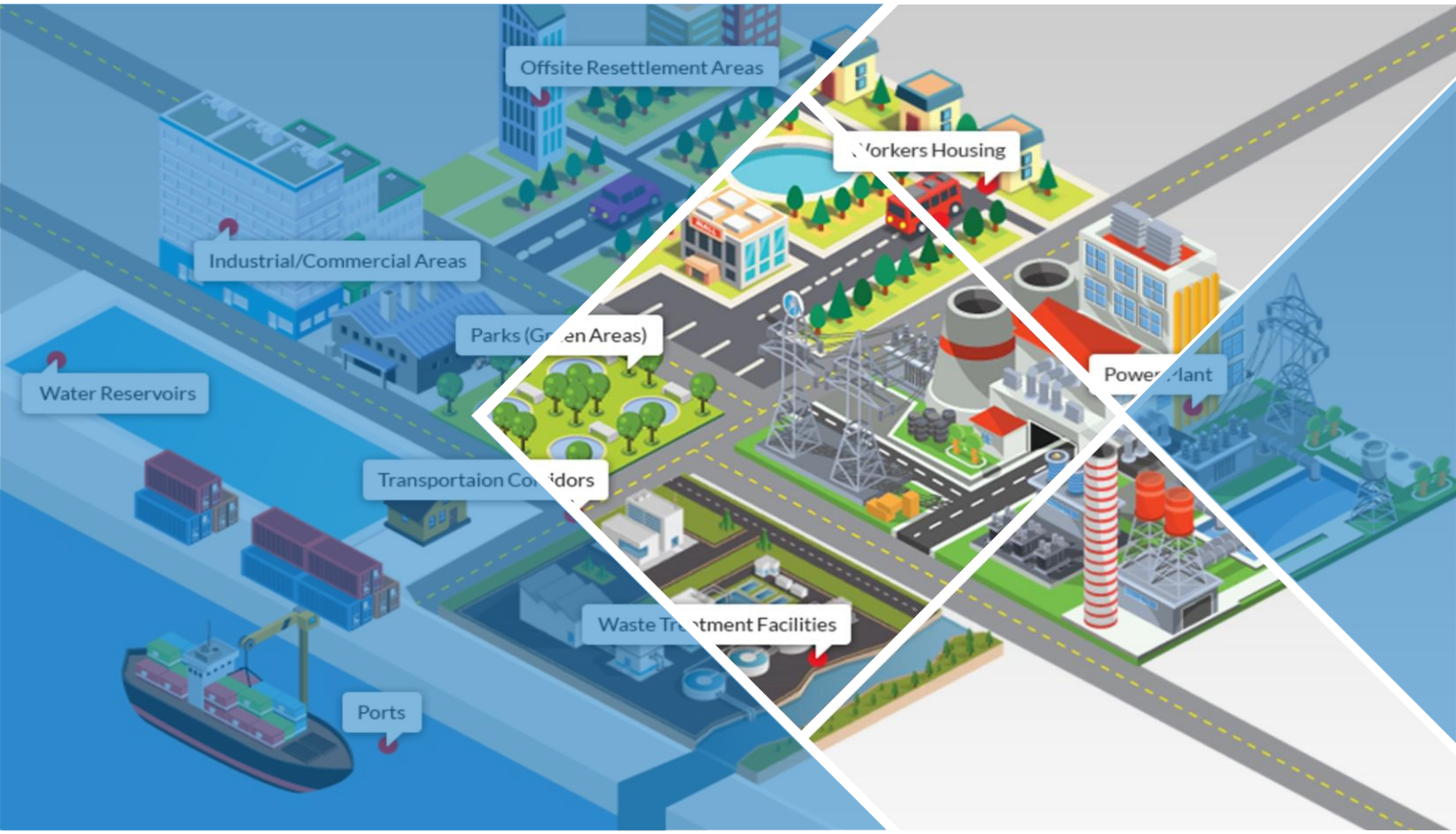
Government of the People's Republic of Bangladesh

Bangladesh Economic Zones Authority

CUMULATIVE IMPACT ASSESSMENT

Regional Environmental and Social Assessment for National Special Economic Zone



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CUMULATIVE IMPACT ASSESSMENT AS PART OF REGIONAL ENVIRONMENTAL AND SOCIAL ASSESSMENT FOR NATIONAL SPECIAL ECONOMIC ZONE

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ACRONYMS AND ABBREVIATIONS

AAQ	Ambient Air Quality
AERMOD	American Meteorological Society/Environmental Protection Agency Regulatory Model
AOI	Area of Influence
BBS	Bangladesh Bureau of Statistics
BDT	Bangladesh Taka
BEPZA	Bangladesh Export Processing Zones Authority
BEZA	Bangladesh Economic Zone Authority
BFD	Bangladesh Forest Department
BGMEA	Bangladesh Garment Manufacturers and Exporters Association
BHTPA	Bangladesh High Tech Park Authority
BIEZL	Bashundhara Industrial Economic Zone Ltd
BITAC	Bangladesh Industrial Technical Assistance Center
BIWTA	Bangladesh Inland Water Transport Authority
BMD	Bangladesh Meteorological Department
BNBC	Bangladesh National Building Code
BOD	Biochemical Oxygen Demand
BR	Bangladesh Railway
BRAC	Bangladesh Rural Advancement Committee
BREB	Bangladesh Rural Electrification Board
BRPL	BR Powergen Limited
BRTC	Bangladesh Road Transport Corporation
BRTC	Bureau of Research, Testing, and Consultation
BTCL	Bangladesh Telecommunication Company Limited
BUET	Bangladesh University of Engineering and Technology
BWDB	Bangladesh Water Development Board
CBO	Community Based Organization
CDM	Clean Development Mechanism
CEGIS	Center for Environmental and Geographic Information Services
CETP	Common Effluent Treatment Plant
CGS	Central Generating Station
CIA	Cumulative Impact Assessment
CO	Carbon Monoxide
CPP	Cyclone Preparedness Programme

CSO	Civil Society Organization
CSTP	Common Sewage Treatment Plants
CWASA	Chattogram Water and Sewerage Authority
DA	Department of Agriculture
DFO	Divisional Forest Officer
DO	Dissolve Oxygen
DOE	Department of Environment
DPHE	Department of Public Health Engineering
DPP	Development Project Proposal
DRS	District Regulating Station
DTW	Deep Tube Well
EC	Electrical Conductivity
EC4J	Export Competitiveness for Jobs Project
ECR	Environment Conservation Rules
EDP	Estuary Development Program
EGCB	Electricity Generation Company of Bangladesh Ltd
EHS	Environment, Health, and Safety Guidelines
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EPA	Environmental Protection Agency
ESF	Environmental and Social Framework
ESIA	Environmental and Social Impact Assessment
ESMF	Environmental and Social Management Framework
ESMP	Environmental and Social Management Plan
ESS	Environmental and Social Standards
EZ	Economic Zone
FHRC	Flood Hazard Research Centre
GIIP	Good International Industry Practices
GIS	Geographic Information System
GLC	Ground Level Concentration
GM	Grievance Mechanism
GOB	Government of Bangladesh
GPH	Good Practice Handbook
GTCL	Gas Transmission Company Limited
GTL	Gas Transmission Line
HFO	Heavy Fuel Oil

HIV/AIDS	Human Immunodeficiency Virus/ Acquired Immunodeficiency Syndrome
HSBC	Hong Kong and Shanghai Banking Corporation
ICT	Information and Communications Technology
IEE	Initial Environmental Examinations
IFC	International Finance Corporation
IPCC	Intergovernmental Panel on Climate Change
IUCN	International Union for Conservation of Nature
IWM	Institute of Water Modelling
JV	Joint Venture
KGDCL	Karnaphuli Gas Distribution Company Limited
KPI	Key Performance Indicator
kV	Kilovolt
LC	Least Concern
LGED	Local Government Engineering Department
LILO	Line IN Line Out
LMP	Labor Management Procedure
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas
MLD	Million Liter Per Day
MMSCFD	Million Standard Cubic Feet Per Day
MOEFCC	Ministry of Environment, Forest and Climate Change
MOSW	Ministry of Social Welfare
MOWR	Ministry of Water Resources
MSW	Municipal solid waste
MVA	Mega Volt Amp
MW	Megawatt
NGO	Non-Government Organization
NMVOC	Non-methane Volatile Organic Compound
NOC	No Objection Certificate
NOx	Nitrogen Oxides
NSEZ	National Special Economic Zone
ODS	Ozone Depleting Substance
OECD	Organization for Economic Co-operation and Development
PBS	Palli Bidyut Samity
PD	Power Division
PDO	Project Development Objective

PET	Polyethylene Terephthalate
PGCB	Power Grid Company of Bangladesh
PM	Particulate Matter
PPP	Public Private Partnership
PRIDE	Private Investment and Digital Entrepreneurship
PSDSP	Private Sector Development Support Project
PUC	Project Under Consideration
RAJUK	Rajdhani Unnayan Kartripakkha
RAP	Resettlement Action Plan
RESA	Regional Environmental and Social Assessment
RFFA	Reasonably Foreseeable Future Action
RHD	Roads and Highway Department
ROW	Right of Way
RPF	Resettlement Policy Framework
SO_2	Sulfur Dioxide
SOx	Sulphur Oxides
SQ	Soil Quality
SRTM	Shuttle Radar Topography Mission
STP	Sewage Treatment Plant
SWQ	Surface Water Quality
TDS	Total Dissolved Solids
TSS	Total Suspended Solids
UDD	Urban Development Directorate
UEO	Upazila Education Office
UHC	Upazila Health Complex
UHFPO	Upazila Health and Family Planning Officers
UNDP	United Nations Development Programme
USEPA	United States Environmental Protection Agency
UTM	Universal Transverse Mercator
VCs	Valued Components
VU	Vulnerable
WB	World Bank
WHO	World Health Organization
WTP	Water Treatment Plant

EXECUTIVE SUMMARY

The Government of Bangladesh has launched an initiative to provide land and infrastructure for industrial development in order to attract more private and foreign investment to support its economic goals. The Bangladesh Economic Zone Authority (BEZA) is the overarching agency responsible for setting up economic zones. The Private Sector Development Support Project (PSDSP) is facilitating the development of EZs in Feni and Chattogram Districts. The PSDSP facilitated the development of a master plan for establishing the National Special Economic Zone (NSEZ) across the Mirsharai, Sitakunda Upazila in Chattogram District, and Sonagazi Upazila in Feni District.

The NSEZ site covers a vast total land area of 33,805 acres or 136.86 square kilometers, with a significant portion comprising reclaimed land. The proposed Bangladesh Private Investment and Digital Entrepreneurship (PRIDE) project will build upon the foundation laid by PSDSP and strengthen the capacity of BEZA to deliver on its mandates. The process of accurately phasing the site according to best practices has become more intricate, as not all the land within NSEZ has been acquired, and some portions have already been allocated to investors. Taking these factors into consideration, the master plan area has been divided into three phases: Phase I: Years 0 - 5; Phase II: Years 6 -10; Phase III: Years 11-20.

Over the course of time, all the existing projects and development in the economic zone are contributing to environmental impacts on Valued Components (VCs) like land use, air quality, water quality, water resource, mangrove habitat, aquatic ecology, community health and safety, socioeconomics, etc. The development and operation of the economic zone are likely to contribute to the impact on VC. The overall approach for the CIA study was developed in reference to the guidance issued by the International Finance Corporation (IFC) in the form of the Good Practice Handbook for Cumulative Impact Assessment and Management.

A preliminary set of VCs has been identified by reviewing individual project EIAs and ESIAs, and stakeholder consultation outcomes. The shortlisted VCs are primarily linked to potential cumulative impacts from the development and operation of the NSEZ, natural processes, and human activities within the defined spatial boundary, also considering other past, present, and future developments and stressors.

The spatial boundary demarcation for the CIA has been done based on the location of economic zones and their likely impacts on potential VCs within their area of influence. The PUC has the potential to have a negative impact on VC, which may have a cumulative impact on the existing and proposed projects in Phases I, II, and III. Considering this, the entire NSEZ area (Phases I, II, and III) has been considered for the CIA spatial boundary. The spatial boundary demarcation for the CIA has been delineated based on the location of NSEZ and their likely impacts on potential VCs within their Area of Influence. The temporal boundaries for the CIA study have been considered for 36 years, which includes 16 years of foreseeable future for proposed industrial development on NSEZ, plus 20 years of project lifecycles, considering the foreseeable projects planned in the NSEZ area.

The development of infrastructures in NSEZ, which include transport networks (internal and external), railway networks, water transport, power networks, gas pipelines, water supply, waste management facilities, telecommunication networks, embankment/super dyke, plantation, etc.

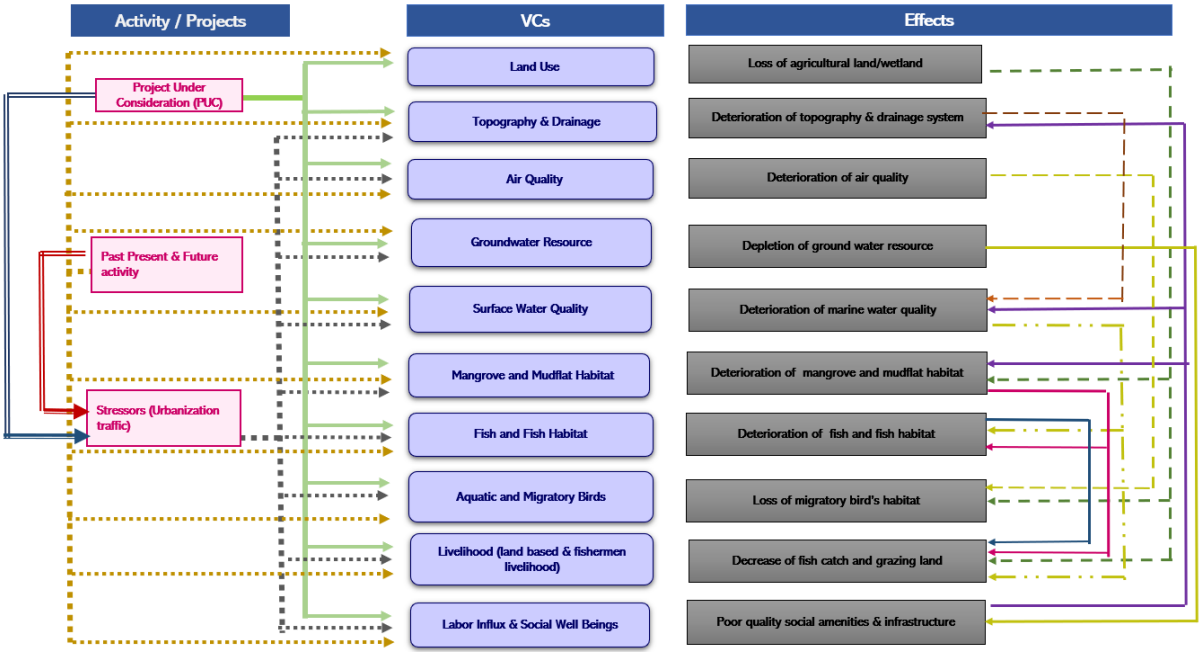
In addition, the study has considered the following external stressors or drivers that have the potential to have an impact on selected VCs:

- *Industrialization*: Presently, there are no accommodation facilities in EZ. However, it is planned to construct accommodation facilities in the Zone of EZ. It is estimated that 1.4 million working population in the year 2040.
- *Natural Stressors*: Natural influences and environmental drives include those linked to climate change. These include floods, cyclones, coastal floods, etc. comprise major stressors that

reportedly affect the surface water resource and aquatic biodiversity, livelihood, physical infrastructure, and properties in the EZ.

A VC screening process was applied, using a logical analytical framework, to determine ones which of the preliminarily identified VCs can be reasonably expected to be affected by some combination of other projects and/or external stressors and the project. The key VCs selected for this CIA land use, topography & drainage, air quality, groundwater resource, marine water quality, mangrove, and mud-flood habitat, aquatic and migratory bird species, protected marine fauna, livelihood (land-based & fisherman), and social well-being. The interactions of the project considered with the key VCs, leading to cumulative impacts, are summarized in Figure-1.

Figure 1: Activity/Project – VC Interactions and Effects



Key and relevant stakeholders were identified as a part of the CIA study process, and consultations were undertaken with them to gather information on VCs, understanding past and present conditions, obtaining inputs on potential cumulative impacts identified by the study team, and what stakeholders thought would be appropriate mitigation measures. The issues and concerns raised by the stakeholders are summarized as follows:

- *Land-use*: Land value has increased in the adjacent areas of NSEZ. Landowners expressed satisfaction as they are getting increased value. On the other hand, the affected landowners received compensation for their land. Landowners are also receiving offers from various investors and developers who are interested in coming to their areas to invest in different sectors, such as opening businesses, developing housing, developing markets/ shops, etc.
- *Air quality*: Dust generation from the movement of vehicles on the access roads has increased. It may impact the local community health if dust control measures are not followed. RESA should consider assessing the ambient air quality in the NSEZ region and the surrounding area.
- *Drainage and flooding*: Currently, the local community in the NSEZ surrounding area is constructing their housing without considering adequate provision for stormwater drainage; therefore, it can accelerate the waterlogging/flooding in the region in the future.
- *Groundwater resource*: Stakeholders emphasized the water issue, specifically the groundwater availability. Groundwater, especially shallow tubewells, is the main water supply source for local people in the surrounding communities of the NSEZ.
- *Livelihood*: Most of the people's livelihoods in the NSEZ adjacent areas depend on agricultural farming, fishing, livestock, small businesses, etc. Participants in the consultations opined that the

EZ would bring both positive and negative impacts on their existing livelihood patterns. Potential impacts would include the scope of new works, occupational shifting, increase of wages, migration, increased access to the service facilities, etc., while negative impacts are assumed to be made for some particular type of occupations such as fishing, agriculture, buffalo grazing, etc.

- *Fishing livelihood*: Consultation with the Jaldash community/traditional fishermen and fishery office found that fishing could be impacted in some ways, such as the fish catching rate could be reduced if fishermen face difficulties netting in the seas due to navigation; if fishermen encounter difficulties accessing boats due to relocation of Ghats or boat parking station, etc.
- *Community health & safety*: Local people are looking forward to enjoying their access to increased health services and safety as a positive result of the NSEZ in their areas. The establishment and operation of health centers in NSEZ will contribute greatly to community health.

The cumulative impacts on the VCs accounting for the NSEZ, other past, present, and future developmental projects/activities, as well as external drivers/stressors, have been assessed, and a summary of the impacts and recommended mitigation measures is summarized below.

VC	Cumulative Impact	Indicator	Management measures
Land use change	The cumulative impact of land use changes in terms of loss of agricultural land and wetland is assessed as high, and the PUC contribution is low.	Land use plan considering all environmental and social sensitivities	• Zonal land use planning for future expansion of industries, residential areas, and commercial areas. Some of the key components that need to be covered include: • Zoning of industrial units, residential areas, and commercial areas. • Control of polluting industries in the new industrial areas or re-developed industrial areas through land use control (unplanned growth of polluting industries can be regulated/discouraged through a land use zoning approval process). • Dedicated road networks for industrial clusters. • Provision of dedicated sites for hazardous and solid waste disposal. • Provision of common treatment facilities for small and medium-scale industries with homogenous effluent qualities. • Adequate space provision for vehicle parking, laydown areas, greenbelt, and other infrastructure. • Implement the phase-wise development after the completion of one phase, and develop the next phase of land. • Develop the land use plan for the region, considering future industry development and induced development.
Topography and drainage	The cumulative impact of topography and drainage in terms of loss of agricultural land and wetland is assessed as medium, and the	Waterlogging and flooding situation	• Conduct a regional-level drainage study to understand the impact of drainage due to the NSEZ area. • Prepare a regional plan to mitigate the drainage impact.

VC	Cumulative Impact	Indicator	Management measures
	PUC contribution is low.		
Air quality	The cumulative impact of air quality in terms of concentration of PM and NOx is assessed as high and medium, respectively, and the PUC contribution is assessed as low.	A monitoring program with due consideration of regional pollution sources and receptors.	• Preparation of a program for regional air quality monitoring, including provision of infrastructure and manpower requirements. • Periodical review of the regional monitoring program and tracking of cumulative indicators by the task force. Based on the review of regional monitoring data, the task force (if required) can inform MOEFCC/DOE to consider appropriate steps to regulate industries by linking them with the issue of Environmental Clearance or decisions about new industries or industrial mix.
Groundwater resources	The cumulative impact of groundwater resources on the groundwater depletion rate is assessed to be high, and the PUC contribution is low.	Annual groundwater depletion/replenishment rates.	• Issuance of a directive related to mandatory permission required for the abstraction of groundwater from WARPO, and also the introduction of a cess for the use of water. • Regular monitoring of groundwater table; defining groundwater potential zones (excellent, good, moderate, poor, very poor); formulation of a plan for setting up permissible limits for the different user categories. • Implement the sourcing of surface water from drainage channels in the NSEZ area and the Sandwip channel for the NSEZ area.
Surface water quality	The cumulative impact of surface water quality in terms of concentration of DO, BOD, and toxic metals is assessed as medium the PUC contribution as low.	Pollution trends and quality of the environment.	• Preparation of a program for regional water quality monitoring, including provision of infrastructure and manpower requirements. • Regular regional water quality monitoring and disclosure of cumulative data on monitoring at a regional level. • Periodical review of the regional monitoring program and tracking of cumulative indicators by the task force. Based on the review of regional monitoring data, the task force (if required) can inform MOEFCC/DOE to consider appropriate steps to regulate industries by linking them with the issue of Environmental Clearance or decisions about new industries or industrial mix.

VC	Cumulative Impact	Indicator	Management measures
Mangrove and mud-flood habitat	The cumulative impact of mangrove and mud-flood habitats is assessed to be high, and the PUC contribution is low.	Plantation area under NSEZ	▪ Phase-wise land development: Phase III land development should start after the allotment of the entire land developed for Phase I. ▪ According to the consultation with BEZA, the Bangladesh Rural Advancement Committee (BRAC) has already planted approximately 42 thousand trees on 68 acres of land in Mirsharai, part of NSEZ, financed by HSBC Bank. BEZA has planted 4 lakh trees so far in the NSEZ site and the closest road networks of NSEZ. The Forest Department also planted trees along the super dyke with their own financing. In the NSEZ Sarobar area (a 112-acre dighi nearby), BEZA has planted trees on approximately 3 acres of land. ▪ Implement the plantation plan prepared by the forest department for NSEZ, which includes (i) low line water line area of Subarna Char, (ii) 40% of the reclaimed Sabuj – Char, (iii) low line water line area of Sabuj Char, and iv) 60% - low line water line area of Sandeep Char.
Aquatic and Migratory bird species	The cumulative impact of migratory birds and aquatic bird species is assessed as medium, and the PUC contribution is low.	Pollution trends and quality of the environment.	▪ Land use planning and implementation, as suggested in the land use section, ▪ Environmental pollution control (surface water quality) as suggested in the surface water quality section. ▪ Periodical monitoring of bird species with special emphasis on endangered and migratory birds. ▪ Awareness generation amongst the local people and workforce regarding the conservation importance of biodiversity.
Protected marine fauna	The cumulative impact of Protected marine fauna is assessed as medium, and the PUC contribution is low.	Dolphin population in the river basin	▪ Identify the pressure and threats on dolphins and turtles. ▪ Identify the dolphin breeding ground and prepare a conservation plan. ▪ Awareness generation among the fishermen and the riverside community towards dolphin conservation. ▪ Periodical census of dolphins in the Sandwip Channel.
Livelihood (land-based and fisherman)	The cumulative impact of Livelihood (land-based and fisherman) is assessed to be medium, and the	The number of jobs and economic opportunities created for the local people	▪ Job and economic opportunities for the local people, especially project-affected families, and unemployed youths. ▪ Job-based training for the local youth. ▪ Regional-level fishery study focuses on fish species, endangered fish species, trends in fish yield and species composition,

VC	Cumulative Impact	Indicator	Management measures
	contribution from PUC is low.		fishermen's livelihood, and fish conservation. ▪ Provision of alternative ground/ provision of stall-feeding. ▪ Phase-wise development, so grazing can be done in undisturbed areas. ▪ Regional-level CSR plan, involving all the operating industries. ▪ External stakeholder grievance system.
Social well-being	The cumulative impact of social well-being is assessed to be medium, and the contribution from PUC is low.	Monitoring SIP implementation to ensure that environmental concerns are addressed	▪ Participatory planning improvement of Slum Infrastructure Improvement (sanitation facility, safe drinking water). ▪ Monitoring SIP implementation to ensure that environmental concerns are addressed.

1 INTRODUCTION

Bangladesh Economic Zone Authority (BEZA) has initiated to develop National Special Economic Zone (NSEZ) in the Chattogram and Feni Districts. NSEZ with multi-dimensional features is a great junction of domestic and foreign investment, industrialization, and economy at the entrance of the southeastern part of the country. One of the largest economic and industrial zones in South Asia, NSEZ, will be a state-of-the-art industrial city. It is one of the priority projects of the government for industrialization and job creation. BEZA engaged EQMS Consulting Limited to conduct a Regional Environmental and Social Assessment (RESA) to assess the potential impacts on the regional environment from NSEZ and to identify mitigation and management measures to address these potential impacts. Cumulative Impact Assessment (CIA) was carried out as part of RESA. The focus of the CIA was to assess the combined impact of existing and planned projects on the environmental and social conditions of the region.

This CIA was undertaken by BEZA to strengthen an understanding of environmental and social risks and impacts of the NSEZ that go beyond individual project-level impact assessments by considering a multi-project, regional understanding of potential cumulative impacts in the NSEZ and its surrounding area. Data and information for this CIA have been collected from previous environmental assessment reports of the study region and individual IEEs/EIAs/ESIAs prepared for the related facilities. Furthermore, the CIA is supplemented with data related to third-party projects that are being planned and or underway, but for which no publicly available reports are yet available.

The CIA study has been carried out by following the prevailing administrative framework of the Government of Bangladesh as well as World Bank Environmental and Social Standards 1-10 under the World Bank Environmental and Social Framework 2018, and International Finance Corporation's (IFC's) Good Practice Handbook on Cumulative Impact Assessment and Management: Guidance for Private Sector in Emerging Markets (IFC 2013).

1.1 Background of the NSEZ

The Government of Bangladesh has launched an initiative to provide land and infrastructure for industrial development in order to attract more private and foreign investment to support its economic goals. The plan is to establish 100 Economic Zones (EZs) across the country over the next ten years, utilizing various arrangements. The BEZA, under the Chief Adviser's Office, is the overarching agency responsible for setting up these economic zones. BEZA aims to create EZs in all potential areas, including backward and underdeveloped regions, to stimulate rapid economic growth through increased industrialization, job creation, production, and export promotion.

The ongoing Private Sector Development Support Project (PSDSP) has supported the establishment of BEZA and the development of EZ in the Feni and Chattogram districts. The PSDSP facilitated the development of a master plan for establishing the National Special Economic Zone (NSEZ) across the Mirsharai, Sitakunda, and Sonagazi Upazilas.

The NSEZ site is situated at a distance of 200 kilometers from Dhaka, the capital city. It is located 60 kilometers away from Chattogram, a major port city, and 70 kilometers from both the Chattogram Port and the Shah Amanat International Airport. Additionally, the site is approximately 330 kilometers from Sylhet. The NSEZ area spans across two districts, three upazilas, and six unions, encompassing a total of 26 mouzas, refer to Figure 1-1.

The NSEZ site covers a vast total land area of 33,805 acres or 136.86 square kilometers, with a significant portion comprising reclaimed land. It boasts an extensive 25-kilometer coastline along the Sandwip Channel in the Bay of Bengal. In NSEZ, approximately 1,450 acres of land are under Zones 2A and 2B, of which most of the plots have been allocated to private investors by BEZA. The proposed Bangladesh Private Investment and Digital Entrepreneurship (PRIDE) project will build upon the foundation laid by PSDSP and strengthen the capacity of BEZA to deliver on its mandates.

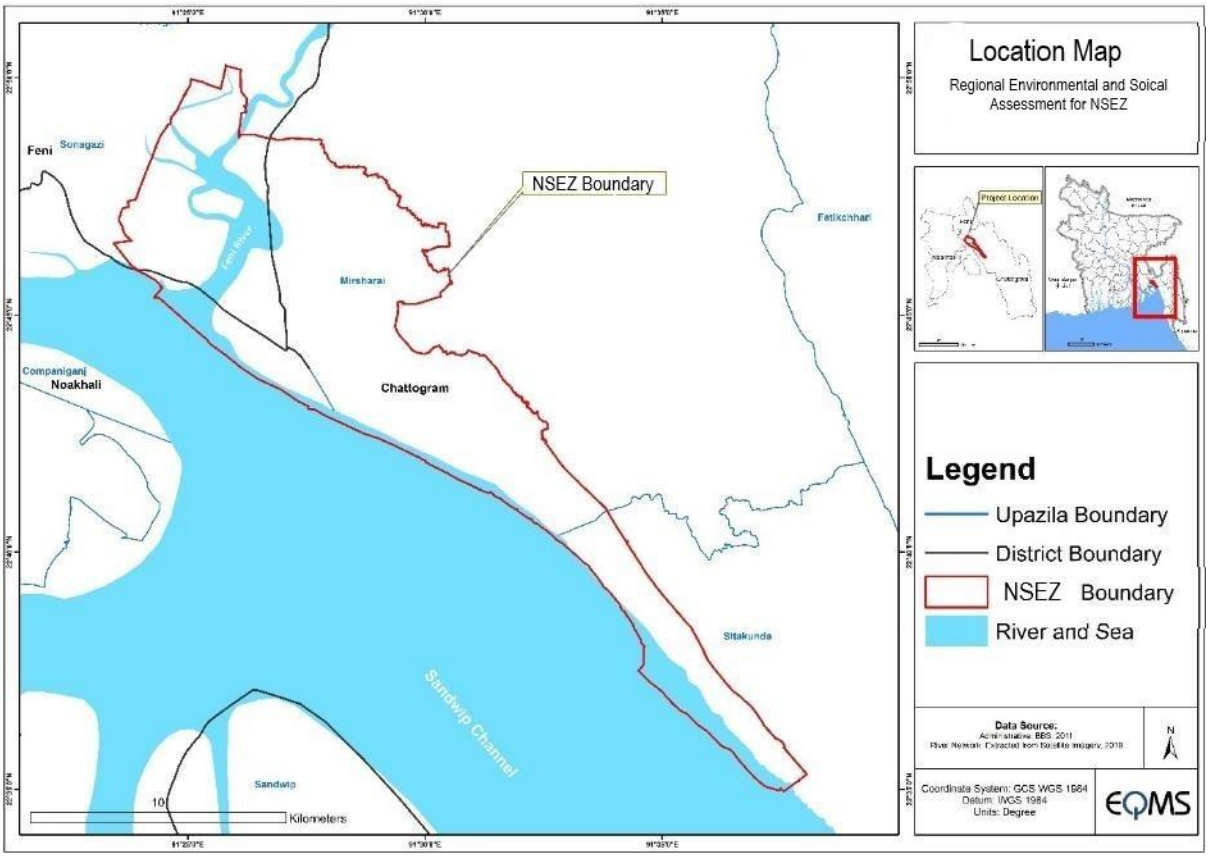
The project development objective (PDO) of the PRIDE project is “to promote private investment and job creation in economic zones and digital entrepreneurship in hi-tech parks.” The project has four components, and the first three components will be implemented by BEZA, and the fourth component will be implemented by BHTPA. The three components of BEZA will be implemented, and the World Bank will provide financial support. The three components are as follows:

- Component 1: creating an enabling environment for private investment, sustainability & jobs.
- Component 2: developing a greener and resilient NSEZ.
- Component 3: creating a dynamic private market for serviced industrial land.

The process of accurately phasing the site according to best practices has become more intricate, as not all the land within NSEZ has been acquired, and some portions have already been allocated to investors. Taking these factors into consideration, the NSEZ site has been divided into three phases. The execution period has also been segmented into three phases, as follows:

- Phase I: Years 0 - 5
- Phase II: Years 6 - 10
- Phase III: Years 11 - 20

Figure 1-1: Industrial Cluster Location Map



Source: EQMS, June 2024

1.2 Objectives of the Study

The main objective of this regional environmental and social assessment is to identify the cumulative impacts of the development and operation of the NSEZ in the context of previous, existing, and reasonably foreseeable future development in the surrounding area of the NSEZ. The specific objectives of the CIA under the RESA include the following:

- Define the spatial and temporal boundaries for assessing cumulative impacts.

- Identify the valued components (VCs) that could potentially experience cumulative impacts within the study area affected by the NSEZ, taking into account inputs from relevant stakeholders and potentially affected communities through the consultation process.
- Identify and map other existing and planned projects/activities, as well as external environmental and social drivers, that could cumulatively impact the VCs.
- Consult stakeholders to identify VCs and formulate recommendations for managing cumulative impacts.
- Assess the potential cumulative impacts on VCs, considering the proposed project/activities, other identified projects (existing and planned), and external drivers in the region, while determining the project's contribution to the cumulative impacts.
- Recommend an integrated management framework for addressing potential cumulative impacts.

1.3 Context of CIA

Over the course of time, all the existing projects/activities and development in the economic zone are contributing to environmental impacts on Valued Components (VCs) like land use, air quality, water quality, water resource, mangrove habitat, aquatic ecology, community health and safety, socioeconomics, etc. The proposed projects/activities and development in the economic zone are likely to contribute to the impact on VC.

BEZA has conducted an environmental impact assessment (EIA) for the Mirsharai Economic Zone and Feni Economic Zone and obtained environmental clearance. BEZA also conducted an environmental and social assessment (ESA) report by updating the existing EIA and SIA reports prepared for Zones 2A and 2B under PSDSP. As discussed with BEZA, individual industries also obtained environmental clearance. However, the projects that will be supported by the financial institute would require an ESIA study. These assessments have restricted themselves to the project being studied as standalone operations without any consideration for surrounding projects or developmental activities. However, a cumulative impact assessment (CIA), considering all the existing and proposed industries and developmental activities, has not been conducted.

Therefore, in view of the situation prevailing in the economic zone, it is important to understand the cumulative impact of the existing projects, and related development activities that are in operation and those that have been planned in the future in the economic zone on a set of key VCs. Therefore, the World Bank has commissioned this cumulative impact assessment (CIA) study as part of the RESA for the proposed economic zone.

1.4 Description of the NSEZ

Various types of infrastructure/utilities will be developed following international standards within NSEZ to provide world-class networks, structures, and services, which will make a competitive, sustainable, and resilient zone. These infrastructures/utilities differ in their structural characteristics, services and functions, and performance standards. The NSEZ is considered as a project under consideration (PUC) for the CIA study. Table 1-1 provides an overview of the types of general infrastructure envisioned for NSEZ.

Table 1-1: Key Types of Infrastructure Services and Assets Planned for NSEZ

Key Infrastructure, Services, and Functions	Types of Infrastructure/Utility Assets
Flood Protection and Management	Coastal embankments, river dykes, canals, sluice gates, pumps, stormwater drainage, etc.
Water Storage/Recreation	NSEZ Sarobar (Lake)

Key Infrastructure, Services, and Functions	Types of Infrastructure/Utility Assets
Transport	Roads, Bridges, Jetties, inland container depot, Rail, Light Rapid Transit, etc.
Buildings	Industrial sheds, Administration Buildings, Residential/Commercial/ Retail/ Educational/Medical/Hotels/Club and Community Services Buildings, Fire Services, etc.
Telecommunication	Towers, Cables, Fiber Optics, Backbone, Switches, etc.
Water Supply and Sanitation	Water Supply System (Potable/Grey), Sewage Treatment Plants (STP), Water Treatment Plants (WTP), Water Reservoirs, Deep Tubewells (DTW), Desalination Plants, etc.
Energy	Power Plants, Sub-Stations, Power Supply Network, provision of use of Solar Energy (including Floating Solar), Renewable, Gas Supply Network, District Regulating Station (DRS), City Gas Station (CGS), ,etc.
Waste Water Management	Sewage Treatment Plants (STPs) and Common Effluent Treatment Plants (CETPs)
Solid Waste Management	Municipal and Industrial Solid Waste (ISW), Biomedical Waste, and Bio-Gas Plant facilities

Source: BEZA, 2020a

1.5 Limitation

The CIA report is based on scientific principles and professional judgment applied to facts with resultant subjective interpretations. Professional judgments expressed herein are based on the analysis of available data and information. The CIA report was prepared with the following limitations:

- The assessment of the environment and social risks is limited to the NSEZ information available at this stage, discussion with stakeholders, primary and secondary data collected, consultation with the local community, and observations made during the site survey. Professional judgment and interpretation of facts have been applied to present inferences from the collected information. If information to the contrary is discovered, the findings in this RESA report need to be modified accordingly.
- The information contained in this report was sourced from information, data, and reports supplied by BEZA, investors/individual industries, utility providers, related facility owners, and the local community, which is assumed to be complete, valid, and true.
- Baseline information within available environmental assessment reports is used for the assessment. Data available within the environmental assessment reports and in the public domain were triangulated with stakeholder perceptions at a regional level to compile the environmental, ecological, and social conditions of identified VCs. Additional primary data collection on environmental, ecological, and social parameters was also undertaken as part of the RESA.
- Available maps and related nonspatial data were collected and collated from NSEZ, different government agencies, and stakeholders, and then utilized for preparing GIS layers.
- Incomplete information about other projects and activities (information is not available in the public domain).

1.6 Structure of the Report

The CIA report is structured as follows:

- **Chapter 1: Introduction:** provides an objective of the study, context, and limitations.

- **Chapter 2: Approach and Methodology:** identification of potential VCs and defining the spatial and temporal boundaries for CIA.
- **Chapter 3: Administrative framework:** applicable national regulations and international guidelines to the EZ.
- **Chapter 4: Development in industry clusters:** describes the baseline condition in relation to all identified VCs.
- **Chapter 5: Valued Components:** VC selection for cumulative impact assessment, selection of indicator and threshold values for assessment of VC impact.
- **Chapter 6: Stakeholder Engagement:** identification of stakeholders, stakeholder mapping, and consultation brief.
- **Chapter 7: Assessment of Cumulative Impacts:** describes the baseline condition of selected VC, cumulative impact assessment of selected VC based on indicator and threshold levels for each VC.
- **Chapter 8: Recommendations and conclusion:** recommendations formulated considering short and long-term environmental planning, considering proposed/planned and anticipated developments within the study area.

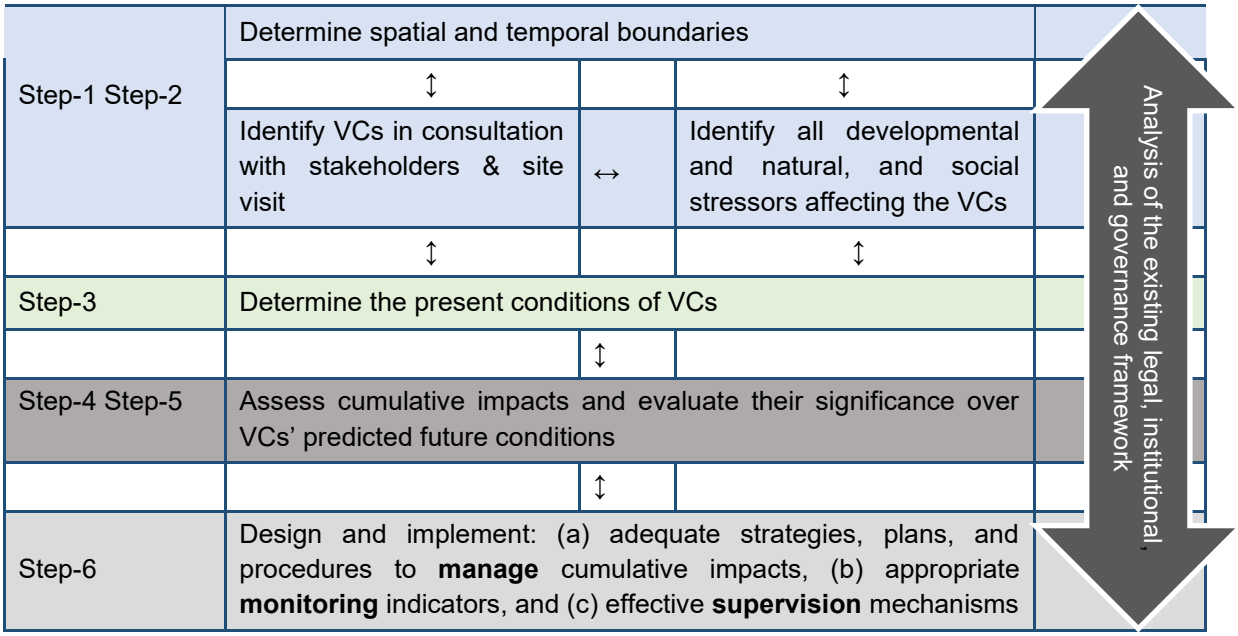
2 APPROACH AND METHODOLOGY

2.1.1 Approach

The IFC 'Good Practice Handbook for CIA and Management' (IFC, 2013) provides a practical and preliminary six-step approach (Figure 2-1) for developers in emerging markets to conduct a Cumulative Impact Assessment (CIA) that meets such requirements.

The proposed approach recognizes that, especially in emerging markets, the many challenges associated with managing a good CIA process include a lack of basic baseline data, uncertainty associated with anticipated developments, limited government capacity, and the absence of strategic regional, sectoral, or integrated resource planning schemes.

Figure 2-1: IFC Good Practice Handbook CIA Six-Step Approach



Source: IFC Good Practice Handbook for CIA and Management, 2013

2.1.2 Methodology

The methodology in this CIA has been based on the principles of the IFC guidance, which sets out a six-step structure (i.e., the foundation) for conducting a comprehensive CIA, with the objectives from each step presented in Figure 2-2. It is not always possible to follow this methodology word-for-word, and the IFC guidance document is exactly that - a useful guide. Where there are deviations from the guidance - because of the specifications of the Project and other activities - or lack of information about third-party other projects/ initiatives, then the reasons are stated. The assessment was adapted and modified throughout the course of compiling the CIA.

The report's sections, which follow, present the findings of the six steps for the assessment of the cumulative impacts upon the relevant VCs of the EZ.

Figure 2-2: CIA Guidance Process

Source: IFC Good Practice Handbook for CIA and Management, 2013

2.1.3 CIA Scoping

The first two steps of the scoping process involve identifying the Valued Components (VCs) to be examined in the assessment and determining the spatial and temporal boundaries for each VC. The VCs were identified by the CIA team in collaboration with stakeholders.

The existing and proposed industrial projects/activities, as well as developmental projects/activities, were identified through a review of documents prepared by BEZA and consultations with BEZA authorities. External activities, natural stressors, and social stressors were identified by the CIA team by reviewing secondary data and leveraging their knowledge of the regional context, which was gained through site reconnaissance visits and consultations with the BEZA team.

2.1.3.1 Identifying VCs

Valued Components (VCs) are key elements of the physical, biological, or socio-economic environment that are most likely to be impacted by the cumulative effects of projects combined with other stressors.

A preliminary set of VCs has been identified by reviewing individual project Environmental Impact Assessments (EIAs) and Environmental and Social Impact Assessments (ESIAs), stakeholder consultation outcomes, site observations, and reviews of potential cumulative impacts on environmental and social components from the development projects/activities, natural drivers, and human activities. The shortlisted VCs are primarily linked to potential cumulative impacts from the construction and operation of the development projects, natural processes, and human activities within the defined spatial boundary, also considering other past, present, and future developments and stressors. However, some residual construction-related impacts, such as habitat loss and loss of livelihoods, if not mitigated, may also result in cumulative impacts on environmental and social components.

In the preliminary VC selection process, project-level EIAs and ESIAs conducted in this region have been considered.

The following candidate VCs were identified for the CIA study:

- Land environment
  - Land use
  - Soil and sediment quality

- Topography & Drainage
- Air environment (air quality)
- Acoustic environment (noise quality)
- Water Environment
  - Surface water resources
  - Groundwater resources
  - Surface water quality
  - Groundwater quality
- Biodiversity
  - Mangrove and mudflat habitat
  - Aquatic and Migratory Birds
  - Protected marine fauna
- Socio-economy
  - Livelihood (land-based & fisherman)
  - Social well-being

The VC screening process was conducted to determine which of the preliminary VCs would be included in the CIA. Findings from the VC screening process are presented in Table 5-1.

The first stage of the CIA identified potential VCs and defined the spatial and temporal boundaries. It entailed defining which VCs needed to be included within the CIA, considering the characteristics of the Project/activities and the prevailing environmental and social conditions within areas that are potentially impacted by the Project/activities. The VCs identification process has been assisted through the completion of engagement activities with relevant stakeholders.

2.1.3.2 Identification of Source of Impacts

The past and present projects or activities with the potential to cause cumulative impacts on VCs have been identified in the scoping stage. An analysis has then been undertaken, which aims to define those development projects that are scoped into the CIA, given their potential ability to generate a cumulative impact associated with the Project (due to temporal/spatial interactions with the Project).

Past and Present Activities

Land Development

NSEZ has a total land area of 33,805 acres or 136.86 km^2 (mostly reclaimed land) with a 25 km coastline along the Sandwip Channel in the Bay of Bengal. A major part of the NSEZ was a mangrove plantation area, mudflat area, and low aquaculture land. To reclaim the NSEZ area, BEZA, with the help of the Bangladesh Water Development Board (BWDB), constructed a super dyke of approximately 22.5 km long all along the coastline for the protection of the EZ site from flood, saline intrusion, erosion caused by tidal surges, and natural disasters. The super dyke structure prevents tidal activity in the mangrove and mudflat areas. BEZA, or proposed industries, developed the land by raising the land with sand. In the north-western part of the NSEZ, land development activity has been completed, and construction activities by the different industries have been initiated. Approximately 2,500 ha of land was already developed.

It was reported that, for the construction of the super dyke and landfilling activity, dredge materials were used. The dredged materials were sourced from the Sandwip Channel in the Bay of Bengal.

Industrial Activity

Based on the available secondary information, the following industrial construction activity started or is in the commissioning stage:

- Samuda Group of Industries
- Basundhara Multi Steel Industries
- Basundhara Chemical Industries

- Haiying Tianjin
- SQ Electronics
- Kiam Glassware Industries
- Marico Bangladesh Ltd.
- Bay Footwear Ltd.
- Jahangir Stainless Steel Ltd.
- RSPL Health Ltd.
- McDonald Steel Building Products Ltd.
- Bangladesh Auto Industries Limited
- Asian Paints Bangladesh
- B-R Powergen Limited
- Modern Syntex Ltd.

Infrastructure Development

The infrastructure development activities include:

- Construction of access roads from Dhaka-Chattogram Highway to the NSEZ
- Construction of jetty
- Construction of super dyke
- PGCB Gridline
- Power Plant by BR PowerGen
- Gas network by KGDCL
- 33/11 KV MEZ sub-station
- BEZA office

Reasonably Foreseeable Future Actions (RFFAs)

The overall project/activities have been planned into three sequential phases, each spanning a distinct and predetermined timeframe. Phase-1, considered the initial stage, encompasses the first five years, from the project's inception until the fifth year. Following this, Phase-2 takes over, covering a duration of six years, commencing in the sixth year and continuing until the eleventh year. Finally, Phase-3, the longest and concluding phase, unfolds over a substantial period of ten years, stretching from the eleventh year until the twentieth year of the project's lifespan.

In the first phase, certain projects spanning various industries like food, steel, paints, consumer goods, chemicals, and ready-mix facilities are already up and running. Simultaneously, other projects are in the construction stage, for some projects, only land has been designated, without any construction activities initiated yet. The timeframe for this phase is set between the 0^{th} and 5^{th} years of the project's duration.

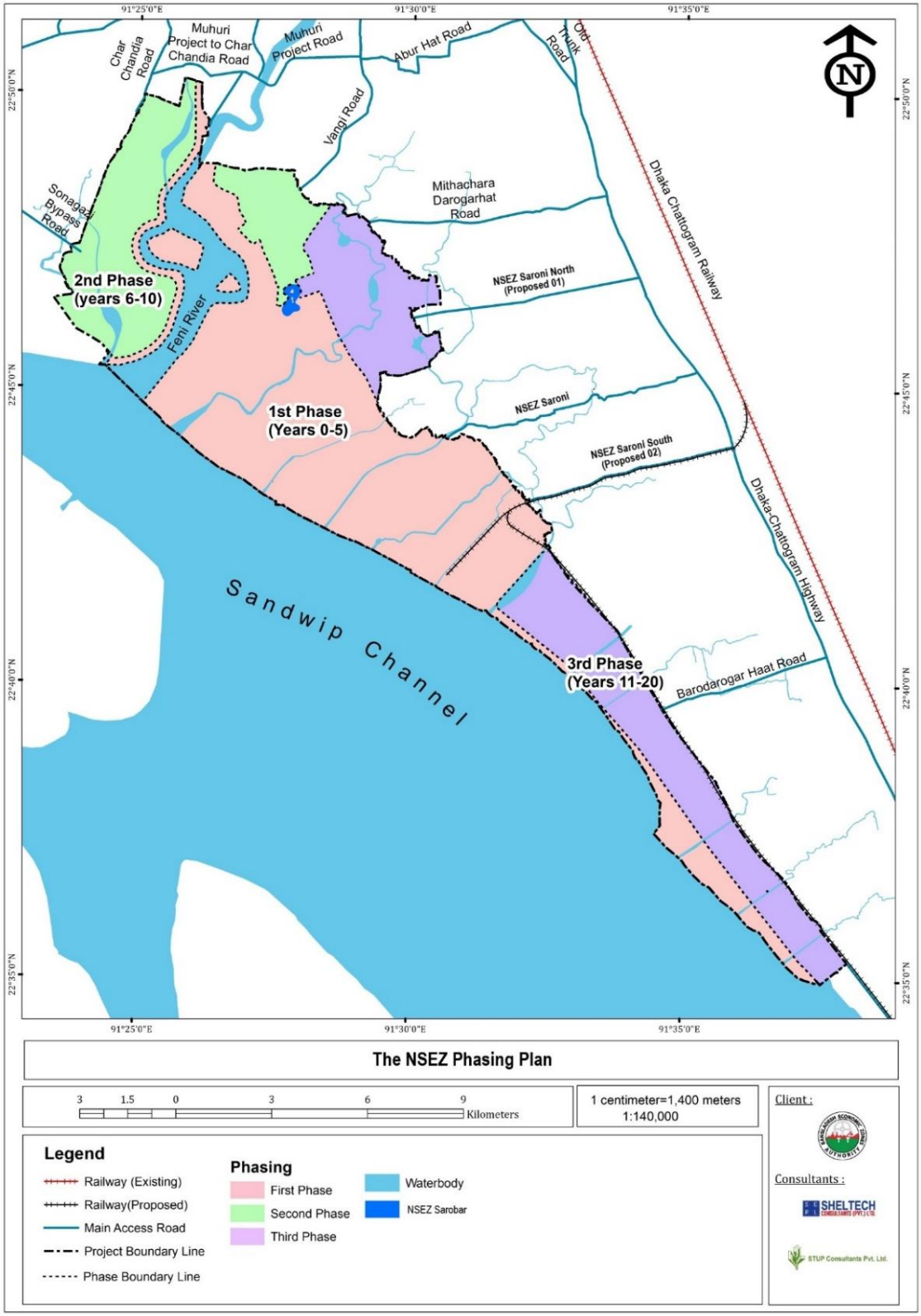
In the second phase, it was planned to construct NSEZ infrastructure and related facilities, which include:

- NSEZ infrastructure
  - Transport network
  - Power network within NSEZ
  - Gas supply pipeline within NSEZ
  - Water supply facility within NSEZ
  - Waste management facility
  - Telecommunication
- Related facilities
  - External road network
  - Railway network
  - Water transport
  - Transmission line for power supply

In the 3rd phase, the land is allocated for the construction of heavy machinery. The time frame for this phase is 11–20 years.

A map of the NSEZ phasing plan has been shown in Table 2-3. The details have been provided in Section 4.

Figure 2-3: NSEZ Phasing Plan



Source: BEZA, 2020a

External Stressors or Drivers

Human activities and natural drivers that exert an influence on VC conditions have been identified and characterized based on existing knowledge and secondary information available in the public domain.

Industrialization

Presently, there are no accommodation facilities in the NSEZ. However, it is planned to construct accommodation facilities in the Zone of the NSEZ. It is estimated that there will be 1.4 million working population in the year 2040. The nearby area is rural, with limited infrastructure and amenities. The workforce for the upcoming industries (during the development and operational stages) is likely to stay in the nearby area. Industrialization will increase the consumption of natural resources like water and generate sewage and municipal solid waste. Presently, there is no water supply, sewage treatment plant, or municipal solid waste disposal site. In-migration of the workforce has the potential to have a negative impact on water resources, surface, and groundwater quality.

Natural Stressors

Natural influences and environmental drivers include those linked to climate change. These include floods, cyclones, coastal floods, etc. comprise major stressors that reportedly affect the surface water resource and aquatic biodiversity, livelihood, physical infrastructure, and properties in the NSEZ.

2.1.3.3 Identification of Stakeholders

The stakeholder engagement process typically refers to the efforts made to understand and involve identified stakeholders to find solutions to shared challenges within the wider socio-economic and ecological context. The process begins with the identification of relevant stakeholders, impacting or being impacted by the EZ.

The potential stakeholders are mapped as part of CIA scoping and are listed in Table 6-1. The identified stakeholders that were found to be relevant to the CIA on the basis of the information review undertaken and the guidance provided by IFC's expectations on identification, i.e., stakeholders that represent one or more entities that:

- Directly benefit from the PUCs
- Are adversely affected by the PUCs
- Directly interact with or oversee environmental and social components that overlap with the PUCs
- Indirectly influence or regulate the condition of environmental and social components.

2.1.3.3.1 Determining Spatial Boundaries

The spatial boundary demarcation for the CIA has been done based on the location of projects/activities and their likely impacts on potential VCs within their area of influence. Special attention was given to the impacts caused by the PUC activities, viz., development and operation of the plant that could exacerbate the impacts of other projects/activities in the vicinity. The CIA spatial boundary considers a combination of these impacts and extends beyond the PUC's area of influence, keeping the likely extent of cumulative impacts in mind.

The PUC has the potential to have a negative impact on VC, like ambient air quality, water resources, water quality, and community health and safety, which may have a cumulative impact on the existing and proposed projects in Phase I. It is envisaged that after the implementation of Phase II and Phase projects, the potential to have a cumulative impact on VC, those are impacted by Phase I projects and activity. Considering this, the entire NSEZ area (Phases I, II, and III) has been considered for the CIA spatial boundary. Table 2-1 provides a shortlisting of the identified VCs along with the delineated spatial boundaries.

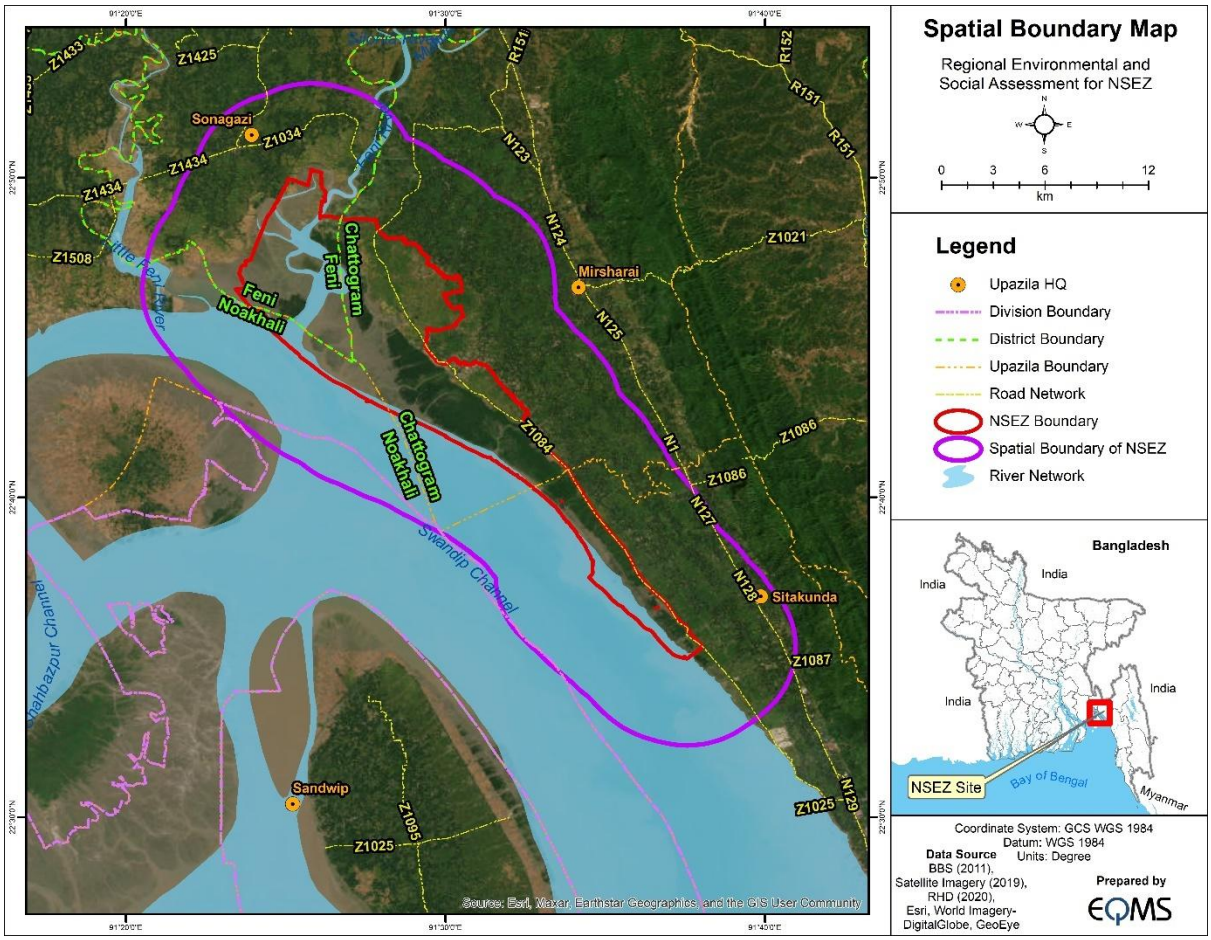
Table 2-1: VC-wise Spatial Boundary for CIA Study

Candidate VCs	Consideration for Spatial Boundary	Spatial Boundary
Land Environment (Land use)	NSEZ has a total land area of 33,805 acres, mostly reclaimed land. The proposed NSEZ infrastructure under PUC (transport network, power network, gas pipeline, water supply pipeline, telecom facility, waste management facility) will be constructed within the NSEZ; therefore, no additional land would be required. The related facilities, like an external road, a railway network, a water supply pipeline, and a transmission line, would require additional land. Stressors like industrialization are likely to cause the induced development of urbanization, and the same would require additional land. The surrounding land use in the region is agricultural land. Potential land use change is localized within the EZ site or its immediate vicinity.	Spatial boundary for this VC is a 5.0 km buffer from the NSEZ area.
Land Environment (soil and sediment quality)	The construction of related facilities has the potential to have an impact on the topsoil if not scraped before land development and stored for future use. The hazardous waste is generated during the construction and operational stages of the existing industries in the NSEZ. If not properly managed (stored and disposed of), the potential will also have an impact on soil and sediment quality. There is no common hazardous waste landfill site in this region or Bangladesh; hazardous waste generated from these industries is generally disposed of through a third-party vendor for recycling, reuse, or final disposal. Improper handling of these wastes by the operating industry has the potential to have a localized impact on soil and sediment quality.	Spatial boundary for this VC is a 1.0 km buffer from the NSEZ area.
Air environment (Air quality)	The VC may be impacted by the construction of PUCs and other industries. Fugitive air emissions are due to construction-related activities and are localized. The VC may be impacted by the operation of PUCs (i.e., transportation of raw materials and finished products) and operating industries due to point source emission, i.e., stack emission. The potential area of influence is likely to be 3-4 km towards the downwind direction from NSEZ.	The spatial boundary for this VC is a 5 km buffer towards the land side of the NSEZ area.
Acoustic environment (noise quality)	The VC may be impacted by the construction and operation of PUCs; however, the potential impact is likely to be localized considering the project-level engineering control measures and additional mitigation measures proposed in EIA. The other operating industries in the NSEZ also have a negative impact on noise levels. Potential noise quality impacts may be localized within the EZ site or its immediate vicinity.	Spatial boundary for this VC is a 1.0 km buffer from the NSEZ area.

Candidate VCs	Consideration for Spatial Boundary	Spatial Boundary
Surface and groundwater resources	The VC may be impacted by the PUCs, other industries, and stressors- industrialization. It is proposed that the water required for NSEZ will be sourced from the Feni River and Meghna River. However, during the construction phase of the PUC and the initial operational phase of the EZ, water will be sourced from groundwater. The competitive users of the groundwater resource are in the nearby settlements, located towards the eastern side of the NSEZ.	The spatial boundary for this VC is a 5 km buffer towards the land side.
Marine water quality	The VC may be impacted by the PUCs, other industries, and related activities- like the operation of jetties and the movement of vessels along the shipping channel.	The spatial boundary for this VC is a coastal area further 1 km from the shipping channel.
Mangrove and mudflat habitat	The VC may be impacted by the PUCs, other industries, and related activities, like the construction of access roads, gas pipelines, etc. The entire mangrove and mudflat area has been considered for a spatial boundary.	The spatial boundary for this VC is the entire mangrove and mudflat area.
Aquatic and migratory bird species	The VC may be impacted due to modification of habitat (mangrove, mud-flood), noise and illumination, discharge of treated and untreated effluent and wastewater from PUCs, other industries, and related activities – like operation of vessels, and jetties.	The spatial boundary for this VC is the entire mangrove and mudflat area.
Marine protected species	The VC may be impacted due to underwater noise, construction of offshore facilities, jetties, marine water quality from PUCs, other industries, and related activities - like the operation of vessels, jetties, and sourcing of dredge material from the Sandwip channel.	The spatial boundary for this VC is a coastal area further 1 km from the shipping channel.
Livelihood (land-based and fisherman)	The VC may be impacted due to the impact on procuring of private agricultural land and pisciculture land, access to grazing land, marine water quality, impacted fish breeding and nursing ground, and operation of vessels and jetties.	The spatial boundary for this VC is up to the day fishing zone.
Social well-being	This VC may be impacted due to urbanization and in-migration.	The spatial boundary for this VC is a 2 km buffer towards the land side.

Considering the VC-wise spatial boundary justification discussed in Table 2.1, the spatial boundary considered in the CIA study is 5 km around the NSEZ. The spatial boundary map for the CIA study has been presented in Figure 2-4.

Figure 2-4: Spatial Boundary Map for CIA Study



Source: EQMS

2.1.3.4 Determining Temporal Boundaries

Temporal delineation for a CIA is a challenge due to the inherent uncertainty about potential future projects and activities. The following are the basic assumptions to determine temporal boundaries for the assessment according to the IFC CIA Guidelines.

a. The time frame expected for the complete life cycle of the proposed development (including construction, operation, and decommissioning).
b. The expected time frame for the potential effects of the proposed development can extend beyond (a).
c. The most conservative time frame is between (a) and (b).
d. Use professional judgment to balance between overestimating and underestimating, and make sure to document the justification or rationale.
e. Exclusion of future actions if (i) they are outside the geographical boundary, (ii) they do not affect VCs, or (iii) their inclusion cannot be supported by technical or scientific evidence.

The NSEZ development has been planned in a phased manner. The phase-wise development activities have been considered to determine the temporal boundary.

Table 2-2: Phase-wise Development in the NSEZ

Scenario	List of Projects and Activities
Scenario 1: Existing Projects Scenario (Baseline) *(2020 – 2025)*	• Land acquisition, resettlement, and land development (partial). It is expected that approximately 16,900 acres of area will be developed. • Dredging requirements - approximately 225.33 million m³ • Central Effluent Treatment Plant establishment - no • Sewage Treatment Plant establishment - no • Construction of external road - NSEZ Saroni (Barotakia-Bamonsundor Road) (2 lanes) • Construction of internal roads inside of NSEZ (zone 2A and 2B) (partial) • Super dyke/embankment - 22.5 km at Mirsharai section • Construction of boundary wall - 23 km • Establishment of groundwater deep tubewell - 10 MLD water extraction and distribution line at Mirsharai site • Establishment of HFO based Power plant at Mirsharai site • Electricity transmission line and substation (partial) at Mirsharai site • Electricity distribution line - different zones in NSEZ (partial) at Mirsharai site • Establishment of a gas pipeline (partial) at the Mirsharai site • Water transport/jetty – 1 jetty under BIWTA • Waste management facility (partial) at Mirsharai site • Stormwater network/khal/canal excavation (partial) at Mirsharai site • Telecommunication network - 22 km optical fiber cable (partial) at Mirsharai site • Plantation inside of NSEZ and outside of NSEZ (partial) • Dredging and landfill/land development (partial) for Mirsharai site • Projects in operation - 7 nos. (Asian Paints Ltd., Bashundhara Ready Mix, Nippon & MacDonald Steel Industries Ltd., MacDonald Steel Building Products Ltd., Marico Bangladesh Ltd., Samuda Construction Ltd., Bashundhara Chemical Industries Ltd.) • Upcoming projects/investors/industries (approximately 132 investors have been allocated land in the NSEZ)
Scenario 2: Under Construction and Committed Scenario (Existing + Under Construction + Committed Projects) *(2026 - 2030)*	• Land acquisition, resettlement, and land development (partial). It is expected that approximately 25,350 acres of area will be developed. • Dredging requirements - approximately 338.08 million m³ • Central Effluent Treatment Plant establishment - 2 nos. (50+50 MLD) • Sewage Treatment Plant establishment - no • Expansion of internal road - NSEZ Saroni (Barotakia-Bamonsundor Road) (2 lanes) • Construction of external roads – other roads (NSEZ Sarani North, NSEZ Sarani South, and EZ site to Sonagazi-Feni Road) to connect the Dhaka-Chattogram Highway and local roads for worker's mobility (partial) • Expansion of internal roads – inside of different zones in NSEZ (partial in phase 2 area) • Super dyke/embankment at Feni site • Railway transport - 13.4 km length, 6 new bridges, 11 culverts, and 1 station building in Mirsharai area • Water transport/jetty - 1 under BEZA, 2 under private sector (Bashundhara and Samuda)

Scenario	List of Projects and Activities
	• Establishment of water treatment plant - 100 MLD from Feni reservoir and distribution line at Feni site • Surface water from Meghna River - 250 MLD • Establishment of Solar Power Plant at Feni site • Electricity distribution line - different zones in NSEZ (partial in phase 2 area) at Feni site • Establishment of gas pipeline - different zone in NSEZ (partial in phase 2 area) at Feni site • Waste management facility (partial) • Township development at the Feni and Mirsharai site (accommodation facilities for the workers, investors, etc.) • Telecommunication network - 15 km of optical fiber cable will be laid from Sonagazi of Feni to Mirsharai EZ through Dasherhat (Char Chandia) • Stormwater network/khal/canal excavation (partial in phase 2 area) • Plantation inside of NSEZ and outside of NSEZ (partial in phase 2 area) • Dredging and landfill/land development (partial) for the Feni site • Upcoming projects/investors/industries in Mirsharai and the Feni site (approximately 132 investors have been allocated land in the NSEZ)
Scenario 3: Full Development Scenario (Existing + Under Construction + Committed + Planned Projects): (2031 - 2040)	• Land acquisition, resettlement, and land development (Complete). It is expected that approximately 33,805 acres of area will be developed. • Dredging requirements - approximately 450.89 million m³ • Central Effluent Treatment Plant establishment - 4 nos. (50+50+100+150 MLD) • Sewage Treatment Plant establishment - 2 nos. (45+80 MLD) • Super dyke/embankment (12.5 km from Domkhali in Mirsharai to Guliyakhali in Sitakunda, 27 meters high with a 60-meter base and 9.8-meter top, with hosting a two-lane road). • Construction of external roads - other roads (complete in phase 3 area) in the Sitakunda site • Construction of internal roads - different zones in NSEZ (complete in phase 2 area) in Sitakunda site • Establishment of gas pipeline - different zone in NSEZ (complete in phase 2 area) in Sitakunda site • Electricity distribution line - different zones in NSEZ (complete in phase 2 area) in Sitakunda site • Water supply pipeline at the Sitakunda site • Stormwater network/khal/canal excavation (complete) in Sitakunda site • Waste management facility (complete) • Plantation inside of NSEZ and outside of NSEZ (complete in phase 3 area) • Establishment of a desalination plant • Dredging and landfill/land development (complete) in the Sitakunda site • All committed/planned projects (complete) (including heavy industries in the Sitakunda area) • Other development projects/infrastructures in the region including Feni-Noakhali National Highway to 4-Lanes at Begumgonj to Sonapur, Chattogram - Cox's Bazar Rail Link project, Dhaka-Chattogram Highway - providing easier access to the Chattogram region including a better connection with the Chattogram Sea Port, Karnaphuli Tunnel, Bay Terminal project, Matarbari Port Development, Power hub in Matarbari

Scenario	List of Projects and Activities
	area, Flyover and Elevated Expressway in Chattogram, Chattogram Airport Development Project, Bayezid-Faujdarhat Link Road, Sonadia Ecotourism, Sabrang and Naf Tourism Park, S Alam Banshkhali EZ, 900 MLD Water Pipeline from the estuary of Padma Meghna Dakatia Estuary, Economic zones are in the Chattogram and Cox's Bazar region (Anowara (Gohira) EZ, Anowara-2 EZ, Cox's Bazar Free Trade Zone, Moheshkhali/Dhalghata EZ, etc.), Hazardous waste Treatment Storage and Disposal Facility at Sitakunda area for waste from the ship-breaking industry, Construction of Jetty in Sandwip and Teknaf (Sabrang and Jaliar Island), Bangladesh Regional Waterway Transport Project 1 (Dredging of the river routes on the Chattogram-Dhaka-Ashuganj corridor).

The temporal boundaries for the current CIA have been established keeping in mind the following:

- **Life cycle of existing projects and foreseeable planned projects**: At least a 20-year period for the current project lifecycle, additionally 16 years (*Scenario 3) has been considered as* foreseeable future for proposed industrial development on NSEZ, the 16-year period represents a feasible and appropriate timeline for identifying projects to be considered for the CIA.
- **Climate change and anthropogenic factors**: anticipated timescales for selected other external factors (e.g., climate change) that may impact all selected VC conditions beyond the project lifecycle and stretch to a 100-year period. These consider the contribution of the natural driving forces of long-term climate cycles and anthropogenic activities that may impact hydrological factors such as water availability, floods, etc.

The temporal boundaries for the CIA study have been considered for 36 years, which includes 16 years of foreseeable future for proposed industrial development on NSEZ, plus 20 years of project lifecycles, considering the foreseeable projects planned in the NSEZ area.

Based on the CIA scoping, further assessment has been conducted, focusing on the present condition of VCs, cumulative impact assessment, and management measures. The methodology has been discussed in the following sections.

2.1.4 Determining Present Conditions of VCs

Defining the baseline characteristics of VCs is an important stage in the whole CIA process, as this identifies their sensitivity to change. The purpose of this task was to define the existing condition of VCs and understand potential interaction with development influences and stressors. Available relevant baseline data were gathered from an extensive review of secondary documents (available IEE/EIA/ESIA/EMP reports of ongoing and proposed projects in the region and related facilities) and primary surveys for the identified VCs as part of the RESA. Cause Effect (Network) diagrams were also developed to clearly understand the interactions between the key VCs and the developmental stressors (refer to Figure 5.2).

2.1.5 Assess Cumulative Impacts on VCs

Assessing the cumulative impact on the screened-in VCs was done for the identification of indicators (linked to the baseline conditions of the VCs) and thresholds (indicating vulnerability that may lead to an adverse impact), and thereafter assessing significance. Considerations for the development of indicators were conducted keeping in mind:

- Representation of VCs
- Measurable based on some temporal data availability
- Understood by the decision-makers and other key stakeholders.

Threshold levels for the indicators have been developed to assess the significance of cumulative impacts on VCs. The threshold level for an indicator has been considered any national regulatory standards or comparison with previous studies as part of different ESIAs in the area. This approach is based on certain exemplary socio-economic indicators, discussed in *Section 5.3* of the IFC GPH on CIA (2013), to reflect cumulative impacts over selected VCs. These indicators and thresholds have been estimated potential impact on the vulnerability, and/or risk to the sustainability, of the VCs assessed.

2.1.5.1 Assessment of Cumulative Impacts on VCs

The significance of cumulative impact will be determined based on the criteria set out in Table 2-3.

Table 2-3: Impact Significance Definition

High	VC would experience changes that would likely exceed its range of tolerance/ resilience/threshold level within the spatial and temporal boundariesconsidered, and the viability of the VC would be threatened.
Substantial	VC would experience changes beyond natural variation, but within its range of tolerance/ resilience/threshold level within the spatial and temporal boundaries considered; the viability of VC will not be threatened.
Medium	VC would experience noticeable changes, but within natural variations/with the threshold level within the spatial and temporal boundaries considered.
Low	VC would not experience noticeable changes within the spatial and temporal boundaries considered.

2.1.6 Management of Cumulative Impacts – Design and Implementation

Many of the mitigation measures were identified to apply to the mitigation of cumulative impacts. However, it was also recognized that the CIA identified potential cumulative impacts of Moderate or Major significance, which may require additional mitigation or management actions (or monitoring) beyond those that have been developed for the EZ-induced impacts as reported within the RESA report.

3 ADMINISTRATIVE FRAMEWORK

This section provides an overview of the existing legal, institutional, governance, and planning framework, as it pertains to CIAs for the NSEZ, in order to identify existing legal instruments, precedents, and/or initiatives to review towards management of cumulative impacts in Bangladesh. The review attempts to bring together the Country's environmental and social policies, regulations, and the World Bank Environmental and Social Standards 1-10 under the Environmental and Social Framework 2018, World Bank Group Environment, Health and Safety (EHS) Guidelines, as well as Good International Industry Practices (GIIP).

3.1 World Bank Environmental and Social Framework

The World Bank Environmental and Social Framework, adopted in October 2018, set out a commitment to sustainable development through a set of environmental and social standards that are designed to support borrower projects. The ESSs set out the requirements for Borrowers relating to the identification and assessment of environmental and social risks and impacts associated with projects supported by the Bank.

The relevance of the WB-ESSs to the NSEZ is given in Table 3-1.

Table 3-1: Relevance of the World Bank ESSs to the NSEZ

World Bank ESSs	Relevance
World Bank Environmental and Social Framework	World Bank ESF will need to be followed during the implementation of the master plan prepared for the NSEZ.
ESS1: Assessment and Management of Environmental and Social Risks and Impacts	The standard is relevant to the NSEZ. Although the EZ is likely to reap positive environmental and social benefits, there are potential environmental and social risks and impacts deriving from activities during the implementation of the master plan. The proposal of mitigation measures, activities, and plans, and the mitigation hierarchy will be used accordingly.
ESS2: Labor and Working Conditions	The implementation of the NSEZ master plan will involve employing labor for various activities. Occupational Health and Safety (OHS) issues throughout the entire EZ lifecycle will be covered. Accordingly, a Labor Management Procedure (LMP) has been prepared, inclusive of the Grievance Mechanism for workers.
ESS3: Resource Efficiency and Pollution Prevention and Management	The NSEZ seeks to avoid, minimize, and/or manage EZ-related nonhazardous and hazardous waste, including e-waste. The EZ will also promote the sustainable use of energy and water during the lifecycle as necessary. The above activities will need to comply with pollution prevention measures in WB ESS3 and the reference framework.
ESS4: Community Health and Safety	The community health and safety risks associated with the NSEZ will cover the whole lifecycle. The risks may include unfenced excavated areas without safety tapes or signboards, and the movement of heavy machinery and vehicles carrying construction equipment on the access road. High dust levels from earthworks, high noise, emission levels from traffic congestion and idling of vehicles, and an influx of workers could potentially cause local discomfort and potential conflicts with residents. The influx of labor could also expose local communities to public health risks and communicable diseases, such as HIV/AIDS and COVID-19. The EZ development and operational activities can also

World Bank ESSs	Relevance
	cause sexual exploitation and abuse. The EZ site will need to be extended to affected communities as recommended in WB ESS4. The requirement of security personnel in the lifecycle of the EZ and their relevant health and safety risks will need to be considered in compliance with ESS4.
ESS5: Land Acquisition, Restrictions on Land Use, and Involuntary Resettlement	The EZ is envisaged to be located on reclaimed land and privately owned land (a total of 33,805 acres). Land acquisition and/or physical and economic displacement will occur. For this, BEZA has prepared a Resettlement Policy Framework (RPF) that establishes eligibility criteria for affected persons, sets out procedures and standards for compensation, and incorporates arrangements for consultations, monitoring, and addressing grievances. RAP will be developed to minimize, avoid, or mitigate risks as needed, and before construction work begins.
ESS6: Biodiversity Conservation and Sustainable Management of Living Natural Resources	There is a planted forest area found on the EZ site. The EZ site is in a modified habitat, some of them with potential significant biodiversity value. Site clearance and construction activities involve the removal of vegetation and felling of trees. Construction activities will be dealing with earthmoving, excavation, transportation of materials, labor, machinery, etc., and thus might cause soil erosion, and could damage vegetative cover, etc., in the EZ site as well as in its area of influence. In addition, two Important Bird and Biodiversity Areas, namely the Ganges-Brahmaputra-Meghna Delta and Muhuri Dam, fall within the EZ's area of influence. Both sites support a significant population of migratory winter birds with conservation significance. The disturbances associated with the EZ could disrupt their normal activities and potentially shrink their habitat. The EZ-specific environmental and social management plan will address specific measures.
ESS7: Indigenous Peoples	The standard is currently not relevant, as there are no Indigenous Peoples found in the NSEZ boundary.
ESS8: Cultural Heritage	NSEZ does not likely envisage any impact on physical, cultural, and/or archaeological sites.
ESS9: Financial Intermediaries	The standard is currently not relevant.
ESS10: Stakeholder Engagement and Information Disclosure	RESA will identify different stakeholders, i.e., EZ-affected parties and other interested parties, including vulnerable and disadvantaged groups, poor households (such as female-headed, widows, older persons, orphans, and persons living with severe illness), persons with disabilities, Illiterate community members, government agencies, regional and local authorities, affected community, host community, farmers, religious and local leaders, NGOs, etc. RESA will assess the EZ's impact upon them as well as their interests in the project. A Stakeholder Engagement Plan (SEP) including a Grievance Mechanism (GM) has been prepared following the ESS10. This document and other safeguards instruments (LMP, RPF, ESMF) have been disclosed, and consultations with the relevant stakeholders have been held. NSEZ authority will engage with, and provide sufficient information to, stakeholders throughout the life cycle of the EZ, in a

World Bank ESSs	Relevance
	manner appropriate to the nature of their interests and the potential environmental and social risks and impacts of the project.
OP/BP 7.50 Projects on International Waterways	NSEZ is not located on an international waterway.
OP/BP 7.60 Projects in Disputed Territories	NSEZ is not located in disputed territories.

Source: World Bank Environmental and Social Framework, 2018

3.2 Environment and Social Regulation Framework

The GOB has developed a policy framework that requires environmental issues to be incorporated into economic development planning. The key tenets of the various applicable policies are detailed in the following subsections. A brief analysis of the local laws and regulations and their applicability to PUC is presented in Table 3-2.

Table 3-2: Environmental and Social Regulations Applicable for NSEZ

Act/rules/law/Policies	Relevance for NSEZ Master Plan Implementation
Bangladesh Environment Conservation Act, 1995, and its amendments in 2000, 2002, and 2010	The requirements for conducting IEE or EIA of any projects, approval processes, and other associated requirements are provided.
Environment Conservation Rules, 2023	Provides environmental quality standards that need to be complied with during the implementation of the NSEZ master plan.
Environment Court Act, 2010, and its amendment in 2019	Settlement of any environmental disputes, offenses, or compensation under environmental law.
Noise Pollution (Control) Rules, 2006	Provides standards for ambient noise level requirements.
Air Pollution (Control) Rules, 2022	Provides standards for air quality requirements.
Ecologically Critical Areas Management Rules, 2016	No relevance as there are no ECAs located in the study region.
Bangladesh Economic Zone Act, 2010	Enforce compliance with all the existing laws on the environment and environmental protection.
Bangladesh Economic Zones (Construction of Building) Rules, 2017	Present standards for economic zones and individual building design requirements. Also, ensure the building construction permit and occupancy certificate.
Bangladesh Public Private Partnership Act, 2015	Ensure extensive investment in different sectors and expedite socioeconomic development as well as environmental protection.
Bangladesh Climate Change Trust Act, 2010	Identify climate change and disaster-related issues and mitigation.
Ozone Depleting Substance (Control) Rules 2004 and amendments in 2014	Presents requirements for obtaining an NOC for selling, stocking, or exhibiting for sale or distributing any ODS.

Act/rules/law/Policies	Relevance for NSEZ Master Plan Implementation
Bangladesh Labor Act, 2006, and amendments in 2013, Labor Rules, 2015	Enforces the requirement for providing the health, safety, and well-being of the workforce.
Fire Prevention and Extinction Act, 2003, and Fire Prevention and Extinction Rules, 2014	Regulate the prevention of fire accidents and the reduction of damages and consequences of fire. Presents requirements for obtaining approval regarding fire prevention or extinction, and an occupancy certificate for buildings.
Fatal Accidents Act, 1855	Ensure the compensation for the death of a person caused by a wrongful act, neglect, or default, and act, neglect, or default.
Natural Water Reservoir Conservation Act, 2000	Enforces the requirement for preserving playgrounds, open spaces, parks, and natural water bodies in all municipal areas of the metropolitan, divisional cities, and district towns.
Bangladesh Water Act, 2013	Regulates the sustainable use of groundwater and surface water resources, protects flood control structures, bans activities over any natural watercourses, stops the natural flow or creates obstacles, or diverts or attempts to divert the direction.
Bangladesh Water Rules, 2018	Presents requirements for obtaining NOC for project development and establishes priority for different water development schemes (for example, flood control & management, surface water, construction of hydraulic structures, groundwater, irrigation, fisheries, riverbank protection, river excavation and dredging, canal excavation and re-excavation)
National River Protection Commission Act, 2013	Ensure the prevention of illegal occupation of rivers, pollution of water and environment, and pollution of rivers caused by industrial factories.
Water Supply and Sanitation Act, 1996	Ensure proper management and control of water supply and sanitation.
Embankment and Drainage Act, 1952	Presents protection of embankment and drainage condition, and their conservation requirement.
Penal Code, 1860	Enforcement to manage environmental pollution, protection of the environment, and protection of health and safety.
Solid Waste Management Rules, 2021	Provides guidelines for solid waste management.
Hazardous Waste (e-waste) Management Rules, 2021	Provides guidelines for hazardous waste (e-waste) management.
Medical Waste (Management and Handling) Rules, 2008	Provides guidelines for medical waste management.
Hazardous Wastes and Ship Breaking Waste Management Rules, 2011 & amendments in 2012	Provides guidelines for hazardous waste management.
Disaster Management Act, 2012	Provides guidelines for different authorities from the national level to the local level for effective coordination for disaster management.

Act/rules/law/Policies	Relevance for NSEZ Master Plan Implementation
Ports Act, 1908	Enforces the requirement for the protection of water resources from the discharges of oily water, ballast, and rubbish in the marine environment.
Road Transport Act, 2018	Provide standards for the level of emission of smoke or any other form of discharge or emission of environmental pollutants, and permit motor vehicles.
Bangladesh Maritime Zones Act, 2019	Protection and prevention of the marine environment and resources from pollution.
Inland Shipping (Amendment) Act, 2005	Regulate the discharge of wastewater and sewage into inland water.
Coast Guard Act, 2016	Pollution prevention in maritime zones, disaster warning information dissemination, relief and rescue operations during natural calamities.
Chittagong Port Authority Ordinance, 1976	Enforces the requirement for the protection of water or the environment.
Children Act, 2013	Protection of child labor and exploitation of children.
Acquisition and Requisition of Immovable Property Act, 2017	Requirements for conducting RAP, procedures for land acquisition, compensation and rehabilitation, and other associated requirements are provided.
Biodiversity Act, 2017	Enforces the requirement for the protection of biodiversity, including endangered animals or organisms.
Wildlife (Conservation and Security) Act, 2012	Enforces the requirement for protection of wildlife species, declaration of protected areas, import and export of wild animals, determining penalties for certain offenses of wildlife-related crimes, and banning certain activities within 2 km from the boundary of a sanctuary.
Protected Area Management Rules, 2017	Management and co-management of forest-protected areas.
Marine Fisheries Act, 2020	Enforces the requirement for protection of marine species/ ecosystems, declaration of MPAs, fish sanctuaries, fishing zones, and ban on certain activities like destructive fishing by chemical or net, or explosives.
Protection and Conservation of Fish Act, 1950, and its amendment in 1982, and the Rules, 1985	Enforces the requirement for the protection of fish resources and bans certain activities like fishing during spawning periods and the killing of fish by explosives, guns, bows, and arrows.
Forests Act, 1927, and its amendments in 1982, 1989, 2000, and 2018	Prohibit certain activities in the declared reserved forest area, make various provisions for the conservation of forests, and provide guidelines for social forestry practice.
Antiquities Act, 1968, and Antiquities Preservation Rules, 1986	Presents requirements for the protection of antiquities and obtaining a license for the preservation or storage of any kind of movable antiquity.
Power System Master Plan, 2016	Ensure energy and power during project implementation.

Act/rules/law/Policies	Relevance for NSEZ Master Plan Implementation
Bangladesh Energy Regulatory Commission Act, 2003	Ensure efficient use, quality services, determine tariff, and safety enhancement of electricity generation.
Electricity Act, 2018	Ensures compensation to the person affected or the owner of the land affected for acquiring land for the construction of electricity towers, power stations, and substations.
Telegraph Act, 1885	Ensures compensation for temporary impacts resulting from the construction of lines and towers, full compensation for property damage, and compensation for any tree removal.
Factory Act, 1965, and Factory Rule, 1979	Ensures occupational rights and safety of factory workers and a comfortable work environment, effective waste management, and emergency response.
Boiler Act, 1923	Presents requirements for obtaining a boiler certificate, renewal, inspection, and reporting of accidents.
Explosive Act, 1884	Presents requirements for a license for explosive-related activities, i.e., import, transport, and possession.
Explosive Substances Act, 1908	Regulate the manufacture, possession, use, sale, and transport of explosives.
Natural Gas Safety Rules 1991 and amendments in 2003	Provide guidelines for the design and construction of gas transmission and pipeline systems.
Petroleum Act 2016	Presents requirements for import, transport, storage, production, refinement, blend, or reclaim by recycling of petroleum and other inflammable substances.
LPG Rules 2004 and Amendment 2016	Regulate import, transport, store and storage, bottling, and distribution-related matters.
Bangladesh Standards and Guidelines for Sludge Management, 2015	Provides standards and guidelines for effective sludge management and ensures human health & environment.
Imports and Exports (Control) Act, 1950	Presents licensing provisions for import or export.
Vehicle Act 1927 and Motor Vehicle Ordinance 1983	Regulates vehicular emissions, fitness and registration, and driving licenses.
Right to Information Act, 2009	Ensure the free flow of information to the citizens to establish good governance.
Bangladesh National Building Code (BNBC), 2020	Presents project requirements for infrastructure development.
Sand Quarry and Soil Management Act 2010, and amendments in 2023	Ensure the requirement for the selection of dredging sites, extraction, and use of sand or soil for the implementation of the Government/ NSEZ.

Act/rules/law/Policies	Relevance for NSEZ Master Plan Implementation
National Environment Policy, 2018	Ensure sustainable, long-term, and environmentally friendly use of all-natural resources.
Bangladesh Climate Change Strategy and Action Plan, 2009	For managing climate change-related issues and including disasters.
National Adaptation Programme of Action, 2009	For managing climate change-related issues.
Bangladesh Delta Plan, 2100	Ensure long-term water and food security, economic growth, and environmental sustainability while effectively reducing vulnerability to natural disasters and building resilience to climate change.
National Disaster Management Policy, 2015	Presents the strategies of disaster management.
Standing Orders on Disaster, 2019	Ensure inclusion of all stakeholders, and underscore the participation of women, children, elderly people, and persons with disabilities in all stages of disaster risk management.
National Biodiversity Strategy and Action Plan, 2016-2021	Ensuring the conservation and restoration of biodiversity, as well as the maintenance and improvement of the environmental stability of ecosystems.
Bangladesh Wildlife Conservation Master Plan 2015-2035	Promote the socio-economic development of local communities through the sustainable use of wildlife resources and ensure sustainable management and conservation of wildlife resources.
Bangladesh Dolphin Action Plan 2020-2030	Conservation and protection of dolphins as an endangered species and reducing threats to their survival in the surrounding marine environment, i.e., Sandwip Channel and the Bay of Bengal, where Dolphins are observed.
National Occupational Health and Safety Policy, 2013	Ensure occupational rights and safety of workers, a comfortable work environment, and reasonable working conditions for all employees.
National Child Labor Elimination Policy, 2010	Eliminate child labor, including hazardous work and the worst forms of child labor.
National Water Policy, 1999	Ensure the preservation of water quality in the Sandwip Channel, Bay of Bengal, and adjacent waterbodies.
National Land Use Policy, 2001	Ensure the best use of land for social development by ensuring the use of land is consistent with the natural environment.
National Energy Policy, 1995	Not relevant to the implementation of the NSEZ master plan.
Power Policy, 1995	Not relevant to the implementation of the NSEZ master plan.
National Industry Policy, 2016	Ensure the use of green technology to protect the environment, i.e., setting up of ETP, CETPs, CDM, and adoption of the 3R principle (Reduce, Reuse, Recycle).
Coastal Zone Policy, 2005	Ensure the sustainable management of natural resources and conservation of both aquatic and terrestrial ecosystems.

Act/rules/law/Policies	Relevance for NSEZ Master Plan Implementation
Coastal Development Strategy, 2006	Ensure the safety from man-made and natural hazards, as well as marine and coastal environmental development.
National 3R Strategy for Waste Management, 2010	Management of waste to minimize environmental, social, and economic problems.
National Health Policy, 2011	Ensure healthcare services for every citizen in the region.
National Policy for Safe Water Supply and Sanitation, 1998	Preventing water contamination and ensuring safe drinking water and sanitation.
National Forest Policy, 2016	Ensure sustainable management of forest, wildlife, and other forestry resources and climate resilience.
National Fisheries Policy, 1999	Provisions to protect the habitats and migration of fish resources.
National Shrimp Fish Policy, 2014	Ensure the conservation and management of marine shrimps.
National Tourism Policy, 2010	Ensure the tourism resources in the project region.
National Oil and Chemical Spill Contingency Plan, 2020	Ensure effective coordination in case of an incident or an emergency (oil and chemical spills).
KPI Safety Policy, 2013	Ensure adequate safety provisions for fire events as well as different natural disasters, i.e., cyclones and floods.
Renewable Energy Policy, 2008	Promote renewable energy as well as clean energy for CDM.
National Land Transport Policy, 2004	Conduct an EIA for new road construction under the NSEZ master plan.
National Agriculture Policy, 2018	Ensure food security, socio-economic development, and environmental conservation.
Petroleum Policy, 1993	Ensure safety and environmental protection from all the activities related to oil and gas in the NSEZ.
Bangladesh Economic Zones (Workers Welfare Fund) Policies, 2017	Create and ensure the workers' welfare fund for the Bangladesh Economic Zone.

4 DEVELOPMENTS IN NSEZ

This section defines the planned and reasonably defined developments in the vicinity of the EZ. If the EZ is able to interact with such developments (temporally and/or spatially), the EZ may be able to exert a potential cumulative impact. Information was obtained from the stakeholder engagement and consultation process, in particular, information has been obtained from local and national governmental organizations, and a review of available literature.

Detailed identification of other projects, activities, or actions that are likely to have significant impacts and can play an important role in the management of cumulative impacts is appropriate. In addition to other human activities, natural drivers that exert an influence on VC conditions were identified and characterized. Natural environmental processes-for example, flooding, have significant impacts on a variety of environmental and social components.

4.1 Master Plan of NSEZ

NSEZ has a total land area of 33,805 acres. The masterplan sets out: i) land uses, ii) access and transport networks, iii) precinct boundaries and characteristics, iv) zoning and permitted uses, v) development guidelines, and iv) environmental and green resilient rules to follow when implementing the zone. The NSEZ site has been divided into 12 separate precincts, which have their own land uses, refer to Table 4-1 and Figure 4-1.

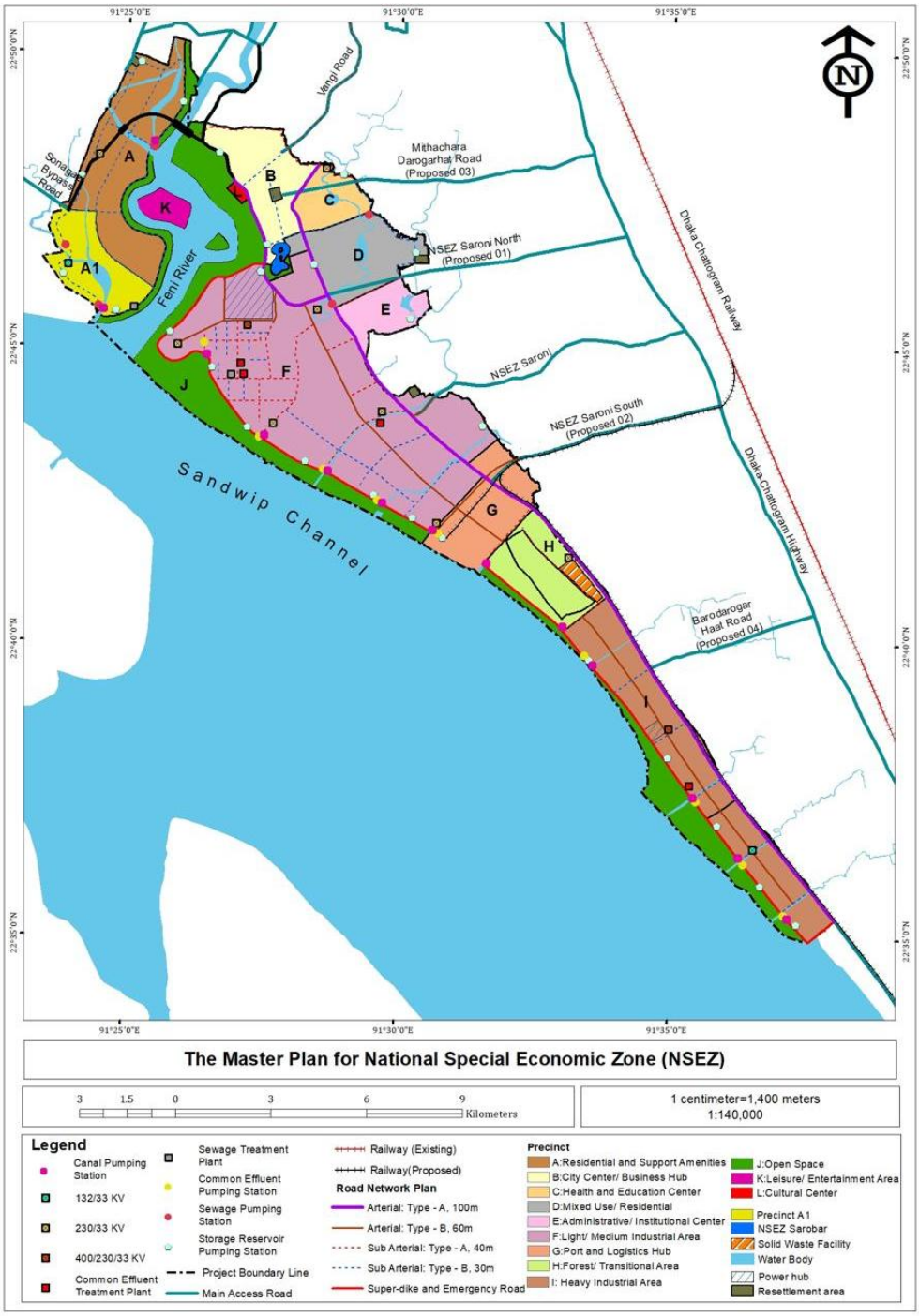
Table 4-1: NSEZ Precincts and Land Use by Size

Precinct	Land Use Designation	Land Use	Size in Acres	Size in %
A	Residential and Support Amenities	Low-scale residential units, convenience retail, and educational/ health	4,606.57	13.63
B	City Center/ Business Hub	Commercial, retail, administrative, and technology/ ICT-related uses, high-rise residential towers, and support amenities	1,732.91	5.13
C	Health and Education Center	Health clinics, hospitals, educational uses, support amenities, short-term residences/ dormitories, hotels, and parking facilities	837.35	2.48
D	Mixed-Use/ Residential	Low and medium residential typologies (apartments, dormitories, rowhouses, etc.), support amenities, convenient retail, and alike	1,778.59	5.26
E	Administrative/ Institutional Center	Government buildings, libraries, museums, galleries, shopping/retail, commercial facilities, support amenities, etc.	880.68	2.61
F	Light/Medium Industrial Area	Light & medium industries, and chemical hub only if buffered with landscaped boundaries	10,043.12	29.71
G	Port and Logistics Hub	Port and logistics-related activities and transport support amenities	1,802.29	5.32
H	Forest/Transitional Area	Forest conservation purposes but transitional to port, logistics, and/or heavy industrial uses, if required. Utility facilities are permitted	1,778.75	5.26
I	Heavy Industrial Area	Heavy industrial uses and associated support amenities	3,956.35	11.70
J	Open Space	Active and passive parks and open spaces. Limited development permitted	5,980.42	17.69

Precinct	Land Use Designation	Land Use	Size in Acres	Size in %
K	Leisure/ Entertainment Area	A variety of leisure and entertainment uses and support amenities	350.89	1.04
L	Cultural Center	Performing arts facilities, a cultural complex, sporting events, festivals, and large outdoor gatherings	56.85	0.17
		Total Area	**33,805**	**100**

Source: BEZA, 2020a

Figure 4-1: Master Plan for National Special Economic Zone

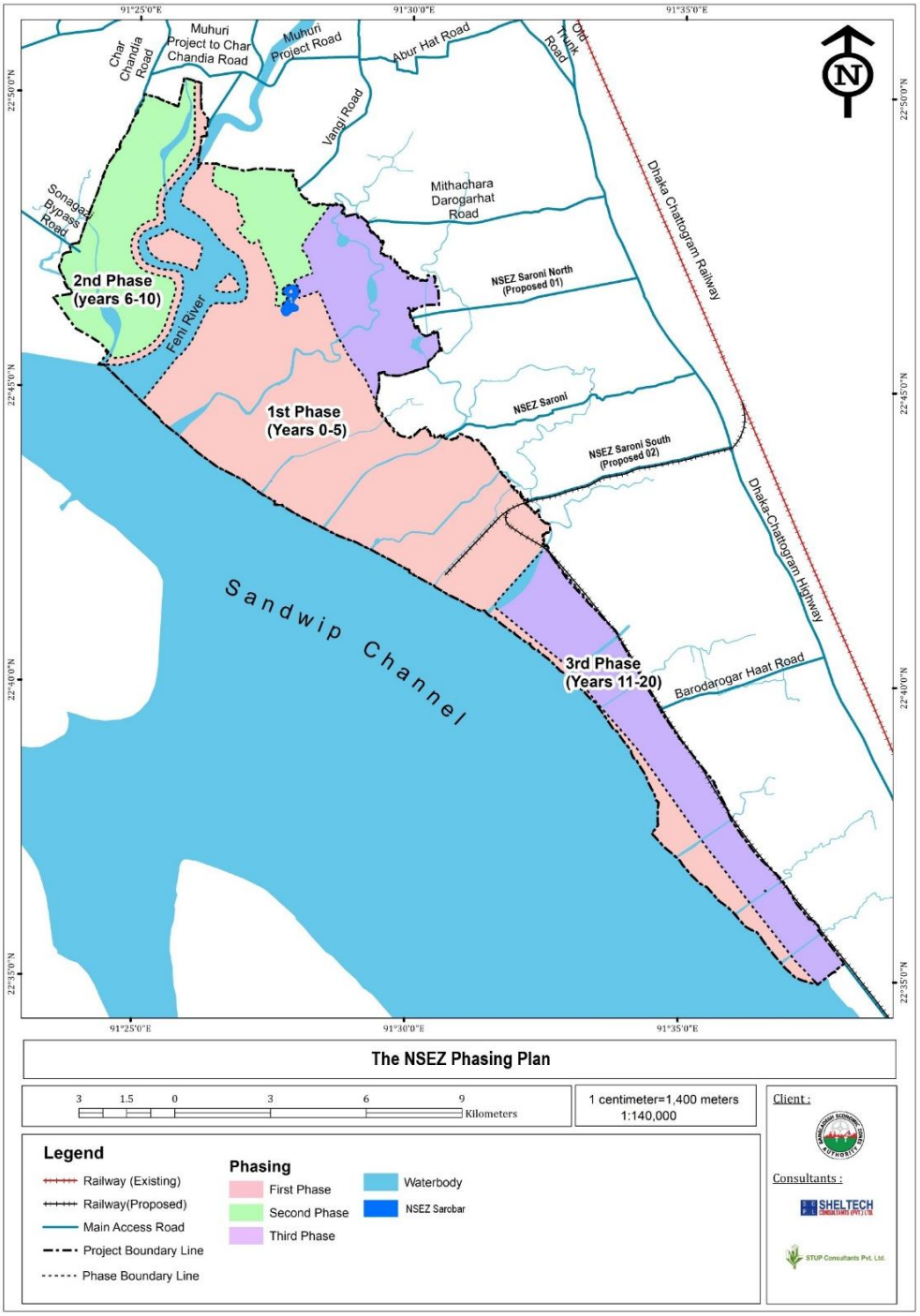


Source: BEZA, 2020a

4.2 Phasing of NSEZ

All the land within NSEZ has not yet been acquired, and some lands have been allocated to investors; it is more complicated to accurately phase the site according to best practices. Considering the above facts, the Master Plan area has been divided into three phases. The execution period is divided into three phases, i.e., a) Phase-I: years 0 - 5, b) Phase-II: years 6 -10, and c) Phase-III: years 11-20. A map of the NSEZ phasing plan is shown in Figure 4-2.

Figure 4-2: NSEZ Phasing Plan



Source: BEZA, 2020a

4.3 Project Under Consideration (PUC)

As discussed in Section 1.4, the proposed projects/activities (PUC) will develop infrastructures in NSEZ, which include transport networks, power networks, gas pipelines, water supply, waste management facilities, telecommunication networks, etc. The proposed project will develop the related facilities, which include the external road network, railway network, water transport, water supply, power transmission, embankment/ super dyke, plantation, etc. The related facilities will be mostly developed outside the NSEZ site. A brief description of the EZ and potential environmental and social interactions has been discussed in Table 4-2.

Table 4-2: Brief Description of EZ Components

SL#	EZ Components	Brief Description	Potential E&S Interaction
A.	**NSEZ Infrastructure**		
1.	Road network within NSEZ	A hierarchy of roads has been designed within NSEZ, which includes: • An Emergency Road - Super Dyke (100m ROW) • Arterial Roads - Type A (100m ROW) • Arterial Roads - Type B (60m ROW) • Sub Arterial Roads - Type A (40m ROW) • Sub Arterial Roads - Type B (30m ROW) • Collector Street - (20m ROW). The road network plan within NSEZ is shown in **Appendix A-1.**	• All the internal roads will be constructed on NSEZ land; no additional land will be required for this EZ. • Air and noise emissions during construction (fugitive emissions) and the operational phase (emissions from operational vehicles) of the road. • Water is required during the construction of the road.
2.	Power network within NSEZ	• Bangladesh Rural Electrification Board (BREB) power distribution network within the NSEZ from the substations. • Construction of (i) two 400/230/33 kV, (ii) six 230/33 kV, and (iii) two 132/33 kV substations within the NSEZ. The transmission network is shown in **Appendix A-2.**	• All the substations and distribution lines will be constructed on NSEZ land; no additional land will be required for this EZ. • Air and noise emissions during construction (fugitive emissions) of the transmission line. • Water is required during the construction of the transmission line.
3.	Gas supply	• Karnaphuli Gas Distribution Company Limited (KGDCL) has initiated a project entitled “Construction of Gas Pipeline for Mirsharai Economic Zone and KGDCL, Gas Distribution Network Up-gradation Project by KGDCL”. • Construction of 17 km Gas Transmission Line 1-Mirsharai Economic Zone (BKB to MEZ); its associated installations are DRS (at Ichhakhali Village and Char Sadar Bangla Bazar Village), valve stations (4 at Mirsharai), and CGS (at Noapara village).	• Additional land would be required for the laying of the pipeline and construction of the DRS, Valve Station. • Air and noise emissions during construction (fugitive emissions) of gas pipelines, DRS, and valve stations. • Water is required during the construction of the transmission line, gas pipeline, DRS, and valve station.

SL#	EZ Components	Brief Description	Potential E&S Interaction
		• Construction of 20 km Gas Transmission Line 2 -KGDC Gas Distribution Network (Anowara to Sikalbaha Upazila); its associated installations are valve stations (one at Shahmirpur, two at Char Patharghata, and three at Lakhera). The location of gas transmission pipelines and associated installation alignments is shown in **Appendix A-3** and **Appendix A-4.** Respectively.	
4.	Water supply	• Gross water demand for NSEZ is 10 MLD (in 2025), 130 MLD (in 2030), ,and 429 MLD (in 2040). • Source of raw water – In the Master Plan, the development of the NSEZ area has been divided into three main time horizons- 2020-2025, 2026-2030, and 2031-2040. Accordingly, the production of water from surface water, groundwater, desalination plants, CETPs, and rainwater harvesting has been planned for NSEZ **First Phase** • 10 Million Litter per Day (MLD) of groundwater will be extracted using Deep Tube Wells (DTW). **Second Phase** **Second Phase** • 30 MLD of groundwater will be extracted using DTW. • 100 MLD of surface water will be extracted from the Feni reservoir. **Third Phase** • 100 MLD of surface water will be extracted from the Feni reservoir. • 250 MLD water will be extracted from the Meghna River at Chandpur. • 50 MLD water will be sourced from from desalination plant. • 5 MLD water will be sourced from the rainwater harvesting system. • 24 MLD water will be sourced from CETP.	• Additional land would be required for the laying of the pipeline and the construction of the raw water treatment plant. • Air and noise emissions during construction (fugitive emissions) of the pipeline and the raw water treatment plant. • Depletion of groundwater resources due to the withdrawal of groundwater from bore wells.

SL#	EZ Components	Brief Description	Potential E&S Interaction
		The location of the proposed intakes and water treatment plant map, considering the source of the Feni Reservoir, is shown in **Appendix A-5**.	
5.	Waste management		
5. a.	Liquid waste- Sewage and industrial effluent treatment system	• Sewage generated from the NSEZ area will be treated through two (2) common sewage treatment plants (CSTP), • Industrial effluent generated from the different industries in the NSEZ area will be treated through four (4) common effluent treatment plants (CETP). • Treated effluent will be discharged into the drainage channels. The sewerage system planning, together with the locations of different pumping stations, is shown in **Appendix A-6**.	• Air and noise emissions during construction (fugitive emissions) of STP, ETP, and their network. • Discharge of treated wastewater into the drainage channel and finally into the Bay of Bengal.
5. b.	Solid waste- Municipal solid waste. (MSW), biomedical waste and hazardous waste management	• According to the Master Plan, total 777,084 tons/year amount of industrial solid waste will be generated including 245,644 tons/year of industrial solid waste and 531,440 tons/year of municipal solid waste from the EZ by the year 2040. • The estimated area required for only the MSW landfill will be 185 acres, and the total land requirement, considering other facilities like a composting plant, different infrastructure, an area for biomedical waste, and a separate area for hazardous waste storage and management, will be about 274 acres. The solid waste management system in NSEZ is shown in **Appendix A-7.**	• Air and noise emissions during construction (fugitive emissions) of a waste management facility. • Emission of methane, nitrous oxide, and non-methane volatile organic compounds from the MSW landfill site. • Generation of effluent from MSW and hazardous waste landfill sites.
5. c.	Stormwater drainage system	• Stormwater drains shall be provided on either side of the proposed road network of the area to collect the storm runoff generated from the catchment and get it discharged to the drainage channel for ultimate disposal to the sea. • An assessment of storm runoff contribution from NSEZ and areas outside NSEZ for individual drainage catchment areas has been made, considering rainfall intensity of 34.4 mm/hr. and average runoff	• Discharge of runoff water from the construction area and industrial area to the natural drainage channel and finally into the Bay of Bengal.

SL#	EZ Components	Brief Description	Potential E&S Interaction
		coefficient of 0.60 (keeping into consideration that rainwater harvesting will be extensively practiced in NSEZ for the area within NSEZ and an average runoff coefficient of 0.40 for the area outside NSEZ. The drainage network plan of NSEZ is shown in **Appendix A-8.**	
6.	Telecommunication network	• Bangladesh Telecommunications Company Limited (BTCL), a 22 km Optical Fiber Cable (OFC) will be laid from the main road of the Dhaka-Chattogram highway to NSEZ on both sides of the access road. Besides, another 15 km of OFC will be laid from Sonagazi of Feni to Mirsharai EZ through Dasherhat (Charchandia). • BTCL requested BEZA to provide approximately 1,600 square meters of area in a suitable place inside NSEZ to build a telecom compound. Now, the construction activities of a 4-storied telecom building are ongoing, which will house all telecom, transmission, IP, and power systems equipment, offices, and customer service centers, engine and substation rooms, residential buildings, etc.	• Air and noise emissions during construction (fugitive emissions) of the building and laying of the fiber network.
7.	NSEZ plantation	• NSEZ, in consultation with the Divisional Forest Officer (DFO) Coastal Plantation, Chattogram, draws up a plantation plan for 48,376 acres, which includes: o Subarna Char - low line water line area of Subarna Char will be kept for green coverage (24,924 acres). o 40% of the reclaimed Sabuj–Char (7048 acres). o Sabuj Char - low line water line area of Sabuj Char will be kept for green coverage (10,404 acres). o 60% - low line water line area of Sandeep Char will be kept for green coverage (6,000 acres). The proposed plantation area is shown in **Appendix A-9.**	• Land will be reclaimed for a plantation.
B.	**Related Facilities**		

SL#	EZ Components	Brief Description	Potential E&S Interaction
1.	External road network	• At present, the capacity of the local access roads adjacent to NSEZ is quite limited, and the number of existing links to NSEZ is inadequate to cater to the additional volume of traffic likely to be generated by NSEZ. • It is proposed that the existing connecting roads are mainly from Dhaka-Chattogram Road (i) Muhuri Project Road (Zorarganj - Muhuri Project), (ii) Bamonsundar Road, (iii) NSEZ Saroni, and (iv) Mohan Nagar Barodarogarhat Road will be upgraded to 4 4-lane road. A map of the external network is shown in **Appendix A-10**.	• Additional land would be required for the expansion of the existing road. • Air and noise emissions during the construction (fugitive emissions) of the road • Air and noise emissions during the operational phase of the road due to an increase in traffic.
2.	Railway network	• A new railway line has been proposed to establish the connectivity between the NSEZ and the existing Dhaka-Chattogram railway line. • The proposed railway line will take off from the existing Bartakia railway station, having a length of 13.4 km. Under this project, 6 new bridges, 11 culverts, and one station building will be constructed. • The project area will cover a total of seven mauzas in Mirsharai Upazila. The land requirement for the project is approximately 89 acres. A location map of the proposed railway line to connect NSEZ is shown in **Appendix A-11.**	• Additional land would be required for the construction of a new railway line. • Air and noise emissions during the construction (fugitive emissions) of the railway.
3.	Water transport	• A permanent jetty will be constructed at Sandwip channel for carrying the materials/goods, and it will be operated by BIWTA. • The capacity of the jetty will be 2,500 to 3,000 tons. The jetty will have provisions like a terminal building, parking yard, boundary wall, etc. • Capitan and maintenance dredging and land development will be required during the jetty construction and operation. The final jetty location and related information are shown in **Appendix 1, Figure 12.**	• Dredging and disposal of dredging materials. • Air and noise emissions during the construction of jetties. • Increase in river traffic. • Discharge of ballast and bilged water.
4.	Water supply	• The water demand in NSEZ will increase to 429 MLD by the year 2040. In order to meet the water demand, CWASA prepared a plan to source the water from the Meghna River.	• Additional land would be required for the laying of the pipeline and the construction of the raw water treatment plant.

SL#	EZ Components	Brief Description	Potential E&S Interaction
		• As per the plan, after extraction and purification 250 MLD of water from the Meghna River in Chandpur will be transported through a pipeline. A location map of the water supply pipeline project from Chandpur to NSEZ is shown in **Appendix A-13.**	• Air and noise emissions during construction (fugitive emissions) of the pipeline and the raw water treatment plant.
5.	Power		
5. a.	Source of power	• NSEZ requires about 3,652 MW of power (without diversity factor) in 2040 (PGCB, 2023). • To supply power to the NSEZ, a reliable transmission infrastructure has been proposed to be constructed internally in the industrial hub by the BEZA through the PGCB, along with the upgradation of the existing grid network. The EZ interventions have been provided in **Appendix A-14.**	• Air and noise emissions during construction (fugitive emissions) of the transmission line. • Water is required during the construction of the transmission line.
5. b.	Transmission and distribution network	• To provide a reliable power supply to NSEZ, transmission utilities have already been extended to the grid network by constructing a 7 km dedicated 400 kV overhead line, presently powered by 230 kV voltage and a 230/33 kV substation at the site. • In infrastructure planning, more links in 400 kV and 230 kV voltage levels may be considered with the national grid network to enhance the power supply reliability. • A 230/33 kV Substation having a capacity of 2 x 120/140 MVA (+ Future: 2x120/140 MVA) has been commissioned on 20th May 2020, feeding through a 400 kV architecture transmission line for a reliable power supply in the NSEZ. • The substation is for 400/230/33 kV substation, the rest 400/230kV substation section with 2x1000 MVA capacity.	• Additional land would be required for the construction of the transmission line. • Air and noise emissions during construction (fugitive emissions) of the transmission line. • Water is required during the construction of the transmission line.

SL#	EZ Components	Brief Description	Potential E&S Interaction
		• Currently, power is mainly supplied through the existing Baroirhat-Hathazari 132 kV double circuit line link from Baroirhat and Sitakundu substations. • The distribution utility of PBS is supplying power through a 33 kV feeder at NSEZ. The link will be strengthened in the near future by making Line IN Line Out (LILO) at Korerhat and Fatikchari, having a capacity of 120 MW. • There are two 33 kV source lines with a 477 sq mm conductor getting power from the Baroirhat 132/33 kV grid substation. • One 2x20/28 MVA substation has already been established by Bangladesh Steel Re-Rolling Mills Ltd. (BSRM). • Three substations are under construction, having a capacity of 2x10/14 MVA, 2x20/28 MVA, and 2x20/28 MVA, respectively. All project interventions inside of NSEZ have been shown in **Appendix A-15.**	
5. c.	Power	• BR Powergen Limited (BRPL) has established a 150 MW dual-fuel (Gas/HFO) engine-based power plant in the NSEZ. The power plant started its operation in December 2018	• Air and noise emissions from the power plant stacks
6.	Embankment/ super dyke	• Bangladesh Water Development Board (BWDB) under the Ministry of Water Resources (MOWR) has constructed a coastal embankment (suer dyke) with slope protection of 18.488 km, hydraulic structures, etc., for the protection of the EZ site from flood, saline intrusion, and erosion. • A 12.5 km embankment will be constructed along the coastline from Domkhali in Mirsharai to Guliyakhali in Sitakunda. The embankment, 27 meters high with a 60-meter base and 9.8-meter top, will host a two-lane road. Additionally, 6 to 8 sluice gates will be constructed.	• Additional land is required for the construction of the embankment. • Dredge materials required for the construction of the embankment • Change of drainage network, • Clearing of vegetation

SL#	EZ Components	Brief Description	Potential E&S Interaction
7.	Plantation	• BWDB, with the help of the Bangladesh Forest Department (BFD), planted trees in an area of 100 acres to create a green zone along the coastline of the Bay of Bengal as well as NSEZ. • Bangladesh Rural Advancement Committee (BRAC) has already planted approximately 42 thousand trees on 68 acres of land in Mirsharai, part of NSEZ, financed by HSBC Bank. • BEZA has planted 4 lakh trees so far in the NSEZ site and the closest road networks of NSEZ. • The Forest Department also planted trees along the super dyke with their own financing. In the NSEZ Sarobar area (a 112-acre dighi nearby), • BEZA has planted trees on approximately 3 acres of land. In the Sonagazi part, they have already planted some trees along the road.	• Land will be reclaimed for a plantation.

4.4 Past and Present Development

4.4.1 Infrastructure Development

Land Development: As discussed, the NSEZ is developed on reclaimed land, and its total area is about 33,805 acres. The major portion of the NSEZ area was a mangrove plantation area and a mudflat area, with a number of creaks and interconnecting channels. To reclaim the NSEZ area, BEZA, through BWDB, constructed a super dyke of 22.5 km along the coastline. The super dyke structure prevents tidal activity in the mangrove and mudflat areas. BEZA, or proposed industries, developed the land by raising the land with sand. In the north-western part of the NSEZ, land development activity has been completed, and construction activities by the different industries have been initiated. Approximately 2,500 ha. of land was already developed. It was reported that the filling materials were sourced from the Sandwip Channel by dredging.

Construction of External Road: A 9.5 km long two-lane NSEZ Saroni has been constructed from Dhaka-Chattogram Highway (N-1) to NSEZ.

Construction of internal roads: Internal roads in Zone 2A and 2B have been developed by BEZA.

Super dyke/ embankment: BEZA and BWDB have constructed a 22.5 km-long super dyke at the Mirsharai section of the NSEZ.

Establishment of borewell: BEZA, with the help of DPHE, has developed bore wells for the supply of water required for construction activities and the supply of water for operating industries (10 MLD).

Electricity transmission line and substation: A 7 km dedicated 400 kV overhead line, presently powered by 230 kV voltage and a 230/33 kV substation at the site. A 230/33 kV Substation having a capacity of 2 x 120/140 MVA (+ Future: 2x120/140 MVA) has been commissioned on 20th May 2020. The substation is for 400/230/33 kV substation, the rest 400/230kV substation section with 2x1000 MVA capacity. The present power supply capacity through the Mirsharai-BSRM 230kV Double circuit line is around 1100 MW.

Electricity distribution line: Power distribution lines for Zone 2A and 2B have been developed by BEZA.

Establishment of gas pipeline: The existing KGDCL gas distribution network capacity is 350 MMSCFD to facilitate adequate gas supply to bulk and industrial customers of KGDCL.

Stormwater network/Canal excavation: A stormwater drainage system (partial) along with a sluice gate has been developed for the Mirsharai section of the NSEZ.

4.4.2 Industrial Activity

Based on the available secondary information, there are seven operating industries and other under-construction industries in the NSEZ area. The list of industries has been provided in Table 4-3.

Table 4-3: Operating and Under Construction Industries in NSEZ

SL#	Type of Industry	Number	Name	Present status	Natural Resource Dependency (Water)	Air emission	Effluent Discharge
1.	Chemical	3	1. Bashundhara Chemical Industries 2. Asian Paints 3. Zinyoun Chemical	Operational	• Process and domestic water, • Water sourced from DPHE bore wells	• Particulate matter (PM), VOC • Back up DG sets- PM, NOx, and SOx from boiler	• Process effluent and domestic wastewater
2.	Ready Mix	1	1. Bashundhara Ready Mix	Operational	• Process and domestic water, • Water sourced from DPHE bore wells	• Particulate matter (PM)	NA
3.	Steel	3	1. Bashundhara Multi Steel 2. Nippon & McDonald Steel 3. McDonald Steel	Operational	• Cooling water and domestic water, • Water sourced from DPHE bore wells	• Emission of PM, NOx, • Emission from boiler Backup DG sets- PM, NOx, and SOx	• Cooling blowdown water and domestic wastewater
4.	Hair oil, Shampoo, and a PET bottle	1	1. Marico Bangladesh	Operational	• Industrial water and domestic water, • Water sourced from groundwater	• Emission of PM, NOx, • Emission from boiler Backup DG sets- PM, NOx, and SOx	• Cooling blowdown water and domestic wastewater
5.		1	1. Samuda Construction Limited	Operational	• Industrial water and domestic water, • Water sourced from groundwater	• Emission of PM, NOx, • Emission from boiler Backup DG sets- PM, NOx, and SOx	• Cooling blowdown water and domestic wastewater

SL#	Type of Industry	Number	Name	Present status	Natural Resource Dependency (Water)	Air emission	Effluent Discharge
6.	Thermal power plant	1	1. BR Powergen Limited (BRPL)- 150 MW Dual Fuel (Gas/HFO) Engine-Based Power Plant	Operational	• Stack emission- PM, NOx, and CO	• Colling water, and domestic water	• Cooling blowdown water and domestic wastewater
7.	Chemical	1	1. Jinyuan Chemicals Limited 2. Colgate Palmolive ACI Limited	Under construction	• Process and domestic water, • Water sourced from DPHE bore wells	• Particulate matter (PM), VOC • Back up DG sets- PM, NOx, and SOx from boiler	• Cooling blowdown water and domestic wastewater
8.	Automobile	1	1. Bangladesh Auto Industries	Under construction	• Domestic water, • Water sourced from DPHE bore wells	• Back up DG sets- PM, NOx, and SOx from boiler	• Domestic wastewater
9.	Yarn	1	1. Modern Syntex Limited	Under construction	• Domestic water, Water sourced from groundwater	•	• Waste Water generation from yarn dyeing
10.	Food processing	2	2. RSPL Health	Under construction	• Domestic water, Water sourced from groundwater	• Fugitive emissions from the process, mainly particulate matter, • Backup DG sets- PM, NOx, and SOx	• Domestic wastewater
11.	Green Pharmaceuticals	1	• Healthcare Life Science Limited	Under construction	• Domestic water, Water sourced from groundwater	• -	• Wastewater generated from the process & domestic wastewater

SL#	Type of Industry	Number	Name	Present status	Natural Resource Dependency (Water)	Air emission	Effluent Discharge
12.	Electrical	1	• SQ Electricals Limited	Under construction	• Domestic water, Water sourced from groundwater	• Backup DG sets- PM, NOx, and Sox	• Domestic wastewater
13.	Glassware	1	• Kiam Glassware Industries	Under construction	• Domestic water, Water sourced from groundwater	• Fugitive process emission (PM). • Backup DG sets- PM, NOx, and SOx.	• Domestic wastewater
14.	Medical Products	1	• Jiehong Medical Industries	Under construction	• Domestic water, Water sourced from groundwater	• -	• Wastewater generated from the process & domestic wastewater

4.5 Reasonably Foreseeable Future Actions (RFFAs)

4.5.1 Infrastructure Development

The committed infrastructural developmental activities during 2025-2030 are listed below:

- Land acquisition, resettlement, and land development (partial). It is expected that approximately 25,350 acres of area will be developed.
- Dredging requirements - approximately 338.08 million m³
- Central Effluent Treatment Plant establishment - 2 nos. (50+50 MLD)
- Sewage Treatment Plant establishment - no
- Land acquisition, resettlement, and land development (partial)
- Expansion of internal road - NSEZ Saroni (2 lanes)
- Construction of external road – other roads (NSEZ Sarani North, NSEZ Sarani South, and EZ site to Sonagazi-Feni Road) to connect Dhaka-Chattogram Highway and local roads for workers' mobility (partial)
- Expansion of internal roads – inside of different zones in NSEZ (partial in phase 2 area)
- Super dyke/embankment at Feni site
- Railway Transport - 13.4 km length, 6 new bridges, 11 culverts, and 1 station building
- Water Transport/Jetty - 1 under BEZA, 1 under BIWTA, 2 under the private sector (Bashundhara and Samuda)
- Establishment of a water treatment plant - 100 MLD from the Feni reservoir
- Surface water from Meghna River (CWASA) - 250 MLD
- Establishment of a desalination plant
- Electricity Distribution line - different zones in NSEZ (partial in phase 2 area)
- Establishment of gas pipeline - different zones in NSEZ (partial in phase 2 area)
- Waste management facility (partial)
- Township development at the Feni and Mirsharai site (accommodation facilities for the workers, investors, etc.)
- Telecommunication network - 15 km of OFC will be laid from Sonagazi of Feni to Mirsharai EZ through Dasherhat (Char Chandia)
- Stormwater network/Canal excavation (partial in phase 2 area)
- Plantation inside of NSEZ and outside of NSEZ (partial in phase 2 area)
- Dredging and landfill/land development (partial) for the Feni site

Proposed projects/investors - 132 Nos. (attached list)The full development scenario (Existing + Under Construction + Committed + Planned Projects): *(2031 - 2040)* infrastructure in the NSEZ area is as follows:

- The land amount is approximately 33,805 acres
- Land acquisition, resettlement, and land development (Complete)
- Dredging requirements - approximately 450.89 million m³
- Central Effluent Treatment Plant establishment - 4 nos. (50+50+100+150 MLD)
- Sewage Treatment Plant establishment - 2 nos. (45+80 MLD)
- Construction of external road – other roads (Complete in phase 3 area)
- Construction of internal roads - different zones in NSEZ (Complete in phase 3 area)
- Establishment of gas pipeline - different zones in NSEZ (Complete in phase 3 area)
- Electricity Distribution line - different zones in NSEZ (Complete in phase 3 area)
- Stormwater network/Canal excavation (Complete in phase 3 area)
- Waste management facility (Complete)
- Super dyke/embankment (12.5 km from Domkhali in Mirsharai to Guliyakhali in Sitakunda. 27 meters high with a 60-meter base and 9.8-meter top, with hosting a two-lane road).
- Plantation inside of NSEZ and outside of NSEZ (Complete in phase 3 area)

- Dredging and landfill/land development (Complete in phase 3 area)
- All committed/planned projects (Complete) (including heavy industries in the Sitakunda area)

4.5.2 Industrial Activity

As per the Master plan, around 132 proposed projects or investors will set up the industries in the NSEZ area. The list of projects has been provided in Table 4-4.

Table 4-4: Proposed Industries in NSEZ

SL#	Type of Industry	Number	Name
1.	Textiles	67	1. Amann Bangladesh Ltd. 2. Visual Knitwears Ltd. 3. Unigears Ltd. 4. Towel Tex Ltd. 5. Tafof Apparels Ltd. 6. Sterling Denims Ltd. 7. SQ Celsious Ltd. 8. Shin Shin Apparels Ltd. 9. SF Denim Apparels Ltd. 10. Sams Attrie Ltd. 11. RNSCO Sweaters Ltd. 12. RDM Appreals Ltd 13. R.O Textiles Mills (Pvt.) Ltd. 14. Musk Trousers Ltd. 15. Afrah Dressess Ltd. 16. Advanced World Ltd. 17. Unitex 18. Dysin Internationa Ltd 19. MajumdarImage Graments Ltd 20. Global Shirt Ltd 21. Energypac fashion LTD 22. EH Fabrics LTD 23. Denim Fashion LTD 24. Delicate Garments 25. Columbia Apearls LTD 26. Chowdhury Fashion Wear LTD 27. Babylone Garments LTD 28. Babylon Casualwear LTD 29. Israq Spinning Mills Ltd 30. Alif Embroidery Village Ltd. 31. Raquef Apparels Washing & Packaging Industry Ltd. 32. Metro Spinning Ltd 33. Maksons Group 34. Reza Fashion Ltd 35. East Asian Cox 36. Juhana Tex Ltd 37. Nafa Apparels Ltd 38. Ananta Apparels Ltd. 39. Pacific Cotton Ltd 40. Aswad Composite Mills Ltd

SL#	Type of Industry	Number	Name
			41. Maf Shoes Ltd. 42. TBH Fashion Tex (Pvt) Ltd 43. Apparel gallery ltd 44. Alps Apparels LTD 45. Karim Textile Ltd 46. Columbia Garments LTD 47. Arman Haque Denims Ltd. 48. Impressive Knit Comp. Ltd. 49. Integra Apparels (Bangladesh) Ltd. 50. Quality Fashion Wear Ltd 51. Shamser Rezia Fashion Ltd 52. Mars Sportswear Ltd 53. Al-ittefaq textile ltd 54. Graphics Textiles LTD 55. Garments Home Ltd 56. Four H fashion LTD 57. Clifton Cotton Mills Ltd 58. Charm Fashion 59. Metro Knitting & Dyeing Mills Ltd 60. Aman Spinning Mills Limited 61. Ratools Apparels Ltd 62. Uranus Apparels Ltd 63. Aust- Bangla (JV) Accessories Industries Ltd. 64. Metro Spinning Ltd 65. Fakhruddin Textile Ltd/Urmi 66. Well Composite Knit Ltd 67. Sanzy Textile
2.	Chemical	9	1. Jiangsu Yabang Dyestuff Co. 2. Zhuzhou Jinyuan Chemical Industry Co. 3. Samuda Chemical Complex Ltd. 4. SPL Petrochemical Complex Limited 5. Samuda Food Products Ltd 6. Dysin International Ltd 7. Unitex 8. Berger Paints Bangladesh Limited 9. Auxicolour Bangladesh
3.	Steel	11	1. CCECC Bangladesh LTD 2. BSRM Steel Mills Limited 3. PHP Steel Works Limited 4. Jahangir Steel Mill Ltd 5. McDonald Steel Building Product Ltd. 6. PEB Steel allience LTD 7. Surjin Tech Co. Ltd 8. Others proposed
4.	Consumer Durables	10	1. BSRM (Bangladesh Agriculture Products Ltd.) 2. Ayurvedia Pharmacy Limited 3. Eurasia Food Processing (BD) Ltd. 4. Overses Marketing Corp. (Pvt) Ltd. 5. Arab Bangladesh Foods Ltd

SL#	Type of Industry	Number	Name
			6. Bangladesh Edible Oil Ltd 7. Trade-MAK Partners 8. Master racks and Furniture 9. KIAM Metal Industries Ltd. (BRB Cables) 10. CNG Zone Ltd.
5.	Power Plant	4	1. Confidence Power Holdings Ltd. 2. Chittagong Power Company Ltd. (BSRM) 3. BR-Pwergen Ltd. 4. GAS-1 Ltd.
6.	Electrical	3	1. Mango Teleservices Limited 2. BDCOM Online Ltd. 3. Vicar Electricals Ltd.
7.	Health	4	1. Green Health Ltd. 2. HA Tech Ltd. 3. Healthcare Pharmaceuticals Ltd. 4. Jeihong Medical Products Co. Ltd.
8.	Heavy construction equipment	4	1. Walton Hi-Tech Industries Ltd. 2. Star Allied Venture Ltd (GPH Ispat Ltd.) 3. Ifad Autos Limited 4. Uttara Motors Ltd.
9.	Hotel & Tourism Service	4	1. Sayeman Beach Resort Ltd. 2. Knit Plus Ltd. 3. Biotec Printing Plus Limited 4. AMEZ Infrastructure Ltd.
10.	LPG	2	1. Fawn International 2. Super Refinery
11.	Paperboard & Plastic	6	1. Clifton Apparels Ltd. 2. Astech Ltd. 3. Karmo Foam & Adhesive Ind. Ltd. 4. ACI Limited 5. N. Mohammad Plastic Ltd. 6. Modern Syntex Ltd.
12.	Brick Kiln	17	1. Different locations
13.	Paint	2	
14.	Petroleum Refinery	1	
15.	Fertilizer	2	

4.6 External Stressors or Drivers

Human activities and natural drivers that exert an influence on VC conditions have been identified and characterized based on existing knowledge and secondary information available in the public domain. Any impacts or risks these identified drivers may have on the identified VCs have been linked and assessed.

4.6.1 Industrialization

It is proposed to develop the workers' accommodation within the NSEZ. It is also proposed that drinking water, electricity, MSW collection, and a sewage treatment system will be provided in the NSEZ. It is estimated that 1.4 million workforces will be immigrated to the NSEZ area by 2040. The entire workforce may not be accommodated in the NSEZ residential area. Employees and workers of existing and upcoming industries (during the construction and operational stages) mainly stay in the nearby area. The nearby area in these industry clusters is rural. The residential areas have an electric supply and drink water mainly from household-level tube wells and bore wells provided by Union Parishads. There is no sewerage network, sewage treatment system, or solid waste collection and disposal system. Industrialization will increase the consumption of natural resources like water and generate sewage and municipal solid waste. Presently, there is no water supply, sewage treatment plant, or municipal solid waste disposal site.

4.6.2 Climate Change and Natural Hazards

Climate change projections for Bangladesh predict increased temperature and drought, change in the precipitation intensity-frequency regime, increased flooding, salinity intrusion, and increasing sea levels. Climate variability poses economic and health concerns, including increased drought durations, decreased water quality, increased risk of disease, crop loss and failure, infrastructure damage, disruption of energy services, biodiversity loss, land degradation, increased erosion, and reduced mangrove habitat. Furthermore, Bangladesh is prone to various natural hazards that have significant environmental, social, and economic impacts. Climate change has the potential to intensify the impacts of Bangladesh's natural hazards.

Extreme climate events have become more frequent in Bangladesh, and future events and impacts have been forecasted to intensify. The coastal regions of Bangladesh are the most susceptible to cyclones and associated tidal surges, making the area vulnerable to extreme weather events. The IPCC concludes that there is evidence of a 5%-10% increase in intensity (wind speed) that would contribute to enhanced storm surges and coastal flooding, and projects a 20% increase in the intensity of associated precipitation that would contribute to flooding (Agrawala et al., 2003).

Sea level rise will directly result in increased coastal flooding, which will increase in the event of storm surges. Sea level rise in Bangladesh is higher than the mean average rate of global sea level rise over the past century, because of the effects of tectonic subsidence (Rahman and Alam, 2003). The recent IPCC Fourth Assessment Report states that glaciers in the Himalayas are receding faster than in any other part of the world, and this can be attributed primarily to global warming (Cruz et al., 2007). Sea levels are expected to rise by an average of two to three mm per year during the first part of this century (IPCC, 2007). The effects on the coastal areas will be severe and include erosion, coastal land subsidence, siltation of river estuaries, reduced sedimentation, waterlogging, and saltwater intrusion.

Climate change is also associated with hotter summers and colder winters. Temperatures in Bangladesh have increased by about 1°C in May and 0.5°C in November between 1985 and 1998, and further temperature increases are expected. However, although the overall climate is warming, temperature extremes are increasing, and winter temperatures as low as 5°C were recorded in January 2007, reportedly the lowest in 38 years (Reid and Sims, 2007).

Seismically, Bangladesh is divided into four seismic zones, i.e., low (zone 1), moderate (zone 2), severe (zone 3), and very severe (zone 4) (BNBC, 2020). According to this seismic zoning, the NSEZ site and study region fall in a severe seismic intensity zone (zone 3) with coefficients of 0.28g and a moderate seismic intensity zone (Zone 2) with coefficients of 0.20g.

There are four different types of floods encountered in Bangladesh, i.e., flash floods, river floods, tidal floods, and storm surges. The EZ region is mainly subjected to moderate flash floods and severe tidal/storm surge areas.

5 VALUED COMPONENTS

5.1 Impact Sources Scoped into CIA

The PUC has the potential to interact with VCs like land environment (land use), air environment (air quality), water environment (resources and quality), biodiversity (mangrove and mud flood, estuarine habitat), occupation and livelihood (land-based and river-based), and community health and safety. The industrial activities and other developments that have potential interaction with the above-mentioned VC have been scoped for CIA study. The consultant has considered the following sources of cumulative impacts based on the IFC Good Practice Handbook Guidance:

5.1.1 Past and Present Projects in the CIA Spatial Area

The past and present projects or activities with the potential to cause cumulative impacts on VCs include the following:

- Industries:
  - *Existing industries*- thermal power plants, steel, chemical, and ready-mix industries.
  - *Under-construction industries*: chemical industries, steel, food processing industries, textile & garments.
  - *BEPZA unit Investors:* Investors from different national and international parts are likely to set up industry in the BEPZA area.
  - *Proposed industries*: around 132 new industries/investments are likely to be set up in the economic zone.
- Other development projects/activities in the area
  - Road and rail network to NSEZ
  - Water supply from the river and groundwater
  - Power transmission and substation.
  - Telecommunication network.
  - Construction of jetties for river transport
  - Embankment for flood protection
  - Dredging and landfilling for land development

5.1.2 Reasonably Foreseeable Future Actions (RFFAs)

Proposed industrial projects identified in the NSEZ area- phase-wise development has been considered in CIA.

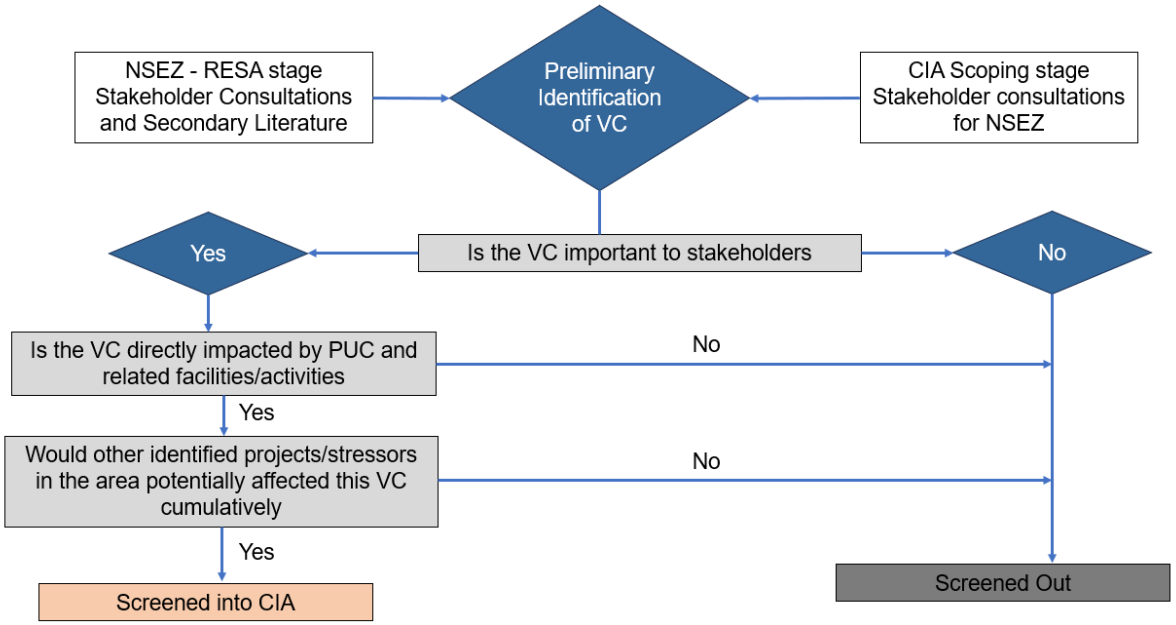
5.1.3 External Stressors or Drivers

The external drivers and stressors, like industrialization and climate change-flood have been considered by the CIA.

5.2 VC Selection for CIA Study

The VC screening process was conducted to determine which of the preliminary VCs would be included in the CIA (Refer to Figure 5-1). The VC must be reasonably expected to be affected by some combination of other projects and/or external stressors and the PUC.

Figure 5-1: VC Screening Process



Based on the above-mentioned logical framework, preliminary VCs have been identified. The key VCs selected for this CIA are presented in Table 5-1.

Table 5-1: VC Screening and Selection

Preliminary VC	Impacted by PUC	Important to stakeholders	Impacted by past, present, and future projects & developmental activities	Impacted by Stressors	Screening in or out of the CIA	Justification
Land use	Yes	Yes	Yes	Yes	Yes	The total area of NSEZ is 33,805 acres. The land use and land cover before the development of the NSEZ revealed that mangrove and mud-flood areas (especially towards the Mirsharai and Sitakunda sides) and mud-flood and low-lying agriculture land were used for pisciculture toward the Sonagazi side. Agricultural land and waterbodies are other land-use areas in the NSEZ area. NSEZ infrastructure planned for the economic zone (EZ) will be mostly developed within the EZ; therefore, no additional land will be required. However, the associated infrastructure under PUC planned for the EZ would require additional land, which includes private agricultural land and government land. The Land amount for Scenario 1 is 16,900 acres, Scenario 2 is 25,350 ,and Scenario 3 is 33,805. The induced development occurring beyond the boundaries of the BEZA area will result in the conversion of agricultural lands to other land uses, such as residential, commercial, or industrial purposes. The potential impact on land use from PUC and existing, and proposed industries and stressors would have a cumulative impact on land use. Therefore, land use as VC has been considered for the CIA.

Preliminary VC	Impacted by PUC	Important to stakeholders	Impacted by past, present, and future projects & developmental activities	Impacted by Stressors	Screening in or out of the CIA	Justification
Soil & sediment quality	Yes	No	Yes	No	No	Earthworks, improper handling and disposal of construction waste, and hazardous waste generated during construction works from PUC and other industrial projects may have localized impacts on soil quality. The ESIAs reports prepared for individual projects have a proposed management plan for the handling and disposal of construction waste and hazardous waste. Proper implementation of the management plan is unlikely to leave any residual effects on the quality of soil and sediment. A waste management facility (MSW and hazardous waste) will be developed within NSEZ under PUC. Implementation of a waste management facility will minimize the impact on soil and sediment quality. The other identified projects (refer to Section 4.5.2) are likely to have a localized impact on soil and sediment quality. The cumulative impacts on this VC are not anticipated and, therefore, not scoped into the CIA study.
Topography & drainage	Yes	Yes	Yes	Yes	Yes	The linear projects under PUC (road, railway network, water supply pipeline) are likely to cross the number of drainage channels. The construction of these facilities without considering micro-drainage has the potential to have an impact on the local drainage system. The Phase I industrial project will be developed in BEZA, which is reclaimed land. Most of the area was vacant. The partial land was mangrove plantations and mudflat areas with creeks and interconnecting channels. A super dyke was constructed all along the coast. Only four drainage

Preliminary VC	Impacted by PUC	Important to stakeholders	Impacted by past, present, and future projects & developmental activities	Impacted by Stressors	Screening in or out of the CIA	Justification
						channels have been retained and regulated by sluice gates. The super dyke structure prevents tidal activity in the mangrove and mudflat areas. All the interconnecting micro-drainage channels have been filled up due to land development. Due to the construction of the Phase I industrial project, there is a potential for waterlogging and flooding due to topographical and drainage changes. Considering these topography and drainages have been included in the CIA.
Air environment (Air quality)	Yes	Yes	Yes	Yes	Yes	During the construction of the PUC, Stage 1 industrial project, fugitive emissions are likely to be generated, potentially having a negative impact on the local environmental quality. Land development activity and the construction of industries have the potential to negatively impact the air environment. The existing industries, like thermal power plants, steel industries, chemical industries, and glass industries, have the potential to adversely affect air quality. The operating industries, future industries, and development activities have the potential to cumulatively impact ambient air quality. Therefore, the air environment as a Valued Component (VC) has been screened for the Cumulative Impact Assessment (CIA).
Acoustic environment	Yes	No	Yes	No	No	During the construction of the PUC and Stage 1 industrial project, the operation of construction machinery,

Preliminary VC	Impacted by PUC	Important to stakeholders	Impacted by past, present, and future projects & developmental activities	Impacted by Stressors	Screening in or out of the CIA	Justification
(noise quality)						equipment, and transport vehicles has the potential to impact localized ambient noise quality. During the operation stage of the Phase I industrial project, the noise impact is expected to be localized, as plants and machinery will be operated within industrial sheds, which will act as noise barriers. Again, there are no settlements in the NSEZ, and the settlements are located on the eastern side of the NSEZ. The cumulative impacts on this VC are not anticipated and, therefore, not scoped into the CIA study.
Groundwater resource	Yes	Yes	Yes	Yes	Yes	During the construction stage of the PUC and Stage 1 industrial project, the required water will be sourced from the BEZA water supply. Similarly, during the operational stage, some projects might require processing water and domestic water, which will also be sourced from the BEZA water supply. Presently, BEZA is sourcing water from groundwater (bore wells). NSEZ has planned to source the water from surface water (Feni River and finally from Meghna River). Prior to the implementation of surface water supply for the NSEZ, water will be sourced from groundwater. The local people also depend on groundwater resources for drinking water and domestic uses. The induced industrialization is expected to increase the population and likely increase the demand for groundwater for water supply and domestic uses. The cumulative impacts on this VC are

Preliminary VC	Impacted by PUC	Important to stakeholders	Impacted by past, present, and future projects & developmental activities	Impacted by Stressors	Screening in or out of the CIA	Justification
						anticipated, and therefore, it has been scoped into the Cumulative Impact Assessment (CIA) study.
Surface Water Quality	Yes	Yes	Yes	Yes	Yes	The construction of the jetties (one under PUC and three by the 1st phase industries) is likely to contribute to the total dissolved solids (TDS) and total suspended solids (TSS) in surface water quality. The required fill materials for the site development have been sourced from the Sandwip channel. The dredging activities for the sourcing of fill materials will also contribute to the TDS and TSS in surface water quality. The surface runoff from the construction site during the rainy season is also likely to contribute to the TDS and TSS in the surface water quality. The operation of diesel-powered vessels during the construction and operational stage of the Stage 1 industrial project is likely to contribute oil and grease to the surface water. The discharge from the chemical industry, textile plants, and thermal power plants in the Stage 1 industrial project has the potential to have a negative impact on surface water quality. The operation of passenger and cargo vessels also has the potential to impact surface water quality due to accidental spillage and leakage of oil and grease from machinery, and the disposal of sewage from the vessels. All the above-mentioned potential sources of impact will have a cumulative impact on surface water quality.

Preliminary VC	Impacted by PUC	Important to stakeholders	Impacted by past, present, and future projects & developmental activities	Impacted by Stressors	Screening in or out of the CIA	Justification
Mangrove and mudflat habitat	Yes	Yes	Yes	Yes	Yes	The major portion of the NSEZ area has been planned on reclaimed land. The land was reclaimed through land-filling activities carried out by BEZA or individual industries. A super dyke was constructed all along the coast for the BEZA land reclamation activity. Only four drainage channels have been retained. The super dyke structure prevents tidal activity in the mangrove and mudflat areas. All the interconnecting micro-drainage channels have been filled up due to land development. As the tidal water entering the mangrove and mudflat area has been prevented, it will be degraded, and the species composition will be modified, so only freshwater-tolerant species will remain in the habitat. Considering all the potential sources of impact, the mangrove and mudflat habitat has been scoped in for the Cumulative Impact Assessment (CIA).
Aquatic and Migratory Birds	Yes	Yes	Yes	Yes	Yes	It was reported that the mangrove and mud-flood habitat and estuarine area have provided the habitat for the migratory bird species. NSEZ land development and PUC (construction of related facilities) have a potential impact on land use, especially marshy land and wetlands. Land use potential to have a negative impact on migratory birds' habitats, The noise and artificial illumination from the existing industries and proposed industries have a potential impact on migratory bird species.

Preliminary VC	Impacted by PUC	Important to stakeholders	Impacted by past, present, and future projects & developmental activities	Impacted by Stressors	Screening in or out of the CIA	Justification
						PUC, past, present, and future industries, and developmental projects potential to have a negative impact on surface water quality and aquatic ecology. This has a negative impact on the food base of the migratory bird species. Considering all the potential sources of impact, fish and fish habitats have been scoped in CIA.
Protected Marine fauna	Yes	Yes	Yes	Yes	Yes	The underwater noise and vibration for PUC, terminals, ferry ghats, and river port operations have a potential impact on dolphins, especially their communication and feeding. Accidental spillage of oil and grease from the PUC, terminals, and ferry ghats during river port operations has a potential impact on dolphins. Even a major oil spillage can cause the death of dolphins. PUC and other projects, including construction of jetties, dredging activity for sourcing of fill materials, movement of vessels, underwater noise, etc., have potential cumulative impacts on aquatic protected species. Considering these, this VC has been scoped in the CIA.
Livelihood (land-based & fishermen's livelihood)	Yes	Yes	Yes	Yes	Yes	Procurement of private land for NSEZ and Associate infrastructure under PUC has a potential impact on land use- agricultural land and pisciculture land use. Procurement of these and the potential to have a negative impact on livelihood.

Preliminary VC	Impacted by PUC	Important to stakeholders	Impacted by past, present, and future projects & developmental activities	Impacted by Stressors	Screening in or out of the CIA	Justification
						The stakeholder consultation revealed that local villagers have livestock, and the mangrove area is being used for grazing. The entire mangrove area under NSEZ has been acquired for the project, and the same will be developed for industries, and ultimately, grazing land will be affected, and the livelihood of the local people. During the construction and operational stages of developmental activities, marine water quality may have a potential negative impact. The operation of jetties and vessels can affect fisheries. Fishermen's livelihoods are influenced by factors such as fish breeding and nursing grounds, water quality, and aquatic ecology. Therefore, based on a multidisciplinary understanding of other related variables of environmental concern (VCs), cumulative impacts on fisheries and fishermen's livelihoods should be considered. All potential sources of impact on livelihood (land-based & fishermen's livelihood) have been scoped in the CIA.
Social well-being	Yes	Yes	Yes	Yes	Yes	Due to the stage 1 industrial project, employees and workers will migrate to the surrounding area of BEZA, leading to an influx of labor and population. This population increase has the potential to negatively impact existing socio-economic infrastructure and amenities. The stage 1 industrial project, along with all existing and future industries and development activities, has the potential for cumulative impacts on demography. Additionally, the development of roads, hospitals, education

Preliminary VC	Impacted by PUC	Important to stakeholders	Impacted by past, present, and future projects & developmental activities	Impacted by Stressors	Screening in or out of the CIA	Justification
						facilities, other social infrastructure, etc., has the potential for cumulative impacts on community dynamics. Therefore, this variable of environmental concern (VC) has been scoped for the CIA.

5.3 Indicators and Thresholds to Assess Cumulative Impacts

Indicators have been developed to assess the cumulative impact on key VCs. The overall consideration for the development of indicators is as follows:

- Representative of VCs
- Easily measurable
- Easily understood by the decision-makers and other key stakeholders.

Threshold levels for the indicators have been developed to assess the significance of cumulative impacts on VCs. The threshold level for an indicator has been considered either in the form of national regulatory standards, international guidelines (in the absence of national standards), or by comparing with national trends. The threshold value of the indicators selected is presented in Table 5-2.

Table 5-2: Indicators & Threshold Value for Assessment of Cumulative Impacts

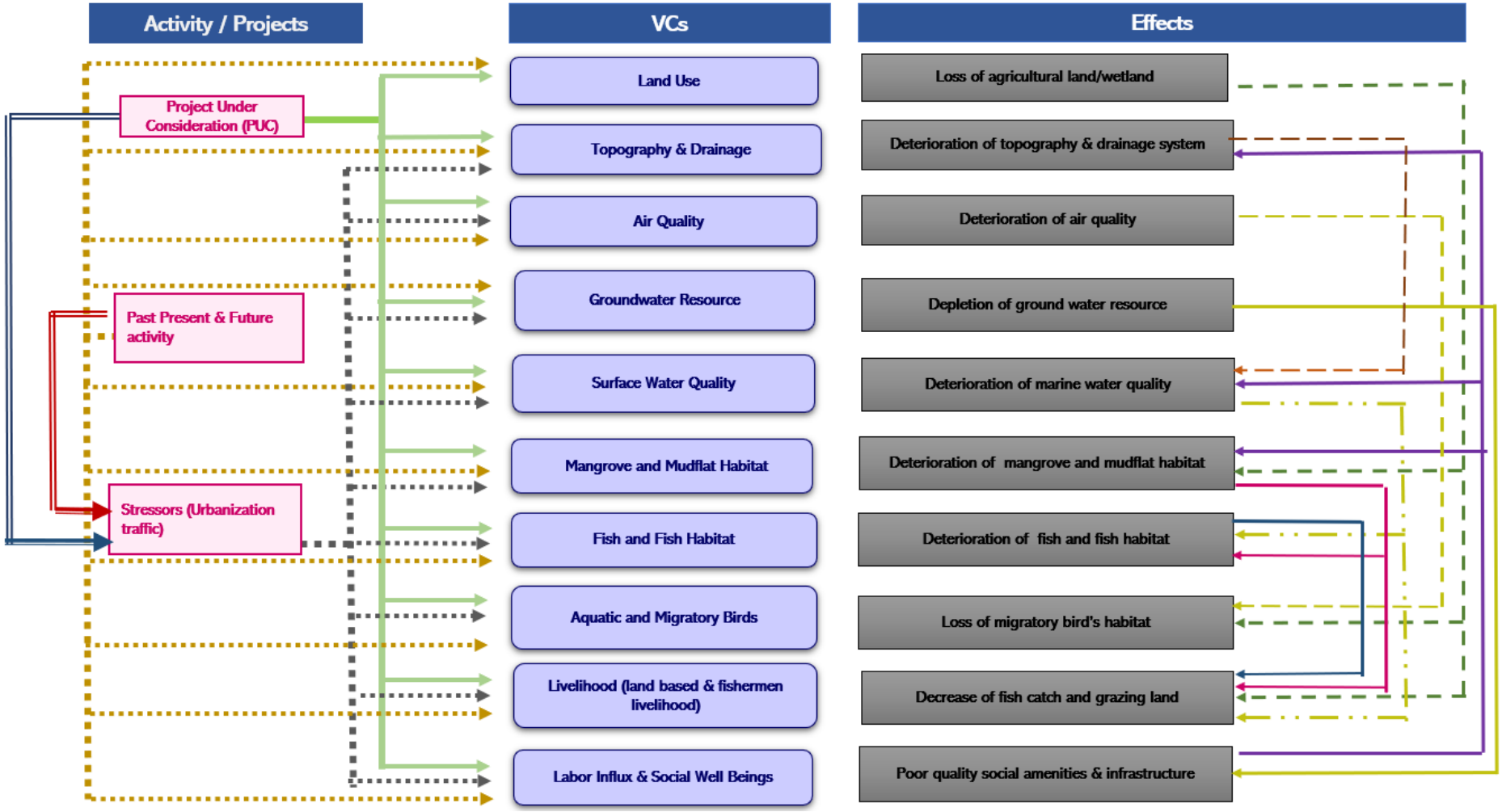
VC	Indicator	Threshold	Reference
Land environment (Land use)	Loss of agricultural and wetland	Loss of agricultural land/ wetland ≤ National land conservation rate of agricultural land for industry and urbanization	Land use analysis
Topography and drainage	Area under waterlogging	Increase in the local waterlogged area compared to the pre-project annual waterlogged area.	ESIA study for Mirsharai and Feni EZ
Air environment (Air quality)	Concentration of Particulate Matter (PM_{10} + $PM_{2.5}$) in the air shed	PM_{10}: 150 µg/m^3 $PM_{2.5}$: 65 µg/m^3	Air Pollution Control Rules 2022
	Concentration of Oxides of Nitrogen (NOx) in the air shed	NOx: 80 µg/m^3	
Water Environment (Groundwater resource)	Depletion of groundwater resources	Depletion rate ≤ natural replenishment rate	State of Groundwater Management in Bangladesh
Water environment marine water quality)	Ecological health (DO and BOD) concentration	5 mg/l or more (water usable by fisheries) 6 mg/l or less (water usable by fisheries)	ECR 2023
	TDS & TSS	1000 mg/kg	ECR 2023
Mangrove and mud-flood habitat	Loss of habitat	Loss of mangrove and mud-flood habitat ≤ National level habitat conservation rate of mangrove and mud-flood habitat	Land use analysis
Aquatic and Migratory bird species	Migratory bird population in the river stretch	Species diversity	ESIA study for Mirsharai and Feni EZ

VC	Indicator	Threshold	Reference
Protected Marine Fauna	Irrawaddy Dolphin population	Recorded dolphin population prior to implementation of the project	
Livelihood (land-based & fisherman)	Fish catch	Number of the local workforce in the NSEZ industrial area. Fish landing data of the region	
Social well-being	Low-cost housing	100% access to quality sanitation facilities and comparison with national trends	Bangladesh Census 2022

5.4 Activity/ Project - VC Interaction and Effects

The past, present, and future industrial projects/activities in the spatial and temporal boundary and other developmental activities and stressors have various interactions with key VCs and lead to a cumulative impact on the overall environment. The interaction with VCs is presented in Table 5-2.

Figure 5-2: Activity/Project – VC Interactions and Effects



6 STAKEHOLDER ENGAGEMENT

6.1 Introduction

The stakeholder engagement process provided a platform for two-way communication between the CIA study team and various stakeholders. This helped the CIA study team develop an understanding of the key issues relevant to this study. All through the CIA study period and at different stages, several stakeholders were consulted with a view to (i) gathering information on VCs, (ii) understanding the past and present condition of VCs, (iii) assessing the cumulative impact on VCs, (iv) suggesting appropriate recommendations, and (v) finding out about reasonably foreseeable future actions. A dissemination workshop was also conducted to share the findings of the study with key stakeholders, which also paved the way for formulating the suggestions and recommendations that have been proposed as part of the CIA study.

6.2 Identification of Stakeholders

The stakeholder engagement process typically refers to the efforts made to understand and involve identified stakeholders to find solutions to shared challenges within the wider socio-economic and ecological context. The process begins with the identification of relevant stakeholders impacting or being impacted by the project.

The identified stakeholders that were found to be relevant to the CIA on the basis of the information review undertaken and the guidance provided by IFC's expectations on identification, i.e., stakeholders that represent one or more entities that:

- Directly benefit from the PUCs.
- Are adversely affected by the PUCs.
- Directly interact with or oversee environmental and social components that overlap with the PUCs.
- Indirectly influence or regulate the condition of environmental and social components.

The key stakeholders were consulted during various stages of the CIA study comprised:

- Institutional stakeholders - direct interaction with PUC.
- Local people - directly or indirectly impacted by PUC.
- NGO & Experts - indirectly influenced by PUC.

Stakeholders consulted during the CIA process are represented in Table 6-1.

Table 6-1: Stakeholder Identification

Categories of Stakeholders	Stakeholder Groups
Project Affected Parties	• Affected Persons who are living in or beside the planned IMD land. • Communities in the vicinity of the project's planned activities. • The local population and local communities, including ethnic communities. • The vulnerable group (which includes the elderly, physically and mentally disabled persons, single mothers, adolescent girls, minority transgender community, and children). • Local health, education, and like services would have to provide basic support to the NSEZ/EZ staff, workers, and their families, including school-going children, like basic healthcare, schooling, etc. • Residence, business entities, and individual entrepreneurs in the area of the EZ are adversely affected owing to the EZ development and operational activities.

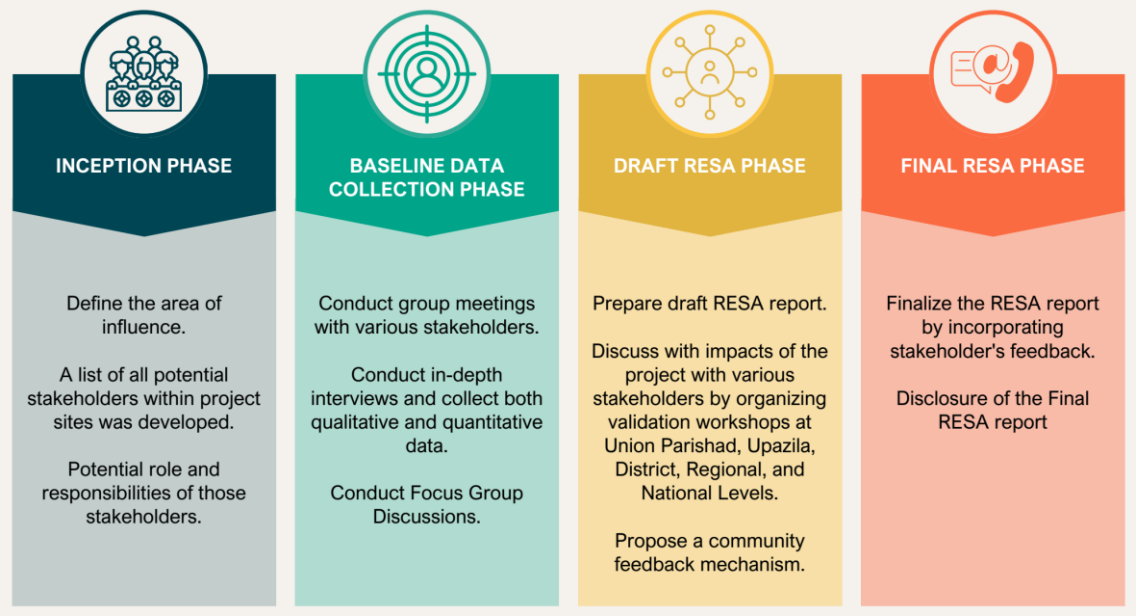
Categories of Stakeholders	Stakeholder Groups
	• Local laborers are to be engaged in the project work. • Suppliers and service providers. • Contractors, subcontractors. • Transport owners & workers.
Other Interested Parties (International Level: Investors)	• Environmental and societal NGOs (including those working on Labor, Human rights, environment, Gender, and GBV matters) • Foreign investors & companies, Development Partners (at National and International levels), Indian Economic Zone, etc. • Multinational or foreign companies • Donor agency
Other Interested Parties (National Level: Government, investors, political groups)	• Bangladesh Garment Manufacturers and Exporters Association (BGMEA) • Bangladesh Export Processing Zones Authority (BEPZA), Bangladesh Economic Zone, SBG EZ • Local investors • Chittagong Port Authority • Business and workers' organizations • Academic institutions (e.g., universities, think tanks, schools) • Training service providers • Urban Development Directorate (UDD) • Roads and Highway Department (RHD), Chattogram Water and Sewerage Authority (CWASA), Bangladesh Railway (BR), Urban Development Directorate (UDD), Bangladesh Telecommunication Company Limited (BTCL), Bangladesh Industrial Technical Assistance Center (BITAC), Karnaphuli Gas Distribution Company Limited (KGDCL), Gas Transmission Company Limited (GTCL), Cyclone Preparedness Programme (CPP), Ministry of Social Welfare (MOSW), Export Competitiveness for Jobs (EC4J) Project. • Civil Society Organization (CSO)/Community Based Organization (CBO)/ Non-Government Organization (NGO)/Other NGOs (HR, Gender, Labor Issues). • GOB officials (Deputy Commissioner, Upazila Nirbahi Officer), permitting and regulatory agencies at the national and regional levels, including environmental, technical, social protection, and labor authorities. • GOB officials at the district level and below including the Department of Environment (DOE), Upazila Health and Family Planning Officers (UHFPO)/Upazila Health Complex (UHC), Bangladesh Rural Electrification Board (BREB), Fire Service and Civil Defense, Department of Youth Development, Department of Public Health Engineering (DPHE), Department of Narcotics Control, Forest Department (FD), Department of Agriculture (DA), Department of Fisheries (DOF), Bangladesh Water Development Board (BWDB), Bangladesh Inland Water Transport Authority (BIWTA), Power Grid Company of Bangladesh (PGCB), Power Division (PD), Bangladesh Meteorological Department (BMD), Upazila Education Office (UEO). • Local Government, including Union Parishad, Upazila Parishad in the EZ area, village administrations, elected representatives such as Member of Parliament (MP) and Major Political Representatives

Categories of Stakeholders	Stakeholder Groups
	• Business owners and providers of services, goods, and materials will be involved in the EZ's wider supply chain & transportation business. • Feni and Chattogram Chamber of Commerce and Industry. • Mass media and associated interested groups, including District and local Press Clubs, local, regional, and national print and broadcasting media, digital/web-based entities, and their associations.

6.3 Stakeholder Engagement Process

The engagement of stakeholders is an evolving process that commences from the inception phase and continues throughout the RESA and CIA report preparation. Each stage and phase has its specific objectives of engagement and results in specific outputs to be integrated into the RESA and CIA. Special attention was given to vulnerable groups, including women groups, elderly people, landless and economically vulnerable, and other vulnerable community members. A summary of the stakeholder engagement process for the RESA and CIA has been given in Figure 6-1.

Figure 6-1: Stakeholder Engagement Process during the RESA/CIA



Source: EQMS, April 2024

6.4 Summary of Stakeholder Consultation

6.4.1 Baseline data collection

A total of 98 consultations were conducted with various stakeholders including BEZA, NSEZ officials, investors, utility providers, permitting and regulatory government authorities, government departments, community leaders, non-governmental organizations, business community, students, journalists, teachers, religious leaders, raw materials supplier, women, disadvantage/vulnerable groups, and local communities that include different occupational groups i.e., farmers, buffalo grazers, fishermen, workers, drivers, etc. The summary of stakeholder consultation has been provided in Table 6-2.

Table 6-2: Key Findings of the Stakeholder Consultations

Themes/Aspects/ Issues Raised	Response/Findings/Observations
Ambient Air Quality	• Dust generation from the movement of vehicles on the access roads has increased. It may impact the local community health if dust control measures are not followed. • RESA should consider assessing the ambient air quality in the NSEZ region and the surrounding area. • The government should assess the pollution load resulting from any industrial facilities that will be established because there are agricultural lands and vegetation surrounding NSEZ.
Water Resources	• Stakeholders emphasized the water issue, specifically the groundwater availability. Groundwater, especially shallow tubewells, is the main water supply source for local people in the surrounding communities of the NSEZ. • Currently, there is a groundwater crisis for domestic uses as well as irrigation during the dry season. The extraction of groundwater for NSEZ (development and operation activities) may cause a groundwater crisis and conflict with the surrounding community. Requested to reduce or stop the use of groundwater specifically for the operational purpose and find out alternative sources of water, i.e., surface water from the Meghna River. • In case of unavailability of water, investors may not be interested in investing in the NSEZ. • RESA study should consider future impacts on water resources, water quality, and groundwater issues in the region. • Requested to consider rainwater harvesting systems in individual industries.
Ambient Noise Level	• Ambient noise levels in the NSEZ area increased due to the movement of vehicles. • Construction activities associated with the project generate noise that is also likely to affect wild animals. • Proper mitigation should be followed to avoid noise pollution during construction works; otherwise, it would harm community health. • BEZA needs to encourage its investors to adopt environmentally friendly equipment and technology to avoid noise pollution.
Livelihoods	• Most of the people's livelihoods in the NSEZ adjacent areas depend on agricultural farming, fishing, livestock, small businesses, etc. Participants of the consultations opined that the project would bring both positive and negative impacts on their existing livelihood patterns. Potential impacts would include the scope of new works, occupational shifting, increase of wages, migration, increased access to the service facilities, etc., while negative impacts are assumed to be made for some particular type of occupations such as fishing, agriculture, buffalo grazing, etc. • The development of access roads will reduce travel time to reach Chattogram and Feni towns. People from Saherkhali, Ichakhali, and adjacent areas have already started migration to those towns to sell their labor, temporary businesses, or sell their locally produced agricultural products. It is also assumed that once the NSEZ is fully developed, the in-migration would take place greatly instead of out-migration.

Themes/Aspects/ Issues Raised	Response/Findings/Observations
	• Fishermen communities and buffalo owners/grazers are identified to be one of the most impacted groups as they assume to lose their access to the fishing ground and grazing land, respectively. • Fishermen have raised their concerns as they are encountering interruptions to fishing in the Sandwip Channel due to the increased navigation of ships and vessels. They are often getting their net harmed by the bulk carriers and other cargo ships, which requires additional time and money to repair the nets. Such nets are costly, with prices reaching up to 50,000 BDT per net. Fishermen also mentioned that such interruption and damage are gradually increasing their costs for fishing in the Sandwip Channel. • Buffalo grazers have already experienced a reduction in grazing areas due to the intervention under the NSEZ. • Day laborers expressed their hope to get more work opportunities with increased wages in different activities like construction work. At the same time, they have raised a concern about not being able to utilize the opportunities if require any particular skill that they do not have currently. • Proper mitigation measures such as alternative livelihoods/employment opportunities, skill-development training, increased communication and business opportunities, and other facilities could contribute to reducing the impacts on the livelihoods of different occupational groups.
Employment Generation	• The local people are expecting that the NSEZ will create a lot of work opportunities for them. Young people are hoping to be directly employed in different activities during the construction and operation phases. • Local people with educational qualifications are expected to be employed in different official and managerial positions. • In addition to the anticipated scope of direct employment in the activities, the EZ has also been considered to contribute indirectly to employment generation in the adjacent areas. Surrounding the EZ areas, for instance, many types of economic activities are taking place/planned to take place, such as small businesses, shopkeeping, service providers (e.g., legal services for land, engineering services for housing development, etc.), etc. • Department of Youth Development opined that the NSEZ would be a great contributor to the local labor market. Although they have not yet introduced any activities to prepare local youth for the future skilled labor demand in NSEZ. They are in the process of enhancing their capacities by providing skill development training on time-demanding trades. They hope that their capacities and future large-scale training programs will contribute to preparing the local youth as a potential labor force for NSEZ.
Land and Other Resources	• Land value has increased in the adjacent areas of NSEZ. Landowners expressed satisfaction as they are getting increased value. On the other hand, the affected landowners received compensation for their land. Landowners are also receiving offers from various investors and developers who are interested in coming to their areas to invest in different sectors, such as opening businesses, developing housing, developing markets/ shops, etc. • For the fishermen and fish traders, fishing nets and fishing boats are the common assets. There are different types of fishing nets used by the Jaldas

Themes/Aspects/ Issues Raised	Response/Findings/Observations
	community to catch fish. “Ton”, “Binti”, and ‘Chandi” are the most common types of fishing nets used by the fishermen in Saherkhali. Boats are typically light-fiber boats with diesel engines. A boat costs between BDT 200,000 to BDT 400,000, depending on the size and condition of the boat.
Fish Production/ Fish Landing Stations/Ghats	• Currently, both capture and culture fisheries are there. The culture fish yield rate is 6 tons/acre in Mirsharai Upazila. The number of registered fishermen in the Upazila is around 2,557. Fisherman mostly catches fish in the Sandwip channel using light fiber boats with diesel engines. Few fishermen in the EZ areas catch fish in the deep sea. • There are four main fisheries ghat/landing stations according to the local fisherman community. These are Domkhali, Mithachora, Saherkhali, Ichakhali, and Bamansundor Ghat. • Usually, fishermen from three villages use one fishery landing ghat. They collect necessary items like string bought from Chaktai, Chattogram, and diesel acquired from local shops. • Fish yield varies by season and depends on other factors like rainfall, salinity, marine traffic, etc. In recent times, fish have become scarce. On average, 15-20 kg of fish is caught by every boat per day. As their current practice, they usually sell the fish immediately after landing at the ghat and do not preserve it. Usually, the “Bepari” (vendor) or the middleman buys those fish from the fisherman and supplies them to the market. • Consultation with the Jaldash community/traditional fishermen and fishery office found that fishing could be impacted in some ways, such as the fish catching rate could be reduced if fishermen face difficulties netting in the seas due to navigation; if fishermen encounter difficulties accessing boats due to relocation of Ghats or boat parking station, etc.
Community Health and Safety	• Currently, local people access their healthcare services from Upazila hospitals, private clinics, and Chattogram Medical College, which is both time-consuming and expensive for the general community people. Mostly dependent on private clinics. • Local people are looking forward to enjoying their access to increased health services and safety as a positive result of the NSEZ in their areas. The establishment and operation of health centers in NSEZ will contribute greatly to community health. • Many opined that they will require more community clinics, specialized hospitals, and medical colleges in their areas. • Local health practitioners, including UHFPO, emphasized enhancing their resources and capacities proportionately with the increased population and service demand in the areas. They also gave importance to increasing ambulance services, medical practitioners, support staff, infrastructure, and training on handling occupational diseases and health hazards.
Flora and Fauna	• Stakeholders emphasized plantation, protection of wildlife, and biodiversity to keep the ecosystem balanced. Some opined that biodiversity and natural resources, such as wild animals and forest areas, are the unique features of the areas, which should not be harmed.

Themes/Aspects/ Issues Raised	Response/Findings/Observations
	• Stakeholders suggested rehabilitating the wild animals in alternative forest areas. If there are any endangered species, it requires to take steps to save them.
Local Culture	• People of different sociocultural backgrounds are living in the NSEZ adjacent areas with community harmony and their traditional norms and values. Residents are mostly Muslim and Hindu in terms of religious background. There is a mentionable number of artisanal fishermen who have practiced fishing over the generations as their hereditary occupation.
Tourist Spots and Tourism Development	• There are many tourist spots and natural resources surrounding the NSEZ, particularly in Sitakunda and Mirsharai, such as Chandranath Hill and Temple, Sohosrodhara waterfalls, Shuptodhara waterfalls, Sitakunda Botanical Garden and Eco-Park, Guliakhali Sea Beach, Mohamaya lake, etc. There is great scope for developing and promoting these potential tourist places. It is also suggested that the government can develop tourist zones in the area. • There would be a demand for recreational facilities and tourism if a city developed at NSEZ. The existing tourist spots would be the main source of such facilities. Some other tourist spots outside the Paurashava could also have potential for tourism development. • Stakeholders also raised concerns that a negative impact on the environment of tourist spots may be made if there is no development plan targeting the attractive spots of the areas. • Proper management plans are required to manage waste generated in tourist spots and ensure accommodation for tourists and their security. • Local law enforcement agencies suggested that tourist police could play an important role in ensuring the security of tourists in the future.
Social Infrastructure/ Capacity and preparation of regional/local service providers	• In terms of the capacity and preparation of local service providers, they would require additional support to enhance the services. The capacity of the local government offices needs to be enhanced to handle the potential population influx in the future. • **Accommodation and Housing:** stakeholders highlighted the future demand for housing facilities in NSEZ's surrounding areas, particularly in the Mirsharai areas. They opined that the Upazilas are not yet ready to provide housing facilities for the large number of newcomers. They suggested some potential places for developing the residential and market facilities for the upcoming population, i.e., UP no. 6, 7, 8 of Sonagazi Upazila; Dakshin Edilpur and Shibpur areas of Sitakunda Paurashava; and Mahasimpur and hillside fallow lands of Mirsharai Upazila. • The National Housing Authority is also searching for a potential location near Ichakhali Union and Muhuri Reservoir for future housing development. • Stakeholders also raised concerns regarding the increase in house rent in the future. • A separate township could be developed to manage the population influx, considering the provision of schools, hospitals, markets, graveyards, mosques, playgrounds, sports complexes, recreational facilities, etc. Separate accommodation facilities for the workers and investors should be developed.

Themes/Aspects/ Issues Raised	Response/Findings/Observations
	• A dedicated development authority, such as RAJUK, can be established to regulate the unplanned building construction and ensure a planned development in the region. • Currently, houses, shops, and markets are being constructed beside the existing roads. Further expansion of existing roads will be required in the region. In that case, such types of structures will be a problem during land acquisition for road improvement. • **Educational Institutes:** schools and other educational institutes are able to provide services with their current resources. Capacity enhancement, including academic building, teachers, supporting staff, etc., of the existing educational infrastructure will be required to meet the future demand. A demand for the establishment of additional educational institutes, such as colleges, universities, and engineering institutes in the region was raised by the stakeholders. The quota for local students in the NSEZ's educational facilities is expected by the local people. • **Healthcare Facilities:** additional healthcare facilities with well-trained medical practitioners and staff are required. According to the consultation, medical facilities need to be increased gradually, considering the rise of population in the NSEZ surrounding area, including Saherkhali, Ichakhali, Saidpur, Muradpur, and other areas. A demand for a Medical Institute/Medical College establishment in the Sonagazi area arises from the stakeholder consultation. • **Electricity Supply:** increased demand for electricity in the future is being anticipated. Considering the existing demand, one power station has already been established in the NSEZ by an independent power producer. It is anticipated that the community-level demand will also increase in the future, considering the township development in the region. Therefore, the sourcing and distribution of electricity need to be considered in the development planning. • **Roads and Communication:** The current roads and transportation system in the NSEZ surrounding area is inadequate to meet future demand. RHD has already prepared a DPP for the development of infrastructure targeting the increasing demand. On the other hand, LGED has not yet taken any initiative in the NSEZ region. The improved road network in the Sonagazi area will reduce the travel time from Dhaka to NSEZ and facilitate movement to the nearby districts. Mirsharai Upazila Development Plan, prepared by the Urban Development Directorate, suggested considering regional roads such as Sitakunda to Sonaimuri (Noakhali) via Domkhali to facilitate the movement in this direction. Stakeholders also suggested developing road networks from Sonagazi to the NSEZ to facilitate communication from the NSEZ to the different locations of the region. The roads such as Muhuri Project to NSEZ (7.8 km); Jorarganj to Sonapur Road; Badamtali - Raghunathpur (this road will connect NSEZ to Dhaka - Chattogram Highway (via Koshka). • Considering the need for workers' movement from different locations of the region (Baroirhat and Sitakunda) to NSEZ, Bangladesh Road Transport Corporation (BRTC) has introduced a bus service. Stakeholders recommended increasing the number of trips, considering the demand of workers.

Themes/Aspects/ Issues Raised	Response/Findings/Observations
	• According to the Department of Fire Service and Civil Defense, currently, it is not practically possible to timely respond to any emergency in the NSEZ region due to narrow and undeveloped roads. • **Embankment and Super Dyke:** Bangladesh Water Development Board has constructed a Super Dyke that spans 22.5 km at the Mirsharai portion, with plans to extend it by an additional 12.5 km towards Sitakunda. Within the existing 22.5 km, the BWDB-financed Bangladesh Forest Department is for the plantation of 100 acres of vegetation along the seaside. • **Jetty and Others:** BIWTA has planned to establish a permanent jetty in the Sandwip Channel. Raw materials suppliers demanded access to the Jetty facilities so that they could timely deliver their goods and materials to facilitate the construction activities in the NSEZ.
Waste Management	• Generation and management of waste in NSEZ will be a critical task. Currently, there is no mentionable waste management system in the region. Even the local municipal authority has a lack of ability to handle waste in the region. • UDD suggested a waste treatment plant in the Domkhali for the community. Paurashava authority demanded for establishment of waste management systems in their areas to meet future demand. • The establishment and function of WTPs, CSTPs, and CETPs need to be ensured to protect the environment in the region. Proper solid waste management facilities should also be ensured in the NSEZ. • The cost and technology of CETPs and CSTPs must be investment-friendly. If the cost of CETPs and CSTPs is higher, then the investor may not be interested in establishing and using them. Modern and cost-effective treatment systems for individual industries should be ensured.
Drainage	• The rainwater naturally drains out through the canals. Stakeholders suggested considering drainage facilities parallel to the road network and keeping existing canals functional at any cost. • Currently, the local community in the NSEZ surrounding area is constructing their housing without considering adequate provision for stormwater drainage, therefore it can accelerate the waterlogging/flooding in the region in the future.

6.4.2 Validation Workshops

According to the RESA study ToR, six validation workshops were carried out (one for each Upazila - Mirsharai, Sitakunda, and Sonagazi, one District level at Feni, one regional level at Chattogram, and one national level at Dhaka). In addition, as per request from BEZA, two additional validation workshops were carried out in two Union Parishads, namely Sonagazi and Maghadia. The summary outcome of the validation workshops is given in Table 6-3.

Table 6-3: Summary of the Validation Workshops

Issue Raised	Comments/Concerns/Expectations
1	**Sonagazi Union**
Impact on Different	• Farmers and fishermen community would be impacted by the NSEZ's development in the Sonagazi end.

Issue Raised	Comments/Concerns/Expectations
Occupational Groups	• There are approximately 560 registered fishermen and many other non-registered and irregular fishermen. Fishermen who catch Hilsha fish only get a ration during the banned periods. • Fishermen of Sonagazi mostly catch fish in near-shore areas, and only 14-20 fishermen go to the deep sea for fishing. • They will need support from BEZA to restore their livelihoods. Livelihood training and alternative livelihood options are demanded. • Industries should recruit from affected households. • Expecting that compensation should be ensured for land acquisition and resettlement, following applicable national legislation, prior to starting construction activities. • Fish in the Sandwip Channel are reducing day by day. Sedimentation in the channel is one of the causes behind this, and they have been observing the trend for the last 4 years. • The fishing community expects training, modern equipment, and vessels for fishing in the deep sea.
Social Infrastructure	• Educational facilities/institutes required in Sonagazi Union. Chairman and other participants emphasized the need for: - At least one (1) high school. Currently, there is no high school. - Increase community clinics and their scope of services. - Need a government hospital considering the future demand. Currently, they have to go to Sonagazi Upazila or Feni Sadar Hospital. - One (1) playground. Currently, there is no playground in the union. • Road improvement is required in terms of the roads' carrying capacity and width. • Solar power plants could be established to ensure an uninterrupted electricity supply to the area. • Cyclone shelters should increase their capacity, like spaces, animal shelters, etc.
Social Cohesion and Safety	• If any influx happens to Sonagazi, people will welcome outsiders, although initially, it will take time to build integration between outsiders and locals. • Outsiders could be a threat to locals at some points, like gender-based violence and other crimes.
Biodiversity and Wildlife	• There is a need for wildlife conservation. Wildlife is at risk due to increased human intervention near the forest and char areas.
2	**Maghadia Union**
Resettlements, Compensation, and Livelihood Restoration	• Employment preference should be given to the affected people. • Currently, industries are not recruiting employees above the age of 30-35 years, which is challenging others to find alternative ways for earning. • The Chairman of the Union Parishad is not included in the Grievance Mechanism of BEZA. Therefore, requested to include them in the grievance committee. • Local people demanded employment opportunities for their household members not only as workers but also in other skilled sectors, as per their qualifications. • In addition to that, they also demanded priority for jobs in other service sectors such as banks, hospitals, etc. • Local people requested to ensure compensation according to the government's law before the commencement of any project.

Issue Raised	Comments/Concerns/Expectations
Social Infrastructure	• Participants validated the need for more health complexes, particularly in the Maghadia Union. • Educational facilities/institutes required in Maghadia Union. Chairman and other participants emphasized the need for: - Currently, there is one (1) high school. Expecting at least additional one (1) high school in the Union. - One (1) playground. - One (1) medical center/hospital. - Police camp (increased number of police and security personnel). - Growth centers should be more developed with improved communication facilities. • Fish landing stations have been relocated, and this creates a challenge for fishermen to access the sea.
Drainage	• Some participants focused on drainage improvement, and they mentioned that there is no provision for drainage culverts in the existing 4-lane road (NSEZ Saroni). • Currently, rainwater drains out naturally through the canal to the sea. Unplanned development in the community could lead to drainage congestion and long-term waterlogging in the future. • Major canals in the NSEZ should not be closed.
Waste Management	• Currently, there are no waste management facilities at the Union Parishad level. • As an existing practice, people dump their household waste on their land.
3	**Mirsharai Upazila**
Water Resources	• Emphasize the importance of groundwater currently used by the local community as the main source of drinking water. They opined to reduce the withdrawal of groundwater as early as possible and only use it for the construction phase activities. • The extensive extraction of groundwater by the NSEZ for industry operations may result in a severe water crisis for the local community and the natural ecosystem. • Water supply from other sources (e.g., Meghna River) needs to be ensured as early as possible; otherwise, investors will be demotivated and could leave NSEZ. • Rainwater harvesting should be introduced in NSEZ to reduce the pressure on water resources.
Agriculture	• Impact on agricultural practices and production has been anticipated due to the future availability of irrigation water, reduction of agricultural land, and infrastructural development. • If local food production is impacted, it will trigger the food prices and impact on the local community. • Agriculture-based entrepreneurship should be created and encouraged.
Resettlement, Compensation, and Livelihood Restoration	• Affected households should be given priority for the restoration of their livelihoods. • Compensation should be ensured for land acquisition and resettlement following applicable national legislation prior to starting construction activities. • Buffalo owners, fishermen, and other involved people have almost lost their livelihoods. There is an immense need for a livelihood restoration plan for them.

Issue Raised	Comments/Concerns/Expectations
	• Some local investors (fishery project) of Ichakhali Union were affected.
Employment	• Approximately 1.4 million employment opportunities will be created in different phases of NSEZ implementation. It is needed to know phase-by-phase numbers to prepare plans for government departments/service providers. • Job placement should be prioritized with skill-developing training. • Industry should prefer local employees during recruitment.
Transportation and Communication	• Industries are facing a labor crisis due to insufficient transport and accommodation facilities in the NSEZ region. • There is a gap between the need and existing facilities in terms of transportation services. • BRTC has already launched a service, but it is insufficient in terms of frequency of services, number of buses, etc. • Transport cost for labor is also high. Steps need to be taken to reduce it; otherwise, it will demotivate the workers to work in NSEZ. • There is another road from Mirsharai to NSEZ besides the Mirsharai Upazila Parishad that could be developed to reduce pressure on NSEZ Saroni.
Social Infrastructure	• Housing and accommodation for workers and outsiders should be constructed with other facilities. Already, 12,000 workers are working in NSEZ, and they are struggling for housing and transportation. • Housing loan facilities should also be introduced. • Unplanned housing should not be allowed. It will create hurdles in the future, specifically for road and drainage improvement. • Educational institutes are required to meet future demand. Local technical educational institutes should enhance their capacity, and new institutes should be established to supply skilled manpower to the industries. • A foot overbridge near Nurul Absar school is to reduce the accident risk for students and villagers. • Clinics/hospitals and other medical facilities should need to be established. • Hat bazar/growth centers are mostly in a traditional way; those should be developed in a planned way. • There is a high opportunity for tourism development in the NSEZ region.
Fish Landing Station/Boat parking	• Fish landing stations have been relocated, and the current distance creates a challenge for fishermen to access them. There is no sanitation, drinking water, and recreation/resting facilities at the boat parking area. • Boats are vulnerable during cyclones or storms in the newly shifted boat parking area.
Wildlife/ Biodiversity/ Ecosystem	• Wildlife restoration should be given priority as wild animals are losing their habitat. It can be transferred to the hills and Mohamaya Lake areas. • Impact on biodiversity should be avoided, and proper mitigation should be followed. • Plantation should be prioritized outside of the NSEZ.
Environment	• Eco-friendly building/construction materials should be preferred for use in NSEZ to avoid the environmental impact as much as possible. • Topsoil management should be prioritized, and no agricultural land should be damaged in the future.
Drainage	• Canals should not be closed. • Proper planning and implementation of drainage systems should be ensured to avoid waterlogging/flooding in the surrounding areas.

Issue Raised	Comments/Concerns/Expectations
	• If a proper plan is not considered, drainage congestion will be another big challenge in the future. Roadside drainage should also be considered.
Waste Management	• Waste management facilities need to be established for the community, considering the workers influx in the region. • Waste treatment and recycling should be preferred, as a huge volume of waste will be generated. If it is not managed properly, it will greatly cause pollution.
Other Services	• The service facilities of other service providers need to be increased, particularly in the Mirsharai areas. • Safety and security for both the community and industries/investors should need to be ensured. • Security personnel should be increased.
4	**Sonagazi Upazila**
Resettlement, Compensation, and Livelihood Restoration	• Affected households should be given priority for the restoration of their livelihoods, specifically for the livelihoods relevant to fishermen and livestock rearing. • Compensation should be ensured for land acquisition and resettlement following applicable national legislation prior to starting construction activities. • Currently, there are fishery projects in the Feni site, and people related to this sector will be impacted.
Employment	• Participants emphasized the employment opportunities for the local people. • The workers' movement will increase from the Feni side if the road network is developed, and it will reduce the transportation cost.
Transportation and Communication	• Due to insufficient road networks on the Feni side, workers from Sonagazi are not interested in going to NSEZ at present. • A bridge on the Feni River has been initiated by LGED, and it must be implemented on a priority basis to connect both the Feni and Mirsharai economic zones. • Transport costs for the workers are very high compared with their daily income. Currently, a few workers are moving via Mirsharai. • A road from the Muhuri project to NSEZ, following the bank of the Feni River, could be an option.
Social Infrastructure	• Unplanned urbanization will be an issue. • Existing social infrastructures need to be improved.
Drainage	• The Feni River is the main drainage system in the area. It carries water from the upstream area and finally falls into the Sandwip Channel.
Erosion/ Sedimentation	• After the implementation of the river straightening program in 2011, it reduced the riverbank erosion activities in the area.
Miscellaneous	• About 8,000 acres of land have been considered for the NSEZ. • Mainly residential areas will be developed on the Sonagazi, Feni side. An initial site selection study is ongoing. • Only two industries are established under the jurisdiction of the Feni district. No other physical progress is observed at the Feni site. • Land grabbers are more active now on the Feni side and grabbing land. They are excavating ponds for aquaculture. Participants are requested to secure the land as early as possible; otherwise, the landfill requirements will be increased in the future.

Issue Raised	Comments/Concerns/Expectations
	• Proper pollution prevention mechanisms and waste management systems should be established. • Although the development of NSEZ is being carried out in different phases, it should make some visible progress at the Sonagazi end as soon as possible.
5	**Sitakunda Upazila**
Water Resources	• Groundwater crisis already exists in the Sitakunda area, putting local life in immense trouble. • NSEZ should focus on surface water resources to avoid conflicts between different water users.
Agriculture	• No agricultural land should be acquired. • The land acquired for the NSEZ in the Sitakunda area is government land and located outside of the embankment and towards the Sandwip Channel. • Agricultural productivity will also not be impacted.
Resettlement, Compensation, and Livelihood Restoration	• Fishermen will lose their livelihoods. There is an immense need for a livelihood restoration plan for them. • Livestock (buffalo) dependent communities will be impacted. • Fishermen's livelihoods should be ensured.
Employment	• Skill development training considering the requirements of the industries.
Transportation and Communication	• According to the planning, the existing Dhaka-Chattogram Highway will be a 10-lane highway in the future; therefore, it needs to be considered. • Marine Drive Road can be linked with NSEZ, which will reduce the distance to 60-80 km.
Social Infrastructure	• Social infrastructure, i.e., roads, schools, hospitals (100 beds), and community clinics, needs to be established and improved. • A technical college will be required to develop skilled labor. • Housing in the Sitakunda area could be proposed. • A dedicated fire station will be established in the NSEZ. In addition, the capacity of existing fire stations needs to be improved. • Existing internal roads in Saidpur and Muradpur need to be improved to ensure better movement of workers.
Fish Landing Station/Boat parking	• Accessibility of the fishing area, as well as fish landing stations, is decreasing due to the NSEZ interventions. • Fishing equipment, such as boats and nets, is being damaged due to the increasing interventions of vessels in the Sandwip Channel/fishing area.
Wildlife/ Biodiversity/ Ecosystem	• Vegetation cover should be protected. • Wildlife rehabilitation should be done. Due to the disturbance of habitat and food, wildlife may come to the local community, and a conflict between humans and wildlife may occur. • Impact on biodiversity should be avoided, and proper mitigation should be followed.
Environment	• Green industry should be introduced in the NSEZ to reduce environmental pollution.
Natural Disasters	• Sitakunda coast is vulnerable to natural disasters, mainly Cyclones and associated tidal surges. Natural disaster issues should be considered in the NSEZ planning.

Issue Raised	Comments/Concerns/Expectations
	• Green belts should be developed to protect the coast from Cyclones and tidal surges.
Drainage	• Proper drainage systems should be developed to avoid flooding in the surrounding areas.
Waste Management	• Regarding waste management, NSEZ can introduce the 3R principles (Reduce, Reuse, and Recycle). • Waste management facilities need to be established, considering the workers influx in the region. • Shipbreaking waste management could be integrated with the NSEZ master plan, which will save agricultural land. A project regarding shipbreaking waste management facilities establishment in Sitakunda Pourashava is in process.
Tourism	• Tourist spots should be avoided for the interventions, and it should be promoted as a potential sector. • Enhancement of the tourist spots and tourism activities should be done.
6	**Regional Workshop at Chattogram**
Water Resources	• Groundwater crisis already exists in the Mirsharai and Sitakunda areas. The extraction of groundwater needs to be stopped immediately. NSEZ should focus on surface water resources to avoid conflicts between different water users. • Runoff from rainfall is a water source that can be stored in the internal canals/khals by closing the sluice gate and used for construction activities. • Proposed water sources, i.e., groundwater, Feni River, and seawater desalination, are not feasible options considering the total water requirements for the NSEZ operation. These could be a temporary option, but not a permanent source of water to operate the NSEZ. In addition, the Feni is a transboundary river. • Seawater desalination plants to meet the water demand of the NSEZ will be a costly option. • There are two rivers in Chattogram, namely Karnaphuli and Halda. Halda is an ecologically sensitive area; therefore, this option has been excluded. In addition, the salinity level is high in the Karnaphuli River, so this option is also excluded. • Water crises are observed from October to June in the Chattogram area. • Surface water collection from the Meghna River could be a feasible option. A 150 km pipeline, including pumping stations, needs to be established following the alignment of the existing railway line. The approximate cost for a thousand liters will be 100 BDT to 120 BDT, which is lower compared to other countries. • Only one service provider has been appointed for the PPP Project titled "Water Supply to Mirsharai NSEZ from the Meghna River". However, an open competitive tendering/selection process is required for the selection of the most qualified PPP service provider and to negotiate the price of water. • The proposed water supply project will also be able to supply water to nearby towns, cities, and pourashavas along the pipeline route, as well as the Chattogram City area, if needed. • Rainwater harvesting, recycling, and the reuse of water can be introduced to reduce the pressure on water resources.

Issue Raised	Comments/Concerns/Expectations
	• In order to improve the groundwater situation, it is necessary to introduce artificial recharge in the depleted groundwater aquifers.
Agricultural Land and Productivity	• No agricultural land should be acquired in the future, considering the national food security issue. • Due to a lack of water availability, agricultural production was hampered last year in two upazilas, namely Mirsharai and Sitakunda.
Livelihood Restoration	• Fishermen and livestock (buffalo) dependent communities will lose their livelihoods. There is an immense need for a livelihood restoration plan for them.
Job opportunities	• Training should be given to the community people residing in the NSEZ and its area of influence in order to increase their readiness to get a job in different industries in the NSEZ. • Requested to provide job opportunities to the community people/affected people. • Requested to keep the quota for the people from the Mirsharai area. • Currently, there is a gap between the demand and supply of workers. Around 2,000 people are already engaged from the Mirsharai area.
Lack of proper infrastructure	• Participants were concerned about the shortage in educational, health, and recreational facilities (schools, community clinics, hospitals, medical colleges, etc.), in addition to the shortage in the infrastructure (mainly roads) in the EZ area. Thus, they requested to pay special attention to the infrastructure and the educational and health facilities. • A technical college/university will be required to develop skilled manpower. • Two nos. of bridges have been proposed on the Feni River to make a connection between the Sonagazi and Mirsharai areas. It will be helpful for the workers to move to the industrial zone from their proposed residence in Sonagazi, Feni area. • One jetty will be constructed in the Sandwip Channel by BIWTA. • KGDCL is facilitating the gas supply in the NSEZ.
Flora and Fauna/Wildlife/ Biodiversity	• Wildlife rehabilitation in surrounding suitable habitats/hilly areas needs to be done. • A wildlife sanctuary in the hilly area can be declared/established to rehabilitate the existing wildlife available in the proposed NSEZ sites. • Wildlife Park/ecotourism can be introduced in the NSEZ surrounding area. • Due to the disturbance of habitat and food scarcity, wildlife is coming to the locality. • Vegetation should be restored. Plantation on both sides of the road in the NSEZ would be a good option.
Environmental and Social Impacts and Risks	• The existing scenario (land use and land cover) of the NSEZ and the surrounding area will be completely changed due to the implementation of the NSEZ master plan. • Existing natural resources, i.e., air, water, soil, vegetation, and wildlife in the NSEZ site, will be impacted. • Considering the township development, groundwater depletion may occur. In that case, there will be a possibility of salinity intrusion in the groundwater aquifer. • Ambient air and water pollution from different industries in the NSEZ.

Issue Raised	Comments/Concerns/Expectations
	• Traffic will be increased on the existing roads located in the NSEZ's surrounding area; therefore, traffic congestion may occur. • Green industry should be introduced in the NSEZ to reduce environmental pollution.
Natural Disasters/ Hazards	• To protect the NSEZ from the cyclones and tidal surges, a Super Dyke has been constructed at the Mirsharai end and planned an additional 12.5 km at the Sitakunda end. In addition, they have excavated local canals/khals. Participants were requested to consider the existing small khals/canals located in the Sitakunda area. • Green belts should be developed to protect the coast from Cyclones and their associated tidal surges.
Storm Water Drainage	• Existing canals need to be reactivated to ensure a smooth flow of water. • Proper drainage systems should be developed to avoid flooding in the surrounding areas.
Waste Management	• A biogas plant can be established considering the types of waste that will be generated in the NSEZ. • The establishment and function of CETPs in the NSEZ must be ensured to confirm that no hazardous/toxic waste is discharged into the aquatic/marine environment from the NSEZ. • Regarding waste management and pollution prevention, NSEZ should introduce the 3R principles (Reduce, Reuse, and Recycle).
Tourist Spots and Tourism Development	• Tourism development focusing on wildlife could be an option. • According to the NSEZ master plan, one tourist spot, namely Guliakhali Sea Beach, falls inside the proposed boundary. This place should be avoided during land acquisition. • Enhancement of the tourist spots and tourism activities could be done.
Law Enforcement and Security	• An industrial police unit will be established in the NSEZ to provide security in industrial zones. • A separate police unit (Thana Police) will be required for maintaining peace and enforcement of law and order in the NSEZ surrounding area. • Bangladesh Coast Guard is responsible for controlling piracy, illegal trafficking, protecting the fishery, oil, gas, forest resources, and environmental pollution in Bangladesh waters and coastal areas, ensuring overall security and law and order through security assistance to seaports, and conducting relief and rescue operations in the coastal areas during natural calamities. They have an inadequate number of petrol vessels/boats in the Mirsharai area to respond immediately in case of any need. In this case, capacity strengthening is required.
Establishment of an authority	• Due to the future influx of a large number of laborers in the region, there is a possibility of unplanned development activities in the region. Therefore, it is essential to prepare a land use plan to regulate the unplanned development in the region. • Participants also propose to establish the “Mirsharai Development Authority” to ensure planned development in the NSEZ region and protect agricultural land from encroachment.

Issue Raised	Comments/Concerns/Expectations
Coordination and cooperation among various entities	• All governmental entities will have a proper line of coordination and cooperation that enables them to implement the NSEZ smoothly. • Coordination and knowledge sharing between the NSEZ authority and investors are very important and expected.
Miscellaneous	• Sand from the Sandwip channel is extracted by outsiders. • Now, land grabbing is an important issue. Land grabbers are excavating ponds for aquaculture activities. Participants requested to stop the activities immediately, mentioning the additional soil required during the land development stage. • Separate facilities for the workers and investors should be ensured. • Transportation facilities for the workers' movement should be ensured.

7 ASSESSMENT OF CUMULATIVE IMPACT

This section presents a qualitative assessment of the cumulative impacts posed by the past, present, and foreseeable industrial and development stressors in the NSEZ on the Valued Components (VCs). It also looks at the specific contributions from the World Bank's Bank-financed NSEZ Infrastructure and related facilities (referred to as the projects under consideration or PUC) toward impacts that cumulate on VCs in NSEZ areas.

7.1 Land Use Change

The VC interaction and effect diagram (Figure 5.2) indicates that the PUC (related facilities component) NSEZ and external factors or stressors (expansion of residential area) directly or indirectly interact with the land use of the spatial boundary of CIA. The cumulative impact on land use change is assessed through the loss of mangrove and mud-flood area ≤ National land conversion rate of mangrove and mud-flood.

7.1.1 Baseline Condition

The spatial boundary of NSEZ is located in Chattogram and Feni districts. The decadal land use changes of both the districts has been presented in the following table.

Table 7-1: Decadal Land Use Changes of Chattogram and Feni Districts

District	Year	Area in sq. km						
		Agriculture land	Forest land	Built-up area	Land not in use	Inland water	Inland water not in use	Total
Feni	2015	497.15	8.06	354.97	16.16	33.25	13.03	922.62
	2023	423.3	8.18	418.85	14.53	41.42	16.34	922.62
	Changes (%)	**-14.85**	**1.49**	**18.00**	**-10.09**	**24.57**	**25.40**	
Chattogram	2015	1548.24	1280.28	1329.69	41.13	1087.71	118.12	5405.17
	2023	1669.14	1114.83	1417.19	149.5	854.49	200.02	5405.17
	Changes (%)	**7.81**	**-12.92**	**6.58**	**263.48**	**-21.44**	**69.34**	
Feni + Chattogram	**Changes (%)**	**2.30**	**-12.83**	**8.99**	**186.32**	**-20.07**	**64.97**	

(*Source: Bangladesh Environment Statistics 2024*)

The decadal land use changes of both the districts show that built-up area (residential, industrial, and infrastructure) has been increased. The agricultural land and land not in use decreased for the Feni district. The forest land and inland water land decreased for the Chattogram district.

In the spatial boundary, the predominant land use and land cover is agricultural land, which is about 190.62 km² and accounts for only 30.36% of the total area. The Settlement with Homestead Vegetation covers 90.784 km² and accounts for only 14.46% of the total area. The inland water body has with area covering 18.606 km² and accounts for only 2.96%. The aquaculture area covers 26.761 km² and accounts for only 4.26%. The built-up area & developed land area cover 1.3% and 2.28% of the total study area. The mudflat area covers 36.688 km², Mangrove Plantation, mixed hill forest, railway, river, and road area covering 5.26% (33.004 km²,), 0.09% (0.572 km²), 0.70% (3534.19 km²), 0.03% (0.181), 32.02% (202.309 km²), 0.92% (5.771 km²) respectively.

The total area of NSEZ is 33,805 acres. The land use and land cover before the development of the NSEZ revealed that mangrove and mud-flood areas (36.688 acres, i.e., 33,805 of the total land under NSEZ) have been provided in Figure 7-1. The implementation of NSEZ will mainly impacted the mud flood area and agricultural lands.

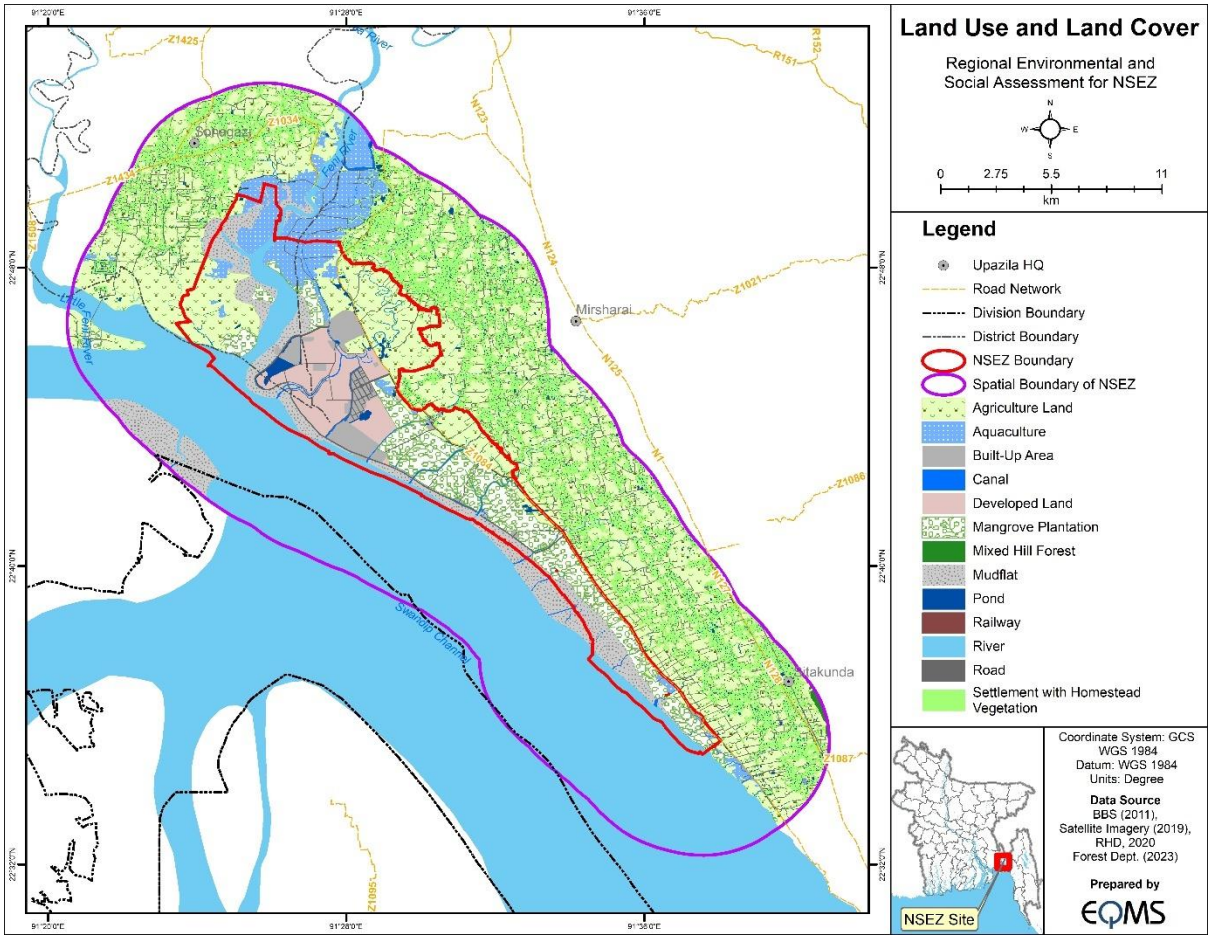
7.1.2 Stressors and Impact

PUC: NSEZ infrastructure planned for the economic zone (EZ) will be mostly developed within the EZ; therefore, no additional land will be required. However, the related infrastructure under PUC planned for the EZ, which includes external roads, a railway network, a water supply pipeline from the Feni and Meghna Rivers, and transmission lines, would require additional land, which includes private agricultural land and government land. The potential impact of the implementation of related facilities on land use change is assessed as medium.

Past and Present Projects (Phase I): In the northwestern part of the EZ, land development activity has been completed, and construction activities by the different industries have been initiated. Approximately 2500 acres of land were already developed. In the developed land, there are eight operating industries and 10 under construction industries. The land use and land cover map showed that the entire developed land was mangrove and mud-flood land. The potential impact of existing industries and development on land use change is assessed as medium.

Proposed Projects (Phase II): As per the master plan, phase II industrial developmental activity will be carried out in 6-10 years. The phase II development plan has been planned in the Sonagazi area of the NSEZ and the northeastern part of Mirsharai. The land use and land cover of the Phase II area are mostly low-lying agricultural land and mud-flood areas. The land use changes due to Phase II development are assessed to be medium.

Figure 7-1: Land Use/ Land Cover of CIA Spatial Boundary



Proposed Projects (Phase III): Phase III industrial developmental activity will be carried out in 11-20 years. The phase III development plan has been planned in the Sitakunda area of the NSEZ. The land use and land cover of the Phase III area are mostly mangrove and mud-flood areas. The potential impact of proposed industries (Phase III) and development activities on land use change is assessed as medium.

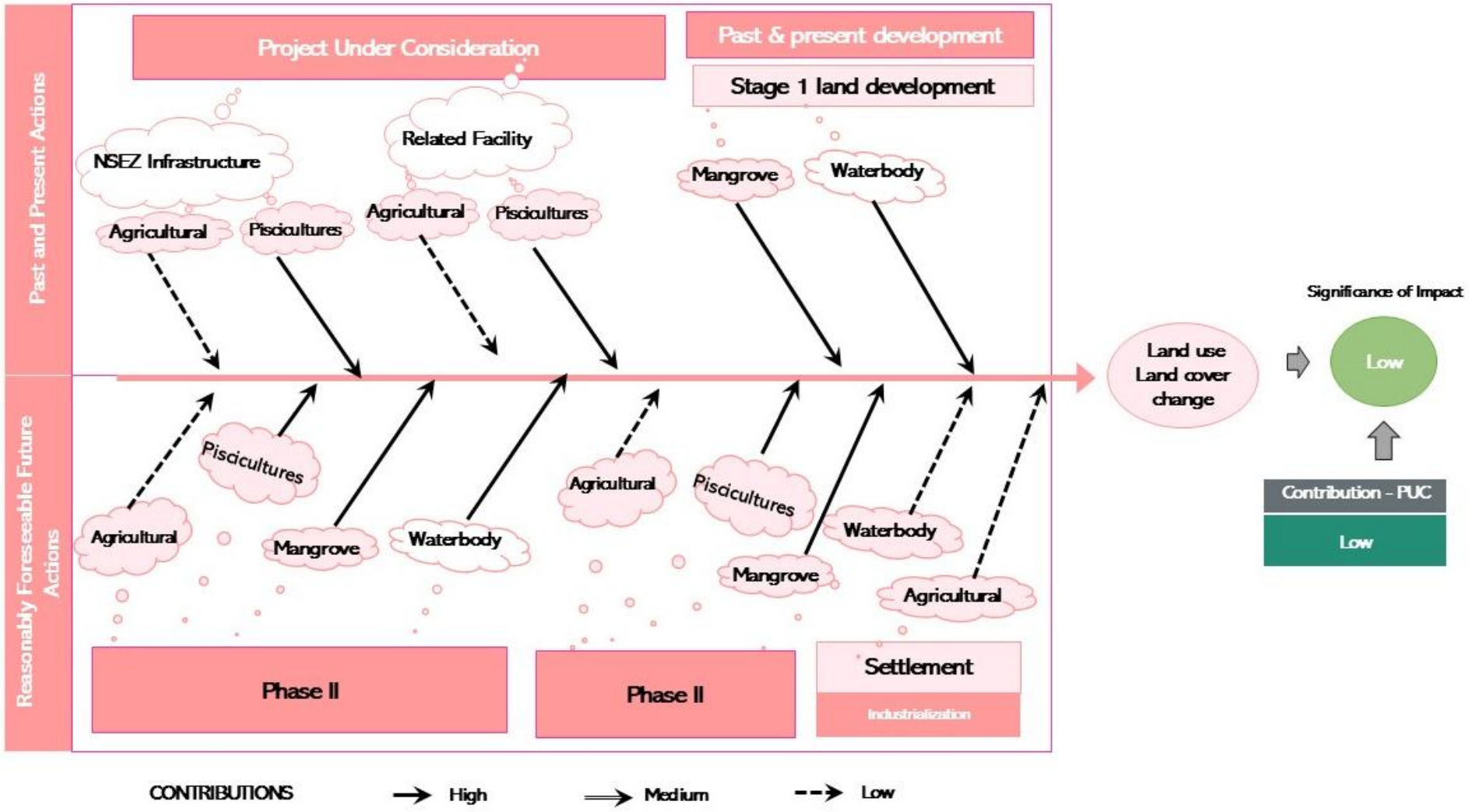
Stressors or Drivers: As per the master plan, NSEZ will provide low-scale residential units within the EZ. The estimated workforce for EZ will be 4.41 million in 2040. The entire workforce during the operational stage of the EZ and during the construction stage may not be accommodated within the EZ residential units. The working population mostly resides in nearby residential areas. The settlements in the spatial boundary are mostly rural; therefore, additional accommodation and workforce may require additional residential units. It is envisaged that agricultural lands will likely be converted into residential land. The potential impact on land use due to induced development is assessed to be medium.

7.1.3 Significance of Cumulative Impact

Loss of agricultural land and wetlands within the spatial boundary is more than the national land conversion rate of agricultural land for industry and urbanization. The decadal land use changes of Feni and Chattogram district indicates the inland and forest land has been diverted to other land use; i.e built-up area (urbanization and development projects), about 12.83% and 20.07% of the respective land use category. The past and present land use changes of spatial boundary are about 5.25% of the total land use; this is mostly mud-flood & mangrove area and agricultural land. The contributions to land use change from past and present activities are within the threshold limit or moderate. The future development activities, i.e., Phase II and III development in NSEZ, are likely to modify about 71% of the total land use, and additional stressors, i.e., urbanization, will also contribute to the land use changes of the spatial boundary area. The past, present, and future development activities, along with external factors (settlement growth), will cumulatively impact the land use change. The cumulative impact will exceed the threshold values for agricultural land (2.30% of total land use) and mud-flood & mangrove areas and inland water bodies (21.44%). The cumulative impact is assessed to be high. However, the contribution from PUC on land use change is assessed to be low. The land use potential to impact the livelihood of the local people has been discussed in the Livelihood Impact section.

The contribution towards land use changes due to PUC, past and present activities, and future activities in the spatial boundary of CIA, along with their cause-effect relationship, is graphically presented in Figure 7-2.

Figure 7-2: Land Use and Land Cover Change - Cause and Effect Relationship



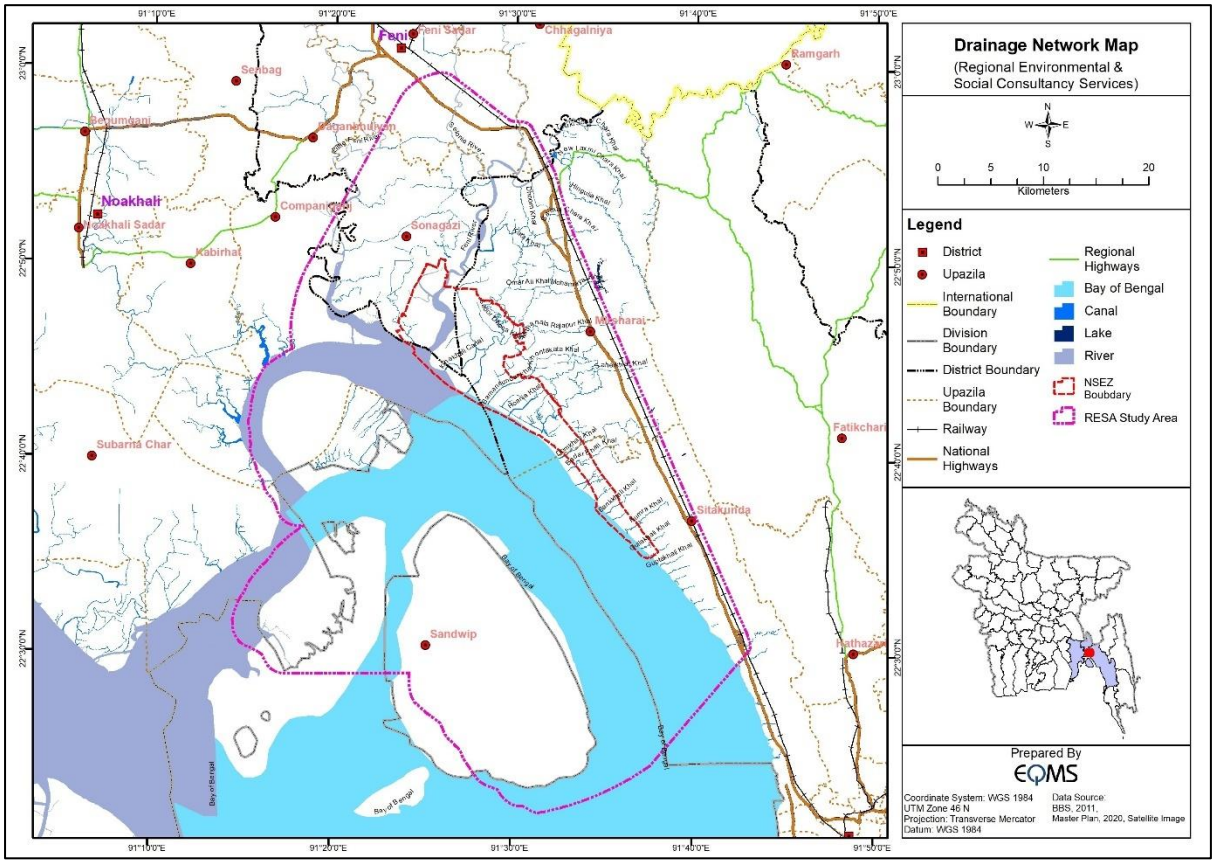
7.2 Topography and Drainage

7.2.1 Baseline Condition

The study area is generally flat and low-lying towards the Bay of Bengal and Sandwip Channel. The site belongs to the sea-land interactive sedimentary plain, and the terrain appears to be relatively flat. In the NSEZ site, topographic elevation ranges between -7.90 mMSL to 6.50 mMSL. In the downstream of the Feni River and the low-lying area, topographic elevation ranges in negative values like -7.90 mMSL to -0.64 mMSL. Over the NSEZ land site, topographic elevation ranges between 2.28 mMSL to 6.50 mMSL.

Feni and Little Feni are the two major rivers that flow down to the Bay of Bengal in the northwest of the proposed NSEZ area. These two major rivers make a confluence near Char Chandia. The char land at the confluence of these two major rivers has been considered as part of NSEZ. The major Khals/Canals which flow through the proposed NSEZ area are Ichakhali, Bamon Sundar, Saherkhali, and Domkhali Khal. Others are Daborkhali, Khutakhali, Hoania, and Donakhali Khals. Most of the Khals/Canals receive water from hills to the east of the Dhaka-Chattogram Highway. The drainage system of the study area is shown in Figure 7-3.

Figure 7-3: Drainage System of the Study Area



Source: EQMS, 2023

7.2.2 Stressors and Impact

PUC: The linear projects under PUC (road, railway network, water supply pipeline) are likely to cross a number of drainage channels. For the construction of roads, railway networks, and water supply pipelines, the corridors will be elevated above the maximum flood level. The construction of these facilities without considering micro-drainage has the potential to have an impact on the local drainage system and can cause waterlogging during heavy rainfall. The potential impact on local drainage is assessed to be low.

Past and Present Projects (Phase I): The Phase I industrial project has been developed in NSEZ, which is reclaimed land. The entire land was mangrove plantations and mudflat areas with creeks and interconnecting channels. For the development of the NSEZ area, a 22-kilometer-long super dyke was constructed along the coastline of the Mirsharai area. To prevent the tidal water from entering the NSEZ area, four sluice gates were constructed on the channels passing through this area. The phase I land was elevated by the filling of sand above the flood level, which caused an alteration in the topography of the developed area. All the interconnecting micro-drainage channels of the Ichakhali Canal, Daborkhali Canal, Hoania Canal, and Saherkahli Canal have been filled up due to land development. During heavy rainfall, the upper catchment area of the Ichakhali Canal, Daborkhali Canal, Hoania Canal, and Saherkahli Canal may cause waterlogging. The situation may be aggravated during high tide periods. The potential impact of topography and drainage due to Phase I land development is assessed to be medium.

Proposed Projects (Phase II): Phase II land, towards the Sonagazi site, will be developed for a residential area and amenities. The Phase II site is also a low-lying area and elevated by the filling of sand above the flood level, which caused an alteration in the topography of the Phase II area. The main drainage channel at the Sonagazi site is the Feni River and its small drainage channels. The potential impact of topography and drainage due to Phase II land development is assessed to be low.

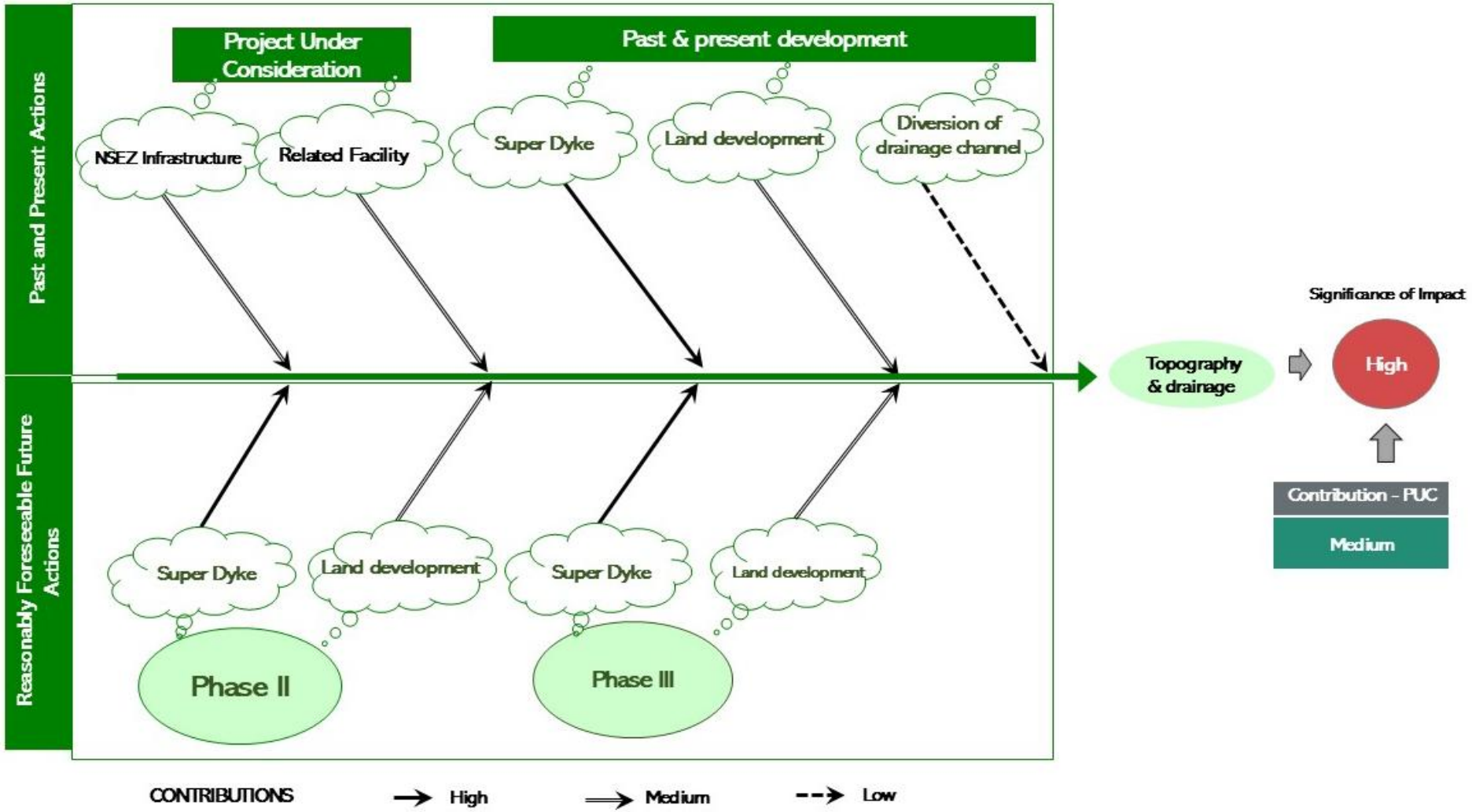
Proposed Projects (Phase III): Phase III land, towards the Sitakunda side, will be developed for industrial development. The Phase III site is also a low-lying area and elevated by the filling of sand above the flood level, which caused an alteration in the topography of the Phase III area. The super dyke will also be constructed towards the Sitakunda site, and the drainage system will also be regulated through a sluice gate. The potential impact of topography and drainage due to Phase III land development is assessed to be medium.

7.2.3 Significance of Cumulative Impact

The past & present projects (Phase I), and proposed projects in Phase II and Phase III will cause significant changes in the topography of the NSEZ area. The construction of related facilities (road, railway network, water supply pipeline) will also cause the topography change of its alignment. The anticipated topographical change may cause local drainage systems and waterlogging in the region. The past, present, and future development activities will cumulatively impact topography and drainage. The cumulative impact is assessed to be medium. The contribution from PUC to the land use change is assessed to be low.

The contribution towards topography and drainage due to PUC, past and present activities, and future activities in the spatial boundary of CIA, along with their cause-effect relationship, is graphically presented in Figure 7-4.

Figure 7-4: Topography and Drainage - Cause and Effect Relationship



7.3 Air Environment (Air Quality)

The VC interaction and effect diagram (Figure 7.2) indicated that the PUC and other proposed projects under Phases I, II, and III, along with other development projects, and external factors, directly or indirectly interacted with the ambient air quality of the airshed. The cumulative impact on air quality is assessed through (i) concentration of particulate matter - PM_{10} and $PM_{2.5,}$ (ii) concentration of NOx in the airshed.

7.3.1 Baseline Condition

There are eight operating industries and multiple industries under construction in the Phase I area of the NSEZ. Air emissions from operational industries, site development activities, construction activities, and the movement of vehicles for the transport of materials and finished products are the main sources of air emissions.

To understand the historical ambient air quality baseline condition of the study region, an extensive secondary documentation review was conducted by the RESA Consultant. From the secondary literature review, a total of 28 ambient air quality monitoring results have been identified in the study region. The primary ambient air quality was monitored in 10 locations in the RESA study.

Secondary Monitoring Results

Particulate Matter (PM_{10}): PM_{10} concentration in ambient air in the study region was recorded in the range of 32.4 - 310.0 µg/m^3. The concentration of PM_{10} was observed to be a minimum (32.4 µg/m^3) at Mirsharai Site 2 and a maximum (310.0 µg/m^3) at South Mougadia Union, Mirsharai (AAQ-7). Observed values at five monitoring locations exceeded the Air Pollution (Control) Rules 2022 standard (150 µg/m^3) for 24 hours. All observed values except AAQ-6, AAQ-13, AAQ-18, AAQ-22, and AAQ-26 exceed the IFC/WB standard (45 µg/m^3) for 24 hours.

Particulate Matter ($PM_{2.5}$): $PM_{2.5}$ concentration in ambient air in the study region was recorded in the range of 14.8 - 304.0 µg/m^3. The concentration of $PM_{2.5}$ was observed to be a minimum (14.8 µg/m^3) at Mirsharai Site 2 and a maximum (304.0 µg/m^3) at South Mougadia Union, Mirsharai. Observed values at four monitoring locations exceeded the Air Pollution (Control) Rules 2022 standard (65 µg/m^3) for 24 hours. All observed values except AAQ-6 exceed the IFC/WB standard (15 µg/m^3) for 24 hours.

Nitrogen Oxide (NO_x): NO_2 concentration in ambient air in the study region was recorded in the range of 20.5 - 32.2 µg/m^3. The concentration of NO_2 was observed to be a minimum (20.5 µg/m^3) at Mirsharai Site 2 (AAQ-6) and a maximum (32.2 µg/m^3) at Poshchim Ichakhali. All the observed values were within the Air Pollution (Control) Rules 2022 standard (80 µg/m^3) for 24 hours. However, observed values at three monitoring locations exceeded the IFC/WB standard (25 µg/m^3) for 24 hours.

Primary Monitoring Results

Particulate Matter (PM_{10}): The average concentration of PM_{10} in the spatial boundary ranged between 36.31 and 77.04 µg/m^3. The average concentration of PM_{10} values at all stations was found to be in compliance with the Air Pollution Control Rules 2022 standard of 150 µg/m^3.

Particulate Matter ($PM_{2.5}$): The average concentration of $PM_{2.5}$ in the AOI ranged between 27.86 and 51.66 µg/m^3. The average concentration of $PM_{2.5}$ values at all stations was found to be in compliance with the Air Pollution Control Rules 2022 standard of 65 µg/m$^{3.}$

Nitrogen Oxide (NO_x): The average concentration of NOx in the AOI ranged between 10.15 and 20.85 µg/m^3. The average and maximum concentrations of NOx reported across all four monitoring locations were in compliance with the standard value of 80 µg/m^3, as per Air Pollution Control Rules 2022.

7.3.2 Concentration of PM

7.3.2.1 Stressors and Impact

PUC: The construction phase of the PUC has the potential for fugitive dust generation. This can occur from the landfilling activity, earthwork, and handling (unloading from transport vehicles to storage areas

and use during construction activities) of construction materials such as sand, aggregate, and cement. These activities contribute to the overall air pollution load in the surrounding area. The primary pollutant of concern is particulate matter (PM), which is expected to settle in the vicinity of the site and persist throughout the construction stage.

During the operational phase of the PUC (internal and external roads), there is potential to increase the traffic load. The traffic movement will also contribute to PM in the ambient air. The potential impact on PM in ambient air from PUC (construction and operational stage) is assessed to be low.

Past and Present Projects (Phase I): There are eight operating industries, including thermal power plants (utilizing both natural gas and heavy fuel oil), steel manufacturing facilities, ready-mix concrete plants, and the chemical industry. The existing thermal power is dual fuel, and the PM contribution is assessed to be low. The process emissions from steel manufacturing facilities and ready-mix concrete plants are assessed as medium.

There are also 10 under-construction industries in the Phase I area. The construction activities of these under-construction industries have the potential to generate fugitive dust emissions. This could occur during the handling (unloading from transport vehicles to storage areas and use during construction activities) of construction materials.

The side development activities under Phase I also have the potential to generate fugitive emissions due to the handling (unloading from transport vehicles to storage areas and use during construction activities) of construction materials. The potential impact on PM in ambient air from past and present activities is assessed to be medium.

Proposed Projects (Phase II): Phase II development is primarily a residential area and amenities for the NSEZ. The land development and construction of residential buildings and amenities potential to generate particulate matter, and its potential impact will be localized. During the operation phase of the Phase II activities, power requirements will be sourced from the grid supply, which may not contribute to the significant PM load in the ambient air. The potential impact on PM in ambient air from proposed industries and development is assessed to be low.

Proposed Projects (Phase III): Phase III land will be developed for heavy industries. The land development and construction of phase III industries (heavy industries) have the potential to generate particulate matter, and their potential impact will be localized. As per the master plan, the energy demand of NSEZ will be supplied by the grid supply. However, for the operation of heavy industries, the individual industries are likely to have LNG-based backup power facilities. During the operation stage of Phase III, heavy industries have the potential to contribute PM due to process emissions, the handling of raw materials, and the operation of fuel-based boilers or power sources. The potential impact on PM in ambient air from proposed industries and developments is assessed to be low.

Air quality modelling: To assess the cumulative impact on PM from the above-mentioned industry sectors and their contribution to the airshed has been assessed through a modelling exercise. Predicted GLC from industry sectors has been presented in Table 7.1. Details have been provided in Appendix G (Volume 3).

The major contributors of the particulate matter in the NSEZ are power plants, paint industries, chemicals, steel, cement, fertilizer, refinery, road traffic, and construction activities. The particulates produced by natural gas combustion are usually less than 1 micrometer (micron) in diameter and are composed of low molecular weight hydrocarbons that are not fully combusted.

Other than industrial activity, development stressors like road & traffic and construction material handling and storage activities are also contributing to the PM in the airshed. In the study domain, there are the Dhaka-Chattogram Highway and the approach road from the Dhaka-Chattogram Highway to the NSEZ. The existing traffic load on the highways is quite high. The burning of fossil fuel (oil/gas) in the vehicles plying on these roads has been generating PM through tailpipe emissions. Vehicular emissions are likely to be dispersed locally along the transport corridors. Future industrial growth and urbanization will lead to an increase in the traffic load, and the increased traffic volume will result in

more PM emissions. There are 27 active brick kilns within the study domain, which mainly operate during the dry season.

The contribution of PM from key industrial sources (power plants, other industries like cement, steel, fertilizer, chemical, paint, steel, and refinery) on the ambient air quality in the model domain was understood through predictions from the EPA Regulatory Model (AERMOD), as described above. The predictions were made at the locations selected for primary air quality monitoring during the study to enable appropriate comparison and analysis of the predicted results. The air quality modelling results for 24-hourly maximum ground level concentrations (GLCs) are presented in Table 7-2. The isopleths generated for different scenarios, representing both 24-hourly maximum GLCs, are presented in Appendix G (Volume 3).

Table 7-2: Predicted 24-Hourly Maximum Ground Level Concentration of PM_{10}

Monitoring Locations	Monitored Conc. of PM (µg/m³)	Predicted 24 Hourly Max Concentration of PM_{10} (µg/m³)					
		Power Plant	Industry		Brick Kiln	Road	All Sources
			Inside NSEZ	Outside NSEZ			
AAQ-1	79.5	3.68	2.75	0.029	7.0	6.34	7.20
AAQ-2	55.75	2.67	2.25	0.017	7.5	5.62	8.91
AAQ-3	33.9	5.07	2.58	0.020	10.2	11.42	13.24
AAQ-4	59.48	8.10	2.79	0.026	7.7	9.72	10.47
AAQ-5	54.32	4.91	3.58	0.031	11.0	17.13	12.91
AAQ-6	19.5	1.84	3.69	0.041	4.9	12.53	13.40
AAQ-7	31.7	1.76	4.74	0.030	7.3	17.50	36.75
AAQ-8	58.2	3.74	3.61	0.032	11.4	25.97	13.54
AAQ-9	25.7	1.94	5.37	0.040	6.3	10.60	28.97
AAQ-10	71.2	5.93	3.04	0.028	11.0	14.96	11.24

The air quality modelling study shows that the predicted contribution of PM_{10} from the existing power plant varied from 1.76 µg/m³ (minimum), i.e., only 5.6% of the monitored PM_{10} concentration at AAQ-7 (Goll Chattor of Komor Ali Bazar, Mirsharai) to 8.10 µg/m³ (maximum), i.e., 13.6% of the monitored PM_{10} concentration at AAQ-4 (Near BEZA Administrative Building, NSEZ).

The predicted contribution of PM_{10} from industries inside the NSEZ varied from 2.25 µg/m³ (minimum), i.e., only 4.0% of the monitored PM concentration at AAQ-2 (Near 7 no. Sonagazi Union Parishad, Sonagazi, Feni) to 5.37 µg/m³ (maximum), i.e., 20.9% of the monitored PM_{10} concentration at AAQ-9 (In front of the Government Technical School & College, Sitakunda).

The predicted contribution of PM_{10} from industries outside the NSEZ varied from 0.017 µg/m³ (minimum), i.e., only 0.03% of the monitored PM_{10} concentration at AAQ-2 (Near 7 no. Sonagazi Union parishad, Sonagazi, Feni) to 0.04 µg/m³ (maximum), i.e., 0.21% of the monitored PM_{10} concentration at AAQ-6 (Beribadh Road, Infront of Unigas Plant, Barabkunda, Sitakunda).

The contribution of PM_{10} from the brick kilns varied from 4.94 µg/m³ (minimum), i.e., 25.4 % of the monitored PM_{10} concentration at AAQ-6 (Beribadh Road, in front of Unigas Plant, Barabkunda, Sitakunda) to 11.4 µg/m³ (maximum), i.e., 19.7% of the monitored PM concentration at AAQ-8 (Middle Abu Turab Bazar, Mirsharai, Chattogram).

The air quality modelling study shows that the predicted contribution of PM_{10} from roads varied from 5.6 µg/m^3 (minimum), i.e., 10.1% of the monitored PM_{10} concentration at AAQ-2 (Near 7 no. Sonagazi Union Parishad, Sonagazi, Feni) to 25.9 µg/m^3 (maximum), i.e., 44.6% of the monitored PM_{10} concentration at AAQ-8 (Middle Abu Turab Bazar, Mirsharai, Chattogram).

The contribution of PM_{10} from existing and future industries, including power plants, chemicals, paint, steel, cement, fertilizers, petroleum refinery, glass, brick, and glass has been predicted through a modelling study. The modelling result reveals that brick kiln and road dust will cumulatively result in increased PM_{10} concentrations in the study area. The model reveals that major PM_{10} contributors in the study region are road dust and brick kilns. However, the brick kiln only contributes to air pollution during the dry period only. The model shows that the contribution of PM_{10} from the existing industries in the NSEZ on air quality monitoring locations is insignificant.

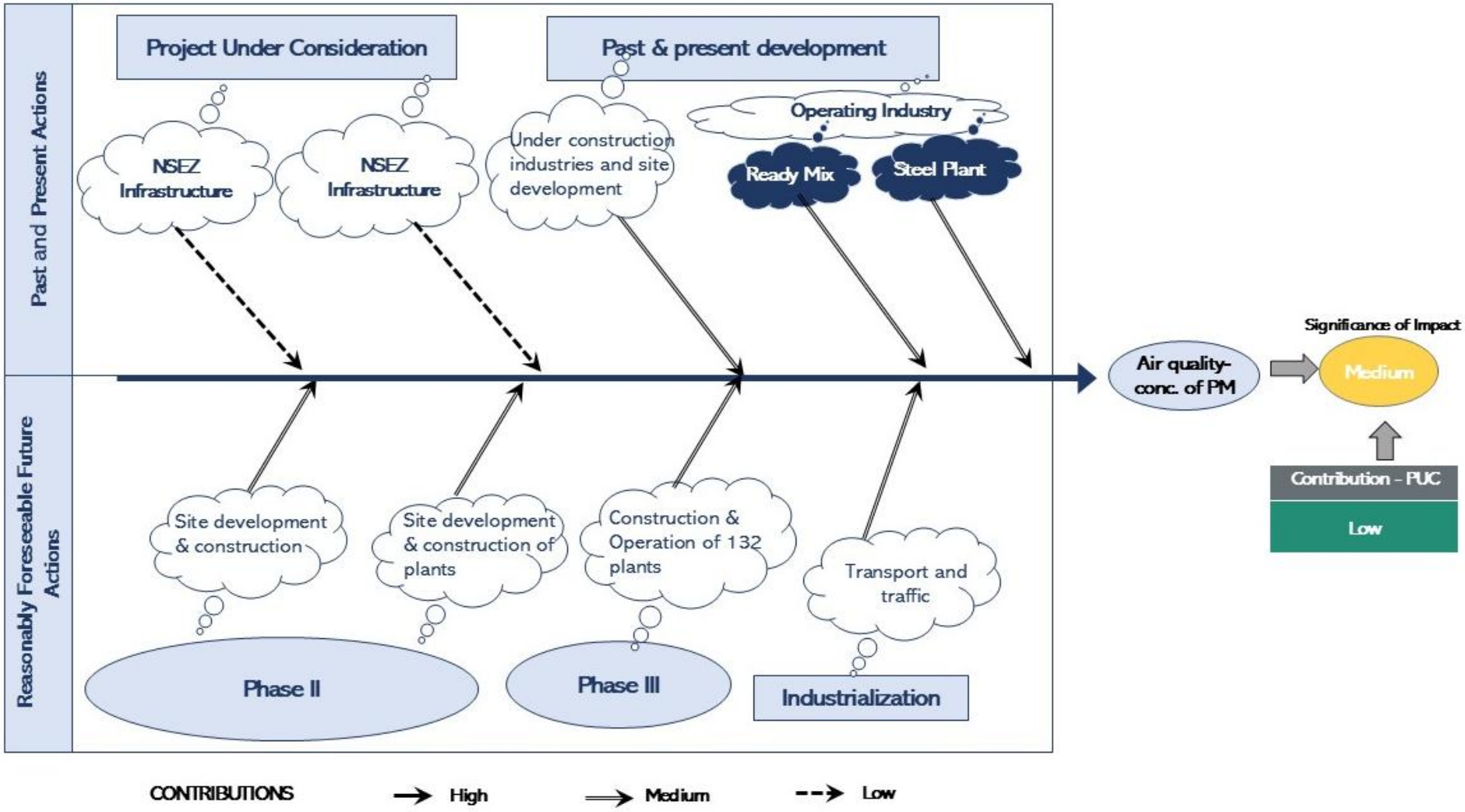
7.3.2.2 Significance of Cumulative Impact

The contributions to the PM in the airshed from past and present activities are medium. The monitored PM concentration in the spatial boundary is within the threshold limit. The past, present, and future industrial activity, along with external factors (rapid urban growth and traffic), will cumulatively increase the PM concentration in the NSEZ Airshed.

Along with the industrial growth, other PM-generating activities (traffic, small and medium air-polluting industrial sources, and urban & commercial activity) will also be contributing additional PM in the airshed. Therefore, the cumulative contribution of PM in the NSEZ area from past, present, and future industry activities and development stressors is expected to lead to an exceedance of the PM threshold level. The cumulative impact is assessed to be medium. The contribution of PM from PUC towards PM concentrations in the airshed is assessed to be low.

The contribution towards PM due to PUC, past and present activities, and future activities in the spatial boundary of CIA, along with their cause-effect relationship, is graphically presented in Figure 7-5.

Figure 7-5: Ambient Air Quality (Concentration of PM) - Cause and Effect Relationship



7.3.3 Concentration of NO_2

7.3.3.1 Stressors and Impact

PUC: During the construction stage of the PUC, heavy equipment such as excavators, payloaders, trucks, concrete mixers, lifting equipment, etc., will be deployed onsite. Exhaust emissions from the operation of machinery and equipment are likely to contribute to the air pollutant load, including but not limited to pollutants such as PM, NOx, SO_2, and CO.

During the operational phase of the PUC (internal and external roads), there is potential to increase the traffic load. The traffic movement will also contribute to NOx in the ambient air. The potential impact on NOx in ambient air from PUC (construction and operational stage) is assessed to be low.

Past and Present Projects (Phase I): There are eight operating industries, including thermal power plants (utilizing both natural gas and heavy fuel oil), steel manufacturing facilities, ready-mix concrete plants, and the chemical industry. The existing thermal power is dual fuel, and the NOx contribution is assessed to be medium. The process emissions from steel manufacturing facilities and ready-mix concrete plants are assessed as low.

There are also 10 under-construction industries in the Phase I area. The construction activities of these under-construction industries have the potential to generate NOx from the operation of machinery and equipment. The potential impact on NOx in ambient air from under-construction industries is assessed to be low.

Proposed Projects (Phase II): Phase II development is primarily a residential area and amenities for the NSEZ. For the land development and construction of residential buildings and amenities, heavy equipment such as excavators, payloaders, trucks, concrete mixers, lifting equipment, etc., will be deployed onsite. Exhaust emissions from the operation of machinery and equipment are likely to contribute to the air pollutant load, such as PM, NOx, SO_2, and CO. During the operation stage of the Phase II activities, power requirement will be sourced from the grid supply, which may not contribute a significant NOx load in the ambient air. The potential impact on PM in ambient air from proposed industries and development is assessed to be low.

Proposed Projects (Phase III): Phase III land will be developed for heavy industries. The land development and construction of phase III industries (heavy industries), heavy equipment such as excavators, payloaders, trucks, concrete mixers, lifting equipment, etc., will be deployed onsite. Exhaust emissions from the operation of machinery and equipment are likely to contribute to the air pollutant load, such as PM, NOx, SO_2, and CO. As per the master plan, the energy demand of NSEZ will be supplied by the grid supply. However, for the operation of heavy industries, the individual industries are likely to have LNG-based backup power facilities. During the operation stage of Phase III, heavy industries have the potential to contribute to NOx due to fossil fuel burning. The potential impact on NOx in ambient air from proposed industries and developments is assessed to be medium.

Air quality modelling: To assess the cumulative impact on NOx from the above-mentioned industry sectors and their contribution to the airshed has been assessed through a modelling exercise. Predicted GLC from industry sectors has been presented in Table 7.2. Details have been provided in Appendix G (Volume 3).

The air quality monitoring result shows that the NO_2 concentration is well within the national standard. The major contribution to the study region is road traffic. Daily huge number of vehicles plying on the Dhaka-Chattogram highway, which is the key NO_2 emission source in the study area.

The industries located in the NSEZ and Sitakunda region are operating by gas. Hence, NO_2 emissions from these industries are comparatively lower than oil-based industries. In the NSEZ, there is only one HFO-based power plant, which is the major contributor to generating NO_2 in the airshed. Combustion of fossil fuels (gas and oil) at high temperatures results in the generation of NO_2. The emission of NO_2 from oil-based power plants is almost three times higher than from gas-based power plants.

As stated above, the one major highway and approach road from the Dhaka-Chattogram highway to NSEZ acts as a stressor on the air environment. NO_2 emissions from the traffic are due to the burning of fossil fuels and resultant tailpipe emissions. Future industrial growth and urbanization are expected to increase the corresponding traffic load. The increased traffic volume will also result in an increase in NO_2 emissions.

The contribution of NO_2 from existing industrial sources (power plants and other industries) in the air shed in the NSEZ and surrounding area was understood through predictions from the EPA Regulatory Model (AERMOD), as described above. The air quality modelling results for 24-hourly maximum ground level concentrations (GLCs) are presented in Table 7-3 while the isopleths generated for different scenarios, representing both 24-hourly maximum GLCs, are presented in Appendix G (Volume 3).

Table 7-3: Predicted 24-Hourly Maximum Ground Level Concentration of NO_2

Monitoring Locations	Monitored Conc. of PM ($\mu g/m^3$)	Predicted 24 Hourly Max Concentration of NO_2 ($\mu g/m^3$)					
		Power Plant	Industry		Brick Kiln	Road	All Sources
			Inside NSEZ	Outside NSEZ			
AAQ-1	21.18	3.82	15.43	0.43	0.23	0.15	17.38
AAQ-2	29.24	2.77	11.92	0.28	0.25	0.09	13.27
AAQ-3	31.06	5.26	14.30	0.31	0.34	0.34	16.08
AAQ-4	27.14	8.41	13.85	0.40	0.26	0.35	14.27
AAQ-5	17.91	5.10	16.73	0.49	0.37	0.49	16.95
AAQ-6	19.47	1.91	21.96	0.55	0.17	1.49	23.22
AAQ-7	15.98	1.83	23.55	0.46	0.24	2.00	23.81
AAQ-8	18.59	3.89	18.02	0.51	0.38	2.06	18.03
AAQ-9	33.06	2.01	28.43	0.64	0.21	2.43	29.10
AAQ-10	21.18	3.82	18.55	0.43	0.23	0.15	18.76

The air quality modelling study shows that the predicted contribution of NO_2 from the existing power plant varied from 1.8 $\mu g/m^3$ (minimum), i.e., only 11.4% of the monitored NO_2 concentration at AAQ-7 (Goll Chattor of Komor Ali Bazar, Mirsharai) to 8.41 $\mu g/m^3$ (maximum), i.e., 31.0% of the monitored NO_2 concentration at AAQ-4 (Near BEZA Administrative Building, NSEZ).

The predicted contribution of NO_2 from industries inside the NSEZ varied from 11.92 $\mu g/m^3$ (minimum), i.e., 40.8% of the monitored NO_2 concentration at AAQ-2 (Near 7 no. Sonagazi Union Parishad, Sonagazi, Feni) to 28.43 $\mu g/m^3$ (maximum), i.e., 86.0% of the monitored NO_2 concentration at AAQ-9 (In front of the Government Technical School & College, Sitakunda).

The predicted contribution of NO_2 from industries outside the NSEZ varied from 0.28 $\mu g/m^3$ (minimum), i.e., only 0.96% of the monitored NO_2 concentration at AAQ-2 (Near 7 no. Sonagazi Union Parishad, Sonagazi, Feni) to 0.64 $\mu g/m^3$ (maximum), i.e., 1.95% of the monitored NO_2 concentration at AAQ-9 (In front of the Government Technical School & College, Sitakunda).

The contribution of NO_2 from the brick kilns varied from 0.17 $\mu g/m^3$ (minimum), i.e., 0.85% of the monitored NO_2 concentration at AAQ-6 (Beribadh Road, Infront of Unigas Plant, Barabkunda, Sitakunda) to 0.38 $\mu g/m^3$ (maximum), i.e., 2.06% of the monitored NO_2 concentration at AAQ-8 (Middle Abu Turab Bazar, Mirsharai, Chattogram).

The air quality modelling study shows that the predicted contribution of NO_2 from roads varied from 0.09 µg/m^3 (minimum), i.e., 0.30% of the monitored NO_2 concentration at AAQ-2 (Near 7 no. Sonagazi Union Parishad, Sonagazi, Feni) to 2.43 µg/m^3 (maximum), i.e., 7.36% of the monitored NO_2 concentration at AAQ-9 (In front of the Government Technical School & College, Sitakunda).

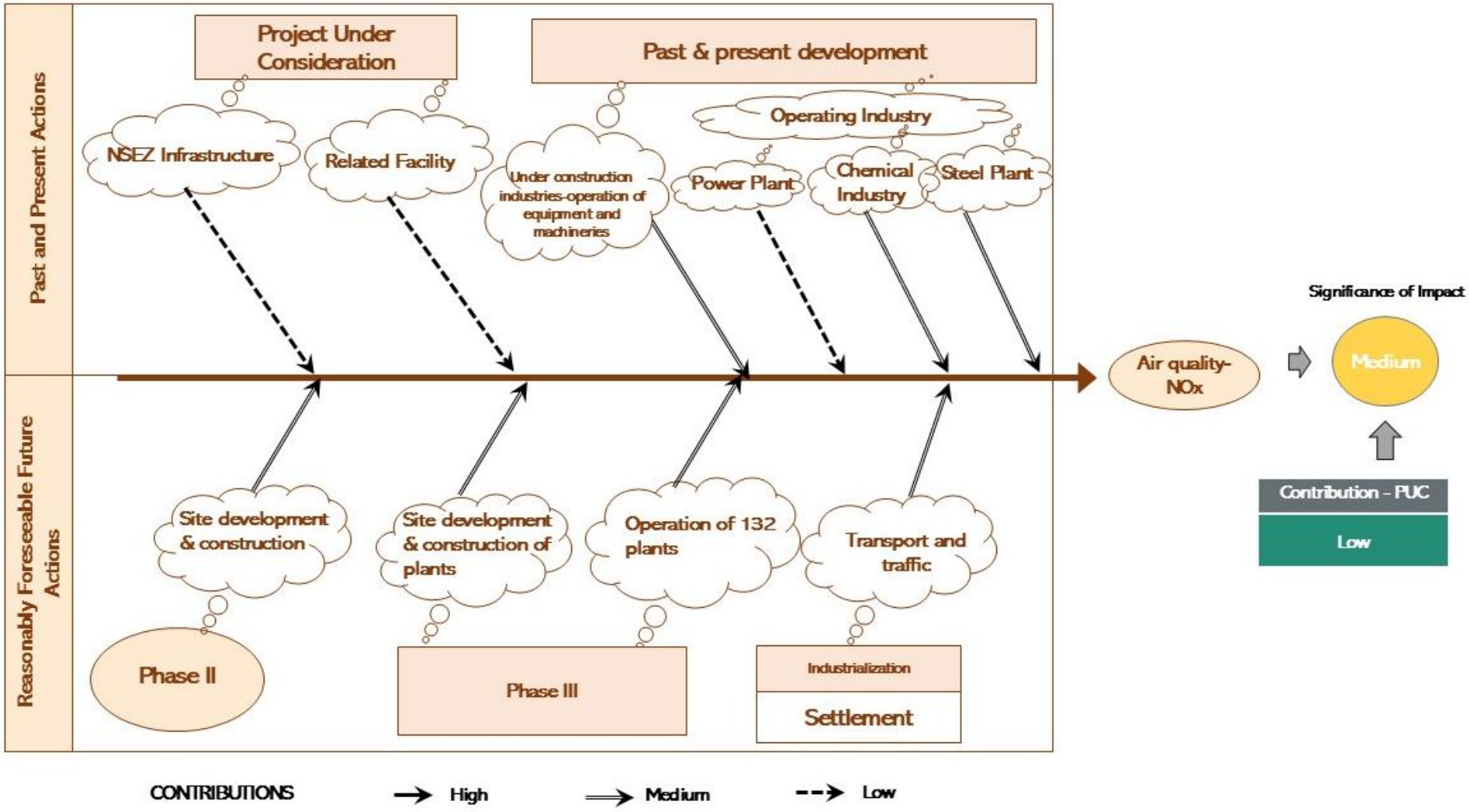
The contribution of NO_2 from existing and future industries, including power plants, chemicals, paint, steel, cement, fertilizers, petroleum refinery, glass, brick kilns, and road vehicles, has been predicted through a modelling study. The modelling result reveals that industrial, brick kiln, and road sectors will cumulatively result in increased NO_2 concentrations varying from 13.27 µg/m^3 (minimum), i.e., 45.4% of the monitored NO_2 concentration at AAQ-2 (Near 7 no. Sonagazi Union parishad, Sonagazi, Feni) to 29.10 µg/m^3 (maximum), i.e., 88.0% of the monitored NO_2 at AAQ-9 (In front of the Government Technical School & College, Sitakunda).

7.3.3.2 Significance of Cumulative Impact

The existing NOx concentration in the NSEZ area is within the threshold limits. The past, present, and future industrial activity, along with external factors (rapid urban growth), will cumulatively impact the ambient air quality in terms of increasing the NOx concentration in the airshed. However, the cumulative contribution of NOx in the NSEZ area from past, present, and future industry activities and development stressors is not expected to exceed the NOx threshold level. The cumulative impact is assessed to be moderate. The contribution of NOx from PUC is assessed to be low.

The contribution towards NOx due to PUC, past and present activities, and future activities in the spatial boundary of CIA, along with their cause-effect relationship, is graphically presented in Figure 7-6.

Figure 7-6: Ambient Air Quality (Concentration NO_2) - Cause and Effect Relationship



7.4 Groundwater Resource

7.4.1 Baseline Condition

Groundwater is abundant in Bangladesh, and the aquifers are highly productive. Water tables vary across the country but are typically shallow at around 1–10 m below the ground surface. These factors have made groundwater an attractive and easily accessible resource. This shallow depth, coupled with the aquifer productivity, has historically made groundwater an attractive and readily extractable resource.

In the United Nations Development Programme (UNDP) study, the country has been divided into 15 (fifteen) groundwater development zones (A-Q), based on aquifer characteristics and land development units. Each zone has been classified and rated as to its development potential in relation to the other zones. The study area constitutes Zone L and Zone N.

Zone L: Zone L covers the Piedmont deposits of the Chattogram District and the Meghna estuarine floodplains of the Noakhali District. It includes Feni Sadar and Daganbhuyan Upazilas of Feni district; Mirsharai, Fatikchhari, Hathazari, Raojan, Boalkhali, Patiya, Anowara, and Banshkhali Upazilas of Chattogram district. The area is not considered favorable for extensive groundwater development. Aquifers in the area are generally confined. At places, semi-confined conditions exist, but leakage from the overlying water-bearing formations is negligible. Transmissivities average about 400 m^2/day. Hydrogeological analyses indicate that well discharge of 28.3 lit/sec (1 cusec) is considered as maximum, with optimum values ranging from 14.2 to 21.2 lit/sec (0.5 to 0.75 cusecs).

Zone N: Zone N covers the coastal areas of the Noakhali and Chattogram districts. Daganbhuyan Upazila of Feni district; Mirsharai, Boalkhali, Patiya, Anowara, and Banshkhali of Chattogram district; and Moheshkhali of Cox's Bazar district. It comprises the floodplains of the Ganges-Padma and Meghna Rivers as well as the Chattogram coastal plain. Groundwater conditions are highly variable, and development is highly impaired by the low quality of water affected by the intrusion of brackish and saline water. The development of the main and composite aquifers is limited to isolated freshwater areas. The groundwater potential of the coastal zone depends upon the development of the deep aquifer. The potential of the deep aquifer is relatively unknown, but there are indications that fresh water may be encountered.

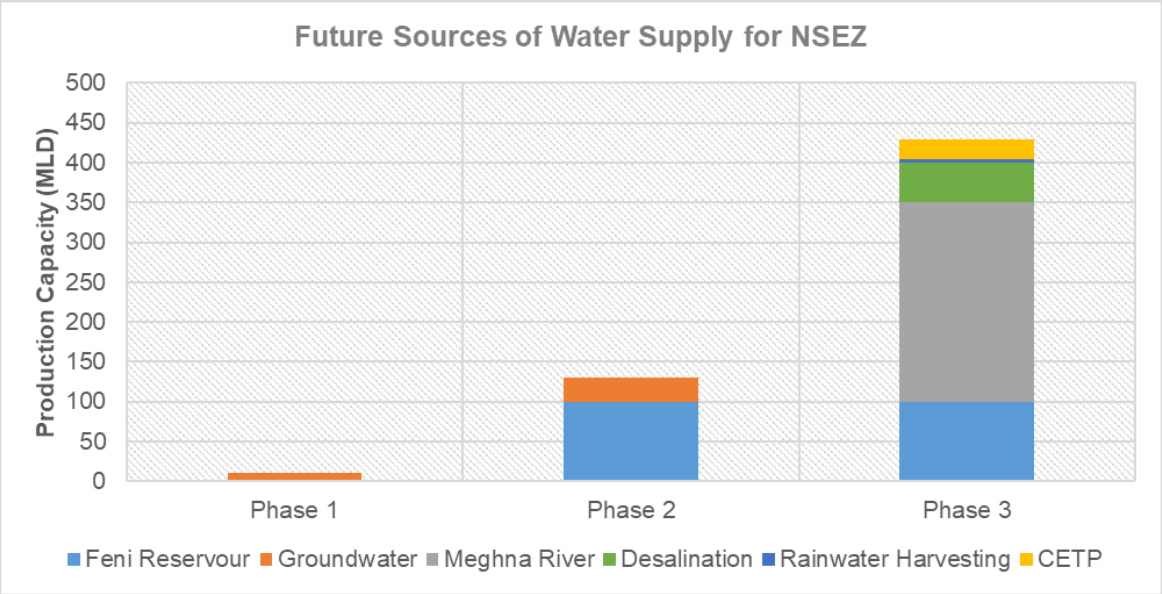
According to the detailed study on total water demand & water availability assessment for NSEZ, the hydrogeological investigation shows that the topsoil in the study area is composed mainly of silty clay. The shallow (10m to 121m) aquifer consists of very fine to fine sand that is mainly brackish in nature and shows a resistivity range between 0.9 Ωm to 12 Ωm. The aquitard thickness is highly variable and varies from ~15m to ~100m. The resistivity of the aquitard ranges between 1.24 Ωm to 17 Ωm and is composed of clay or silty clay. The deep aquifer shows a resistivity range varying between 23 Ωm to 73 Ωm and confirms having fine to medium sand with fresh pore water. The depth of the deep aquifer varies between ~50m to ~150m and is increasing towards the southeast.

It is observed that shallow or deep aquifers in the study area are interrupted by discontinuous clay deposition at multiple depth levels of different thicknesses. Aquifers containing saline water show low resistivity values, and it is difficult to identify lithology or pore water quality unless direct information about the texture of the formation or the water quality of the formation water is available.

7.4.2 Stressors and Impacts

Dependency on groundwater resources: In the Master Plan, the development of the NSEZ area has been divided into three main time horizons- 2020-2025, 2026-2030, and 2031-2040. Accordingly, the production of water from surface water, groundwater, and desalination plants has been planned for NSEZ as shown in Figure 7-7.

Figure 7-7: Future Sources of Supply for NSEZ



Source: BEZA, August 2025

Figure 7.7 indicates the groundwater dependency throughout the two phases of the EZ. The groundwater withdrawal will increase over the project implementation period. It is estimated that 30 MLD of groundwater will be withdrawn in 2030.

PUC: During the construction stage of various EZ components under PUC would required water and the same will be sourced from groundwater. During the operational stage, a large volume of water would not be required. The potential impact of the PUC on groundwater resources is assessed to be low.

Past and Present Projects (Phase I): The site development, construction of operating industries, and under-construction industries require water that has been sourced from the ground. In the operational phase, the required water for operating industries is being sourced from groundwater. For the sourcing of groundwater, BEZA has constructed bore wells within the NSEZ area. The existing and proposed industries in Phase I are not water-intensive industries. These industries require some process water or cooling water-domestic water. The potential impact of the past and present industries on groundwater resources is assessed to be medium.

Proposed Projects (Phase II): The site development, construction of residential areas, and amenities would require water, which would be sourced from the ground. For the sourcing of additional water for Phase II activities, BEZA has planned to install additional bore wells in the NSEZ area. As per the master plan, the required water for the NSEZ will be sourced from the Feni River (medium term) and the Meghna River (long term). It is envisaged that during the operation phase of the Phase activity, surface water will be supplied to the NSEZ area. Considering the initial phase of sourcing the required water from groundwater and the later stage from surface water, the potential impact on groundwater resources is assessed to be medium.

Proposed Projects (Phase III): The site development and construction of proposed industries in Phase III would require water, which would be sourced from the BEZA supply water, i.e., surface water. It is expected that, during the Phase III operational stage, the required water for operational industries will be sourced from surface water. as per discussion with BEZA, groundwater will not be extracted for Phase III.

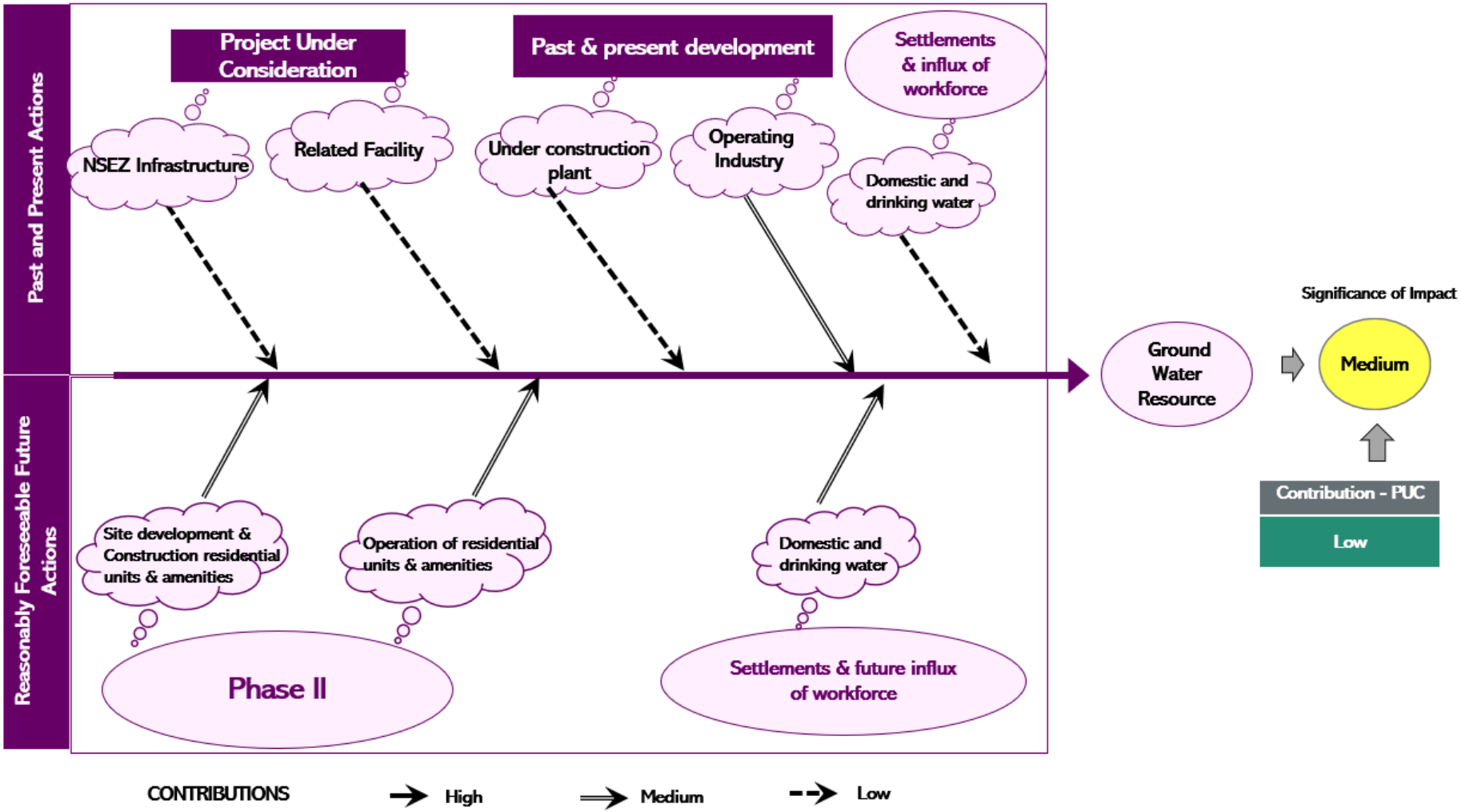
Stressors: Future industrialization process is likely to increase the influx of migrant workers in this region. Water demand for domestic needs will increase and will be sourced from groundwater. Presently, potable needs are mostly being met from groundwater sources, and future growth is likely to exert further pressure on this VC.

The contribution towards depletion of groundwater due to different industrial and development stressors, along with their cause-effect relationship, is graphically presented in Figure 7-8.

7.4.3 Significance of Cumulative Impact

The aquifers in the area are generally confined. At places, semi-confined conditions exist, but leakage from the overlying water-bearing formations is negligible. It is observed that shallow or deep aquifers in the study area are interrupted by discontinuous clay deposition at multiple depth levels of different thicknesses. Aquifers containing saline water show low resistivity values, and it is difficult to identify lithology or pore water quality unless direct information about the texture of the formation or the water quality of the formation water is available. Past industrial activity, PUC, and future industrial activity are expected to result in further depletion of groundwater resources in the future. The cumulative impact on the depletion of groundwater resources is assessed to be high. The contribution of groundwater depletion from PUC is assessed to be low.

Figure 7-8: Ground Water Resource - Cause and Effect Relationship



7.5 Surface Water Quality

The VC interaction and effect diagram (Figure 7.2) indicated that the PUC and other proposed projects under Phases I, II, and III, along with other development projects, and external factors, directly or indirectly interact with the surface water quality of the river. The cumulative impact on surface water quality is assessed through (i) organic load (BOD) in the river water, and (ii) TDS and TSS of the surface waterbodies.

7.5.1 Baseline Condition

The quality of surface water was assessed through primary monitoring under the RESA study as well as through the collection of secondary data from various sources.

Secondary Data

To understand the historical surface water quality baseline condition of the study region, an extensive secondary documentation review was conducted by the RESA Consultant. From the secondary literature review, a total of 41 surface water quality monitoring results have been identified in the study region.

Dissolved Oxygen (DO): DO was observed to be in the range of 4.18 to 9.5 mg/l. All samples were in compliance with Schedule 2A of ECR, 2023. High DO levels in surface water are good for the existing aquatic life of the area.

Biochemical Oxygen Demand (BOD): BOD was observed to be in the range of 0.4 to 192.6 mg/l. BOD concentrations in all samples except SWQ-2, SWQ-11, SWQ-15, SWQ-33, SWQ-34, SWQ-35, SWQ-36, and SWQ-37 were less than 12 mg/l, which were compliant with the Schedule 2A of ECR, 2023.

Total Dissolved Solids (TDS): TDS concentrations of all samples ranged between 0.402 to 20,844 mg/l. TDS concentrations in samples SWQ-1, SWQ-2, SWQ-3, SWQ-4, SWQ-7, SWQ-8, SWQ-9, SWQ-11, SWQ-12, SWQ-15, SWQ-31, SWQ-34, SWQ-38, SWQ-39, SWQ-40, and SWQ-41 were more than 1,000 mg/l, which was not compliant with the Schedule 2A of ECR, 2023.

Primary Monitoring

Surface water samples were collected from the Feni River (Muhuri Reservoir), Sandwip Channel, and different canals/khals, including Ichakhali, Daborkhali, Bamansundar, Hoania, Saherkhali, and Domkhali.

Dissolved Oxygen (DO): DO concentrations in the surface water samples were in the range between 5.7 mg/l to 7.7 mg/l. The maximum DO (7.7 mg/l) was observed at SWQ-5/2 (U/S), and the minimum (5.7 mg/l) was observed at SWQ-1/1 (U/S). All the sampling results met the permissible limit of the ECR, 2023 standard for surface water DO.

Biochemical Oxygen Demand (BOD): BOD concentrations in the surface water samples were in the range between 2.1 mg/l to 5.8 mg/l. The maximum BOD (5.8 mg/l) was observed at SWQ-1/2 (D/S), and the minimum (2.1 mg/l) was observed at SWQ-4/2 (D/S).

Total Suspended Solids (TSS): TDS concentrations in the surface water samples were in the range between 119 mg/l to 208 mg/l. The maximum TDS (208 mg/l) was observed at SWQ-6/2 (D/S), and the minimum (119 mg/l) was observed at SWQ-5/1 (U/S). There are no standards in ECR 2023 for surface water TSS.

7.5.2 Concentration of DO & BOD

7.5.2.1 Stressors and Impacts

PUC: During the construction stage of various EZ components under PUC would like to generate domestic wastewater at the construction sites, and the same will be treated through bio tanks and soak wells. The accidental release of untreated sewage can happen only in the case of a malfunctioning bio-tank and soak wells. Untreated sewage, if directly discharged into a surface water channel, will increase the organic load and the bacteriological load. This can lead to degradation of water quality (increasing

the BOD and decreasing the DO levels). The potential impact of the PUC on surface water quality (DO and BOD) is assessed to be low.

Past and Present Projects (Phase I): As discussed with BEZA, the CETP and CSTP will be implemented under the NSEZ. The operating industries in Phase I have plant-level water treatment plants. The wastewater generated from the industries (effluent and sewage) is being treated and discharged into the drainage channels. The domestic wastewater generated from the existing operating industries and under-construction industries is being treated through STP/ bio tanks and soak wells. Untreated sewage, if directly discharged into a surface water channel, will increase the organic load and the bacteriological load. This can lead to degradation of water quality (increasing the BOD and decreasing the DO levels). There are eight operating industries and 10 under-construction industries, which include chemical, ready-mix, steel, chemical, thermal power, automobile, food processing, Pharmaceuticals, and medical products. The waste streams from the different units are expected to have effluent; however, the BOD load is expected to be low except for food processing units. The potential impact of the PUC on surface water quality (DO and BOD) is assessed to be low.

Proposed Projects (Phase II): During the construction stage of various EZ components under Phase II (residential areas and amenities), will generate domestic wastewater at the construction sites, and the same will be treated through bio-tanks and soak wells. The accidental release of untreated sewage can happen only in cases of malfunctioning bio-tanks and soak wells. Untreated sewage, if directly discharged into a surface water channel, will increase the organic load and the bacteriological load.

During the operational stage of the Phase II project, components will generate sewage from residential units and amenities. It is envisaged that CSTP will be installed in the NSEZ area, and sewage generated from Phase II will be treated through CSTP. Considering this, the potential impact of the Phase II EZ components on surface water quality (DO and BOD) is assessed to be low.

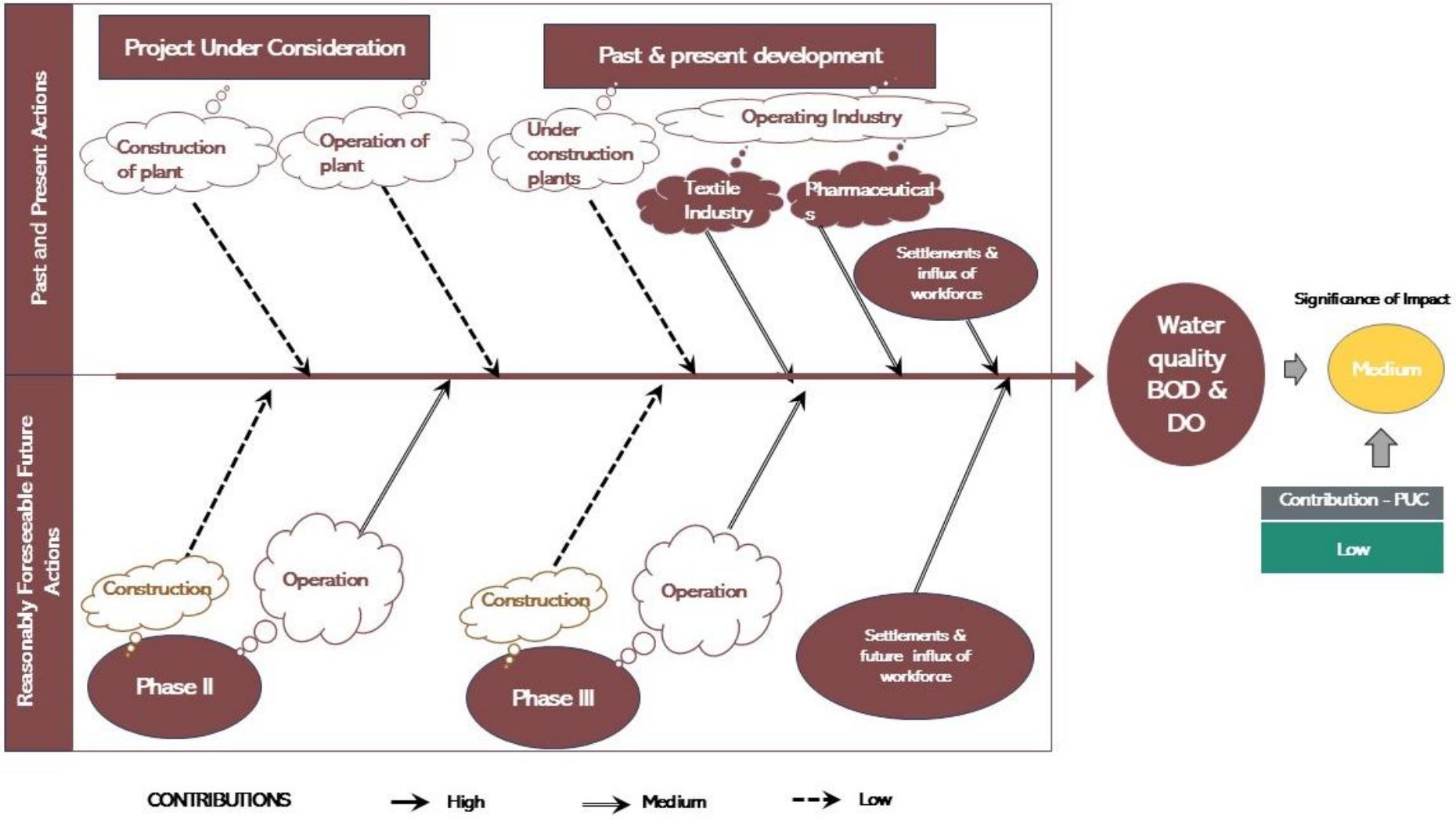
Proposed Projects (Phase III): During the construction stage of various EZ components under Phase III (residential areas and amenities), will generate domestic wastewater at the construction sites, and the same will be treated through bio-tanks and soak wells. During the operational stage of the Phase III project, components will generate sewage from residential units and amenities. It is envisaged that CSTP will be installed in the NSEZ area, and sewage generated from Phase II will be treated through CSTP. Considering this, the potential impact of the Phase II EZ components on surface water quality (DO and BOD) is assessed to be low.

As per the master plan, 132 industries will be set up in the NSEZ area, which includes pulp and paper, RMG & textile, food processing, chemical, hotel and tourism services, paperboard, and power plants. The waste streams from the different units are expected to have effluent; however, the BOD load is expected to be low.

Stressors: In the NSEZ industrial region, there are no large urban centers, or the slumification effect has not been observed. NSEZ still retains its inherent rural character. However, untreated domestic wastewater from existing residential areas is being directly discharged into the river.

The contribution towards the addition of organic load in the river waters due to different industrial and development stressors, along with their cause-effect relationship, is graphically presented in Figure 7-9.

Figure 7-9: Surface Water Quality (DO and BOD) - Cause and Effect Relationship



7.5.2.2 Significance of Cumulative Impact

The contribution of organic load in the surface water channels and the Sandwip channel from the past activities (industrial and external factors) is not significant. The existing BOD level in the river water is within the threshold limit for Class D waters (i.e., propagation of wildlife and fisheries). The concentration of DO in the river was well above the threshold limit for Class D waters. The increase in BOD in the river has a potential negative impact on DO. However, the organic load in the river water was good, and the concentration of DO was good. The past, present, and future development activity, along with external factors (rapid urban growth), will cumulatively impact the surface water quality in terms of increasing the BOD levels in these surface water bodies. The cumulative impact is assessed to be medium. The direct contribution of any organic load from the PUC is assessed to be low.

7.5.3 Total Dissolved Solids and Total Suspended Solids

The Turbidity and total suspended solids TSS could be easily used for indicating water quality because they are the most visible indicators of water. The particles of suspended solids can come from runoff, discharges, soil erosion, stirred bottom sediments, or algal blooms. The clarity of water has generally been used as an indicator of healthy water, whereas a sudden increase in turbidity in a previously clear water body could be used as a cause for concern.

PUC: During the construction stage, the proposed construction of the jetty would lead to resuspension of suspended solids due to piling and foundation work in the Sandwip Channel and surface runoff during the monsoon season from land-side construction activities. Construction of on-land infrastructures like roads, railways, raw water pipelines, transmission lines, and telecommunication lines would require earthwork and handling of construction materials. Surface runoff from construction may contribute to the TDS and TSS in the receiving surface water bodies. The fill materials for phase I land development were sourced from the Sandwip Channel, and future land development fill materials will also be sourced from the channel. The dredging activity for sourcing fill materials would lead to the resuspension of suspended solids. The potential impact on TDS and TSS in surface water bodies from Phase I projects is assessed to be medium.

Past and Present Projects (Phase I): The Phase I site was developed by the construction of super-dyke and landfilling. The construction of super-dyke and fill materials for site development was sourced from the Sandwip channel. During the dredging activity, TDS and TSS were generated; however, the same has been assimilated in the natural process. The construction of jetties would lead to the resuspension of suspended solids due to piling and foundation work in the Channel, and surface runoff during the monsoon season from landside construction activities will contribute to the TDS and TSS in the channel. The fill materials for the remaining Phase II land development will also be sourced from the Sandwip Channel; the sourcing of fill materials will also contribute to the TSS and TDS in the surface water body. The construction of super-dyke in the Phase II site will also contribute to the TSS and TDS in the surface water body.

There are eight operating industries and 10 under-construction industries, which include chemical, ready-mix, steel, chemical, thermal power, automobile, food processing, Pharmaceuticals, and medical products. The waste streams from the different units are expected to have effluent and will be treated through the plant-level ETP. The potential impact of the PUC on surface water quality (TDS & TSS) is assessed to be low.

Proposed Projects (Phase II): The surface runoff from the construction sites of the Phase II EZ components (residential areas and amenities) may contribute to the TDS and TSS in the receiving surface water bodies. It is also planned that three jetties will be constructed by the industries in the Sandwip Channel. The construction of jetties would lead to the resuspension of suspended solids due to piling and foundation work in the Channel, and surface runoff during the monsoon season from landside construction activities will contribute to the TDS and TSS in the channel. The fill materials for the Phase II land development will also be sourced from the Sandwip Channel; the sourcing of fill

materials will also contribute to the TSS and TDS in the surface water body. The construction of super-dyke in the Phase II site will also contribute to the TSS and TDS in the surface water body.

During the operational stage of the Phase II project, components will generate sewage from residential units and amenities. It is envisaged that CSTP will be installed in the NSEZ area, and sewage generated from Phase II will be treated through CSTP. The potential impact on TDS and TSS in surface water bodies from Phase I projects is assessed to be medium.

Proposed Projects (Phase III): The surface runoff from the construction sites of the Phase II EZ components (residential areas and amenities) may contribute to the TDS and TSS in the receiving surface water bodies. The fill materials for the Phase II land development will also be sourced from the Sandwip Channel; the sourcing of fill materials will also contribute to the TSS and TDS in the surface water body. The construction of super-dyke in the Phase II site will also contribute to the TSS and TDS in the surface water body.

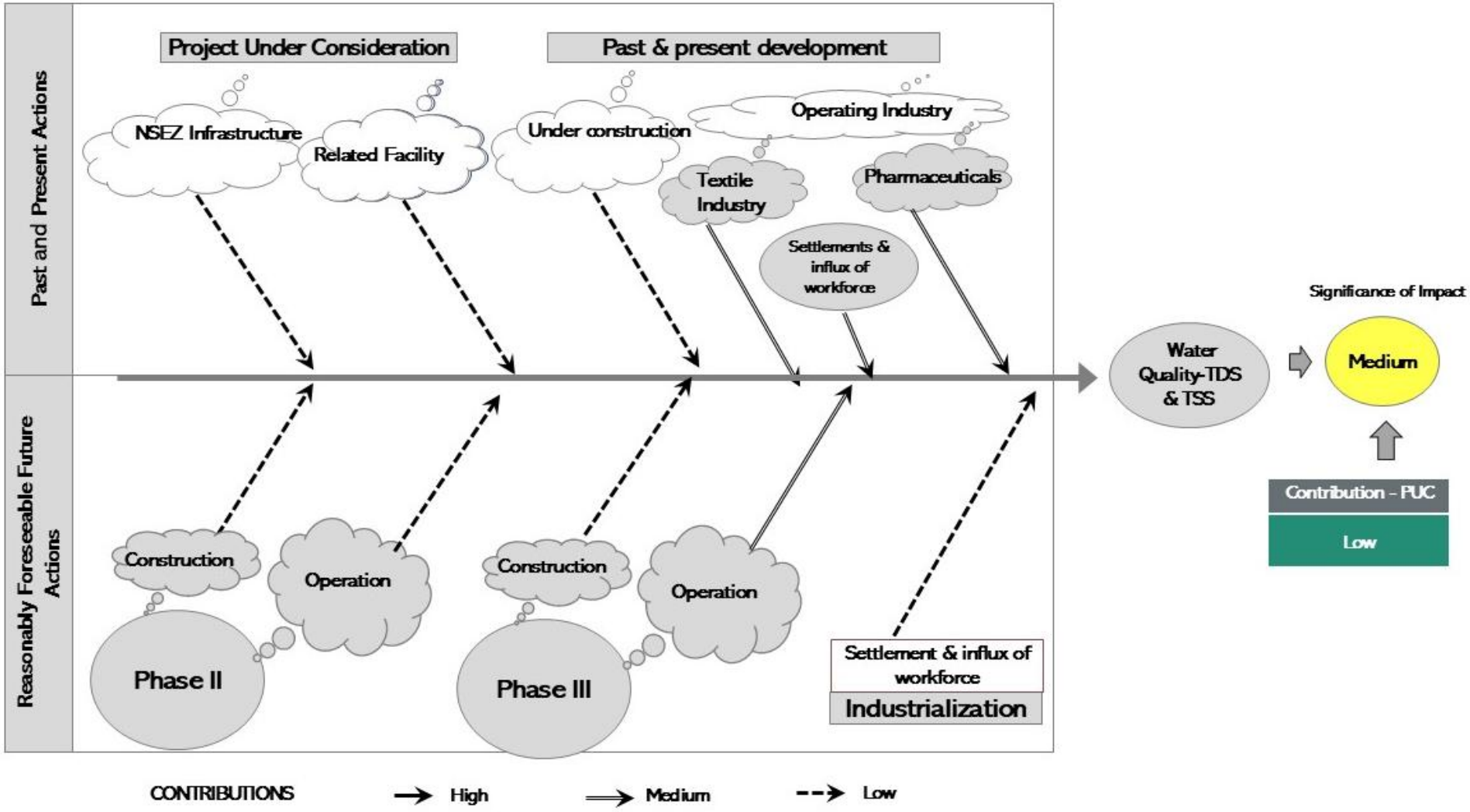
As per the master plan, 132 industries will be set up in the NSEZ area, which includes pulp and paper, RMG & textile, food processing, chemical, hotel and tourism services, paperboard, and power plants. The waste streams from the different units are expected to have effluent, and the same will be treated through plant-level ETP and CETP.

The contribution towards the addition of TDS and TSS in the surface water due to different industrial and development stressors, along with their cause-effect relationship, is graphically presented in Figure 7-10.

7.5.3.1 Significance of Cumulative Impact

The contribution of TDS and TSS in the surface water channels and Sandwip Channel from the past activities (industrial and external factors) is not significant. The existing TSS and TDS levels are well with the ECR standard. The past, present, and future development activity, along with external factors (rapid urban growth), will cumulatively impact the surface water quality in terms of increasing the TDS and TSS levels in these surface water bodies. The cumulative impact is assessed to be medium. The direct contribution of TDS and TSS from the PUC is assessed to be low.

Figure 7-10: Surface Water Quality (TDS & TSS) - Cause and Effect Relationship



7.6 Mangrove and Mud-flood Habitat

7.6.1 Baseline Condition

Mangroves are highly productive coastal ecosystems that offer exceptional habitat opportunities for numerous species, serving as feeding sites and spawning grounds. In the project site's vicinity, particularly in the southern region, coastal plantations are prevalent along the shoreline and surrounding areas. *Avicennia* spp. and *Sonneratia apetala* are the primary mangrove species used for plantation in this area. Additionally, *Acanthus ilicifolius,* another common mangrove species, is widely distributed throughout this region.

Habitats within the NSEZ comprised primarily mudflats with small mangrove patches. The coastal forest department has carried out mangrove plantation in this region (the entire BEZA area) since 1967, primarily using species like species *Avicennia marina* [LC (IUCN v2023-1)]*, Sonneratia apetala* [LC (IUCN v2023-1)]*, and Excoecaria agallocha* [LC (IUCN v2023-1)].

Mangrove areas in the NSEZ area are dominated by *Avicennia marina,* but largely the mangroves are mature, and there are signs of natural regeneration as well. Most of the remaining mangrove forests are more than 50 years old and are mature.

Mudflat areas are present in the adjacent areas of the NSEZ site and within the study region. A rich assemblage of marine invertebrates is found here. This makes it an important foraging area for some migratory avian species such as Common Sandpiper *(Actitis hypoleucos),* White Wagtail *(Motacilla alba),* Citrine Wagtail *(Motacilla citreola),* Common Greenshank *(Tringa nebularia),* Pacific Golden Plover *(Pluvialis fulva),* Whimbrel *(Numenius phaeopus),* etc. The mudflats also support a good number of crustacean species.

7.6.2 Stressors and Impacts

PUC: NSEZ infrastructure will be constructed mainly in the Phase I area, and a major part of the area has already been developed. Additional land development will be required for the implementation of NSEZ infrastructure. The already developed land and proposed site are mangrove and mud-flood habitats. The implementation of the PUC will have an impact on mangrove and mud-flood habitats.

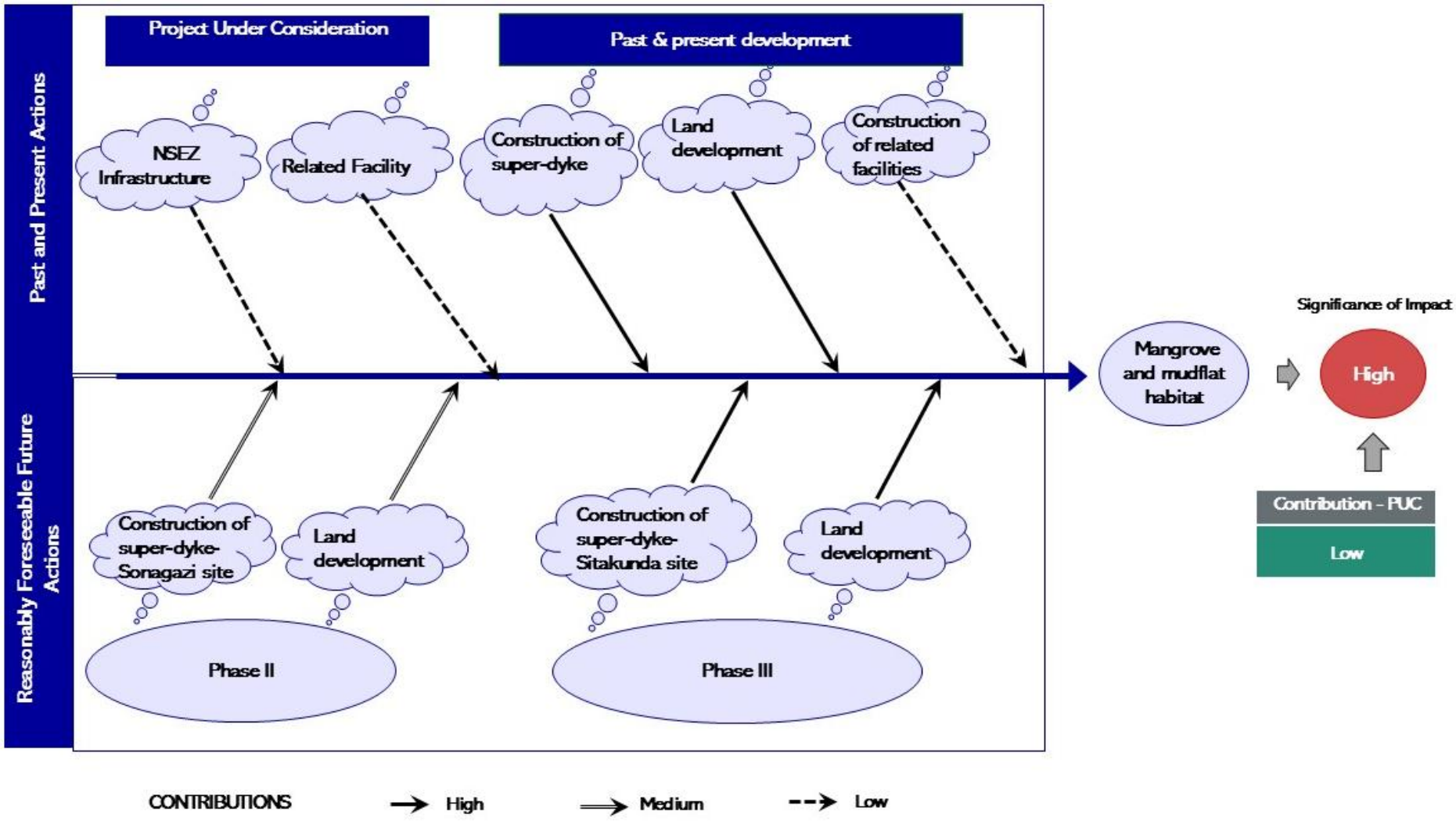
Past and Present Projects (Phase I): For the Phase I site development, the land was reclaimed through landfilling activities carried out by BEZA or individual industries. A super dyke was constructed along the coast for the BEZA land reclamation activity. Only four drainage channels have been retained. The super-dyke structure prevents tidal activity in the mangrove and mudflat areas.

All the interconnecting micro-drainage channels have been filled up due to land development. As the tidal water entering the mangrove and mudflat area has been prevented, it will be degraded, and the species composition will be modified, so only freshwater-tolerant species will remain in the habitat.

Proposed Projects (Phase II): As per the master plan, phase II industrial developmental activity will be carried out in 6–10 years. The phase II development plan has been planned in the Sonagazi area of the NSEZ and the northeastern part of Mirsharai. The proposed land for Phase II development is mostly mud-flood and low-lying agricultural land used for pisciculture purposes. The side development (landfilling and construction of the super-dyke) will have a negative impact on the mud-flood habitat.

Proposed Projects (Phase III): The Phase III industrial developmental activity will be carried out in 11–20 years. The phase III development plan has been planned in the Sitakunda area of the NSEZ. The Sitakunda area's primary habitat is mangrove and mud flood. The side development (landfilling and construction of the super-dyke) will have a negative impact on the mud-flood habitat.

Figure 7-11: Mangrove and Mud-Flood Habitat - Cause and Effect Relationship



7.6.3 Significance of Cumulative Impact

Construction of super-dyke and land development in the Mirsharai area of NSEZ and modification of the drainage channel have already impacted the mangrove and mud-flood habitat. The past, present, and future development activities (phases II and III) will cumulatively impact mangrove and mud-flood habitats. The cumulative impact is assessed as high. However, the contribution from PUC to the loss of mangrove and mud-flood habitats is assessed to be low.

The contribution towards mangrove and mud-flood habitat due to PUC, past and present activities, and future activities in the spatial boundary of the CIA, along with their cause-and-effect relationship, is graphically presented in Figure 7-11**.**

7.7 Aquatic and Migratory Bird Species

7.7.1 Baseline Condition

Bangladesh is in a unique geographical position in South Asia. The country's vast wetlands, spanning approximately 6.8 hectares, and its relatively less challenging terrain provide an ideal habitat for avian species seeking a comfortable home away from the challenges of seasonal transitions. Every year, birds from the farthest corners of the world, including Siberia, Mongolia, and the Tibetan plateau, migrate to Bangladesh to enjoy its temperate winter climate.

The aquatic habitat and mudflats of the study area are regarded as an important area for migratory birds due to their location along the migratory routes of many bird species. The vast wetlands, marshes, and mudflats of this area provide suitable habitats for many migratory bird species, offering them a place to rest and feed during their long journeys. The survey conducted in the study region recorded a total of 65 migratory bird species. Among the recorded species, 21 species were found in the NSEZ site. Notable migratory species observed in the sites were Common Sandpiper *(Actitis hypoleucos),* Common snipe *(Gallinago gallinago),* Lesser whistling duck *(Dendrocygna javanica),* Black-headed Ibis *(Threskiornis melanocephalus),* Eurasian Curlew *(Numenius arquata),* Green Sandpiper *(Tringa ochropus),* Spotted Redshank *(Tringa erythropus)*, Wood Sandpiper *(Tringa glareola)*, etc. In the NSEZ site, the Black-headed Ibis *(Threskiornis melanocephalus)* is the only species that holds conservation significance as the species is categorized as Vulnerable (VU) (IUCN, 2015).

All the recorded species were also found in the study region of the project. However, 30 species were exclusively identified within the study region. Notable migratory birds recorded from the study region were the Common Sandpiper *(Actitis hypoleucos),* Green Sandpiper *(Tringa ochropus),* White Wagtail *(Motacilla alba),* Pied Avocet *(Recurvirostra avosetta),* Grey-headed lapwing *(Vanellus cinereus),* Pacific golden plover *(Pluvialis fulva),* Black-tailed godwit *(Limosa limosa),* Common snipe *(Gallinago gallinago),* Grey heron *(Ardea cinerea),* Eurasian curlew *(Numenius arquata),* Ruddy Shallduck *(Tadorna ferruginea),* Gadwall *(Mareca strepera),* Northern pintail *(Anas acuta),* Northern Shoveller *(Anas clypeata),* Eurasian Teal *(Anas crecca),* Baikal teal *(Sibirionetta formosa),* Marbled duck *(Marmaronetta angustirostris),* Eurasian wigeon *(Mareca penelope),* Long-toed stint *(Calidris subminuta),* Black-headed Ibis *(Threskiornis melanocephalus),* Sooty tern *(Onychoprion fuscatus),* Black-naped tern *(Sterna sumatrana)*, etc. Some of these birds start visiting the site in October and return in April. The early migrants are the Common Sandpiper *(Actitis hypoleucos),* White Wagtail *(Motacilla alba),* Lesser Sand plover *(Charadrius mongolus),* Common Whimbrel *(Numenius phaeopus),* Brown-headed gull *(Chroicocephalus brunnicephalus),* etc. Among the migratory birds of the study region, the Black-headed Ibis *(Threskiornis melanocephalus)* is categorized as Vulnerable (VU), and all other species don't hold any conservation significance as per the IUCN Red List of Threatened Species of Bangladesh (2015).

7.7.2 Stressors and Impacts

PUC: The construction and operation of the PUC would generate noise and illumination. The noise and illumination have the potential to affect important behaviors such as foraging, breeding, and resting.

The baseline condition revealed that migratory birds and other aquatic birds were mostly reported in mangrove & mud-flood areas, marshy areas, estuaries, and agricultural land. The noise and illumination generated from the PUC have a potential impact on the foraging of migratory birds near the PUC. The potential impact on the diversity of these species is assessed as low.

Past and Present Activities (Phase I):

Habitat modification: As discussed in Section 7.1, mangrove & mud-flood areas, agricultural land, marshy land, and wetlands have been converted into industrial and residential areas. The mangrove & mud-flood area, agricultural land, marshy land, and wetland provide habitat for the birds as well as migratory bird species. The past and present industries and the expansion of human settlement have developed on agricultural land, marshy land, and wetlands. Habitat modification has a potential impact on the habitat of migratory birds and aquatic bird species. The potential impact on birds' habitat degradation is assessed to be medium.

Noise and illumination: noise and illumination from the existing industries and traffic (road and river transport) have the potential to affect important behaviors such as foraging, breeding, and resting. The potential impact on the diversity of endangered and migratory bird species is assessed as medium.

Surface water quality: As discussed in Section 7.5.2, surface water quality may be degraded due to the discharge of treated and untreated effluent and sewage from past and present projects and activities. The degradation of surface water quality has the potential to have an impact on aquatic ecology and ultimately have a negative impact on the food base of aquatic bird species.

Proposed Project (Phase II and Phase III): The proposed project plan indicates that Phase II and Phase III land will be developed for the proposed projects. The proposed sites are mostly mangrove and mud-flood areas. The proposed industries have a potential impact on habitat degradation (land use change) and noise and illumination during construction and operational stages. The potential impact on birds' habitat degradation is assessed to be medium.

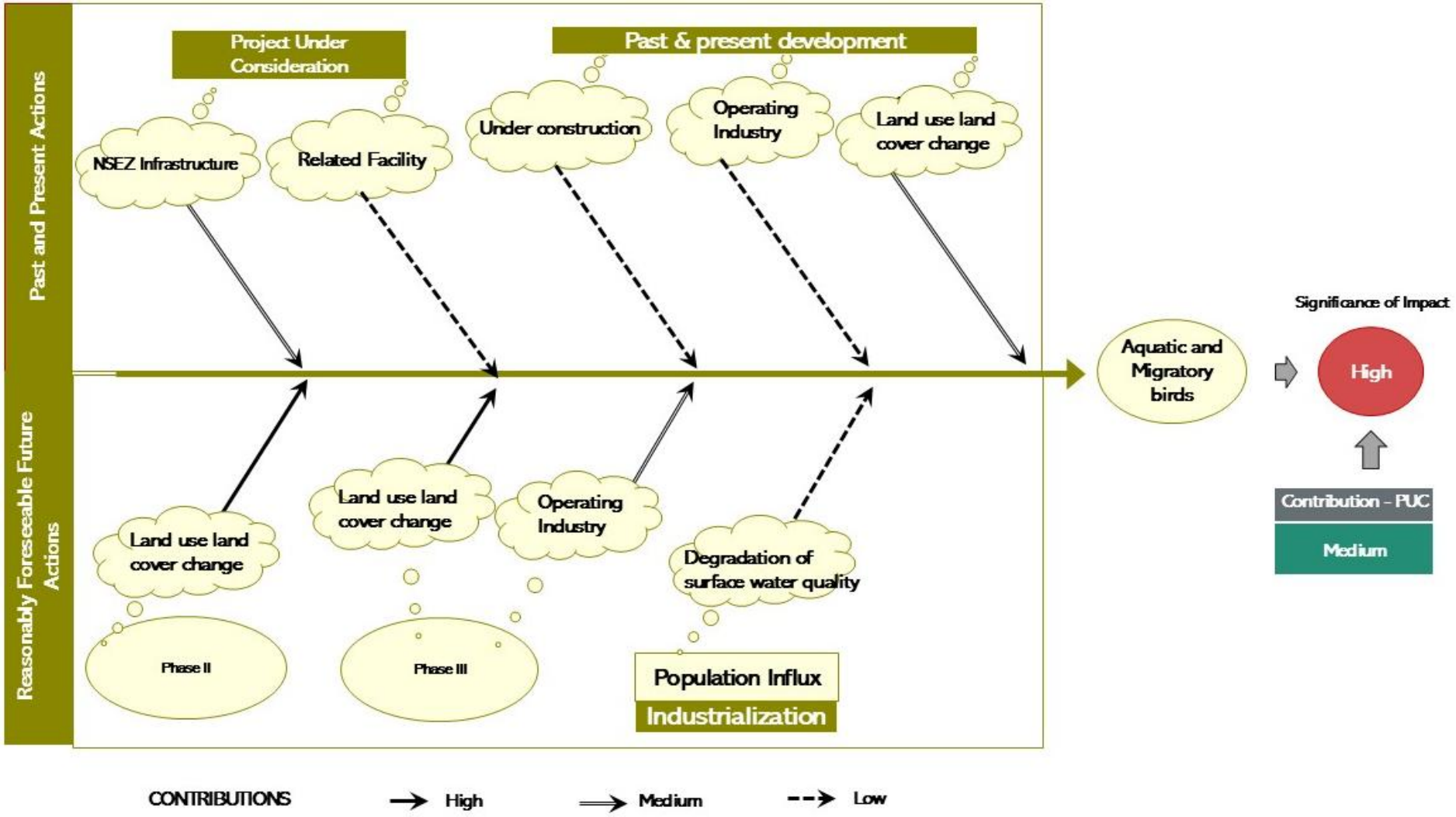
Influx of labour: The various construction activities, existing, proposed, and future projects would require a large number of workers. The workforce may reside in the labor camp near the project sites. There is a potential threat to capture or hunt the protected bird species. The potential impact on the diversity of endangered and migratory bird species is assessed to be low.

The potential impact on aquatic and migratory bird species due to PUC and past, present, and future industries and activities, along with their cause-and-effect relationship, is graphically presented in Figure 7.12.

7.7.3 Significance of Cumulative Impact

The habitat degradation, noise, artificial illumination, surface water quality, and influx of workforce in the NSEZ area, with aquatic and migratory bird species prevailing within the impact zone, have a potential impact on the diversity of these species that is assessed to be medium. The contribution of the potential impact of the diversity of endangered and migratory bird species from PUC is assessed to be low.

Figure 7-12: Aquatic and Migratory Birds Habitat - Cause and Effect Relationship



7.8 Protected Marine Fauna

7.8.1 Baseline Condition

The secondary literature indicates that two species of dolphins, namely the Irrawaddy Dolphin *(Orcaella brevirostris)* and the Indo-Pacific Humpback Dolphin *(Sousa chinensis),* have been documented in the Sandwip Channel (Khan, 2018; IUCN Bangladesh, 2015). Consultation with local people has further affirmed the presence of these dolphin species in the aquatic ecosystem of the Sandwip Channel, adjacent to the NSEZ.

7.8.2 Stressors and Impacts- Central Cluster

Underwater noise: The potential source of underwater noise from PUC, past, present, and future projects and activities are the construction of offshore structures for jetties, dredging for sourcing of fill materials, maintenance of navigation channels, movement of vessels for the transport of construction materials, raw materials, and finished products for the existing and proposed industries.

A review of various studies into behavioral disturbance in high-frequency cetaceans from continuous man-made noise was carried out. As per the review, it was concluded that not all behavioral responses are equally significant. Behavioral changes may be relatively minor and/or brief but have the potential to affect important behaviors such as foraging, breeding, and resting. The study concluded that the behavioral changes to levels below 120 dB re 1 µPa were relatively minor. Significant and sustained avoidance behavior was recorded when noise levels exceeded 140 dB re 1 µPa in the case of the harbor porpoise. For turtles and dolphins, this level is 150 dB and 177 d(B), respectively.

Another impact of the high noise level generated due to various projects and development activities is the masking of biologically important sounds. These sounds may interfere with communication and social interaction and cause changes in behavior as well. The zone of masking impact will be highly variable and depends on many factors, including the distance between the listener and sources of the signal and masking noise, the level of the signal and masking noise, and the propagation of noise from the signal and masking source to the listener. It is, however, important to note that masking of communication and echolocation signals naturally occurs in the ambient noise environment. Man-made noise causes additional masking of a signal only when it is of a higher level than the ambient environment within the species' critical hearing bandwidth at the signal's dominant frequencies. This is well above the dominant frequency range of most man-made noise, including pump noise. Masking of echolocation signals is therefore not a significant issue for most man-made sources (Richardson et al., 1995).

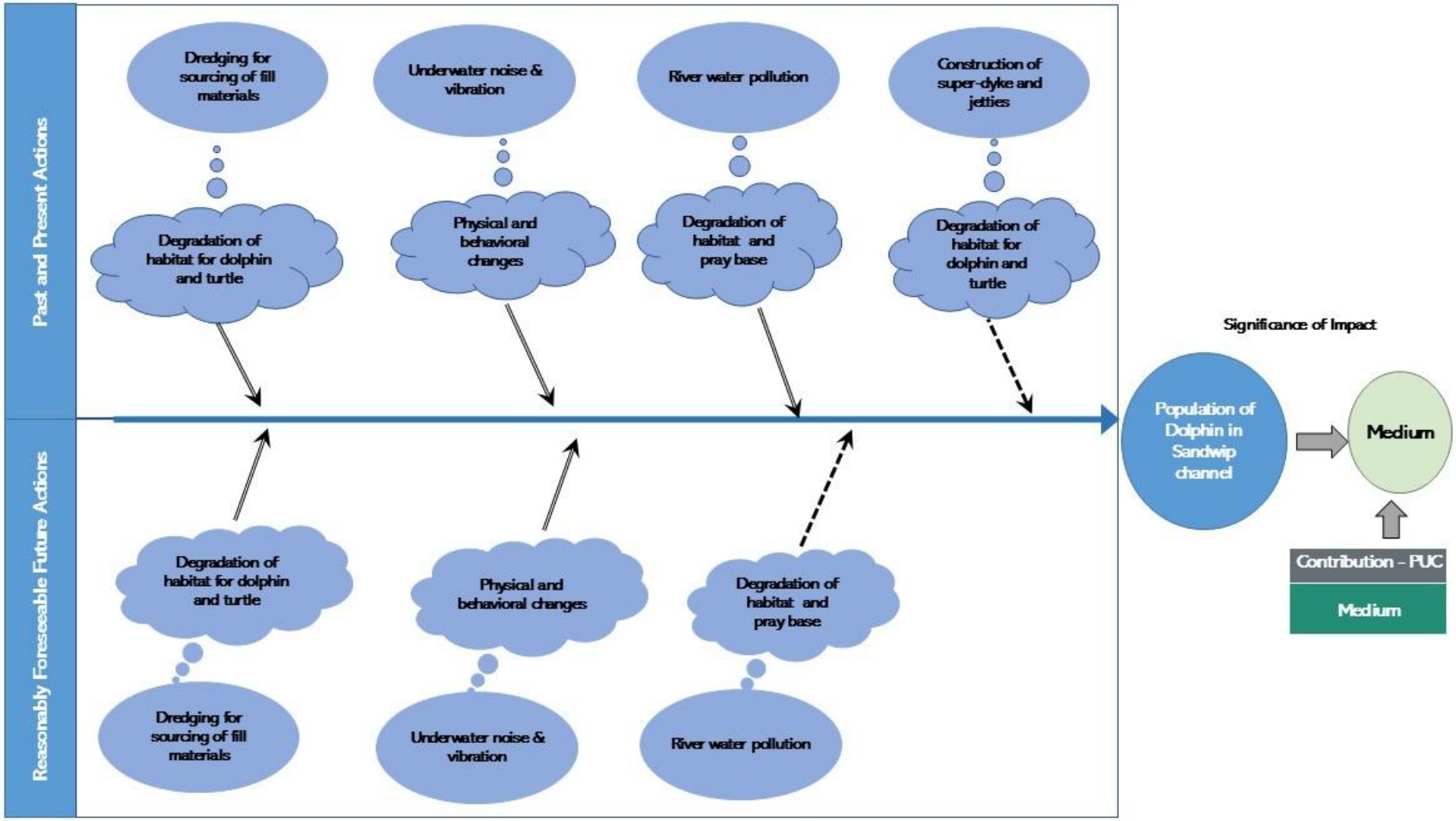
The underwater noise due to various projects and development activities in the area, with sensitive habitats (dolphins and turtles) prevailing within the impact zone, has a potential impact on dolphins and turtles that are assessed to be of medium level. However, the potential impact on aquatic protected species from PUC is assessed to be low.

Marine water pollution: The potential source of impact on water quality from PUC, past, present, and future projects and activities in the river stretch have been discussed in Section 7.5.2 and Section 7.5.3. The potential cumulative impact on marine water quality is assessed to be medium.

Dredging has a short-term effect as an increase in turbidity, TDS, TSS, and metals like Cadmium and lead. The increase in TDS and turbidity may affect the primary productivity of the marine ecosystem and, subsequently, the fish population, but the effect will be temporary.

The potential impact on aquatic protected species due to PUC and different riverfront activities and projects, along with their cause-and-effect relationship, is graphically presented in Figure 7-13.

Figure 7-13: Protected Marine Fauna - Cause and Effect Relationship



7.8.3 Significance of Cumulative Impact

The underwater noise and marine water pollution in the Sandwip channel, with sensitive habitats (dolphins and turtles) prevailing within the impact zone, have a potential impact on dolphins and turtles that is assessed to be medium. The contribution of underwater noise, geomorphological changes, and river water pollution from PUC is assessed to be low.

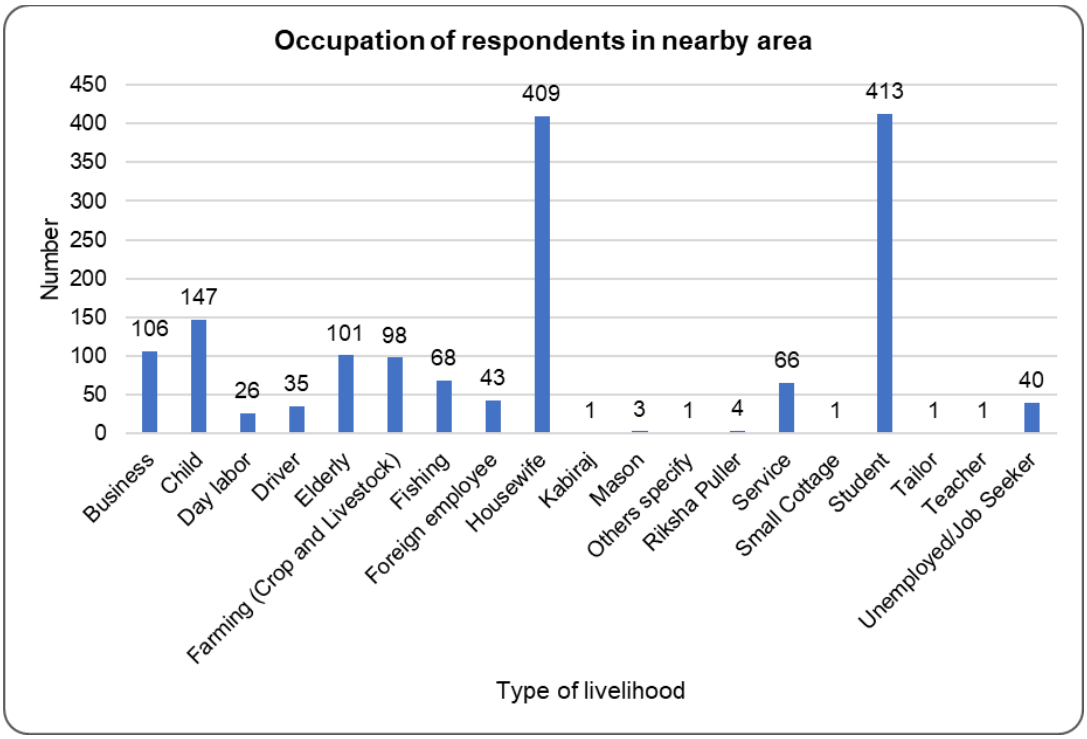
7.9 Livelihood (Land-based & Fisherman)

7.9.1 Baseline Condition

To assess the livelihood and occupation categories in the studied areas, the consultant team followed both secondary and primary data sources. According to the primary socio-economic survey data, the main source of livelihood is mostly related to agriculture, comprising crop cultivation, fisheries, direct farming, sharecropping, agricultural laborers, etc. A mentionable number of fishermen were found in Mirsharai, Sitakunda, and Sonagazi upazila during the stakeholder consultation. In addition to crop farming, the number of poultry farms is 44 and 397, the number of dairy farms is 9 and 43, the number of nurseries is 30 and 14, the number of decorative services is 90 and 67, respectively, in Mirsharai and Sitakunda upazila. Moreover, thirty-four brick kilns were also found in these two upazilas. On the other hand, eighty-nine poultry farms, 79 dairy farms, 3 nurseries, and 42 decorative services were found in Sonagazi (BBS 2011).

According to the household survey (Figure 7-14), primary sources of livelihood are farming, fishing, business, service, day labor, driving, etc.

Figure 7-14: Occupation of Respondents in Nearby Area



Source: Household Survey conducted by EQMS 2023

Qualitative data provides an outline of potential employment opportunities for the nearby communities as well as for the eligible/skilled workers from all over the country. NSEZ is expected to create thousands of employment opportunities in various sectors such as business, service, production, residence/housing, market and commodities, transportation, tourism, etc.

Buffalo Grazing, Fishing, and Fisheries Landing Site: The vast areas of Saherkhali, Ichhakhali, Sonagazi, Char Chandia, and Muradpur Union are used for buffalo, cow, and sheep grazing. Typically,

an individual farmer owns up to one hundred buffaloes or 150 sheep on average. Buffalo and cows provide both milk and meat, while sheep are for meat only. There is an established dairy value chain in the area.

There are five major fisheries landing sites/ghats in the area:1) Saherkhali Ghat, 2) Domkhali Ghat, 3) Bamonsundor Ghat, 4) Muhuri Project Mukh Ghat, and 5) Mithachora Ghat.

7.9.2 Stressors and Impacts

Land use change: The land required for the NSEZ is 33,805 acres. The predominant land use of the NSEZ area is reclaimed land (mangrove and mud-flood area). The agricultural land procured for the project is towards the northeastern side of the Mirsharai area, which was used for paddy cultivation. Low-lying agricultural land, used for pisciculture, was also acquired in the Sonagazi area. The procurement of agricultural land and pisciculture land has a potential negative impact on the occupation and livelihood of the landowners and land users.

The related facilities, like the expansion of roads, railway network, water supply pipeline, and gas pipeline, would also require additional land. The exact land requirement for this infrastructure has not been finalized at this stage; however, the tentative alignment reveals that agricultural lands need to be procured. Procurement of agricultural land has a potential negative impact on impact occupation and livelihood of the landowners and land users.

Loss of grazing land: As discussed in section 7.1.2, the mangrove land and char island have been modified to industrial land. The mangrove area and the char area have been used for the grazing of livestock. The past and present project (Phase I) and proposed project (Phase II and III) will convert the entire mangrove and char island for industrial use. There is no other grazing land for these impacted villages. The loss of grazing land has the potential to have a negative impact on dairy-based livelihoods.

Loss of fish habitat: Mangrove and mudflat areas are suitable habitats for fish breeding and nursing grounds. As discussed in the earlier section, mangrove and mudflat habitats will be degraded or modified, with the potential to have a negative impact on fish and fish habitats. The loss of fish habitat may have a potential negative impact on fish availability and the fish catch of the local fishermen.

Access to the fishing ground: The major channels in the NSEZ area are Ichakhali, Bamon Sundar, Saherkhali, and Domkhali Khal. The other channels are Daborkhali, Khutakhali, Hoania, and Donakhali Khals. The construction of super-dyke at the Mirsharai area and sluice gates has been constructed on Ichakhali, Bamon Sundar, Saherkhali, and Domkhali Khal. The local fisherman generally used the abovementioned channels/khals to anchor the boats and to reach the respective villages to sell the catch. However, due to the construction of these sluice gates, fishermen are not able to directly access to fishing ground (Sandwip Channel) by boat. Now they have to walk 2-3 km to reach the Sandwip Channel for fishing, to sell the catch, and also to take a rest at their homes. The consultation also revealed that fishing boats are now anchored near sluice gates. The storms and cyclones can damage these boats.

River water quality: The potential source of impact on surface water quality from PUC, past, present, and future projects and activities in the river stretch has been discussed in Section 7.5.2, and Section 7.5.3. The potential cumulative impact on river water quality is assessed to be medium. The pollution of surface water quality has a potential negative impact on the primary productivity of the ecosystem, which will ultimately affect the fish diversity and fish catch.

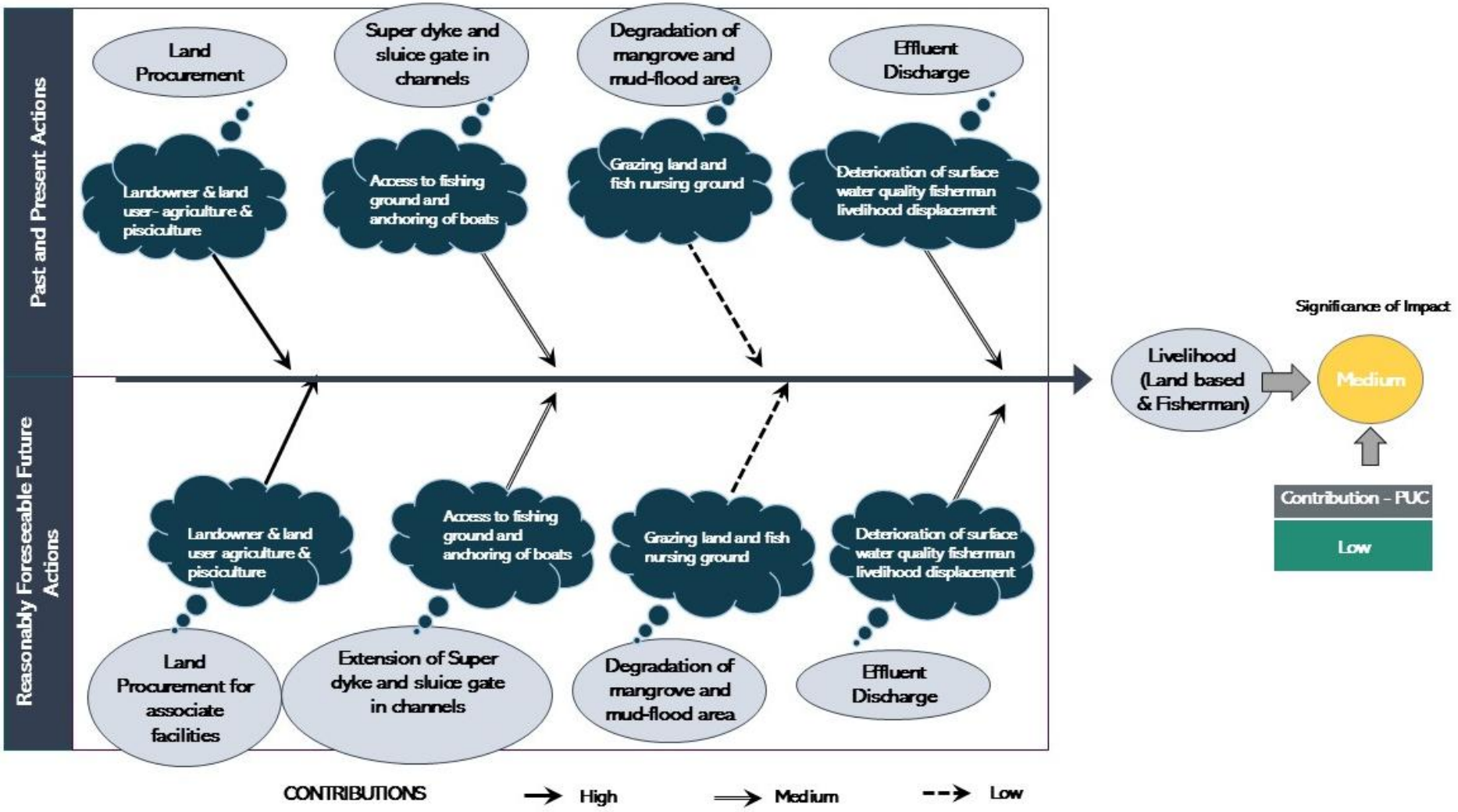
Vessel Movement: Small motorized and non-motorized boats have been used. Generally, they use passive gear, especially gillnets. The gear used extends over very long distances from the boat, sometimes more than 1 km. The movements of vessels used for carrying construction materials, dredge materials, raw materials, and finished products for the proposed jetties may overrun fishing gear, causing partial or total damage to the gear deployed. This may incur an additional cost for fishermen. In the central cluster, the operations will increase in frequency as well as nighttime navigation. This may have increased conflicts.

The contribution towards the impact on livelihood (land-based and fisherman) from different industrial development stressors, along with their cause-effect relationship, is graphically presented in Figure 7-15.

7.9.3 Significance of Cumulative Impact

The land use change, loss of grazing land, loss of fish habitat and nursing ground, access restriction, river water pollution, and movement of vessels in the Sandwip Channel have a potential impact on land-based livelihood (agriculture and dairy), fisherman livelihood (fish catch and damage to fish gear and boats). The potential cumulative impact on livelihood (land-based and fisherman) is assessed to be high. The contribution of PUC is assessed to be low.

Figure 7-15: Livelihood (Land-based and Fishman) - Cause and Effect Relationship



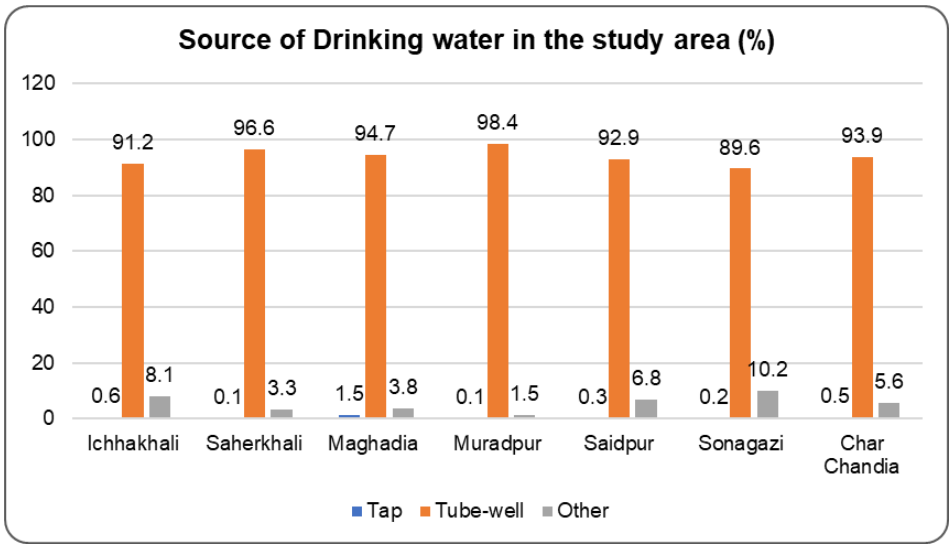
7.10 Social Well-being

7.10.1 Baseline Condition

Social Wellbeing has been selected as a VC because of its intrinsic importance in human life. It is an end state in which basic human needs are met, and people are able to coexist in communities. This end state is characterized by equal access to the basic needs of services (water, sanitation, health services, etc.).

Drinking water: Figure 7-16 shows the secondary data obtained from the Population and Housing Census (2011). Primary findings indicate an increase in the number of households that collect water from deep tube wells. The number of other sources of drinking water in the survey area reduced significantly.

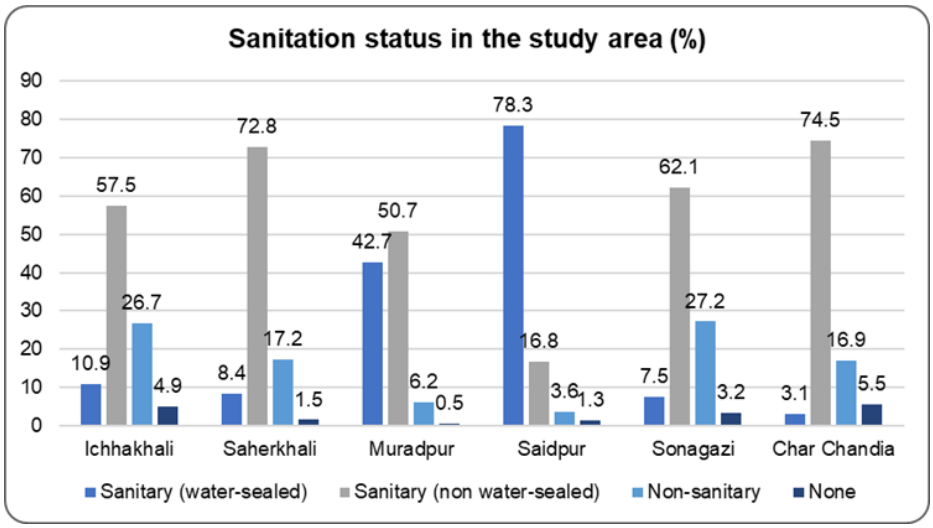
Figure 7-16: Source of Drinking Water in the Study Area



Source: Population and Housing Census, BBS, 2011

Sanitation: In the study area, households that use water-sealed sanitary latrines and non-water-sealed sanitary latrine facilities are 31% and 69% respectively, which indicates almost the entire survey population has access to sanitary latrines.

Figure 7-17: Sanitation Status in the Study Area



Source: Population and Housing Census, BBS, 2011

Healthcare and Education Facility: During the survey, it was found that around 12.44% of the total households have healthcare facilities within 1 km of their houses, while 32% have healthcare services between 1 to 3 km distance. However, a significant number of HHs (55.47%) have to travel more than 3 km to get healthcare facilities. More than half of the survey population have a market (60.20%) and primary school (65.42%) within 1 km of their household. Table 7-4 shows the distance to the local hospitals, local markets, and primary schools from households.

Table 7-4: Distance to school, market, and hospital

Distance	Distance of Local Market		Distance of Primary School		Distance of Nearest Hospital	
1-3 km	116	28.86%	139	34.58%	129	32.09%
Less than 1 km	242	60.20%	263	65.42%	50	12.44%
More than 3 km	44	10.95%	0	0.00%	223	55.47%
Total	**402**	**100%**	**402**	**100%**	**402**	**100%**

Source: Household Survey conducted by EQMS 2023

7.10.2 Stressors and Impact

PUC: The residential facility will be developed for the NSEZ in Phase II. During the construction phase, the workforce is likely to be stayed in the labour colony in the NSEZ township or the nearby villages. Labour influx during the construction stage has a potential impact on social well-being.

Past and Present Project (Phase I): NSEZ is comparatively a new habitat of industrial development and has the scope to accommodate further industrialization. It was reported that labour influx as the industries do not prefer to hire local community people as workers; however, no slums have been identified in the region. The Union Parishads near NSEZ still retain their rural physical features. Makeshift housing arrangements have been observed at some locations, but it is scattered and not clustered as a slum. This region faces an inadequacy of basic services. Current industrialization in the region has not triggered slum growth but has shown traces of slumification (slum-like growth).

Proposed Projects (Phase II and Phase III): The master plan indicates the existing industries in Phase I and the proposed industries in Phase II and III, and the number of industries will be increased. The growth of other industries will also facilitate the expansion of service sector activities. This will result in an influx of both skilled and unskilled workforce in the region. Altogether, this may lead to slumification in the near future. Migration of the low-wage-earning workforce will contribute towards unorganized, unplanned growth of housing structures with inadequate civic infrastructure and will eventually deteriorate the living conditions of the people.

The contribution towards the impact on social well-being from different industrial development stressors, along with their cause-effect relationship, is graphically presented in Figure 7-18.

7.10.3 Significance of Impact

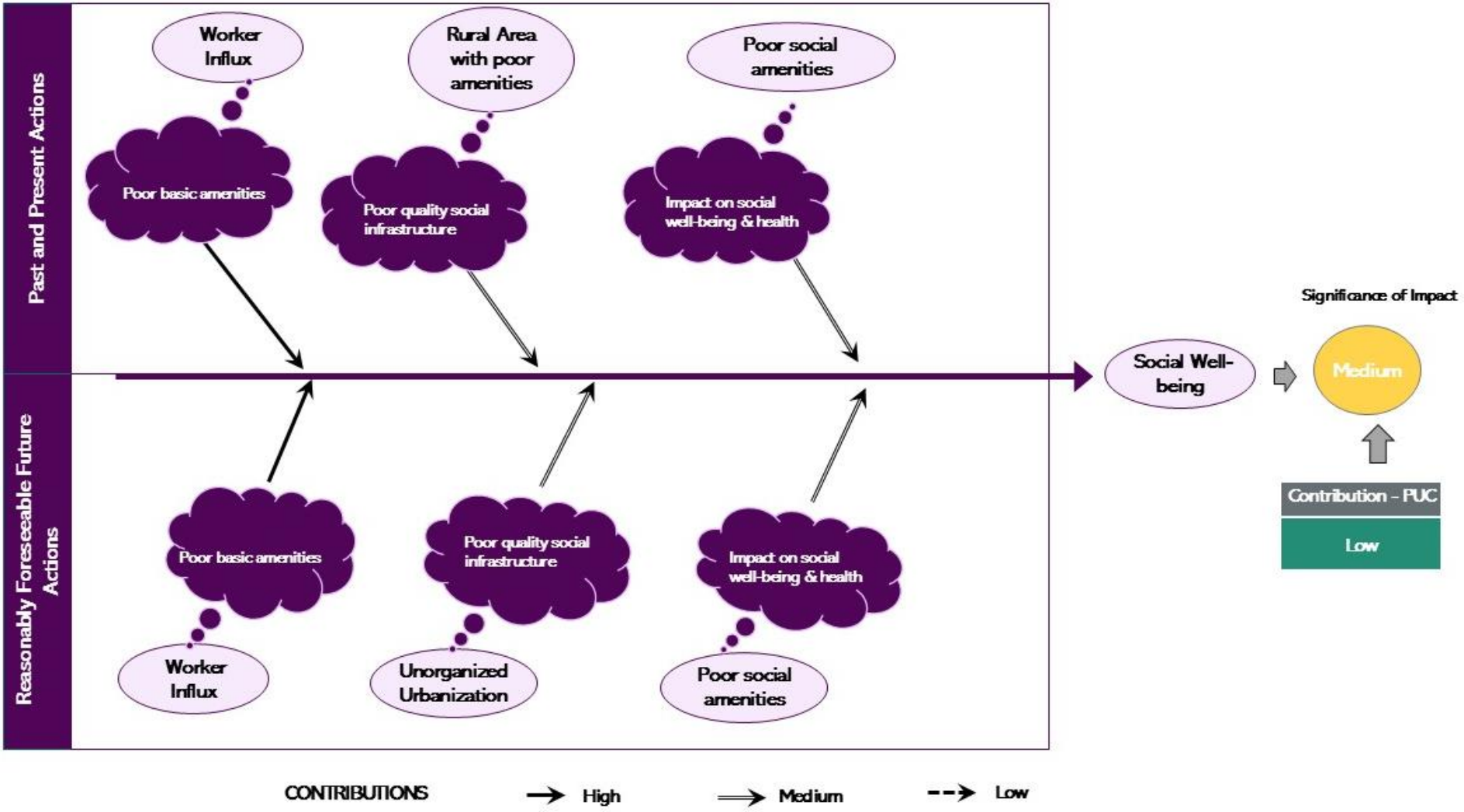
Low-cost housing growth is likely to be increased in the nearby Union Parishads to accommodate the labour influx. Inadequate sanitation facilities are another feature of low-cost housing. The census data illustrate that there has been an increase in the number of sanitary latrines, but the percentage of water-sealed latrines (31%) is significantly lower than that of non-water-sealed latrines (69%). The situation that has not yet resulted in slumification can lead to unplanned slum growth, with further advancements in industrialization, if planned actions are not taken.

The existing projects are entirely dependent on groundwater resources for the supply of construction and operational-phase water. The master plan also indicated that groundwater dependency would increase over the plan period. The groundwater withdrawal for existing and proposed industries has the potential to have a negative impact on the availability of drinking water for the local people.

As all the Union Parishads have rural settings, health care and educational facilities are not adequate. The influx of labor and access to existing services and facilities have the potential to have a negative impact on the social well-being of the local people.

The cumulative impact of past, present, and future stressors is assessed to have a medium impact on the social well-being of the community. The cumulative impact of social well-being is assessed to be medium, and the contribution from PUC is low.

Figure 7-18: Social Well-being - Cause and Effect Relationship



8 RECOMMENDATIONS AND CONCLUSIONS

8.1 Summary of Cumulative Impacts

The cumulative impact assessment of the selected VCs has clearly indicated that there is a level of stress on the VCs not only due to the proposed terminals under PUC but also due to other industries and developmental projects, which were studied. A summary of cumulative impacts is presented in Table 7.5.

8.2 Management Measures

In order to reduce further adverse impacts on the VCs as well as to mitigate some of the impacts, which were identified as key differentiators, the following recommendations have been provided for better environmental and social management. The management of cumulative impacts is being proposed at two levels:

- **Project Specific**: The responsibility for the management of cumulative impacts on the VCs for the PUC will be entirely on the project developers.
- **NSEZ/Economic Zone Specific**: The cumulative impacts on the VCs in the entire CIA spatial could be managed through collaborative efforts from other project developers, local communities, and government and public authorities.

The management approaches discussed in Table 8-1 vary across sub-basins with respect to the level of conformance to international best practices. The proposed timeframe for implementation of the various actions ranges from immediate (within six months), short-term (1-3 years), medium-term (3-5 years), and long-term (5+ years).

Table 8-1: Cumulative Impact Mitigation Measures

VC	Specific conclusion from cumulative impact assessment	Key Issues	Management Measures		Key Performance Indicator	Timeframe	Actor / Agencies	Source of Fund
			Project specific	Spatial Boundary				
Land use change	The cumulative impact of land use change in terms of loss of agricultural land and wetland is assessed as high, and the PUC contribution is low.	▪ NSEZ has a phase-wise industry development plan; however, there is no regional land use plan.	▪ Finalize related facilities alignment, considering the minimum procurement of private land. ▪ Avoid the residential land for the proposed project and also mangrove and mud-flood areas. ▪ Prepare a resettlement action plan to compensate the project-affected people.	Zonal land use planning for future expansion of industries, residential areas, and commercial areas. Some of the key components that need to be covered include: • Zoning of industrial units, residential areas, and commercial areas. • Control of polluting industries in the new industrial areas or re-developed industrial areas through land use control (unplanned growth of polluting industries can be regulated/discouraged through a land use zoning approval process). • Dedicated road networks for industrial clusters. • Provision of dedicated sites for hazardous and solid waste disposal. • Provision of common treatment facilities for small and medium-scale industries with homogenous effluent qualities. • Adequate space provision for vehicle parking, laydown areas, greenbelt, and related infrastructure. • Implement the phase-wise development after the completion of one phase, and develop the next phase of land. • Develop the land use plan for the region, considering future industry development and induced development.	Land use plan considering all environmental and social sensitivities	Short Term	BEZA, NHA, UDD, LGED & Union Parishads	BEZA, NHA, UDD, LGED, and Funding Agency
				▪ Plan implementation through responsible agencies	Number of new industries in the planned area	Medium term	Union Parishads	LGED
				▪ Integration of requirements under proposed zoning control with DOE's site clearance process	EC condition	Continuous activity	DOE	-
Topography and drainage	The cumulative impact of topography and drainage in terms of loss of agricultural land and wetland is assessed as medium, and the PUC contribution is low.	▪ Conduct the topography and drainage of each EZ component under PUC. ▪ Prepare a plan for topography drainage impact and implement it during the construction of the EZ component.	The Phase I (Mirsharai) area was already developed by constructing super-dyke and landfilling, and the provision of the sluice gate. Phase II and Phase III land will be developed by constructing the super-dyke and landfilling.	▪ Conduct a regional-level drainage study to understand the impact of drainage due to the NSEZ area. ▪ Prepare a regional plan to mitigate the drainage impact.	Waterlogging and flooding situation	Short term	BEZA and BWDB	BEZA
Air quality	The cumulative impact of air quality in terms of concentration of PM and NOx is assessed	▪ No regional monitoring stations for the industrial areas.	*Construction stage*: ▪ Dust suppression at construction sites and site access roads.	▪ Preparation of a program for regional air quality monitoring, including the provision of infrastructure and manpower requirements	A monitoring program with due consideration of regional pollution sources and receptors.	Immediate	DOE	DOE

VC	Specific conclusion from cumulative impact assessment	Key Issues	Management Measures		Key Performance Indicator	Timeframe	Actor / Agencies	Source of Fund
			Project specific	Spatial Boundary				
	as high and medium, respectively, and the PUC contribution is assessed as low.	▪ Project-specific limited environmental monitoring is being carried out during EIA Studies and subsequently during periodic compliance monitoring- it is usually limited to power plant premises and is not representative of the regional airshed.	▪ Covered storage for construction materials. ▪ Diesel-operated machinery & equipment and vehicles used during construction activity have fit certificates. ▪ DG set with proper stack heights. ▪ Periodic ambient air quality monitoring in the area of the influent of terminals. *Operational stage:* ▪ Maintain the proposed infrastructure as per design.	▪ Setting up a *Regional Monitoring Lab,* hiring of manpower, and other resources.	Monitoring laboratory with adequate facilities.	Short Term	DOE	MOEFCC / External Funding Agency
				▪ Regular regional air quality monitoring and disclosure of cumulative data on monitoring at a regional level	Monitoring as per plan and disclosure of information.	Continuous activity	DOE	Funding Agency / DOE
				▪ Periodical review of the regional monitoring program and tracking of cumulative indicators by the task force. Based on the review of regional monitoring data, the task force (if required) can inform MOEFCC/ DOE to consider appropriate steps to regulate industries by linking them with the issue of Environmental Clearance or decisions about new industries or industrial mix.	Pollution trends and quality of the environment.	Continuous activity	Task Force	MOEFCC
Groundwater resources	The cumulative impact of groundwater resources on the groundwater depletion rate is assessed to be high, and the PUC contribution is low.	▪ Industries are mostly dependent on groundwater. Decreasing trends in groundwater levels are observed in both industrial areas. ▪ The process of groundwater abstraction is currently not regulated ▪ Local communities raised concerns about falls in groundwater levels.	*Construction stage:* ▪ Minimize the groundwater use only for domestic and drinking water purposes. ▪ Construction water should be sourced from surface water. ▪ Maintain the water use record. ▪ Obtain groundwater withdrawal permission from the concerned authority. *Operational stage:* ▪ Phase-wise reduction of groundwater dependency, ▪ Provision of drinking water supply to settlements within the spatial boundary	▪ Issuance of a directive related to mandatory permission required for the abstraction of groundwater from WARPO, and also the introduction of a cess for the use of water.	Issuance of the directive with respect to groundwater abstraction	Immediate	Department of Public Health Engineering (DPHE) / Upazila Parishads	DPHE
				▪ Integration of mandatory groundwater clearance requirements with the EC/EC Renewal Process.	Compliance with the directive	Immediate	DOE	-
				▪ Regular monitoring of groundwater table; defining groundwater potential zones (excellent, good, moderate, poor, very poor); formulation of a plan for setting up permissible limits for the different user categories.	Annual groundwater depletion/replenishment rates.	Short Term	DPHE / Bangladesh Water Development Board (BWDB)	DPHE/ BWDB
				▪ Implementation of the sourcing of surface water from the Feni River for the NSEZ area.	Volume of surface water use for NSEZ	Medium term	BEZA	BEZA
				▪ Implement the sourcing of surface water from drainage channels in the NSEZ area and the Sandwip channel for the NSEZ area.	Volume of surface water use for EZ	Long term	CWASA	CWASA
Surface water quality	The cumulative impact of surface water quality in terms of concentration of DO, BOD, and toxic metals is assessed as	▪ Water quality of the channels has been degraded over time due to the discharge of industrial effluent and sewage.	*Construction stage*. ▪ Treat the domestic wastewater through a septic tank and soak-pit. ▪ Channelize the surface runoff from the construction	▪ Preparation of a program for regional water quality monitoring, including the provision of infrastructure and manpower requirements	A monitoring program with due consideration of regional pollution sources and receptors.	Immediate	DOE	DOE
				▪ Setting up a *Regional Monitoring Lab,* hiring of manpower, and other resources.	Monitoring laboratory with adequate facilities.	Short Term	DOE	MOEFCC / External

VC	Specific conclusion from cumulative impact assessment	Key Issues	Management Measures		Key Performance Indicator	Timeframe	Actor / Agencies	Source of Fund
			Project specific	Spatial Boundary				
	medium, and the PUC contribution is low.		site to the sedimentation tank. *Operational Stage* ▪ Construct the CETP and CSTP of NSEZ. ▪ Ensure that all the industry complies with the discharge standard as mentioned in ECR.					Funding Agency
				▪ Regular regional water quality monitoring and disclosure of cumulative data on monitoring at a regional level	Monitoring as per plan and disclosure of information.	Continuous activity	DOE	Funding Agency /DoE
				▪ Periodical review of the regional monitoring program and tracking of cumulative indicators by the task force. Based on the review of regional monitoring data, the task force (if required) can inform MOEFCC/ DOE to consider appropriate steps to regulate industries by linking them with the issue of Environmental Clearance or decisions about new industries or industrial mix.	Pollution trends and quality of the environment.	Continuous activity	Task Force	MOEFCC
				▪ Implement the CETP and CSTP for the NSEZ area.	Volume of wastewater treated in CETP & CSTP	Medium term	BEZA	BEZA
Mangrove and mud-flood habitat	The cumulative impact of mangrove and mud-flood habitat is assessed to be high, and the PUC contribution is low.	▪ The major portion of the NSEZ area is under mangrove and mud-flood habitat. The proposed development will degrade the entire habitat.	▪ Restrict the jetty construction within the demarcated area. ▪ Greenbelt plantation within the plant boundary. ▪ Mangrove plantation in Char Island, identified by BEZA.	▪ Phase-wise land development: Phase III land development should start after the allotment of the entire land developed for Phase I. ▪ According to the consultation with BEZA, the Bangladesh Rural Advancement Committee (BRAC) has already planted approximately 42 thousand trees on 68 acres of land in Mirsharai, part of NSEZ, financed by HSBC Bank. BEZA has planted 4 lakh trees so far in the NSEZ site and the closest road networks of NSEZ. The Forest Department also planted trees along the super dyke with their own financing. In the NSEZ Sarobar area (a 112-acre dighi nearby), BEZA has planted trees on approximately 3 acres of land. ▪ Implement the plantation plan prepared by the forest department for NSEZ, which includes (i) low line water line area of Subarna Char, (ii) 40% of the reclaimed Sabuj – Char, (iii) low line water line area of Sabuj Char, and iv) 60% - low line water line area of Sandeep Char.	Plantation area under the NSEZ project	Medium-term and long-term	BEZA FD BWDB	BEZA FD BWDB
Aquatic and Migratory bird species	The cumulative impact of migratory birds and aquatic bird species is	▪ Loss of habitat. ▪ Environmental pollution	▪ Implementation of pollution control measures is suggested during the	▪ Land use planning and implementation, as suggested in the land use section,	Maintain the inland surface water bodies and marshy areas	Medium term	Union Parishads	LGED

VC	Specific conclusion from cumulative impact assessment	Key Issues	Management Measures		Key Performance Indicator	Timeframe	Actor / Agencies	Source of Fund
			Project specific	Spatial Boundary				
	assessed as medium, and the PUC contribution is low.		construction and operational phase of the project. ▪ Awareness among the workforce regarding the conservation of bird species. ▪ Directional illumination at the construction site.	▪ Environmental pollution control (surface water quality) as suggested in the surface water quality section.	Pollution trends and quality of the environment.	Continuous activity	DOE	DOE
				▪ Periodical monitoring of bird species with special emphasis on endangered and migratory birds.	Number of migratory bird species	Continuous	Wildlife wing of the Forest Dept.	Forest Dept.
				▪ Awareness generation amongst the local people and workforce regarding the conservation importance of biodiversity.	Number of awareness meetings	continuous	Wildlife wing of Forest Dept./ NGO	Forest Dept.
Protected marine fauna	The cumulative impact of Protected marine fauna is assessed as medium, and the PUC contribution is low.	▪ Anthropogenic activity (dredging, movement of vessels, offshore facilities)	▪ Project-specific underwater noise control measures as suggested under the underwater noise and vibration section. ▪ Project-specific surface water pollution control measures as suggested under the surface water quality section.	▪ Identify the pressure and threats on dolphins. ▪ Identify the dolphin breeding ground and prepare a conservation plan ▪ Awareness generation among the fishermen and the riverside community towards dolphin conservation. ▪ Periodical census of dolphins in the Sandwip Channel.	Dolphin population in the river basin	Long term	Forest Dept.	Forest Department
Livelihood (land-based and fisherman)	The cumulative impact of Livelihood (land-based and fisherman) is assessed to be medium, and the contribution from PUC is low.	▪ Unemployment of the agricultural workforce. ▪ Decrease of fish catch	▪ Job and economic opportunity for the land losers and land users. ▪ CSR activity in the AOI of the industry.	▪ Job and economic opportunities for the local people, especially project-affected families, and unemployed youths. ▪ Job-based training for the local youth. ▪ Regional-level fishery study focusing on fish species, endangered fish species, trends in fish yield and species composition, fishermen's livelihood, and fish conservation. ▪ Provision of alternative ground/ provision of stall-feeding. ▪ Phase-wise development, so grazing can be done in undisturbed areas. ▪ Regional-level CSR plan, involving all the operating industries. ▪ External stakeholder grievance system.	The number of jobs and economic opportunities created for the local people	Continuous	Union Parishads	Operating and future industries.
Social well-being	The cumulative impact of social well-being is assessed to be medium, and the contribution from PUC is low.	▪ A considerable section of the population lives in slums and informal settlements characterized by poor living conditions. ▪ Rapid unplanned urban growth lacks proper infrastructure like sanitation,	*Constructing stage:* ▪ Provision of a labor colony with proper drinking water, drainage system, and sanitation. *Operational stage:* ▪ Residential facility for the operational workforce with	▪ Participatory planning improvement of Slum Infrastructure Improvement (sanitation facility, safe drinking water.	Availability of recent information on the poverty status of the slum population and slum-like growth areas	Short Term	Local Government Engineering Department (LGED)	External Funding Agency
				▪ Program implementation.	Periodic monitoring of plan implementation	Continuous	LGED	External Funding Agency

VC	Specific conclusion from cumulative impact assessment	Key Issues	Management Measures		Key Performance Indicator	Timeframe	Actor / Agencies	Source of Fund
			Project specific	Spatial Boundary				
		drinking water facilities, solid waste disposal facilities, drainage, etc.	the NSEZ will have all amenities and infrastructure.	▪ Monitoring SIP implementation to ensure that environmental concerns are addressed.	*Slum Infrastructure Improvement*- access to improved sanitation facilities, safe drinking water	Continuous	LGED	LGED

8.2.1 Monitoring

A plan has been developed for monitoring the measures that have been recommended as part of the CIA. This plan tracks the progress of the program/actions during the implementation phase and accordingly informs agencies that are responsible for implementation/supervision.

Principally, the monitoring will entail:

- Collection of data on the implementation of activities and outputs, according to the indicators specified in the recommended action plan.
- Collecting data on the delivery of results and impacts according to the indicators identified in the monitoring framework and evaluation programs to be able to follow an adaptive management approach to initiate any changes (if required) to the programs that have been proposed as part of the CIA study.

The monitoring plan is presented in Table 8-2.

Table 8-2: Monitoring Plan

VC	Key Performance Indicator	Timeframe	Responsibility for Supervision
Land use	Land use plan considering all environmental and social sensitivities	During the formulation of the study (Draft / Final)	LGD & Union Parishads
Topography and drainage	Regional drain impact assessment and management plan	During the formulation of the study (Draft / Final)	BWDB and BEZA
Air quality	Air quality pollution trend in the NSEZ area	Continuous monitoring	DOE
Groundwater resources	Groundwater depletion rate in the NSEZ area	Continuous monitoring	DPHE
Surface water quality	Water quality pollution trend in drainage channels and Sandwip channels	Quarterly	DOE
Mangrove and mud-flood habitat	Compensatory plantation of mangroves and afforesting	Annually	Forest Department
Migratory bird species	Diversity index of the bird species in the NSEZ area	Pre-monsoon and winter seasons	Forest Department
Marine protected fauna	Dolphin population in the Sandwip channel	Every 3-5 year cycle	Forest Department
Livelihood (land-based and fisherman)	The number of local people get the job and job-related training	Annually	Union Parishads
Social well-being	Number of households having water-sealed latrines and a safe drinking facility	Annually	LGED & Union Parishads

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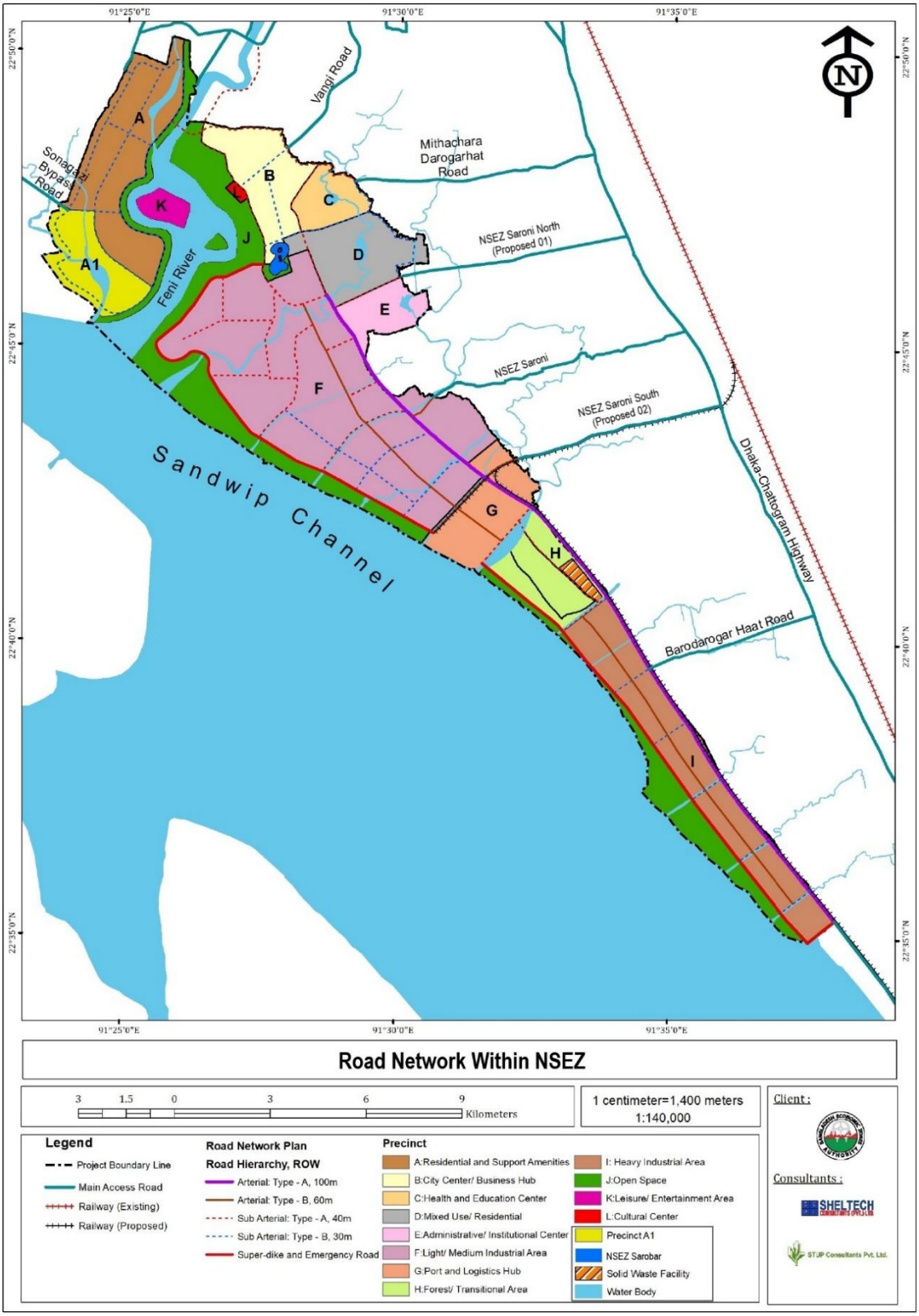
APPENDICES

APPENDIX A

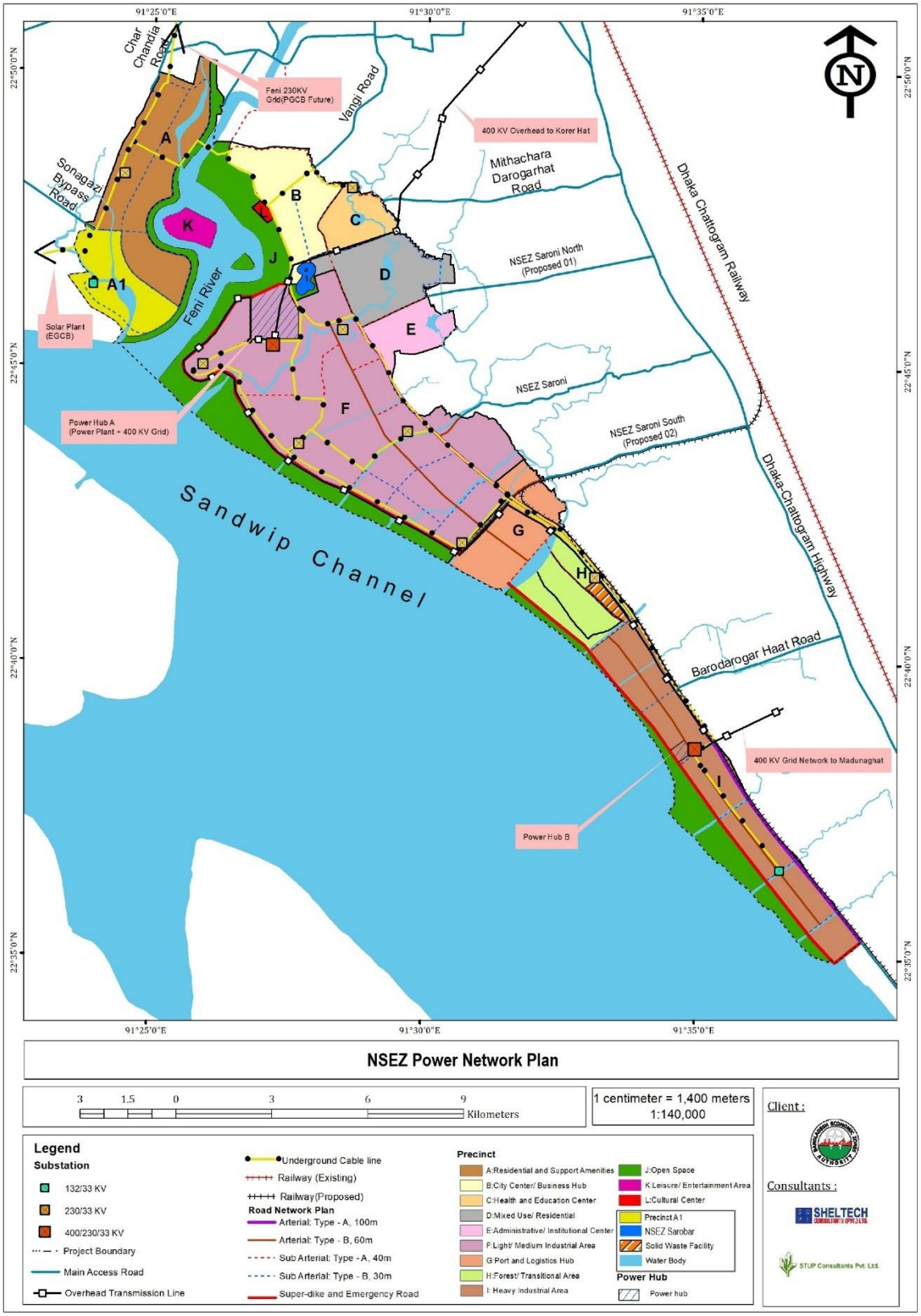
Appendix A: Maps showing the proposed Infrastructures for NSEZ

Appendix A-1: Road Network Within NSEZ



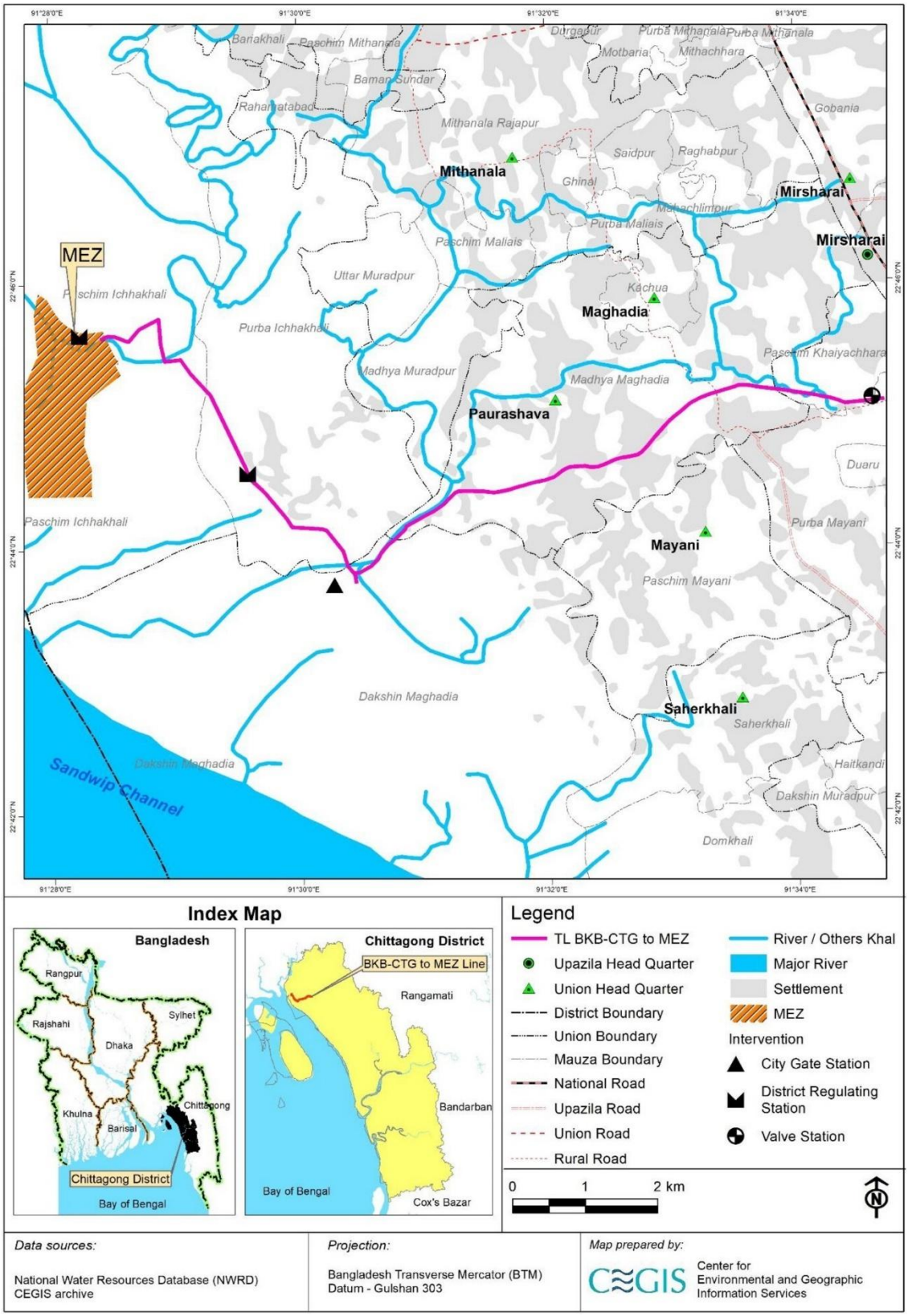
Source: BEZA, 2020a

Appendix A-2: Power Network Plan Within NSEZ



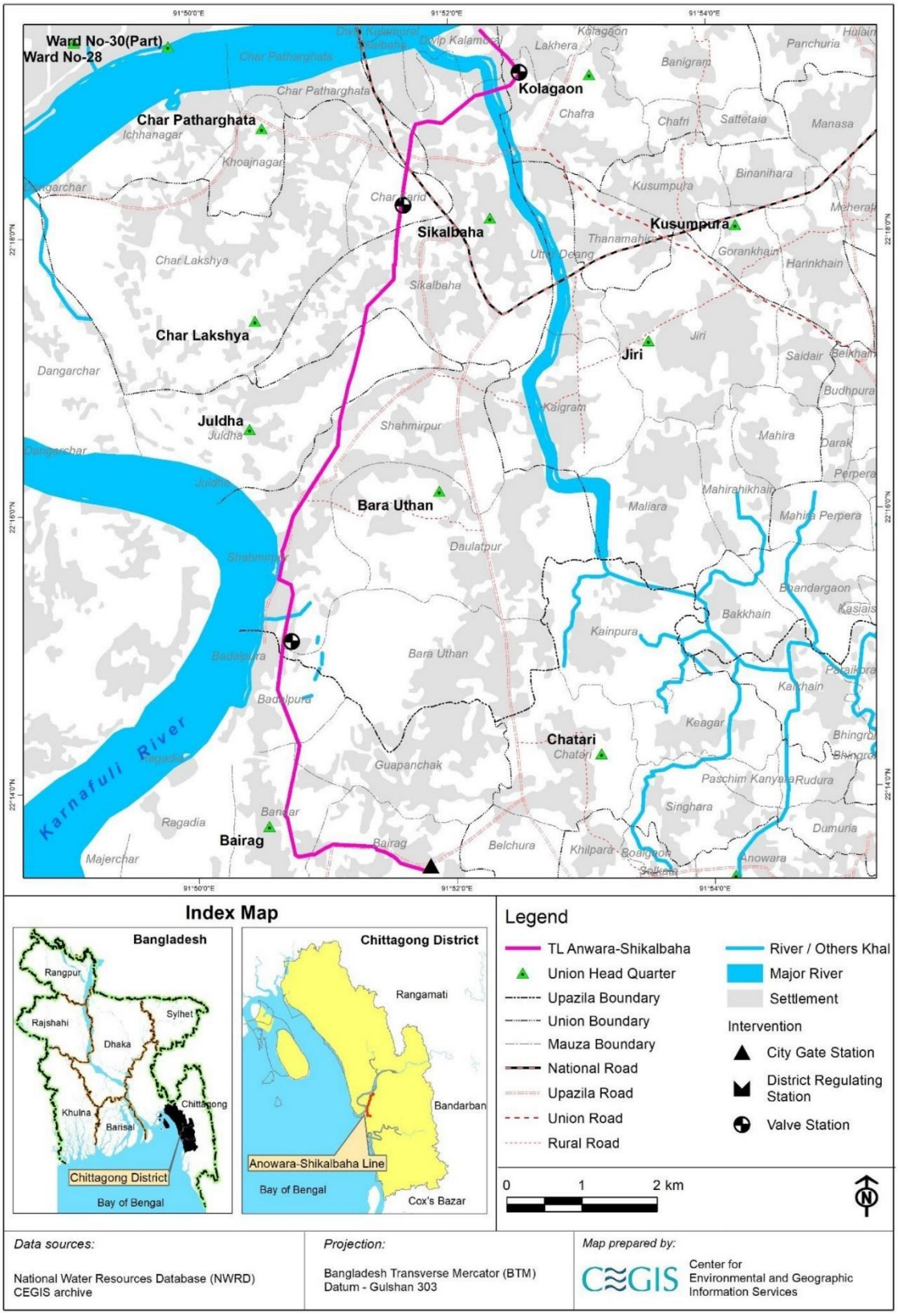
Source: BEZA, 2020a

Appendix A-3: Location of GTCL Gas Transmission Pipeline 1



Source: GTCL, 2021

Appendix A-4: GTCL Gas Transmission Pipeline 2

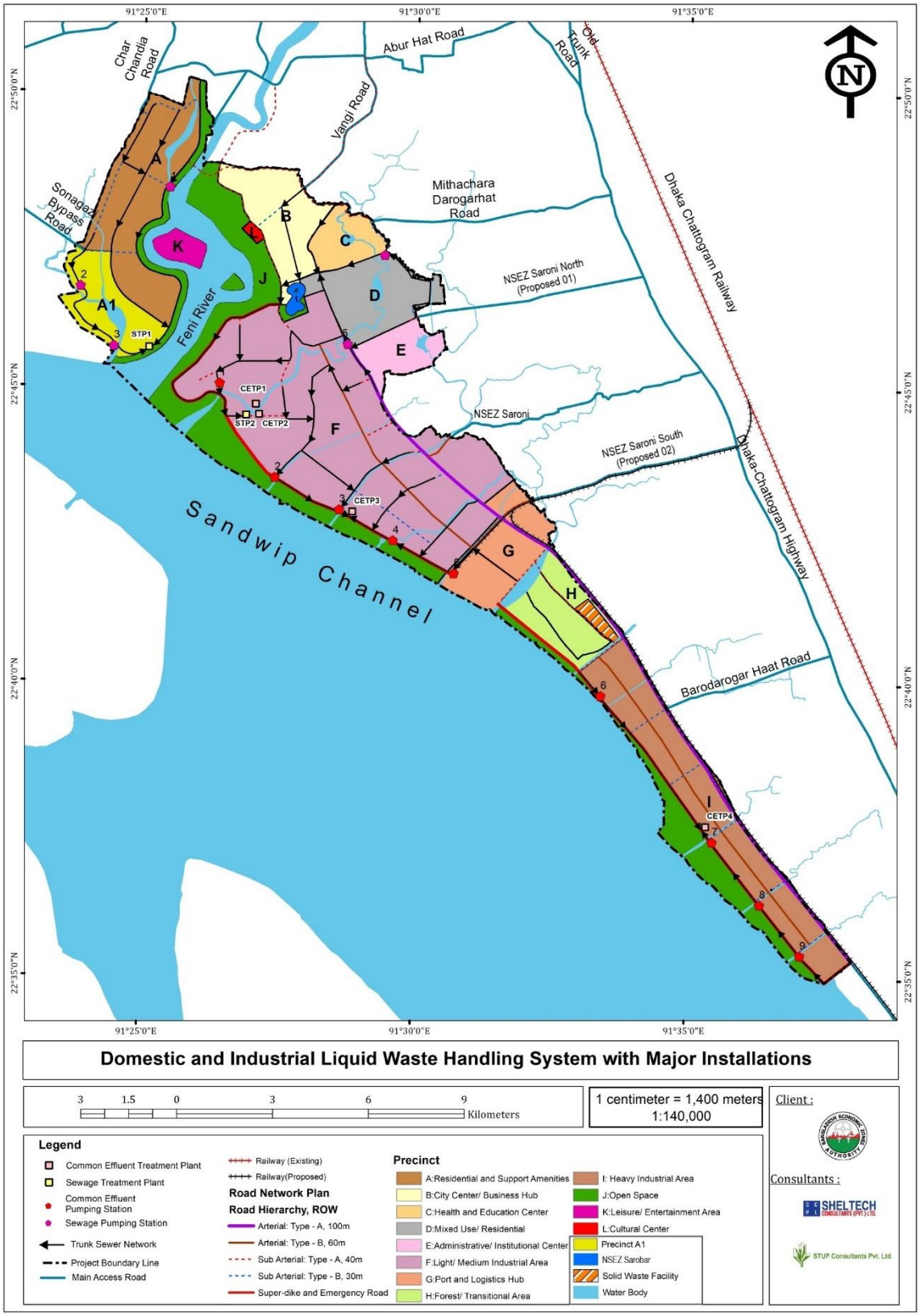


Source: GTCL, 2021

Appendix A-5: Proposed Intake and WTP Map Considering Source Feni Reservoir

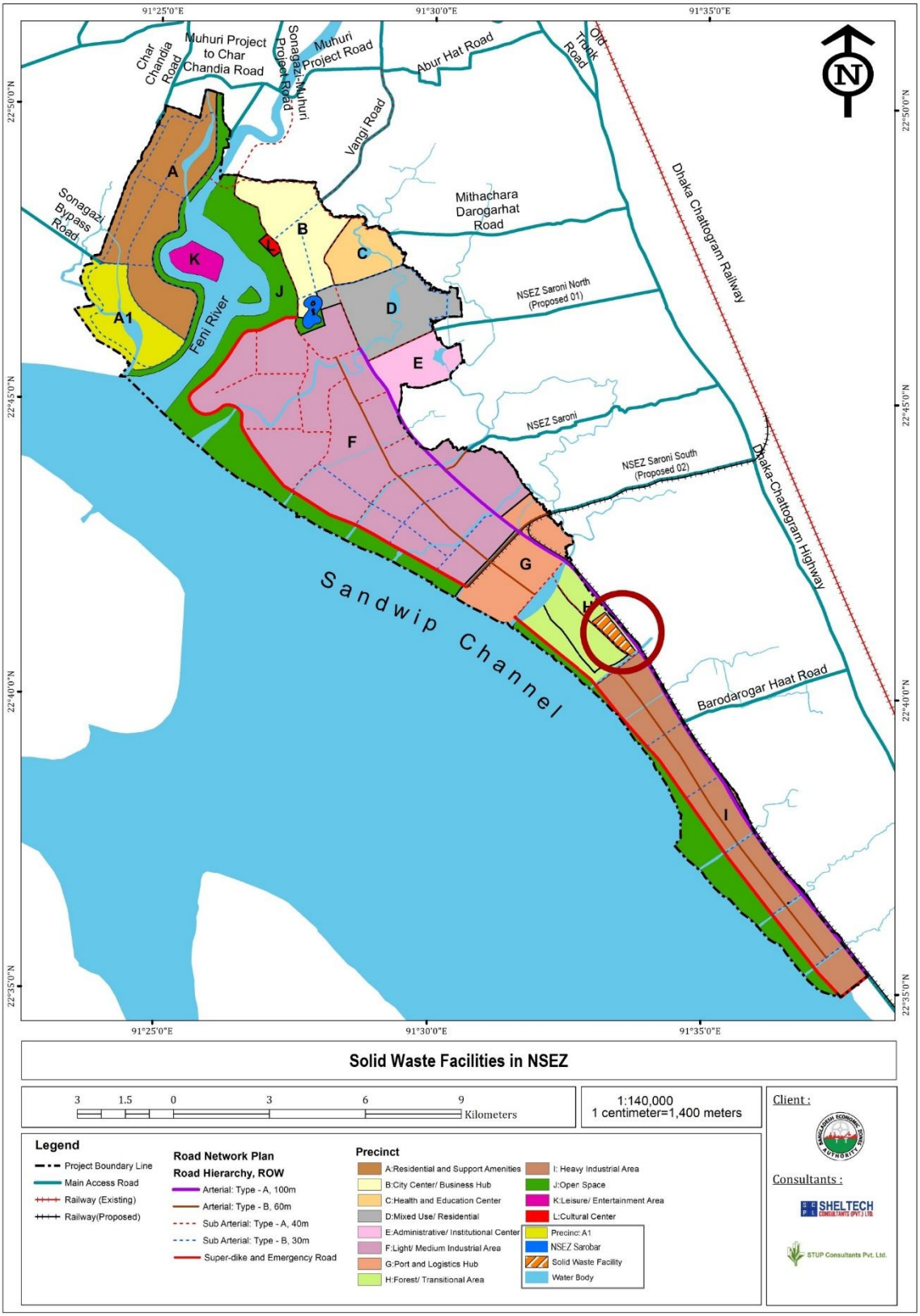
Source: BEZA, 2020b

Appendix A-6: Liquid Waste Handling System with Major Installations



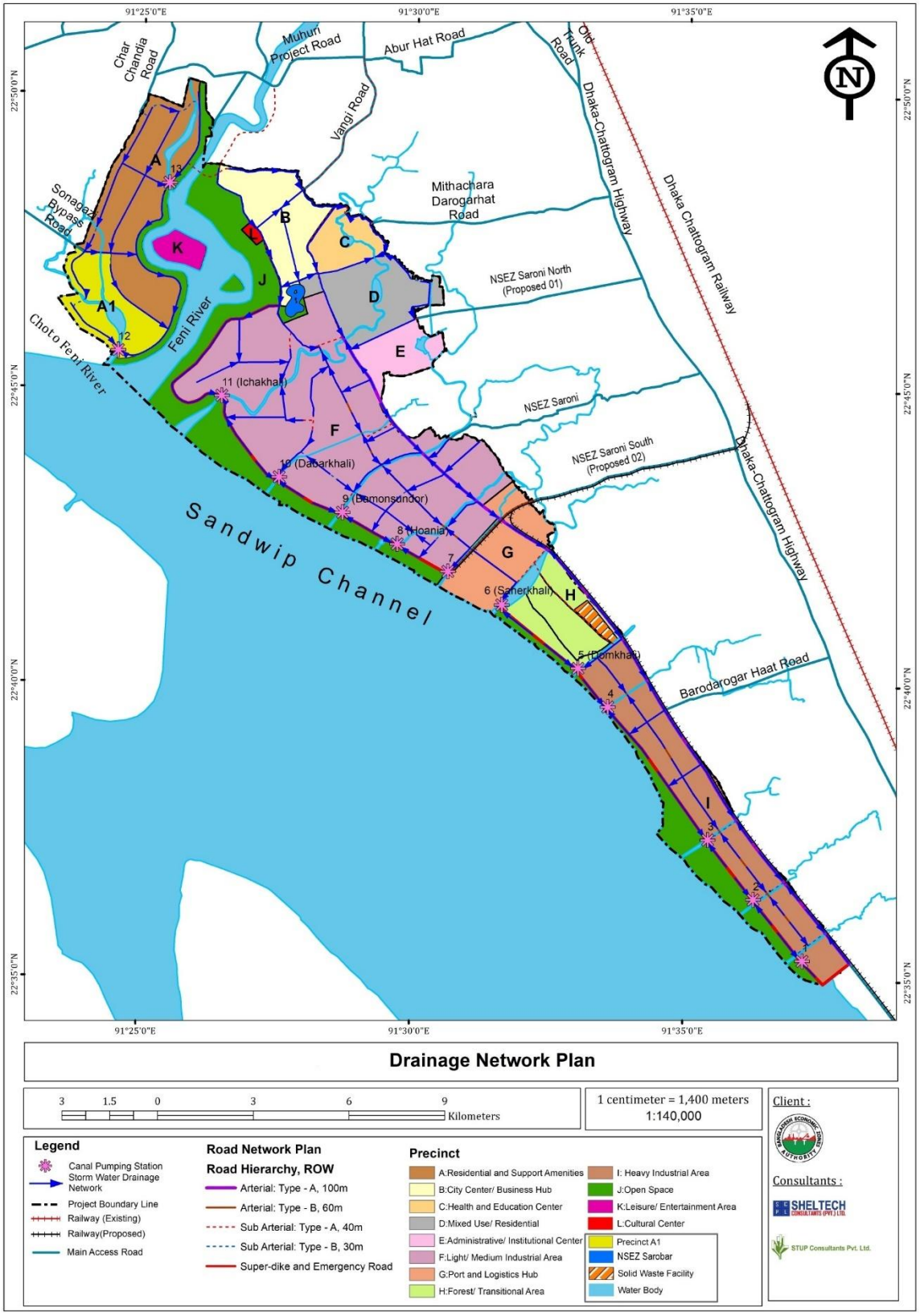
Source: BEZA, 2020a

Appendix A-7: Solid Waste Facilities in NSEZ



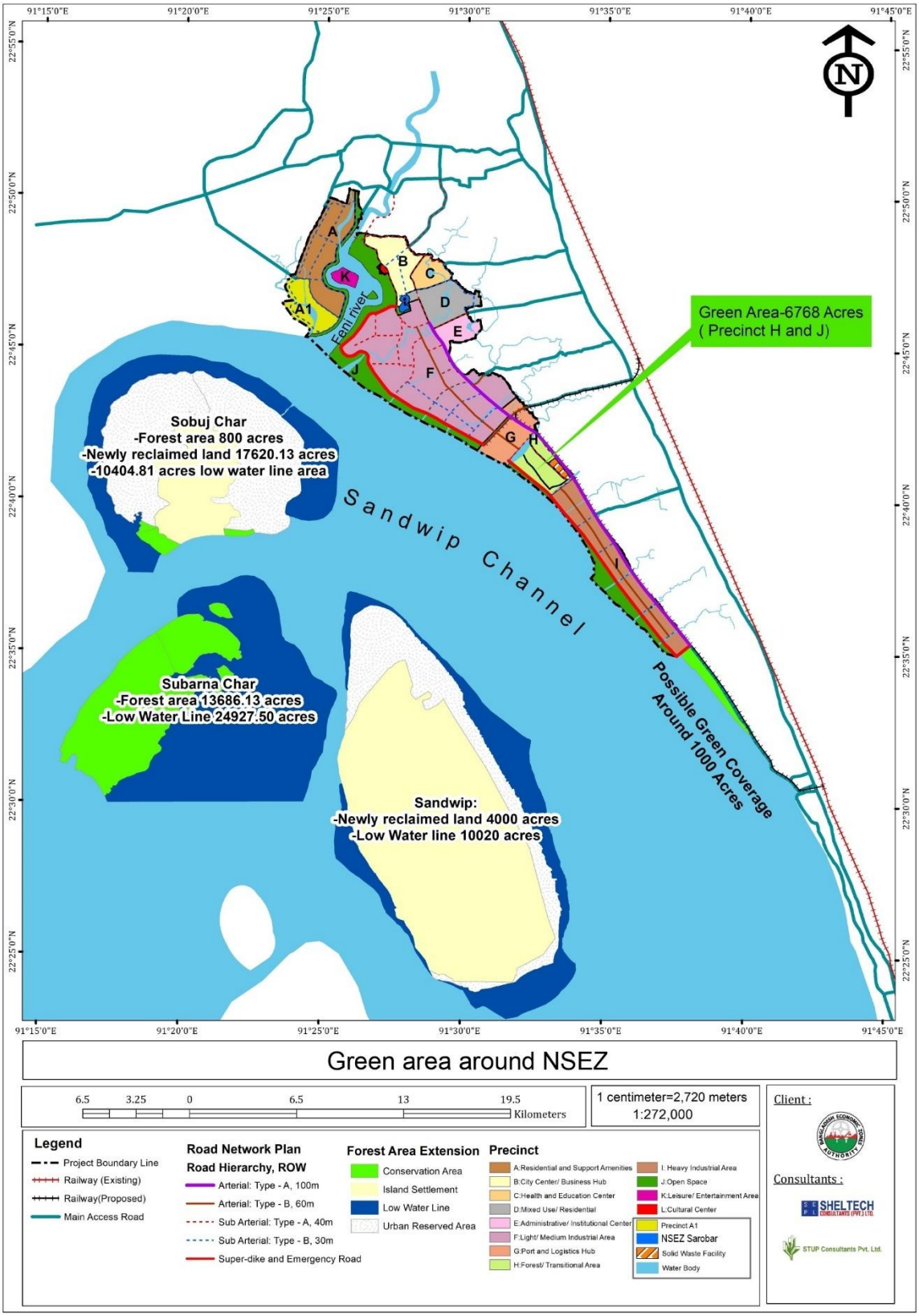
Source: BEZA, 2020a

Appendix A-8: NSEZ Drainage Network Plan



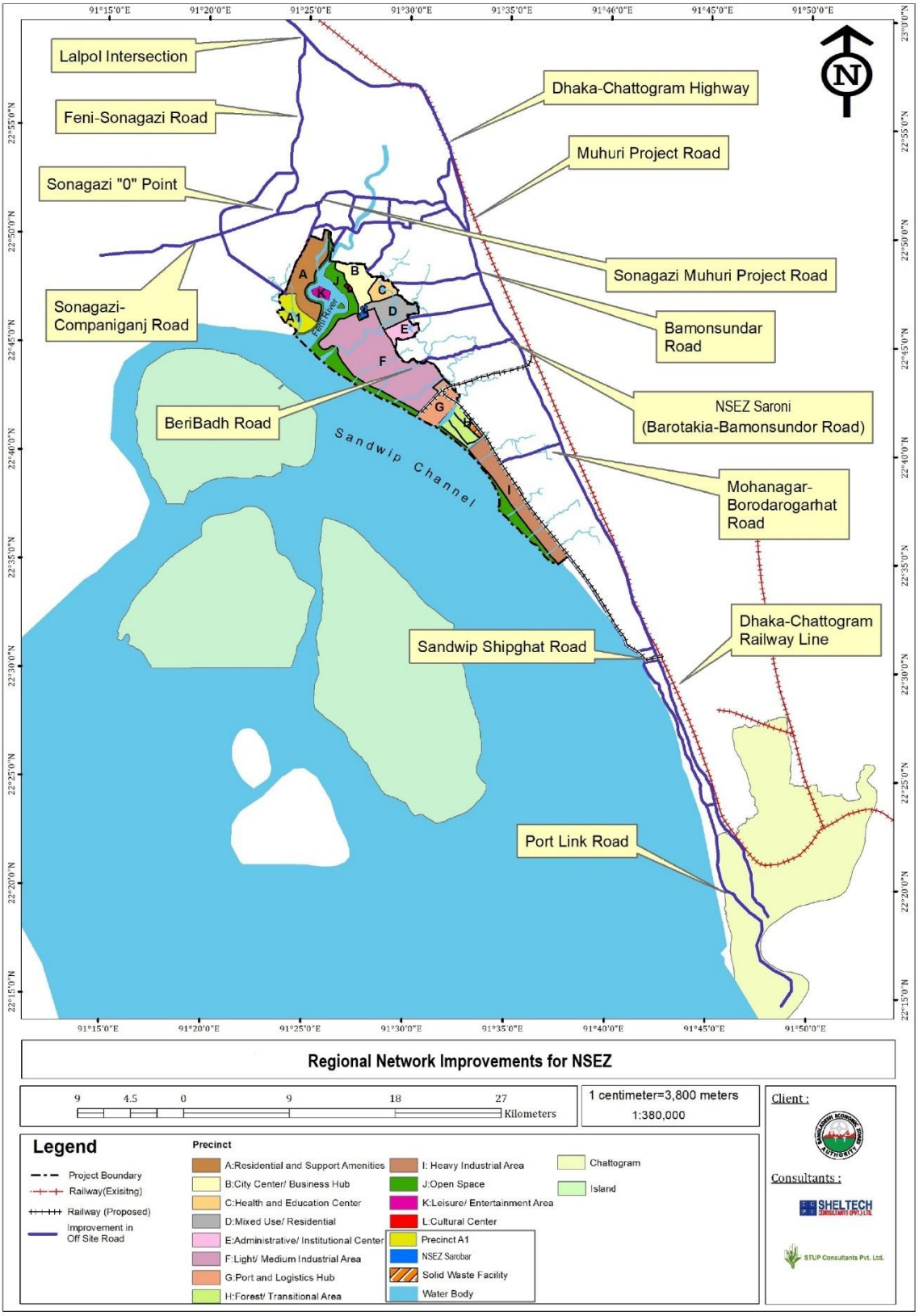
Source: BEZA, 2020a

Appendix A-9: Green Areas Around NSEZ



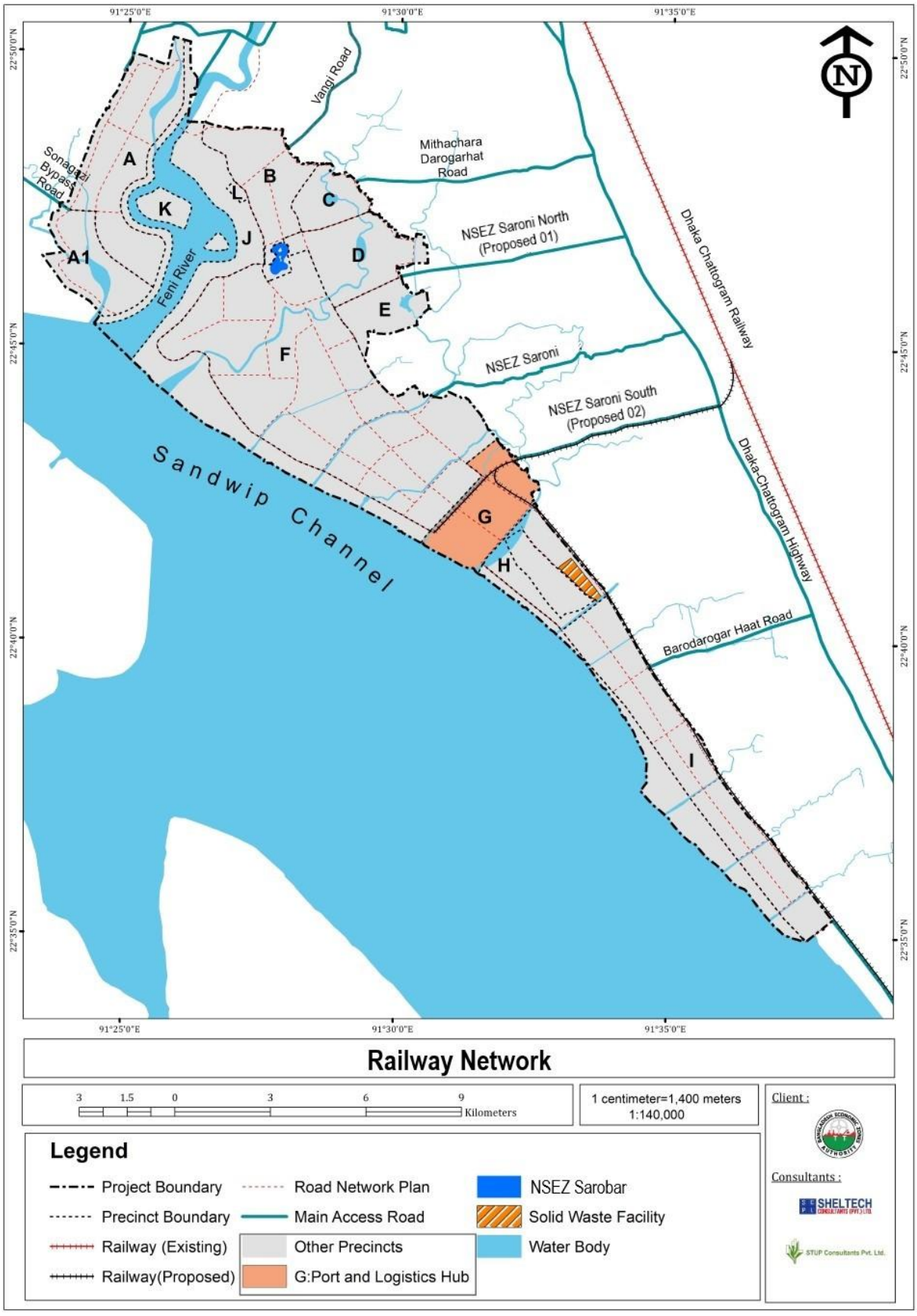
Source: BEZA, 2020a

Appendix A-10: Regional Network Improvements for NSEZ



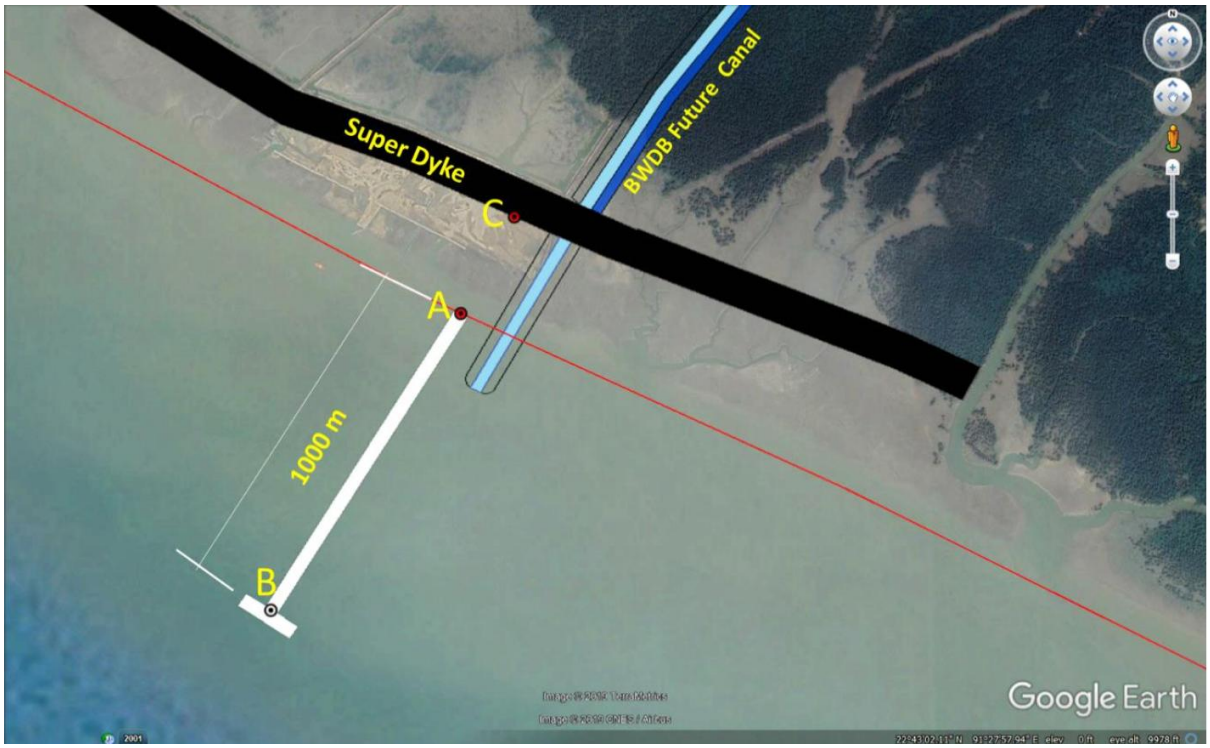
Source: BEZA, 2020a

Appendix A-11: Proposed Alignment of Railway Line to Connect NSEZ



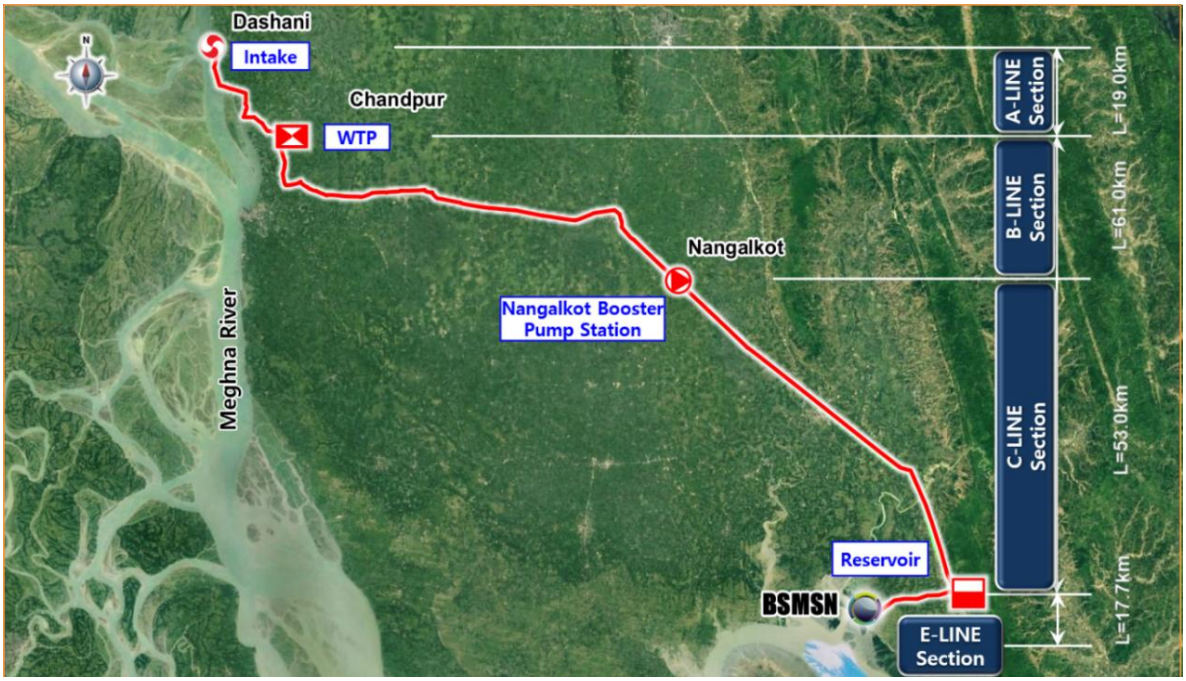
Source: BEZA, 2020a

Appendix A-12: Jetty location at NSEZ, Mirsharai



Source: BIWTA, June 2019

Appendix A-13: Location Map of the Water Supply Pipeline Project



Source: https://thefinancialexpress.com.bd/trade/korean-cos-awarded-preferential-rights-for-water-supply-project-in-bangladesh

Appendix A-14: Proposed Project Interventions

SL#	Name of the Substation	Transmission Line	Bay Extension	Implementation Agency	Status of Implementation	Demand (MW)
A.	**Phase-1 (2022 – 2027)**					
1.	Bashundhara IEZL 230 kV substation (Zone-15)	Existing Mirsharai 230/33 kV grid substation (Hub A) to Bashundhara IEZL 230 kV four circuit overhead (O/H) line (two circuits for Bashundhara): xy1 km	2 nos of 230 kV GIS bay extension at Mirsharai 230/33 kV grid substation	Consumer	Proposed	200
2.	PHP Steel Works 230 kV substation (Zone-20)	Bashundhara to PHP Steel 230 kV four circuit O/H line (two circuits for PHP): xy km	2 nos of 230 kV GIS bay extension at Mirsharai 230/33 kV substation	Consumer	Not yet done	335
3.	BSRM 230 kV substation (Zone-3)	Mirsharai 230/33 kV grid substation to BSRM 230 kV D/C underground line: xy km	2 nos of 230 kV GIS bay extension at Mirsharai 230/33 kV substation	Consumer	Not yet done	220
4.	ACI 132/33 kV substation (Zone-2A)	Mirsharai grid substation to ACI 132 kV D/C underground line: xy km	2 nos of 33 kV GIS bay extension at Mirsharai 230/33 kV substation	BEZA & Consumer	Not yet done	24
5.	BEPZA 132/33 kV Substation (Zone-14)	Mirsharai grid substation to BEPZA 132 kV D/C line: xy km	2 nos of 33 kV GIS bay extension at Mirsharai	BEZA & Consumer	Not yet done	30

SL#	Name of the Substation	Transmission Line	Bay Extension	Implementation Agency	Status of Implementation	Demand (MW)
			230/33 kV substation			
6.	Mango Teleservices Limited 132 kV substation (Zone-4)	Mirsharai grid substation to Mango 132 kV D/C underground line: xy km	2 nos of 33 kV GIS bay extension at Mirsharai 230/33 kV substation	Consumer	Not yet done	60
7.	Capacity upgradation of Mirsharai 230/33 kV grid substation with 2x140 MVA Transformer (3rd & 4th)	-	-	PGCB	Not yet done	300
8.	Upgradation of Mirsharai 230/33 kV substation with 400/230kV, 2x1000 MVA transformer	-	-	PGCB	Not yet done	740
B	**Phase-2 (2028-40)**					
1.	Upgradation of Mirsharai 400/230/33 kV substation to 400/230/132/33 kV grid substation: 400/132kV, 3x325 MVA transformer additions	-	-	PGCB	Proposed	1700
2.	400/230 kV, 3x750 MVA Mirsharai-2 grid substation	Mirsharai-2 substation to planned Mirsharai 765/400 kV grid substation: xy km	2 nos of 400 kV GIS bay extension at Mirsharai 765/400 kV grid	PGCB	Proposed	1400

SL#	Name of the Substation	Transmission Line	Bay Extension	Implementation Agency	Status of Implementation	Demand (MW)
3.	ACI 132/33 kV substation, 3x80/120 MVA GIS grid substation (Zone-2A)	2 no's of 132 kV GIS bay extension at Mirsharai substation (Hub A)	-	BEZA & Consumer	Proposed	66
4.	BEPZA 132/33 kV substation, 3x80/120 MVA GIS grid substation (Zone-14)	2 no's of 132 kV GIS bay extension at Mirsharai substation (Hub A)	-	BEZA & Consumer	Proposed	120
5.	Mango Teleservices Limited 132 kV substation (Zone-4)	-	2 nos of 132 kV GIS bay extension at Mirsharai substation (Hub A)	Consumer	Consumer	Proposed
6.	230/132/33 kV Common grid substation at Zone 20 (230/132 kV, 2x300/450 MVA, 132/33 kV, 3x80/120 MVA) (Zone 20)	Mirsharai-2 substation to Zone-20 230 kV D/C line: xy km	2 nos of 230 kV GIS bay extension at Mirsharai-2 substation 230 kV Bus and Bay extension at PHP for Zone 20 common grid substation	BEZA & Consumer	BEZA & Consumer	Proposed
7.	230 consumer substations at Zone 25 (Zone 25)	Mirsharai-2 substation to zone-25 consumers substation 230 kVD/C line: xy km	2 nos of 230 kV GIS bay extension at Mirsharai-2 substation	Consumer	Consumer	Proposed
8.	Mirsharai Residential	Mirsharai grid substation	2 nos of 132 kV	BEZA	Proposed	90

SL#	Name of the Substation	Transmission Line	Bay Extension	Implementation Agency	Status of Implementation	Demand (MW)
	Area 132/33 kV, 2x80/120 MVA GIS grid substation (Zone 29)	(Hub A) to residential area 132 kV D/C line: xy km	GIS bay extension at Mirsharai substation (Hub A)			
9.	Zone-7 132/33 kV, 3x80/120 MVA GIS grid substation (Zone-7)	Mirsharai grid substation (Hub A) to Zone-7 132 kV D/C line: xy km	2 nos of 132 kV GIS bay extension at Mirsharai gird substation (Hub A)	BEZA	Estimation ongoing	90
10.	Indian Economic Zone 132 kV substation (Zone-19)	Zone 20 common grid to Indian Economic zone 132 kV D/C underground line: 1.20 km	2 nos of 132 kV GIS bay extension at PHP common grid	Consumer	Not yet decided	N/A
11.	Zone 22 Consumer 132 kV substation (Zone-22)	Zone 20 common grid to Zone 22 Consumer 132 kV D/C underground line: 1.46 km	2 nos of 132 kV GIS bay extension at PHP common grid	Consumer	Proposed	90

NB: Line length xy shall be finalized after the route survey and consultation with BEZA.

Source: PGCB, 2023

Appendix A-15: Map showing all project interventions inside NSEZ

Source: PGCB, 2023