Government of the People's Republic of Bangladesh
Ministry of Water Resources

Bangladesh Water Development Board

PROJECT COMPLETION REPORT : IMED 04/2003 (Revised)

for

Detailed Feasibility Study for Identifying Erosion Vulnerability and Protection of Proposed Economic Zone Construction at Bhuapur Upazila in Tangail District

November, 2022

Government of the People's Republic of Bangladesh
Ministry of Planning
Implementation Monitoring and Evaluation Division

PROJECT COMPLETION REPORT: IMED 04/2003 (Revised)

A. PROJECT DESCRIPTION:

01.	**Name of the Project**	:	Detailed Feasibility Study for Identifying Erosion Vulnerability and Protection of Proposed Economic Zone Construction at Bhuapur Upazila in Tangail District **(Project code- 224344800)**
02.	**Administrative Ministry/Division**	:	Ministry of Water Resources (MoWR)
03.	**Executing Agency**	:	Bangladesh Water Development Board (BWDB)
04.	**Location of the Project**	:	Bhuapur, Tangail

05. Objective of the Project:

The overall objective of the study is to devise measures for protection of the proposed Tangail Economic Zone (TEZ) from flooding and river bank erosion from the Jamuna River. The study also aims to investigate immediate and long-term solutions for tackling the possible effects on the stability of the East and West guide bundh of Bangabandhu Bridge and Hard Points at Sirajganj and Gobindashi Bazar due to the implementation of the proposed TEZ along with necessary protective works and infrastructures considering technical, environmental and social aspects. It also requires devising appropriate measures for protection of Bangabandhu Cantonment adjacent to Bangabandhu Bridge from erosion of Jamuna River.

The specific objectives of the project are:

Technical

- To review the existing protective works and morphological changes in the study area;
- To analyze the effects of land development along with necessary infrastructures to protect proposed TEZ on the Bangabandhu bridge and Hard Points at Sirajganj and Gobindashi Bazar;
- To enhance the understanding of the dynamic erosion phenomena in details;
- To predict morphological changes both in long and short term for land development along with necessary infrastructures to protect proposed TEZ;
- To assess the need of dredging, dredging alignment, char conservation & dredging volume with design and prepare dredged material management plan;
- To develop different potential options for protection of the proposed TEZ from flood and river bank erosion from Jamuna River considering hydrodynamic and morphological condition;
- To devise options for protection of Bangabandhu Cantonment adjacent to Bangabandhu Bridge from erosion of the Jamuna River considering hydrodynamic and morphological condition;
- To develop integrated and sustainable river management plan for the study area with "no regret" concept (BDP 2100).

Environmental and Social

- To conduct an Environment and Social Impact Assessment (ESIA) study.
- To conduct baseline conditions of the project area.
- To assess the project with respect to Environmental Sustainability, Climate Resilience and Disaster Risk and find the ways for reducing/mitigating negative impacts;
- To prepare environmental enhancement and conservation plan.
- To prepare biodiversity conservation plan.
- To devise a plan for improved livelihood in the developed chars within project area.
- To develop Environmental Management and Monitoring Plan (EMMP) for conservation of aquatic resources, fisheries resources, bird sanctuaries etc.

06. Estimated Cost :

(In lakh Taka)

	Original	Latest Revised
(a) Total	282.38	-
(b) Taka	282.38	-
(c) Foreign Currency	-	-
(d) Project Aid	-	-
(e) RPA	-	-

		PCP/PFS	PP
07. Date of Approval	:		
(a) Original	:	**07.10.2021**	-
(b) Latest Revised	:	-	-

08. Implementation Period :

	Date of Commencement	Date of Completion
(a) Original	October 2021	June 2022
(b) Latest Revised	-	-
(c) Actual	October 2021	June 2022

09. Financing Arrangement (Source-wise):

9.1 Status of Loan/Grant

a) Foreign Financing : *Not Applicable*

Source (s)	Currency as per Agreement	Amount in US $ (Million)	Nature (Loan/Grant/ supplier's/ credit)	Date of Agreement	Date of Effective-ness	Date of Closing	
						Original	Revised
1	2	3	4	5	6	7	8

b) GOB:

(In lakh Taka)

Total amount	Loan	Grant	Cash Foreign Exchange
1	2	3	4
282.38	-	282.38	-

9.2 Utilization of Project Aid: *Not Applicable* (In million)

Source (s)	Total Amount		Actual Expenditure		Unutilized Amount	
	In US $	In Local Currency	In US $	In Local Currency	In US $	In Local Currency
1	2	3	4	5	6	7

9.3 Re-imbursible Project Aid (RPA) : *Not Applicable*

(In lakh Taka)

R P A Amount		Amount Spent	Amount Claimed	Amount Re-imbursed	Remarks
As per PP	As per Agreement				
1	2	3	4	5	6

B. IMPLEMENTATION POSITION

01. Implementation Period:

Implementation Period as per PP		Actual Implementation period	Time Over-run (% of original implementation period)	Remarks
Original	Latest Revised			
1	2	3	4	5
October,2021-June, 2022 (09 Months)	-	October,2021-June, 2022 (09 Months)	-	-

02. Cost of the Project:

(In lakh Taka)

Description	Estimated Cost		Actual expenditure	Cost over-run (% of original cost)	Remarks
	Original	Latest revised			
1	2	3	4	5	6
TOTAL	282.38	-	271.02	-	-
TAKA	282.38	-	271.02	-	-
PA	-	-	-	-	-

03. Project Personnel:

Sanctioned strength as per PP	Manpower employed during execution	Status of the existing manpower			Manpower Employed	
		Manpower requirement for O&M as per pp	Existing manpower for O & M	Others		
1	2	3	4	5	Male	Female
Officer (s)	11	-	-	-	11	0
Staff(s)	11	-	-	-	6	5
Total:	22	Existing Manpower of Directorate of Planning-1, BWDB			17	5

04. Training of Project Personnel (Foreign/Local): No provision of training in this project.

Field of Training /Study tour/workshop/ Seminer etc.	Provision as per PP		Actual		Remarks
	Number of persons	Man - months	Number of persons	Man - months	
1	2	3	4	5	6
a. Foreign	-	-	-	-	
b. Local	-	-	-	-	

05. Component-wise Progress (As per latest approved PFS):

(In lakh Taka)

Items of work (As per PFS)	Unit	Target (as per PFS)		Actual Progress		Reasons for deviation (±)
		Financial	Physical	Financial	Physical	
1	2	3	4	5	6	7
A. Revenue						
1. Consultancy (47 MM)	Lot	274.01	100%	265.735	100%	
2. Other stationary	LS	1.57	100%	1.55	100%	
3. Honorarium/Fees/Renuneration		3.80	100%	1.745	60.53%	
4. Travel Expense	LS	1.00	100%	0.0	0.0%	
Sub-total (Revenue):		**280.38**		**269.03**		
B. Capital						
1. Computer and accessories	LS	2.00	100%	1.99	100%	
Sub-total (Capital):		**2.00**		**1.99**		
Grand-Total		**282.38**	**100%**	**271.02**	**99.11%**	

06. Information regarding Project Director (s):

Name & Designation with pay Scale.	Full time	Part time	Responsible for more than one project	Date of		Remarks
				Joining	Transfer	
1	2	3	4	5	6	7
Dr. Shamal Chandra Das Superintending Engineer (Civil) Grade-4; 50,000-71,200	Full time	-	Yes	15.11.2021	Till Date	-

07. Procurement of Transport (in Nos.): *Not Applicable*

Type of transport	Number as per P.P.	Procured with date	Transferred to Transport Pool with date	Transferred to O & M with date	Condemned/ damaged with date	Remarks
1	2	3	4	5	6	7
Jeep	-	-	-	-	-	
Pick-up	-	-	-	-	-	
Motor Cycle	-	-	-	-	-	

08. Procurement of Goods, Works and Consultancy Services:

08.1 Goods & Works of the Project costing above Tk. 200.00 lakh and Consultancy above Tk. 100.00 lakh:

Description of procurement (goods/works /consultancy) as per bid document	Tender/Bid/Proposal Cost (in lakh Taka)		Tender/Bid/Proposal		Date of completion of works/services and supply of goods	
	As per PFS	Contracted value	Invitation date	Contract signing/ L.C opening date	As per contract	Actual
1	2	3	4	5	6	7
Detailed Feasibility Study for Identifying Erosion Vulnerability and Protection of Proposed Economic Zone Construction at Bhuapur Upazila in Tangail District	274.01	270.96	17.10.2021	09.12.2021	30.06.2022	30.06.2022

8.2 Use of Project Consultant (s) (Foreign/Local):

Name of the Field	Approved man month		Actual man month utilised	Remarks
	As per PP	As per contract		
1	2	3	4	5
a) Foreign:	-	-	-	
b) Local	47	47	47	Conducted by IWM

09. Construction/Erection/Installation Tools & Equipment: *Not Applicable*

Description of items	Quantity (as per PP)	Quantity procured with date	Transferred to O & M with date	Disposed off as per rule with date	Balance	Remarks
1	2	3	4	5	6	7
Laptops	2 set	2 set (Procured at 22/06/2022)	-	-	2 set	Used by Planning BW

C. FINANCIAL AND PHYSICAL PRO

01. (a) Original and revised schedule as per PFS:

Financial Year	Financial provision & physical target as per original PP				Fina
	Total	Taka	P.A.	Physical %	Total
1	2	3	4	5	6
2021-22	282.38	282.38	-	100%	-
Total	**282.38**	**282.38**	**-**	**100%**	**-**

01. (b) **Revised ADP allocation and progress:**

(In lakh Taka)

Financial Year	Revised Allocation & target				Taka release	Expenditure & physical progress			
	Total	Taka	P.A.	Physica l %		Total	Taka	P.A.	Physical %
1	2	3	4	5	6	7	8	9	10
2020-21	282.38	282.38	-	100%	281.00	271.02	271.02	-	100%
Total	**282.38**	**282.38**	**-**	**100%**	**281.00**	**271.02**	**271.02**	**-**	**99.11%**

D. ACHIEVEMENT OF OBJECTIVES OF THE PROJECT:

Objectives as per PP/PFS	Actual achievement	Reasons for shortfall, if any
Technical		
To review the existing protective works and morphological changes in the study area;	Completed (Chapter 2 in Final report) Physical condition of existing protective works and morphological changes in the river regime with in the study reach have been investigated and reviewed through field visits, collection of the following relevant data and analyzing the same: • 30 km (20km at upstream and 10km at downstream respectively of Bangabandhu Bridge) of bathymetric survey. • Water level and discharge data at different locations of structure like BHP, SHP, WGB, EGB etc. • Cross section data of 20 years (2000 to 2019) within the study area of the Jamuna river. • 21 years satellite images.	-
	Information in relation to the hydro-morphological characteristics, existing structures and riverbank protective works, their performance and present condition have also been studied through reviewing past studies.	
To analyze the effects of land development along with necessary infrastructures to protect proposed TEZ on the Bangabandhu bridge and Hard Points at Sirajganj and Gobindashi Bazar;	Completed (Chapter 3 Section 3.10 in Final report) Effects of land development along with necessary infrastructures to protect proposed TEZ on Bangabandhu bridge and Hard Points at Sirajganj and Gobindashi Bazar have been analysed through model simulation.	-
To enhance the understanding of the dynamic erosion phenomena in details;	Completed (Chapter 3 Section 3.7 in Final report) Historical Planform Changes including those during the "Capital Dredging" period by BWDB and recent changes after the "Capital Dredging" near the Study area, have been studied to enhance the understanding of dynamic erosion phenomena in details.	-

Objectives as per PP/PFS	Actual achievement	Reasons for shortfall, if any
To predict morphological changes both in long and short term for land development along with necessary infrastructures to protect proposed TEZ;	Completed (Chapter 3 Section 3.9 in Final report) Through Mathematical Model Analysis, the long- and short-term morphological changes due to land development have been predicted.	-
To assess the need of dredging, dredging alignment, char conservation & dredging volume with design and prepare dredged material management plan;	Completed (Chapter 8 in Final report) The dredging alignment, dredging volume with dredging strategy and design, dredged material management plan have been proposed.	-
To develop different potential options for protection of proposed TEZ from flood and river bank erosion from Jamuna River considering hydrodynamic and morphological condition;	Completed (Chapter 8 Section 8.2 in Final report) Four (4) different options have been proposed. And these are: • Option-1: Intervention of Preliminary Bank Protection by phases plus dredging • Option-2: Intervention of Cross-Bars plus dredging (3 Cross-Bars, first one of length of 1.85km with termination of 300m followed by two consecutives of 1.95 km and 1.85 km respectively. along with the same Dredging intervention activity adjacent to TEZ) • Option-3: Intervention of Top Block Permeable Groyne (TBPG) with Option-2. • Option-4: Intervention of Partial TEZ with Cross-Bar plus dredging along with 9.33 km protective works (One Cross-Bar of length of 1.22km with with 5.56 km dredging adjacent to the alternate proposed TEZ. In this option the area of TEZ would be reduced to 885 acres). Option-4 was recommended using mathematical model results & engineering judgment.	-
To devise options for protection of Bangabandhu Cantonment adjacent to Bangabandhu Bridge from erosion of Jamuna River considering hydrodynamic and morphological condition;	Completed (Chapter 8 in Final report) Considering the hydrodynamic and morphological changing conditions, the four interventions for the protection of TEZ have been proposed in connection with the protection of Bangabandhu Cantonment adjacent to Bangabandhu Bridge from erosion.	-
To develop integrated and sustainable river management plan for the study area with "no regret" concept (BDP 2100).	Completed (Chapter 3 And Chapter 8 in Final report) As a part of "no regret" concept (BDP 2100), few steps have been taken for the sustainability of the Jamuna River. Such as: • The erosion prone reaches have been found out, • Future morphological changes have been	-

Objectives as per PP/PFS	Actual achievement	Reasons for shortfall, if any
	predicted through mathematical model analysis; • Proper protection work have been proposed, • A dredging alignment has been incorporated, Dredged material management plan has been given etc.	
Environmental & Social Study		
To conduct an Environment and Social Impact Assessment (ESIA) study.	Completed (Chapter 4 in Final report) The environmental and social impacts due to the TEZ project have been assessed and presented as a ESIA report in DoE format.	-
To conduct baseline conditions of the project area.	Completed (Chapter 4 in Final report) The present environmental and social baseline condition data of the study area have been collected through field survey. And some of these data are: • Air, water, noise and soil quality data, • Climate condition, temperature, rainfall, humidity of the study area, • Biological diversity of the area, • Socio-economic condition of the area, Infrastructure facilities etc.	-
To assess the project with respect to Environmental Sustainability, Climate Resilience and Disaster Risk and find the ways for reducing/mitigating negative impacts;	Completed (Chapter 4 Section 4.2 and 4.3 in Final report) All the negative/positive impacts have been predicted considering the Climate Resilience and Disaster Risk. And the mitigation measures have also been incorporated.	-
To prepare environmental enhancement and conservation plan.	Completed (Section 4.4; 4.5; 4.6 in Final report) An Environmental Management Plan (EMP) has been incorporated in EIA report.	-
To prepare biodiversity conservation plan.	Completed (Section 4.4 in Final report) For the preservation of endangered species and to hold the quality of various environmental parameters according to ECR'97, a biodiversity plan has been prepared.	-
To devise a plan for improved livelihood in the developed chars within project area.	Completed (Section 4.6 and 4.7 in Final report) Proper management and monitoring plan with the disaster risk assessment, emergency response and disaster management plan have been given to develop the livelihood of the char area.	-
To develop Environmental Management and Monitoring Plan (EMMP) for conservation of aquatic resources, fisheries resources, bird sanctuaries etc.	Completed (Section 4.6 in Final report) EMMP for conservation of aquatic resources, fisheries resources, bird sanctuaries have been prepared.	-

E. BENEFIT ANALYSIS

01. Annual Out-put: ***Not Applicable*** **for the Study Project.**

Items of out-put	Unit	Estimated quantity expected at full capacity	Actual quantity of out-put during the 1st year of operation at full capacity (or during, real production for newly completed project).

02. Cost / Benefit: ***Not Applicable*** **for the study project**

Item	Estimated	Actual
(1) Benefit cost ratio of the project (i) Financial (ii) Economic (2) Internal Rate of Return (i) Financial (ii) Economic		

03. Please give reasons for shortfall, if any, between the estimated and actual benefit: ***Not Applicable***

F. MONITORING AND AUDITING

1. Monitoring: ***Nil***

Name & designation of the inspecting official	Date of Inspection	Identified Problems	Recommendations
1	2	3	4

(a) **Ministry / Agency:**

(b) **IMED:**

(c) **Others:** **(Please specify)**

2. Auditing during and after Implementation:

2.1. Internal Audit: ***No audit conducted.***

Period of Audit	Date of submission of Audit Report	Major findings/ objections	Whether objections resolved or not.
1	2	3	4
-	-	-	-

2.2. External Audit:

Audit period	Date of submission of Audit Report	Major findings/ objections	Whether objections resolved or not.
1	2	3	4
01/09/2022-07/09/2022	-	No objections arisen	-

G. DESCRIPTIVE REPORT

1. General Observations/Remarks of the Project on:

1.1 Background

Bank line shifting due to erosion and flood during monsoon in the major rivers is a major concern in Bangladesh. These rivers carry huge number of sediments during high monsoon flow. River banks of Bangladesh tender little resistance to the hydraulic forces of the rivers especially during the periods of high flow. Major rivers of Bangladesh are meandering and braided and become very active during flood season. The Jamuna is one of the world's largest braided rivers. The Jamuna River is a hydro-morphologically very dynamic river and is subject to large and variable discharges of water and sediment which result in its braided pattern. During floods, large discharge and heavy sediment load cause the Jamuna River to be extremely unstable, so it constantly migrates in lateral directions. This trend of lateral channel movement is accountable for erosion of the river banks. A GIS and remote sensing (RS) based study shows erosion rate varies from 37-92 m/year from Kazipur to Sirajganj Hard point during 1976-2015.

Proposed Tangail Economic Zone (TEZ) consisting of 502.02 acres is going to be established in the Gobindabashi and Nikrail unions at Bhuapur Upazila of Tangail district. This 502.02-acre land has been already registered to Bangladesh Economic Zone Authority (BEZA). Another 1250 acres of land acquisition is under process which would extend the economic zone area about 1752 acres. Proposed TEZ is going to be established in the left bank of the Jamuna River. This emerged the necessity of protecting this newly formed economic zone from flooding and river bank erosion.

As per directives of honorable agricultural minister of GoB and member of the parliament (Tangail-1), the concerned field office of BWDB visited the proposed project area of TEZ and sent design data to the concerned design wing of BWDB. Design office prepared a draft design of protective work and included following observations:

- As the proposed work site is located adjacent to the U/S of East side Guide Bundh of Bangabandhu bridge, a KPI (Key Point Installation) structure, any kind of intervention i.e. proposed land development along with protective work may affect the stability of the bridge. So, before undertaking such development work, detail physical and mathematical model study should be performed.

- Feasibility study of this project shall include physical and mathematical model analysis of west and east side guide bundh of Bangabandhu bridge and hard point at Sirajganj and Gobindasi bazaar.

Proposed land development for the TEZ along with protective work may affect those infrastructures. According to the observations from design office and decision from subsequent follow-up meeting

held between BEZA authority and BWDB officials, a detailed feasibility study including mathematical and physical model is required before implementing works of TEZ.

In these circumstances, before implementing the physical works of TEZ and potential protective options- it is important to undertake a study to analyze such probable effects on the surrounding infrastructures and riverbank morphology. Morphological study by using mathematical and physical modeling tools can be used as effective approaches to assess with and without project conditions in an integral manner and to devise erosion protection plan and design. BWDB decided to carry out a detail mathematical modeling study for protection of TEZ from flooding and river erosion of the Jamuna River.

1.2 Justification/Adequacy

Linkage WithBangladesh Delta Plan (BDP), 2100

Bangladesh Delta Plan (BDP) 2100 is a water centric, multi sectoral techno-economic long term adaptive plan. Delta Vision and Goals show a broader scope (water, food, economy) leading to a holistic approach with 19 themes. Among those themes first two themes are directly related to Water resources. Those themes are-

i)Morphological Dynamics & River Management
ii) Water Resources

The Project will contribute to the implementation of the Bangladesh Delta Plan 2100 from technical aspect. The concept of the project is in line with BDP2100. Particularly, the Project contributes to the following goals, strategies and sub-strategies:

BDP 2100 Higher Level Goals
Goal 1: Eliminate extreme poverty by 2030;
Goal 2: Achieve upper middle-income status by 2030; and
Goal 3: Being a Prosperous Country beyond 2041.

BDP 2100 Specific Goals
Goal 1: Ensure safety from floods and climate change related disasters;
Goal 3: Ensure sustainable and integrated river systems and estuaries management;
Goal 6: Achieve optimal and integrated use of land and water resources.

Strategy at National Level
Flood Risk (FR) Management Strategies
- Strategy FR 1: Protecting Economic Strongholds and Critical Infrastructure.
- Strategy FR 2: Equipping the Flood Management and Drainage (FMD) Schemes for the Future
- Strategy FR 3: Safeguarding Livelihoods of Vulnerable Communities
- Sub-strategy FR 3.7: River management as well as improved flood management, drainage, O&M and flow management

Hotspot Specific Strategies
5) River Systems and Estuaries
- Improvement of the conveyance capacity as well as stabilize the rivers
- Strengthening river and estuaries management in the newly accredited lands;

Linkage withSustainable Development Goal (SDG), 2100

SDGs' Goal	Relevant Target
SDG 6. Ensure availability andsustainable managementof water and sanitation for all	**SDG 6.5.** By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate • **Indicator 6.5.1.** Degree of integrated water resources management

1.3 Objectives

The overall objective of the study is to devise measures for protection of proposed TEZ from flooding and river bank erosion from the Jamuna River. The study also aims to investigate immediate and long-term solutions for tackling the possible effects on the stability of the East and West guide bundh of Bangabandhu Bridge and Hard Points at Sirajganj and Gobindashi Bazar due to the implementation of proposed TEZ along with necessary protective works and infrastructures considering technical, environmental and social aspects. It also requires devising appropriate measures for protection of Bangabandhu Cantonment adjacent to Bangabandhu Bridge from erosion of the Jamuna River.
The specific objectives of the project are:

Technical

- To review the existing protective works and morphological changes in the study area;
- To analyze the effects of land development along with necessary infrastructures to protect proposed TEZ on the Bangabandhu bridge and Hard Points at Sirajganj and Gobindashi Bazar;
- To enhance the understanding of the dynamic erosion phenomena in details;
- To predict morphological changes both in long and short term for land development along with necessary infrastructures to protect proposed TEZ;
- To assess the need of dredging, dredging alignment, char conservation & dredging volume with design and prepare dredged material management plan;
- To develop different potential options for protection of proposed TEZ from flood and river bank erosion from Jamuna River considering hydrodynamic and morphological condition;
- To devise options for protection of Bangabandhu Cantonment adjacent to Bangabandhu Bridge from erosion of Jamuna River considering hydrodynamic and morphological condition;
- To develop integrated and sustainable river management plan for the study area with "no regret" concept (BDP 2100).

Environmental and Social

- To conduct an Environment and Social Impact Assessment (ESIA) study.
- To conduct baseline conditions of the project area.
- To assess the project with respect to Environmental Sustainability, Climate Resilience and Disaster Risk and find the ways for reducing/mitigating negative impacts;
- To prepare environmental enhancement and conservation plan.
- To prepare biodiversity conservation plan.
- To devise a plan for improved livelihood in the developed chars within project area.
- To develop Environmental Management and Monitoring Plan (EMMP) for conservation of aquatic resources, fisheries resources, bird sanctuaries etc.

1.4 Project revision with reasons: Not Applicable

2. Rationale of the project in respect of Concept, Design, Location and Timing.

Tangail Economic Zone (TEZ) would consist of 502.02 acres area along left bank of the Jamuna near Gobindashi and Nikrail unions at Bhuapur Upazila of Tangail district. These 502.02 acres land has been already registered to Bangladesh Economic Zone Authority (BEZA). Another 1250 acres of land acquisition is under process which would extend the economic zone area to about 1752 acres. The proposed Tangail Economic Zone site is located within the river corridor of the river Jamuna and some of the tributaries of the Jamuna are flowing through the TEZ site and merged with the main river within 1.5 km from the southern boundary of the site. The site usually gets inundated completely during the monsoon due to heavy flow & flood from the Jamuna River. The east guide bund of the existing Bangabandhu Bridge is adjacent to d/s the proposed site on the north. As such, development of the EZ would take care of any adverse condition that may affect its stability. It is essential to protect the economic zone from flooding and river bank erosion of the Jamuna River. At the same time, it is also necessary to know about the impact of the presence of the TEZ on overall morphology of the Jamuna in the vicinity of the bridge area, on the bridge and its ancillary structures and devise the TEZ accordingly. This present study aims to conduct a mathematical modelling study to provide an assessment of past and probable bank erosion, impact of the TEZ on the existing structures (EGB, WGB, Bangabandhu Bridge, Bhuapur hard point, etc.) from hydro-morphological view point.

3. Brief description on planning and financing of the project and its applicability.

- **Project Identification**

Government of Bangladesh has taken initiatives towards shaping up the country's economy as a "developed economy" by 2041. Focusing this initiative of the government, Bangladesh Economic Zones Authority (BEZA), the nodal agency and regulator of economic zone (EZ) development in the country, has embarked in an ambitious journey of proliferation of EZs within the country. To support the commitment of the government to develop EZs in Bangladesh, BEZA intends to undertake 12 independent studies for setting up 12 Economic Zones in various locations, where Tangail Economic Zone is one of the important establishments.

The proposed Tangail Economic Zone site is located within the river corridor of the river Jamuna and some of the tributaries of the Jamuna are flowing through the TEZ site and merged with the main river within 1.5 km from the southern boundary of the site. The site usually gets inundated completely during the monsoon due to heavy flow & flood from the Jamuna River. The east guide bund of the existing Bangabandhu Bridge is adjacent to d/s the proposed site on the north. As such, development of the EZ would take care of any adverse condition that may affect its stability. It is essential to protect the economic zone from flooding and river bank erosion of the Jamuna River. At the same time, it is also necessary to know about the impact of the presence of the TEZ on overall morphology of the Jamuna in the vicinity of the bridge area, on the bridge and its ancillary structures and devise the TEZ accordingly.

- **Project Preparation**

Proposed land development for the TEZ (Tangail Economic Zone along with protective work may affect those infrastructures. According to the observations from BWDB design office and decision from subsequent, follow-up meeting held between BEZA authority and BWDB officials, a detailed feasibility study including mathematical and physical model is required before implementing works of TEZ.

A river acts in different manner from its usual course when it is subjected to any kind of obstruction like river bank protection work to stabilize the bank, bridge piers, guide bund, dredging, abutments, etc. Mathematical modelling is the state-of-the-art technology to apply during planning & design, implementation and post construction stages of structures for safe and economic design of the same and devising suitable mitigation measures.

- **Appraisal:** DPEC Meeting was held on 06.09.2021 at MoWR
- **Credit Negotiation: N/A**
- **Credit Agreement: N/A**
- **Credit Effectiveness: N/A**
- **Loan Disbursement: N/A**
- **Loan Conditionalities: N/A**
- **Project Approval:** The project was approved by the Honorable State Minister, MoWR on 07.10.2021
- **Others (if any): N/A**

4. <u>Analysis of the Post-Implementation situation and result of the project</u>: ***Not Applicable for this study project***

4.1 Whether the beneficiaries of the project have clear knowledge about the Target/ Objectives of the project.

4.2 Programme for use of created-facilities of the project

4.3 O & M programme of the project.

4.4 Impact of the project -

4.4.1 Direct

4.4.2 Indirect

4.5 Transfer of Technology and Institutional Building through the project

4.6 Employment generation through the project.

4.7 Possibility of Self employment

4.8 Possibility of women-employment opportunity

4.9 Women's participation in development

4.10 Probable Impact on Socio-Economic activity.

4.11 Impact on environment

4.12 Sustainability of the project

4.13 Contribution to poverty alleviation/reduction

4.14 Opinion of the public representatives, local elite, local administration, teachers, religious leaders, women's representatives etc.

4.15 Contribution of Micro-credit programmes and Comments on overlapping with any NGO activities.

5. Problems encountered during Implementation (with duration & steps taken to remove those)

5.1 Project Management
5.2 Project Director
5.3 Land Acquisition
5.4 Procurement
5.5 Consultancy
5.6 Contractor
5.7 Manpower
5.8 law & Order
5.9 Natural clamity
5.10 Project financing, allocation and
5.12 Project aid disbursement and re-imbursment
5.13 Mission of the development partners.
5.14 Time & Cost Over-run
5.15 Project Supervision/Inspection
5.16 Delay in Decision
5.17 Transport
5.18 Training
5.19 Approval
5.20 Others.

release.

5.11 Design formulation/approval

It is a consultancy service procurement project. The above problems don't occur.

6. Remarks & Recommendations of the Project Director:

"Detailed Feasibility Study for Identifying Erosion Vulnerability and Protection of Proposed Economic Zone Construction at Bhuapur Upazila in Tangail District" was sanctioned in administrative approval from Ministry of Water Resources given vide memo no-42.00.0000.040.014.010.2021-365 dated:07/10/2021. Project has been completed on 30/06/2022 successfully.

The project area of Tangail Economic Zone (TEZ) is located at upstream of the East side Guide Bundh of the Bangabandhu bridge over Jamuna River and the hard point at Gobindashi bazaar. The West Guide Bundh of the Bangabandhu Bridge and Sirajgang Hard Point, located at the opposite bank of the river, are close to the project area. It can be noted that the Jamuna River is one of the world's largest braided rivers. It is hydro-morphologically very dynamic and subject to large and variable discharges of water and sediment, which result in its braided pattern. During floods, large discharge and heavy sediment load cause the Jamuna River to be extremely unstable which causes river erossion.

The overall objective of the study is to devise measures for protection of TEZ from flooding and river bank erosion from Jamuna River. The study also aims to investigate immediate and long-term solutions for tackling the possible effects on the stability of the East and West guide bundh of Bangabandhu Bridge and Hard Points at Sirajganj and Gobindashi Bazar due to the implementation of TEZ along with necessary protective works and infrastructures considering technical, environmental and social aspects.

For the stability of TEZ alternative four options were proposed. Among those, one option was recommended with proper mathematical model results & engineering judgment. One Cross-Bar of length of 1.22 km with 5.56 km dredging (66.21 million cubic-meter dreding volume) and 9.33 km protective works adjacent to the TEZ is proposed in the study recommendation. The impact of this project was also analyzed in the point of view of environmental & social. The Impact Mitigation Plan (IMP), Disaster Risk & Emergency Response Plan have been also assessed.

Estimated cost for the investment project is BDT 123048.44 Lakh where Economic IRR is 12.52%, Economic NPV is BDT 3956.02 crore and Economic BCR is 1.03. As, Economic BCR is greater than 1, thus considering it the project is economically feasible to implement. All the major activities have been accomplished under the project. The design, cost estimate and ESIA have been prepared through this study based on which the DPP of the investment project would be finalized.

24-11-2022

Date: .....

Signature and seal

(Dr. Shamal Chandra Das)
Superintending Engineer (Civil)
Directorate of Planning-1
BWDB, Dhaka.

Approved

(FAZLUR RASHID)
Director General
BWDB, Dhaka.

Government of the People's Republic of Bangladesh
Ministry of Water Resources

Bangladesh Water Development Board

Detailed Feasibility Study for Identifying Erosion Vulnerability and Protection of Proposed Economic Zone Construction at Bhuapur Upazila in Tangail District

FINAL REPORT

JUNE 2022

Water Environment & Climate

INSTITUTE OF WATER MODELLING

EXECUTIVE SUMMARY

Basic Information

1	Name of the Project	:	Detailed Feasibility Study for Identifying Erosion Vulnerability and Protection of Proposed Economic Zone Construction at Bhuapur Upazila in Tangail District
2	(a) Sponsoring Ministry/Division (b) Implementing Agency	:	Bangladesh Economic Zones Authority (BEZA) Attached with Prime Minister's Office (PMO) Bangladesh Water Development Board (BWDB)
3	Project Objectives (Project to be taken based on the study)	:	-To devise measures for protection of Tangail Economic Zone (TEZ) from flooding and river bank erosion from Jamuna River. -To investigate immediate and long-term solutions for tackling the possible effects on the stability of the East and West guide bundh of Bangabandhu Bridge and Hard Points at Sirajganj and Gobindashi Bazar due to the implementation of TEZ along with necessary protective works and infrastructures considering technical, environmental, and social aspects.
4	Estimated Project Cost (Taka in Core)	:	
5	Sector & Sub-Sector	:	• Water Resources • River Training
6	Project Category (Based on Environment Conservation Rules 1997)	:	Red Category
7	Project Geographic Location (a) Countrywide (b) Division (c) District (d) Upazila (e) Others (City Corporation/Pourashava)	:	(a) Bangladesh (b) Dhaka (c) Tangail (d) Bhuapur
8	Project Duration	:	

Introduction

The Bangladesh Economic Zone Act, 2010, has been introduced by the Government of Bangladesh to facilitate development of Economic Zones (EZs) in the potential regions of the country, aiming to boost up the country's economic development and ensure standard, ecofriendly industrial zone that would encourage more foreign investment. Under this Act, the Bangladesh Economic Zone Authority (BEZA) has been established under the Prime Minister's Office (PMO) and governed by a Board chaired by the Prime Minister. The law provides legal coverage for attracting and leveraging private investment in the development of zones as zone developers or operators, and in the provision of tailored infrastructure services, such as private provision of power, effluent treatment, etc.

In response to the commitment of the Govt. of Bangladesh, BEZA has enthusiastically planned to set up an Economic Zone named Tangail Economic Zone (Hereinafter "TEZ"). The total planned area for the economic zone is 1752 acres at Bhuaur Upazila of Tangail District. BWDB appointed Institute of Water Modeling (IWM) as consultant for undertaking the Detailed Feasibility Study for Identifying Erosion Vulnerability and Protection of Proposed Economic Zone Construction at Bhuapur Upazila in Tangail District.

This present study aims to conduct a mathematical modelling study to provide an assessment of past and probable bank erosion, impact of the TEZ on the existing structures (EGB, WGB, Bangabandhu Bridge, Bhuapur hard point, etc.) from hydro-morphological view point. The present document is the Interim Report of the study titled "Detailed Feasibility Study for Identifying Erosion Vulnerability and Protection of Proposed Economic Zone Construction at Bhuapur Upazila in Tangail District" showing the updated progress of the study.

Objective

The overall objective of the study is to devise measures for protection of TEZ from flooding and river bank erosion from Jamuna River. The study also aims to investigate immediate and long-term solutions for tackling the possible effects on the stability of the East and West guide bundh of Bangabandhu Bridge and Hard Points at Sirajganj and Gobindashi Bazar due to the implementation of TEZ along with necessary protective works and infrastructures considering technical, environmental and social aspects. It also requires devising appropriate measures for protection of Bangabandhu Cantonment adjacent to Bangabandhu Bridge from erosion of Jamuna River.

Technical

- To review the existing protective works and morphological changes in the study area;
- To analyze the effects of land development along with necessary infrastructures to protect TEZ on the Bangabandhu bridge and Hard Points at Sirajganj and Gobindashi Bazar;
- To enhance the understanding of the dynamic erosion phenomena in details;
- To predict morphological changes both in long and short term for land development along with necessary infrastructures to protect TEZ;
- To assess the need of dredging, dredging alignment, char conservation & dredging volume with design and prepare dredged material management plan;
- To develop different potential options for protection of TEZ from flood and river bank erosion from Jamuna River considering hydrodynamic and morphological condition;
- To devise options for protection of Bangabandhu Cantonment adjacent to Bangabandhu Bridge from erosion of Jamuna River considering hydrodynamic and morphological condition;
- To develop integrated and sustainable river management plan for the study area with "no regret" concept (BDP 2100).

Environmental and Social

- To conduct an Environment and Social Impact Assessment (ESIA) study.
- To conduct baseline conditions of the project area.
- To assess the project with respect to Environmental Sustainability, Climate Resilience and Disaster Risk and find the ways for reducing/mitigating negative impacts.
- To prepare environmental enhancement and conservation plan.
- To prepare biodiversity conservation plan.
- To devise a plan for improved livelihood in the developed chars within project area.

To develop Environmental Management and Monitoring Plan (EMMP) for conservation of aquatic resources, fisheries resources, bird sanctuaries etc.

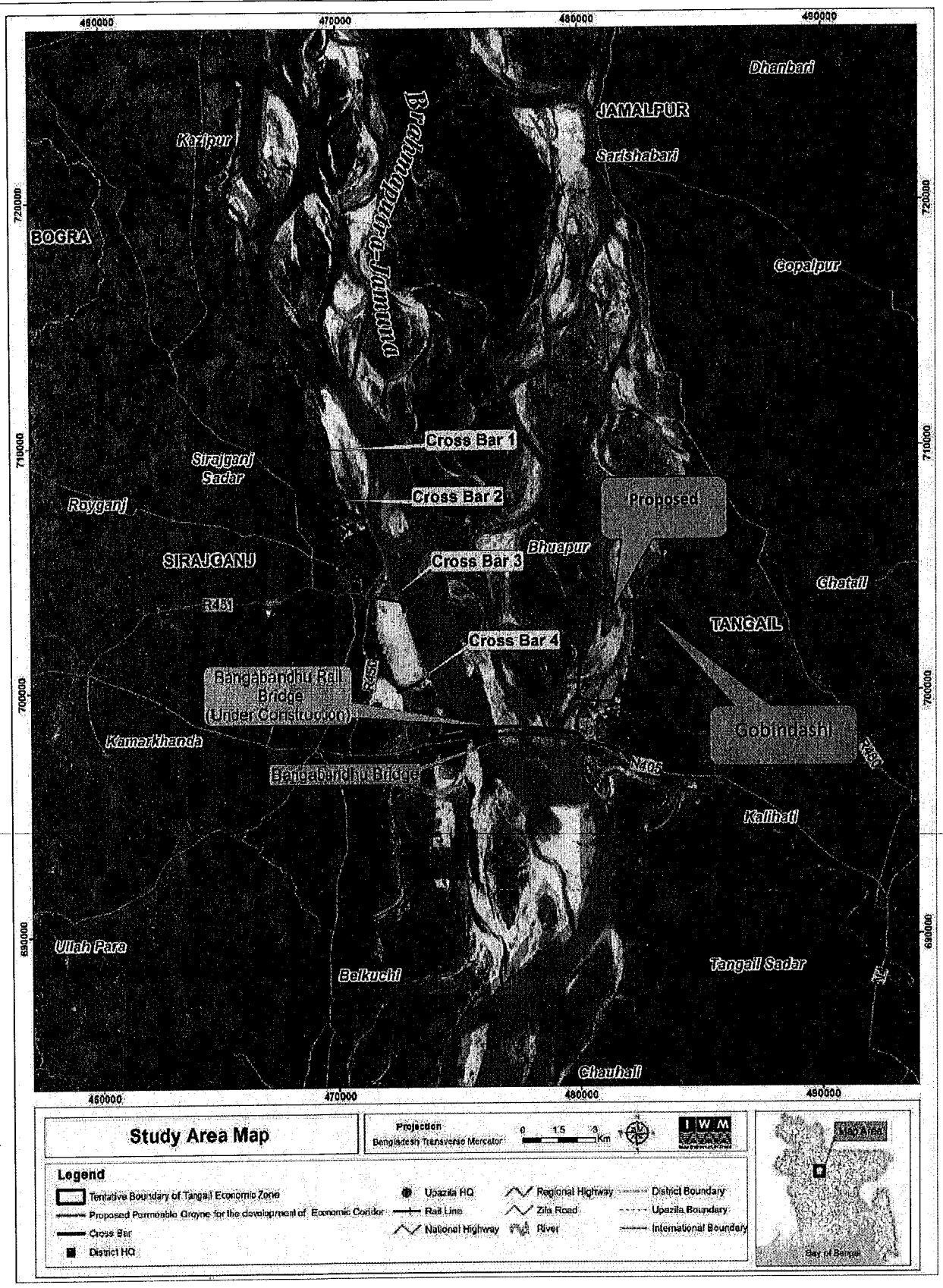

Figure 1: *Map of the Study Area*

Expected Output

Study Reports (with different solution options and recommendation for best option) which includes:

- Provide potential options for protection of the TEZ from flood and erosion of Jamuna;
- Provide potential options for protection of the Bangabandhu Cantonment from erosion of Jamuna;
- Present condition of erosion vulnerable areas and existing protective works showing in bathymetric charts/contour maps of the riverbed and profiles of velocity vector;
- Critical location for devising necessary protective measures; predict on potential threat for the long term;
- Erosion, Flood control and drainage improvement plan with proposed maintenance program;
- Type, location and detailed design of proposed structures, if required;
- Design and drawings for erosion protection works;
- Dredging location and alignment, dredged material management plan, capital and maintenance dredging volume (if needed);
- Comprehensive design parameters for the protective measures, i.e., near bank maximum velocity, d50, scour depth, flow levels and water flow etc.;
- Cost estimate of protective works and dredging (if needed);
- Environmental Management and Monitoring Plan (EMMP) which should include Mitigation Plan, Enhancement Plan, Compensation Plan, and Environmental Monitoring Plan.
- Environmental and Social Impact Assessment study report along with clearance certificate from DoE;
- Recommendation for bio-diversity conservation within the study area;
- Plan for improved livelihood in the char areas;
- Investment cost with year-wise break-up as per DPP requirement;
- Estimation of BCR, EIRR, FIRR, NPV for different option considering project situation as well same for without project condition;
- Costing with phasing and economic analysis considering agriculture, industry, fisheries, shipping, and city development/urbanization sector for the forecasting year 2041 and to achieve Sustainable Development Goals (SDGs) and implement Bangladesh Delta Plan (BDP)-2100;
- Implementation plan.

Collection of Primary data/Information through field measurement

In connection of the project the following data have been collected:

- Bathymetric Data
- Bankline Survey/Structural information
- Water Level Data
- Discharge Data
- Suspended Sediment Data
- Hydrometric Data
- Cross-section Analysis
- Map Collection and Processing

ALTERNATIVE/ OPTIONS ANALYSIS

Considering the Hydro-Morphological situation, the dynamic nature of the Jamuna, and the observed output of the base models, the following alternative approaches with four interventions have been thought for the protection of the "to be developed Tangail Economic Zone area":

Option 1: Preliminary Bank Protection by phases along with a simultaneous Dredging adjacent to TEZ along the alignment of the "would be self-dredging occurrence" as is observed in the base models output. The dredging is suggested to make the channel wider for smooth passage of flood water in monsoon period.

Option 2: 3 Cross-Bars, first one of length of 1.85km with termination of 300m followed by the rest two consecutives of 1.95 km and 1.85 km respectively along with the dredging intervention activity adjacent to TEZ considered in option-1.

Option 3: The option 2 i.e. 3 Cross-Bars and Dredging intervention activity of option 2 with a series of Top Blocked Permeable Groyne (TBPG) at d/s in Kalihati.

Option 4: One Cross-Bar of length of 1.22 km with dredging adjacent to the proposed TEZ, where TEZ in the river side would be along the connecting line between BHP and EGB as shown in **Figure 2**. In this option the area of TEZ would be reduced to 885 acres from 1752 acres of the other three options, where the river regime with biological environment will be preserved and the river corridor would not be disturbed.

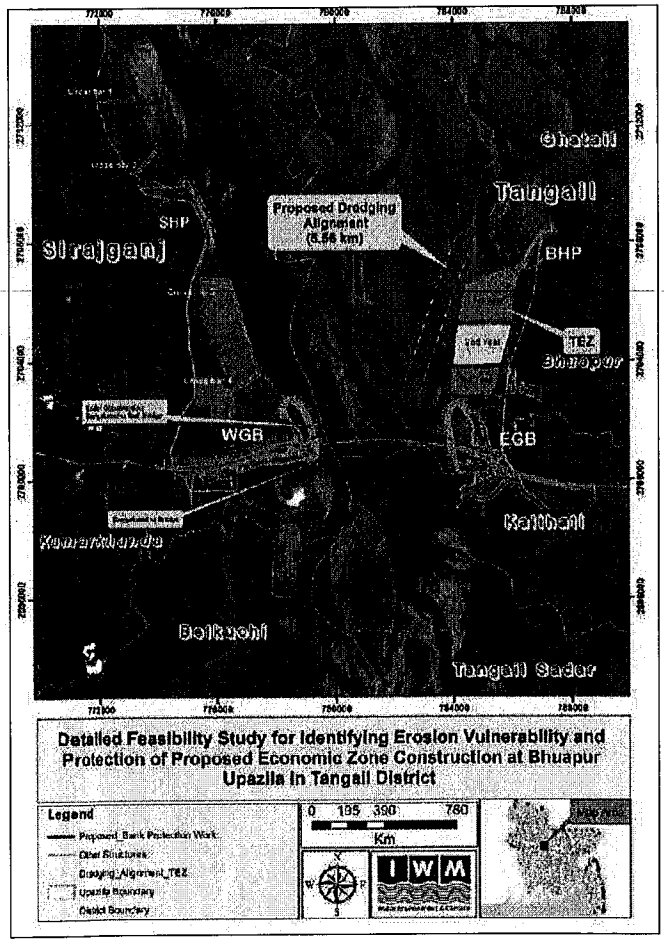

Figure 2 *Intervention of PTEZ with Cross-Bar plus dredging (Option 4)*

Based on the results of mathematical modelling, multi-criteria analysis, construction cost and difficulties, option-4 is found more acceptable with respect to the other options. In "Brahmaputra Economic Corridor" Study report, a dredging alignment is proposed for the navigation of Jamuna River. The placement of TEZ as proposed by BEZA and considered in option 1, option 2, and option 3, interferes with the left proposed channel of the Economic Corridor. In the fourth option the propose position of TEZ can avoid this conflict, and in addition dredging alignment of the fourth option will match the alignment of the left channel of the Economic Corridor. Further the proposed TEZ area in option 1, option 2 and option 3 is not filled up with the available dredged material. Rather it will be sufficient for option 4.

So, considering all these option 4 is recommended.

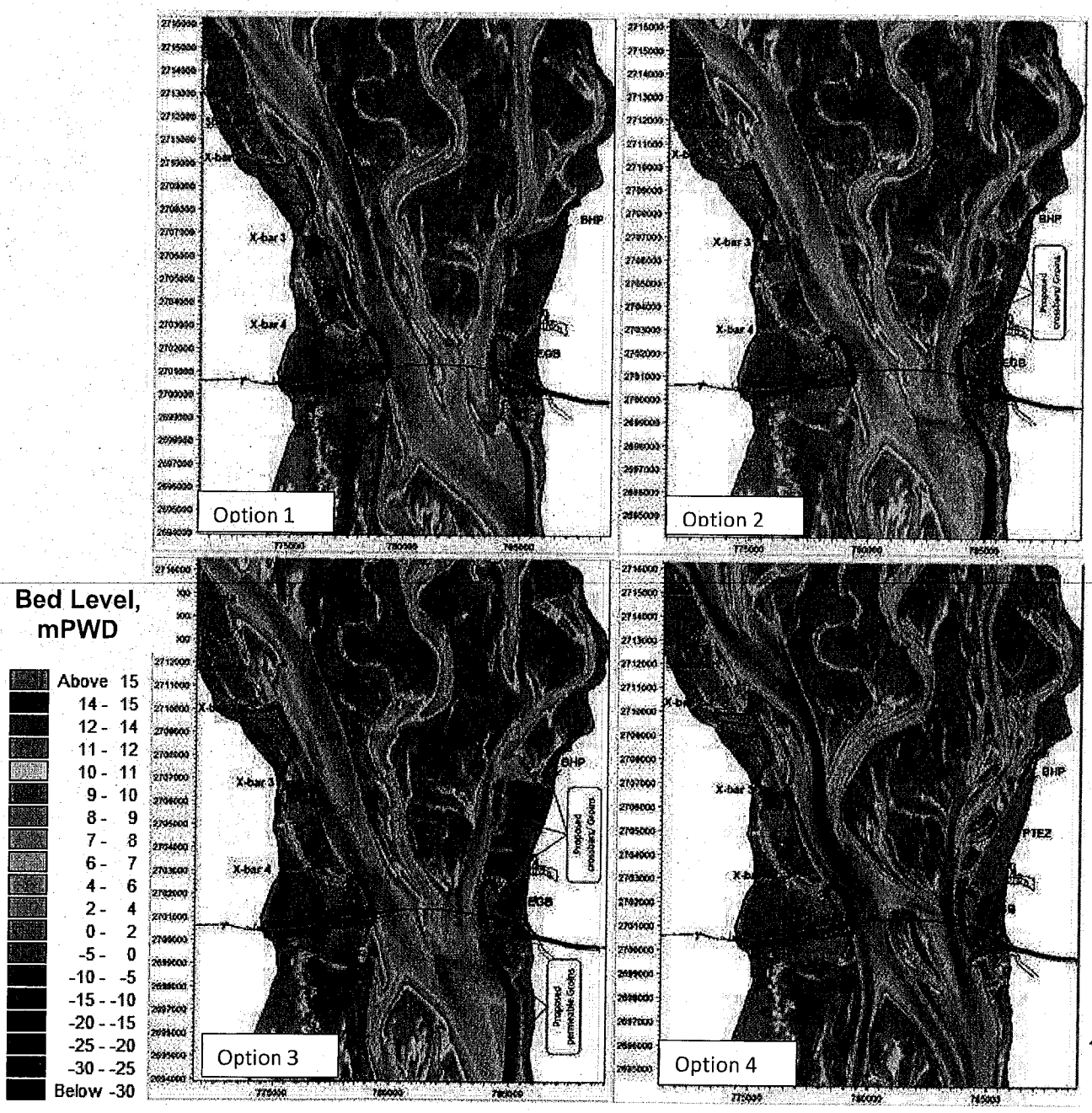

Figure 3 *Model Generated minimum bed level for different options*

Conclusion

The study aimed to make a comprehensive analysis on the morpho-dynamics of the Jamuna River to find out the erosion prone areas & assess the feasibility of TEZ. With the aid of satellite image analysis, it has been observed that the Jamuna River is very dynamic one. Its bank & chars are not stable & changing its with continuously.

Through the mathematical model analysis the critical velocity & scour are assed & depending on these the feasibility of TEZ on proposed site is also assessed. For the stability of TEZ alternative three protective measures or interventions were proposed. Besides among those three which intervention was more accurate, also recommended with proper mathematical model results & engineering judgment.

The impact of this project was also analyzed in the point of view of environmental & social. The Impact Mitigation Plan (IMP), Disaster Risk & Emergency Response Plan were also assessed.

Based on the results of the evaluation on technical aspects, multi-criteria analysis, construction cost and difficulties, option-4 is found more acceptable with respect to the other options. In "Brahmaputra Economic Corridor" Study report, a dredging alignment is proposed for the navigation of Jamuna River. The placement of TEZ as proposed by BEZA and considered in option 1, option 2, and option 3, interferes with the left proposed channel of the Economic Corridor. In the fourth option the propose position of TEZ can avoid this conflict, and in addition dredging alignment of the fourth option will match the alignment of the left channel of the Economic Corridor.

Considering the environmental aspect also, option 4 is more viable. With the dredging work the flow will divert through the dredged channel, which will bring relief to the people living on the banks of the river. Some preliminary effect on the flora and fauna will be recovered with time. In terms of social environment, TEZ shall ensure the compliance with provisions of all relevant ordinances relating to compensation and rehabilitation issues properly. On the other hand, some positive impacts of the project, such as increase in job opportunity and improvement of social infrastructure are also expected

Recommendations

I. The fourth option of the study i.e. one Cross-Bar of length of 1.22 km with dredging adjacent to the proposed TEZ, where TEZ in the river side would be along the connecting line between BHP and EGB as shown in **Figure 2**. In this option the area of TEZ would be reduced to 885 acres from 1752 acres of the other three options, where the river regime with biological environment will be preserved and the river corridor would not be disturbed.

II. Monitoring & evaluation of dredging is most essential and is recommended before, during & after dredging work. Based on monitoring results, maintenance dredging has to be carried out for the sustainability of dredged channel.

III. During pre-construction, construction and post construction period of the protection works necessary precautionary measures should be taken to protect the biodiversity with the implementation of proposed EMP (Environmental Management Plan) EMoP (Environmental Monitoring Plan) in the EIA report.

IV. National 3R Strategy for Waste Management (viz. Reduce, Reuse, Recycle) should be followed for the solid waste management.

V. Development of a green belt surrounding the area should be considered with due importance.

VI. The TEZ should apply the concept of "Corporate Environmental and Social Responsibilities (CESR)" in order to hold the responsibility for the TEZ's actions and encourage a significant positive impact through its activities on the environment,

consumers, employees, communities, stakeholders and all other members of the society.

VII. Before industry development, separate environment impact assessment study should be carried out by individual industries proposed to be developed in the EZ.

VIII. And every industry should have their own individual or combined ETP (Effluent Treatment Plant).

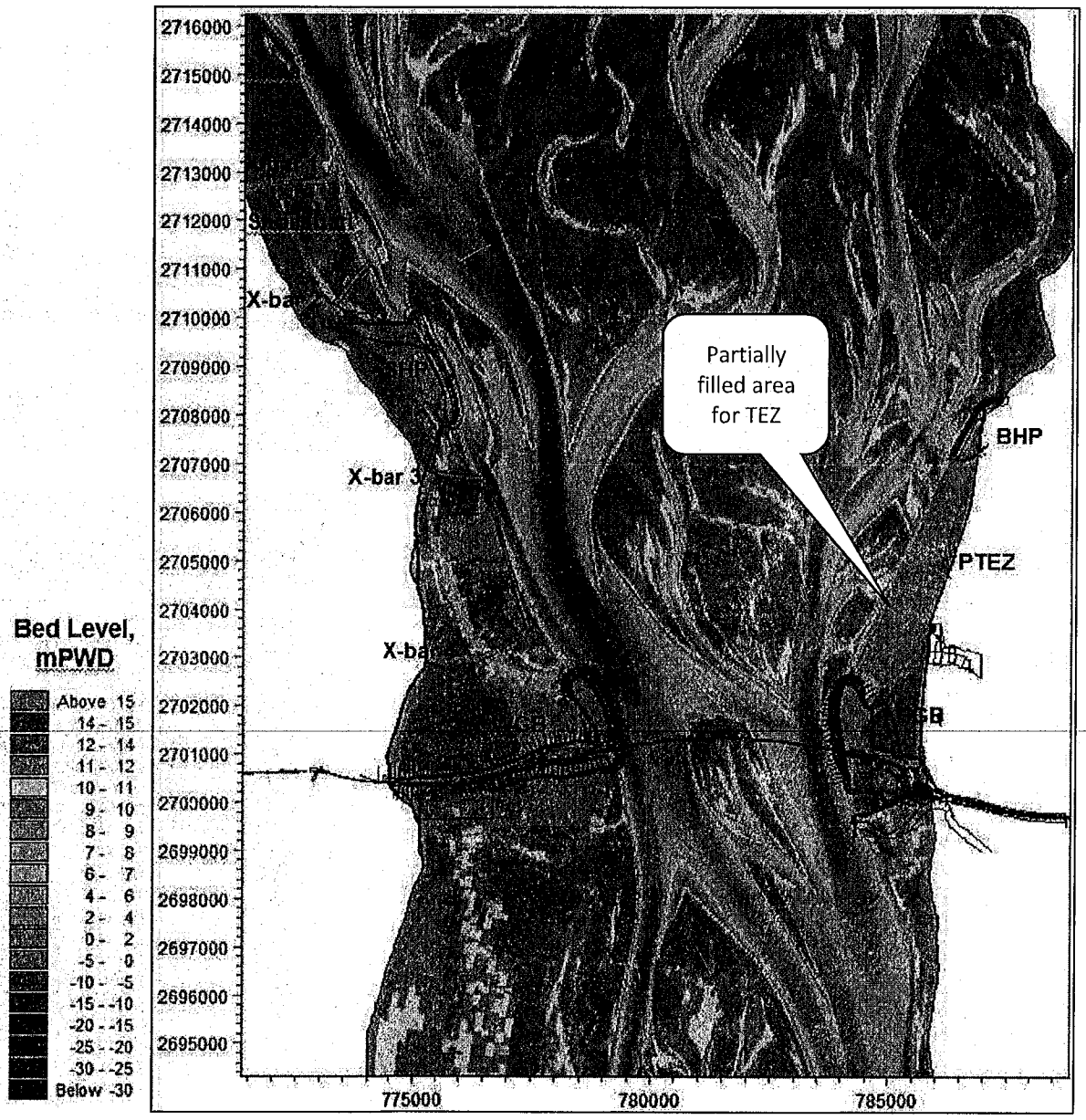

Figure 4 *Partially Filled Area for TEZ*

Government of the People's Republic of Bangladesh
Ministry of Water Resources

Bangladesh Water Development Board

Approved
20/07
2022
(FAZLUR RASHID)
Director General
BWDB, Dhaka.

Detailed Feasibility Study for Identifying Erosion Vulnerability and Protection of Proposed Economic Zone Construction at Bhuapur Upazila in Tangail District

EIA REPORT

June 2022

Water Environment & Climate

INSTITUTE OF WATER MODELLING

EXECUTIVE SUMMARY

Introduction

The Bangladesh Economic Zone Act, 2010, has been introduced by the Government of Bangladesh to facilitate development of Economic Zones (EZs) in the potential regions of the country, aiming to boost up the country's economic development and ensure standard, ecofriendly industrial zone that would encourage more foreign investment. Under this Act, the Bangladesh Economic Zone Authority (BEZA) has been established under the Prime Minister's Office (PMO) and governed by a Board chaired by the Prime Minister. The law provides legal coverage for attracting and leveraging private investment in the development of zones as zone developers or operators, and in the provision of tailored infrastructure services, such as private provision of power, effluent treatment, etc.

In response to the commitment of the Govt. of Bangladesh, BEZA has enthusiastically planned to set up an Economic Zone named Tangail Economic Zone (Hereinafter "TEZ"). The total planned area for the economic zone is 1752 acres at Bhuaur Upazila of Tangail District. BWDB appointed Institute of Water Modeling (IWM) as consultant for undertaking the Detailed Feasibility Study for Identifying Erosion Vulnerability and Protection of Proposed Economic Zone Construction at Bhuapur Upazila in Tangail District with the Environment Impact Assessment (EIA) study for the respective works.

The overall objective of the study is to devise an Environmental & Social Impact Assessment of the project as an integral component of the feasibility study in order to identify and evaluate major environmental issues and incorporate measures required project area.

- To conduct baseline conditions of the project area.
- To assess the project with respect to Environmental Sustainability, Climate Resilience and Disaster Risk and find the ways for reducing/mitigating negative impacts.
- To prepare environmental enhancement and conservation plan.
- To prepare biodiversity conservation plan.
- To devise a plan for improved livelihood in the developed chars within project area.
- To develop Environmental Management and Monitoring Plan (EMMP) for conservation of aquatic resources, fisheries resources, bird sanctuaries etc.

Study Area

The project area of TEZ is located at u/s of the East side Guide Bundh (EGB) of the Bangabandhu Bridge over Jamuna River, and the hard point at Gobindashi bazaar. The West Guide Bundh of the Bangabandhu Bridge and Sirajganj Hard Point (SHP), located at the right bank of the river, are within the study area (**Figure I**).

For conducting Environmental Impact Assessment (EIA), an area of 10 km radius is selected as the study area, shown in **Figure I**. The connectivity and the surroundings of the study area is presented in **Table I**.

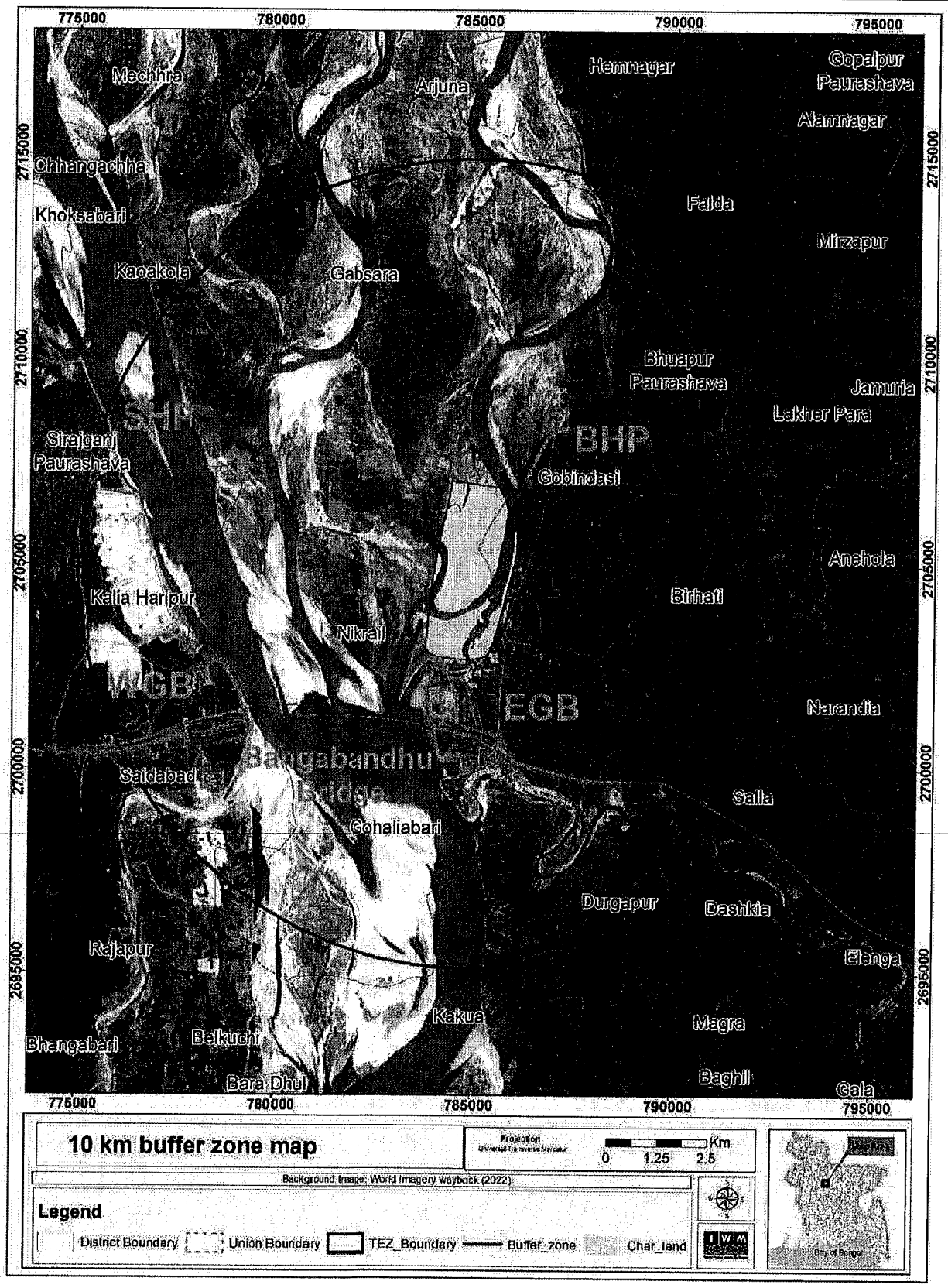

Figure I *Study Area of TEZ*

Table I Connectivity and Surroundings of the Study Area

Particulars	Details
Location	The EZ Site is located at Union: Gobindashi, Nikrail, Upazila: Bhuapur, District: Tangail.
Site co-ordinates	24°25'11.00"N 89°48'60.00"E
Site Boundaries	**West-** Jamuna River **North-** Agricultural land (single crop) and branch of Jamuna River **South-** Jamuna River, Bangabandhu Bridge about 1.72 km from the end boundary of TEZ. **East-** Tributary of River Jamuna, settlements and Gobindashi
Project Area	Existing area approximately 1761.85 acres. Approximately 502.02 acres are Government Land / Khas Land & 1259.83 acres are privately owned land.
Road Access	Adjacent Dhaka-Elengaj Highway. It further connects with Joydebpur-Jamalpur Highway.
River Access	Proposed EZ is located immediately adjacent to River Jamuna and a tributary of the river is passing through the site and is also surrounding the proposed EZ on all sides.
Nearest Airport	About 109 km from Hazrat Shah Jalal International Airport (Dhaka).
Railway Station	109 km from Kamalapur Railway Station, Dhaka 3 km from Bangabandhu Setu East railway station.
Nearest Port	65 km from Baghabari river port, 136 km from Narayanganj river port & 352 km from Chittagong Sea Port.
Climatic conditions	Avg. Yearly wind speed– 2-2.5 m/s; Avg. Monthly Min. Temp. – 20.0°C; Avg. Monthly Max. Temp. – 30.5°C; Annual Avg. Rainfall – 1994.6 mm Average humidity ranges – 75% to 80%;
Seismic Zone	Zone III
Forests / National Parks	None within 10 km
Archaeologically important places/monuments	No Archaeologically important places/monuments near to the site

Legal and Regulatory Framework and Project Categorization

The proposed project will be implemented in compliance with applicable environmental and social laws and regulations of the Government of Bangladesh (GoB). Relevant environmental and social regulations of GoB and policies, framework and standards have been reviewed and compared which was the basis of risk categorization of the project and assessment and management of environmental and social risks. According to Environmental Conservation Rules, 1997 all development projects / activities are classified into the following four categories:-

a) Green,
b) Orange – A,
c) Orange – B and
d) Red.

The TEZ project consists of a number of activities like dredging, land development related works, bank protection works etc. which fall under Red Category as per Environmental Conservation Rules, 1997. So, given the project's nature and scale, potential environmental and social risk and impacts, the capacity of the implementing agency to manage, implement and monitor the EMP and the project context, the project has been categorized as "Red" category project. Detailed screening of environmental and social risks and impacts were conducted following the similar screening process recommended in the TOR, approved by

DoE (**Memo No: 22.02.0000.018.72.049.22.82**, dated 06.06.2022) in connection with this project.

Environmental and Social Baseline

The report provides detailed information on the environmental baseline condition, including:

- Physio-Chemical Environment
- Ambient Air Quality
- Ambient Noise Level
- Water Resources
- Drainage System
- River Morphology
- Land Resources
- Faunal Diversity
- Floral Diversity
- Threatened Flora and Fauna

The report provides detailed information on the socio-economic baseline condition, including:

- Demographic Profile
- Agriculture Resources
- Fisheries
- Income and Poverty Levels
- Local Trade/Business/Organizational profiles
- Assessment of Infrastructure Facilities
- Housing Condition
- Water Supply and Sanitation
- Other Infrastructure Facilities
- Assessment of Baseline information on gender and women

Analysis of Alternatives

Since the project area has already been selected and around 502.02 acres of land has already registered to BEZA by the GoB, so no other alternative sites are analyzed. Rather based on the results of mathematical modelling, multi-criteria analysis, construction cost, difficulties and environmental-social aspects, option-4 is found more acceptable with respect to the other options where the area of TEZ would be reduced to 885 acres from 1752 acres of the other three options. And the river regime with biological environment will be preserved and the river corridor would be less disturbed. In "Brahmaputra Economic Corridor" Study report, a dredging alignment is proposed for the navigation of Jamuna River. The placement of TEZ as proposed by BEZA and considered in option 1, option 2, and option 3, interferes with the left proposed channel of the Economic Corridor. In the fourth option the propose position of TEZ can avoid this conflict, and in addition dredging alignment of the fourth option will match the alignment of the left channel of the Economic Corridor. Further the proposed TEZ area in option 1, option 2 and option 3 is not filled up with the available dredged material. Rather it will be sufficient for option 4.
So, considering all these, option 4 is recommended in the feasibility study report done by IWM.

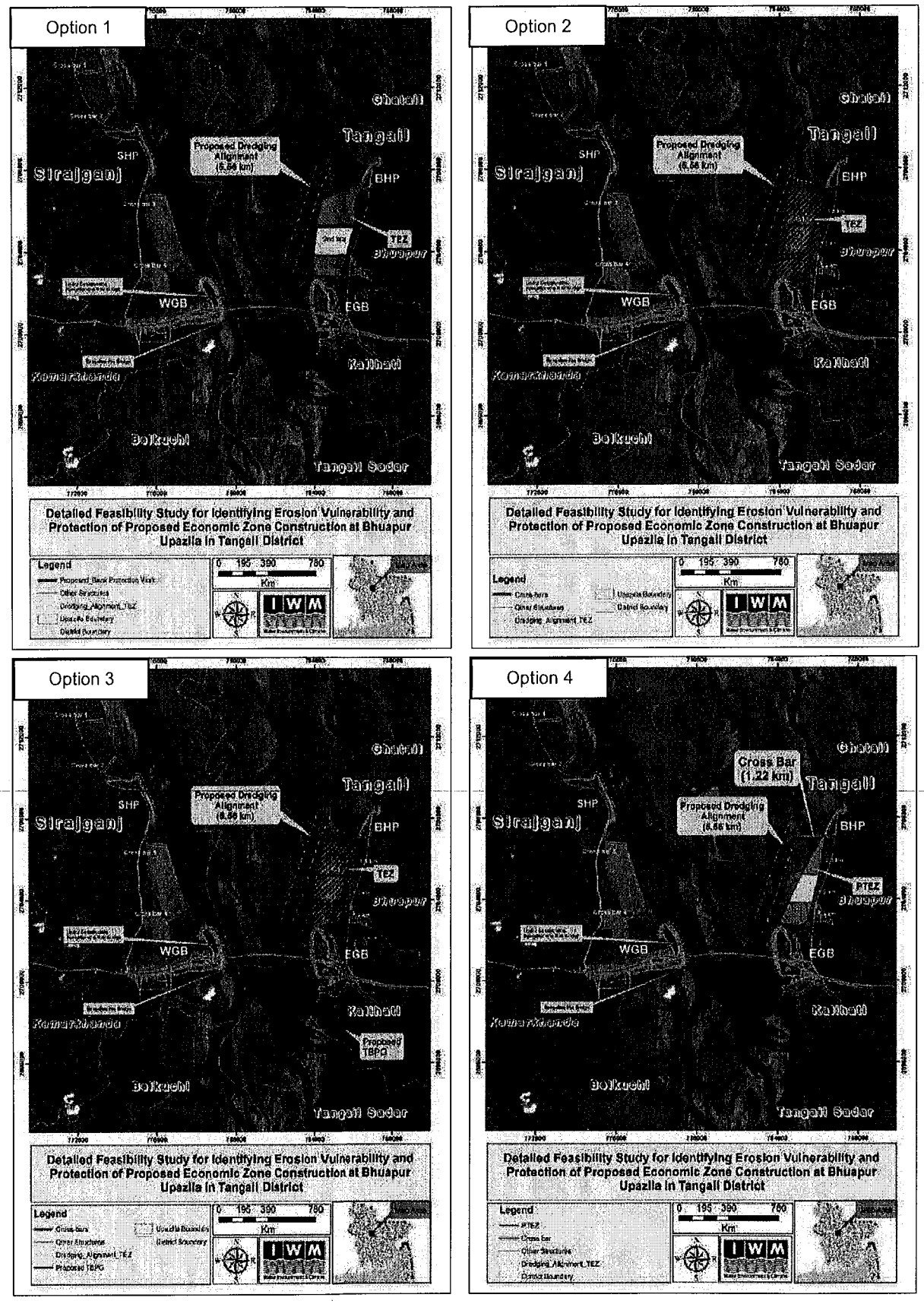

Figure II: *Four Alternative Protection Work for Land Development*

Study Findings

In the conducted EIA study for the land development work of TEZ project, the following items are identified:

- In terms of living environment, most of the impacts are controlled and limited in and around of the project area. The key expected negative impacts because of the activities to be done for development of TEZ are: emission of gas and dust, deterioration of water quality, generation of noise and vibration, impact on fisheries. However, implementation of appropriate mitigation and management plan, such as to spray water to bare areas for dust prevention, and to avoid the incentive operation of the construction machinery for prevention of emission gas, noise and vibration during construction phase, proper storage of construction materials, not to conduct dredging at the period of laying eggs by fishes will minimize these impacts.

- In consideration of natural environment, there is no key negative impact as the EZ will be established on 'no forest area'. So, there is no sensitive•ecological protection area. However, implementation of appropriate mitigation measures, such as planting trees, vegetation and sodding of public spaces as soon as possible, and keeping the environmental conditions along the existing canal and river will minimize the impact on the surrounding ecosystem.

- In terms of social environment, TEZ shall ensure the compliance with provisions of all relevant ordinances relating to compensation and rehabilitation issues properly. On the other hand, some positive impacts of the project, such as increase in job opportunity and improvement of social infrastructure are also expected.

- In terms of health and safety, some impacts on occupational/community health and safety and increase in number of accidents are expected. However, implementation of appropriate mitigation and management plan, such as to manage working conditions during the construction work and to provide security and maintain safety prevention measures during construction/operation phase will minimize these impacts.

It was confirmed that the environmental, social and health impacts of the Project were assessed and the EMP was formulated properly. In the process of EIA, opportunity of public involvement was ensured and comments from the public were reflected into the final report. Thus, the EIA was completed in accordance with the requirements of the EIA procedure properly; in that case Project proponent will follow EMP accordingly.

Recommendation

The recommendations made for the project development phase on the basis of EIA study are given below:

- Construction activities for the development of project facilities should be started after obtaining environment clearance certificate from DoE.
- Proposed EMP and EMoP should be implemented strictly during pre-construction, construction and operation phase of the project.
- National 3R Strategy for Waste Management (viz. Reduce, Reuse, Recycle) should be followed for the management of solid waste.
- Development of a green belt surrounding the area should be considered with due importance.
- All infrastructures should be built based on the seismic design consideration to avoid potential hazard risk.

- To avoid hazard due to any disaster, warning system, emergency evacuation system, construction of ground floor at an elevated level, provision of emergency equipment should be considered.
- Safety Management guideline for workers should be strictly followed to minimize occupational health hazards.
- Proper training of environmental management, health and safety should be given to project management unit in both construction and operation phase.
- Eligible local people should be considered on priority basis that will be helpful for minimizing the socio-economic disruption.
- The TEZ should be applied the concept of "Corporate Environmental and Social Responsibilities (CESR)" in order to hold the responsibility for the TEZ's actions and encourage a significant positive impact through its activities on the environment, consumers, employees, communities, stakeholders and all other members of the society.
- Before industry development, separate environment impact assessment study should be carried out by individual industries proposed to be developed in the EZ.