sand (locally known as charland) by the mighty Jamuna River. Jamuna River is in east direction which can serve as a waterway

connectivity to the other area of Bangladesh. A branch of Jamuna River pass through the proposed project boundary.

BEZA identified the land and requested land acquisition on March 21, 2016, in accordance with the GOB strategy for the SEZ. The land acquisition was approved by the Prime Minister's office on March 24, 2016. In addition, the district land allocation committee approved SEZ's land needs request dated April 13, 2016. On August 21, 2016, the Deputy Commissioner issued acquisition notification U/s: 3 after completing all internal procedures. The project's chosen property is classified as public land. On 3 October 2018, the Bangladesh Economic Zones Authority (BEZA) granted a consortium of 11 enterprises the final permission to establish the Sirajganj Economic Zone.

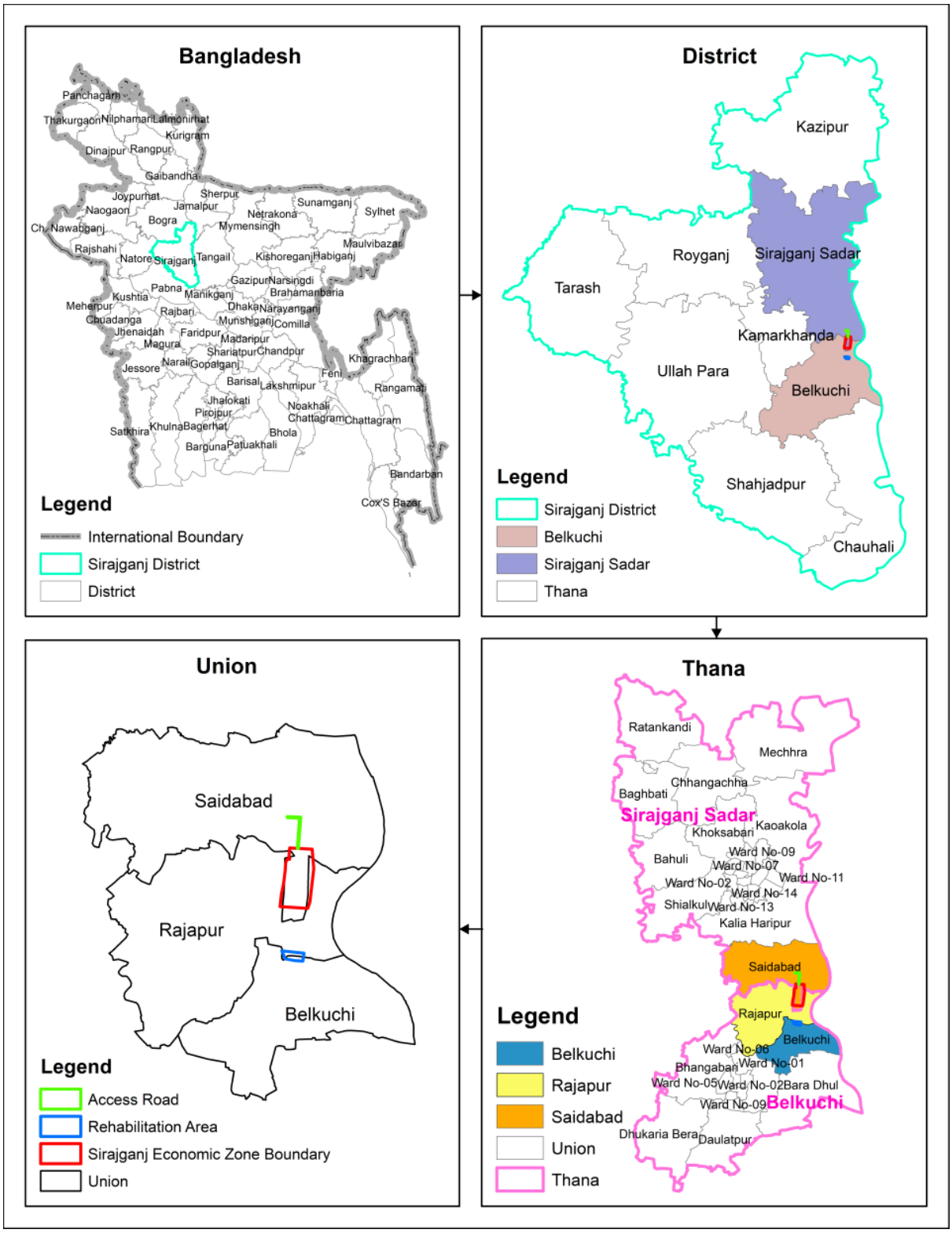


Figure 1-1: Location of the project site

The Sirajganj Economic Zone has been given final permission as Bangladesh's first private economic zone in the country's northern area. On the banks of the Jamuna River, the EZ will be built with the facility of Textile, Chemicals, Footwear, Healthcare, RMG, Knit, dying,

composite, woven, yarn, Garments accessories, Plastics, Hospitality industry, Agro-business, Building/infrastructure construction items, Healthcare, Electronics etc. The goal of constructing this EZ was to create the country's most profitable green economic zone. This will make it easier for both domestic and foreign investors to invest. This zone will employ 500,000 people and attract significant foreign investment to Bangladesh's private sector. This zone will aid in the de-stressing of Dhaka's labor markets.

This proposed EZ will be implemented by the Sirajganj Economic Zone Limited which is legally authorized to use these guidelines for its employees as per its legal identity, which is registered with the Joint Stock Companies and Firms of Bangladesh under the Companies Act (Act XVIII) of 1994. The registration number is C-126697/2015.

1.2 Impact Assessment Objectives

The objectives of this ESIA 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 ESIA Process, and how stakeholder feedback has been considered in the ESIA;
- Predict and evaluate the significance of the impacts of the Project;
- Identify the (environmental, social 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, considering the implementation of mitigation measures; and
- Generate plans for the management and monitoring of impacts, including plans for ongoing stakeholder engagement.

1.3 Scope of the ESIA Study

1.3.1 Applicable Reference Framework

- The "World Bank Performance Standards," which are IFC Performance Standards on Environmental and Social Sustainability established as the "World Bank Performance Standards" in 2013 pursuant to WB Operational Policy 4.03, are referred to as "Environmental and Social Performance Standards." As a result, the following standards/guidelines will regulate the ESIA study's reference framework: Applicable Bangladesh national, regional, and local regulatory requirements[2];
- World Bank Performance Standards for Private Sector Projects;
- World Bank Group General EHS Guidelines;
- Fundamental Conventions of ILO;

[2] Applicable Bangladesh Laws and Regulations are detailed in Chapter 2: Section 2.1 to 2.4

- Guidelines on Environmental & Social Risk Management (ESRM);
- Environmental and Social Policy and Procedures of IPFF II Project.

1.3.2 Coverage of ESIA Study

The proposed project comprises of development of the economic zone measuring total 1041.43 acres out of which current ESIA study will be limited in Phase-1 (415 acres) area only. SEZL at present will develop the off-site and on-site infrastructure to make site accessible and buildable. Embankment along the project site will be developed by BWDB[3]. Other off-site and on-site facilities include site filling, boundary wall, construction of internal road connectivity with the access road, administration building, internal drainage line, transmission line, telecommunication line running across the site. Development of EZ & off-site facilities attracts the applicability of Environment Conservation Act (ECA), 1995 & Environmental Conservation Rules, 1997. The proposed project component is classified under red category as per Environmental Conservation Rules, 1997. Thus, it was required to carry out EIA study for the proposed project as per ECA, 1995 & Environmental Conservation Rules (ECR), 1997 and obtain approval of DoE before taking up any construction activity for the project. As per the guideline, a detailed EIA has been studied and based on that approval of the EIA (Memo No.: DoE/Clearance/5325/2014/586) has been issued to SEZL on 26th November, 2017. Land development and access road of the project has been already started which has been financed by the SEZL's own fund. Gas supply will be sourced from Pachimanchol Gas Company Limited (PGCL) and pipeline will be developed by Petrobangla[5]Further development of the Project will be implemented with the financial support of World Bank (WB). So, this ESIA study has been carried out as per the OP 4.03 performance standards of the World Bank and general EHS guidelines of WBG also industrial sector specific EHS guidelines. The proposed PFI for this project is Trust Bank Limited, IDLC and IDCOL. Under the IPFF fund, the proposed amount will be 142.50 crore and under the non-IPFF fund, the proposed amount will be 172.50 crore.

1.3.3 Scope of Work

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

- Screening of the Project based on applicable reference framework OP 4.03 based on reconnaissance survey and desk-based review of Project documents;
- Development of a regulatory, policy and administrative framework relevant to the Project;
- Monitoring, analysis and reporting of the environmental and social 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;
- Assessment of social impacts on the local community as well as Project affected people and any other stakeholders, which have been identified during the social consultation process;
- Assessment of cumulative impacts of the Saidabad Power Hub on available information;
- Risk assessment and consequence analysis of the Project;

[3] As per information from SEZL and also letter given in Annex C
[5] As per information from SEZL

- Formulation of an Environment and Social Management Plan and associated/specific mitigation plans for identified impacts; and
- Formulation of Public and Stakeholder Consultation and Grievance Redress Mechanism for the Project.

1.4 Approach and Methodology

The ESIA 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 ESIA methodology follows the overall impact assessment approach illustrated in **Figure 1-2**. 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.

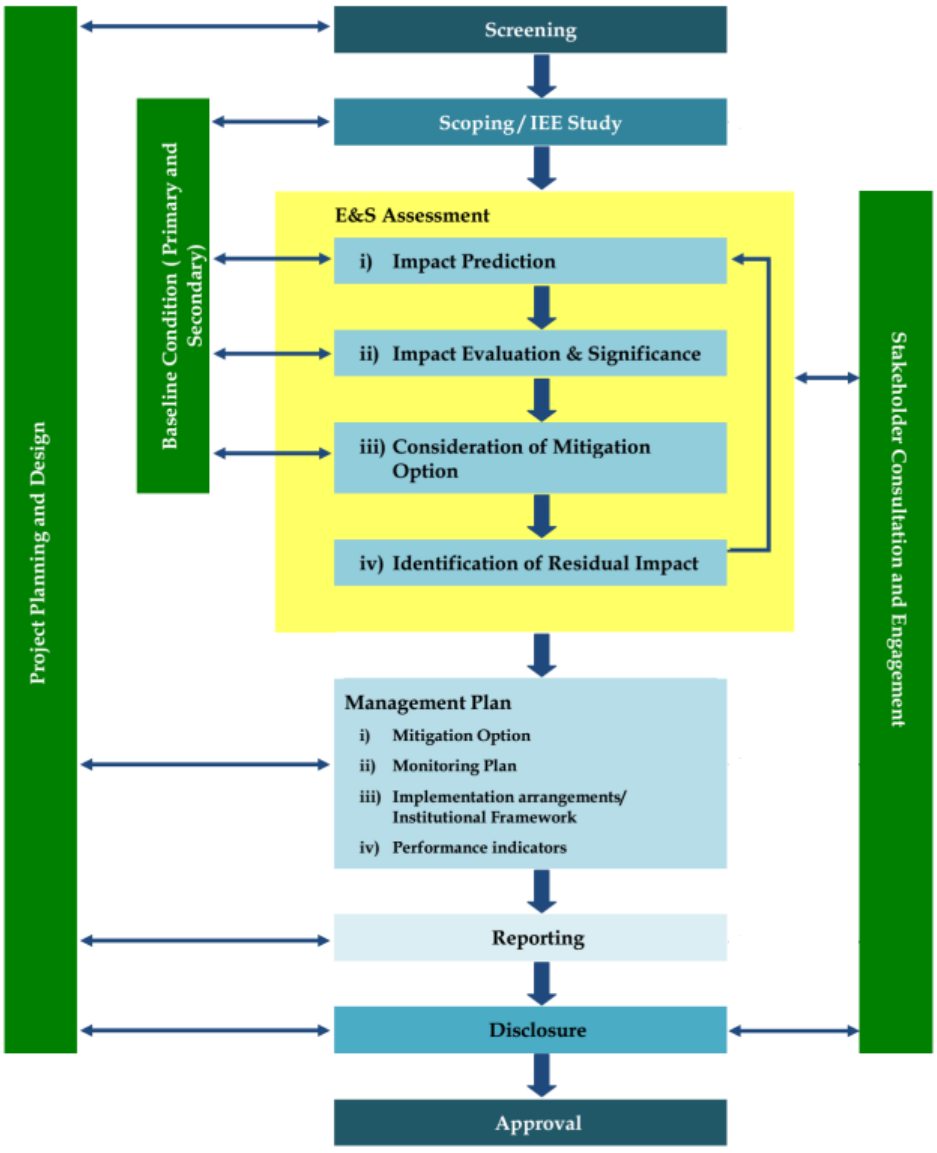


Figure 1-2: Methodology of ESIA Study

1.4.1 Screening

At the initial stage of the ESIA, 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. The results of the screening exercise are reported in Annex C of this ESIA Report.

1.4.2 Scoping

Scoping was undertaken to identify the potential Area of Influence 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. The findings of the scoping exercise are reported in Annex C of this ESIA Report.

1.4.3 Categorization

Total land area allocated for the project is 415 acres, which was previously used for agriculture. Currently, the project area is in development stage and plots in the SEZL are still unallocated. However, a diverse type of industries will be allocated in this economic zone. Based on the statistical considerations, the potential impacts have been addressed in Chapter 6 of this main report. Detail environmental and social analysis indicated that, the impact is either moderate or low. Thus, the SEZL sub-project has been classified as a medium risk (i.e., Category-B) sub-project.

Cateforization as per ESPP of IPFF II is given in **Table 1-1**.

Table 1-1: Categorization of SEZL as per ESPP of IPFF II

SL.	Criteria	Impact	Category
1.	Environmental Impacts	The potential impacts anticipated from the project are diverse- in nature. However, the details impact assessment indicated that the potentials impacts will not cause large scale change on local air quality, noise level, generation of hazardous wastes. It is also mentionable here that, the waste water will be treated in a Central Effluent Treatment Plant (CETP). In most of the cases, the potential impacts are mitigable with proper mitigation measure. The potential impacts are local in nature and the possibility of unprecedented impacts are very low. Therefore, the potential impacts can be assessed as medium to low. Based on the assessment, the risk rating is assessed as medium risk.	Medium Risk
2.	Social Impacts	Resettlement Action Plan (RAP) was prepared under this project to find out the number of affected persons	Medium risk

		specifying the procedures to follow and the actions to take to properly resettle and compensate affected people and communities. In accordance to the RAP study, the affected people due to the acquisition of land, have been compensated prior starting of the project. The social impact due to the implementation of the project is diverse in nature but mitigable with proper mitigation measures and replaceable. Moreover, the potential impact is replaceable. Therefore, the potential social impacts can be assessed as of medium risk.	
3.	Impact on critical habitat	The acquired land for the proposed project was previously used as agricultural land. The project AOI bears 49% of agricultural land (including grasslands, homestead plantation, fallow lands), 15 % of waterbodies, including the Jamuna River, 9% waste land (Including grasslands, riverine habitats and Char Land), 2.3% of plantation (including the Jamuna Eco park and surrounding plantation areas) and 15 % of built-up area. Nearest ecological sensitive area lies around 1.44 km away from the project site. Therefore, no potential impact on critical habitat is anticipated	Low Risk
4.	Impact on vulnerable group	The field investigation identified the existence of vulnerable group in the project area in terms of gender, age, income, and physical ability. Detail analysis of primary socio-economic data analysis indicated that, 75.3% of the total surveyed households have less than BDT 12000 monthly incomes which is considered as vulnerability according to HIES 2010. It is also mentionable here that, primary field investigation also found that around 2% of the surveyed households are women headed. With proper mitigation measures the impacts on vulnerable group are minimizable. Based on the assessment, the risk rating is assessed as medium risk.	Medium Risk
5.	Impact on ethnic minorities	Though, Sirajganj Sadar Upazila registers 38 ethnic households, according to the public consultation and KII no ethnic households were reported from the project site. The nearest tribal dominated area is Tarash which is located around 36 km away from the project site. Therefore, no potential impact is anticipated.	Low Risk
6.	Large scale involuntary resettlement	The project would require to resettle around 439 households. The affected households have been compensated accordingly prior start of the project. Moreover, a project specific Resettlement Action Plan (RAP) has been prepared. Therefore, the potential	Medium Risk

		impact can be assessed as Medium risk.	
7.	Critical cultural heritage	The primary field investigation did not report any critical cultural heritage in the project AOI. As no critical cultural heritage is located within 10 km from the project site, no impact is anticipated.	Low risk

As per World Bank Group principles, applicable guideline with relevant chapter has given in **Table 1-2**.

Table 1-2: List of Studies and Work streams required for compliance with WBG PS

Sl. No.	Study Items/Topics	Applicable WBG PS and other guidelines	Relevant Chapter/Annex
1.	Project Description & Study of the project's Area of Interest for Environmental and Social Setting, Scoping and Categorization.	This is part of screening, which is a vitally important tool for visualizing and understanding potential environmental and social impacts, as it can help to identify significant issues for the project, and spotlight what issues to monitor and prioritize for studies needed and risk analysis. Year wise phase implementation schedule should be provided. Applicable Standards/Guidelines: PS1, WBG EHSG	• Chapter 2 and Chapter 3. • Annex A and Annex B
2.	Legal and Policy Framework	Applicable Standards/Guidelines: PS1	• Chapter 2 and Annex C
3.	Baseline Studies	Applicable Standards/Guidelines: PS1, PS3	• Chapter 4 and Annex B
4.	Water Resources and water pollution potential Study	Applicable Standards/Guidelines: PS3, WBG EHSG, Water Pollution Control Ordinance 1970, Bangladesh Water Rules 2018, Water Supply and Sanitation Act 1996.	• Chapter 4 and 5 and Annex B
5.	Air Quality study	Applicable Standards/Guidelines: PS3, WBG EHSG, ECR 1997 and Air Quality SRO 2005	• Chapter 4 and 5 and Annex B
6.	Climate Change and Disaster Risk	Applicable Standards/Guidelines: PS3, IPCC Assessment Reports (2014 and 2018)	• Chapter 4 and 5 and Annex L
7.	Assessment and GHG Emission Assessment	Applicable Standards/Guidelines: PS1, WBG EHSG	• Chapter 4 and 5 and Annex L

Sl. No.	Study Items/Topics	Applicable WBG PS and other guidelines	Relevant Chapter/Annex
8.	Noise Pollution Study	Applicable Standards/Guidelines: PS3, WBG EHSG, Noise Pollution Control Rules 2006	• Chapter 4 and 5 and Annex B
9.	Soil Characteristics Assessment	Applicable Standards/Guidelines: PS3, WBG EHSG	• Chapter 4 and 5 and Annex B
10.	Seismicity	Applicable Standards/Guidelines: PS3, WBG EHSG	• Chapter 4 and Annex B
11.	Flood Potential Assessment	Applicable Standards/Guidelines: PS3, WBG EHSG	• Chapter 4 and Annex B & L
12.	Cumulative Impact Assessment	Applicable Standards/Guidelines: PS3	• Chapter 5
13.	Labor, Human Rights and Gender Assessment	Applicable Standards/Guidelines: PS2	• Chapter 5, 8 and Annex C & H
14.	Community Health, Safety (including Hazardous materials) and Security Review	Applicable Standards/Guidelines: PS3, PS4, WBG EHSG, BLR 2015	• Chapter 5, 8 and Annex H
15.	Critical Habitat Review and Ecosystem Services Assessment	Applicable Standards/Guidelines: PS6, IUCN Guidelines, Bangladesh Wildlife Preservation Act 19741974, Revision 2008 (Draft), National Biodiversity Strategy and Action Plan	• Chapter 4 and 5 and Annex B & F
16.	Grievance Redress	Applicable Standards/Guidelines: PS1, PS5	• Chapter 7 and Annex J
17.	Consideration of Alternatives	Applicable Standards/Guidelines: PS1	• Chapter 5
18.	Land Acquisition and Resettlement Action Plan (RAP)	Applicable Standards/Guidelines: PS5, The Land Acquisition Act 1984, The Acquisition and Requisition of Immovable Property Ordinance 1982 and subsequent amendments in 1994, 1995, 2004 & 2017	• Chapter 4 and 5
19.	Indigenous People	Applicable Standards/Guidelines: PS7	• Chapter 2 (section 2.4.6) and Chapter 4 (section 4.1.6.1.5)
20.	Cultural Heritage	Applicable Standards/Guidelines: PS8	• Chapter 1 (section 1.5.3), Chapter 2

Sl. No.	Study Items/Topics	Applicable WBG PS and other guidelines	Relevant Chapter/Annex
			(section 2.3 and 2.4.6)
21.	Environmental and Social Management Plan and Environmental and Social Action Plan (including EHS, Community EHS, Fire safety, Traffic Safety, Emergency Response and Preparedness, Monitoring)	The management plan can be a phased program depending on the activities in the project. Applicable Standards/Guidelines: PS1, PS3, PS4, PS6, PS8, EHS guidelines	• Chapter 8 and Annex H

1.4.4 Consultation Meeting

A number of consultation meetings were held as a part of the scoping process. Brief descriptions of the meetings are given below:

- The Team of Consultants and SEZL met on 7th July, 2019 to discuss the overall project, funding issues and probable local and foreign industries to be a part of the project.
- In 5th August, 2019 another meeting was held, organized by the IDLC to discuss the relevant issues of this project with the client and local lenders like IDCOL.
- In 3rd October, 2019 a meeting was held where representatives from the Bangladesh Bank, IDLC and the Client SEZL were present to discuss the salient issues, applicability of the Performance Standards, and the structure of the ESIA report.
- After submission of the ESIA report, lastly the team of Consultants met again as the Bangladesh Bank felt to instruct some issue regarding the report and instructed to restructure the report with related information.

1.4.5 Baseline Data Collection

An environmental and social baseline survey has been carried out to gather information on the existing physicochemical, biological, and socio-economic environment of areas surrounding the proposed area. These data collection campaign were as follows:

- Identification of the monitoring locations for air, water and noise for sensitive receptors, and at key locations;
- The baseline data collection, monitoring and analysis for environmental parameters was completed during the period from end of July - September 2019;
- Socio-economic data collection and consultations were carried out in July - October 2019;
- Secondary data was also collected from different government departments, local bodies and through literature surveys etc.; and
- All the data was compiled and compared with applicable standards where relevant, and is presented in this report;
- Stakeholder consultation was completed with the intent of collecting baseline information on the environmental and social conditions and sensitivities, developing a better

understanding of the potential impacts, informing the public of the proposed project and to gain an understanding of the perspectives/concerns of the stakeholders;

- A summary of the stakeholder engagement process and the profile of the groups and their opinions forms a part of the Information Disclosure, Consultation and Participation Chapter of this report; and
- Information gathered was used for formulating mitigation measures and environmental and social management plan.

1.4.6 Impact Assessment and Mitigation Measures

Analysis of the baseline results and the incremental impacts of the project were assessed in accordance with the Bangladesh national guidelines for air, water and noise emissions; standards stipulated in the Environment Conservation Rules (ECR), 1997 and amendments thereof and with reference to the World Bank's Performance Standards, WB Safeguard Policies, WBG's Environmental, Health and Safety (EHS) Guidelines, including the General Guidelines. The impact assessment involved the prediction and evaluation of impacts from the project in different phases, including site preparation, construction and operation phase, decommissioning of project and included consideration of mitigation measures towards the same. Impact prediction covered residual impacts (impacts remaining after all possible mitigations have been incorporated) and took into account control measures that are part of the project design (e.g. acoustic enclosures for major equipment). Additional measures aimed at further avoiding, minimizing and mitigating predicted impacts were proposed where necessary or appropriate. Impact assessment also involved risk assessment covering hazard identification, consequence analysis and risk reduction measures and recommendations and impacts have been further classified as insignificant, minor, moderate or major based on the criteria for rating of impacts.

1.4.7 Management Plans and Grievance Redress Mechanism

Environmental and Social Management Plan (ESMP) were developed for the mitigation measures suggested and included defined roles and responsibilities for implementation. A Grievance Redress Mechanism (GRM) was developed to address any complaints and concerns from all stakeholders. Based on the risk assessment, risk reduction measures and recommendations for an emergency response and preparedness plan were also developed. ESMP also addressed the Institutional review, finalization of EMP and grievances.

1.4.8 Data Sources

For the study of the ESIA report data have been sourced from both primary and secondary sources. Detailed data sources is given in the Table 1-3.

Table 1-3: Data sources for the ESIA Study

Parameters	Information Sources	Remarks
Policy, Legal, and Administrative Framework	• National Policy and Law; • Bangladesh Bank Website; • WB Documents.	Both national and international policy, law and guidelines have been studied for this study.

Parameters	Information Sources	Remarks
Technical details of project and others associated components	• Project Specification document from Feasibility study report of SEZL; • Project detailed drawing from the SEZL authority.	Initially all the documents were prepared during the feasibility study report. Few documents are also prepared by the SEZL authority. During the design and construction phases, the detail design will be taken place and the master plan will be modified.
Physical Environment	• Primary data have been collected during field study from July 2019 to September 2019; • Secondary data have been sourced from different project's reports of Sirajganj area (like the ESIA report of the Sirajganj Power Stations); • GIS based land use analysis; • Bangladesh Meteorological Department	Field survey analysis have been reported in the physical environment part. Besides, details of satellite data, secondary source analysis and BMD data analysis report are presented in this part.
Biological Environment	• Primary data have been collected during field study from July 2019 to September 2019; • Secondary data have been sourced from different ESIA reports and monitoring project report of Sirajganj Power Plant; • IUCN database; • Birdlife related publications and website.	Data collection was carried out from July to September, 2019. Besides ESIA report of the 3 units of Sirajganj Power Plant was studied. Also, to find out the endangered species, IUCN red list have been studied to find out the endangered species.
Social Environmental	• Primary surveys in the project area and data collection from the DC office; • Extensive consultations, meetings and discussions held with stakeholders; • Bangladesh population Census for 2011; • Land Regulation Policy, Bangladesh.	In the months of July and September of this year, a primary socioeconomic survey was conducted. Details provided in baseline environmental and social conditions chapter.

1.4.9 The ESIA Report

The ESIA report has been largely structured based on the guideline and content of ESPP and OP 4.03. The layout of the Report has been divided into 11 sections as briefly described in **Table 1-4**.

Table 1-4: Layout of the Report

Chapter No.	Chapter Title	Description
Volume I (ES)	Executive Summary	This section includes: • introduction about the project; • requirement of ESIA; • summary compilation of the baseline conditions; • impact assessment and mitigation measures proposed; and • critical facts, significant findings and recommended actions for the project.
Volume II (Chapter-1)	Introduction	This section includes: • the purpose of the report; • identification of the project and project proponent; • brief description of nature, size, location of the project and its importance to the country; and • limitations of the study.
Volume II (Chapter-2)	Policy, Legal and Administrative Framework	This section discusses: • the national and local legal and institutional framework within which the environmental and social assessment is carried out; • project-relevant international environmental agreements to which the country is a party; and • the applicable reference framework being used for the ESIA study.
Volume II (Chapter-3)	Description of the Project	This section describes: • the proposed project; • the major components; and • the geographic, ecological, social, and temporal context, including associated facility required by and for the project.
Volume II (Chapter-4)	Description of the Environment (Baseline Data)	This section describes: • relevant physical, biological, and socioeconomic conditions within the study area; • current and proposed development activities within the project's area of influence, including those not directly connected to the project which indicates the accuracy, reliability, and sources of the data.

Chapter No.	Chapter Title	Description
Volume II (Chapter-5)	Analysis of Alternatives	This section includes: • assessed alternative options ranging from project site alternatives, no build scenario and zero option considering their potential environmental impacts, the feasibility of mitigation measures for high residual impact/risk, if any etc.
Volume II (Chapter-6)	Identification and Analysis of Potential Impcats	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; • 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; • 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.
Volume II (Chapter-7)	Consultation, Participation and Information Disclosure	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 • describes the planned information disclosure measures and the process for carrying out consultation with affected people.
Volume II (Chapter-8)	Grievance Redress Mechanism	This section describes: • the grievance redress framework, setting out the time frame and mechanisms for resolving complaints about environmental performance; and • structure of the grievance redress cell to be formed for the project.
Volume II (Chapter-9)	Environmental and Social Management Plan (ESMP)	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 ESMP.

Chapter No.	Chapter Title	Description
Volume II (Chapter-10)	Institutional Setting and Implementation Arrangements	This section normally emphasize on- • training and plan for both construction and operation stage.
Volume II (Chapter-11)	Conclusion and Recommendation	This section provides- • the conclusions drawn from the impact assessment; and • recommendations for environmental and social management during the project lifecycle.

1.5 Analysis of Alternatives

Analysis of alternative options was considered to minimize impacts of the project while undertaking the ESIA study. The alternative options assessed in the study ranged from project site alternatives, no build scenario and zero option. Alternatives are considered in terms of their potential environmental impacts, the feasibility of mitigating these impacts alternatives for mitigation measures for high residual impact/risk, if any etc.

1.6 Site Selection and Development Activities

Initially BEZA was responsible for total identification and promotion of the economic zones. BEZA identifies the location, acquired the land and handover to SEZL authorities for further development. SEZL will develop the necessary off-site infrastructure to make site accessible and buildable. Local developer has been appointed by SEZL to develop the EZ as per EZ Act, 2010. The off-site facilities as planned by the SEZL to be carried out for Sirajganj Economic Zone are given below:

- Construction of administration building;
- Site Preparation which includes-
  - Land filling of 415 acres;
  - Construction of boundary wall for 415 acres all around the boundary;
  - Access road;
  - External power supply;
  - External gas supply;
  - River bank protection work; and
  - Drainage system of the Economic Zone.

The on-site facilities as planned by the SEZL to be carried out for Sirajganj Economic Zone are given below:

- Internal Road and footpath;
- Storm water drain;
- Water supply system;
- Sewerage system;
- Street lighting & power distribution;
- Telecom duct

- Sewerage Treatment Plant (STP)
- Solid waste management
- Landscaping works

CHAPTER 2

2 POLICY, LEGAL, AND ADMINISTRATIVE FRAMEWORK

2.1 Introduction

In ESIA Study, Proponent must make sure the compliance of following guidelines and standards:

- Department of Environment (DOE) including Environment Conservation Rules, 1997, practices all applicable guidelines and standards as;
- Environmental and Social Risk Management Guidelines, 2018 of IPFF II, Bangladesh Bank;
- Environmental and Social Risk Management Guidelines, 2017 of Bangladesh Bank
- Environmental and Social Policy and Procedure, 2018 of IPFF II, Bangladesh Bank;
- The World Bank practices Environmental and Social Framework, 2017 and other relevant guidelines and standards including Operational Policies (OP) and Bank Policies (BP) as;
- Other best-practice guidelines as are practiced widely environmental, social and occupational safeguards purpose;

2.2 Environment and Social Related Legislation in Bangladesh

The main Acts and Regulations guiding environmental protection and conservation in Bangladesh are outlined in the following subsections.**Bangladesh Environmental Conservation Act, 1995 (subsequent amendments in 2000 and 2002)**

The provisions of the Act authorize the Director General of the 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 Certification;
- 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 the environment;

2.2.2 Environment Conservation Rules (ECR), 1997 (subsequent amendments in 2002 and 2010)

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 based on actual (for existing industries/development projects/activities) and anticipated (for proposed industries/development projects/activities) pollution load;
- Procedure for obtaining Environmental Clearance (provided in **Figure 2-1**);
- Requirements for undertaking IEE and EIA's as well as formulating EMP's according to categories of industries/development projects/activities; and
- Procedures 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).

Detailed categorization as per ECR, 1997 in Bangladesh is given in Annex C.

2.3 Regulatory Requirements for the Proposed Project

The Government of Bangladesh has framed various laws and regulation for protection and conservation of natural environment. These legislations with applicability to this project are summarized in following table **Table 2-1**.

Table 2-1: Applicability of Key Environmental Legislation at a Glance

Name	Key Requirement	Applicability	Remarks
Act/ Rules			
Bangladesh Environmental Conservation Act, 1995 (ECA, 1995) and Environment Conservation Rules 1997 (ECR, 1997)	Mandatory requirement of prior environment clearance for certain category of project for conservation and improvement of environment and control and mitigation of pollution of the environment. Standards are described under ECR, 1997	Applicable. Project classified under red category. EIA study required to be undertaken	Site approval certificate is to be obtained from DoE prior carrying out EIA study. EIA study is carried out on basis of ToR approved by DoE.
ECA & ECR amendment 2000	To ascertain responsibility for compensation in case of damage to ecosystem		
ECA & ECR amendment 2002	Restriction on polluting automobiles, sale and production of environmental harmful items;		
Environment Court Act, 2000 and subsequent amendments in 2002	To give high priority to environment pollution prevention;	Applicable, for all projects have potential of environmental threat	All the developments to be carried it as per ECA, 1995 & ECR, 1997 and amendments. Regulatory authority is Judiciary and Ministry of Environment & Forest.

Name	Key Requirement	Applicability	Remarks
Act/ Rules			
Bangladesh Wildlife Preservation Act, 1974 and Revision 2008 (Draft)	No person shall damage or destroy any vegetation in any wild life sanctuary & the wild Animals shall not be hunted or captured. For preservation of Wildlife Sanctuaries, parks, reserves;	**Not Applicable**. Project site is not located within any wildlife sanctuary/ national park or any other protected area under this act.	Development activity will not have any interface with wildlife or wild habitat at any stage. Regulatory authority is Ministry of Environment and Forest Bangladesh Wild Life Advisory Board.
The Forest Act 1927, Amendment 2000 (Protected, village Forests and Social Forestry)	• Declare any forests land or wasteland as protected forests. • May stop public or private way or watercourse in the interest of preservation of the forest. • Declare a reserved forest area as Village Forests • Declare an area as Social forests or launch a social forestry programme in Govt. land or private land with permission.	**Not Applicable**. No forestland diversion is involved.	No forestland will be required to be diverted;
The Private Forests Ordinance Act, 1959	Conservation of private forests and for the afforestation on wastelands;	**Applicable**	Tree cutting will be carried out (No. of tress)
The Penal Code	• Chapter XIV of the Penal Code provides offences affective public health, safety, convenience, decency and morals; Section 277: Falling Water or Public Spring or Reservoir; Section 278: Making Atmosphere Noxious to Health; • Section 284: Negligent Conduct with Respect to	**Applicable**	It is required to take all the measures proposed and suggested by DoE, Bangladesh during both construction an operation phase to minimize the environmental pollution

Name	Key Requirement	Applicability	Remarks
	Act/ Rules		
	Poisonous Substance; Section 285: Negligent Conduct with Respect to Fire or Combustible Matter; • Section 286: Negligent Conduct with Respect to Explosive Substance. • Section 277: whoever voluntarily corrupts or fouls the water of any public spring or reservoir, to render it less fit for the purpose for which it is ordinarily used will be punished under the law. • Section 278: whoever voluntarily vitiates the atmosphere in any place so as to make it noxious to the health of persons in general dwelling or carrying on business in the Neighborhood or passing along a public way will get punishment.		
The Protection and Conservation of Fish Act, 1950 and The Protection and Conservation of Fish Rules, 1985	Prohibit or regulate the construction, temporary or permanent of weirs, dams, bunds, embankment and other structures	**Applicable**	The project site is located adjacent to the Jamuna River. So there is a chance to pollute the water body
The Explosive Act, 1884	To prevent any accident due to explosive storage, use or transportation due to careless handling/management	**Applicable** Possibly Applicable depending on quantity of fuel storage	Fuel will be stored and used at site for running various construction machinery and equipment
Water Pollution Control	Prevention of water pollution	**Applicable** from the	Applicable primarily during

Name	Key Requirement	Applicability	Remarks
	Act/ Rules		
Ordinance 1970		prospective of prevention of pollution	construction stage (e.g. sewage and equipment washing and maintenance liquid waste discharges from construction camps)
Water Supply and Sanitation Act, 1996	Management and Control of water supply and sanitation in urban areas	**Applicable** for all development projects	Regulatory authority is Ministry of Local Government, Rural Development and Cooperatives
The ground Water Management Ordinance 1985	Management of Ground Water Resources; Tube well shall not be dug in any place without permission from Upazila Parishad.	**Applicable**, if tube wells will be dug to develop water supply system during operation phase	Permission should be taken if ground water is used, before digging tube wells
The Embankment and Drainage Act 1952	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 dike will be constructed to avoid flooding	Regulatory authority Ministry of Water Resources and FCD
Wetland Protection Act 2000	• Adhere to a formal environmental impact assessment (EIA) process, as set out in EIA guidelines and manuals for water sector projects or related to alteration of natural drainage. • No construction of roads if likely to affect the flow of	**Not Applicable**	Site is not situated at wetland area

Name	Key Requirement	Applicability	Remarks
	Act/ Rules		
	navigable waterways without clearance from concerned authority's Upland flow in water channels to preserve eco-system. • Protection against degradation and resuscitation of natural water-bodies such as lakes, ponds, beels, khals, tanks, etc. affected by man-made interventions or other causes. • Completely stop the filling of publicly-owned water bodies and depressions in urban areas.		
Antiquities Act 1968	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 no structure of national cultural heritage will be affected due to project development	Regulatory authority is Ministry of cultural Affairs
The Building Construction Act 1952 (with amendments)	For the prevention of haphazard construction of building and excavation of tanks which are likely to interfere with planning of certain areas in Bangladesh.	**Applicable** as the project involves development of infrastructure	Regulatory authority is Ministry of Works
The Vehicle Act, 1927 The Motor Vehicles Ordinance, 1983 The Bengal Motor Vehicle Rules, 1940	To regulate vehicular exhaust emissions	**Applicable** as heavy vehicle movement is involved both during construction and operation phase	Regular maintenance and up keeping of the vehicles should be carried out. Regulatory authority is Bangladesh Road Transport Authority

Name	Key Requirement	Applicability	Remarks
Act/ Rules			
The Land Acquisition Act, 1894 The Acquisition and Requisition of Immovable Property Ordinance 1982 and subsequent amendments in 1994, 1995, 2004 & 2017	To provide appropriate compensation for the land acquired	**Applicable** as the land acquisition has been carried out	Regulatory authority is Deputy Commissioner
The Factories Act, 1965 Bangladesh Labour Law, 2006	This Act pertains to the occupational rights and safety of factory workers and the provision of a comfortable work environment and reasonable working conditions.	**Applicable** as the workers will be employed during construction and operation phase of EZ	Regulatory authority is Ministry of Labour
Bangladesh Labour Law, 2006, Bangladesh Labour Act, 2013 and Bangladesh Labour Rules, 2015	Provides health, safety, and well-being of workforce during project life cycle. In addition, it also stipulated that children under 18 years are not allowed to be employed during project life cycle and therefore, this law requires to be complied.	**Applicable**	skill, semiskilled and day labor will be worked in the project
Noise Pollution (Control) Rules 2006	• Prevention of Noise pollution • Standards for noise levels	**Applicable**	Noise will be generated due to the construction activity
National Biodiversity Strategy and Action Plan	• Conserve, and restore the biodiversity of the country for wellbeing of the present and future generations. • Maintain and improve environmental stability for ecosystems	**Not Applicable**	There is no biological heritage site and also no prominent forest area except the homestead vegetation.

Name	Key Requirement	Applicability	Remarks
	Act/ Rules		
	• Ensure preservation of the unique biological heritage of the nation for the benefit of the present and future generations • Guarantee the safe passage and conservation of globally endangered migratory species, especially birds and mammals in the country • Stop introduction of invasive alien species, ge netically modified organisms and living modified organisms		
National Water Bodies Protection Act, 2000	The characterization of water bodies as rivers, canals, tanks or flood plains identified in the master plans formulated under the laws establishing municipalities in division and district towns shall not be changed without approval of concerned ministry	**Applicable**	The adjacent Jamuna River and the branch of Jamuna River flowing through the project site need to be kept natural.
Frramework for Leasing Government (Khas) Agricultural Land	The rules for allotting and leasing Government-owned (khas) land to land less families	**Not Applicable**	
Ozone Depleting Substances Control Rules, 2004	Ban on the use of Ozone depleting substances • Phasing out of Ozone depleting substances	**Applicable**	During operation period, there is a possibility of using such gases.
Policies			
National Environment Policy, 1992	For sustainable development	**Applicable** for all development projects	Usage of energy efficient building material, fuel etc. should be encouraged

Name	Key Requirement	Applicability	Remarks
Act/ Rules			
National Landuse Policy, 2001	• Deals with several lands 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**	land use change from seasonal cultivable land to Industrial Area
National Environment Management Action Plan 1995	Conservation of natural habitats, bio-diversity, energy, sustainable development and improvement of life of people	**Applicable** for all development projects	Usage of energy efficient material, green building techniques, reduction of carbon foot prints etc.
National Conservation Strategy	Sustainable development of Industrial Sector	**Applicable** for all development projects	Usage of energy efficient material, green building techniques, reduction of carbon foot prints etc.
National Fisheries Policy, 1998	• Preservation, management, and exploitation of fisheries resources in inland open water • Fish cultivation and management in inland closed water. • Prawn and fish cultivation in coastal areas • Preservation, management, and exploitation of sea fishery resources	**Not Applicable**	
The National Forest Policy (1994)	Conserve the existing forest areas and to increase forest cover of country and increase the reserve forest.	**Not Applicable**, no diversion of forest land is involved	Not Applicable

Name	Key Requirement	Applicability	Remarks
Act/ Rules			
The National Energy Policy, 1995	Protecting the environment by requiring an EIA for any new energy development project, introduction of economically viable and environment friendly technology.	**Not Applicable**. Separate EIA study is to be carried out	Energy efficient materials and techniques should be explored
The National Water Policy, 2000	To ensure efficient and equitable management of water resources, proper harnessing and development of surface and ground water, availability of water to all concerned and institutional capacity building for water resource management.	**Applicable** Ground water is required to be withdrawn for fulfilling water requirement during operation phase	Conjunctive use of water should be explored
The National Water Management Plan, 2001	Addresses options for water quality, considerations behind measures to clean up industrial pollution, where effluent discharge monitoring and zoning regulations for new industries are emphasized;	**Applicable** as it is industrial project and will involve generation of effluent and sewage	Installation of effluent treatment facility within the premises
Industrial Policy, 1999	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**	Applicable to the Project is a private industrial development

2.3.1 Environmental Clearance from DoE, Bangladesh

Bangladesh has very simple administrative framework regarding environmental aspect. It has strong interface between local government and federal Government. Department of Environment is responsible for a grant of environmental clearance to a project. A schematic representation of the various steps involved in obtaining the Environment Clearance certificate from DoE for Red category projects is given in **Figure 2-1**.

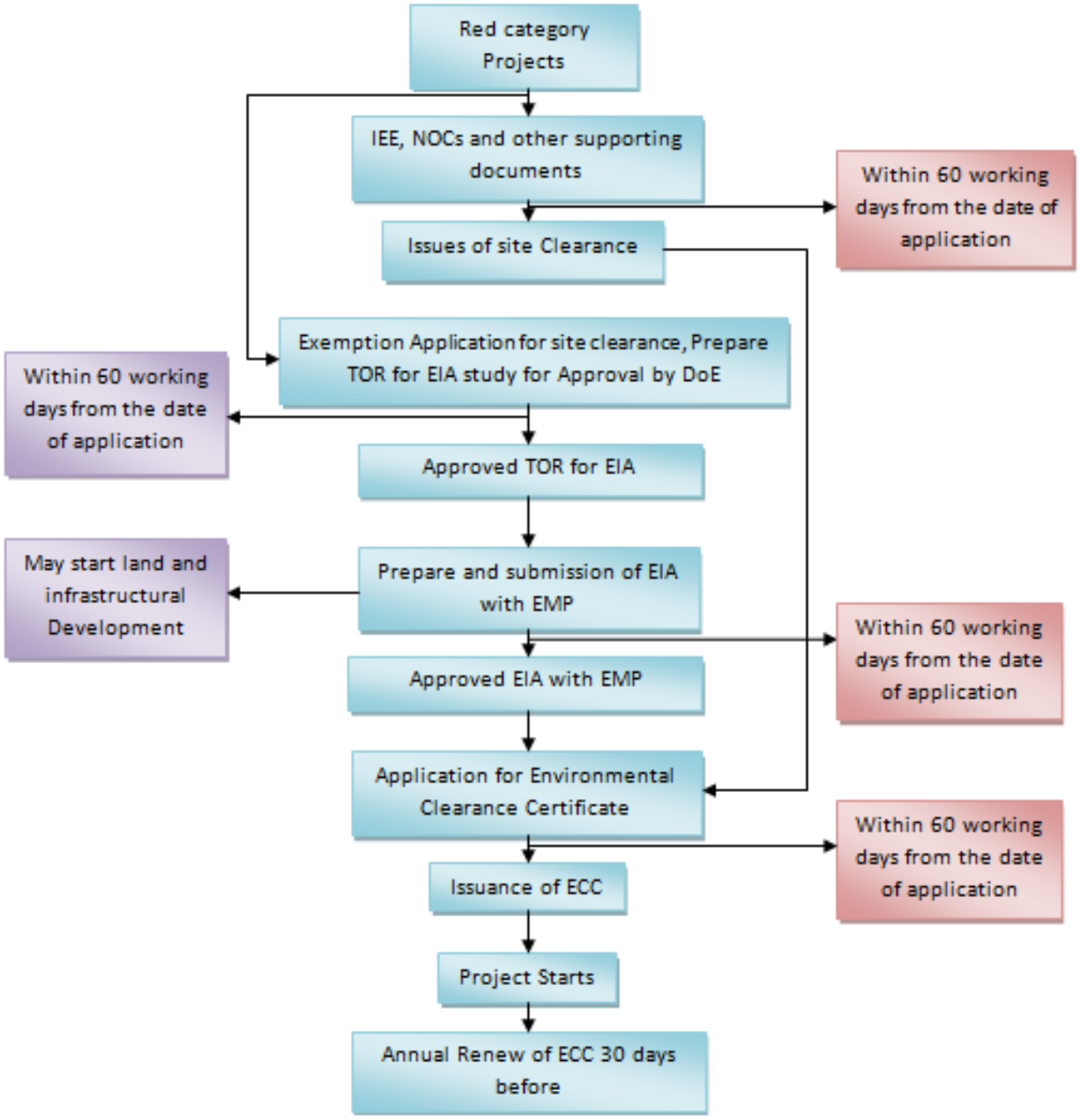


Figure 2-1: Steps for Obtaining Environment Clearance from DoE

Detail procedure of obtaining environmental clearance of SEZL is given in Annex C.

2.3.2 National 3R (Reduce, Recycle, and Reuse) Strategy for Waste Management

The National 3R Strategy for waste management has been established by Department of Environment on December, 2010. Sector specific strategies for promotion of 3R are depicted in this national 3R strategy.

The national 3R goal for waste management is achieve complete elimination of waste disposal on open dumps, rivers, flood plains by 2015 and promote recycling of waste through mandatory segregation of waste at source as well as create a market for recycled products and provide incentives for recycling of waste.

The main objective of this 3R strategy is to delineate ways and means of achieving national 3R goals through providing a uniform guideline for all stakeholders. Specific objectives of this strategy are to:

- address the key issues and challenges of waste management acting as a barrier for promotion of 3R in the country;
- define the roles of various actors to promote 3R in the country; and
- Guide the creation of enabling conditions for success regarding implementation of 3R in the country.

During construction and operation of proposed Sirajganj Economic Zone Limited will generate solid waste so the national 3R strategy for waste management should be followed by the BEZA.

2.3.3 Land Acquisition of Private Land

The current legislations governing land acquisition in Bangladesh is the Acquisition and Requisition of Immovable Property Ordinance 1982 (hereinafter, "the Ordinance") and subsequent amendments (1989, 1993, 1994, 2004, 2009, 2011& 2017). The Ordinance provides certain safeguards for landowners and has provisions for payment of 'fair value' for the property acquired. Besides, the 1994 amendment made provisions for payment of crop compensation to tenant cultivators. However, it does not cover project-affected persons without titles or ownership record, such as informal settler/squatters, occupiers and informal tenants and lease-holders (without document) and does not ensure replacement value of the property acquired. It does not permit the affected persons to take the salvageable materials for which compensation have been paid by the Deputy Commissioner (DC). It has no provision of resettlement assistance and transitional allowances for restoration of livelihood of livelihoods of the non-titled affected persons. The ordinance (2009) made provision to refuge the compensation by the authority to those households or individual who constructed or will construct any structure with mal fid intention to get compensation.

In all cases, the DC determines (i) market value of acquired assets on the date of notice of acquisition (based on the registered value of similar property bought and/or sold in crops) due to compulsory acquisition. The DC payments or "awarded" to owners is called Cash Compensation under Law (CCL). The value thus paid is invariably less than the "market value" as owners customarily report undervalued land transaction prices in order to pay

lower stamp duty and registration fees. As a result, compensation for land paid by DC, including premium, remains less than the real market price or Replacement Value (RV).

Khas (Government owned) lands should be acquired first when a Project acquires both khas (public) and private land. If a Project acquires only khas, the land will be transferred through an inter- ministerial meeting following the preparation of acquisition proposal submitted to DC /MOL. Places of worship, graveyard and cremation grounds are not to be acquired for any purpose.

The DC processes land acquisition under the Ordinance and pays compensation to the legal owners. There is provision for Arbitration Appellate Tribunal on compensation assessment by the DC, but the law allows only 10 percent enhancements on the DC "award." Of the acquired land, the Ministry of Lands (MOL) is authorized to deal with land acquisition through the DCs.

2.3.4 Policies, Act and Regulations related to Economic Zones

The government may, with a view to encouraging rapid economic development in potential areas including backward and underdeveloped regions of the country through increase and diversification of industry, employment, production and export and to implement the social and economic commitments of the State establish Economic Zone Act for the stablishment of different types of industries. Bangladesh Economic Zones Act, 2010 (the Act) was enacted with provision, among others, for establishing an authority naming Bangladesh Economic Zones Authority (BEZA). The BEZA was established under Section 17 of the Act. For smooth administration and proper management of the activities in respect of Economic Zones, BEZA framed rules and formulated policy. Details to be provided in the Annexure C.

2.3.5 ESRM Guidelines, 2018 in relevant to IPFF II as well as ESRM Guidelines, 2018 of Bangladesh Bank

The core objective of the ESRM Guideline is to make banks and FIs realize to integrate Environment & Social (E&S) risks and incorporate appropriate risk mitigation measures in overall credit management to be able for expanding the credit/investment portfolio rather than avoid investing in high E&S risks. Consequently, compared to the erstwhile ERM Guidelines, the ESRM Guidelines introduce the following features to be more streamlined, interactive and user friendly in nature:

- The ESRM Guideline provides a robust, auto generated, quantitative risk rating system to reduce the subjectivity of a qualitative risk assessment method that was present in the ERM Guidelines.
- The ESRM guideline has a bigger focus on social and climatic risks, which are becoming relevant and crucial for Bangladesh.
- The generic and sector specific E&S Due Diligence (ESDD) checklists at ESRM Guideline) in the ESRM Guideline incorporate guidance notes to assist the Relationship Managers (RM) in carrying out the due diligence process.

- The ESRM Guideline, in addition to investment threshold, define applicability based upon sector specific E&S impacts and the categories are expanded to include agriculture, retail, trade, microfinance, SME and corporate financing and project financing.
- The organizational roles and responsibility defined in the ESRM Guideline are built upon the principles of integration of E&S risks into the bank or FI's overall credit policy. It clearly delineates the responsibility of different functions of a bank or FI in terms of E&S risk assessment and the decision-making process based upon E&S risk rating.
- The new ESRM Guideline includes one Generic ESDD checklist and 10 sector specific checklists for high risk sectors. Thus, it is broad in scope but at the same time, the process is much more streamlined for ease of use by the practitioners in the financial sector.

2.3.6 Environmental and Social Policy and Procedures (ESPP)

Environmental and Social Policy and Procedures (ESPP) document for IPFF II that details key elements of the ESMS and serves as the basis for the PFIs to prepare their internal ESMSs. ESPP is a guideline for IPFF II in terms of ESIA and ESPP encompasses all the necessary guidelines required for the WB financed sub-project. ESPP for IPFF II includes: (a) E&S Policy Statement, applicable E&S requirements; (b) information on relevant national laws and regulations; (c) procedures to be followed by all project stakeholders; (d) guidance for conducting assessment of E&S risks and impacts for subprojects; and (e) arrangements for E&S related disclosure and periodic reporting.

2.4 International Treaties

Bangladesh has signed most international treaties, conventions and protocols on environmental protection **Table 2-2** shows relevant international treaties, conventions and protocols signed by Bangladesh.

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

Treaty or Convention	In	Brief Description	Responsible Agency
International Convention for Protection of Birds, Paris	1950	Protection of birds in wild state	Department of Environment/ Department of Fisheries
International Plant Protection Convention, Rome	1951	To secure coordinated, effective action to prevent and to control the introduction and spread of pests of plants and plant products	Department of Environment

Treaty or Convention	In	Brief Description	Responsible Agency
International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties, Brussels	1969	Civil liability on oil pollution damage from ships	Department of Environment/ Ministry of Shipping
Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar Convention), Ramsar	1971	Protection of wetlands	Department of Environment/ Department of Fisheries
Convention Concerning the Protection of the World Cultural and natural Heritage, Paris	1972	Protection of major cultural and natural monuments	Department of Archaeology
Convention on International Trade in Endangered Species of Wild Fauna and flora (CITES), Washington	1973	Ban and restrictions on international trade in endangered species of wild fauna and flora	Department of Environment/ Department of Fisheries
Convention Concerning the Prevention and Control of Occupational Hazards caused by Carcinogenic Substances and Agents, Geneva	1979	Conservation of migratory species of wild animals	Department of Environment/ Department of Fisheries
Convention Concerning the Protection of Workers Against Occupational Hazards in the Working Environment due to Air Pollution, Noise and Vibration, Geneva	1974	Protect workers against occupational exposure to carcinogenic substances and agents	Ministry of Health and Family Welfare
Convention on the Conservation of Migratory Species of Wild Animals, Bonn	1977	Protect workers against occupational hazards in the working environment	Ministry of Health and Family Welfare
Convention Concerning Occupational Safety and Health and the Working Environment, Geneva	1981	Prevent accidents and injury to health by minimizing hazards in the working environment	Ministry of Health and Family Welfare

Treaty or Convention	In	Brief Description	Responsible Agency
Convention Concerning Occupational Health Services, Geneva	1985	To promote a safe and healthy working environment	Ministry of Health and Family Welfare
Vienna Convention for the Protection of the Ozone Layer, Vienna	1985	Protection of ozone layer	Department of Environment/ Ministry of Environment and Forest
Basel Convention on the Control of Trans-boundary Movements of Hazardous Wastes and Their Disposal, Basel	1989	Safe methods for transport of dangerous goods by road, railway and inland vessels	Ministry of Communication
International Convention on Oil Pollution Preparedness, Response and Cooperation, London	1990	Legal framework and preparedness for control of oil pollution	Department of Environment/ Ministry of Shipping
London Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer, London	1990	Control of global emissions that deplete ozone layer	Department of Environment/ Ministry of Environment and Forest
United Nations Framework Convention on Climate Change (UNFCCC), New York	1992	Regulation of greenhouse gases emissions	Department of Environment/Ministry of Environment and Forest
Convention on Biological Diversity (CBD), Rio De Janeiro	1992	Conservation of bio-diversity, sustainable use of its components and access to genetic resources	Department of Environment/ Ministry of Environment and Forest
Kyoto Protocol to the United Nations Framework Convention on Climate Change, Kyoto	1997	International treaty on climate change and emission of greenhouse gases	Department of Environment/ Ministry of Environment and Forest
Cartagena Protocol on Biosafety to the Convention on Biological Diversity, Montreal	2000	Biological safety in transport and use of genetically modified organisms	Department of Environment/ Ministry of Environment and Forest
Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from	2010	Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from	Minister for Environment and Forests of Bangladesh

Treaty or Convention	In	Brief Description	Responsible Agency
their Utilization to the Convention on Biological Diversity		their Utilization to the Convention on Biological Diversity	
Paris Climate Agreement	2015	Climate Change	Minister for Environment and Forests of Bangladesh

2.4.1 Fundamental Convention of ILO

The ILO Governing Body has identified eight "fundamental" Conventions, covering subjects that are considered to be fundamental principles and rights at work: freedom of association and the effective recognition of the right to collective bargaining; the elimination of all forms of forced or compulsory labor; the effective abolition of child labor; and the elimination of discrimination in respect of employment and occupation. Details of the applicable ILO Conventions are provided in Annex C.

2.4.2 Development Agency's Guidelines

Under the study health and safety guidelines of few development agencies will be reviewed. This will include "Environmental, Health, and Safety Guidelines of the World Bank Group Performance Standard" and "World Bank Environmental Policies".

2.4.3 World Bank Group (WBG) Performance Standards

The Performance Standards (PS) (January 2012) established by WBG that the Project shall meet certain requirements throughout the life cycle of an investment by WBG or other relevant financial institution such as other DFIs (eg. FMO) or commercial banks, which are signatory to the Equator Principles, 2006. A brief description of the Performance standards is provided.

Table 2-3: WBG Performance Standards

Performance Standards	Specific Areas
Performance Standard 1	Assessment and Management of Environmental and Social Risks and Impacts
Performance Standard 2	Labor 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

(Source: 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 Annex C. 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.

2.4.4 WBG Project Categorization

As part of its review of a project's expected social and environmental impacts, WBG 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 WBG's institutional requirements. Like ADB, the WBG categories are:

a) **Category A Projects:** Projects with potential significant adverse social or environmental impacts that are diverse, irreversible or unprecedented;
b) **Category B Projects:** Projects with potential limited adverse social or environmental impacts that are few, generally site-specific, largely reversible and readily addressed through mitigation measures;
c) **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;
d) **Category FI Projects:** All FI projects excluding those that are Category C projects.

WBG therefore categorizes project primarily according to the significance and nature of impacts. WBG 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.

2.4.5 Triggering of WBG Performance Standards

The triggering of the WBG Performance Standards (PS) in the present project with explanations are given in the Table 2-4 below. The applicable GOB laws, Rules, Policies, and Guidelines are listed alongside the WBG PS. The International Conventions signed by Bangladesh are also included, as once signed these are equivalent to the laws. The applicability of WBG standard has given in.

Table 2-4: Triggering of WBG Performance Standards

SL.	PS and Title	Triggered (Yes/No)	Applicable Bangladesh Laws/Rules and Conventions to which Bangladesh is a Party
1.	**Performance Standard 1:** Assessment and Management of Environmental and Social Risks and Impacts	Yes	Bangladesh Environmental Conservation Act 1995 and amendments; Environment Conservation Rules (ECR), 1997 and amendments; National Environmental Policy, 2018 &1992; Environmental Court Act, 2010; National Environmental Management Action Plan, 1995, National Water Policy, 2000; National Water Management Plan, 2001
Explanations: PS1 is triggered in this project. This is an umbrella Standard as Assessment and Management of Environmental and Social Risks and Impacts are important in all projects with land-based activities (i.e., during construction, operation and decommissioning phases). The issues that may pose potential E&S risks and/or impacts include air emissions, water pollution, wastes and effluents and engagement of labor etc. These issues have to be assessed to determine the extent of the risks and impacts.			
2.	**Performance Standard 2:** Labor and Working Conditions	Yes	Bangladesh Factories Act (1965); Bangladesh Labor Act, 2006; Bangladesh Labor Rules (2015), Bangladesh Children's Act 2013; ILO Conventions 29, 87, 98, 100, 105, 111 and 182
Explanations: PS2 is triggered in this project; as during all phases of the project labor force will be needed and mobilized to carry out various duties to construct and operate the project. It is therefore necessary for the Project to maintain appropriate labor and working conditions.			
3.	**Performance Standard 3:** Resource Efficiency and Pollution Prevention	Yes	*ECA95 and amendments, ECR 97 and amendments; Noise Pollution (Control) Rules 2006,* International Convention for the Prevention of Pollution of the Sea by Oil, London, 1954 (Ratified 1981); *The Ground Water Management Ordinance, 1985;* Basel Convention on the Control of Trans-boundary Movements of Hazardous Wastes and their Disposal, Basel, 1989 (Ratified 1993); Montreal Protocol on Substances that Deplete the Ozone Layer, Montreal, 1987 (Ratified 1990), (London Amendment, 1990) (Ratified 1994).
Explanations: PS3 is triggered in this project; as it will involve use of a lot of resources both raw, semi-manufactured, manufactured components and energy. Thus, pollutants will be produced and these need to be minimized to comply with standards; resources and energy conservation are also prime needs.			
4.	**Performance Standard 4**: Community Health, Safety, and Security	Yes	The Fertilizer Regulation Order, 1995; Disaster Management Act 2012; Motor Vehicle Ordinance

			1983; Bangladesh Private Security Regulations Act, 2006 etc.
Explanations: PS4 is triggered in the project. There is considerable number of households, villages and local communities within 3km impact zone around the site. With increased activities in the project area following construction of various industries, there will be influx of workers and service providers, which will add to the local communities; who will be impacted by the activities in the industries within the site. Although the project is likely to be beneficial to entrepreneur and stakeholders, some beneficial impacts are also expected to the community e.g. employment as well as negative impacts e.g. fire and explosion risks, accidents, etc.			
5.	**Performance Standard 5:** Land Acquisition and Involuntary Resettlement	Yes	Acquisition and Requisition Ordinance, 1982
Explanations: PS5 will be triggered in the project. The concerned Deputy Commissioner, upon receiving the land acquisition request from BEZA, started land acquisition process and served to the landowners. After the completion of all actions guided by the ARIPO-1982, finally, The Deputy Commissioner handed over the acquired land (1041.43 acre) to the SEZL.			
6.	**Performance Standard 6:** Biodiversity Conservation and Sustainable Management of Living Natural Resources	No	*Bangladesh Wild Life (Preservation) Act, 1974; National Biodiversity Strategy and Action Plan (2004):* Fish Act and Rules, Bangladesh Water Act 2013; National Water Bodies Protection Act 2000, National Conservation Strategy, 1992, ECA95, National Water Policy, 2000; National Water Management Plan, 2001; International Plant Protection Convention, Rome, 1951 (Ratified 1978); Convention on Wetlands of International Importance, especially as Waterfowl Habitat, Ramsar, 1971; the Ramsar Convention (Ratified 1992); Convention on International Trade in Endangered Species of Wild Fauna and Flora, Washington, 1973 (CITES Convention) (Ratified 1982); Agreement on the network of Aquaculture Centers in Asia and Pacific (NACA), 1988; Convention on Biological Diversity, Rio de Janeiro, 1992 (Ratified 1994); International Convention to Combat Desertification, 1994.
Explanations: PS6 is not triggered in the project. The project area was previously agricultural land which did not support any critical habitat and no endangered species thrives on this land. No significant biological or ecological issues were found in the area, therefore PS is not triggered.			
7.	**Performance Standard 7:** Indigenous Peoples	No	Chittagong Hill Tracts Regional Council Act, 1998.

Explanations: PS7 is not triggered in the project. There are no indigenous people in the impact zone of the project			
8.	**Performance Standard 8:** Cultural Heritage	No	Antiquities Act, 1968; Convention Concerning the Protection of the World Cultural and Natural Heritage, Paris, 1972 (World Heritage Convention) (Ratified 1983).
Explanations: PS8 is not triggered as there is no cultural heritage site around the project site which might be impacted due to construction or operation of this project.			

2.4.6 WBG EHS Guidelines

During the design, construction, and operation of the project the borrower/client will apply pollution prevention and control technologies and practices consistent with international good practice, as reflected in internationally recognized standards such as the World Bank Group's Environment, Health and Safety Guidelines. These standards contain performance levels and measures that are normally acceptable and applicable to projects. For this purpose, WBG EHS guidelines are recommended.

The Environmental, Health, and Safety (EHS) General Guidelines (April 30, 2007) will be applicable for this Project. In addition to that, WBG's Sector specific EHS Guidelines for Thermal Power Plants and other industries will also be applied.

2.4.7 Applicable EHS Standards

The EHS standards as stipulated in ECR 1997 and amendments of DOE as well as in the WBG EHS guidelines (General for Economic Zone) for air quality, surface and ground water quality, ambient noise levels, emissions and effluent discharge have been presented in the environmental baseline section (Chapter 4) as well as in impact assessment section (Chapter 6) for comparison with the baseline conditions and predicted impacts, respectively.

2.5 Equator Principles Financial Institutions (EPFIs) Guidelines

Equator Principles are a set of principles aiming towards promotion of responsible environmental stewardship and socially responsible development, including fulfilling responsibility to respect human rights by undertaking due diligence. There are 10 principles in total detail of which is given in Annex C.

2.6 Applicable Standards

The applicable standards for the SEZ project will be applicable only for the air, water, noise and soil. For air, water and noise applicable standards of ECR, 1997 is applicable. In case of absences of national standards WBG standards need to be followed strictly. Detail applicable standards for this project are given in the annexure part (Annex C: Secton C.7)

2.7 Compliance of Legal Register

From starting of the process to still now, SEZL authority has taken NOC and other concern from many local and national authorities for the development of the EZ. Still few legal issues are not aligned, but under process to align. A total list of legal compliance issue has been listed in C8 of Annex C.

Table 2-5: Legal Register for Sirajganj Economic Zone Limited

Sl.No.	Item	Issuing Authority	Issue Date	Validity	Status	Attachment	Remarks
1	Trade License	Soydabad Union Parisad	2/10/2019	30/06/2020	Align	Figure C 2	
2	License for Economic Zone	BEZA	4/10/2018	15 Years	Align	Figure C 3	
3	NOC from Local Authority	Soydabad Union Parishad	17/05/2017	N/A	Align	Figure C 5	
4	NOC from Local Authority	Rajapur Union Parishad	18/05/2017	N/A	Align	Figure C 4	
5	EIA Approval	DOE	26/11/2017	N/A	Align	Figure C 6	
6	Land Acquisition Gazette	Land Acquisition, DC Office	24/09/2017	N/A	Align	Figure C 7	
7	Concern Letter for Site Embankment	Prime Minister Office and BWDB	15/12/2016	N/A	Align	Figure C 8	
8	Permission Letter for Land Filling	DC Office	29/04/2019	N/A	Align	Figure C 9	
9	NOC from Local Governmental Office	BIWTA	-	N/A	Not Align	Figure C 10	SEZL has applied to BIWTA for the NOC on 25th August, 2019.
		PGCL	-	N/A	Not Align	Figure C 11	SEZL has applied to PGCL on 25/08/2019 for the NOC of gas supply.

Sl.No.	Item	Issuing Authority	Issue Date	Validity	Status	Attachment	Remarks
		BWDB	-	N/A	Not Align	Figure C 12	SEZL has applied to BWDB on 25/08/2019 for the NOC.
		DAE	-	N/A	Not Align	Figure C 13	SEZL has applied to DAE on 25/08/2019 for the NOC.
		Fisheries Officer	-	N/A	Not Align	Figure C 15	SEZL has applied to Fisheries Officer on 22/08/2019 for the NOC.
		BREB	-	N/A	Not Align	Figure C 14	SEZL has applied to BREB on 22/08/2019 for the NOC.
10	Concern letter for Transmission Line	NESCO	-	N/A	Not align	Figure C 16	Based on the application of SEZL on 31/08/2019 regarding electricity connection, NESCO replied back that they are able to connect, but they need ministry permission as the proposed area is under BREB
11	Concern Letter for ICD Container Port	BR and BEZA	-	N/A	Not align	Figure C 17	SEZL has requested to BEZA to take initiative to set up ICD at Bongabondhu Setu West Railway Station on 17th February, 2019. Based on the letter, BEZA forwarded a letter to BR for taking initiative on 24th February, 2019.

Sl.No.	Item	Issuing Authority	Issue Date	Validity	Status	Attachment	Remarks
12	Permission for Installation of STP/ CETP from Department of DoE		-	-	Not align		As per EIA approval copy (Sl. No. 19), STP and CETP will be installed and as per EIA document (Page 16), before installation, the design will be finalized in consultation with DoE.
13	Water abstraction	Water Resources Planning Organization (WARPO)			Not align	Figure C 19	SEZL has applied to Union Parishad for the abstraction of water as the bore well point is located under Soydabad Union Parishad. However, SEZL also need to comply Bangladesh Water Rules 2018 and consequently get NOC from WARPO)(They also need to apply to WARPO. for water abstraction as .
14	Road Connectivity	BEZA and RHD			Not Align	Figure C 18	BEZA has written a letter to RHD for revise the design for connecting all the EPZs from the main road on 26th July, 2017.
15	Telecommunication Line	BTRC			Not align	-	Yet to apply for the telecommunication line.

CHAPTER 3

3 DESCRIPTION OF THE PROJECT

3.1 Introduction

The proposed project involves development of economic zone and associated off-site facilities for the upcoming Sirajganj Economic Zone. At present both economic zone and off-site facilities will be constructed. The economic zone and off-site development will include the following:

The basic infrastructure:

1. Internal Roads;
2. Storm water drainage system;
3. Water supply from deep wells or surface water through water supply pipeline;
4. Sewage-water treatment plant.

Other facilities and Buildings:

2. Gate/Security Guards booth;
3. Administration building;
4. Access Road: Garden/walkway/parking;
5. Commercial Development.

The total area of the upcoming SEZ is about 415 acres. EZ can have following components as per EZ Act, 2010:

- **Industrial plot:** Specified for industrial establishment;
- **Green Area:** Specified for green belt area;
- **Utility:** Specified for STP, CETP, Power Station, Fire Service etc.;
- **Admin and Commercial Area:** Specified for offices, markets etc.;
- **Rehabilitation:** Specified for resettlement purposes;
- **Internal Road:** Specified for internal road communication.

The developer will carry out EZ development at later stage. As per the planning, industries like Agriculture/food processing industry, Plastic and Rubber Products, RMG/ apparels, Wooden Products, Knitting and Textile, Jute and Jute Goods Materials, Pharmaceutical and Healthcare Goods, Footwear and Leather Goods, Electrical and Electronics, Garments Accessories and Light Engineering industry will come up within EZ. Detailed project report will be prepared by the developer at later stage prior developing the EZ detailing the type of industries which will come, utility requirement for the industries and assessment of the environmental impacts of those industries. Also at this stage, fixed land or block for each type

of industries is not fixed as the industries are proposed. It will be finalized before the construction stage and also based on the interest of the industries. Currently 4 plots (A, B, C and D) have been proposed for the industrial area consisiting of 289 acres out of 415 acres of land.

3.2 Rationale of the Project

Initially BEZA has identified and acquired the land and handover to SEZL authority for further development. The area has been identified considering factors such as land use, land ownership, accessibility & connectivity, linkage to economically important towns/cities, infrastructure availability and engineering, environmental and social feasibility of the site. The proposed project site (415 acres) identified for the upcoming Sirajganj EZ (Phase 1) is a continuous section of land but is dissected by the branch of Jamuna River into two parts. Both the portions will be connected through a bridge. The land is Governmental khas land and registered land use of the land is Char land (Wetland). The proposed land site does not lie within any city Corporation, Municipality and Cantonment Board Area as per requirement of sub-section 3 of section 5 of Economic Zone Act, 2010. There will be both limitations and benefits are associated with the land for developing EZ at the proposed site location as per the feasibility and EIA report. However, identified weakness and threats can be overcome by adopting alternative technologies and preventive measures. Identified strength and weakness of the site as carried out by SEZL are given in the following table.

Table 3-1: **Strength and Weakness of Site of Sirajganj Economic Zone (as per feasibility and EIA report)**

Parameters	Strength	Weakness
Location and Surroundings	• Located in a char land, proximity to Elenga-Nalka-Hatikumrul Highway (N405) and Bangabandhu Setu West railway Station. • Area is closed to the Jamuna River and so well developed for inland water transport. • As per the sub-section 3 of section 5 under EZ Act 2010, the area is not under City Corporation, Municipality and Cantonment Board Area. • Agro based and Handloom industry can flourish well in this area as most of the people are engaged agriculture and handloom activities.	• The area is a flood prone area due to presence of Jamuna River. • Site wall or dike is required to protect the site from outer intervene. • Embankment is required to protect the site from erosion.
Accessibility	• The site of phase 1 is well connected with 2.8 km approach road (under construction) of SEZL. • Elenga-Nalka-Hatikumrul (N-405) Highway is just 2.8 km from Phase 1 of SEZL which is linked by the approach road. • Bangabandhu Railway West Station is just 1 km away from project approach road. • Navigation is possible throughout the Jamuna River. • Nearest land port (Hili Land Port, Dinapur) is about 160km away from the project site	• About 110km away from the nearest Hazrat Shahjalal International Airport. • About 328 km from the nearest Mongla Sea Port.
Proximity to urban & industrial areas	• Sirajganj district is about 13km from the proposed economic zone. • Many handloom small industries are exists within the regions.	• No Cargo handling facilities by rail transport • Air shipment of Cargo facility is also absent
Available infrastructure facility	• Site can be filled up by the dredged sand from Jamuna River. • The highway of the northern gateway is very near to the site.	• Fire Service Station is about 14km away from the project site.

Parameters	Strength	Weakness
	• Gas supply is available through pipeline of Titas gas field. • Development of new infrastructure facility will introduce new town area. • Fiber optic telecommunication system is available at site.	• Police station is also about 14 km away from the project site. • Absence of urban living and recreational facilities in nearby areas.
Availability of Raw Material	• Large nos. of unskilled and semiskilled labour available	• Shortage of skilled labour.
Eco-sensitivity and threat to bio-diversity	• Many trees will be planted by the Proponents/tenants in consultation with Department of Forests. • Existing natural river channel within the zone will be preserved. • No significant flora at site	• Jamuna Eco-Park close to the site. • At pre-construction phase all the floras will be cut down. • The aquatic ecosystem may become vulnerable by the wastewater if not properly treated. • Extraction of sand from Jamuna River may causes interruption of aquatic ecology. • Endangered species may become more vulnerable during construction and operation stage.
Quality of life & Employment generation	• Creation of large nos. of direct and indirect jobs for skilled, semi-skilled and un-skilled labour • Enhanced infrastructure facilities • Developments in nearby area after development of EZ	• Unavailability of adequate skilled labour • Seasonal aqua culture and agriculture practice at site • Acquisition of land and displacement of families

3.2.1 Outline of Project Objectives

The Sirajganj Economic Zone is aimed to develop as a green economic zone following the international standards, with the support of local and international lenders. Previous approved EIA report has been studied covering all the perspective of environmental and social issues. The ESIA study has also been undertaken with the intent of integrating best environmental management practices as per the project design.

The physical, economic, and social development of SEZL are based upon the following planning and development objectives.

- To make the economic zone as environmentally friendly
- To provide adequate light, air, and open space for all investors;
- To ensure proper safety from fire, flood, panic, and other natural and man-made disasters;
- Preservation, conservation and development of areas of natural scenery and landscape;
- To ensure that development within EZ does not conflict with any development regulation;
- To encourage energy efficient site designs;
- Maintenance of highest standards of environmental planning;
- Protection of natural resources and environmental assets through land use and development regulations.

For satisfying these destinations, a progression of key core values has been studied for SEZL.

3.2.2 Key Features of the Sirajganj Economic Zone License

BEZA has issued a License in favor of Sirajganj Economic Zone. Some of the key features of the Licesne are as follows:

- The license is issued for the establishment, development, operation, maintenance and promotion of SEZ on 1035.93 acres of land located in different mouzas under Sirajganj Sadar and Belkuchi Upazila of Sirajganj District.
- The License will be valid up to 15 years from its issuance and also under some applicable conditions.
- The License may be renewed for next 10 years after the expiry of 15 years if the Authority (BEZA) finds satisfactory performance of the SEZ and also finds reasons to consider that the license require to be renewed. From this period, the license will be renewed in every 10 years upon payment of renewal fees as prescribed by the Authority.
- The License should not sell or transfer any part or whole of this License by the SEZ authority.
- The economic zone will be established as per the approved Master Plan within the specific time as scheduled. All approved activities will be completed phase wise as set out in the timetable for execution of such activities.
- The License ensures that any kind of activity of SEZ will not be contrary to the policies relating to public morality, order, public safety or public health. Any kind of activity of SEZ also will not violate environmental laws or policies and also any intellectual property rights, will not endanger health or life of human, animal or plant. The activities should not be prohibited, restricted or excluded under any other applicable laws. The Contractor and the sub-contractor are also not exceptional to these conditions.
- The License may be cancelled or suspended in part or as a whole if the License violates any provisions of the Act, the Policy and other applicable law, rules, regulations, legal

instruments and any terms and conditions of the License and the agreement between the authority and the Licensee.

- The License shall be liable to be cancelled, if the Licensee –
    - Sells, transfer to any third party or shifts to another place the whole or any part of the License;
    - Fails to adhere to the Phase-wise timetable and specific time schedule in performing the activities of development, operation, promotion and maintenance of the Sirajganj Economic Zone and receives notice in writing twice from the authority for such non-performance of obligations;
    - Is declared bankrupt;
    - Fails to pay any fees, taxes or any other dues owed to the authority or any other competent authority or agency;
    - Obtains License upon furnishing falls information, declaration or statement in the application; and
    - Is engaged in any prohibited, unlawful or illicit activity specified in Schedule-1 of the Policy.
- In the event of cancellation of this License the agreement between the Authority and the Licensee shall be treated to have been automatically terminated.

3.3 Project Description

The project is located at Sirajganj district which is a gateway of the northern part of Bangladesh.

Detail description of the project is presented from section 3.3.1 to 3.3.4.

3.3.1 Description of the Site

The Sirajganj Economic Zone is the largest private economic zone in terms of land. The project will be developed for the industrialization of the Northern gateway area to get more industrial output and to increase the export of industrial product. The area is already known to people for the displacement of people as Bongobondhu Bridge over Jamuna River is situated very near (approximately 1km from the approach road) to the project area. Also the 4 unit of combined cycle power plant is also situated beside the project site. Details of site description is presented in **Table 3-2**.

Table 3-2: Site Description of the Project Area

Particulars	Details
Location	Site is located at Union: Saidabad, Upazila: Sirajganj Sadar, District: Sirajganj and Union: Rajapur, Upazila: Belkuchi, District: Sirajganj.
Mouza	Saidabad, Baro Shimul Panchashona, Khash Baro Shimul, Birhati and Chackboyra Mauzas of Saidabad Union and Boyra Masum, Bera and Berakharua mauzas of Rajapur Union.
Nearby Villages	West – Ramdhuni Bari, Bag Bomra North - Baro Shimul Ponchoshona

Particulars	Details
	South - Choto Berakharua East - Jamuna Bali, Phulbari, Birhati
Project Area	415 acres
Approach Road	2.8 km from the National Highway to the project site
Road Access	Adjacent to Elenga-Nalka-Hatikamrul Road (Currently under construction for a 4 lane road from existing 2 lane)
Possible Employment	50000 in total project (as per EIA) 20000 people for phase 1 (In ratio of total project)
District Headquarters	Approximately 13km from the district headquarters

Source: Google Earth, EIA report & Site Visits

Besides these, detail environmental features were enlisted in Annex B. There are lots of mosques in or around the project area. Besides mosques, few schools and madrasas are also located near the project site. No heritage sites exist near the project boundary. The important environmental features are given in following **Table 3-4**.

Table 3-3: Important Environmental Features (IEFs) around the Project Site with photographs



Ponchoshona Jame Mosque



Al Arafa Jame Mosque



Gachabari jame Mosque



Calkmakimpur Jame Mosque

	
Khasboroshimul Mosque	Khas BoroShimul Madrashah
	
Fulbari Uttarpara Jame Mosque	Fulbari Moddhopara Jame Mosque
	
Fulbari Madrasah	Fulbari Dokkinpara Mosque
	
Boro Shimul Madrashah	Bangabandhu Ecopark



Jamunabali Gov. Primary School



Manob Mukti Academy



Boroshimul Ponchosona Gov. Primar y School

3.3.2 Planning for Economic Zone Development

The off-site facilities as planned by the SEZL authority to be carried out for SEZ are given below:

- Construction of Administration building;
- Site Preparation which includes;
    - Land filling of 415 acres for the first phase SEZL;
    - Construction of walls for 415 acres all around the boundary;
    - Access road;
    - Plan for power generation, transmission, and distribution;
    - Telecommunication plan;
    - Gas supply plan;
    - Plan for roads in the surrounding area;
    - Drainage channels
    - Water supply pipeline

A Developer has been appointed already as per the guidelines mentioned in EZ Act, 2010. Preliminary planning has been made for the economic zone based on market and feasibility study. The planning has been taken into consideration with the broad objective of establishing a world class business environment by targeting essentially high growth manufacturing and processing of industrial and related infrastructure sector. It has been considered during

planning that each zone will be a self-sufficient unit in terms of facilities and able to attract investors and revenue generation. The project is planned to be housed in a lush green environment and accordingly, landscaping and greenery has been planned.

During the stage of zoning, the whole area was divided into various zones. The major factors considered during zoning are wind direction, connectivity, and demand forecast. The zoning design has been prepared in consideration of smooth movement of the pedestrian and strategic location catering to the visitor's vehicles. As per the feasibility report, the following site parameters have been considered while specifying the zones.

- Boundary shape
- Physical site features
- Area availability
- Environmental consideration
- Micro-climatic considerations
- Compatibility issues
- Surrounding areas
- Accessibility
- Transportation issues
- Visibility

Based on this zoning, detail master plan has been prepared covering following components:

- Micro level zoning
- Land use plan
    - Detailing the locations and sizes of various land uses
- Showing the sub-division of industrial land
- Phasing
- Utilities mapping
- Greenery and open space plan
- Road category

The probable industries for the SEZ as per analysis of the feasibility study are as follows.

- Textile
- Chemicals,
- Footwear,
- Healthcare,
- RMG,
- Knit, dying, composite, woven, yarn,
- Garments accessories,
- Plastics,
- Hospitality industry,
- Agro-business,
- Building/infrastructure construction items,
- Electronics

Other developments like admin and custom blocks, roads, residents, utilities, and green and open space are also marked in the master plan. A layout map for EZ as per preliminary planning is given in Annex A.

The land use pattern of the phase 1 of EZ is determined considering the land requirement for various Industries, R&R facilities and utilities etc. Based on the above land use pattern, 88.43% of land area accounts for processing area. Out of 88.43% total processing area, 69.64% is accounts for processing area and 18.79% is accounts for utilities, road and Green space. Table below provides the land use pattern for the proposed SEZ-Phase 1.

Table 3-4: Land use pattern for the proposed SEZ

Land use pattern	Total area		Saleable area		Non-saleable area	
	Acres	Percentage (%)	Acres	Percentage (%)	Acres	Percentage (%)
Processing Area						
Industrial Area	289	69.6	289	69.6		
Utility	9	2.2			9	2.2
30m wide road	23.8	5.7			23.8	5.7
25m wide road	27	6.5			27	6.5
Green and open space	18.2	4.4			18.2	4.4
Total processing area	367	88.4	289	69.6	78	18.8
Non-Processing Area						
Admin and customs block	13.9	3.3			13.9	3.3
R&R zone	34.2	8.2			34.2	8.2
Total Non-processing area	48	11.6			48	11.6
Total Area	415	100	289	69.6%	126	30.4

[Source: Feasibility Study Report]

As per the above table and graph, we can see that the total project area is 415 acres of land. The area has been divided into two areas:

I. Processing Area: This area includes 88.4% of land of total 415 acres. Out of this 88.4% of land, 69.6% of land is saleable and 18.8% of land are non-saleable. Saleable lands are for the industrialization purpose, non-saleable lands are for utilities, 25m and 30m wide road and for green and open space.

II. Non-processing Area: Rest of the areas are for non-processing area which are totally non-saleable. These are for specially the admin and custom block and for the R&R zone.

3.3.3 Project Activity

Project activities mainly included the development works in Pre-construction, Construction and Operation stage.

I. At **pre-construction** phase mainly temporary works, mobilization and demobilization will be taken place which is already under process. Land development is the big task in this part. Current ground elevation of the area is about 10m PWD. So, around 4.5m average will be raised from the existing ground level. Around 180,774,000 cft. Sand will be needed for raising the land from the gfround level.

II. Construction stage involved major activities including the development of road and building of infrastructure for different purposes. Infrastructure development also divided in three portions which include:

- **Infrastructure for industries:** This include specialized infrastructure in the production zones, industrial and manufacturing zones with social infrastructure development and development of logistics.
- **Environmental infrastructure:** This includes infrastructure for municipal solid waste collection and their transportation and treatment facilities, development of industrial waste management system for collection and transportation of hazardous and non-hazardous wastes, infrastructure for source development, treatment and recycling, and development of wastewater treatment and recycling and finally infrustrature for central environmental laboratory setup.
- **Physical and social infrastructure:** The physical and social infrastructure will be developed for the residential, commercial and social for a holistic industrial investment and business environment.

Beside these activities, the following activities also will be taken place also during the construction phase in the project area. These are:

- Mobilization of personnel, material and equipment (including establishment of project office and labour shed etc.);
- Ground preparation according to the topographical survey;
- Construction of the Utility section and also internal stormwater drainage and sewarage line;
- Construction of water distribution network;
- Construction of internal road network;
- Installation of the electro-mechanical equipment including fire-fighting system;
- Security system, traffic and pedestrian management system;

- Construction of gas pipeline and transmission line from the source up to receiving point;
- All kind of interior design and furniture set up for the office areas;
- Landscapping/tree plantation etc.

III. Operation stage will include overall project activities which have been listed in details below sourced from SEZ feasibility study and from SEZL authority during conversation.
    - Regular operation and maintenance of the proposed industries;
    - Operation and maintenance of the Sewage Treatment Plant;
    - Operation and maintenance of the Central Effluent Treatment Plant;
    - Operation and maintenance of the Water Treatment Plant;
    - Maintenance of the Internal road network;
    - Maintenance of the electro-mechanical equipment including fire system;
    - Maintenance of internal sewerage line and storm water drainage line;
    - Environmental monitoring and auditing at regular interval;
    - Social auditing at regular interval;
    - Security operation etc.

3.3.4 Development Plan of the Project

3.3.4.1 Accessibility to the Site:

Sirajganj Economic Zone is located at the bank of Jamuna River. The proposed project area is bordered with the Combined Cycle Power Plant of Sirajganj at north-east side. Detailed accessibility to site with the approximate length and width of different types of roads and waterways are given below:

Connectivity through Road:

- The project will be connected to the Elenga-Nalka-Hatikumrul Highway (N405);
- The Dhaka division is located at south-east of the project site, connected by Bongobondhu Multipurpose Bridge which has passed over Jamuna River;
- Dhaka division is approximately 115 km away from the project site;
- Rajshahi division is approximately 133 km away from the project site;
- Rangpur division is about 188 km away from the SEZL site;
- Nearest district by road is Tangail which is approximately 33 km away from the site;
- The nearest land port is Hili land port (approximately 161 km far from the project site);
- The nearest international airport is Hazrat Shahjalal International Airport, Dhaka. The airport is about 110km far from the site through road;
- Chittagong Sea Port is about 366 km away through road, Payra Sea Port is about 359km away from SEZ and Mongla Sea Port is about 328 km away from SEZ. So, the nearest Sea Port is Mongla Sea Port.

Connectivity through Air:

- The divisional airport of Sirajganj is approximately 137 km away from SEZL which is in Rajshahi district.
- The Hazrat Shahjalal International Airport (HSIA), Dhaka is the nearest airport. So, after landing at HSIA, roadway is the only way to reach at site.

Connectivity through Railway:

- The nearest station of the project site is the Bangabandhu West Railway Station which is about 1.8km far away.
- Another busy railway station is Sh. M Monsoor Ali Railway Station which is about 6.8 km away from the project site.

Connectivity through River:

- The Jamuna River is situated is just beside of the SEZ. So, transportation of goods through river will create a good opportunity for the businessmen or the investors
- The Dhaka River Port is about 250km away through river way from the project site.
- The Chandpur River port is approximately 165 km away through river way.
- Through waterway, the SEZL project site is about 350km away from Chattogram port, 337km from Payra port and 400 km from Mongla port.

3.3.4.2 Site Development

- The average natural ground level for the proposed economic zone is >10.5m level.
- The land filling is considered of 4.5m above the existing natural ground level.
- The sand will be dredged from the nearest Jamuna River sand bar which is locally named us Balumohol. The area has been approved by the local governmental authority of Sirajganj. The proposed area has been marked in the following **Figure 4-1**.

From the Table 3-6, we can see that the proposed project is about 2.5 km away from the sand source. The sand bar is about 1545 acres which is 2.265 km in length.

3.3.4.3 Boundary Wall:

- The total length of the boundary wall is estimated to be 5,000 m.
- A boundary wall all along the EZ boundary to a height of 4.5 m above normal ground level has been proposed to be constructed
- 0.9 m height barbed wire fencing on top of the wall alo will be constructed.

The details of boundary wall are depicted in Figure A11 and Figure A12 of Annex A.

3.3.4.4 Roads

Two types of road will be constructed at SEZ to provide access to the industries within Economic zone apart from catering to R&R zones which shall be looped with inter connecting roads. These are:

I. Arterial,
II. Primary & secondary roads

The detail area for the road plan has been summarized in the following table:

Table 3-5: Summary of road plan

Category	Road with (m)	Carriage way width (m)	Number of lanes	Total Length (m)
Arterial road	30	7.5+7.5	4 lanes two way	3210
Primary road	25	7.5+7.5	2 lanes two way	4554
Total				7764

The composition of pavement structure is provided in the following table:

Table 3-6: Composition of pavement structure

Layer	Composition details
Wearing course	Semi dense bituminous concrete of 25 mm thick laid with mechanical spreaders
Binding coat	A tack coat of 0.25 kg / sq. m. of 60/70 grade bitumen
Binding course	Dense Bituminous Macadam (DBM) 50 mm thick, laid with mechanical spreaders
Binding coat	A prime and tack coat of 1.2 kg / sq. m of 60/70 grade bitumen
Base Course	Wet mix macadam (WMM) 250 mm thick
Sub-base	150 mm thick granular sub-base to a soaked CBR of min. 30%
Sub-grade	Min. soaked CBR value of 9%

Beside this, there will be an approach road to connect with the main premises of SEZ with the national highway. This road is about 2.8 km from the main SEZ. Hence, approach road can be constructed from (N 405) to eastern side of the proposed EZ. The layout plan of the proposed SEZ has been identified in **Annex A1**, where the road network has been marked by red color. The access road is not under the scope of phase 1. The construction work is already under process for the access road. We have come to know from DC office LA section that the total land of the access road has been handovered to the SEZL.

3.3.4.5 Sewerage Network

The entire sewerage network is planned along the proposed 30 m and 25 m wide roads of Economic zone. Proposed total length with the pipe sizes have given below:

Table 3-7: Required Pipe Size

Pipe size in mm	Total Length in m
150	2,717
200	1,553
300	1,165
400	1,165
500	776
600	388
Total	7,764

Layout design of the sewarage network has been given in **Figure A 3** of Annex A. It has been observed that all the line from each section will mix together and then will go to Sewarage Treatment Plant for treatment. As the proposed project will implement zero discharge policy so there will be no discharge of the treated water outside the project area. So, from the STP, the treated water will go to the CETP and then from CETP, the water will discharge to the adjacent Jamuna River. Detail of seweage treatment plant (STP) and Central Effluent Treatment Plant (CETP) is given in the Annex part (section M.2.7 and M.2.8.

3.3.4.6 Sewage Treatment Plant (STP)

Sewage is made up of wastewater from homes and businesses, as well as possibly pre-treated industrial wastewater. Sewage treatment is the process of removing contaminants from wastewater, comprising of storm run-off, domestic sewage and primary treated effluent. It removes contaminants from sewage to produce effluent suitable for discharge to the surrounding environment or reuse, thereby preventing water pollution from raw sewage discharges. As there will be CETP for this project, so the conventional septic tank will be used for each industrial premises. But the layer will be 3 layered for make the treatment more effective.

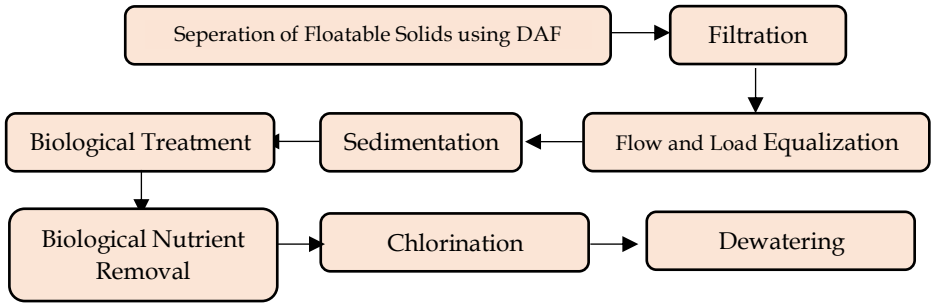
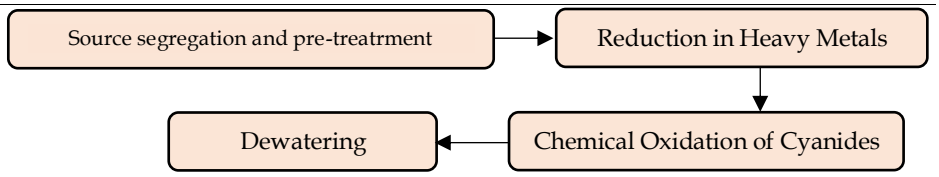
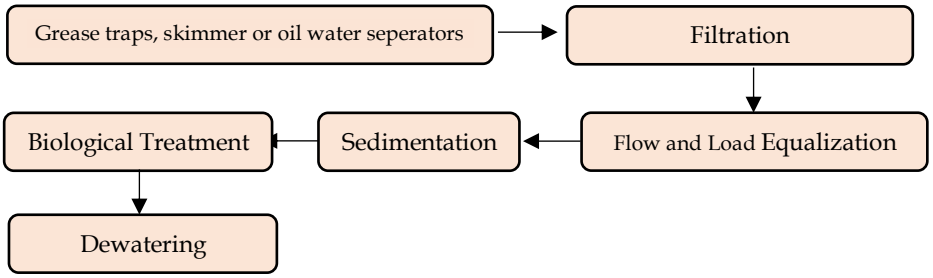
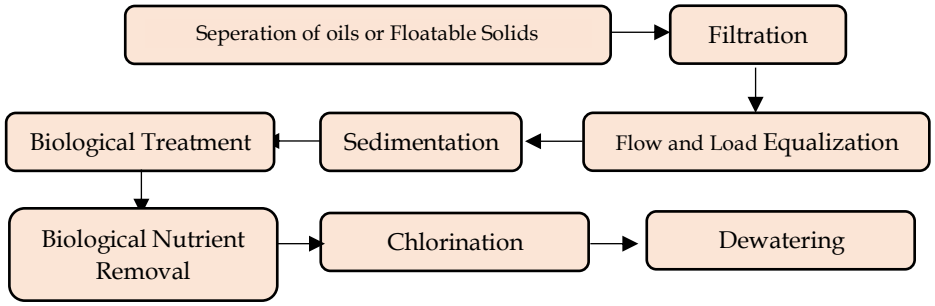
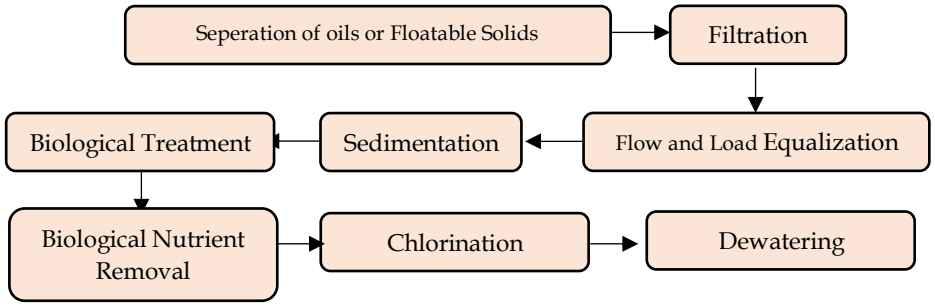
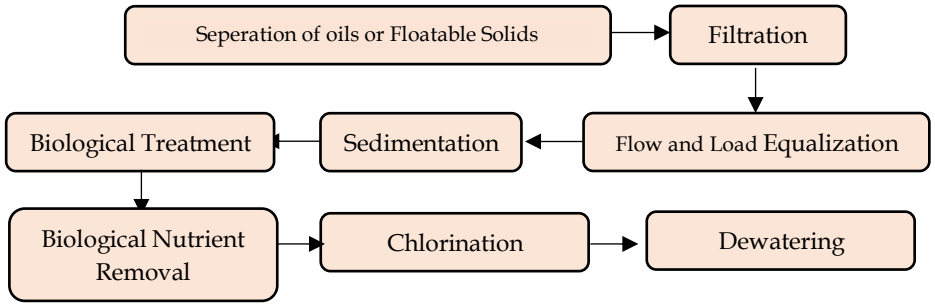
3.3.4.7 Effluent Treatment Plant

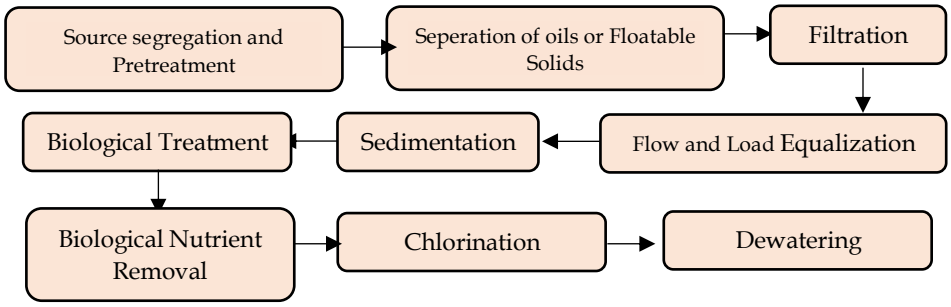
The entrepreneur will install an effluent treatment plant on their premises (if necessary) as part of their wastewater pretreatment facility. The treated water will flow from the pre-treatment facility to the Central Effluent Treatment Plant before being discharged into the adjacent branch of the Jamuna River.

Typical wastewater treatment steps for different industries are listed in **Table 3-8**.

Table 3-8: Industry based treatment process (Source: IFC guidelines)

Sl. No	Types Of Industries	Steps For Treatment

1.	Textile Manufacturing	
2.	Electronics manufacturing	
3.	Manufacturing of Wood Products	
4.	Pharmaceuticals	
5.	Metal and Plastic Products	
6.	Food and Bevarage	

7.	FootwearFinishing	

Detail treatment process of sewerage water as per WBG guideline is given in Annex A

3.3.4.8 Central Effluent Treatment Plant (CETP)

SEZL authority will install a CETP in the project area to treat all kind of pre treated wastewater from all the industry. As per the EIA report, detail design, specification, and layout will be finalized in consultation with DoE before installation. Current information from the SEZL authority is that they will follow the process of SBR methodology for the CETP. Total capacity of CETP will be 6 MLD. Studying secondary source, common process flow of the CETP following SBR technology has been considered. Detail layout of the CETP is still not available. But, SEZ authority has choosen a suitable place for construction of the CETP which is in Utility section of the proposed economic zone.

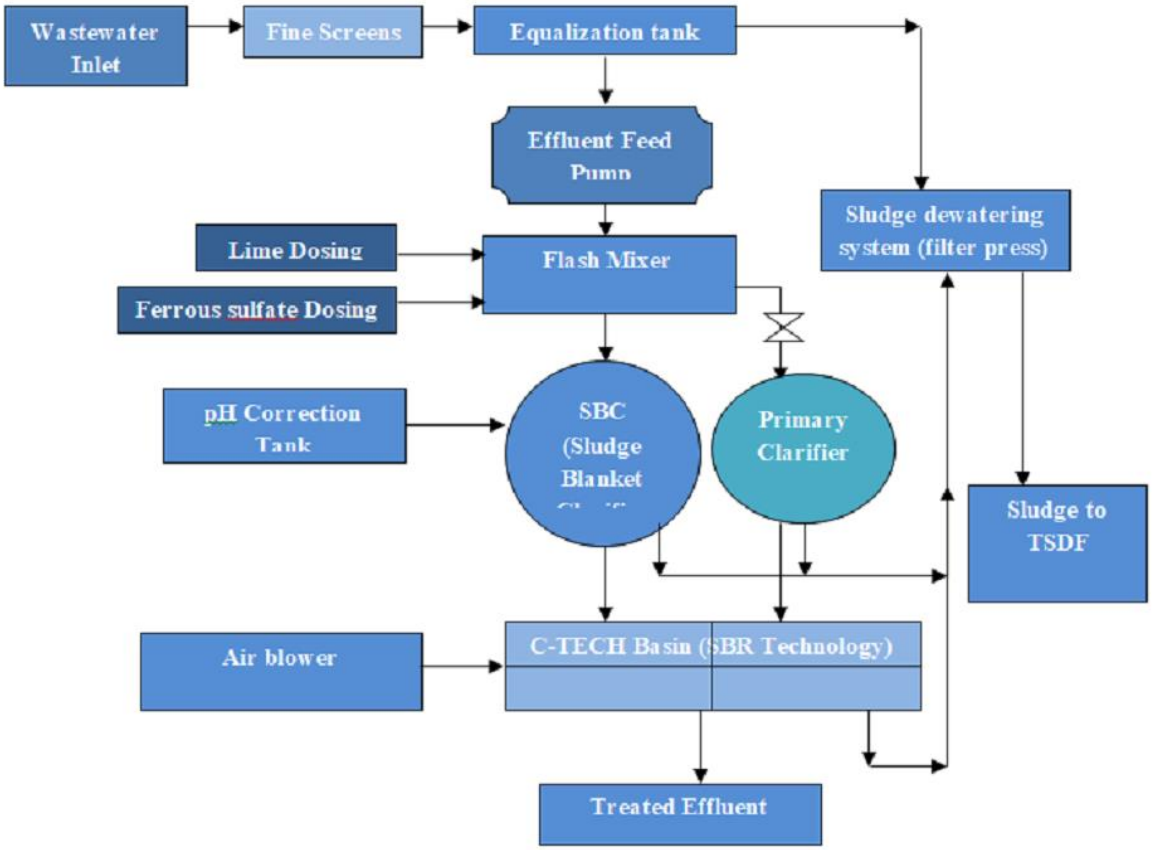


Figure 3-1: Process flow of CETP

3.3.4.9 Storm Water Drainage Outflow

Stormwater drainage requires rainwater that comes off the roofs of buildings and paved or unpaved areas to be managed, and directed as necessary to storm water drains, or other appropriate outlets or storage areas. Design of a stormwater drainage system has been considered for any project like a way which prevents flooding, and also prevents contaminants from entering stormwater catchment systems.

For SEZ, gravity fed system has been choosen for the storm water drainage. Detail layout of the storm water drainage has given in **Figure A4** of **Annex A**. From the storm water drainage outlate, it will be drained out to the existing branch of Jamuna River flowing through the project area.

Stormwater storage

Currently there is no storage plan of the rainwater. As per the proposed layout, they will discharge the stormwater to the branch of Jamuna River. But for such discharge, the stormwater drainage will be totally separated from any kind of wastewater. Also suspended solid will be controlled before discharging to the branch of Jamuna. Detail mitigation measures has been identified in section 9.2.1 and 9.5. The dimension of the stormwater drainage line is 1.5m X1.4m approximately as per information of the SEZL authority.

3.3.4.10 Solid Waste Management

Solid waste management includes the both municipal and electrical waste which will come from the construction activities and operation activities of the SEZ. As per the guideline of the WBG, the main souces of the soild wastes are residential, indystrial, commercial, institutional, construction and demolition and municipal services. From these sources, the typical waste generators are:

- the single and multifamily dwellings,
- light and heavy manufacturing, fabrication, construction sites etc.,
- office buildings, schools, hospitals etc.,
- street cleaning, landscaping, parks, beaches, other recreational areas,
- sewarage treatment plant, central effluent treatment plant and water treatment plant etc.

For managing such solid wastes, EHS guidelines of Waste Management Facilities will be followed wherever applicable. Details classification of solid wates with their common management as per WBG guidelines is given in Annex M.2.

3.3.4.11 Power

As per the design, the plan for power supply has given in following table:

Table 3-9: Plan for Power Supply as per Design

Electrical System EHV/HV supply	
Nominal voltage	132/33 kV ± 5%
Frequency	50 Hz ± 2.5%
No. of phases	3 phases, 3 W
Fault level	26 kA
Distribution Suppy	
Nominal voltage	11 kV/ 415 V/ 230 V ± 6%
Frequency	50 Hz ± 3%
No. of phases	3 phases, ¾ W

The demand of power for proposed SEZ has been given in following table:

Table 3-10: Demand of Power for SEZ

Description	Power Requirement
Processing Area	
Industries	450 KVA/ ha
Utility	250 KVA/ha
Road	35 KVA /ha
Green and open space	4 KVA / ha
Non-processing area	
Admin and custom block	250 KVA /ha
R & R Zone	250 KVA /ha

So, as per the feasibility study, the total power demand for the proposed SEZ has been estimated to be approximately 44.48 MVA. For fulfilling the demand of this power, a main receiving substation of 132/33/11 kV substation must be established in the site (layout given in Figure A7 and Figure A8**Error! Reference source not found.**). A new 132 kV dedicated power transmission line has been proposed from the nearby sub-station to EZ site for fulfilling the needs of industries occupying the economic zone along with 132/33/11 KV substation within EZ. As per the information of the SEZ, the transmission line will be installed by the NESCO (application letter to NESCO by SEZL has attached in Annex C). Since the proposed line from the nearby power plant enters the site in the Northern side, it is planned to establish the proposed main receiving substation of 132 /33/11 kV sub-station at entry of feeder line. From the sub-station the transmission line network is planned along the proposed road

network to feed the individual plots. But as per the project proponent's verbal status, the sub-station will be located at the utility zone. The following layout plan has been sourced from the SEZL authority. If required detailed study for this will be carried out as per the local and international guideline.

3.3.4.12 Transmission Line

A 33Kv transmission line has been proposed in the feasibility report. But from the existing situation and as per the information from the discussin with the project authority (SEZL), it is confirmed that the detail design and location of the power station and also layout of the transmission line has been primarily assessed. The proposed layout plan has been given in Figure A5, Figure A7, Figure A8, and Figure A9 of Annex A. SEZL has given a letter to NESCO for the installation of transmission line (NESCO related letter has given in Annex C). But NESCO has not given yet any final confirmation. It could be finalized during prior starting of the electrical line in the SEZL.

3.3.4.13 Street Lighting

Street lighting has been conceived in 2 different forms.

- Street lights for the road network;
- Solar street lighting.

All the road and streets will be provided with street lighting not only to assist pedestrians and traffic, but also to increase safety and security in the area. It has been recommended that all lighting should be by high-pressure sodium lanterns mounted on power poles or on street light columns. For major roads the average illumination should be about 20 lux.

3.3.4.14 Water Supply

The total potable water demand for the proposed economic zone (phase 1) is 7 MLD. It has been decided to build three to four new bore wells within the proposed site to draw the ground water to meet the initial demand of EZ. It is recommended in the feasibility report that while operationalizing the proposed EZ, the possibility of both ground water and surface water is evaluated. During the initial stage of operation, it has been considered that the proposed EZ would be dependent on ground water supply, however for the long-term sustenance, provision of sourcing water from surface water has been assimilated in the infrastructure assessment. Preliminary assessment suggests that extracting water from Jamuna River located 2 km towards eastern boundary of the proposed EZ may be considered by providing suitable intake system and water treatment plant. Exact location of the water intake will be finalized during the implementation stage. It has been proposed to lay 210 dia. DI pipes for the length of 2 km for the incoming external water supply network from Jamuna River for the EZ. The exact location of pumping station & booster stations will be finalized during the implementation stage.

3.3.4.15 Gas Supply Pipeline

There is an existing gas pumping station by Poschimanchol Gas Company Limited (PGCL) located at approx. 1 km from the site. Further pipelines could be laid to supply gas to the

industrial tenants from this pumping station. As per the feasibility report, Pipes with 20"and 30" diameters transmitting gas at 200–1,500psi are available at the area. It is estimated that the demand of gas for the SEZ is 50 MMCFT. Proposed layout of the gas pipeline has been given in Figure A15 of Annex A. The Petro bangla will develop a plan to supply gas in SEZL. It is proposed to further detail study by the respective concern before construction of gas supply pipeline to the SEZ.

3.3.4.16 Telecommunication System

Optical fiber cables are available near the site and the bandwidth available is around 2 mbps. At present, the internet and telecom services are provided by private telecom subscribers such as Grameen Phone, Airtel, Banglalink, Teletalk and Robi in this region. Service by private operators has significantly improved the telecom connectivity in the region. Proposed layout plan of the telecommunication system has given in Figure A6 of Annex A:

3.3.4.17 Project Schedule:

The project schedule has been depicted in the following table. The source has been referred to the feasibility study report.

Table 3-11: Proposed Project Schedule as Per Feasibility Study Report

Task Name	%	Upto June 2021	Sep-21	Dec-21	Mar-22	Jun-21	Sep-22	Dec-22
Land Cost	100%	100%						
Site grading	100%	79%	6%	15%				
Compound wall, fencing and gates	100%	15%	20%	30%	15%	10%	10%	
Road carriageway & median	100%	5%	20%	25%	15%	15%	10%	10%
Foot path and plot entry culvert	100%	5%	20%	25%	15%	15%	10%	10%
Drains and culvert	100%	5%	20%	25%	15%	15%	10%	10%
Bridge	100%	10%	20%	25%	20%	15%	10%	
Water supply network	100%		10%	30%	35%	10%	10%	5%
Sump, Overhead Tank, Pumps	100%		10%	30%	35%	10%	10%	5%
Water Treatment plant	100%			30%	35%	15%	10%	10%

Task Name	%	Upto June 2021	Sep-21	Dec-21	Mar-22	Jun-21	Sep-22	Dec-22
External water supply network	100%		10%	30%	35%	10%	10%	5%
Electrical, street lighting & fire fighting	100%		10%	25%	40%	5%	10%	10%
Telecom & communication systems	100%		5%	15%	25%	25%	15%	15%
Sustainable infrastructure elements, RW harvesting, summer storage tank & greenery	100%		10%	20%	15%	20%	20%	15%
Decentralized wastewater, network and solid waste management	100%	10%	20%	25%	20%	10%	5%	10%
Buildings	100%			25%	20%	25%	15%	15%
Gas Infrastructure	100%		10%	15%	20%	20%	25%	10%
Standard Factory Building (SFB)	100%				20%	25%	25%	30%

3.3.4.18 Poject Cost

Proposed project cost for the establishment of the SEZ is given in the **Table 3-13**.

Table 3-12: Proposed Project Cost of SEZ

Amount in Crore Taka

SL	Particulars	Unit	Quantity (NOs)	Rate (TK.)	Cost (TK.)
1.	Cost of Land	Acre	415	0.316	131.14
2.	**Land Development and Other Costs:**				
2.1	Earth Filling	CFT	21.78	6.5	141.6
2.2	Compound wall, Fencing and Gates	RM	5000		21.3
2.3	Internal Road, bridge, culverts and drainage				136.5
2.4	Water Supply, treatment and distribution	MLD	7.06		45.913
2.5	Electrical, street lighting and fire fighting	MVA	44.48		70.331
2.6	Telecom and communication system				4.705
2.7	Sustainable infrastructure elements, RW harvesting etc	RM	7764		0.35
2.8	Wastewater, network and solid waste management				36.104
2.9	Building- commercial				16.272
2.10	Building - MEP				0.136
2.11	Gas supply and network				16.6
2.12	Standard factory buildings				49.01
	Total				669.961
3.	**Financing Cost During Construction and Pre-Construction Period**				
3.1	Pre-Construction Stage				
3.2	Construction Stage				78.1
	Grand Total				748.061

So, for the proposed project cost, the SEZL authority is expecting of money from the national and international Lenders. Expected mode of finanace is given in the **Table *3-13***

Table 3-13: Mode of Finance for SEZL

In crore BDT

Mode of Finance	BDT
Equity	198.1
Inter Company Loan	0
World Bank	377.5
ADB/IDCOL	172.5
Commercial Bank	
Others Institution	
Total	**748.1**

3.4 Approximate Workforce and Construction Materials

3.4.1 Workforce

For the construction activities of offsite and onsite facilities, construction material and workforce will be needed in good amount. Currently, there is no detail design and drawing of the facilities. So, estimation of such workforce and construction materilas is really tough job in this stage. There is an estimation of workforce during construction and operational period in the feasibility study report is given in **Table 3-14**. As per feasibility study report, the organofarm of SEZL will be like the **Figure 3-2**.



Figure 3-2: Organogram of SEZL authority

Table 3-14: Number of personnel during construction and operation period

Designation/Department	Number of Persons	
	Construction level	Operation Period
CEO	1	1
Finance (Director, GM, Manager)	3	3
Marketting (Director, GM, Manager)	3	3
Technical (Director, GM, Manager)	3	3
Engineers and Supervisors	5	5
Support Staff	3	3
Security Staff	10	10
Total	28	28

(Source: Feasibility Study Report)

The number of labour during construction period is not confirmed yet. But initial planning of SEZL (Source: SEZL authority) is to enagage more or less 250 people per day for the

construction work. Labour during operation period can only be confirmed based on the type, size and requirement of the industries.

3.4.2 Construction Materials

During construction activity of SEZ, the main activities will be:

- Site development by sand filling;
- Boundary wall;
- Internal road construction;
- Internal drainage line;
- Treatment plant;
- Transmission line;
- Gas supply pipeline;
- Water supply pipeline;
- Telecommunication line.

Out of these development activities, estimation of the construction materials for the above development works are currently not available except the sandfilling, boundary wall, and internal road network and drainage line. Though the estimation of the construction works for these development works are also based on their previous experience and as per assumptions.

The total sand required for the filling purpose is about 180,774,000 cft. The requirement of the construction materials for the boundary wall has given in **Table 3-16**.

Table 3-15: Estimated construction materials for Boundary Walls

Sl.	Description	Quantity	Unit
1	Picket brick	719408	Nos
2	1st Class brick	577065	Nos
3	Cement	19877	Bag
4	Local sand	50653	Cft
5	Sylhet sand	22441	Cft
6	M Rod	325080	kg

(Source: SEZL)

CHAPTER 4

4 DESCRIPTION OF THE ENVIRONMENT

As a part of the environmental assessment of the proposed "Sirajganj Economic Zone" project, an environmental baseline survey was carried out in areas surrounding the proposed location. The specific objectives of the baseline study were:

- To document the existing condition of physical and biological environment and prevailing socio-economic condition of the project areas;
- To identify the significant environmental and social aspects that are likely to be affected by the proposed project activities; and
- Setting of baseline parameters to identify possible adverse and beneficial impacts due to the proposed project activities.

4.1 Environmental and Socio-Economic Baseline

The baseline studies have been carried over a period of three months from July 2019 to September 2019 (air, noise, soil, sediment, water, ecology, and social survey) as part of ESIA of the SEZL project.

4.1.1 Project Site

The site and surrounding details have already been presented under **Chapter 3**. The study area considered major settings, roads, river, airport, railway and port distance around the SEZL site. The project activity areas are considered as core area and remaining study area as buffer zone. Environmental setting and site description are given at **Table 4-1** below. Details of site and surroundings are presented at **Figure 4-1**.

Table 4-1: Site Description and Environment

Particulars	Details
Location	Site is located at Union: Saidabad, Upazila: Sirajganj Sadar, District: Sirajganj and Union: Rajapur, Upazila: Belkuchi, District: Sirajganj.
Mouza	Saidabad, Baro Shimul Panchashona, Khash Baro Shimul, Birhati and Chackboyra Mauzas of Saidabad Union and Boyra Masum, Bera and Berakharua mauzas of Rajapur Union.
Nearby Villages	West – Ramdhuni Bari, Bag Bomra North - Baro Shimul Ponchoshona South - Choto Berakharua East - Jamuna Bali, Phulbari, Birhati
Project Area	415 acres (1st phase), 1041.43 acres total
Road Access	Adjacent to Elenga-Nalka-Hatikamrul Road

Particulars	Details
River Access	Approx. 01 km from Jamuna River Approx. 79.82 from Padma River Approx. 189.68 from Meghna River 188.19 km from Chandpur River Port 234.00 km from Narayanganj River Port 244.53 km from Dhaka River Port &
Nearest Airport	Hazrat Shahjalal International Airport about 110 km away from the site.
Nearest Railway Station	Jamuna Bridge West (Shahid M Monsur Ali) Railway Station about 2.1 km away from the site.
Nearest Port	Chittagong Sea Port about 366km; Mongla Sea Port about 328 km; and Payra Sea Port about 359 km away from the site.
Climatic Conditions	Avg. Monthly wind speed: 1.02 m/s to 7.71 m/s Avg. Monthly Min. Temperature: 11.3 ~ 26.1 Avg. Monthly Max. Temperature: 24.0 ~ 34.4 Annual Avg. Rainfall – approximately: 798.5 mm. Monthly Average Relative humidity ranges: 66.7% ~ 83.4%
Seismic Zone	Zone-2 (Coeffi. 0.15g)
Forests/National Parks	None within 10 km (Bangabandhu Jamuna Eco-park within 300m radius)
Archaeologically important places	No Archaeologically important places/monuments near to the site.

Source: Google Earth, BBS-2011 & Site Visits

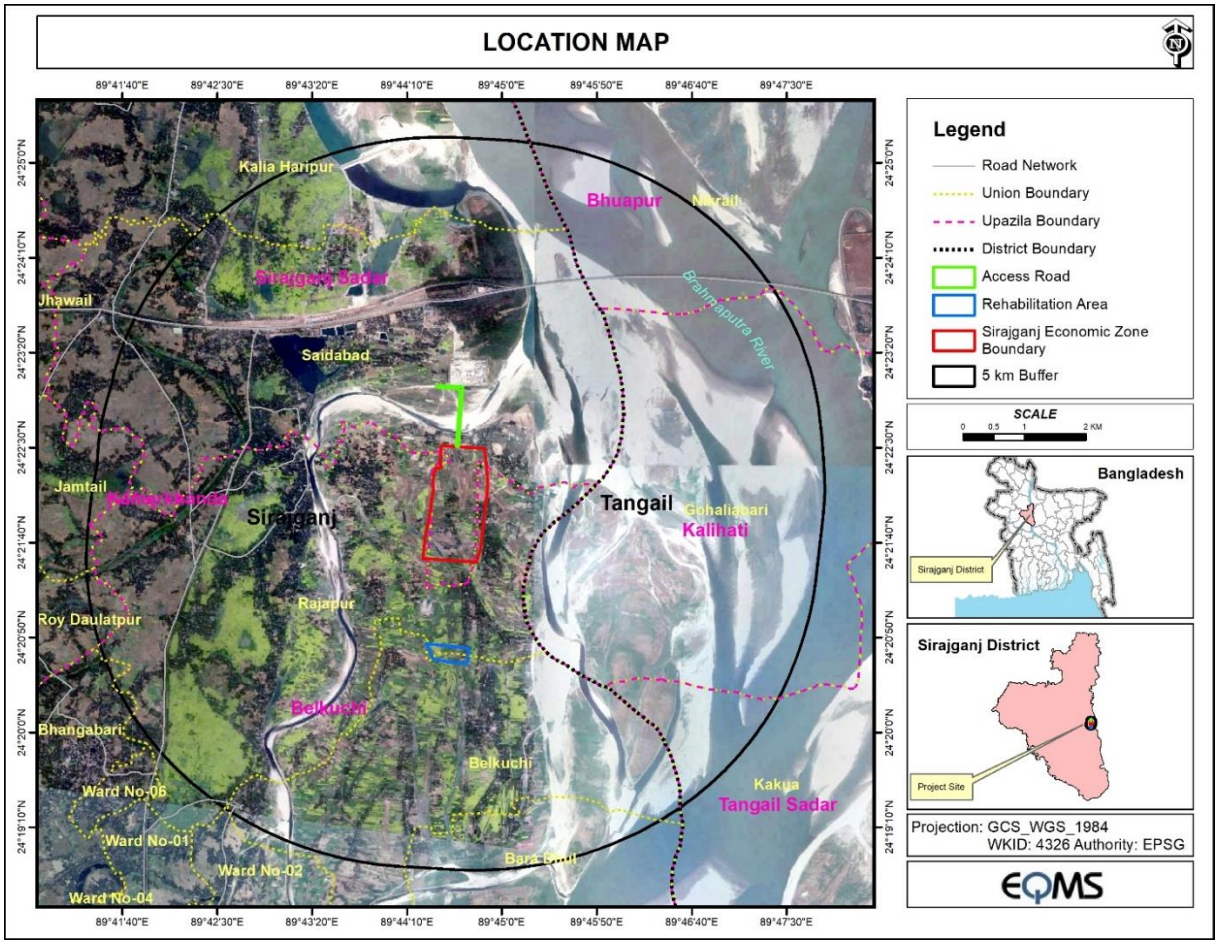


Figure 4-1: Project site and surrounding within 5 km radius

4.2 Natural Capital: Physical Environment

The proposed Sirajganj Economic Zone (SEZ) site is located at Soydabad & Rajapur Union, under Sirajganj Sadar and Belkuchi Upazila which is adjacent to the Elenga-Nalka-Hatikumrul highway. The total land of SEZ is approximately 415 acres for 1st phase.

BEZA issued the final license to SEZL for establishment, development, operation, maintenance and promotion of Sirajganj Economic Zone on 1041.43 acres of land in different mouza of Sirajganj Sadar and Belkuchi Upazila of Sirajganj district with a view to encouraging rapid economic development through increase and diversification of industry, employment, production and export. The phase 1 will cover 415 acres of land where the 1st phase activity will go on for the development of land and for further construction work. Mosque inside the projcet area. Some of the important features around the project area is illustrated below in **Figure 4-2.** Distance of project site from these features are also shown in the **Figure 4-3.** Connectivity Map with the project site in National Context is shown in **Figure 4-4** as well as the Connectivity Map with the project site in Regional Context is shown in **Figure 4-5.**

	
Khas boro Shimul Mosque	Boro Shimul Mosque
	
Gachabari jame Mosque	Calkmakimpur Jame Mosque
	
Ponchoshona Jame Mosque	Al Arafa Jame Mosque
	
Fulbari Uttarpara Jame Mosque	Fulbari Moddhopara Jame Mosque

	
Fulbari Madrasah	Fulbari Dokkinpara Mosque
	
Boro Shimul Madrashah	Bangabandhu Eco park
	
Jamunabali Gov. Primary School	Manob Mukti Academy

Figure 4-2: Important Environmental Features

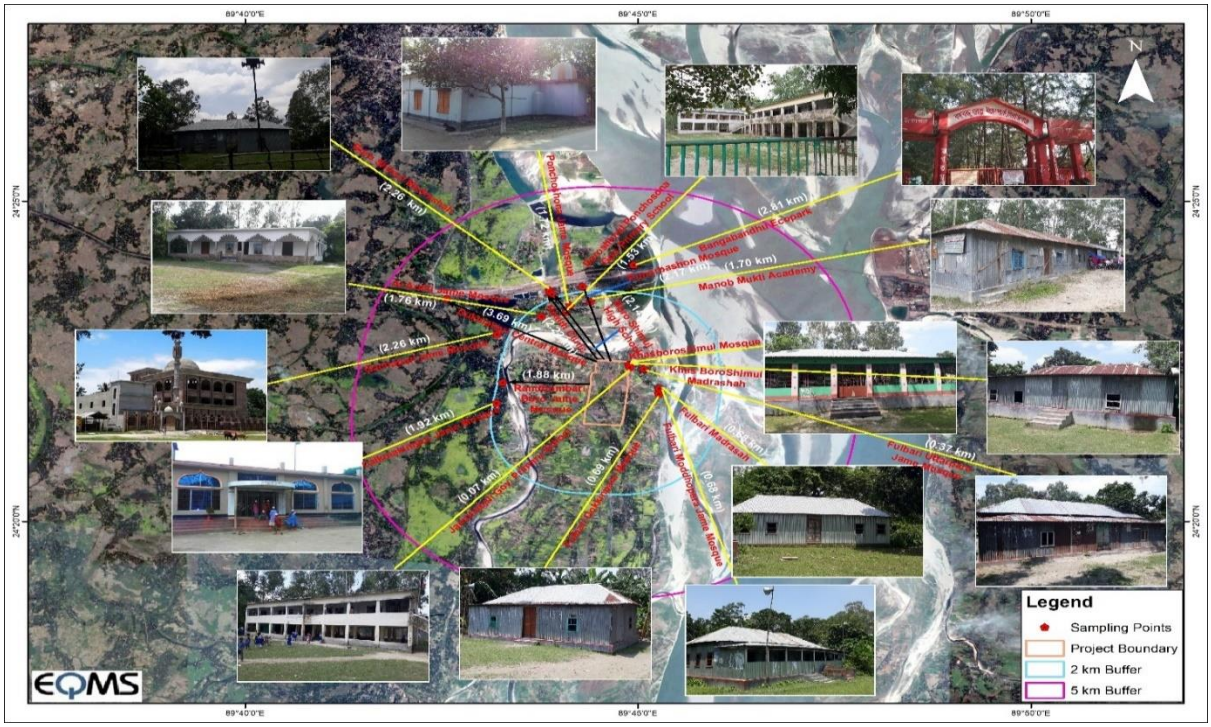


Figure 4-3: Distance of IEFs from the project site

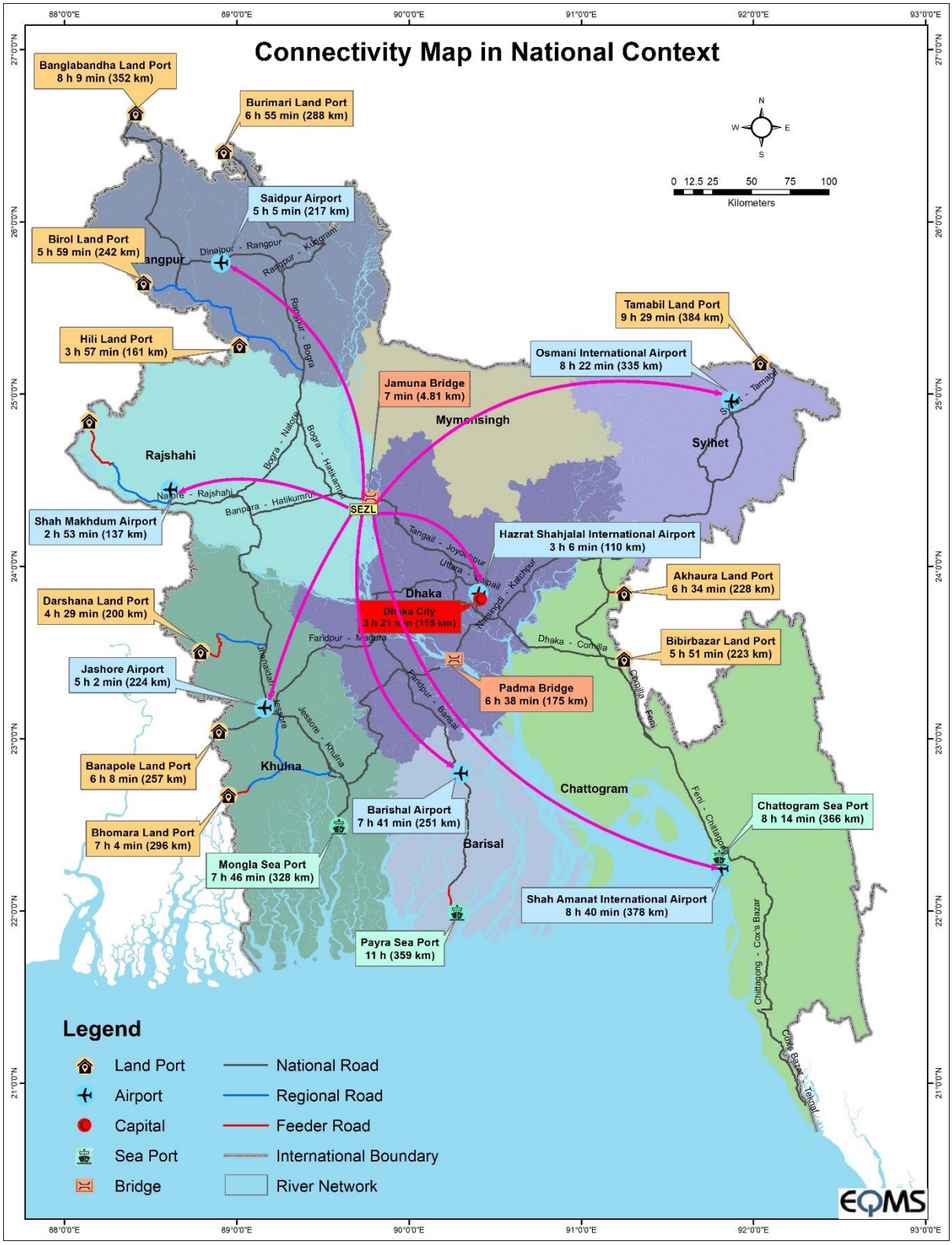


Figure 4-4: Connectivity Map with the project site in National Context

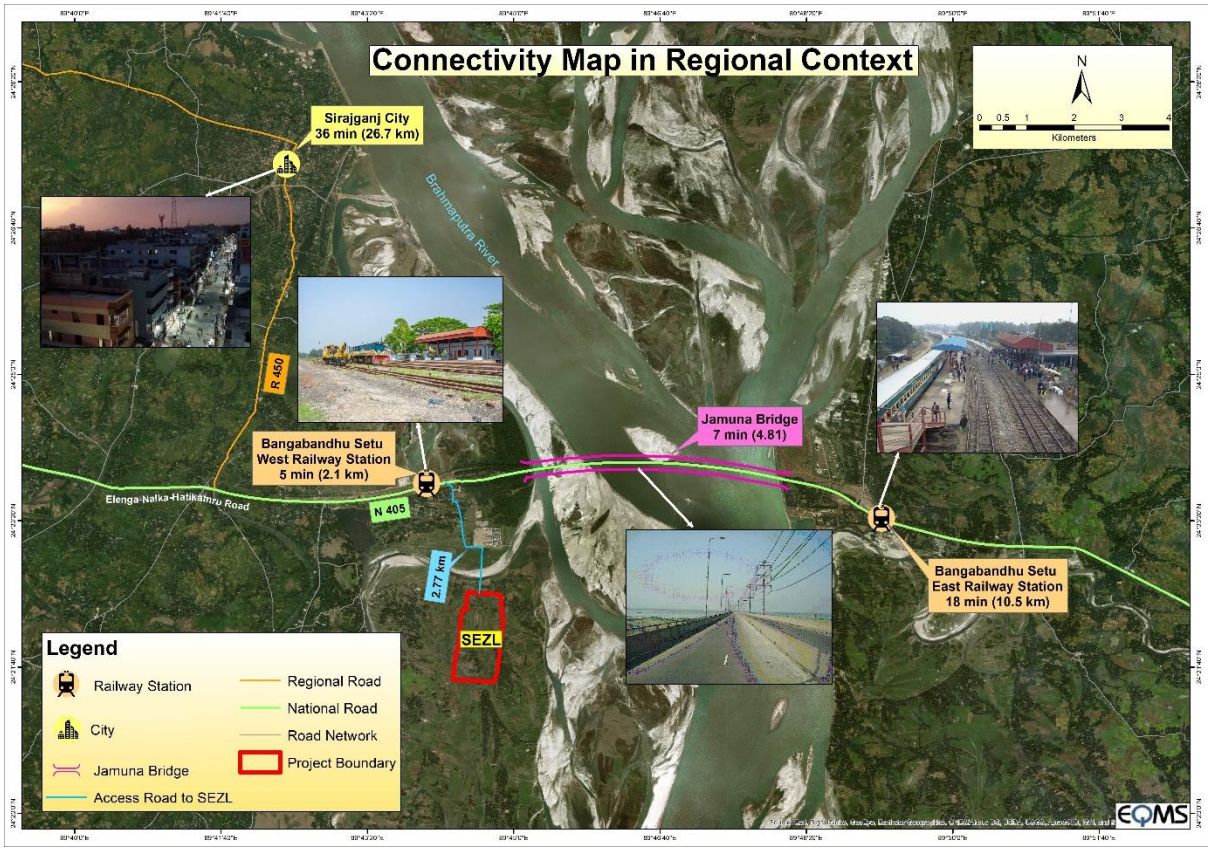


Figure 4-5: Connectivity Map with the project site in Regional Context

4.2.1 Landuse/cover – AOI

Land use/cover inventories are an essential component for evaluating land resources and environmental studies due to changing nature of land use pattern of the project area. Jamuna River is flowing within the project AOI, which plays a big role to change the land pattern, especially in monsoon.

The land use study of the proposed SEZ and its 5 km buffer was undertaken with the following objectives:

- To study the land use in the 5km radius areas of the proposed economic zone and provide inputs for environmental planning of the SEZ by analyzing the existing land use/land cover scenario.
- To establish the existing baseline scenario using a GIS database for incorporation of thematic information on the different physical features including drainage and water bodies, settlements, transport networks and administrative boundaries etc.
- To identify and map the homestead vegetation, agricultural land, waterbodies, drainage and the streams in the study area.

Methodology

In the present study for delineation and analysis of land use / land cover, cloud free multi-temporal Satellite Imagery of Google Earth, 15-DEC-2018 has been used for Robi (December to February) of 2018. The date of over pass is optimum for classifying the Robi

crop/vegetation as it is in the peak of the season. Besides satellite imagery data, reference sheets provided by the Local Government Engineering Department, Local GIS Units and field surveys were used for detailed mapping of roads, railway line, etc.

Land Use Interpretation of the Study Area

The evaluation of the existing environmental status of the study area has represented 0-5 km around the Project site (**Figure 4-6**). Level classifications are presented in following tables and figures gives the Land use/Land cover map for the AOI.

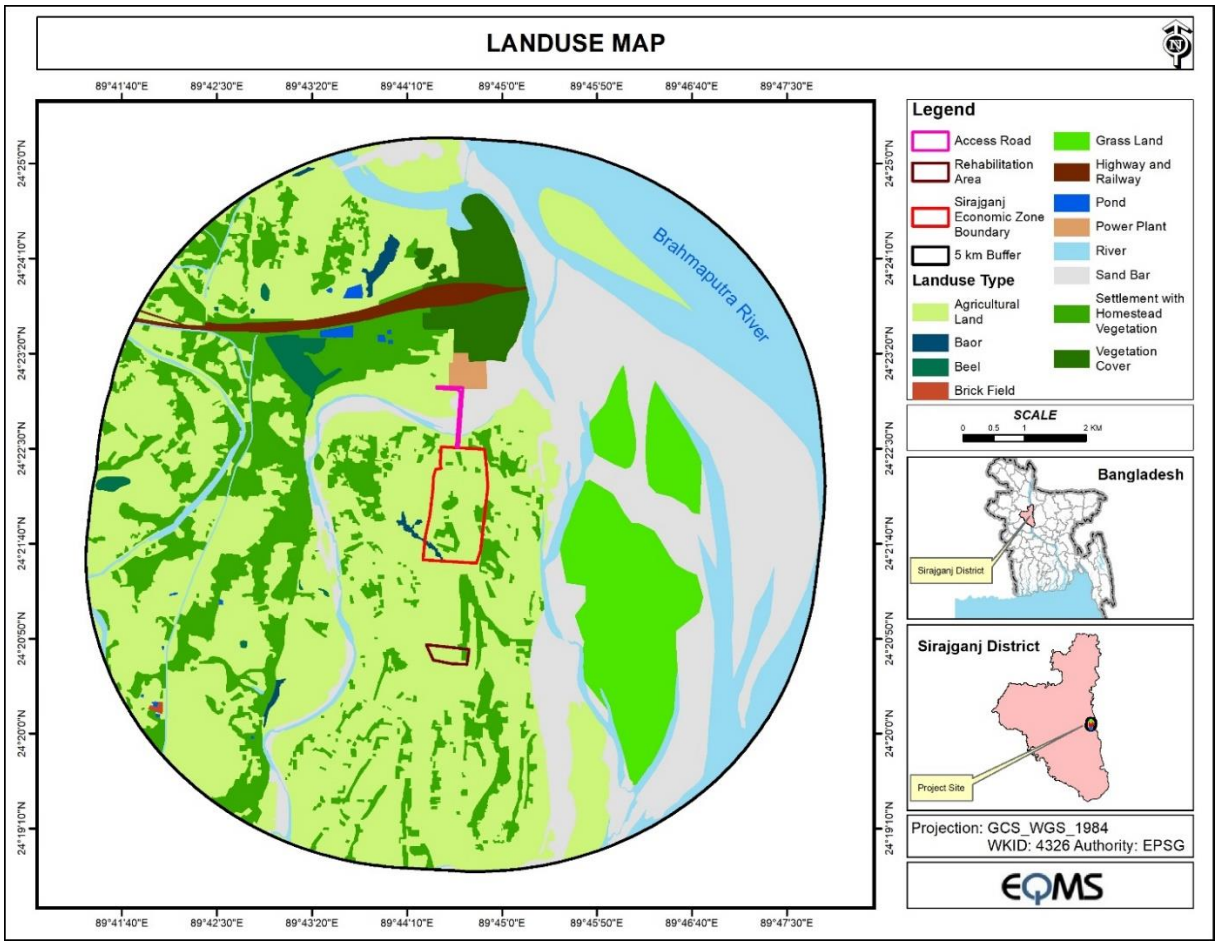


Figure 4-6 : Land use cover in 5km buffer AOI around the project

The detailed land use or land cover within the 5 Km AOI is illustrated in the below **Table 4-2**. The area is defined both in acres and the percentage of area covered by the classes. The land use or land cover of the processing area and Land use cover in 5km buffer AOI around the project is also shown in the **Table 4-2** and **Figure 4-7.**

Table 4-2: Land use/Land cover for SEZ within 5km AOI

Sl	Classes of Land Cover	Area (Acres)	Percentage (%) of Area
1.	Agricultural Land	10897.01304	41.65493
2.	Sand Bar	4809.664768	18.38543

3.	River	3717.937041	14.21219
4.	Settlement with Homestead Vegetation	3667.849691	14.02073
5.	Grass Land	1833.31901	7.008047
6.	Vegetation Cover	603.707483	2.307733
7.	Highway and Railway	256.843736	0.981811
8.	Beel	175.416042	0.670546
9.	Baor	79.338297	0.303279
10.	Power Plant	69.736877	0.266576
Sl	**Classes of Land Cover**	**Area (Acres)**	**Percentage (%) of Area**
11.	Pond	43.578466	0.166583
12.	Brick Field	5.793312	0.022146
13.	**Total**	**26160.19777**	**100**

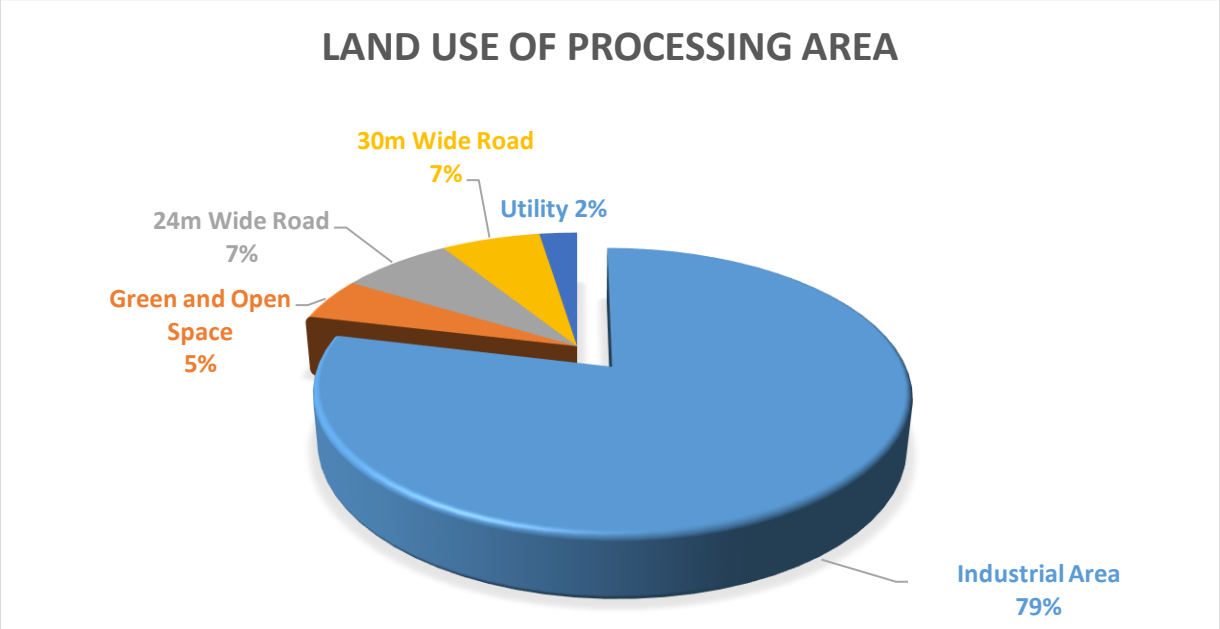


Figure 4-7: Land Use Pattern of Processing Area

Built up Land

The major categories noticeable on the satellite data within the study area include several rural residential areas and very marginal mixed built-up areas. Settlement areas are very scattered. In the areas, settlement patches are visible adjacent to the Riverbed cultivated areas. Some industrial activities are also seen within the study area. The proposed project site is in such an area. Built up area including the rural settlement, Mixed Built Up, Transportation/open land and Industrial area acquired land covers only 15.29% of the 5 km buffer area around the proposed site. Homestead vegetation area is covering 14.02%, power plant area is covering

0.3%, Brick field area is covering 0.02% and highway and railway area is covering 1% of area 5km buffer around the project.

Agricultural Land

Agricultural landuse cover is largely dependent on the agro-climatic condition of the area. Cropped areas appear in lime color with varying shape and size in a contiguous to non-contiguous pattern. The riverbed cultivation areas were found to be confined to the areas around the Jamuna river and other natural drains and streams. Agricultural land is the major land use class in the study area as agriculture is the main source of livelihood in the area. The total agriculture area is 10897 acres in 5km buffer area which is representing about 41.65% of total area. In monsoon season, the area is normally flooded due to upstream water through Jamuna River and heavy rain in this area.

Water bodies

River, Baors, Beels and Ponds are the important waterbodies seen in the study area. The area has been represented by sky blue to dark blue in the above figure. The major river in the study area is Jamuna River flowing along the eastern most corner of the proposed project site. A branch is also flowing through the project site which will be conserved. The river is using for navigation purpose also in monsoon. Within the AOI, the streams and natural drainages are found to be discontinuous. At some place drainages break and develop some waterbodies. Dark patches of water were also observed. Water bodies cover 4016.27 acres of total land which is about 15.35% of the total geographical area of the 5 km buffer zone. The river Jamuna covers 14.21% area of the total buffer area.

Vegetation Cover

Except the homestead vegetation in the 5km study area, there are also some vegetation cover which has been represented by dark greenish color. Normally the vegetation covers situated at Northern site of the project which is currently known as Eco-park area. It is covered about 603.71 acres area, representing 2.3% of the total 5km buffer area.

Others

There are also two more classifications which is sand bar and grassland in the project's AOI. Grassland area has been represented by dark lime color and the sand bar has been represented by light ash color. Grassland area is covering 1833.32 acres of land, presenting 7% of the 5km buffer area. Sand bar found at Jamuna River, covering about 4809 acres of land. The area has covered 18.39% of 5km buffer area.

4.2.2 Topography

The project site is next to the Jamuna River, one of the major of its kind in Bangladesh. A digital elevation model (DEM) or 3-D representation of the terrain surface of 5 km Project AOI is shown **Figure 4-8.** Contour maps derived from DEM shows that the topography of the Project AOI is predominantly flat terrain with depressions in the Jamuna River section. However, interestingly the sandbars/ island areas within the River are clearly visible with higher elevation values. The Jamuna Eco Park and Saidabad Power Generation Complex can

be observed to be in the elevation range of 12-18 m above MSL from the map. As referred from the Project report of SEMBCORP Power Plant (Unit-4), the average elevation of the NWPGCL's plant site is 15.75 m above MSL **Figure 4-8.**

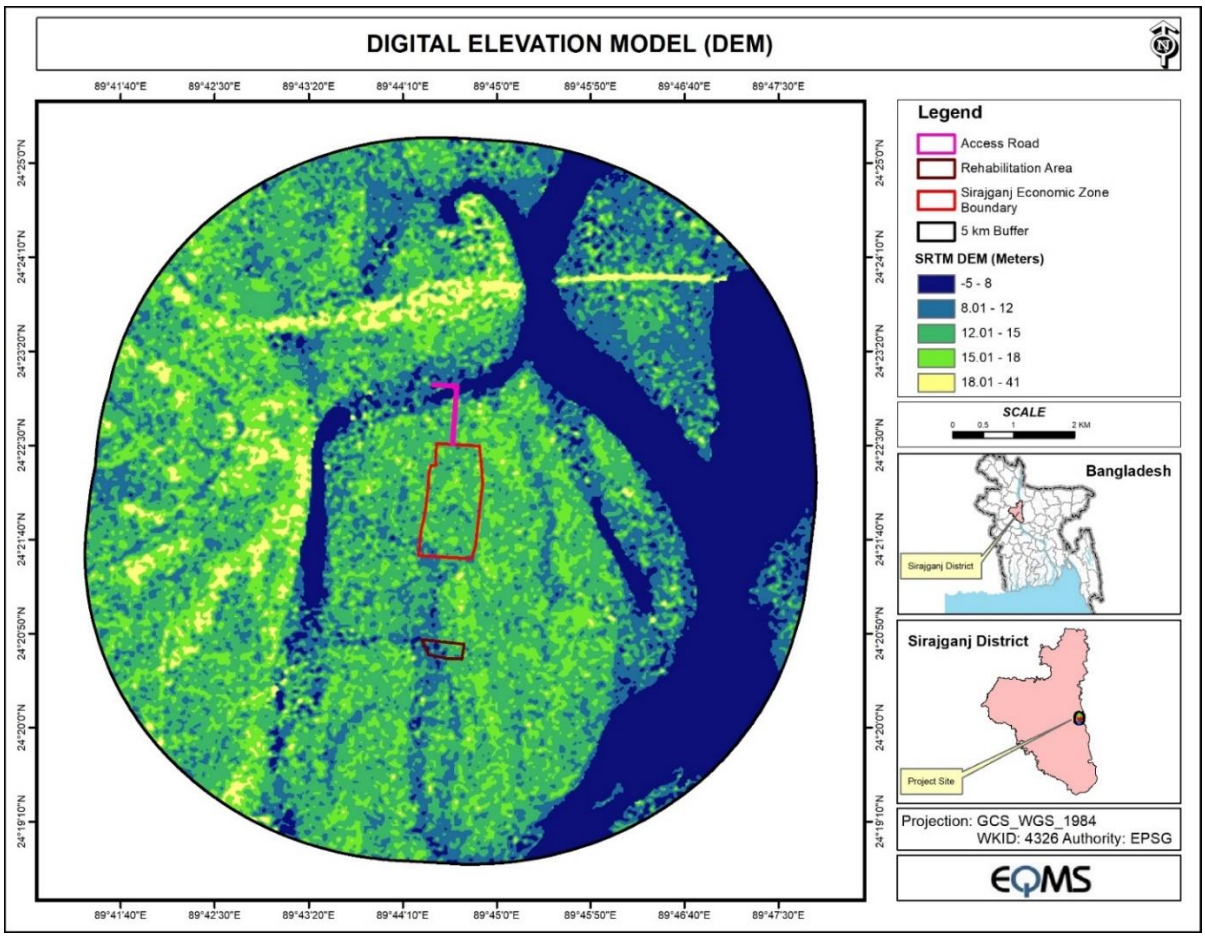


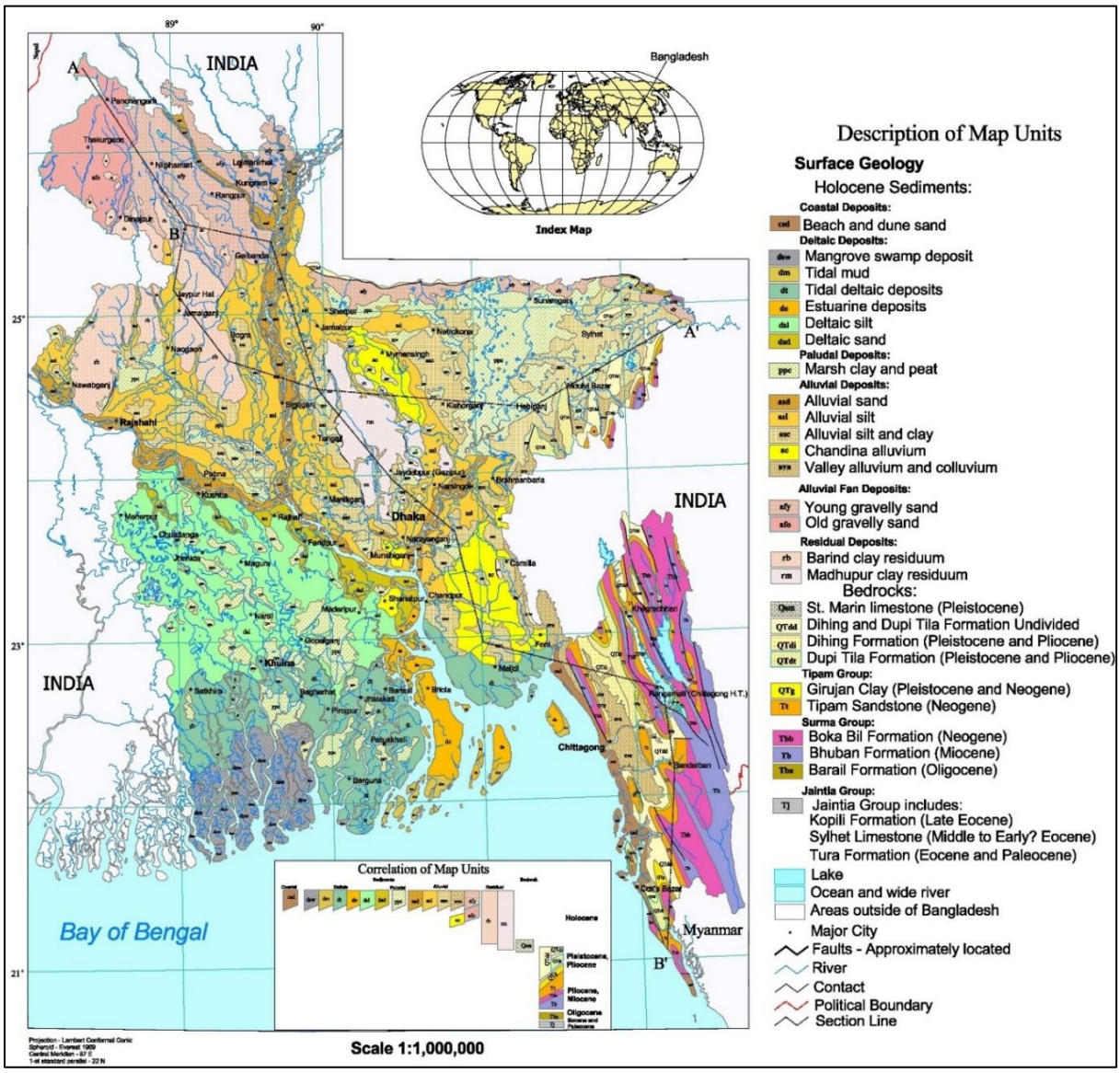
Figure 4-8: Digital Elevation Model around 5km buffer of the project

So, the proposed project site also needs to be in same level as the total power hub has been developed in consideration of flood protection. A slope map of the SEMBCORP Power Plant also has been studied to understand the scenario. The SEMBCORP Power Plant is just adjacent to the project site. So, the slope map of the power plant is also representing the slope of the project adjacent area. It has been understood that the area has no considerable slope variations. More than 80 % of the area falls in the gradient range of 0-5 % and some places have 5-10 % slope. Very few areas fall in the 20-27% gradient range, i.e. near Saidabad, near river bank of Jamuna Eco Park and at the edges of few char areas on the Jamuna River. The entire river bank can be seen to have a slope range of 10-15% variation because of the difference in the land embankment and the river level.

4.2.3 Geology

The country occupies major part of the Bengal delta, one of the largest in the world. The Ganges - Brahmaputra delta basin or the Bengal basin includes part of the Indian state of West Bengal in the west and Tripura in the east. Geological evolution of Bangladesh is basically related to the uplift of the Himalayan Mountains and outbuilding of deltaic landmass by

major river systems originating in the uplifted Himalayas. This geology is mostly characterized by the rapid subsidence and filling of a basin in which a huge thickness of deltaic sediments was deposited as a mega-delta out built and progressed towards the south. The delta building is continuing into the present Bay of Bengal and a broad fluvial front of the Ganges-Brahmaputra-Meghna river system gradually follows it from behind. Only the eastern part of Bangladesh has been uplifted into hilly landform incorporating itself into the frontal belt of the Indo - Burman range lying to the east.



Source: *US Geological Survey - https://pubs.usgs.gov/of/1997/ofr-97-470/OF97-470H/BANGLA/PLOT/BANG_GEO.PDF*

Figure 4-9: Geological Map of Bangladesh

The geological map of Bangladesh is shown in the **Figure 4-9** which can be discussed under the following headings:

(i) ***Tectonic framework:*** This refers to the basic structural frame on which Bangladesh stands. Bangladesh is divided into two major tectonic units: (a) Stable Precambrian Platform in the northwest, and (b) Geosynclinal basin in the southeast. A third unit, A narrow northeast-southwest trending zone called the Hinge Zone separates the above two units almost through the middle of the country.

(ii) ***Stratigraphy:*** Stratigraphic subdivision of the rock sequences in Bangladesh follows the broad tectonic divisions. In the Precambrian platform, a thin to limited sedimentary sequence of Permian to Recent age lies on a crystalline basement conforming to the relative tectonic stability of the area. In the Geosynclinal basin, on the other hand, a huge clastic sequence of mostly Tertiary age testifies to high tectonic mobility.

(iii) ***Economic geology:*** Occurrence of economic deposits of petroleum and mineral resources has been controlled by the geological parameters especially by the tectonic-structural setting and stratigraphy. For example, the large bituminous coal deposits are restricted to northwestern Bangladesh because of the occurrence of Permian rocks in graven basins within the Precambrian platform. On the other hand, the large natural gas reserves are in eastern Bangladesh because folded structures are available to trap the gas in thick Mio-Pliocene sandstone reservoirs there. Bangladesh has so far discovered significant amounts of economic mineral resources including natural gas, coal and peat, limestone, crystalline hard rocks, heavy minerals, kaolinite and glass sand. Each of these resources is associated with specific geological settings.

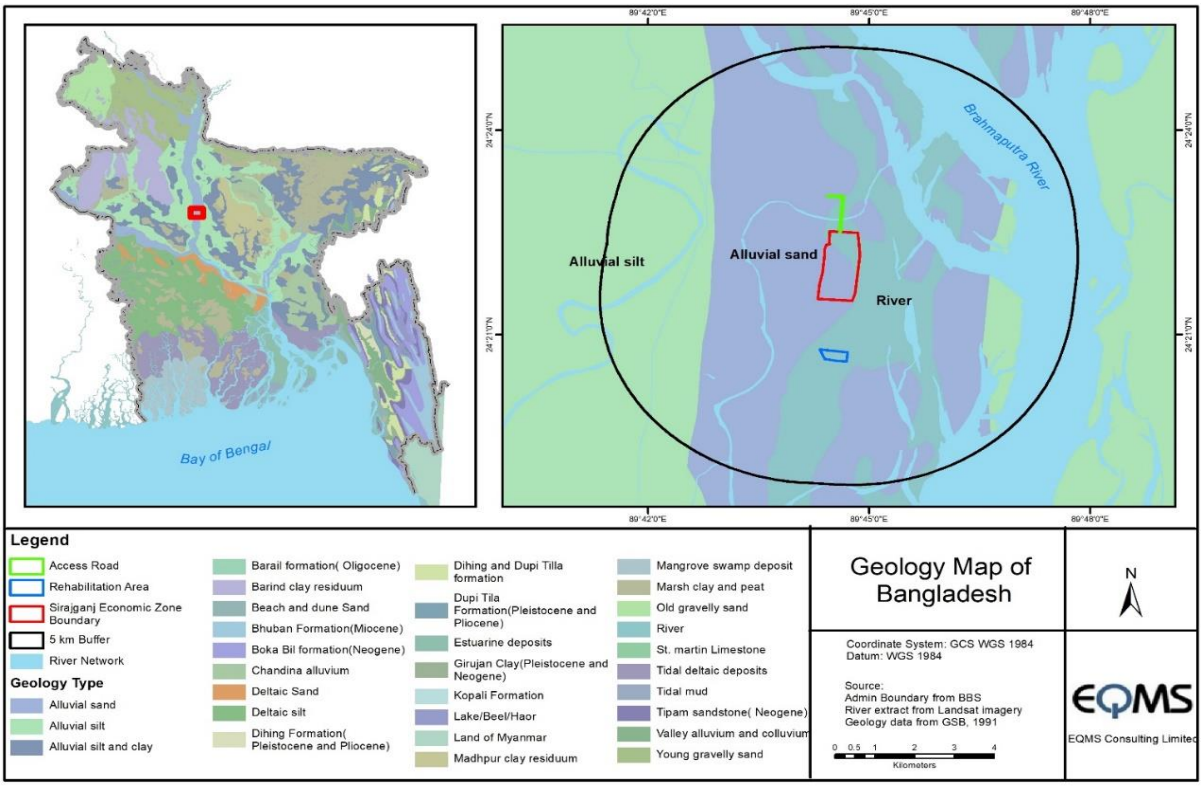


Figure 4-10: Geological Map of Project Site

The project site is located at Sirajganj lies in the Rajshahi Division of Bangladesh which falls under a stable Precambrian platform and is characterized by limited to moderate thickness of sedimentary rocks above a Precambrian igneous and metamorphic basement**.** This unit is geologically stable in relative terms and has not been affected by fold movement. **Figure 4-10** shows the 5km buffer AOI of the project site is in Active Brahmaputra-Jamuna Floodplain and the geology of the surface covered by alluvial silt and sand and by river.

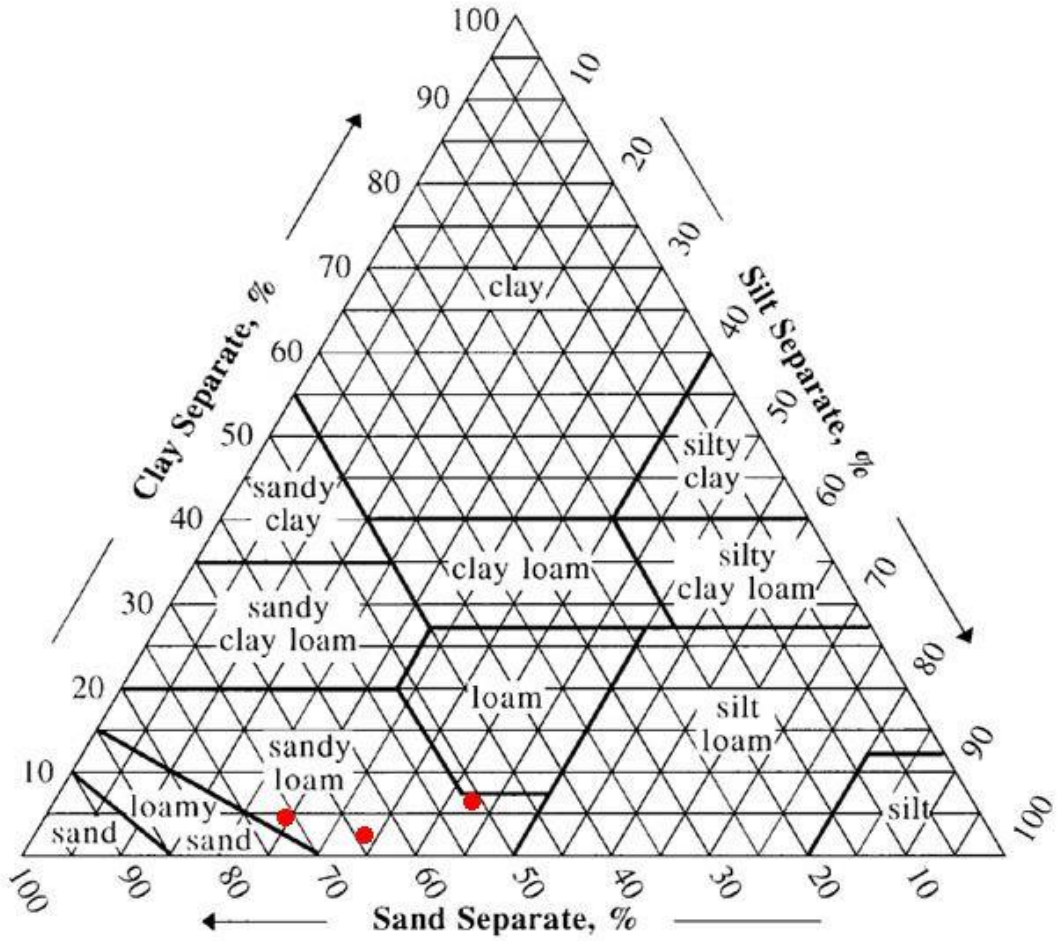
4.2.4 Soil and Sediment Texture

Details of the soil and sediment texture is given in the following **Figure 4-3, Figure 4-4, Figure 4-11** and **Figure 4-12.**

Table 4-3: Granulometric Analysis for Soil Texture

Sl	Sampling Location	Grain Type	(%) of Granules	Total (%)
1.	SQ1	Sand	72	100
		Silt	24	
		Clay	4	
2.	SQ2	Sand	65	100
		Silt	33	
		Clay	2	
3.	SQ3	Sand	52	100
		Silt	42	
		Clay	6	

Source: EQMS Laboratory Analysis



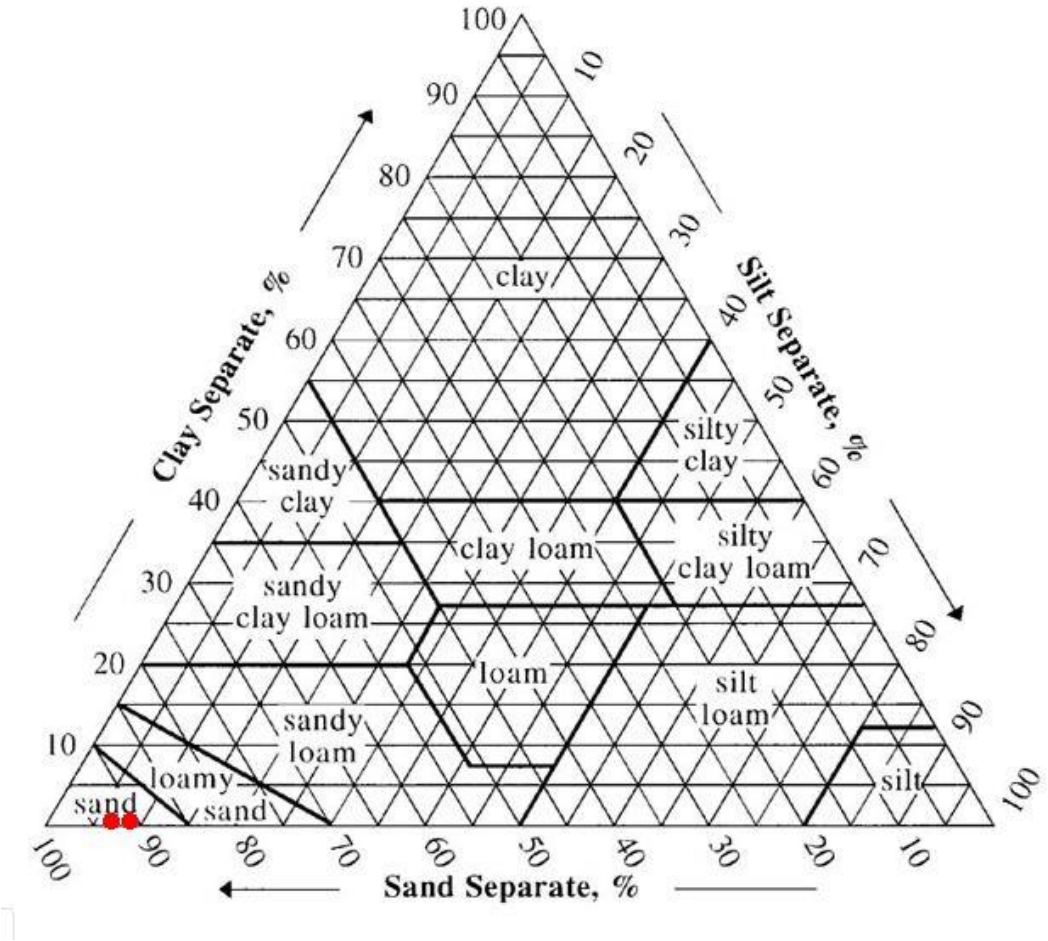
Source: EQMS Laboratory Analysis and USDA Texture Calculator

Figure 4-11: Soil Texture Triangle of proposed SEZL Site

Table 4-4: Granulometric Analysis for Sediment Texture

Sl	Sampling Location	Grain Type	(%) of Granules	Total (%)
1.	SeQ1	Sand	92	100
		Silt	8	
		Clay	0	
2.	SeQ2	Sand	94	100
		Silt	6	
		Clay	0	

.



Source: EQMS Laboratory Analysis and USDA Texture Calculator

Figure 4-12: Sediment Texture Triangle of proposed SEZL Site

4.2.5 Soil and Sediment Quality

Sampling Methodology and Locations

The soil sampling strategy was designed to assess the existing soil quality over the study area. Three soil samples have been collected from the study area. The details of the soil sampling locations are presented in

Table 4-5, **Figure 4-13** and **Figure 4-14**. A composite sampling technique has used for soil sampling from each location. Soil samples were collected from the top soil surface. At each location, soil samples were collected from two spots and homogenized. The homogenized samples were collected following a quartering technique and then packed in polythene plastic jars and sealed. The sealed samples were sent to the laboratory for analysis. The soil samples were analysed for physical and chemical characteristics including minerals, heavy metals and trace elements.

Table 4-5: Soil Sampling Locations

Sl.	Sampling Station	Station Code	Geographic Location	Sample Type
1.	Near Salim House (Project Site)	SQ1	24°22'18.89"N 89°44'36.06"E	Project area
2.	Suruj Mia House (Project Site)	SQ2	24°23'4.17"N 89°44'26.80"E	Project area
3.	Ramdhuni Bari (Project Site)	SQ3	24°21'45.67"N 89°43'54.36"E	Project area

Source: Field Survey, 2019

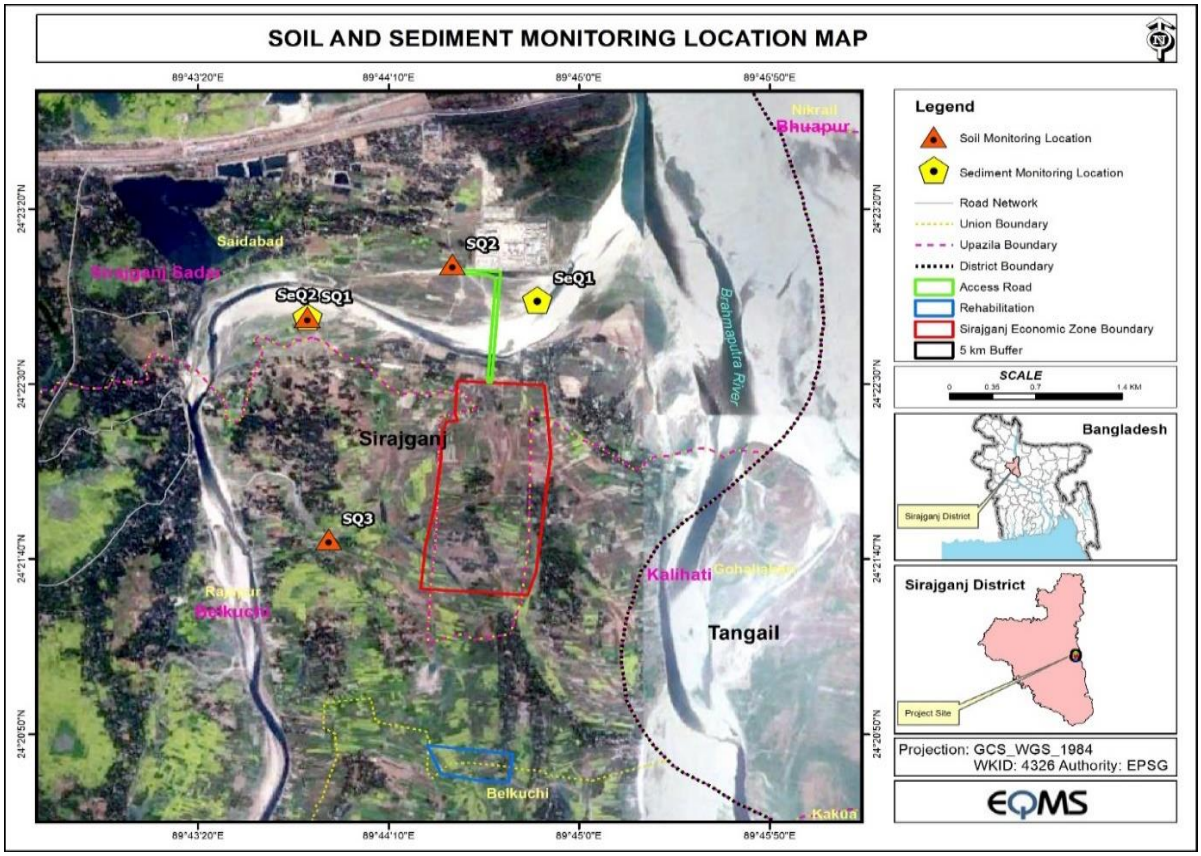


Figure 4-13: Soil and Sediment Sampling Location Map



SQ1	SQ2	SQ3

Figure 4-14: Soil Sampling Photos (Source: Field Survey, 2019)

Results and Discussions

The analysis results of soil samples are presented in the following **Table 4-6.**

Table 4-6: Result of soil Samples analysis

Parameters	Unit	Soil Quality	Soil Quality	Soil Quality	USEPA Guideline*
Sample Code		SQ1	SQ2	SQ3	
pH	-	7.1	6.8	7.6	-
Organic Matter	%	0.2	0.7	0.9	-
EC	dS/m	0.5	0.8	1.3	-
Saturation %	%	16.3	15	10	-
Bulk Density	gm/cm^3	0.8	0.7	0.65	-
Cation Exchange Capacity	meq/100g	2	2.5	3.5	-
N	%	0.045	0.06	0.1	-
P	µg/g	2.6	2.6	3.1	-
K	meq/100g	0.1	0.2	0.34	-
Ca	meq/100g	3.42	4.1	4.8	-
Mg	meq/100g	3.28	4.2	4.8	-
Na	meq/100g	1.2	1.6	2.1	-
S	µg/g	22.3	28.6	34.3	-
Fe	µg/g	18.32	21.6	26.7	-
Mn	µg/g	8.32	10.21	14.1	-
Zn	µg/g	0.87	0.92	0.96	459
Pb	µg/g	7.43	8.4	9.2	128
Cd	µg/g	0.22	0.23	0.26	4.98

pH level of soil

The pH of the soil samples from SQ1 and SQ2 was found to be neutral as per the standard soil classification given in **Table 4-7**. Sample collected from SQ3 was found slightly alkaline.

Table 4-7: Standard pH level of soil and sediment

pH	Classification
<4.5	Extremely acidic
4.51-5	Very strong acidic
5.01-5.5	Strongly acidic
5.51-6	Moderately acidic
6.1-6.5	Slightly acidic
6.51-7.3	Neutral
7.31-7.8	Slightly alkaline
7.81-8.5	Moderately alkaline
8.51-9.00	Strongly alkaline
>9	Very strongly alkaline

Source: SOP of SRDI

Metals in soil

Calcium, Magnesium, Iron, Manganese, Zinc, Lead and Cadmium has been detected in the soil sample. Environmental Conservation Rules (ECR), 1997 doesn't provide any soil quality standard. So, the soil quality in the study area was compared with the heavy metal content standard of USEPA office of solid waste and emergency response, hazardous waste land treatment**.** Baseline soil qualities of the study area have observed to be well below the threshold limit compared with the USEPA standard (**Table 4-8**) of heavy metal content in soil.

Table 4-8: Heavy Metal Contents of the Natural Soil and Sediment

Element	Symbol	Common Range (ppm or mg/kg)	Average Concentration (ppm or mg/kg)
Manganese	Mn	200-3000	600
Lead	Pb	2-200	10
Zinc	Zn	100-300	50

Source: USEPA office of solid waste and emergency response, hazardous waste land treatment, SW-874 (April 1983, page 273)

Sediment Sampling Methodology and Locations

The sediment sampling strategy was designed to assess the existing sediment quality over the study area. Two sediment samples have been collected from the study area. The details of the sediment sampling locations are presented in **Table 4-9**, **Figure 4-13** and **Figure 4-15**. A composite sampling technique has used for sediment sampling from each location. Sediment samples were collected from the top soil surface. At each location, sediment samples were

collected from two spots and homogenized. The homogenized samples were collected following a quartering technique and then packed in polythene plastic jars and sealed. The sealed samples were sent to the laboratory for analysis.

Table 4-9: Location of Sediment Samples

Sl.	Sampling Station	Station Code	Geographic Location	Sample Type
1.	Northeast corner of Project Site	SeQ1	24°22'53.94"N 89°44'49.04"E	Channel of Jamuna River
2.	Northwest corner of Project Site	SeQ2	24°22'49.09"N 89°43'48.74"E	Channel of Jamuna River

Source: Field Survey, 2019



SeQ1



SeQ2

Figure 4-15: Sediment Sampling Photos (Source: Field Survey, 2019)

Results and Discussions

The sediment samples were analysed for physical and chemical characteristics including minerals, heavy metals and trace elements as like as soil samples. The soil samples were analysed for physical and chemical characteristics including minerals, heavy metals and trace elements. Testing results of sediment samples are given in **Table 4-10**.

Table 4-10: Testing result of sediment samples

Parameters	Unit	Sediment Quality	Sediment Quality	USEPA Guideline*
Sample Code		SeQ1	SeQ2	
pH	-	7.4	7.8	-
Organic Matter	%	0.7	0.7	-
Organic Carbon	%	0.4	0.4	-
EC	dS/m	2.4	2.5	-

Parameters	Unit	Sediment Quality	Sediment Quality	USEPA Guideline*
Sample Code		SeQ1	SeQ2	
Saturation %	%	8	6	-
Bulk Density	gm/cm3	0.6	0.6	-
Cation Exchange Capacity	meq/100g	1.2	1.3	-
N	%	0.035	0.035	-
P	µg/g	1.32	1.45	-
K	meq/100g	0.38	0.26	-
Ca	meq/100g	22.32	19.03	-
Mg	meq/100g	5.12	3.93	-
Na	meq/100g	1.2	1.15	-
S	µg/g	35.32	29.85	-
Fe	µg/g	12.29	14.21	-
Mn	µg/g	2.8	3.82	-
Zn	µg/g	0.95	1.41	459
Pb	µg/g	9.6	7.2	128
Cd	µg/g	0.17	0.22	4.98

pH level of Sediment

The pH of the sediment samples from SeQ1 and SeQ2 was found to be slightly alkaline based on classification given in **Table 4-7.**

Metals in Sediment

Calcium, Magnesium, Iron, Manganese, Zinc, Lead and Cadmium has been detected in the soil sample. Environmental Conservation Rules (ECR), 1997 doesn't provide any soil quality standard. So, the soil quality in the study area was compared with the heavy metal content standard of USEPA office of solid waste and emergency response, hazardous waste land treatment (**Table 4-8**). Baseline sediment qualities of the study area have observed to be well below the threshold limit compared with the USEPA standard of heavy metal content in soil.

4.2.6 Hydrology and Drainage Pattern

The Sirajganj District mostly falls under the Brahmaputra-Jamuna floodplains on the eastern side and Karatoya-Bangali floodplains on the western side. The Jamuna River borders the eastern side of the Sirajganj District and divides it from the Tangail District. The other

important rivers of the district are Baral, Ichamati, Karatoya, Bangali, Sarsagar, Gumni, Gohala and Phuljhuri. River Jamuna is next to the project boundary.

The hydrological regime of the Project AOI is governed by the Jamuna River and it is the main drainage channel of the area. Historically, the sediments carried by the Jamuna River have been deposited in the area. The Jamuna River is a braided River characterized by a network of interlacing channels with numerous sandbars enclosed in between them. The sandbars, known locally as "Chars" do not, however, occupy a permanent position. The river deposits them in one year often to destroy and redeposit them in the very next rainy season. The process of deposition erosion and re-deposition goes on continuously making it difficult to precisely demarcate the boundary between the district of Sirajganj and Tangail. Some of the chars have stabilized due to continuous depositions every year and people have started using it because the fertile alluvial deposits provide good agricultural yield.

Another river within the Project AOI is Hurasagar River, a tributary of Jamuna River in the western side of the Project AOI. There are also many small streams and ponds within the Project AOI. Through the eastern and southern boundaries of the Saidabad Power Generation Complex flows a Channel branching out of the main Jamuna River. This channel carries water during the rainy season (June onwards) and gets dry after January, till the arrival of rains, due to siltation on the mouth of the channel. Details hydrology and the drainage pattern of the project area is shown in **Figure 4-16**.

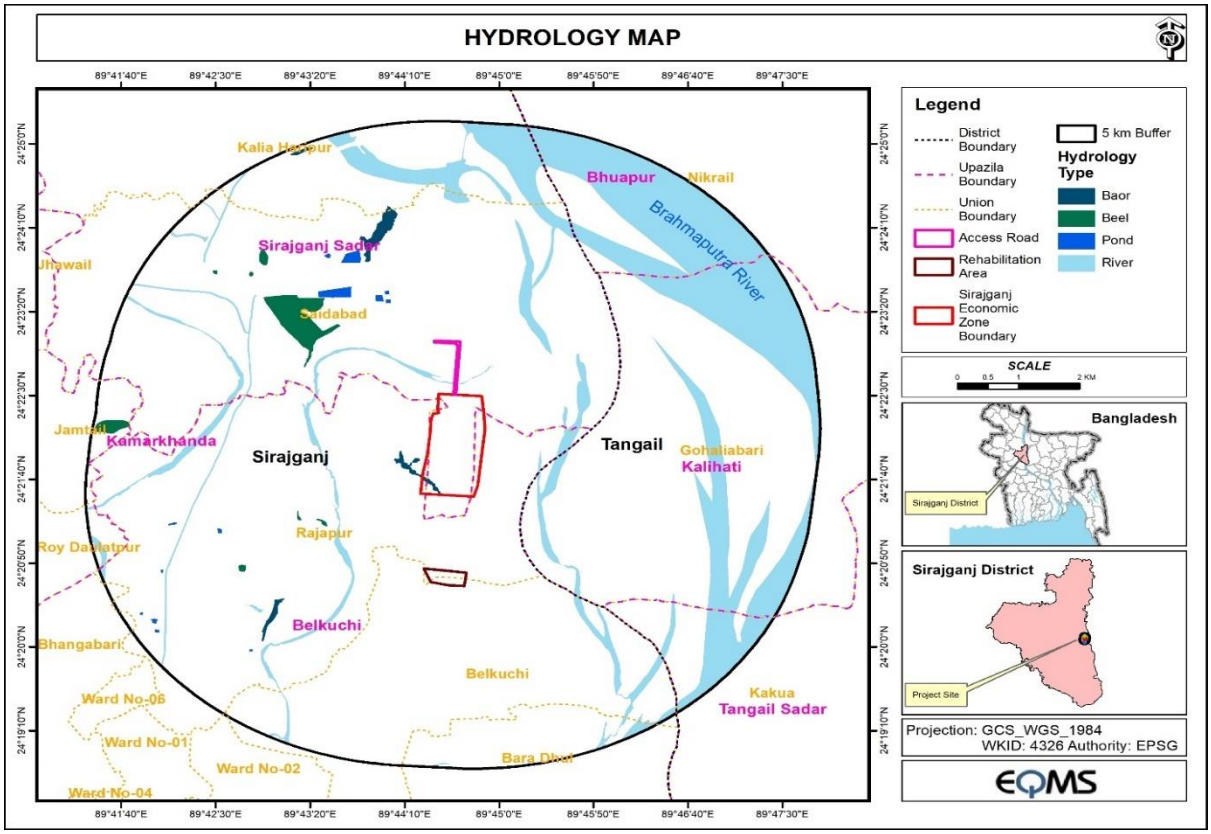


Figure 4-16: Hydrology map of the SEZL surrounding area*Navigation*

Navigability of rivers in Bangladesh has been deteriorating steadily over the years. The withdrawal of water beyond the border and within Bangladesh for irrigation and other purposes has resulted in decreased navigability of rivers during dry season resulting in gradual channel decline. The river network connects almost all the country's major cities, towns and commercial centers. Moreover, being cheap, safe and environmentally friendly, inland water transportation is often the only mode that serves the poor, proving especially useful during periods of widespread flooding.

Chittagong Sea Port is about 366km away from proposed SEZL project site (**Table 4-1**). Due to the steady growth in traffic volume, Chittagong Port performs well on the financial front. Another important sea port, Mongla Sea Port is about 328 km away from the project site. The Prime Minister inaugurated the third port, Payra Seaport, on 19th November 2013. It is on Rabnabad channel - which is 31 Km from the sea boundary, 316 Km from Chittagong, 130 Km from Mongla port and 340 Km from the capital and about 359 km away from the project site. This port shall have Draft of 8 -10 m when in operation. All the above mention port facility can be connected to the SEZL through both road, rail and waterways.

Drainage Congestion and Water Logging

The proposed SEZL site is flat agricultural land and submerged in the rainy season. A channel of Jamuna is flowing within the area (Figure B-30 of Annex B). The channel has been using for transportation of agricultural products and fertilizers by small boat in monsoon season. In winter, it is normally dry. Water logging observed at site during monsoon season. The area is severely flood prone. However, during heavy rainfall and monsoon season the river water enter in the low laying area causes water stagnation in the area for some time.

4.2.7 Water Availability in Jamuna River

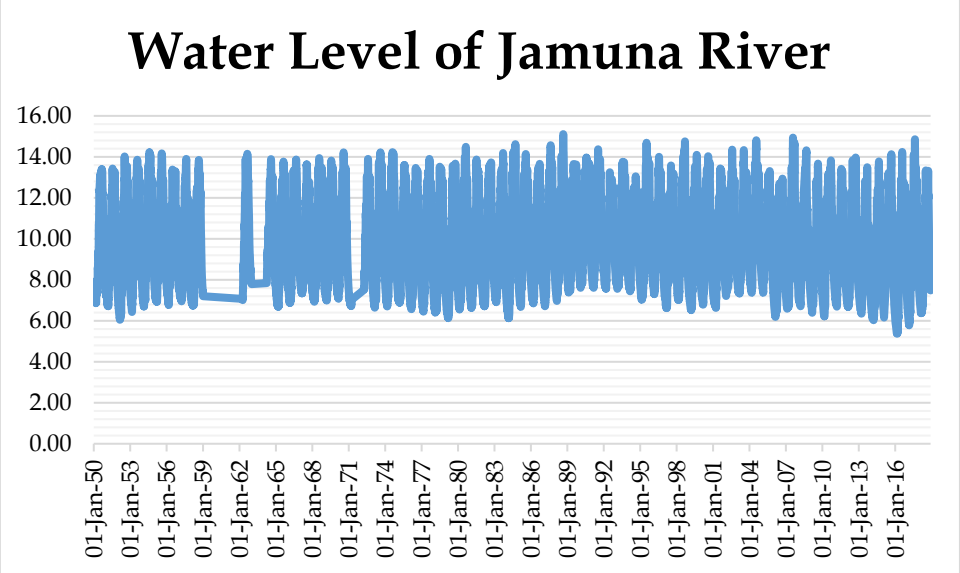
Jamuna river is the nearby surface water source of the proposed site for the Economic Zone. The hydrological regime of the project area is governed by this river. A holistic profile of Jamuna river with its associated drainage network is given in the following **Table 4-11**.

Table 4-11: Profile of Jamuna River

Sl.	Items	Jamuna River
1	Off take	Himalaya
	Geographical Location	Nageshwari (Kurigram)
2	Outfall	Padma River
	Geographical Location	Goalanda (Rajbari)
3	District and Upazilla	**Upazilla:** Belkuchi, Bera, Bhuapur, Char Rajibpur, Chauhali, Chilmari, Daulatpur, Dewanganj, Dhunat, Fulchhari, Gaibandha Sadar.
		District: Sirajganj, Pabna, Tangail, Kurigram, Jamalpur, Bogra, Gaibandha, Rajbari, Manikganj

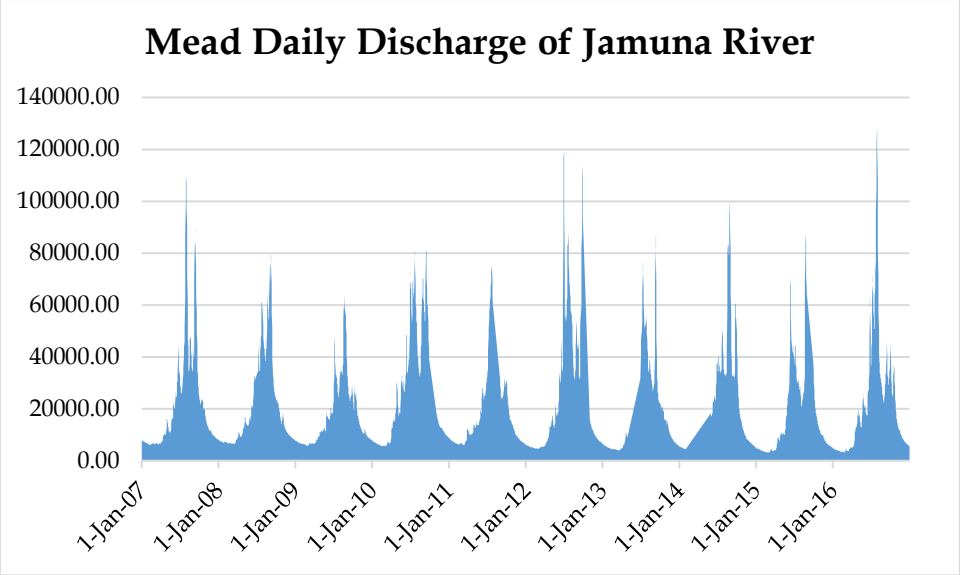
Sl.	Items	Jamuna River
4	Tributary river	Ghaghat, Teesta, Dudhkumar, Dharla, Badai, Kageshari, Girai.
	Distributary	Manos
	Branch	Hura Sagor
5		**Physical Setting**
	Length	230 km (approximate)
	Width	Min. 09 km, Max. 16 km, Avg. 12 km.
	Characteristics	Braided, average flood flow slope 07 cm/km
6		**Discharge**
	Seasonal/Perennial	Perennial
	Months of Minimum discharge (dry season)	February – April
	Months of Maximum discharge (wet season)	July – September
	Average discharge quantity	Dry Season (February-April): 3,430.00 m^3/sec Wet Season (July-September): 102,535.00 m^3/sec
	Tidal	No impact

Source: BWDB River Guide



Source: BWDB Data (SW49)

Figure 4-17: Water Level of Jamuna river at Sirajganj Sadar



Source: BWDB Data (SW46.9L)

Figure 4-18: Mean Daily Discharge of Jamuna river at Bahadurabad Ghat

Figure 4-17 and **Figure 4-18** represents the water level and the mean daily discharge of the Jamuna River respectively. According to the **Figure 4-17** and **Figure 4-18** water level of Jamuna River fluctuates within 6-14 m annually. Apart from this, the mean daily discharge of Jamuna River was found below 40000 cusecs in maximum time, except the peak monsoon

4.2.8 Water Quality

Surface Water Quality

Surface water samples had been collected from representative selected surface water sources representing different parts of the study area. The surface water sampling had been conducted at the Jamuna River near to the project area. Surface water sampling locations were selected to obtain a representative water sample from various zones within the study area. Four samples of surface water were collected from Jamuna River and adjacent stream channel of Jamuna River. Details of the surface water sampling location provided in the **Table 4-12, Figure 4-19** and **Figure 4-20.**

Table 4-12: Details of Surface Water Sampling Locations

Sl.	Sampling location	Sampling Code	Geographic location	Type of Source
1.	Upstream of Jamuna River	SW1	24°22'55.92"N 89°45'15.66"E	River
2.	Adjacent Channel of Jamuna River	SW2	24°22'41.14"N 89°44'28.24"E	River
3.	Adjacent Channel of Jamuna River	SW3	24°22'54.09"N 89°43'37.04"E	River

Sl.	Sampling location	Sampling Code	Geographic location	Type of Source
4.	Adjacent Channel of Jamuna River	SW4	24°22'10.82"N 89°43'19.79"E	River

Source: Field Survey, 2019

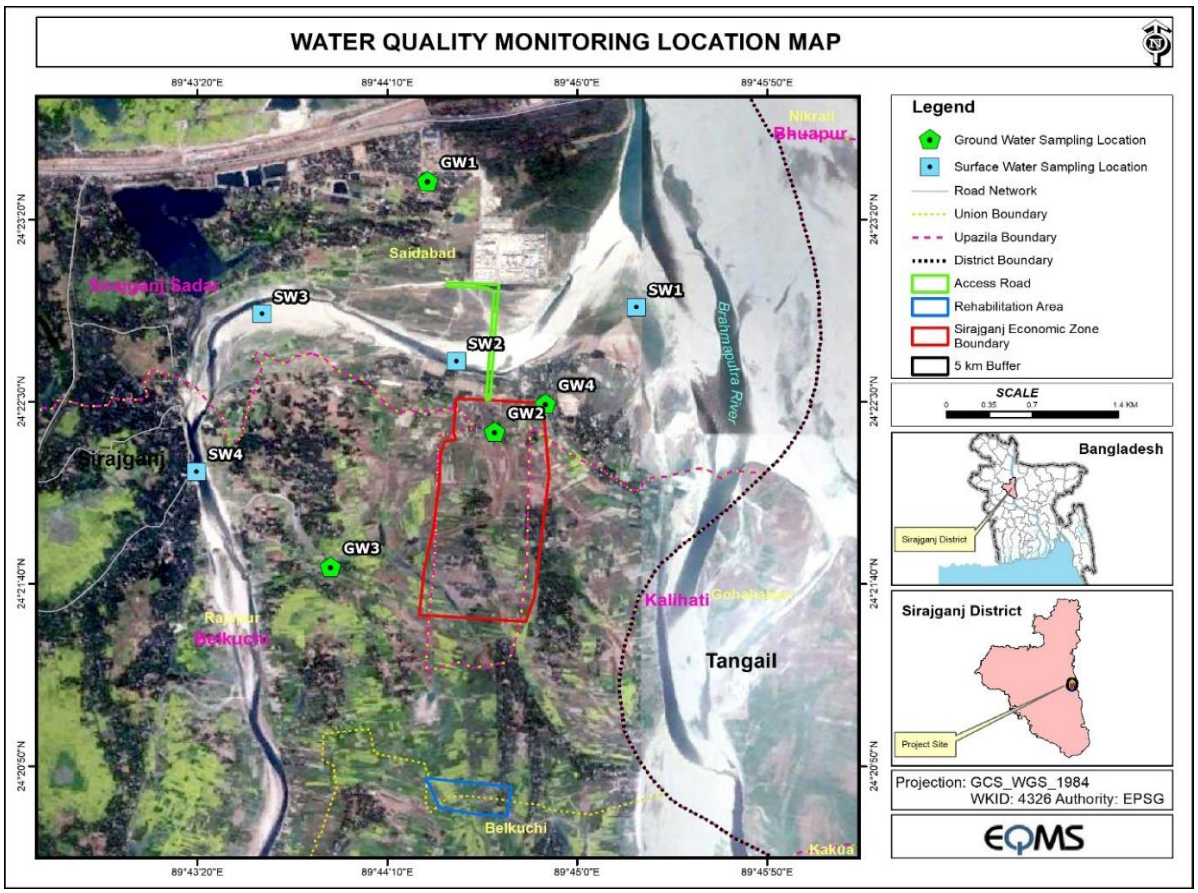


Figure 4-19: Surface Water & Ground Water Sampling Locations



SW1



SW2



SW3



SW4

Figure 4-20: Surface Water Sampling Photos (Source: Field Survey, 2019)

Water sampling and analysis undertaken to understand the overall baseline water quality characteristics of the surface water in the study area. The samples were analyzed for parameters covering physico-chemical characteristics that include certain heavy metals and trace elements. Water samples were collected as grab water samples in pre-washed 2-litre sterilized clean PET bottle for complete physico-chemical analysis. The samples were analyzed as per standard procedures/methods given in Standard Method for Examination of Water and Wastewater Edition 20, published by APHA. Details of the analysis method and protocol are presented in **Table 4-13.** Results of the water quality analysis are presented in **Table 4-14.**

Table 4-13: Methods for Water Analysis

Sl.	Parameter	Test method (APHA)
1.	Temperature (°C)	Digital thermometer
2.	TDS (ppm)	Digital TDS meter
3.	EC (microSiemens/cm)	Digital EC meter
4.	DO (mg/l)	Digital DO meter
5.	pH	Digital pH meter
6.	BOD	5 days incubation
7.	COD	CRM
8.	Chloride	Titrimetric
9.	Hardness	Titrimetric
10.	Fe	AAS
11.	Ca	CRM
12.	Sulphate	UVS

Sl.	Parameter	Test method (APHA)
13.	Turbidity	Turbidity Meter
14.	As	CRM
15.	Cd	AAS
16.	Pb	AAS
17.	Hg	AAS
18.	Mg	AAS
19.	NO_3	Test Kit
20.	NO_2	Test Kit
21.	Oil and Grease	ASTM
22.	PO4	EMD Millipore
23.	K	AAS
24.	Salinity	Salinity Meter
25.	Na	CRM
26.	TOC	UV-Persulfate

Source: SOP

Table 4-14: Surface Water Quality Analysis

Characteristics	Unit	SW1	SW2	SW3	SW4	Bangladesh Standard*					
						Source of drinking water for supply only after disinfecting	Water usable for recreational activity	Source of drinking water for supply after conventional treatment	Water usable by fisheries	Water usable by various process and cooling industries	Water usable for irrigation
Arsenic	mg/L	<0.010	<0.010	<0.010	<0.011	-	-	-	-	-	-
BOD_5	mg/L	2.1	2.4	3	3.5	2 or less	3 or less	3 or less	6 of less	10 or less	10 or less
Cd	mg/L	0.001	0.00094	0.00098	0.00097	-	-	-	-	-	-
Ca	mg/L	100	115	112	116	-	-	-	-	-	-
Chloride	mg/L	2.8	3.2	3.1	3.2	-	-	-	-	-	-
COD	mg/L	32	22	21	24	-	-	-	-	-	-
DO	mg/L	5.8	6.3	5.4	5.8	6 or above	5 of more	6 or more	5 or more	5 or more	5 or more
EC	µS/cm	1300	1200	1200	1250	-	-	-	-	-	-
Fe	mg/L	0.61	0.58	0.63	0.52	-	-	-	-	-	-
Pb	mg/L	<0.01	<0.01	<0.01	<0.01	-	-	-	-	-	-
Hg	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	-	-	-	-	-	-
Mg	mg/L	0	0	0	0	-	-	-	-	-	-
NO_3	mg/L	0	0	0	0	-	-	-	-	-	-

Characteristics	Unit	SW1	SW2	SW3	SW4	Bangladesh Standard*					
						Source of drinking water for supply only after disinfecting	Water usable for recreational activity	Source of drinking water for supply after conventional treatment	Water usable by fisheries	Water usable by various process and cooling industries	Water usable for irrigation
NO_2	mg/L	0.04	0.04	0.05	0.05	-	-	-	-	-	-
Oil and Grease	mg/L	<2.00	<2.00	<2.00	<2.00	-	-	-	-	-	-
PO_4	mg/L	0.2	0.5	0.3	0.4	-	-	-	-	-	-
pH	-	8.27	7.89	7.47	7.54	6.5-8.5	6.5-8.5	6.5-8.5	6.5-8.5	6.5-8.5	6.5-8.5
K	mg/L	3.5	3.2	3.9	4.1	-	-	-	-	-	-
Salinity	mg/L	0.07	0.05	0.05	0.05	-	-	-	-	-	-
Na	mg/L	15	14	15	15	-	-	-	-	-	-
Temperature	^oC	26.7	26.7	26.8	26.8	-	-	-	-	-	-
TDS	ppm	600	600	600	610	-	-	-	-	-	-
TOC	mg/L	<5.00	<5.00	<5.00	<5.00	-	-	-	-	-	-
Hardness	mg/L	84	92	88	90	-	-	-	-	-	-
Turbidity	NTU	115.2	128	86.5	82.4	-	-	-	-	-	-

Source: Laboratory Analysis, 2019 (DPHE, BCSIR and EQMS laboratory)

* Bangladesh Environment Conservation Rules, 1997- Schedule 3 (Standards for inland surface water)

Ground Water Quality

The water sampling and analysis was undertaken to understand the overall baseline water quality of the groundwater in the study area. The groundwater sampling locations were selected to obtain a representative water sample from various zones within the study area. The samples were collected from existing tube wells (hand-tube wells being use by the villagers). A total four (4) ground water samples were collected from different locations of study area. Details of the sampling locations provided in **Table 4-15**, **Figure 4-19** and **Figure 4-21**.

Table 4-15: Details of Ground Water Sampling Locations

Sl.	Sampling location	Sampling Code	Geographic location	Source Type
1	Abdul Mia House, opposite of Manob Mukti Sangstha	GW1	24°23'30.43"N 89°44'20.68"E	Tube well
2	Salim House	GW2	24°22'21.61"N 89°44'38.38"E	Tube well
3	Aminul House	GW3	24°21'44.58"N 89°43'55.13"E	Tube well
4	Abdul Kader House	GW4	24°22'29.32"N 89°44'51.68"E	Tube well

Source: Field Survey, 2019



GW1



GW2



GW3



GW4

Figure 4-21: Ground Water Sampling Photos (Source: Field Survey, 2019)

The samples analyzed for parameters covering physico-chemical characteristics, which included certain heavy metals and trace elements. Water samples were collected at 2L sterilized clean PET bottle for complete physico-chemical study. The samples were analyzed as per standard procedure/method given in Standard Method for Examination of Water and Wastewater Edition 20, published by APHA. Details of the analysis method and protocol are presented in **Table 4-16.**

Table 4-16: Methods for Water Analysis

Sl.	Parameter	Test method (APHA)
1.	Temperature (˚C)	Digital thermometer
2.	TDS (mg/l)	Digital TDS meter
3.	EC (µmhos/*cm*)	Digital EC meter
4.	Lead (Pb)	AAS
5.	pH	Digital pH meter
6.	Arsenic (As)	AAS
7.	Calcium (Ca)	AAS
8.	Iron (Fe)	AAS
9.	Chloride	Titrimetic
10.	Cd	AAS
11.	Cr	AAS
12.	Hardness	CRM
13.	Fluoride	CRM

14.	Mercury	AAS
15.	Potassium	AAS
16.	TC	MFM
17.	FC	MFM

Source: SOP

N.B: AAS-Atomic Absorption Spectrophotometer, CRM-Closed reflex Methods, MFM-Membrane Filtration Method

Detail testing results of ground water analysis is presented in **Table 4-17**.

Table 4-17: Ground Water Quality Analysis Result

Sl.	Parameters	Unit	Sampling code				Bangladesh Standard	WHO
			GW1	GW2	GW3	GW4		
1.	As	mg/L	<0.010	<0.010	<0.010	<0.010	0.05 mg/l	0.05
2.	Cd	mg/L	0.00045	0.00057	0.00045	0.00056	0.005	
3.	Ca	mg/L	200	188	100	195	75	200.0
4.	Chloride	mg/L	5.6	6.3	7.1	6.9	150-600	250.0
5.	Cr	mg/L	0	0	0	0	0.05	
6.	EC	µS/cm	1390	900	450	680	-	2,000 by EPA
7.	Hardness	mg/l	675	525	615	575	200-500	
8.	Fluoride	mg/L	0.14	0.12	0.13	0.12	1.0	1.5
9.	Iron (Fe)	mg/L	0.2	0.2	0.51	0.3	0.3-1	0.3
10.	Lead (Pb)	mg/L	<0.01	<0.01	<0.01	<0.01	0.05	0.01
11.	Mercury	mg/L	<0.001	<0.001	<0.001	<0.001	0.01	
12.	Potassium	mg/L	20	20	18	15	12	
13.	pH	-	7.52	7.05	7.22	7.06	6.5-8.5	9.2
14.	TDS	mg/L	700	450	220	340	1000	1500
15.	Temperature	^{0}C	27.2	27.2	27.1	27.1	20-30 °C	-
16.	TC	N/100ml	0	0	0	0	0	0
17.	FC	N/100ml	0	0	0	0	0	0

Source: Laboratory Analysis, 2019 (DPHE, BCSIR and EQMS laboratory)

The arsenic content of the project site sample was found 0.02 mg/l, which is within the Bangladesh Standards (0.05mg/l). In July 2019, the survey team collected groundwater samples from tube wells in and around the project area. The result of the groundwater field samples and the GoB standards for potable water (ECR, 1997) is shown below in Table B 19 of Annex B. Results revealed that, overall groundwater quality of the project area is within the Bangladesh and WHO standard except Ca, K and hardness of water. These three parameters were found higher that the permitted level. Especially the concentrations of Calcium are approximately 2 times than the Bangladesh standard but are within the WHO standard. Concentrations of Potassium and Hardness are slightly higher than the Bangladesh standard.

4.2.9 Meteorology

Bangladesh is in the tropical monsoon region and its climate is characterized by high temperature, heavy rainfall, often excessive humidity, and fairly marked seasonal variations. From the climatic point of view, three distinct seasons can be recognised in Bangladesh - the cool dry season from November through February, the pre-monsoon hot season from March through May, and the rainy monsoon season which lasts from June through September. January is the coolest month with temperatures averaging near 26°C and April the warmest with temperatures from 33 to 36°C. Most places receive more than 1,525 mm of rain a year, and areas near the hills receive 5,080 mm. Most rains occur during the monsoon (June-September) and little in winter (November-February). Moderate rains are also reported in the months of March, April and October.

Wind direction and speed exhibits seasonal variation. Winds are generally moderate during non-monsoon season, whereas during the monsoon season, these are moderate to strong. The wind speed varies from 1.02 ms to 7.71 ms, with wind speed varying in between 2.31 to 3.34 m/s most of the times. The annual windrose shows the predominant wind direction to be SSE to NNW. During the months of May to October the predominant wind direction is SSE to NNW and during November to April it is NNE to SSW. The climate zone map of Bangladesh is given below in **Figure 4-22** to provide a better understanding of the climatic regions in Bangladesh.

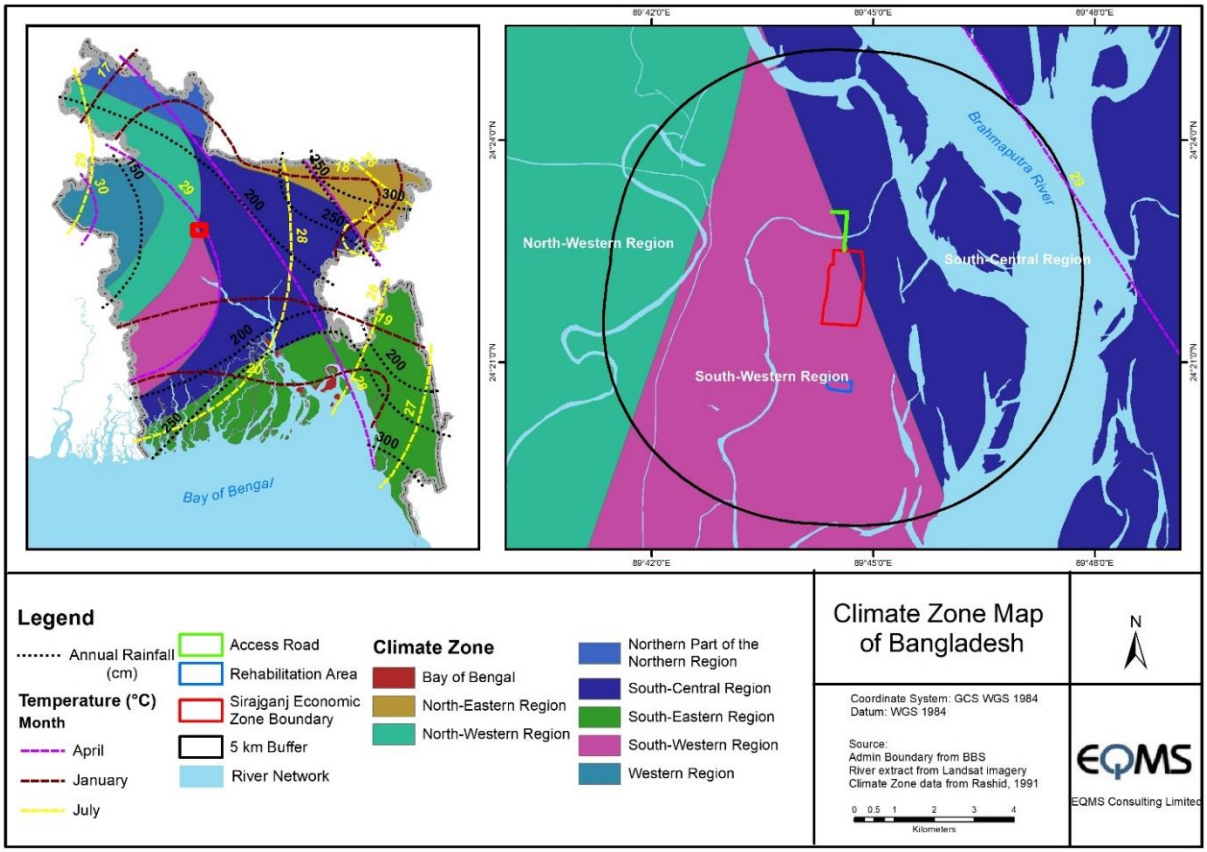


Figure 4-22: Climate Region Map of the Project Site

SEZL project site falls under the South-Western and South-Central climatic sub zone of Bangladesh. These sub climatic zones are experienced with abundant rainfall and moderate temperatures. Eighty percent 80% of the rain falls during the monsoon season. Hail storms and nor westers are also observed in this area. However, to investigate the climatic conditions of the study area SEZL, data from different secondary sources (e.g. BMD, BWDB) have been collected and analyzed.

Long-term Meteorological data of the last 10 years have been collected from the nearest BMD station (Tangail) and analyzed to get the overall micro-climatic conditions of the proposed SEZL area. Details findings of the meteorological analysis are discussed below.

Precipitation

The monthly average normal rainfall variation based on the climatology data and number of normal rainy days in each month in Tangail has been presented in **Figure 4-23.**

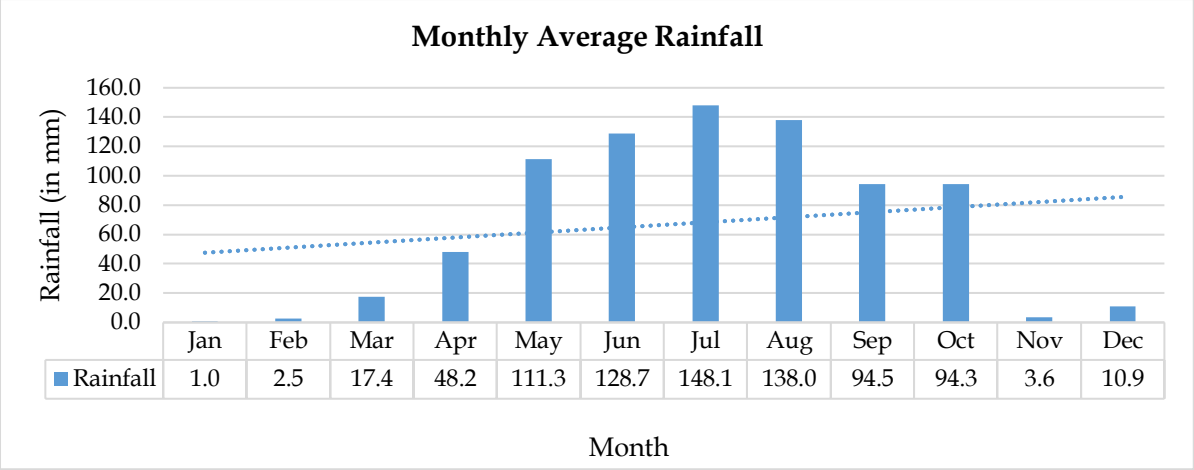


Figure 4-23: Monthly Average Rainfall pattern of the study area

Relative Humidity

Analyzing the meteorological data, it has been found that Relative humidity in the Project AOI is generally above 80% during June to December. The month of March is the driest with relative humidity around 67%. Relative humidity normally varies in the range of 67-84% throughout the year. The monthly variation of normal humidity in Tangail has been presented in **Figure 4-24**.

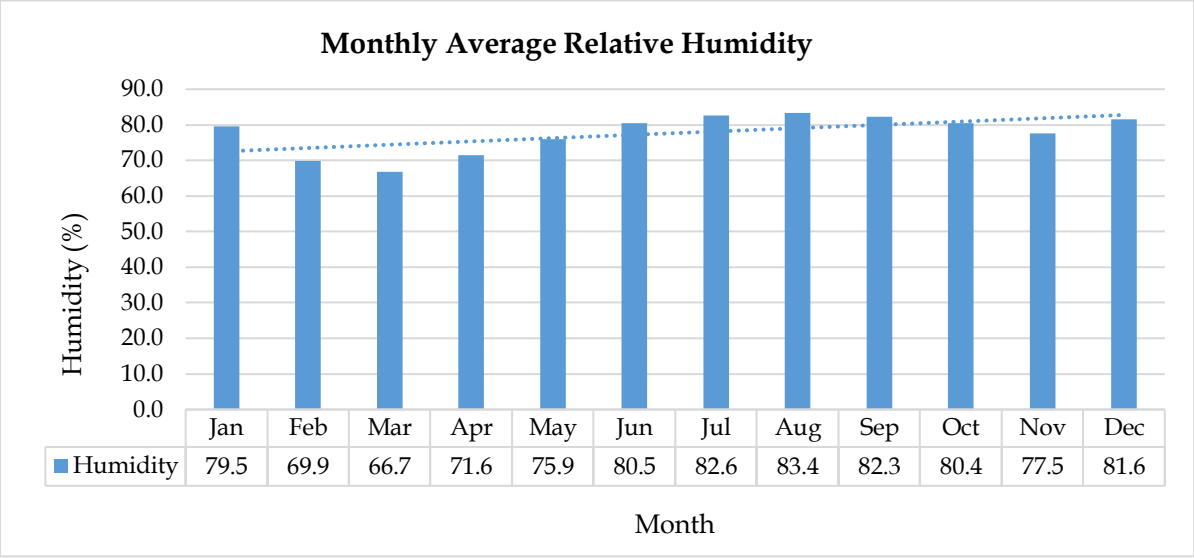
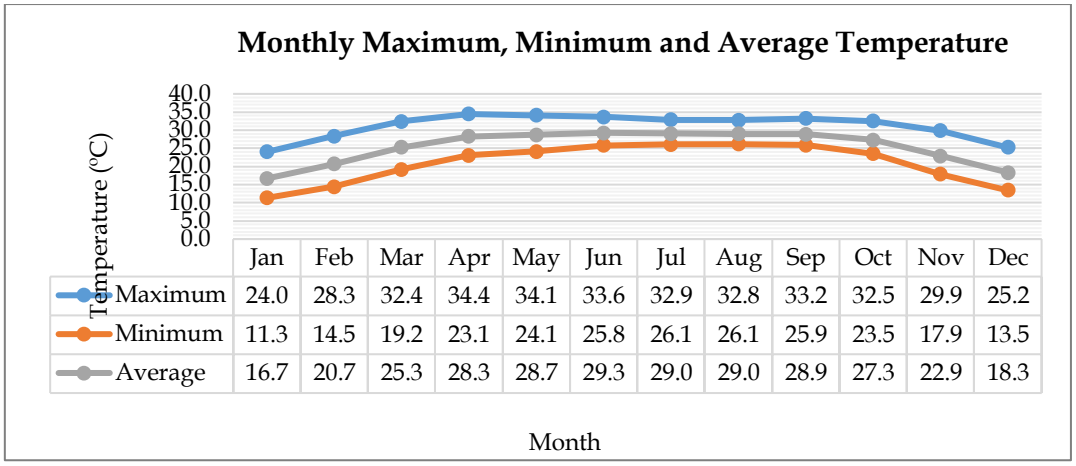


Figure 4-24: Relative Humidity pattern of the study area (Source: BMD Data)

Ambient Air Temperature

The period from February to March is marked by continuous increase in the temperatures. April is the hottest month of the year with a mean daily maximum and minimum temperature of 34.4 °C and 23.1 °C, respectively. With the onset of monsoon by mid-May, the temperatures descend slightly. January is the coolest month of the year with a mean daily maximum and minimum temperature of 24 °C and 11.3 °C, respectively. The monthly variation of normal maximum and minimum temperatures of the project area has been given in the **Figure 4-25**.



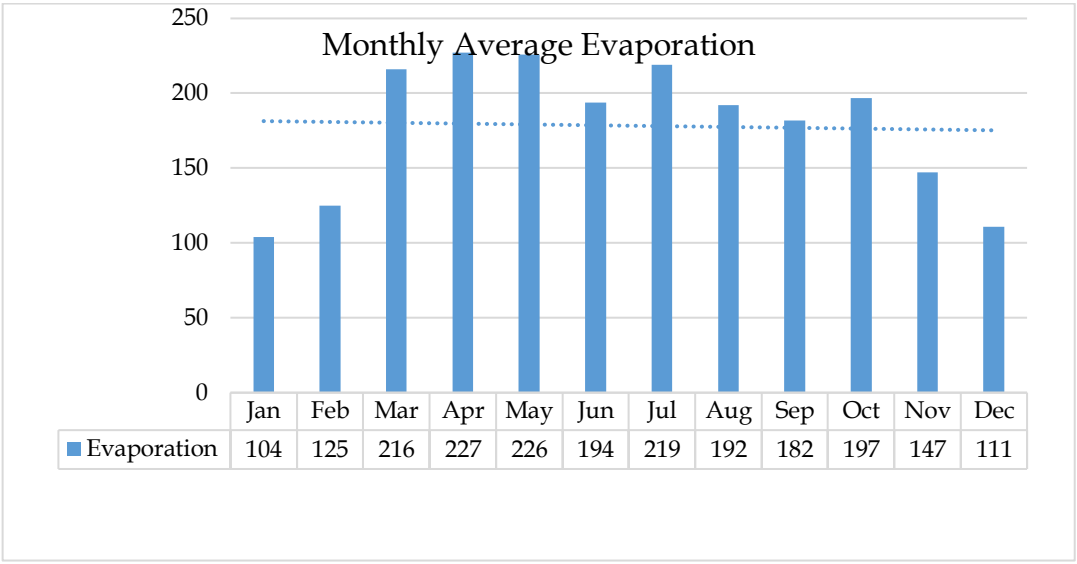
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Maximum	24.0	28.3	32.4	34.4	34.1	33.6	32.9	32.8	33.2	32.5	29.9	25.2
Minimum	11.3	14.5	19.2	23.1	24.1	25.8	26.1	26.1	25.9	23.5	17.9	13.5
Average	16.7	20.7	25.3	28.3	28.7	29.3	29.0	29.0	28.9	27.3	22.9	18.3

Figure 4-25: Monthly Temperature pattern of the study area (Source: BMD Data)

Evaporation

The highest and lowest average evaporation of the project area were 227 mm and 104 mm, respectively in the month of April and January.

The monthly evaporation pattern shows an increasing trend from March to May and decreased at June to December with slightly increase in July and October. The monthly evaporation pattern of the project area has been given in the **Figure 4-26.**



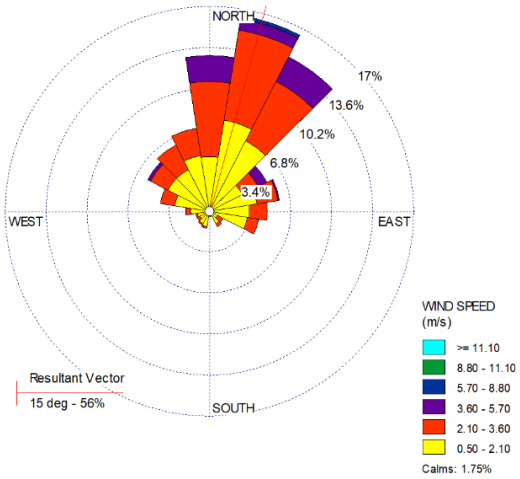
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Evaporation	104	125	216	227	226	194	219	192	182	197	147	111

Figure 4-26: Monthly Average Evaporation trend of the study area (Source: BMD Data)

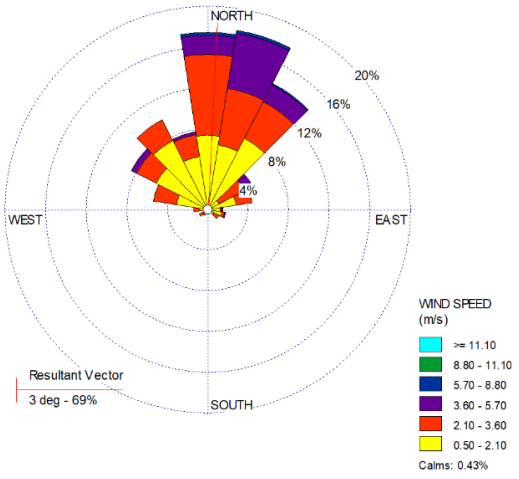
Wind Speed and Direction

Wind direction and speed exhibits seasonal variation. Winds are generally moderate during non-monsoon season, whereas during the monsoon season, these are moderate to strong. The wind speed varies from 1.02 m/s to 7.71 m/s, with wind speed varying in between 2.31 to 3.34 m/s most of the times. The annual windrose shows the predominant wind direction to be SSE to NNW. During the months of May to October the predominant wind direction is SSE

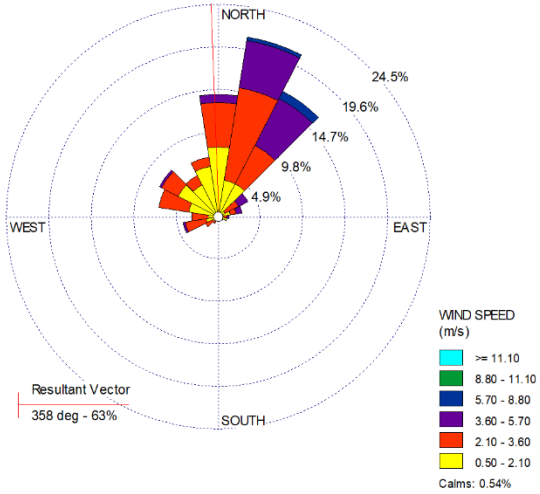
to NNW and during November to April it is NNE to SSW. The annual windrose and monthly wind roses based on the pre-processed meteorological data from are presented in **Figure 4-27**, **Figure 4-28**, **Figure 4-29**, **Figure 4-30** and **Figure 4-31**.



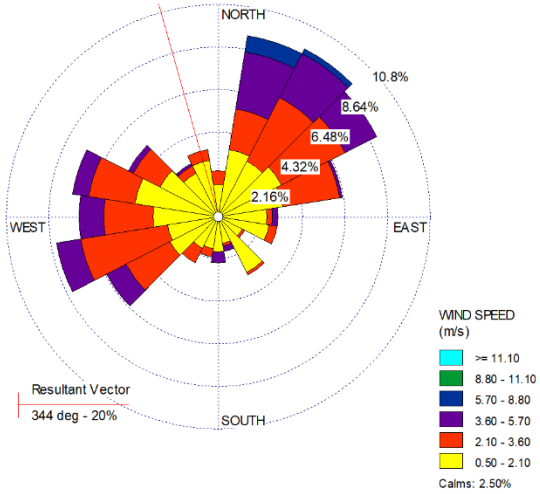
January 2018



February 2018



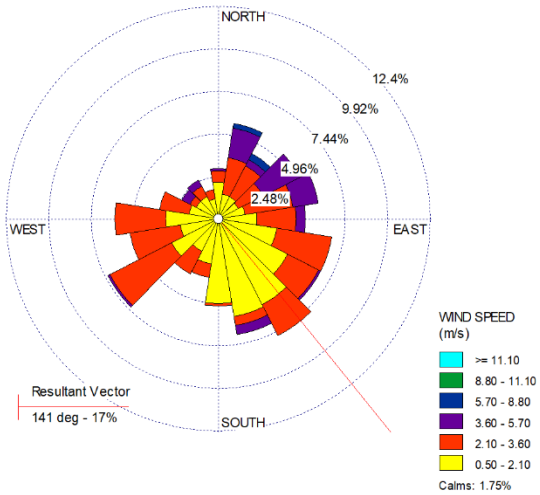
March 2018



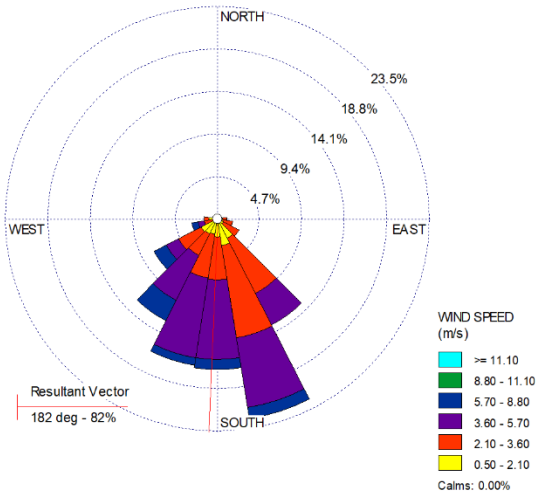
April 2018

Source: TAPM Data

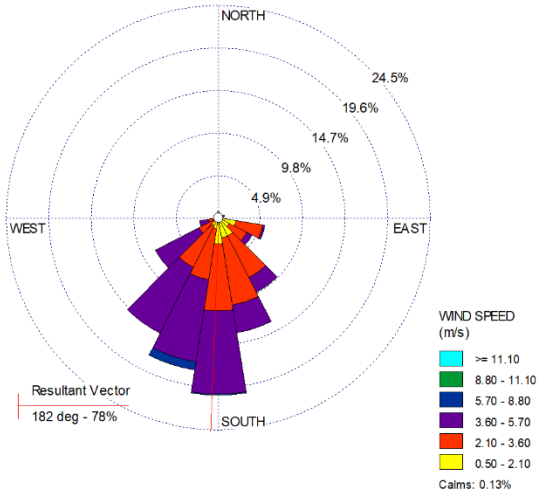
Figure 4-27: WR Plot (January 2018 – April 2018)



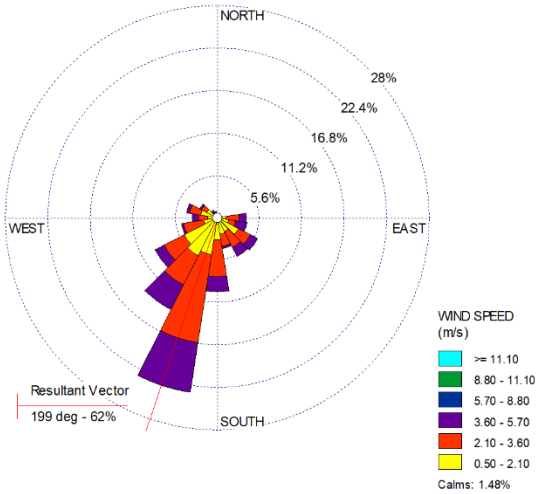
May 2018



June 2018



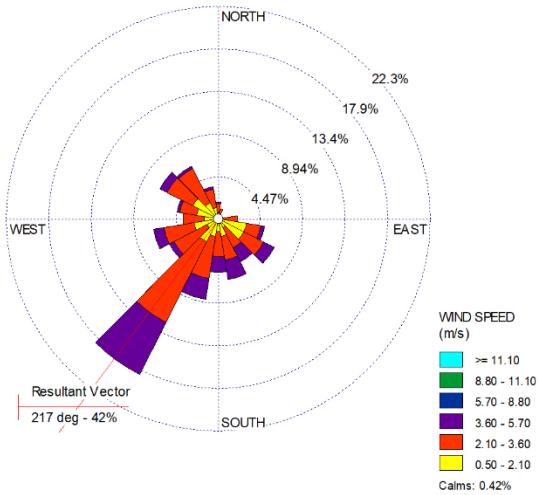
July 2018



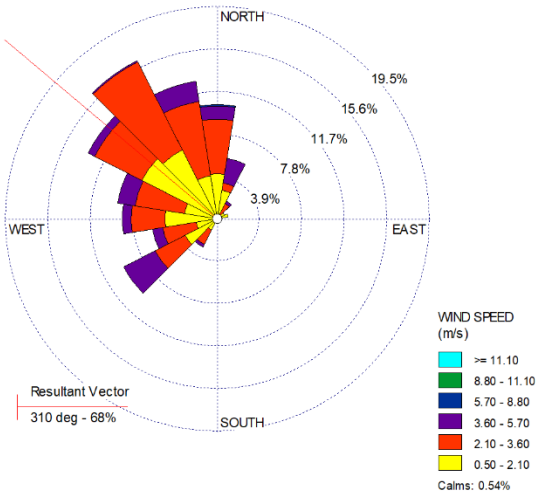
August 2018

Source: TAPM Data

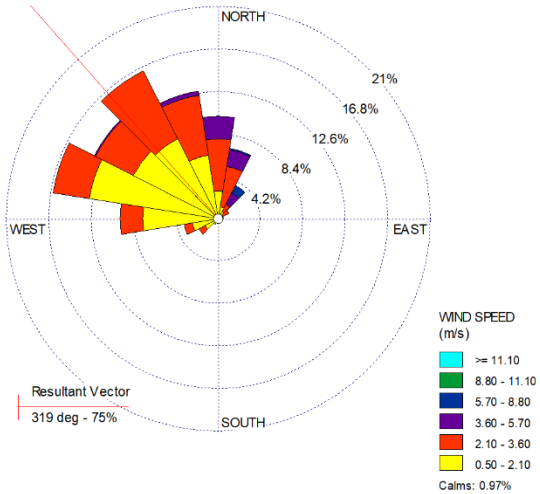
Figure 4-28: WR Plot (May 2018 – August 2018)



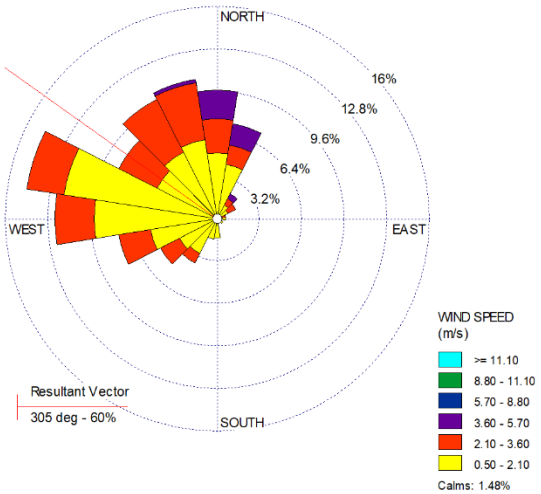
September 2018



October 2018



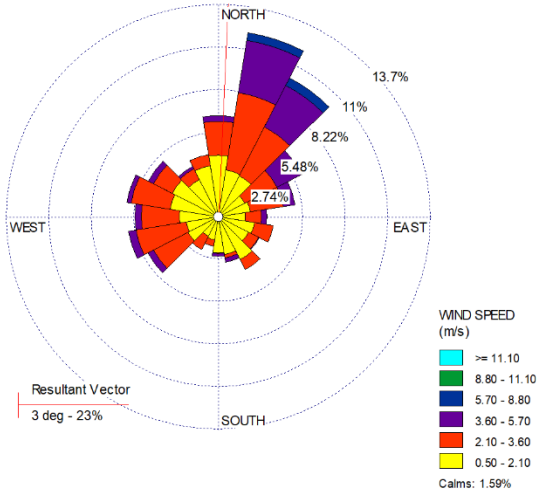
November 2018



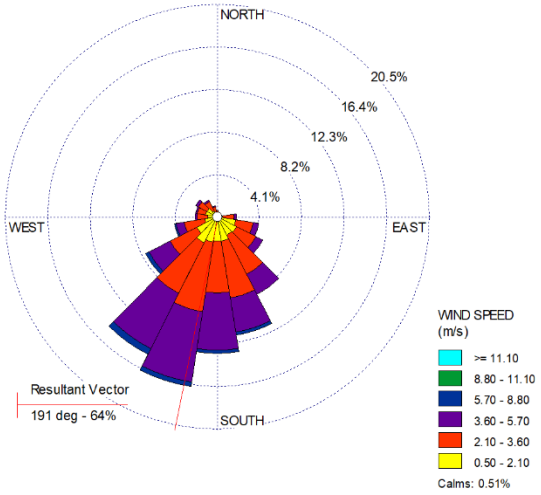
December 2018

Source: TAPM Data

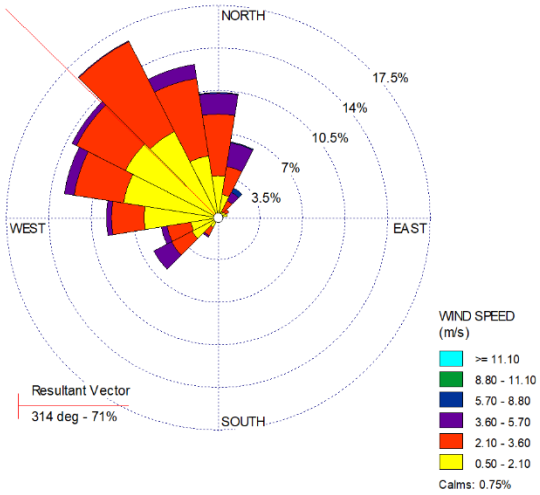
Figure 4-29: WR Plot (September 2018 – December 2018)



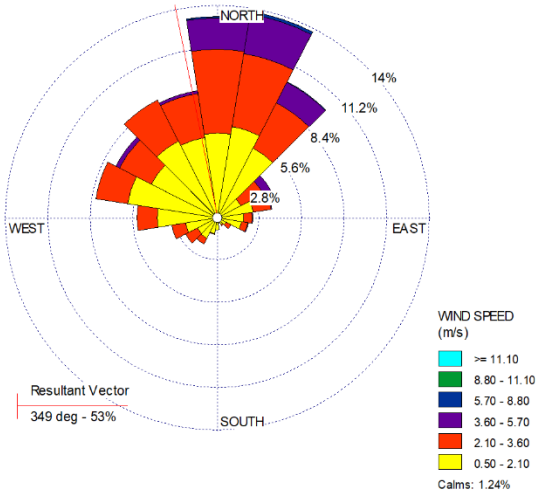
Pre-Monsoon 2018



Monsoon 2018



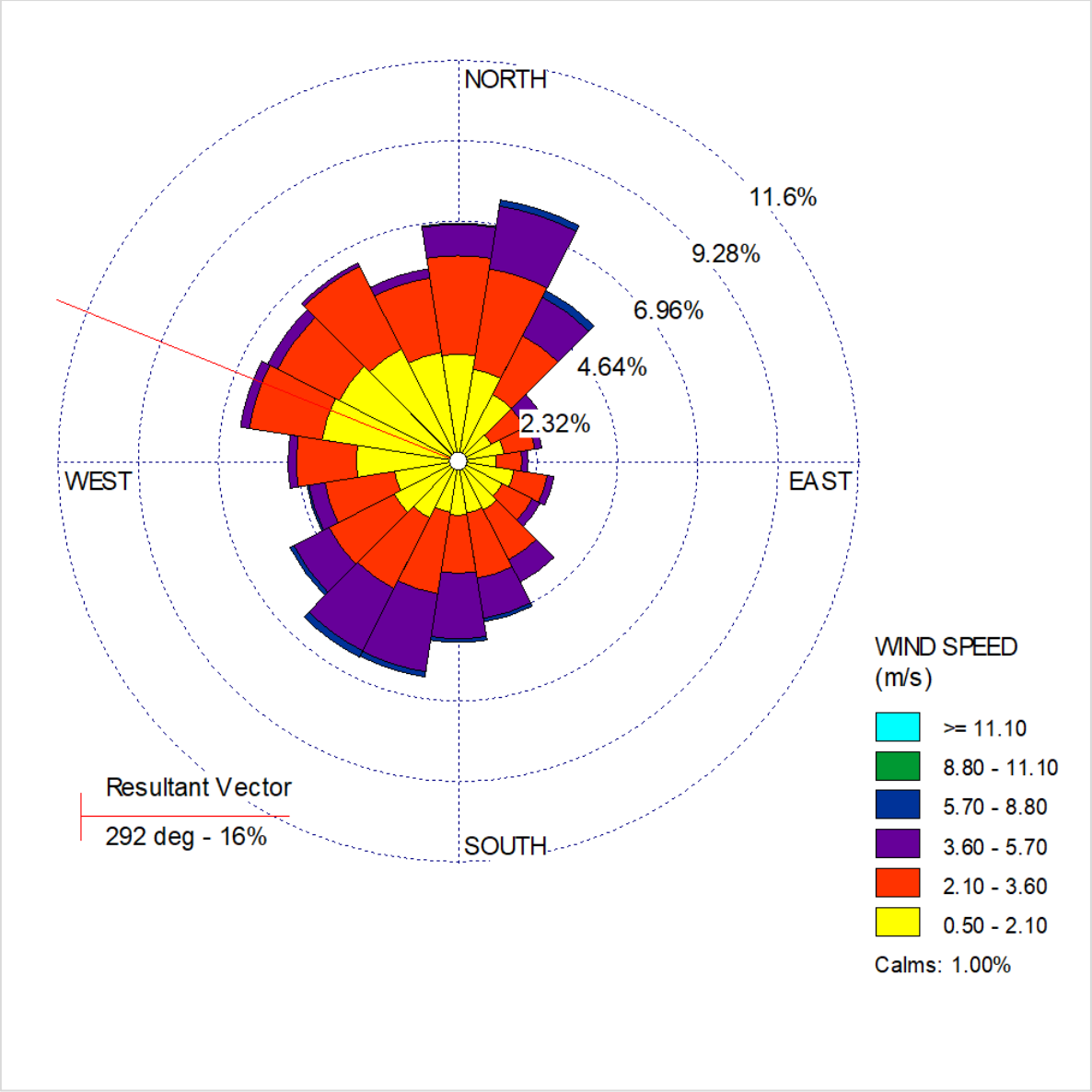
Post-Monsoon 2018



Winter 2018

Source: TAPM Data

Figure 4-30: WR Plot (Pre-monsoon 2018 – Winter 2018)

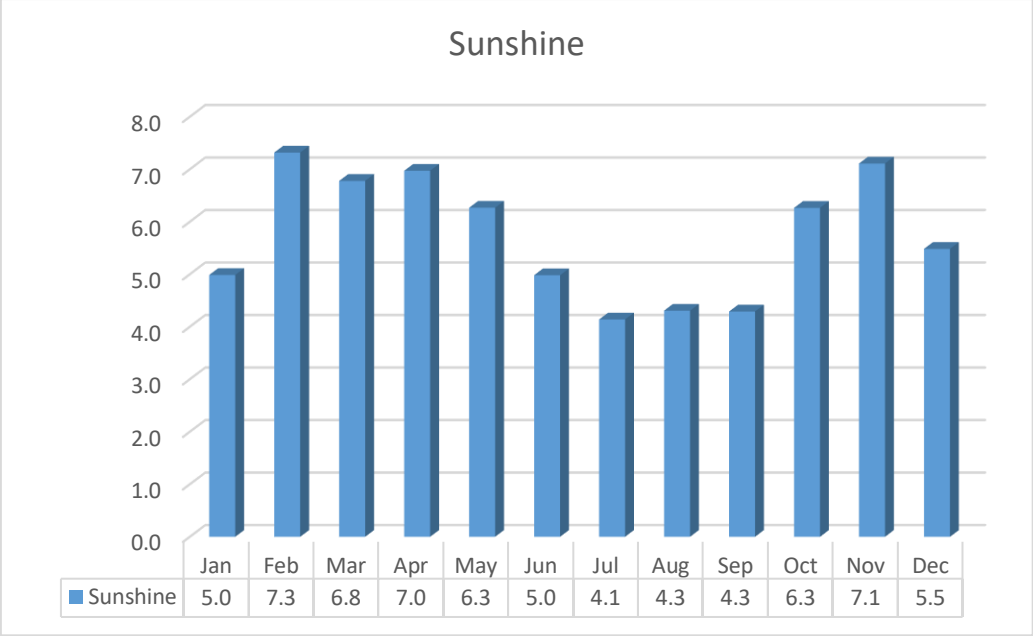


Source: TAPM Data

Figure 4-31: Annual WR Plot, 2018

Sunshine hour

The average monthly sunshine hours at the project has been given in the following **Figure 4-32.**



Source: BMD Data

Figure 4-32: Monthly Average Maximum Sunshine Hours of the study area

4.2.10 Impacts of Climate Change and Natural Hazards

Bangladesh, home to 160 million people, is among the countries most vulnerable to the impacts of climate change. Being a low-lying delta characterized by a dense network of rivers, Bangladesh has been subjected to natural hazards, regardless of climate change. With the onset of globalization, Bangladesh is now experiencing huge infrastructural and industrial development. Experts predict that, the impact of climate change will be risking the country's life, livelihood and economic development as well. The proposed Sirajganj Economic Zone Limited (SEZL) project is on the western bank of the river Jamuna, one of the major rivers of GBM catchment. There are a couple of areas that are under the risk of climate change in near future are discussed below.

Tropical Cyclones and Tidal Surge

Bangladesh very often becomes the landing ground of cyclones formed in the Bay of Bengal. This is because of the funnel shaped coast of the Bay of Bengal, most of the damage occurs in the coastal regions of Khulna, Patuakhali, Barisal, Noakhali, Chittagong and the offshore islands of Bhola, Hatiya, Sandwip, Manpura, Kutubdia, Maheshkhali, Nijhum Dwip, Urir Char and other newly formed islands. The coastal zone of Bangladesh is disaster prone. **Figure 4-33** shows the cyclone affected zone of Bangladesh. According to the figure, proposed project site of SEZL is far away from the coastal areas of Bangladesh. It has less vulnerability to cyclone and associated tidal surge. Change in climatic variability will pose less cyclonic risk to the project site. It also shows that; the proposed project site does not fall under cyclone risk zone or high wind area.

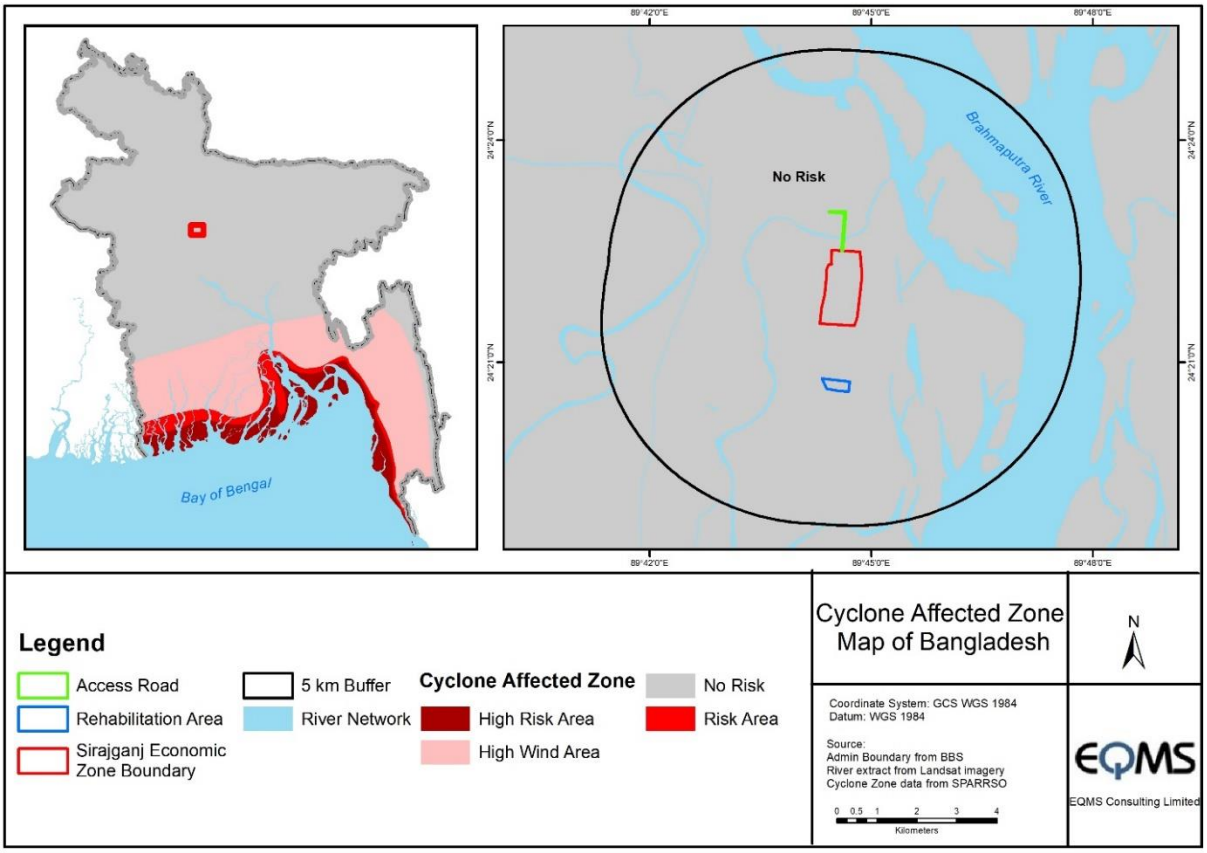


Figure 4-33: Project in the Cyclone Affected Zone Map of Bangladesh

Flood

Floods of high intensity occur when huge rate of discharge of the Bangladeshi rivers is grossly fall behind the rate of accumulation of water. Discharge is often impeded because of low river gradients, unplanned infrastructure and strong backwater effect at the confluences of large rivers, the latter being induced by high oceanic stages. The confluences between the Brahmaputra and the Ganges, and between the Meghna and the combined flow of the earlier two rivers (known as the *Padma*) become two huge water pools during the peak seasons and cause high intensity flooding, particularly in the central part of the country.

A synchronization of peak flows of the major rivers, often caused by variability in timing of occurrence of monsoon over the GBM catchments, induces an unusual situation where the entire drainage system in the floodplain fails to drain all the incoming waters and suffer catastrophic floods of very high intensity. Flood prone areas in Bangladesh is shown in the **Figure 4-34**.

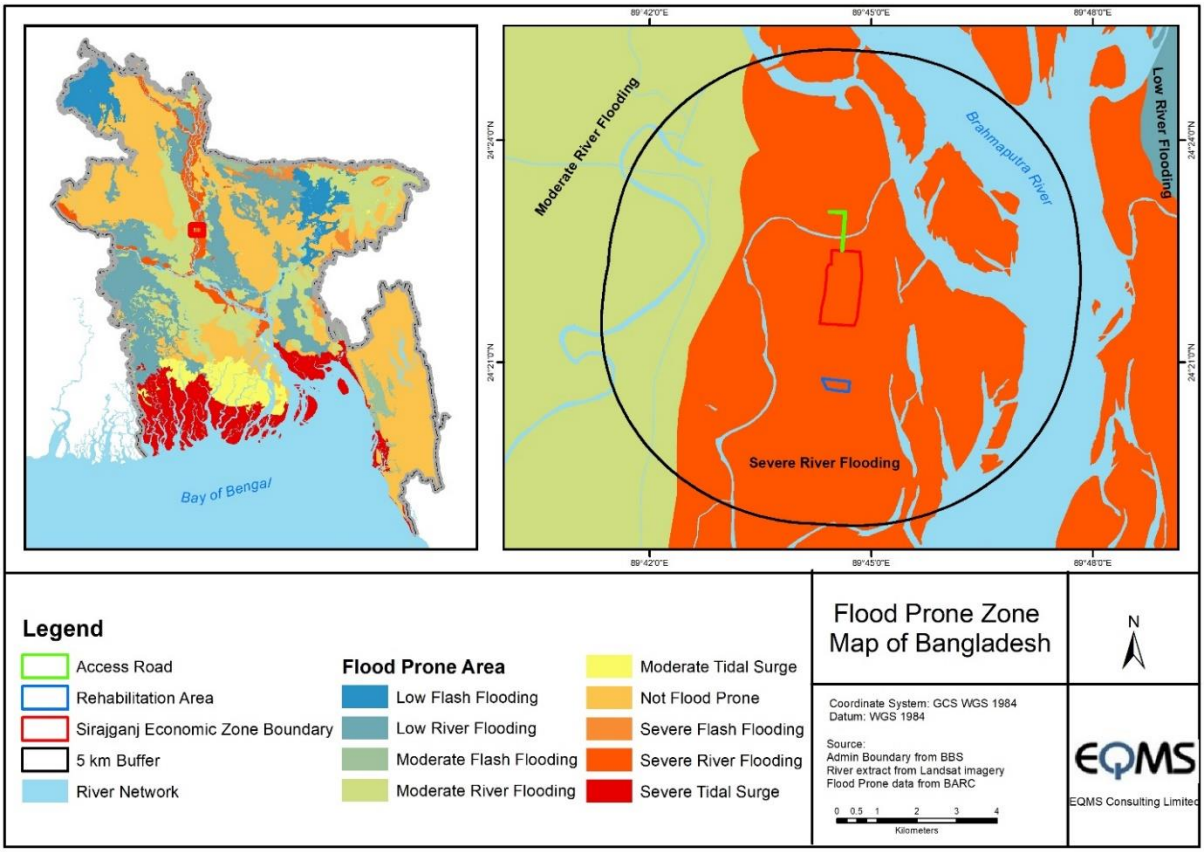


Figure 4-34: Flood-prone areas of Bangladesh

Considering **Figure 4-34Error! Reference source not found.**, The project site falls under severe river flooding zone. According to the 5 km radius area of the project site are within the severe flood prone area. It poses a high risk of heavy flood in future due to climate change. So, the land development needs to be maintained at enough elevation considering the flooding history in this area.

Salinity

Ingress of salinity is a major problem in Bangladesh. The coastal zone directly affected by salinity is extensive and is inhabited by a large population. All the rivers of Bangladesh, except for those in Chittagong in the extreme southeast, combine to form a single, broad, and complex estuary — popularly known as the Meghna estuary. The greatly diminished flow in the dry season allows salinity to penetrate far inland through this estuarine river system.

Major water bodies within 10 km buffer area of proposed SEZL site is Jamuna River. This River carry fresh water in monsoon season and is almost free of salinity. The level of salinity is found very low at the surface water and groundwater as well. Salinity intrusion zone from the studied site is far away and posing less risk of salinity intrusion due to climate change.

GHG Emission

Sirajganj Economic Zone will be established through three stages which are pre-construction, construction and operation period of the project. Both pre-construction and construction period are temporary stage, but operation period will be continued up to a long time. So, in

these stages, surely SEZ will contribute to emit GHGs in this area. Already Sirajganj Power Station (S1, S2, S3 and S4) is emitting CO2 is in good amount to the air. As per the requirement of the fuel, vehicle, electricity and gases in different stages, the assumption on CO2 emission is about 4212 ton/year for construction period and 11.54 ton/day. In this stage for both construction and operation period all the item of scope 1, 2 and 3 is not estimated yet. So, the calculation is based on the available data. During both construction stage and operation stage reporting period, total scope 1, 2, and 3 will be calculated and reported. Detail calculation of GHG emission is given in Annex L of the annexure (section L.5 part).

Riverbank Erosion and Sedimentation

River erosion includes channel shifting, the creation of new channels during floods, bank slumping due to undercutting, and local scour from turbulence caused by obstruction. The Brahmaputra, the Ganges, the Meghna, the Teesta, and the Surma-Kushiyara rivers flow within well-defined meander belts on extensive floodplains where erosion is heavy. Sudden changes are common during floods that cause rapid bank erosion. In lower deltaic areas, river bank erosion is caused by tidal currents and storm surges from the sea.

Most of the rivers of Bangladesh flow through unconsolidated sediments of the Ganges-Brahmaputra-Meghna floodplain and delta. The riverbanks are susceptible to erosion by river current and wave action. The Brahmaputra-Jamuna is a highly braided river, has steadily migrated westward in recent years, eroding the old floodplain and creating new sections of floodplain on its east bank. It has changed its initial course completely after 1762.

In contrast, Bangladesh is the outlet of all the major upstream rivers and the average annual sediment load that passes through the country to the Bay of Bengal ranges between 0.5 billion to 1.8 billion tons. All rivers in Bangladesh are alluvial and highly unstable. Alluvial channels consist primarily of deposited sediment that originated upstream. Constant interactions occur within the suspended sediment load of the channel, leading to significant changes in channel geometry. A part of the sediment load is deposited on the floodplain, gradually changing its topography, and often severely reducing the water conveyance capacity and navigability of the drainage channels. Sediment rating curves developed by the Master Plan Organization (MPO) for its National Water Plan, Phase I (1986) and Phase II (1991), indicated an increase in sediment load in the Ganges and the Brahmaputra between the two periods. There was a sediment discharge increase of 16 per cent at Bahadurabad on the Brahmaputra (near SEZL site) and 46 per cent at Hardinge Bridge on the Ganges. Not all the sediment that flows into the country travels down to the Bay of Bengal; a part is deposited within the channels. The consequence is progressive siltation and decrease of channel depth, thereby increasing the floodability of the alluvial plain. This will eventually increase in coming days due to climate change. River Erosion map of the SEZL surrounding area is shown in **Figure 4-35**.

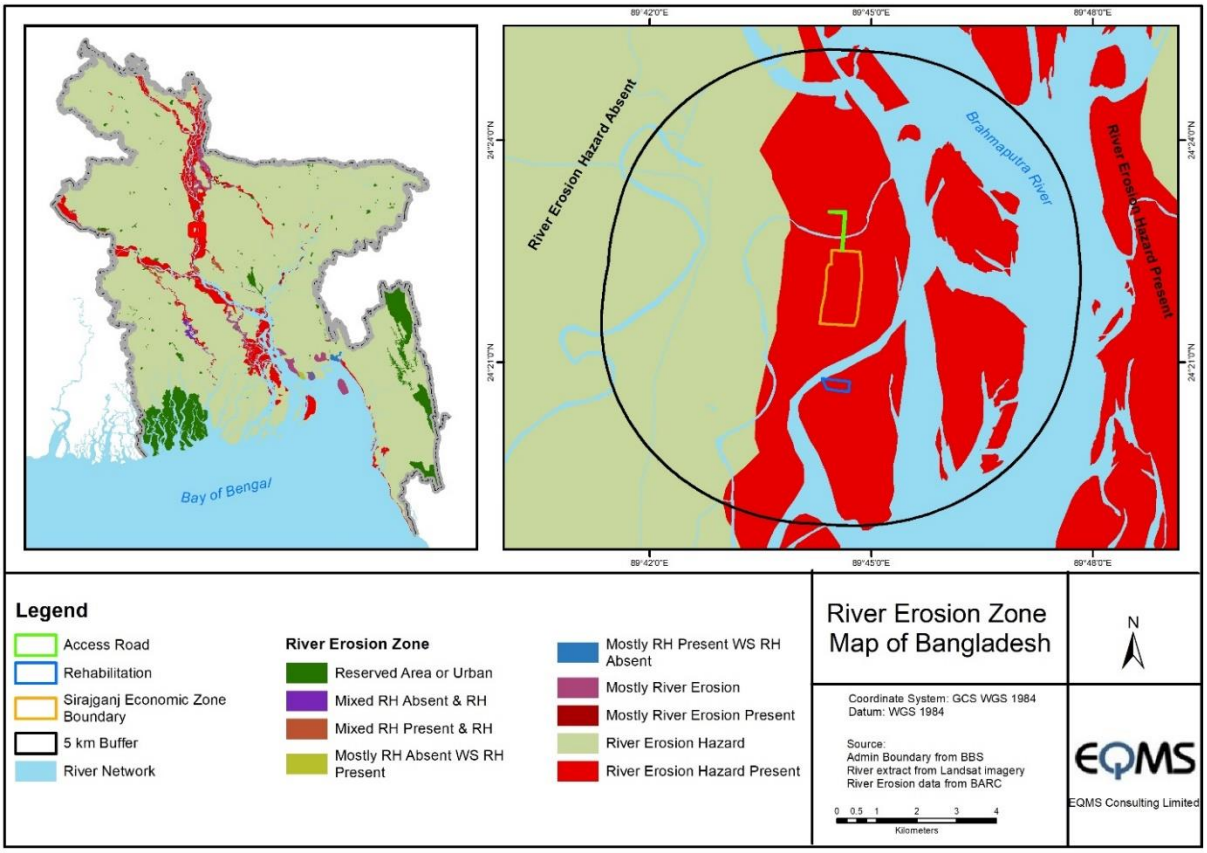


Figure 4-35: River Erosion map of the SEZL study area

According to **Figure 4-35**, Proposed SEZL site is located on the west bank of Jamuna River. It shows that, the project area is already experiencing severe riverbank erosion and sedimentation. Climate change will expose it to the high risk of riverbank erosion and associated sedimentation in coming days. So, special attention needs to be provided on the design and construction phase of the guide bund of the project area.

Drought

In terms of moisture retention capacities, the soils of Bangladesh vary considerably. Based on the characteristics of moisture retention capacity, infiltration etc. high prevalence of drought is observed in the western districts of Rajshahi, Bogra, Pabna, Dinajpur, Rangpur and Kustia. The proposed SEZL site at Sirajganj are close to these districts. It is an alarming matter that, climate change anomalies may affect this area with the impacts of drought.

Earthquake

Earthquake trembling or shaking movement of the earth's surface. Most earthquakes are minor tremors, while larger earthquakes usually begin with slight tremors, rapidly take the form of one or more violent shocks, and end in vibrations of gradually diminishing force called aftershocks. Earthquake is a form of energy of wave motion, which originates in a limited region and then spreads out in all directions from the source of disturbance. It usually lasts for a few seconds to a minute. The point within the earth where earthquake waves originate is called the focus, from where the vibrations spread in all directions. They reach the

surface first at the point immediately above the focus and this point is called the epicenter. It is at the epicenter where the shock of the earthquake is first experienced.

Based on the depth of focus, an earthquake may be termed as shallow focus (0-70 km), intermediate focus (70-300 km), and deep focus (> 300 km). The most common measure of earthquake size is the Richter's magnitude (M). The Richter scale uses the maximum surface wave amplitude in the seismogram and the difference in the arrival times of primary (P) and secondary (S) waves for determining magnitude (M). The magnitude is related to roughly logarithm of energy, E in ergs.

Earthquakes originate due to various reasons, which fall into two major categories viz non-tectonic and tectonic. The origin of tectonic earthquakes is explained with the help of 'elastic rebound theory'. Earthquakes are distributed unevenly on the globe. However, it has been observed that most of the destructive earthquakes originate within two well-defined zones or belts namely, 'the circum-Pacific belt' and 'the Mediterranean-Himalayan seismic belt'.

Although Bangladesh is extremely vulnerable to seismic activity, the nature and the level of this activity is yet to be defined. In Bangladesh complete earthquake monitoring facilities are not available. The Meteorological Department of Bangladesh established a seismic observatory at Chittagong in 1954. This remains the only observatory in the country.

Accurate historical information on earthquakes is very important in evaluating the seismicity of Bangladesh in close coincidences with the geotectonic elements. Information on earthquakes in and around Bangladesh is available for the last 250 years. The earthquake record suggests that since 1900 more than 100 moderates to large earthquakes occurred in Bangladesh, out of which more than 65 events occurred after 1960. This brings to light an increased frequency of earthquakes in the last 30 years. This increase in earthquake activity is an indication of fresh tectonic activity or propagation of fractures from the adjacent seismic zones.

Bangladesh is surrounded by the regions of high seismicity which include the Himalayan Arc and Shillong Plateau in the north, the Burmese Arc, Arakan Yoma anticlinorium in the east and complex Naga-Disang-Jaflong thrust zones in the northeast. It is also the site of the Dauki Fault system along with numerous subsurface active faults and a flexure zone called Hinge Zone. These weak regions are believed to provide the necessary zones for movements within the basin area.

In the generalised tectonic map of Bangladesh, the distribution of epicentres is found to be linear along the Dauki Fault system and random in other regions of Bangladesh. The investigation of the map demonstrates that the epicentres are lying in the weak zones comprising surface or subsurface faults. Most of the events are of moderate rank (magnitude 4-6) and lie at a shallow depth, which suggests that the recent movements occurred in the sediments overlying the basement rocks. In the northeastern region (Surma Basin), major events are controlled by the Dauki Fault system. The events located in and around the Modhupur Tract also indicate shallow displacement in the faults separating the block from the alluvium.

The first seismic zoning map of the subcontinent was compiled by the Geological Survey of India in 1935. The Bangladesh Meteorological Department adopted a seismic zoning map in 1972. In 1977, the Government of Bangladesh constituted a Committee of Experts to examine the seismic problem and make appropriate recommendations. The Committee proposed a zoning map of Bangladesh in the same year.

A detailed map on earthquake zones of Bangladesh is shown in the **Figure 4-36**. As per analysis of the seismicity map, the project area of SEZL falls under zone-2 with gradient of 0.15g. It implies that, the project area is moderately vulnerable to earthquake. As a result, the BNBC guideline should be given special consideration during the design and construction phase.

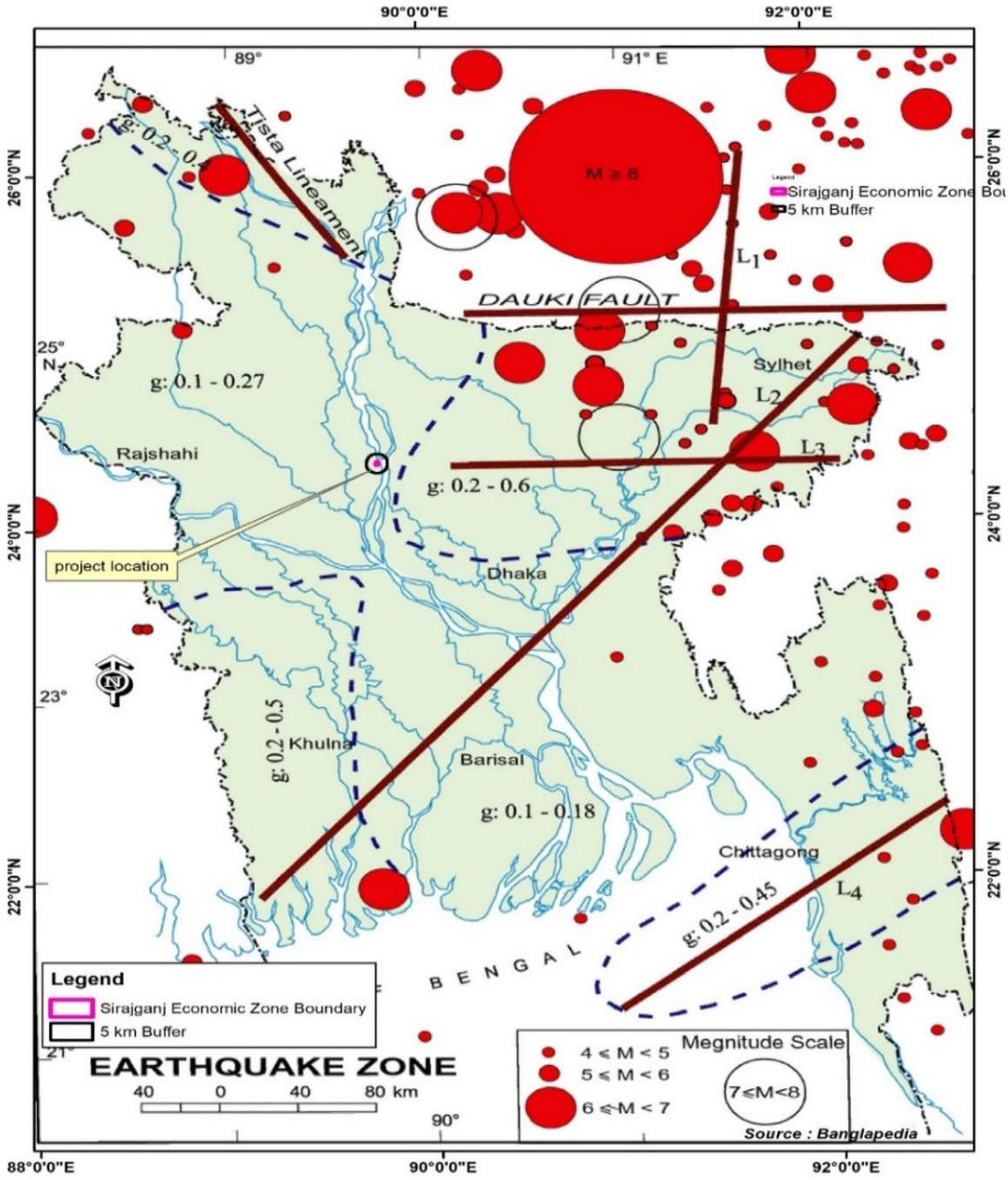


Figure 4-36: Earthquake zones of Bangladesh

Water Resource and Hydrology

In a high-density country like Bangladesh, the effects of Climate Change on the Surface and Ground water resources will be very severe and alarming. Changes to water resources and hydrology will have a significant impact on the country's economy, where people mostly depend on the Surface water for Irrigation, Fishery, Industrial production, Navigation, and similar other activities. There is a high chance of climate change impact on the surface and

groundwater of the project area which will affects life and livelihood of the community and the industrial production as well.

Extreme Temperature

Figure 4-25 shows the monthly Temperature anomalies around the proposed SEZL project site. The overall trend of the regional temperature suggests that, the project may have to face extreme temperature anomalies because of climate change.

Rainfall Pattern

The overall pattern of rainfall is changing over the years which will ultimately impact the microclimate due to climate change. **Figure 4-23 s**hows that, the regularity of the rainfall pattern and the sequence of monsoon is varying from years to years. Climate change will impact this pattern more in coming days.

Climate Change and Security Issue

The climate change in Bangladesh creates insecurities for food, water, life, property, settlement, livelihood assets, livelihoods, and others. Climatic impacts reduce securities directly and indirectly. Environmental degradation, degradation of land resources ultimately reduces food securities, health securities etc and at the same time increases conflicts over resources and livelihood persuasions. Following are limited elaborations of insecure domains;

Food security: Loss of crop due to flood, storm surge, cyclone, and drought are increasing every year. Permanent inundation is also limiting crop production. Peoples living in the project area are at risk of food security due to climate change.

Water scarcity: Reduced precipitation, prolonged dry season and drought are resulting scarcity of drinking water. Contamination of fresh water resources will also increase the vulnerability of the local community because of climate change.

Loss of property and life: An increasing number of people are suffering from damage or loss to their property and sometime life. Increased floods and river bank erosion destroys and damage people's properties including land, house, cattle, and other livelihood assets and living essentials. Frequent disasters increase damage and loss by many folds. Climate change may worsen the existing scenario.

Land degradation and loss: Overall impact of climate change will have a chance to trigger the land degradation and loss near the proposed project area.

Loss of livelihoods: Land loss and degradation, scarcity of water, floods, and other hazards reduces livelihood opportunities. The rough weather limits fishing opportunities. Health hazards, malnutrition, access to services prior, during and after disasters reduces working days and opportunities. Peoples of project area may have to search for alternative livelihood due to climate change impacts.

Insecurity of women: Women and disadvantaged groups are suffering more during disasters as they don't receive warning in time and women must take care of their children, elderly and

disabled. Climate change may increase the vulnerability of women's living around the proposed project area.

Displacement: People compelled to move from their land to other places raises conflicts for resources where they move. Most migrants end up in urban slums, particularly in Dhaka (capital), and there is some evidence that this constant influx of people is contributing to rising crime and insecurity in these areas. Climate change triggered flood and riverbank erosion may cause displacement near project area in coming days.

4.2.11 Ambient Air Quality

The objective of the ambient air quality-monitoring program was to establish the baseline ambient air quality in the study area. The profile of the study area is mainly semi urban, which has a mix of scattered settlements, industries and agriculture areas. Major possible source of air pollution in this area is industrial activities. Other activities, which add to the air pollution, are vehicular movement, agricultural activities, and domestic emissions.

The air quality monitoring locations selected based on the locations of settlements and receptors within the study area. Logistical factors such as consent of villagers, mainly the house owners, accessibility, security, etc. have also been considered in finalizing the monitoring stations.

Sampling Location Selection

The baseline status of the ambient air quality has been established through a scientifically designed ambient air quality-monitoring network. The ambient air quality monitoring locations are based on the following aspects covered in the field survey plan developed prior to the fieldwork:

- Meteorological conditions of the area are based on information provided by the BMD observatory at Dhaka;
- Topography of the study area; and
- Location of sensitive receptors such as major settlements.

The geographical locations and setting of the ambient air quality monitoring locations are illustrated below though detailed of the sampling locations in **Table 4-18, Figure 4-37** and **Source:** Field Survey, 2019

Figure 4-38.

Table 4-18: Ambient Air Quality Sampling Locations

Sl.	Sampling Station	Station Code	Geographic Location	Location Setting
1.	Punorbason Mosque	AQ1	24°23'40.05"N, 89°44'17.62"E	Rural
2.	Salim House	AQ2	24°22'21.70"N, 89°44'38.47"E	Rural

3.	Ramdhuni Bari	AQ3	24°21'45.48"N, 89°43'53.63"E	Rural
4.	Main Gate of CCPP Sirajganj	AQ4	24°23'15.35"N, 89°44'33.90"E	Industrial

Source: Field Survey, 2019

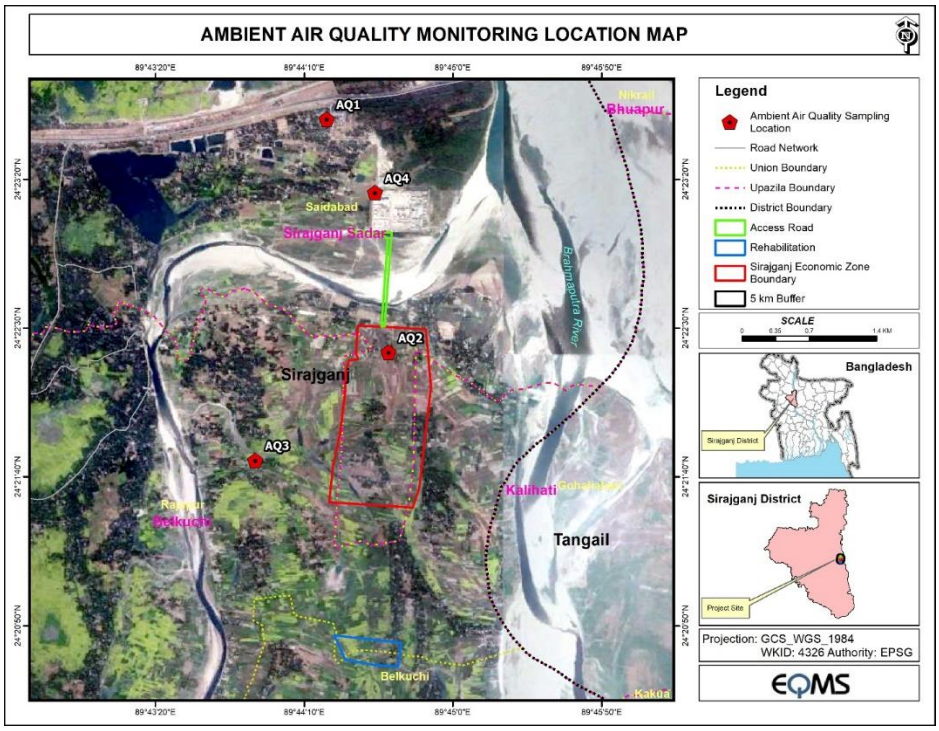


Figure 4-37: Air quality sampling locations map



AQ1



AQ2



AQ3



AQ4

Source: Field Survey, 2019

Figure 4-38: Air Quality Monitoring Locations

Methodology

The wet season ambient air quality of the study area monitored at Four (4) locations during the monitoring period (September & October 2017) and dry season ambient air quality of the study area monitored at Four (4) locations during the monitoring period (March 2018).

The monitoring parameters included Particulate Matter (SPM, PM10 and PM2.5), Sulphur Dioxide (SO_2), Oxides of Nitrogen (NOx), and Carbon Monoxide (CO). SPM and CO monitored for 8 hours with the remaining parameters monitored on a 24-hourly basis during the study period. Methodology for Analysis of Ambient Air Quality are shown in **Table 4-19**.

Table 4-19: Methodology for Analysis of Ambient Air Quality

Sl.	Parameter	Analysis procedure
1.	SPM	Gravimetric method
2.	PM10	Gravimetric method
3.	PM2.5	Gravimetric method
4.	SO_2	Colorimetric method at 560nm using spectrophotometer readings (West-Gaeke method)
5.	NOx	Colorimetric method at 540 nm using spectrophotometer readings (Jacob and Hochheiser method)
6.	CO	Digital CO meter

Source: SOP

Ambient Air Quality in the Study Area

The monitored ambient air qualities near the proposed SEZL site are summarized in **Table 4-20**.

Table 4-20: Ambient Air Quality in the Study Area

SL.	Sampling Station Code	Ambient air pollution concentration					
		PM2.5	PM10	SPM	SO_2	NOx	CO
	Unit	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	ppm
1	AQ1	62.32	92.32	179.42	8.24	32.13	0.03
2	AQ2	45.32	74.23	143.45	24.32	22.32	0.03
3	AQ3	24.67	64.32	110.6	28.45	26.37	0.008
4	AQ4	69.32	114.36	250.56	43.24	51.67	1
Duration (hours)		24	24	8	24	24	8
Weather Condition		Sunny					
Bangladesh Standard (*according to Environmental Conservation Rules' 1997 and subsequent amendment in 2005*)		65	150	200	365	100 (Annual)	9
IFC EHS Guideline (2007)		25	50	-	20	40 (Annual)	-
Method of analysis		Light Scattering Nephotometer				High Sensitivity Electrochemical	

Source: Laboratory Analysis, 2019 (EQMS)

Note:

** 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 19thJuly 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)*

PM2.5

The 24-hourly average PM2.5 concentration in ambient air in the study area was recorded in the range of 24.67 µg/m³ – 69.32 µg/m³. All the monitoring locations result except AQ4 was

within the 24-hourly National Ambient Air Quality Standard (NAAQS) for PM2.5 in Bangladesh. But in consideration to WBG EHS Guidelines (2007), results of all locations were found higher that the standard limit.

PM10

The 24-hourly average PM10 concentration in ambient air in the study area was recorded in the range of 64.32 µg/m^3–114.36 µg/m^3. All the monitoring locations result was within the 24-hourly National Ambient Air Quality Standard (NAAQS) for PM10 in Bangladesh but higher than the WBG EHS Guidelines (2007).

SPM

The 24-hourly average SPM concentration in ambient air in the study area was recorded in the range of 110.6 µg/m^3 - 250.56 µg/m^3. All the monitoring locations except AQ4 results were within the 24-hourly National Ambient Air Quality Standard (NAAQS) for SPM in Bangladesh but results of AQ4 was higher than the national standard. No standards for SPM included in WBG EHS Guidelines (2007).

SO_2

The 24-hourly average SO_2 concentration was recorded within the range of 8.24 µg/m^3 – 43.24 µg/m^3. All the monitoring locations results were found within the 24-hourly National Ambient Air Quality Standard (NAAQS) for SO_2 in Bangladesh. In addition, results of all monitoring locations except AQ1 were found higher than the WBG EHS Guidelines (2007).

NOx

The 24-hourly average NOx concentration was recorded in the range of 22.32 µg/m^3 – 51.67 µg/m^3. All the monitoring locations were within the annual National Ambient Air Quality Standard (NAAQS) for NOx in Bangladesh. In addition, all locations monitoring results except AQ4 were found within the WBG EHS Guidelines (2007), results at AQ4 were found higher than the standard.

CO

The 8-hourly CO concentration was recorded at 0.008 ppm - 01 ppm range. CO concentrations were recorded at all the monitoring locations was within the Bangladesh Standards (9ppm). No available standards for CO are included in WBG EHS Guidelines (2007).

Air Pollution

Air quality of the project area were recorded within the National Ambient Air Quality Standard (NAAQS) of Bangladesh except for the PM2.5 and SPM value at AQ4. On the contrary, values of air quality parameters of almost all the locations were recorded higher than the permitted limit as prescribed in the WBG EHS Guideline (2007). This may be resulting from the emission of vehicles from adjacent highway, emission from shallow engine water vehicles at Jamuna River and Sirajganj CCPP.

4.2.12 Ambient Noise Levels

Noise levels were recorded at Six (06) locations in the study area during the monitoring period. Noise levels were recorded in the form of sound pressure levels with the help of a digital sound level meter. The details of noise monitoring locations are shown in **Table 4-21**, **Figure 4-39** and **Figure 4-40**. The purpose of ambient noise level measurement was to determine sound intensity at the monitoring locations. These locations were chosen in such a way that a representative data could be record all over the study area.

Table 4-21: Details of Ambient Noise Monitoring Locations

Sl.	Location	Location Code	Geographic location	Location setting
1.	In front of Jamuna Health Clinic	NL1	4°23'34.91"N 89°43'53.46"E	Silent
2.	Salim House	NL2	24°22'21.51"N 89°44'38.53"E	Residential
3.	Aminul House	NL3	24°21'44.54"N 89°43'55.34"E	Residential
4.	Punorbason House Market	NL4	24°23'32.20"N 89°43'47.19"E	Commercial
5.	Ponchoshona-Boro Shimul High School	NL5	24°23'24.41"N 89°44'8.12"E	Silent
6.	Main gate of CCPP Sirajganj	NL6	24°23'15.51"N 89°44'33.96"E	Industrial

Source: Field Survey, 2019

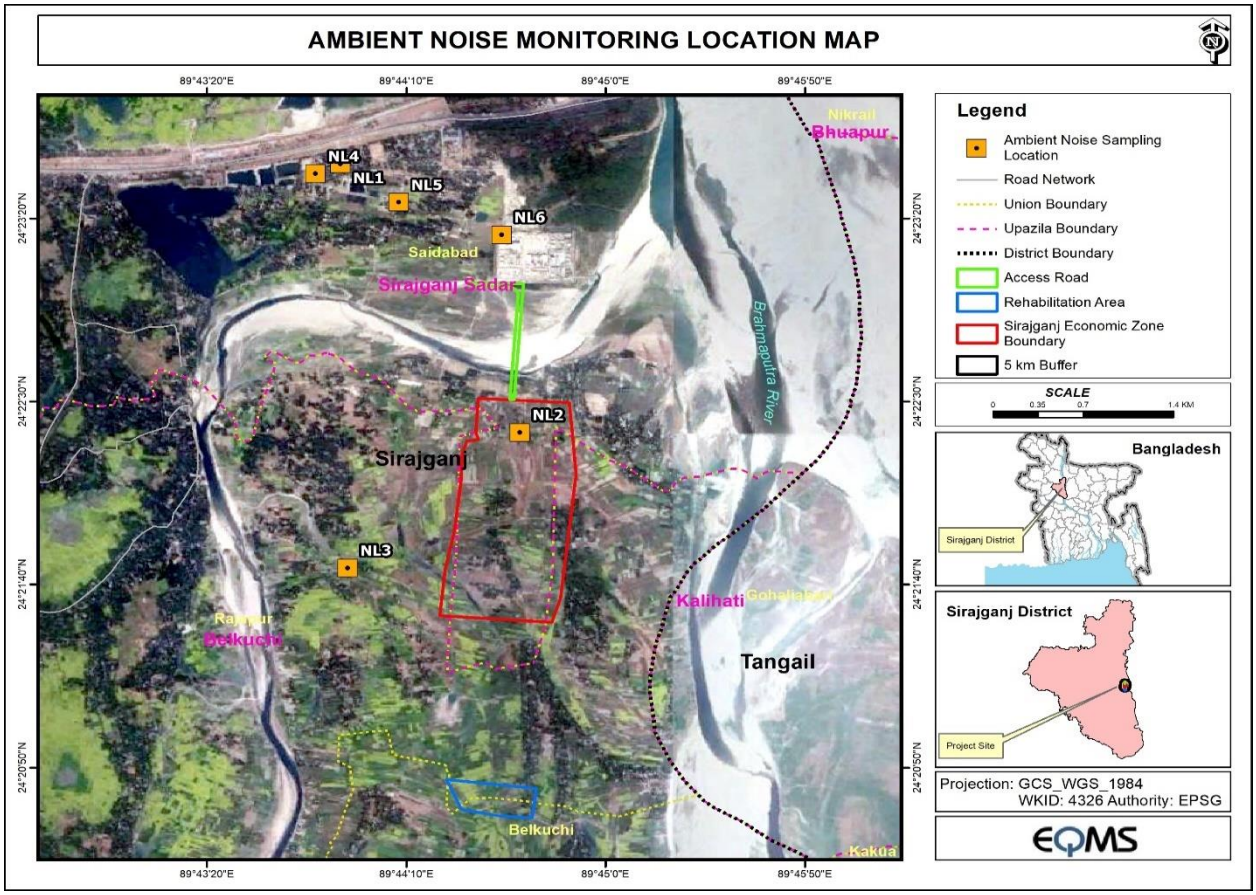


Figure 4-39: Noise Level Monitoring locations map

	
NL1	**NL2**

	
NL3	**NL4**
	
NL5	**NL6**

Figure 4-40: Noise Level Monitoring Photos

The sound level recorded in form of A-weighted equivalent continuous sound pressure level (Leq) values with the use of A-weighting filters in the noise-measuring instrument. The Project will comply with the noise emission criteria as per the standards stipulated in the reference framework, i.e., Schedule 4 of Environmental Conservation Rules (ECR), 1997 of Bangladesh as well as Noise Level Guidelines as prescribed in the WBG EHS Guideline (2007). Results of noise level monitoring in the project area are shown in the **Table 4-22**.

Table 4-22: Noise Level Parameter in and Around the Proposed Site

Location	Noise level (dB(A))		Applicable standard (dB(A)) *		IFC EHS Guideline (2007)		Location setting
	$L_{eq\ (day)}$	$L_{eq\ (night)}$	Day	Night	Day	Night	
NL1	51.67	39.60	50	40	55	45	Silent
NL2	52.30	41.70	55	45	55	45	Residential
NL3	51.60	40.20	55	45	55	45	Residential

NL4	63.40	44.30	70	60	55	45	Commercial
NL5	50.80	36.70	50	40	55	45	Silent
NL6	69.80	52.40	75	70	70	70	Industrial

Source: Field Survey, 2019

*Environmental Conservation Rules, 1997 (subsequent amendment in 2006)

According to the Table B-21 of Annex B, almost all the monitoring locations of noise levels except Leq (day) of NL1 were recorded within the local standard of Environmental Conservation Rules (ECR), 1997 of Bangladesh as well as Noise Level Guidelines as prescribed in the WBG EHS Guideline (2007). Noise level at NL1 was recorded slightly higher (51.67) than that of local standard (50).

Noise Sources

Major sources of noise are vehicles movement at nearby highway, water vehicles engines at Jamuna River and Sirajganj CCPP as well.

4.2.13 Land Resources

Most of the areas of these two Upazila (Sirajganj sadar and Belkuchi) associated to SEZL, are developed from sediments of the rivers draining into the Brahmaputra-Jamuna river system. It is a compound unit of abandoned channel of rivers, low-lying basins, and floodplain landscapes.

General soil color of is grey to dark grey. The top soil is occupied by loamy soils and some parts are clayey. Organic matter contents are moderate in soil and the moisture holding capacity is medium. General fertility is medium to high with the top soil pH level ranging from 4.5-8.5.

Land Type, Suitability and Utilization

The area falls under the Old Brahmaputra Floodplain soil. It shows that, a huge amount of the lands is not suitable for agriculture crop cultivation due to char land, sandy soil texture and vulnerable to flood. But the overall soil quality at Saidabad union were found to suitable to moderately suitable for agriculture. The soil characteristics and the land suitability of crop production in Saidabad union of Sirajganj Sadar upazila have been presented in the

Table 4-24.

Soil and Sediment Texture

Land Zoning report of the Sirajganj sadar upazila shows that, soil texture of Saidabad union (proposed SEZL site) is Loam to Clay. Furthermore, Granulometric analysis has also been conducted to classify the texture of soil and sediment samples collected from the proposed SEZL site. Soil texture of the project area has been calculated using USDA soil texture triangle calculator. It reveals that, soil samples collected from the studies area are mostly sandy loam. Sediment texture of the project area has also been calculated using USDA soil texture triangle calculator. It reveals that, sediment samples collected from the studies area are mostly sandy. Details of the soil and sediment texture triangle are presented at **Table 4-3**, **Table 4-4**, **Figure 4-11** and **Figure 4-12**.

4.2.14 Agricultural Resources

Farming practice and intensity

To ensure maximum use of land is one of the focuses of land zoning effort. Multiplicity of cropping systems has been one of the main features of the upazila. Farmers are harnessing their livelihood by producing various crops round the year. At the same time, the pressure of population on land and other natural resources along with rapid urbanization is a major factor for changing land-use patterns rapidly.

These changes are again causing reduction of agricultural production and the loss of biodiversity. In addition, the availability of land per capita is decreasing and thereby people are becoming landless and marginalized. Overexploitation, mismanagement, and changes in land use pattern are taking place at an unprecedented rate. However, there has been a positive change in adoption of modern technologies like high-yielding varieties of rice and other crops, irrigation, and mechanized cultivation in this area.

It is recognized at a change has taken place in production of different crops including mustard and vegetable in this region. Out of the total cultivable land in Sirajganj Sadar Upazila single cropped area covers 3387ha, double cropped area 11842 ha, triple cropped area 6,743 ha and multi cropped area 85 ha (**Table 4-23**). There is opportunity to shift agricultural land into double and triple crops.

Table 4-23: Heavy Metal Contents of the Natural Soil

Union	Farming Practice and Intensity								Cropping Intensity (%)
	Single		Double		Triple		Multi		
	Area (in ha)	Area (%)	Area (in ha)	Area (%)	Area (in ha)	Area (%)	Area (in ha)	Area (%)	
Saidabad	876	34	1480	58	205	8	0	0	174

Source: National Land Zoning Report, Sirajganj Sadar Upazila, 2015

Cropping pattern and cropping area

Crop land area is occupied with rice cultivation in Sirajganj Sadar Upazila. Other crops like jute, wheat, mustard, sugar cane, vegetables etc are also included in cropping pattern of this upazila. The major cropping pattern and land utilization based on crop cultivation are shown in **Table 4-24.** Out of the total cultivable land in Sirajganj Sadar single cropped area occupied (15%), double cropped area (54%) and triple cropped (31%). Cropping intensity of this upazila is about 216%. The agriculture of the flood plain has started facing problems due to the adverse impact of climate change. Due to geographical location, these areas are more vulnerable to frequent natural disasters.

Table 4-24: Existing Cropping Pattern

Net Cultivable Area (NCA)	Major Cropping Pattern	NCA (%)	Area (in ha)	Cropping Intensity (%)
22,057 ha	Boro - Fallow - T. aman	43	9484	216
	Sugarcane with inter cropping	14	3088	
	Mustard - Boro - T. aman	10	2206	
	Wheat / Maize - Jute - T. aman	9	1985	
	Boro - Jute - T. aman	8	1765	
	Groundnut	6	1323	
	RC - Sesame – Fallow	4	882	
	RC – Jute/Sesame - T. aman	2	441	
	Pulses/ Spices - Jute - T. aman	1	221	
	Others	3	662	
	Total	100	22057	

Source: National Land Zoning Report, Sirajganj Sadar Upazila, 2015

This vulnerability significantly curtails capacity to fulfill basic needs of the people. This part of the country has different hydrological situation experiencing water logging, drought with limited and changing precipitation pattern. So, there is no way but to adopt coping mechanism to protect the farming practice from further endangered condition to ensure food security and livelihood in the days ahead. Sustainable production system covering diversified cropping patterns can ensure technologically sound, economically viable, socially acceptable, and environmentally secure practice for this vulnerable area. More irrigation needed rice variety can switch to short duration drought tolerant varieties and various crops and cereals like wheat, maize, barley etc. are suitable for scanty rainfall condition. With mulch, zero tillage and /or minimum tillage introduction of sugarcane, sweet potato, spinach, gimakalmi, amaranth, lentil, sugarcane, mustard, chili, radish, taro, coriander, soybean etc. can markedly increase crop diversification and reduce vulnerability to climate change.

Multiplicity of cropping systems has been one of main features of the upazila agriculture and it is attributed to rain-fed agriculture and prevailing socio-economic situations of the farming community. Nevertheless, at farmers' level, potential productivity and monetary benefits act as guiding principles while opting for a crop/cropping system.

Bangladeshi agronomists recently have come up with a marvelous way of raising farm output. They have successfully experimented with a "four-crop" model that shows the country's food

production could be more than double. This reflects a great relief for the overpopulated upazila like Sirajganj Sadar. But, flood and other natural disasters here which have been affect the agricultural production system and threatens livelihood of the people.

Crop production

Rice: Rice is the staple food of this area. Here, the rice production has increased very recently with the adaption of modern rice varieties and introducing latest technological equipment and innovation:

- Replacement of local varieties by modern varieties in T. aman season where possible.
- Increasing irrigation areas in both Boro and T. aman season.
- Use of quality seeds.

Mustard: Mustard is widely cultivated in Sirajganj Sadar Upazila. Mustard as an oilseed crops takes first place in respect of cultivated area in Bangladesh. It is treating a short-lengthen crop. Farmers of Sirajganj Sadar generally cultivate mustard in between T. aman and boro cultivation. Mustard oilcake is a nutritious food for cattle. This oilcake also used as organic fertilizer and the dry mustard plants can use as fuel.

Wheat: Wheat is the second most important cereal crop after rice. Although rice is the main crop but wheat is assuming greater importance in Sirajganj Sadar of Sirajganj district. Depending on variety and weather conditions, 100-110 days are required from sowing to harvesting. It is a rabi season crop, requiring dry weather and bright sunlight which permits this region.

It also requires less irrigation with less input like labors, irrigation, fertilizer, and insecticides. Marginal and poor farm families are used to cultivate it as a profitable crop.

Jute: Jute is one of the main cash crops of this upazila. It is an eco-friendly fiber. Jute cultivation requires less input. Sirajganj Sadar annually receives fresh deposit of silts carried down by the floodwater. As such the best quality jute grows here. Jute leaf is a common and favorable vegetable item to the farmer.

Main constraints of crop production

Major problems in crop cultivation are as follows:

(i) Water logging
(ii) River erosion
(iii) Power failure
(iv) Shortage of irrigation
(v) Decrease of agricultural land
(vi) Sudden flood
(vii) Drought
(viii) Cold wave
(ix) Climate change
(x) Changes in rainfall pattern
(xi) Temperature fluctuation

(xii) Siltation
(xiii) Inadequate drainage facilities.

Impact of the above problems on crop cultivation and society are:

1 Essential plant nutrient deficiency
2 Adversely influence the crop production,
3 Natural resource depletion
4 Negative impact on employment and food security
5 Increase insect and pest infestation.

4.3 Natural Capital: Biological Environment

Biodiversity is the variety of plant and animal life in the world or in a habitat, a high level of which is usually considered to be important and desirable. The biodiversity component of the study, focused on a few groups of biological components comprising of flora (tree, herbs, shrubs, and climbers) and fauna (birds, reptiles, amphibians, mammals, and fisheries) as well as the surrounding ecosystems.

Due to the implementation of the project in the Sirajganj, the adjoining area could result in the deterioration of nearby ecosystem directly and indirectly. To assess the probable impact of the proposed "Sirajganj Economic Zone" in Sirajganj, two ecologists of EQMS conducted ecological survey from 5th to 8th August 2019 and 3rd to 6th September with a total of 8 days.

The study area for ecological survey includes an area within 5 km radius of the proposed project site. The area is situated at the right bank of the Jamuna (Brahmaputra) at approximately one kilometer from the Jamuna Multi-Purpose Bridge. Land use of buffer area includes agricultural land, river, canal, homestead forest, etc. The climatic condition during the ecological survey was clear and sunny. The overall objective of this study is to establish the baseline data for flora and fauna of this proposed project area.

The ecological survey was conducted with the following objectives:

- Identification of various habitats available within the study area;
- Estimation of fisheries production, fish migration, fish biodiversity, management, and efforts;
- Enumeration of terrestrial and aquatic species within the study area;
- Identification of floral and faunal species of conservation significance;
- Collection and compilation of secondary information on the status of floral and faunal;
- Components and habitats from the concerned stakeholders; and
- To develop the ecological mitigation and management plan.

4.3.1 Approach and Methodology of the biological study

Inventory of flora species

Block study has been considered for the initial study of the floral compositional survey. For the species diversity, the Shannon diversity index was followed. The team has considered the

Roadside vegetation along with Homestead vegetation, Agriculture field, etc. for the study. The team also documented "Bangabandhu Eco Park" Flora species through field observation and available published secondary literature review[6].

Inventory of Faunal Survey

The faunal survey comprises of Avifauna, Herpetofaunal study (Amphibians, Reptiles), Fishes, Cetaceans, Mammals, and Crustaceans. Following methodologies had been followed for those studies.

Avifaunal Survey: Opportunistic bird sightings

Birds have been identified opportunistically either by their call, nesting identification or by their physical appearance. Species were recorded through digital devices and identified through experts. Also, field guide for avifaunal identification were done in-situ during the primary survey. The secondary literature (Journals, Reports) were also reviewed during the preparation of the baseline study. IBA's Data for Bird Staging Site: The team primarily analyzed (IBA database) the migratory Bird Staging site for the proposed study area.

Methodology for the Herpetofaunal study (Amphibians and Reptiles)

An opportunity basis survey for the herpetofauna (Amphibians and Reptiles) study has been conducted. Species were recorded through digital devices and was identified through expert. Also filed guide for herpetofauna identification was used in-situ to identify the species.

Methodology for the fisheries study

3 important and basic survey processes were used to obtain the primary data and information (through application of Structured Survey Questionnaires and modules) with a view to make qualitative and quantitative situational impression and assessment of the Project AOI about aquatic diversity, open water capture fisheries and closed water pisciculture. Survey Process Modules was applied to the following 'Field Study Components'.

- Limnological and Water Quality Parameter surveys to identify and quantify aquatic habitat characteristics, which includes collection of data and information on limnological parameters for primary productivity analysis;
- Fish catch surveys in Jamuna River and associated canal, flood plains to obtain data and information;
- Fish Landing surveys to obtain data on fish species.

[6]Environmental and Social Impact Assessment of 400 MW ± 10% Combined Cycle Power Plant (Sirajganj-4): Sirajganj, Bangladesh.

[6]Environmental Impact Assessment (EIA) of the Proposed Sirajganj 225MW Combined Cycle Power Plant Project (Dual Fuel-3rd Unit). May 7, 2014.

[6]Sirajganj 225 MW Combined Cycle Power Plant Project (2nd Unit- Dual Fuel), Saidabad, Sirajganj.

[6]Revised Environmental Impact Assessment (EIA) Report on Sirajganj Economic Zone Ltd. Sirajganj, Bangladesh. August, 2016.

To perform the job effectively, the team has gone for a field visit (4 days) undertaken by the EQMS to collect primary information/data on the study area along with verify available (secondary source) data and information. Beside field observation, interviewing with different cross-section of people by arranging 'Focused Group Discussion' meeting with fisheries community and local people, consultation with concern government officials on various aspects of fisheries and fish related activities in the study area.

For acquiring of available data and information (secondary data sources) to supplement the primary data/information, various published scientific journals, literature, and reports/ documents of related subject matters as stipulated in the TOR of this study project, were collected from different organizations and reviewed by the Team Members.

Identification of fishing ground

The methodology to identify the fishing grounds with the collection of fish species from the river, observation of fry and fingerlings/brood fish, available fishing boats, fish production per catch, secondary literature etc. To accomplish the task, EQMS conducted boat to boat survey, consultations in and around the Jamuna River.

Methodology for Cetacean's Observation

The cetaceans are considered the mega fauna within the freshwater and marine water which are comprised of Dolphins and Whales. These are prime species of the water bodies which are considered as an ecological indicator.

Direct field observation (Visual Sighting and Count) were done through the line transect method. The dolphin observation was conducted across the Jamuna river appx 1.5 km up and 1.5 downstream and its adjoining branch. A mechanized boat (speed 6-7 noticle mile per hour) with digital devices (GPS, Binoculars etc.) were used during the observation activity.

Methodology of Aquatic Micro Biological Study

i. Phytoplankton

For qualitative study, phytoplankton were collected by plankton net (No. 20 silk bottling cloth, mesh size: 75 Um). The net was lowered into the water and sample water was collected by pulling the net horizontally and vertically. For quantitative study, phytoplankton were collected by plankton net by passing 10 liters of water through it. After collection they were preserved in 3% formalin and few drops of Glycerin and by Lugols solution. After adding preservatives, they were brought to the laboratory for species identification and numerical abundance. Detailed analysis was done by Sedgewick-Rafter Counter Chamber and by drop method. Results has been expressed by unit/l.

ii. Zooplankton

For qualitative study, Zooplankton were collected by a plankton net (No. 25 silk bottling cloth, mesh size: 67 Um). The net was lowered into the water and sample water was collected by pulling the net horizontally and vertically. For quantitative study, Zooplankton were collected by a plankton net by passing 10 liters of water through it. After collection they were preserved in 3% formalin and few drops of Glycerin and by Lugols solution. After adding preservatives,

they were brought to the laboratory for species identification and numerical abundance. Detailed analysis was done by Sedgewick-Rafter Counter Chamber and by drop method. Results will be expressed by unit/l.

iii. Benthos (microbenthos)

Sediment were collected by Ekman Grab Sampler. After collecting, sample were passed through a sieve (0.5 & 1 cm mesh size net). After that again the sample will be sieved by US sieve no. 30 and preserved the sample by 10% formalin or 70% Ethanol for better identification Rose Bengal (200 mg/l) color was added. Salt and sugar solution were also used to separate the benthic animal from the sediment for better identification.

4.3.2 Fisheries Resources

Introduction

Fishing is a common practice around the study area. The Jamuna, Baral, Ichamati, Karatoa are main waterbodies in Sirajganj district. In the study area, fishing which is actively carried out in Jamuna River, small ponds and water-bodies for both consumption and selling in the market. The fisheries of Sirajgonj Sadar Upazila consist of inland open water fisheries and freshwater aquaculture. Like other parts of the country, fisheries resources of Sirajganj Sadar Upazila are major source of nutrition, and livelihood support of the local people. Rivers and adjoining cannals are among the most abundant and productive ecosystem that support the life cycle of different fauna and flora of this upazila area.

Habitat Description

A total of riverine and wetland is consisting of 12 sq. kilometer (by GPs) considered open water capture fisheries within the project AOI. The area also comprising of Agricultural land, Homesteads plants, Road side plants, Fellow Lands, Aquaculture, Ditches, and ponds. There is no designated forest in the project AOI except a park named "Jamuna Eco-Park" (Non gazetted) is placed within the AOI. Beside good number of plant species (planted), resident birds, mammals (both captive and open), reptiles and amphibians are available in this area.

Significance to fisheries

Sirajganj Economic Zone is going to build infrastructure on site, on competitive commercial basis in a prescribed manner. As a result, there will be large engagement of structures for production of different commodities. So, the construction of this Economic Zone, may impact the river and water bodies especially the adjoining Jamuna River during construction activities, if proper mitigation was not in place, implemented and monitored by economic zone authority. Moreover, before operation phase, the authority needs to install CETP and STP for this project, otherwise a significant impact shall be taken place if the water discharged in waterbody without any treatment[7].

[7] Approval of EIA of the Sirajgonj Economic Zone.Clause 19

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Fisheries Production and Effort

Bangladesh is endowed with extremely rich and extensive inland and marine water resources. The freshwater bodies of Bangladesh are considered a home to at least 265 species of fin fishes (Rahman, 2005). This sector therefore contributes about 3.69% in GDP (Gross Domestic Product) and 22.76% in agricultural GDP and supply about 60% animal protein consumption.

Fishing take places in Jamuna River within the project AOI. It is noted that, fishing related activities are not allowed under the Jamuna Bridge for some security reason. Details of fisheries community and fishinf pond and are given **Table 4-25** and **Table 4-26**.

Table 4-25: Details of the Fisherman Population in the Project AOI

Village	*Total Population	Fishermen (Part time and Full time Approximately)	Number of fishermen Households
Paschim Mohanpur	887	15	10
Khas Chtragachha	101	35	25
Purbo Radhunibari	1972	7	4

*Source: Environmental and Social Impact Assessment of 400 MW ± 10% Combined Cycle Power Plant (Sirajganj-4): Sirajganj, Bangladesh.

Table 4-26: Status of fishing ponds within the project AOI

Name of the pond owner	Union Soydabad	Upazilla	Nos of Ponds	Pond Size	Species Cultured	Cultured Period	Total Fish Production
Abdus Samad	Ponchoshona	Soydabad	Sirajganj Sadar	16 Decimal	Rui, Catla, Mrigal, Sarpunti, Tilapia,	15 years	250 kg/year
Shamsu Basher and Sayed	Punorbason	Soydabad	Sirajganj Sadar	100 Decimal	Rui, Catla, Commo n carp,	18 years	> 2000 kg /year
Abul Kalam	Paschim Radhunibar	Rajapur	Belkuchi	30 Decimal	Rui, Catla, Commo n carp,	7 years	400 kg/ year

*Source: Environmental and Social Impact Assessment of 400 MW ± 10% Combined Cycle Power Plant (Sirajganj-4): Sirajganj, Bangladesh.

In fisheries and conservation biology, the catch per unit effort (CPUE) is an indirect measure of the abundance of species. The best practice is to standardize the effort employed (e.g.,

number of catch per unit efforts from the nets/gear), which controls for the reduction in catch size that often results from subsequent efforts.

However, diurnal survey was done within the Jamuna River as well as the branch of the river. A four days' fisheries study with structured questionnaire has been conducted. From the primary observation (boat to boat survey), highest Catch was observed in day (08-08-19) where CPUE is 0.608 and the lowest observed in day (05-08-19) where CPUE is 0.375. The survey outcome on catch unit per effort is shown in **Table 4-27** and **Figure 4-41**.

Table 4-27: Data of Catch Per Unit Effort (CPUE) for Fisheries Survey

Serial	Date	Number of Hauls	Total weight of Catch	CPUE
1	05-08-19	4	1.5 kg	0.375
2	06-08-19	7	4.2 kg	0.60
3	07-08-19	6	2.75 kg	0.459
4	08-08-19	12	7.3 kg	0.608

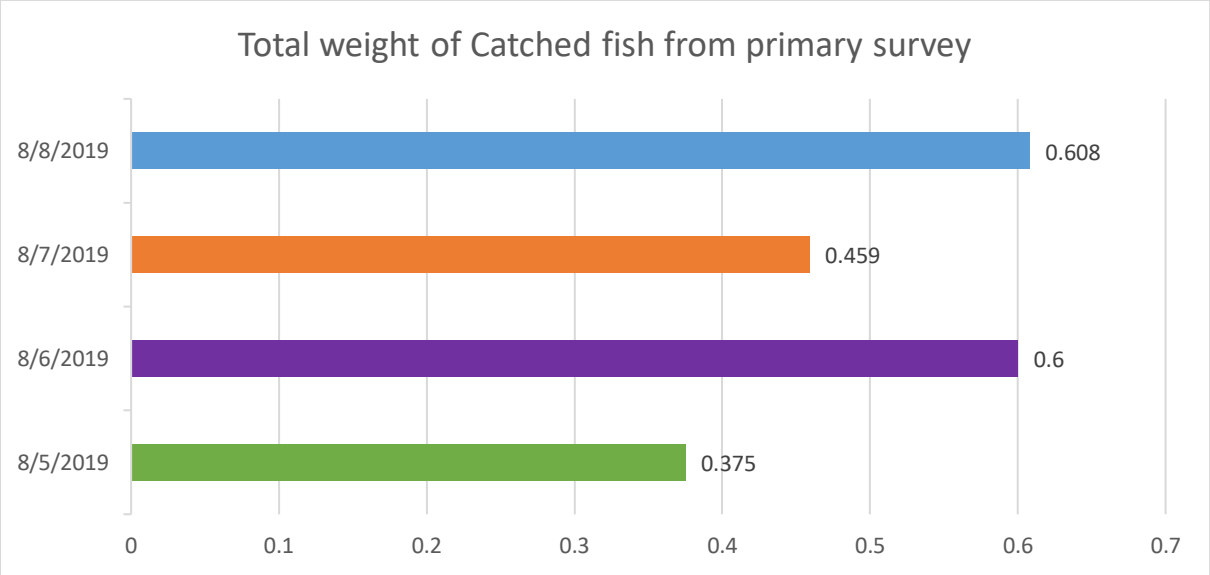


Figure 4-41: CPUE results between hauls and catched fish

Fish Spawning Periods

From the primary observation, fishing ground has been identified based on fishing activities in the Jamuna River. Primarily, no fish spawning ground has been identified. The scours and char land fringed vegetation's spread over the study area river function as fish breeding grounds of diversified fish species. Most of the riverine fishes generally breed within the period of May to August. Details of the fish species and hatchling periods are given in **Table 4-28.**

Table 4-28: Fish species and hatchling periods

Name of the species	Egg release and hatchling Period	Place of hatchling
Rui, Katol, Mrigel	May-June (egg release during rain & thunder storm)	River (Hatchling trapped in pockets/lagoons of char lands with clear water
Boal	June-July (egg release by rubbing with bushes of char land fringes)	Trapped in lagoons; some manage to escape in the river and some are caught (net) or dried up.
Baghair	June-July (egg release in deep water)	Mostly found in the scour area
Chital	May-June (building nest at scours and release egg on blocks, geo bags and submerged boat or other objects)	Scours of river and after attaining the size of fingerling they move individually
Aor	May-June (Point- nest building by making hole in deep water and hatching a mucous like things and hatchlings feed on the mucous.	Deep Water
Elisha	December-January and May- August	It goes upstream in deep water (17-25 m) for laying eggs where current is high

Source: "Environmental Impact Assessment (EIA) of the Sirajganj 225MW Combined Cycle Power Plant Project (Dual Fuel-3rd Unit)"

Fish Migration and Breeding

Major carp species like Rui, Katol, Mrigel and Catfishes like Baghayer, Ayer and clupeid (Elish) uses the Jamuna River for their longitudinal migration. They migrate toward upstream during July to August for breeding when thunder storm occurs. Fries of the major carp species perform their drifting migration from the upstream to the down and spread over the sandbars and lagoons in their courses[8]. Tsai and Ali (1985) identified the existence of two stocks of major carps in these rivers (Jamuna and Brahmaputra). Also, during the FGD with fishermen, it was found that the major species for migration was Carps but small scale *Hilsa* migration also taken place during the post monsoon season.

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Identified fishing ground

From the primary observation, fishing ground has been identified based on fishing activities in the Jamuna River. Primarily, no fish spawning ground has been identified.

The scours and char land fringed vegetation's spread over the study area river function as fish breeding grounds of diversified fish species. Most of the riverine fishes generally breed within the period of May to August.

Fish Diversity

Total fifty-five species of fish were recorded from the project AOI. Based on consultation with the fishermen, fishing ground analysis and fish market survey were considered for Checklist. The common fish species found within the study area are Bagha Air (*Bagarius bagarius*), Boal *(Wallago attu),* Tengra *(Mystus tengra)*, Tengra (*Mystus vittatus)*, Veda (*Nandus nandus)*, Rita (*Rita rita)*, Baim (*Mastacembelus pancalus)*, Shing (*Heteropneustes fossilis)*, Taki (*Channa punctatus),* Aor *(Sprata aor),* Chital *(Notopterus chitala),* Rui fish *(Labeo rohita),* Elish *(Hilsa ilisha),* Kajuli *(Ailia coila), etc.* From them, 3 species are Critically Endangered, 9 species are endangered, 15 species are Nearly Threatened, 6 species are Vulnerable and 18 species are least concern as per IUCN Redlist, 2015.

Fisheries Management

Sustainable management regarding the biodiversity is important for the future production of biota. Government has taken initiative regarding the sustainable fish production special concentration on *Hilsa* as it is declining day by day. Several fisheries policies, forest policies, laws and management plans have been enacted to protect them. The effectiveness of these policies and plans is limited by the poor implementation capacity of the implementing agencies (Iftekhar & Islam 2004). For achieving the SDG targets, National Fisheries Policy 1998 and National Fisheries Strategy 2006 are the key policy documents. There are number of acts and rules under this policy which will help support to achieve the SDG targets. Although, the Forest Department tried to undertake certain conservation planning initiatives such as Environmental Policy, National Conservation Strategy and National Environmental Management Active Plan followed by the implementation of programs.

4.3.3 Ecosystem services and function

The Jamuna River is adjacent to the project boundary. So, it is considered a resourceful ground and supports various services (ecological and occupational) function. A large water bodies supports to maintain an ecological balance from aquatic micro-organism to macro-organism. Micro-organisms are primary producer cares the fish community those are directly depends upon them. The fisheries resources support by providing nutrition to residents. Fishermen are directly depending on the species that are collected by them from the river. Associated planted trees supports the various faunal species importantly the avifaunal species. Avifaunal species used plants as their feeding and resting ground. Plants also provides fuel, food, and other supportive goods to continue their life.

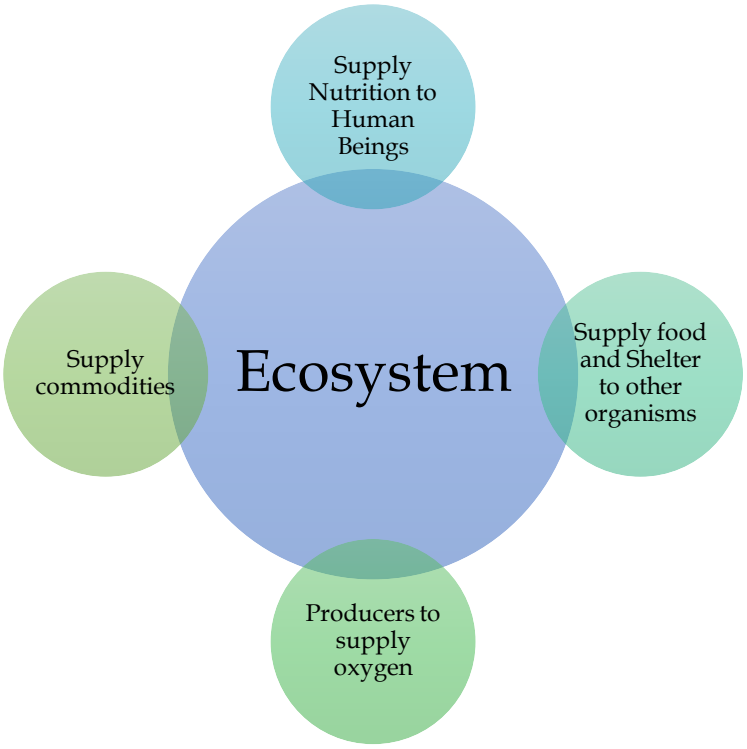


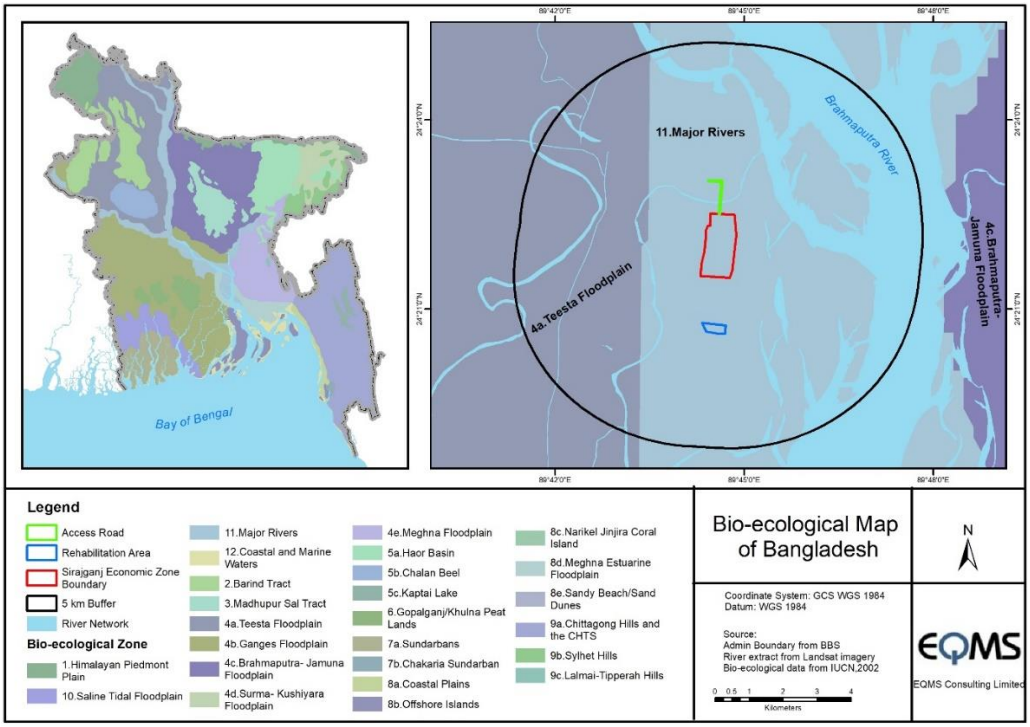
Figure 4-42: Ecosystem Services within the study area

4.3.4 Bio-ecological Zone

The International Union for Conservation of Nature (IUCN) has classified Bangladesh into twenty-five (25) Bio-ecological Zones (Nishat et al., 2002) in the context of physiographic and biological diversity. The study area has fallen under two bio-ecological zones: Major Rivers and Teesta Flood Plain. Bio-ecological zone of the project area is shown in **Table 4-29** and **Figure 4-43**.

Table 4-29: Bio-ecological Zone 11 (Major Rivers)

Features	Information
Location	$22^{0}55'$-$26^{0}15'$ N and $88^{0}10'$-$90^{0}37'$ E
Relevant administrative HQ	Rajshahi, Kustia, Faridpur, Shariatpur, Chandpur, Narayanganj, Manikganj, Tangail, Sirajganj, Kurigram, Rangpur.
Physiography	Young Brahmaputra floodplain, Ganges river floodplain
Soil	Calcareous alluvium (non-saline); Noncalcareous alluvium Soils
Rainfalls	1270-2290 mm
Temperature	Maximum 37^{0}C, Minimum 9^{0}C
Flooding depth	MH, & ML
Land use	Rabi-Aus-T, Aman (2a), Rabi-Mixed B, Aus & Aman (7a), Rabi-B, Aus-Fallow (1e)



Source: Admin. Boundary from BBS.

Figure 4-43: Project area is fallen under Major river and Teesta Flood Plains

4.3.5 Protected Areas of Bangladesh

The protected area refers to an area of land and/or sea especially dedicated to the protection and maintenance of biological diversity and of natural and associated cultural resources and managed through legal or other effective means i.e. protected area is predominantly a natural area established and managed in perpetuity, through legal or customary regimes, primarily to conserve their natural resources. According to the Wildlife (Conservation and Security) Act, 2012 types of protected areas are national park, sanctuary, eco-park, botanical garden, community conservation area, safari park, Kunjaban etc. The closest protected area (Madhupur National Park) is not located within the 10 km buffer of the project area. It is 43.55 km away from the study area. Nearest protected areas of Bangladesh from the project site is shown in **Figure 4-44**.

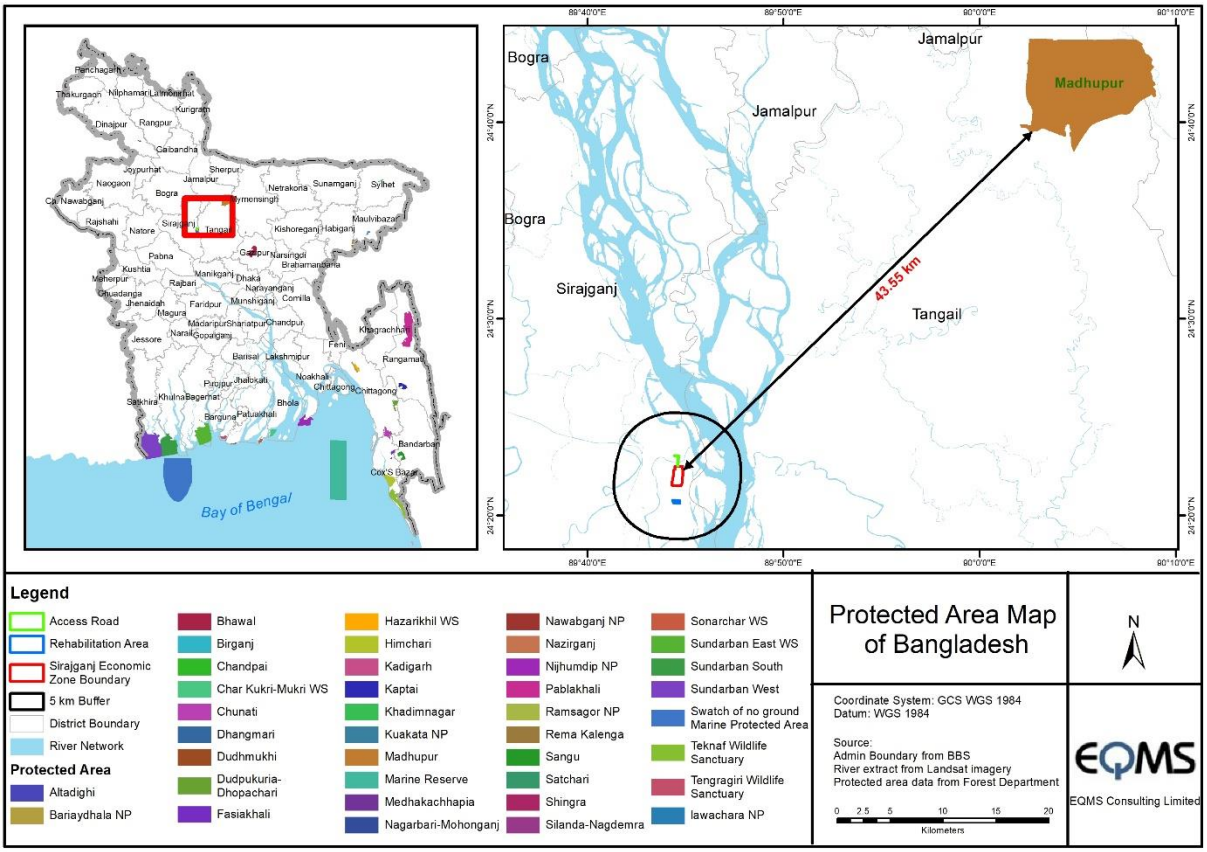
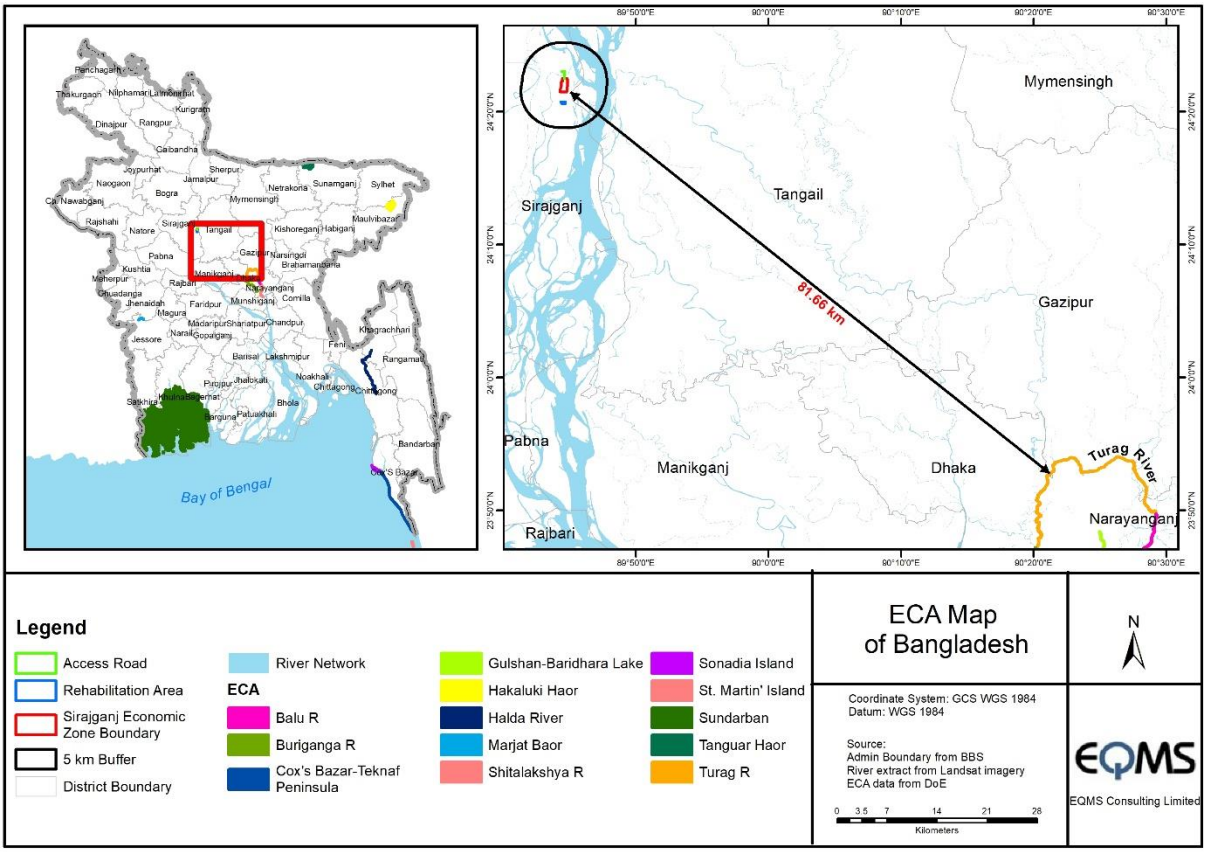


Figure 4-44: Nearest Protected Area is Madhupur Forest.

4.3.6 Ecologically Critical area

An Ecologically Critical Area (ECA) is an environmental protection zone in Bangladesh. In 1995, specific areas in Bangladesh could be deemed Ecologically Critical Areas because of the Environmental Conservation Act. The Government after considering the human habitat, ancient monument, archeological site, forest sanctuary, national park, game reserve, wild animals' habitat, wetland, mangrove, forest area, biodiversity and other relevant factors of the area can declare as ECA. As per the legal mandate, the MoEFCC till now declared 13 areas as ECA. The Department of Environment as a statutory body is entrusted to manage the ECAs. The nearest ECA's from the project site is Turag River which is 81.66 kilometer away. Nearest ECA from the project site is shown in **Figure 4-45**.



Source: Admin Boundary from BBS, 2011

Figure 4-45: Nearest ECA from the Project AOI

4.3.7 IBA's Site

Jamuna-Brahmaputra River is identified as an Important Bird Area (IBA) as category (A1, A4i[9]). The Jamuna-Brahmaputra River IBA (BD009) was assessed in Year 2004 and covers an area of 200,000 ha. The IBA area covers the entire Jamuna River (from its Northern end at the India Bangladesh Border and Southern end at the confluence of Jamuna River with the Padma River). The boundary of the IBA passes through the AOI and the overlap is very small. Only 3 % of the AOI overlaps with the IBA. This overlap represents an insignificant portion of the total IBA area. A map of the IBA site of the project area is given in **Figure 4-46.**

[9] 1 A1: Threatened Species) and A4i: Site known or thought to hold, on a regular basis, ≥ 1% of a biogeographic population of a congregatory waterbird species. For the thresholds of this criterion, relevant flyway populations are combined to produce biogeographic population estimates).

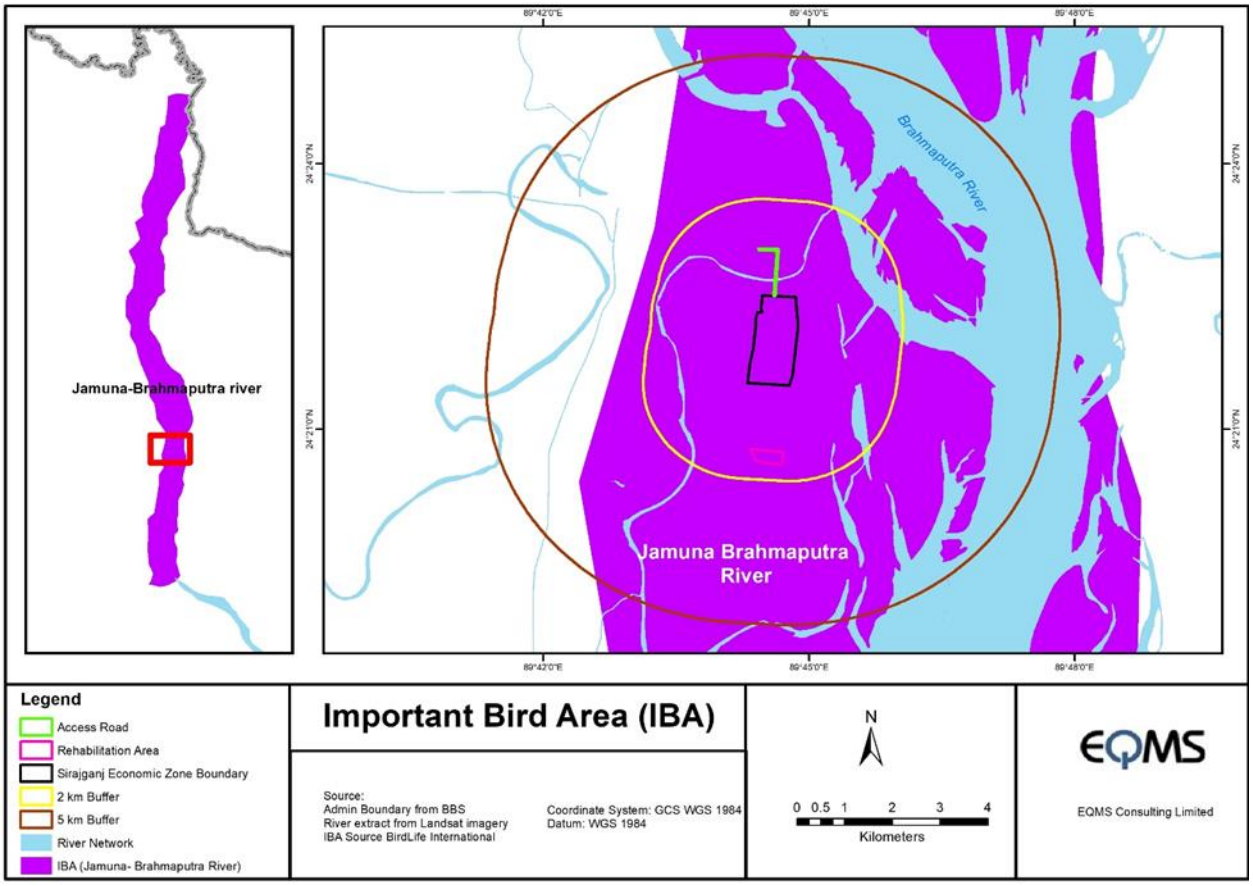


Figure 4-46: Important Bird Area Boundary (Jamuna River) passing through AOI

4.3.8 Common Flora and Fauna

a. Floral diversity

Plants: Binna ghash (*Vetveria zizaniodes*); Kash *(Saccharum spontaneum),* Ghagra *(Xanthium indicum);* Ban Palang *(Rumex maritimus).*

b. Faunal Diversity

Mammals: Ganges River Dolphin (*Platanista gangetica*); Bengal fox (*Vulpes bengalensis*), Greater bandicoot rat (*Bandicota indica*).

Birds: River lapwing (*Vanellus duvaucelii*), Black-bellied tern (*Sterna acuticauda*), Sand lark (*Calandrella raytal*), Spot billed duck (*Anas poecilorhyncha*); Small prantincole (*Glareola tentoria*).

Reptiles: Bibron's softshell turtle (*Pelochelys bibroni*); Gangetic gharial (*Gavialis gangeticus*); Ganges softshell turtle (*Aspideretes gangeticus*); Median roofed turtle (*Kachuga tentoria*).

Amphibians: Jerdon's bull frog (*Hoplobatrachus crassus*); Skipper frog (*Euphlyctis cyanoplyctis*).

4.3.9 Species diversity of Teesta Floodplain

Floral Diversity

The Teesta Floodplain possesses a unique variety of plants, medicinal plants, fruits bearing trees, hundreds of jungle shrubs, creepers and climbers, flowering trees, etc. many of which

yield valuable products. Some of the floral species are Aam (*Mangifera indica*), Kanthal (*Artocarpus heterophyllus*), Kalo jam (*Syzygium cumini*), Litchu (*Litchi chinensis*), Road-side plants: Bhant (*Clerodeudrum viscosm*), Danda kalash (*Leucus aspera*), Trees near water: Jiban (*Trema orientalis*), Pitali (*Trewia nudiflora*), Barun (*Cratatva nurvala*), Hijal (*Barringtonia acutangula*), Foxtail (Rhynchosfylis retusa), Rasna (*Vanda roxburghii*), Kachuripana (*Eichhornia crassipes*), Shada shapla (*Nymphaea nouchali*), Panchuli (*Nymphoides indicum*), Singara (*Trapa bispinosa*), Bara nukha (*Monochoria hastata*).

Faunal Diversity

Like the floral diversity this zone equally enjoys riches of faunal variety. Such as- Five-striped palm squirrel (*Funambulus pennanti*); Jungle cat (*Felis chaus*); Tomb bat (*Taphozous saccolaimus*), Darter (*Anhinga melanogaster*); Brown fish owl (*Ketupa eylonensis*); Black francolin (*Francolinus francolinus*), Sand lark (*Calandrella raytal*), Three-striped roof turtle (*Kachuga dhongoka*); Brown roofed turtle (*Kacitttga smithii*); Dark-bellied marsh snake (*Xenochrophis cerasogaster*); Slender worm luake (*Typhlops porrcctus*), Ornate microhylid (*Microhyla ornata*); Red microhylid (*Microhyla rubra*)

Floral species Diversity Index Analysis

The field data collection was mainly included on biodiversity assessment of different life of floral elements such as trees, herbs, and shrubs. A total of three quadrates has been carried out in and around the study area for different floral aspects. Ecologist has identified the different floral species in the study area. From the graphical point of view, the highest diversity was found in location 3 (Q3) and lowest in location 1 (Q1). So, it is clear indication that the project site dominating the herb species.

The locations and map for the Quadrates study have been provided in **Table 4-30** and **Figure 4-47**. Diversity Index of floral study within the study area is given in Error! Reference source not found.

Table 4-30: Study locations of Quadrate Survey

Area	Quadrates	GPS coordinates
Outside the project location. Eastern side for (Tree)	Q1	24°21'53.57"N 89°44'51.27"E
Inside the project location. Southern west side for (Shrub)	Q3	24°21'28.59"N 89°44'50.15"E
Outside the project location. Eastern side for (Herb)	Q2	24°21'14.78"N 89°44'40.93"E

Source: Field Survey by EQMS Team, June-2019

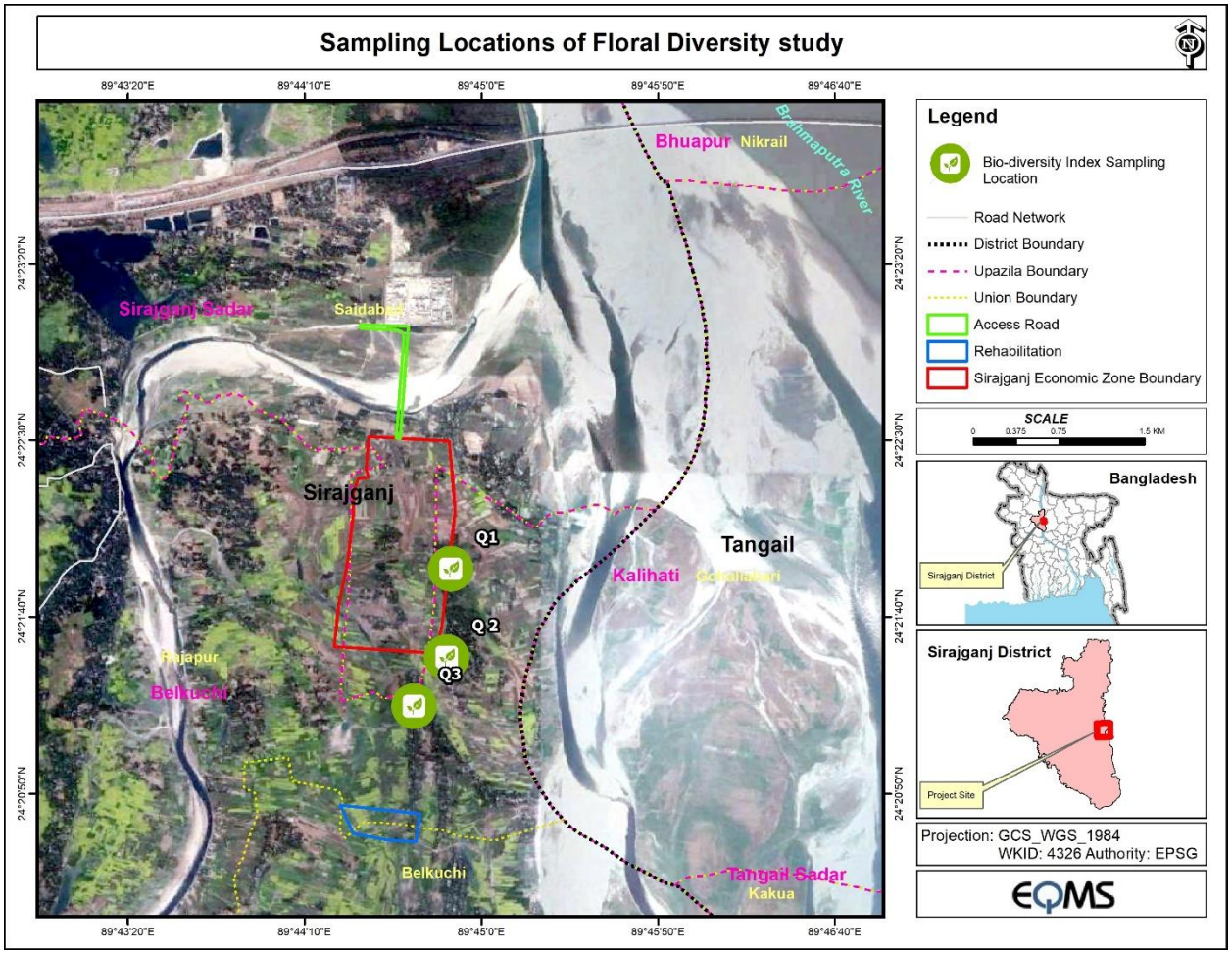


Figure 4-47: Locations of Quadrat study within the study area

Table 4-31: Diversity Index of floral study within the study area

Quadrate study for floral composition within the study			
Parameter	Q 1	Q 2	Q 3
Shannon-Wiener Diversity Index(H)	1.38	1.52	1.60
Evenness (E)	0.75	0.94	0.82
Number of Species (S)	06	13	19

Plants

A total of 52 species of common floral species were recorded within the study area. Species are mainly Eucalytus (*Eucalyptus spp.*), Mangoo (*Mangifera indica)*, Koroi *(Samanea saman),* Nim *(Azadirachta indica),* Khejur *(Phoenix dactylifera),* etc. One vulnerable species named Mahaguni (*Swietenia macrophylla*) was recorded during the survey.

From them, 8 dominant species come from Fabaceae family, 4 species are from the Arececeae followed by Rutaceae, Myrtaceae, Moraceae, Meliaceae, Malvaceae. Homestead flora consists of both native and exotic species, Acacia *(Acacia auriculiformis)* and some of them are naturalized. Uses of these plants in the project area are shown in **Figure 4-48**.

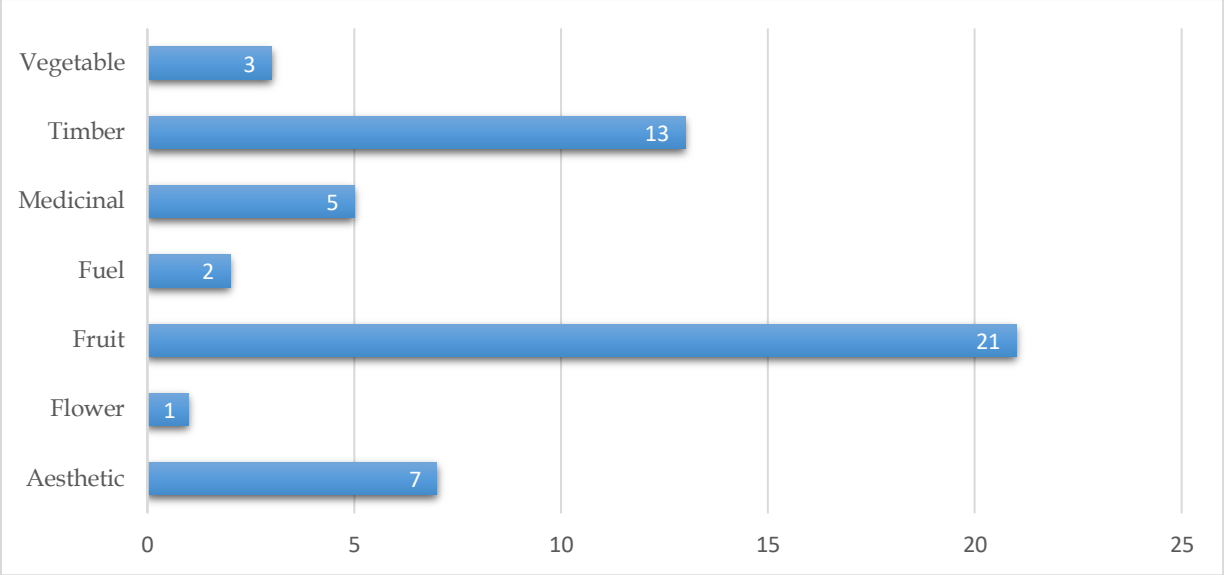


Figure 4-48: Uses of plants within the study area

Family dominance of common plant species in the project area are shown in **Figure 4-49**.

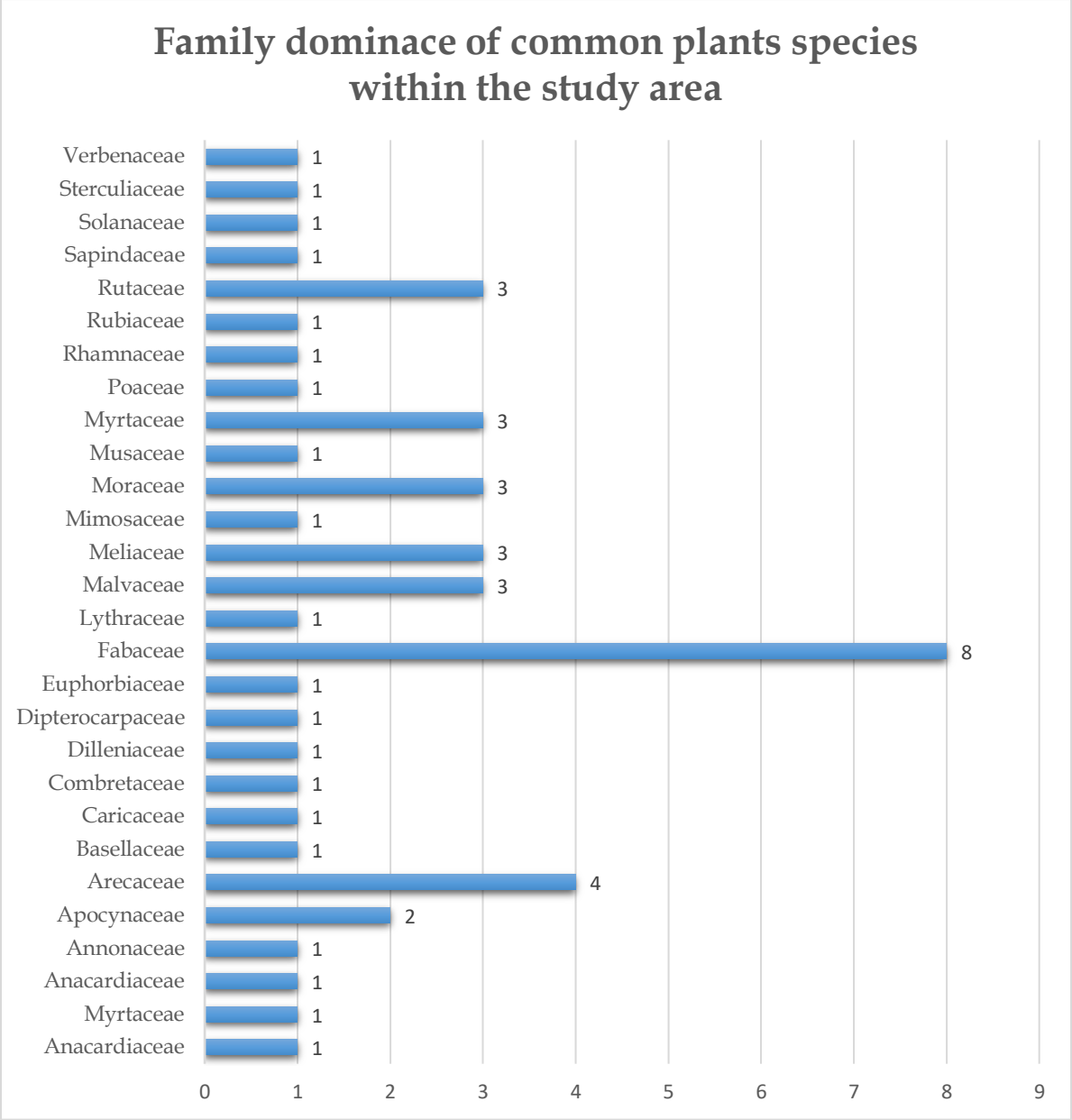


Figure 4-49: Family dominance of common plant species within the study area

Agricultural or crop field vegetation

There are 4 types of cropping pattern practiced in the study area. The most common agricultural crops cultivated in the study area are Peanut, Maize, Jute, Sugarcane, Egg Plant tree, Pumpkin, Cucumber, Mustard, Garlic, Mere Trifle (Kochu), Lentil (Masur), Pea (Motor), Chili, Turmeric, Ginger, Coriander.

Roadside Vegetation

Major tree species observed in the roadside of the project area were Eucalytus (*Eucalyptus spp.*), Koroi (*Samanea saman*), Khejur (*Phoenix dactylifera*), Mahaguni (*Swietenia macrophylla*) and Supari (*Areca catechu*) etc.

Aquatic Flora

Species are mainly Water Hyacinth (*Eichhornia crassipes*), Kochu (*Colocasia esculenta)*, Shapla *(Nymphaea nouchali)*, Dhol kolmi (*Ipomoea carnea),* Akondo (*Calotropis Gigantea*), Alligator Weed (*Alternanthera philoxeroides*), Coco Yam (*Colocasia esculenta*), Water Lettuce (*Pistia stratiotes*), Helencha (*Enhydra fluctuans*), Esthwaite Waterweed (*Hydrilla verticillata*) and Four-Leaf Clover (*Marsilea quadrifolia*) etc.

Birds

A total of fourty nine birds species were recorded belonging to thirty-one families. The dominated birds in the study area were belonging to the family Scolopacidae. Homesteads, Road Side vegetations, Char (Riverine Island), ditches are habitat of this area which supports the wild birds for feeding and roosting ground.

Primarily, one species named River Lapewing (*Vanellus duvaucelii*) was found within the study area which is Nearly Threatened (NT) as per IUCN Redlist, 2015.

From the local consultation, Once the White Rumped Vulture (*Gypes bengalensis*) was present within the Project AOI. However, during the primary survey, there is limited scope of the presence of vulture there due to low likelihood of nesting tree and injecting of Diclofenac in the body of cattles.

Herpetofauna

From the primary observation, Checkered Keelback (*Xenochrophis piscator*), Bengal Monitor (*Varanus bengalensis*), Yellow Monitor (*Varanus flavescens*) were observed from the study area. The most significant secondary sources covers Tiktiki (*Hemidactylus frenatus*), Roktochosa (*Calotes versicolor*), Indian Bull frog (*Hoplobatrachus tigerinus*), Common Asian Toad (*Duttaphrynus melanostictus*), Angina (*Eutropis carinata*), Indian Rat snake (*Ptyas mucosus*), Checkered Keelback (*Xenochrophis piscator*), from the study area.

From them, two species are found NT (Nearly Threatened) as per IUCN red category list. The species are Bengal Monitor (*Varanus bengalensis*) and Yellow Monitor (*Varanus flavescens*).

Mammals

Mammals reported from the study area includes Small Asian Mongoose (*Herpestes auropunctatus*), Golden Jackal (*Canis aureu*), Little Indian Field Mouse (*Mus booduga*) and House Mouse (*Mus musculus*). According to the IUCN Red List 2015, the species correspond to the 'least concern' status. The collection of species and identification are enumerated through FGD's Public Consultation and KII's.

Aquatic Mammal (Dolphin)

The Ganges river dolphins are found in all our major river systems including the rivers Padma, Jamuna, Meghna, Halda-Karnafuli and the Sundarbans. The identified critical winter habitats include Paikerchhara at Dud Kumar river, Gorgachh of Chilmari at Brahmaputra in Kurigram; Silonda-Nagderma in Boral, Nagarbari-Mohonganj in Jamuna; Nazirgonj, Rajshahi

T-band, Godagari and Bakorali in Padma river; Bhairab bridge in Meghna river; Halda and Karnafuli rivers; Rupsha-Bhairab-Atai in Khulna and the Sundarbans[10].

Although EQMS has not detect dolphins during primary field observation but previous observation and secondary source confirms that the area supports of Ganges River Dolphins.

However, a distribution maps of Ganges River Dolphin and sighting (By Atlas on Ganges river Dolphin) and sighting near the project have shown in **Figure 4-50** and **Figure 4-51**.

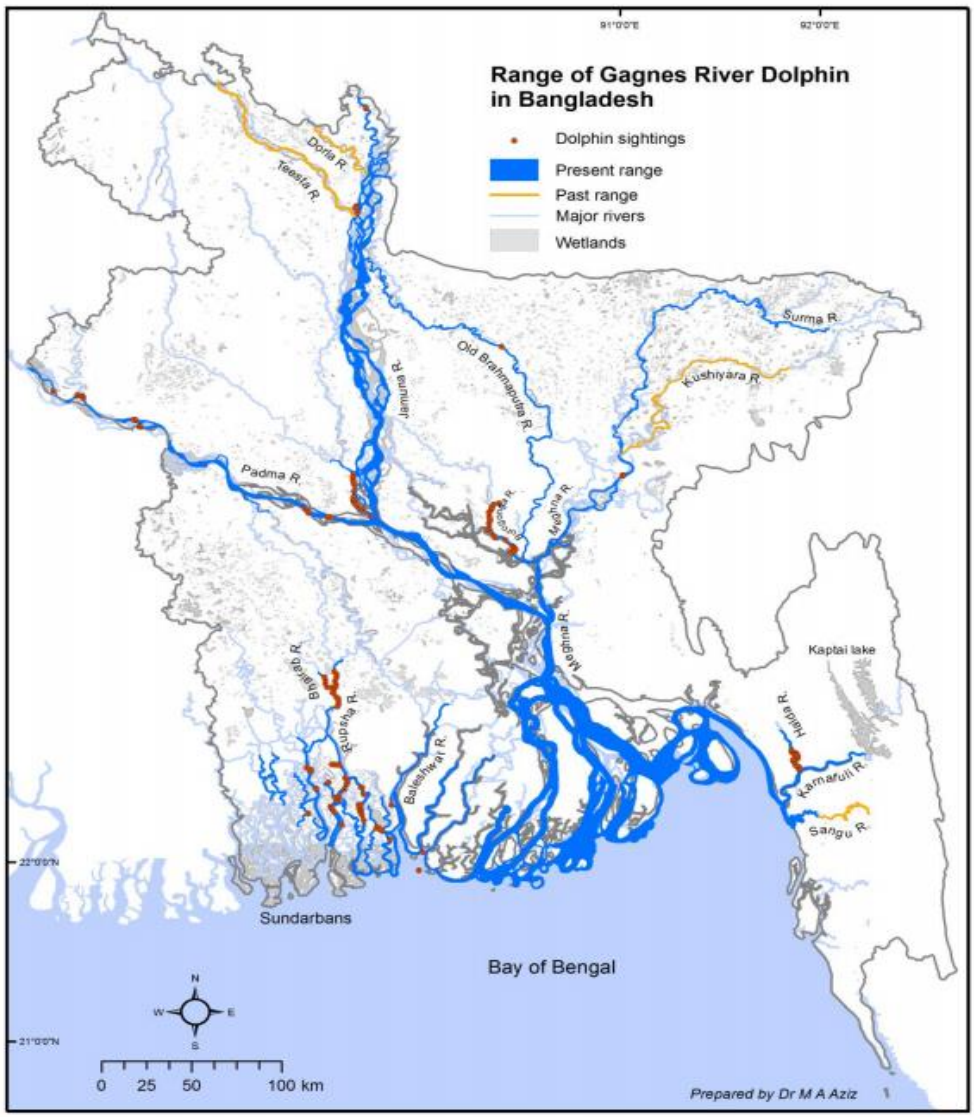


Figure 4-50: Distribution of Ganges River Dolphin in Bangladesh

[10] Final Report of Atlas On Ganges River Dolphin And Irrawaddy Dolphin Of Bangladesh.

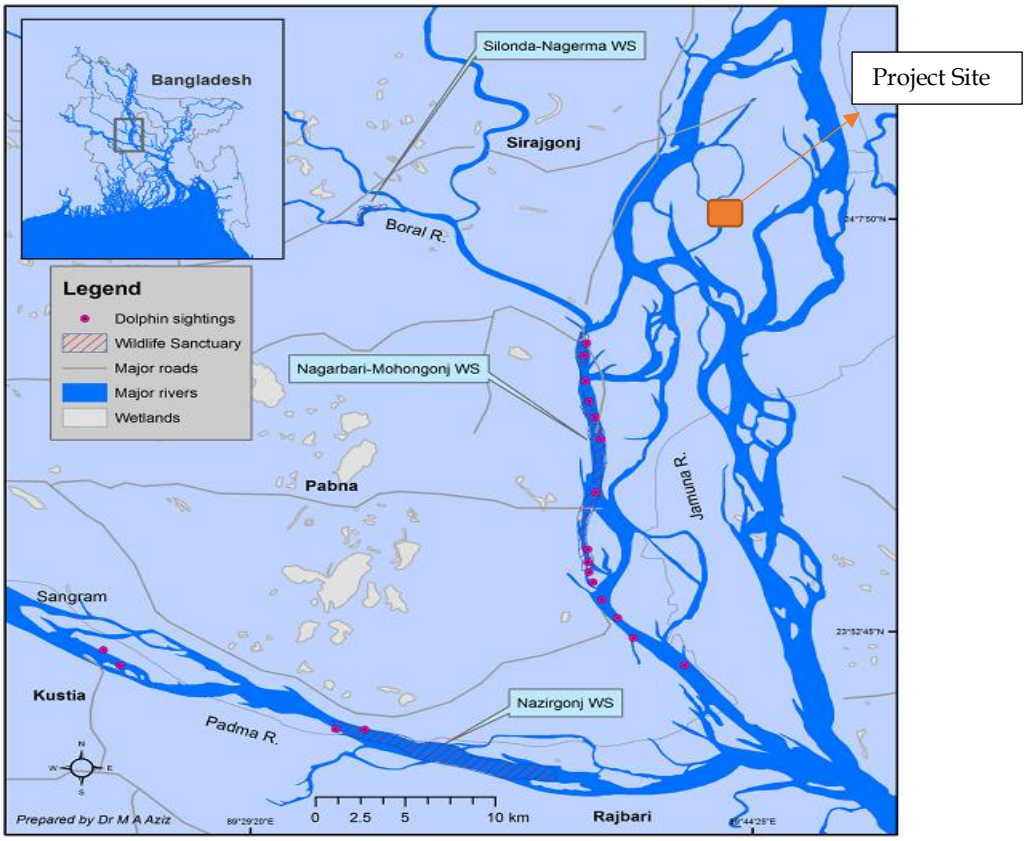


Figure 4-51: Dolphin Sighting at Jamuna River referring to "Atlas on Ganges River Dolphin and Irrawaddy Dolphin of Bangladesh"

4.3.10 Status of Micro-organism in water

Three (03) planktonic samples were collected from Jamuna River to assess the planktonic types and their population. A total of 30 genera of phytoplankton, 13 genera of Zooplankton found in the river and 09 genera of Benthos are confirmed during study. Details of the sampling and species compositions are given in **Table 4-32.**

Table 4-32: Sampling Locations of the Aquatic Microorganism

Study Name	Remarks	GPS Locations
Phytoplankton	P1	24°23'03.22"N 89°44'57.68"E
Phytoplankton	P2	24°23'33.37"N 89°45'12.48"E
Phytoplankton	P3	24°23'23.85"N 89°43'4.90"E
Zooplankton	Z1	24°23'03.22"N 89°44'57.68"E

Zooplankton	Z2	24°23'33.37"N 89°45'12.48"E
Zooplankton	Z3	24°23'23.85"N 89°43'4.90"E
Benthos	B1	24°23'03.22"N 89°44'57.68"E
Benthos	B2	24°23'33.37"N 89°45'12.48"E
Benthos	B2	24°23'23.85"N 89°43'4.90"E

4.4 Social Environment

4.4.1 Socio-Economic

4.4.1.1 Villages Adjacent to the Project Site

Socio-economic assessment of adjacent population of the proposed project is very much crucial for project planning and implementation. Therefore, villages adjacent to proposed economic zone within 2km radius were surveyed for intense socio-economic assessment. Villages are so close to proposed project and communities of the villages are rigorously connected in their daily life to the proposed project area.

Villages situated within the 2km radius from the proposed project were considered for conducting social survey. To get the actual population/households of the studied villages, secondary sources such as Population and Housing Census, District Statistics, District Web Portal and respective Union Parishad Office information have been verified. When total numbers of the households/populations had been confirmed, considering all villages as cluster 15% households were finalized for random sampling. The following **Table 4-5** shows the surveyed villages and households.

Table 4-33: Numbers of Households Surveyed in the 2 km Study Area

Union	Village	Total House Hold	Sample Size	Percent (%)
Saidabad	Khas Barashimul	128	106	15
	Chak Boyra	109		
Rajapur	Bara Berakharua	263		
	Baira Machun	202		

Source: Saidabad and Rajapur Union Parishad, 2019

4.4.1.2 Basic Demographical Characteristics of the Household

Basic demographic characteristics include total population, gender, age, marital status, and health status.

Survey result has found about a total number of 521 populations are living within the 106 households, whereas about 52% are male and rest 48% are female. Average family size is 4.9. On the other hand, 1-70+ age range has been formulated to capture the age distribution of the studied population. Importantly around 64.1% population belongs to 14-69 age range which signifies that most of the populations are eligible for being active in economic activities. Contrary, only 35.9% population is found depended. Additionally, 50.5% population is married. All over health status among the households has been found quite well. Around 96.9% populations are found physically normal and only 0.6% is found handicapped by birth and 2.5% is in acute health problem. Study area is found Muslim dominated where surveyed households were found all are Muslims.

4.4.1.3 Education

Study finds that about 33% primary (class 1-5) education, at least 14.6% S.S.C level, 1.9% who complete at least H.S.C level, 1.2% Hafez (Islamic Curriculum) and 1.3% Graduate. About 48% populations are found underlie within the illiterate category where include children who have future potentiality to enroll in school.

4.4.1.4 Gender and women

The male and female composition of the population is relatively equitable with only Belkuchi indicating a marginally higher male dominated population as compared to female population. Vulnerable groups include specific group of persons, households, or a section of the community vulnerable to multiple stressors including abuse, social marginalization, social exclusion, domination or are under greater susceptibility to external influence. Study finds that common patriotic scenario of the study area. Among all the surveyed household only 2 females headed (1.9%) household has been found and 98.1% are male headed family.

4.4.1.5 Ethnic Composition

According census and SES in 2019 conducted by EQMS consulting Ltd, no indigenous or ethnic minority populations were identified within in 2 km of the project area.

According to Population and Housing Census 2011, Bangladesh Bureau of Statistics (BBS), 2011 it is significant to note that Sirajganj Sadar Upazilla registers an ethnic population of 38 households whereas Belkuchi have only 06 households. Consultations with Saidabad and Rajapur Union president and local communities revealed that the core area of influence does not have any ethnic minority households. However,

4.4.1.6 Household Structure and Assets

In the study area, predominating household structures are Tin made. Survey finds that among the all-surveyed households about 65.4% households' structure is Tin made. Besides, about

1.9% is semi-building. On the other side, only 19.9% and 12.8% households' structure is found respectively Kutcha and Jupri in the study area.

4.4.1.7 Household Utility assets

Tube-well, Solar Power System and Cattle house are the very common household assets found in the study area. During the monsoon period people uses boat for communication. On the other hand, people use Auto, CNG, Cycle and Motor Cycle to go near places around the Union and Upazila.

Study reveals that most of the household's own tube-well for their daily water usage. Declining water level is the major problem in this study area. In this study, it is found 78.3% of the households have the own solar power system by taking loan from the NGO/Bank.

4.4.2 Physical Capital: Development Infrastructure

4.4.2.1 Energy Access

Lighting and cooking sources are the very important energy requirements for any households where high quality and easy access to these energies can ease household's daily life. Results have found that 0.9% of the total households have access to electricity. Most of the household uses solar power panel for their lighting source. About 78.3% households have solar system for their own. 20.8% household depends on kerosene for their lighting source.

In the case of cooking fuel, it is found that most of all the households are relying on the conventional ways of cooking. Firewood, crop residue and cow-dung cake are the source of natural fuels in the study area. Usually, women are engaged for preparing these cooking fuels. In absence of modern cooking system women must work and prepare these fuels, consequently women are depriving themselves from engaging economic activities. About 99.1% households are relying on natural fuels (Firewood, crop residue and cow-dung cake) where rests 0.9% use LPG gas for cooking.

4.4.2.2 Water and Sanitation

Tube-well in the study area is the major source of water. Study finds that 97.5% household uses tube-well water for drinking, cooking purposes and 2.5% household uses river water very conditionally for other purposes. Most of the surveyed households have tube-well for their own.

Among the surveyed households about 12.3% have sanitary toilets. On the contrary, 85.3% households have non sanitary toilet facilities. Moreover, 1.9% households defecate in open place.

4.4.2.3 Occupation and Income

Among the total surveyed population 27.4% are involved with economic activities by engaging in various occupations. This study finds that 10.4% and 6.9% of total surveyed populations are engaged with agricultural activities and day labour work respectively which

represent the highest representation of the total economic-active population. Besides this, 1.5% of the surveyed populations are engaged with business in scale of small to medium level. Moreover, usual form of occupations like farming, fishing, small vehicle driving etc. are also found in the study area.

On contrary 72.7% of the surveyed populations are economic-inactive populations including 26% capable but inactive workforce, 44.1% future/potential workforce and 2.7% incapable and inactive workforce. In the Capable but inactive workforce category, 24.6% populations are engaged with Household works and 1.4% are looking for work opportunities. Moreover, 2.7% is elderly person and physically handicapped constitute incapable and inactive workforce who have no ability to work. On the contrary, 44.1% of the total populations are future/potential workforce of the studied population including 28% students and 16.1% children.

Households' yearly income reveals the poor economic situation of the studied area. Study finds that 26% households of the total surveyed households have equals or less than BDT 5,000. Second largest concentration has been found in BDT 5,001- 10000 category where 49.3% households fall. On the contrary, only 16.4% have yearly income respectively BDT 10,001-15,000. 8.2% households more than BDT 20,000. Poor or insufficient economic gain hindrances accessing to other basic and social services that leads to low inclusion rate and accelerates high poverty rate.

4.4.3 Environment and Social Issues

4.4.3.1 Survey of Social Issues

Social problem is an unexpected situation which hinders to lead normal life in a society. Social problems are multidimensional problem which are created by various reasons. It may include security issues, transportation problem, accidental rate, acute disease, and drug addiction, etc.

According to the survey, transportation (98.1%) has been mentioned as highly social problem by the respondent in the study area for their easy communication to connect with Sadar Upazila and capital city. For this reason, accidental rate (19.8%) in this area is mentioned as low status of the problem. The study also finds that second highest social problem is respectively security problem (71.7%) and acute disease (55.7%). Besides, drug addiction (65.1%) has been mentioned as moderate social problem by the respondent which may increase due to lack of proper awareness among the young people and unemployed persons as well.

4.4.3.2 Survey of Environmental Issues

Environmental problems that are perceived by the respondents in the study area includes water pollution, air pollution, industrial pollution, noise pollution, deforestation, and drainage system etc.

According to the survey, the most pressing problem is water pollution in terms of the percentages of responses. The survey finds that, water pollution (50.9%) has been mentioned by respondent as highly environmental problem at present. Besides, air pollution and industrial populations have also been mentioned by 60.4% and 36.8% respectively as low

status of problem. The survey also reveals that 65.1% of the households mentioned noise pollution as moderately problem in the study area.

4.4.4 Awareness and Impact

4.4.4.1 Project Awareness

Project awareness and perception may hinder or facilitate any project work's successful implementation. Survey result shows that most of the households are completely aware of this proposed project form the local people, DC office and local government.

4.4.4.2 Perceived Impact

Respondents perceived that various benefits were expected to result from the implementation of the project. These benefits, as perceived by the respondents, include; creation of employment opportunity, access to roads, enhanced socio-economic conditions, and overall national development in the area. Among the surveyed population about 98.1% believe that this project will bring positive impacts on the development of the local community and rest 1.9% don't believe so.

According to the survey, creation of employment opportunities is perceived as a beneficial effect of the project for 59.4% of the respondents and 1.9% think that they will lose their homesteaded without proper compensation. Among the studied populations they think that market demand, business opportunity and work opportunity at the project construction activities will be increased. Therefore, employment will be created as well as local people will be blessed with these opportunities. Besides this, people think that other infrastructural developments like educational institute, residence, park, and hospital will be developed. Some believe that basic services and quality of life will be enhanced.

CHAPTER 5

5 ALTERNATIVE ANALYSIS

5.1 Consideration of Alternatives

BEZA initially handover the land for proposed SEZ to SEZL authority by acquiring through DC and AC Land. As per the record, the land is a Khas land and as a result, initially a grant has been given to the project affected people for their displacement. Due to land scarcity in the country, seeking an alternative site for establishing the economic zone area is quite difficult. In addition, land acquisition is a lengthy and complex procedure under the existing Land Acquisition Law of Bangladesh (LA Ordinance 1982).

To avoid or minimize the impacts resulting from the activities of the project, SEZL authority is expected to adopt appropriate technological, improvements or adjustments, policy including good site operational practices and applicable EMP and SMP etc.

The overall strategy shall follow the following sequence:

- Impact avoidance or minimization
- Adequate Compensation where impacts are unavoidable
- Enhancement Measures – Employment benefit enhancement measures proposed by the consultants.

Factors responsible for selection of Saidabad & Belkuchi Upazila as site for development of economic zone are given below:

1. Enough land area for development of EZ ((415 acres for Phase 1) overall 1041.43 acres of development area)
2. Located outside City Corporation
3. Located Near to Dhaka Airport (app. 110 km)
4. Proximity to Jamuna River and well-developed inland water
5. Project site located beside Jamuna branch river which connects to Jamuna River
6. Close vicinity to Elenga-Nalka-Hatikamrul (N405)
7. Located near the Bangabandhu Bridge, the site has easy access to both eastern and western parts of the country.
8. 1.8 km from Bongobondhu Bridge West Railway Station
9. Project site does not lie within any eco-sensitive zone or ecological critical area
10. Availability of large nos. of un-skilled and semi-skilled labour
11. Availability of utilities like power (from nearest power plant), gas (PGCL is about 1km away from the proposed project site) and water

5.2 The No Build Scenario

From a purely physical environmental point of view, the "do-nothing" is preferable to any project implementation, since it would avoid creation of any of the adverse impacts associated with the project. However, the potential socio-economic benefits to the nation would be

foregone and industrial growth would be hampered by going for this option. It is concluded that the "No build" alternative is unacceptable, and the potential socioeconomic benefits of implementation of such project far outweighs the adverse impacts which are minor and temporary can be controlled and minimized to an acceptable level.

5.3 Zero Option

The "zero option" scenario in this report should be based on the current condition of the project and without the development of Economic Zone. The study of the zero option is shown in **Error! Reference source not found.** below. As a result of this study, it is judged that the implementation of the Project should be undertaken because of some advantages in terms of effective urban development and economic development of the country and region including infrastructure development around candidate Economic Zone. In addition, anticipated negative impacts could be avoided or minimized by taking the appropriate countermeasures.

Table 5-1: Study of Zero Option

Aspect		Condition Without the Project	Condition with the Project
Technical Aspect		Random development might be implemented without any plan for overall area development. Then, the future development plan might be restricted after disorderly development	Economic Zone would be developed efficiently in accordance with the planned area development plan.
Economical Aspect	Employment	• Job opportunity would not increase from the current situation	• Job opportunities would increase for residents
	Farmer/ Share Cropper/ Day labor	• No need to change their occupation	• Farmer's will be compensated by the project proponent and they will alter by other profession
	Infrastructures	• Economic development of the entire area would be limited.	• A series of infrastructure development project (water supply, gas supply, telecommunication and power supply) would be beneficiary and cost-effectiveness for Economic Zone development as well as upcoming expansion project.
	Annual revenue from paddy land	• Annual revenue will be increased from paddy land because of no development project	• Annual revenue will be decreased from paddy land but it will be limited
	National Economy	• Contribution of national economic development of the entire area would be limited.	• Because of high industrial development and thousand jobholders will contribute on national economic growth.
	Resettlement	• Involuntary resettlement would not occur.	• Impact on social aspect such as involuntary resettlement would occur.

Aspect		Condition Without the Project	Condition with the Project
Environment/ Social Consideration	Environment	• Impact on natural environment that might be caused by the development of candidate EZ will not occur.	• Impact on natural environment and pollution caused by the construction work and operation of candidate Economic Zone would occur. However, proper management plan could reduce the impacts.
	Social	• Impact on social environment that might be caused by the development of candidate Economic Zone will not occur.	• Impact on social environment (road accident, social conflict, community health and safety) caused by the construction work and operation of candidate Economic Zone might occur. However, proper management plan could reduce the impacts.
	Environmental and Social Consideration	• Issues of environmental and social consideration might be more complicated and segmented in case random developments are conducted.	• Planned area development would effectively and comprehensively address environmental and social consideration issues. • Living environment for local residents would be improved due to the development of the surrounding infrastructure.

Source: ESIA Study Team prepared based on the information from the site visit and project proponent

CHAPTER 6

6 IDENTIFICATION AND ANALYSIS OF POTENTIAL IMPCATS

6.1 Environmental Sensitivity Investigation

Environmental Impact Assessment has been carried out considering the impacts of proposed interventions with associated activities on important components of the environment and society. Firstly, all the environmental components sensitive to proposed activities were identified during reconnaissance field visit based on expert observation, local people's perception, and worldwide practice of ESIA. The scoping process, followed to identify the environment and social sensitive features included professional judgments of the multi-disciplinary ESIA team members and public consultation. The preliminarily identified environmental and social sensitive components are listed in sections below.

6.1.1 Environmental Asset

Environmental assets identified in the study area are listed below:

1. Air Quality of the study area
2. Noise level of the study area
3. Agriculture land
4. Fisheries of the study area
5. Ecosystem of study area
6. Water Quality: Branch of Jamuna River & Jamuna River
7. Transportation system of the study area

Identified environmental assets of the project are likely to be affected due to development of the off-site facilities at all the pre-construction, construction, and operation stages of the project. Project activities, which may have an impact on the environmental assets and the associated impacts, are listed in **Table 6-1**. The detailed impact identification and mitigation measures are given at Chapter 8.

Table 6-1: Environmental Assets of the project area

SL#	Environmental Assets	Impact	Related Project Activity
Pre-Construction & Construction Phase			
1.	Air Quality of the study area	Degradation	• Site clearance/ preparation • Construction activities • Excavation • Exhaust from construction vehicles/machinery
2.	Noise level of study area	Increase in noise levels	• Construction activities • Movement of construction vehicles/machinery
3.	Eco-system of study area: Agriculture activity and aquaculture	Loss of agriculture land	• SEZ area is an Agricultural land and is also some pond used seasonally by people to carry out aquaculture activities
4.	Fisheries of study area	Increased sedimentation of water body	• Increase in run-off from construction/excavated site.
5.	Water Quality: Jamuna River & Branch of Jamuna River	Increased sedimentation of water body	• Increase in run-off from construction/excavated site
Operation Phase			
6.	Air Quality of study area	Air pollution	• Industrial emissions and movement of vehicular access
7.	Noise level of study area	Increase in Noise levels	• Increased traffic movement and industrial operations
8.	Eco-system of study area: Agriculture and aquaculture	Improvement of agriculture and aquaculture production	• Setting up of agriculture & aquaculture-based industries may improve the agriculture and aquaculture activities in the region • Development of paved surfaces may deplete species from SEZ area;
9.	Fisheries of study area	Improvement Entry of pollutant into the Jamuna River, Branch of Jamuna River & other water bodies from upcoming	• Wastewater may discharge into the river that may affect aquatic life.

SL#	Environmental Assets	Impact	Related Project Activity
		industries in EZ zone may impact the aquatic life	
10.	Water Quality: Jamuna River & Branch of Jamuna River	Degradation of Water Quality & Aquatic life	• Discharge of effluents from the industries which are proposed to be in economic zone
11.	Transportation System	Traffic congestion	• Increased nos. of vehicles on Elenga-Nalka-Hatikamrul Road (N405) due to carrying industrial raw materials, local workers, and product

6.1.2 Environmental Hot Spots

The proposed EZ is located across Sirajganj Sadar Upazila and Belkuchi Upazila of Sirajganj District near the west end of the Bangabandhu Bridge. The proposed site (Phase 1) is spread over an area of 415 acres. The project area is mainly covering agricultural low land. During monsoon season some part of the land is inundated and after monsoon season people are growing agricultural product in the project area. EZ site does not lie within Eco-sensitive/Ecological critical area. No reserve or protected forests area was found within the study area. Bangabandhu Jamuna Eco-park within located approximately1.44 km north direction from the Economic Zone. The main Jamuna River is located approximately 1-2 km east side from the EZ. There is natural water body marked as Jamuna Branch River passes north side of the zone and connect again main Jamuna River. The Jamuna Branch River has filled with upstream and rainwater during rainy season and has almost dried during dry season. Average width of the Jamuna Branch River is found 700 ft. Effluent and emissions from industries may impact terrestrial and aquatic life thus only industries impact of which are mitigatable, are proposed for EZ zone. It will be ensured that the environmental management measures should be taken as per the EMP.

Ecological fragile natural feature is Bangabandhu Jamuna Eco-park, Jamuna Branch River & Jamuna River. Retaining wall will be developed all along the Jamuna Branch River within EZ site to prevent direct exposure of industries to Jamuna Branch River which connected with Jamuna River. In addition, it will be ensuring that no waste or effluents discharged into Jamuna Branch River as well as main Jamuna River.

6.1.3 Likely Beneficial Impacts

The project involves development off-site facilities for EZ. These off-site developments will make the site accessible and suitable for setting up of the industries. Development of the off-site infrastructure will attract the investors for setting up of the industries in the economic zone. The likely benefits from the proposed development are listed as below:

1. Rapid Economic development (including enhancement and diversification of Industries, Enhancement of investments)
2. Large scale direct and indirect employment generation- improved quality of life
3. Development of infrastructure facilities
4. Technological enhancement for management of environmental management (like roads, water treatment, waste management, power supply, green belt, environmental monitoring)

As shown in the projected industries for SEZ, the demand from Garment & Textile would be the dominant in the coming few years. Foreign firms are trying to expand their share of domestic markets in Food Processing, Motorbikes, and Consumer Products. Therefore, the proposed SEZL will generate about 20,000 industrial jobs comprising of direct employment.

6.1.4 Community Recommendations

Total 415 acres lands are needed to be acquired for SEZ (Phase-1). In addition, resettlement & rehabilitation is involved in land development for EZ zone and other proposed off-site facilities. As per the focus group discussions carried out with people, it was learned that people are in favour of development of EZ, but also they are looking for their compensation and also the rehabilitation process before displacing them from their household. In addition, they expect large-scale employment will be generated in the area for both males and females that will enhance their standard of living.

Some of them also shared that they expect development of infrastructure facilities like power supply, roads, water supply, educational facilities and hospitals in the area, which will further enhance standard of living. People suggested that only non-polluting industries should come up in the region and all industries should take pollution control measures so that EZ development does not have negative impact on environment and their health. In addition, they demanded that local people should be considered for provision of employment preferably. People also suggested that agro based and aquaculture industries should come up in this region so as it could be beneficial for people engaged in aquaculture activity.

6.2 Impact Assessment and Mitigation/Enhancement Measures

6.2.1 Introduction

As per the discussions with the project proponent and technical project document of the proposed Sirajganj Economic Zone project at Sirajganj District, the possible impacts have been identified in this chapter (Chapter-5). In Section 5.8, the identified impacts significance has been evaluated based on nature, extend and location, duration, intensity/severity, irreplaceable loss, probability and magnitude. Impacts evaluations were made following

expert judgment. This evaluation will help the decision makers to take decision of issuing environmental clearance certificate and to take further policy initiatives.

6.2.2 Criteria for Evaluate Impact Significance

The key issues identified after collecting the baseline information. Each issue consists of components that on their own or in combination with each other give rise to potential impacts, either positive or negative, from the project onto the environment or from the environment onto the project. In the ESIA, the significance of the potential impacts was considered before and after identified mitigation is implemented, for direct, indirect and cumulative impacts, in the short and long term.

6.2.3 Methods of Impacts Significance

A description of the nature of the impact, any specific legal requirements and the stage are given. The following criteria are used to evaluate **Significance**:

A. Nature of Impacts:

This is an assessment of the type of effect the activity is likely to have on the surrounding affected environment. The description includes what is being affected and its magnitude. The nature of the impact was classified as positive or negative and direct, indirect, and induced.

Direct	Potential/possible impacts will be generated directly from the project activities and its associated facilities, which are directly linked with project. (e.g., loss of land due to Economic Zone project development)
Indirect	Potential/possible impacts will be generated from secondary sources, which are induced by project activities. (e.g., loss of any species habitat due to project activities)
Induced	Potential/possible impacts will be generated due to effect/consequence/outcome of project (e.g., influx of camp followers resulting from the importation of a large project workforce)

B. Extent and Location of Impacts:

This indicates the spatial area that may be affected by the project activities or its associated facilities **(Table-A).**

Table-A: Geographical Extent of Impacts

Extent	Description
Project Site	Potential/possible impacts area only at or within the project site/project boundary
Local	Potential/possible impacts area is not only limited to the site but also its immediate surrounding areas/receptors
Regional	Potential/possible impacts area extends to the immediate surrounding areas along with adjacent areas

Extent	Description
National	Potential/possible impacts area considered of national level.
Transboundary	Impact considered of not only within national level but also the neighboring country. Impact considered global level.

C. Duration of Impacts:

This measures the lifetime/existence/continuation of the impact **(Table-B).**

Table-B: Duration of Impacts

Duration	Description
Short Term	Potential/possible impact duration is very limited time or length of construction/ decommissioning period.
Medium Term	Potential/possible impact duration will continue after the construction period but stop/ discontinue/cease within a tenure of 10 years.
Long Term	Potential/possible impact duration will continue more than 10 years or the entire operational life of the project.
Permanent – Mitigated	Potential/possible impact will remain after operational life of the project but appropriate mitigation measures reduce the impact.
Permanent – No mitigation	Potential/possible impact will remain after operational life of project. No mitigation measures will reduce impact after implementation.

D. Intensity/Severity of Impacts:

This is the degree to which the project affects or changes the environment; it includes a measure of the reversibility of impacts **(Table-C).**

Table-C: Intensity of Impacts

Intensity	Description
Insignificant	Changes due to potential/possible impact are minor, not visible/noticeable, natural functioning of the environment not affected.
Low	Natural functioning of the environment is minimally affected. Natural, cultural and social functions and processes can be reversed to their original state if mitigation measure is taken.
Medium	Environment remarkably distorted/disturbed/impacted, still functions, if in modified way. Negative impacts cannot be fully reversed.
High	Cultural & social functions and processes distorted/disturbed/impacted. Potentially ceasing to Environmental function temporarily. Negative impacts cannot be fully reversed.

Intensity	Description
Very High	Natural, cultural and social functions and processes permanently cease, and valued, important, sensitive or vulnerable systems or communities are substantially affected. Negative impacts cannot be reversed.

E. Potential for Irreplaceable Loss of Resources:

This is the degree to which the project will cause loss of irreplaceable resources **(Table-D).**

Table-D: Potential for irreplaceable loss of resources

Potential for irreplaceable loss of resources	Description
Low	No irreplaceable/unique resources will be impacted.
Medium	Irreplaceable/unique resources can be replaced, with mitigation measure/effort and will be replaced after a certain period of time.
High	Potential/possible impact replaces a particular/vulnerable resource.

- **Probability of Impacts:** This is the likelihood or the chances that the impacts will occur **(Table-E).**

Table-E: Probability of Impacts

Probability	Description
Unlikely	Under normal conditions, no potential/possible Impact expected
Low	The probability of the impact to occur is low due to its design or historic experience
Medium	There is a distinct probability of the impact occurring
High	It is most likely that the impact will occur
Definite	The impact will occur regardless of any prevention measures

- **Magnitude:** This is calculated as extent + duration + intensity + potential impact on irreplaceable resources.
- **Significance:** The significance will be rated by combining the consequence of the impact and the probability of occurrence (i.e. Magnitude x Probability = Significance).

Table-F: Significance of Issues (Based on Environmental Parameters)

Significance	Description
Positive Impact	Potential/possible impacts that have a beneficial impact on affected media
Very low	No action required.

Significance	Description
Low	Impacts are within the acceptable range. Potential/possible impacts such as localized or short-term effects on habitat, species, or environmental media.
Medium-Low	Impacts are within the acceptable range but should be mitigated to lower significance levels wherever possible. Potential/possible impacts such as localized, long-term degradation of sensitive habitat or widespread, short-term impacts to habitat, species, or environmental media.
Medium-High	Potential/possible impacts are significant and require attention. Mitigation is required to reduce the negative impacts to acceptable levels. Potential/possible impacts such as localized but irreversible habitat loss or widespread, long-term effects on habitat, species, or environmental media.
High	Impacts are of great importance, mitigation is crucial. Potential impacts such as significant, widespread & persistent changes in habitat, species, or environmental media. Potential impacts such as persistent reduction in ecosystem function on a landscape scale or significant disruption of a sensitive species.
Very High	Impacts are unacceptable. Potential impacts such as loss of a significant portion of a valued species or loss of effective ecosystem function on a landscape scale.

Potential social impacts are inherently variable because community response to a potential impact, perceptions of existing and changing conditions, and the degrees of vulnerability are all heavily dependent on local conditions and the human factor. The significance designations for potential social impacts take into consideration social science expertise and previous experience in Bangladesh regarding the relationships between individuals, communities, government agencies, NGOs etc.

Table-G: Potential Social Impact Significance

Significance	Definition
Positive Impact	Potential/possible impacts that have a beneficial impact on affected stakeholders
Very low	Potential/possible impacts that are practically indistinguishable from the social baseline, with little to no potential impacts to or concerns from affected external stakeholders.
Low	Potential/possible impacts that are short-term nuisance or inconvenience; potentially affected external stakeholders concerned but likely able to adapt with relative ease.
Medium-Low	Potential/possible impacts such as localized or short-term effects; potentially affected stakeholders concerned but likely able to adapt with relative ease.

Significance	Definition
Medium-High	Potential/possible impacts such as local-to-regional (sub-national) or medium-term effects; potentially affected stakeholders concerned and raise the issue as a high priority, but may be able to adapt with some targeted support or assistance.
High	Potential/possible impacts such as local-to-national or long-term effects; potentially affected stakeholders concerned and raised as a high priority; may not be able to adapt without targeted support or assistance in order to maintain pre-impact livelihood.
Very High	Potential/possible impacts such as local-to-global or irreversible long-term effects; potentially affected stakeholders concerned raise the issue as a high priority and are likely not able to adapt without targeted support or assistance.

To determine potential public health impacts, the assessment team considers the public, which has the potential to be exposed to various aspects and potential impacts of the project, whether it is a permanent resident with continuous exposure or a periodic exposure to a fisherman transiting through the project area. The significance determinations for potential public health impacts take into consideration local and regional public health expertise and previous experience in Bangladesh regarding the relationships between individuals, communities, health care providers, government agencies, NGOs, and industries.

Table-H: Potential Public Health Impact Significance

Significance	Definition
Positive Impact	Potential/possible impacts that have a beneficial impact on affected stakeholder
Very low	No impact on the public
Low	Potential/possible illness or adverse effect with limited or no impacts on the ability to function and medical treatment is limited or not necessary.
Medium-Low	Potential/possible illness or adverse effects with mild to moderate functional impairment requiring medical treatment or management.
Medium-High	Potential/possible serious illness or severe adverse health effect requiring a high level of medical treatment or management.
High	Potential/possible serious illness or chronic exposure of a few resulting in life-shortening effects.

Significance	Definition
Very High	Potential/possible serious illness or chronic exposure of many resulting in life-shortening effects.

6.3 Potential impacts and impact assessment

6.3.1 Physical Environment

6.3.1.1 Pre-construction Phase

6.3.1.1.1 Impacts on Ambient air quality

Pre-construction phase will involve site clearance, leveling & filling activities for development of EZ. Considering the amount of soil required for 415 acres project area. River sand will be dredged from the Jamuna River. It is envisaged that around 1crore 30 lakh cubic meter sand will dredged from sand bar (Balu Mahal).

The main sources of air pollution during the dredging activities and land development includes dredger and booster operation, vessel transportation that will carry the sand from the loading point to unloading point. Diesel is used to operate these engines. Diesel combustion will mainly generate sulfur dioxide, nitrogen oxides, particulate matter and greenhouse gases like carbon dioxide and carbon monoxide. The fuel combustion will affect the ambient air quality. As the dredging activity will be short-term and localized in nature, therefore, the impact on air quality has been assessed minimum.

However, these emissions will be limited to the site only and have impact for short duration only during clearance activity. Based on the matrix below the impact has been considered as ***Low***.

Impact	*Ambient Air Quality*				
Impact Nature	Direct		Indirect		Induced
Impact Scale	Within project location and surrounding area				
Frequency	Limited to Pre-construction Phase				
Extent and Location	Project Site	Local	Regional	National	Trans Boundary
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High
Potential for Irreplaceable Loss of Resources	Low		Medium		High

Probability of Impact	Unlikely	Low	Medium	High		Definite
Impact Significance	Very Low	Low	Medium-low	Medium-high	High	Very High
	Significance of impact consider ***Low***					

6.3.1.1.2 Impacts on Noise

The noise level will be increased temporarily in the proposed dredging area due to the operation of dredgers, excavation of the dredge spoil, lifting of dredge materials from river floor up to the suction pipe, transportation of dredging spoil up to the disposal site, pump, generators, propellers and thrusters of the dredgers. The impact of noise caused by the operation of heavy land filling machinery and trucks is predicted but will be limited to the surrounding area.

Noise levels generated by the dredging operation will vary according to the size and type of the equipment used and more importantly, the size and type of the engines. During dredging operations, there are two categories of sound sources that are associated with:

- Dredging excavation
- Clearing vegetation and leveling the site for construction activities

Based on the matrix below the impact has been considered as ***Low***.

Impact	*Noise Level*					
Impact Nature	Direct		Indirect		Induced	
Impact Scale	Within project location and surrounding area					
Frequency	Limited to Pre-construction Phase					
Extent and Location	Project Site	Local	Regional	National	Trans Boundary	
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation	
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High	
Potential for Irreplaceable Loss of Resources	Low		Medium		High	
Probability of Impact	Unlikely	Low	Medium	High		Definite
Impact Significance	Very Low	Low	Medium-low	Medium-high	High	Very High
	Significance of impact consider ***Low***					

6.3.1.1.3 Impacts on Water

Due to project activity at pre-construction phase, there will be impact on water quality. The main source of water pollution will be the land development, construction of access road and

spillage from the heavy equipment which will have brought to the site for construction work. Impact on water quality from muddy water flowing to the Jamuna Branch River and adjacent Jamuna River due to land reclamation work is expected. In the rainy season, dredged soil may sedimented the Jamuna Branch River and Jamuna River by runoff water. The excavated material will be pumped to EZ site as slurry (a mixture of sediment and water). As part of dewatering of the dredge material, tail water would be discharged from the bounded area of EZ site. The inherent risk with tail water discharge is the potential for environment impacts to the receiving waterbodies if tailwater quality is not managed properly. Liquid effluents will also arise from washing of equipment and vehicles. Therefore, proper management can reduce this impact.

Ground water is fresh shallow aquifers of the study area. No significant impacts are anticipated on the ground water quality due to land development of SEZ site. Based on the matrix below the impact has been considered as ***Low***.

Impact	*Water Resource (Surface water and Ground water)*				
Impact Nature	Direct	Indirect	Induced		
Impact Scale	Within project location and surrounding area				
Frequency	Limited to Pre-construction Phase				
Extent and Location	Project Site	Local	Regional	National	Trans Boundary
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High
Potential for Irreplaceable Loss of Resources	Low		Medium		High
Probability of Impact	Unlikely	Low	Medium	High	Definite
Impact Significance	Very Low	Low	Medium-low	Medium-high	High / Very High
	Significance of impact consider ***Low***				

6.3.1.1.4 Impact on Soil Quality

Economic zone area will be developed by the river dredged sediment, which will be disposed on the land as a slurry (mixture of sand and water). The slurry may contaminate the surrounding agricultural land if not properly managed. As the slurry contain mostly sand therefore it may decrease the agricultural productivity of land if not properly managed. Based on the matrix below the impact has been considered as ***Low***.

Impact	*Soil Pollution*		
Impact Nature	Direct	Indirect	Induced
Impact Scale	Within project location and surrounding area		

Frequency	Limited to Pre-construction Phase					
Extent and Location	Project Site	Local	Regional	National	Trans Boundary	
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation	
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High	
Potential for Irreplaceable Loss of Resources	Low		Medium		High	
Probability of Impact	Unlikely	Low	Medium	High	Definite	
Impact Significance	Very Low	Low	Medium-low	Medium-high	High	Very High
	Significance of impact consider ***Low***					

6.3.1.1.5 Impact on Sediment Quality

Sediment contamination during the pre-construction phase may result from leakage and spillage of oil, lubricants, fuel from heavy equipment. Such spills may create impact on sediment, but are expected to be localized in nature. 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.

Based on the matrix below the impact has been considered as Medium ***Low***.

Impact	***Impact on Sediment Quality***					
Impact Nature	Direct		Indirect		Induced	
Frequency	Pre-construction Phase					
Extent and Location	Project Site	Local	Regional	National	Trans Boundary	
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation	
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High	
Potential for Irreplaceable Loss of Resources	Low		Medium		High	
Probability of Impact	Unlikely	Low	Medium	High	Definite	
Impact Significance	Very Low	Low	Medium-low	Medium-high	High	Very High
	Significance of impact consider ***Medium-low***					

6.3.1.1.6 Soil contamination by dredged material

In the preconstruction period waste generation will be limited, mainly waste will be generated due to land filling by dredged sediment in form of slurry (mixture of sand and water). As a project boundary is yet to be developed, there is a chance that the slurry might go down to the adjacent agricultural land on east and west side. Though the slurry is nonhazardous, it might reduce the fertility of the agricultural land. It is mentionable here that, in the preconstruction period no solid waste is likely to be generated during the land development period. Based on the matrix below the impact has been considered as ***very Low***.

Impact	*Air Quality Degradation due to dust generation*				
Impact Nature	Direct		Indirect		Induced
Frequency	Preconstruction Phase				
Extent and Location	Project Site	Local	Regional	National	Trans Boundary
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High
Potential for Irreplaceable Loss of Resources	Low		Medium		High
Probability of Impact	Unlikely	Low	Medium	High	Definite
Impact Significance	Very Low	Low	Medium-low	Medium-high	High / Very High
	Significance of impact consider ***Very Low***				

6.3.1.1.7 Changes in Land Use pattern and production

Total land (415 acres) of the project site is lower agricultural land. During the monsoon season the proposed land is submerged by high precipitation. In the pre-construction phase, agricultural land will be converted into industrial area. Therefore, crop production is likely to be impacted. The project area contributes only 10% of the agricultural lands of the representative unions. Considering all this and based on the matrix below the impact has been assessed as ***Low***.

Impact	**Changes in Land Use pattern and production**				
Impact Nature	Direct		Indirect		Induced
Frequency	Preconstruction Phase				
Extent and Location	Project Site	Local	Regional	National	Trans Boundary
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation

Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High	
Potential for Irreplaceable Loss of Resources	Low		Medium		High	
Probability of Impact	Unlikely	Low	Medium	High	Definite	
Impact Significance	Very Low	Low	Medium-low	Medium-high	High	Very High
	Significance of impact consider ***Low***					

6.3.1.1.8 Working Conditions, Including Occupational Safety

Working conditions are at the core of paid work and employment relationships. Working conditions cover a broad range of topics and issues, from working time (hours of work, rest periods, and work schedules) to remuneration, as well as the physical conditions and mental demands that exist in the workplace. Occupational safety and health (OSH), also commonly referred to as occupational health, or workplace health and safety (WHS), Community Health & Safety is a multidisciplinary field concerned with the safety, health, and welfare of people at work. The details regarding working conditions are given below:

Occupational Health and Safety

There would be some possibility to occur accidents and incident during land development works. Workers may be injured due to imperfect working conditions. Based on the matrix below the impact has been considered as ***Low***.

Impact	*Occupational Health and Safety*				
Impact Nature	Direct	Indirect	Induced		
Frequency	Pre-construction Phase				
Extent and Location	Project Site	Local	Regional	National	Trans Boundary
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High
Potential for Irreplaceable Loss of Resources	Low		Medium		High
Probability of Impact	Unlikely	Low	Medium	High	Definite
Impact Significance	Very Low	Low	Medium-low	Medium-high	High	Very High
	Significance of impact consider ***Low***					

Community Health and Safety

Land development activities of the EZ site will involve removal of vegetation, land leveling & filling activities. These activities will lead to dust generation that may impact on community health and safety. Based on the matrix below the impact has been considered as ***Very-Low***.

Impact	*Community health and safety*				
Impact Nature	Direct		Indirect		Induced
Impact Scale	Within project location and adjacent villagers				
Frequency	Limited to Pre-construction Phase				
Extent and Location	Project Site	Local	Regional	National	Trans Boundary
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High
Potential for Irreplaceable Loss of Resources	Low		Medium		High
Probability of Impact	Unlikely	Low	Medium	High	Definite
Impact Significance	Very Low	Low	Medium-low	Medium-high	High / Very High
	Significance of impact consider ***Very Low***				

6.3.1.1.9 Transboundary impact and climate change

Heavy equipment such as excavators, cranes, and compactors will be used onsite during preconstruction phase. After development of the project area, operation of this heavy equipment will not be necessary. Transportation of construction material using heavy trucks are also likely to contribute to exhaust emissions. In reference with previous similar projects it is anticipated that, impact will be regional in extent. As this activities are limited only to the pre construction phase, impact is considered as ***Very Low***.

Impact	*Climate Change*				
Impact Nature	Direct		Indirect		Induced
Impact Scale	Transboundary				
Frequency	Limited to Pre-construction Phase				
Extent and Location	Project Site	Local	Regional	National	Trans Boundary
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High

Potential for Irreplaceable Loss of Resources	Low		Medium		High	
Probability of Impact	Unlikely	Low	Medium	High	Definite	
Impact Significance	Very Low	Low	Medium-low	Medium-high	High	Very High
	Significance of impact consider ***Very Low***					

Mitigation Measure

For avoiding such impacts in the pre-construction phase, specific mitigation measures have been proposed in the Mitigation plan part under the pre-construction stage for each environmental item. These mitigation measures need to be followed strictly.

6.3.1.2 Construction Phase

Construction of the economic zone will be carried out by the EPC appointed by SEZL authority. The construction phase for the Project will comprise of primarily two distinct phases: (a) Site development like sand filling, leveling the site, demolition of current structure, clearing of vegetation etc. and (b) civil construction work which include of both onsite and off-site facilities and further construction of the industries. The entire construction phase is expected to continue for 36 months. As per the verbal confirmation of SEZL authority, the approximate number of workers for both works is expected to be around 200-250 on an average per day (during peak construction). The workers will be sourced from locally except some technical person from outside if locally not available. Potential impacts to the surrounding environment and human receptors are presented below.

6.3.1.2.1 Impacts on ambient Air Quality

Sources of Impacts

The potential sources of impacts to air quality are as follows:

- Site preparation and levelling;
- Excavation of soil for the development of off-site and on-site facilities;
- Exhaust emission from movement of heavy equipment also by both heavy and light vehicle;
- Loading and unloading of materials;
- Concreting works, including operation of concrete batching plant;
- Debris from the concreting works
- Operation of diesel generators and other diesel based construction machineries.
- Dust generated from stockpiles of materials, waste, loose earth, handling and moving excavated material and transporting wastes on vehicles.

Criteria

For the assessment of air quality, the sensitivity criteria outlined in **Table 6-2** have been used. The standards considered for assessment of potential impacts to air quality, are Schedule 11

ECR, 1997 of the GOB and subsequent amendment in 2005. The air quality impacts associated with the construction activities have been assessed qualitatively, using professional judgement and based on past experience from similar projects.

Table 6-2: Sensivity Criteria for Air Quality

Sensitivity Criteria	Contributing Criteria	
	Human Receptors	**Ecological Receptors**
Low	Locations where human exposure is transitory.	Locally designated sites; and/or areas of specific ecological interest, not subject to statutory protection (for example, as defined by the project ecology team).
Medium	Locations where the people exposed are workers[11], and exposure is over a time period relevant to the air quality objective for PM10 (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day[12].	
High	Locations where members of the public are exposed over a time period relevant to the air quality objective for PM10 (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day).	Internationally designated sites.

Receptors

From the land use analysis and field study, it is clear that most of the land surrounding the Project site is household area with low agricultural/fallow land on the east, west and south sides and sandbar and Sirajganj Power hub on the north side. On the immediate north exists a branch of Jamuna River through the project site with a vacant char land for further development of Sirajganj Economic Zone and also Sirajganj power hub. The immediate south of the Project site has household area with homestead forestry and also barren land. The west site of the project is covered by household area with fallow land followed by the branch of Jamuna River. The east side of the project also represents the household area followed by main Jamuna River. The main village settlements (Panchosona, Fulbari and Randhuni bari) start at about 0-400 m away from the Project site boundary on the east, west and southward direction. It has further been noted that the area on the northern part of SEZ is currently Saidabad Power Generation Complex. The power complex has consisted with four units (S1, S2, S3, S4) all of

11 Notwithstanding the fact that the air quality objectives and limit values do not apply to people in the workplace, such people can be affected to exposure of PM10. However, they are considered to be less sensitive than the general public as a whole because those most sensitive to the effects of air pollution, such as young children are not normally workers. For this reason workers are included in the medium sensitivity category.

12 Schedule 11 ECR, 1997 of the GOB and the World Bank/WBG General EHS Guidelines

which are combined cycle power plant with the capacity of ±1000 MW. As can be referred from **Table 6-2** and above discussion, the human receptors were assessed to be of Medium sensitivity to high sensitivity based on the positions of the village, whereas ecological receptors were considered as of Low sensitivity.

Impact Significance

Dust Generation

Most of the construction activities mentioned above have the potential to generate dust. The extent of impacts from dust will depend on the exact location of these activities and on the weather conditions; stronger winds and dry conditions will enhance the transfer of dust, while damp or wet conditions will reduce this impact. Construction dust dispersion is expected to be localized due to the relatively high mass of the dust particles which will tend to confine the most significant dust impacts to the area within 200 m of the source. The potential for dust emissions during the wet season will be small, due to the moistening of any dust by rainfall. During the dry season, dust suppression techniques will be used and stockpiles will be covered to minimize fugitive dust emissions from spoil storage. As the dust is expected to settle within 200 m and dust suppression techniques will be practiced, the main receptors would be workers on site and neighboring plant and people living near the project site. On the basis of the above factors and considering the high levels of SPM and PM10 recorded during the baseline monitoring in the surrounding areas, the severity of the impact associated with the emission of dust during construction activities is predicted to be medium, probability of impact is also considered as medium. But considering overall condition and based on the matrix below the impact has been considered as ***Low***.

Impact	*Air Quality Degradation due to dust generation*					
Impact Nature	Direct		Indirect		Induced	
Extent and Location	Project Site	Local	Regional	National	Trans Boundary	
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation	
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High	
Potential for Irreplaceable Loss of Resources	Low		Medium		High	
Probability of Impact	Unlikely	Low	Medium	High	Definite	
Impact Significance	Very Low	Low	Medium-low	Medium-high	High	Very High
	Significance of impact consider ***Low***					

Exhaust Emissions

Heavy equipment such as excavators, cranes, and compactors will be used onsite. Emissions from these equipment and diesel generator sets used to generate power will cause impacts to ambient air quality. Transportation of construction material using 10-15 heavy trucks and other transport vehicles per hour during daytime will also contribute to exhaust emissions. Normally the impacts from vehicle emissions decrease rapidly with increasing distance from the source and are not likely to be significant at distances of more than 200 m from the source. So from the source, the nearest household will be affected by the exhaust emission. The implementation of the good site practices, such as the regular maintenance of vehicles and equipment, using cleaner fuels and switching off vehicles when not in use will reduce exhaust emissions from the operation of the diesel-powered construction equipment and therefore minimize adverse air quality impacts. Based on the above discussion, the air quality impacts associated with the vehicular and equipment emissions during construction activities are assessed to be low potential significance.

Impact	*Air Quality Degradation due to exhaust emission*				
Impact Nature	Direct		Indirect		Induced
Impact Scale	Within 100 m of the project location				
Frequency	Preconstruction Phase				
Extent and Location	Project Site	Local	Regional	National	Trans Boundary
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High
Potential for Irreplaceable Loss of Resources	Low		Medium		High
Probability of Impact	Unlikely	Low	Medium	High	Definite
Impact Significance	Very Low	Low	Medium-low	Medium-high	High	Very High
	Significance of impact consider ***Low***				

Mitigation Measures

The mitigation measures will be implemented to ensure that air quality impacts during the construction phase are as low as reasonably practicable. Detail mitigation measures have been discussed in the mitigation plan under Construction stage part. This need to be strictly followed to reduce dust impacts.

Residual Impact

Criterion	Rating Pre-mitigation	Rating Post-mitigation	Comment
Air Quality Degradation due to Dust Generation			
Residual Impact	**Low**	**Very Low**	With implementation of the precautionary and the mitigation measures mentioned for prevention/reduction of dust generation the residual impacts would be very low.
Exhaust Emission			
Residual Impact	**Low**	**Very low**	With implementation of the precautionary and the mitigation measures mentioned for minimizing exhaust emissions the residual impacts would be low.

6.3.1.2.2 Noise Level

Sources of Impact

The potential sources of noise during the construction phase of the Project include equipment, machinery and transportation used for the construction activities. The heavy equipment used for the construction activities will be the major sources of noise. This will include piling and preparing concrete foundations for major plant and buildings. There is expected to be an increase in traffic and thereby in traffic noise impacts to receptors near the existing access road from the transportation of equipment, construction materials and workers. To minimize these impacts, only those vehicles meeting the standards stipulated in Schedule 5 of the Environmental Conservation Rules, 1997 will be used. Construction works are expected to last for 30 months. As per the Master Specifications, the Contractor is required to seek permission from the authorities to carry out construction works at night (21:00 to 06:00) on weekdays.

The detailed breakdown of activities is not available at this stage, and as the Contractor has not yet been appointed, no construction plant inventory is available at the time of assessment. Therefore, an assumed plant inventory is provided in **Table 6-3**. Assumptions have made regarding the type, number and Sound Power Levels (SPLs) of construction plant, based on similar projects and secondary available data. It has been assumed that only one of each type of plant will be on-site during any day or night period. Reassessment of noise levels may be required if the actual plant inventory and SPL vary from the assumed list.

Table 6-3: Assumed Construction Equipment Sound Pressure Level Inventory

Construction Equipment	SPL (dBA)
Bulldozer	115
Backhoe	96
Backhoe	101
Loaders	108

Vibratory roller	102
Fuel Truck	104
Welding machine	101
Cranes	106
Dump Truck	105
Grader	114
Fork Lifts	112
Compressor	104
Generators	93

(Source: The SPLs of the construction equipment have been taken from ESIA report of Unit 4 under Sirajganj Power Plant)

Due to movement of the heavy and also light vehicle, traffic noise will be increased and as a result may impact to the receptors living near the project area. To minimize these impacts, only those vehicles meeting the standards stipulated in Schedule 5 of the Environmental Conservation Rules, 1997 will be used.

Criteria

The noise impact assessment was conducted with reference to Bangladesh Environmental Conservation Rules, 1997 and the WBG EHS Guidelines. Details of the standards are presented in Table 2.10. Furthermore, for the assessment of ambient noise, the sensitivity and magnitude criteria outlined in Table 6-4 respectively have been used:

Table 6-4: Sensivity Criteria for Noise Level

Sensitivity Criteria	Contributing Criteria	
Ambient Noise Level	**Human Receptor**	**Ecological Receptor**
Low	Industrial Use	Locally designated sites; and/or areas of specific ecological interest, not subject to statutory protection (for example, as defined by the project ecology team).
Medium	Residential area near the approach road and Medical Facilities	Nationally designated site.
High	Educational/Religious/ Residential Space	Internationally designated sites.

Receptors

Baseline noise monitoring was carried out at 6 locations, including 2 locations within or just outside the SEZ. The results of baseline monitoring indicated that ambient noise levels are under control at all locations except near Jamuna Health Clinic (NL1) and Ponchoshona Boroshimul High School (NL5) both which is zoned as silent as per the Schedule 4 of ECR, 1997 (amended in 2006). The nearest receptors are in Project boundary mainly from fulbari village and Randhunibari village who will be exposed to noise from construction activities. Apart from this the receptors located close to the access road of Khas Bara Shimul and Punorbason villages will also be affected due to the movement of vehicles. As can be referred from **Table 6-4** and above discussion, the receptors within the SEZ as well as the ecological receptors were assessed to be of Low sensitivity, whereas the human settlements in the surrounding areas (residential areas) were assessed to be of Medium to high sensitivity.

Impact Significance

It is evident from the baseline ambient noise level that the adjacent noise level is currently under control except the health clinic near the Punorbashan market and the Ponchosona Khas Boro Shimul High School. From our previous experience of noise level monitoring during construction period and referencing noise impact modeling of S4 unit of Sirajganj power plant, it has been observed and recorded that the noise level doesn't create great impact to the adjacent area except the boundary area of the project at day time, if the area is bounded by the protective wall. But at night time impact of noise level in the adjacent area will be medium to high based on the construction activity.

So, the impacts of noise will potentially affect the following: -

- Impacts of Noise to Immediate Neighbors
- Exposure of employees to high noise level (above 85dB)

The construction of access road, utility line, boundary wall and other infrastructure may generate noise and impact on adjacent residential area. Vehicles and machinery may generate huge noise. However, low-noise construction vehicles will be used and construction work is not done at night. Moreover, construction period will be done as soon as possible. Hence, there would be not significant impact. Based on the overall condition and matrix below, the impact has been considered as ***Low***.

Impact	*Noise level*				
Impact Nature	Direct		Indirect		Induced
Extent and Location	Project Site	Local	Regional	National	Trans Boundary
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High

Potential for Irreplaceable Loss of Resources	Low		Medium		High	
Probability of Impact	Unlikely	Low	Medium	High	Definite	
Impact Significance	Very Low	Low	Medium-low	Medium-high	High	Very High
	Significance of impact consider ***Low***					

Mitigation Measures

For noise level, mitigation measures have been discussed in the mitigation plan under construction stage. These measures need to be strictly followed to minimize the impact of the noise level during construction stage.

Residual Impacts

Criterion	Rating Pre-mitigation	Rating Post-mitigation	Comment
Change in Ambient Noise Levels			
Residual Impact	**Low**	**Very low**	With implementation of the precautionary and the mitigation measures mentioned for prevention/reduction in noise generation at source impacts would also be low.

6.3.1.2.3 Impact on Water Resource

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

- Excavation activities at the Project site and for gas and water pipeline RoW may increase the erosion, especially during rainfall, which may increase the suspended sediment concentrations and pollute water sources. Similar impacts are possible from construction of the temporary jetty north of Bangabandhu Bridge for receiving heavy equipment;
- Sewage generated from the construction workforce (toilets). Liquid effluents will be generated from washing of construction equipment and vehicles;
- Commissioning phase testing of pipelines and wastewater generation; and Inappropriate storage of waste leading to water quality impacts from runoff entering the adjoining channel to the Project site or seepage to ground water.

For the assessment of water resources, the sensitivity criteria outlined in Table **6-5** have been used respectively.

Table 6-5: Sensitivity Assessment Criteria for Water Resources (Surface water and Ground water)

Sensitivity Criteria	Contributing Criteria	
	Environment	**Social**
Water Resources - Surface water and ground water (quality/quantity related criteria)	The extent to which the water resource plays an ecosystem or amenity role in terms of supporting biodiversity either directly or indirectly, particularly with respect to dependent ecosystems.	The extent to which the water resource provides or could provide a use (drinking water, agricultural uses, washing and other domestic or industrial, use as waterways) to the local communities and businesses, or is important in terms of national resource protection objectives, targets and legislation.
Low	The water resource does not support diverse aquatic habitat or populations, or supports aquatic habitat or population that is of low quality.	The water resource has little or no role in terms of provisioning services as agricultural water source, other domestic uses as washing, bathing, industrial use and waterways for the local community. The groundwater resource is not currently abstracted and used in the vicinity of the Project, but is of sufficient quality and yield to be used for that purpose in the future (and there is a reasonable potential for future use).
Medium	The water resource supports diverse populations of flora and / or fauna but available in the surface water bodies in the region.	The surface water resources have local importance in terms of provisioning services but there is ample capacity and / or adequate opportunity for alternative sources of comparable quality. The groundwater resource is an important water supply, and is currently used, but there is capacity and / or adequate opportunity for alternative sources of comparable quality.
High	The water resource supports economically important or biologically unique aquatic species or provides essential habitat for such species	The surface water resources are wholly relied upon locally, with no suitable technically or economically feasible alternatives, or is important at a regional or transboundary watershed level for provisioning services.

Sensitivity Criteria	Contributing Criteria
	The groundwater resource is wholly relied upon locally, with no suitable technically or economically feasible alternatives, or is important at a regional or national level for water supply or contribution to groundwater dependent ecosystems.

Receptors

The major surface water body adjacent to the western boundary of the Project site is an adjacent main branch located about 0.8 to 1.8km away from the boundary of the SEZ and also a branch of Jamuna River has flown through the project site of the SEZ. The channel is seasonal and runs dry during the non-rainy season with water left only in depressions. The main Jamuna River might be used as means of transport for heavy equipment. Details of the hydrology and drainage pattern in the AOI are discussed in Section 4.3.5. Based on the sensitivity assessment criteria described in **Table 6-5** for both surface and ground water resource was found to be medium. However, at places where discharge is to the channel when it is dry.

Impact Significance

Wastewater Discharge

Wastewater will be generated from washing of equipment and machinery 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/ WBG General EHS Guidelines prior to discharge of such wastewater. Sanitary facilities including toilets will be provided for the use of the construction workforce. Such sewage streams are likely to be high in organic matter, suspended solids, coliform and other pollutants. Septic tanks with soak pit facility will be provided to treat sanitary wastewater. The contractor will be responsible for ensuring that any wastewater discharges meet the standards stipulated in Schedule 9 of ECR, 1997 and the applicable World Bank/ WBG General EHS Guidelines prior to discharge of such wastewater if required. Potential impacts are expected to be short-term and localized in nature. Based on the above discussion, the impact to surface water from wastewater discharges during construction is assessed to be medium low.

Impact	*Wastewater*				
Impact Nature	Direct		Indirect		Induced
Extent and Location	Project Site	Local	Regional	National	Trans Boundary
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation

Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High	
Potential for Irreplaceable Loss of Resources	Low		Medium		High	
Probability of Impact	Unlikely	Low	Medium	High	Definite	
Impact Significance	Very Low	Low	Medium-low	Medium-high	High	Very High
	Significance of impact consider ***Medium-low***					

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. Mitigation measures such as storage of chemicals at concreted laydown areas will be implemented to minimize contamination in the event of a spill. Drainage outline of the mechanical workshop will be separated to treat the wastewater from the mechanical section. Septic tanks will be provided to treat sanitary wastewater. As stated above, all wastewater discharges will meet the standards stipulated in Schedule 9 and 10 of ECR, 1997 and the applicable World Bank/ WBG General EHS Guidelines prior to discharge. While there is a potential for long-term direct impacts to groundwater quality from construction, with the implementation of mitigation measures for proper handling of chemicals, waste and liquid effluents, impact to ground water would be limited. Based on the above discussion, the impact to groundwater from spills and leaks is assessed to be low.

Impact	*Groundwater*					
Impact Nature	Direct		Indirect		Induced	
Extent and Location	Project Site	Local	Regional	National	Trans Boundary	
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation	
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High	
Potential for Irreplaceable Loss of Resources	Low		Medium		High	
Probability of Impact	Unlikely	Low	Medium	High	Definite	
Impact Significance	Very Low	Low	Medium-low	Medium-high	High	Very High

	Significance of impact consider ***Low***

Mitigation Measures

A detailed mitigation measures have been discussed under construction stage of the mitigation plan. These need to be strictly followed to avoid the impacts regarding water pollution.

Residual Impacts

Criterion	Rating Pre-mitigation	Rating Post-mitigation	Comment
Wastewater			
Residual Impact	**Medium Low**	**Very Low**	With implementation of the precautionary and the mitigation measures mentioned for wastewater contamination, the residual impacts would be very low.
Groundwater Level			
Residual Impact	**Low**	**Very Low**	With implementation of the precautionary and the mitigation measures mentioned for prevention of groundwater contamination the residual impacts would be very low.

6.3.1.2.4 Waste

Source of Impacts

There will be two kind of wastes which are solid wastes and hazardous wastes. The possible source of waste during construction phase has given below:

- General construction waste is expected and typically managed by the appointed contractors;
- Construction sludge by boring from underground and domestic waste from the base camp may generated during construction;
- Civil works, gas/power supply line, building construction, access road and internal road construction may generate both solid and liquid waste;
- Burn mobile and small amount of biomedical waste from the first aid area as a hazardous waste
- Bio-degradable waste from the workforce canteen area and also temporary office area and also some non-biodegradable waste may generate from the project site.

Criteria

For the assessment of waste, the sensitivity criteria Table 6-6 has been used.

Table 6-6: Sensitivity Criteria for wastes

Sensitivity Criteria	Contributing Criteria	
Waste of both solid (bio-degradable and non-biodegradable) and hazardous waste	**Environment**	**Social**
Low	The waste will be managed in proper way to reduce the possibility of contamination	Management of wastes will be in a good process and as a result social people will not be affected by the wastages
Medium	Surrounding environment may be polluted by the improper management of wastes	The sourrounding people may be affected by the improper management of wastes
High	There will be no management of wastes and surrounding environment will be polluted by the disposing of wastes in the natural environment	The social people also will be greatly affected by the dumping of wastes at their area.

Receptors

The nearest receptors of the surrounding project area is the household area at south, east and west side of the project boundary and branch of Jamuna River within the project site. All these are sensitive receptor of the unwanted wastes.

Impact Significance

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. During the construction phase of the Project, solid waste generation will mainly be concrete waste and bitumen. Bitumen or any hazardous wastes will be disposed off to licensed contractors. 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. The construction contractor will handle, store and dispose of all waste in accordance with applicable GOB guidelines. There is a potential for direct, long-term negative impacts to soil quality from improper waste handling; however, with the implementation of the mitigation measures discussed above the impacts to soil quality is assessed to be very low.

Impact	*Waste*					
Impact Nature	Direct		Indirect		Induced	
Extent and Location	Project Site	Local	Regional	National	Trans Boundary	
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation	
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High	
Potential for Irreplaceable Loss of Resources	Low		Medium		High	
Probability of Impact	Unlikely	Low	Medium	High	Definite	
Impact Significance	Very Low	Low	Medium-low	Medium-high	High	Very High
	Significance of impact consider ***Very Low***					

The mitigation measures under the construction stage of the mitigation plan should be followed strictly to minimize waste impacts during the construction phase:

Residual Impact

Criterion	**Rating Pre-mitigation**	**Rating Post-mitigation**	**Comment**
Waste			
Residual Impact	**Very low**	**Very Low**	With implementation of the precautionary and the mitigation measures, the impact of waste will be very low.

6.3.1.2.5 Soil and Sediment Quality

Potential sources of impacts to soil and sediment quality due to the construction phase activities include:

- Clearance of vegetation from the project site and ancillary areas within the project site and laydown areas outside the project area;
- Civil work activities;
- Transportation of construction material, equipment and personnel;
- Storage of construction materials including hazardous material;

- 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).

Criteria

For the assessment of soil and sediment quality, the sensitivity criteria outlined in Table 6-7 have been used.

Table 6-7: Sensitivity criteria of soil and sediment quality

Sensitivity Criteria	Contributing Criteria	
	Environment	Social
Soil and sediment Quality related criteria as compaction, erosion and contamination and Land use change	The extent to which the soil and sediment quality plays an ecosystem role in terms of supporting biodiversity. This includes its role as in supporting a lifecycle stage	The extent to which the soil and sediment quality provides a use (agricultural use, fishing) to the local communities and businesses, or is important in terms of national resource protection objectives, targets and legislation
Low	• The soil quality does not support diverse habitat or populations and/or supports habitat or population of low quality. • The sediment quality does not support diverse aquatic habitat or populations and and/or supports aquatic habitat or population of low quality. • Designated area, no change or eligible change from designated Land-use. • Minor Visual Change.	• The soil and sediment quality has little or no role in provisioning of services as agricultural uses for the local community. • Land use not of relevant use by Community.
Medium	• The soil quality supports diverse habitat or population of flora and fauna and supports habitats commonly available in the Project AoI. • The sediment quality does not support diverse aquatic habitat and supports habitats commonly available in the Jamuna River across the Project AoI. • Perceived change from designated land use.	• The soil and sediment has local importance in terms of provisioning services as agricultural services but there is ample capacity and / or adequate opportunity for alternative sources of comparable quality i.e. ready availability across the AoI.

Sensitivity Criteria	Contributing Criteria	
	Environment	Social
	• Visual Change but common feature in Project AoI.	• Land use of important local use by communities.
High	• The soil quality supports economically important or biologically unique species or provides essential habitat for such species. • The sediment quality supports economically important or biologically unique aquatic species or provides essential habitat for such species. • Major change in Landuse. • Visual Change aesthetically affecting locals.	• The soil and sediment is wholly relied upon locally, with no suitable technically or economically feasible alternatives, or is important at a regional level for provisioning services. • Land use of regional importance. Change would impact Land use classification of the area.

Receptors

The analysis of soil and sediment sampling in the Project area indicate that the soils are mainly sandy loam to silty clay loam and sediments from the Jamuna River were of the silty clay loam type. Soil samples were found to be slightly acidic in nature (i.e. pH between 6.8 and 7.6) while the pH of sediment samples from Jamuna River was found to be neutral. The soil at the project site contains sand depositions from the Jamuna River used for filling. It does not support any diverse habitat or species and agricultural activities. Furthermore, soil of the areas identified for laydown, and industrial facilities are covered by household and vegetation and also agricultural activities. But for sediment, the scenario is totally different and there is no agricultural activities. So, soil was considered as medium low and sediment was considered as very low under sensitivity assessment criteria.

Impact Significance

Soil Compaction

The Project site contains sand depositions from the Jamuna River used for filling to raise the height of the entire SEZ Complex above the highest flood level recorded. However, soil outside the project site will be compacted during the establishment of laydown areas to ensure soil stability and also others on-site and off-site facilities. Movement of heavy vehicles and heavy construction machinery will also cause soil compaction. However, a permanent access road to the Project site is already under construction from the national highway. Soil compaction and possible damage to the soil structure due to heavy vehicular movement will be limited to the vicinity of this access road, gas pipeline route, water pipeline route and Project site. The pipeline routes will follow the exiting road of the SEZ and will be sourced from the nearest valve station of PGCL. Based on the above discussion and also following the matrix, the impact was assessed as low.

Impact	*Soil compaction*					
Impact Nature	Direct		Indirect		Induced	
Extent and Location	Project Site	Local	Regional	National	Trans Boundary	
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation	
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High	
Potential for Irreplaceable Loss of Resources	Low		Medium		High	
Probability of Impact	Unlikely	Low	Medium	High	Definite	
Impact Significance	Very Low	Low	Medium-low	Medium-high	High	Very High
	Significance of impact consider ***Low***					

Soil erosion

The project AOI is prone to soil erosion due to nature of soil enhanced by heavy rains and flooding in the area. As mentioned earlier, the project site within the SEZ will be raised and compacted with filled sand. There will be also embankment for safety from flood induced erosion which will be developed by the BWDB. However soil erosion may occur in vicinity of the gas pipeline, water pipeline and laydown areas due to clearance activities, transportation of materials and excavation. Soil erosion will typically be worse during the monsoon months however no construction activities will be taking place during this period. Further it will be proposed in the specification manual for EPC contractors that:

- All areas of excavation will be closed and compacted before the monsoon season to prevent soil erosion.
- Storm water is properly channelized to settling tanks for controlling soil erosion.

Based on the above discussion and also following the matrix given below, impact was assessed as low.

Impact	*Soil erosion*				
Impact Nature	Direct		Indirect		Induced
Extent and Location	Project Site	Local	Regional	National	Trans Boundary
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High

Potential for Irreplaceable Loss of Resources	Low		Medium		High	
Probability of Impact	Unlikely	Low	Medium	High	Definite	
Impact Significance	Very Low	Low	Medium-low	Medium-high	High	Very High
	Significance of impact consider ***Low***					

Soil and Sediment Contamination (Spills and Leaks)

Soil contamination during the construction phase may result from leaks and spills of oil, lubricants, fuel from heavy equipment or leakage from chemical/fuel storage. Such spills can have long-term impact on soil and sediment quality, but are expected to be localized in nature. 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 EPC Contractors:

- The Contractor will prepare unloading and loading protocols for the temporary jetty 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 and sediment samples analysis indicates that the soil/fill material at the Project site and Jamuna River 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 (Table 2.8 and Table 2.9); and the applicable World Bank/WBG guidelines (Table 2.8) 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 above discussion and using impact matrix, it has been considered as medium low.

Impact	*Soil and Sediment Contamination (Spills and Leaks)*				
Impact Nature	Direct		Indirect		Induced
Extent and Location	Project Site	Local	Regional	National	Trans Boundary
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation

Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High	
Potential for Irreplaceable Loss of Resources	Low		Medium		High	
Probability of Impact	Unlikely	Low	Medium	High	Definite	
Impact Significance	Very Low	Low	Medium-low	Medium-high	High	Very High
	Significance of impact consider ***Medium-low***					

Mitigation Measures

Potential impacts to soil and sediment during the construction phase are attributed to soil compaction, erosion and soil /sediment contamination from spills and leaks and wastes. Detail mitigation measures under mitigation plan in construction stage need to be implemented to mitigate potential soil impacts.

6.3.1.3 Operation Phase

6.3.1.3.1 Impacts on ambient Air Quality

In the operation phase different types of industries are likely to be installed inside the project area. Due to post development of the economic zone & setting up of industries, there could be some impacts on the air quality of the site and nearby areas. Industrial development will involve generation of emissions and increased vehicular movements. There will be minimal dust emissions from paved access and all internal roads. These altogether may have overall negative impact on the air quality of the EZ site and the nearby areas.

Industries like Textile, Chemicals, Footwear, Healthcare, RMG, Knit, Dyeing, Composite, Woven, Yarn, Garments accessories, Plastics, Hospitality industry, Agro-business, Building/Infrastructure construction items, Healthcare, Electronics etc. will be set up and then start their operation in the SEZ area.

Potential impact from anticipated industries

Agro-business

Operations consist of particulate matter (PM) and odor. PM may arise from solids handling, solid reduction and drying. Odor may be released by thermal processing steps such as steam peeling, blanching and dehydrating and by microbial action in stored solid waste. In meat processing, odor may also be emitted from cooking and smoking activities. Specific mitigation measures for food and beverage sector has been proposed in the mitigation plan under Operation stage. These mitigation measures need to be followed by the industry strictly.

Footwear

The potential impact of operation of footwear industry is dust / total particulate may be generated from various operations (e.g. storage and handling of powdery chemicals, dry shaving, buffing, dust removal machines, milling drums, and staking). Specific mitigation measures also have been proposed in the mitigation plan part under the operation stage for Footwear industry. These measures need to be followed during operation period.

Textile manufacturing operations

Operation of this industry is most likely to generate significant sources of air pollutants include the finishing processes (e.g. coating and dyeing operations). Other significant sources of air emissions in textile operations include drying, printing, fabric preparation, and wastewater treatment residues. Solvents may be emitted from coating/treatment finishing processes, drying ovens and high-temperature drying and curing. Other potential emissions may include formaldehyde, acids (especially acetic acid), and other volatile compounds, such as carriers and solvents, emitted during dyeing operations and from wastewater treatment operations. Solvent vapors may contain toxic compounds such as acetaldehyde, chlorofluorocarbons, dichlorobenzene, ethyl acetate, methylnaphthalene, chlorotoluene, among others.

Dust emissions associated with textile manufacturing occur during natural fiber and synthetic staple processing and yarn manufacturing. Fiber (especially cotton) handling and storage are sources of dust, particularly within work areas. The main sources of dust include bale breakers, automatic feeders, separators and openers, mechanical conveyors, pickers, and cards.

Odors may be generated in textile manufacturing, particularly during dyeing and other finishing processes, and use of oils, solvent vapors, formaldehyde, sulfur compounds, and ammonia.

For mitigating such impacts, specific measures for textile industries have been proposed in the mitigation plan part. The measures need to be followed for such type of industries.

Plastic industries

Plastic industries are likely to impact air quality of the project site and adjacent area. Air emissions may contain particulate matter and volatile organic compounds (VOC). Particulate matter may be released during handling of dry additives and granulation of polymers. In addition, heating of thermoplastics during compounding and forming may result in formation and release of fine aerosols.

VOC, including low-molecular weight additives and solvents, may be released during compounding and forming operations, especially when heated.

Under the operation stage of the mitigation plan, mitigation measures related to plastic industries have been proposed which need to follow for controlling such impacts.

Electrical & Electronics Equipment

Non-metallic Mineral Products Light Engineering and Pharmaceutical industries etc. These are particulate matter, sulphur dioxide, metals and other criteria pollutants like ozone, oxides of nitrogen and carbon monoxide. Lead may be generated in some of the processes. These industries will emit low process-air emissions. Most processes use electrical power and rarely emit harmful compounds to environment. However, air emissions from water treatment plant of these industries are a major concern.

Considering the above limited impacts and based on the matrix below the impact has been considered as ***Medium-Low***.

Impact	*Ambient Air Quality*				
Impact Nature	Direct	Indirect	Induced		
Impact Scale	Within project location and surrounding area				
Frequency	Limited to Operation Phase				
Extent and Location	Project Site	Local	Regional	National	Trans Boundary

Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High
Potential for Irreplaceable Loss of Resources	Low		Medium		High
Probability of Impact	Unlikely	Low	Medium	High	Definite
Impact Significance	Very Low	Low	Medium-low	Medium-high	High / Very High
	Significance of impact consider *Medium-low*				

6.3.1.3.2 Noise Level

Noise will be generated during operation of the industries. In the operation phase of SEZ, traffic in the area will increase significantly, which will increase the noise level of the area. Operation of tenants, water pumps and light engineering factories in proposed EZ may increase the noise level. Large rotating machines, such as compressors and turbines, pumps, electric motors, air coolers, rotating drums, spherodizers, conveyor belts, cranes, fired heaters, and emergency depressurization, can all produce noise. The main source of noise at textile plants could be yarn processing and woven fabric production.

Agro-business

The potential sources of noise in food and beverage processing includes different sources. A variety of operations in food and beverage processing units are likely to generate substantial noise levels, for example the canning plant, bottling machines, conveyors, and blanching applications.

Textile manufacturing

The main sources of noise in textile plants are associated with yarn processing (e.g. texturizing and twisting and doubling) and woven fabric production. If there is any provision of sewing facility it is also likely to generate noise.

Plastic industries

Plastic products manufacturing operations are inherently noisy due to the large amount of mechanical equipment and activities.

It can be mentionable here that, in the operation phase Footwearfinishing, production of Electrical & Electronics Equipment is likely to cause negotiable noise.

The generated noise is likely to affect the workers and employee of the industries. However, the adjacent villagers might be impacted if the noise level is very high. Noise is likely to impact on the flora and fauna during operation phase of the project. Based on the matrix below the impact has been considered as ***Medium-Low***.

Impact	*Noise Level*				
Impact Nature	Direct		Indirect		Induced
Impact Scale	Within project location and surrounding area				
Frequency	Limited to Operation Phase				
Extent and Location	Project Site	Local	Regional	National	Trans Boundary
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High
Potential for Irreplaceable Loss of Resources	Low		Medium		High
Probability of Impact	Unlikely	Low	Medium	High	Definite
Impact Significance	Very Low	Low	Medium-low	Medium-high	High / Very High
	Significance of impact consider ***Medium-low***				

The mitigation measures for minimizing the impact of noise pollution have been identified in the mitigation plan. These need to be followed to prevent noise pollution during the operation phase:

6.3.1.3.3 Water Quality

A. Impact on Surface Water Quality

Water is required for different operational activity and domestic purpose. The nearby branch of Jamuna River might be one of the potential sources of water. The industries proposed as per the feasibility study Food Processing Industry, Leather & Leather Products, Textile/RMG,

Electrical & Electronics Equipment, Non-metallic Mineral Products, Fertilizers, Plastic, Light Engineering and Pharmaceutical etc. Though the impact on water mostly depends on the manufacturing process a general impact on water is assessed in this stage of the study.

Agro-business

Effluent streams from food and beverage is likely to have a high biochemical and chemical oxygen demand (BOD and COD) resulting from organic wastes entering into the wastewater stream and from the use of chemicals and detergents in various processes including cleaning. In addition, effluent may contain pathogenic bacteria, pesticide residues, suspended and dissolved solids such as fibers and soil particles, nutrients and microbes, and variable pH.

Specific mitigation measures have been proposed in the mitigation plan for minimizing such surface water pollution by the operation of food and beverage industry. So these mitigation measures need to be followed to avoid such water pollution.

Textile manufacturing process

Waste water generated from textile manufacturing are likely to impact on water if not treated properly before discharge. Waste water effluents are related to wet operations of the different industries. Process wastewater from textile manufacturing is typically alkaline and has high BOD and COD loads. Pollutants in textile effluents include suspended solids, mineral oils (e.g. antifoaming agents, grease, spinning lubricants, non-biodegradable or low biodegradable surfactants (alkylphenol ethoxylates APEO, nonylphenol ethoxylates), and other organic compounds, including phenols from wet finishing processes (e.g. dyeing), and halogenated organics from solvent use in bleaching. Effluent streams from dyeing processes are typically hot and colored and may contain significant concentrations of heavy metals (e.g. chromium, copper, zinc, lead, or nickel).

For textile manufacturing process, specific mitigation measures have been proposed in mitigation plan to minimize adverse impact related to surface water pollution by textile related industries.

Plastic Industry

Process wastewater used in the *plastic* molding and forming processes can be subdivided into three main categories: (1) cooling (or heating) water for plastics production; (2) surface cleaning and wash water used both for plastics product surface cleaning and equipment washing; and (3) finishing operation water to remove waste plastic material or to lubricate the product. Cooling (and heating) water may be a source of thermal pollution if discharged. Toxic pollutants potentially detectable in process wastewater discharged by contact cooling and heating processes include phthalates. Cleaning water may be characterized by significant levels of biochemical oxygen demand (BOD_5) and chemical oxygen demand (COD), total suspended solids (TSS), total organic carbon (TOC), oil and grease, total phenols, and zinc. Finishing water may contain significant levels of TSS and water-soluble additives. Plastic industry related mitigation measures have been proposed in the mitigation plan part to avoid such impacts.

Electrical & Electronics Equipment, Non-metallic Mineral Products, Light Engineering and Pharmaceutical industries may generate domestic and industrial effluent. Liquid waste, which can be generated from light engineering industries will include waste acid, waste alkali, grease, used/spent oil, liquid metal, spent solvents etc. Majorly domestic and cleaning waste is likely to be generated. No significant liquid waste is generated from RMG garments.

Pollutants from these industries may be discharged into the existing branch of Jamuna River which may be carried away to the Jamuna River system. The Jamuna River supports a variety of fish. Storm water will be generated from post development of EZ site and measures should also be taken to prevent contamination of storm water with any industrial pollutant. Based on the matrix below the impact has been considered as ***Medium-high***.

Impact	*Surface Water*				
Impact Nature	Direct	Indirect	Induced		
Impact Scale	Within project location and adjacent waterbodies				
Frequency	Limited to Operation Phase				
Extent and Location	Project Site	Local	Regional	National	Trans Boundary
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High
Potential for Irreplaceable Loss of Resources	Low		Medium		High
Probability of Impact	Unlikely	Low	Medium	High	Definite
Impact Significance	Very Low	Low	Medium-low	Medium-high	High	Very High
	Significance of impact consider ***Medium-high***				

Following measures should be adopted during operation phase to minimize impacts of development of economic zone on surface water quality:

<u>Mitigation Measures</u>

- Each industry should obtain an ECC from the DoE Bangladesh before construction and operation of the factory and must comply with the conditions stated in the ECC.
- Each industry must arrange STP facility to treat their processed effluent and sewage they generate;
- Wastewater will be treated in the effluent treatment plant to meet national waste water discharge standards of Bangladesh;
- Storm and industrial wastewater should be collected in separate pipe networks to prevent contamination of storm water draining to natural wetlands;
- Common waste disposal sites should also be developed within EZ site as per the standards and prior permission of DoE should be taken before development;
- Peripheral drain shall also be lined and shall not be connected to internal storm water drainage system;
- Surface water quality of nearby water body shall be monitored periodically (as per EMP);
- Adoption of most efficient and most economically viable technology available at that moment.

B. Impact on Ground Water Quality

There will be minimum chance of contamination of ground water pollution from wastewater and sewage during the operation phase. Wastewater will be collected from factories through anti-corrosive pipes to the treatment plant and only be discharged after meeting the national discharge standards. The local people are using the groundwater for drinking and domestic purposes. Water abstraction for domestic and operational purposes will not result in water scarcity for the locals because ground water will be recharged on a continuous basis by the available water source around the project site. Though proper monitoring of the ground water level needs to be ensured. Based on the matrix below the impact has been considered as ***Low***.

Impact	*Ground Water*				
Impact Nature	Direct	Indirect	Induced		
Impact Scale	Within project location and surrounding area				
Frequency	Limited to Operation Phase				
Extent and Location	Project Site	Local	Regional	National	Trans Boundary
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High

Potential for Irreplaceable Loss of Resources	Low		Medium		High	
Probability of Impact	Unlikely	Low	Medium	High	Definite	
Impact Significance	Very Low	Low	Medium-low	Medium-high	High	Very High
	Significance of impact consider ***Low***					

Following measures should be taken to minimize the ground water pollution.

Mitigation Measures

For reducing impact on ground water by the proposed industries, specific mitigation measures have been proposed under the operation stage of the mitigation plan.

6.3.1.3.4 Waste

The potential sources of waste generation during operation of the EZ are from the following:

- Office and Canteens;
- CRTP, ETP and STP;
- Laboratories;
- Industrial waste etc.

It is anticipated that, during the operation phase different types of industries will generate different types of solid wastes.

Food and beverage processing activities are likely to generate significant volumes of organic putrescible solid waste in the form of inedible materials and rejected products from sorting, grading and other production processes. Where meat products are the raw material, solid waste generated during processing may include organic materials that have the potential to significantly impact food safety due to the proliferation of pathogenic microorganisms. Mitigation measures related to waste management have been given in the mitigation plan which need to be followed strictly.

Wastes specific to the *textile industry* include trials, selvedge, trimmings, cuttings of fabrics, and yarns; spent dyes, pigments, and printing pastes; and sludge from process wastewater treatment containing mainly fibers and grease.

Non-hazardous solid wastes may be generated from the chemical industries and footwear industries.

Significant quantities of solid waste are typically generated in plastics manufacturing as scrap materials resulting from shaping and finishing operations can be recycled. Electrical &

Electronics equipment, non-metallic mineral products, light engineering, and pharmaceutical industries will generate less amount of domestic and industrial waste.

Land types in and around the project site are mostly agricultural, settlement and water body. Jamuna River is located immediately 200m east of the project site. Improper storage, handling, disposal of solid and hazardous waste may lead to contamination of the land and water bodies nearby. In addition, organic waste, rubbish waste may generate odour and cause health hazards to employees and communities nearby. Waste to be generated from the light engineering industries can be solid and liquid in nature. Solid waste will include packaging waste, metal pieces, damaged electrodes, ends of coils, wires and spools, flux cored electrodes, greased clothes/cotton, damaged rods, burnt rods, scrap flux, slag (residue from flux reaction and composed of metal and nonmetal oxides), Dross (oxidized metal expelled during thermal cutting and gouging operations), metal dust, dust collected in filter ventilation systems/air pollution control devices, floor sweepings, coal ash (if coal used as fuel), solid waste recovered from treatment of wastewater like sludge etc. Solid waste from the food processing industries includes both organic and packaging waste. Organic waste that is the rinds, seeds, skin, and bones from raw materials, results from processing operations. Inorganic wastes typically include excessive packaging items that are plastic, glass, and metal. Solid waste from textiles majorly composed of resins, fabric, apparel, dye, discarded machinery and fibers. These wastes required to be collected and disposed of periodically. Lubricate oil/waste oil is generated from the machineries as hazardous waste. Considering all these the impact is assessed as ***Medium-low***.

Impact	*Waste*				
Impact Nature	Direct		Indirect		Induced
Impact Scale	Within project location				
Frequency	Limited to Operation Phase				
Extent and Location	Project Site	Local	Regional	National	Trans Boundary
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High
Potential for Irreplaceable Loss of Resources	Low		Medium		High
Probability of Impact	Unlikely	Low	Medium	High	Definite

Impact Significance	Very Low	Low	Medium-low	Medium-high	High	Very High
	Significance of impact consider ***Medium-low***					

Specific mitigation measures for such issue for each industry have been discussed in the mitigation plan.

6.3.1.3.5 Soil Pollution

After development of economic zone, disposal of industrial domestic and process waste may contaminate land and soil quality of the area. The impact may be long term in case of uncontrolled discharges. Improper disposal of waste (hazardous and non-hazardous waste) may degrade soil, water, air quality and ecology of the area.

As per the preliminary planning, it is planned that industries like light engineering, textile and food processing will come up in the EZ zone. These industries are not heavily polluting like power plant, distilleries etc. but generate significant waste both hazardous and non-hazardous in nature, which can pollute the environment if not managed properly. Natures of the waste, which can be generated from these industries, are discussed below. Based on the matrix below the impact has been considered as ***Low***.

Impact	*Soil Pollution*				
Impact Nature	Direct	Indirect	Induced		
Impact Scale	Within Project Location				
Frequency	Limited to Operation Phase				
Extent and Location	Project Site	Local	Regional	National	Trans Boundary
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High
Potential for Irreplaceable Loss of Resources	Low		Medium		High
Probability of Impact	Unlikely	Low	Medium	High	Definite

Impact Significance	Very Low	Low	Medium-low	Medium-high	High	Very High
	Significance of impact consider ***Low***					

Mitigation measures are required to be adopted to prevent soil pollution of the area. Detailed mitigation measures are proposed in the mitigation plan to avoid such pollution.

6.3.1.3.6 Sediment Quality

After development of the Economic Zone, disposal of industrial waste and domestic waste from different industries such as Food and Beverage Processing, Textile Manufacturing, plastic industries, etc. may contaminate land and bottom sediment of the area. Solid and liquid waste will be treated properly before discharge into nearest water body.

Solid waste generated during operation phase will include but not limited to packaging waste, metal pieces, damaged electrodes, ends of coils, wires and spools, flux cored electrodes, greased clothes/cotton, damaged rods, burnt rods, scrap flux, slag (residue from flux reaction and composed of metal and nonmetal oxides), metal dust, packing item, fabric, apparel, solid waste recovered from treatment of wastewater like sludge etc. These wastes may contaminate the sediment quality.

Wastes are likely to increase the concentration of different metals, heavy metals, or other particles (metals, heavy metals, particles that are to be used in the processing) in the sediment of the nearby river. The sediment contamination may enter the food chain through bio accumulation and bio magnification process. If the sediment contamination enter into the food chain they are likely to impact human health as well. However, the nearby river is around 1 km away from the project site. Therefore, based on the matrix below the impact has been considered as medium ***Low***.

Impact	*Air Quality Degradation due to dust generation*				
Impact Nature	Direct	Indirect	Induced		
Impact Scale	Within 100 m of the project location				
Frequency	Limited to construction Phase				
Extent and Location	Project Site	Local	Regional	National	Trans Boundary
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High
Potential for Irreplaceable Loss of Resources	Low		Medium		High
Probability of Impact	Unlikely	Low	Medium	High	Definite

Impact Significance	Very Low	Low	Medium-low	Medium-high	High	Very High
	Significance of impact consider ***Medium-low***					

Mitigation measures are required to be adopted to prevent bottom sediment pollution of the area. Specific mitigation measures have been proposed in the mitigation plan which need to be followed.

6.3.1.3.7 Topography and Geology

It is envisaged that the project is likely not to cause impact on topography and geology at operation phase. Therefore, impacts are negligible. Based on the matrix below the impact has been considered as ***Very-Low***.

Impact	*Topography & Geology*					
Impact Nature	Direct		Indirect		Induced	
Impact Scale	Within project location					
Frequency	Limited to Operation Phase					
Extent and Location	Project Site	Local	Regional	National	Trans Boundary	
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation	
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High	
Potential for Irreplaceable Loss of Resources	Low		Medium		High	
Probability of Impact	Unlikely	Low	Medium	High	Definite	
Impact Significance	Very Low	Low	Medium-low	Medium-high	High	Very High
	Significance of impact consider ***Very Low***					

6.3.1.3.8 Working Conditions, Including Occupational Safety

A. Occupational Health and Safety

During operation phase, each industry will start their operation. So, accidents or incidents are expected to occur during the operation phase. Physical trouble, noise, vibration, lighting, electrical, heat and cold, nuisance dust, fire/explosion, machine grinding, working space, chemical, gases, dusts, fumes, vapours, liquids are the major hazards which are harmful for workers health.

Based on the rules (Labour Law 2006 and subsequent amendment 2015), the respective industries should prepare and implement appropriate mitigation measure. In addition, the accommodation for workers (if any) to be arranged according to the project proponent of

logistic, residential and commercial area in order to provide dwelling place for them. Since the type of business is different in each industry, the mitigation measure should be prepared for the respective occupational risk based on the operation plan and working condition of each industry. Based on the matrix below the impact has been considered as H***igh***.

Impact	*Air Quality Degradation due to dust generation*				
Impact Nature	Direct		Indirect		Induced
Impact Scale	Within 100 m of the project location				
Frequency	Limited to construction Phase				
Extent and Location	Project Site	Local	Regional	National	Trans Boundary
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High
Potential for Irreplaceable Loss of Resources	Low		Medium		High
Probability of Impact	Unlikely	Low	Medium	High	Definite
Impact Significance	Very Low	Low	Medium-low	Medium-high	High	Very High
	Significance of impact consider ***High***				

To avoid such impact, mitigation measures in the mitigation plan related to this issue need to be followed strictly.

B. Community Health and Safety

The health and safety risks during operations include potential for respiratory diseases, allergies and accidents among immediate neighboring communities if adequate mitigation measures to prevent are not implemented. In addition, local public health centers may report an increase in cases involving respiratory ailments like coughing, phlegm; eye irritation etc. due to the dust and particulate matter from operations.

Traffic:

in the operation phase, the final products produced from the Economic Zone will be transported into different areas of Bangladesh. The increased number of vehicles to carry the raw materials and final products are likely to create additional impact on the existing traffic system. On the other hand, the local people would be benefitted from strengthening of road connecting the access road to the project site as well. It is highly recommended to prepare a traffic management manual prior starting of the operation and install traffic management system in the project area.

Influx: Apart from the construction phase, skilled technicians and operators are also likely to be sourced for operating the plants/industries once it goes into operation. It is envisaged that the local people will be engaged as per their skill in the operation phase and few technicians or skilled personal from outside of the project area. However, the on site program management team should provide the skill enhancement training to locals to carry out specific tasks and enhance the skill of local people.

The influx of labor is likey to raises different social problems that include; (i) interference on regular social life; (ii) possibility to increase infectious and sexually transmitted diseases, especially of HIV/AIDS.

Based on the matrix below the impact has been considered as ***Medium-Low***.

Impact	*Community Health & Safety*					
Impact Nature	Direct		Indirect		Induced	
Impact Scale	Within project location & Surrounding area					
Frequency	Limited to Operation Phase					
Extent and Location	Project Site	Local	Regional	National	Trans Boundary	
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation	
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High	
Potential for Irreplaceable Loss of Resources	Low		Medium		High	
Probability of Impact	Unlikely	Low	Medium	High	Definite	
Impact Significance	Very Low	Low	Medium-low	Medium-high	High	Very High
	Significance of impact consider ***Medium-low***					

Mitigation Measures

Possible impacts to the community's health and safety during the operation phase of the project are health related, traffic issue and issues arising out of the influx of outsider populations. Mitigation measures recommended in the mitigation plan part for the community health and safety impacts.

C. Accidents

During the operation phase of the project, the regular traffic and transportation will increase due to the movement of factories personnel and contracted workers during their working shifts. Their transportation will lead impact on road safety of the nearby communities using the access road. Road accidents may increase due to industrial vehicles, commuter buses, and motor lines.

The operation and maintenance of the economic zone likely to have risks of industrial accidents and fatalities for workers. Based on the matrix below the impact has been considered as ***Low***.

Impact	*Accident*					
Impact Nature	Direct		Indirect		Induced	
Impact Scale	Within project location & Surrounding area					
Frequency	Limited to Operation Phase					
Extent and Location	Project Site	Local	Regional	National	Trans Boundary	
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation	
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High	
Potential for Irreplaceable Loss of Resources	Low		Medium		High	
Probability of Impact	Unlikely	Low	Medium	High	Definite	
Impact Significance	Very Low	Low	Medium-low	Medium-high	High	Very High
	Significance of impact consider ***Low***					

For avoiding accidents, specific mitigation measures have been proposed in the mitigation plan part.

6.3.2 Biological Environemnt

6.3.2.1 Pre-Construction Phase

6.3.2.1.1 Impact on Terrestrial Flora (Plants)

Pre-construction phase will involve site clearance, leveling & filling activities for development of EZ. Upon land acquisition, SEZL plans land grading of the EZ in order for the land to be flooding resilient. Considering the amount of soil required for 415 acres project area.

Clearance of site will involve removal of vegetation, land leveling & filling activities. From the information from the proponents, there are 90,526 thousand fruit trees existing in the project site. From them, the number of banana plant is 62,035 thousand in the project site. On the other hand, 43,422 thousand of timber tree (Bamboo) likely to be cut down during the preconstruction period. As a result, large trees are scarced in the project site.

However, among the species, the Mahaguni species which is globally Vulnerable is less than one thousand in the project site. Considering all this, the impact is considered Medium low.

Impact	*Impcat on Terrestrial flora during pre-construciton phase*		
Impact Nature	Direct	Indirect	Induced
Impact Scale	Within project location		

Frequency	Limited to Pre construction Phase				
Extent and Location	Project Site	Local	Regional	National	Trans Boundary
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High
Potential for Irreplaceable Loss of Resources	Low		Medium		High
Probability of Impact	Unlikely	Low	Medium	High	Definite
Impact Significance	Very Low	Low	Medium-low	Medium-high	High / Very High
	Significance of impact consider ***Medium-low***				

6.3.2.1.2 Impact on Terrestrial Fauna (Birds)

Bird species are responsive to the increased sound and increase of sound level will hinder the lifecycle of the birds. The noise level will be increased temporarily in the proposed site due to the operation of dredgers, excavation of the dredge spoil, lifting of dredge materials from river floor up to the suction pipe, transportation of dredging spoil up to the disposal site, pump, generators, propellers and thrusters of the dredgers, movement of others support vessels in the waterway.

Noise levels generated by the dredging operation will vary according to the size and type of the equipment used and more importantly, the size and type of the engines. During dredging operations, there are three categories of sound sources that are associated with:

- Dredging excavation;
- Dredging vessels during transport;
- Dredged material placement;

The impact of noise caused by the operation of heavy land filling machinery and trucks is predicted but will be limited to the surrounding area. As a result, species will move to the nearest suitable place. So the impact assessed low.

Impact	*Impact on birds during pre-construction phase*				
Impact Nature	Direct	Indirect	Induced		
Impact Scale	Within project location				
Frequency	Limited to Pre construction Phase				
Extent and Location	Project Site	Local	Regional	National	Trans Boundary
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation

Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High	
Potential for Irreplaceable Loss of Resources	Low		Medium		High	
Probability of Impact	Unlikely	Low	Medium	High	Definite	
Impact Significance	Very Low	Low	Medium-low	Medium-high	High	Very High
	Significance of impact consider ***Low***					

6.3.2.1.3 Impact on Aquatic Fauna

6.3.2.1.3.1 On Fish Species

Due to project activity at pre-construction phase, there will be influence on water. The main source of water pollution will be the land development, construction of access road and spillage from the heavy equipment which has brought to the site for construction work. Impact on water quality from muddy water flow from the Jamuna Branch River and adjacent Jamuna River due to land reclamation work is expected. In the rainy season, dredged soil may contaminate the Jamuna Branch River and Jamuna River by runoff water. The excavated material will be pumped to EZ site as slurry (a mixture of sediment and water). As part of dewatering of the dredge material, tail water would be discharged from the bounded area of EZ site. The inherent risk with tail water discharge is the potential for fisheries to the receiving waterbodies if tail water quality is not managed properly. Liquid effluents will also arise from washing of equipment and vehicles which are also impacts fishes. Therefore, proper management can reduce this impact.

Additionally, the noise level will be increased temporarily in the proposed dredging area due to the operation of dredgers, excavation of the dredge spoil, lifting of dredge materials from river floor up to the suction pipe, transportation of dredging spoil up to the disposal site, pump, generators, propellers and thrusters of the dredgers. Also vibration may occur on the bottom of the river bed may led to disrupt the movement of fish in the Jamuna River.

But, Jamuna River is unlikely to have the tide (low and ebb) like coastal region. So the impact of water shall be within the 500 meter upstream and 500 downstream. However, the team considered significant impacts anticipated on the surface water quality due to land development of SEZ site. Based on the matrix below the impact has been considered as medium low.

Impact	*Impcat on fish during pre-contruction phse*		
Impact Nature	Direct	Indirect	Induced
Impact Scale	Projcet adjacent area		
Frequency	Limited to Pre construction Phase		

Impact	*Impcat on fish during pre-contruction phse*					
Extent and Location	Project Site	Local	Regional	National	Trans Boundary	
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation	
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High	
Potential for Irreplaceable Loss of Resources	Low		Medium		High	
Probability of Impact	Unlikely	Low	Medium	High	Definite	
Impact Significance	Very Low	Low	Medium-low	Medium-high	High	Very High
	Significance of impact consider ***Medium-low***					

6.3.2.1.3.2 Aquatic Mammals (Platistina gangeticus)

The noise level will be increased temporarily in the proposed dredging area due to the operation of dredgers, excavation of the dredge spoil, lifting of dredge materials from river floor up to the suction pipe, transportation of dredging spoil up to the disposal site, pump, generators, propellers and thrusters of the dredgers. Noise levels generated by the dredging operation will vary according to the size and type of the equipment used and more importantly, the size and type of the engines.

Sediment contamination during the pre-construction phase may result leakage and spillage of oil, lubricants, fuel from heavy equipment. Such spills may create impact on Aquatic mammals, but are expected to be localized in nature. 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.

Due to project activity at pre-construction phase, there will be impact on aquatic mammals. The main source of water pollution will be the land development, construction of access road and spillage from the heavy equipment which has brought to the site for construction work. Impact on aquatic mammals from muddy water flowing to the Jamuna Branch River and adjacent Jamuna River due to land reclamation work is expected. In the rainy season, dredged soil may contaminate the Jamuna Branch River and Jamuna River by runoff water. The excavated material will be pumped to EZ site as slurry (a mixture of sediment and water). As part of dewatering of the dredge material, tail water would be discharged from the bounded area of EZ site which have some extent impact upon them. The inherent risk with tail water discharge is the potential for aquatic mammals to the receiving waterbodies if tail water quality is not managed properly. Liquid effluents will also arise from washing of equipment and vehicles. These significances may impede the life cycle of the aquatic mammals. But it is

anticipated, the impact will be within the 500m upstream and 500m downstream from the center of the project site. Thus, the impact is assessed medium Low.

Impact	*Impcat on aquatic mammals during pre-construction phase*				
Impact Nature	Direct		Indirect		Induced
Impact Scale	within 500 m upstream and 500 downstream from the projcet site				
Frequency	Limited to Pre construction Phase				
Extent and Location	Project Site	Local	Regional	National	Trans Boundary
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High
Potential for Irreplaceable Loss of Resources	Low		Medium		High
Probability of Impact	Unlikely	Low	Medium	High	Definite
Impact Significance	Very Low	Low	Medium-low	Medium-high	High / Very High
	Significance of impact consider ***Medium-low***				

Mitigation Measures:

Mitigation measures to minimize impacts on each part is given in **Table 8-1** under pre-construction stage.

6.3.2.2 Construction Stage

6.3.2.2.1 Impact on Terrestrial Fauna (Birds)

Noise from human activities (from infrastructure and construction sites) has a strong impact on the physiology and behavior of bird species[13]. Operation of different machineries and equipment for construction activities, running of heavy load traffic for construction materials transportation and regular traffic movement may generate noise during construction period. The produced noise may have impact on existing acoustic environment of rural category defined in ECR, 1997. Resident Birds may have disturbed due to noise from line sources (traffic movement).

[13]https://www.researchgate.net/publication/277589185_Effect_of_Noise_Generated_by_Construction_Siteso

The construction of access road, utility line, boundary wall and other infrastructure may generate noise and impact on bird species. Vehicles and machinery may generate huge noise. However, low-noise construction vehicles will be used and construction work is not done at night. Moreover, construction period will be done within shortest possible time. Hence, there would be no significant impact on birds. They are also transitory and can move themselves to the suitable habitat. Based on the matrix below the impact has been considered as Low.

Impact	*Impcat on birds during construction phase*				
Impact Nature	Direct		Indirect		Induced
Impact Scale	within the projcet site				
Frequency	Limited to construction Phase				
Extent and Location	Project Site	Local	Regional	National	Trans Boundary
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High
Potential for Irreplaceable Loss of Resources	Low		Medium		High
Probability of Impact	Unlikely	Low	Medium	High	Definite
Impact Significance	Very Low	Low	Medium-low	Medium-high	High	Very High
	Significance of impact consider ***Low***				

6.3.2.2.2 Impact on Fishes during construction phase

Wastewater will be generated from washing of equipment and machinery on site. This wastewater may contain suspended solids and traces of hydrocarbon. The contractor will be accountable for ensuring that any wastewater discharged meets the standards stipulated in Schedule 10 of ECR, 1997 and the applicable World Bank/ WBG General EHS Guidelines prior to discharge of such wastewater.

Sanitary facilities including toilets will be provided for the use of the construction 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. Septic tanks will be provided to treat sanitary wastewater. The contractor will be responsible for ensuring any wastewater discharges meet the standards stipulated in Schedule 9 of ECR, 1997 and the applicable World Bank/ WBG General EHS Guidelines prior to discharge of such wastewater if required. Potential impacts are expected to be short-term and localized in nature.

Accidental spillage or surface runoff containing hazardous materials may cause harm to fisheries resources. Thus impact will be significant. But the proponents ensured to take the possible safety measures to avoid contamination. As a result, the impact assessed Medium-High.

Impact	*impcat on fisheries during construction phase*				
Impact Nature	Direct		Indirect		Induced
Impact Scale	within the projcet site				
Frequency	Limited to construction Phase				
Extent and Location	Project Site	Local	Regional	National	Trans Boundary
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High
Potential for Irreplaceable Loss of Resources	Low		Medium		High
Probability of Impact	Unlikely	Low	Medium	High	Definite
Impact Significance	Very Low	Low	Medium-low	Medium-high	High	Very High
	Significance of impact consider ***Medium-low***				

6.3.2.2.3 Aquatic Mammal (Platistina gangeticus)

Due to project activity at construction phase, there will be impact on Aquatic Mammals. The main source of water pollution will be the building development, establishment of water pipe and electricity line, construction of access road and spillage from the heavy equipment which has brought to the site for construction work. Impact on Aquatic Mammal from muddy water flowing to the Jamuna Branch River and adjacent Jamuna River due to land reclamation work is expected.

In the rainy season, dredged soil may contaminate the Jamuna Branch River and Jamuna River by runoff water. The excavated material will be pumped to EZ site as slurry (a mixture of sediment and water). As part of dewatering of the dredge material, tail water would be discharged from the bounded area of EZ site. The inherent risk with tail water discharge is the potential for Aquatic Mammal to the receiving waterbodies if tail water quality is not managed properly.

Liquid effluents will also arise from washing of equipment and vehicles. Jamuna River is the main water body in the project AOI and is also a main source of transportation of heavy equipment from their source to the temporary jetty to be constructed for the Project. Transportation will be undertaken with the help of barges/trawlers. There is a likelihood of accidental leakage of fuels and other contaminants from barges/trawlers to Jamuna River.

Ganges river dolphin was reported (Public Consultation) from the Jamuna River fall under the category of IUCN Red List. However, since the spillage may affect their habitat and movement hence, due care should be exercised to avoid any leakages and ballast water discharge near the construction area and proponents agreed on that. These significances may impede the life cycle of the species. But it is anticipated, the impact will be within the 500m upstream and 500m downstream from the center of the project site. Thus, the impact is assessed Medium low.

Impact	*Impcat on dolphin during construction phase*				
Impact Nature	Direct	Indirect	Induced		
Impact Scale	within the Project site				
Frequency	Limited to construction Phase				
Extent and Location	Project Site	Local	Regional	National	Trans Boundary
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High
Potential for Irreplaceable Loss of Resources	Low		Medium		High
Probability of Impact	Unlikely	Low	Medium	High	Definite
Impact Significance	Very Low	Low	Medium-low	Medium-high	High	Very High
	Significance of impact consider ***Medium-low***				

Mitigation Measure:

Mitigation measures to minimize impacts for each specific parts are given in **Table 8-1** under construction stage of the mitigation plan.

6.3.2.3 Operation Stage

6.3.2.3.1 Impact on Fishes during operation stage

Industries are likely to generate domestic and industrial effluent. Liquid waste, which can be generated from light engineering industries will include waste acid, waste alkali, grease, used/spent oil, liquid metal, spent solvents etc. Wastewater is not generated in significant amount from these industries. Majorly domestic and cleaning waste is likely to be generated.

No significant liquid waste will be generated from RMG garments. Food processing industries similarly may generate both liquid and solid waste. Concern with wastewater from the food processing industry is high BOD levels, high TSS, excessive nutrient loading like nitrogen and phosphorus compounds and pathogens which may hazardous to fish health.

The discharged effluent characteristic shall be in accordance to GOB Environment Conservation Rule (1997) Schedule 10 (Standards for Waste from Industrial Units or Project Waste) and the applicable World Bank Group environmental requirements and World Bank/WBG guidelines. This discharge will be having about <3°C of temperature at the outlet of condenser. Dispersants and algaecides will be added in the water to prevent fouling of the heat exchangers and piping. It is proposed to used non-toxic and heavy metal base free dispersants and algaecides in the project site. Impact of elevated temperature due to discharge water is also reported to be lethal to the larval stages[14].

However, pollutants from these industries may be discharged into Jamuna Branch River and may be carried away to Jamuna River system, which may hamper the breeding and spawning biology of fish species. Run-off may significantly increase post development of economic zone. It will be managed storm water which will be generated from post development of EZ site to manage the fisheries resources. Based on the matrix below the impact has been considered as Medium-low.

Impact	*Impcat on fishes during operation phase*				
Impact Nature	Direct	Indirect	Induced		
Impact Scale	within the projcet site				
Frequency	Limited to construction Phase				
Extent and Location	Project Site	Local	Regional	National	Trans Boundary
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High
Potential for Irreplaceable Loss of Resources	Low		Medium		High
Probability of Impact	Unlikely	Low	Medium	High	Definite
Impact Significance	Very Low	Low	Medium-low	Medium-high	High / Very High
	Significance of impact consider ***Medium-low***				

[14] http://drs.nio.org/drs/bitstream/2264/3339/2/Indian_J_Environ_Prot_11_525.pdf

6.3.2.3.2 Aquatic Mammal (Platistina gangeticus)

Water is mainly required for washing/dying/processing/cooling purposes for different industries in the project which will be sourced from ground water and discharged after primary treatment. The discharged effluent characteristic shall be in accordance to GOB Environment Conservation Rule (1997) Schedule 10 (Standards for Waste from Industrial Units or Project Waste) and the applicable World Bank Group environmental requirements and World Bank/WBG guidelines. This discharge will be having about <3°C of temperature at the outlet of condenser. Dispersants and algaecides will have to be added in the water to prevent fouling of the heat exchangers and piping. It is proposed to used non-toxic and heavy metal base free dispersants and algaecides in the project. Elevated temperature typically decreases the level of dissolved oxygen (DO) in water. The decrease in levels of DO can harm aquatic animals such as fish, amphibians, dolphins and planktons.

Temperature increase may also increase the metabolic rate of aquatic animals (Ganges River Dolphin), as enzyme activity, resulting in these organisms consuming more food in a shorter time. An increased metabolic rate may result in food source shortages, causing a sharp decrease in a population. Changes in the environment may also result in a migration of dolphins to another, more suitable environment and to in-migration of fishes that normally only live in warmer waters elsewhere. Increased temperature may lead to the replacement of the species[15]. The indirect detrimental impact on the fishes and dolphins forms due to elevated temperature levels is decrease level of dissolved oxygen in the aquatic ecosystem.

Since, the project is not having any direct discharge into the Jamuna River or the adjoining Jamuna Channel and magnitude criteria described in the impact matrix.

Also noise will be generated during operation of the industries. In the operation phase of SEZ, traffic in the area will increase significantly, which will increase the noise level of the area. Operation of tenants, water pumps and light engineering factories in proposed EZ may increase the noise level. Likely impact on the aquatic mammals during operation phase of the project will be from noise generation due to operation of the industries. Based on the matrix below the impact has been considered as Medium-Low.

However, it is anticipated that, the project will treat waste water by CETP and will practice Zero Liquid Discharge practice. Therefore, the potential impacts on aquatic mammal operational phase is considered as low.

Impact	*Impact on Ganges River Dolphin during operation phase*				
Impact Nature	Direct		Indirect		Induced
Impact Scale	Within Projcet AOI				
Frequency	During Operation Phase				
Extent and Location	Project Site	Local	Regional	National	Trans Boundary

[15] www.eolss.net/Sample-Chapters/C06/E6-13-04-07.pdf

Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation	
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High	
Potential for Irreplaceable Loss of Resources	Low		Medium		High	
Probability of Impact	Unlikely	Low	Medium	High	Definite	
Impact Significance	Very Low	Low	Medium-low	Medium-high	High	Very High
	Significance of impact consider ***Low***					

Mitigation Measure:

Mitigation measures to minimize impacts for each specific parts are given in **Table 8-1** under operation stage of the mitigation plan.

6.3.2.3.3 Habitat analysis

The AOI bears 49% of agricultural land (including grasslands, homestead palantation, fallow lands), 15 % of waterbodies, including the Jamuna River, 9% waste land (Including grasslands, riverine habitats and Char Land), 2.3% of plantation (including the Jamuna Ecopark and surrounding planytation areas) and 15 % of built up area.

Criteria

The assessment of the potential impacts to the flora and fauna has considered IUCN category for conservation status of flora and fauna to determine their rare, endangered and threatened status.

Classification of Habitats

The WBG Performance Standard 6 classifies habitats into three major categories;

Natural Habitats: Natural habitats are areas composed of viable assemblages of plant and/or animal species of largely native origin, and/or where human activity has not essentially modified an area's primary ecological functions and species composition.

Modified Habitats: Modified habitats are areas that may contain a large proportion of plant and/or animal species of non-native origin, and/or where human activity has substantially modified an area's primary ecological functions and species composition. Modified habitats may include areas managed for agriculture, forest plantations, reclaimed coastal zones, and reclaimed wetlands. Definition of the modified habitat also includes significant biodiversity value, as determined by the risks and impacts identification process required in Performance Standard 1. The client should minimize impacts on such biodiversity and implement mitigation measures as appropriate.

Critical Habitats: WBG PS 6 identifies critical habitats as areas with high biodiversity value, including (i.) habitat of significant importance to Critically Endangered and/or Endangered species; (ii.) habitat of significant importance to endemic and/or restricted-range species; (iii.) habitat supporting globally significant concentrations of migratory species and/or congregatory species; (iv.) highly threatened and/or unique ecosystems; and/or (v.) areas associated with key evolutionary processes.

Based on the definitions given above and the rationale provided in **Table 5-9**, Habitat such as built up areas, all types lands which include homestead plantations and Roadside can be considered as natural habitats within the AOI while Jamuna river is natural habitat.

The WBG PS-6 also suggests that, "In areas of critical habitat, the client will not implement any project activities unless all of the following are demonstrated:

- No other viable alternatives within the region exist for development of the project on modified or natural habitats that are critical;
- The project does not lead to measurable adverse impacts on those biodiversity values for which the critical habitat was designated, and on the ecological processes supporting those biodiversity values;
- The project does not lead to a net reduction in the global and/or national/regional population of any Critically Endangered or Endangered species over a reasonable period; and
- A robust, appropriately designed, and long-term biodiversity monitoring and evaluation program is integrated into the client's management program."

Table 6-8: Habitat identification as per WBG 2012 PS 6

Land use class	Attributes	Habitat type (WBG PS 6, 2012)	Rationale
Road side Plantation	Different species of fruit and Vegetable bearing trees were recorded in the Roadside. Most common floral species were Eucalytus (*Eucalyptus spp.*), Koroi (*Samanea saman*), Khejur (*Phoenix dactylifera*), Mahaguni (*Swietenia macrophylla*) and Supari (*Areca catechu*) etc. Furthermore, only eight species are listed in the IUCN global list and among them one found as Endangered and one as Vulnerable.	Modified	All trees planted are for local use and no parts of the Road side plantations have succeeded into natural forest.
Home stead plantation	Home stead plantation were dominated by tree species. Common planted tree species are Eucalytus	Modified	All trees planted and are for domestic use. Therefore, no parts of the

Land use class	Attributes	Habitat type (WBG PS 6, 2012)	Rationale
	(*Eucalyptus spp.*), Mangoo (*Mangifera indica*), Koroi (*Samanea saman*), Nim (*Azadirachta indica*), Khejur (*Phoenix dactylifera*), etc etc. Raintree (*Samanea saman*), Narikel (*Cocos nucifera*) and Supari (*Areca catechu*) occupied the top canopy.		homestead Plantations have succeeded into Natural forest.
Jamuna River	Includes entire natural area Encompassing the water of the river	Natural	The river is Confined within Natural banks and habitats, with no man made alteration such as concrete Banks etc. Furthermore, there are no Manmade Canals leading from the River thereby.

The table above provides the species that were recorded in the area either through direct observations or through consultations with local communities. The screening for potential critical habitat species has been carried out against Criteria 1 to 3 which are-

- Habitat of significant importance to Critically Endangered (CR) and/or Endangered (EN) species;
- Habitat of significant importance to endemic and/or restricted-range species;
- Habitat supporting globally significant concentrations of migratory species and/or congregatory species.

With respect to Criteria 4 and 5

- Highly threatened and/or unique ecosystems
- Areas associated with key evolutionary processes

The baseline assessment has not identified any highly threatened and/or unique ecosystems. Natural habitats within the project area are neither unique nor threatened as they are common in the bio geographical region.

Critical Habitat Criteria

Criteria	Tier 1	Tier 2(1)
Criteria 1: Critically Endangered (CR)/Endangered (EN) Species	a) Habitat required to sustain ≥ 10 percent of the global population of an IUCN Red-listed CR or EN species where there are known, regular occurrences of the species and where that habitat could be considered a discrete management unit for that species	a) Habitat that supports the regular occurrence of a single individual of an IUCN Red-listed CR species and/or habitat containing regionally-important concentrations of an IUCN Redlisted EN species where that habitat could be considered a discrete management unit for that species
	b) Habitat with known, regular occurrences of CR or EN species where that habitat is one of 10 or fewer discrete management sites globally for that species.	b) Habitat of significant importance to CR or EN species that are wideranging and/or whose population distribution is not well understood and where the loss of such a habitat could potentially impact the long-term survivability of the species.
		c) As appropriate, habitat containing nationally/regionally-important concentrations of an EN, CR or equivalent national/regional listing
Criterion 2: Endemic and Restrictedrange Species	a) An endemic species is defined as one that has ≥ 95 percent of its global range inside the country or region of analysis.	Habitat known to sustain ≥ 1 percent but < 95 percent of the global population of an endemic or restricted-range species where that habitat could be considered a discrete management unit for that species, where adequate data are available and/or based on expert judgment.
Criterion 3: Migratory and Congregatory Species	a) Habitat known to sustain, on a cyclical or otherwise regular basis, ≥ 95 percent of the global population of a migratory or congregatory species at any point of the species' life-cycle where that habitat could be considered a discrete management unit for that species.	a) Habitat known to sustain, on a cyclical or otherwise regular basis, ≥ 1 percent but < 95 percent of the global population of a migratory or congregatory species at any point of the species' life-cycle and where that habitat could be considered a discrete management unit for that species, where adequate data are available and/or based on expert judgment.
		b) For birds, habitat that meets BirdLife International's Criterion A4 for congregations and/or Ramsar Criteria 5

Criteria	Tier 1	Tier 2(1)
		or 6 for Identifying Wetlands of International Importance.
		c) For species with large but clumped distributions, a provisional threshold is set at ≥5 percent of the global population for both terrestrial and marine species. d) Source sites that contribute ≥ 1 percent of the global population of recruits.
Criterion 4: Highly Threatened and/or Unique Ecosystems	No Tiered system is prescribed a) That are at risk of significantly decreasing in area or quality; b) with a small spatial extent; and/or c) containing unique assemblages of species including assemblages or concentrations of biome-restricted species. Highly threatened or unique ecosystems are defined by a combination of factors which may include long term trend, rarity, ecological condition, and threat	
Criterion 5: Key Evolutionary Processes	The criteria is defined bya) Isolated areas (e.g., islands, mountaintops, lakes) are associated with populations that are phylogenetically distinct. b) Areas of high endemism often contain flora and/or fauna with unique evolutionary histories (note overlap with Criterion 2, endemic and restricted-range species). c) Landscapes with high spatial heterogeneity are a driving force in speciation as species are naturally selected on their ability to adapt and diversify. d) Environmental gradients, also known as ecotones, produce transitional habitat which has been associated with the process of speciation and high species and genetic diversity.	

Criteria	Tier 1	Tier 2(1)
	e) Edaphic interfaces are specific juxtapositions of soil types (e.g., serpentine outcrops, limestone and gypsum deposits), which have led to the formation of unique plant communities characterized by both rarity and endemism. f) Connectivity between habitats (e.g., biological corridors) ensures species migration and gene flow, which is especially important in fragmented habitats and for the conservation of metapopulations. This also includes biological corridors across altitudinal and climatic gradients and from "crest to coast." g) Sites of demonstrated importance to climate change adaptation for either species or ecosystems are also included within this criterion.	

Note (1) No tier system is in place for Criteria 4 and Criteria 5

- The WBG PS-6 also suggests that, "In areas of critical habitat, the client will not implement any project activities unless all of the following are demonstrated:
- No other viable alternatives within the region exist for development of the project on modified or natural habitats that are critical; The project does not lead to measurable adverse impacts on those biodiversity values for which the critical habitat was designated, and on the ecological processes supporting those biodiversity values;
- The project does not lead to a net reduction in the global and/or national/regional population of any Critically Endangered or Endangered species over a reasonable period of time; and
- A robust, appropriately designed, and long-term biodiversity monitoring and evaluation program is integrated into the client's management program."

Species Name	Scientific Name	Criteria 1 Cr or EN species	Criteria 2 Endemic/ Restricted Range	Criteria 3 Migrfatory /Congratory	Critical Habitat Tier 1	Critical Habitat Tier 2	Rational	Information
Fish								
	Bagarius bagarius, *Wallago attu,* *Sprata aor,* *Notopteru chitala,* *Labeo bata,* *Labeo gonius,* *Labeo culbasu,* *Puntius sophore,* *Puntius sarana,* *Puntius ticto,* *Puntius phutunios,* *Mystus cavasius,* *Chaca chaca,* *Oxygaster bacaila,* *Rasbora daniconius,* *Osteobrama cotio,* *Clupisoma garua,* *Aspidoparia jaya,*	CR,EN,VU,NT		✓	✓		Criteria Tier 1 & 2	These species are commonly found in the Jamuna river and adjacent canal of project AOI. Baghair (*Bagarius bagarius)* is significant and common species of Jamuna river. However, the production of the species is comparatively high comparing the other region of Bangladesh.

Species Name	Common Name	Criteria 1 Cr or EN species	Criteria 2 Endemic/ Restricted Range	Criteria 3 Migrfatory /Congratory	Critical Habitat Tier 1	Critical Habitat Tier 2	Rational	Information
Bird								
	Vanellus duvaucelii (River Lapewing)	NT				✓	Criteria 1 Tier 2e	A study confirmed that the upper Padma River along the Indian border in Chapai Nawabganj district is an important breeding area for River Lapwings[16]. The predator for the species and their eggs are mainly Large Billed Crow and Ferous Dog. The study are have a large proportion of anthropogenic activities which may disturb the nesting and breeding ground of the species.
					Mammals			
Ganges River Dolphin (Platanista Gangetica)	Ganges River Dolphin (*Platanista gangetica*)	VU				✓	**Criteria 1 Tier 2e** The presence of species was confirmed been confirmed by sighting 12 individuals in the Jamuna River. Local fisheremen confirm its presence frequently in post monsoon season;	The species is present in Ganges, Brhmaputra (Jamuna in Bangladesh), Meghna, Karnaphuli and Sangu river system in India, Bangladesh population of 4000-5000 and Nepal. A total of world population of 4000-5000 is

[16] Surveys of River Lapwings *Vanellus duvaucelii* in Bangladesh and observations on their nesting ecology

Species Name	Common Name	Criteria 1 Cr or EN species	Criteria 2 Endemic/ Restricted Range	Criteria 3 Migrfatory /Congratory	Critical Habitat Tier 1	Critical Habitat Tier 2	Rational	Information
							It is under the threat from the accidental catch in the Sirajganj area.	estimated. A study in 1998 estimated 38-58 (1.16%) of individuals of species in Jamuna river of Bangladesh in (190 Km) stretch. **Rf**. Smith, BD., Aminul Haque, A.K.M Hossain, M.S. and Khan, A. 1998. River Dolphins in Bnagladesh. Conservation and the effects of water development.
					Reptile			
Batagur dhongoka	Three Striped Roof Turtle	EN				✓	Critical Tier 2e The species is reported from Jamuna River during consultation of villages during fishermen survey. The species was not physically seen during both the surveys. According to IUCN (Ref. EIA of the River Management Improvement Programmof e (Bangladesh Water Board, Ministry of water resources, May 2015)	The species is considered as Endangered Species.

Species Name	Common Name	Criteria 1 Cr or EN species	Criteria 2 Endemic/ Restricted Range	Criteria 3 Migrfatory /Congratory	Critical Habitat Tier 1	Critical Habitat Tier 2	Rational	Information
							Major turtle habitats lie in north of the project site)	
					Flora			
Swietenia mahagoni	Small-leaved Mahogany	EN				✓	The species is reported in Primary survey. Its presence has been confirmed in a plantation as an homestead plants.	The species is exotic to Bangladesh. But, this species commonly planted and found everywhere in Bangladesh. Also it is palnted under the strip palntion program of forest department.

6.3.3 Social Economic Impact

6.3.3.1 Introduction

The Sirajganj Economic Zone is the largest private Economic Zone in Bangladesh. The Bangladesh Economic Zones Authority (BEZA) has awarded the final license for setting up the Sirajganj Economic Zone to a consortium of 11 companies on 3 October 2018. The SEZ will be established on the banks of the Jamuna River. It is expected to host textile and knitwear, food processing, pharmaceuticals, leather, steel manufacturing, and other proposed industries. The aim of building this particular EZ was to operate the most lucrative green economic zone in the country. This will facilitate both local and foreign investment. This zone will create jobs for good amount of people, and bring in a lot of foreign investment for the private sector of Bangladesh. This zone will help to reduce pressure on Dhaka's job markets.

6.3.3.2 Social Impact Assessment Methodology

A combination of tools was used for assessing potential social impact of SEZ due to land acquisition and project interventions. These were as follows:

Document Review: EQMS Consulting Limited, the appointed Consultant to assess Environmental and Social Impact Assessment (ESIA) for Sirajganj Economic Zone (SEZ) project review related documents i.e. Feasibility Report, Details Project Design and Resettlement Action Plan (RAP). The objective of document review was to obtain better understanding and magnitude of potential social impact.

Focus Group Discussion: Consultation and discussion were conducted with the different occupational groups such as farmers, fishermen, businessmen, small vendors, women and youth populations extensively to acquire their views and perceptions towards the project and assess potential social impact during pre-construction, construction and operational phases.

Public Consultation Meeting: Three Public Consultation Meetings (PCM), one in belkuchi upazila and other two in sadar upazila were conducted participated by the project affected populations, representative of local government institutes, local elites and social philanthropic leader. In PCM, the project executing authority presented process of site selection through alternative options, project objective, purpose, opportunities for the locals, and land acquisition and compensation policy to the affected person. There was question-answer session to obtain their views towards the project and to assess probable social impact due to land acquisition and project interventions.

Key Informant Interview (KII): To assess impending sectoral social impact due to the land acquisition and project activities, the EQMS Consulting Limited carried out numeral Key Informant Interview (KII) with different government and non-government agencies in both project conceived upazilas of Sirajganj. The main objectives and purposes of conducting KII was to discover prospective sectoral impact could be created by the proposed project.

6.3.3.3 Social Impact Assessment

The Sirajganj Economic Zone (SEZ) project has large and very significant social impact on populations and community in and around the project due to land acquisition and project

interventions. The consultant identified and assess both negative and positive impending social impact due to the land acquisition and project interventions at different stages of the project. The project has voluminous negative social impact to the affected and surrounding communities; conversely, the project will also create innumerable opportunities to consequential social development. The project has substantial social impact at different stages i.e. during pre-construction stage, construction period and operational & maintenance period at different degrees.

6.3.3.4 Pre-Construction Period

6.3.3.4.1 Land Acquisition

Sources of Impact

After completing the site selection for EZ, BEZA sent letter on 21 March 2016 to the Deputy Commissioner of Sirajganj and requested to initiate acquisition process for 1041.93-acre land located across Sirajganj Sadar Upazila and Belkuchi Upazila of Sirajganj District. The concerned Deputy Commissioner, upon receiving the land acquisition request from BEZA, started land acquisition process and served notice u/s-3 to the landowners on 8th August 2016. The whole land acquisition process was proceeded following *The Acquisition and Requisition of Immovable Property ordinance1982 (ARIPO-1982)*. After the completion of all actions guided by the ARIPO-1982, finally, the Deputy Commissioner handed over the acquired land (1041.43 acre) to the SEZL on 17 September 2017.

Whole EZ development activities have been phased out into two phases. For the first phase it requires 415-acre land that already has been acquired. Acquisition of 415-acre land costs land loss for the local community residing around the project site. Thus, the loss of land incurred by the acquisition of 415 acre has been assessed.

Sources

- Land acquisition and ownership transfer
- Land development and changes of the land modalities
- Restriction in usage of land

Receptor

According to the consultation with the officials of DC office, Shirajganj, it was known that approximately 748 listed legal owners will lose their land for the acquisition of 415 acres land. But, DC office usually lists owners' name based on the plot ownership, where same owner's may have multiple ownership on plots and be enlisted multiple times. However, it has been confirmed from FGD and PCM that 500-600 households will lose lands for the consequence of land acquisition. Primary study also suggests that villagers from Khas Barashimul, Chak Boyra, Bara Berakharua and Baira Machun resided within 2km radius from the proposed project site are the land users. Thus, it is expected that the impact will be bounded in local area only.

Impact Assessment

A total of 415-acre land will be taken through acquisition. According to the official of DC office, Sirajganj, 272.7-acre land will be taken from Chalkboyra & Khasborshimul Mouza under Saidabad Union and 142.3-acre land will be taken from Boyra Masum & Boroberakharua Mouza under Rajapur Union. Land users/users who use the acquired land live within Chalkboyra, Khasborshimul, Bara Berakharua and Baira Machun villages, thus the Potential/ possible Impacts' area is not only limited to the site but also its immediate locality.

Current land users (500-600 households) were using this land since years. Land was being used for both homestead with vegetation and agricultural purposes. As the consequence of the land acquisition, these owners/users will loss the right of land usages permanently. But this permanent loss can be mitigated once proper measures are taken.

According to the PHS 2011 (BBS), both Saidabad and Rajapur Union cover 15034[17] acre land consisting a total of 20756 households. Among the 15034 acre almost 6000[18] acre of land is being used for agriculture and homestead purposes with the ratio of 80% (4800 acre) and 20% (1200 acre) respectively. The acquired land amount (415 acre) represents only 2.07% of total available land of these two unions. Moreover, in terms of all available agricultural and homestead land under these two unions, this acquired land represents 7%. On the other hand, the affected two unions have a total of 20756 households where the potential affected households for land acquisition are 500-600 representing 2.9% of total residing households. In such rural areas where agriculture is the prime way of living for its residents, loss of agriculture and homestead land would affect remarkably. Land loss will cause decreased production amount. Moreover, depending farmers and other occupants (day labors, sharecroppers) will be impacted too. This impact is anticipated as remarkable and the social setting might be distorted as a result but still it may continue functioning in modified way for some times. This kind of loss can be minimized in a certain period time with proper mitigation measures. (providing replacement cost for agricultural land, establishing resettlement sites etc.)

Due to its permanent, irreplaceable loss and severity, this loss of land is considered as ***Medium High***.

Impact	*Loss of Land*				
Impact Nature	Direct	Indirect	Induced		
Impact Scale	Approximately 500-600 households residing four villages around the project site				
Frequency	Permanent and covers the whole life time of the project				
Extent and location	Project Site	Local	Regional	National	Trans boundary
Impact Duration	Short Term	Medium Term	Long-term	Permanent – Mitigated	Permanent – no mitigation

[17] Population & Housing Census 2011, Bangladesh Bureau of Statistics refers the area of Saidabad Union is 8856 acre with a total of 10485 households and the area of Rajapur Union is 6178 acre with a total of 10271 households.
[18] National Land Zoning Report, Shirajganj Sadar Upazila (2015)

Impact Intensity/ severity	Insignificant	Low	Medium	High	Very High	
Potential for irreplaceable loss of resources	Low		Medium		High	
Magnitude	Insignificant	Low	Medium-low	Medium - high	High	Very High
Probability of Impact	Unlikely	Low	Medium	High	Definite	
Impact Significance	Very low	Low	Medium-Low	Medium-high	High	Very High
	Significance of impact consider ***Medium High***					

Land loss impacts have been assessed and it is assessed that impact is ***Medium-high*** in nature which is characterized by;

- Potential/possible impacts are significant and required attention;
- Mitigation measures are required to reduce the negative impacts to acceptable levels;
- Potential/possible impacts are localized but irreversible loss and long-term effects

6.3.3.4.2 Loss of Homestead Assets

Sources of Impact

According to the available information with the SEZL official at site, 439 households are currently residing within the 415-acre land. These households will need to be displaced from their homestead. Residing 439 households have living structures, cattle shed, toilet, electricity meter etc. with homestead vegetation including fruit bearing & timber trees. According to Acquisition and Requisition of Immovable Property Ordinance (ARIPO), 1982, compensation is determined by the Deputy Commissioner at market value.

Sources

- Land acquisition and ownership transfer
- Land development and changes of the land modalities
- Restriction in usage of land

Receptor

Above mentioned 439 households who are currently residing within the 415 acre area proposed for first phase.

Impact Assessment

Affected households are those who are residing within the project site thus the Potential/ possible Impact area is only at or within the project site/project boundary. Affected households will lose the homestead land and other immovable homestead structures

including homestead trees. On the other hand, they also need to shift their movable assets i.e. homestead structures, cattle shed, toilet, electricity meter, tube-well etc. These losses are permanent and will remain after operational life of project but appropriate mitigation measures can reduce the cost of losses.

According to PHC 2011 (BBS), affected villages Khas Barashimul, Chak Boyra, Bara Berakharua and Baira Machun consists 702[19] households where the affected households are 439 (62.5% of total residing households). 62.5% living households are required to be displaced which might remarkably distort the social setting of the affected areas and might cannot be fully reversed.

It is anticipated that the affected peoples will be significantly impacted as the consequence of homestead assets loss. Due to its permanent, irreplaceable loss and severity, this loss of land is considered as ***Medium Low***.

Impact	*Loss of Homestead Assets*					
Impact Nature	Direct		Indirect		Induced	
Impact Scale	Project Site					
Frequency	Permanent					
Extent and location	Project Site	Local	Regional	National	Trans boundary	
Impact Duration	Short Term	Medium Term	Long-term	Permanent – Mitigated	Permanent – no mitigation	
Impact Intensity/ severity	Insignificant	Low	Medium	High	Very High	
Potential for irreplaceable loss of resources	Low		Medium		High	
Magnitude	Insignificant	Low	Medium-low	Medium - high	High	Very High
Probability of Impact	Unlikely	Low	Medium	High	Definite	
Impact Significance	Very low	Low	Medium-Low	Medium-high	High	Very High
	Significance of impact consider ***Medium Low***					

Impacts of homestead assets loss have been assessed and it is assessed that impact is ***Medium-Low*** in nature which is characterized by;

- Potential/possible impacts are significant and required attention;
- Mitigation measures are required to reduce the negative impacts to acceptable levels;
- Potential/possible impacts are within the project site but irreversible loss and long-term effects

[19] Population & Housing Census, 2011 (Bangladesh Bureau of Statistics) refers the households in Chalkboyra 109, Khasborshimul 128, Boyra Masum 202 & Bara Berakharua 263.

6.3.3.4.3 Loss of Livelihood

Sources of Impact

The land use of the project site will be changed from agriculture to industry permanently. The direct resultant impact (adverse) of land use change in the project area (and the other planned components) is the reduction in land area available for cultivation and resultant livelihood impacts on land users, share croppers, day labours.

Sources

- Land acquisition and ownership transfer
- Land development and changes of the land modalities
- Restriction in usage of land

Receptor

Primary study finds different land-based livelihood patterns such as farmers, agricultural labors, sharecroppers. Guided from the FGD and the consultation with the community it was known that the number of the affected users (land users, share croppers, day labours) may be varied (700-800) who live within 2km of proposed project namely in Khas Barashimul, Chak Boyra, Bara Berakharua and Baira Machun villages.

Impact Assessment

All the affected populations whose livelihood might get affected as the consequence of land acquisition are residing within the above-mentioned villages and thus the impact would be manifested locally.

Current land use of the acquired land is approximately 80% agriculture (330 acre) and 20% homestead (85 acre)[20]. In this 330-acre agriculture land all affected groups including land users/owners, share croppers, day labours will lose access to the land and not be able to continue agriculture activities. Therefore, their agriculture-based livelihoods on that particular land will be hampered permanently. Though the impacts of this permanent restriction may vary based on degree of engagements but this impact can be reduced if proper mitigation measures are taken.

According to NLZR 2015, Shirajganj Upazila, there are approximately 16000[21] farm families who involve with agriculture including landless, marginalized, small, medium and large categories. Among them 700-800 (5% of total) farm families will be affected due to the acquisition of 415-acre land. It was known from the FGD that a landless farmer (day labours) will lose crops equivalent to BDT 5000 and lose earnings equivalent to BDT 24000 yearly. Additionally, marginalized farmers will lose crops equivalent to BDT 6000 to BDT 150000. On the other hand, small, medium & large farmers will lose crops equivalent to BDT (160000-280000), (280000-830000) and (830000+) respectively. These 700-800 (5% of total) farm families will be encountered of crop loss with different degrees that mentioned above.

[20] Findings from FGD & Public Consultations
[21] Both Saidabad and Rajapur Union consists 16000 farm families

It is envisaged that the affected peoples will be significantly impacted as the consequence of land use change. Farmers, sharecroppers and agricultural labors will lose their livelihood once the agricultural activity stops permanently.

Impact	*Loss of Income & Livelihood*				
Impact Nature	Direct		Indirect		Induced
Impact Scale	Local				
Frequency	Permanent				
Extent and location	Project Site	Local	Regional	National	Trans boundary
Impact Duration	Short Term	Medium Term	Long-term	Permanent – Mitigated	Permanent – no mitigation
Impact Intensity/ severity	Insignificant	Low	Medium	High	Very High
Potential for irreplaceable loss of resources	Low		Medium		High
Probability of Impact	Unlikely	Low	Medium	High	Definite
Impact Significance	Very low	Low	Medium-Low	Medium-high	High / Very High
	Significance of impact consider ***Medium Low***				

In pre-construction and construction phases livelihood loss impacts have been assessed and it is assessed that impact is Medium-Low in nature which is characterized by;

- Potential/possible impacts are significant and required attention;
- Mitigation measures are required to reduce the negative impacts to acceptable levels;
- Potential/possible impacts are localized but irreversible loss and long-term effects

6.3.3.4.4 Restriction on accessing primary School

Sources of Impact

Four primary schools; is a school in which children receive primary or elementary education from the age of about five to twelve, are situated within the proposed 415-acre land area. Among them threes are government primary schools (Jamunabali govt. primary school, Bara Berakharua govt. primary school and Nakpata gov. primary school) and one is NGO run non-formal school (Manab Mukti Academi). Land acquisition leads to transfer ownership of these primary schools. Therefore, these schools will need to be displaced once the land development activity starts. Consequently, users/students of these primary schools will restrain from accessing schooling facilities.

Sources

- Land acquisition and ownership transfer
- Land development and changes of the land modalities
- Restriction in usage of land

Receptor

Students from Khas Barashimul, Barashimul Panchasona, Dharma Chithalia, Chak Boyra, Baira Machhun, Fulbaria and Birhati usually come for accessing school facilities in these above mentioned schools.

Impact Assessment

A total of 38[22] schools including both government & private are operating for providing primary schooling services where number of affected schools is 4 representing 10.5% of total. But this cann't depicts the acute impacts of displacement. Khas Barashimul, Barashimul Panchasona, Dharma Chithalia, Chak Boyra, Baira Machhun, Fulbaria and Birhati are isolated villages as these villages are bifurcated by Jamuna River. These villages have no paved road connection with Saidabad Union and Rajapur Union. Jamunabali govt. primary school, Bara Berakharua govt. primary school, Nakpata gov. Primary school and Manab Muki Academy are the main sources of primary schooling facilities in these villages and a total of 700 students with 15-20 teachers engaged with teaching profession.

Impact	*Restriction accessing to School*					
Impact Nature	Direct		Indirect		Induced	
Impact Scale	Local					
Frequency	Permanent					
Extent and location	Project Site	Local	Regional	National	Trans boundary	
Impact Duration	Short Term	Medium Term	Long-term	Permanent – Mitigated	Permanent – no mitigation	
Impact Intensity/ severity	Insignificant	Low	Medium	High	Very High	
Potential for irreplaceable loss of resources	Low		Medium		High	
Magnitude	Insignificant	Low	Medium-low	Medium - high	High	Very High
Probability of Impact	Unlikely	Low	Medium	High	Definite	
Impact Significance	Very low	Low	Medium-Low	Medium-high	High	Very High
	Significance of impact consider ***Medium High***					

[22] According to District web portal, Saidabad & Rajapur Union have 21 & 17 primary schools including both government & private schools respectively.

In pre-construction and construction phases restriction on accessing to school impacts have been assessed and it is assessed that impact is Medium-High in nature which is characterized by;

- Potential/possible impacts are significant and required attention;
- Mitigation measures are required to reduce the negative impacts to acceptable levels;
- Potential/possible impacts are localized but irreversible loss and long-term effects

6.3.3.4.5 Restriction on accessing Mosque for Religious Observance

Sources of Impact

A total of seven Mosque (one mosque one madrasa inside the project boundary, five out the project area); religious institution for Muslims, are situated within the 415-acre land. Three Mosques lie in Chak Boyra Mouza, two mosques lie in each Khas Boroshimul & Bara Berakharua Mouza. Acquisition of 415-acre land will cause to displace these institutions.

Sources

- Land acquisition and ownership transfer
- Land development and changes of the land modalities
- Restriction in usage of land

Receptor

Muslim believers residing within Dakshinpara, UttarPara & Maddhyapara of Chak Boyra village, Dakshinpara & UttarPara of Khas Boroshimul village and Purbapara & Hafizia Madrasha area of Bara Berakharua village will lose the access to these Mosques for their daily religious observance.

Impact Assessment

Chak Boyra, Khas Boroshimul and Bara Berakharua villages are mostly Muslim dominated area where almost 99%[23] community populations are Muslims. It is known from District Web Portal that a total of 127[24] Mosques are available within the Saidabad & Rajapur Union. But this can't depict the actual scenario of the loss of access. From FGDs it was known that people usually prefer proximity with the religious institutions. Moreover, residents of one village don't visit other village for performing daily life religious observance. It was also know that the community is very much concerned regarding these religious institutions and preferred realistic solution of it. Thus, Due to its permanent, irreplaceable loss and severity, this loss of accessing Mosques is considered as ***Medium High***.

Impact	*Restriction accessing to Mosque for Religious Observance*		
Impact Nature	Direct	Indirect	Induced
Impact Scale	Local		
Frequency	Permanent		

[23] According to PHC 2011, BBS, 100% populations of Chak Borya & Bara Berakharua are Muslims where 97.8% populations of Khas Boroshimul are Muslims.

[24] District Web Portal refers that Saidabad and Rajapur Union have 75 & 52 Mosques respectively.

Extent and location	Project Site	Local	Regional	National	Trans boundary	
Impact Duration	Short Term	Medium Term	Long-term	Permanent – Mitigated	Permanent – no mitigation	
Impact Intensity/ severity	Insignificant	Low	Medium	High	Very High	
Potential for irreplaceable loss of resources	Low	Medium	High			
Magnitude	Insignificant	Low	Medium-low	Medium - high	High	Very High
Probability of Impact	Unlikely	Low	Medium	High	Definite	
Impact Significance	Very low	Low	Medium-Low	Medium-high	High	Very High
	Significance of impact consider ***Medium High***					

The impacts of this loss have been assessed and it is assessed that impact is ***Medium-high*** in nature which is characterized by;

- Potential/possible impacts are significant and required attention;
- Mitigation measures are required to reduce the negative impacts to acceptable levels;
- Potential/possible impacts are localized but irreversible loss and long-term effects

6.3.3.4.6 Effect on Vulnerable Households

Sources of Impact

Land acquisition usually causes land loss, homestead assets loss and income & livelihood loss for any community. For vulnerable households these kinds of losses make them more vulnerable as they have common tendency to fail cope up with the drastic change of the existing settings. It results impoverishment of the vulnerable households.

Sources

- Land acquisition and ownership transfer
- Land development and changes of the land modalities
- Restriction in usage of land

Receptor

Affected households (by means of land loss, homestead loss or livelihood loss) are those who underlie below poverty line or headed by elder, women or physically disable person.

Impact Assessment

According to HIES 2010, Monthly BDT 12000[25] is the lower poverty line in rural areas of Shirajganj Division. EQMS primary survey has found that about 75.3% of the total surveyed households have less than BDT 12000 monthly incomes. It depicts the extreme vulnerable situation of the affected households in terms of income. Moreover, with FGD & KII it was confirmed that elder, women and disable headed households also belong to affected populations.

Impact	*Effects on Vulnerable Households*					
Impact Nature	Direct		Indirect		Induced	
Impact Scale	Project affected populations					
Frequency	Parmanent					
Extent and location	Project Site	Local	Regional	National	Trans boundary	
Impact Duration	Short Term	Medium Term	Long-term	Permanent – Mitigated	Permanent – no mitigation	
Impact Intensity/ severity	Insignificant	Low	Medium	High	Very High	
Potential for irreplaceable loss of resources	Low		Medium		High	
Magnitude	Insignificant	Low	Medium-low	Medium - high	High	Very High
Probability of Impact	Unlikely	Low	Medium	High	Definite	
Impact Significance	Very low	Low	Medium-Low	Medium-high	High	Very High
	Significance of impact consider ***Medium Low***					

Mitigation Measures

Potential impacts like loss of land acquisition, loss of homestead assets, loss of livelihoods, restriction of access etc will be occurred due to the pre-construction phase. These impacts are expected to be Medium low to Medium-***High*** and therefore specific mitigation measures are proposed in the mitigation plan under pre-construction stage for implementation to minimize the impacts

6.3.3.5 Construction Period

Discussion and consultation with affected populations, local elite and different government and non-government agencies indicated that there would be specific social impact both in

[25] HIES, 2010 refers individual's lower poverty line in terms of income is BDT 1236. Households level poverty line has been calculated by EQMS.

negative and positive form. Social impact during construction is identified and assessed as follows:

6.3.3.5.1 Employment Generation

During the construction period, huge temporary employment to be created for project affected person as well as for community people. In recruitment of workers and technicians for the project, priority will be given to individuals who are affected by the project, including women. Women and vulnerable groups of people will be employed in the tree plantation and maintenance program. After finalization of construction, new permanent jobs opportunity will be created, most of them related to Operation and Maintenance (O & M) of the SEZ. Potentials investors/industrialist will establish new industries and manufacturing factories, and thus huge employment and job opportunity would be created for project affected person and local populations. However, there will also be new businesses opportunities in the resettlement sites and jobs to replace the loss in employment in agriculture and fisheries.

The construction phase activities will facilitate intermixing of local workforce (mostly unskilled) with the outsider workforce (mostly skilled). In addition to that, on the job skill enhancement associated with technical detailing and designing, health and safety, work-based skills, etc. will also enhance the skills of the local workforce. The transfer of knowledge will not only be limited at the level of the workforce but also at the level of the contractors and sub-contractors who would benefit from it. Considering the potential for employment generation and skill enhancement, the significance of the employment generation is summarized below:

Impact	**Employment Generation**				
Impact Nature	Negative	Positive			Neutral
Impact Type	Indirect	Direct			Induced
Impact Duration	Temporary	Short Term		Long Term	Permanent
Impact Extent	Local	Regional			International
Impact Magnitude	Positive	Negligible	Small	Medium	Large

6.3.3.5.2 Benefit to Local Enterprises

Local enterprises, particularly those involved in the production and sale of construction materials, are potential benefactors of the civil works involved in the project. Brick-making provides employment to many local unskilled labours. Similarly, stone crushers and local transporters of these materials will also benefit from the project. The significance of the benefit to local enterprises is summarized below:

Impact	**Benefits to Local Entrepreneur**

Impact Nature	Negative	Positive			Neutral
Impact Type	Indirect	Direct			Induced
Impact Duration	Temporary	Short Term		Long Term	Permanent
Impact Extent	Local	Regional			International
Impact Magnitude	Positive	Negligible	Small	Medium	Large

Safety and health risks

Besides construction-related impacts, the affected population identified potential negative impacts to be: (i) the possibility of an increased number of accidents in the area during construction, (ii) the increased safety risk for women and children, and (iii) the possible increase of infectious diseases, especially of HIV/AIDS. The significance, nature, types and magnitudes of safety and health risk summarized below.

Impact	**Social Safety and Health Risk**				
Impact Nature	Negative	Positive			Neutral
Impact Type	Indirect	Direct			Induced
Impact Duration	Temporary	Short Term		Long Term	Permanent
Impact Extent	Local	Regional			International
Impact Magnitude	Positive	Negligible	Small	Medium	Large

Mitigation Measures:

The Public Health Action Plan is need to be designed to address project-related health impacts, not only for the construction period but also for the period afterwards. This plan also covers other health issues in the area, such as improved sanitation, malaria prevention and improved childcare.

6.3.3.5.3 Loss of income and livelihood

Persons whose livelihoods are affected because of the project will be supported with short-term income and livelihood restoration assistance, the transitional period. These short-term measures will be for immediate assistance and include the following: (i) Compensation for land and other lost assets in full prior to relocation. (ii) Temporary or short-term employment in construction activities at the resettlement or project construction sites; (iii) Special assistance for vulnerable groups such as women, the aged and disabled.

Mitigation Measures:

A long-term livelihood support program for post-relocation activities is committed for a period of 5 years. A national NGO experienced in rural livelihood development will

be engaged to design the program in consultation with the stakeholders and implemented over a period of 5 years.

6.3.3.6 Operation Period

6.3.3.6.1 Livelihood impacts.

Project affected persons and communities will experience loss of livelihood sources mainly due to loss of shops/commercial enterprises and agricultural fields. In addition, wage earners such as employees in shops and businesses, and workers on the agricultural fields will also incur impacts on their incomes. With the new and increased employment opportunity, the affected persons may face competition with the outside workforce to get jobs in the SEZ. Similarly, local small businesspersons, traders and vendors could be in struggle with the possible outside traders and vendors.

Mitigation Measures:

To mitigate these impacts adequate provisions has been made in the RAP by means of alternative income generation/skill development and other enabling strategies. A long-term program to achieve sustainable livelihood and income restoration need to be worked out in the Livelihood and Income Restoration Plan. In addition, a dedicated Social Development Fund (SDF) to be created to ensure livelihood restoration of the affected households.

6.3.3.6.2 Labor Influx

It was expected that the proposed Sirajganj Economic Zone (SEZ) will create of some 500.000 employment boosting regional and national economy. In the operational phase the factories will require mostly skilled labourere and few unskilled labourere as well. It is anticipated to engage local people to extend possible. However, in some cases such local people may not be available. Therefore, skilled laborer is likely to be sorted from out side of the project area which is likey to result on labor influx. However, at this stage of the study it is not unknown the exact numbers of laborer required for operation of the project. Based on high labor influx, they may be needed to accommodate out side of the project area.

The influx of labor may raises many social problems that include; (i) interference on regular social life; (ii) possibility to increase infectious and sexually transmitted diseases, especially of HIV/AIDS.

6.3.3.6.3 Density on Populations

The project location or project conceived district i.e Sirajgong is already considered as most populous region. Historically the project location is one of the major erosion prone area in the country. Addition of huge workforce with the existing population may arise some social difficulties in different direction; (i) residential accommodation would have to available on limited land; (ii) burden on local civic facilities like mosque, schools, shops, hospitals will increase; (iii) existing social norms, practice and structures will be affected, which actually breaks social harmony.

Mitigation Measures:

Mitigate above quoted social impact, the project would have long-term program planning with other stakeholders for improvement and sustainable positive changes in living standard of the project affected populations. The SEZ could conform Public Works Department, Roads & Highway Department, and LGED for planning of appropriate residential accommodations and networking & communication system.

6.4 Cumulative Impact

6.4.1 Water Resources

Cumulative Impacts on Water Resources

Criteria

For the assessment of water resources, the sensitivity and magnitude criteria outlined in Table 5.6 has been used respectively. The assessment of potential impacts to surface water has considered Schedule 3 (a), 9 and Schedule 10 of ECR, 1997 and WBG EHS guidelines for sector specific industries and general guidelines (refer to Table 2.6.1). For groundwater, Schedule 3 (b) of ECR, 1997, standards for drinking water has been considered.

Receptors

Surface water:

The total potable water demand for the proposed EZ-phase 1 is 7 MLD[26]. As per said report, it is planned to build three to four new bore wells within the proposed site to draw the ground water to meet the initial demand of EZ. During the initial stage of operation, it has been considered that the proposed EZ would be dependent on ground water supply, however for the long-term sustenance, provision of sourcing water from surface water has been assimilated.

Impact Significance

Preliminary assessment in EIA report of Sirajganj Econmic Zone[27], suggests that extracting water from Jamuna River located 2 km towards eastern boundary of the proposed EZ may be considered by providing suitable intake system and water treatment plant. Exact location of water intake needs to be finalized during the implemention stage. It is proposed to lay 210 dia. DI pipes for the length of 2 km for the incoming external water supply network from Jamuna River for the EZ. The exact location of pumping station & booster stations will be finalized during the implementation stage.

However, the SEZL is in their Pre-construction assessment decided to use Jamuna branch river water (in order to mitigate holistic impact on Jamuna river along with distribution of pipeline relevant issues) as a source of surface water if required /or scarcity gain from ground water during the operation phase. In connection of this action, SEZL is going to dredge the branch

[26] Final Feasibility Report Feasibility Study for Sirajganj Economic Zone, Bangladesh, may 21, 2019

[27] Revised Environmental Impact Assessment (EIA) Report on Sirajganj Economic Zone Ltd. Sirajganj, Bangladesh, nov 2017

river which currently standing inside the project boundary with a length of 772 meter, depth 5 meter along with width of 210 meter.[28]

Based on the sensitivity criteria, surface water resource is assessed as Medium-low

Impact	*Cumulative Impact due to Surface Water Abstraction*					
Impact Nature	Direct		Indirect		Induced	
Extent and Location	Project Site	Local	Regional	National	Trans Boundary	
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation	
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High	
Potential for Irreplaceable Loss of Resources	Low		Medium		High	
Probability of Impact	Unlikely	Low	Medium	High	Definite	
Impact Significance	Very Low	Low	Medium-low	Medium-high	High	Very High
	Significance of impact consider ***Medium-low***					

Mitigation Measures

- The volume of surface water likely to be used by SEZL yet to figure out and other 4 power plants of Sirajganj complex also used small scale of water for cooling tower purpose as make up water. So, it is evident that requirement of surface water likely to be higher in future.
- An approval required from Water Resource Planning Organization (WAPRO) having with submitting adequate requirement of water use along with embankment protection outline.

Receptors

Groundwater: Ground water samples analysis indicate high levels of iron (0.51 mg/l) with other parameters being within standard permissible limits for drinking water specified by Bangladesh ECR, 1997 Schedule 3 (B). Arsenic concentration is also reported in ground water tube well in the Project AOI though the samples analyzed were within limits. Groundwater is used by residents in the area for drinking as well as for irrigation purposes. Based on the sensitivity criteria Table 5.7, ground water resource is assessed as Medium.

Impact Significance

Cumulative Impact due to Groundwater Abstraction

The Revised Environmental Impact Assessment (EIA) Report on Sirajganj Economic Zone Ltd. Sirajganj, Bangladesh, Nov 2017, revealed that during the construction phase, a total of

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estimate 4274.5 m^3 per day water required for the first phase of 415-acre area. (About 10.3 m^3 of water will be required per acre). The entitled requirement will be meet up by ground water installing 3 deep tube-well inside the project area. The report also mentioned a total of 7MLD (7000 m^3) per day during the operation phase.

Furthermore, the EIA study report of NWPGCL's Sirajganj 2 (proposed 225 MW CCPP) prepared by Engineer's Associates Limited, May 2014 states that its existing plant (Sirajganj 1) uses 600 m3/hr from ground water and that its proposed plant (Sirajganj 2) would be also using similar quantity of 600 m^3/hr from ground water. Groundwater modelling in this EIA study was undertaken to assess the suitability of the aquifer system of Sirajganj and surrounding areas to provide a continuous supply of 1200 m3/hour of water for cooling purposes of both their power plants. The EIA study concluded that the natural aquifer condition in the Project area would be suitable for supplying 30000 m^3/day of water continuously without any permanent lowering of groundwater table or environmental degradation. Jamuna River invariably fully recharges the aquifer in the wet season of each year preventing any adverse effect on the natural condition of the project area. Since, there is another project Sirajganj 3 (225 MW) proposed within the Saidabad Power Generation Complex and due to similar capacity as that of Sirajganj 1 and 2 project, it has been assumed that the water requirement for this project will also be of the order of 600 m3/hr. Source of this water demand is currently unknown (i.e. ground water or surface water from River Jamuna) and it has been assumed that the project will follow same source as that of Sirajganj 1 and 2 projects, i.e. ground water abstraction from project site. This will lead to daily water abstraction from ground water within the power generation complex of the order of 43,500 m^3.[29]

Theoretically, if we sum up of the water abstraction requirement (Sirajgnanj Power Complex and SEZL), the requirement of construction phase likely to be reach 47,774.5 m^3 and consequently the operation phase demand will be 50,500 m^3 per day.

The above-mentioned analysis clearly indicates that overall ground water abstraction from the Saidabad Power Generation Complex and SEZL (both construction and operation phases) will be higher than safe water supply potential of the aquifer of the order to 30,000 m^3/day. This will create significant stress on the ground water aquifer and quality due to higher abstraction in comparison of recharge. However, it was further been observed that the Sirajganj 1 project is currently discharging the cooling tower blowdown and other effluent after treatment on land in the eastern boundary of the complex (which is about 200 m away from the adjoining channel) and the other 3 projects will also be doing the discharge in the similar manner, which will lead to a total discharge of the order of 6,700 m^3/day, which do not flow towards the adjoining channel during non-monsoon season and will help in recharging the ground water aquifer. Further it was also mentioned in the ground water modelling study that, recent studies indicate that the rainfall in Bangladesh and surrounding

[29] Final Report of Environmental and Social Impact Assessment of 400 MW ± 10% Combined Cycle Power Plant (Sirajganj-4): Sirajganj, Bangladesh, August 2016

areas is increasing due to climate change (UK Met Office 2011) which would contribute to enhanced recharge to the aquifer in the projected period.

So, the overall cumulative impact of ground water abstraction is assessed as High

Impact	*Cumulative Impact due to Groundwater Abstraction*				
Impact Nature	Direct		Indirect		Induced
Extent and Location	Project Site	Local	Regional	National	Trans Boundary
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High
Potential for Irreplaceable Loss of Resources	Low		Medium		High
Probability of Impact	Unlikely	Low	Medium	High	Definite
Impact Significance	Very Low	Low	Medium-low	Medium-high	High	Very High
	Significance of impact consider		***High***		

Mitigation Measures:

- A separate hydrological study shall have to be conducted for ground water extraction before construction phase in order to develop sound environmental management plan along with align with DoE ECC legal covenant.
- An approval required from Water Resource Planning Organization (WAPRO) having with submitting adequate requirement of water use along with embankment protection outline.

6.4.2 Air Quality

Four projects within Saidabad Power Generation complex include dual fuel fired combined cycle power plant (CCPP), consisting of 1 GT, 1 HRSG and 1 ST, each is at proximity to the project boundary. In the operation phase emission from the existing power generation complex and factories installed in the Economic Zone would impact the ambient air quality.

Prerequisite of cumulative impact assessment includes but not limited to detail process flow diagram, fuel type and specification, stack (if any) height etc. In the project area, different types of industries for example food and beverage industry, fertilizer industry, tanning/leather industry, textile industry etc will be set up in the operational phase which is likely to impact the ambient air quality of the project site. At this stage of the study their process flow, fuel type and specification, emission control system, stack (if any) height etc. is

unknown to us. Therefore, the cumulative impact cannot be assessed. However, it is suggested that during installation of industries individual factories will conduct separate Environmental Impact Assessment assessing the cumulative impact on ambient air quality.

6.4.3 Noise

In the project area different types of industries for example food and beverage industry, fertilizer industry, tanning/leather industry, textile industry etc. will generate noise in the operation phase. Noise generated from different industries in the economic zone along with the noise generated from operation of Sirajganj unit 2, unit 3 and unit 4 will likely to have cumulatively impact on noise level.

To assess the cumulative impact of noise it is necessary to know the existing noise level of the area (described in section 4.1.4.11), potential noise level that is likely to generate during operation period and infrastructure design. At this stage of the study, the potential generated noise level in the operation phase is unknown to us. Moreover, infrastructure design is a matter of further study and confirmation. Therefore, the cumulative impact of noise level cannot be assessed. However, it is suggested that during installation of industries individual factories will conduct separate Environmental Impact Assessment assessing the cumulative impact on noise level.

6.4.4 Labor Influx

In the construction phase it is anticipated that, majority of the workers will be recruited from local area and a few laborers may be recruited from outside of the project area. However, in the operation phase it would require skilled manpower. It is envisaged that, in the operation phase the required number of skilled manpower may not be locally available. Therefore, skilled laborer is likely to be recruited from outside of the project area which is likely to result influx of labor. Based on unavailability and unaffordability of accommodation inside the project area, few laborers might be accommodating outside of the project area, This is likely to result in an increase in the interaction of the local community with otherworkers, with an increased risk of sexually transmitted and communicable diseases, conflict and social unrest. Also, due to the presence of a large workforce, there may be a strain on local resources. and infrastructure, especially water, medical facilities, electricity, food and provisions in the local markets. This may also result in an increase in the overall price of essential commodities in the area.

However, keeping in mind the existing population of the AOI and that the population coming from other area is unlikely to comprise more than 30% of the workforce requirement, the severity of the impacts identified in expected to be medium low.

Impact	*Cumulative Impact from labor influx due to operation on SEZ*				
Impact Nature	Direct		Indirect		Induced
Impact Scale	Adjacent Projcet Area				
Frequency	Limited to Operation Phase				
Extent and Location	Project Site	Local	Regional	National	Trans Boundary

Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation	
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High	
Potential for Irreplaceable Loss of Resources	Low		Medium		High	
Probability of Impact	Unlikely	Low	Medium	High	Definite	
Impact Significance	Very Low	Low	Medium-low	Medium-high	High	Very High
	Significance of impact consider		***Medium-low***			

CHAPTER 7

7 CONSULTATION, PARTICIPATION AND INFORMATION DISCLOSURE

7.1 Public Consultation and Disclosure

Public consultation is a two-way communication between the project ESIA team and the target and affected groups for a proposed development project. The PCM were organized in three places, within and adjacent to the proposed SEZL project site, in between August and September 2019. Views from the general public, local leaders, surrounding institutions, communities and development partners who are interested in and/or would be potentially affected by the proposed project were taken during the consultation meeting.

The proposed SEZL project is known to local people before interaction with the field ESIA team, which indicates that proper information has been disseminated to them. Participants opined that proper land value should be provided to the project affected landowners. Otherwise, they will be marginalized or become landless. Some of the participants opined that rehabilitation also should be in Sadar upazila for the affected household of Chakboayra and Borshomul and must be completed in Phase-I.

Some participant opined that local air is very hot, most of the time, due to sand filling for site preparation. They are also concerned about future air pollution caused by the industries of the SEZL increasing the sufferings of the villagers. Some participants expressed their concern regarding the sound pollution that might be created for use of heavy construction equipment.

One of the important issues was employment opportunities should give based on the priority of local people according to their educational qualification. If needed training and skills development program can be initiated for the locals as well.

The project sponsor assured that SEZL will implement fully the proper compensation plan for the affected landowners and livelihood of the local communities. It was also confirmed that they will start working simultaneously for the development of SEZL and rehabilitation for the 753 affected households. The emission and discharge standards as prescribed by the World Bank and the Department of Environment, Government of Bangladesh will be fully complied in this project. SEZL will provide adequate opportunity to local people for employment during the construction and operation phase of the project. Detail information regarding Public Consultation and Stakeholder Engagement Plan is given in **Annex I**.

CHAPTER 8

8 GRIEVANCE REDRESS MECHANISM

The implementation of an infrastructural project is a complex time and labour intensive process involving multitude of lifecycle phases and processes. Over the duration of the project, it encounters numerous instances of conflicts, allegation and dissatisfaction within the working and associated human capital and their interactions. Some of these issues could be related to compensation payment, improper estimation of affected assets, failure to fulfil commitments, poor management of construction activities, accidents due to inappropriate planning of vehicle movement, and cultural conflicts between other workers and local communities etc. amongst others. Most of the conflicts and allegations may not appear to be of serious nature but if not managed appropriately from the beginning may snowball into a bigger issue.

In order to manage these risks, an internal mechanism is required to be in place where the aggrieved party/s can lodge their complaints and get it amicably settled prior to approaching the formal mode of solution available to them i.e. access to legal system through courts. In order to provide a formal forum to the aggrieved parties to deal with issues arising out of project, it is proposed that a joint grievance redress mechanism be instituted for both environmental and social related issues.

The proposed Grievance Redress Mechanism (GRM) will be developed for the Project in order to settle as many disputes as possible through consultations, negotiation and mutual settlement. Such a mechanism is important as it is expected that most cases, if not all, would be resolved amicably; and the process, as a whole, will promote dispute settlement through mediation to reduce litigation. However, the options of legal recourse will not be restricted in any way by the project proponent. The main objectives of GRM is to provide an accessible mechanism to the affected people, community or any stakeholders. GRC will be formed by the representation of people from all source (like chairman, member, SEZL personnel and administrative officer etc.). There will be a proceure for reporting of any grievance to the GRC. After getting the report GRC will solve the issue in a neutral way. There will be a specific budget from the project proponent for this GRM process. Also concerned person mobile number will be published for any kind of grievance. Detail GRM related procedure is given in **Annex J**.

CHAPTER 9

9 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

9.1 Introduction

The Environmental and Social Management Plan (ESMP) is the synthesis of all proposed mitigation and monitoring actions, set to a time frame with specific responsibility assigned and follow-up actions defined. ESMP is a plan of actions for avoidance, mitigation and management of the negative impacts of the project. Environmental & Social enhancement is also an important component of ESMP. A detailed set of mitigation measures have been compiled in view of the likely impacts associated with the proposed off-site development in Sirajganj Economic Zone. The ESMP consists of a set of mitigation, monitoring and institutional measures to be taken during the design, construction and operation (post-construction) stages of the project. The ESMP has been designed keeping in view the regulatory and other requirements to ensure the following:

- Minimum disturbance to the native flora and fauna;
- Mitigation of potentially adverse impacts;
- Compliance with the air, water, soil and noise quality norms;
- Conservation of water to the extent possible through rain water harvesting, wastewater recycling;
- Link up the ESMP with different stage project planning, drawing, construction and operation
- Institutional capacity building and training

9.2 Mitigation Plan

The proposed off-site developments may have some impacts on the environment and society such as change in land use, removal of vegetation, increased dust emissions etc. Health & Safety Plan along with the ESMP has been drafted. Details of which are given below. All offsite facilities shall be constructed by SEZL and its sub-contractors. So, the ESMP implementation shall also be complied by all the sub-contractors.

The construction phase of the Project is anticipated to last approximately 36 months. The SEZ will be responsible for ensuring the mitigation measures of the ESMP are implemented throughout the life span of the Project.

9.2.1 Mitigation Plan for Pre-Construction, Construction Phase & Operation Phase

A summary of mitigation measures identified for the pre-construction, construction& operation phases of the Project is presented in **Table 8-1**. This also identifies lead responsibility for implementing the mitigation measures and sources of funds for such implementation.

Table 9-1: Environmental and Social Mitigation and Management Plan (Pre-Construction Phase)

Projcet Activity/ Affected area	Expected Environmental and Social Impacts	Potential Impacts	Proposed Environmental Mitigation Measures and Environmental Management	Implemented by	Supervisioned by	Reporting Requirements	Source of Mitigation Cost
Pre-Construction Stage							
Air Pollution	• Site clearance and leveling & filling activities • Removal of vegetation,	• Dust generation • Exhaust emission	• Implementation of a regular and rigorous watering and sprinkling regime for dust suppression during the dry season; • Use of low sulphur content diesel (lesss than 350 ppm) for the vessels which are likely to be used • Machine fitness need o be checked before mobilization to the site. Third party inspection certificate from the approved authority of Gov. need to be ensured. • Prpoer PPE need to ensure for the protection from dust. • No waste will be burnt on or around the Project site.	Appointed Contractor	On site Project Management team	Monthly report to SEZ	Contractor Cost
Noise & Vibration Level	• Operation of different machineries • Running of heavy load traffic for sand transportation Regular traffic movement	• Noise generation	• Vehicles and machinery should be regularly serviced and check for pollution control • Machinery to be used should comply with the noise standards prescribed by DoE (Schedule 5 ECR 1997). • No activities to be undertaken during night hours to prevent any disturbance to nearby residents and labours in labour camps. • Fitting noise machines with noise reduction devices; • If needed, provide extra barricade for reducing the noise level. • Protection devices (ear plugs or ear muffs) shall be provided to the workers/employee minimize adverse impact of occupational noise	Appointed Contractor	On site Project Management team	Monthly report to SEZ	Contractor Cost
Water Pollution	• Impact on water quality Dredged soil may contaminate the canal by runoff water during rain	• Pollute ground water and surface water	• Avoid excavation activities during rain; • Implement the national 3R (Reduce, Reuse and Recycle) strategy for both solid and liquid waste management; • Minimize run-off by using sprays for curing; • Proper management plan should take in the land filling period by contractor;	Appointed Contractor	On site Project Management team	Monthly report to SEZ	Contractor Cost

Projcet Activity/ Affected area	Expected Environmental and Social Impacts	Potential Impacts	Proposed Environmental Mitigation Measures and Environmental Management	Implemented by	Supervisioned by	Reporting Requirements	Source of Mitigation Cost
Soil Quality	• Development of the structures and construction of the access road • Land filling activities and assocoiated facility	Degradation of soil quality and soil contamination	• Fuel storage area should be proper containment; I • Adoption of best management practices to prevent any spillage of raw materials; • Debris should be stored under covered sheds and paved surface and should be disposed off regularly to designated sites; • Recyclable waste should be sold to the authorized dealers/local agencies responsible for waste management in the area;	Appointed Contractor	On site Project Management team	Monthly report to SEZ	Contractor Cost
Waste	• Site clearing • Site leveling	Contamination of surface water and surrounding agricultural land	• Avoid excavation activities during rain; • Construct the project boundary by the earth material prior to the land filling for avoiding tailwater runoff in the surrounding agricultural land;	Appointed Contractor	On site Project Management team	Monthly report to SEZ	Contractor Cost
Topography and Geology	• Site preparation	• Alteration of Topology	• Land development should be confined within the project site. • Ensure the surrounding land would not be affected due to the land development;	Appointed Contractor	On site Project Management team	Monthly report to SEZ	Contractor Cost

Projcet Activity/ Affected area	Expected Environmental and Social Impacts	Potential Impacts	Proposed Environmental Mitigation Measures and Environmental Management	Implemented by	Supervisioned by	Reporting Requirements	Source of Mitigation Cost
Occupational Health & Safety (OHS)	• General Construction activities	• Accidents and incident • health safety	• Provide adequate health care facilities and first aid within dredging sites; • Provide OHS training program and information of basic site rules of work, basic hazard awareness, site specific hazards, safe work practices and emergency procedure; • Provide adequate supplies and easy access of drinking water and sanitary; • Provide temporary shelters to protect against heat stroke during working activities or for use as rest areas as needed; • Provide appropriate PPE that offers adequate protection to the worker, co-workers, and occasional visitors;	Appointed Contractor	On site Project Management team	Monthly report to SEZ	Contractor Cost
	• Dust generation that may impact on community health and safety. • heavy traffic movement	• Traffic safety • Health safety	• Ensuring that only licensed drivers are employed by the Project • Traffic management system shall be initiated • To minimize the dust generation, water should sprinkle regularly at the site. Vehicles movement will be very minimum at project site.	Appointed Contractor	On site Project Management team	Monthly report to SEZ	
Terrestrial Ecosystem	• site clearance, leveling and filling activities • cutting down of trees	• Decrease of vegetation	• If tree Removal cannot be avoided, adequate compensatory afforestation (at least 3 times) including conservation of EN species in Consolation with Forest Department shall be undertaken. • Efforts to be taken to replant the species nearby where no disturbance due to project activity is envisaged. • Vegetation clearing will be kept to the minimum extent practicable for the project site, temporary jetty, transportation route through water and gas pipeline.	Appointed Contractor	On site Project Management team	Monthly report to SEZ	Contractor Cost

Projcet Activity/ Affected area	Expected Environmental and Social Impacts	Potential Impacts	Proposed Environmental Mitigation Measures and Environmental Management	Implemented by	Supervisioned by	Reporting Requirements	Source of Mitigation Cost
Terrestrial Fauna (Birds)	• Noise generation from site.	• Shifting of birds	• Avoiding unnecessary engine operations (e.g. equipment's with intermitted use switched off when not working); • Machines and/or equipment with less noise-emitting capability should be used; • Install the barrier around the booster if it install construction site. • Vegetation clearing will be kept to the minimum extent practicable for the project site; • Vehicles and machinery should be regularly serviced and check for pollution control.	Appointed Contractor	On site Project Management team	Monthly report to SEZ	contractor cost
Fish Species	• Impact on habitat of Fishes and reverence fauna due to accidental spillage • Transportation of equipment • Leakages and Discharge from River Transportation	• Disrupt movement and migration; • Impact on lifecycle	• Each industry should obtain an ECC from the DoE Bangladesh before construction and operation of the factory and must comply with the conditions stated in the ECC. • During Breeding season May-October, no fishing activities should be done in Adjacent Jamuna River. • Avoid excavation activities during rain; • Construct the project boundary by the earth material prior to the land filling for avoiding tail water runoff in the surrounding agricultural land and water bodies; • Leaching from the sediments as well as other site runoff shall be contained, either to seep into the subsoil, or to be discharged in a controlled manner so as to minimize release of sediment laden water in excess of 200mg/l of suspended materials into adjacent lands or waterways; • Avoidance of any leakage of fuels and other contamination from adjacent Jamuna River if applicable.	Appointed Contractor	On site Project Management team		Contractor Cost

Projcet Activity/ Affected area	Expected Environmental and Social Impacts	Potential Impacts	Proposed Environmental Mitigation Measures and Environmental Management	Implemented by	Supervisioned by	Reporting Requirements	Source of Mitigation Cost
Aquatic Mammals (*Platistina gangeticus)*	• Impact on movement and exploration of food.	• Impact on lifecycle	• Dredging works should be carried in the lowest time frame possible; • Reduce the dredger noise at source by isolation of exhaust systems, by keeping engine room doors shut and by additional measures such as shielding; • Expert Monitoring (Monthly) during pre-construction especially from March to December; • Avoiding unnecessary engine operations (e.g. equipment with intermitted use switched off when not working; • Leaching from the sediments as well as other site runoff shall be contained, either to seep into the subsoil, or to be discharged in a controlled manner so as to minimize release of sediment laden water in excess of 200mg/1 of suspended materials into adjacent lands or waterways; • Worker must be aware of draining out the spoilage into the river and authority should deliver awareness regarding the issue.	Appointed Contractor	On site Project Management team	Monthly report to SEZ	contractor cost
Hydrology	• drainage pattern	Drainage congestion	• It is to be confirmed that the path and the direction of Branch of Jamuna River will not be altered at any phases of the project.	Appointed Contractor	On site Project Management team	Monthly report to SEZ	Contractor Cost
Land Acquisition	• Total 415 acres of land will be acquired for economic Zone (1st phase)	• Resettlement • loss of livelihood	• Implementation of resettlement action Plan (RAP) and Livelihood Restoration Plan (LRP); • Payment of replacement value for agriculture land • Establishing a grievance redress mechanism; • Prioritization for work during project construction period; • Prior notification before land development so that farmers can collect their yields or homestead users get enough time to shift their movable assets.	SEZL Project Official	SEZL Corporate, DC Office	Report to lenders	As per approved RAP Study

Projcet Activity/ Affected area	Expected Environmental and Social Impacts	Potential Impacts	Proposed Environmental Mitigation Measures and Environmental Management	Implemented by	Supervisioned by	Reporting Requirements	Source of Mitigation Cost
Loss of Homestead assets	• Approximately 439 nos of households are likely to lose their land	• Resettlemet • Land Acqusition	• Income loss can be mitigated by providing alternative job opportunities for PAPs; • Give proper compensation to farmers and sharecroppers as per LAP • All direct income loss must be adequately compensated within the RAP; • A major segment of the population on the area is unemployed. Construction activity will provide employment to huge nos. of people including skilled, unskilled and non-skilled workers. This will improve the quality of life of people; • Provision of proper training to all workers for handling the construction equipment	SEZL Project Official	SEZL Corporate, DC Office	Report to lenders	As per approved RAP Study
Restriction on accessing primary School	• Land acquisition and ownership transfer • restriction of use of land	• Need to change the school Increase of drop out of student	• Relocate affected schools before land development starts; • Schools should be relocated in same villages as current users/students don't face hinder accessing schooling facilities; • Relocated schools must have similar or better facilities compared to the existing facilities; • Relocation of schools may increase the dropout rates in the affected area, thus awareness program for encouraging affected students need to be organized; • Establishing a grievance redress mechanism; • Prioritization for work during project construction period or skill improvement training.	SEZL Projcet Official	SEZL Corporate, DC Office	Report to lenders	As per approved RAP Study
		• Accessing Mosque for Religious Observance					

Projcet Activity/ Affected area	Expected Environmental and Social Impacts	Potential Impacts	Proposed Environmental Mitigation Measures and Environmental Management	Implemented by	Supervisioned by	Reporting Requirements	Source of Mitigation Cost
	• Land acquisition and ownership transfer • Land development and changes of the land modalities • Restriction in usage of land	• Relocation of mosque	• Relocate affected Mosques before land development starts; • Mosques should be relocated in same villages as current community users don't face hinder accessing Mosque for religious observance; • Relocated Mosques must have similar or better facilities compared to the existing facilities; • Establishing a grievance redress mechanism;	SEZL Projcet Official	SEZL Corporate, DC Office	Report to lenders	As per approved RAP Study
Effects on Vulnerable Households							
	• Land acquisition and ownership transfer • Land development and changes of the land modalities	land loss, homestead loss or livelihood loss	• RAP & LRP should list out the vulnerable households in terms of income, age, gender and disability of affected household heads for future monitoring; • Additional grant provision for the vulnerable households; • Establishing a grievance redress mechanism;	SEZL Project Official	SEZL Corporate, DC Office	Report to lenders	As per approved RAP Study

Table 9-2: Environmental and Social Mitigation and Management Plan (Construction Stage)

Construction Stage						
Air Pollution	• Excavation of soil for the development works; • Concrete works • Transportation related activities • Clearing vegetation in Construction period	• Dust •	• Implementation of a regular and rigorous watering and sprinkling regime for dust suppression during the dry season; • As far as possible, locate the concrete batching plant away from sensitive receptors and additional net fencing on section of boundary wall facing the residential receptors to reduce dust transport.; • Maintain the maximum possible distance between stockpiles and receptors; • Cover and/or water spray all stockpiles of dusty materials such as excavated spoils, loose • construction material piles to avoid fugitive dust; • During construction, the access road will be regularly maintained to keep it clean, free from mud and slurry. • Material transport will be totally enclosed with impervious sheeting and wheel washing will be carried out at site. • No waste will be burnt on or around the Project site. • A speed limit of 15-20 km/hr will be enforced on the construction site/access road; • Regularly maintain all diesel-powered equipment and reduce idling time to avoid emissions of NOx, PM10 and SO2; • Where available use low sulphur diesel (LSD) in HGVs and diesel powered equipment; • Implement best practice procedures to control vehicle / equipment air emissions (such as turning off equipment when not in use); and • Vehicle / equipment exhausts observed to be emitting significant black smoke from their exhausts will be serviced/ replaced	Appointed Contractor	on site project management team and designated HSE team	Monthly report to SEZ	Contractor Cost

Noise	• Heavy machinery operations for construction works • Transportation related activities	• increase in ambient noise level	• Normal working hours of the contractor will be between 06:00 and 21:00 hours from Monday to Sunday. If work needs to be undertaken outside these hours, it should be limited to activities that do not lead to exceedance of the noise criteria at nearby residential area; • Only well-maintained equipment should be operated on-site; • Regular maintenance of equipment including lubricating moving parts, tightening loose parts and replacing worn out components should be conducted; • Machines and construction plant items (e.g. trucks) that may be in intermittent use should be shut down or throttled down between work periods; • Low noise equipment should be used as far as practicable; • The number of equipment operating simultaneously should be reduced as far as practicable; • Equipment known to emit noise strongly in one direction should be orientated so that the noise is directed away from nearby NSRs as far as practicable; • Noisy plant (such as breakers and rollers) shall be located as far away from receptors as practicable.	Appointed Contractor	on site project management team and designated HSE team	Monthly report to company	Contractor Cost
Wate rresources	• Wastewater Discharge from washing of equipment and machinery • Sanitary facilities	waste water contamination	• Vehicle servicing areas and wash bays located within roofed and cemented areas. The drainage in these covered areas connected to oil/water separator and channelized properly to the land/inland waters ; • Oil leakage or spillage contained and cleaned up immediately. Waste oil to 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 to be treated to comply with discharge standards before it is discharged; • Adequate sanitary facilities, i.e. toilets and showers, provided for the construction workforce; • Workers trained in the use of designated areas/bins for waste disposal and encouraged to use toilets. • Septic tanks provided to treat sanitary wastewater; and all sewage and liquid effluent treated to meet the standards specified in Schedules 9 and 10 of the ECR, 1997 respectively and WBG EHS Guidelines prior to discharge to land/inland waters.	Appointed Contractor	On site Project Management team and designated HSE team	Monthly report to SEZ	Contractor Cost
surface water quality	• Leaks and spills of oil, lubricants, fuel Improper handling of sewage or chemical	Ground water contamination				

Waste	• Storage, handling and disposal of construction waste	• Environmental pollution	• Design processes to prevent/minimize quantities of wastes generated and hazards associated with the waste generated; • Training labourers for waste disposal in designated areas and use of sanitation facilities; • Provide dedicated storage areas for construction materials to minimise the potential for damage or contamination of the materials; • Implement a 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; • Segregate hazardous and non-hazardous waste and provide appropriate containers for the waste types generated (e.g. enclosed bins for putrescible materials to avoid attracting pests and vermin and to minimise odour nuisance); • Store wastes in closed containers away from direct sunlight, wind and rain; • Provide enough space to allow for inspection between waste containers so as to identify any leaks or spills; • Ensure storage areas have impermeable floor and containment, of capacity to accommodate 110% of the volume of the largest waste container; • Implement the national 3R (Reduce, Reuse and Recycle) strategy for both solid and liquid waste management; • Storage of inert concrete waste in a laydown area near the concrete batching plant and reuse of these wastes under floors or roads; and • Dispose of hazardous waste including bitumen by licensed contractors.	Appointed EPC Contractor	On site Project Management team and designated HSE team	Monthly report to SEZ	Contractor Cost

Soil Pollution	• Development of site, construction work of on-site and off-site facilities	• soil erosin and compactiton	• Demarcation of routes for movement of heavy vehicles especially near the temporary jetty; • Stripping and placing soils when dry, and not when wet; and • Restricting the height of topsoil stockpiles to minimize erosion and compaction. • Building small bunds in areas with slope to prevent soil erosion.	Appointed EPC Contractor	On site Project Management team of Project developer	Route plans and top soil management inventory submitted to HSE and Project Management team	EPC Contractor Cost
Soil and Sediment Quality	• Fueling and operation of heavy machinery and transport vehicles, Unloading and loading activities • Storage and handling of chemicals	• Soil and sediment contamination through spills and leaks	• Fuel tanks and chemical storage areas to be sited on sealed areas and provided with locks to prevent unauthorized entry; • Preparation of guidelines and procedures for immediate clean-up actions following any spillages of oil, fuel or chemicals; • Development of a site specific Emergency Response Plan for soil clean-up and decontamination; • Implementation of a training program to familiarise staff with emergency procedures and practices related to contamination events; • Storage areas for oil, fuel and chemicals to be surrounded by bunds or other containment devices to prevent any spilled oil, fuel or chemicals from contaminating soils, sediment, water or groundwater; • Use of spill or drip trays to contain spills and leaks, and use of spill control kits to clean small spills and leaks; and • Installation of oil/water separators to treat surface run-off from bounded areas prior to discharge to the storm water system.	Appointed Contractor	HSE Division of Project developer and on site Project Management team	Plans submitted to HSE division for approval and monthly reports to SEZ	Contractor Cost

working conditions, including occupational safety	• Occupational Health & Safety • Possibility to occur accidents and incident during construction works; • Physical trouble, noise, vibration, lighting, electrical, heat and cold, nuisance dust, fire/explosion, machine grinding, working space, Chemical, Gases, dusts, fumes, vapours, liquids are the major hazards which are harmful for workers health; • May insect and snake bite in the labour camp; • Road Accident	• To provide adequate health care facilities and first aid within construction sites; • To provide OHS training program and information of basic site rules of work, basic hazard awareness, site specific hazards, safe work practices, and emergency procedure; • To provide adequate lavatory facilities for the number of people expected to work in the facility; • To provide adequate supplies and easy access of drinking water with a sanitary • To provide temporary shelters to protect against heat stroke during working activities or for use as rest areas as needed; • To arrange for provision of clean eating areas where workers are not exposed to the hazardous or noxious substances where there is potential for exposure to substances poisonous by ingestion of food as necessary; • To promote the use of repellents, clothing, netting and other barriers to prevent insect bites and snake bite; • Adequate preventive measures from negative factors such as fire precautions, lighting, safe access, work environment temperature, area signage, labelling of equipment, communicate hazard codes and electrical; • To establish rights-of-way, site speed limits, vehicle inspection requirements, operating rules and procedures, and control of traffic patterns or direction; • To identify and provide appropriate PPE that offers adequate protection to the worker, co-workers, and occasional visitors; • Proper maintenance of PPE and the instruction of proper use;	Appointed Contractor	BEZA, SEZL, DoE,	Report to lenders	Contractor Cost

	• Community Health and Safety • Traffic congestions on roads • Increased risks with respect to safety; • Inconvenience to community in terms of air and noise pollution; • Structural and surface damage of road • Generation of dust, noise and odour from the construction site • Fire Safety from the ongoing construction activities;	• Provision of infrastructure for outsider labour such as water supply, electricity, sanitary facilities, medical aid and other basic amenities to avoid dependence on limited local resources; • Provision of infrastructure for outsider labour such as water supply, electricity, sanitary facilities, medical aid and other basic amenities to avoid dependence on limited local resources; • Proper disposal of wastes generated from the camp and construction activity to maintain general hygiene in the area; • Creating awareness among the drivers about speed, traffic safety, use of horns etc while driving through settlement areas; • Covering of trucks while carrying soil, sand, cement, aggregates etc to minimise spread of dust and spill over; • Avoiding unnecessary movement of vehicle through settlement area to minimise disturbance and traffic safety related issues; • Creating awareness among children, women, and old age people in particular and the community in general on traffic safety by using existing mediums such as school, women self-help groups, village union and religious occasions; • Strengthening and regular maintenance of village road to minimize surface and structural damage of road; • Sprinkling of water to suppress dust generation in the construction zone; • Provide training and create awareness about fire and safety among workers at site; • Disposal of wastes at pre identified waste dumping site to avoid unauthorized dumping; • Avoid disposing of wastes in the river and providing silt traps to arrest silt flowing into the river during the rainy season.	Appointed Contractor	BEZA, SEZL, DoE,	Report to lenders	Contractor Cost

	• Risk of Fire • Risk of fire might increase due to the implementation of the construction work. Faulty electrics are the biggest cause of workplace fires, loose wires, plugs that are over loaded • Old equipment can all make for a potential death trap		• To minimize the impact, the abovementioned rule and the internal regulation for the Economic Zone of Sirajganj will be applied and obligate industries to install appropriate security and safety system for their implementation; • Maintain safe housekeeping practices that reduce the risk of fire danger; • Implement a program that includes preparation, prevention, and recognition of fire Risk; • Proper handling of combustible and flammable material; • Keep all fires and heaters well-guarded, especially open fires; • Keep portable heaters and candles away from furniture and curtains; • Don't dry or air clothes over or near the fire, or the cooker; • Do not smoke in the project site;	Appointed Contractor	BEZA, SEZL, DoE,	Report to lenders	Contractor Cost
	• Accidents • Construction accidents and road accidents around the project; • Excavation of retention pond • Access road construction		• Follow Health and Safety Management Plan (HSMP) rules and regulations designated by contractors; • Provision of traffic sings, road mark, bump, zebra mark, guard rail and pole, and curb stones etc.;	Appointed Contractor	BEZA, SEZL, DoE,	Report to lenders	Contractor Cost
Terrestrial (birds)	• •Site preparation and related activities.	Impact on lifecycle	• Noise levels must be attenuated to the extent possible by proper lubrication of machineries and equipment and installation of noise barriers/acoustic enclosures at appropriate locations; • Minimizing the secondary sources of noise generation such as vehicle noise and other operation and maintenance; • Vehicles and machinery should be regularly serviced and check for pollution control; • Fitting noise machines with noise reduction devices.	Appointed Contractor	SEZL	Report to lenders	Contractor Cost

Fish species	• Surface runoff; • Sewage streams to the river; • Accidental spillage.	• Impact on lifecycle	• Construction of storm water drains along with sedimentation tanks with sandbags as partition as barrier for direct flow of run off to Jamuna branch river and Jamuna river. • Septic tanks should be provided to treat sanitary wastewater; • To avoid excavation activities during rain. • Maintaining appropriate flow of water sprinklers at site. • Collection & Reusing of curing over flow, tyre wash water etc within the site; • Construction of soak pits/septic tanks to dispose-off the domestic waste water generated from labour camps to prevent disposal of sewage in surface water bodies; • The surface water quality should comply Schedule 3 of ECR, 1997 of the GOB and the WHO Guidelines.	Appointed Contractor	SEZL	Report to lenders	Contractor Cost
Aquatic Mammals (*Platistina gangeticus*)	• Surface runoff; • Sewage streams to the river; • Accidental spillage	• Impact on lifecycle	• Construction of storm water drains along with sedimentation tanks with sandbags as partition as barrier for direct flow of run off to Jamuna branch river and Jamuna river. • Septic tanks should be provided to treat sanitary wastewater; • To avoid excavation activities during rain. • Maintaining appropriate flow of water sprinklers at site. • Collection & Reusing of curing over flow, tyre wash water etc within the site; • Construction of soak pits/septic tanks to dispose-off the domestic waste water generated from labour camps to prevent disposal of sewage in surface water bodies; • The surface water quality should comply Schedule 3 of ECR, 1997 of the GOB and the WHO Guidelines.	Appointed Contractor	SEZL	Report to lenders	Contractor Cost
Local Economics, such as employment, livelihood	• PAPs who earn income from paddy fields and/or vegetable fields might lose their income source. • Many sharecroppers depended on agriculture in dry season. They cultivate IRRI and vegetable that period. • On the other hand, increase of job opportunity as construction workers or commercial Opportunity targeted to the workers is expected.		• Income loss can be mitigated by providing alternative job opportunities for PAPs; • Give proper compensation to farmers and sharecroppers as per LAP • All direct income loss must be adequately compensated within the RAP; • A major segment of the population on the area is unemployed. Construction activity will provide employment to huge nos. of people including skilled, unskilled and non-skilled workers. This will improve the quality of life of people; • Provision of proper training to all workers for handling the construction equipment;	Appointed Contractor	SEZL, DoE, DC Office	Report to BEZA and lenders	DC Office

Local Conflict of Interest	• Due to employment, opportunity will be increasing during construction; candidates of construction workers may have some conflicts between communities.	• Job opportunities should be provided in fair way • Clear information about the needs of labor (number and qualification) should be provided with local people • The job skills and the priority for the affected people shall be taken into account and the workers can be chosen;	Appointed Contractor	SEZL, DoE	Report to BEZA and lenders	Contractor Cost
Land Use and Utilization of local resources	• The temporary storage and stockyard are built up on the agricultural lands, and then the crop production will be obstructed in those areas. • Crops will also be damaged when the equipment, and heavy vehicles will pass through agricultural fields of the proposed project areas.	• Plantation area which will be tentatively occupied during construction, will be restored to original state and returned to the land users/owner after construction.	Appointed Contractor	SEZL, DoE,	Report to BEZA and lenders	Contractor Cost

Children's Rights	• Impact on educational opportunity on school children in PAHs of the Project; • Impact on educational opportunity of school children in local community; Impact of the Project on increase of child	• Child labor at the construction site during the project implementation shall be strictly prohibited since such practices are banned by both Bangladesh laws and WBG guidelines; • The RAP Implementing Agency and EZ authority shall regularly monitor project sites to guide contactors and their related firms to discourage child labor; • Support of sending children to school; • Helping the parents with hunting for a job, including the one at the construction site; • Mediation for micro credit loan; • Introducing them to assistance organizations such as NGO and so forth	Appointed Contractor	SEZL, DoE,	Report to BEZA and lenders	Contractor Cost

Table 9-3: Environmental and Social Mitigation and Management Plan (Operation Stage)

Operation Phase							
Air Quality							
Agro-business							
Ambinet air quality	• Solids Handing, Solid Reduction and drying	• Particular matter generation	• Cover skips and vessels, and stockpiles, especially outdoors; • Enclose soils and containers used for bulk storage of powders and fine materials • Where enclosure is not feasible, use sprays, windbreaks, sweeping, sprinkling, and other stockpile management techniques to suppress dust • Use closed conveyors equipped with filters to clean transport air prior to release; • Smoking unit emissions of PM should typically not exceed 50 mg/Nm3 • Use cyclones and, if necessary, and fabric filters to remove dust from exhaust air; • Remove particulate matter from the gas stream using dry cyclones, venturi scrubbers, electrostatic precipitators (ESPs) or dry filter systems, as necessary. • Monitoring of ambient air quality to ensure that emission is within national standard • Each factory shall prepare their own EIA report	Appointed EHS officer of the industry	Plant Management or plant EHS team	Monthly	Factory O&M Cost
• Textile Manufacturing							

Ambinet air quality	• Drying, prongting, fabric preparation, and waste water tearatment residues • Volatile Compounds	• Gneeration of toxic compounds (acetaldehude), choloroflorocarbons	• Use of dust extraction and recycling systems to remove dust from work areas • Using appropriate control technologies (e.g. diversion of stack emissions through boilers; installation of scrubbers with activated carbon slurries etc.) • Substituting odor-intensive substances with less impacting compounds (e.g. sulfur containing dyestuffs and reducing agents with non-pre-reduced sulphide-free dyestuffs; sodium dithionite in dyeing after treatment with aliphatic short-chain sulfinic acid derivatives); • Capturing and recovering the off-gases from the processes (e.g. installation of heat recovery systems); • suggested to measure parameters (VOCs, Chlorine, Formaldehyde, etc.) as prescribed in WBG air emission level for textile industry. • Each factory shall prepare their own EIA report	Appointed EHS	Plant Management or plant EHS team	Monthly	Factory O&M Cost
Plastic industry						
Ambient air quality	• Handling of dry additives and granulations of polymers, heating of thermoplastic	• volatile Organic Compound • Dust	• Installation of refrigerator coils (or additional coils) above the degreaser vapor zone • Application of an air flow over the top of the degreaser that should not typically exceed 40 m / minute; • In order to reduce emissions during welding and coating, metal surfaces should be carefully cleaned; • Installation of in-line aspirators with filters or scrubbers Electrostatic precipitators (ESP) • Where possible, maintaining wetness on the metal surface in order to prevent or minimize dust production • Each factory shall prepare their own EIA report	Appointed EHS	Plant Management or plant EHS team	Monthly	Factory Operation Cost
Footwear industry						

Ambient air quality	• Operation process and Waste water treatment	• Generation of organic solvents • Dust	• Consider water-based formulations (containing low quantities of solvent) for spray dyeing • Control dust through use of employing cyclones, scrubbers, and / or bag filters, as needed.	Appointed EHS	Plant Management or plant EHS team	Monthly	Factory Operation Cost
Noise							
Food and Beverage, Textile Manufacturing, Plastic Industry, etc.							

Ambient noise level	• Plant operation	• Increased noise level	• Installing suitable mufflers on engine exhausts and compressor components • Provide Personal protective Equipment (PPE) to the workers and employees who are working around noise generating area • Installing acoustic barriers without gaps and with a continuous minimum surface density of 10 kg/m2. • Green buffer zone should be developed all along the project boundary. Green buffer should compose of the only one row of plants of variable height and thick canopy so as to form continuous barrier. This will help in reducing the noise level significantly; • Relocating noise sources to fewer sensitive areas. • Reducing project traffic routing through community • areas wherever possible • monitor noise level in the working area to ensure that the noise level is within standard. • Each factory shall prepare their own EIA report	Appointed EHS	Plant Management or plant EHS team	Monthly	Factory Operation Cost
Waste						
Food processing						

Sorting, grading and other production process	• Food safety due to proliferation of pathogenic microorganism	• Generation of solid waste	• Minimize inventory storage time for raw materials • Consider use of enclosure techniques to minimize damage to raw materials stored outdoors • Provide leak proof container for collected solid and liquid waste. • Segregating individual by-products from each other and from waste to maximize their use and minimize waste • Monitor and optimize process yields, e.g. during manual grading or cutting activities, and encourage the most productive employees to train others in efficient processing • Contain solid waste in dry form and consider disposal through composting and / or use for soil amendment • maintain an inventory of wastes generated during the production process collect and reuse rejected raw materials for manufacturing other products (for example such as coleslaws; sauerkraut; orange peels for use in dietary fiber supplements; potato pulp for production of biofuel; onion material for onion oil production)	Appointed EHS	Plant Management or plant EHS team	Monthly	Factory Operation Cost
Plastic Industry							
Mixing, milling, calendering, molding operation	• Soil pollution	• Generation of solid waste	• separating metal dust or scrap by type to promote recovery and recycling; • Reducing and treating slags from welding, forging, machining, and mechanical finishing, which may contain metal ions; • Proper management of metals removed from wastewaters for recovery or disposal; • disposal of sludge from surface finishing processes (e.g. galvanizing, painting, hot dip).	Appointed EHS	Plant Management or plant EHS team	Monthly	Factory Operation Cost
Chemical industry							

Plant operraion	• Spent over catalyst, • prilling and granulators dust	• Dust particulates	• Proper on-site management, including submerging pyrophoric spent catalysts in water during temporary storage and transport until they can reach the final point of treatment to avoid uncontrolled exothermic reactions • Return of catalyst to the manufacturer for regeneration and recovery • Off-site management by specialized companies/ certified vendor that can recover the heavy or precious metals through recovery and recycling processes whenever possible • Conduct and Separate EIA study prior installation of a fertilizer industry • Conduct a HazMat study prior production of the industry. • Establishing a waste management hierarchy that considers prevention, reduction, reuse, recovery recycling, removal and finally disposal of wastes • Provide PPE to the workers and employees	Appointed EHS	Plant Management or plant EHS team	Monthly	Factory Operation Cost
Footwear industry						
Plant operation	• Salt from raw skin, hair from liming, dehairing process, wet blue timming	• Generation of Chomium oxide, dye, and • buffing dust	• Reduce inputs of process agents (particularly precipitation agents in wastewater treatment) to the extent practical; • Segregate different waste residue fractions to facilitate recovery and re-use (e.g. to manufacture pet toys, pet food, leather fiberboard); • Recycle sludge as compost soil conditioner or in anaerobic digestions for energy generation. • Processed sludge may be used for composting / agriculture after appropriate assessment for contaminants and potential impacts to soil and groundwater;	Appointed EHS	Plant Management or plant EHS team	Monthly	Factory Operation Cost
Water Pollution						

• Generation of waste likely to polluted water resources • Domestic and cleaning waste • Cinsumption of 7 MLD water	Detoriation of surface and ground water level and quality •	**Surface Water Quality** • Each industry must arrange pretreatment facility to treat their processed effluent and sewage they generate to meet certain level of pollution load set by the SEZ operator; • Industrial wastewater to be treated in ETP by each tenant to meet national wastewater discharge standards (Schedule 10, ECR'97); • Suggested to harvest rain water to reduce the pressure on surface and ground water resources in the operation phase; • High temperature water from cooling water shall not be discharged into the water bodies; • Preferable to implement Zero Liquid Discharge (ZLD) in operation phase, if not, CETP shall be installed; • Storm and industrial wastewater will be collected in separate pipe networks to prevent contamination of storm water draining; • Common waste disposal sites shall be developed within EZ site as per standards with permission of DoE before development; • Peripheral drain shall also be lined and shall not be connected to internal storm water drainage system; • Surface water quality of nearby river to be monitored at regular interval to comply with national standard (Schedule 3, ECR'97) **Ground Water Quality** • Wastes shall be stored in a confined area and a secondary place shall be used to avoid leaching of liquid waste to ground water; • Treated wastewater will be passed through a lagoon to ensure bio monitoring of water quality; • If medical waste is generated shall be disposed by registered medical waste disposal trader to avoid ground water pollution. • Ground water quality shall be monitored periodically to comply the national standard (Schedule 3, ECR 1997). • Amount of ground water extraction shall be maintained by individual industries (if any); • Reuse of water by implementing zero discharge policy will reduce the pressure on ground resources.	Appointed EHS	Plant Management	Monthly	Factory Operation Cost
Occupational Health and Safety						
Food and Beverage						

Plant operation	• Physical hazard • Exposure to noise • Biological hazards • Chemical hazards • Exposure to heat and cold	Occupational Health and safety •	**Physical hazard** • Maintain walking and working surfaces clean and dry by preventing spillages through ani slip foot ware where necessary • Ensure hygiene and safety of workers by providing training on proper use and maintenance of safety tools and PPEs e.g. hearing protection, gloves, aprons, etc. • Provide pure drinking water to the workers at working place; • Prepare emergency plans and train staff for emergencies; • Installing suitable mufflers on engine exhausts and compressor components; **Biological hazard** • suggested to avoid dust and aerosol generating activates (such as use of compressed air or high-pressure water for cleaning) • Provide workers PPE that is appropriate for the activities; • Ensure physical segregation of work and welfare facilities; **Chemical hazard** • Keeping the number of employees exposed, or likely to become exposed, to a minimum; • Training workers in the use of available information (such as MSDSs), safe work practices, and appropriate use of PPE; • Any means of written messages should be in an easily understood language and be readily available to exposed workers and first-aid personnel **Heat and cold** • Use of protective clothing (such as aluminized) and PPE; • Providing easy access to adequate hydration i.e. drinking water or electrolyte drinks, and prohibit alcohol consumption; • Adjustment of work and rest periods according to temperature stress management;	Appointed EHS	Plant Management	Monthly	Factory Operation Cost
Footwear Industry						

Plant Operation	• Exposure to chemicals; • Exposure to biological hazards.	Occupational Health and Safety •	**Exposure to chemical** • Use of personal protection equipment (e.g. gloves, glasses boots, aprons, masks, hoods, respirators), particularly in the wet activity areas of the tannery • Respirators / masks with particulate filters and glasses should be used when handling powder and liquid chemicals • Implement management procedures and controls for discharge of floats from paddles and drums • Limit exposure to hazardous chemicals by promoting chemical handling procedure • Keeping the number of employees exposed, or likely to become exposed, to a minimum • Training workers in the use of the available information (such as MSDSs), safe work practices, and appropriate use of PPE (Such as imperviable gloves, respiratory chemical musk) • Communicating chemical hazards to workers through labeling Materials Safety Data Sheets (MSDS), or equivalent • Any means of written communication should be in an easily understood language and be readily available to exposed workers and first-aid personnel	Appointed EHS	Plant Management	Monthly	Factory Operation Cost
Textile industry							

Plant Operatoin	• Chemical Hazard • Physical Hazard • Heat • Noise	Occupational Health and Safety •	**Chemical Hazard** • Use of personal protective equipment (PPE) for exposed workers, such as masks and respirators, as necessary • Installation of dust extraction, recycling and ventilation systems to remove dust from work areas, especially in cotton mills • prohibition of the use of asbestos dust fiber as respiration of the dust is known as lung carcinogen **Physical Hazard** • Maintain walking and working surfaces clean and dry by preventing spillages through ani slip foot ware where necessary • Ensure hygiene and safety by providing workers with training in proper use and maintenance of safety devises and personal protective equipment such as hearing protection, and gloves, aprons etc. • Provide pure drinking water to the workers at working place • Prepare emergency plans and train staff for emergency situations **Heat** • Use of protective clothing (such as aluminized) and PPE • Providing easy access to adequate hydration such as drinking water or electrolyte drinks, and avoiding consumption of alcoholic beverages • Adjustment of work and rest periods according to temperature stress management **Noise** • Use personal protective equipment (muffler, ear plug, plug etc.) • Installing suitable mufflers on engine exhausts and compressor components	Appointed EHS	Plant Management	Monthly	Factory Operation Cost

Chemical industry

• Chemical hazards • Fire and explosion hazards.	Occupational Health and Safety •	**Chemical Hazard** • of gas detectors in hazard areas, wherever possible; • Provide adequate ventilation in all areas where ammonia, • nitric acid and aqueous formaldehyde is handled • Provide air extraction and filtration in all indoor areas where urea and dust can be generated. **Fire and Explosions** • Install leak detection units and other devices (alarm detection systems, such as automatic pH monitoring in nitric acid plants) to detect releases early • Segregate process areas, storage areas, utility areas, and safe areas, and adopting of safety distances • Remove potential ignition sources • Avoid pressurizing large quantities of nitric acid for loading/unloading • Use carbon austenitic stainless steel for nitric acid tanks, vessels and accessories • keep contact with local Fire service station • Arrange fire drilling on regular basis and train at least 20% of the worker on fire fighting • Keep adequate firefighting extinguisher (at least 2 extinguishers for less than or equal 400 m2)	Appointed EHS	Plant Management	Monthly	Factory Operation Cost
Plastic industry						

Plant Operation	• Physical hazards • Chemical hazards	Occupational Health and Safety	**Physical hazard** • Use of screens or flaps to protect against material flying out from machinery feed openings • Installation of emergency stop switches within reach of operating stations • Maintain walking and working surfaces clean and dry by preventing spillages through ani slip foot ware where necessary • Ensure hygiene and safety by providing workers with training in proper use and maintenance of safety devises and personal protective equipment such as hearing protection, and gloves, aprons etc. • Provide pure drinking water to the workers at working place • Prepare emergency plans and train staff for emergency situations • Each industry shall prepare own EIA report specifying **Chemical Hazard** • A work permit system should be established • Smoking should be prohibited anywhere EPS (Raw Expandable polystyrene) bead is manufactured, used, or stored • During pre-expansion, pentane vapor is mixed with steam which reduces its flammability. Pentane / steam vapor should be vented • A gas monitor should be used to identify where pentane 'hot spots' are likely to occur, and to monitor concentrations	Appointed EHS	Plant Management	Monthly	Factory Operation Cost

Ecology

Fish species	• Post development of the economic zone & setting up of industries. Water discharge	Impact on lifecycle •	• Each industry should obtain an ECC from the DoE Bangladesh before construction and operation of the factory. • Periodic monitoring shall be carried out as per the monitoring plan for air, water, noise and soil and ensure that no impact; • Wastewater will be treated in the effluent treatment plant to meet national waste water discharge standards; • Storm and industrial wastewater will be collected in separate pipe networks to prevent contamination of storm water draining to natural wetlands • Implement the national 3R (Reduce, Reuse and Recycle) strategy for both solid and liquid waste management; • No waste shall be discharged in water bodies, i.e. river and canals etc. • Central ETP should install to treat the effluent generated and to reuse and recycle it completely. No untreated effluent should be discharged in water bodies, i.e. canal and agricultural land;	Third Party Agency / Tenant	SEZL	Report to BEZA and lenders	Occupant's own cost
quatic Mammals (*Platistina gangeticus*)	• Post development of the economic zone & setting up of ndustries.Water discharge	Impact on lifecycle •	• Each industry should obtain an ECC from the DoE Bangladesh before construction and operation of the factory. • Periodic monitoring shall be carried out as per the monitoring plan for water, noise ensure that no impact; • Wastewater will be treated in the effluent treatment plant to meet national waste water discharge standards; • Storm and industrial wastewater will be collected in separate pipe networks to prevent contamination of storm water draining to natural wetlands; • Implement the national 3R (Reduce, Reuse and Recycle) strategy for both solid and liquid waste management; • No waste shall be discharged in water bodies, i.e. river and canals etc. • Central ETP should install to treat the effluent generated and to reuse and recycle it completely. No untreated effluent should be discharged in water bodies, i.e. canal and agricultural land.	Third Party Agency / Tenant	SEZL	Report to BEZA and lenders	Occupant's own cost

Children's Right	• Children's educational opportunity will be temporarily disrupted due to the relocation • Child Labour	• Project proponents will implement ―EZ neighbors' students Support Program‖ as one of the community support programs targeting not only for children of PAH but also for surrounding communities. • The project proponent will implement this kind of educational program continuously based on needs and requests from the community. • Support of sending children to school; • Introducing them to assistance organizations such as NGO and so forth • According to the Labour Law of Bangladesh 2006, the minimum legal age for employment is 14. According to international standard, the legal age is 18. • The Project and industries keep laws in Bangladesh; illegal child labor will be preventing in employment of labors.	Third Party Agency / Tenant	SEZL, BEZA, DoE	Report to BEZA and lenders	Occupant's own cost
Infectious Diseases	• This is a possibility to increase the risks of infectious diseases due to influx of workers of the industries and the semi-urbanization of the project area and its surroundings area.	• Conduct mitigation measures stipulated in the international guidelines such as EHS Guidelines of WBG • To conduct Information, Education and Consultation Communication (IEC) campaign at least every other month to all site staff, employees, and immediate local communication concerning the risks, dangers and impact and appropriate avoidance behavior with respect to, of Sexually Transmitted Disease (STD) or Sexually Transmitted Infection (STI) in general and HIV/AIDS in particular, • To provide male or female condoms for all staff and laborers as appropriate and • To provide for STI and HIV/AIDS screening, diagnosis, counseling and referral to dedicated national STI and HIV/AIDS program.	Third Party Agency / Tenant	SEZL, BEZA, DoE	Report to BEZA and lenders	Occupant's own cost

9.3 Enhancement Plan

The proposed project involves development of EZ and off-site facilities for the upcoming Sirajganj EZ. These off-site facilities will be developed by SEZL. Development of these off-site infrastructure facilities will attract the investors and make the proposed site location more accessible for trading and business. Proximity of the proposed project site to the Dhaka-Hatikumrul Highway (N405) adds to the suitability of site for setting up the industries. As enhancement plan, it is proposed that SEZL authority should develop a thick green belt all around the EZ site, proper storm water drainage to prevent flooding and rainwater harvesting system to harvest rainwater and use it to meet daily water demand and reduce pressure on ground water resources.

9.4 Contingency Plan

In order to be in a state of readiness to face adverse effects of accidents, a Contingency Plan is required to be prepared which includes on-site and off-site emergency plan by the individual industry and industrial estate. SEZL is committed to develop a Contingency Plan in consultation with district authorities and industry association. The Contingency Plan will have the following minimal components:

- Accidents preventions procedures/ measures
- Fire prevention planning and measures
- Fire water storage and foam system
- Accident/emergency response planning procedure
- Communication
- Emergency control centre
- Emergency information system with role & responsibility and command structure
- Recovery procedure
- Assessment of damages and rectification
- Evaluation of functioning of disaster management plan
- Accident investigation
- Clean-up and restoration

9.5 Monitoring Plan

The objective of environmental monitoring during the construction and operation phases is to compare the monitored data against the baseline condition collected during the study period to assess the effectiveness of the mitigation measures and the protection of the ambient environment based on national standards. A monitoring schedule has been sketched based on the environmental components that may be affected during the construction for 3 years time period and operation of the project is given below in **Table 9-4:** .

Table 9-4: : Environmental and Social Monitoring Plan

Project Stage/Affected Component	Potential Impact	Parameter to be Monitored	Location	Measurements	Frequency	Responsibility	Cost
Site Preparation and Construction Stage							
General	Inspection of mitigation compliance	General compliance with mitigation measures presented in the ESMP and as specified in EPC Contractor Manual	Project Activity areas and any shelter connected to project activity	Visual inspection of all active work areas	Daily	EHS Team of Contractor	Contractor cost
Ambient Air Quality	Dust generation	SPM, PM 2.5, PM10	At 4 Locations following baseline monitoring points or wherever needed as per instruction of the monitoring consultant.	24-hour covering both day and night time[30]	Bi-monthly	Contractor/ 3rd party Environmental Consultant	Contractor cost

[30] In Bangladesh, due to security issue and also shortage of utility facilities, 24 hours monitoring of air quality will not be possible in village area. At that case, 8 hour monitoring will be performed. The conversion equation will be used which is $C_{long} = C_{short}*(t_{short}/t_{long})^{\wedge p}$ (Source: Julie Schroeder and Denis Jugloff (2012), Interpretation of 24-hour sampling data: Development of 24-hour ambient air quality criteria and their use in Ontario, Human Toxicology & Air Standards Section, Standards Development Branch, Ontario Ministry of the Environment, Toronto, ON, Canada)

Project Stage/Affected Component	Potential Impact	Parameter to be Monitored	Location	Measurements	Frequency	Responsibility	Cost
	Vehicle Exhaust	NO_x, SO_2, CO	At 4 Locations following baseline monitoring points or wherever needed as per instruction of the monitoring consultant.	24-hour covering both day and night time[31]	Bi-monthly	Contractor/ 3rd party Environmental Consultant	Contractor cost
Noise	Increase in ambient noise levels	Noise levels in Leq, Leqday and Leqnight in peak hour[32]	At 6 Locations (Following baseline monitoring points)	24 hour	Monthly	Contractor/ 3rd party Environmental Consultant	Contractor cost
Soil Quality	Quality of filling earth/ sand	pH, Particle Size Distribution, Organic Matter, EC, Saturation (%), Bulk Density, Cation Exchange Capacity, N, P, K, Ca, Mg, Na, S,	3 locations from adjacent agricultural land of the project boundary	Standard analytical methods	Quarterly, but incase in the event of any leakage or spillage of hazardous substances, oil, or toxic chemicals	Contractor/ 3rd party Environmental Consultant	Contractor cost

[31] In Bangladesh, due to security issue and also shortage of utility facilities, 24 hours monitoring of exhaust gases will not be possible in village area. At that case, 8 hour monitoring will be performed. The conversion equation will be used which is $C_{long} = C_{short}*(t_{short}/t_{long})^{\wedge}p$ (Source: mention the source??)

[32] Peak hour include the timeline when the workforce and construction activity is in mostly busy.

Project Stage/Affected Component	Potential Impact	Parameter to be Monitored	Location	Measurements	Frequency	Responsibility	Cost
		Fe, Mn, Zn, Pb, Cd,					
Water	Contamination of surface water	pH, BOD, COD, DO, TDS, TSS, EC, Oil and Grease	3 locations from baseline sampling points (covering upstream, middle and downstream of the Branch of Jamuna River) or	Standard analytical methods	Monthly	Contractor/ 3rd party Environmental Consultant	Contractor cost
	Contamination of wastewater	Alkalinity, As, BOD, Cd, Ca, Chloride, COD, DO, EC, Fe, Pb, Hg, Mg, NO3, NO2, Oil and Grease	Outflow point	Standard analytical methods	Monthly	Contractor/ 3rd party Environmental Consultant	Contractor cost
	Ground water quality	As, Cd, Ca, Chloride, Cr, EC, Hardness, Fluoride, Fe, Pb, Hg, K, pH, TDS, Temperature, TC, FC	From 3 adjacent household tube wells	Standard analytical methods	Quarterly	Contractor/ 3rd party Environmental Consultant	Contractor cost

Project Stage/Affected Component	Potential Impact	Parameter to be Monitored	Location	Measurements	Frequency	Responsibility	Cost
Ecology (Birds, Fish and Dolphin)	Impcat on lifecycle	Species counts	Project AOI	In number	Half Yearly	Contractor's EHS Team	Contractor Cost
Operation Phase							
Ambient Air Quality							
Food and beverage							
	Particulate matter	SPM, PM 2.5, PM10, NOx	**2 locations** inside project boundary outside project boundary	24-hour covering both day and night time	Monthly	3rd party Environmental Consultant	Factory operation cost Contractor cost
	Toxic compound	**VOC, CFC,** acetaldehyde,	**2 locations** inside project boundary outside project boundary	24-hour covering both day and night time	Monthly	3rd party Environmental Consultant	
Chemica;							
	Particulate matter, Gaseous emission	PM 10, PM 2.5, CO_2, Nitrous oxide, SOx,	**2 locations** inside project boundary outside project boundary	24-hour covering both day and night time	Monthly	3rd party Environmental Consultant	Project proponent's cost
Plastic Industry							

Project Stage/Affected Component	Potential Impact	Parameter to be Monitored	Location	Measurements	Frequency	Responsibility	Cost
	VOC, Dust	**VOC, Ozone,** PM 10, PM 2.5, CO_2,	**2 locations** inside project boundary outside project boundary	8-hour covering both day and night time	Monthly	3rd party Environmental Consultant	Project proponent's cost
Footwear Industry							
	Organic solvents, dust	**VOC, PM 2,5, PM 10, Sulfide, NOX,**	**2 locations** inside project boundary outside project boundary	8-hour covering both day and night time	Monthly	3rd party Environmental Consultant	Project proponent's cost
Electrical industry							
		VOC, HCHO, Ammonia	**2 locations** inside project boundary outside project boundary	8-hour covering both day and night time	Monthly	3rd party Environmental Consultant	Project proponent's cost
Noise							
	Increase in ambient noise levels	Noise levels in Leq, Leqday and Leqnight in peak hour[33]	At 4 Locations (working area, Inside project area, residential area, nearest	24 hour	Monthly	3rd party Environmental Consultant	Project proponent's cost

[33] Peak hour includes the timeline when the workforce and construction activity is in mostly busy.

Project Stage/Affected Component	Potential Impact	Parameter to be Monitored	Location	Measurements	Frequency	Responsibility	Cost
			sensitive receptor)				
Water							
Food and Beverage Industry							
	Surface and ground water pollution	pH, BOD_5, COD, Oil and Grease, Temperature, Total Coliform Bacteria, Total Suspended Soilid,	Water Discharge Point, Nearest surface and groud water source	Standard analytical methods	Monthly	3rd party Environmental Consultant	Operation cost
Chemical							
	Surface and ground water pollution	pH, Temperature, NH3,Total Nitrogen, TSS, Urea	Water Discharge Point, Nearest surface and groud water source	Standard analytical methods	Monthly	3rd party Environmental Consultant	Operation cost
Plastic							
	Surface and ground water pollution	pH, COD, Oil and Grease, Arsenic, Chromium, Iron, Lead, Murcery, Total Nitrogen, Temperature	Water Discharge Point, Nearest surface and groud water source	Standard analytical methods	Monthly	3rd party Environmental Consultant	Operation cost

Project Stage/Affected Component	Potential Impact	Parameter to be Monitored	Location	Measurements	Frequency	Responsibility	Cost
Footwear Industry							
	Surface and ground water pollution	pH, BOD_5, COD, Oil and Grease, Chromium, Chloride, Sulfate, Phenol, Temperature, Total Coliform Bacteria, Total Suspended Soilid	Water Discharge Point, Nearest surface and groud water source	Standard analytical methods	Monthly	3rd party Environmental Consultant	Operation cost
Textile Industry							
	Surface and ground water pollution	pH, BOD, COD, TSS, Oil and grease, Chromium, Cooper, Zinc, Phenol, Total Nitrogen, Ammonia		Standard analytical methods	Monthly	3rd party Environmental Consultant	Operation cost
Electrical							
	Surface and ground water pollution	pH, COD, BOD5, Oil and grease, Ammonia, Arsenic, Lead, Mercury, Silver, Zinc		Standard analytical methods	Monthly	3rd party Environmental Consultant	Operation cost

Project Stage/Affected Component	Potential Impact	Parameter to be Monitored	Location	Measurements	Frequency	Responsibility	Cost
Soil							
Soil Quality		pH, Organic Matter, N, P, K, Ca, Mg, Na, S, Fe, Mn, Zn, Pb, Cd,		Standard analytical methods	Monthly	3rd party Environmental Consultant	Operation cost
Ecology							
Aquatic Ecology	Fisheries, Aquatic Mammals	Species Count	River and Adjacent canals	In number	Half yearly	Occupant (Industrial authority)/ Third Party Consultant	Operation and Maintenance Cost
Terrestial Ecology	Birds	nesting, Species abundance count	in and around project site	nesting, Species abundance count	Half Yearly	Occupant (Industrial authority)/ Third Party Consultant	Operation and Maintenance Cost
Community halth and safety							
	Community disturbance and potential safety hazard due to road traffic	Accidents, incidents and complaints	Access Road	Incidents, accidents and community complaints	Quarterly	SEZ Liaison Officer	Operation and Maintanence Cost

Project Stage/Affected Component	Potential Impact	Parameter to be Monitored	Location	Measurements	Frequency	Responsibility	Cost
	Discharge from CETP	incidents and complaints	**Adjoining Channel**	Incidents, and community complaints	Quarterly	SEZ Liaison Officer	Operation and Maintanence Cost
	Public concerns	Complaints from community	Neighbouring communities around the Project activity areas	As per the grievance redress mechanism	Continious	Community Liaison Officer	Operation and Maintanence Cost
CSR							
	Community Development	Activities/ Programmes and No. of beneficiaries	As per stakeholder mapping and Company policy	No. of beneficiaries and outcome of the activities	Periodic and need based	Admin/ HR of SEZ	CSR Budget

9.6 Reporting Mechanism for Environmental and Social Monitoring Program

A detailed reporting system will provide the Project with the necessary feedback mechanisms to ensure quality and timely implementation of the works. The reporting system will ensure regular flow of information from the Project site to the Project headquarters and, as necessary, to regulatory authorities and funding agencies. The reporting system will provide a mechanism to ensure that the measures proposed in the Project's ESMP are implemented. Before the civil works start, the HSE Division of SEZL or the third-party Consultant of SEZL will finalize the format for reporting on the status and progress of environmental monitoring. The format will be designed to meet all the compliance conditions associated with the environmental clearance from the Department of Environment and the Government of Bangladesh. The contractor will be required to submit the duly filled up reporting form on a monthly basis to the Project Developer (i.e., the SEZ). A further report, detailing the results of pollution monitoring for air, noise, soil, and water will be submitted monthly and quarterly basis as envisaged in the monitoring plan. A health and safety incident/accident report will be prepared and submitted in the event of an incident or accident. Independent verification of the effectiveness of the mitigation measures by the EPC contractor during the construction phase can be done by SEZL audit team with a periodic third-party audit.

During the operation phase of the Project, the Operations Manager and HSE Personnel will monitor the effectiveness of the ESMP implementation. The Project Administration and Human Resources (HR) Manager will have additional responsibility of monitoring the implementation of social components of the ESMP. He/ she will also responsible for implementation of corporate social responsibility (CSR) activities to be conducted by the Project authority. The quarterly reports of the management measures will form an integral part of the Quarterly Progress Reports that can be submitted to the lenders. Additional compliance reports to the Regional Office and Head Office of the DOE required as a part of environmental clearance process shall also be prepared and submitted based on the necessary monitoring and reporting formats.

9.7 Institutional Arrangement for ESMP & EMoP

The ESMP (mitigation plan) will be included in the construction contract and the contractor will be responsible for implementation of the measures associated with design and construction. The Project Developer's staff, specifically the HSE Officer and Site Engineer, will monitor the implementation of these mitigation measures by the contractors at the site. These two officers will be responsible for the field level monitoring of the Project. The flow diagram depicting the institutional arrangement for implementation of the ESMP is presented ***Figure 9-1***.

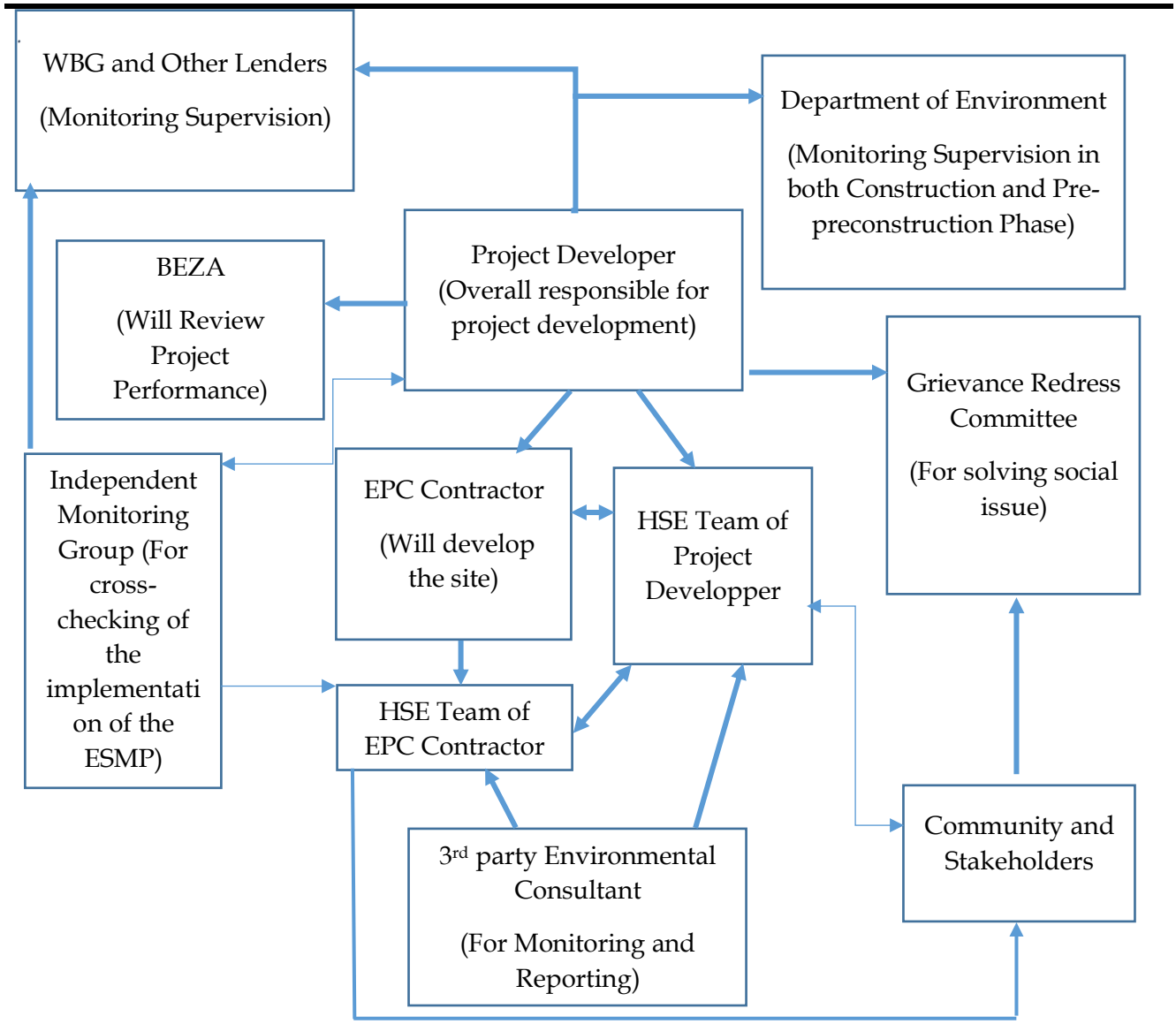


Figure 9-1: Instiutional arrangement for ESMP and EMOP

9.8 Monitoring Cost

9.8.1 Cost Estimation for Environmental Monitoring

SEZL will allocate a separate budget for environmental management plan implementation, training, environmental monitoring, analysis and reporting, verification monitoring and capacity building. It should be noted that cost for many in-built mitigation measures, such as, acoustic enclosures for noise control, water and wastewater treatment etc, need to be included in the contract cost estimation and/or operating cost estimation. The environmental management and monitoring budget estimation for construction and operation phase of the Project is provided in **Table 9-5,Table 9-6** and **Table 9-7** The EZ's tenant companies will be required to acquire their factory/facility environmental clearances from DoE, and they will have to enforce the instructions from ESMP and secure a budget to monitor instructed environmental parameters accordingly. The following table shows the overall cost for the EZ development and its monitoring only without individual tenant factories/facilities requirements.

Table 9-5: Cost of Management Plan Implementation during Pre-Construction and Construction Period

No.	Description of item	Unit	Quantity	Unit Rate	Item Total (BDT)
1.	Dust management by water sprayer	LS			1,000,000
2.	Maintenance and protection of traffic including construction of diversion road, warning signs, and posting of signboard detaining project activities	LS			300,000
3.	Campsite waste disposal facilities	Nos			1,000,000
4.	First aid box for treatment of injuries in emergency situations	Nos			300,000
5.	Water Supply	Nos			600,000
6.	Sanitary facilities	Nos			300,000
7.	Tree plantation and green area development plan	LS			5,500,000
8.	Water quality protection measures: soil erosion and sedimentation control at the construction site and prevention of spillages, leakages of polluting materials, etc. to be at the satisfaction of the engineer.	LS			200,000
9.	Stripping topsoil from borrowed agricultural lands, stockpiling and replacing the same to rehabilitate the land to the entire satisfaction of the owner and the engineer	LS			Included in construction cost

No.	Description of item	Unit	Quantity	Unit Rate	Item Total (BDT)
10.	Rehabilitation of ancillary sites including stockpile sites, brick crushing sites, borrow areas, work force camps/ site office, etc. and turfing to the entire satisfaction of the engineer.	Sq. Meter			300,000
11.	Orientation to the technical personnel/ Construction worker associated with the Economic Zone about the key issues of EMP	LS			Included in construction cost
	Total (A)				9,200,000

Table 9-6: Management Plan Cost during Operation Period (Every Year)

No.	Description of item	Unit	Quantity	Unit Rate	Item Total (BDT)
1.	Maintenance and protection of traffic Including construction of diversion road, warning signs, and posting of signboard detaining project activities	LS			100,000
2.	Campsite waste disposal facilities	Nos			150,000
3.	First aid box for treatment of injuries in emergency situations	Nos			100,000
4.	Water Supply	Nos			Included in operation and Maintenance Cost
5.	Sanitary facilities	Nos			Included in operation and Maintenance Cost
6.	Tree plantation and green area development plan	LS			300,000
7.	Orientation to the technical personnel/ Construction worker associated with the Economic Zone about the key issues of EMP	LS			Included in operation and Maintenance Cost
	Total (B)				650,000

Table 9-7: Environmental Monitoring Cost for Pre-Construction, Construction and every year Operation period.

Component	Stage	Item	Quantity	Unit Rate	Item Total (BDT)
Involuntary Resettlement	Pre-Construction &During Construction	LS			Included in Resettlement Cost
Accident	During Construction	Ensuring that HSMP works right on the road track			Included in Construction Cost
	During Operation	Installing traffic signs, road mark, bump, zebra mark, guard rail and pole, and curb stones etc			Included in Construction Cost
HIV/ AIDs	During construction	Ensuring that contractor's personnel and local community understand HIV-AIDS awareness campaign			Included in ESMP Cost
	During operation	HIV-AIDS awareness campaign			Included in ESMP Cost
Air pollution	During Pre-construction During Construction	As per the parameter of air quality in ***Table 9-4*:**	48	20,000	960,000
	During operation	As per the parameter of air quality in ***Table 9-4*:**	16	20,000	320,000
Water pollution (Surface & Ground Water)	During Pre-construction During Construction	As per the parameter of both surface water and ground water in ***Table 9-4*:**	144	16,000	2,304,000
	During operation	As per the parameter of surface water, ground water and	60	16,000	960,000

Component	Stage	Item	Quantity	Unit Rate	Item Total (BDT)
		wastewater in ***Table 9-4*:**			
Waste	During Construction	As per the plan presented in ***Table 9-4*:**			Included in management plan cost
	During operation	As per the plan presented in ***Table 9-4*:**			Included in management Plan cost
Noise	During Construction	As per the plan presented in ***Table 9-4*:**	216	5,000	1,080,000
	During operation	As per the plan presented in ***Table 9-4*:**	72	5,000	360,000
Soil and Sediment	During Construction	As per the plan presented in ***Table 9-4*:**	60	20,000	1,200,000
	During operation	As per the plan presented in ***Table 9-4*:**	20	20,000	400,000
Offensive odor	During operation	As per the plan presented in ***Table 9-4*:**			Included in construction cost
Occupational Health & Safety and Community Health& Safety	During Construction	As per the plan presented in ***Table 9-4*:**			Included in management Plan cost
	During operation	As per the plan presented in ***Table 9-4*:**			Included in management Plan cost
Ecology	During Construction	As per the plan presented in ***Table 9-4*:**	6	100,000	600,000
	During operation	As per the plan presented in ***Table 9-4*:**	2	100,000	200,000
Total (C)					8,384,000
Environmental Training cost (D)					2,000,000
Grand Total (A+B+C+D)					**20,534,000**

9.8.2 Cost Estimation for Environmental Laboratory

Besides monitoring as per the management plan by the third party, there should be a separate environmental laboratory in the vicinity of the SEZ area for the operation period for monitoring continuous basis. The laboratory could be set up in a room of an admin building. The required equipment with their possible pricing have been listed in the **Table 9-8**

Table 9-8: Cost for Setting up an Environmental Laboratory

Sl. No.	Name of Equipment	Nos	Unit Price (BDT)	Total Price (BDT)
1	Continuous Air Quality Monitoring System	01		4,000,000
2	pH meter	02	22000	44,000
3	EC meter			
4	TDS meter			
6	Salinity Meter			
7	Temperature			
8	Turbidity Meter	02	20000	40000
9	TSS Meter	02	L/S	10000
10	DO meter	02	24000	48000
11	BOD Testing Apparatus	01	100,000	100,000
12	COD Testing Apparatus	01	50,000	50,000
13	Chemical Balance	01	40,000	40,000
14	Lab Settings		L/S	400,000
15	Spectrophotometer	01	L/S	1,600,000
16	Noise Meter (Type-II)	04	25000	100,000
	Total			**6,432,000**

CHAPTER 10

10 INSTITUTIONAL SETTING AND IMPLEMENTATION ARRANGEMENTS

The ESMP (mitigation plan) will be included in the construction contract and the contractor will be responsible for implementation of the measures associated with design and construction. The Project Developer's staff, specifically the HSE Officer and Site Engineer, will monitor the implementation of these mitigation measures by the contractors at the site. These two officers will be responsible for the field level monitoring of the Project. The roles and responsibilities of the Project Developer (SEZL) and EPC Contractor for implementation and monitoring have been outlined in **Table 10-1**. The flow diagram depicting the institutional arrangement for implementation of the ESMP is presented in Figure 9.1.

Table 10-1: Responsibilities of SEZL and EPC Contractor

Project Developer (SEZ owned 100% by SEZL)	EPC Contractor
Obtaining statutory clearances required during pre-construction stage of the Project	Obtaining permits required during the construction stage
Overall project co-ordination and management through EPC and supported by the third party environmental consultant/s	Joint verification with Project Developer and Third-Party Environmental Consultant for review of ESMP implementation
Interaction and reporting to the respective department of GOB	Interaction with Project Developer and appointed supervision consultant, if any
Interaction and reporting to lenders	Filling of reporting formats as per the reporting schedule and submission to Project Developer
Effective implementation of ESMP and monitoring of ESMP implementation	Environmental monitoring through Third Party Environmental Laboratory
Carryout verification/ supervision exercises during the construction phase of the Project for implementation of ESMP	Preparation of various plans for effective implementation of ESMP as detailed out in the "Specification Manual" by the Project Developer
Keeping records of all permits obtained by EPC Contractor	Identification of staff camp, site for batch mix plant, laydown areas
Overall supervision of ESMP implementation	Management of staff camp and to provide drinking water, sanitation facility
Approval of plans prepared by EPC facility Contractor	
Addressing grievances of local community and information dissemination	
Environmental monitoring through	

laboratory

While the contractor or a party is responsible for physical implementation of the mitigating measures, the whole implementation process requires supervision, checking, documentation and verification so that problems are identified and properly addressed before they get out of hand. In order to ensure proper execution of the EMP, implementation reviews will be conducted by the project engineer such as the weekly construction meetings, construction log book, monthly and other construction reports etc. Records of these minutes of the weekly meeting, monthly reports and special reports on implementation of the mitigating measures will also be maintained and available for review by the Project management. It is suggested to identify documents and records that require templates and accordingly suitable templates shall be developed, which shall include but not limited to policies, procedures and work instructions, meeting minutes, monitoring results, training attendance records, emergency contract lists, action plans etc. Further, all these templates shall be communicated to all potential users. All these records will be archived at the Project office and will be maintained by the HSE officer. All documents and records shall be archived with a unique identifier so that they can be distinguished from any other material and can be easily retrieved. SEZL will document the process for creating, allocating and approving unique identifiers and will communicate this to relevant staff.

10.1 Training

10.1.1 Construction Phase

Prior to commencement of major civil works at site, a suitably qualified in house/ external expert will be appointed by the EPC contractor in consultation with SEZ to develop and deliver a training program on implementation of the EMAP, environmental monitoring and reporting in line with the applicable reference framework for the Project. The training will include the following topics:

- Environment, Health and Safety Policy of the EPC contractor;
- Environment and fundamentals of environmental pollution in relation to the Project;
- HSE management plans prepared by the EPC Contractor;
- Do's and Don'ts for the construction workers;
- Safety procedures and guidelines;
- Internal reporting and response system;
- Hazardous chemicals and waste handling;

In addition, specific training will be provided to the team involved in environmental monitoring and reporting, which will include:

- Applicable environmental guidelines and standards;
- Sampling site selection guidelines in line with environmental monitoring plan;
- Sample collection, storage, transportation and analysis procedures;
- Solid and hazardous waste management;
- Quality assurance and quality control;
- Environmental monitoring report preparation

The training will help in capacity building and implementation of the EMAP during the construction phase of the Project. It will also help in ensuring internal and external monitoring and verification of the environmental performance of the Project. The reporting and verification during the construction phase will be quarterly and the reports will be submitted to the DOE and the Lenders.

10.1.2 Operation Phase

Prior to the commencement of the EZ, a suitably qualified inhouse/ external environmental expert will be engaged by the SEZ to develop and deliver a training program on operation phase environmental monitoring and reporting. The topics will be mostly same as that during the construction phase. However, it will also include following modules, which are specific to the operation phase:

- Continuous emission monitoring;
- Wastewater and thermal discharge monitoring;
- Aquatic ecology monitoring;
- Hazardous chemicals and waste management;
- Occupational health and safety programs;

The training will help in capacity building and implementation of the EMP during the operation phase of the Project. It will also help in ensuring internal and external monitoring and verification of the environmental performance of the Project. The reporting and verification during the operation phase will be annual and the reports will be submitted to the DOE and the Lenders.

10.2 Plans for Construction and Operation Phase of the Project

10.2.1 Construction Phase

Prior to the beginning of major land works, the EPC contractor in cooperation with Project Developer will develop the following plans:

Health and Safety Plan

The EPC Contractor will prepare and implement a Health and Safety Plan prior to commencing work. This plan will include method statements for work activities, construction sequence and safety arrangements. Measures will be implemented to reduce the likelihood and consequence of the following hazards:

- falling from height;
- falling into water;
- tripping over permanent obstacles or temporary obstructions;
- slipping on greasy or oily walkways;
- falling objects;
- explosion;
- contact with dangerous substances;
- electric shock;
- variable weather conditions;
- lifting excessive weights; and
- traffic operations.

Environmental Management Action Plan

The EPC Contractor will prepare and implement an Environmental Management Action Plan prior to commencing work to manage the construction related environmental aspects as waste management, sanitation aspects, water conservation etc.

Traffic Management Plan

The EPC Contractor will prepare and implement Traffic Management Plan prior to commencing work to manage the construction traffic. This will be required towards prevention of local traffic disruptions, avoid peak hours rush and prevent accidents. Movement of all heavy equipment and vehicles from main road (N-405) to project site needs to be coordinated with the logistics team of project developer. Considering the laydown area on the other side of highway and heavy traffic movement on the national highway (Dhaka – Bogra Highway), specific traffic management planning will be carried out by the EPC contractor and this will include traffic stewards near the highway for smooth traffic movement.

Emergency Response Plan

Emergencies can be categorized into three broad levels on the basis of seriousness and response requirements, namely:

a) Level 1: This is an emergency or an accident, which:

- can be effectively and safely managed, and contained within the site, location or installation by the available resources; and
- has no impact outside the site, location or installation.

b) Level 2: This is an emergency or an accident, which:

- cannot be effectively and safely managed or contained at the location or installation by available resource and additional support is alerted or required;
- is having or has the potential to have an effect beyond the site, location or installation and where external support of mutual aid partner may be involved; and
- is likely to be danger to life, the environment or to industrial assets or reputation.

c) Level 3: This is an emergency or an incident with off-site impact which could be catastrophic and is likely to affect the population, property and environment inside and outside the installation, and management and control is done by district administration. Although the Level-III emergency falls under the purview of District Authority but till they step in, it should be responsibility of the unit to manage the emergency.

Level 1 and Level 2 shall normally be grouped as on-site emergency and Level 3 as off-site emergency. In order to address any level of emergency situation, the EPC contractor must develop emergency response plan (ERP) during the construction stage of the project.

The ERP should ensure:

- Emergency Response Team (ERT) of the EPC contractor as initial responder in case of any on-site and/or off-site emergency caused due to the project related activities;
- Provide mutual aid in case of any emergency arising due to other construction/ operations within the SEZ Complex as well as any off-site facility;

- The local fire, police and district administration, emergency medical services, the public health authorities, collectively referred to as the External Emergency Response Team (EERT).

The EPC contractor will provide and sustain the required technical, human and financial resources for quick response during the construction phase of the project. Roles and responsibilities in case of any emergency incident response are presented in Table 10-2

Table 10-2: **Roles and Responsibilities in Emergency Incident Response**

Sl.	Entity	Responsibility
1.	Emergency Response Team (ERT)	• Immediate response to the emergency • Prepare the emergency site to facilitate the response action, e.g. Vacating, clearing, restricting, etc. • Communicate/ alert the EERT • When necessary and requested by the EERT, lends support/ aids during the EERT's response operations. • Provide mutual aid in case of any emergency arises in the surrounding area/s or construction site.
2.	EPC Contractor Resources	• Provide and sustain the people, equipment, tools and funds necessary to ensure Subproject's quick response to emergency situations. • Maintain good communication lines with the EERT to ensure prompt help response and adequate protection, by keeping them informed of Subproject progress.
3.	External Emergency Response Team (EERT)	• Provide support to the ERT based on communication received from ERT for Level 1 and Level 2 type emergencies. • Immediate action in case of Level 3 type emergency/accident. • Co-ordination with different agencies.

The ERT will be led by the senior EPC Contractor Engineer (designated ERT Lead) on-site with a suitably trained site supervisor or junior engineer as deputy. Trained first-aiders and security personnel will be the core members of the ERT. The EPC contractor will ensure that ERT members are physically, technically and psychologically fit for their emergency response roles and responsibilities. Prior to the mobilization of civil works, the EPC contractor, through its Construction Manager, ERT-Lead, will meet with the ultimate response institutions to discuss the overall construction process, including, but not limited to:

- Project site, laydown areas, construction staff camp areas, temporary areas to be used for transportation of heavy lifts, etc., located within the project site and outside;
- construction time frame and phasing;
- any special construction techniques and equipment that will be used;
- any hazardous materials that will be brought to and stored in the construction premise and details on their applications and handling/management system;
- the Contractor's Emergency Management Plan; and
- names and contact details of the ERT members

The objective of this meeting is to provide ultimate response institutions the context for:

- their comments on the adequacy of the respective Emergency Management Plans;
- their own assessment of what types, likely magnitude and likely incidence rate of potential hazards are anticipated; and
- the arrangements for coordination and collaboration with district administration and external agencies working on emergency response and disaster management.

To ensure effective emergency response, prior to mobilization of civil works, the EPC Contractor will:

- set up the ERT;
- set up all support equipment and facilities in working condition;
- decided with the EERT;
- conducted proper training of ERT members, and encouraged and trained volunteers from the work force;
- conducted orientation to all construction workers on the emergency response procedures and facilities, particularly evacuation procedures, evacuation routes, evacuation assembly points, and self-first response, among others; and
- conducted drills for different possible situations.

To sustain effective emergency response throughout the Project implementation an adequate budget shall be provided to sustain the capabilities and efficiency of the emergency response mechanism, the emergency response equipment, tools, facilities and supplies. Drills and reminders will take place regularly, the former at least every two months and the latter at least every month.

Alert Procedures:

Means of communicating, reporting and alerting an emergency may be any combination of the following:

- audible alarm (siren, bell or gong);
- visual alarm (blinking/rotating red light or orange safety flag);
- telephone (landline);
- mobile phone;
- two-way radio; and
- public address system/loud speakers.

Some rules relative to communicating/alerting will be:

i. Whoever detects an emergency first shall immediately:
   - call the attention of other people in the emergency site,
   - sound the nearest alarm, and/or
   - report/communicate the emergency to the ERT

ii. Only the ERT-Lead and, if ERT-Lead is not available, the Deputy ERT Lead are authorized to communicate with the EERT. Exceptional cases to this rule may be necessary and should be defined in the Emergency Management Plans.

iii. When communicating/alerting an emergency to the EERT, it is important to provide them with at least:
   - the type of emergency;
   - correct location of the emergency;
   - estimated magnitude of the situation;
   - time it happened;
   - in case of a spill, which hazardous substance spilled; and
   - in case of fire and explosion, what caused it.

Such details would allow the EERT to prepare for the appropriate response actions. For an effective reporting/alerting of an emergency:

i. The names and contact details of the relevant persons and institutions should be readily available in, or near to, all forms of communication equipment, and strategically posted (at legible size) in all Subproject sites and vehicles:
    - Most relevant construction/operations staffs namely, the ERTL, Deputy ERTL, first-aiders, supervising engineers, foremen
    - EERT institutions/organisations
    - Concerned Union authority/ies.

ii. Project site and activity areas outside (such as laydown area, construction workers camp, temporary jetty, water intake structure area, etc.) should have good access to any combination of audible and visual alarms, landline phones, mobile phones and two-way radio communication always.

iii. Contractor's construction vehicles should also be equipped with the appropriate communication facilities.

Emergency Response Situations

The following tables suggest general procedures that will be refined in the final EMP during detailed design, and described in more detail in the Emergency Management Plans of the EPC Contractor.

Table 10-3: Evacuation Procedures

Sl.	Procedure	Remarks
1.	Move out as quickly as possible as a group, but avoid panic.	• All workers/staff, sub-contractors, site visitors to move out, guided by the ERT.
2.	Evacuation through the directed evacuation route	• The evacuation shall have been determined fast by the ERT-Lead/Deputy ERT-Lead and immediately communicated to ERT members.
3.	Keep moving until everyone is safely away from the emergency site and its influence area.	• A restricted area must be established outside the emergency site, all to stay beyond the restricted area.
4.	Once outside, conduct head counts.	• Foremen to do head counts of their subgroups; ERT-Lead/Deputy ERT-Lead of the ERT
5.	Report missing persons to EERT immediately.	• ERT-Lead/Deputy ERT-Lead to communicate with the EERT.
6.	Assist the injured in evacuation and hand them over to the ERT first-aiders or EERT medical group	• ERT to manage injured persons to ensure proper handling.
7.	If injury warrants special care, DO NOT MOVE them, unless necessary and instructed/directed by the EERT.	• ERT-Lead/Deputy ERT-Lead communicates with EERT to get instructions/directions in handling the injured.

Table 10-4: Response Procedure during Medical Emergency

Sl.	Procedure	Remarks
1.	Administer First Aid regardless of severity immediately.	Fundamentals when giving First Aid: • Safety first of both the rescuer and the victim. • Do not move an injured person unless: • victim is exposed to more danger when left where they are, e.g., during fire, chemical spill • it would be impossible for EERT to aid victims in their locations, e.g., under a collapsed structure • instructed or directed by the EERT. First AID to be conducted only by a person who has been properly trained in giving First Aid.
2.	Call the EERT emergency medical services and/or nearest hospital.	ERT-Lead/Deputy ERT-Lead or authorized on-site emergency communicator
3.	Facilitate leading the EERT to the emergency site.	ERTL/Deputy ERTL to instruct: • An ERT member on- site to meet EERT in access road/strategic location. He/she shall hold orange safety flag to get their attention and lead them to site. • Other ERT members to clear access road for smooth passage of the EERT.
4.	If applicable, vacate site and influence area at once, restrict site, suspend work until further notice.	• Foremen to do head counts of their subgroups; ERT-Lead/Deputy ERT-Lead of the ERT

Table 10-5: Response Procedure during Fire Emergency

SL No.	Procedure	Remarks
1.	Alert a fire situation	Whoever detects the fire shall immediately: • call the attention of other people in the site, • sound the nearest alarm, and/or • Foreman or any ERT member among the construction sub-group contacts the fire department (in this case it should be agreed on that it is alright for any ERT member in the sub-group to alert the fire department) • Report/ communicate the emergency to the ERTL/Deputy ERTL.
2.	Stop all activities/operations and evacuate.	All (non-ERT) workers/staff sub-contractors, site visitors and concerned public to move out to safe grounds following the evacuation procedure.
3.	Activate ERT to contain fire/control fire from spreading.	Guided by the training they undertook, ERT members assigned to mitigate the fire shall assess their own safety situation first before attempting to control fire spread.

SL No.	Procedure	Remarks
4.	Call the nearest fire and police stations and, if applicable, emergency medical services.	When alerting the EERT, ERTL will give the location, cause of fire, estimated fire alarm rating, any injuries.
5.	Facilitate leading the EERT to the emergency site.	ERT-Lead/Deputy ERT-Lead to instruct: • an ERT member to meet the EERT in the access road or strategic location and lead them to the site. He/she shall hold the orange safety flag to get their attention and lead them to the site. • some ERT members to stop traffic in, and clear, the access road to facilitate passage of the EERT.
6.	ERT to vacate the site as soon as their safety is assessed as in danger.	• Follow appropriate evacuation procedure.

Some of the guidance framework management plans for (a) pollution prevention, (b) waste management, (c) traffic management, (d) emergency response, and (e) stakeholder engagement, applicable for the site preparation and construction activities have been presented in Annex J. These management plans are prepared to provide guidance to the EPC Contractor and the SEZ/ SEZ on expected content and requirement from the detailed management plans and associated procedures/ checklists.

10.2.2 Operation Phase

During the operation/industrial phase of the Project, the Project Developer will develop the following plan/ management systems for effective operation of the EZ:

HSE and Social Management System

The Project Developer will develop and implement an HSE and Social Management System (HSE & SMS) to international guidelines for the entire SEZ premises and its impact zones (project area of influence as defined under WBG PS) within 1 year of operation phase.

10.2.2.1 Waste Management Plan

For effective segregation, handling, storage and disposal of solid and hazardous wastes generated from the EZ operations, a waste management plan will be developed by the SEZ for the SEZ premises. Also, the industries which will be located here also need to develop a waste management plan for the specific industry.

10.2.2.2 Spill Response and Emergency Plan

The Project Developer and all the industries will prepare a spill response and emergency plan to address accidental spillages or release of hazardous wastes.

10.2.2.3 Emergency Response and Disaster Management Plan

Based on the outcome of the consequence analysis as well as detailed quantitative risk assessment of the Project after finalization of project design, an emergency response will be developed and disaster management plan will be updated by the SEZ. This will define

protocols to be followed in the event of emergencies or disasters in order to limit the impact on the employees and the local community. The plan will address both on-site and off-site emergency situations due to the operation of the project. The project authority will involve the specific industries also for such management. The plan will disclose potential disasters and potential risks from the specific industries to the local community as well as the plan of action on emergency protocol in the event of any such eventuality. This will also include awareness programs for each specific industries personnel, local community and local administration.

10.2.3 Budget

The EPC Contractor and the Project Developer will allocate separate budget for environmental and social management plan implementation, training, environmental monitoring, analysis and reporting, verification monitoring and capacity building. It should be noted that costs for many in-built mitigation measures, such as, acoustic enclosures for noise control, water and wastewater treatment, etc., are already included in the EPC contract cost estimate and/or operating cost estimates. The ESMP budget estimates for construction and operation phase of the Project will be updated in the Final ESIA report. In addition, separate budget will be allocated for CSR activities, which will be conducted by the Project Developer for community development.

10.3 Updating of ESIA

This ESIA will be updated in case of any design is changed of the Project. Further, the ESMP of the Project will be reviewed as per outcome which might result the upgradation of ESMP. Furthermore, in the event of an unanticipated impact and design change with respect to the project Standards (including Bangladesh Government and WBG requirements), then the ESIA would be updated as necessary.

CHAPTER 11

11 CONCLUSION AND RECOMMENDATION

11.1 Introduction

BEZA aims to establish economic zones in all potential areas in Bangladesh including backward and underdeveloped regions with a view to encouraging rapid economic development through increase and diversification of industry, employment, production and export. The government of Bangladesh has requested the private company to come up for the investment in the economic zone. Sirajganj Economic Zone Limited has formed in vision of such investment for countries development.

So, for starting of the development work of the economic zone for further investment, a detailed Environmental Impact Assessment has been already studied which has been approved already by the DoE. Now SEZL is looking for funding from national and international lenders. All the operations related to projects should be carried out in an environmentally responsible manner that comply with all local environment legal obligations and appropriate World Bank guidelines. In this regard, the developments in the SEZL project should conform to the World Bank's Performance Standards for Private Sector Activities (OP 4.03). As part of the World Bank funding guidelines, an Environmental and Social Impact Assessment (ESIA) should be carried out to address the environmental and social issues of the project following operational procedures, policies, guidelines and standards set by the World Bank. So, as per the ToR provided by IDCOL and following the World Bank Group guidelines, this ESIA has been studied.

As a part of the ESIA preparation of the proposed project, the baseline environment (including physical, biological and socio-economic environment) within and surrounding the project areas has been carefully surveyed and documented. The project activities during both construction and operational phases have been analyzed in order to assess their impacts on the baseline environment. The environmental impacts resulting from the proposed project activities have been assessed and evaluated for: (a) pre-construction phase, (b) construction phase, and (b) operational phase. This study finds that, most of the impacts are controlled and limited in and around the project area. The key negative impacts such as emission of gas and dust, deterioration of water quality, generation of noise, soil pollution, 415 acres land acquisition and some scale of involuntary resettlement are expected. Impact on livelihood of the project-affected persons (PAPs) are expected during the pre-construction phase. Clearance of existing vegetation during pre construction phase is likely not have any significant impact as there is no sensitive ecological protection area. However, implementation of appropriate mitigation and management plan has been developed for guiding management of project activities during pre-construction, construction and operational phases. The above steps have been conducted following the World Bank Guidelines OP4.03 where eight Performance Standards were compared with the project activities as a part of the Gap Analysis. Documentations of the gap analysis have been presented in the Annex H as an Environmental and Social Action Plan and an Environmental and Social Management Plan has been provide

which has to be strictly followed by the project proponent to attain the requirements. This section summarizes the major conclusions from the assessment of impacts and recommendations for the ESIA study.

11.2 Conclusions

The proposed private Economic Zone is envisaged to build up in a green field area by the project proponents. The site is located at Saidabad union under Sirajganj Sadar upazila and Rajapur union under Belkuchi upazila of Sirajganj district. The area is just located beside the national highway of N4. The total land of Sirajganj Economic Zone (SEZ) is approximately 415 acres for 1st phase. Upon completion, SEZ is envisaged to create approximately 50,000 jobs when fully occupied by investors. The area is divided into four blocks for setting up the industries comprises of 289 acres out of 415 acres of land. These 289 acres of land will be used to attract both national and foreign investment and then the plot will be allocated to the proponents based on the revised master plan before the construction period. Following sections provide a summary of the findings of the ESIA study and recommendations.

General Issues and Categorization

As a part of the build-up process, the pre-construction phase involved dredge-filling of 415 acres of lowlands of SEZL. This filling operation will create negligible impact on the physical environment (like air, water, noise, soil and sediment etc.) and the area will be settled down to a new ambient condition. The nature of proposed industries and their environmental impact can't be specified with certainty at the present time. Though there are some proposed industries which impact has considered medium low to low with some specific mitigation measures. However, based on statistical considerations, the impacts are likely to be similar; as no industries on the negative list in the ESPP document will be allowed in the zone. Detailed analysis of impacts/risk in this document shows that impact significance are identified from medium low to low, on all environmental and social issues. Thus, the SEZ sub-project of IPFF II has been classified as a medium risk (i.e., Category-B) sub-project. Based on the categorization of the World Bank Group, the project also triggered all the performance standards except biodiversity, indigenous people, and cultural heritage related performance standards. But as per overall consideration and based on the applicable mitigation measures, the project will be considered as Category B Projects as per World Bank group guidelines.

Construction of Project

The construction phase of the project involved three steps which are pre-construction, construction, and operation stage. During the pre-construction stage, normally the land will be developed by dredging sand from the Jamuna River and by clearing up the existing structures and flora. In the construction stage both on-site and off-site facilities will be developed. The basic infrastructure includes internal roads, storm water drainage system, water supply from deep wells or surface water through water supply pipeline, wastewater related treatment plant. Also, gate/security guards booth, administration building, access roads, commercial development also will be took place during construction stage. Besides some off-site facilities like external road connection, gas pipeline, transmission line etc. also will be taken place during the construction phase. Thus, the impacts during the construction

phase would be caused by the activities both by the proponent and its tenants. The project activities during construction phase impacting the physico-chemical environmental parameter such as, drainage congestion, water pollution, noise pollution and air pollution, have been identified. In operation period, different kind of industries will run their operation in the SEZ premises. So, activities during operation period also create some impact on the physico-chemical environmental parameters and also on some biological and social part. Proposed additional measures are expected to be sufficient to deal with the impacts.

Environmental and Social Baseline

Environmental and social baseline part includes all the informations regarding the receptors and also the resources around the project site area. Total baseline condition has been devided into three parts which are physical environment, biological environment and social environment.

Physical Environment

The major categories noticeable on the satellite data include several rural residential areas and very marginal mixed built-up areas. Agricultural activity is totally dependent on the agro-climatic condition of this area. The project area is covered by the main Jamuna River and a branch of this Jamuna River goes through the project site. Thus the area is geographically low land and flooded during the monsoon and post-monsoon period. There is no forest area except the homestead vegetation area. Also, there are some sand bars in and around the project site. Environmental items like soil, sediment, air, water and noise were also studied around the project site. The study was taken during the monsoon period. As a result full scenario was not depicted for the baseline data. It would be better if we could study during the dry period. But to cover such shortfalls, secondary data have been used to describe the condition of air, water, noise, soil and sediment of the surrounding area. As the area is Greenfield area with the sandbars, so particulate matter is little bit higher in the dry period. Soil is little bit alkaline which is very good for the agricultural productivity. Noise level was found with in the standard level. From the meteorological part, it has been seen that the April is the hottest month and the January is the driest month. Highest humidity has found in August. Maximum average rainfall has found in July which is about 150mm. The area is moderately vulnerable to the seismicity. Climate change also create a great impact in this area. Already there is a food security issue due to the extreme flood condition. Also, due to flood lots of people lose their property and life in every year. Also the precipitation is reduced in this area and as a result, there is a scarcity of water in dry period in the branch river.

Biological Environment

The key habitats that support "Natural Habitat" determination by analyzing WBG, are char land used by different birds for forage, roost and staging. The riverine and adjoin waterbodies supports good number of species for longitudinal migration and spawning as connected with international water bodies. This whole waterbodies area partially overlaps IBA's according to Bird life international. No Ecologically sensitive (ECA, PA etc.) area is fallen within the project AOI.

Social

Baseline survey result has found about a total number of 521 populations are living within the 106 households out of 439 households, whereas about 52% are male and rest 48% are female. Average family size is 4.9. On the other hand, 1-70+ age range has been formulated to capture the age distribution of the studied population. Importantly around 64.1% population belongs to 14-69 age range which signifies that most of the populations are eligible for being active in economic activities. Contrary, only 35.9% population is found depended. Additionally, 50.5% population is married. All over health status among the households has been found quite well. Around 96.9% populations are found physically normal and only 0.6% is found handicapped by birth and 2.5% is in acute health problem. Study area is found Muslim dominated where surveyed households were found all are Muslims.

Identification of Impacts

Impacts have been analyzed based on the different stages of the project namely pre-construction, construction and operation stage. From physical environmental part, the items are mostly common in all the stages. These are ambient air, ambient noise, water, soil and sediment, all kind of wastes and others. In pre-construction stage, the impact on physical environment is comparatively low than the construction and operation stage as the activities are mostly limited with site development. During construction stage, except wastewater, rest of the items are considered as low impact. Wastewater is considered as the medium low in terms of impact significance. For operation period, most of the items are considered as medium low in terms of impact significance. Specific mitigation measures have been proposed in the mitigation plan to avoid such impacts.

For biological part, we can conclude that, the area supports diversified biodiversity but the dominance of threatened species is minor. So, to maintain the natural habitat and sustainable biodiversity, there is no alternative to follow the proper management and monitoring plan for every stage of the project.

In terms of social part, the most impact will occur in the pre-construction stage as the land development and clearing of existing structures and biological component will be held in this stage. The affected people will be shifted to their new resettlement area, as a result these people will lose their existing livelihood, and there will be a restriction to access the existing site. In construction phase, both positive and negative impact will be there. Due to construction activity many local people will get employment opportunity. Due to both direct and indirect impact, new entrepreneurship will be grown up based on the construction activity. But as like as the pre-construction phase, in this stage also there will be restriction on local access to the project site surroundings. In operation stage, the impact will be negligible as there will be minimal social issues rather than the pre-construction and construction stage.

Cumulative Impacts

This ESIA study finds that most of the adverse impacts resulting from the project during construction and operation phase would be medium low to medium high. However, these impacts could further be minimized if appropriate mitigation measures are taken. However, the cumulative impact of including the tenant industries may be significant in the future. The main impact is considered on the water resources, air quality, noise level and the labour influx.

Environmental and Social Management Plan

An Environmental and Social Management Plan (ESMP), including monitoring requirements, has been developed to ensure implementation of the "mitigation measures" identified in the environmental assessment. Proper mitigation measures, as suggested in the ESMP, should be followed to reduce such adverse impacts to the extent possible. Accordingly, the ESMP has provided suggestions on tree plantation, wetland and surface water body preservation and green area delineation which should be ensured by the proponent. On the other hand, some positive impacts of the Project such as increase in job opportunity (approximately 50000) and improvement of social infrastructure are also expected. The project would bring about socioeconomic benefits during its operational phase through improvement of resilient building construction, risk reduction, disaster preparedness and trained personnel in the entire country. In consideration of the result of the ESIA study for the Project, the Environmental and Social Management Plans (ESMPs) including adequate mitigation measures to reduce the negative impacts and Environmental Monitoring Plan (EMoP) are proposed for this Project: pre-construction phase, construction phase, and operation phase. It was also confirmed that the environmental, social and health impacts of the Project were assessed and the Environmental and Social Management Plan was formulated properly.

Public Participation and Community Concern

In the process of ESIA, opportunity of public involvement was ensured and comments from the public were reflected into the final ESIA Report. Affected persons, local community and relevant stakeholders including both govt. and private sector representatives irrespective of gender were participated in this Public Consultation Meeting. During the operational phase, the project is likely to bring about significant benefit for the nation. Social issues are likely to play important role during the construction as well as operational phases. The project activities are likely to generate opportunity for significant employment. Relationship between the community and the project personnel regarding safety and security through a participatory program. The local people residing near the boundary of the economic zone has expressed concern regarding the resettlement issue and also other environmental issues due to the construction and operation stage of the project. Mitigation of such issue should be addressed at the earliest to assuage the concerns of the local people. As mentioned earlier, during the operational phase of SEZL requires withdrawal of a significant volume of groundwater with the existing Sirajganj Power Plant which in consequence may create shortage of drinking water in the adjacent area during winter season. So, continuous monitoring of water table has been suggested to realize the impacts on groundwater resources due to the project. It has also been recommended to adopt measures for increasing groundwater recharge to compensate the impact. Also RAP need to be implemented as accordingly to resolve the concern of the local people. As per updated information from the SEZL authority, all the PAPs have been compensated by the DC office. Also, resettlement area is also under construction for resettling them at the proposed site.

Grievance Redress Mechanism

A Grievance Redress Mechanism has been proposed with due procedures; through which aggrieved parties may launch complaint during both the pre-construction, construction, and

operational phase, which will be addressed by a committee upon formal hearing and investigation.

Compliance with PSs and Management Plan

The Project will make its best effort to minimize the environmental and social impacts unavoidably associated with the Project; during its entire life cycle by implementing suggested mitigation measures and management plans as described in this ESIA to ensure compliance with the requirement of the World Bank PS and EHS guidelines. Provision for indicative budget resources have been recommended for the purpose. SEZ will ensure that the Project conforms to all the legal, regulatory and policy objectives and also ensure that all the necessary permits are obtained and renewed from time to time as necessary.

Disclosure

The ESIA document will have been disclosed on the SEZL website and also been posted on the website of the Bangladesh Bank. Finally, it is expected that all necessary information/ evidence contained in this report are enough to meet all requirements for the operation of the SEZL's facilities in accordance with WB OP4.03 and applicable WBG guidelines and standards.

11.3 Recommendations

Thus, the ESIA was completed in accordance with the requirements of the ESIA Procedure properly in case that project proponent will follow EMP accordingly. Recommendations made for the project development based on ESIA study are given below:

- Branch of Jamuna River should be retained in its natural position;
- Proposed Environment & social management plan should be implemented strictly both during pre-construction, construction and operation phase of the project;
- Suggestions & requests made by public for employment shall be taken into consideration;
- Proper training of maintaining environment, health and safety should be given to Project management unit in both constructions an operation phase;
- Provision of CETP, Drainage system, Retention pond and green belt need to be implemented;
- Rainwater harvesting should be carried out to reduce the pressure on surface and ground water resources as per the EIA and feasibility report;
- Construction activities for proposed off-site developed should only be started by following the condition of the environment clearance certificate from DoE, Bangladesh;
- Environmental monitoring should be conducted as proposed in environment and social management plan;
- Separate Environment impact assessment study need to be carried out for individual industries where applicable as per the ECR, 1997.