



Bangladesh Inland Water Transport Authority (BIWTA)
Ministry of Shipping
Government of the People's Republic of Bangladesh



Project: Bangladesh Regional Waterway Transport Project-1
(BRWTP-1)
(IDA Credit No.: 5842-BD, Contract # BRWTP-S6)



Environmental and Social Impact Assessment of proposed new and upgradation of Cargo and Passenger River Terminals

Final Report

**ESIA for Cargo and Passenger River Terminals
Executive Summary**

(EC5706-FINAL-ESIA-EXS-BRWTP-S6-Ed04)

FEBRUARY 2022

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& ARCHITECTS

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- DOCUMENT: FINAL ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT REPORT. EXECUTIVE SUMMARY

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• REVISION HISTORY

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Ed04	Final Executive Summary Report.

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LIST OF ABBREVIATIONS

▪ ARIPA	Acquisition and Requisition of Immovable Property Act of 2017
▪ BCCSAP	Bangladesh Climate Change Strategy and Action Plan
▪ BIWTA	Bangladesh Inland Water Transport Authority
▪ BIWTMAS	Bangladesh Inland Water Transport Master Plan
▪ BMD	Bangladesh Meteorological Department
▪ BNBC	Bangladesh National Building Code
▪ BRWTP	Bangladesh Regional Waterway Transport Project
▪ CEAP	Contractor's Environmental Management Plan
▪ CEDAW	Convention on Elimination of All Forms of Discrimination against Women
▪ CIA	Cumulative Impact Assessment
▪ CSC	Contractor's Supervision Consultant
▪ CT	Cargo Terminal
▪ DC	Deputy Commissioner
▪ DEPTC	Deck and Engine Personnel Training Center
▪ DFR	Draft Feasibility Report
▪ DGPS	Differential Geographic Positioning System
▪ DoE	Department of Environment
▪ DTR	Diurnal Temperature Range
▪ ECA	Ecologically Critical Area
▪ ECAP	Environmental Corporate Action Program
▪ ECC	Environmental Clearance Certificate
▪ ECoP	Environmental Code of Practices
▪ ECR	Environment Conservation Rules
▪ EMF	Environmental Management Frameworks
▪ EQS	Environmental Quality Standards
▪ ESIA	Environmental and Social Impact Assessment
▪ ESIA	Environmental and Social Impact Assessment
▪ ESMF	Environmental and Social Management Framework
▪ ESMP	Environmental Management Plan
▪ ESR	Environmental and Social Receptors
▪ FFR:	Final Feasibility Report
▪ FGD	Focus Group Discussion
▪ GBV	Gender-Based Violence
▪ GCM	General Circulation Models
▪ GoB	Government of Bangladesh
▪ GRC	Grievance Redress Committees
▪ GRM	Grievance Redress Mechanism
▪ HP:	Horsepower
▪ ICT	Inland Container Terminal
▪ IEE	Initial Environmental Examination
▪ IMTP:	Integrated Multimodal Transport Policy
▪ IUCN	International Union for Conservation of Nature
▪ IWT	Inland Waterway Transport
▪ kN	Kilonewton
▪ kV	Kilovolt
▪ kVA	Kilovolt ampere



EXECUTIVE SUMMARY



- LNG Liquified Natural Gas
- MARPOL International Convention for the Prevention of Pollution from Ships
- MoEF Ministry of Environment and Forest
- MoS Ministry of Shipping
- NEMAP National Environmental Management Action Plan
- NEP National Environment Policy
- NIMTP National Integrated Multimodal Transport Policy
- NPV Net Present Value
- OHS Occupational Health and safety
- OP: Operational Policy
- OSPAR Oslo/Paris convention (for the Protection of the Marine Environment of the North-East Atlantic)
- PA Protected Area
- PIU Project Implementation Unit
- PT Passenger Terminal
- RAP Resettlement Action Plan
- REB: Rural Electrification Board
- RFP Request for Proposal
- RPF Resettlement Policy Framework (RPF)
- SDG Sustainable Development Goal
- SIA Social Impact Assessment
- SMF Social Management Framework
- SMRC SAARC Meteorological Research Center
- SPM Shore Protection Manual
- STP: Sewage Plant
- TOR Terms of Reference
- IUCN International Union for Conservation of Nature
- WB World Bank

1. INTRODUCTION

Bangladesh lies predominately within the Bangla basin, the world' largest delta formed by the Ganges, Brahmaputro (Jamuna) and Meghna (GBM) river system and its tributaries and distributaries. Bangladesh is a riverine country with some 700 rivers, streams and canals with a total length of about 24,000 kilometers (km). Approximately 6,000 km are navigable during the monsoon (wet) period for different size vessels, shrinking to about 3,900 km in the dry periods. While the larger rivers are up to 50 meters (m) depth in place and the lower Meghna (the main trafficked route on the Dhaka Chittagong Corridor or DCC) is generally 10-20m depth, navigation is hindered by very shallow depths on bars, especially in the delta area, at the confluences of the major rivers and their tributaries, river bends and mouths. Navigation is further complicated by the braided nature of the main rivers. These are characterized by high sediment delivery and extremely low gradients, leading to very low sediment throughput. In total, the GBM System annually carries up to one billion tons of sediment and drains into the Bay of Bengal principally through the Shahbazpur and Hatia estuaries in the Mouths of the Ganges – feeding the Bengal Fan, the largest depositional system in the world. Inland Water Transport carries over 50 percent of all Bangladesh's cargo traffic and one quarter of all passenger traffic.

There are over 22,300 registered vessels engaged in this trade, mainly transporting dry and liquid cargoes in bulk or break-bulk form. Investment by the vibrant shipping and inland water transport industry in Bangladesh total approximately US\$ 4 billion.

The Government has identified 65 main river navigation routes that are essential to passenger and ferry ghat transport within Bangladesh. The routes are categorized as Classes I through IV depending on their advertised depth as tabulated below:

Class	Max Vessel Draft/Least Advertised River Depth	Length	%
I	3.65 m/ 3.96 m	683 km	11%
II	2.13m/ 2.43 m	1,000 km	17%
III	1.52m/ 1.82 m	1,886 km	32%
IV	<1.52m	2,400 km	40%

The development and control of Inland Water Transport (IWT) is the responsibility of the Bangladesh Inland Water Transport Authority (BIWTA), under the Ministry of shipping (MoS). Among its functions for passenger traffic, BIWTA is responsible to:

- Develop, maintain and operate inland river routes to maintain the advertised Least Available Depth (LAD) and width by necessary surveys and dredging works including maintaining the necessary navigation measures to operate the vessel effectively
- Develop, maintain and operate inland river ports, landing ghats and terminal facilities in such ports or ghats and,
- Develop the most economical facilities for passenger traffic to ensure comfort, safety and speed on mechanized craft.

This BRWTP, currently under implementation, intends to improve the following inland waterway ports and terminals comprising, among others the following packages:

- Package 3. Development of Cargo Terminals at Pangaon and Upgrade the Cargo Terminal at Ashuganj.



- Package 4. Development of new Passenger Terminals at Shashanghat and Chandpur, Upgrade the Existing facility at Narayanganj and Barishal;
- Package 5. Development of fifteen (15) Landing stations (ghats) and six (6) vessel shelters.

Package BRTW S6 is related to Environmental and Social Impact Assessment of proposed new and up-gradation of Cargo and Passenger River Terminals. Landing Stations and Vessel Storm Shelters, covering ESIA and RAP preparation for packages 3, 4 and 5. This ESIA is related to BRWTP S3 Passenger Terminals and BRWTP -S4 Cargo terminals.

1.1. BACKGROUND

1.1.1. The proposed project

The Bangladesh Inland Water Transport Authority (BIWTA), under the Ministry of Shipping, is implementing the '**Bangladesh Regional Waterway Transport Project 1**', which involves investments in development of **Inland Water Transport (IWT)** routes and infrastructure between **Dhaka – Chittagong IWT Corridor**, including branches to Ashuganj, Narayanganj and Barisal. The World Bank is financing the Project.

Key components of this program are:

- Component 1 Improved Inland Waterway Navigation:
- Component 2 Improved Services at Priority Inland Waterway Terminals and Landing Ghats/Stations.
- Component 3 Institutional capacity development and sector sustainability:

Under Component 2 the Bangladesh Inland Water Transport Authority (BIWTA), intends to develop works to improve six common use cargo and passenger terminals with last mile connectivity access infrastructure. The passenger terminals included are a new terminal at Sashanghat near Dhaka, and rehabilitation/upgrade of three existing terminals at Narayanganj (refurbishment/expansion of Narayanganj DEPTC), Chandpur (reconstruction or completely new construction) and Barishal. The cargo terminals included in the project are a new terminal at Pangaon near Dhaka and rehabilitation/upgrade of the existing Ashuganj cargo terminal.

Additionally, BIWTA intends to develop 15 river landing stations and 6 vessel storm shelters. These facilities would improve the multimode transport networks reducing the current transport bottlenecks in Bangladesh. Component 2 comprises the following sub-components:

Package	Name of Contract
BRWTP-S3	Feasibility study, detailed survey, design, and supervision of new construction/upgrade of Passenger Terminals at a) Sashanghat, b) Chandpur, c) Barishal and d) Narayanganj/ DEPTC
BRWTP-S4	Feasibility study, detailed survey, design, and supervision of new construction/upgrade of Cargo Terminals at a) Pangaon and b) Ashuganj
BRWTP-S5	Feasibility study, detailed survey, design, and supervision for newly proposed and upgrading of a) Existing 15 Landing Stations; and b) 6 Vessel Storm Shelters along Dhaka -Chittagong inland water route.

1.1.2. The ENVIRONMENTAL AND SOCIAL IMPACT ASSESMENT (ESIA)

The ESIA is developed in two reports

- ESIA for Passenger and Cargo terminals, S3 and S4 packages
- ESIA for Launch Ghats/Stations and Vessel Storm Shelters

This ESIA is related to BRWTP S3 Passenger Terminals and BRWTP -S4 Cargo terminals. The present ESIA does not include the BRWTP–S5 sub-component.

1.1.3. Scope of the ESIA

The ESIA follows the Environmental and Social Impact Assessment (ESIA) for **Component 1**, and the **Environmental Management Framework (EMF)** and **Social Management Framework (SMF)** for **Component 2** previously prepared by **BIWTA** for the Bangladesh Regional Inland Water Transport Project 1

The ESIA complies with the World Bank safeguards requirements and standards and the National environmental requirements defined in the Bangladesh Environmental Conservation Act, 1995 and subsequent regulations and guidelines.

The ESIA Report complies with the Department of Environment (DoE) requirements.

1.1.4. ESIA Team

The following team members have actively participated in the preparation of the ESIA Report.

Table 1. ESIA Team

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	COMMUNITY ENGAGEMENT EXPERT	Ashadullah Sadat	KS Consultants
	GENDER EXPERT	Begun Samshum	KS Consultants



2. LEGISLATIVE, REGULATIONS AND POLICY CONSIDERATIONS

Regulatory requirements aimed at the protection and conservation of the environment and various environmental resources and at protection of the social environment from adverse impact of projects and activities associated with them have been expressed by the GoB as well as WB. These requirements are summarized below. Also reviewed in the Chapter are the relevant international treaties of which Bangladesh is a signatory. The World Bank environmental and social safeguard policies are also highlighted.

2.1. COMPLIANCE STATUS WITH BANGLADESH LEGISLATION AND WORLD BANK POLICIE

The present compliance status of the project with Bangladesh legislation and World Bank safeguard policies is indicated in the following table

Table 2. Compliance of Project with GoB Legislation and World Bank Safeguard Policies

	Legislation/Policy	Actions Taken to Comply
GoB requirements	Environmental Conservation Act	BIWTA will submit the ESIA report of Component 2 works to DOE for environmental clearance
	International treaties	Verification of protected sites, Red List and protection of vulnerable habitats in all environmental screenings and assessments under the project. Inclusion of relevant mitigation measures in each ESMP for each sub-project/activity.
	Public information and disclosure	The draft ESIA, ESMP reports have been disclosed on BIWTA's website. Public consultations meetings were held site specifically to disclose the project information and ESIA and to solicit stakeholder feedback.
World Bank requirements	OP 4.12 Participatory approach	Key informant interviews, participatory rural appraisals, consultation meetings and focus group discussions were held between October 2019 and January 2020.
	OP 4.01 Integrate environmental and social assessment	Natural environment, public health, and social aspects are integrated in planning documents.
	OP 4.04 Natural Habitats	Verification of protected sites and ecosystems, Red List and endangered flora and fauna has been prepared for all proposed activities..
	OP 4.01 Risk assessment	Health and safety risks for population and workers are identified in the ESIA and BIWTA EMF, and management measures will be included in tender documents. BIWTA's capacity will also be strengthened on health and safety risk management.

	Legislation/Policy	Actions Taken to Comply
World Bank requirements	OP 4.01 Climate Change and floods	Impact of climate change effects are assessed and design of infrastructure facilities (river terminals, landing stations, vessel shelters) will consider climate change adaptation in the designs
	OP 4.01 Cumulative Impacts	Cumulative impact assessment has been conducted as part of the ESIA to cover the impacts from all components of the Project and other related developments in the Project area.
	OP 4.01 Alternatives	Alternatives considered included: “No – action” (without project) case in the ESIA for terminals
	OP 4.01 Pollution	Baseline survey of environmental quality has been carried out. Environmental standards of GoB and World Bank will be complied. Environmental Code of Practices (ECoPs) will be included in contractors’ bidding documents of all sub-projects.
	OP 4.11 Physical Cultural Resources	No physical cultural resources which warrant special treatment under the World Bank OP 4.11 were identified in the project impact area.. Chance find procedures will be included in bidding documents.
	OP 4.01 Social impacts	For negative social impacts on land/assets/livelihood/access to resources etc. mitigation plans will be prepared in keeping with the Bank’s Operational policies.
	OP 4.01 OP 4.20 Gender	Gender consultations, including women only consultation meetings, were carried out during social assessment. Female friendly aspects will be incorporated into designs for river terminals and landings.
	OP 4.01 Public Health	Public health aspects were studied, and public health impacts are covered in ESIA and EMF
	OP 4.01 OP 4.12 Consultation and access to information	The ESIA, EMF and RPF have been disclosed in the country area (on BIWTA website and hard copies will be made available in locally accessible locations of the project, including BIWTA offices at the existing terminals) and also sent to WB Info Shop. Public consultations were held at each of the 6 project sites in October 2019. Further planned public consultations, including a second national level workshop, are expected.



3. DESCRIPTION OF THE PROJECT

Bangladesh Inland Water Transport Authority (BIWTA) is the sole authority of the inland water transport network in Bangladesh. BIWTA is also responsible for the development, operation and maintenance of inland water transport network of the country.

Bangladesh is a land of rivers covered by the Bengal Delta, the largest delta on the planet. The country has 700 rivers and 8,046 kilometers (5,000 miles) of inland waterway of which only 5,968 kilometers are navigable by mechanized vessels during monsoon. The waterway shrinks to about 3,900 kilometers during dry periods. The Inland Water Transport (IWT) sector carries about 50 percent of all arterial freight traffic and one quarter of all passenger traffic. Bangladesh has three seaports and 22 river ports. All these seaports and 22 river ports are significantly contributing to the country's economy through transportation of goods and passengers. There are some 22,300 registered vessels made up of dry cargo vessels, barges, tankers, double bottom vessels etc. In addition to the registered vessels, there are about 750,000 country boats of different shapes and sizes. The carriers play an important role in transporting goods and passengers particularly in rural areas.

3.1. PASSENGER TERMINALS

3.1.1. Sashanghat passenger terminal

The main IWT terminal of Dhaka city is located in Sadarghat (near Dhaka and also known as Dhaka River Port/Terminal) and is located downstream of Buriganga River, on the left bank. The proposed Sashanghat Terminal is a Greenfield site located on left bank of Buriganga River and will be used as a satellite terminal to Sadarghat for development of passenger IWT terminal mainly to relieve/relax/divert the long-distance traffic (towards Barishal & Chandpur and other destinations). Sashanghat site is about 2.5 Km to the east of Sadarghat.



Figure 1. Passenger IWT site at Sashanghat

Source: FFR Sashanghat IWT terminal, December 2019. Package Passenger S3 Consultant

The earmarked Land Area for proposed IWT Terminal Development at Sashanghat is about 2.4 acres (120 m x 80 m approx.). The earmarked area is under Dhaka South City Corporation, Ward 54. Furthermore, adjacent (Northern Side) to the proposed site, about 3-4 acres of land is available which is owned by Bangladesh Railway and the same could be used (by leasing or purchasing) by BIWTA if required.

Terminal building requirements.

The following table provides the summary of facilities and area requirement for Sashanghat terminal

Table 1. Sashanghat Terminal Building Area Requirements

Sl. No.	Description	Area Requirement for Phase 1 (sq.mt.) (up to Yr. 2029)	Additional Area Required for Phase 2	Additional Area Required for Phase 3
1	Terminal Facilities	4,506	Theoretically about 1500-2000 Sqm is required) <i>The area provided as per Phase 1 requirement will suffice for Phase 2 (traffic of up to Yr 2036) as well</i>	An additional area of 3,350 Sq. m will have to be provided during Phase 3 for increment in the passenger traffic
2	Services	168		
3	Amenities	2,306		
4	Management Offices	2,560		
5	Rentable Area	5,727		
6	Accommodations	512		
7	Miscellaneous	3,116		
	Total Area	18,896		

Integrated Master Plan option 1 for Sashanghat is presented hereinafter.

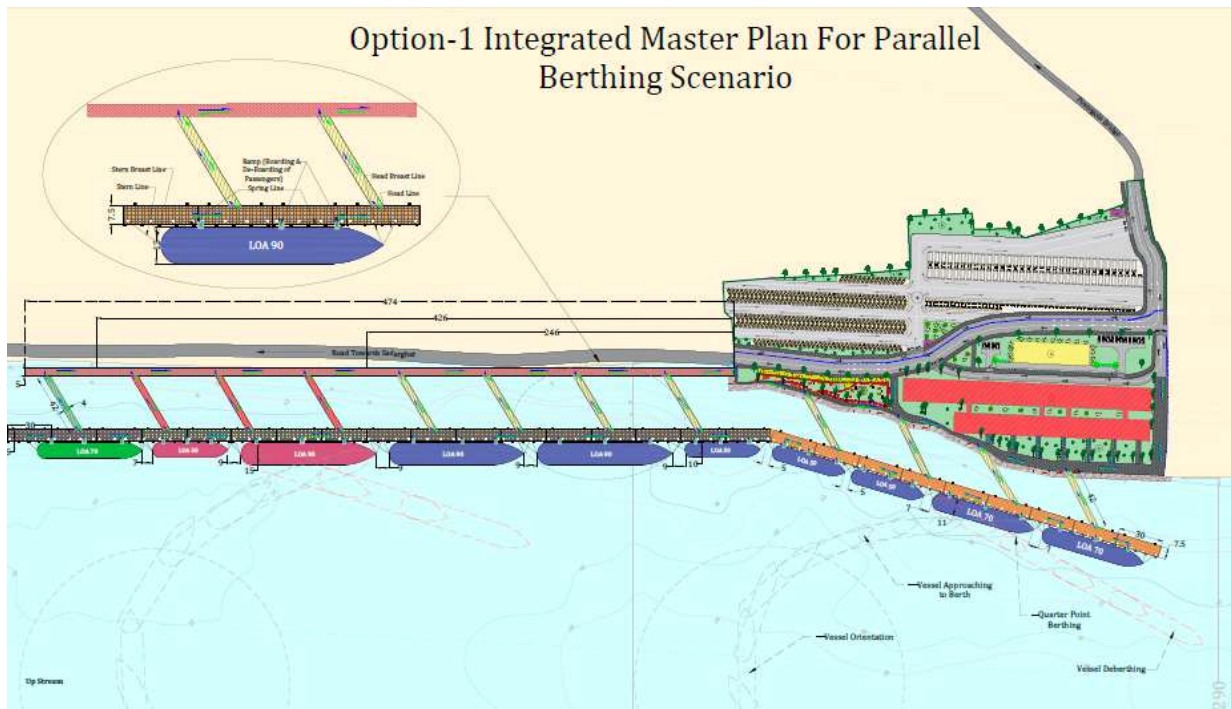


Figure 2. Integrated Master Plan for Sashanghat

3.1.2. Chandpur passenger terminal

The Chandpur terminal is located in the center of Bangladesh passenger IWT system. Chandpur terminal acts as transit point for people who want to go to Chittagong from Dhaka or south-western regions and vice versa. Chandpur is close to confluence of Padma and Meghna rivers. Chandpur is about 60-70 Km from Sadarghat.



Chandpur terminal is situated on the confluence of the river Padma and the river Upper Meghna where the river is wider. Although the available river width is considerable, because two rivers meet, there are strong swirl currents which could lead to vessels drifting. At this location vessels are not always able to navigate properly.

Chandpur is a very old Port, having multi-modal connection with steamer, rail and road transport systems. Steamer routes exist from Calcutta (Kolkata) to Narayanganj via Chandpur and vice versa, with railway connections to big cities of Chittagong and Dhaka.



Figure 3. Existing land side facilities at Chandpur Terminal

Source: FFR Chandpur IWT terminal, December 2019. Passenger Package S3Consultant

According to BIWTA close to 2.4 acres of land were available of which about 0.5-0.6 acres have subsided under water over the period of time. However, currently, 1.8 acres are available for terminal building development. BIWTA intends to develop new port facilities at this new site on the banks of river Meghna. This development will be a green field project.

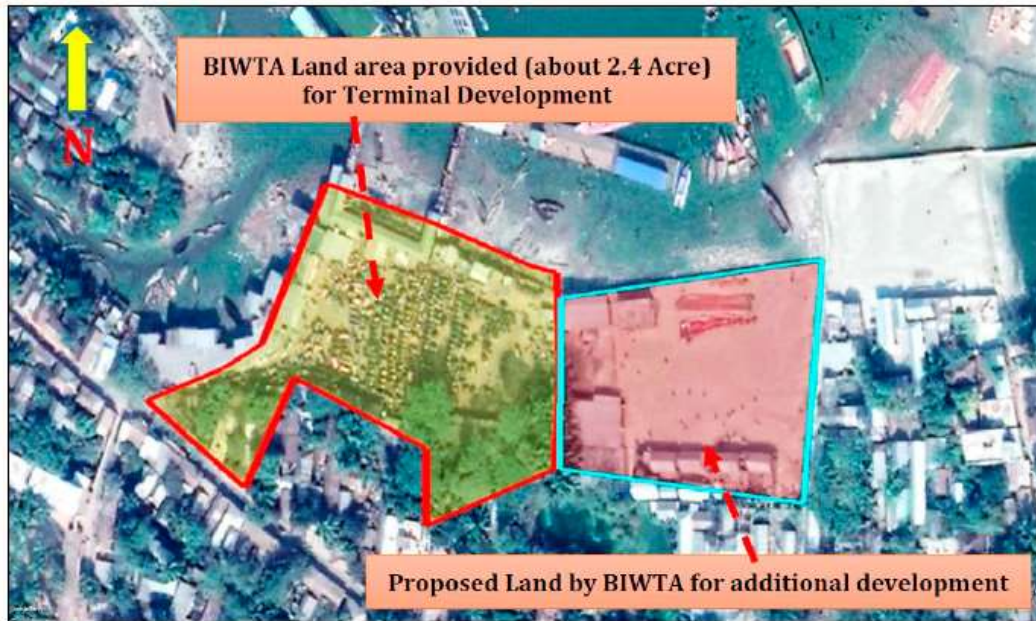


Figure 4. Earmarked area for Chandpur Terminal Development

Source: FFR Chandpur IWT terminal, December 2019. Passenger Package S3 Consultant

Terminal building requirements

The following table provides the summary of facilities and area requirement for Shasanghat terminal

Table 3. Sashanghat Terminal Building Area Requirements

Sl. No.	Description	Area Requirement for Phase 1 (sq.mt.) (up to Yr. 2029)	Additional Area Required for Phase 2	Additional Area Required for Phase 3
1	Terminal Facilities	1,858	Additional area of 819 Sq. m will have to be provided during Phase 2 for increment in the passenger traffic	Additional area of 869 Sq. m will have to be provided during Phase 3 for increment in the passenger traffic
2	Services	216		
3	Amenities	696		
4	Management Offices	714		
5	Rentable Area	270		
6	Accommodations	94		
7	Miscellaneous	290		
	Total Area	4,138		

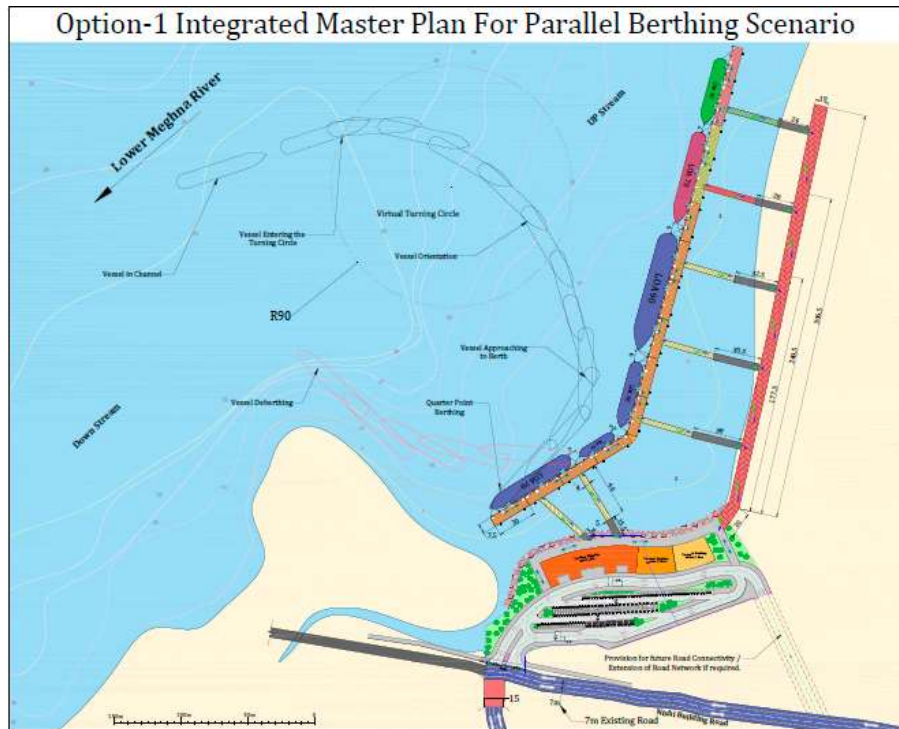


Figure 5. Integrated Master Plan

3.1.3. Narayanganj Passenger Terminal

Narayanganj IWT Passenger Terminal is situated on right bank of Shitalakshya River at a distance of about 20 Km, traveling by road from Dhaka / Sadarghat. However, via waterways, the distance is about 35 Km from Sadarghat. The Narayanganj Terminal is situated next to Narayanganj Railway Station. In older days there were very good connections between these two and the multi-modal transport was very effective. Narayanganj IWT Port was established in 1972. Existing facilities include a single story building, 4 pontoons, 3 gangways, an RCC jetty and an administrative office. Existing facilities also include cargo-handling facilities with 4 pontoons.

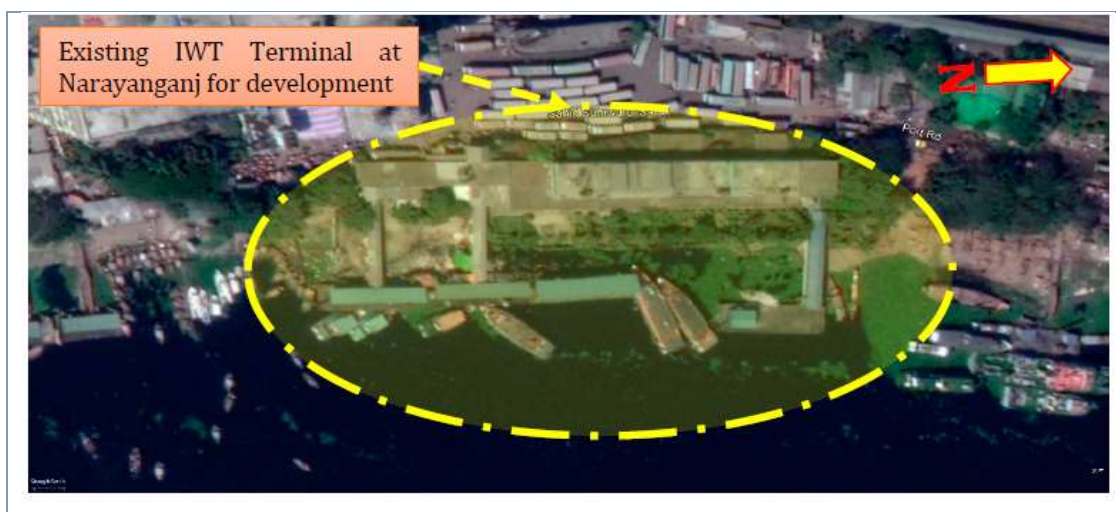


Figure 6. Satellite Imagery of Narayanganj IWT Terminal

Source: FFR Narayanganj IWT terminal, December 2019. Package Passenger S3 Consultant

Terminal building requirements

The following table provides the summary of facilities and area requirement for the Narayanganj terminal

Table 4. Narayanganj Terminal Building Area Requirements

Sl. No.	Description	Area Requirement for Phase 1 (sq.mt.) (up to Yr 2029)	Additional Area Required for Phase 2	Additional Area Required for Phase 3
1	Terminal Facilities	1,139	Additional area of 1,000 Sq. m will have to be provided during Phase 2 for increment in the passenger traffic	Additional area of 1,000 Sq. m will have to be provided during Phase 3 for increment in the passenger traffic
2	Services	472		
3	Amenities	740		
4	Management Offices	876		
5	Rentable Area	2291		
6	Accommodations	141		
7	Miscellaneous	559		
	Total Area	6,219		

Integrated Master Plan for Narayanganj, option 1, is presented below.

Option-1 Integrated Master Plan For Parallel Berthing Scenario With Idle Berthing

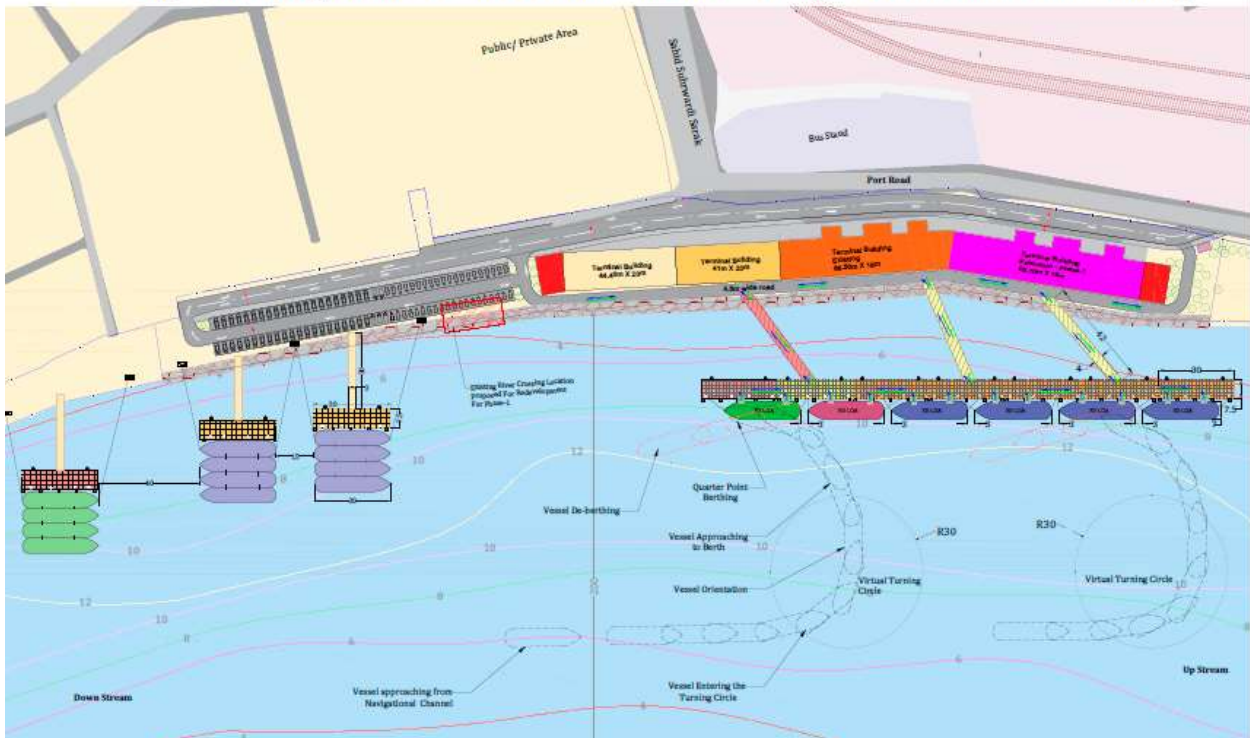


Figure 7. Integrated Master Plan for parallel Berthing scenario with idle berthing for Naryanganj terminal

3.1.4. DEPTC, Deck and Engine Personnel Training Center

Integrated within Narayanganj Project Design, the Deck and Engine Personal Training Center (DEPTC) is a training center situated on the left bank of Shitalakshya River and is very close to Narayanganj IWT terminal location.



This training institute currently has the Admin building, Hostel (for 200 persons) and staff quarters. However, all the buildings are very old (about 40 years) and need substantial renovation/upgrade. New Admin Building shall consider the provision of Bridge Simulator Space + New hostel for 500 persons + Staff Quarters (Multi storied – 3-5 floors) + Directors / Principal Bungalow etc. (as per the requirement suggested by DEPTC Principal)

A total area of 4.12 acres of land is earmarked for DEPTC development. DEPTC counts on its own pontoon and Link span for berthing of vessels.



Figure 8. Location of DEPTC site

Source: FFR DEPTC, December 2019. Package Passenger S3 Consultant

Based on the facility requirement, the area required for the Master plan is provided in Table 5.

Table 5. Area statement for DEPTC

Sl. No.	Item	Unit	Master Plan	Phase I	Phase II	Phase III
1	Administration Building Plinth Area	sq. m	790	790	0	0
2	Admin Building (8 storied)	Sq. m	6314	3701	2613	0
3	Number of Floors of Administration Building	Nos.	8	5	3	0
4	Hostel Building Plinth Area	sq. m	1818	1818	0	0
5	Number of Floors in Hostel Building	Nos.	8	6	2	0
6	Playground Area	sq. m	1720	0	0	0
7	Swimming Pool Area (approx)	sq. m	194	0	0	194
8	Gym Building Area (approx)	sq. m	129	0	0	129
9	Staff Quarters Plinth Area	sq. m	316	0	316	0
10	Number of Floors in Staff Quarters	Nos.	8	0	8	0
11	Principal and Vice Principal Quarters Plinth Area	sq. m	116	0	116	0
12	Number of Floors in Principal and Vice Principal Quarters	Nos.	2	0	2	0
13	Internal Road	sq. m	1442	1169	223	50
14	Footpath	sq. m	541	541	0	0
15	Land scaping	sq. m	1070			1070
16	Mosque	sq. m	225		225	

Based on the facility requirement, a master plan for Phase I only is provided in Figure 9



Figure 9. DEPTC master plan for Phase I

- Water side development: pontoons and linkspan

The proposed berthing system for passenger terminals is designed as pontoons and linkspan. Number of pontoons and linkspan depends on system berthing options, parallel, finger pier or bow berthing. Figure below shows a schematic figure of berthing system selected.

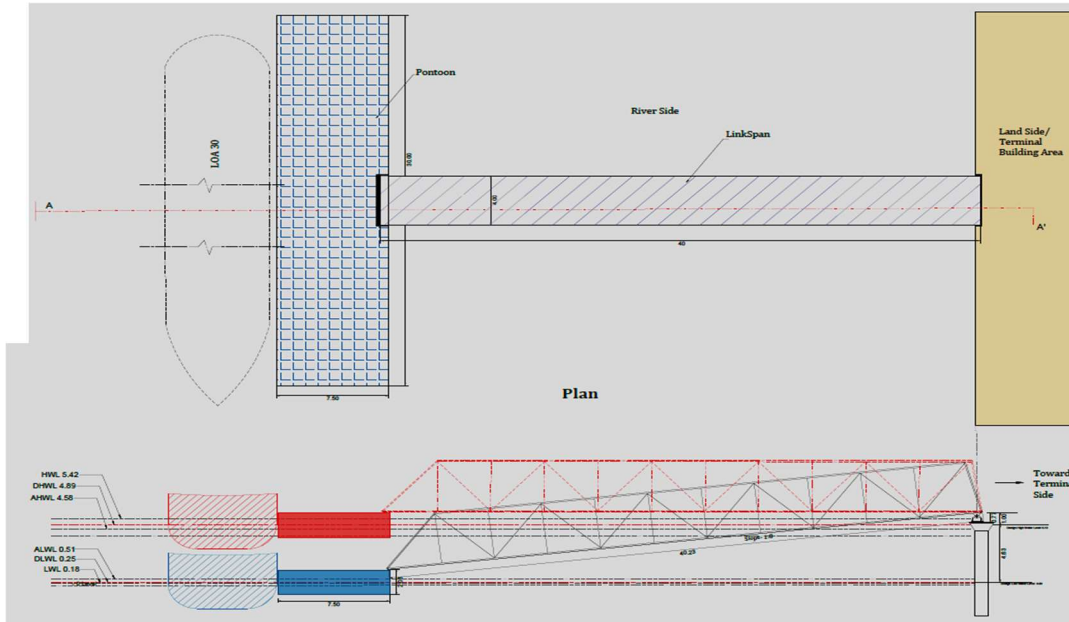


Figure 10. Pontoon and linkspan berthing system

Bank protection along berthing system shall be provided. Armor stone or concrete blocks can be used for bank protection. Geo-textiles may be used as a part of the filtering system, either with or instead of the granular filter. The detailed design of bank protection shall be provided in the Design Report.

A typical image of bank protection is shown in figure 11:

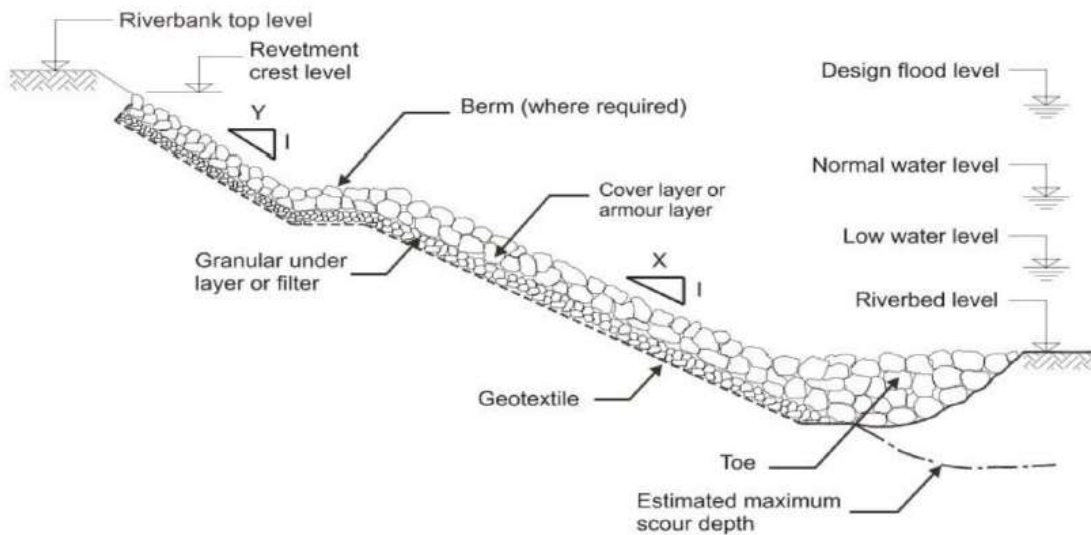


Figure 11. Image Showing Cross Section of Bank Protection

3.1.5. Barishal Passenger Terminal

The Barishal River port is located in the south western region of lower Meghna River. Barishal River Port is on the right bank of Kirtonkhola River (which branches from lower Meghna River). The waterway distance from Sadarghat to Barishal is about 150 Km towards the south.

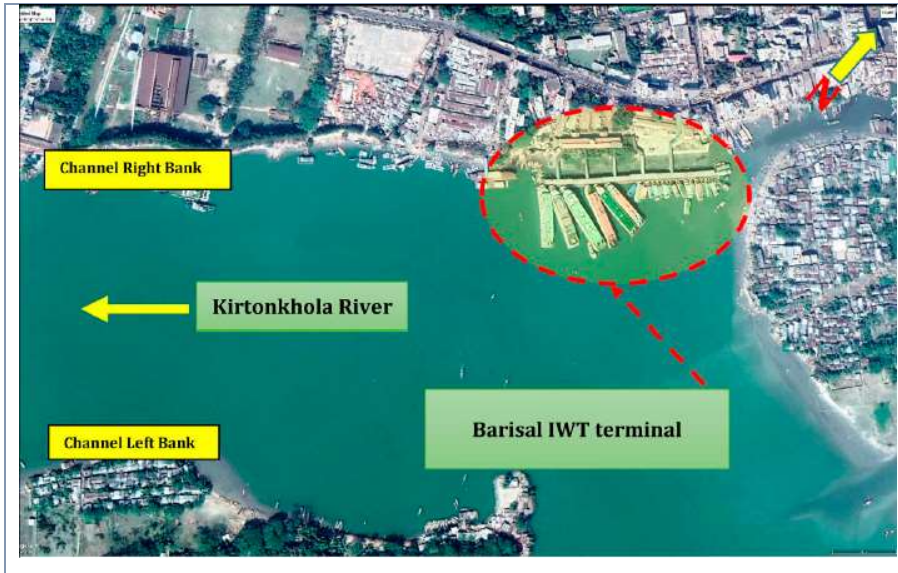


Figure 12. Satellite Imagery showing Barishal Site

Source: FFR Sashanghat IWT terminal, December 2019. Package Passenger S3 Consultant

Barishal port was established way back during the British period, the port was used by Steamer Company, for their steamer route from Calcutta (Kolkata) to Chandpur and Narayanganj. The company had their own buildings and landing station. The present port buildings were constructed in 1964. Existing facilities include two-storied terminal building, passenger waiting space, 6 pontoons, 4 gangways, cargo shed, transit shed, parking yard and access road.

After Sadarghat, Barishal is the second largest IWT Passenger terminal in terms of traffic Origin/Destination.

Terminal building requirements

The following table provides the summary of facilities and area requirement for Barishal terminal

Table 6. Barishal Terminal Building Area Requirements

Sl. No.	Description	Area Requirement for Phase I (sq.mt.)	Area Requirement for Phase II (sq.mt.)	Area Requirement for Master Plan
1	Terminal Facilities	4,017	For Phase II, additional development of 3,962 Sq. m. is envisaged	For Master plan requirement additional development of 850 Sq m. is envisaged
2	Services	708		
3	Amenities	4,349		
4	Management Offices	2,560		
5	Rentable Area	539		
6	Accommodations	94		
7	Miscellaneous	386		

Integrated Master Plans Option 1 is presented below



Option-1 Integrated Master Plan For Parallel Berthing With Idle Berthing Scenario



Figure 13. Integrated Master Plans Option 1 for Barishal Terminal

3.2. CARGO TERMINALS

3.2.1. Pangaon Cargo Terminal

The proposed terminal is located adjacent to the Pangaon inland container port (ICT) at Keraniganj, on the bank of river Buriganga, located at Keraniganj Upazila of Dhaka district. The area is surrounded by industrial establishments, banks, shops, markets and educational institutions.

The Inland Container Terminal (ICT) has been in existence since 2013 on the western bank of Buriganga River, about 20 km from the Dhaka Metropolitan Area, in an industrial suburb of Keraniganj Upazila. This Terminal was developed by BIWTA and is now operated by CPA. It has been planned for the Proposed Terminal site to be located upstream of the existing ICT.

Area identified for the proposed Terminal facility is vacant land presently. Within this area one landing station with pontoon facilities for river crossing of passengers exists.



Figure 14. Index Plan of the Proposed New Cargo Terminal at Pangaon

Source: FFR Pangaon IWT terminal, June 2019. Package S4 Consultant



Figure 15. Pangaon cargo terminal proposed area and access road

Source: TYPSA

- Terminal capacity and main features

Berth capacity causes the main bottleneck of the terminal. The length of the quay and available storage area however are very compatible, while the area shape is good for port operations. The proposed terminal layout is estimated to have a capacity of approx. 2.4 million tons/year

A pile-supported concrete platform (suspended deck) is the most feasible alternative for a fixed quay structure and at the same time the only practical solution for the location. Being founded on piles, such structure overcomes poor soil conditions directly, by carrying the loads down to the firm strata. Pile deck is 362m long and divided in 8 equal segments, separated by dilatation joints.

The deck is supported by concrete beams running along the length of the quay. Beams are in turn supported by bored piles, D=1000mm, placed in a 5.5 X 6.8 m matrix. The suspended deck is designed to withstand a range of quay specific loads, such as mobile crane, trucks with trailers and distributed live load of 30 kN/m². Two pneumatic unloaders will be used for unloading food grains from ships. There will be two pieces of bagging equipment on the quay, each with a productivity of approx. 100 tonnes/hr and containing two bagging lines. Fertilizer will be unloaded by a material handler supplying two hoppers



and bagging units on the quay. Cement will be unloaded by a crane or bag conveyors. Cargo will be loaded directly on trucks or stored in warehouses in bags.

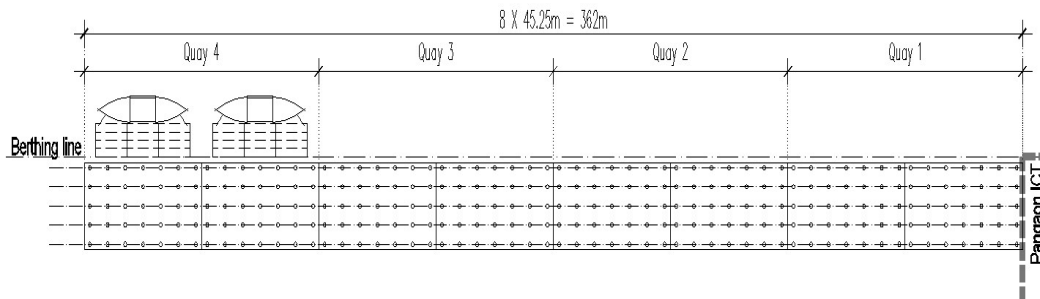


Figure 16. General Arrangement of Pangaon Terminal Jetty

Source: FFR Ashunganj IWT terminal, June 2019. Package S4 Consultant

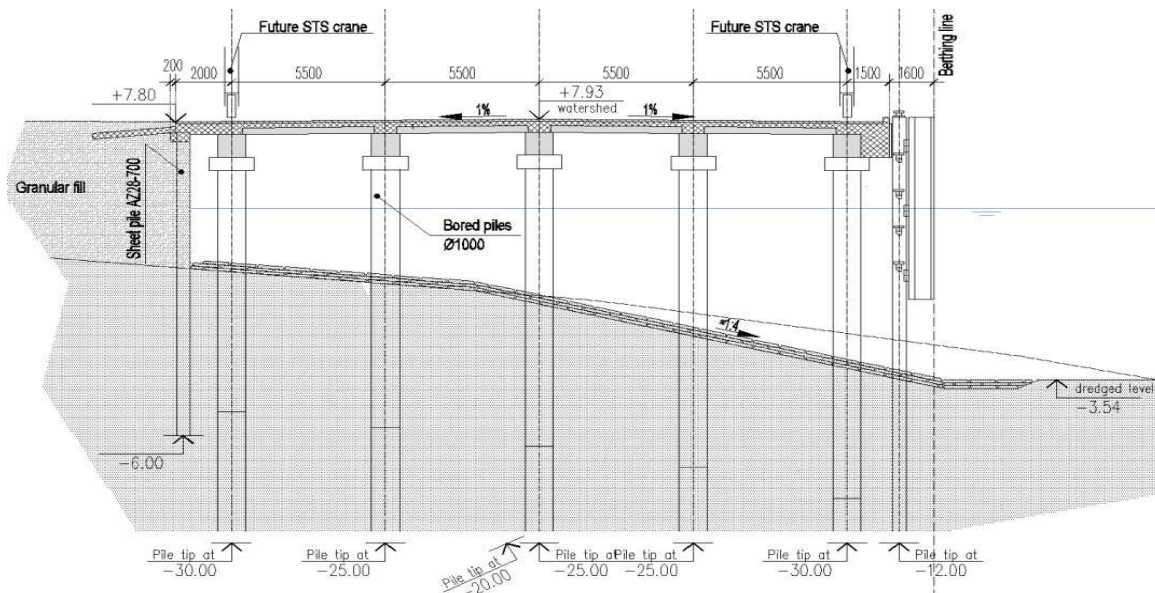


Figure 17. Typical Cross Section of Pangaon Suspended Deck Structure

Source: FFR Ashunganj IWT terminal, June 2019. Package S4 Consultant

The terminal will contain 7 warehouses of 1,800 m² (total 12,600 m²) of which 2 are dedicated to cement, 1 is dedicated to fertilizer and 4 to food grains. An area of approx. 485 m² is left undeveloped in front of each warehouse (total 3,395 m²) and can potentially serve as open storage yards for dry and break bulk in the future. Required cargo storage capacity depends on the dwell time estimated from the traffic study and should be adapted when in operation. Warehouses are planned now for bags, but can be used for other cargoes as well as for bulk.

Using Land Utilization				
SI	Item	Area (sqm)		
		Phase-1	Phase-2	
1	Jetty	5,347.00	3,703.00	
2	Covered storage	3,958.00	9,895.00	
3	Open stake yard	3,813.00	1,099.00	
4	Parking+ circulation	5,567.00	3,213.51	
5	Terminal road	10,321.00	3,118.00	
6	Local road	1,105.00	NA	
7	Walkway, median verge, etc.	2,219.00	373	
8	Land side boundary slope portion	706	NA	
9	Utility (septic tank, soak well)	40	NA	
10	Terminal Building	A. Service building	352.54	NA
		B. Welfare office & canteen	280.39	NA
		C. Gate & employment office	142.18	NA
		D. Substation	314.05	NA
		E. Pump house	168	NA
		F. Toilet block	77.46	193.65
		G. Watch tower	12.00	NA
		H. Toll box	12.00	NA
		I. Approach gate	15.30	NA
11	Existing house	89	NA	
12	Green	6949.47	947	
Subtotal area (sqm)		41,488.84	22,542.51	

Source: FFR Ashunganj IWT terminal, June 2019. Package S4 Consultant

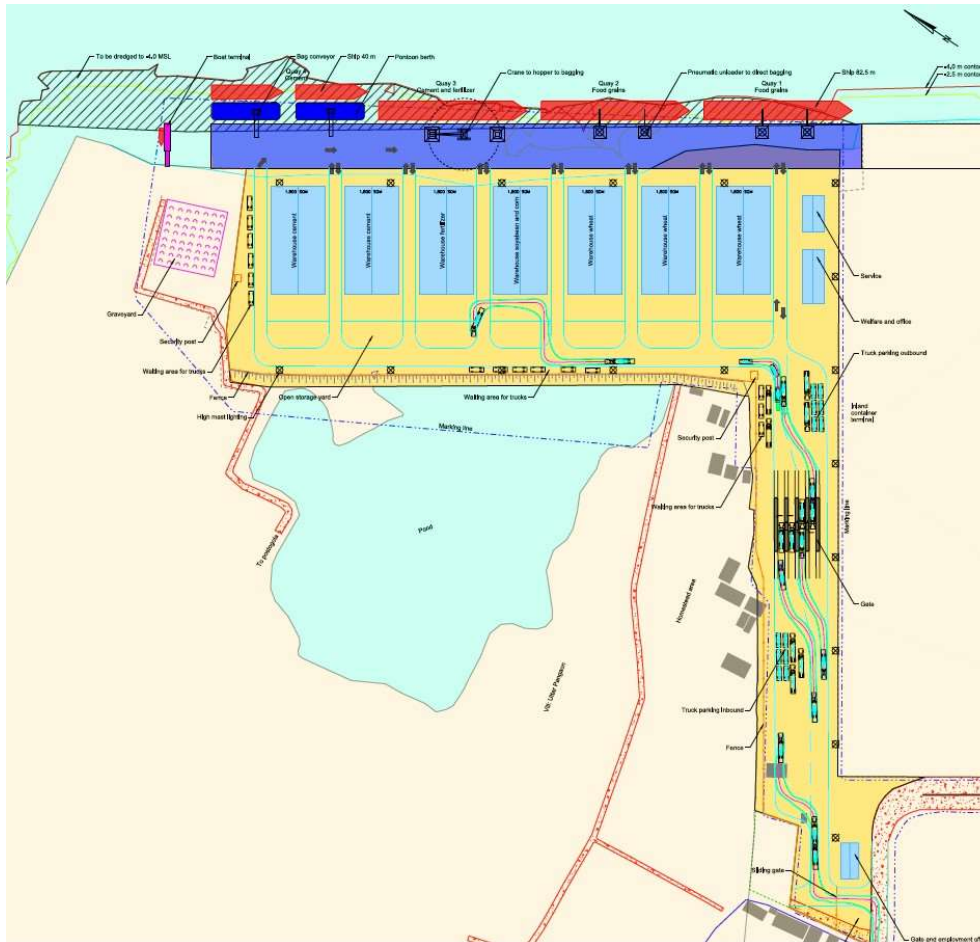


Figure 18. Proposed Master Plan Layout of Pangaon Cargo Terminal.

Source: Feasibility Report. June 2019. Package S4 Consultant



3.2.2. Ashuganj Cargo Terminal

This is an existing port under operation, considered to be one of the most important among other Cargo Terminals in Bangladesh. Ashuganj is a BIWTA owned river port established in 2004, located on the east bank of Meghna River. The river port of Ashuganj is located about 60 km from Dhaka city and 28 km and 43 km respectively from Brahmanbaria town and the Akhaura land border between Bangladesh and India. The port is located in an industrial area in the vicinity of the Ashuganj fertilizer factory, silo and power station, a 1,777-megawatt thermal power plant which is one of the largest in Bangladesh.

Temporary facilities have been made to attend the ships due to a limited number of jetty facilities and manual handling of commodities, this situation occupied the entire bank. Proposed development must consider this condition and either propose site development at the present location or to a new location in a green field situation as shown in following figure, or a combination of the two considering the demand. The proposed terminal layout is estimated to have a capacity of approx. 2.1 million tonnes/year.

The layout is based on 2 berths for 82.5-metre-long vessels and three berths for 40-metre long vessels. Cement bags are mainly unloaded from pontoon berths and it is expected that the selected operator will choose an appropriate mechanized method to transport bags from the vessel hold to the fixed quay platform. Cement bags are either loaded directly on trucks or stored in the warehouse.



Figure 19. Index Plan of the Existing Terminal at Ashuganj

Source: FFR Ashuganj IWT terminal, June 2019. Package S4 Consultant

The terminal will contain 7 warehouses (total 8,100 m²) of which 3 are dedicated to cement, 1 is dedicated to fertilizer and 3 to food grains. An area of approx. 6,000 m² is left undeveloped in the south-eastern part of the terminal to potentially serve as open storage yards for dry and break bulk in the future. Two warehouses of 900 m² each are indicated in this area to show that this can also be accommodated in the future if desired. The storage capacity is not adequate for volumes created by the berth capacity, such that Terminal ground soils will need improvement. The soil needs to be improved to avoid excessive settlement and prevent stability failure that affects the safety of the infrastructure.

In order to accelerate the process of consolidation settlement for the construction of any structure, the useful technique of Vertical Sand Drains (VSD)/sand compaction pile can be used.

Dredged sand from the riverbed with FM > 0.80 has been considered for filling. Clayey soil from borrow area or outside may be used for a cover layer of slopes. The embankment shall be prepared in layers not exceeding 300 mm.



Figure 20. Ashunganj Cargo Terminal location. A: phase 1 location, B: Phase 2 location

Some or even most of the cargo could be transported directly by trucks to limit the need for storage. Following figure shows Ashunganj Final layout.



Figure 21. Proposed Master Plan Layout of Ashunganj Cargo Terminal.

Source: FFR Ashunganj IWT terminal, June 2019. Package S4 Consultant



Table 7. Land use areas for Ashunganj cargo terminal

Using Land Utilization				
SI	Item	Area (sqm)		
		Phase-1/1	Phase-1/2	
1	Jetty	8.051,00	NA	
2	Covered storage	4.716,00	3.294,00	
3	Open stake yard	3.642,00	1.081,00	
4	Parking+ circulation	4.979,00	NA	
5	Terminal road	8.277,00	NA	
6	Local road	NA	NA	
7	Walkway, median verge, etc.	2.502,00	NA	
8	Land side boundary slope portien	NA	NA	
9	Utility (septic tank, soak well)	NA	NA	
10	Terminal Building	A. Service building	343,00	NA
		B. Welfare office & canteen	237,00	NA
		C. Gate & employment office	126,00	NA
		D. Substation	239,00	NA
		E. Pump house	119,00	NA
		F. Toilet block	152,00	114,00
		G. Watch tower	12,00	NA
		H. Toll box	12,00	NA
		I. Approach gate	54,00	NA
11	Existing house	NA	NA	
12	Green	2.582,00	NA	
Subtotal area (sqm)		36.043,00	4.489,00	

Source: FFR Ashunganj IWT terminal, June 2019. Package S4 Consultant

3.3. PROJECT ALTERNATIVES

3.3.1. Alternative Analysis

- No-action alternative

The definition of the no action alternative for newly proposed development considers what would happen if the new development is not implemented. A no action alternative for an ongoing infrastructure considers what would happen if the infrastructure continued to operate without modifications.

No-action option is a case that BRWTP S3 package and BRWTP S4 package Projects will not be implemented. Therefore, objectives of component 2 of BRWTP program will never be achieved, at least by the implementation of upgrade and new proposal of these identified terminals, owned by BIWTA.

Currently in most existing terminals, Narayanganj, Barishal, Chandpur and Ashunganj, there is a lack of proper waste management. Presently there are no facilities at the terminals for collection of liquid waste from the ships. Drainage for rainwater/liquid waste or wastewater are under minimum requirements. Some current impacts related to water and soil contamination in the port environment are: leakage and spillage of cargo storages including fuels, waste disposal sites and accidents. The waste generated from ships mainly includes inert materials such as food packaging, and food waste. Solid waste is being collected from the ships and is being dumped in to the municipal dust bins located near the terminals. During operations of terminals, the sources of air pollution are the combustion emissions from the vessels. Land-based operations of the cargo terminals generate emissions from vehicles and equipment. Noise sources in port operations include cargo handling, vehicular traffic, and loading / unloading containers and ships.

Thus, implementation of the Project as upgrade and improvement of existing does not imply significant negative environmental impact since current poor environmental conditions could be improved through the implementation of waste, liquid and solid, management infrastructure as well as improvement of water supply and the implementation of more rational planning for the terminal area. Such an upgrade can improve current environmental conditions.

Regarding new terminals, at the proposed Shasanghat passenger site, environmental conditions are at present very bad. Air, noise, soils, water are under minimum quality levels due to negative effects derived from human activities. It is, therefore, expected that the construction of a new terminal can improve environmental conditions at the site just by removing and relocating the current high pollutant activity and introducing to the new terminal, water drainage management, wastewater management, spills, dumps and debris control, among others.

Regarding the Pangaon site, although some vegetation can be found and the terminal area will be developed partially on water where expected impacts could be characterized as low. Vegetation and fauna habitat do not have ecological significance, species of flora and fauna are common and largely distributed around the region. The Project implementation scenario, even if it will not preserve current conditions, does not imply high levels of environmental impact, while there are some significant, positive socio-economic effects are anticipated.

Regarding social impacts, the most likely negative impacts related to S3 and S4 packages are the loss of a certain amount of privately owned land, but mostly Government owned lands. Some business enterprises, small- and medium- sized will be affected. There will be significant impacts on living and livelihood of the people under the project due to displacement of houses and shops in terminals under S3 & S4. Laborers working in different business enterprises, particularly employed in the Chatal business, may be



temporarily impacted. The other occupational groups such as boat and other land transport owners/operators are expected to continue their activities, including during construction.

It is expected that the establishment of the Safety Management System will regulate the safe movement of vessels within the harbor, protect the general public from dangers arising from marine activities at the harbor and prevent events that may result in injury to workers, the public, or the environment. Gender issues could also be integrated within new terminals.

No-action alternative does not imply the preservation of natural values, positive environmental quality or social and economic high, even medium, standards. Project implementation is, therefore, an acceptable alternative in terms of environment and social issue.

3.3.2. Assessment of proposed alternatives

Alternatives considered are those proposed in the feasibility studies for Passenger and Cargo terminals.

- Passenger terminals

Two options were proposed for landside development for every terminal: option 1 and option 2. Footprint of both options, option 1 and 2, are developed in the same area proposed and at the same available land, therefore, no distinction in regards of surface affected. Additionally, both options meet the fixed requirements in terms of some breakdown of areas and facilities.

As a result, for every site the two options will have similar effects on environmental and social factors: same place and same requirements imply very similar or even equal likely impacts. Thus, other than environmental and social factors, the alternative selection for landside development must be determined.

Option 1 was the preferred option from all terminal proposals.

The alternative proposal for water side development is based on IWT facility requirements, planning considerations, site-specific conditions and challenges. Feasibility study for passenger terminals (s3 package) developed 6 alternative concepts, a multi-criteria-matrix (MCM) analysis was carried out for the selection of best layouts.

Main differences between the said 6 alternatives related to environmental issues and with significant impact are based on the berthing system developed. These 6 alternatives for water side were developed for every four passenger terminals under study: Sashanghat, Narayanganj, Barishal and Chandpur, all with the same concept design.

The 6 layout alternatives are:

- 1: Finger Pier Berthing Arrangement (with pontoons acting as Berths)
- 2: RCC Pile Deck Finger Pier Berthing
- 3: Bow Berthing Arrangement
- 4: Guided Berthing Arrangement with Donut Fenders
- 5: Parallel Berthing
- 6: Staggered Berthing Arrangement

Finger Pier berthing arrangement (alternative 1), bow berthing arrangement (alternative 3) and parallel berthing (alternative 5), consists of pontoons and Linkspan systems, steel pontoon is envisaged as the

berthing structure. The water side and land side integration shall be made through the installation of a steel Linkspan (gangway) arrangement.

Regarding alternative 2, the notable element in this alternative is the pontoon acting as a berth. The berth will be constructed with a superstructure (Beam / Slab) and sub-Structure (pile foundation) made of Reinforced Cement Concrete (RCC).

The staggered berthing facility, alternative 6, is provided using RCC pile deck oriented parallel to the shoreline in a staggered form, vessels are oriented parallel to the shoreline in a staggered formation.

For optimization of length required for berthing facility or to reduce the size of piers and for ideal berthing of vessels Alternative 4 is designed on doughnut fenders with guide piles acting as breasting dolphins providing 5m spacing between vessels.

Environmental and social impact assessment for the 6 alternatives considers the most likely impact for each one expressed on air, water, soils and aquatic ecology. Regarding social aspects, all alternatives show similar characteristics, therefore any of them will have the same level of impact on socio-economic environment.

The discussion of environmental best alternative takes into account the berthing system proposed and its capacity to impact the aquatic ecosystem during construction and the disruption of the river bank by permanent construction: piling, RCC deck or mooring dolphins.

From an environmental point of view, the berthing system of pontoons and linkspan are improved, have less impact on river sediment, water quality and riverbank, than RCC deck or staggered berthing (alternative 2 and 6), while alternative 4 scores worse due to the construction of breasting dolphins.

Based on the MCM analysis carried out in the feasibility study the following alternative layout were kept for further evaluation and for environmental assessment, the same and following alternative layout shows lesser environmental impact and should be kept for further evaluation:

- 1: Finger Pier Berthing Arrangement (with Pontoons acting as Berths)
- 3: Bow Berthing Arrangement
- 5: Parallel Berthing

- Ashunganj cargo terminal

A total of six preliminary layout proposals are presented in the feasibility study for the future cargo terminal in Ashunganj.

Alternative A –This Alternative includes construction of a new fixed concrete berth and a new floating pontoon pier. The areas have been changed in order to have more efficient port operations such that the concrete platform has an area of 1250 m², and the pontoon has an area of 750 m². A gangway with a conveyor system will connect the pontoon berth to the terminal area whereas a jetty bridge will connect the concrete platform to the terminal area.

Alternative B – Existing RCC Jetty and 4 Fixed Berths and 2 Double Berths. It is proposed to construct 4 fixed berths in Layout Alternative B. This solution requires that the existing pontoon quay and gangway is removed such that two identical concrete double quay structures will be placed downstream and upstream of the existing concrete berth. The platforms are connected to each other and to the terminal area by jetty bridges as this configuration will reduce the amount of construction materials and still provide good operational conditions.



Alternative D1 – Existing Berths and 3 Additional Pontoon Berths. Configuration of berths involves keeping the two existing berths and establishing 3 new pontoon piers connected by gangways to the terminal. Similar to Alternative B and C, the proposed layout includes land reclamation and new revetments.

Alternative D2 – Expansion of Existing Berths and 3 Additional Pontoon Berths. Alternative D2 is identical to Alternative D1 except for configuration of the existing concrete berth. In this layout, the existing concrete quay is expanded offshore to investigate if larger vessels will be able to berth at this quay since this could lead to increased throughputs.

Alternative E - 4 Continuous Fixed Berths, Nearshore. In Layout Alternative E, a continuous quay structure of 363 m is constructed as a pile supported concrete deck located at the -3.5 m MSL contour. The area between the concrete deck and the existing terminal area will be reclaimed, and new revetments for the land reclamation will be constructed below the concrete deck.

The analysis carried out by the S4 package Consultant indicates that alternatives B, C or E are most favorable. Future cargo terminal in Ashuganj will be developed based on the conceptual layout of Alternative E.

Environmental and social impact assessment for the 6 alternatives considers the main likely impact for each one expressed on air, water, soils and aquatic ecology. Regarding social aspects all alternatives shown similar characteristics, therefore any of them will reach the same level of impact on socio-economic environment.

For Alternatives A, B and C; the presence of the piles could disturb the free flow and could cause some sedimentation, for alternatives D1 and D2 little impact on flow patterns and possible dredging costs are expected to be low. The presence of the piles for alternative E could disturb the free flow and could cause some sedimentation, although not expected to be excessive. There could be a more significant impact on coastal stability.

For all alternatives project boundary is slightly exceeded to allow for vessel under-keel clearance

Alternatives A to D show similar environmental impact and social factors; as such none of them show less environmental impact. Alternative E: 4 Fixed berths Attached to land can be further discussed, and mitigation measures should be designed and applied the reduction of expected impacts.

- Pangaon Cargo terminal

A total of five preliminary layout proposals are presented in the feasibility study for the future cargo terminal in Pangaon.

Alternative A - 2 berths, and 190 m: supported concrete deck with two berths. The platform, width of 25 m, is connected to the terminal area by 2 two-lane jetty bridges. Three warehouses are proposed to be located in the terminal as incoming cargo is limited by only two berths. The quayside is located to respect the -4.0 m MSL contour line in the river such that the largest vessels are able to call at the port during the dry season. As berths must be parallel to the river flow, the entire quay structure will have to be moved away from the river bank in order to respect the shallow waters to the north. The consequence of placing berths closer to the river bank will be significant initial and maintenance dredging to ensure a sufficient under-keel clearance for the large vessels.

Alternative B1 - 4 Fixed berths Aligned with ICT 364 m: The quay structure is constructed as a 364 m long pile supported concrete deck. Following the construction principle from Alternative A, the width of the concrete platform is 25 m. The terminal will contain 4 warehouses. An area of approx. 5400 m² is allocated to silos with the purpose of storing and bagging food grains. Alignment of the future quay

will lead to shallow waters when approaching the port as well as shallow waters by the berths. Since the port is to also be operated during the dry season, significant initial and maintenance dredging will be required.

Alternative B2 - 4 Fixed berths Optimum depth 364 m: similar to layout Alternative B1. For this layout alternative, the concrete platform is located further from the riverbank such that the quay front respects the -4.0 m MSL contour and provides sufficient under-keel clearance for the largest vessels all year around. Extent of initial and maintenance dredging is thereby expected to be minimized.

Alternative C. 4 Pontoons Optimum Depth; Layout Alternative C consists of 4 separate floating pontoon berths connected to land by gangways. Due to the tremendous water level variations during the year in Pangaon, the level of the pontoons can potentially vary by up to 7 m in a year. The connecting gangways therefore need to be flexible structures capable of adapting to this and at the same time be robust enough to sustain loads from light service vehicles and cargo on conveyors. Configuration of warehouses and silos are similar to Alternative B1 and B2.

Alternative D - Lagoon solution: The main purpose of preparing Alternative D is to investigate the possibility of constructing a lagoon behind the terminal area. Considering the close vicinity of the existing ICT, the most rational configuration of a lagoon will include an entrance in the upstream part of the project site. The lagoon entrance limits the quay length to 267 m on the river side and yields 3 berths. A slightly smaller berth of approx. 65 m could be located in the entrance of the lagoon. The quay structure on the river side is proposed to be a pile supported concrete platform with a design similar to Alternative A, B1 and B2. The proposed dimensions of the lagoon will require significant dredging and excavation of the project area.

In order to obtain sufficient storing facilities for imported cargo, land acquisition and subsequent land reclamation of the adjacent homestead area is necessary. Besides the land acquisition, construction of the lagoon will necessitate demolition of the existing embankment/dyke currently protecting the areas around the pond against flooding. Tearing down the existing embankment would therefore require construction of a new embankment to provide flood protection for residential areas in the village.

3.3.3. Evaluation and Recommendation of Layout Alternative

All Layout Alternatives for Pangaon are compared and evaluated based on operational conditions, navigational conditions, expenditure and structural considerations. This is carried out by in the feasibility study arranging all alternatives in two matrices. One matrix provides an illustrative and simple weighted comparison of the layout alternative while the other matrix contains a Multi Criteria Analysis (MCA). The MCA is provided with scores on various weighted parameters for all alternatives.

From the two comparisons the following is noted and recommended: Fixed berths are preferable, as they have the best operational functionality, have more flexible use (and thus highest capacity), are proven solutions and are the most robust.

The Multi Criteria Analysis indicates that alternatives B1 or B2 are most favorable. Alternative A has less capacity and should be considered as a short-term alternative only. Alternative D (lagoon solution) is less favorable, due to important issues such as significant exceedance of project boundaries into residential areas, lack of respect for dyke protective structure – and less favorable conditions.

From an environmental and social point of view, the presence of the piles for alternatives A, B1, B2 and D could disturb the free flow and could lead to some sedimentation. Alternative B1 will have significant initial and maintenance dredging in approach and berth areas.



For alternative D, lagoon its entrance channel and harbor basin will need to be dredged and maintained; therefore, significant dredging is needed, which will enhance ecological system when connecting the lagoon to the rivers system. Berthing systems of pontoons have fewer negative effects, that is why alternative 4 scores higher.

- Conclusions

Thus, the following alternative layout shows lower environmental impact and should be maintained for further evaluation: Alternative A., 2 berths, 190 m and Alternative C. 4 Pontoons Optimum depth.

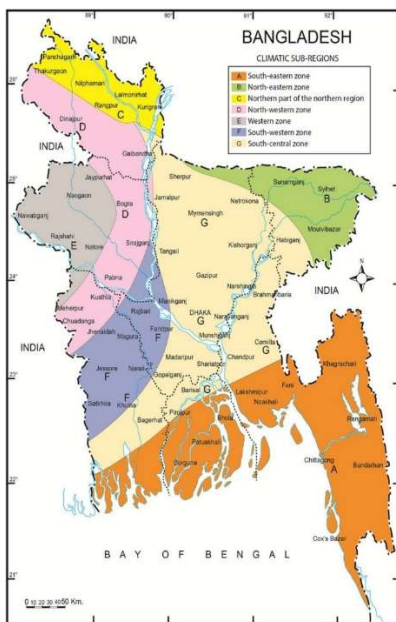
Secondly the following alternative can be further discussed, and mitigation measures should widely propose to mitigation of expected impacts, Alternative B14 Fixed berths Aligned with ICT 364 and Alternative B2. 4 Fixed berths Optimum depth 364 m.

4. DESCRIPTION OF THE ENVIRONMENT

This section provides information on the physical and biological characteristics of the environment as it relates to the proposed works of the BIWTA Project. All baseline data were obtained through a combination of desktop studies, consultations (stakeholders and communities) and field surveys.

The area of influence of the overall Project is defined as areas that are likely to be directly or indirectly affected by the proposed construction activities. This includes, but is not limited to, the extent to which the project would impact floodplain areas, hydrology, morphology, and the project footprints.

4.1. PHYSICAL ENVIRONMENT



- Climate: The climate of Bangladesh is divided in 7 sub-regions shown in following figure whereby temperature, wind, cloud cover, rainfall and humidity are specifics of each sub-region, according to Bangladesh Meteorological Department. According to the climatic sub-regions all the subproject locations fall in the **South-Central Zone (Zone G)**. See next figure for details.

South-central zone (zone G). In this zone rainfall is abundant, being above 1,900 mm. The range of temperature is, as can be expected, much less than to the west, but somewhat more than in South-eastern zone. This is a transitory zone between the South-eastern, North-western and South-western zones and most of the severe hailstorms, or ‘westers’, and tornadoes are recorded in this area.

Figure 22. Climatic sub-regions of Bangladesh. All the sub-projects fall in sub-region G (source: BMD)

- Physiography: Dhaka is situated at the southern tip of a Pleistocene terrace, the Madhapur tract. Two characteristic geological units cover the city and surroundings, viz Madhapur Clay of the Pleistocene age and alluvial Barishal-Chandpur High interpreted as a gravity and magnetic anomaly caused by a magmatic body at a great depth. This zone is located between Faridpur trough and Hatiya trough of the Bengal Foredeep.
- Hydrology: The Buriganga River rises in Dhaka city, borders the city and ends in the junction with the Dhaleshwari River. Sashanghat and Pangaon are in the section of this river (North Central Region). Narayanganj is located on last course of the Shitalakshya River (North Central Region). Ashunganj belongs to Meghna (Upper) River and Chandpur is in the junction between Padma River and upper part of Meghna River (South East Region). Barishal belongs to Kirtankhola River, but it is considered inside of Meghna (Lower) River estuary area to understand its hydrology (South West Region).
- Tide: In the Lower-Meghna and Meghna Estuary the amplitudes of the two cycles differ slightly. Over a longer term, a fortnightly variation in amplitude between spring and neap tides is also evident, with spring tide amplitudes approximately 2.5 to 3 times higher than the neap tide. The duration of one tidal cycle is 12 hours 25 minutes. A new cargo terminal and a new passenger



terminal proposed into Bangladesh Regional Waterway Transport Project - 1 are located along the course of Buriganga River. The maximum flow occurs during monsoons, which is 2630 m³/s. The minimum flow over the period of 1996 to 2012 is 110 m³/s. The river exhibits high seasonality of water flow triggering a critical condition for navigability during the dry season.

- Cyclones: Cyclones pose a threat to IWT, lives and property in low-lying coastal regions in Bangladesh. Cyclonic storms, occasionally of severe intensity, can occur in the months of March-May and October-November, accompanied by storm surges, high winds, and intense rainfall.

4.2. CHEMICAL ENVIRONMENT

- Air quality

The air quality monitoring was carried out at 6 locations for the project sites to verify the current quality of air. The air quality monitoring was performed from 22 October 2019 to 29 October 2019. Air quality sampling results are given below:

1. **PM10:** Particle pollution, also called particulate matter or PM, is a mixture of solids and liquid droplets floating in the air. From the test results, it is seen that, for all the locations, the values were within the national standard.
2. **PM2.5:** PM2.5 are 2.5 micrometers in diameter or smaller and can only be seen with an electron microscope. Fine particles are produced from all types of combustion, including motor vehicles, power plants, residential wood burning, forest fires, agricultural burning, and some industrial processes. The test results show that for the locations the values of PM2.5 was within the national standards.
3. **SOx:** Sulphur oxides (Sox). From the test results it can be said that, for all the locations, the value was within the national standard.
4. **NOx:** In atmospheric chemistry, NOx is a generic term for the nitrogen oxides that are most relevant for air pollution, namely nitric oxide (NO) and nitrogen dioxide (NO₂). These gases contribute to the formation of smog and acid rain, as well as tropospheric ozone. The test results show that, for all the locations the values of NOx are within the national standard.
5. **CO:** Carbon monoxide. The test result shows that, for all the sampling locations, CO was within the national standard.
6. **O3:** Ozone (O₃) There is no air quality standard for ozone in Bangladesh. However, according to the Environmental Protection Agency (EPA), in USA air quality standard for ozone is set as 240 µ/m³ which has not been exceeded in the sites.

- Noise

Level Measurement were analyzed at 6 locations, the same as for air quality monitoring locations. The monitoring was performed from 22 October 2019 to 29 October 2019 for both day and night-time see. Noise measurement at each location was carried out continuously for 1hour both at day and night-time. Result of the noise level monitored along with details of the sampling locations have been shown in next table. Noise level exceeding Bangladesh Standards are highlighted.

Table 8. Test results of noise sampling at Terminal sites.

Sample ID	Sample Location	GPS Location	Land Use Category	Time		Noise Level (dBA) (LAeq)		Bangladesh Standard (dBA) **	
				Day	Night	Day	Night	Day	Night
BIWTA_NM_01	Shashanghat, Dhaka New Terminal near Postagola	23°41'24.55"N, 90°25'34.72"E	Commercial	10:27	20:09	61.13	52.21	65	55
BIWTA_NM_02	Narayanganj Passenger Terminal	23°36'58.86"N, 90°30'20.53"E	Commercial	11:27	20:50	71.25	67.56	65	55
BIWTA_NM_03	Ashuganj Cargo Terminal	24° 2'32.78"N, 91° 0'1.37"E	Commercial	11:52	20:05	72.35	66.87	65	55
BIWTA_NM_04	Pangaon Cargo Terminal	23°39'30.79"N, 90°27'14.68"E	Commercial	13:58	20:50	70.84	65.63	65	55
BIWTA_NM_05	Barishal Passenger Terminal	22°41'59.44"N, 90°22'31.39"E	Commercial	10:52	21:45	73.14	64.23	65	55
BIWTA_NM_06	Chandpur Passenger Terminal	23°13'59.61"N, 90°38'54.65"E	Commercial	11:58	22:00	76.06	62.47	65	55

▪ Surface water quality:

Surface Water samples were collected from 6 project locations from 22 October 2019 to 29 October 2019. EZDO 8200 Multimeter was used to conduct the on-site test of pH, TDS, EC, Salinity and Temperature. The samples were sent to the Departments of Public Health Engineering (DPHE) and of Soil, Water and Environment, at Dhaka University Laboratories for physicochemical parameters testing within 24 hours of being collected

- Temperature:** Differences in water temperature and density cause stratification. A property that is unique to water versus other substances is that it is most dense at 4 degrees Celsius, or 39 degrees Fahrenheit, and is less dense at either higher or lower temperatures. The standard for inland surface water is undefined. The test results show that the highest temperature was found to be 33.1°C in BIWTA_SW_01 (Shashanghat, Dhaka New Terminal near Postagola, Buriganga River) and lowest temperature was found to be 26.2°C in BIWTA_SW_04 (Pangaon Cargo Terminal, Buriganga River).
- pH:** The "desirable" range of pH prescribed by the DOE is between 6.5 and 8.5. This is the range, which provides adequate protection to the life of freshwater fish and bottom dwelling invertebrates. The test results revealed that the amounts of pH for all the sampling location are



exceed within the national limit because the water is polluted and people through their waste in the water body. The test result also shows that the highest pH was found to be 9.12 in BIWTA_SW_01 (Shashanghat, Dhaka New Terminal near Postagola, Buriganga River) and lowest pH was found to be 8.29 in BIWTA_SW_04 (Ashuganj Cargo terminal, Meghna River).

9. **Electrical Conductivity (EC):** EC stands for electrical conductivity, which measures the potential for a material to conduct electricity. The test results show that the highest temperature was found to be 535 $\mu\text{s}/\text{cm}$ in BIWTA_SW_04 (Pangaon Cargo Terminal, Buriganga River) and lowest temperature was found to be 205 $\mu\text{s}/\text{cm}$ in BIWTA_SW_03 (Ashuganj Cargo Terminal, Meghna River).
10. **Dissolved Oxygen (DO):** Dissolved oxygen is necessary for many forms of life including fish, invertebrates, bacteria and plants. Decrease in DO values below the critical level of 3 mg/L causes death of most fishes and other aerobic aquatic organisms. The test result shows that the highest DO was found to be 5.2 mg/L in BIWTA_SW_06 (Chandpur Passenger Terminal, Meghna River) and lowest DO was found to be 3.1 mg/L in BIWTA_SW_01 (Shashanghat, Dhaka New Terminal near Postagola, Buriganga River).
11. **Total Dissolve Solids (TDS):** Dissolved solids refer to any minerals, salts, metals, cations or anions dissolved in water. Total dissolved solids (TDS) comprise inorganic salts (principally calcium, magnesium, potassium, sodium, bicarbonates, chlorides, and sulphates) and some small amounts of organic matter that are dissolved in water. The standard of TDS for inland surface water is undefined. The test results show that, TDS value was highest in BIWTA_SW_02 (Narayanganj Passenger Terminal, Shitalakshya River) where it was 2666 mg/L and lowest in BIWTA_SW_03 (Ashuganj Cargo Terminal, Meghna River) where it was 189 mg/L.
12. **Biochemical Oxygen Demand (BOD₅):** Biochemical Oxygen Demand is supposed to measure the amount of food (or organic carbons) that bacteria can oxidize. The standard for inland surface water for BOD₅ is 6 or less mg/L. BOD concentration was below the national standard limit for all the sampling locations.
13. **Total Suspended Solids (TSS):** Total suspended solids (TSS) are the dry weight of particles trapped by a filter. The test result shows that the highest TSS was found to be 17 mg/L in BIWTA_SW_03 (Ashuganj Cargo Terminal, Meghna River) and lowest TSS was found to be 8 mg/L in BIWTA_SW_06 (Chandpur Passenger Terminal, Meghna River).
14. **Sulphate:** Sulphate is second to bicarbonate as the major anion in hard water reservoirs. Sulphates (SO_4^{2-}) can be naturally occurring or the result of municipal or industrial discharges. When naturally occurring, they are often the result of the breakdown of leaves that fall into a stream, of water passing through rock or soil containing gypsum and other common minerals, or of atmospheric deposition. The test result shows that the highest Sulphate concentration was found to be 38 mg/L in BIWTA_SW_01 (Shashanghat, Dhaka New Terminal near Postagola, Buriganga River) and lowest Sulphate concentration was found to be 4 mg/L in BIWTA_SW_05 (Barishal Passenger Terminal, Kirtankhola River).
15. **Iron:** Natural waters contain variable amounts of iron depending on the geological area and other chemical components of the waterway. Iron in groundwater is normally present in the ferrous or bivalent form [Fe^{++}] which is soluble. It is easily oxidized to ferric iron [Fe^{+++}] or insoluble iron upon exposure to air. The concentration of iron was higher downstream than upstream. The test result shows that the highest Iron concentration was found to be 0.61 mg/L in BIWTA_SW_01

(Shashanghat, Dhaka New Terminal near Postagola, Buriganga River) and lowest Iron concentration was found to be 0.25mg/L in both BIWTA_SW_04 (Pangaon Cargo Terminal, Buriganga River) and BIWTA_SW_06 (Chandpur Passenger Terminal, Meghna River).

16. **Turbidity:** Turbidity is a measure of the degree to which the water loses its transparency due to the presence of suspended particulates. The more total suspended solids in the water, the murkier it seems and the higher the turbidity. Turbidity is considered as a good measure of the quality of water. The test result shows that the highest turbidity was found to be 85.5 NTU in BIWTA_SW_05 (Barishal Passenger Terminal, Kirtankhola River) and lowest turbidity was found to be 2.5 NTU in BIWTA_SW_01 (Shashanghat, Dhaka New Terminal near Postagola, Buriganga River).
17. **Total organic carbon (TOC):** Total organic carbon (TOC) is the amount of carbon found in an organic compound and is often used as a non-specific indicator of water quality or cleanliness of pharmaceutical manufacturing equipment. The test result shows that the highest TOC was found to be 2.258 mg/L in BIWTA_SW_01 (Shashanghat, Dhaka New Terminal near Postagola, Buriganga River) and lowest turbidity was found to be 1.314 mg/L in BIWTA_SW_05 (Barishal Passenger Terminal, Kirtankhola River).
18. **Oil and Grease:** Oil and grease has the natural tendency to float on the water surface under quiescent conditions, as the density of oil and grease is usually less than one. Not all the oil and grease are in liquid or solid form. Appreciable amounts remain in a finely divided emulsified form. From the test result it is found that, all the samples contain concentration of less than 5 mg/L.

- Riverbed sediment (soil) quality

The quality of the riverbed sediment was identified to characterize the baseline status. The Riverbed sediment samples were collected from around the 6 project locations from 22 October to 29 October 2019. Test results of sediment analysis are given

1. **Total Organic Carbon:** From the test results, the TOC concentration in the project influenced areas ranged from 0.11% to 0.52%. The minimum value was in BIWTA_RBM_03 (Ashuganj Cargo Terminal, Meghna River) and maximum value was in BIWTA_RBM_05 (Barishal Passenger Terminal, Kirtankhola River).
2. **Total Phosphate (PO43-):** From the test results, the total phosphate concentration in the project influenced areas ranged from 649.78 mg/kg to 1487.78 mg/kg. The minimum value was in BIWTA_RBM_03 (Ashuganj Cargo Terminal, Meghna River) and maximum value was in BIWTA_RBM_05 (Barishal Passenger Terminal, Kirtankhola River).
3. **Water Soluble Phosphate (PO43-):** From the test results, the soluble phosphate concentration in the project influenced areas ranged from 6.13 mg/kg to 26.14 mg/kg. The minimum value was in BIWTA_RBM_03 (Ashuganj Cargo Terminal, Meghna River) and maximum value was in BIWTA_RBM_06 (Chandpur Passenger Terminal, Meghna River).
4. **Total Arsenic (As):** From the test results, the As concentration in the project influenced areas ranged from 1.743 mg/kg to 3.158 mg/kg. The minimum value was in BIWTA_RBM_02 (Narayanganj Passenger Terminal, Shitalakshya River) and BIWTA_RBM_06 (Chandpur Passenger Terminal, Meghna River).
5. **Total Mercury (Hg):** From the test results, Lowest Hg concentration was found to be 0.19 µg/kg in BIWTA_RBM_05 (Chandpur Passenger Terminal, Meghna River) and highest Hg concentration



was found to be 0.35 µg/kg in BIWTA_SW_01 (Shashanghat, Dhaka New Terminal near Postagola, Buriganga River).

6. **Total Nickel (Ni):** From the test results, Lowest Ni concentration was found to be 8.22 mg/kg in BIWTA_RBM_03 (Ashuganj Cargo Terminal, Meghna River) and highest Ni concentration was 29.80 mg/kg in BIWTA_RBM_06 (Chandpur Passenger Terminal, Meghna River).
7. **Total Zinc (Zn):** From the test results, Lowest Zinc (Zn) concentration was found to be 35.73 mg/kg in BIWTA_RBM_02 (Narayanganj Passenger Terminal, Shitalakshya River) and highest Zinc (Zn) concentration was 57.50 mg/kg in BIWTA_RBM_03 (Ashuganj Cargo Terminal, Meghna River).
8. **Total Lead (Pb):** From the test results, Lead (Pb) concentration ranges from 5.88 mg/kg to 18.75 mg/kg. The minimum value was in BIWTA_RBM_03 (Ashuganj Cargo Terminal, Meghna River) and maximum value was in BIWTA_RBM_05 (Barishal Passenger Terminal, Kirtankhola River).
9. **Total Cadmium (Cd):** From the test results, all the samples have shown concentration below the detection level.
10. **Total Chromium (Cr):** From the test results, Chromium concentration ranges from 1.68 mg/kg to 21.30 mg/kg. The minimum value was in BIWTA_RBM_06 (Chandpur Passenger Terminal, Meghna River) and maximum value was in BIWTA_RBM_03 (Ashuganj Cargo Terminal, Meghna River).

4.3. BIOLOGICAL ENVIRONMENT

4.3.1. Main Ecosystems in Project sites

- Agriculture and homestead areas

Agriculture is the largest employment sector in Bangladesh. In Bangladesh, only nine crops: rice (73.94%), wheat (4.45%), jute (3.91%), rape and mustard (3.08%), lentil (1.54%), chickling vetch (1.25%), potato (1.13%), sugarcane (1.12%), and chilli (1.05%) are grown on 90 percent of the crop acreage (14.61 million ha) and may be considered as major crops.

- Aquatic & Riverbank (Terrestrial) flora

Aquatic plants are plants that have adapted to living in aquatic environments (saltwater or freshwater). They are also referred to as hydrophytes or macrophytes. Aquatic vegetation can be broken down into a few communities or types. In the Project Influence Area, eight communities of aquatic vegetation were identified:

- 1. Submerged plants
- 2. Free floating plants
- 3. Rooted floating plants
- 4. Sedges and meadows
- 5. Floodplain grassland (transitional; includes sedge/meadow and reed swamp species, and grass species)
- 6. Reed swamp
- 7. Crop field vegetation
- 8. Homestead vegetation

■ **Natural Vegetation-Endemic**

Basically, natural vegetation in Bangladesh has being substituted by agricultural uses and urban areas, with just a little remaining and residual natural vegetation. Out of 3,611 plant species of Bangladesh, 28 are endemic at or below species level which is about 0.78% of the total species. No endemics at generic or supra-generic level could be recognized from Bangladesh. Cover Vegetation on Project Sites

In general, all S3 and S4 project sites are poor in floral diversity and abundance. A total of 151 flora species, represented by 50 species of herbs, 47 species shrubs, 7 species climbers, 45 species tree and two species of Pteridophytes, were recorded from the project sites. Of these, 129 species are terrestrial, seven species aquatic and the rest 15 species are both aquatic and terrestrial. Except, Pangaon, ground vegetation cover is very scarce and limited to some localized spots within the project boundary. However, there are wide differences in the occurrence and abundance of recorded flora species among the study sites.

Table 9. Flora diversity in S3 and S4 Site Terminals

		Tree	Herb	Shrub	Climber	Pteridophyte	TOTAL
S3	Shashanghat	17	5	4	0	0	26
	Narayanganj	21	11	25	3	0	60
	Barishal	25	18	21	3	0	67
	Chandpur	19	2	6	1	0	28
S4	Pangaon	16	46	18	3	2	85
	Ashuganj	18	13	5	2	1	39

4.3.2. **Fauna: Terrestrial and Aquatic Habitats**

Because of poor vegetation at the sites and huge anthropogenic activities, all Passenger and Cargo Terminal sites are poor in terrestrial fauna diversity and abundances, and mainly represent the non-conspicuous. No endemic fauna was reported from the project site.

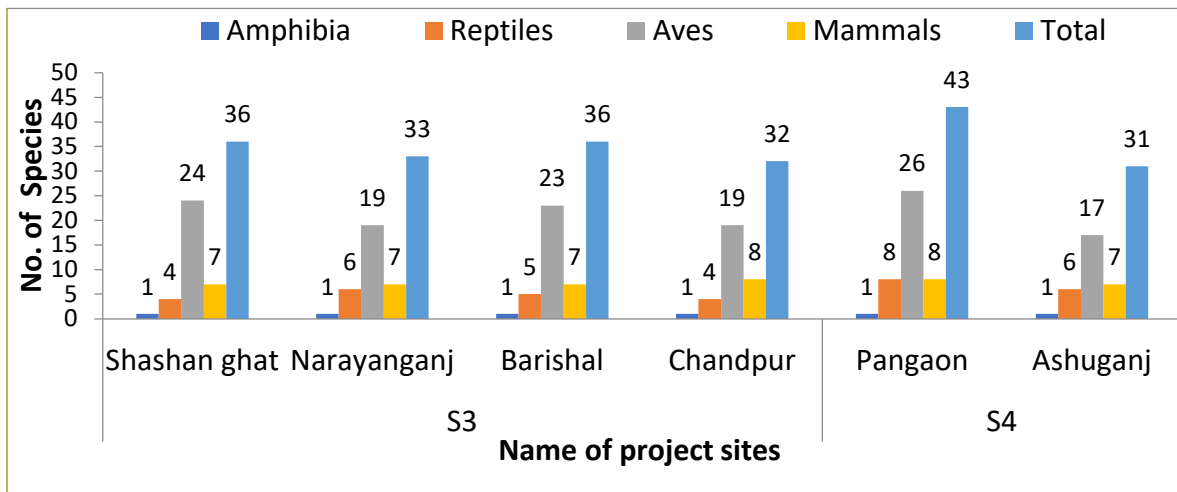


Figure 23. Number of terrestrial wildlife species recorded from different S3 and S4 project sites

■ **Aquatic Wildlife**



Significant Species

- **Gangetic Dolphin (*Platinista gangetica*):** Gangetic dolphin is an iconic and flagship species in Bangladesh. The species is considered endangered both nationally and globally according to IUCN Redlist (IUCN 2015). During wet season they forage in the project area. Dolphins are found to forage across all sites, except Barishal site, particularly in monsoon months. In Shasanghat dolphin is rarely found, while in Ashuganj the species is relatively a frequent visitor
- **Turtle Species:** A diverse species of turtles are available in Bangladesh. Unfortunately, the population of most of the turtle species have declined over time, mainly due to over exploitation, habitat degradation, pollution and food shortage. Three turtle species potentially occur within the project areas, of which Indian Softshell turtle is considered endangered nationally and vulnerable globally.
- **Threatened fishes:** Of the recorded fishes 21 nationally threatened fish species potential occur within the project site areas, include one Critically Endangered, 9 Endangered and 11 vulnerable species.
- **Hilsa shad (*Tenuualosa ilisha*):** Hilsa shad is the single most commercial fish species in Bangladesh and contributes mostly to the fish demand in the country. It is also an exportable commodity. A huge workforce is involved with the hilsha fishery. The Bangladesh Government has an elaborate management plan to ensure its sustainable production. Occurrence of hilsa shad was ascertained through interview of local fishers.

▪ Zooplankton

Both species diversity and abundance of zooplanktonic community were studied. The zooplanktonic community comprised 6 major groups. A total of 19 zooplankton species, comprising three Protozoan, seven Rotifers, four Copepods, two Cladocerans, two nauplii and one ostracod species, was recorded from the study sites

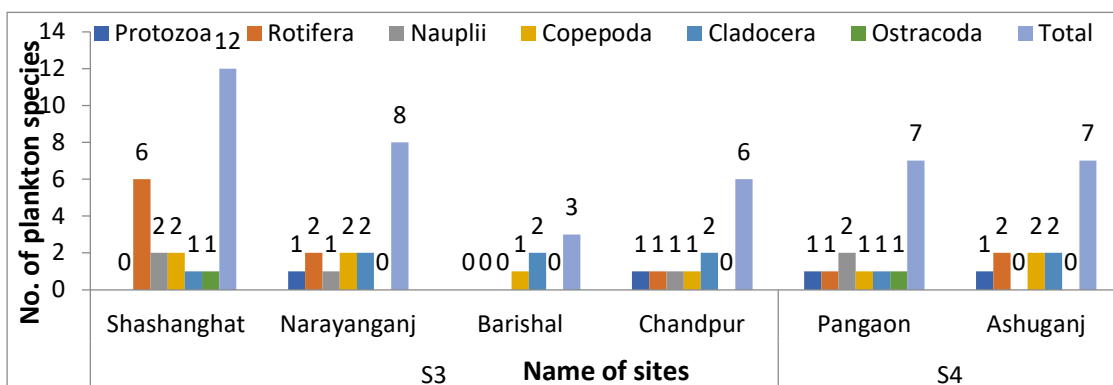


Figure 24. Group wise species number of Zooplankton recorded from the project sites (October 2019)

■ Fishes

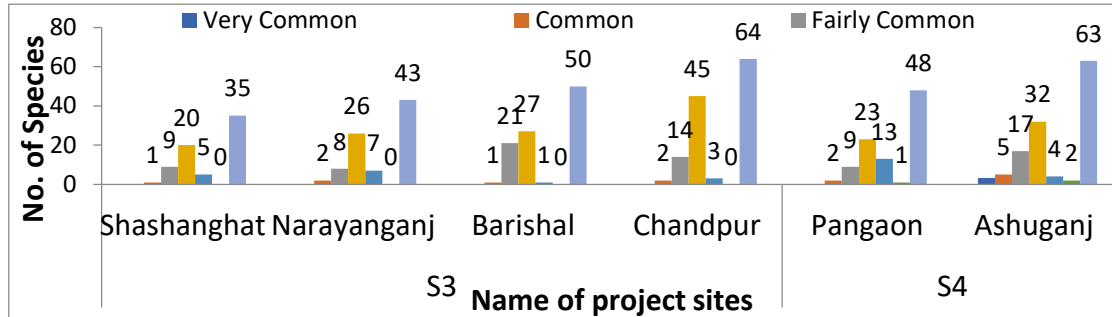


Figure 25. Species diversity and relative abundance of fish recorded from project sites

4.4. BRIEF SOCIOECONOMIC BASELINE

In the 6 project locations, a census and socioeconomic survey has been conducted among the affected people. A total of 618 affected households (residential and commercial) consist of 3,343 individuals have been identified within the proposed boundary of the terminals. Apart from this, 03 community properties (two Madrasah and One Mosque) and 18 other offices/institutions are also affected within the footprint of Six terminals. Population census of the Bangladesh Bureau of Statistics (BBS) 2011 report has been considered as a baseline to calculate the total population in 2020 considering 1% increase rate per year. In the five project districts (Dhaka, Chandpur, Narayanganj, Barisal and Brahman Baria) population in 2020 stands at 24,687,676 including male 12,825,696 and female 11,861,979. Total HHs of these districts are 502,161 and total area is 8,459 square km. Average population density per sq. km is 2,919 persons/sq km with a range from 912 (in Barisal district) to 8993 (in Dhaka district). Average HH size in the project districts is 4.92 which is higher than the national average HH size (4.06 in 2016-HEIS) and lower than the same at the project footprint (5.40 as per census and SES). Table 88 presents demographic data for the project districts.

Table 10. Demographic information of the project districts

Districts	Total Population	Male	Female	Area (Sq. km)	Total HHs	Avg. HH size	Gender ratio	Population Density
Dhaka	13,162,647	7,165,119	5,997,528	1463.6	2,786,133	4.72	119	8,993
Chandpur	2,658,791	1,261,591	1,397,199	1645.28	506,321	5.25	90	1,616
Narayanganj	3,222,106	1,662,797	1,559,309	684.37	675,652	4.77	107	4,708
Barisal	2,539,752	1,242,567	1,297,185	2784.52	513,673	4.94	95.78	912
BrahmanBaria	3,104,380	1,493,622	1,610,758	1881.2	539,837	5.75	93	1,650
Total	24,687,676	12,825,696	11,861,979	8458.97	5,021,616	4.92	100.96	2,919

Source: BBS 2011 (Adopted in 2020)

Among the district population a very small percentage (0.0135%) will be affected by the project interventions at 6 terminals. Out of the total 3,343 affected people in the 6 terminal sites, 1,732 (51.81%) male and 1,611 (48.19%) female which is slightly lower than the national average (49.41% female)¹.

¹ World Bank, Tradingeconomics.com 2020



Male/female ratio in the project sites is almost similar in all 6 terminal areas except Barisal (22.97% female and 21.42% male).

Table 11. Affected population by sex

Location	Population					
	Male	%	Female	%	Total	%
Ashuganj	634	36.61	569	35.32	1203	35.99
Barisal	371	21.42	370	22.97	741	22.17
Chandpur	557	32.16	520	32.28	1077	32.22
Narayanganj	100	5.77	93	5.77	193	5.77
Pangaon	69	3.98	57	3.54	126	3.77
Sashanghat	1	0.06	2	0.12	3	0.09
Total	1732	100	1611	100	3343	100
Percentage	51.81		48.19		100	

Source : Social Survey, S-6 Consultants, October 2019- February 2020

In the project districts at least four categories of people i.e. Muslim, Hindu, Christian and Buddhist are found but in the terminal area only Muslim and Hindu people are affected. Small ethnic groups /Adibasi is not found in the project foot print. The table underneath provides a breakdown of religious affiliation of affected people in the terminal areas.

A total of 618 households are affected (3343 people) among which 96.76% are Muslim and remaining 3.24% are Hindu by faith. In the project districts Muslims are 93.58% Hindu 6%, Christian 0.34% and Buddhist and others 0.08%) There are no indigenous people (tribal or ethnic minority) living in the terminals hinterland and, therefore, no indigenous people are affected by the Project interventions under S-3 and S-4 components.

Table 12. Religion of Household Heads in the terminals

Location	Households by Religion		
	Hindu	Muslim	Total
Ashuganj	8	204	212
Barisal	7	147	154
Chandpur	3	179	182
Narayanganj	2	38	40
Pangaon		29	29
Sashanghat		1	1
Grand Total	20	598	618
Percentage	3.24%	96.76%	100

Source : Social Survey S-6 Consultants October 2019 to February 2020

Table 13. Religion of the people living in the Project districts

Administrative Unit	Muslims	Hindus	Christians	Buddhists	Others	Total
Dhaka	12,458,949	618,984	67,830	14,500	2,385	13,162,647
Chandpur	2,480,059	177,397	462	120	752	2,658,791
Narayanganj	3,062,925	157,492	1052	413	223	3,222,106
Barisal	2,229,612	296,620	13363	87	70	2,539,752
Brahman Baria	2,871,934	231,584	425	129	308	3,104,380
Total	23,103,479	1,482,077	83133	15,249	3,738	24,687,676
Percentage	93.58	6.00	0.34	0.06	0.02	100

Source: BBS 2011(Adopted in 2020)

4.4.1. Gender and Women

The gender and development are concerned with the interdependent relations between men and women, the ways in which these relationships produce inequalities between them, for instance in access to resources within the family, community and wider institutions; while absence of discrimination on the basis of a person's sex in opportunities and the allocation of resources or benefits or in access to services confirm gender equality.

The principle of "leaving no one behind" guides every goal of the 2030 agenda and the focus on gender equality and women's empowerment is explicit across all the SDGs, both as a stand-alone goal (SDG 5: Gender equality and empowerment of women and girls) on gender equality and as a cross-cutting theme with more than 30 related targets. Gender equality is a right as fundamental as any other in the national and international bills of rights, because in the long run, discrimination against gender consequently breeds violations of discriminated persons' other basic rights such as education, choice of partner, choice of career, decision making power and expression.

The concept of gender equity not only recognizes the different needs of women and men, but also acknowledges that women and girls have been disadvantaged due to past discrimination and require additional support to rectify the existing gender imbalance.

According to the census survey result, 48.19% of affected population are female in the six terminal area, meaning male–female ratio is 107.51 males vs. 100 females, while it was 102.83 males per 100 females in 2015 and 102.35 male per 100 female in 2019². However, among the affected households, 561 are male headed and 57 are female headed. The female headed households are most vulnerable as per their socio-economic condition. Thus, it is essential and highly recommended that any opportunity provided by the project must have equal access to women irrespective of their individual characteristics or differences across the country.

The table 14 presents the demography including heads of HHs and population.

² GOB Web portal



Table 14. Heads of households and population

Location	Household			Population			HH Size
	MHH	FHH	Total	Male	Female	Total	
Ashuganj	190	22	212	634	569	1203	5.7
Barisal	134	20	154	371	370	741	4.8
Chandpur	169	13	182	557	520	1077	5.9
Narayanganj	40		40	100	93	193	4.8
Pangaon	27	2	29	69	57	126	4.3
Shashanghat	1		1	1	2	3	3.0
Total	561	57	618	1732	1611	3343	5.4
%	90.78	9.22	100	51.81	48.19	100	

Source: Census and IOL survey, October 2019 to February 2020

Among the affected population in 6 terminals, the majority of them (63.50%) fall within the age group of 15-60 followed by age group 0-14 (28.20%) and age group more than 60 years (8.30%). The percentage of working population (15-60 years) is considerably higher than the dependent population implying that most of the population belongs to the employable age group, which is vital for fueling the economic growth of the local area.

Table 15. Age group of affected people by gender

Location	Upto 5			5+ to 15			15+ to 30			30+ to 60			More than 60			Total		
	F	M	Total	F	M	Total	F	M	Total	F	M	Total	F	M	Total	F	M	Total
Ashuganj	53	66	119	93	94	187	185	186	371	207	221	428	31	67	98	569	634	1203
Barisal	29	36	65	75	79	154	100	91	191	132	135	267	34	30	64	370	371	741
Chandpur	56	67	123	105	102	207	153	149	302	152	200	352	54	39	93	520	557	1077
Narayanganj	8	8	16	13	24	37	33	25	58	35	37	72	4	6	10	93	100	193
Pangaon	4	9	13	10	10	20	13	19	32	25	22	47	5	9	14	57	69	126
Sashanghat							1		1	1	1	2				2	1	3
Total	150	186	336	296	309	605	485	470	955	552	616	1168	128	151	279	1611	1732	3343

Source : Social Survey S-6 Consultants October 2019 to February 2020

4.4.2. Education

It is revealed that, 28.77% of the affected people with almost equal numbers of male and female (Male 14.37%, Female 14.40%) passed Junior School Certificate (JSC) examination while 10.08% (Male 5.52%, Female 5.56%) obtained Secondary School Certificate (SSC). After passing SSC, it is observed that number of female students declines compared to male.

A total of 10.31% of affected people obtained graduation or higher degree, 6.22% male and 4.09% female. Table 16 below presents education level of the affected people by location and by gender.

Table 16. Education level of the affected people by location and by gender

Education Level	Ashuganj	Barisal	Chand Pur	Narayan Ganj	Pangaon	Sashan ghat	Total	By gender	
								Male	Female
Illiterate	1.20	3.99	5.98	6.21	7.08	0.00	3.85	1.39	2.46
Only Signature	2.95	14.94	8.81	14.12	18.58	33.33	8.78	4.02	4.76
Upto Primary	11.35	22.78	20.95	24.29	21.24	33.33	18.19	9.58	8.61
Primary School Certificate (PSC)	13.84	17.31	26.10	20.34	17.70	0.00	11.07	5.59	5.49
Junior School Certificate (JSC)	21.13	20.12	20.65	23.73	20.35	33.33	28.77	14.37	14.40
SSC/ Dakhil	14.67	9.02	7.02	5.65	5.31	0.00	10.08	5.52	4.56
HSC/ Alim	13.93	6.51	6.18	4.52	6.19	0.00	8.95	4.72	4.22
Graduate/ Fazil	8.95	2.81	2.83	1.13	1.77	0.00	4.89	3.06	1.83
Masters / Kamil	8.49	1.18	1.26	0.00	1.77	0.00	3.79	2.16	1.63
Higher Education	3.51	1.33	0.21	0.00	0.00	0.00	1.63	1.00	0.63
Total	100	100	100	100	100	100	100	51.41	48.59

Source : Social Survey S-6 Consultants October 2019 to February 2020

4.4.3. Physical Disability among the affected people

The social survey sought opinion of the household heads regarding disabled members in their family. According to the census survey about 96% of the affected people were found to be in good physical condition while 3% partially disable (one-eyed, arms broken, etc.) and only 0.96% were found to be totally disabled (Paralyzed, blind, old aged, etc.) who cannot move alone without the help of others. This is representative of the total district population. Necessary measures for these disabled members would be taken in the terminals and vessels for their easy movement.

Table 17. Disability status of the affected people

Locations	Good		Partially Disable		Fully Disable		Total	
	No.	%	No.	%	No.	%	No.	%
Ashuganj	1166	36.35	32	31.07	5	15.625	1203	35.99
Barisal	711	22.16	26	25.24	4	12.5	741	22.17
Chandpur	1020	31.80	37	35.92	20	62.5	1077	32.22
Narayanganj	189	5.89	3	2.91	1	3.125	193	5.77
Pangaon	119	3.71	5	4.85	2	6.25	126	3.77
Sashanghat	3	0.09	0	0	0	0	3	0.09
Total	3208	95.96%	103	3.08%	32	0.96%	3343	100

Source: Social Survey S-6 Consultants October 2019 to February 2020

Source of Lighting

Electricity reached about 93.5 percent people in **Bangladesh** in 2019 as a source of lighting their households, compared to 90.1 percent in 2018, according to a report of the **Bangladesh** Bureau of Statistics (BBS) Jun 30, 2020. This scenario is very much consistent with the project area. It is found that more than 99% of the affected people enjoy electricity facility in the terminal area. Only 0.49% households use solar power/generator/IPS and similar numbers of HHs use Diesel/Kerosine.



Table 18. Source of lighting in the terminal areas

Project Locations	Source of lighting			Total
	Diesel/ Kerosin	Electricity	Solar/Generator /IPS	
Ashuganj	0	211	1	212
Barisal	1	153	0	154
Chandpur	1	179	2	182
Narayanganj	1	39	0	40
Pangaon	0	29	0	29
Sashanghat	0	1	0	1
Total	3	612	3	618
Percentage	0.49	99.03	0.49	100

Source: Social Survey S-6 Consultants October 2019 to February 2020

4.4.4. Settlement and Housing

Urban and semi-urban living in Bangladesh is the standard settlement in all the project locations under S3 and S4. Low-income high-density housing areas in spontaneous urban poor settlements (or slums and squatter areas) consists of apartment housing together with some kutcha and semi- pucca structures like rural settlements. It is estimated that 555 entities (111 residence and 444 shops) out of 618 affected HHs will be physically displaced due to the project interventions. In the Six terminals under S3 and S4, three community properties and 18 other offices/ institutions have been found affected. The community properties include two Madrasahs and one Mosque at Chandpur. Offices/institutions include Government office, government school, Samity (Society), and the labor union.

Compensation and special grants for the CPRs will be paid to the Management Committee for the construction of a better one. The mosque will be dislocated since it is fully affected but the Madrasahs are partially affected and not required displacement. Management committee/authorities may take away salvageable materials free of cost within the BRWTP declared deadlines.

Such offices and CPRs are affected on government land. Table underneath presents affected entities including residential HHs, Commercial enterprises, Offices and CPRs by location. CPRs include two Madrasah and one mosque (operated by community) and offices /institutions include government school, offices, club, labor union, etc.

Table 19 underneath presents the number of households and types of housing structure for each of the project districts. The dominant type of housing by building material is pucca and semi-pucca in the vicinity while most of the affected structures are semi-pucca and tin-made in the foot print of the project locations. Building design and Technology are important components in housing as these reflect the cultural, social and functional needs of the people in this sense. Most areas are experiencing transformation, with adoption of urban housing designs, or construction of two or even multistoried buildings.

Table 19. Distribution of affected entities by location

Affected in Category	Location						Total
	Ashuganj	Barisal	Chandpur	Narayanganj	Pangaon	Sashanghat	
Residential	13	12	87		1	1	114
Commercial	142	137	86	40	16		421
Both Residential and Commercial	6		5				11
Sub-total of Residential and Commercial	161	149	178	40	17	1	546
Only Land	43						43
Pond					1		1
Tree			1		7		8
Secondary Structure	8	5	3		4		20
Sub-total of other affected entities	51	5	4	0	12	0	72
Total	212	154	182	40	29	1	618
Offices/Institutions	6	5	3	2	1	1	18
CPRs	0	0	3	0	0	0	03
Grand Total	218	159	188	42	30	2	639

Source : Social Survey S-6 Consultants October 2019 to February 2020

Table 20. Number of affected CPRs and Offices/Institutions by location

Type of entities	Location						Total
	Ashuganj	Barisal	Chandpur	Narayanganj	Pangaon	Sashanghat	
CPRs							
Madrasah	--	--	2	--	--	--	2
Mosque	--	--	1	--	--	--	2
Sub Total	--	--	3	--	--	--	3
Other Offices/Institutions							
Govt. Office	2	3	2	1	1	1	10
Govt. School	--	--	1	--	--	--	1
Samity/club	3	1	--	--	--	--	4
Labor Union	1	1	--	1	--	--	3
Sub-total	6	5	3	2	1	1	18
Total	6	5	6	2	1	1	21

Source : Social survey of S6 Consultants October 2019 to February 2020

Among the affected households, more than 6% are losing pucca (concrete roof with brick wall and floor) structures, 46% are losing semi-pucca (CI sheet roof with brick wall and brick/earthen floor) structures. Apart from these two types, more than 26% households use Tin-made (CI sheet roof and walls) and 21% use Katcha (CI Sheet roof with bamboo/wooden walls) and only 0.61% use thatched (straw roof with bamboo/straw walls) in the terminal area.

Table 21. Categories of affected structures at the 6 terminals

	Area (Sft.) by site	Total	%
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Type of structures	Ashuganj	Barisal	Chandpur	Narayanganj	Pangaon	Shashanghat		
Pucca	6,239	4,237	72	-	418	-	10,966	6.25
Semi-pucca	63,942	1,938	13,690	176	1,125	-	80,871	46.08
Tin-Made	3,424	7,705	32,647	1,228	1,051	-	46,055	26.24
Katcha	33,206	784	256	1,945	324	19	36,534	20.82
Thatched	250	668	156	-	-	-	1,074	0.61
Total	107,061	15,332	46,821	3,349	2,918	19	175,500	100
Percentage	61.00	8.74	26.68	1.91	1.66	0.01	100	

Census and IOL survey, S-6 Consultants, October–November 2019

4.4.5. Land Use

Land use pattern adjacent to the river route has different scenarios for rural and urban sites. Terminals are established in urban or semi urban areas that have developed the Ghat areas as commercial centers of the region with shops and markets. Almost 65% of the private land around the Ferry Ghats and Launch Ghats are found to be used for agricultural production. Most of the titleholders use their land for commercial purposes. Most of the non-titleholders are using government land for business and other purposes. Detailed socio-economic and cultural information has been gathered from the census and socio-economic baseline survey.

4.4.6. Community Safety and Health

The public health system in Bangladesh is hierarchically structured as a five-layer pyramid of health facilities. At the base of the pyramid there are community clinics (CC), the next levels are Union Health and Family Welfare Centers (UHFWC) and/or the Union Sub-Centers (USC)/rural dispensaries (RD), Upazila Health Complex (UzHC) is the District Sadar Hospital (DSH) and the highest level is the tertiary tier, consisting of the teaching hospitals attached to the medical college and post graduate institutes offering a wider range of specialty services.

The current doctor-patient ratio in Bangladesh is only 5.26 to 10,000, that places the country at second position from the bottom, among the South Asian countries, according to the WHO (2019). The country also falls behind from all of its South Asian neighbors in nurses-patient ratio as it has only 3.06 nurses to provide services to every 10,000 population, The Government of Bangladesh has been relentlessly working for development of the public health and reducing maternal and infant mortality rates. Maternal mortality rate is being declined every year by 6%-7%. For instance, the maternal mortality rate for 2017 was 173.00, a 6.99% decline from 2016 which was 186.00 in 2016 (7% decline from 2015) and similarly it was 200 in 2015 (a 6.54% decline from 2014). Regarding the infant mortality rate, it has been falling in Bangladesh in the past decade, from 40.5 deaths per 1,000 live births in 2009 to 25.6 in 2019 (MoHPW October 6, 2020).

According to World Health Organization (WHO), total population in Bangladesh in 2020 was 164,689,383 among them women of reproductive age (15–49 years) in 2020 was 46,215,591. WHO presents the

mortality rate in the year 2020 is 5.541 while death growth rate is -0.050% and population growth rate is 1.00%³

Bangladesh has made substantial progress in improving sanitation coverage across the country. According to the WHO/UNICEF Joint Monitoring Programme (JMP), in 2000, approximately 18% of the population was practicing open defecation (JMP 2017).

As of 2018, the country had nearly ended open defecation. Bangladesh has made significant progress in reducing open defecation, from 34 percent in 1990 to just one percent of the national population in 2015. However, the current rate of improved sanitation is 61 percent, growing at only 1.1 percent annually.

Still, the quality of sanitation coverage is an emerging area of concern, with more than 40 percent of all latrines classified as “unimproved.” Drinking water access is widespread, but half of the drinking water consumed fails to meet water safety standards. In urban areas of Bangladesh, piped water supply reaches only about one-third of the population, and there is no systematic sewer disposal and treatment system. Only Dhaka, Bangladesh’s capital city, has a sewer system, and it serves just 18 percent of the city.

In the 6 terminal areas affected, people mostly use sanitary toilets (75.40%) followed by slab/water sealed toilets (22.17%). Only 1.94% use Katcha (made of CI sheet/wood, non-water sealed) and only 0.49% practice open defecation which is very much consistent with the national statistics as stated above.

Table 22. Use of toilets by affected people

Location	Type of Toilets				
	None	Open/Katcha	Slab	Sanitary	Total
Ashuganj		1	4	207	212
Barisal		2	54	98	154
Chandpur	2	8	67	105	182
Narayanganj			10	30	40
Pangaon	1	1	2	25	29
Sashanghat				1	1
Grand Total	3	12	137	466	618
Percentage	0.49	1.94	22.17	75.4	100

Source: Census and Socioeconomic Survey, S-6 Consultants October-November 2019

4.4.7. Public Utilities: Water Supply, Sanitation and Solid Waste

Though Bangladesh has for many years enjoyed almost universal access to drinking water, arsenic contamination of 22 percent of the country’s tube wells lowered the service coverage to below 80 percent.

Among the affected 618 households, about 57% use their managed deep tubewell water and about 25% use pipe water supply from the municipality. About 17.64% of the affected households depend on hand tube wells for drinking water. Regarding safe water supply to Population, Tables below outlines the scenario at project districts and their terminal areas.

³ All 2020 and later data are UN projections and DO NOT include any impacts of the COVID-19 virus.



Table 23. Source of drinking in project districts

Administrative Unit	Number of Households	Percentage of Source of Drinking Water		
		Pipe supply %	Tube well %	Others %
Dhaka	2,786,133	62.92	30.25	6.84
Chandpur	506,321	5.99	87.95	6.06
Narayanganj	675,652	17.72	77.39	4.89
Barisal	513,673	1.63	93.31	5.06
B.Baria	538,937	2.17	93.67	4.16

Source: BBS 2011

Table 24. Sources of drinking water in the terminal area

Location	Source of drinking water				Total
	Deep Tubewell	Pipe line	Hand Tube well	Bottled water	
Ashuganj	137	24	47	4	212
Barisal	95	35	24		154
Chandpur	73	85	24		182
Narayanganj	26	7	7		40
Pangaon	21	1	7		29
Sashanghat		1			1
Total	352	153	109	4	618
Percentage	56.96	24.76	17.64	0.65	100

Source : Social Survey S-6 Consultants October 2019 to February 2020

As is known, the terminals are located at urban or semi-urban area, therefore water supply and sanitation condition is relatively better. Among the affected people in six terminals, people of Shasanghat and Pangaon under Dhaka district count on piped supply water for domestic use including drinking, dish/cloth washing, bathing, etc. while at Chandpur and Barisal a significant number of people use river/pond water for domestic use.

It is revealed that people of Narayanganj do not use river water, even for domestic use, since the water quality of Shitalakhya River is quite poor. It is good sign that most of the affected people at Shasanghat, Pangaon (under Dhaka), Narayanganj and Ashuganj (Brahman Baria) use sanitary (water sealed) toilet, while about 97% use sanitary water at Chandpur and Barisal. Sustainable Development Goal (SDG) 6.1 and 6.2 ensure safely managed sanitation systems in each of the households.

Tables underneath present water supply for domestic use, drinking and sanitation facilities among the affected people and sources of drinking water in the district level.

Table 25. Sources of water for domestic use among the affected people

Source of Water for domestic use	Pangaon & Shasanghat (Dhaka %)	Chandpur %	Barisal %	Narayanganj %	Ashuganj (B. Baria) %
Deep TW/ Pipe supply/Tap	100.00	60.53	51.61	88.89	72.10
Hand Tube Well	0.00	18.42	6.45	11.11	20.92
Pond/River	0.00	21.05	41.94	0.00	6.98
Total	100.00	100.00	100.00	100.00	100.00

Source : Social Survey S-6 Consultants October 2019 to February 2020

4.4.8. Economy and Employment

The socioeconomic survey revealed that among the affected 618 HHs in six terminals, all of them are identified as businessmen in Dhaka (Shasanghat, & Pangaon) and Narayanganj while it is 87% at Barisal, 80% at Ashuganj (Brahman Baria) and 52% at Chandpur., Other main occupation household heads were found to be fishermen (19.44%) and in service (12.50% at Brahman Baria and 11.12% at Chandpur) (Table 102).

During construction of the project businessmen/traders will be temporarily dislocated but will be paid compensation and resettlement benefits for loss of structures and restoration of business. Suppliers and other large and medium scale businessmen/traders will get the opportunity to perform as sub-contractors or suppliers of necessary goods for the laborers. It is to be noted that at Ashuganj and Chandpur significant numbers of residential households will be affected within the proposed site. Eligible members of the HHs may get preferential employment in the construction process.

Table 26. Occupation of the sampled HH heads

Occupation	Pangaon & Shasanghat (Dhaka %)	Chandpur %	Barisal %	Narayanganj %	Ashuganj (B. Baria) %
Business/trade	100.00	52.78	87.50	100.00	80.00
Service	0.00	11.11	3.13	0.00	12.50
Fisherman	0.00	19.44	3.13	0.00	0.00
Housewife	0.00	5.56	3.13	0.00	2.50
Carpenter	0.00	5.56	0.00	0.00	0.00
Day Laborer	0.00	0.00	0.00	0.00	5.00
Student	0.00	0.00	3.13	0.00	0.00
Mason	0.00	2.78	0.00	0.00	0.00
Boatman	0.00	2.78	0.00	0.00	0.00
Grand Total	100.00	100.00	100.00	100.00	100.00

Source : Social Survey S-6 Consultants October 2019 to February 2020



4.4.9. Income and Poverty

It is known that the terminal areas are full of small business units/shops run by poor people for their livelihood. Most of the business units are small or medium scale and a very few are large scale. Income level of the small businessmen is quite low. According to the income level of the affected households (618), a total of 276 households are found vulnerable among which 241 HHs have been identified income under poverty line (BDT 21000), 17 HHs are headed by the person with physical disability and 18 HHs are both (income under poverty line cum disable). The households, living under the poverty line⁴ and persons with disability have been mostly identified in Chandpur site (118 out of 276 households) followed by Barisal (95 out of 276). It is revealed from the census and socioeconomic survey that very few affected households have fallen under the poverty line at Narayanganj, Ashuganj and Pangaon while no one have been identified at Shashanghat.

Household living below the poverty line are called vulnerable and they will be entitled to additional grants on top of other compensation. They will also be provided skill development training (one from each vulnerable HHs) under the RAP policy on income generating activities with seed grant, market linkage and linkage with financing institutions under income and livelihood restoration program (ILRP). Apart from these, vulnerable people will get preferential employment opportunities in the civil construction of the project according to their eligibility. The table underneath presents income level of the affected households at six terminal locations.

Table 27. Income and poverty level of the HHs

Income range	Ashuganj	Barisal	Chandpur	Narayanganj	Pangaon	Sashanghat	Total
Up to 21000	12	94	113	23	16	1	259
21001-30000	27	31	39	15	10		122
30001-40000	16	18	7	0	1	0	42
40001-50000	24	7	10	1	0	0	42
50001-60000	17	0	6	0	0	0	23
More than 60000	116	4	7	1	2		130
Total	212	154	182	40	29	1	618

Source : Social Survey S-6 Consultants October 2019 to February 2020

⁴According to the Household Income and Expenditure Survey (HIES) 2016 of the Bangladesh Bureau of Statistics (BBS) the upper poverty line for HH size of 4.06 in 2016 was BDT 15,988 per HH/month. Acknowledging the average HH size of the project area (5.40) BDT 21000 has been adopted as the 2020 poverty line for the project. Therefore, HHs with average income up to BDT 21,000 per month is considered to be living under the poverty line.

Table 28. HHs under poverty line including HH Heads with physical disability

Location	Under Poverty Line			Disable			Both (under poverty line cum disable)			Total		
	Male Headed	Female Headed	Total	Male Headed	Female Headed	Total	Male Headed	Female Headed	Total	Male Headed	Female Headed	Total
Ashuganj	8	2	10	7	1	8	1	1	2	16	4	20
Barisal	73	16	89	1		1	3	2	5	77	18	95
Chandpur	94	8	102	5		5	9	2	11	108	10	118
Narayanganj	23		23							23	0	23
Pangaon	15	1	16	3		3				18	1	19
Sashanghat	1		1							1	0	1
Grand Total	214	27	241	16	1	17	13	5	18	243	33	276

Source : Social Survey S-6 Consultants October 2019 to February 2020

4.4.10. Labor Influx

Labor influx for construction works can lead to a variety of adverse social and environmental risks and impacts. While many of these impacts could have been present already or might occur regardless of the labor influx, they are likely to be exacerbated by it. The actual type and degree of impact varies significantly depending on the characteristics of the project, community, and incoming workforce.

Gathering of the people from various cross sections may lead to social and environmental adverse impacts on the community including Risk of social conflict, Increased risk of illicit behavior and crime, Influx of additional population, impacts on community dynamics, increased burden on and competition for public service provision, increased risk of communicable diseases (STDs, HIV/AIDS, COVID) and burden on local health services, Gender-based violence (GBV), SEA/SH, Child labor and school dropout, local inflation of prices, increased pressure on accommodations and rents, Increase in traffic and related accidents and others. In the operation phase of the project, day laborers (koolee) will be working in the cargo and passenger terminals.

The project will have to take necessary steps to register the laborers with their work attire and identity cards so that passengers can safely deal with them. The mobile vendors selling fruits and other necessary commodities in the vessels would also have identity cards. Selected contractors will have to develop a Workers code of conduct and duly approved by the PIU before deployment of workers at site.



5. POTENTIAL ENVIRONMENTAL AND SOCIAL IMPACTS

This chapter describes the environmental impacts that are likely to result from the project activities during construction and operation. The interaction between various project components and environmental elements are being analyzed to identify and evaluate impacts. A summary of these impacts and interactions has been described in EIA Identification Matrix and Impact Magnitude tables.

5.1. IMPACT ASSESSMENT METHODOLOGY

In order to have an integrated approach for the impact assessment, a simple matrix is design. This matrix is based on a concept of rapid Impact Assessment, which is ideally to provide a rapid and clear assessment of the existence of major impacts. This is the first step and simple exercise to identify where potential impact may occur.

5.1.1. EIA Matrix of impacts

The Assessment identifies, analyses, and assesses environmental and social impacts of the Project. It distinguishes between positive and negative impacts, major or minor intensity, immediate or long-term impact, its timing, reversibility and persistence. The significance of impacts of the proposed project will be assessed on its magnitude, and the basis of this assessment will be specified.

Table 29. Example of EIA Identification Matrix. Construction Phase.

Impact Identification Matrix		PROJECT'S ACTION DURING CONSTRUCTION PHASE										
Environmental components		Mobilization of Workers, Heavy Machinery, Equipment and Material.	Camp site operation during construction phase	Land cleaning and topsoil removing	Filling & leveling	Earth movement: Excavations. Land-side develop.	Excavations and dredging development	Water- side Dumping of dredge materials and building materials	Construction of buildings	Construction of paved surfaces, parking, Land-side development	Piling and Jetty Construction/pile-supported concrete platform (suspended – deck)	Basement and Access Road Construction
AIR QUALITY	Pollutants and Dust											
NOISE AND VIBRATION	Excessive Noise and Vibration											
LANDSCAPE	Change of Landscape											
TOPOGRAPHY, GEOMORPHOLOGY AND GEOLOGY	Contour alteration and land change											
SOILS QUALITY AND EROSION	Change of Soil structure and Erosion effect											
	Contamination of Soils											

For each environmental and social factor the most likely impacts are identified for each stage of the project, construction and operation. Environmental factors are placed in rows and actions likely to produce impacts are placed in columns, thereafter, likely impacts are identified and highlighted with corresponding crossings.

An identification Matrix for construction phase and EIA Identification Matrix for both construction and operation phases have been prepared.

The EIA Identification Matrix used earlier allows us to identify where impacts are likely to happen. At a second stage this identified impact may be investigated in depth, identifying which is the particular project action that impacts on which environmental or social sub-factor.

Once we obtain the list of impacts or changes on the different elements of the environment as a result from the preceding exercise of the EIA Matrix: impact identification, we proceed to characterize them, for which we use the following features and impact attributes and criteria:

The following describes the meaning of the terms used:

- **N** Sign /Nature of the impact: Alludes to the beneficial nature (+) or adverse (-)
- **Ty** Type: Refers to the nature of the impact; direct (3) indirect (2)
- **IN** Intensity: Refers to the degree of impact on the factor, in the specific area in which it operates. Ranked from 1 to 3. The three expressed an almost total impact of the factor in the area in which the effect occurs.
- **EX** Extension/Location: An area of influence covered by the impact in relation to the project environment. In this sense, if the action produces a localized effect within the space, it is considered that the impact is of a restricted nature (1). If, however, the effect does not support a precise location within the project environment, having a pervasive influence on all of it or even beyond, the impact will be large (3). Intermediate situations are considered as partial (2).
- **TM** Timing: Refers to the moment of occurrence, the time lag between the onset of action and effect on the appearance of the corresponding factor. We consider three categories according to this time period are; zero, up to 2 years, or more than two years, which are called respectively: immediately (3), medium term (2), and long term (1).
- **RV** Reversibility: Refers to the possibility of reconstructing the initial conditions of the effect. These can be characterized as: short-term (1), medium term (2) and impossible (3).
- **RC** Recoverability: Refers to the possibility of providing or not the corrective measures to avoid or minimize impact. For impacts with positive sign no value should be added; from 1 to 3.
- **D** Duration/ Persistence: Refers to the time that the effect supposedly lasts, from the onset of the action. Two situations are considered, depending on whether the action produces a temporary (1) or permanent (2) effect.



Table 30. Impact Characterization rating attributes

EVALUATION PARAMETER	RATING	RATING
Sign. Nature of impact (N)	Positive Negative	+ -
Type of Impact (TY)	Direct Indirect	2 1
Intensity (IT)	Major Medium Minor	3 2 1
Extension (EX)	Disperse Medium Located	3 2 1
Timing (TM)	Immediate Medium term Delayed, long term	3 2 1
Reversibility (RV)	Not reversible Long term Short term	3 2 1
Recoverability (RC)	Not avoidable Avoidable if mitigated	3 1
Duration/ Persistence (D)	Permanent effect Temporary effect	2 1

■ Impact magnitude

The **Significance (or Magnitude) of the impact** represents the entity or significance of the effect, it includes the degree of incidence and the "form" of that effect. Its value is clear from taking the attributes and criteria described above and applying the following formula.

$$Sg = N (2x TY + 4x IT + 3x EX + TM + RV + 2x RC + D)$$

Where **Sg**: Significance or Magnitude of the impact generated by the action of the project over the environmental component.

Minimum and maximum values of Magnitude are 14 and 39 respectively. The major adverse impact is the one corresponding to a direct immediate impact with major intensity and broad effect, not reversible even if avoidable and with permanent effect to one environmental element.

Table 31. Environmental Significance Ratings

SIGNIFICANCE	DESCRIPTION	SCORE
	The following Impacts will usually result in either a positive or negative medium to long-term effect on the social and/or natural environment	
Low	Localized, minor intensity, recoverable, acceptable impact for which mitigation is desirable but not essential. The impact by itself is insufficient even in combination with other low impacts to prevent the development being approved.	14 to 19
Moderate	An impact which requires mitigation, medium intensity and extension. The impact is insufficient by itself to prevent the implementation of the project.	20 to 26
High	An important impact to medium to high environmental or social factor values, major or medium extension in conjunction with medium to major intensity, low recoverability, needs for mitigation.	27 to 34
Very High	A very serious impact. The impact may result in permanent change, loss of environmental and social values, very often these impacts are immitigable and usually result in severe effects, or very beneficial effects if positive. May be sufficient by itself to prevent implementation of the project if not strongly mitigated or compensated.	34 to 39

5.2. SUMMARY OF IMPACTS AND MITIGATION MEASURES

5.2.1. Construction phase key impacts

- Emission of Smoke, Dust and CO₂, increased NO_x in Air.
- Noise and vibration generation
- Topographic and landscaping changes occasioned by construction
- Land changes because of levelling and filling, top-soil removing and earth movements
- Alteration of siltation pattern
- Soil changes because of spills, material removal and construction work, erosion increasing because of vegetation clearance and earth movements
- Change in riverbank contour and line
- Increase in erosion/sedimentation of river shore
- Likely changes in water quality due to pollution associated with civil works, particularly dredging, and/wastewater in camp site, Increase in run-off and erosion, and hence water turbidity
- Likely changes in flux of water for a specified or unspecified period due to earth movements, dumping of materials or topsoil removing.
- Likely changes in sediment quality due to pollution coming from dredging and jetty construction particularly. Port traffic and use of fuel, wastewater discharge etc. can also cause sediment pollution.



- Likely changes in ground water quality due to construction materials depots
- Loss of natural vegetation
- Loss of agricultural land
- Loss of natural habitats and fragmentation of ecosystems
- Loss of wildlife
- Loss of fish biodiversity
- Temporarily Acquisition of private lands
- Decrease in farming areas
- Increase in time and distance
- Loss of income and employment for those who will be temporarily affected directly or indirectly
- Influx of labor in the river port working at the terminals coming from different parts of the Country
- Impact on Women Folk or sexual activities or harassments
- Increased job opportunities
- Change from farming to commercial
- Opportunity for employment, Increased income levels
- Diversion and disruption of local traffic
- Improved job opportunities for women, Increased family incomes, social and economic empowerment of women

5.2.2. Construction phase mitigation measures

Physical Environment

- Air quality
 - Implement measures in ECoP 6 Air Quality Management.
 - Dust generation will be restricted as much as possible and water sprinkling carried out as appropriate, especially where earthmoving and excavation are carried out.
 - Provide water spray vehicles to water the unpaved ground, storage piles and other areas where airborne dust may originate. The water spray operation should be carried out at least twice a day (morning and afternoon).
 - Open stockpiles of construction materials (e.g. aggregates, sand and fill material) of more than 50m³ shall be covered with tarpaulin or similar fabric during rainstorms.
- Noise
 - Implement ECoP 7: Noise Management
 - The Contractor shall abide by the provisions of the Specifications of Contract regarding environmental protection and DOE regulations.
 - The Contractor shall at its own expense take all appropriate measures to ensure that work carried out (including works by sub-contractors), whether on or off the site, will not cause any unnecessary or excessive noise.

- All equipment, engines and motors shall be equipped with proper silencers or mufflers during construction.
 - Geology & Soils
- Implement ECoP 4: Soil Quality Management
- The Contractor is required to reuse the excavated soil as much as possible unless the soil is considered unsuitable for filling.
- The Contractor shall plan his works to minimize surface excavation works during the rainy season where practicable.
- Maintain record of all sand or sediment extraction (quantities, location shown on map, timing).
- Place the sediments for filling the proposed disposal areas. Prior to filling commencing, the areas being filled will be subdivided into compartments by construction of temporary containment bunds of suitable material (e.g. dredged sand). Filling will be achieved by progressively pumping slurry of sand and water into the bunded areas, allowing the surplus water to drain away to artificial and natural waterways in a controlled manner through the pipeline, without affecting floodplains.
- Dredged soil should not be disposed in river or on its banks (especially during breeding and spawning seasons of aquatic organisms) Soil stockpiles should be covered to protect them from being eroded by heavy rains and from dust during windy dry periods.
 - Water quality
- Implement measures in ECoPs 2,3 and 5
- Workforce camps will be located away from water resources. All practical measures such as provision of septic tanks, garbage bags and other sanitation facilities will be implemented at the construction camps to prevent the wastewater and solid wastes from contaminating surface water.
- Oil/water separators and trapping catch basins should be installed and maintained regularly to keep them operational. Recovered contaminated solids or liquids disposed of as hazardous materials.
- Installing filter mechanisms (e.g. draining swabs, filter berms, drainage inlet protection, sediment traps and sediment basins) to prevent sediment and particulates from reaching the surface water;
- The earthwork sites where exposed land surface is vulnerable to runoff, etc. shall be consolidated and/or covered;
- The material stockpile sites shall be located far away from water bodies and areas prone to surface run-off.
- Storage areas for sand and soil, and all work areas, must be located at least 20 meters from river. Construction equipment must not be cleaned or washed within 50 meters of the river.
- Prevent all solid and liquid wastes entering waterways by collecting solid waste, oils, chemicals, bitumen spray waste and wastewaters from brick, concrete and asphalt cutting where possible and transport to an approved waste disposal site or recycling depot.
 - Ground Water



- Ensure that no drinking water sources (surface or ground water) are located within 500 m radius of the facility.
- Use as much as surface water for construction and labor camp purpose instead of ground water.
- Use supply water to compensate for local withdrawal of groundwater
- Use STP to treat wastewater so that water does not contaminate groundwater table.

Biological Environment

Based foregoing discussions on impacts and proposed mitigation measures this Section summarizes the mitigations measures to be undertaken for different components of Biological Components, viz, vegetation, terrestrial fauna and wildlife, aquatic wildlife and fish ecology, dolphins and by sites.

- Sashanghat PT site

Vegetation

- The Contractor shall provide adequate knowledge to the workers regarding protection of flora and fauna and relevant government regulations and punishing for illegal poaching. The killing of animals discovered on site is considered poaching and is strictly forbidden – inductions for staff and workers must be carried out on the topic.
- Develop a green area (garden) in waste spaces within the terminal site premise
- Undertake plantation of at least 20 trees (plant 5 trees for 1 tree cut) . at the peripheral area of the project site. Plantation should be done with indigenous species. .
- Strictly delimitate the extension of the area to be affected by the Project, before the construction works start, the contractor will proceed to mark the outer limit of the Project. A perimeter security fence at least 1.5m in height constructed from appropriate materials.

Terrestrial Wildlife

- Check for and drive out the slow moving animals just before earth filling of the site.
- Enhance local community awareness on conserving the wildlife in the area.

Aquatic life and dolphins

- Ensure that all land-based pollutants are collected and stored in safe place, not allowing to go into aquatic environment;
- Avoid construction works in the river during wet season, when dolphins forage in the area
- Temporary barricade should be made around the land based construction
- Confirm that dredge silt booms /or bubble curtains are in place and operating during piling so that pile driving meets Narayangonj threshold limits for shock-wave impactson order to reduce impacts of sounds on dolphin and turtles egetation
- • Implement awareness program on the compliance to Fish Conservation ACT, particularly to not to harvest juvenile and gravid fish of major threatened species among local fishers.
- • Collaborate with Department of Fisheries in collecting fisheries data on major threatened fish abundance, particularly relating to major threatened species and review this data to assess the efficacy of mitigation measures.

1) Narayanganj PT Site

Vegetation

- The Contractor shall provide adequate knowledge to the workers regarding protection of flora and fauna and relevant government regulations and punishing for illegal poaching. The killing of animals discovered on site is considered poaching and is strictly forbidden – inductions for staff and workers must be carried out on the topic.
- Rehabilitate and restore the existing garden after construction work is completed
- Undertake plantation of at least 715 trees (plant 5 trees for 1 tree cut) . at within the site boundary and/ or in available spaces nearby the site. Plantation should be done with indigenous species. .
- Strictly delimitate the extension of the area to be affected by the Project, before the construction works start, the contractor will proceed to mark the outer limit of the Project. A perimeter security fence at least 1.5m in height constructed from appropriate materials.

Terrestrial fauna and wildlife

- Check for and drive out the slow moving animals just before earth filling of the site.
- Enhance local community awareness on conserving the wildlife in the area;
- If tree removal time coincides with period for bird nesting, check the trees for bird nests, if noted wait until nesting period is, over.

Aquatic Life, turtles and dolphin

- Ensure that all land-based pollutants are collected and stored in safe place, not allowing to go into aquatic environment.
- Avoid construction works in the river during wet season when dolphins forage in the area.
- Confirm that dredge silt booms /or bubble curtains are in place and operating during piling so that pile driving meets threshold limits for shock-wave impacts on order to reduce impacts of sounds on dolphin and turtles.
- Temporary barricade should be made around the land-based construction.

2) Barishal PT Site

Vegetation

- The Contractor shall provide adequate knowledge to the workers regarding protection of flora and fauna and relevant government regulations and punishing for illegal poaching. The killing of animals discovered on site is considered poaching and is strictly forbidden – inductions for staff and workers must be carried out on the topic.
- Develop a green area (garden) in waste spaces within the terminal site premise and enrich the existing one within the BIWTA Rest House premise.
- Undertake plantation with trees (plant 5 trees for 1 tree cut) in the suitable available areas within the site and in the rest house garden.. Plantation should be done with indigenous species. .



- Strictly delimitate the extension of the area to be affected by the Project, before the construction works start, the contractor will proceed to mark the outer limit of the Project. A perimeter security fence at least 1.5m in height constructed from appropriate materials

Terrestrial fauna and wildlife

- Check for and drive out the slow moving animals, like frogs, water snakes, garden lizards, etc. just before earth filling of the site.
- Enhance local community awareness on conserving the wildlife in the area;
- If tree removal time coincides with period of bird nesting, check the trees for bird nests, if noted wait until nesting period is over.

Aquatic life and turtle

- Ensure that all land-based pollutants are collected and stored in safe place, not allowing to go into aquatic environment;
- Temporary barricade should be made around the land based construction

3) Chandpur PT Site

Vegetation

- The Contractor shall provide adequate knowledge to the workers regarding protection of flora and fauna and relevant government regulations and punishing for illegal poaching. The killing of animals discovered on site is considered poaching and is strictly forbidden – inductions for staff and workers must be carried out on the topic.
- Develop a green area (garden) in waste spaces within the terminal site premise.
- Undertake plantation of at least 1812 trees (plant 3 trees for 1 tree cut) . within and around at the peripheral area of the project site. Plantation should be done with indigenous species.
- Strictly delimitate the extension of the area to be affected by the Project, before the construction works start, the contractor will proceed to mark the outer limit of the Project. A perimeter security fence at least 1.5m in height constructed from appropriate materials.

Terrestrial fauna and wildlife

- Check for and drive out the slow moving animals just before earth filling of the site.
- Enhance local community awareness on conserving the wildlife in the area.

Aquatic life, turtles and dolphins

- Ensure that all land-based pollutants are collected and stored in safe place or led in to a pit , not allowing to go into aquatic environment;
- Avoid construction works in the river during wet season when dolphins forage in the area
- Confirm that dredge silt booms /or bubble curtains are in place and operating during piling so that pile driving meets threshold limits for shock-wave impacts on order to reduce impacts of sounds on dolphin and turtles.
- Temporary barricade should be made around the land based construction.

4) Pangaon CT Site

Vegetation

- The Contractor shall provide adequate knowledge to the workers regarding protection of flora and fauna and relevant government regulations and punishing for illegal poaching. The killing of animals discovered on site is considered poaching and is strictly forbidden – inductions for staff and workers must be carried out on the topic.
- Avoid unnecessary removal of herbaceous vegetation.
- Develop a green area (garden) in waste spaces within the site premise
- Undertake plantation of at least 3145 trees (plant 3 trees for 1 tree cut) . within and around the project site, if adequate space is not available for plantation distribute some saplings among adjacent homesteads for plantation in their premises. . Plantation should be done with indigenous species. .

Strictly delimitate the extension of the area to be affected by the Project, before the construction works start, the contractor will proceed to mark the outer limit of the Project. A perimeter security fence at least 1.5m in height constructed from appropriate materials.

Terrestrial fauna and wildlife

- Check for and drive out the slow moving animals just before earth filling of the pocket areas containing herbaceous vegetation.
- Enhance local community awareness on conserving the wildlife in the area.

Aquatic life, turtles and dolphins

- Ensure that all land-based pollutants are collected and stored in safe place or led in to a pit , not allowing to go into aquatic environment;
- Avoid construction works in the river during wet season when dolphins forage in the area
- Confirm that dredge silt booms /or bubble curtains are in place and operating during piling so that pile driving meets threshold limits for shock-wave impacts on order to reduce impacts of sounds on dolphin and turtles.
- The slurry with bentonite from drilling point should carefully be collected and store it in safe and secured places for subsequent safe disposal;
- Temporary barricade should be made around the land based construction.
- Create a barricade in the pond before earth filling of pond area and remove the aquatic animals, frogs, snakes , turtles, etc. from the pond area by netting,
- Implement awareness program on the compliance to Fish Conservation ACT, particularly to not to harvest juvenile and gravid fish of major threatened species among local fishers.
- Collaborate with Department of Fisheries in collecting fisheries data on major threatened fish abundance, particularly relating to major threatened species and review this data to assess the efficacy of mitigation measures.



5) Ashugonj CT Site

Vegetation

- The Contractor shall provide adequate knowledge to the workers regarding protection of flora and fauna and relevant government regulations and punishing for illegal poaching. The killing of animals discovered on site is considered poaching and is strictly forbidden – inductions for staff and workers must be carried out on the topic.
- Develop a green area (garden) in waste spaces within terminal site premise
- Undertake plantation of at least 570 trees (plant 3 trees for 1 tree cut) . within and around the peripheral area of the project site. Plantation should be done with indigenous species.
- Strictly delimitate the extension of the area to be affected by the Project, before the construction works start, the contractor will proceed to mark the outer limit of the Project. A perimeter security fence at least 1.5m in height constructed from appropriate materials.

Terrestrial fauna and wildlife

- Check for and drive out the slow-moving animals just before earth filling of the site.
- Enhance local community awareness on conserving the wildlife in the area;

Aquatic life, turtles and dolphins

- Ensure that all land-based pollutants are collected and stored in safe place or led in to a pit , not allowing to go into aquatic environment;
- Avoid construction works in the river during wet season when dolphins forage in the area
- Confirm that dredge silt booms /or bubble curtains are in place and operating during piling so that pile driving meets threshold limits for shock-wave impacts
- Implement awareness program on the compliance to Fish Conservation ACT, particularly to not to harvest juvenile and gravid fish of major threatened species among local fishers.
- Collaborate with Department of Fisheries in collecting fisheries data on major threatened fish abundance, particularly relating to major threatened species and review this data to assess the efficacy of mitigation measures.
- Temporary barricade should be made around the land based construction.
- The slurry with bentonite from drilling point should carefully be collected and stored it in safe and secured places for subsequent safe disposal.

Social Environment

- Fair compensation at replacement cost to be paid to the owners of the acquired land and structures irrespective of title to the land . All the land acquisition process and compensation payments to be done pertinent to GOB and WB prevailing policies/guidelines. A Resettlement Action Pan (RAP) has been prepared following GOB ARIPA 2017 and WB OP 4.12.
- Market value of the trees affected during implementation
- New plantations expecting to bring benefits in connection to natural environment
- In addition to aforesaid compensation, the vulnerable PAPs may be provided employment in the project construction works

- Different income restoration program may be initiated especially for the affected people to improve their livelihood and living conditions
- Displaced HHs and shops can be relocated in a cluster manner by the PAPs. Minimum civic facilities can be provided
- Minimum residence facilities with other facilities including food arrangements and fair wages etc. to be provided to laborers by the contractors

Provisions of time-to-time mandatory training and awareness buildings for the workforce to as precautionary measures for anti-social activities those includes sexual harassment and gender-based violence, women trafficking communal diseases etc. are punishable offences

5.2.3. Operation phase key impacts

- Noise from river traffic increase, port operation, road traffic
- NOx emission associated with CO2 from fuel burning by vessels and cargo transports
- Spills and pollutants entering water system
- Spills and pollutants entering water system, consequently to sediment
- Spills and pollutants entering water system
- Pollutant emission to farms crops and soils nearby
- Increase in water navigation transit and pollution of water induce impacts on fish biodiversity
- Increase of solid waste if not managed can pollute soils and block drainage
- New cargo terminal displaces boat passenger, boat passengers may be impact due to cargo vessel traffic
- New terminals and vessel crew will create new employment
- New terminals may introduce commercial and industrial areas nearby
- New terminals and possible industries nearby will create new opportunities, thus income generating activities.
- Local traffic will be affected by trucks

5.2.4. Operation phase mitigation measures

- Air Quality & Noise
 - Maintain all vehicles to keep them in good working order in accordance with manufactures maintenance procedures.
 - Use the quietest available machinery and equipment, fit high efficiency mufflers to appropriate railway operation or, modify equipment to reduce noise, i.e., using noise control kits.
 - Implementing tank and piping leak detection and repair programs
 - Water Quality b
 - Use STP to treat wastewater so that water does not contaminate groundwater table.
 - Prepare and apply spill protocol
 - -Ground water



- Avoid installation of storm drainage catch basins that discharge directly into surface waters, using containment basins in areas with a high risk of accidental releases of oil or hazardous materials (e.g. fueling or fuel transfer locations), and oil / grit or oil / water separators in all runoff collection areas
- Oil/water separators and trapping catch basins should be maintained regularly to keep them operational. Recovered contaminated solids or liquids disposed of as hazardous materials
- Terminals should include secondary containment for above ground liquid storage tanks and tanker truck loading and unloading areas
 - Fish Ecology
- Implement stringent control over releasing used fuels, and greases from vessels
- Develop and implement a waste management program for collecting, storing and safe disposal of solid wastes
- Prepare and apply spill protocol
- At the cargo sites loading and unloading of hull materials should be carefully done so that hull materials are not released into the aquatic environment
 - Gangetic Dolphin
- Orient the vessel operators on how to make careful sightings and avoid the foraging areas of dolphins

5.3. CUMULATIVE IMPACTS

Cumulative impacts are those that result from the successive, incremental, and/or combined effects of an action, project, or activity when added to other existing, planned, and/or reasonably anticipated future ones. For practical reasons, the identification and management of cumulative impacts are limited to those effects generally recognized as important on the basis of scientific concerns and/or concerns of affected communities.

Initial appraisal suggests that all S3 or S4 site environments are affected and/ or likely to be affected by other activities /projects sourced nearby. Some sorts of qualitative predictions or approximation of impacts could be made in order to guide development of mitigation measures. An assessment of cumulative effects for each of the individual S3 and S4 project sites is made below with recommendations on required mitigation measures, in addition to measures identified in the preceding sections.

Identification of other existing and reasonably anticipated and/or planned and potentially induced developments have been identified focussing on Developments related on ports, river transport and industries planned on or close to water.

Identification of VECs shall focus on the most important VECs, availability of data acquisition of VECs in further monitoring should also be taken into consideration.

Identified VECs are the following:

- Air quality
- Noise
- Water quality

- Aquatic Ecosystem

In addition, BRWTP-1, Environmental and social impact assessment framework identified: Gangetic Dolphin (*Platanista gangetica*) as VEC.

Effects of Projects terminals and other developments combined should:

- Effects on ambient conditions such as the incremental contribution of pollutant emissions in an airshed.
- Increases in pollutant concentrations in a water body, the rivers where Terminals will be upgrade or constructed.
- Increases in sediment loads on a watershed or increased erosion.
- Interference in Aquatic fauna and ecosystems
- Increases in local transport activity surrounding the Project and in the project's area of influence.
- Changes in river/inland water transport capacity and level of modernization.

5.3.1. Assessment of future conditions of VECs

Air quality and noise

In general, all sites under study show relevant problems in air quality and noise level, as a result of heavily populated surrounding areas, industries, and heavy traffic, among others. Implementation of several new developments, or they upgradation, will results in a probable increase in air quality and noise level problem.

Water quality

In general, Buriganga, Sitalakhya, Megnah and Kirtankhola River are heavily polluted as they receives sewage discharges from the populated areas and effluents from industrial units located at the upstream. This degradation in water quality have caused severe depletion in fisheries resources and other aquatic biodiversity, particularly in dry season. Although, the construction activities at the sites will have little, short-term and reversible impacts, in lean flow season this impact during construction period may additively increase the impacts with greater potentials to negatively affect the aquatic biodiversity. Any other project upstream, even downstream, could multiply the effects on water quality. During Operation the effects from wastes and waste water could have the same cumulative effects.

It has to be pointed out that the upgradation of the terminals and the construction of the new ones could alleviate such a pression on water quality since these facilities will be implemented under a more environmental friendly design and mismanaging replacing the current ones that shows important problems in waste treatment and resources management.

Aquatic ecosystem

The dredging and inland land construction activities proposed under the Project will negatively affect the aquatic biodiversity in the Project Rivers. Anyhow only Pangaon Cargo Terminal shows relevant amount of dredged materials. Wastes, and waste water should be the main impact on a cumulative basis that can affect biodiversity and general quality of river ecosystems.

The potential developments in the IWT sector can impact the breeding grounds of fishing due to dredging activities. Focused on Terminals developments waste water discharges should be considered as the more relevant effects.

Dolphin



Effects of vessel traffic on river dolphins is identified as the main impact on cumulative or combined effects of plans and projects. Ferry crossings, commercial ports, and primary fishing grounds in rivers are generally located downstream of convergent channels or sharp meanders, which are also the preferred habitat of river dolphins. River dolphins are often observed swimming in areas with high vessel traffic, that includes small boats, motorized ferries, and in some location's large container ships and oil tankers, with no visible damaging effects. Cumulative effects for Terminals should be focus on collisions and noise and vibration due to increase in river transport. Losing of preys due to dredging is more related to dredging activities of other projects since only Pangaon shows a relevant volume of dredged activity, very little amount of dredging, Ashunganj even more volume of dredged materials, and no dredging planned to passenger terminals.

5.3.2. Mitigation of Cumulative effects

The estimated overall cumulative impact indicates the need for mitigation to be implemented by the various project owners or proponent parties to ensure that their respective contributions to the overall condition of the VECs is coherent and/or compatible as a minimum compliant with ambient quality standards for the desired use.

In general, we need to follow the following measures for all sites:

- BIWTA needs to review the situation and involve all parties, vessel operators, CT, ICD and PT authorities to jointly prepare and implement a pollution control program
- Air quality and noise level monitoring in the areas needs to be implemented.
- Ensure that wastes and waste water management plans are operational and efficient to avoid any kind of pollution of water bodies and terminals surroundings.

The following measures will be more specifically for each site, mitigation measures during construction and operation of a particular Terminal are proposed for each phase in the main mitigation measures section of this report and the following ESMP:

Pangaon and Shasanghat PT Site

Pangaon and Shasanghat sites are located on the same Buriganga River, very close to each other. The cumulative impacts described for Pangaon site are also entirely apply for Shasanghat site. Therefore, the mitigation measures prescribed for Pangaon site are also be the same for Shasanghat site.

Narayanganj PT Site:

Sitalakhya River at Narayanganj is also heavily polluted as it receives sewage discharges from the city area and effluents from hundreds of industrial units located at the upstream. This degradation in water quality have caused severe depletion in fisheries resources and other aquatic biodiversity, particularly in dry season. However, in monsoon the water quality gets better allowing some fish other biodiversity to reappear. Although, the construction activities at the site will have little, short-term and reversible impacts, in lean flow season this impact during construction period may additively increase the impacts with greater potentials to negatively affect the aquatic biodiversity'

Ashunganj CT Site

A new ICD terminal is being developed for Indian ships within 1.5 km downstream of the project site with potential increase in air, noise, and navigation traffic activities, both during construction and operation period. Adjacent to it is also located a Petroleum Depot which receives petroleum from ships and contributes to local navigation traffic congestion.

The existing BIWTA launch ghat is also within a kilometre of the site. All these have contributed to and will contribute to increased navigation traffic and river water pollution in the area, particularly during dry season. The traffic situation will further worsen when the proposed cargo terminal and the ICD terminal will be commissioned and operationalized. The increased navigation from all these sources will also have potentials to further degrade the water quality, negatively affecting the aquatic biota, the fish and dolphins. Therefore, there is a need for the implementation of a well-coordinated mitigation measures developed through dialogue among the stakeholders considering the cumulative impacts.

Barishal PT Site

There are some developments nearby, Payra deep sea port, power plant and LNG plant that might have the potentials for further degrade the water quality. Therefore, the cumulative impacts at the site will need to be monitored.

Chandpur PT Site

There would be some navigation, traffic at the site. Having the presence of wider river confluence at the site, the anticipated increase in navigation is unlikely to create traffic congestion. As having no other development activities nearby, no cumulative impacts are anticipated.

General Mitigation measures

Following Mitigation measures should be implemented by BIWTA on a wide spatial basis and not only for the S3 and S4 packages and particularly during operational period.

The main mitigation tasks should be as follows:

- Regularly check and carry out maintenance work of vessels to reduce air pollution and noise levels.
- Regularly check air noise level in terminals and other riverine BIWTA facilities.
- Do not discharge liquid and solid waste into the river from vessels. Adopt environmentally friendly management plans to avoid discharges of wastes and any pollutant substances into the water.

Mitigation measures proposed in this ESIA report covers the ones that shall be undertaken to prevent cumulative effects derived from the 4 Passenger and the 2 Cargo terminals.

5.3.3. Monitoring

Because cumulative impacts often result from the successive, incremental, and/or combined impacts of multiple developments, responsibility for their prevention and management is shared among the various contributing developments, and for the Terminals development should at first be managed by BIWTA. Because it is usually beyond the capability of any one party to implement all of the measures needed to reduce or eliminate cumulative impacts, collaborative efforts will likely be needed. For the Terminals development and taken into account the framework of the BRWTP should at first be managed by BIWTA.



6. CLIMATE CHANGE

It is impossible to “predict” future climate change, especially at a local level, as this change is dependent on global greenhouse gas emissions trends that cannot be known with certainty. Additionally, even if there was certainty in the emissions trends, the science of climate change is limited in the certainty it can provide for different climate variables such as temperature and rainfall.

The implications of climate change on the projects are given in the table 32.

Table 32. Climate Change Impacts and Adaptation Measures for Project corridor

Climate element	Status of change	Impacts	Recommended Actions
Temperature	Current change: 0.40°C during last 50 years; Future: 1.38-1.42°C by 2030 and 1.98-2.35°C by 2050	Infrastructure damaged by long exposure to heat, new concrete structures weakened due to poor curing.	Materials and design to be selected suitable for resilience of high temperature. Placing and curing of concrete requires more water.
		Surface water is rapidly evaporated affecting household water supplies and garden irrigation. Due to heat, overall per capita water needs will increase. Agriculture and fisheries suffer due to rise of temperature and greater salinity.	Water supply projects should include future increased demands in addition to that due to increase of population and future development. Rainwater harvesting needs to be encouraged and suitable design may be prescribed for this purpose including opting for rainwater preservation and use for domestic application. Reserve ponds may be dug to preserve rainwater for community use. Additional water storage may be required.
		High temperature affects health due to heat stroke, dehydration and facilitates diseases like diarrhea, asthma and heart and kidney failure.	Building design criteria should consider suitable factors to keep interiors cooler. Green coverage should be developed over suitable areas of the towns, so that there is a shielding against the incoming solar radiations which may to some extent provide people with comfort from the heat.

Climate element	Status of change	Impacts	Recommended Actions
Rainfall	Current trend: 25 cm in last 50 years; Wetter monsoon rainfall with future scenarios: Increase of: 13.5-18.7% in 2030 22.3-24.7% in 2050, 27% in 2060	Floods impacting infrastructures	Increased and more intensive rainfall will cause more floods inundating roads and yards, marketplaces and other important areas. It is recommended that the infrastructure is built such that the floods do not damage them or the water supply plants, reservoirs, pipelines are not affected.
		Reduced drainage channel size causes flooding	Rehabilitating and enlarging existing drains and large capacity new drains will be required to discharge excess storm water. As the regions' topographies, sea level rise and organizational capacities will not allow steeper drains, with complex pumping or water management arrangements with larger cross sections, channel lining and detention will be required to the maximum extent possible. Land availability for larger drains and detention capacity are also significant constraints. Drains are to be kept free of waste, siltation and encroachments. Arrangements and capacity for short-term/emergency pumping should be considered when and where appropriate.
Rainfall		Roads damaged due to more flooding and overflowing.	Ensure road is cambered as designed. Use concrete surfaced roads. Better compaction and use of stronger materials for road bases.



7. CONSULTATION WITH STAKEHOLDER AND PUBLIC CONSULTATION

ESIA Stakeholders consultation meetings were held at the proposed six terminals (Sashanghat, Pangaon, Narayanganj, Ashuganj, Barishal and Chandpur) with the potentially affected people, vessel owners, laborers, BIWTA local officials and passengers. Meetings were held in easily accessible places with prior notice to the people. ESIA Social Development & Resettlement Specialist, Ecologist and Environmental specialist facilitated the meetings. BIWTA senior officials including Environmental Specialist, Social Specialist and Executive Engineer attended some of the meetings.

Project information including interventions, potential impacts and mitigation measures, role of the project authority, affected people and other stakeholders were discussed in the meetings. In the discussion ecological, environmental, social and resettlement issues of project implementation have been shared. A total of 393 people including 373 male and 20 females were present at the 6 meetings.

They took active part in the discussion and gave their opinions for betterment of the project. The table below presents date, location, category and number of participants at all six meetings. The meetings were organized by TYPSA & KS Consultants Ltd and BIWTA supported the activity. The summary of the meeting places and participants is listed in the Table 33

Table 33. Stakeholder consultation meeting summary

Date	Location	Category of participants	Number of participants	
			Male	Female
22/10/2019	Sashanghat	Businessmen, Ward Councilor, Teacher, Service holder, BIWTA officials, Student, Hired Laborer	52	08
22/10/2019	Pangaon	Businessmen, UP Member, Teacher, BIWTA officials, Boatman, Hired Laborer	53	04
23/10/2019	Narayanganj	Businessmen, Cargo/ Launch owner, BIWTA local officials, Boatman, DEPTC instructor and trainees, Student, Hired Laborer	63	00
24/10/2019	Ashuganj	Businessmen, Doctor, Cargo owner, BIWTA local officials, Boatman, Truck owner, Hired Laborer	60	00
27/10/2019	Barishal	Businessmen, Councilor, Service holders, BIWTA local officials, Hired Laborer, Boatman	78	06
29/10/2019	Chandpur	Mayor, Councilor, Auto-Rickshaw Driver, Businessmen, Service holders, BIWTA local officials, Hired Laborer, Boatman, Student, Laborer leader, Rickshaw operator, Expatriate	67	02
Total	06		373	20

Apart from the consultation meetings, a total of 24 focus group discussions (FGDs) were held with various occupational groups at five terminals except Shashanghat under S3 and S4 sites. At the Shashanghat site only one shop is affected within the project footprint. A mass consultation was held at Shashanghat at the beginning of the study with all level stakeholders. A total of 411 people from various occupational groups

including squatters, vendors, tenants, hire laborers, landowners, female heads of households were present in the 24 FGDs.

During consultation meetings all level stakeholders were briefed about the project interventions, components, potential impacts and mitigation measures. Different issues were discussed in different locations.

People raised various pertinent issues relating to land acquisition, compensation and resettlement benefits, relocation and livelihood restoration and employment opportunity during construction and operation phase, equal facilities for male and female in the terminals and vessels.

ESIA consultants responded to all questions and therefore, affected people and other stakeholders by location were well aware of the project. Issues raised by the participants by location and responses of the consultants are provided un Table 34:

Table 34. People’s raised concerns in the consultation meetings

Location	Issues raised by the people
Sashanghat	<ul style="list-style-type: none"> ▪ Compensation for the structures and business demolished by BIWTA some weeks ago ▪ Search alternative location for the terminal since Sashanghat is closed to the residential area, Bangladesh Army camp and Postogola Bridge ▪ People took land lease from Bangladesh Railway for business. Whether they will be paid compensation for their losses ▪ Need access to the river from cremation ground for sacrificing Gods (Murti) of Hindu Community and ashes of burnt dead body ▪ Women and disabled would have all facilities in the improved terminals and vessels ▪ Adequate compensation and benefits for the affected people is to be paid ▪ Second largest ship breaking yard is located at Sashanghat where thousands of people are involved. How their livelihood will be restored ▪ Access road to the Shahanghat is very narrow. How the access to the improved Terminal will be developed.
Pangaon	<ul style="list-style-type: none"> ▪ Avoid private land acquisition if possible. In case of urgency please acquire open land and avoid residential area. ▪ Pay adequate compensation for land, if acquired ▪ Plan the terminal facilities including construction of a good mosque ▪ People go to Pagla (business hub) by crossing the river for their daily needs. Construct a separate pontoon and staircase for the river crossing people ▪ Pontoon with passenger shed for the river crossing boat would be constructed in safe distance from the cargo terminals
Narayanganj	<ul style="list-style-type: none"> ▪ Avoid private land acquisition ▪ Displaced shops would be paid compensation ▪ A space for relocation of the shop keepers within the terminal or outside the terminal ▪ Drainage system would be uninterrupted ▪ River crossing boats along with separate pontoon and stairs would be in safe distance ▪ Employment opportunity of the affected people in the project construction and operation phase ▪ Primary treatment facilities for the terminal users would be available with at least 10 beds ▪ Necessary facilities for the women and disabled passenger including separate toilet, prayer



Location	Issues raised by the people
	hall, breast-feeding area, etc. in the terminal and vessels
Ashuganj	<ul style="list-style-type: none">▪ Instead of the existing terminal choose free space, preferably RHD land (28 Acre free land) nearer to the Petro Bangla in the lower level, to avoid mass displacement of shops, huge compensation▪ Resettlement of the shops will be required since it is a resettlement site of the Bhairab Bridge Project provided by RHD▪ Need access to the river since business here is fully dependent on the river▪ Around 50 river-crossing boats are operated here where about 300 families are dependent on it. Needs separate space along with pontoon and staircase for easy access to the boats
Barishal	<ul style="list-style-type: none">▪ Avoid private land acquisition▪ There are about 500 shops at the vegetable market and City Market in BIWTA land those require relocation in suitable place.▪ Want relocation even instead of compensation for structure and business▪ Discuss with Honorable Minister and Mayor before finalization of design and relocation plan▪ Separate location for the river crossing boat and speed boat with independent pontoon and staircase
Chandpur	<ul style="list-style-type: none">▪ Avoid private land acquisition▪ Compensation for the structure and business on GOB land▪ People living on the Bangladesh Railway land want to have compensation and relocation▪ Environmental issues are to be carefully taken care of▪ Approach road will need to be developed along with terminal to enjoy better facility. Suggested to construct approach road from terminal to Bus stand alongside the river

8. ENVIRONMENTAL MANAGEMENT AND MONITORING

The ESMP Report contains general chapters applicable to all terminals and specific chapters for each of the terminals.

The ESMP is therefore divided into two main sections:

- ESMP general section with common measures that apply to all the terminals under study.
- 7 specific appendices containing site specific ESMP for each single terminal: Barishal, Chandpur, Narayanganj, Shasanghat, DEPTC, Pangaon and Ashunganj.

The basic objective of the ESMP is to manage adverse impacts of proposed project interventions in a way that minimizes the adverse impact on the environment and people at the subproject sites.

Each terminal under study has a chapter of general application measures and a specific appendix about its uniqueness. For each terminal, the measures to be implemented specifically by the contractor have been differentiated.

The key components of ESMP are summarized below and each of this component is explained in detail in the following subsections:

- Institutional Arrangement
- ESMP: Environmental Management & Mitigation Measures
- Environmental and Social Monitoring Program
- Grievance redressal Plan
- Reporting
- ESMP Budget

8.1. INSTITUTIONAL ARRANGEMENTS

BIWTA is responsible for ensuring that the mitigative and monitoring tasks defined in this ESMP are effectively carried out and completed on time. Monitoring of ESMP by BIWTA will require field surveys, analysis and technical reporting to DoE in addition to receiving environmental reports from the contractor and the Supervision and Monitoring Consultants. At present, BIWTA lacks such capability, and therefore, will require to strengthen the actual project implementation Unit (PIU) to address ESMP and RPF during project implementation, as proposed in the ESMP Report.

The Project implementation will be led by the Project Implementation Unit (PIU) that will be established within BIWTA. The overall responsibility of environmental performance including ESMP implementation of the Project will rest with the PIU

Figure 26 details the general management structure for the ESMP implementation and monitoring.

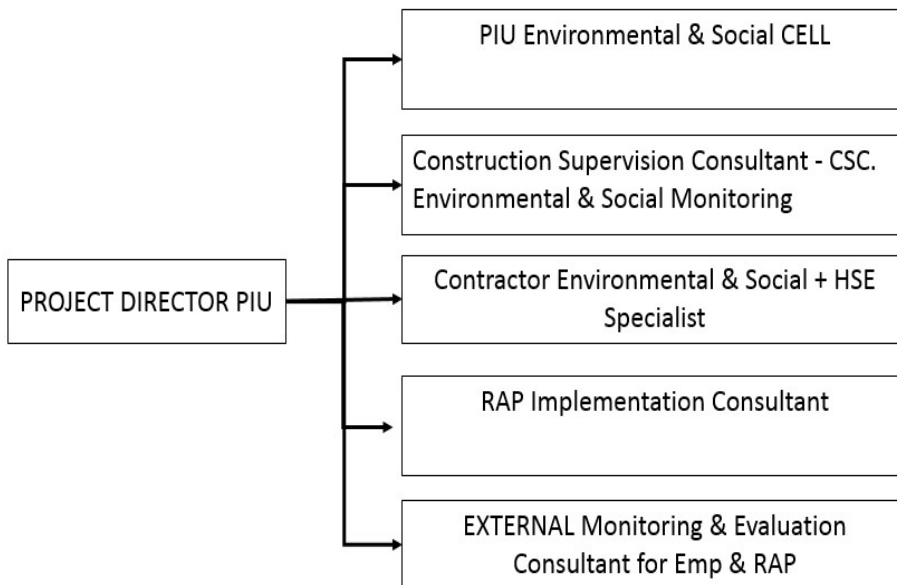


Figure 26. Management Structure of the ESMP

8.2. ENVIRONMENTAL MANAGEMENT

Site specific Environmental Management Plan has been prepared as Appendix to this ESMP for each Project location.

8.2.1. Construction Phase key impacts

The Impact list has been prepared based on the impact identification and impact characterization matrix given in Chapter 5 as part of the ESIA Report.

8.2.2. Construction Phase Mitigation measures

Mitigation measures have been suggested based on the knowledge of the Environmental Specialist, suggestions, on the stakeholders collected during public consultation, and opinions from other relevant specialists. The mitigation measures list has been prepared based on the mitigation measures given in Chapter 5 as part of the ESIA Report.

Since these are mainly preventive measures to be assumed by the contractor of the works during the execution of the works, they are mainly related to good construction practices.

Most of these mitigation measures must be included within **the contractors' site-specific management plans** listed below.

8.2.3. Operation phase key impacts

The Impact list has been prepared based on the impact identification and impact characterization matrix given in Chapter 5 as part of the ESIA Report

8.2.4. Operation Phase Mitigation measures

The mitigation measures list has been prepared on the basis of the mitigation measures given in Chapter 5 as part of the ESIA Report

8.2.5. Site-specific management plans

The following site-specific plans will be prepared by the contractors as part of their bid package, and implemented throughout the life of the contract, to manage and mitigate/reverse potential adverse environmental impacts. All these plans will be prepared based on this ESMP document (including the mitigation measures items presented in ESMP Tables), ECoPs presented in Annex 10 and all applicable national and World Bank requirements including WBG EHS Guidelines (2007).

They will be submitted to BIWTA as part of the bid package, and then during the mobilization period and prior to starting any physical works, will be validated, updated as needed, and re-submitted the CSC for review and approval. Each plan shall provide site-specific details for each route, and shall indicate requirements, milestones for implementation, indicators for verification and monitoring, skills and equipment required to implement, and training requirements / training plan, among any other relevant aspects:

- **Pollution Prevention and control Plan** will be prepared and implemented by the contractors on the basis of the ECoPs and WBG EHS Guidelines (2007) that will be part of the bidding documents.
- **Waste Disposal and Effluent Management Plan** will be prepared and implemented by the Contractor based on the ESMP, ECoP, and WBG EHS Guidelines (2007), which will be part of the bidding documents.
- **Drinking Water Supply and Sanitation Plan.**
- **Occupational Health and Safety (OHS) Plan.**
- **Traffic Management Plan** will be prepared by the contractors after discussion with BIWTA and authorities responsible for roads and traffic.
- **Construction Camp Management Plan** will be prepared by the contractors.
- **Fuel and Hazardous Substances Management Plan** will be prepared by the contractors
- **An Emergency Preparedness and Response Plan** will be prepared by the contractors after assessing potential risks and hazards that could be encountered during construction.
- **Specific Plan for Piling Activities (S4 Cargo Terminals)**

During implementation of the project, the contractor will carry out continuous surveying and will prepare a monthly work plan projecting the specific activities, dredge locations and volumes to be carried out in the coming month, based on the updated survey data. As part of this monthly plan, the contractor will include a Detailed Updated Contractor's ESMP, which shall specify any relevant updates or modifications to the above-mentioned site-specific plans.

The monthly work plan will be submitted to the CSC for approval prior to the contractor initiating activities that month. As part of this review, the CSC's Environmental Expert shall review and approve the Detailed Updated Contractor's ESMP component of the monthly work plan.



All these plans will be prepared on the basis of this ESMP document (including the mitigation measures items presented in ESMP Tables

Table 35. Example of Environmental Management Plan for Passenger Terminals. Construction Period

ENVIRONMENTAL COMPONENT	IMPACTS	MITIGATION MEASURE	RESPONSABLE FOR IMPLEMENTATON	RESPONSIBLE FOR SUPERVISION
AIR QUALITY	The emission of Smoke, Dust and CO ₂	<ul style="list-style-type: none"> - Fit machinery with appropriate exhaust systems and emission control devices. Maintain these devices in good working condition in accordance with the specifications defined by their manufacturers to maximize combustion efficiency and minimize the contaminant emissions. Undertake servicing of all equipment regularly to minimize emissions - Water the material stockpiles, access roads and bare soils as required to minimize the potential for environmental nuisance due to dust. Increase the watering frequency during periods of high risk (e.g. high winds, high temperature). Stored materials such as gravel and sand shall be covered and confined to avoid their being wind-drifted. - Provide filtering systems, duct collectors or humidification or other techniques (as applicable) to the concrete batching and mixing plant to control the particle emissions in all its stages, including unloading, collection, aggregate handling, cement dumping, circulation and others. 	CONTRACTOR	Supervision Consultants (CSC), PIU
	Noise and vibration generation	<ul style="list-style-type: none"> - Appropriately site for all noise-generating activities to avoid noise pollution of local residents. - Monitor and analyses noise and vibration results and adjust construction practices as required. - Maintain all equipment in good working condition in accordance with manufactures maintenance procedures/protocols. Equipment suppliers and contractors shall present the proof of maintenance register of their equipment. 		

8.2.6. Environmental Code of Practices

The environmental codes of practice (ECoPs) are generic, non-site-specific guidelines. The ECoPs consist of environmental management guidelines and practices to be followed by the contractors for sustainable management of all environmental issues. The contractors will be required to follow them and also use them to prepare site-specific management plans.

The ECoPs are listed below and attached in Appendix 8 to the ESMP.

The contractor is expected to interpret these requirements in a site-specific manner as part of the detailed, site specific Environmental Management Action Plan which shall be presented as part of the detailed work plan for CSC and BIWTA approval prior to initiation of works Contractors must make monthly work plan as an essential part of ECAP.

- ECoP 1: Dredging Management
- ECoP 2: Waste Management
- ECoP3: Fuels and Hazardous Goods Management
- ECoP4: Water Resources Management
- ECoP 5: Drainage Management

- ECoP 6: Soil Quality Management
- ECoP7: Erosion and Sediment Control
- ECoP 8: Topsoil Management
- ECoP 9: Topography and Landscaping
- ECoP10: Borrow Areas Management
- ECoP11: Air Quality Management
- ECoP 12: Noise and Vibration Management
- ECoP 13: Protection of Flora
- ECoP 14: Protection of Fauna
- ECoP 15: Protection of Fisheries
- ECoP 16: Road Transport and Road Traffic Management
- ECoP 17: River Transport Management
- ECoP 18: Construction Camp Management
- ECoP 19: Cultural and Religious Issues
- ECoP20: Workers Health and Safety

8.3. MONITORING PLAN

Monitoring of the project is the long-term process that normally begins at the start of the project and should continue throughout the life of the project. Its purpose is to establish benchmarks so that the nature and magnitude of anticipated environmental impacts are continually assessed.

Therefore, monitoring involves the continuous or periodic review of mitigation activities to determine their effectiveness. Monitoring will be carried out by various bodies/agencies such as internal monitoring by the contractor/RAP implementation NGOs, Construction Supervision Consultants, PIU's Environmental and Social Cell and External Monitoring Agency. World Bank Safeguard Mission will conduct periodic review of the progress of work on a timely fashion. External Monitoring Agency will be deployed by the PIU for progress and compliance monitoring of the RAP implementation. They will report to the PIU and World Bank on a half-yearly basis.

The main responsibility for mitigation monitoring during the Construction and Operation phase will lie within BIWTA. The monitoring activities will be led and coordinated by the Project Implementation Unit (PIU) that will be established within BIWTA. The overall responsibility of environmental and social performance including monitoring implementation of the mitigation measures will rest with the PIU

- Responsibility Matrix
 - The monitoring activities will be led and coordinated by the **Project Implementation Unit (PIU)** that will be established within BIWTA.
 - Similarly, the **CSC** will also monitor the contractors for the effective implementation of the environmental and social mitigation measures in the different phases of the Project.
 - **The contractors** in turn will also have HSE supervisors who will ensure ESMP implementation during construction activities.



As few monitoring entities are involved in the process, the following tables specifically indicate the leading monitoring agent for each specific task. Also, these monitoring tables specify the type of monitoring, who will do it, how much it will cost to carry out monitoring. During the construction period, the vast majority of the measures to be monitored do encompass the **requirements of the civil works contractors**, these are compiled in separate tables,

As one of the key elements of the ESMP, a monitoring program has been proposed comprising compliance monitoring, effects monitoring, and external monitoring. As few monitoring entities are involved in the process, the tables specifically indicate the leading monitoring agent for every specific task. Also, these monitoring tables specifies the type of monitoring, who will do it, how much it will cost to carry out monitoring

Table 36. Example of Monitoring Plan table. Passenger Terminals. Construction Period. Requirements of the civil works contractors

ENVIRONMENTAL PARAMETER	Mitigation Target	Monitoring Parameters	Standards/ Guidelines	Location	Means of Monitoring	Frequency of Monitoring	Responsible Agency /Institution	
							Implement.	Supervision
NOISE	Noise Control	Equivalent Sound Level (Leq) with GPS location of measuring site and wind speed and direction	Noise quality standard of DOE, Bangladesh ECoP12	Construction site	On site noise level monitoring	As an when required/ Monthly	Contractor	CSC/ M&E Consultant
AIR QUALITY	Air quality dust control	PM2.5, PM10, CO, SO2, NO, NO2;	Air quality standard of DOE, Bangladesh ECoP11	Construction site	Sampling and laboratory analysis;	Quarterly	Contractor through a nationally recognized laboratory	CSC/ M&E Consultant
		Spraying of water			Visual inspection			

During the construction period, the vast majority of the measures to be monitored do encompass the requirements of the civil works contractors, these are compiled in the blue colour tables, Those which are not, like all other aspects of environmental and social management during construction and operational phases are addressed in a separate additional green color table

Site specific Monitoring Plan has been prepared and included within Project location's Appendix

8.4. REPORTING

The Contractor shall prepare the following site-specific reports

- Site Specific Environmental Management Plans.
- Contractor Environmental Action Plans (CEAPs);
- Advance monthly plan for environmental and social mitigation measures implementation
- Monthly progress report for environmental and social measures.

The Contractor will submit monthly report including progress achieved in respect to the implementation of the mitigation measures included in the ESMP. The Contractor shall submit sample copy of the monthly progress report 30 days in advance to the Engineer’s Environmental Expert for review and approval.

The M&E consultant will prepare Quarterly and Annual Reports for submission to the Environmental Consultant of E&S Cell to ensure ESMP compliance.

8.5. COST OF ENVIRONMENTAL AND SOCIAL MANAGEMENT

The environmental management and monitoring total budget is **US 5,485,550**

Summary	
Description	Amount
	(USD)
Ashunganj	1,332,750.00
Barishal	620,300.00
Chandpur	617,100.00
DEPTC	257,700.00
Naranyanganj	635,275.00
Pangaon	1,399,625.00
Sashanghat	622,700.00
TOTAL	5,485,550.00

The environmental management and monitoring site-specific budgets proposed **for each sub-project are included in the site specific ESMP appendix.**



9. CONCLUSIONS AND RECOMENDATIONS

The ESIA reveals that there will be both negative and positive impacts due to the construction and operation of the proposed S3 and S4 sub-projects.

The main positive environmental impact of the Project are development and improvement of key multi-modal transport networks through waterways, which has always been a natural, environment friendly transportation system. This will certainly reduce the use of other not so sustainable means of transportation in such a congested and saturated environment, especially as it relates to the surroundings of the capital Dhaka.

More locally, the project means a general and substantial improvement of the facilities, accesses, traffic etc. which will achieve a significant improvement in the current levels of pollution, emissions,

and noise, which is in line with the objectives of the different existing master plans for these spaces.

From a social point of view the improvement of the facilities for transportation of passengers and cargo will mean the generation of employment opportunities during construction operation and maintenance stages as well as induced economic growth and activities.

From a gender perspective, gender specific facilities will be ensured in the terminals. Gender related facilities for the women in general, will include pregnant women, lactating mothers, elderly, and disabled people who will be in the waiting area or working in the terminals and vessel shelters. Gender and Development issues have been identified as crosscutting priority by both the Government and the development partners to enable women and girls to get the benefit of development and thus reduce the existing gap in their comparative situation with men and boys. It deals with unequal relations of power that prevents equitable development and women's full participation.

The major negative environmental impacts of the project are loss of benthic flora and fauna, obstruction to navigation traffic, loss of land, alteration of habitat, health, hygiene and sanitation of construction workers, public nuisance, blocking of natural drainage, noise, and air.

In summary:

- The water pollution will increase to much higher than its present level and is likely to further affect the aquatic biota, including fish and other aquatic animals, leading to its likely complete disappearance. except few species that can survive in polluted water, like air breathing fishes, viz. climbing perch, snakeheads, stinging and walking catfishes. Dredging will kill or cause damages to benthic organisms at the river site depleting/ reducing feeding opportunities of fish and some other aquatic biota and may also cause shift in composition, abundance, and dominance benthic and zooplanktonic communities. In some places like Pangaon and Barishal a total of 9 aquatic wild species have been recorded from the site, include frog species, snakes, turtles, bird species and one mammal species, the Gangetic dolphin.

The frogs and snakes may be buried in the process of land filling. The aquatic bird may avoid visiting the area. In Sashanghat Dolphin will be particularly affected due to increase in sound produced from dredging and working vessels. Three turtle species were also reported from the site and likely to be impacted with an avoidance reaction,

- River traffic level is likely to increase threefold and will affect the aquatic biota and sounds from vessels trucks will affect the adjacent city dwellers and wildlife. Dolphins will be

specially affected. particularly because of noise and vibration impacts from pile driving and dredging, notwithstanding that these may persist for a limited time during construction

- Land traffic will also increase significantly, resulting in local severe traffic congestion and there will also be an increase in air pollution.

The key social impacts are due to project interventions are

- Land acquisition and subsequent resettlement
- Loss of livelihoods
- Inconvenience and nuisance during construction
- Loss of access
- Likely increase in transport time and costs.

It is important to remark that a RAP Report will be prepared, site specific for each of the S3 and S4 sub-projects, during the planning and design stage.

An ESMP has been prepared to mitigate the negative impacts during various phases (pre- construction, during construction and operation) of the Project to acceptable levels. Also, public consultations, including consultation workshops at regional and national levels have been organized in addition to preparation of resettlement policy framework as per World Bank guidelines to address resettlement and compensation issues.

To ensure that these enhancement and compensation measures are implemented correctly, and negative impacts avoided, the ESMP along with adequate budget is to be included in the contract documents of the Project with a separate line item on environmental management in the BOQ. The main monitoring parameters include monitoring of pollution during works and waste disposal, biological monitoring and enhancement, environmental quality monitoring (air, noise, surface water, riverbed sediment), health and safety, etc.

Most of the potential impacts are short-term and likely to be produced in the construction phase, so that can be avoided or mitigated by **adopting mitigation measures and relevant ECoPs**. As it has been deeply analyzed in the ESIA report, they would not persist with the adequate application of the proposed mitigation measures.

Cumulative impacts may also appear, Initial appraisal suggests that all S3 or S4 site environments are affected and/or likely to be affected by other activities/projects sourced nearby. However, cumulative effects can be difficult to predict and manage due to inadequate environmental baseline data, complex ecological processes, and the large scale at which human development occurs.

An assessment of cumulative effects for each of the individual S3 and S4 project sites is made in this ESIA with recommendations on required additional mitigation measures. The estimated overall cumulative impact indicates the need for mitigation to be implemented by the various project owners or proponent parties to ensure that their respective contributions to the overall condition of the VECs is coherent and/or compatible as a minimum compliant with ambient quality standards for the desired use.

Residual impacts are those that might remain after measures are taken to avoid and minimize impacts. The risks and impacts identification process should consider direct and indirect project-related impacts and identify any significant residual impacts. According to the mitigation hierarchy where residual impacts remain, compensation/offset, wherever technically and financially feasible should be taken.



After mitigation residual impacts of Cargo Terminals are:

- Increase in Noise level due to Terminal operation
- Impact on air quality due to dust emissions by cargo operation, exhaust gases emission from engines and other machinery and vessel traffic.
- Traffic congestion on local road network due to load vehicles.
- The effects above will persist during terminal operation period.
- Pangaon is a new Cargo Terminal while Ashunganj site is currently under operation. Thus deterioration of ambient noise level and air quality will be worse for Pangaon site.

In general, we need to follow the following measures for all sites:

- BIWTA needs to review the situation and involve all parties, vessel operators, CT, ICD and PT authorities to jointly prepare and implement a pollution control program.
- The present access road in the area needs to be widened to accommodate the increased traffic load with provision for a permanent local traffic control system
- Ensure that all transports, vehicles comply with the GoB set standards, use emission reduction and sound reduction devices.

To keep the project influence area environmentally friendly, BIWTA should ensure that the Contractor prepares site specific EMPs including Emergency Response Plan, and Mitigation Measures Plan, regular and effective monitoring of environmental quality parameters as indicated in this ESIA report.

Based on the assurance of minimal disturbance to the natural environment and implementation of ESMP in every step of the project activities, the proposed Project could be environmentally feasible. Then DOE may issue necessary environmental clearance to such a nationally important project. BIWTA should follow the guidelines illustrated in the ESMP and other legal and administrative requirements to carry out the activities for improvement of the terminal facilities.

On the other hand, the Project will require a considerable amount of manpower during construction and operation stage. The operation of terminals will generate new employment opportunities for the people directly or indirectly on permanent and temporary basis. Besides, some backward linkage institutions will be established considering updating of the terminals and new business ventures i.e. suppliers, contractors/subcontractors, new water vessels launching, etc. are opened. The laborers, who will be engaged in construction period, may or may not be deployed in operation phase of the project due to lack of relevant skills. They would be trained on some specific tasks particularly for the cargo terminals, that will help them getting job in operation phase which will reduce unemployment.

Opportunities of local goods and services will be enough to provide required support to the huge quantity of employees. Local businessmen will make available necessary goods in the local market. Employees and businessmen will be more benefitted from the project and therefore their economic condition will be improved.

Local people can travel with safety and security in the water vessels and businessmen can develop their business by carrying more goods and enjoy facilities of improved cargo terminals.

9.1. RECOMMENDATIONS

The implementation of the project is suggested to proceed following the recommended mitigation measures as outlined in the ESMP. The ESMP shall be included in the bid document of civil works and need to become part of the civil works contracts.

The timely implementation of ESMP will reduce negative impacts.

The ESMP is a living document and will need to be continuously updated by BIWTA during the construction and operation to reflect any significant changes in the project scope of work with recommended mitigation measures or to respond to the regular environmental monitoring results, collection and analysis of detailed bio-physical and environmental data.