Periodic Financing Request Report

Project Number: 44167-015
MFF Number: 0082
August 2021

People's Republic of Bangladesh: Flood and Riverbank Erosion Risk Management Investment Program (Tranche 2)

Asian Development Bank

CURRENCY EQUIVALENTS
(as of 24 June 2021)

Currency Unit	–	taka (Tk)
Tk1.00	=	$0.0118049
$1.00	=	Tk84.710400

ABBREVIATIONS

ADB	– Asian Development Bank
BWDB	– Bangladesh Water Development Board
COVID-19	– coronavirus disease
DDM	– Department of Disaster Management
EIRR	– economic internal rate of return
FRERM	– flood and riverbank erosion risk management
ha	– hectare
JLB	– Jamuna left bank
JMREMP	– Jamuna–Meghna River Erosion Mitigation Project
JRB	– Jamuna right bank
km	– kilometer
MFF	– multitranche financing facility
O&M	– operation and maintenance
PLB	– Padma left bank
STIs	– sexually transmitted infections

NOTES

(i) The fiscal year (FY) of the Government of Bangladesh and its agencies ends on 30 June. "FY" before a calendar year denotes the year in which the fiscal year ends, e.g., FY2018 ends on 30 June 2018.

(ii) In this report, "$" refers to United States dollars.

Vice-President	Shixin Chen, Operations 1
Director General	Kenichi Yokoyama, South Asia Department (SARD)
Deputy Director General	Manmohan Parkash, SARD
Director	Mio Oka; Environment, Natural Resources and Agriculture Division (SAER); SARD
Team leader	Olivier Drieu, Senior Water Resources Specialist, SAER, SARD
Team members	Mikael Andersson; Financial Management Specialist; Portfolio, Results and Quality Control Unit; SARD Brando Angeles, Associate Environment Officer, SAER, SARD Angelique Dawn Badelles; Strategy and Policy Officer; Strategy, Policy and Business Process Division; Strategy, Policy and Partnerships Department Pamela Barrameda, Associate Operations Officer, SAER, SARD Cynthia Pancracia Ceniza, Senior Operations Assistant, SAER, SARD Orna Joyce, Social Development Specialist, SAER, SARD Marie L'Hostis, Water Resources Specialist, SAER, SARD Soma Misra; Procurement Specialist; Procurement Division 1; Procurement, Portfolio and Financial Management Department Douglas Perkins, Principal Counsel, Office of the General Counsel Sumit Pokhrel, Environment Specialist, SAER, SARD Md. Sohel Rana, Project Analyst, Bangladesh Resident Mission (BRM), SARD Nasheeba Selim, Senior Social Development Officer (Gender), BRM, SARD Pushkar Srivastava, Project Management Specialist, BRM, SARD
Peer reviewer	Rabindra Osti; Senior Water Resources Specialist; Environment, Natural Resources and Agriculture Division; East Asia Department

CONTENTS

TRANCHE AT A GLANCE

1. Basic Data

Project Number: 44167-015

Project Name	Flood and Riverbank Erosion Risk Management Investment Program - Tranche 2	**Department/Division**	SARD/SAER
Country	Bangladesh	**Executing Agency**	Bangladesh Water Development Board
Borrower	Bangladesh		
Country Economic Indicators	https://www.adb.org/Documents/LinkedDocs/?id=44167-015-CEI		
Portfolio at a Glance	https://www.adb.org/Documents/LinkedDocs/?id=44167-015-PortAtaGlance		

2. Sector

	Subsector(s)	ADB Financing ($ million)
✓ Agriculture, natural resources and rural development	Rural flood protection	136.59
	Rural water policy, institutional and capacity development	20.41
	Total	**157.00**

3. Operational Priorities

- ✓ Addressing remaining poverty and reducing inequalities
- ✓ Accelerating progress in gender equality
- ✓ Tackling climate change, building climate and disaster resilience, and enhancing environmental sustainability
- ✓ Promoting rural development and food security
- ✓ Strengthening governance and institutional capacity

Climate Change Information

GHG reductions (tons per annum)	0.000
Climate Change impact on the Project	High

ADB Financing

Adaptation ($ million)	47.40
Mitigation ($ million)	0.00

Cofinancing

Adaptation ($ million)	0.00
Mitigation ($ million)	0.00

Sustainable Development Goals

SDG 1.5
SDG 5.5
SDG 6.b
SDG 9.1
SDG 10.3
SDG 13.a

Gender Equity and Mainstreaming

Effective gender mainstreaming (EGM) ✓

Poverty Targeting

Geographic Targeting ✓

4. Risk Categorization: Complex

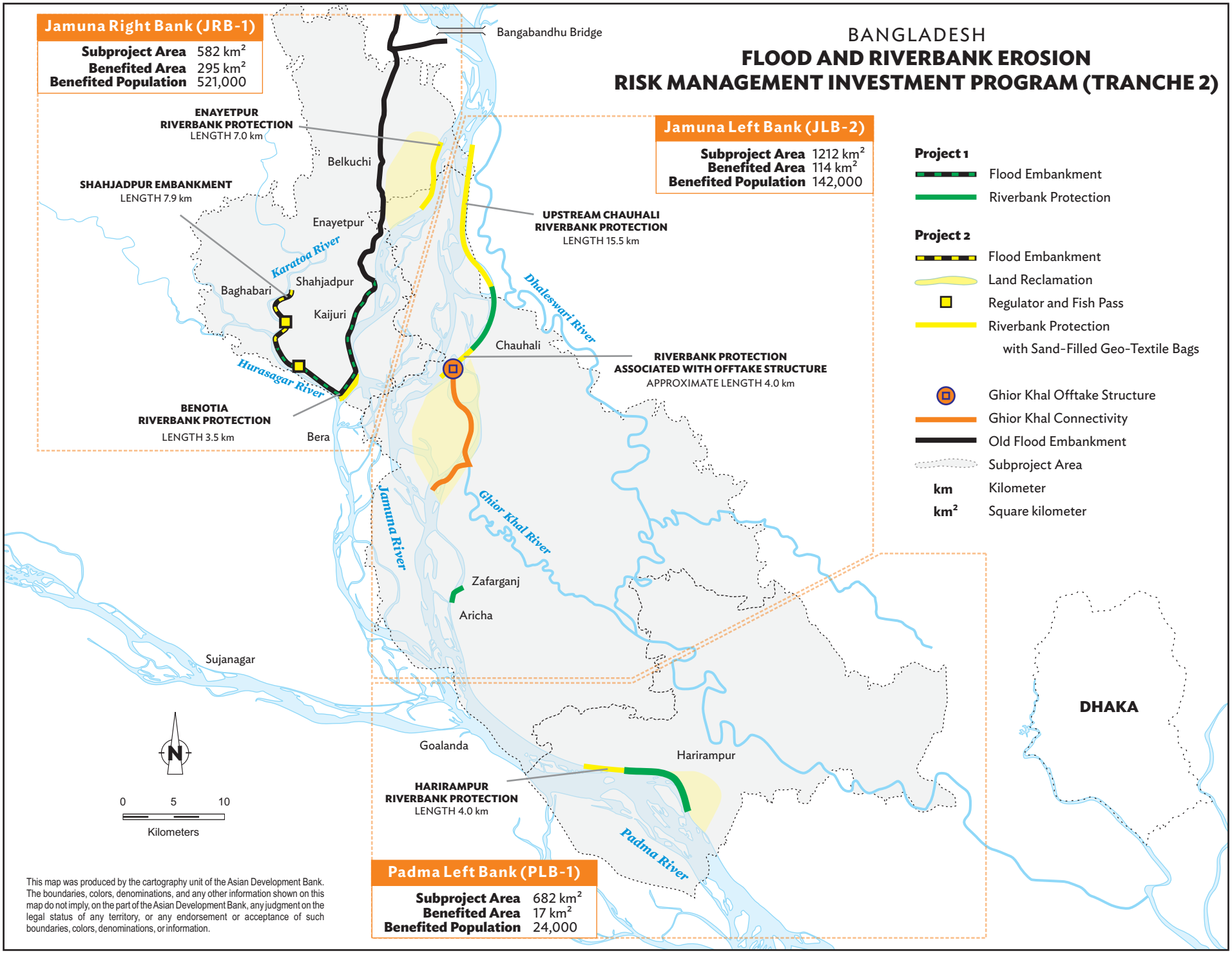
5. Safeguard Categorization

Environment: A **Involuntary Resettlement:** A **Indigenous Peoples:** C

6. Financing

Modality and Sources	Amount ($ million)
ADB	**157.00**
Sovereign MFF-Tranche (Concessional Loan): Ordinary capital resources	157.00
Cofinancing	**17.89**
Government of the Netherlands - MFF-Tranche (Grant) (Full ADB Administration)	17.89
Counterpart	**37.91**
Government	37.91
Total	**212.80**

Currency of ADB Financing: US Dollar



This map was produced by the cartography unit of the Asian Development Bank. The boundaries, colors, denominations, and any other information shown on this map do not imply, on the part of the Asian Development Bank, any judgment on the legal status of any territory, or any endorsement or acceptance of such boundaries, colors, denominations, or information.

200983E ABV

I. BACKGROUND

1. **Multitranche financing facility.** The multitranche financing facility (MFF) to the People's Republic of Bangladesh for the Flood and Riverbank Erosion Risk Management Investment Program (the investment program) was approved in 2014 to improve the livelihoods in the project area along the Jamuna, Padma, and Ganges rivers in Bangladesh.[1] The investment program will reduce flood and riverbank erosion risks in priority erosion reaches and strengthen resilience against climate change impacts through structural and nonstructural interventions and institutional and knowledge-based strengthening. The investment program extends successful cost-effective riverbank protection technologies of the Jamuna–Meghna River Erosion Mitigation Project (JMREMP) to other areas, with necessary improvements.[2]

2. Bangladesh is densely populated and located mainly on a vast low-lying floodplain at the confluence of three main rivers—the Jamuna, the Ganges,[3] and the Meghna.[4] The country is highly prone to natural hazards and vulnerable to disasters because of its location, climate variability, high incidence of poverty, poor institutional capacity, inadequate financial resources, and weak integrated planning and maintenance of infrastructure.[5] While overall national poverty incidence has declined, rural poverty is still pervasive as about 85% of the poor live in rural areas.[6] Their conditions are exacerbated by highly dynamic river morphology and climate impacts, recurrent floods, and riverbank erosion. The situation discourages investment in riparian areas and results in lower economic growth that has prevented incomes from rising and perpetuated high poverty rates.[7] The high population density has restricted people from leaving the most disaster-prone areas. In these areas, the investment program aims to tackle a critical development inhibitor: recurrent flooding from the Jamuna–Padma–Ganges–Meghna river system, exacerbated by unpredictable riverbank erosion.[8]

3. Against this background, in 2012 the government adopted *Vision 2021,* which endeavors to eradicate poverty and achieve economic and social well-being for all through a pro-poor climate change management strategy, further pursued in the second perspective plan.[9] Reducing remaining poverty and inequalities by decreasing flooding and riverbank erosion impacts in line with the Bangladesh Delta Plan 2100 contributes to achieving Vision 2021.[10]

---

[1] ADB. 2014. *Report and Recommendation of the President to the Board of Directors: Proposed Multitranche Financing Facility to the People's Republic of Bangladesh: Flood and Riverbank Erosion Risk Management Investment Program*. Manila.

[2] ADB. 2002. *Report and Recommendation of the President to the Board of Directors: Proposed Loan to Bangladesh for the Jamuna–Meghna River Erosion Mitigation Project*. Manila (Loan 1941-BAN, closed on 30 June 2011); and Independent Evaluation Department. 2020. *Project Performance Evaluation Report for Jamuna-Meghna River Erosion Mitigation Project in Bangladesh (Loan 1941)*. Manila: ADB. Innovative features developed under JMREMP and further under Project 1, such as sustainable low-cost geotextile bag revetments implemented underwater with global positioning system to mitigate erosion and stabilize the riverbanks adaptively, will be expanded under Project 2 by combining them with dredging, bioengineering and nature-based solutions.

[3] Also referred to as Padma river in Bangladesh.

[4] Floodplains occupy about 80% of the national territory, of which 66% are less than 5 meters above mean sea level.

[5] The 2021 edition of the Germanwatch Climate Risk Index ranked Bangladesh as the seventh of 180 nations most affected by the impacts of extreme weather events during 2000–2019. Climate-induced intense and extreme weather events damage crops (ADB. 2017. *A Region at Risk*. Manila).

[6] World Bank. 2017. *Bangladesh Continues to Reduce Poverty but at a Slower Rate*. Washington, DC.

[7] Overbank flows and inefficient drainage result annually in inundation of 20%–25% of the country. The 100-year return period flood is projected to inundate 60% of the country and has already become more frequent.

[8] River erosion causes devastating flood damage when it undercuts flood embankments during flood season. Since the Great Assam Earthquake in 1950, the Jamuna River has widened from about 8 to 12 kilometers in Bangladesh.

[9] Government of Bangladesh. 2012. *Perspective Plan of Bangladesh 2010–2021: Making Vision 2021 a Reality*. Dhaka; and Government of Bangladesh. 2020. *Making Vision 2041 a Reality: Perspective Plan of Bangladesh 2021–2041*.

[10] Government of Bangladesh, Planning Commission. 2018. *The Bangladesh Delta Plan 2100*. Dhaka.

4. The government requested the Asian Development Bank (ADB) to contribute to the national program using the MFF modality to (i) provide a longer-term lending instrument suited to strategic flood and riverbank erosion risk management (FRERM) and institutional strengthening of key agencies; and (ii) afford flexibility in terms of project scope, timing, and size, to cope with the morphologically dynamic river system and meet emerging priorities of the road map.

5. The framework financing agreement for the MFF was signed between ADB and Bangladesh on 12 May 2014. On 26 June 2014, the Board approved an MFF of up to $270.3 million equivalent, comprising regular and concessional ADB loans and ADB-administered cofinancing, with an availability period until June 2023. The investment program implements three subprojects (Jamuna right bank-1 [JRB-1], Jamuna left bank-2 [JLB-2], and Padma left bank-1 [PLB-1]) comprising flood embankments protecting critical riparian productive areas in central Bangladesh and capacity-building initiatives.[11] The program has the following individual tranche outputs contributing to the facility's outputs: (i) flood and riverbank erosion risk mitigation functioning at priority river reaches, (ii) a strengthened institutional system for FRERM, and (iii) an operational program management system. The executing agency is the Bangladesh Water Development Board (BWDB) under the Ministry of Water Resources. The Department of Disaster Management (DDM) under the Ministry of Disaster Management and Relief is the implementing agency for community-based flood risk management activities.

6. **Tranches.** The investment program was designed to be implemented over 9 years and financed in three tranches. Project 1 comprised a concessional loan of $65.0 million and an ADB-administered grant of $15.3 million from the Government of Netherlands, both approved on 3 July 2014, signed on 14 August 2014, and effective on 17 September 2014. Project 1 activities included (i) 18 kilometers (km) of riverbank erosion protection and the construction of 21 km of flood embankments, (ii) community-based flood risk management activities in 40 villages, and (iii) a pilot of wave protection technology using jute along 4 km of embankment and riverbank slopes. The newly built infrastructure performed well after completion.

7. Due to Project 1 implementation delays and preparation of the subsequent tranches, exacerbated by coronavirus disease (COVID-19)–induced lockdowns, the government requested that (i) the remaining tranches be combined into a single and final tranche; and (ii) the MFF availability period be extended until 26 June 2024, ensuring sufficient time to implement the Project 2 activities.[12] On 7 March 2021, ADB received the government's periodic financing request for Project 2 to continue implementing the investment program in the three priority reaches and strengthening capacities. Project 2 will apply the same technologies and methodologies developed under Project 1, except for minor improvements related to actual site conditions, such as latest erosion and river morphology, and lessons learned from Project 1.

8. Project 2 is in ADB's country operations business plan for Bangladesh, 2021–2023[13] and aligned with several operational priorities of ADB's Strategy 2030: (i) addressing remaining poverty and reducing inequalities; (ii) accelerating progress in gender equality; (iii) tackling climate change, building climate and disaster resilience, and enhancing environmental sustainability; (iv) promoting rural development and food security; and (v) strengthening governance and institutional capacity.

[11] Built in 1950–1960, the flood embankments in these areas are in the most critical reaches of the river system and at risk of being breached by river erosion and overtopped during extreme flood events.
[12] An extension of the MFF availability period from 30 June 2023 to 26 June 2024 was approved on 16 April 2021.
[13] ADB. 2020. *Country Operations Business Plan: Bangladesh, 2021–2023*. Manila.

9. **COVID-19 pandemic.** The World Health Organization declared COVID-19 a public health emergency of international concern on 30 January 2020 and a pandemic on 11 March 2020.[14] Flooding increases the risk of water- and vector-borne diseases.[15] Flood mitigation, and subsequently, prevention of communicable diseases induced by floods, is key to reduce undue stress COVID-19 has already brought on Bangladesh's health system. Considering the impact of the pandemic on the national economy, the investment program remains relevant to provide needed support for long-term economic growth.

II. ASSESSMENT OF MULTITRANCHE FINANCING FACILITY IMPLEMENTATION

10. **Progress on road map.** The road map focuses on long-term stabilization of the main rivers, increasing climate resilience, and reducing disasters. Project 1 significantly contributed to the road map progress by (i) preparing a river stabilization approach approved by BWDB, aligned with the adaptive delta management approach of the Bangladesh Delta Plan 2100;[16] (ii) assisting to set up a river management specialized office in BWDB; (iii) supporting DDM implement community-based flood risk management activities; (iv) piloting new technologies and construction principles; and (v) expanding the knowledge base with systematic data collection and development of information and asset management systems. Project 1 used innovative and cost-effective approaches for erosion management and progressive knowledge development.

11. **Improvements in policy framework.** The national policy framework has been enhanced by the Bangladesh Delta Plan, which adopts the proactive river stabilization approach developed under Project 1. Stabilization of the main rivers is also in the Eighth Five-Year Plan (FY2021–FY2026).[17] Project 2 will continue the road map actions by integrating the long-term stabilization approach beyond emergency response to critical erosion by (i) broadening the knowledge base; (ii) building the capacity of the office of the chief engineer, river management, BWDB; (iii) expanding river-training technologies with nature-based solutions; (iv) integrating stabilization with floodplain management; and (v) strengthening climate change adaptation measures.[18]

12. **Performance rating.** Both the MFF and Project 1 are rated *on track*. The total MFF amount converted to financing is $80.3 million (29.7% of the approved MFF amount, para. 5). The Project 1 loan was provided through special drawing rights equivalent to $65.0 million at the time of approval (footnote 1). Because of currency fluctuations, the US dollar equivalent of the loan decreased to $58.2 million, resulting in the following activities being deferred to Project 2: (i) livelihood development support, (ii) community capacity development support for participatory operation and maintenance (O&M), (iii) information system development, (iv) environment management and risk mitigation programs, and (v) construction of about 1.7 km of embankment. Paved roads on the embankments will not be financed under the MFF as other government agencies will undertake the work using their own funds.

13. The Project 1 loan closing date was extended twice: (i) from 30 June 2019 to 30 June 2020 because of land acquisition delays, and (ii) from 30 June 2020 to 31 March 2021 to enable works to be completed while the government managed the impacts of COVID-19. All works were completed in June 2020. As of 23 June 2021, of the $58.2 million net loan, $56.52 million (97%)

[14] World Health Organization. *Rolling Updates on Coronavirus Disease (COVID-19)* (accessed 12 May 2021).
[15] World Health Organization. *Flooding and Communicable Diseases Fact Sheet* (accessed 12 May 2021).
[16] The plan has alternative pathways to adapt to evolving socioeconomic, physical, and political environments.
[17] Government of Bangladesh, Planning Commission. 2020. *The Eighth Five-Year Plan (FY2021–FY2026)*. Dhaka.
[18] Project 2 will expand the road map for a follow-on project to stabilize further the Ganges–Jamuna confluence and address wider water management issues of the North-central Region (dry-season flows in distributaries).

worth of contracts had been awarded and $57.82 million (99%) disbursed, and of the $15.3 million grant, $14.70 million (96%) had been awarded and $14.21 million (93%) disbursed.

14. **Compliance with undertakings and loan covenants.** Under Project 1, all loan covenants are being complied with, including all safeguard-related covenants. The government is in compliance with all facility undertakings set out in the framework financing agreement that need to be complied with.

III. PERIODIC FINANCING REQUEST

A. Impact and Outcome

15. Project 2 has the same impact, outcome, and outputs as Project 1, and is aligned with the following impact: livelihoods in the project area improved.[19] Project 2 will have the following outcome: flood and riverbank erosion risks in the subproject areas reduced.[20]

B. Outputs

16. **Output 1: Flood and riverbank erosion risk mitigation functioning at priority reaches improved.** Project 2 combines structural and nonstructural measures in the three subproject areas to stabilize further the Lower Jamuna river by applying the integrated river stabilization approach developed under Project 1. Specifically, the size of a major eroding channel downstream of Chauhali will be reduced through an innovative combination of dredging and bioengineering to provide an offtake into a distributary and enable future development of some 6,000 hectares (ha) of floodplain land from reclaimed char land.[21] The structural measures will include (i) 30 km of riverbank protection with innovative technologies combined with nature-based solutions for channel closure, (ii) 40 km of riverbank protection adaptation works and 6 km of emergency works, (iii) 7.9 km of climate-resilient flood embankment, (iv) an offtake, and (v) two regulators. As a lesson learned from Project 1 and per the project performance evaluation report for JMREMP (footnote 2), monitoring, adaptive maintenance, and emergency works for 5 years after construction will be included to cope with the highly dynamic river system. The nonstructural measures will continue the approach used under Project 1 and cover community involvement and community-based flood risk management activities such as (i) establishing at least 160 community disaster management units and developing their capacity, (ii) training 40 disaster units created under Project 1 to enhance sustainability, (iii) establishing at least 14 community groups for livelihood training programs, (iv) raising awareness on FRERM, and (v) strengthening disaster preparedness and emergency response with a focus on women's participation.

17. **Output 2: Institutional system for flood and riverbank erosion risk management strengthened.** Project 2 will continue to strengthen the knowledge base and institutional capacity of BWDB and DDM in sustainable asset and strategic management of the rivers. Activities will include (i) support to the office of the chief engineer, river management, and BWDB, including drone surveys for O&M needs; (ii) river surveys; (iii) incorporation of knowledge base products such as the river stabilization plan and site data on BWDB's website; and (iv) update of the river stabilization guidelines. Project 2 activities will include training, publications, and study tours.

18. **Output 3: Program management systems operational.** The output will ensure that the outputs will be timely delivered within budget. The output will reinforce BWDB's management

[19] The impact statement was defined for the investment program following previous design and monitoring framework guidelines. However, the impact statement remains aligned with the Eighth Five-Year Plan (FY2021–FY2026).
[20] The design and monitoring framework is in Appendix 1.
[21] An accretion in a river, the chars are valuable to the economy as additional cultivable areas.

system to ensure that (i) the project management office and subproject management offices are supported by management information and quality control systems, accountability measures, and remote-sensing–based monitoring tools; and (ii) the project and subproject management offices take more ownership of newly introduced concepts and work methods, including the participatory process. ADB will support the BWDB in conducting a feasibility study for the adaptive stabilization of the Jamuna–Ganges confluence area for a follow-on project.[22]

C. Summary Cost Estimates and Financing Plan

19. Project 2 is estimated to cost $212.8 million (Table 1). Detailed cost estimates by expenditure category and by financier are included in the project administration manual.[23]

Table 1: Summary Cost Estimates
($ million)

Item			Amount[a]
A.	**Base Cost**[b]		
	1.	Flood and riverbank erosion risk mitigation functioning at priority reaches improved	154.3
	2.	Institutional system for flood and riverbank erosion risk management strengthened	17.8
	3.	Program management systems operational	8.7
		Subtotal (A)	**180.8**
B.	**Contingencies**[c]		**27.1**
C.	**Financial Charges during Implementation**[d]		**4.9**
		Total (A+B+C)	**212.8**

[a] Includes taxes and duties of $27.3 million. Such amount does not represent an excessive share of the project cost. The government will finance taxes and duties of $18.4 million as cash contribution.
[b] In mid-2021 prices.
[c] Physical contingencies computed at 8.5% for civil works and 6.5% for surveys, investigations, capacity development, equipment, vehicles, consultancy services. Price contingencies computed at an average of 1.7% on foreign exchange costs and 5.5% on local currency costs; includes provision for potential exchange rate fluctuation under the assumption of a purchasing power parity exchange rate.
[d] Includes interest. Interest during construction for the estimated amount of ADB financing has been computed at 2.0% per year. The charges include 2% of administration charges for ADB's administration of a grant from the Government of the Netherlands.
Source: ADB estimates.

20. To finance Project 2, the government has requested a concessional loan of $157.0 million from ADB's ordinary capital resources and a grant of $17.89 million from the Government of the Netherlands to be fully administered by ADB.[24] The loan will have a 25-year term, including a grace period of 5 years; an interest rate of 2.0% per year during the grace period and thereafter; and such other terms and conditions set forth in the draft loan and project agreements.

21. The summary financing plan is in Table 2. The ADB loan will finance the expenditures in relation to civil works, consulting services, trainings, equipment, and office operation. The grant from the Government of the Netherlands will finance consulting services and pilot works.

Table 2: Summary Financing Plan

Source	Amount ($ million)	Share of Total (%)
Asian Development Bank (ADB)		
Ordinary capital resources (concessional loan)	157.00[a]	73.78
Government of the Netherlands (grant)	17.89[b]	8.42
Government	37.91	17.82
Total	**212.80**	**100.00**

[a] Project 2 will be funded by ordinary capital resources (concessional loan) from the country allocation ($122.85 million) and savings and cancellations of ongoing projects ($34.15 million).
[b] Fully administered by ADB. Includes 2% of ADB's administration charges.
Source: ADB estimates.

[22] A follow-on project will prioritize the inclusion of outstanding components originally included in the scope of this MFF: 40 km of flood embankment and 23.5 km of wave protection with concrete blocks along riverbanks.
[23] The project administration manual is in Appendix 5.
[24] A letter of intent was received from the Government of the Netherlands on 28 March 2021.

22. Climate adaptation, estimated to cost $54.8 million, includes (i) additional geobags for increased scour depth, (ii) additional length against outflanking, (iii) increased thickness against wave action, (iv) climate-resilient construction, and (v) training of the local population. ADB will finance 86.5% of this cost. Details are in the climate change assessment.[25]

D. Implementation Arrangements

23. The implementation arrangements are summarized in Table 3 and described in the project administration manual.

Table 3: Implementation Arrangements for Project 2

Aspects	Arrangements		
Implementation period	September 2021–June 2024		
Estimated completion date	26 December 2023		
Estimated loan closing date	26 June 2024		
Management			
(i) Oversight body	Program steering committee: Secretary, MoWR (chair) and 21 members, representing MoWR, BWDB, DDM, and other government agencies Technical committee at BWDB level: Additional director general, BWDB (chair) and 12 members (BWDB, DDM, other relevant organizations) Panel of experts for any specific technical and implementation issues		
(ii) Executing agency	BWDB		
(iii) Implementing agency	DDM		
(iv) Implementation unit	Executing agency: PMO in Dhaka: 34 staff, including 5 staff for finance and accounts; 3 SMOs: 59 staff Implementing agency: PMO in Dhaka, 1 project manager		
Procurement	Open competitive bidding	8 contracts (goods) 18 contracts (works)	About $55.0 million About $74.5 million
Consulting services	QCBS CQS Individual consultants Direct contracting	1 contract 9 contracts 8 contracts 6 contracts[a]	About $2.8 million About $4.5 million About $0.7 million About $18.3 million
Retroactive financing and/or advance contracting	Retroactive financing and advance contracting will be used for goods, civil works, and consulting services. Retroactive financing will be provided to finance expenditure incurred before loan effectiveness but not earlier than 12 months before the date of signing of the loan agreement and not exceeding 20% of the loan amount.		
Disbursement	The loan and grant proceeds will be disbursed following ADB's *Loan Disbursement Handbook* (2017, as amended from time to time) and detailed arrangements agreed between the government and ADB.		

ADB = Asian Development Bank, BWDB = Bangladesh Water Development Board, CQS = consultant's qualification selection, DDM = Department of Disaster Management, MoWR = Ministry of Water Resources, PMO = project management office, QCBS = quality- and cost-based selection, SMO = subproject management office.

[a] Direct contracts for (i) a river survey and a modelling study of the channel closure to the Institute of Water Modelling, (ii) an erosion study by the Center for Environmental and Geographic Information System, (iii) physical modelling by the River Research Institute, (iv) geotechnical studies by Bangladesh University of Engineering and Technology, and (v) an institutional strengthening and project management consultant for continuity as per schedule 3 of the framework financing agreement.

Source: Asian Development Bank.

E. Project Readiness

24. Project readiness for Project 2 is high.

IV. DUE DILIGENCE

A. Technical

25. Project 2 builds on experience and lessons learned from more than 15 years of ADB's support to riverbank protection and stabilization of the Lower Jamuna river. Key lessons include:

[25] The climate change assessment is in Appendix 16.

(i) the use of sand-filled geotextile bag technology is a cost-effective and sustainable means to stabilize and protect riverbanks and embankments, and (ii) the knowledge base should be continuously increased. Hence, Project 2 will expand proven planning, design, and construction principles of JMREMP and Project 1 toward broader river stabilization. The climate change impacts, assessed in a climate risk and vulnerability assessment, were applied to the designs.[26]

B. Economic and Financial

26. The major benefits of the investment program are (i) reduced land losses caused by riverbank erosion, (ii) mitigation of flood damage and increased agricultural production, and (iii) development of reclaimed char lands. The economic analysis indicates that each subproject exceeds the minimum 9% of the economic internal rate of return (EIRR) and, therefore, is economically viable. The EIRRs are 13.6% for subproject JRB-1, 13.2% for JLB-2, 13.2% for PLB-1, and 13.4% for the investment program.[27] The investment program will bring nonquantifiable benefits such as (i) mitigation of injuries and loss of life (human and animal) caused by flooding, (ii) mitigation of economic activities disrupted by riverbank erosion and flooding, (iii) reduced cost for relief and reconstruction of households, and (iv) environmental benefits. Switching values were calculated to estimate the percentage by which the benefits and costs would need to change to reach an EIRR of 9% and a net present value of zero. The results show that the investment program would require a reduction in annual benefits of 28% or an increase in costs of 40% to become economically unviable. Overall, the subprojects and the investment program are robust to adverse changes in benefits and costs.

27. BWDB is responsible for the maintenance of all the assets built under the project. As the assets will not generate any revenue, BWDB's financial resources for O&M activities rely on government budgetary allocations. As less than 15% of the estimated requirement for O&M is allocated yearly in BWDB's budget, the risk is substantial that adequate O&M will not be provided, leading to premature asset deterioration. Mitigation measures under Project 2 will include (i) piloting of 5-year O&M in works contracts, (ii) strengthening further BWDB's maintenance planning and asset management systems to enhance remote-sensing–based monitoring and planning and risk-based budget requests, and (iii) training and engaging beneficiary communities in routine maintenance. The government provided an assurance to reduce the gap between budget allocation and O&M needs.

C. Governance

28. **Financial management.** A financial management assessment of BWDB was conducted in accordance with ADB's guidelines.[28] The financial management risk is *substantial* as (i) limited accounts staff have been assigned to Project 2, (ii) BWDB's internal audit function may not have the capacity to audit the project regularly, (iii) reporting is to be improved, and (iv) receipts and payments under the ADB financing funds are still manual. Mitigation measures are in Table 4.

29. **Procurement and anticorruption measures.** The government requested that the procurement of goods, works, and services follow ADB's Procurement Policy (2017, as amended from time to time). The procurement risk for Project 2 is *moderate*.[29] Value for money will be achieved by targeting local contractors and combining packages as per geographical locations to encourage competition and response. ADB's Anticorruption Policy (1998, as amended to date) was explained to and discussed with the government and BWDB. The policy requirements and

[26] The Climate Risk and Vulnerability Assessment is in Appendix 17.
[27] The economic and financial analyses is in Appendix 7.
[28] The financial management assessment is in Appendix 14.
[29] The strategic procurement planning assessment is in Appendix 13.

specific measures are in the project administration manual.

D. Poverty, Social, and Gender

30. The project area is in the riparian districts where poverty incidence is higher and occupants are typically the landless poor, repeatedly displaced by perennial riverbank erosion and flooding. Project 2 will directly protect the poor, including women, and contribute to development of more sustainable livelihoods through provision of increased land protection and a livelihood program.[30]

31. **Gender.** The project is categorized as *effective gender mainstreaming*. Women in the project area face multiple challenges because of lack of resources (food and water), outmigration of men, and constant displacement. The gender action plan will account for gender disparities and provide jobs to women based on lessons learned from Project 1.[31] The plan will ensure that (i) the design and monitoring framework has measurable targets and quotas for women's participation and representation, particularly for (a) livelihood training, (b) participatory O&M activities, (c) integration of gender-responsive mechanisms in river management guidelines and project monitoring tools, and (d) greater decision-making capacities and awareness of gender-based violence; (ii) all issues are resolved by the local government grievance redress mechanism or alternative community-based systems; and (iii) implementation will be supported by two social development and/or resettlement specialists and two gender specialists.

32. **Sexually transmitted infections (STIs), COVID-19, and human trafficking.** A small proportion of the project requires a large and nonlocal construction workforce. Therefore, the risk of spreading communicable diseases, including sexually transmitted diseases (STIs) and COVID-19, is low. BWDB will ensure that contractors disseminate information at worksites on the risks of STIs and COVID-19. The contractors will hold awareness sessions, which gender experts will monitor, on STIs, COVID-19, and human trafficking for their laborers at worksites.

E. Safeguards

33. In compliance with ADB's Safeguard Policy Statement (2009), the project safeguard categories are as follows.[32]

34. **Environment (category A).** The works under Project 2 are a continuation of those under Project 1. The draft environmental impact assessment was disclosed on ADB's website on 6 August 2020 and the final one on 24 May 2021. The updated environmental assessment and review framework improved the grievance redress mechanism and incorporated the project design changes.[33] A tranche report was also prepared.[34] The category *A* classification is triggered as without mitigation, direct impacts of interventions on the biodiversity habitat could be significant, long-lasting, and cumulative. The works are confined to riverbanks and outside any sensitive or protected areas. Significant negative impacts of the interventions include the reduction in width of a 15 km long channel and of its inside wetland resulting from the reclamation of char land, and risks to wildlife habitat induced by alteration to flow patterns, reduced river–floodplain connectivity, and construction of the flood embankment.[35] Key mitigation measures will include (i) establishing

[30] Farm income is set at 30% and farm labor demand at 24% by ADB's software FARMOD for the farm-level financial and economic analysis of agricultural projects.
[31] Details are in the gender section of the project administration manual.
[32] ADB. Safeguard Categories.
[33] The environmental assessment and review framework is in Appendix 10.
[34] ADB. 2021. *Tranche Report: Bangladesh: Flood and Riverbank Erosion Risk Management Investment Program (Tranche 2).* Manila.
[35] The wetland currently in the river channel due to two decades of erosion of the riverbank will be restored under the project as char land; chars (accretions in a river) are valuable to the national economy as additional cultivable areas.

sanctuaries and buoys to reduce fishing pressures, (ii) constructing regulators with fish passes, (iii) increasing dry season flow in a distributary, and (iv) following COVID-19–related protocols. Other impacts (i.e., increased sediments, water contamination, and health and safety risks) are local, temporary, and mitigable. BWDB obtained environmental clearance for Project 2 from the Department of Environment on 13 December 2020.

35. Three rounds of stakeholder consultations were conducted from 2013 to 2017, with the most recent focused on Project 2 interventions. Although coronavirus disease restrictions prevented any more recent consultations, in late 2020, the local population was consulted through questionnaires.[36] Further, in May 2021, project information was shared through a brochure in Bangla. Stakeholders expressed strong support for the project to solve their severe and urgent erosion and flooding issues. Consultation will continue during project implementation. Project 1 complies with the Safeguard Policy Statement environmental safeguard requirements. BWDB showed its capability to manage them satisfactorily and will engage an external monitoring expert.

36. **Involuntary resettlement (category A).** The riverbank protection and embankment will go through private cultivated land, commercial land, and pond areas, resulting in (i) about 68 ha of land acquisition; and (ii) physical and economical displacement of more than 720 households, comprising about 3,900 persons; loss of 2,650 structures; and loss of 14,000 trees (timber, medicinal, fruit bearing) because of involuntary land acquisition. The affected persons were extensively consulted during Project 2 preparation,[37] and project information and the resettlement framework were explained to them. The affected persons are direct beneficiaries of the protection works.[38] Land acquisition and resettlement will take place in the three subproject areas; riverbank protection requires narrow strips of land in each area and embankment construction only in JRB-1 and JLB-2 areas. The project follows a sector approach; the updated resettlement framework and one sample resettlement plan (Shahjadpur in JRB-1) were prepared and disclosed on ADB's website on 24 May 2021, and four other resettlement plans will be prepared. This approach is taken due to COVID-19 constraints to conduct a full census for the Shahjadpur resettlement plan, and the need to complete riverbank stabilization underwater works prior to land acquisition for the four remaining resettlement plans. All five resettlement plans will be finalized and disclosed with ADB approval during project implementation, but prior to award of works contracts. The resettlement plans will consider measures to mitigate COVID-19–related risks, including effective methods of safe consultation and resettlement, and updated vulnerability assessments to address real-time impacts of COVID-19 on affected persons, such as loss of livelihoods, reduced access to services, and diminished community health. BWDB has acquired capacity to mitigate social risks and will engage a nongovernment organization and an external monitoring expert.

37. **Indigenous peoples (category C).** As there are no tribes, minorities, or ethnic communities in any subproject areas, Project 2 will have no impact on the dignity, human rights, livelihood systems, or culture of tribes, minorities, ethnic communities or on their ancestral domain.

F. Summary of Risk Assessment and Risk Management Plan

38. Significant risks and mitigating measures are summarized in Table 4 and described in detail in the risk assessment and risk management plan.[39]

[36] The last round of consultation for social safeguards included information relevant to environmental matters.
[37] These included an initial socioeconomic survey of affected persons and two rounds of consultation (2017 and 2020).
[38] The resettlement framework is in Appendix 10.
[39] The risk assessment and risk management plan is in Appendix 12.

Table 4: Summary of Risks and Mitigating Measures

Risks	Mitigation Measures
Disasters induced by natural hazards exceed the design flood return period which may reduce program benefits.	In addition to structural works, Project 2 includes support for increasing resilience of communities to flood and riverbank erosion risks through measures such as disaster awareness campaigns, strengthening of disaster preparedness and emergency response, and improvements to flood forecasting and warning systems.
River morphological changes exceed the anticipated range, leading to delays in implementation.	Project 2 includes (i) implementing adaptive riverbank protection to flexibly adjust to morphological changes; (ii) taking proactive measures driven by erosion forecasting, scour calculations, regular monitoring, and surveys of structure performance; and (iii) replicating the approach, designs, and construction methods used under Project 1 and JMREMP as they have demonstrated effective performance for up to 15 flood seasons.
Weak financial management arrangements at BWDB and the PMO.	Project 2 includes (i) assigning experienced accounts staff to the PMO and SMOs and engaging a financial management expert for support; (ii) providing frequent training to PMO and accounts staff on disbursement procedures and systems, financial reporting, and audit requirements; (iii) reporting comprehensive financial information in quarterly progress reports and PMO adopting computerized systems to capture receipts and payments; and (iv) ensuring that Project 2 is included in the annual audit plan of BWDB's internal audit team.
Lack of maintenance funds and asset management may cause project assets to deteriorate prematurely.	The project will include 5-year maintenance in selected contracts to ensure better asset quality and improved maintenance. The communities will be involved in maintenance activities and undergo training. The asset management systems of BWDB will be strengthened. The government agreed to increase its budget allocation to BWDB for operation and maintenance; the agreement is included as a loan covenant.
Implementation may be delayed due to communicable diseases such as COVID-19, resulting in time and cost overruns.	Readiness is high through advance actions. Potential COVID-19 constraints will follow flexible and adaptive management: (i) updating the vulnerability assessment and contingencies for livelihood restoration activities, (ii) conducting additional stakeholder consultations at the onset, (iii) following the latest health and safety protocols for all interactions at sites and work processes, (iv) regularly assessing field work and travels risks and informing project staff, and (v) modifying the project status at midterm review.

BWDB = Bangladesh Water Development Board, COVID-19 = coronavirus disease, JMREMP = Jamuna–Meghna River Erosion Mitigation Project, PMO = project management office, SMO = subproject management office.
Source: Asian Development Bank.

V. ASSURANCES

39. The government and BWDB have assured ADB that implementation of the project shall conform to all applicable ADB policies, including those concerning anticorruption measures, safeguards, gender, procurement, consulting services, and disbursement as described in detail in the project administration manual and loan documents.

40. The government and BWDB have agreed with ADB on certain covenants for the project, which are set forth in the loan, grant, and project agreements.

VI. THE PRESIDENT'S DECISION

41. On the basis of the approval by ADB's Board of Directors for the provision of loans and administration of cofinancing under the multitranche financing facility in an aggregate principal amount not exceeding $270,300,000 to the People's Republic of Bangladesh for the Flood and Riverbank Erosion Risk Management Investment Program, the President has approved the tranche as described in para. 20 and such other terms and conditions as are substantially in accordance with those set forth in the draft loan, grant, and project agreements.

DESIGN AND MONITORING FRAMEWORK FOR PROJECT 2[a]

Impact the Project is aligned with: Livelihood in the project area improved (program defined)[b]

Results Chain	Performance Indicators with Targets and Baselines	Data Sources and Reporting Mechanisms	Risks and critical assumptions
Outcome Flood and riverbank erosion risks in the subproject areas reduced	By 2025: a. 15,400 ha of land protected from inundation damages (2020 baseline = 0) (3,600 ha)[c] (OP 3.2, 5.3) b. About 0.5 million people protected from inundation damages (2020 baseline = 0) (0.1 million people)[c] (OP 2.1, 3.2) c. 3,000 ha of lands with assets protected from riverbank erosion (2020 baseline = 0) (200 ha)[c,d](OP 3.2, 5.1.1) d. 8,000 ha of char land recovered from the river for development (2020 baseline = 0) (OP 2.1, 3.2, 5.1.1)	a–b. Districts' flood damage records c–d. BWDB's dry season satellite image analysis (outsourced to CEGIS)	Disasters induced by natural hazards exceed the design flood return period which may reduce the program benefits(R) Flood embankment completed on time (A).
Outputs 1. Flood and riverbank erosion risk mitigation functioning at priority reaches improved	By 2024: 1a. 30 km of riverbank protected by applying appropriate technology and methodology[e] (2020 baseline = 0 (18 km)[c,d] (OP 1.2) 1b. 7.9 km of climate-resilient flood embankment constructed, rehabilitated, or upgraded against 100-year probable floods (200-year flood along the main rivers) (2020 baseline = 0) (21 km)[c] (OP 1.2, 5.1.1) 1c. 2 regulators and other hydraulic structures (i.e., fish passes) installed (2020 baseline = 0) (4)[c] 1d. 1 channel closure with "building with nature" approach[f] (2020 baseline = 0) (OP 1.2) 1e. 160 community-based disaster management units established (minimum of 35% women-led) and developing of their capacity (2020 baseline = 0) (baseline 40 units with 14 led by women)[c] (OP 1.3) 1f. 14 community groups[g] established and livelihood training program conducted (50% women participants) (2020 baseline = 0) (6)[c] (OP 2.3, 2.5) 1g. 12 fish sanctuaries established (2020 baseline = 0)	1a–d. BWDB project progress and completion reports 1e–g. implementation NGOs reports BWDB project progress reports	River morphological changes exceed the anticipated range leading to delays in implementation. (R) Implementation may be delayed due to communicable diseases such as COVID-19, resulting in time and cost overruns. (R) Possible departmental restructuration of the organizational structure of the BWDB does not hamper project implementation (A).
2. Institutional system for flood and riverbank erosion risk management strengthened	2a. Office of the CE-River Management operational (2020 baseline = office established) (OP 6.2) 2b. Information and management systems refined and piloted including: (i) project website and database with sex-disaggregated data as appropriate in use; (ii) web-based asset database developed and piloted; (iii) project monitoring system in use; and (iv) guideline for river stabilization prepared. (2020 baseline = databases outlined) (OP 6.2) 2c. 5-year budgetary plan for riverbank protection O&M and emergency work for the main rivers submitted for endorsement by BWDB. (2020 baseline = initial draft submitted in November 2020) 2d. Long-term river stabilization and river management master plans refined to include char lands development and submitted for endorsement by BWDB (2020 baseline = initial plan for stabilization of main rivers endorsed by BWDB) 2e. Gender responsive[h] guideline for river management (focus Lower Jamuna) submitted for	2a–b, 2d–e. BWDB project progress reports 2c. BWDB annual budgetary plan BWDB construction material stockade plan 2f. BWDB project reports and webpage	

Results Chain	Performance Indicators with Targets and Baselines	Data Sources and Reporting Mechanisms	Risks and critical assumptions
	endorsement to BWDB. (2020 baseline = studies initiated under Project 1, guideline approved in 2010) 2f. Project website updated (2020 baseline = website developed under Project 1)		
3. Program management systems operational	3a. Management information system, quality control systems, accountability measures, and gender-sensitive project monitoring tools[i] established and used by PMO and SMOs (2020 baseline = N/A) (OP 6.2) 3b. At least 60% of Office of the Chief Engineer River Management staff (including a minimum of 60% of female staff) with increased knowledge on Adaptive Approach[j] (2020 baseline: 0). 3c. Follow-on project in line with Bangladesh Delta Plan 2100 and approved River Stabilization Plan (2020), expanding innovative technologies developed under this MFF prepared for the Government of Bangladesh and ADB approval. (2020 baseline = N/A)	3a. BWDB financial records and progress reports 3b. BWDB annual reports and facility completion report 3c. Government of Bangladesh and ADB draft loan processing documents	

Key Activities with Milestones

1. Flood and riverbank erosion risk mitigation functioning at priority reaches improved

1.1 Infrastructure improvement
- a. Complete land acquisition (Q4 2021–Q2 2023)
- b. Complete construction works (Q1 2022–Q2 2024)

1.2 Building with Nature
- a. Complete preparatory studies (Q1 2022–Q3 2022)
- b. Complete construction works (Q4 2022–Q2 2024)

1.3 Community-based flood risk management
- a. Engage firm(s) / NGO(s) and refine methodologies and guidelines (Q4 2021–Q2 2022)
- b. Form community disaster management units, with necessary training (Q1 2022–Q4 2022)

1.4 Livelihood support for project affected people
- a. Identify affected people, suitable for livelihood support activities and interest (Q4 2021–Q3 2022)
- b. Firm(s) /NGO(s) implement livelihood trainings and support program (Q3 2021–Q2 2024)
- c. Establish 12 fish sanctuaries and community-involvement (Q4 2021–Q2 2024)

2. Institutional System for flood and riverbank erosion risk management strengthened

2.1 BWDB institutional capacity strengthening for river management and sustainable asset management
- a. Conduct training for BWDB staff including staff of CE River Management office, in design of river and flood protection works, river management and O&M (Q1 2022–Q2 2024)
- b. Develop capacity of CE River Management office in particular planning and MIS (Q1 2022–Q2 2024)
- c. Develop, test, rollout and use MISs: (i) project website and database, (ii) web-based asset database, and (iii) project monitoring and MIS (Q1 2022–Q2 2024)
- d. Prepare 5-year budgetary plan with BWDB for their approval (Q4 2021 to Q4 2022)
- e. Conduct annual information sharing workshops with other agencies (Q3 2022– Q2 2024)

2.2 Data and knowledge base development for state-of-the-art implementation guidelines
- a. Refine the long-term river stabilization and river management master plans to include char lands development; present to BWDB and stakeholders for wider adoption in planning (Q4 2022–Q4 2023)
- b. Undertake studies to add to quality of planning and design guidelines covering: (i) river management, river training and riverbank protection, (ii) distributary flows and rehabilitation, (iii) land reclamation and development, (iv) fisheries, and (v) resettlement, social, and environmental impacts. (Q4 2021–Q2 2024)
- c. Extend/refine pilots such as grout-filled mattresses and bio-engineering measures with katkin/vetiver grasses, channel closure and distributary offtake design. (Q4 2021–Q2 2023)
- d. Conduct flood and river surveys, and input data into web-based database (Q4 2021–Q3 2023)
- e. Input data into web-based (project) database (Q4 2021–Q2 2024)

3. Program Management Systems Operational 3.1 State-of-the-art implementation and documentation a. Regular progress documentation by PMO/SMOs applying database and MIS tools (Q4 2021–Q2 2024) b. Complete management transfer to the office of the CE River Management by midterm review (Q1 2023) 3.2 Follow-on project commensurate with River Stabilization Plan and Bangladesh Delta Plan a. Prepare follow-on project feasibility study (Q4 2021–Q3 2022) b. Process and approve follow-on project (Q4 2022–Q3 2023)
Project Management Activities Institutional set-up extended with PMO as part of office of CE River Management, BWDB (by Q4 2021). Engage/extend services of the ISPMC (by Q4 2021). Planning of activities, including works, resettlement and land acquisition activities, and MIS (by September 2021) Use of MIS, quality control system by PMO and SMOs (by Q2 2022) PMO/SMOs to conduct regular stakeholder workshops (Q4 2021–Q2 2024) Timely procurement and supervision of works (throughout project implementation) Timely procurement and management of services to be delivered by third-party firms / NGOs (by Q1 2022) Coordination between BWDB and DDM, including signing a MoU for CbFRM activities (Q3 2021–Q2 2024) Timely and quality reporting (Q4 2021–Q2 2024) Preparation of follow-on project and necessary documents for approval by the Government of Bangladesh and ADB (Q2 2022–Q2 2024) Facility completion report (Q1 2024–Q2 2024)
Inputs ADB: $157,000,000 (concessional loan) Government of the Netherlands: $17,890,000 (grant) Government: $36,910,000

ADB = Asian Development Bank, BBS = Bangladesh Bureau of Statistics, BWDB = Bangladesh Water Development Board, CE = Chief Engineer, CEGIS = Center for Environmental and Geographic Information Services, DC = deputy commissioner, DDM = Department of Disaster Management, DMU = disaster management unit, ha = hectare, ISPMC = institutional strengthening and project management consultant, km = kilometer, MFF = multitranche financing facility, MIS = management information system, MoU = memorandum of understanding, N/A = not applicable, NGO = nongovernment organization, O&M = operation and maintenance, OP = operational priority, PMO = project management office.

[a] The design and monitoring framework (DMF) for Project 2 was prepared within the frame of the DMF of the MFF but adjusted to comply with the new DMF guidelines (ADB. 2020. *Guidelines for Preparing a Design and Monitoring Framework*. Manila).

[b] The impact statement was defined for the investment program following previous DMF guidelines. However, it remains aligned with government priorities outlined in the Eighth Five-Year Plan, FY2020–FY2025 (Government of Bangladesh, Planning Commission. 2021.

[c] Achieved under Project 1.

[d] In the DMF of the MFF, 10 km were defined as baseline, as previously implemented in the project area under ADB-financed JMREMP, resulting in a pre-FRERMIP outcome of 43 ha of lands with assets protected from erosion.

[e] Appropriate technology entails long-guiding revetments placed alongside the existing riverbanks, and built from cost effective, sustainable sand-filled geotextile bags. The revetments will be adapted in accordance with morphological changes (deepening of the river) with separate work packages under this Project 2. Appropriate methodology refers to the construction technology making use of precisely positioned floating equipment. The precise amount of underwater works along the highly variable banklines will be determined within 5 days prior to dumping (implementation design) and as-built conditions will be determined within 5 days after dumping. Subsequently, regular monitoring to determine performance and potential adaptation works takes place making use of multi-beam echosounder surveys.

[f] "Building with nature" entails stimulating natural processes, for example closing an aggressively eroding bankline channel (Solimabad channel) through overloading with sediment, and measures involving bio-engineering, such as the plantation of large reed fields, which encourage the settlement of finer material and help building up char land to floodplain level.

[g] Community groups are comprised of vulnerable people from the Project area.

[h] Including, but not limited to, women's participation in consultations, surveys, accountability mechanisms, and collection and reporting on sex-disaggregated data

[i] Including explicit gender equality objectives and indicators. The M&E tools developed will assess qualitative and quantitative data measuring accountability of progress made on gender equality issues.

[j] "Adaptive Approach" refers to the adoption of flexible implementation to address ongoing morphological changes in the river with protection of riverbanks with launching aprons that are subsequently strengthened and built to the final scour depth with the deepening of the river.

Contribution to Strategy 2030 Operational Priorities

Expected values and methodological details for all OP indicators to which Project 2 will contribute results are detailed in Contribution to Strategy 2030 Operational Priorities (Appendix 6).

Source: Asian Development Bank.

Project Administration Manual

Project Number: 44167-015
MFF Number: 0082
August 2021

Bangladesh: Flood and Riverbank Erosion Risk Management Investment Program – Tranche 2

ABBREVIATIONS

ADB	–	Asian Development Bank
APFS	–	audited project financial statement
BWDB	–	Bangladesh Water Development Board
CAP	–	Corrective action plan
CQS	–	consultant qualification selection
DDM	–	Department of Disaster Management
DMF	–	design and monitoring framework
EARF	–	environmental assessment and review framework
EIA	–	environmental impact assessment
EMP	–	environmental management plan
EMR	–	environmental monitoring report
FAPAD	–	Foreign Aided Projects Audit Directorate
FMA	–	financial management assessment
GAP	–	gender action plan
GFIS	–	grant financial information system
GoN	–	Government of Netherlands
ha	–	hectare
ISPMC	–	institutional strengthening and project management consultant
km	–	kilometer
LFIS	–	loan financial information system
MIS	–	management information system
NGO	–	nongovernment organization
OCB	–	open competitive bidding
PAM	–	project administration manual
PFR	–	periodic financing request
PMO	–	project management office
PMU	–	project management unit
QPR	–	quarterly progress report
RAC	–	Regional Accounting Centre
SMO	–	subproject management office
SPS	–	Safeguard Policy Statement, 2009

CONTENTS

LIST OF ATTACHMENTS

Project Administration Manual Purpose and Process

The project administration manual (PAM) describes the essential administrative and management requirements to implement the project on time, within budget, and in accordance with the policies and procedures of the government and Asian Development Bank (ADB). The PAM should include references to all available templates and instructions either through linkages to relevant URLs or directly incorporated in the PAM.

The Bangladesh Water Development Board are wholly responsible for the implementation of ADB-financed projects, as agreed jointly between the borrower and ADB, and in accordance with the policies and procedures of the government and ADB. ADB staff is responsible for supporting implementation including compliance by Bangladesh Water Development Board of their obligations and responsibilities for project implementation in accordance with ADB's policies and procedures.

At loan negotiations, the borrower and ADB shall agree to the PAM and ensure consistency with the loan agreement. Such agreement shall be reflected in the minutes of the loan negotiations. In the event of any discrepancy or contradiction between the PAM and the loan agreement, the provisions of the loan agreement shall prevail.

After ADB Board approval of the project's report and recommendations of the President (RRP), changes in implementation arrangements are subject to agreement and approval pursuant to relevant government and ADB administrative procedures (including the Project Administration Instructions) and upon such approval, they will be subsequently incorporated in the PAM.

I. PROJECT DESCRIPTION

1. The livelihoods of people in Bangladesh are often affected by water-related disasters including floods, riverbank erosion, droughts, cyclones, and tidal surges, some being directly related to the location of the country on a vast flat floodplain at the confluence of three main rivers—the Jamuna (and Padma), the Ganges, and the Meghna. Climate change impacts exacerbate these disasters.

2. Riverbank erosion is one of the most prominent causes of disasters in Bangladesh due to its highly dynamic river morphology. In the last 40 years, over 80,000 hectares (ha) of agricultural land were lost to the river due to erosion along both riverbanks. This process disproportionately affects the poor, who face significant social hardships, such as loss of homestead, lands, and crops, and are displaced to fringe lands or urban slums. Disaster risks increase as the population grows, and the high population density of the country restricts the scope for moving people away from disaster-prone areas.

3. Erosion damage also extends to public infrastructure, including roads and flood embankments, and the high incidence of riverbank erosions hinders construction and rehabilitation of flood embankments. About 20% of the country is inundated annually during the monsoon season, resulting in loss of assets and crops. The threat of recurrent floods and riverbank erosion also discourages investment and leads to lower economic growth in the riparian areas. Effective flood and riverbank erosion risk management is therefore essential for economic growth, livelihood improvement, and poverty reduction in these locations. With a growing population as well as the expansion of settlements within the floodplain, future development will need to be carefully managed to protect the population from natural disasters. In addition, the existing system of embankments cannot be relied upon for protection from floods and can often lead to disaster when the embankments breach or overtop during severe flood events. Furthermore, the growing population will demand more reliable protection from riverbank erosion and flooding to safeguard their increasing assets and to sustain economic development.

4. Securing the livelihoods of the floodplain population therefore needs to be addressed through public sector interventions aimed at: (i) mitigating the economic losses and social displacement caused by riverbank erosion, (ii) reducing the economic losses resulting from flooding, and (iii) providing a secure environment to facilitate an increase in agricultural and industrial production and to enhance related economic activities.

5. The multitranche financing facility to the People's Republic of Bangladesh for the Flood and Riverbank Erosion Risk Management Investment Program was approved by the Asian Development Bank (ADB) in 2014. The facility increases the reliability and effectiveness of flood and riverbank erosion risk management systems in priority reaches along the Jamuna, Padma and Ganges rivers through structural and nonstructural interventions, policy strengthening, and institutional and knowledge bases.

6. The investment program is a follow-on to the Jamuna–Meghna River Erosion Mitigation Project (JMREMP). It extends successful technologies of the Jamuna–Meghna project to other geographical areas, with technological improvements.

7. Project 2 builds upon the achievements of Project 1. This project administration manual (PAM) is for Project 2. A map of the main works under Project 2 is in Figure 1.

8. **Impact and outcome and outputs.** Project 2 has the same impact, outcome and outputs as Project 1, and is aligned with the following impact: livelihood in the project area improved.[1] Project 2 will have the following outcome: flood and riverbank erosion risks in the subproject areas reduced. The design and monitoring framework (DMF) is in Section IX.

9. **Output 1: Flood and riverbank erosion risk mitigation functioning at priority reaches improved.** Project 2 combines structural and nonstructural measures in the three subproject areas to stabilize further the Lower Jamuna river by applying the integrated river stabilization approach developed under Project 1. Specifically, a major eroding channel near the Chauhali channel will be reduced in size through an innovative combination of dredging and bio-engineering to provide an offtake into a distributary and enable future development of some 6,000 ha of reclaimed char land.[2] The structural measures will include: (i) 30 km of riverbank protection with innovative technologies combined with nature-based solutions for channel closure; (ii) 40 km of riverbank protection adaptation works and 6 km of emergency works; (iii) 7.9 km of climate-resilient flood embankment; (iv) an offtake; and (v) two regulators. Also, as a lesson learned from Project 1 and per the Project Performance Evaluation Report for JMREMP , monitoring, adaptive maintenance, and emergency works for 5 years after construction will be included as a pilot to cope with the highly dynamic morphological processes of the river system. The nonstructural measures will continue the approach used under Project 1 and cover community involvement and community-based flood risk management activities such as (i) establishing 160 community-based disaster management units (minimum of 35% women-led) and developing their capacity; (ii) training 40 disaster units (14 units out of 40 led by women) created under Project 1 to enhance sustainability; (iii) raising awareness on FRERM; and (iv) strengthening disaster preparedness and emergency response with a focus on women participation.

10. **Table 1** outlines the civil works items proposed under Project 2 and salient features at each subproject area, while the map in **Figure** 1 depicts the locations of the subprojects and sites.

Table 1: Proposed Scope of Works of Project 2

Work Item	Scope of Work	Remarks
Jamuna Right Bank-1 subproject		
Shahjadpur flood embankment	7.9 km realignment along the Hurasagar and Korotoya Rivers	This is an extension of the flood embankment at Kaijuri built under Project 1 and will close the remaining reach to achieve full benefits of this subproject. LGED may build a road on the top of the embankment and held informal meetings with the BWDB field office on this.
Regulator with fish pass	2 nos. to the Hurashagar River	Additional to the DMF of the MFF.
Riverbank protection	3.5 km new works at Benotia to expand the Koijuri riverbank revetment. 7 km new works at Enayetpur	1 km of Project 1 works was deferred to Project 2 due to char formation in this area. However, the bankline channel has returned and BWDB provided emergency protection that now needs to be upgraded to 3.5 km of full protection. Out of the 11 km initially planned for Project 2 in the FAM in 2014, only 7 km will be required to stabilize the river upstream of Enayetpur.

[1] Government of Bangladesh, Planning Commission. 2021. *The Eighth Five Year Plan: FY2020–FY2025*. Dhaka.
[2] An accretion in a river, the chars are valuable to the economy of Bangladesh as additional cultivable areas.

Jamuna Left Bank-2 subproject		
River training	15.5 km bifurcation stabilization upstream of Chauhali	The works will extend the 7 km Chauhali riverbank revetment built under Project 1, stabilize the approach channel to the bifurcation, and prevent from severe bank erosion and the merging of Jamuna and Dhaleswari Rivers. This is an extension of the 5 km initially planned in the FAM in 2014 due to recent unfavorable morphological developments.
Land recovery	Updating model study for Solimabad channel closure with recent morphology Intelligent dredging of the Jamuna to fill the Solimabad channel with sediment and reclaim the Solimabad char	Works downstream of Chauhali as originally planned to recover lost floodplain from the river. This work is part of the wider river stabilization plan. Approximately 6,000 ha of lost floodplain to be recovered. Works will reduce riverbank erosion of about 15 km of bankline along the left bank channels. The approach planned in the FAM of 2014 was adjusted to account for changed river situation and incorporate "building with nature" or "nature-based solutions" approach.
Offtake	Offtake stabilization for the Ghior Khal	Stabilizing of the offtake by providing underwater protection to shape the offtake in a hydraulically favorable way. The offtake is expected to be provided with a flood management structure (flood barrier) during the construction of a flood embankment.
Padma Left Bank-1 subproject		
Riverbank protection	4 km upstream of bank protection work constructed under Tranche 1	Per original FAM 2014 approach
Adaptation and emergency works		
Adaptation	40 km	Extended from the original approach of the FAM 2014 to incorporate previously built sites, as well as expected works at Projects 1 and 2 sites.
Emergency	6 km	To cover for unforeseen developments.

BWDB = Bangladesh Water Development Board, DMF = design and monitoring framework, FAM = facility administration manual, JLB = Jamuna Left Bank, JRB = Jamuna Right Bank, km = kilometer, LGED = Local Government Engineering Department, MFF = multitranche financing facility, PLB = Padma Left Bank.

11. **Output 2**: **Institutional system for flood and riverbank erosion risk management strengthened.** Project 2 will continue to strengthen the knowledge base and institutional capacity of BWDB and the Department of Disaster Management (DDM) in sustainable asset and strategic managements of the rivers. Activities will include: (i) supporting the office of the Chief Engineer River Management, BWDB, including piloting drone flight surveys for O&M needs; (ii) carrying out river surveys; (iii) incorporating knowledge base products, such as the river stabilization plan and site information on BWDB's website; and (iv) updating the river stabilization guidelines. Project 2 activities will also include trainings, publications, and study tours (to the delta works in the Netherlands and/or an international conference on scour and erosion, for example). The institutional development activities will build on Project 1:

(i) Support to the office of the Chief Engineer River Management in developing and

operationalizing an asset management system for riverbank stabilization works and flood embankments. The development will be extended in the subproject areas towards an operational system. This activity includes piloting embankment surveys through drone flights to objectively assess O&M requirements, and incorporating lessons learned from the adaptation contract.

(ii) Expanding the knowledge base especially on morphological developments, fundamental as baseline and predictor for river stabilization measures. To this end, systematic, frequent water and sediment discharge measurements will be undertaken in the Lower Jamuna during Project 2. Distributaries will be mapped, and the geotechnical properties of the riverbanks investigated.

(iii) As part of a communication strategy, the website developed and operated under Project 1, which is currently incorporated into the BWDB website, will be further developed and expanded to knowledge base products, including the river stabilization plan.

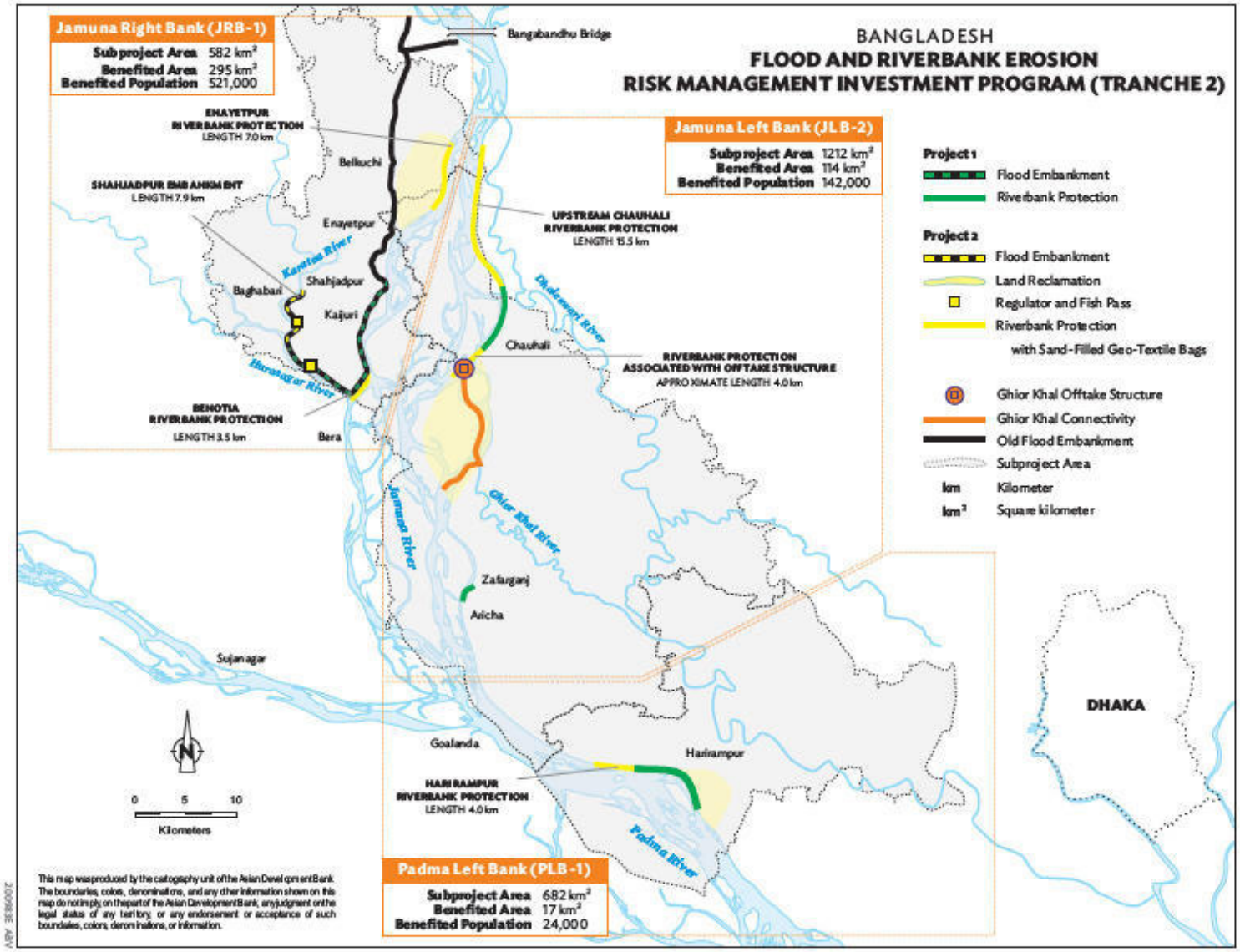
(iv) Providing capacity development through a mix of national and international training courses delivered through specialist institutions (such as the IHE Delft, or the Bangladesh University of Engineering and Technology), study tours, preparing international publications including for conference with participation. Specialist services will provide a broad number of knowledge-based improvements.

(v) Strengthening M&E system of river related programs and projects at BWDB, General Economics Division (GED), ERD and Implementation Monitoring and Evaluation Division (IMED) including establishing a web portal to monitor the progress of adopted indicators supporting the Annual Development Program (ADP) monitoring framework of the government.

12. **Output 3: Program management systems operational.** This output ensures the outputs of Project 2 will be timely delivered within budget. Further to the achievements of Project 1, it will reinforce BWDB's management system to ensure (i) the project management office (PMO) and subproject management offices (SMOs) are supported by a management information system, quality control systems, accountability measures, and efficient monitoring tools[3]; and (ii) the PMO and SMOs take more ownership of newly introduced concepts and work methods, including participatory process. Support will also be provided for BWDB to produce a feasibility study for the adaptive stabilization of the Jamuna–Ganges confluence area for a possible follow-on loan.

[3] This includes reporting to IMED and ERD through an online system the progress against the DMF.

Figure 1: Project 2 Summary Map



II. IMPLEMENTATION PLANS

A. Project Readiness Activities

Table 2: Project Readiness Activities

Indicative Activities	Months						Responsible Individual/Unit/Agency/ Government
	Apr 2021	May 2021	Jun 2021	Jul 2021	Aug 2021	Sep 2021	
Advance contracting actions	x	x	x				BWDB
Retroactive financing actions	x	x	x	x			BWDB
Establish project implementation arrangements		x	x	x			BWDB
ADB approval					x		ADB
Loan signing						x	BWDB and ADB
Government legal opinion provided						x	GoB
Government budget inclusion	x	x					BWDB and GoB
Loan effectiveness						x	BWDB

ADB = Asian Development Bank, BWDB = Bangladesh Water Development Board, GoB = Government of Bangladesh.
Source: Asian Development Bank.

B. Overall Project Implementation Plan

Table 3: Project Implementation Schedule

Item	2021									2022										2023										2024									
	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Output 1: flood and riverbank erosion risk mitigation functioning at priority reaches improved																																											
1.1 Infrastructure Improvement																																										
a. Complete land acquisition (Q4 2021–Q2 2023)																																											
b. Complete construction works (Q1 2022–Q2 2024)																																										
1.2. Building with nature																																										
a. Complete preparatory studies (Q1 2022–Q3 2022)																																										
b. Complete construction works (Q4 2022–Q2 2024)																																										
1.3 Community-based flood risk management																																										
a. Engage firm(s) / NGO(s) and refine methodologies and guidelines (Q4 2021–Q2 2022)																																										
b. Form community disaster management units, with necessary training (Q1 2022–Q4 2022)																																										
1.4. Livelihood support for project affected people																																										
a. Identify affected people, suitable for livelihood support activities and interest (Q4 2021–Q3 2022)																																										
b. Firm(s) /NGO(s) implement livelihood trainings and support program (Q4 2021–Q2 2024)																																										
c. Establish 12 fish sanctuaries and community-involvement (Q4 2021–Q2 2024)																																										
Output 2: institutional system for flood and riverbank erosion risk management strengthened																																										
2.1 BWDB institutional capacity strengthening for river management and sustainable asset management																																										
a. Conduct training for BWDB staff including staff of CE River Management office, in design of river and flood protection works, river management and O&M (Q1 2022–Q2 2024)																																										
b. Develop capacity of CE River Management office in particular planning and MIS (Q1 2022–Q2 2024)																																										
c. Develop, test, rollout and use MISs: (i) project website and database, (ii) web-based asset database, and (iii) project monitoring and																																										

Item	2021												2022												2023												2024											
	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
management information system (Q1 2022–Q2 2024)										■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
d. Prepare 5-year budgetary plan with BWDB for their approval (Q4 2021 to Q4 2022)							■	■	■	■	■	■	■	■	■	■	■	■	■	■	■																												
e. Conduct annual information sharing workshops with other agencies (intermittent from Q3 2022–Q2 2024)													■	■	■										■	■	■												■	■	■							
2.2. Data and knowledge base development for state-of-the-art implementation guidelines																																														
a. Refine the long-term river stabilization and river management master plans prepared under Project 1 to include char lands development; present to BWDB and stakeholders for wider adoption in planning (Q4 2022–Q4 2023)																			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■														
b. Undertake studies to add to quality of planning and design guidelines covering: (i) river management, river training and bank protection, (ii) distributary flows and rehabilitation, (iii) land reclamation and development, (iv) fisheries, and (v) resettlement and environment impact. (Q4 2021–Q2 2024)							■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■						
c. Extend/refine pilots such as grout-filled mattresses and bio-engineering measures with katkin/vetiver grasses, channel closure and distributary offtake design (Q4 2021–Q2 2023)							■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■																			
d. Conduct flood and river surveys and input data into web-based database (Q4 2021–Q3 2023)							■	■	■										■	■	■										■	■	■													
e. Input data into web-based (project) database (Q4 2021–Q2 2024)							■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■						
Output 3: Program management systems operational																																														
3.1 State-of-the-art implementation and documentation																																														
a. Regular progress documentation by PMO/SMOs applying database and MIS tools (Q4 2021–Q2 2024)							■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■						
b. Complete management transfer to the office of the CE River Management by mid-term review (Q1 2023)																						■	■	■																						
3.2 Follow-on project commensurate with River Stabilization Plan and Bangladesh Delta Plan																																													
a. Prepare follow-on project feasibility study (Q4 2021 to Q3 2022)							■	■	■	■	■	■	■	■	■	■																													

Item	2021									2022										2023										2024									
	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
b. Process and approve follow-on project (Q4 2022 to Q3 2023)																																											
Management Activities																																										
3.1. Institutional set up extended with PMO as part of office of CE River Management (by Q4 2021)																																										
3.2. Engage/extend services of the ISPMC (by Q4 2021)																																										
3.3. Planning of activities, including works, resettlement and land acquisition activities, and MIS (by Sep 2021)																																										
3.4. Use of MIS, quality control system by PMO and SMOs (by Q2 2022)																																										
3.5. PMO/SMOs to conduct regular stakeholder workshops (Q4 2021 to Q2 2024)																																										
Timely procurement and supervision of works (throughout project implementation)																																										
Timely procurement and management of services to be delivered by third party firms / NGOs (by Q1 2022)																																										
Coordination between BWDB and DDM, including signing an MoU for CbFRM activities (Q3 2021–Q2 2024)																																										
Timely and quality reporting (Q4 2021–Q2 2024)																																										
Facility completion report (Q1 2024–Q2 2024)																																										

ADB = Asian Development Bank, AP = affected person, BWDB = Bangladesh Water Development Board, CbFRM = community-based flood risk management, CE = Chief Engineer, DC = deputy commissioner, DDM = Department of Disaster Management, DMU = disaster management unit, ISPMC = institutional strengthening and project management consultant, MIS = management information system, MoU = Memorandum of Understanding, NGO = nongovernment organization, O&M = operation and maintenance, PMO = project management office, Q = quarter, SMO = subproject management office, WMO = water management office.
Source: Asian Development Bank.

III. PROJECT MANAGEMENT ARRANGEMENTS

A. Project Implementation Organizations: Roles and Responsibilities

Table 4: Primary Responsibilities of Program Management Organizations

Project Implementation Organizations	Management Roles and Responsibilities
Project Steering Committee	• Provide policy guidance to the formulation of a future program in line with the river stabilization plan. • Ensure smooth inter-ministry/agency coordination with special focus on the disaster management activities and safeguards. • Oversee project implementation and guide and resolve implementation issues that require higher level interventions.
Technical Committee	• Review and advise on complex and/or controversial technical issues encountered during design and implementation, such as adaptive planning and associated structural design, and project implementation including monitoring, adaptation and maintenance. • Recommend findings to the Project Steering Committee.
Project Implementation Committee	• Provide advice for the successful implementation of the project. • Review the activities of the project, evaluate progress, and provide decisions on issues arising during the implementation. • Meet every three months.
BWDB (Executing agency)	• Overall responsibility for executing the project and ensuring achievement of project objectives. • Prepare annual work plans and budgets meeting government requirements and arrange necessary institutional support and services for project implementation. • Award and manage contracts for procurement of works and goods, and for recruitment of consulting and NGO services. • Manage project finance and accounts, and monitor the use of funds provided by government, ADB and a cofinancer. • Coordinate with and support DDM during implementation. • Communicate and coordinate with other relevant agencies and institutions. • Prepare/cause to prepare and submit periodic progress reports, annual audit reports, and other reports meeting government and ADB requirements. • Keep regular close liaison with the office of the Chief Engineer River Management to coordinate the implementation of the works in line with the river stabilization plan. • Collect and collate expenditure statements, including for expenditures incurred by DDM, and prepare and submit withdrawal applications for funds to ADB. • Update the detailed project proforma (DPP) and other necessary documents, including resettlement and land acquisition plans, to meet ADB and government requirements. • Implement and monitor the EMP, • Inform ADB about the implementation status of safeguard issues through periodic monitoring reports on environment and social safeguard plan implementations • Continue to operate a PMO as the focal point of the Project and investment program. And to operate a SMO in each of the three subproject areas.

Project Implementation Organizations	Management Roles and Responsibilities
	• Provide continued guidance, involving the relevant BWDB Divisional Offices, to the SMOs in each subproject location to manage and supervise day-to-day implementation of works. • Assure that all SMOs will coordinate their activities at district level (District Development Committee and at local level with upazila and union level institutions, as well as with local communities at subproject level.
DDM (Implementing agency)	• Implement community-based flood risk management activities, including recruitment and supervision of NGOs, and procurement of related goods. • Ensure timely and quality outputs of the sub-component. • Manage finance accounts and monitor the use of funds provided by ADB for the sub-component. Submit monthly statements of expenditures to PMO, BWDB (Executing agency) • Prepare and submit quarterly physical and financial progress reports in prescribed formats to BWDB. • Document and prepare periodic monitoring reports on environment and social safeguard plan implementations • Coordinate with BWDB on project related problems and issues and recommendations. • Establish a PMU with necessary staff and appoint a Deputy Director/Deputy Secretary as Project Manager and the focal point for subproject implementation. • Carry out continuous consultations with affected people and communities throughout the project.
Institutional Strengthening and Project Management Consultant	• Support PMO and SMOs during the construction of the works, by - Advising on supporting studies and related designs for not designed works and pilot works. - Identifying design issues and remedial solutions prior to implementation and/or adaptation of the works. - Supporting quality assurance during construction including preparing construction completion reports. - Providing advice on contractual matters. • Provide advice and support DDM during implementation of their activities. • Support capacity development and institutional strengthening activities for BWDB and DDM with focus on the office of the Chief Engineer River Management. • Lead the knowledge-based activities in the fields of river surveys, data-based/MIS developments, and safeguard studies. • Support the subcontracting of surveys and studies summarized under provisional sums. • Draft progress reports for the PMO and prepare special reports/memos on project issues.
ADB	• Review overall project implementation including compliance with loan agreement and project agreement. • Select, following ADB guidelines and as agreed in response to the BWDB's request. the project implementation consultants on behalf of BWDB. • Review project documents that require ADB's approval or no-objection. • Provide funding for eligible items of expenditures.

Project Implementation Organizations	Management Roles and Responsibilities
Government of the Netherlands	• Review project implementation of grant-funded activities together with ADB. • Provide funding for eligible items of expenditures.
External safeguards monitoring consultants	• Monitor the implementation of the project's safeguards documents in compliance with ADB SPS (2009).
External Procurement Monitoring Specialist	• Improve the capacity of the PMO and SMOs to procure works, goods and services. • Monitor the status of procurement of works, goods and services by the PMO, as stated in the procurement plan.
Resettlement Plan INGO	• Assist in the update, finalization, and implementation of the RP in the project areas. • Implement the RPs as per ADB SPS, ensure stakeholder participation, assist or facilitate grievance redress claims, and provide support in compensating the APs as per RPs.
Community-Based Flood Risk Management (CbFRM) INGO	• Design and implement CbFRM along and in the vicinity of the three subproject areas, based on consultations at the institutional and local community levels and expert inputs of the main international and national consultants.
Directly-contracted government Institutes	• Conduct technical surveys and investigations (geotechnical investigations, river surveys, erosion prediction, channel closure modelling, etc.)

ADB = Asian Development Bank, AP = affected people, BWDB = Bangladesh Water Development Board, CbFRM = community-based flood risk management, DDM = Department of Disaster Management; DPP = detailed project proforma, EMP = environmental management plan, INGO = implementation nongovernmental organization, PMO = project management office, PMU = project management unit, RP = resettlement plan, SMO = subproject management office.
Source: Asian Development Bank.

B. Key Persons Involved in Implementation

Executing Agency

Bangladesh Water Development Board	Officer's Name: Rafiqul Islam Choubey Position: Project Director, Project Management Office Telephone: +880-2-9568792 Email address: pdjmremp@gmail.com Office Address: PMO-FRERMIP, BWDB, Pani Bhaban, Level 10, Block-B & D, 72 Green Road, Dhaka-1215

Asian Development Bank

Environment, Natural Resources and Agriculture Division	Staff Name: Mio Oka Position: Director Telephone No.: +632 8632 6834 Email address: moka@adb.org
Mission Leader	Staff Name: Olivier Drieu Position: Senior Water Resources Specialist Telephone No.: +632 8683 1819 Email address: odrieu@adb.org

C. Project Organization Structure

13. The organization structure for the project management and implementation is in Figure 2.

14. Figure **3** shows the organizational structure within BWDB for the implementation of the project.

Figure 2: Organization Structure of the Project

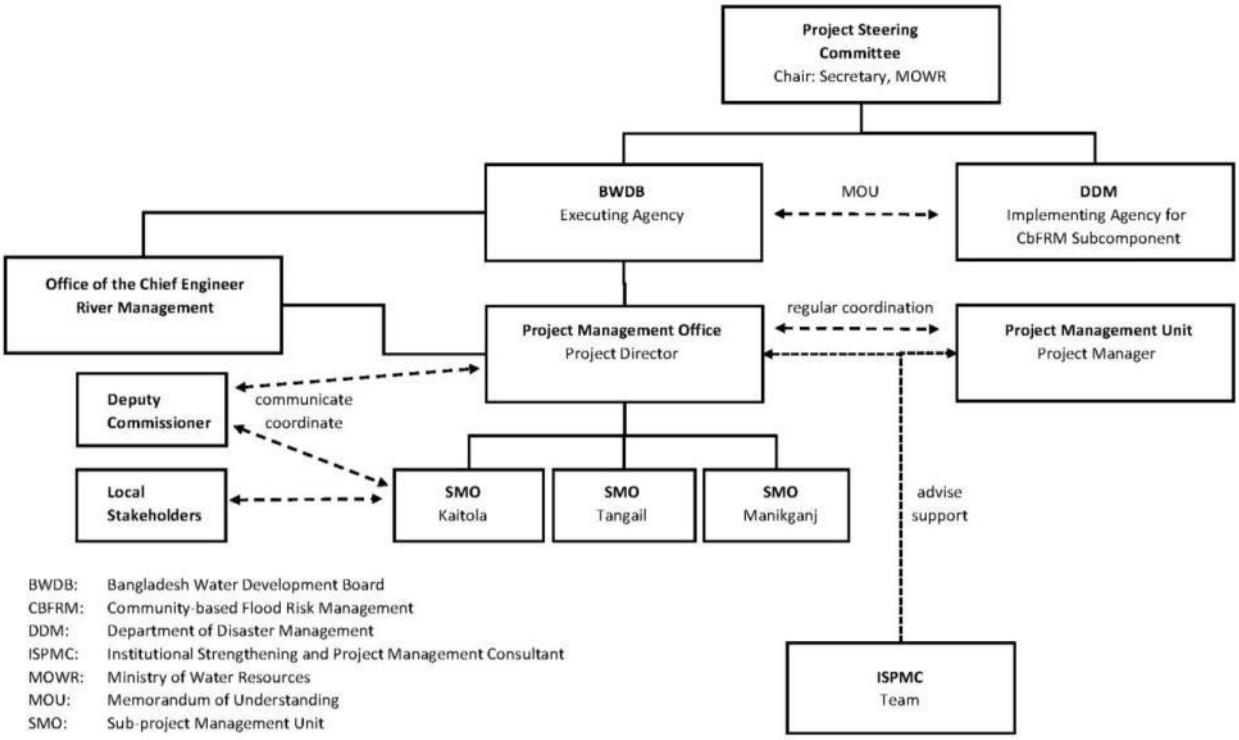
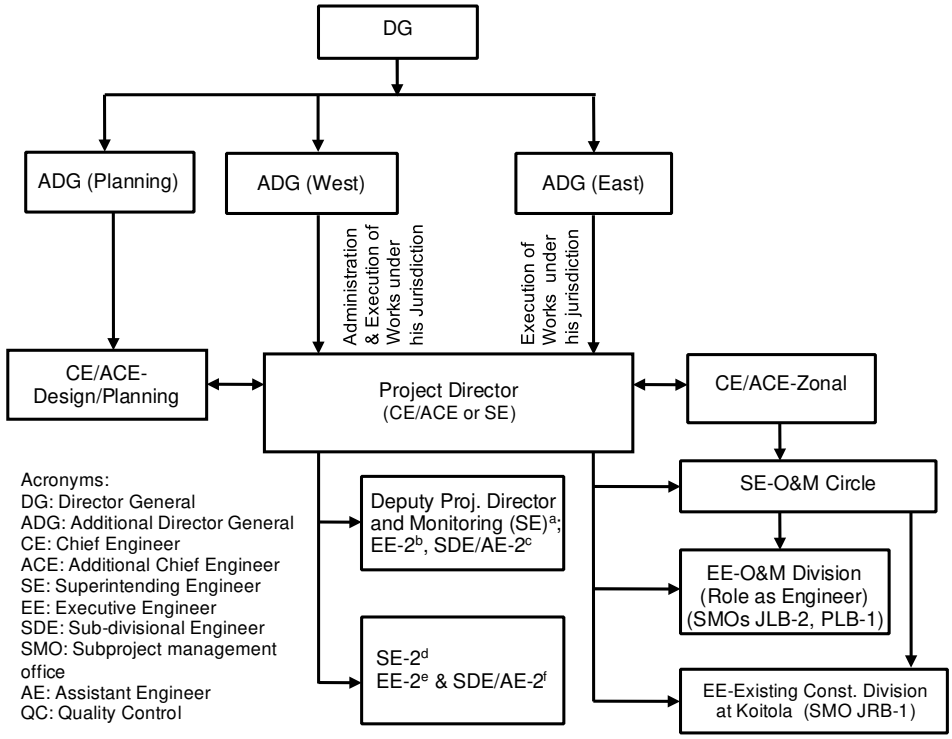


Figure 3: Organization Structure in BWDB



Notes:
[a] Deputy Project Director (SE)- 1: Procurement, Planning, Monitoring, Environment, Safeguards
[b] EE-2 - Procurement, Planning, Design, Monitoring, CRO & Environment
[c] SDE/AE-2 - Procurement, Planning, Design, Monitoring, RP, GAP & Others
[d] Deputy Project Director (SE) – 2: Design, QC, River Training, Loan covenants, DMF
[e] EE-2 - Planning, Design, QC, administrative coordination, training coordination, office management
[f] SDE/AE-2 - Planning, Design, QC
Source: Bangladesh Water Development Board (June 2021).

15. The project steering committee will be chaired by the Secretary, MOWR, and will comprise the members listed in **Table 5**.

Table 5: Project Steering Committee Members

	Name with Designation
1.	Senior Secretary, Ministry of Water Resources (MoWR)
2.	Additional Secretary, MoWR
3.	Director General, Bangladesh Water Development Board (BWDB)
4.	Director General, Department of Disaster Management (DDM)
5.	Additional Director General (Planning, Design & Research), BWDB
6.	Additional Director General (Western Region), BWDB
7.	Additional Director General (Eastern Region), BWDB
8.	Joint Secretary, MoWR
9.	Joint Chief, MoWR
10.	Chief Engineer, Planning, BWDB
11.	Chief Engineer, River Management, BWDB
12.	Director/Project Manager, DDM
13.	Deputy Chief, MoWR
14.	A representative, Department of Environment, Ministry of Environment and Forest
15.	A representative of Economic Relations Division, Ministry of Finance
16.	A representative of Planning Commission
17.	A representative of Implementation Monitoring and Evaluation Division, Ministry of Planning
18.	A representative of Ministry of Land

19.	A representative of Ministry of Agriculture
20.	A representative of Bangladesh Inland Water Transport Authority
21.	A representative of Ministry of Fisheries and Livestock
22.	Superintending Engineer, Procurement and Monitoring, PMO, BWDB
23.	Project Director, PMO, BWDB (Member Secretary)

Source: Bangladesh Water Development Board (October 2020).

16. The technical committee will be chaired by the Additional Director General (Planning, Design & Research) and will comprise the members listed in **Table 6**. Representatives from other parties may be invited to meetings when necessary.

Table 6: Technical Committee Members

	Name with Designation
1	Additional Director General (Planning), BWDB
2	Chief Planning, BWDB
3	Chief Engineer, River Management, BWDB
4	Chief Engineer, Design, BWDB
5	Professor, Bangladesh University of Engineering and Technology
6	Morphologist, The Center for Environmental and Geographic Information Services
7	Superintending Engineer, Design and Quality Control, PMO
8	Superintending Engineer, Pabna O&M Circle, BWDB
9	Superintending Engineer, Mymensingh O&M Circle, BWDB
10	Superintending Engineer, Dhaka O&M Circle, BWDB
11	Executive Engineer, Office of the Chief Planning, BWDB
12	Executive Engineer, PMO, BWDB
13	Project Director, PMO, BWDB (Committee secretary)

Source: Bangladesh Water Development Board

17. The project implementation committee will be chaired by the Director General, BWDB and will comprise the members listed in Table 7.

Table 7: Project Implementation Committee Members

	Name with Designation
1.	Director General, BWDB
2.	Chief Engineer, Planning, BWDB
3.	Chief Engineer, Monitoring, BWDB
4.	Deputy Chief/Desk Officer (Planning Wing), MoWR
5.	Desk Officer (Development Wing), MoWR
6.	Representative, Irrigation Wing, Planning Commission
7.	Representative, Programming Division, Planning Commission
8.	Representative of Coordination Division of NEC-ECNEC and Planning Commission
9.	Representative of relevant Division, IMED
10.	Representative of Finance Division
11.	Project Director, PMO-FRERMIP, BWDB
12.	Representative of relevant Design Circle, BWDB
13.	Superintending Engineer, Design and Quality Control, PMO, BWDB

Source: Bangladesh Water Development Board (June 2021)

18. Project 2 will be executed through BWDB's Divisional offices, under the administrative control of BWDB's existing set up, following the BWDB's procedures of supervision, monitoring and Delegation of Financial Power. The PMO and SMO staffing is in Table 8. The PMO will be responsible for overall project management and monitoring, and will provide the following activities under of the project:

(i) coordination of project management activities;
(ii) monitoring of construction of civil works;
(iii) quality assurance and control;
(iv) fund placement;
(v) project benefit monitoring and evaluation;
(vi) planning and design of the remaining works, preparation of the bidding documents, bid evaluation, supervision and verification of bills before payments; and
(i) preparation of a follow-on project in line with the River Stabilization Plan developed under Project 1 and approved by BWDB in 2020, including all clearances of government documents (EIA, WARPO, Planning Commission, etc.).

Table 8: PMO and SMO Staffing

Position	No. of Staff	Responsibility	Type of engagement/ % of time for Project-2
PMO (Deputation from BWDB)			
Project Director (Additional Chief Engineer or Superintending Engineer)	1	Overall project management responsibility	Full time
Deputy Project Director (Superintending Engineer)	2	1. Design, Quality Control, River Training and compliances of Loan covenants & DMF	Full time
		2. Procurement, Planning, Monitoring and Environmental & Social safeguards	Full time
Executive Engineer (or equivalent rank)	4	1. Procurement, contract management	Full time
		2. Safeguards: Chief Resettlement Officer and environment	Full time
		3. Project management, office management, training coordination and administrative coordination (steering committees, DPP preparation and variations, communication)	Full time
		4. Quality Control, planning, adaptation, monitoring	Full time
Subdivisional Engineer	2	1. Procurement, contract management, Resettlement & GAP	Full time
		2. Quality Control, adaptation, maintenance, Environment,	Full time
Assistant Engineer	2	1. Procurement, contract management, project management and administrative activities	Full time
		2. Monitoring, asset management and O&M system	Full time
Assistant Director	1	Land Acquisition, Resettlement	Full time
Revenue Surveyor	1	Land Acquisition, Resettlement	Full time
Systems Analyst	1	MIS, Inventory, Database, Project Website	Full time
Programmer	1	MIS, Asset Management	Full time
Assistant Programmer	1	Inventory, Database	Full time
Deputy Director (Accounts)	1	Payments and audits; financial management; and ensuring that all loan covenants pertaining to financial management are complied with	Full time
Accounts Officer	1	Support Deputy Director	Full time

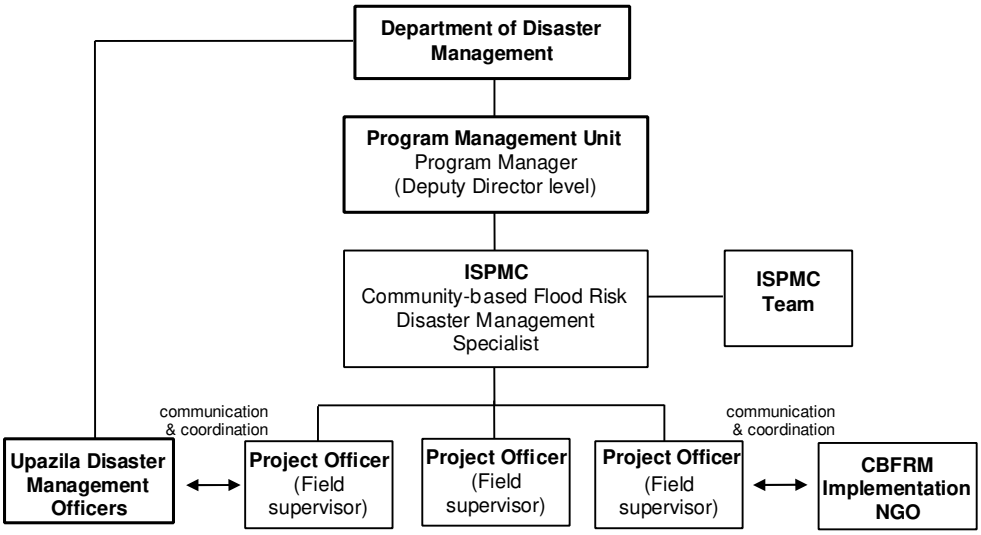
Position	No. of Staff	Responsibility	Type of engagement/ % of time for Project-2
Senior Accountants Assistants	3	Contractors' invoice processing and keeping a record of the accounts, particularly for claims that will be claimed through SOEs	Full time
Data entry operator	1	Riverbank protection & Embankment asset management system	Full time
Driver	4		Outsourced
Guard	2		Outsourced
MLSS	4		Outsourced
Cleaner	2		Outsourced
Sub-total	**34**		
Koitala SMO (Deputation from Board)			
Executive Engineer	1	Head of the SMO in Kaitola and nominated 'Project Manager' / 'Engineer'	Full time
Subdivisional Engineer	2	Exclusively implement FRERMIP works at the subprojects	Full time
Assistant Engineer	1	daily construction supervision at the subproject sites	Full time
Sub Assistant Engineers	3	daily construction supervision at the subproject sites	Full time
Senior Accounts assistant	1	Assist SMO in daily accounting activities	Full time
Data entry operator	1	Update asset management system	Full time
Revenue surveyor	1	Quantity check of contractors' invoices	Full time
Work assistant	6	Daily construction supervision	Full time
Driver	1		Outsourcing
Guard	1		Outsourcing
MLSS	2		Outsourcing
Cleaner	1		Outsourcing
Sub-total	**21**		
Tangail SMO (Deputation from Board)			
Executive Engineer	1	Head of the SMO in Tangail and nominated 'Project Manager' / 'Engineer'	Part-time / 55%
Subdivisional Engineer	2	Implementation of FRERMIP works at the subprojects	Part-time / 60%
Assistant Engineer	1	daily construction supervision at the subproject sites	Part-time / 60%
Sub Assistant Engineers	3	daily construction supervision at the subproject sites	Part-time / 80%
Senior Accounts assistant	1	Assist SMO in daily accounting activities	Part-time / 60%
Data entry operator	1	Update asset management system	Part-time / 60%
Revenue surveyor	1	Quantity check of contractors' invoices	Part-time / 60%
Work assistant	6	Daily construction supervision	Part-time / 80%
Driver	1		Outsourcing
Guard	1		Outsourcing
MLSS	2		Outsourcing
Sub-total	**20**		
Manikganj SMO (Deputation from Board)			
Executive Engineer	1	Head of the SMO in Manikganj and nominated 'Project Manager' / 'Engineer'	Part-time / 65%
Subdivisional Engineer	1	Implementation of FRERMIP works at the subprojects	Part-time / 70%

Position	No. of Staff	Responsibility	Type of engagement/ % of time for Project-2
Assistant Engineer	1	daily construction supervision at the subproject sites	Part-time / 70%
Sub Assistant Engineers	2	daily construction supervision at the subproject sites	Part-time / 80%
Senior Accounts assistant	1	Assist SMO in daily accounting activities	Part-time / 70%
Data entry operator	1	Update asset management system	Part-time / 70%
Revenue surveyor	1	Quantity check of contractors' invoices	Part-time / 70%
Work assistant	6	Daily construction supervision	Part-time / 80%
Driver	1		Outsourcing
Guard	1		Outsourcing
MLSS	2		Outsourcing
Sub-total	**18**		

FRERMIP = Flood and River Erosion Risk Management Investment Program, GAP = gender action plan, MLSS = member of lower subordinate staff, O&M = operation and maintenance, PMO = project management office, SMO = subproject management office, SOE = statement of expenditure
Source: Bangladesh Water Development Board

19. DDM's internal structure is in **Figure 4**.

Figure 4: Organizational structure in the Department of Disaster Management



CBFRM = community-based flood risk management
ISPMC: institutional strengthening and project management consultants
NGO: nongovernment organization

IV. COSTS AND FINANCING

20. The government has requested a concessional loan of $157.0 million from ADB's ordinary capital resources to finance the project. The loan will have a 25-year term, including a grace period of 5 years; an interest rate of 2.0% per year during the grace period and thereafter; and such other terms and conditions set forth in the draft loan and project agreements.

21. ADB will finance the expenditures in relation to civil works, consulting services, trainings, equipment, and office operation. The Government of the Netherlands will provide a grant

cofinancing equivalent to $17.89 million to be fully administered by ADB.[4] The counterpart funds from the government will be used to finance land acquisition, part of the tax and duties, and part of operating costs of PMO, subproject management offices (SMOs) and project management unit (PMU) of DDM. The financing plan is in **Table 9**. The cost estimates are summarized in **Table 10**.

Table 9: Financing Plan

Source	Amount ($ million)	Share of Total (%)
Asian Development Bank		
Ordinary capital resources (concessional loan)	157.00[a]	73.78
Government of the Netherlands (grant)	17.89[b]	8.40
Government	37.91	17.82
Total	**212.80**	**100.00**

[a] Project 2 will be funded by ordinary capital resources (concessional loan) from the country allocation ($122.85 million) and savings and cancellations of ongoing projects ($34.15 million).
[b] Fully administered by ADB. Includes 2% of ADB's administration charges.
Source: Asian Development Bank estimates.

Table 10: Summary Cost Estimates
($ million)

Item		Amount[a]
A.	**Base Cost**[b]	
	1. Flood and riverbank erosion risk mitigation functioning at priority reaches improved	154.3
	2. Institutional system for FRERM strengthened	17.8
	3. Program management systems operational	8.7
	Subtotal (A)	**180.8**
B.	**Contingencies**[c]	**27.1**
C.	**Financial Charges During Implementation**[d]	**4.9**
	Total (A+B+C)	**212.8**

FRERM = flood and riverbank erosion risk management.
[a] Includes taxes and duties of $27.3 million. Such amount does not represent an excessive share of the project cost. The government will finance taxes and duties of $18.4 million as cash contribution.
[b] In mid-2021 prices.
[c] Physical contingencies computed at 8.5% for civil works; and 6.5% for surveys/investigations, capacity development, equipment/vehicles, consultancy services and studies. Price contingencies computed at average of 1.7% on foreign exchange costs and 5.5% on local currency costs; includes provision for potential exchange rate fluctuation under the assumption of a purchasing power parity exchange rate.
[d] Includes interest. Interest during construction for the estimated amount of Asian Development Bank (ADB) financing has been computed at 2.0% per year. The financing charges include 2% of administration fees for ADB's administration of a grant from the Government of the Netherlands.
Source: Asian Development Bank estimates.

A. Cost Estimates Preparation and Revisions

22. A feasibility study for Project 2 was initiated in 2016. The institutional strengthening and project management consultant (ISPMC) submitted the Site Selection and Initial Economic Assessment Report in May 2017, which was discussed between ADB and the Director General of BWDB in July 2017. The third Technical Advisory Committee approved the report on 29 November 2017. BWDB approved the feasibility study in 2019 which has been updated and subsequently approved in August 2020 with revisions made to the scope and cost estimates for the proposed works.

[4] A letter of intent was received from the Government of the Netherlands on 28 March 2021.

B. Key Assumptions

23. The following key assumptions underpin the cost estimates and financing plan:

(i) Exchange rate: Tk84.7 = $1.00 (as of April 2021).
(ii) Price contingencies based on expected cumulative inflation over the implementation period are in **Table 11**.

Table 11: Escalation Rates for Price Contingency Calculation

Item	2021	2022	2023	2024	Average
Foreign rate of price inflation	1.60%	1.70%	1.70%	1.80%	1.70%
Domestic rate of price inflation	5.50%	5.50%	5.50%	5.50%	5.50%

Source: Asian Development Bank.

C. Detailed Cost Estimates by Expenditure Category

Table 12: Detailed Cost Estimates by Expenditure Category

		Total Cost	% of Total Base Cost
A.	**Investment Costs**		
	1. Survey and Investigations	2.6	1.5%
	2. Land Acquisition and Resettlement		
	Land Acquisition	20.2	11.2%
	Resettlement	3.3	1.8%
	3. Civil Works	58.6	32.4%
	4. Materials	53.9	29.8%
	5. Equipment and Vehicles	0.9	0.5%
	6. Consulting services		
	a. Community Based Flood Risk Management	2.8	1.5%
	b. Capacity Development	0.8	0.4%
	c. ISPMC	13.6	7.5%
	d. Other Consultancy Services	5.3	2.9%
	7. Environmental Mitigation and Management	2.0	1.1%
	8. Pilot Land Recovery/River Training	14.0	7.7%
	Subtotal (A)	**178.0**	**98.5%**
B.	**Recurrent Costs**		
	1. PMO Operation	2.8	1.5%
	Subtotal (B)	**2.8**	**1.5%**
	Total Base Cost	**180.8**	**100.0%**
C.	**Contingencies**		
	1. Physical	12.5	6.9%
	2. Price	14.6	8.1%
	Subtotal (C)	**27.1**	**15.0%**
D.	**Financial Charges During Implementation**		
	1. Interest charges and administrative fees	4.9	2.7%
	Subtotal (D)	**4.9**	**2.7%**
	Total Project Cost (A+B+C+D)	**212.8**	**117.7%**

ISPMC = institutional strengthening and project management consultant; PMO = project management office.
Note: Numbers may not sum precisely because of rounding.
Source: Asian Development Bank estimates.

D. Allocation and Withdrawal of Loan and Grant Proceeds

Table 13: ADB Ordinary Capital Resources Concessional Loan

No.	Category	Total Amount Allocated for ADB Financing (US$)	Basis for Withdrawal from the Loan Account
1	Survey and Investigations	1,100,000	41% of total expenditure claimed
2	Land Acquisition and Resettlement	3,300,000	14% of total expenditure claimed
3	Civil Works	53,000,000	90% of total expenditure claimed
4	Materials	50,100,000	93% of total expenditure claimed
5	Equipment and Vehicles	800,000	87% of total expenditure claimed
6	Community-based Flood Risk Management	2,400,000	87% of total expenditure claimed*
6	Capacity Development	700,000	87% of total expenditure claimed
7	ISPMC	1,300,000	9% of total expenditure claimed
8	Other Consulting Services	1,900,000	36% of total expenditure claimed
9	Environmental Mitigation and Management	200,000	12% of total expenditure claimed
10	Pilot Land Recovery/River Training	13,000,000	93% of total expenditure claimed
11	PMO Operation	2,400,000	87% of total expenditure claimed
12	Unallocated	22,300,000	
13	Interest Charge	4,500,000	100% of amount due
	Total	**157,000,000**	

ISPMC = institutional strengthening and project management consultant; PMO = project management office.
* Subject to the condition for withdrawal described in paragraph 7 of Schedule 3 of the FFA. No ADB loan proceeds will be withdrawn under this category until BWDB and the Department of Disaster Management have entered into a memorandum of understanding acceptable to ADB, setting out the terms and practical arrangements for their collaboration for Project 2.
Source: Asian Development Bank estimates.

Table 14 : Grant from the Government of Netherlands

Number	Category	Total Amount Allocated for ADB Financing (US$)	Percentage and Basis for Withdrawal from the Loan Account
1	Survey and Investigations	1,210,000	46% of total expenditure claimed
2	Civil Works (piloting)	1,510,000	3% of total expenditure claimed
3	ISPMC	10,580,000	78% of total expenditure claimed
4	Other Consulting Services	2,710,000	51% of total expenditure claimed
5	Environmental Mitigation and Management	1,530,000	75% of total expenditure claimed
6	ADB Administration Fees	350,000	100% of amount due
	TOTAL	**17,890,000**	

E. Detailed Cost Estimates by Financier

Table 15: Detailed Cost Estimates by Financier

		ADB		Government		Government of Netherlands		Total Cost	
		Amount ($ million)	% of Cost Category	Amount ($ million)	% of Cost Category	Amount ($ million)	% of Cost Category	Amount ($ million)	Taxes and Duties
A.	**Investment Costs**								
	1. Surveys and Investigations	1.1	41.3%	0.3	13.1%	1.2	45.6%	2.6	0.5
	2. Land Acquisition and Resettlement	3.3	14.0%	20.2	86.0%	0.0	0.0%	23.5	2.7
	3. Civil Works	53.0	93.0%	4.1	7.0%	1.5	2.6%	58.6	6.7
	4. Materials	50.1	93.0%	3.8	7.0%	0.0	0.0%	53.9	6.1
	5. Equipment and Vehicles	0.8	87.0%	0.1	13.0%	0.0	0.0%	0.9	0.1
	6. Community Based Flood Risk Management	2.4	86.9%	0.4	13.1%	0.0	0.0%	2.8	0.6
	7. Capacity Development	0.7	86.9%	0.1	13.1%	0.0	0.0%	0.8	0.2
	8. ISPMC	1.3	9.3%	1.8	13.1%	10.6	77.5%	13.6	3.1
	9. Other Consultancy Services	1.9	36.0%	0.7	13.1%	2.7	50.9%	5.3	1.2
	10. Environmental Mitigation and Management	0.2	11.5%	0.3	13.1%	1.5	75.3%	2.0	0.5
	11. Pilot Land Recovery/River Training	13.0	82.2%	1.0	7.0%	0.0	0.0%	14.0	1.6
	Subtotal (A)	**127.8**	**71.8%**	**32.7**	**18.4%**	**17.5**	**9.9%**	**178.0**	**23.2**
B.	**Recurrent Costs**								
	1 PMO Operation	2.4	86.9%	0.4	13.1%	0.0	0.0%	2.8	0.5
	Subtotal (B)	**2.4**	86.9%	**0.4**	13.1%	**0.0**	0.0%	**2.8**	**0.5**
	Total Base Cost	**130.2**	72.0%	**33.1**	18.3%	**17.5**	9.7%	**180.8**	**23.7**
C.	**Contingencies**	**22.3**	82.3%	**4.8**	17.8%	**0.0**	**0%**	**27.1**	**3.5**
D.	**Financial Charges During Implementation**	**4.5**	92.8%	**0.0**	0.0%	**0.4[a]**	**7.2%**	**4.9**	
	Total Project Cost (A+B+C+D)	**157.0**	73.8%	**37.9**	17.8%	**17.9**	**8.4%**	**212.8**	**27.3**
	% Total Project Cost		**73.8%**		**17.8%**		**8.4%**	**100.0%**	

ISPMC = institutional strengthening and project management consultant; PMO = project management office.
Note: Numbers may not sum precisely because of rounding.
[a] The financial charges under GoN are for 2% of administration charges and audit fees for ADB's full administration of the grant.
Source: Asian Development Bank estimates.

F. Detailed Cost Estimates by Outputs

Table 16: Detailed Cost Estimates by Outputs
($ million)

Item	Total Cost	Output 1 Amount	Output 1 % of Cost Category	Output 2 Amount	Output 2 % of Cost Category	Output 3 Amount	Output 3 % of Cost Category
A. Investment Costs							
1. Survey and Investigations	2.6	1.3	50.0%	1.3	50.0%	0.0	0.0%
2. Land Acquisition and Resettlement	23.5	23.5	100.0%	0.0	0.0%	0.0	0.0%
3. Civil Works	58.6	58.6	100.0%	0.0	0.0%	0.0	0.0%
4. Materials	53.9	53.9	100.0%	0.0	0.0%	0.0	0.0%
5. Equipment and Vehicles	0.9	0.0	0.0%	0.0	0.0%	0.9	100.0%
6. Community Based Flood Risk Management	2.8	0.0	0.0%	2.8	100.0%	0.0	0.0%
7. Capacity Development	0.8	0.0	0.0%	0.8	100.0%	0.0	0.0%
8. ISPMC	13.6	0.0	0.0%	9.1	66.7%	4.5	33.3%
9. Other Consultancy Services	5.3	1.0	19.5%	3.8	71.7%	0.5	8.8%
10. Environmental Mitigation and Management	2.0	2.0	100.0%	0.0	0.0%	0.0	0.0%
11. Pilot Land Recovery/River Training	14.0	14.0	100.0%	0.0	0.0%	0.0	0.0%
Subtotal (A)	**178.0**	**154.3**	**86.7%**	**17.8**	**10.0%**	**5.9**	**3.3%**
B. Recurrent Costs							
1. PMO Operation	2.8	0.0	0.0%	0.0	0.0%	2.8	100.0%
Subtotal (B)	**2.8**	**0.0**	**0.0%**	**0.0**	**0.0%**	**2.8**	**100.0%**
Total Base Cost	**180.8**	**154.3**	**85.3%**	**17.8**	**9.9%**	**8.7**	**4.8%**
C. Contingencies							
1. Physical	12.5	5.8	46.8%	0.9	7.1%	0.3	2.4%
2. Price	14.6	12.5	85.3%	1.4	9.9%	0.7	4.8%
Subtotal (C)	**27.1**	**18.3**	**67.6%**	**2.3**	**8.6%**	**1.0**	**3.7%**
D. Financial Charges During Implementation							
1. Interest and Administrative Fees	4.9	4.2	86.7%	0.5	10.0%	0.2	3.3%
Subtotal (D)	**4.9**	**4.2**	**86.7%**	**0.5**	**10.0%**	**0.2**	**3.3%**
Total Project Cost (A+B+C+D)	**212.8**	**176.9**	**83.1%**	**20.6**	**9.7%**	**9.9**	**4.6%**

ISPMC = institutional strengthening and project management consultant; PMO = project management office.
Note: Numbers may not sum precisely because of rounding.
Source: Asian Development Bank estimates.

G. Detailed Cost Estimates by Year

Table 17: Detailed Cost Estimates by Year
($ million)

Item		Total Cost	2021	2022	2023	2024
A.	**Investment Costs**					
	1. Survey and Investigations	2.6	0.4	0.8	1.2	0.3
	2. Land Acquisition and Resettlement	23.5	7.0	11.7	4.7	0.0
	3. Civil Works	58.6	3.6	17.5	31.5	6.0
	4. Materials	53.9	10.8	26.9	16.2	0.0
	5. Equipment and Vehicles	0.9	0.2	0.6	0.1	0.0
	6. Community Based Flood Risk Management	2.8	0.6	1.0	1.0	0.3
	7. Capacity Development	0.8	0.1	0.3	0.3	0.1
	8. ISPMC	13.6	2.7	4.1	4.1	2.7
	9. Other Consultancy Services	5.3	0.8	2.1	1.9	0.5
	10. Environmental Mitigation and Management	2.0	0.0	0.7	0.8	0.5
	11. Pilot Land Recovery and River Training	14.0	0.0	4.9	7.0	2.1
	Subtotal (A)	**178.0**	**26.2**	**70.7**	**68.7**	**12.5**
B.	**Recurrent Costs**					
	1. PMO Operation	2.8	0.3	1.0	1.0	0.6
	Subtotal (B)	**2.8**	**0.3**	1.0	**1.0**	0.6
	Total Base Cost	**180.8**	**26.4**	**71.6**	**69.7**	**13.1**
C.	**Contingencies**	**27.1**	**4.0**	**10.7**	**10.4**	**2.0**
D.	**Financial Charges During Implementation**	**4.9**	**0.0**	**0.0**	**0.0**	**4.9**
	Total Project Cost (A+B+C+D)	**212.8**	**30.4**	**82.4**	**80.1**	**19.9**

ISPMC = institutional strengthening and project management consultant; PMO = project management office.
Source: Asian Development Bank estimates.

H. Contract Awards and Disbursement S-Curves

Table 18: Contract Awards and Disbursement Baseline Projections for the ADB Loan
($ million)

	Contract Awards					Disbursements				
Year	**Q1**	**Q2**	**Q3**	**Q4**	**Total**	**Q1**	**Q2**	**Q3**	**Q4**	**Total**
2021	0.0	0.0	16.00	6.6	**22.6**	0.0	0.0	0.0	18.1	**18.1**
2022	27.4	0.0	12.1	34.9	**74.4**	10.3	10.4	12.7	22.4	**55.8**
2023	15.0	0.0	12.9	16.0	**43.9**	11.7	12.3	12.2	21.7	**57.8**
2024	16.1	0.0	0.0	0.0	**16.1**	5.3	5.3	5.3	9.3	**25.3**
TOTAL					**157.0**					**157.0**

Source: Asian Development Bank estimates.

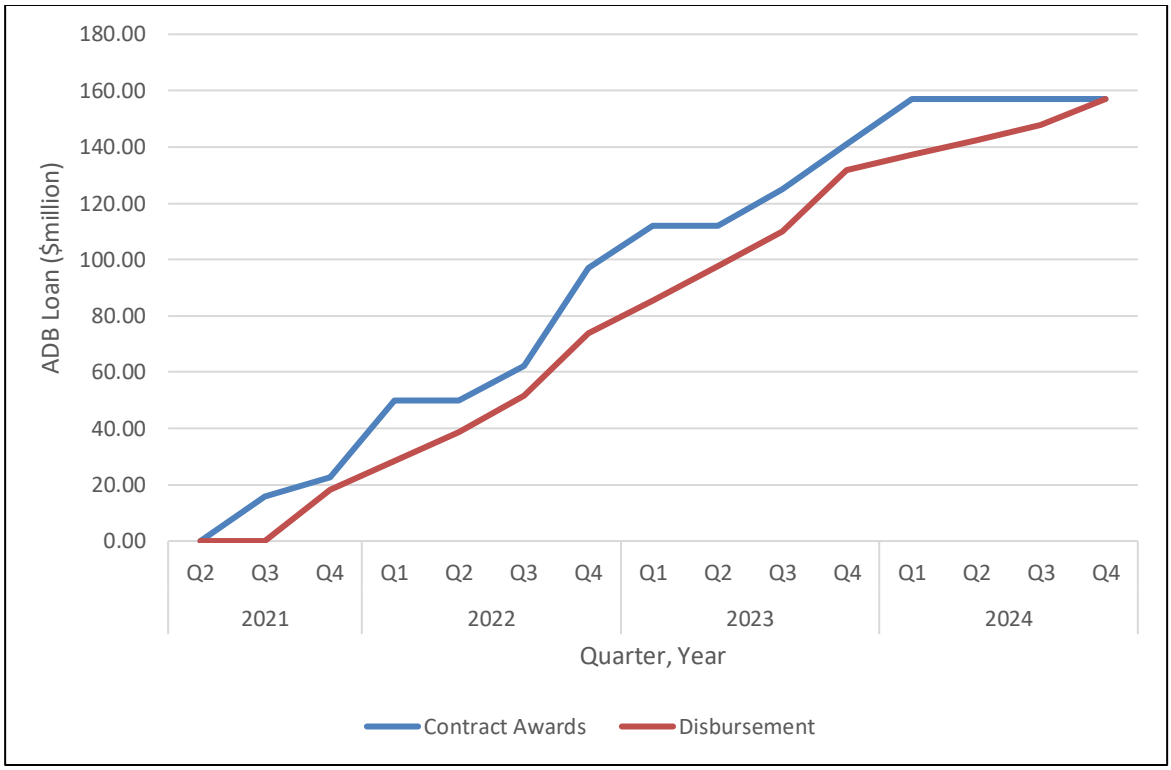


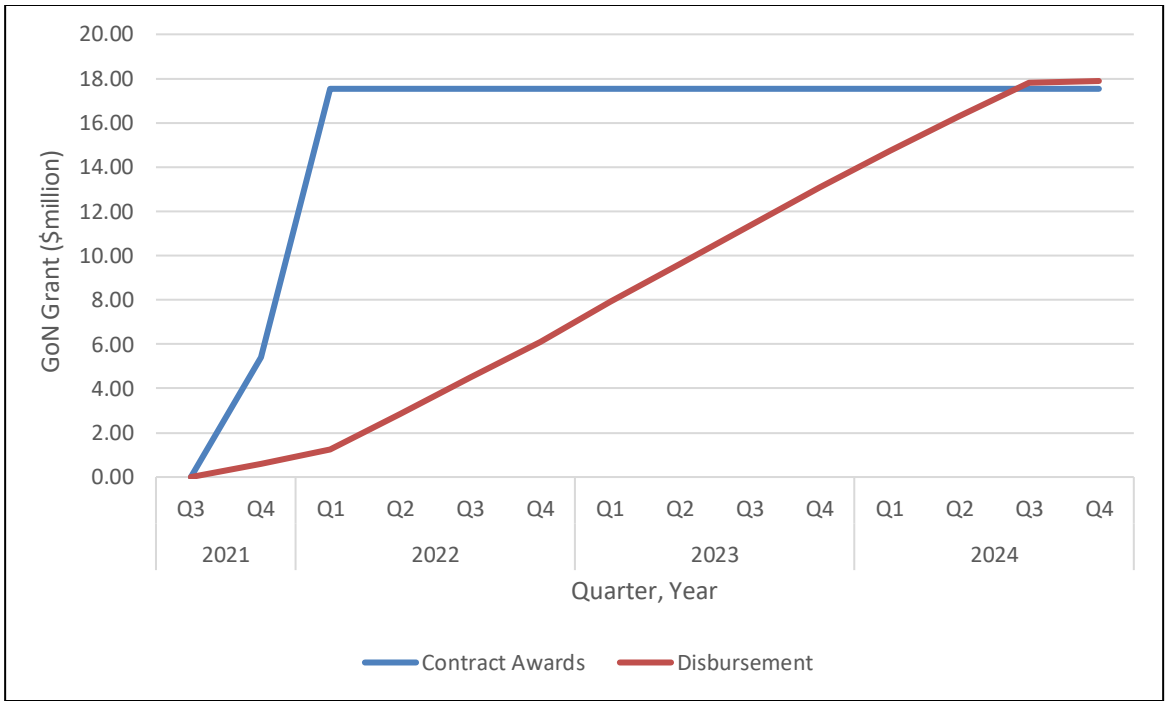
Table 19 : Contract Awards and Disbursement Baseline Projections for the Grant from the Government of Netherlands

($ million)

	Contract Awards					Disbursements				
Year	**Q1**	**Q2**	**Q3**	**Q4**	**Total**	**Q1**	**Q2**	**Q3**	**Q4**	**Total**
2021	0.0	0.0	0.0	5.4	**5.4**	0.0	0.0	0.0	0.6	**0.6**
2022	12.1	0.0	0.0	0.0	**12.1**	0.6	1.6	1.6	1.6	**5.5**
2023	0.0	0.0	0.0	0.0	**0.0**	1.8	1.7	1.7	1.7	**7.0**
2024	0.0	0.0	0.0	0.0	**0.0**	1.7	1.6	1.5	0.1	**4.8**
TOTAL					**17.5***					**17.89**

* Net of 2% administration charges.

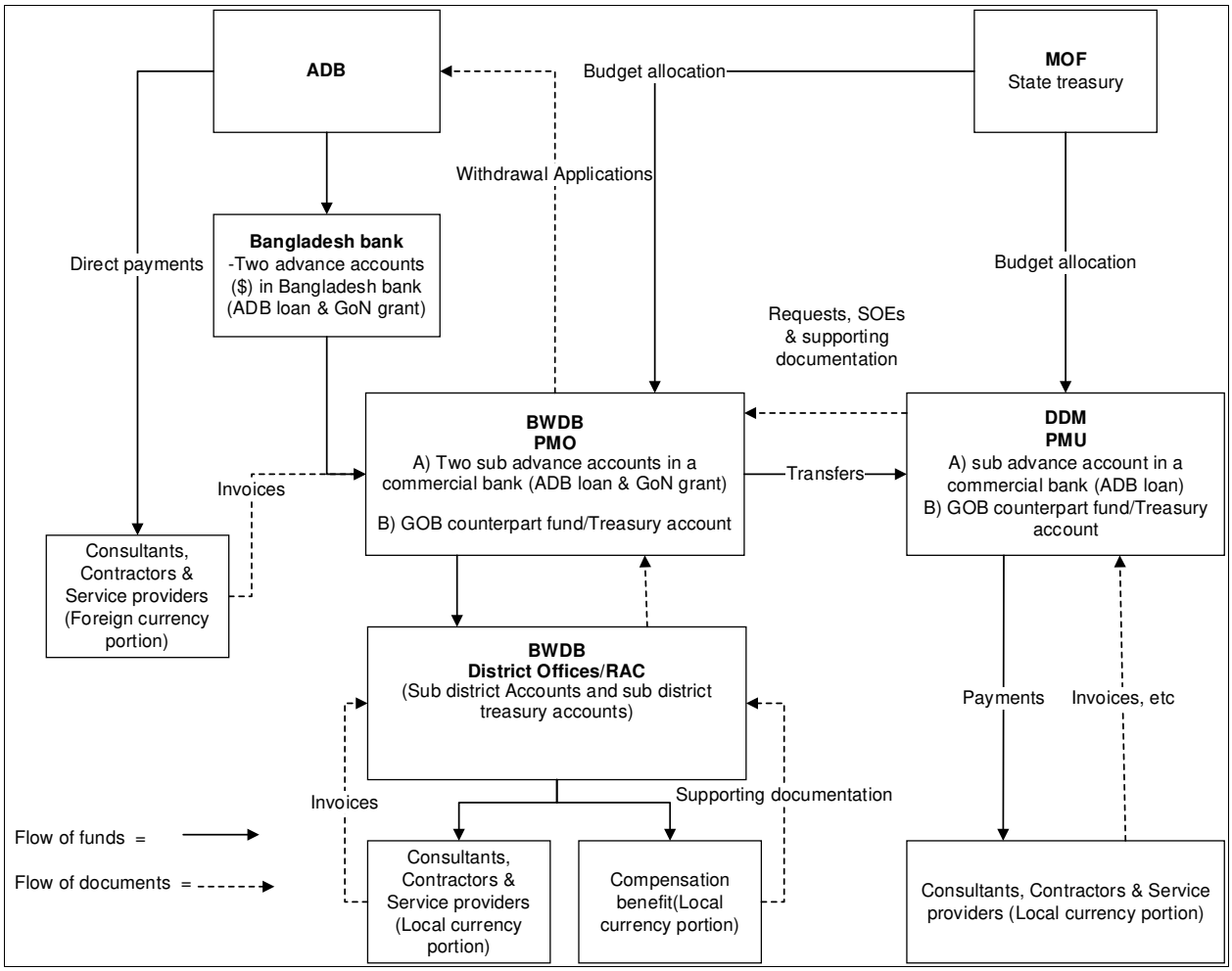
Source: Asian Development Bank estimates.


20.00
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
GoN Grant ($million)
Q3
Q4
Q1
Q2
Q3
Q4
Q1
Q2
Q3
Q4
Q1
Q2
Q3
Q4
2021
2022
2023
2024
Quarter, Year
Contract Awards
Disbursement

I. Fund Flow Diagram

24. The following diagram shows how the funds will flow from ADB and the Government of Bangladesh to implement project activities.

Figure 5: Fund Flow Diagram



Notes to the account:
District Offices and PMU will send to the PMO all supporting documents (or copy of such documents) to support expenditures to be claimed from ADB under Statement of Expenditure (SOE). The supporting documentation is to be filed properly at the PMO to support ADB's SOE reviews and annual project audits.
ADB = Asian Development Bank, CGA = controller general of accounts, GOB = Government of Bangladesh, GoN = Government of Netherlands, LGD = Local Government Division, MOF = Ministry of Finance, MOP = memorandum of payments, PMO = project management office, RAC = regional accounting center, SOE = statement of expenditures.

V. FINANCIAL MANAGEMENT

A. Financial Management Assessment

25. The financial management assessment (FMA) was conducted in accordance with ADB's Guidelines in July 2020.[5] The FMA considered the financial management capacity of BWDB including funds-flow arrangements, governance, staffing, budgeting, accounting and financial reporting systems, internal control procedures, financial information systems, and internal and external auditing arrangements. The purpose of the FMA is to ensure that adequate financial management arrangements are in place for Project 2.

26. The FMA found that BWDB has adequate financial management capacity to: (i) record the required financial transactions, (ii) provide reliable annual financial statements and audit reports in a timely manner, and (iii) safeguard the financial assets. The assessed pre-mitigation financial management risk is substantial mainly because of the following: (i) limited accounts staff has currently been assigned to the proposed project, (ii) the proposed project may not be covered by the BWDB's internal audit function, (iii) there is scope for improving project level financial reporting, and (iv) the use of a manual accounting system to record receipts and payments of ABD's funds at the project level.

27. These risks will be mitigated by the following: (i) assigning adequate and experienced accounts staff to the project by loan effectiveness, (ii) engaging a financial management expert to support the PMO, (iii) providing training on ADB's financial reporting and audit requirements as well as disbursement procedures and systems, (iv) improving the quality and comprehensiveness of annual and quarterly financial reporting, (v) ensuring the project is included in the annual audit plan of BWDB's internal audit function, and (vi) improving the use of computerized systems in the PMO to capture receipts and payments under ADB financing including regular use of ADB's disbursement systems. Moreover, as per ADB requirements, the BWDB will maintain separate books of accounts in accordance with accounting standards acceptable to ADB and the detailed project financial statement will be audited annually by an independent auditor acceptable to ADB in accordance with International Standards on Auditing. The key financial management risks and mitigation actions identified are in Table **20**.

Table 20: Financial Management, Internal Control, and Risk Assessment and Risk Management Plan

Risk		Risk Description	Mitigation Measures or Action Plans
Inherent Risk			
1. Country-specific risks	S	Partly weak PFM systems and financial management capacity.	Not applicable for this project
2. Entity-specific risks	M	BWDB has extensive experience in implementing ADB and other externally -financed projects. However, there is scope for improving the FM arrangements in place.	Specific mitigation actions listed below.
3. Project-specific risks	S	Project will be implemented in several locations and funds will be advanced to district accounts.	Specific mitigation actions listed below.
Overall Inherent Risk	**S**		
Control Risk			

[5] ADB. 2015. *Technical Guidance Note, Financial Management Assessment*. Manila.

Risk		Risk Description	Mitigation Measures or Action Plans
1. Implementing entity	S	The PMO/BWDB and PMU/DDM are proposed to manage and implement the project. Currently, the PMO and PMU are not fully staffed.	The PMO and PMU must be fully staffed by loan effectiveness.
2. Fund flow	S	BWDB and DDM have experience with ADB's disbursement procedures. However, the following risks remain: (i) Delay in release of government counterpart funds. (ii) Decentralized flow of funds to the district level.	Firm commitment from the government to be obtained as part of the legal agreement that counterpart funds will be released in a timely manner. Direct payment mechanism is to be used for major foreign currency payments to contractors and suppliers from ADB's share. SOE threshold set at $150,000 per individual payment. Quarterly reconciliations of advance account, sub advance account and district sub-accounts to be conducted.
3. Staffing	S	The Accounts staff implementing project 1 are expected to be assigned to the project 2.However, the FM capacity of the PMO may need to be further strengthened to ensure full compliance with ADBs requirements.	All Accounts staff positions in the PMO and SMOs and in the PMU need to be filled by loan effectiveness. An FM expert to be engaged to support the project. Continuous training to be provided in ADB's financial reporting and audit requirements as well as disbursement procedures and systems.
4. Accounting policies and procedures	M	Existing GoB policies and procedures are followed by BWDB and DDM. There is scope for improving project level systems and FM procedures to ensure full compliance with ADB procedures.	To ensure full compliance with ADB's requirements at all levels, detailed FM instructions and templates are included in this PAM.
5. Internal audit	S	There is an internal audit function in BWDB. However, internal audit is only conducted annually and based on experience it may not include the ADB-financed projects in its audit plan. There is no internal audit function in DDM.	The BWDB Internal Audit Unit is to include this project in its audit plan, and the report is to be shared with the PMO for follow-up.[6]

[6] All the accounts staff positions in the PMO and SMOs will be deputed from Accounts, Audit & Finance Department of BWDB then send the bill to RAC office of BWDB. RAC office (BWDB staff) arranges with making payment conducting pre-Audit.

Risk		Risk Description	Mitigation Measures or Action Plans
6. External audit	M	Project level FAPAD may not issue a separate audit opinion on the use of the ADB financing, despite this is an ADB's requirement.	The PMO will liaise with FAPAD to ensure the project is included in FAPAD's annual audit plan and that ADB's audit requirements are strictly followed. The audit observations are to be resolved in a timely manner. The status of audit observations is to be included in the quarterly progress reports.
7. Reporting and monitoring	S	At the project level, there is scope for improving the quarterly financial reporting and the quality of the project financial statements.	Comprehensive financial information is to be included in the quarterly progress reports in a format agreed with ADB within 45 days from the end of each quarter. The consolidated PFS is to be improved by including: (i) a statement of budgeted vs actual expenditures, (ii) a WA-wise reconciliation, and (iii) comprehensive disclosure of used accounting policies, and financial reporting framework in the notes.
8. Information systems	S	Accounting systems are currently only capturing payments made through the government treasury system while direct payments and payments from the advance account are recorded manually. Moreover, project financial reports are produced manually.	The PMO is to explore and implement IT solutions to fully computerize the project accounts and automate financial reporting to the extent possible by modifying the existing systems or using a standalone software. To use ADB's client portal for disbursement to submit and track withdrawal applications to ensure timely availability of funds. To use LFIS to reconcile ADB disbursement records with project records on a quarterly basis to ensure all withdrawal applications have been correctly reflected in the PFS.
Overall Control Risk	**S**		
Overall FM risk	**S**		

ADB = Asian Development Bank, BWDB = Bangladesh Water Development Board, DDM = Department of Disaster Management, FAPAD = Foreign Aided Projects Audit Directorate, FM = financial management, GoB = Government of Bangladesh, IT = information technology, LFIS = loan financial information system, M = moderate, PFM = public

financial management, PFS = project financial statements, PMO = project management office, PMU = project management unit, S = significant, SOE = statement of expenditure, WA = withdrawal application.
Source: Asian Development Bank.

28. To mitigate the identified financial management risks, BWDB has agreed to implement the financial management action plan outlined in Table **21**.

Table 21: Financial Management Action Plan

Area	Agreed Action	Responsibility	Target date
Staffing	Assign adequate and qualified accounts staff[7] to the PMO and SMOs as well as the PMU/DDM. Engage an FM expert to support the project and facilitate compliance with ADB's FM requirements as part of the ISPMSC.	BWDB and DDM BWDB	By Loan effectiveness Within one Month after Loan effectiveness
FM capacity building	Training provided in ADB's FM requirements and disbursement procedures and systems (LFIS, CPD)	BWDB and ADB	By project inception and continuous throughout project implementation.
Internal audit	Ensure the project is included in the audit plan of the BWDB internal audit function.	BWDB	By Loan effectiveness
External audit - Project level	-Ensure the project is included in the audit plan of FAPAD; -Cause consolidated project financial statements to be audited separately by FAPAD in accordance with ADB's audit requirements and submit the APFS and management letter to ADB. -Address audit observations in a timely manner.	BWDB	-Within 2 months after Loan effectiveness. -Annually throughout project implementation. -Continuous throughout the project.
Financial reporting	Include comprehensive financial information as agreed with ADB in the QPRs. Prepare PFS in a format agreed with ADB (including statement of budget vs actual, WA-wise reconciliation and comprehensive notes disclosures)	BWDB	Within 45 days from end of each quarter. Annually -within two months after the end of the fiscal year.
Information systems	Use of ADB's disbursement systems (CPD & LFIS) to reconcile project accounts and ADB disbursement records on a quarterly basis. Detailed reconciliation by WA to be included in the QPRs and the APFS submitted to ADB.	BWDB	Quarterly from loan first disbursement throughout project implementation.
Information systems	Computerize all accounts including receipts and payments under the ADB loan and automate financial reporting to the extent possible	BWDB	Within the first 6 months of implementation.
Records management	All supporting documents (or copy of such documents) to support expenditures claimed from ADB under SOE must be sent from District Offices to the PMO regularly.	BWDB and DDM	Monthly

[7] The accounts staff assigned to the PMO will include the following full time positions: (i) A Deputy Director -Accounts, (ii) an accounts Officer (iii) three Senior Accountants Assistants. In addition, each of the three SMOs will include one Senior Accounts Assistant.

	The supporting documentation is to be filed properly at the PMO to support ADB's SOE reviews and annual project audits.		

ADB = Asian Development Bank, APFS = audited project financial statements, BWDB = Bangladesh Water Development Board, CPD = Client Portal for Disbursements, DDM = Department of Disaster Management, FAPAD = Foreign Aided Projects Audit Directorate, FM = financial management, ISPMC = institutional strengthening and project management consultant, LFIS = Loan Financial Information Services, PFS = Project Financial Statements, PMO = project management office, PMU = project management unit, QPR = Quarterly Progress Report, SOE = statement of expenditure, WA = withdrawal application.
Source: Asian Development Bank.

B. Disbursement

1. Disbursement Arrangements for ADB and ADB-administered Cofinancier Funds

29. The ADB loan and the Government of Netherlands (GoN) grant proceeds will be disbursed in accordance with ADB's *Loan Disbursement Handbook* (2017, as amended from time to time),[8] and detailed arrangements agreed upon between the government and ADB. Online training for project staff on disbursement policies and procedures is available.[9] PMO staff are expected to avail of this training from loan effectiveness to ensure efficient disbursement and fiduciary control.

30. ADB's disbursement procedures (direct payment, reimbursement, commitment, and/or advance fund procedure) will be used for withdrawal of project funds.

(i) direct payment procedure will be used for foreign currency payments to suppliers and consultants;
(ii) reimbursement will be used for any eligible payments pre-financed by the government, including all expenditures financed under retroactive financing;
(iii) advance fund (liquidation or replenishment) procedures will be mainly utilized for payments to suppliers, contractors when government pre-financing is not feasible; and
(iv) under the commitment procedure, ADB, at the borrower's request, will provide an irrevocable undertaking to reimburse a commercial bank for payments made or to be made to a supplier against a letter of credit financed from the loan account

31. BWDB through its PMO will be responsible for (i) preparing contract award and disbursement projections, (ii) collecting and retaining supporting documents, and (iii) preparing and submitting withdrawal applications to ADB.

32. **Advance fund procedure.** Two separate advance accounts will be established and maintained by BWDB with the Bangladesh Bank, one for the ADB loan and one for the GoN grant. The currency of the advance accounts will be the United States dollar. In addition, two sub advance-accounts in Bangladesh Taka will be established in a commercial bank and maintained by BWDB, one for the ADB loan and one for the GoN grant. Moreover, one sub-advance account for the ADB loan in Bangladesh Taka will be established in a commercial bank and maintained by DDM. The advance accounts and the sub-accounts will be used exclusively for ADB's share of eligible expenditures. BWDB and DDM are accountable and responsible for proper use of advances to their respective advance accounts including advances to any sub-account.

[8] ADB. 2017. *Loan Disbursement Handbook.* Manila.
[9] Disbursement eLearning: http://wpqr4.adb.org/disbursement_elearning.

33. The total outstanding advance to the advance account should not exceed the estimate of ADB's share of expenditures to be paid through the advance account for the forthcoming 6 months. BWDB may request for initial and additional advances to the advance account based on an estimate of expenditure sheet[10] setting out the estimated expenditures to be financed through the accounts for the forthcoming 6 months. Supporting documents should be submitted to ADB or retained by BWDB in accordance with ADB's *Loan Disbursement Handbook* (2017, as amended from time to time) when liquidating or replenishing the advance account.

34. **Statement of expenditure (SOE) procedure**.[11] The SOE procedure may be used for reimbursement of eligible expenditures or liquidation of advances to the advance account. The ceiling of the SOE procedure is equivalent to $150,000 per individual payment. Supporting documents and records for the expenditures to be claimed under SOE should be maintained and made readily available for review by ADB's disbursement and review missions, upon ADB's request for submission of supporting documents on a sampling basis, and for independent audit. Reimbursement and liquidation for individual payments above the SOE ceiling should be supported by full documentation when submitting the withdrawal application to ADB.

35. Before the submission of the first withdrawal application, the borrower should submit to ADB sufficient evidence of the authority of the persons who will sign the withdrawal applications on behalf of the borrower, together with the authenticated specimen signatures of each authorized person. The minimum value per withdrawal application is stipulated in the ADB's *Loan Disbursement Handbook* (2017, as amended from time to time). Individual payments should be paid (i) by BWDB or DDM and subsequently claimed to ADB through reimbursement, or (ii) through the advance fund procedure, unless otherwise accepted by ADB. The borrower should ensure sufficient category and contract balances before requesting disbursements. Use of ADB's Client Portal for Disbursements (CPD) system[12] is mandatory for submission of withdrawal applications to ADB.

36. No ADB loan proceeds will be withdrawn for the disaster risk management activities under Project 2 until BWDB and the DDM have entered into a memorandum of understanding acceptable to ADB, setting out the terms and practical arrangements for their collaboration.

2. Disbursement Arrangements for Counterpart Fund

37. The government will make funds available to BWDB and the Department of Disaster Management (DDM) through budgetary allocation. Disbursement for counterpart funds will be carried out in accordance with guidelines and practices of the government. BWDB will be responsible for preparing the budget and requesting budgetary allocations for counterpart funds to the Ministry of Finance. BWDB will ensure that counterpart funding is reflected annually in the approved budget. BWDB shall open and maintain the separate account for government's counterpart funds.

38. The following control mechanism will be applied for payment of resettlement costs: (i) a bank account of Regional Accounting Centre (RAC) of BWDB will receive advances from PMO; (ii) RAC will use the cheque payment from the RAC's bank account for the resettlement compensation costs to affected persons (APs); (iii) cheques will be signed by RAC and distributed

[10] Estimate of expenditure sheet is in Appendix 8A of ADB's *Loan Disbursement Handbook* (2017, as amended from time to time).
[11] SOE forms are in Appendix 7B & 7D of the *Loan Disbursement Handbook 2017.*
[12] The Client Portal for Disbursement facilitates online submission of withdrawal applications to ADB, resulting in faster disbursement. The forms to be completed by the Borrower are available online at: https://www.adb.org/documents/client-portal-disbursements-guide.

by RAC with the support of SMOs and/or the resettlement plan implementation NGOs; (iv) RAC will make payments based on supporting documents to evidence genuine payees, such as photographs of APs and with exchange of receipt with a finger print of an AP which will be retained by RAC; and (v) all necessary forms and supporting documentation will be prepared and compiled by RAC with support from SMOs and NGOs, and submitted to the PMO in BWDB.

3. Financial Management Capacity Building and Resources

39. To ensure sufficient knowledge in ADB's financial management requirements, including procedures and related systems, BWDB will ensure that each PMO accounts staff assigned to the project undertake the following actions within the first three months of working with the project:

(i) become aware of the ADB and national anticorruption policy and whistle blowing mechanisms;
(ii) master loan/grant agreement including the loan covenants and the relevant sections of this PAM, as well as the ADB *Loan Disbursement Handbook*; and
(iii) obtain user/reader rights (as required) to ADB's systems including Client Portal for Disbursement and the Loans and Grants information Service (LFIS/GFIS).

40. In addition, the PMO will liaise with ADB on a yearly basis to take advantage of other FM resources[13] and training events organized by ADB, especially in the first two years of project implementation.

4. Accounting and Financial Reporting

41. BWDB through the PMO and DDM through the PMU will maintain, or cause to be maintained, separate books and records by funding source for all expenditures incurred on the project following the government's accounting laws and regulations – cash basis of accounting. BWDB will through its PMO prepare consolidated project financial statements in accordance with the Bangladesh Financial Procedures and Accounting Procedures – cash basis of accounting, consistent with International Accounting Standards. The financial statement will include at least:

(i) statement of cash receipts and payments; showing the funds received by each funding source (ADB loan, GoN grant, counterpart funds, etc.) and expenditures incurred by expenditure category for the current year, prior year and cumulative from inception to date;
(ii) statement of budget versus actual expenditures, including any significant variance sufficiently explained in the notes;
(iii) statement of advance account reconciliation for each advance account;
(iv) statement of disbursement with a breakdown for each funding source; and
(v) detailed notes to the financial statements including significant accounting policies.

42. The notes of the financial statements must provide a detailed breakdown of at least:

(i) funds received from the government during the current year, previous year and cumulative to date;
(ii) breakdown of expenditures incurred by DDM; and reconciliation of DDM sub advance account;

[13] ADB e-learning courses include: ADB Disbursement eLearning course and Cash Basis IPSAS for ADB Project Financial Reporting.

(iii) a list of withdrawal applications submitted and the amounts paid by ADB to date as follows: (a) financing source, (b) withdrawal application number, (c) the amount claimed and currency, (d) period when expenditures were incurred, (e) date submitted, (f) disbursement method, (g) the amount disbursed by ADB, and (h) the exchange rate as applicable.

43. The expenditure categories and outputs used in the financial reports will be aligned with the structure outlined in this PAM. An indicative format of the project financial statements is included in Attachment 1: Project Financial Statements

44. The expenditure categories and outputs used in the financial reports will be aligned with the structure outlined in this PAM. Moreover, to enable for timely and efficient monitoring, BWDB through its PMO, will ensure that consolidated financial information is included in the quarterly progress reports (QPRs) to be submitted to ADB within 45 days after the end of each quarter. In this regard, the DDM through its PMU will provide timely financial reports to the PMO of BWDB in a pre-agreed format.

45. The summary information will include at least:

(i) Cumulative contract awards financed by the ADB loan, GoN grant, and counterpart funds (commitment of funds to date), and comparison with time-bound projections (targets for ADB financing compare the actual contract awards with the contract award curve included in this PAM). Any significant variances between planned and actual contract awards are to be explained and justified;
(ii) Cumulative disbursements from the ADB loan, GoN grant, and counterpart funds (expenditure to date), and comparison with time-bound projections (targets for the ADB financing compare the actual disbursement with the disbursement projections as per the S-curve included in this PAM). Any significant variances between planned and actual disbursements are to be explained and justified;
(iii) Reconciliation of project records and ADB disbursement records (LFIS/GFIS) for the financial year to date and cumulative from project inception to end of the reporting period. Any discrepancies and outline follow-up actions required are to be explained and justified;
(iv) Variance analysis including budget versus actual expenditures and physical versus financial progress, with significant deviations explained and justified;
(v) Summary of the status of financial covenants (if any) as outlined in the loan and project agreement;
(vi) Summary of the status of financial management in the project including: (a) any problems in the existing financial management arrangements and /or flow of funds; and (b) any significant changes occurred during the reporting period (e.g. financial management staff turnover, implementation of new financial systems, emerging financial management-related risks, etc.);
(vii) Summary of the status of the (a) financial management action plan outlined in this PAM, (b) recommendations and actions raised by ADB as part of the audited project financial statement (APFS) review (if any), and (c) financial management-related recommendations agreed during ADB review missions (if any); and
(viii) Summary of the status of status of past audit observations (resolved/ pending).

46. The following detailed schedules will be appended to the QPRs:

(i) Statement of cash receipts and payments by category;

(ii) List of signed contracts;
(iii) Detailed reconciliation (by withdrawal application) of project records and ADB disbursement records (LFIS) for the fiscal year to date and cumulative;
(iv) Status of external audit observations (resolved/ pending); and
(v) Status of financial management action plan (complied/ongoing).

47. Indicative format of the QPR is in Attachment 2.

48. **Variance analysis.** As part of the variance analysis, BWDB through its PMO will examine the differences between budgeted versus actual expenditures as well as financial versus physical progress. The variance analysis will pay particular attention to:

(i) significant deviations from the budgeted engineer's estimates;
(ii) significant deviations between financial and physical progress;
(iii) significant delays on (planned versus reported) physical and/or financial progress; and
(iv) Inconsistent and/or delayed progress reporting.

49. Any significant variances, delays or deviations etc. shall be promptly followed up by the PMO and explained in the financial reports.

50. **Periodic Reconciliations.** To ensure the correctness and completeness of the project's books of accounts and financial reports, BWDB through its PMO shall conduct:

(i) monthly reconciliations of the advance account, its sub-account as well as district subaccounts; and
(ii) quarterly reconciliation of the project book of accounts, and ADB's disbursement data available in LFIS.

51. Any discrepancies and/or reconciliation items will be followed up by the PMO to ensure these are resolved in a prompt manner and that there are no misstatements in the financial reports. The differences between amounts claimed and amounts disbursed will be disclosed and explained in the WA register to be included in the financial reports.

5. Auditing and Public Disclosure

52. BWDB will cause the consolidated project financial statements[14] to be audited in accordance with International Standards on Auditing by an independent auditor acceptable to ADB.[15] The APFS together with the auditor's opinion will be presented in English to ADB within 6 months from the end of the fiscal year by BWDB. BWDB through its PMO will ensure that total amount in APFS will reconcile with amounts disbursed by ADB during the respective fiscal year.

53. The audit report for the project financial statements will include a management letter and auditor's opinions, which cover (i) whether the project financial statements present an accurate and fair view or are presented fairly, in all material respects, in accordance with the applicable financial reporting standards; and (ii) whether the proceeds of the loan and grant were used only for the purpose of the project. The management letter will include from the second year onwards, a follow up of previous years audit observations. In case the auditor does not issue a management

[14] The audit will also cover project expenditures incurred by DDM.
[15] It is expected that the project financial statement will be audited by Foreign Aided Projects Audit Directorate (FAPAD) under the Comptroller and Auditor General of Bangladesh.

letter, the auditor must issue a written confirmation that no internal control issues were identified as part of the audit.

54. Compliance with financial reporting and auditing requirements will be monitored by ADB review missions and followed up regularly with all concerned, including the external auditor.

55. The government and BWDB have been made aware of ADB's approach to delayed submission, and the requirements for satisfactory and acceptable quality of the audited project financial statements.[16] ADB reserves the right to require a change in the auditor (in a manner consistent with the constitution of the borrower), or for additional support to be provided to the auditor, if the audits required are not conducted in a manner satisfactory to ADB, or if the audits are substantially delayed. ADB reserves the right to verify the project's financial accounts to confirm that the share of ADB's financing is used in accordance with ADB's policies and procedures.

56. Public disclosure of APFS, including the auditor's opinion on the project financial statements, will be guided by ADB's Access to Information Policy 2018.[17] After the review, ADB will disclose the APFS and the opinion of the auditors on the project financial statements no later than 14 days of ADB's confirmation of their acceptability by posting them on ADB's website. The management letter, additional auditor's opinions, and audited entity financial statements will not be disclosed.

57. A formal request for the project to be included in the OCAG/Foreign Aided Projects Audit Directorate (FAPAD) audit schedule should be sent by the PMO to OCAG office. This request is best sent when the loan and project agreements are signed, and should include a copy of the loan and project agreements, and any other relevant documents. OCAG would then advise the appropriate field office to include the project in their audit schedule.

58. In addition, to ensure that audited financial statements are timely submitted, BWDB through PMO should submit the consolidated project financial statements for audit to OCAG/FAPAD within 3 months from the close of the financial year. PMO will be responsible for the project financial statements. By 15th October of each year, OCAG/FAPAD should receive the unaudited financial statements. It will then take 3 months to complete the audit, and issue an opinion no later than 6 months from the end of the financial year. A statement of audit requirements is in Attachment 2.

[16] ADB's approach and procedures regarding delayed submission of audited project financial statements:
(i) When audited project financial statements are not received by the due date, ADB will write to the executing agency advising that (a) the audit documents are overdue; and (b) if they are not received within the next 6 months, requests for new contract awards and disbursement such as new replenishment of advance accounts, processing of new reimbursement, and issuance of new commitment letters will not be processed.
(ii) When audited project financial statements are not received within 6 months after the due date, ADB will withhold processing of requests for new contract awards and disbursement such as new replenishment of advance accounts, processing of new reimbursement, and issuance of new commitment letters. ADB will (a) inform the executing agency of ADB's actions; and (b) advise that the loan may be suspended if the audit documents are not received within the next 6 months.
(iii) When audited project financial statements are not received within 12 months after the due date, ADB may suspend the loan.

[17] ADB. Access to Information Policy: https://www.adb.org/documents/access-information-policy

6. ADB Loan and Government of Netherlands Grant Closure

59. To close the ADB loan and GoN Grant accounts in a timely manner and to comply with ADB's requirements, BWDB will ensure that the following measures are undertaken:

(i) All expenditures financed by the ADB loan and the GoN Grant are incurred before or by the loan/grant closing date;
(ii) All withdrawal applications including liquidation of the advance account are submitted to ADB, preferably by the loan closing date, but in no case later than the end of the winding-up period; that is, within 4 months after the loan closing date;
(iii) Any unutilized advances are refunded to ADB within 2 months after the end of the winding-up period;
(iv) The final project financial statements are prepared in a timely manner. The final project financial statements are to include a reconciliation of the project account and the ADB disbursement records for the fiscal year and cumulatively from inception. Any differences must be disclosed and explained;
(v) All past external audit observations have been duly addressed;
(vi) The final project financial statements are audited by independent auditors as agreed with ADB and the APFS and the management letter are submitted to ADB as soon as possible after the loan and grant closing date. The final APFS must include all expenditures incurred up to the loan closing date as well as up to the final withdrawal application; and
(vii) All projects financial records are filed in an orderly manner, backed up electronically and stored in a secure location for at least 1 year following receipt by ADB of the final APFS or 2 years after the loan closing date, whichever is later.

VI. PROCUREMENT AND CONSULTING SERVICES

A. Advance Contracting and Retroactive Financing

60. All advance contracting and retroactive financing will be undertaken in conformity with *Procurement Regulations for ADB Borrowers: Goods, Works, Nonconsulting and Consulting Services* (2017, as amended from time to time).[18] The issuance of invitations to bid under advance contracting and retroactive financing will be subject to ADB approval. The borrower and BWDB have been informed that approval of advance contracting and retroactive financing does not commit ADB to finance the project.

61. **Advance contracting.** Advance contracting may be used for works, and goods packages with bidding documents reviewed and accepted by ADB. Open competitive bidding (OCB) procedure will be used for advance contracting packages.

62. Consistent with Schedule 3 of the FFA and as requested by the government, the ISPMC joint venture of Project 1 will be engaged for Project 2 through single source selection; this will be considered as advance contracting.

63. **Retroactive financing.** Retroactive financing is allowed for reimbursement of eligible expenses mentioned in para. 60, up to a maximum amount equivalent to 20% of the ADB loan incurred before loan effectiveness, but not more than 12 months before the signing of the loan agreement.

[18] ADB. 2017. Procurement Regulations for ADB Borrowers: Goods, Works, Nonconsulting and Consulting Services.

B. Procurement of Goods, Works, and Consulting Services

64. All procurement of goods, works and consulting services will be undertaken in accordance with ADB's Procurement Regulations for ADB Borrowers: Goods, Works, Nonconsulting and Consulting Services (2017, as amended from time to time).

65. Electronic mode of procurement will be used for goods and civil works contracts to be procured through OCB national advertising.[19] Bidders will be post-qualified by applying single-stage; one-envelope bidding procedure.

66. The procedures to be followed for OCB, national advertisement for works and goods, shall be those set forth for the National Open Tendering Method in *The Public Procurement Rules, 2008* (as updated and pursuant to *The Public Procurement Act, 2006* issued by the Government of Bangladesh) with the clarifications and modifications described in the following paragraphs required for compliance with the provisions of the Procurement Regulations for ADB Borrowers (2017, as amended from time to time):

(i) **Eligibility.** The eligibility of bidders shall be as defined under Section-I "Introduction" of the Procurement Regulations; accordingly, no bidder or potential bidder should be declared ineligible for reasons other than those provided in Section I of the Procurement Regulations, as amended from time to time.
(ii) **Location of bid submission.** Submission of bids to 'primary' and 'secondary' locations, or 'multiple droppings' of bids, shall not be required or allowed. Advertisements and bidding documents shall specify only one location for delivery of bids.
(iii) **Bid price award as percentage (+/–)10 of costs estimate.** Bids shall not be rejected or awarded on the basis of percentage above or below the estimated cost, and contract award shall be based on the lowest evaluated bid price of responsive bid from eligible and qualified bidder.
(iv) **Lottery.** A lottery system shall not be used to determine a successful bidder, including for the purpose of resolving deadlocks.

67. For works packages:

(i) Requests for Quotations will be used for civil works contracts estimated to cost less than $100,000.
(ii) OCB procedures will be used for civil works contracts estimated to cost $100,000 or more.
(iii) OCB with international advertising will be used when contracts $15,000,000 or more with OCB national advertising used for contracts estimated below this value.

68. The following approval procedures will be adopted for OCB civil work contracts:

(i) All OCB (international advertising) civil works packages will be prior reviewed by ADB.
(ii) For OCB (national advertising), BWDB will use the master bidding document reviewed and approved by ADB.
(iii) The first three contract packages under OCB (national advertising) will be prior reviewed by ADB. Succeeding packages will be through post-review (sampling) and BWDB may proceed with contract award for these contract packages without

[19] Approval of e-GP for national competitive bidding (OCB) was granted by ADB in August 2016.

prior ADB review and approval. The following post facto approval procedures will apply: (a) BWDB will retain a record of all procurement documentation, including copies of the signed contracts and the bid evaluation reports, to be available for inspection;[20] (b) at the time of each contract award, BWDB will provide ADB with a certified summary sheet reporting on the main aspects of the bid evaluation and contract award; and (c) BWDB will promptly inform ADB on achieving the award of 30% and 70% equivalent amount of contracts[21] for ADB to conduct post sampling reviews.[22] The procurement processes and contract awards will be audited as part of the performance audit following award of 30% and 70% of contracts. ADB may conduct random post facto reviews of procurement processes and contract awards at any time.

(iv) If any contract award is found to be unacceptable by ADB, ADB may refuse to finance the contract. If any disbursement has been made in part or in full towards financing the contract, ADB reserves the right to request BWDB to refund the total amount disbursed.

69. For goods packages:

(i) Requests for Quotations will be used for goods contracts estimated to cost less than $100,000,
(ii) OCB procedures will be used for goods contracts estimated to cost $100,000 or more. OCB with international advertising will be used for contracts estimated at $1,000,000 or above; while OCB with national advertising will be used for contracts below this value.
(iii) All OCB (international advertising) goods contracts will be prior reviewed by ADB and will apply domestic preference.

70. The government will timely inform ADB of the changes made to the national procurement regulations, if any, to ensure consistency with ADB's guidelines. The procurement plan should be updated whenever change in the procurement arrangements are required and agreed.

71. All consultants and nongovernment organizations (NGOs) will be recruited according to ADB's Procurement Regulations for ADB Borrowers: Goods, Works, Nonconsulting and Consulting Services (2017, as amended from time to time) and this PAM.

72. Consulting services are required for (i) institutional strengthening and project management, (ii) various community-based consultancy support, (iii) various surveys; and (iv) external safeguards monitoring experts. Consultants will be engaged through:

(i) Quality- and cost-based selection (QCBS) method for larger packages (> $250,000) with a standard quality–cost ratio of 80:20 or 90:10 depending on the complexity of the surveys/scope of works;
(ii) Consultant's qualification selection for smaller packages (< $250,000);
(iii) Single source selection for the following selected packages: (a) erosion study by the Center for Environmental and Geographic Information System; (b) physical modelling by River Research Institute; (c) geotechnical investigations by Bangladesh University of Engineering and Technology; (d) ISPMC to ensure

[20] Original documentation on the procurement process must be kept at the PMO of BWDB to enable easy access for review and auditing by ADB.
[21] 30% and 70% of total ADB financing amount.
[22] ADB. 2018. Procurement Review - Guidance Note on Procurement.

continuity from Project 1 as per Schedule 3 of the FFA; (e) river surveys by IWM; and (f) model study for Solimabad channel closure by IWM; and

(iv) Individual consultant selection for external safeguards monitoring experts.

C. Procurement Plan

73. The procurement plan (Attachment 4) is prepared in accordance with ADB's country-specific template. The procurement plan indicates thresholds and review procedures, goods, works, and consulting services contract packages and OCB guidelines.[23] The procurement plan provides: (i) a list of goods, works, and consulting services contract packages that will be processed over the next 18 months with corresponding advertisement dates; (ii) the proposed methods for procurement of such contracts that are permitted under the loan and grant agreement; and (iii) the related ADB review procedures. The procurement plan will be updated by the PMO for approval by ADB, at least annually, and more frequently if necessary, and should cover the next 18 months of procurement activity. A delay in loan effectiveness, other start-up delays, and delays during implementation will require an additional procurement plan update. ADB will review and approve each updated procurement plan prior to disclosure on the ADB's website.

74. The Project Director, PMO, BWDB will be the Procuring Entity for procurement of all goods & services packages, supported by PMO staff and consultants. Executive Engineers of three SMOs, BWDB will be the Procuring Entity for procurement of all works packages under the direction of the Project Director, PMO. All procurement activities will be the responsibility of the Project Director of the PMO of BWDB. ADB will closely monitor all procurement activities estimated at $1.0 million and above.

75. Before the start of any procurement, ADB and the government will review the public procurement laws of the government to ensure consistency with ADB's Procurement Regulations for ADB Borrowers: Goods, Works, Nonconsulting and Consulting Services (2017, as amended from time to time).

D. Consultant's Terms of Reference

76. The draft terms of reference for consulting services are in Attachment 5.

VII. SAFEGUARDS

77. **Prohibited investment activities.** Pursuant to ADB's Safeguard Policy Statement, 2009 (SPS), ADB funds will not be applied to the activities described on the ADB Prohibited Investment Activities List set forth at Appendix 5 of the SPS.[24]

78. BWDB will ensure that all the requirements in the following frameworks prepared for the facility and updated for Project 2 will be complied with during the entire implementation period of Project 2:

(i) Resettlement framework[25]

[23] Checklists for actions required to contract consultants by method are available in the e-Handbook on Project Implementation at: https://www.adb.org/documents/handbook-project-implementation.

[24] ADB. 2009. *Safeguard Policy Statement*. Manila.

[25] Resettlement framework (accessible from the list of appendixes of the periodic financing request report).

(ii) Environmental assessment and review framework[26]

79. BWDB will ensure that all the requirements prescribed in the following safeguard documents for Project 2 will be complied with during the entire implementation period:

(i) Five resettlement plans for the 3 subprojects
   a. JRB-1: three RPs: (i) Shahjadpur; (ii) Enayetpur; and (iii) Benotia;
   b. JLB-2: Upstream Chauhali
   c. PLB-1: Harirampur extension.

(ii) Environmental impact assessment (EIA), including its environmental management plan (EMP).

80. A sector approach will be taken for the implementation of land acquisition and resettlement. One sample resettlement plan is prepared and disclosed for the embankment at Shahjadpur and will be finalized to cope with the COVID-19 restrictions on implementation of the 100% census. Four resettlement plans for riverbank protection works will be developed and finalized to cope with the dynamic river morphology. These finalizations will be carried out post project approval, but prior to any award of works contracts for the above water works. Meaningful consultations will be undertaken during preparation of the four RPs and the updating of Shahjadpur RP. All disclosure requirements, including local disclosure and disclosure on ADB's website, will be met for the updated and final RPs. Preparatory and implementation work for the RPs including, but not limited to, meaningful consultations will be supported by ISPMC and the INGO. Further information on the role of the INGO is in para. 99.

81. During the implementation period, BWDB will regularly review the status of compliance with the safeguards plans, frameworks, and EIA and submit the monitoring reports to ADB. If major noncompliance is discovered over the course of the review of ongoing projects, a corrective action plan will be prepared for implementation and submitted to ADB for concurrence.

82. The PMO, with the support of the ISPMC and other consultants, will be responsible for:

(i) ensuring that safeguards documents as required in the frameworks, EIA and the resettlement plans are prepared and finalized;
(ii) ensuring all safeguards monitoring and requirements are fulfilled to ensure safeguards compliance.

83. External monitoring consultants (external monitors or external monitoring agency) will be retained by the PMO over the entire implementation period to ensure compliance to approved and accepted safeguards documents.

A. Environment Safeguards

84. **Category.** The project is classified as category A in accordance with the classification system of SPS. The works under Project 2 are a continuation of those under Project 1. The draft EIA, including an EMP, was disclosed on ADB's website on 6 August 2020.[27] The environmental assessment and review framework (EARF) was updated to describe the established grievance redress mechanism (GRM) and incorporate minor changes and improvements in the design and

[26] Environmental assessment and review framework (accessible from the list of appendixes of the periodic financing request report).
[27] Government of Bangladesh, Bangladesh Water Development Board. 2020. *Environmental Impact Assessment: Flood and Riverbank Erosion Risk Management Investment Program – Project 2* (prepared for ADB).

disclosed on ADB's website in May 2021. A tranche report was prepared.[28] The category *A* classification is triggered as without mitigation, direct impacts of Project 2 interventions on biodiversity habitat could be significant, long-lasting and cumulative. The main works are confined to the riverbanks outside of any protected areas. However, likely significant negative impacts of Project 2 interventions include: (i) loss of 15 km of channel whose outer riverbank is being severely eroded; (ii) damage to adjacent wetland resulting from reclamation of *char* land[29]; and (iii) risks on wildlife habitat due to alteration to flow patterns, reduced river and floodplain connectivity. The mitigation measures will include (i) setting sanctuaries and placing buoys to reduce fishing pressures; (ii) regulators and fish passes; and (iii) increasing dry season flow from one distributary. Other impacts such as increased sediments, water contamination, air and noise pollution, and health and safety-related concerns associated with construction activities are local, temporary, and mitigable. The environmental clearance, to be renewed annually, for Project 2 was obtained by BWDB from the Department of Environment on 13 December 2020.

85. Three rounds of stakeholder consultations were conducted in 2013 and 2017. The latter focused on Project 2 interventions. Stakeholders expressed strong support for the project to solve their severe and urgent erosion and flooding issues. A more recent large-scale consultation could not take place due to COVID-19 restrictions. Instead, consultations were conducted based on questionnaires through the SMOs in late 2020, establishing knowledge of status and scope of the planned project in local stakeholders. Furthermore, in May 2021, brochures in Bangla were distributed to the local population, outlining updates of the project interventions and the process and entitlements for resettlement. Project 1 complies with SPS environmental safeguard requirements; and BWDB has demonstrated that it is capable of managing the environmental safeguards satisfactorily. For Project 2, an independent environment monitoring expert will be engaged by PMO to monitor the mitigation measures and environmental impacts.

86. An external environmental monitoring expert will be engaged to monitor the implementation of the project's environmental management plan (EMP) of the approved Environmental Impact Assessment (EIA) in compliance with ADB SPS (2009). The expert will report to BWDB and share findings and recommendations with ADB.

87. **Environmental Management Plan (EMP).** The EMP outlines measures to mitigate all anticipated environment impacts during pre-construction, construction, and operation stages and will be included in the respective contract agreements with the civil works contractors. Prior to construction, specific mitigation measures will be updated by the contractor with details of the location and schedule of implementation, and other information based on their survey of the project area.

88. **Environmental Monitoring Reports (EMRs).** The EMRs, covering a 6-month period, will be submitted semi-annually to document the progress on the EMP implementation. The PMO and SMOs will be supported by the ISPMC to monitor EMP implementation (pre-, during-, and post-construction). An outline of the EMR is in Attachment 6. This outline is a template but additions, such as additional text, tables, charts, figures, may be made to ensure appropriate documentation of (i) project implementation progress, (ii) compliance with safeguard measures and their progress, and (iii) necessary corrective actions. The semi-annual EMRs will be due for submission to ADB within one month following the end of the EMR period covered for Project 2. The

[28] ADB. 2021. Tranche Report: Bangladesh: Flood and Riverbank Erosion Risk Management Investment Program (Tranche 2). Manila.

[29] An accretion in a river, the chars are valuable to the economy of Bangladesh as additional cultivable areas.

submission of EMRs to ADB will continue until the end of the MFF and a facility completion report is issued by ADB.

89. The EMRs will be disclosed on the ADB's and BWDB's websites after review and acceptance by ADB.

90. **Public Consultation and Grievance Redress Mechanism (GRM).** Throughout the project implementation, consultations with affected people will be conducted on an annual basis (ideally during the last quarter of every calendar year within the project implementation period). Due to health risks and government rules to manage COVID-19 pandemic, the PMO will use online platforms, brochures, questionnaires and other forms of media as applicable to provide project information updates and receive feedback from the people, beneficiaries, government agencies and other stakeholders. A single GRM will ensure that the affected people's concerns and grievances on the project's environmental and social performance are received, addressed, and resolved. Project 2 will use and expand the same GRM established under Project 1.[30]

B. Roles and Responsibilities Roles related to Environmental Safeguards

91. The PMO is responsible for the full compliance of the project with the loan agreement, ADB's SPS, and all applicable laws and rules of the government. The PMO will be supported by three SMOs to ensure compliance with environmental safeguards stated in this PAM and the EIA. The PMO will:

(i) comply with the government Environment Conservation Act (1995) and Environment Conservation Rules (1997), and other environment-related statutory requirements of the project;
(ii) review and approve the construction EMP(s) prepared by the contractor(s) with the support of ISPMC and SMOs;
(iii) be responsible for application of key documents and forwarding to government agencies for the processing of clearances and permits including, but not limited to: environmental clearance certificate, forest clearance, tree cutting permit, and other relevant permits and license, prior to awarding any works contracts to any contractor;
(iv) ensure the preparation, review, and submission of EMRs (as stated on the loan agreement) for disclosure on the ADB's and BWDB's websites;
(v) conduct training and workshops on environmental management, and site induction of all staff and workers involved in the project implementation. The staff and workers will include all engineers, and staff and laborers of contractors;
(vi) guided by the EIA submitted to ADB, implement effective environmental monitoring during pre-construction, construction, and operation phases. This includes, but is not limited to, inspections, review of monitoring forms prepared by the contractors, and documentation of the issues received through GRM;
(vii) take proactive and timely measures to address any environment safeguards related challenges at the national or division/district levels such as (a) delays in processing of clearances during pre-construction stage and (b) significant grievances during construction and operation stages);
(viii) review and approve, for submission to BWDB and ADB, semi-annual EMRs prepared by the SMOs and ISPMC;
(ix) lead in complying with disclosure of semi-annual EMRs;

[30] GRM is properly functioning, and administered by the PMO with the support of SMOs.

(x) review and approve corrective action plans (CAPs) for environment safeguard non-compliance.
(xi) inform ADB on any unanticipated environmental impact/s occurred during project implementation phase; and
(xii) ensure GRM, as envisaged in the EIA and in this PAM, is in place and fully operational from the onset of project implementation.

92. The SMOs will:

(i) ensure that the project, and all contractors obtain permits, licenses, etc. for activities such as the operation of asphalt plants, quarries, borrow areas etc. before the implementation of the respective construction activity;
(ii) carry out regular field verification and review environmental compliances by the contractor during project implementation, in coordination with the ISPMC and the contractor's environmental focal person;
(iii) with ISPMC's support, provide and record environmental observations during any site visits that may include, but not limited to, excessive dust, loud noises, improper disposal of wastes, chemical/oil spills, camp hygiene, health and safety, and improper borrow area management; and
(iv) in case of potential risks and hazards to health, environmental quality, and properties that may result from poor EMP implementation, immediately instruct the contractor to cease the construction activities that pose risk and conduct immediate containment and mitigation activities.

93. If there are any unanticipated environment impacts during project implementation, the PMO, with support from the ISPMC, will update the EIA and EMP. Both documents will be reviewed by ADB and disclose on the ADB's website.

94. **Contractor.** The contractor[31] is the principal agent to implement the EMP and environmental quality monitoring during the pre- and construction, and operation stages. Specifically, the contractor will:

(i) appoint the contractor's environment, health and safety focal person and attend the site induction workshop to be organized by the PMO/SMOs;
(ii) obtain necessary environmental license(s), permits etc. from relevant agencies as specified in the EIA and this PAM for the ancillary facilities such as quarries, wet mix plant, etc. prior to commencement of works;
(iii) as part of detailed survey, collect the baseline data on environmental quality of the construction sites before the start of physical works and continue collection of information (e.g., air quality, noise level, and water quality) during civil works as per the initial EMP;
(iv) revise and finalize the construction EMP and environmental quality monitoring plan;
(v) implement and document all mitigation measures in the EMP and environmental quality monitoring plan;
(vi) ensure that all workers, site agents, including site supervisors and management, participate in all environmental safeguard related training sessions;
(vii) ensure compliance with environmental statutory requirements and contractual obligations;

[31] Includes any subcontractor(s) of the contractor.

(viii) participate in resolving issues as a member of the GRM;
(ix) respond promptly to grievances raised by the local community or any stakeholder and implement environmental corrective actions or additional environmental mitigation measures as necessary and inform the relevant SMO; and
(x) based on the results of EMP monitoring, cooperate with the SMOs to implement environmental corrective actions and corrective action plans, as necessary.

95. If there are any environment safeguard non-compliance during project implementation, the PMO will prepare necessary CAP, and reflect them in the EMRs. ADB will monitor the PMO's performance on the CAP.

96. ADB is responsible for the following:

(i) review EMRs, and disclose the final reports and on ADB's website;
(ii) explain policy requirements and safeguard covenants in the loan and project agreements to PMO, SMOs and PMU;
(iii) monitor implementation of the EMP through due diligence missions;
(iv) assist PMO, if required, in carrying out its responsibilities and in building capacity for safeguard compliance;
(v) monitor overall compliance of the subprojects to this PAM; and
(vi) if necessary, provide further guidance to BWDB and PMO on the format, content, and scope of the periodic monitoring reports for submission to ADB.

C. Social Safeguard

97. **Involuntary resettlement.** Project 2 is categorized as *A* for involuntary resettlement safeguards. The riverbank protection and flood embankment alignment of the project will go through private cultivated land, commercial land, and pond areas, requiring about 68 ha of land acquisition and resulting in physical or economic displacement of about 730 households (3,870 persons).

98. **Resettlement framework and resettlement plan.** Following the requirements of the sector approach a draft resettlement framework, aligned with government's laws and regulations and ADB SPS (2009), for the investment program has been updated, agreed, and disclosed on ADB's website. The scope of impacts, based on preliminary assessments, is expected be 67.9 hectares (ha) of land, approximately 728 households comprising 3,868 APs—482 of whom are vulnerable—prior to COVID-19. The works will impact 14,024 trees, 2652 structures, and 296 businesses. Among the three subprojects under Project 2, only one (Shahjadpur) has a draft resettlement plan prepared, which will be updated during implementation and disclosed on ADB's website prior to award of contract for works in line with the ADB sector approach requirements. The works at Shahjadpur consist of 7.9 km river protection and embankment, with 34.1 ha of land required for acquisition, impacting 366 households (1,944 persons), 1,333 various structures (residences, kitchens, and others), and 7,048 various trees (timber, medicinal, fruit-bearing). For finalization, a 100% census and updated survey of vulnerabilities to understand real-time impacts of COVID-19 will be conducted starting in June 2021. For the other four sites, resettlement plans, in line with the resettlement framework, will be prepared by BWDB for ADB's approval following detailed design and updated surveys. Land acquisition and resettlement planning will be developed in accordance with the two-phased approach of the resettlement framework. These resettlement plans will be disclosed on the ADB's website and by BWDB in the project area (in local language), following their approval by ADB.

99. **Cut-off date.** The cut-off date is the date after which eligibility for compensation or resettlement assistance will no longer be considered. For legal titleholders, the date of publication of the notice by the Deputy Commissioner under Section 4 of ARIPA, 2017 will be considered as the cut-off date. While for affected non-titleholders, such as nodibhashis (erosion displaced households squatting on others' land, also called uthuli) or informal settlers/squatters living in the acquired area, the date of the updated Detail Measurement Survey (DMS) will be the cut-off-date. Any persons moving into the project area after the cut-off date will not be entitled for compensation or assistance under the project. Any persons moving into the project area after the cut-off date will not be entitled to any assistance.

100. **Implementation of involuntary resettlement.** A Resettlement Unit (RU) will be established within the PMO headed by a Chief Resettlement Officer (CRO). The SMOs and an experienced implementing agency (NGO/ social consulting firm) will support implementation of resettlement activities.

101. **PMO.** The PMO is responsible for the full compliance of the project with the loan agreement, ADB SPS, and all applicable laws and rules of the government. The PMO will be supported by SMOs to ensure project implementation and resettlement plans. The PMO is fully responsible to review and approve resettlement plans prepared by ISPMC and SMOs or other consultants engaged under Project 2, ensure preparation, review, and submission of semi-annual monitoring reports, conduct training and workshops on involuntary resettlement and land acquisition for all those involved in project implementation (staff, engineers, contractors, and consultants), address issues or challenged in relation to involuntary resettlement in a timely manner, engage and retain an external monitor or external monitoring agency (para. 106) for the entire duration of Project 2 implementation as well as review and approve CAPs as recommended by such external monitor, and ensure that the GRM is in place and operational from the onset of project implementation, as well as ensure that grievance redress mechanism is continuously functioning. The PMO will request clearance from ADB for the award of civil works contract or notice to proceed in involuntary resettlement impacted areas upon meeting of relevant plan implementation milestones.

102. **SMOs.** The SMOs will support the PMO at subproject level, including ensuring resettlement plan activities and land acquisition are implemented according to the approved plans, effect payment of compensation, conduct consultations with affected persons, ensure displaced persons are informed of development programs and prepare reports during such consultations and field visits as to observations in the resettlement plans implementation, including any concerns involving grievances or that may requiring corrective actions.

103. **Implementation NGO(s).** NGO(s) will be engaged to support BWDB in preparation and implementation of the resettlement plans. The NGO(s) will carry out information campaigns and involve affected persons including women in the implementation process from the start of new works. The NGO(s) will collect, collate, computerize and process data for identification of eligible persons correctly for resettlement benefits and assess their entitlements as per resettlement plan policy. Preparatory and implementation work for the RPs will be supported by the INGO including, but not limited to, meaningful consultations will be supported, make the landowners / tenants / informal occupiers aware about details of land acquisition process, compensation entitlement, payment procedure/ mechanism, resettlement benefit offered by the project, socio-economic surveys, 100% census, and valuations will be supported by the ISPMC and the INGO. Legal owners will be assisted by INGO to organize legal documents in support of their ownership. The INGO will identify loss and entitlement of female owners and co-sharers through share determination at the field upon receipt of payment data from the DC office. The INGO will also

support the APs to access transitional support such as, to find alternative land, purchase low-cost, low-lying land by bundling resettlement benefits, access land development services through the project, encourage APs to consider purchasing land or investing the money in productive/income generating activities, provide linkage with government housing schemes. The details of this support are found in the RF in Section V entitlement matrix.

104. Involuntary resettlement safeguard requirements will be implemented by other various stakeholders, such as the Joint Verification Team and Property Valuation Advisory Team, as stated in the resettlement plans. The BWDB will be involved in establishing some of these stakeholder groups and will maintain regular communications through regular consultations and meetings schedules established at the outset of their instigation. The BWDB will be responsible to address any issues or concerns that may arise in the course of these stakeholders' work and to monitor their progress to ensure timely completion of all activities.

105. **Monitoring reports.** A consolidated Social Monitoring Report (SMR), covering all subprojects and a six-month period, will be prepared semi-annually and submitted to ADB for review and guidance, within 30 days from the end of the reporting period. The SMR will report on progress of the resettlement plan implementation. The ISPMC will support PMO and SMOs in monitoring and reporting on resettlement plan implementation. Upon clearance by ADB, the SMRs will be publicly disclosed on the ADB's and BWDB's websites. Submission of SMRs to ADB will continue until the end of the MFF and a facility completion report is issued.

106. **External monitoring.** BWDB will retain or engage a qualified and experienced expert or qualified NGO to verify monitoring information and activities related to land acquisition and resettlement. The external monitoring of the resettlement plan will be undertaken by an external monitor, who is independent and not involved in the day-to-day supervision of the project. The main objective is to verify information in the SMR, and submit an external monitoring report which verifies information in the SMR including whether resettlement goals have been achieved, livelihoods and living standards have been restored and/or enhanced, and suggest suitable recommendations for improvement. The external monitoring report will be submitted to the Director General of BWDB who will issue them also to IMED, and to ADB within 3 months following submission of SMRs. The external monitor will also advise on any ADB SPS noncompliance issues and suggested corrective actions to address such noncompliance. In case there is noncompliance identified, BWDB will not implement specific project components for which involuntary resettlement impacts are identified until such corrective action plan is formulated, approved and disclosed. The external monitor will be mobilized within 3 months from loan effectiveness and the monitoring will be carried out intermittently during the resettlement plan implementation. The external monitor will assess resettlement outcomes, their impacts on the standard of living of displaced persons, and whether the objectives of the resettlement plan have been achieved by considering the baseline conditions and the results of resettlement monitoring. The external monitor will undertake a post-resettlement evaluation of the effectiveness of resettlement plan implementation with comparison to baseline information and provide a final report to ADB and BWDB.

107. **Consultation and Grievance Redress Mechanism.** Initial consultation of affected people has been conducted in 2017 at the site of the Shahjadpur embankment. Further consultations were done through the SMOs at all sites in November and December 2020 to establish knowledge of project interventions and status as well as raising awareness of resettlement and land acquisition procedures and compensation. In consideration of COVID-19 these consultations were implemented through questionnaires used to both collate information about the APs understanding of the project, its consultation and grievance mechanisms,

compensation and impacts of resettlement, as well as to share information on the same. In late April 2021, the project disseminated brochures with further information about the project, its impacts and the mechanisms to the APs in the Shahjadpur area. Ongoing consultation has been conducted informally through the local BWDB offices overseeing tranche 1. During the implementation of the resettlement plans, detailed consultation with affected people will be carried out to promote the effective finalization of the resettlement plans and until resettlement activities are completed. BWDB will utilize and expand the same GRM established under Project 1 to include a second, PMO level grievance redress committee (GRC) to allow appeals to decisions of the first, SMO level GRC. The GRM will ensure that the affected people's concerns and grievances on the project's environmental and social safeguards implementation are received, addressed, and resolved. The contractor(s) will actively participate in resolving issues recorded under the GRM. The affected people can access the national judicial system at any stage.

108. **Indigenous Peoples.** Project 2 is categorized as *C* for Indigenous Peoples safeguards. There are no tribes, minor races, ethnic sects, and communities, within the meaning of ADB SPS, present in Project 2 areas and it will have no impact on the dignity, human rights, livelihood systems, or culture of tribes, minor races, ethnic sects, and communities or affect their ancestral domain.

109. **COVID-19.** The global pandemic has impacted the Project and its stakeholders. The consultation process has been impacted with project team unable to access the field for effective consultations. Special measures can and have been taken to address such issues, e.g., the PMO will use online platforms, brochures, questionnaires and other forms of media as applicable to provide project information updates and receive feedback from the people, beneficiaries, government agencies and other stakeholders. Vulnerabilities of APs may be impacted real-time through loss of livelihoods, access to services and community health. Enhanced surveys will be conducted to reassess vulnerabilities to understand the true impact of COVID on the APs and updated level of vulnerabilities as well as how to address those through livelihoods restoration programming. Depending on the status of COVID at the time of RP preparation, BWDB will be requested to put in place adaptive management measures to manage relevant actions (e.g., surveys, consultations, resettlement) in alignment with WHO health and safety guidelines as well as to ensure the project best responds to their needs. The RPs will be updated as relevant to include the COVID-19 adaptive management measures.

D. Gender and social dimensions

110. **Social Development and Poverty Reduction.** Riverbank erosion along the main rivers is a prominent problem in Bangladesh, and is a perennial phenomenon caused by dynamic channel shifting of the rivers within the floodplain. Such erosion frequently destroys land, assets and infrastructure, and as a consequence poses a repeated threat to people's lives and assets from erosion and increased flooding. Uncertainty in the face of frequent floods and riverbank erosion prevents investment in infrastructure and of the poor themselves in higher value agriculture and small business. As such, poverty is higher in riverine districts. Investments in erosion prevention can be viewed as investments in prevention of migration to more vulnerable locations and urban slums. Government's Eighth Five-Year Plan focuses on rapid poverty reduction and climate-resilient sustainable development.[32] The country operations business plan for Bangladesh, 2020–2023 supports this development specifically in targeting the reduction of

[32] The five core themes of the Eighth Five-Year Plan are (i) rapid recovery from COVID-19; (ii) gross domestic product growth acceleration, employment generation, and rapid poverty reduction; (iii) a broad-based strategy of inclusiveness; (iv) a sustainable development path resilient to disaster and climate change; and (v) the development and improvement of critical institutions.

flood risks.[33] Project 2 interventions will provide a more stable environment with reduced flood and riverbank erosion risks, while providing income generation during the construction of the civil works, which potentially provides higher opportunity for future income generation.[34]

111. **Gender.** The project is classified as *effective gender mainstreaming*. A gender action plan (GAP) has been prepared with clear targets and responsibilities (Attachment 7). Lessons learned from Tranche 1 show that adolescent girls and women face different types of violence and hazards during and after natural disasters were neglected. A demand for focusing on women's leadership positions and active participation in O&M of infrastructures built also emerged through women's engagement in Tranche 1.[35] Thus, Project 2 will have a myriad of positive impacts on gender. Women's leadership will be enhanced—not only through formation of community-based disaster management (CBDM) units (35% led by women) but also through specific leadership training for those women to ensure that they can actively voice their opinions and influence decision-making. Women will be actively involved in O&M, gaining training and knowledge on CBDM and regular O&M of infrastructures. Based on the findings on GBV, at least one awareness program per package on GBV and community-based redress mechanism will be implemented to influence social norms. Information at worksites on the risks of STIs (including HIV/AIDS) will be disseminated, such that participants – including 30% women – will have enhanced knowledge on how to respond to and protect against these risks. Fourteen newly established community groups[36] across the project area will be economically empowered through livelihoods training with participants including 50% women. Gender-responsive[37] mechanisms will be integrated into the new river management guidelines ensuring that women are participants to the process and more equitable beneficiaries the guidelines' implementation. Gender-sensitive[38] project monitoring tools will be used by PMOs and SMOs with explicit gender equality objectives and indicators. These will ensure that the sex disaggregated MIS and M&E tools developed track qualitative and quantitative data measuring accountability and progress made on gender equality issues, project impacts on gender relations, the different priorities and needs of women and men, and determine gender aspects that need to be integrated into M&E systems for the follow-on project. Finally, women will access employment opportunities during the construction.

112. **Labor.** Project construction is expected to generate employment opportunities for local communities during the construction and maintenance phases. Provisions are in the bidding documents for the contractors to ensure that all the civil works comply with core labor standards (e.g., no child labor; no bonded labor; no work discrimination due to gender, race, and ethnicity; freedom of association and collective bargaining; and providing equal pay for equal work). This will be monitored by the ISPMC and reported in the project QPRs.

113. **Health.** BWDB will ensure that civil works contracts under each project shall include provisions for carrying out HIV/AIDS awareness programs for labor and disseminate information at worksites on risks of sexually transmitted diseases (including HIV/AIDS) as part of health and safety measures for those employed during construction; and (ii) following legally mandated

[33] ADB. 2020. *Country Operations Business Plan: Bangladesh, 2020–2023*. Manila.
[34] ADB's *Handbook on Social Analysis: A Working Document*. http://www.adb.org/Documents/Handbooks/social-analysis/default.asp.
[35] ADB. 2013. *Completion Report: Jamuna-Meghna River Erosion Mitigation Project*. Manila.
[36] Community groups are comprised of vulnerable people from Project area, and not only APs.
[37] Including, but is not limited to, women's participation in consultations, surveys, accountability mechanisms, and collection and reporting on sex-disaggregated data.
[38] Including explicit gender equality objectives and indicators. The M&E tools developed will assess qualitative and quantitative data measuring accountability of progress made on gender equality issues.

provisions for health, safety, sanitation, welfare and working conditions. The contracts shall also include clauses for termination in case of any breach of these provisions by contractors.

IX. PERFORMANCE MONITORING, EVALUATION, REPORTING, AND COMMUNICATION

A. Project Design and Monitoring Framework[a]

Impact the Project is aligned with: Livelihood in the project area improved (program defined)[b]

Results Chain	Performance Indicators with Targets and Baselines	Data Sources and Reporting Mechanisms	Risks and critical assumptions
Outcome Flood and riverbank erosion risks in the subproject areas reduced	By 2025: a. 15,400 ha of land protected from inundation damages (2020 baseline = 0) (3,600 ha)[c] (OP 3.2, 5.3) b. About 0.5 million people protected from inundation damages (2020 baseline = 0) (0.1 million people)[c] (OP 2.1, 3.2) c. 3,000 ha of lands with assets protected from riverbank erosion (2020 baseline = 0) (200 ha)[c,d](OP 3.2, 5.1.1) d. 8,000 ha of char land recovered from the river for development (2020 baseline = 0) (OP 2.1, 3.2, 5.1.1)	a–b. Districts' flood damage records c–d. BWDB's dry season satellite image analysis (outsourced to CEGIS)	Disasters induced by natural hazards exceed the design flood return period which may reduce the program benefits(R) Flood embankment completed on time (A).
Outputs	By 2024:		
1. Flood and riverbank erosion risk mitigation functioning at priority reaches improved	1a. 30 km of riverbank protected by applying appropriate technology and methodology[e] (2020 baseline = 0 (18 km)[c,d] (OP 1.2) 1b. 7.9 km of climate-resilient flood embankment constructed, rehabilitated, or upgraded against 100-year probable floods (200-year flood along the main rivers) (2020 baseline = 0) (21 km)[c] (OP 1.25.1.1) 1c. 2 regulators and other hydraulic structures (i.e., fish passes) installed (2020 baseline = 0) (4)[c] 1d. 1 channel closure with "building with nature" approach[f] (2020 baseline = 0) (OP 1.2) 1e. 160 community-based disaster management units established (minimum of 35% women-led) and developing of their capacity (2020 baseline = 0) (baseline 40 units with 14 led by women)[c] (OP1.3) 1f. 14 community groups[g] established and livelihood training program conducted (50% women participants) (2020 baseline = 0) (6)[c] (OP 2.3, 2.5) 1g. 12 fish sanctuaries established (2020 baseline = 0)	1a–d. BWDB project progress and completion reports 1e–g. implementation NGOs reports BWDB project progress reports	River morphological changes exceed the anticipated range leading to delays in implementation. (R) Implementation may be delayed due to communicable diseases such as COVID-19, resulting in time and cost overruns. (R)
2. Institutional system for flood and riverbank erosion risk management strengthened	2a. Office of the CE-River Management operational (2020 baseline = office established) (OP 6.2) 2b. Information and management systems refined and piloted including: (i) project website and database with sex-disaggregated data as appropriate in use; (ii) web-based asset database developed and piloted; (iii) project monitoring system in use; and (iv) guideline for river stabilization prepared. (2020 baseline = databases outlined) (OP 6.2) 2c. 5-year budgetary plan for riverbank protection O&M and emergency work for the main rivers submitted for	2a–b, 2d–e. BWDB project progress reports 2c. BWDB annual budgetary plan BWDB construction material stockade plan	Possible departmental restructuration of the organizational structure of the BWDB does not hamper project implementation (A).

Results Chain	Performance Indicators with Targets and Baselines	Data Sources and Reporting Mechanisms	Risks and critical assumptions
	endorsement by BWDB. (2020 baseline = initial draft submitted in November 2020) 2d. Long-term river stabilization and river management master plans refined to include char lands development and submitted for endorsement by BWDB (2020 baseline = initial plan for stabilization of main rivers endorsed by BWDB) 2e. Gender responsive[h] guideline for river management (focus Lower Jamuna) submitted for endorsement to BWDB. (2020 baseline = studies initiated under Project 1, guideline approved in 2010) 2f. Project website updated (2020 baseline = website developed under Project 1)	2f. BWDB project reports and webpage	
3. Program management systems operational	3a. Management information system, quality control systems, accountability measures, and gender-sensitive project monitoring tools[i] established and used by PMO and SMOs (2020 baseline = N/A) (OP 6.2) 3b. At least 60% of Office of the Chief Engineer River Management staff (including a minimum of 60% of female staff) with increased knowledge on Adaptive Approach[j] (2020 baseline: 0). 3c. Follow-on project in line with Bangladesh Delta Plan 2100 and approved River Stabilization Plan (2020), expanding innovative technologies developed under this MFF prepared for the Government of Bangladesh and ADB approval. (2020 baseline = not applicable)	3a. BWDB financial records and progress reports 3b. BWDB annual reports and facility completion report 3c. Government of Bangladesh and ADB draft loan processing documents	

Key Activities with Milestones

1. Flood and riverbank erosion risk mitigation functioning at priority reaches improved

1.1 Infrastructure improvement
- a. Complete land acquisition (Q4 2021–Q2 2023)
- b. Complete construction works (Q1 2022–Q2 2024)

1.2 Building with Nature
- a. Complete preparatory studies (Q1 2022–Q3 2022)
- b. Complete construction works (Q4 2022–Q2 2024)

1.3 Community-based flood risk management
- a. Engage firm(s) / NGO(s) and refine methodologies and guidelines (Q4 2021–Q2 2022)
- b. Form community disaster management units, with necessary training (Q1 2022–Q4 2022)

1.4 Livelihood support for project affected people
- a. Identify affected people, suitable for livelihood support activities and interest (Q4 2021–Q3 2022)
- b. Firm(s) /NGO(s) implement livelihood trainings and support program (Q4 2021–Q2 2024)
- c. Establish 12 fish sanctuaries and community-involvement (Q4 2021–Q2 2024)

2. Institutional System for flood and riverbank erosion risk management strengthened

2.1 BWDB institutional capacity strengthening for river management and sustainable asset management
- a. Conduct training for BWDB staff including staff of CE River Management office, in design of river and flood protection works, river management and O&M (Q1 2022–Q2 2024)
- b. Develop capacity of CE River Management office in particular planning and MIS (Q1 2022–Q2 2024)
- c. Develop, test, rollout and use MISs: (i) project website and database, (ii) web-based asset database, and (iii) project monitoring and MIS (Q1 2022–Q2 2024)
- d. Prepare 5-year budgetary plan with BWDB for their approval (Q4 2021 to Q4 2022)
- e. Conduct annual information sharing workshops with other agencies (Q3 2022– Q2 2024)

2.2 Data and knowledge base development for state-of-the-art implementation guidelines a. Refine the long-term river stabilization and river management master plans to include char lands development; present to BWDB and stakeholders for wider adoption in planning (Q4 2022–Q4 2023) b. Undertake studies to add to quality of planning and design guidelines covering: (i) river management, river training and riverbank protection, (ii) distributary flows and rehabilitation, (iii) land reclamation and development, (iv) fisheries, and (v) resettlement, social, and environmental impacts. (Q4 2021–Q2 2024) c. Extend/refine pilots such as grout-filled mattresses and bio-engineering measures with katkin/vetiver grasses, channel closure and distributary offtake design. (Q4 2021–Q2 2023) d. Conduct flood and river surveys, and input data into web-based database (Q4 2021–Q3 2023) e. Input data into web-based (project) database (Q4 2021–Q2 2024) **3. Program Management Systems Operational** 3.1 State-of-the-art implementation and documentation a. Regular progress documentation by PMO/SMOs applying database and MIS tools (Q4 2021–Q2 2024) b. Complete management transfer to the office of the CE River Management by mid-term review (Q1 2023) 3.2 Follow-on project commensurate with River Stabilization Plan and Bangladesh Delta Plan a. Prepare follow-on project feasibility study (Q4 2021–Q3 2022) b. Process and approve follow-on project (Q4 2022–Q3 2023)
Project Management Activities Institutional set-up extended with PMO as part of office of CE River Management, BWDB (by Q4 2021). Engage/extend services of the ISPMC (by Q4 2021). Planning of activities, including works, resettlement and land acquisition activities, and MIS (by September 2021) Use of MIS, quality control system by PMO and SMOs (by Q2 2022) PMO/SMOs to conduct regular stakeholder workshops (Q4 2021–Q2 2024) Timely procurement and supervision of works (throughout project implementation) Timely procurement and management of services to be delivered by third-party firms / NGOs (by Q1 2022) Coordination between BWDB and DDM, including signing a MoU for CbFRM activities (Q3 2021–Q2 2024) Timely and quality reporting (Q4 2021–Q2 2024) Preparation of follow-on project and necessary documents for approval by the Government of Bangladesh and ADB (Q2 2022–Q2 2024) Facility completion report (Q1 2024–Q2 2024)
Inputs ADB: $157,000,000 (concessional loan) Government of the Netherlands: $17,890,000 (grant) Government: $36,910,000

ADB = Asian Development Bank, BBS = Bangladesh Bureau of Statistics, BWDB = Bangladesh Water Development Board, CE = Chief Engineer, CEGIS = Center for Environmental and Geographic Information Services, DC = deputy commissioner, DDM = Department of Disaster Management, DMU = disaster management unit, ha = hectare, ISPMC = institutional strengthening and project management consultant, km = kilometer, MIS = management information system, MFF = multitranche financing facility, MoU = memorandum of understanding, N/A = not applicable, NGO = nongovernment organization, O&M = operation and maintenance, OP = operational priority, PMO = project management office.

[a] The design and monitoring framework (DMF) for Project 2 was prepared within the frame of the DMF of the MFF but adjusted to comply with the new DMF guidelines (ADB. 2020. *Guidelines for Preparing a Design and Monitoring Framework*. Manila).

[b] The impact statement was defined for the investment program following previous DMF guidelines. However, it remains aligned with government priorities outlined in the Eighth Five-Year Plan, FY2020–FY2025 (Government of Bangladesh, Planning Commission. 2021.

[c] Achieved under Project 1.

[d] In the DMF of the MFF, 10 km were defined as baseline, as previously implemented in the project area under ADB-financed JMREMP, resulting in a pre-FRERMIP outcome of 43 ha of lands with assets protected from erosion.

[e] Appropriate technology entails long-guiding revetments placed alongside the existing riverbanks, and built from cost effective, sustainable sand-filled geotextile bags. The revetments will be adapted in accordance with morphological changes (deepening of the river) with separate work packages under this Project 2. Appropriate methodology refers to the construction technology making use of precisely positioned floating equipment. The precise amount of underwater works along the highly variable banklines will be determined within 5 days prior to dumping (implementation design) and as-built conditions will be determined within 5 days after dumping. Subsequently, regular monitoring to determine performance and potential adaptation works takes place making use of multi-beam echosounder surveys.

[f] "Building with nature" entails stimulating natural processes, for example closing an aggressively eroding bankline channel (Solimabad channel) through overloading with sediment, and measures involving bio-engineering, such as the plantation of large reed fields, which encourage the settlement of finer material and help building up char land to floodplain level.

[g] Community groups are comprised of vulnerable people from the Project area.

[h] Including, but not limited to, women's participation in consultations, surveys, accountability mechanisms, and collection and reporting on sex-disaggregated data

i Including explicit gender equality objectives and indicators. The M&E tools developed will assess qualitative and quantitative data measuring accountability of progress made on gender equality issues.
j "Adaptive Approach" refers to the adoption of flexible implementation to address ongoing morphological changes in the river with protection of riverbanks with launching aprons that are subsequently strengthened and built to the final scour depth with the deepening of the river.

Contribution to Strategy 2030 Operational Priorities
Expected values and methodological details for all OP indicators to which Project 2 will contribute results are detailed in Contribution to Strategy 2030 Operational Priorities (Appendix 2). In addition to the OP indicators tagged in the DMF, this operation will contribute results for:
OP 1.2: Skilled jobs generated or facilitated through stable environment (5,000 people trained through livelihood programs, 3,000 jobs created)
OP 1.3 Opportunities for the most vulnerable increased through employment during construction (5,000 people) and livelihood support program (40 groups)
OP 2.3 Gender equality in decision making and leadership enhanced (min. 33% of CbFRM and 50% of CbO&M groups led by women)
OP 2.5 Women's resilience to external shocks strengthened (training in 40 livelihood groups and 160 CbFRM groups)
OP 3.2 People protected from inundation damages (0.5 million) and trained in disaster management (160 CbFRM groups)
OP 3.3: People benefiting from strengthened environmental sustainability (0.5 million)
OP 5.1: Rural development (protection from inundation damages (15,400 ha, 0.5 million) and provision of embankments to be developed with roads giving access to rural areas (7.9 km)
OP 5.2 Agricultural value chains (river training and offtake structure to increase dry-season water supply to distributaries, access improved through embankments (7.9 km) and areas protected from inundation damages (15,400 ha, 0.5 million)
OP 5.3 Food security (areas protected from inundation damages (15,400 ha, 0.5 million)
OP 6.2 Governance and institutional capacity for service delivery improved through training of BWDB and DDM personnel
OP 7.1 Greater and quality connectivity between economies through river training inducing river deepening (up to Jamuna bridge) and facilitating dry-season accessibility of distributaries (Ghior Khal)
Source: Asian Development Bank.

B. Monitoring

114. **Project Performance Monitoring.** The PMO will continue to use the MIS developed under Project 1 consisting of the project management and O&M modules which include a benefit monitoring function using baselines, targets, indicators, assumptions, and risks in line with the DMF. Data indicators for subsequent years will be input semi-annually in the MIS. The project consultant will support the PMO in monitoring performance. The financial and physical progress will be recorded in the project management module of the MIS.[39]

115. **Compliance Monitoring.** Compliance with loan covenants will be monitored through ADB's project administration missions, including the project inception mission to discuss and confirm the timetable for compliance; project review missions to assess the government's compliance with particular loan covenants and, where there is any noncompliance or delay, discuss proposed remedial measures with the government; and mid-term review mission, if necessary, to assess whether the covenants are still relevant or need to be changed, or waived due to changing circumstances. All non-compliance issues, if any, will be updated in QPRs together with remedial actions. The PMO will include status of compliance in QPRs.

116. **Safeguards Monitoring.** Monitoring and reporting for social safeguards are described in loan agreement, the resettlement framework; also, the resettlement plans provide the arrangement for implementation monitoring including third-party external monitoring. As to environmental safeguards, the EIA provides the monitoring arrangements for main infrastructure works. The status of the implementation of the environmental safeguard documents (EIA and EMPs), and social safeguards documents (the resettlement framework and resettlement plans) will be discussed during ADB review missions and integrated into QPRs. Semi-annual

[39] ADB's project performance reporting system is available at http://www.adb.org/Documents/Slideshows/PPMS/default.asp?p=evaltool

environmental and social safeguard monitoring reports will be provided to ADB within 30 days from the end of each reporting period, until closure of the facility and until a completion report is submitted to ADB.

117. **Gender and Social Dimensions Monitoring.** The GAP will be implemented and monitored by BWDB. The status of the implementation of the GAP will be reported in BWDB's QPR. The status will also be discussed during each ADB review mission.[40]

C. Evaluation

118. Within 6 months of physical completion of the project, BWDB will submit a project completion report to ADB. Within 6 months of physical completion of the facility, BWDB will submit a facility completion report to ADB. DDM will submit a project completion report and a MFF completion report for their activities to BWDB by within 5 months of physical completion of each tranche or the facility. BWDB will submit consolidated reports to ADB.

119. Within 22 months after the effectiveness of the loan, ADB will conduct a midterm review to identify problems and constraints encountered and suggested measures to address them, including appropriateness of scopes, design, implementation arrangements, implementation schedule, compliance with safeguards and other covenants.

D. Reporting

120. BWDB will provide ADB with (i) QPRs in a format consistent with ADB's project performance reporting system; (ii) consolidated annual reports including (a) progress achieved by output as measured through the indicator's performance targets, (b) key implementation issues and solutions, (c) updated procurement plan, and (d) updated implementation plan for the next 12 months; and (iii) a project completion report within 6 months of physical completion of the project. To ensure that projects will continue to be both viable and sustainable, project accounts and the executing agency audited financial statement together with the associated auditor's report, should be adequately reviewed. **Table 22** shows a summary of the reporting requirements.

Table 22: Reporting Requirements

Report	Frequency
Quarterly Progress Reports	Quarterly (15 days from end of previous quarter)
Environmental Monitoring Report	Semi-annual (31 January and 31 July)
Social Safeguards Monitoring Report	Semi-annual (31 January and 31 July)
Audited Project Financial Statements	Within 6 months of end of fiscal year (31 December)
Consolidated Annual Report	Annually (31 January)
Facility Completion Report	Within 6 months of physical completion of the project

Source: Asian Development Bank.

121. In order to gradually minimize the use of paper and costs related to report printing, from the onset of the implementation of Project 2, a cloud repository will be set up by PMO and its consultants for all the (draft and final) reports (such as BWDB FRERMIP Google drive or any similar type of cloud), with access tied to their respective position in the PMO to limit access control; access will also be provided to IMED.

[40] ADB's *Handbook on Social Analysis: A Working Document*, is available at: http://www.adb.org/Documents/Handbooks/social-analysis/default.asp, *Staff Guide to Consultation and Participation*: http://www.adb.org/participation/toolkit-staff-guide.asp, and *CSO Sourcebook: A Staff Guide to Cooperation with Civil Society Organizations*: http://www.adb.org/Documents/Books/CSO-Staff-Guide/default.asp

E. Stakeholder Communication Strategy

122. The stakeholder communication strategy has been built into the design of the project, including the resettlement plans and the GAP, while no separate stakeholder communication strategy has been established, the consultation methodology is defined in the resettlement framework. A key part of the project implementation strategy will be focusing on information sharing and consultation that will guide communications with stakeholders during project implementation. Such information sharing will help to build consensus and ensure continuous stakeholder support throughout the project implementation.

123. The primary audiences for the communication strategy are local communities along the project rivers, the public (NGOs and development partners, key individual decision makers) and government and authorities (local upazila administration, institutions and ministries).

124. The communication activities will include door-to-door awareness campaigns, public meetings, publicity programs with educational institutes, etc – taking into consideration COVID-19 health and safety measures. Stakeholder consultations were initiated during project preparation and under Project 1, with affected households, elected local representatives and other stakeholders. Socio-economic surveys were also conducted and more will be conducted before finalizing the designs. After finalizing the designs, the proposed interventions were and will be explained in each subproject area. This close communication with local stakeholders will be continued throughout the entire implementation of Project 2.

125. Project information will be disclosed to the public and relevant stakeholders per **Table 23**

Table 23: Documents for Disclosure

Project Document	Means of Communication	Frequency	Audience
Project Data Sheet	ADB's website	Quarterly update	General public
Design and Monitoring Framework	ADB's website	After Management approval, as part of the PFRR	General public
Environmental Impact Assessment Report	ADB's website BWDB's website	Prior to Management approval	General public, project-affected people in particular
Resettlement Framework (updated)	ADB's website BWDB's website	Prior to Management approval	General public, project-affected people in particular
Resettlement Plan	ADB's website BWDB's website	Prior to Management approval	General public, project-affected people in particular
Legal Agreements	ADB's website	after loan effectiveness	General public
Project Administration Manual	ADB's website	After Management approval	General public
Social and environmental monitoring reports	ADB's website	semi-annually, within one month of ADB's acceptance of report.	General public

ADB = Asian Development Bank, BWDB = Bangladesh Water Development Board.
Source: Asian Development Bank.

X. ANTICORRUPTION POLICY

126. The government, BWDB, and DDM were made aware of ADB's Anticorruption Policy (1998, as amended to date). ADB reserves the right to investigate, directly or through its agents,

any violations of the Anticorruption Policy relating to the project.[41] All contracts financed by ADB shall include provisions specifying the right of ADB to audit and examine the records and accounts of the executing agency and all project contractors, suppliers, consultants and other service providers. Individuals/entities on ADB's anticorruption debarment list are ineligible to participate in ADB-financed activity and may not be awarded any contracts under the project.[42]

127. To support these efforts, relevant provisions are included in the loan agreement and grant agreement and the bidding documents for the project.

128. The government will publish pertinent information relating to the project on the Central Procurement Technical Unit's website, including business opportunities associated with the project, and information in relation to procurement of goods, works, and consulting services.

XI. ACCOUNTABILITY MECHANISM

129. People who are, or may in the future be, adversely affected by the project may submit complaints to ADB's Accountability Mechanism. The Accountability Mechanism provides an independent forum and process whereby people adversely affected by ADB-assisted projects can voice, and seek a resolution of their problems, as well as report alleged violations of ADB's operational policies and procedures. Before submitting a complaint to the Accountability Mechanism, affected people should make an effort in good faith to solve their problems by working with the concerned ADB operations department. Only after doing that, and if they are still dissatisfied, should they approach the Accountability Mechanism.[43]

XII. RECORD OF CHANGES TO THE PROJECT ADMINISTRATION MANUAL

130. All revisions and/or updates during the course of implementation should be retained in this section to provide a chronological history of changes to implemented arrangements recorded in this PAM, including revision to contract awards and disbursement S-curves.

[41] ADB. 1998. *Anticorruption Policy*. Manila.
[42] ADB Anticorruption Sanctions List.
[43] Accountability Mechanism. https://www.adb.org/site/accountability-mechanism/main.

Attachment 1: Project Financial Statements

Annex XX. Indicative Project Financial statements

NAME of the project
Loan/grant No.

Outline

1. Statement of Cash Receipts and Payments
2. Statement of Budget vs. Actuals
3. Statement of Disbursement By Financing Source
4. Statement of Disbursement Claimed Under Statement of Expenditure (Soe) Procedure
5. Statement of Imprest/Advance account
6. Notes to the financial statements

1. Statement of cash Receipts and Payments for the year ended DD/MM/YYYY							
	Notes	**Current year**		**Previous year**		**Cumulative (from inception to the end of current year)**	
Cash receipts		**Cash Receipts/Payments controlled by the entity**	**Direct/third party payments**	**Cash Receipts/Payments controlled by the entity**	**Direct/ third party payments**	**Cash Receipts/Payments controlled by the entity**	**Direct/ third party payments**
ADB loan (loan number)	3.1						
Netherlands grant	3.2						
GoB	3.3						
Etc.							
Total receipts							
Payments	**4**						
Expenditure category 1	4.1						
Expenditure category 2	4.2						
Expenditure category 3	4.3						
Expenditure category 4							
etc..							
Total payments							
Cash balance at the beginning of the year	**6 .1**						
Cash balance at the end of the year	**6.2**						

Project Director: [Signature]

Accounts officer or equivalent: [signature]

2. Statement of Budget vs. Actual for the year ended DD/MM/YYYY

Loan/Grant No.

	Notes**	For the current year ended 20xx			For the Prior year ended 20xx			Cumulative (from inception to the end of current year)		
Expenditure Categories*		Budgeted	Actual	Variance	Budgeted	Actual	Variance	Project Budgeted as per the PAM	Actual	Variance
Expenditure category 1	5.1									
Expenditure category 2	5.2									
Expenditure category 3	5.3									
Expenditure category 4										
Etc.										
Total Payments										
Total Project Cost										

*expenditure categories as outlined in the PAM

**any significant variances are to be explained in the notes

Project Director: [Signature]

Accounts officer or equivalent: [signature

3.Statement of Disbursement By Financing Source for the year ended DD/MM/YYYY
(Separate statement to be prepared for ADB loan and Government of Netherlands grant)

Loan/Grant No.

Statement of Disbursement	Note	Current Year	Prior Year	Cumulative Project to Date
ADB loan - Funds claimed during the year	7.1			
Reimbursement				
Imprest Fund				
Direct Payment				
Subtotal				
Expenditure incurred not yet claimed	7.2			
Subtotal				

*list of WAs/claims submitted to be disclosed in the notes

Project Director: [Signature]

Accounts officer or equivalent: [signature

4. Statement of Disbursement Claimed Under Statement of Expenditure (Soe) Procedure For The Year/Period Ended Xx, Xxxx

(Separate statement to be prepared for ADB loan and Government Netherlands grant)

Loan/Grant No

in (currency) '000

W/A No. (1)	SOE Sheet no (2)	Category (3)	Total Amount Paid (4)	ADB Financing %1 (5)	Net Eligible Expense (6 = 4 x 5)	Amount Reimbursed (7)	Advance Account Fund Replenished / Liquidated (8)	Total Disbursement using SOE Procedure (7+8 = 9)
		Total						
		Total for [prior year]						

[1] The financing percentages within the table for ADB funds are as per loan agreement Schedule 3.

Project Director: [Signature]

Accounts officer or equivalent: [signature]

5. Statement of Imprest/Advance account for the year/period ended DD/MM/YYYY (for each advance account separately)

Loan/grant No. Account details: XXXX			
	Notes	Current Year	Prior Year
Balance brought forward from previous period			
Add: Advance[1] Replenishment received during the year/period[1] Interest Earned			
Subtotal (A)			
Deduct: Payments made during the year/period Replenishment /Liquidation[1] Expenditure yet to be claimed Amount refunded during the year/period			
Closing Balance (B)			
As per bank statement (copy attached)			

Project Director: [Signature]

Accounts officer or equivalent: [signature]

Notes to the financial statements
For the year ended [year end date]

1.Project Information

1.1 Key highlights:

Project title
Funded by:
Management:
Executing Agency
Implementing agencies
Start Date:
Closing date:
Project Duration:
Funding Sources/modality/amount

1.2 Impact and Outcome

2. Summary of Significant Accounting policies.

2.1 Basis of preparation
2.2. Cash Basis of accounting
2.3. Recognition of Receipts and payments
2.4. Third party payments
2.5. Presentation currency
2.6 Foreign Currency Translation
2.7. Changes in Accounting policies
2.8 Reporting period
2.9 Comparatives

3. Funds received

3.1 Funds received from under ADB loan /List of WAs and amounts
3.2 Funds received from under Netherlands grant /List of WAs and amounts

3.3 provide a breakdown of Funds received from the Government
3.4. funds received from Other sources
etc..

4. Payments

List of Payments from the advance account/subadvance account with a breakdown by category
List of third party payments/direct payments with a breakdown by category.

5. Variances

List and explain any significant variances between budget and actual expenditures.

6. Opening and closing balances

List details of the opening balances
List details of the closing balances

7. Disbursements/Withdrawal Applications

7.1 Include detailed list of WAs claimed from ADB with the following breakdown : i) funding source (ADB loan/Netherlands grant), ii)) WA number, iii) time period in which expenditures were incurred iv) the amount claimed and currency, v) date submitted, vi) disbursement method, vii) the amount disbursed by ADB, vii) used exchange rate and viii) explanation of any difference between the amount claimed from ADB and the amount disbursed by ADB.

7.2 Provide a breakdown of expenditures incurred but not yet claimed from ADB including the eligible portion for ADB financing.

8. Special notes for the FY

Disclose a break down Interest Expenses/ Financial Charges incurred as part of the project for the current year, past year and cumulatively.

Attachment 2: Indicative Statement of Audit Needs

A. Background

1. The ADB and the Government of Bangladesh (GOB) have entered into a Loan and Grant Agreement whereby, ADB shall provide $157 million for the purpose of financing civil works, materials, equipment, consulting services, training, and project management. The Government of Netherlands funds $17.89 million as grant basis for financing consulting services and piloting works. The GOB shall contribute $37.91 million against these funding. This will be carried out through the Bangladesh Water Development Board (BWDB) and the Department of Disaster management. BWDB and DDM shall maintain separate books of account which will be consolidated by the PMO with respect to this Project, including all items of expenditure financed out of the proceeds of the loan and grant agreement.

B. Financial Reporting and Audit Requirements

2. BWDB will prepare consolidated project financial statements on a cash basis of accounting, in accordance with its Financial Administrative Regulations (FAR). This shall not be construed to refer to the financial statements of BWDB as a whole.

3. The audit of the project financial statements shall be carried out by the Foreign-Aided Project Audit Directorate (FAPAD) within the Comptroller and Auditor General of Bangladesh (CAG) in accordance with CAGs Audit Manual and, supplemented by this Statement of Audit needs. The auditor will review that the funds received from all sources and expenditures incurred by BWDB and DDM during the reporting period are as per agreed terms and conditions. This will include all expenditure incurred by BWDB and DDM relating to this project.

4. BWDB will submit to ADB audited project financial statements for each fiscal each year, within 6 months of the end of the fiscal year in English. A complete set of audited project financial statements includes:

a. Audit report including separate Audit opinions on the following:
    i. whether the project financial statements present an accurate and fair view or are presented fairly, in all material respects, in accordance with the applicable financial reporting standards; and;
    ii. whether the proceeds of the loan and grant were used only for the purpose of the project.

b. Project financial statements consisting of the following:
    i. Statement of Cash Receipts and Payments
    ii. Statement of Budget vs. Actuals
    iii. Statement of Disbursement By Financing Source
    iv. Statement of Disbursement Claimed Under Statement of Expenditure (SOE) Procedure
    v. Statement of Imprest/Advance account
    vi. summary of accounting policies and explanatory notes
c. A management letter.

5. To support timely submission, unaudited project financial statements should be submitted to the CAG/FAPAD for audit within 3 months of the end of the fiscal year.

C. Specific Audit Needs

6. The audit would cover the entire Project i.e., covering all sources of funds including the ADB loan, Netherlands grant, and the GOB and all application of funds incurred by BWDB and DDM as part of the project. The audit scope will also include Direct Payments made by ADB to suppliers, contractors an service providers (DPs).

7. The Project Director shall provide all pertinent information to the Auditors including preservation and use of resources procured and its reflection in the project accounts, so as to facilitate comprehensive audit coverage. The audits should be carried out annually from commencement of the Project. The audit for the first year should also cover transactions, which occurred from the commencement of the project, i.e., till the end of the fiscal year. In case the period is less than 6 months, GOB may agree with ADB to provide APFS from the commencement of the Project to the end of the subsequent fiscal year.

8. The auditor will provide assurance as to whether the project financial statements present a true and fair view of the receipts and expenditures, or are presented fairly, in all material respects, in accordance with the applicable financial reporting framework. The auditor will also provide a separate opinion on whether the proceeds of the loan and grant were used only for the purpose of the project.

9. In addition, ADB will also require an assessment by the auditors of compliance with provisions of the financing agreement with ADB, especially those relating to accounting and financial matters. Positive assurance should be provided in accordance with International Standard of Supreme Audit Institutions – 4100 on Compliance Audit. An audit opinion shall be provided that will inter alia include verification that:

i. All funds, including counterpart funds, have been used in accordance with the conditions of the loan agreements, with due regard to economy and efficiency, and only for the purposes for which the funds were provided;

ii. With respect to SOEs, (a) adequate supporting documentation has been maintained to support claims to ADB for reimbursement of expenditures incurred; and (b) except for ineligible expenditures as detailed in the audit observations, if any, appended to this audit report, expenditures are eligible for financing under the Loan Agreement;

iii. The Imprest Account gives a true and fair view of the receipts collected and payments made during the year ended [insert date], and (ii) these receipts and payments support the Imprest Account Liquidation/ replenishments during the year.

10. ADB would expect that the auditors should advise a calendar for discussion/review of audit observations (particularly any serious matters) through tri-partite meetings and review meetings to facilitate executive follow-up on audit observations and recommendations. Moreover, ADB

would need a review of actions taken on the recommendations presented in the previous audit report on the progress made.

D. Project Financial Statements (PFSs)

11. The consolidated Project Financial Statements (PFSs) shall be prepared in accordance with international accounting best principles and practices as well as government's accounting laws and regulations. These should include:

    a. Cash receipts and payment/ Sources and Consolidated Uses of Funds showing the funds received and expended from ADB loan, GoN grant and GOB for the project, showing the third party payments separately and the opening and closing balances

    b. Statement of Budget vs Actual showing expenditure for the current year and cumulative year to date,

    c. Statement of Disbursement By Financing Source (ADB loan, GoN grant and GOB)

    d. Statement of Disbursement Claimed Under Statement of Expenditure (Soe) Procedure (ADB loan, GoN grant)

    e. Statement of Imprest/Advance account

    f. Detailed notes to the financial statements including explanatory notes, break down of expenditure, reconciliation of reimbursements, and Accounting Policies

12. Project Books of Account shall be maintained by the Project Management Office (PMO) of BWDB.

13. Project Financial Statements shall provide sufficient level of detail to identify types of expenditures as identified in the allocation Table of the Loan Agreement; namely civil works, consulting services, training, equipment, community initiatives and design and surveys. Project financial statement shall also provide sufficient detail on the expenditures incurred by DDM as part of the project.

14. Draft template for the project Financial Statements have been included in the project administration manual (PAM) to facilitate compliance with ADB's requirements. Please note that any financial statement template is a working draft, which may require adjustment based on the actual activities of the Project.

E. Management Letter

15. In addition to the audit report, ADB will require a separate management letter. The management letter should specifically:

    a. Give comments and observations on the notes to the accounts, accounting records, systems, and internal controls that were examined during the course of the audit;

b. Identify specific deficiencies and areas of weakness in systems and internal controls and make recommendations for their improvement including MOE response to the identified deficiencies;
c. Communicate matters that have come to attention during the audit which might have a significant impact on the implementation of the Project; and
d. Bring to GOB and ADB attention any other matters that the auditor considers pertinent.
e. The auditor should also make follow-up on past audit recommendations and disclose the status (resolved/pending).

16. Serious issues, which affect the auditor's opinion as to whether the financial statements give a true and fair view, should be referred to in the audit opinion. Management Letter should include only those issues which do not affect the fairness of the financial statements.

F. General

17. ADB review missions and normal program supervision will monitor compliance with financial reporting and auditing requirements and will follow up with concerned parties, including the external auditor.

18. ADB has made BWDB aware of ADB's policy on delayed submission, and the requirements for satisfactory and acceptable quality of the audited financial statements. ADB reserves the right to require a change in the auditor (in a manner consistent with the constitution of the borrower, or for additional support to be provided to the auditor, if the audits required are not conducted in a manner satisfactory to ADB, or if the audits are substantially delayed.

19. ADB retains the right to verify or have audited (i) the project (ii) the validity of BWDB's certification for each withdrawal application, and (iii) that ADB's financing is used in accordance with ADB's policies and procedures.

20. In case an external auditor needs to be commissioned for a supplementary audit, the auditor should be given access to all legal documents, correspondences, and any other information associated with the commission and deemed necessary by the auditor. Confirmation should also be obtained of amounts disbursed and outstanding with ADB and the Government etc.

G. Public Disclosure

21. Public disclosure of APFS, including the auditor's opinion on the project financial statements, will be guided by ADB's Access to Information Policy 2018.[44] After the review, ADB will disclose APFS and the opinion of the auditors on the project financial statements no later than 14 days of ADB's confirmation of their acceptability by posting them on ADB's website. The management letter, additional auditor's opinions, and audited entity financial statements will not be disclosed.

[44] ADB. Access to Information Policy: https://www.adb.org/documents/access-information-policy

Attachment 3: Indicative Format of Quarterly Progress Report

General Instructions

The quarterly progress reports (QPRs) should follow the format outlined below and are to be submitted to ADB within 45 days after each quarter. In case of delays or incomplete information, ADB will submit a reminder to the EA/IA. Repeated delays or incomplete information may have a negative impact on the project performance ratings and may be discussed during review missions and TPRMs.

Section A. Introduction and Basic Data

i. ADB loan/GoN grant number, project title, borrower, executing agency, implementing agency(ies)
ii. total estimated project cost and financing plan;
iii. status of project financing including availability of counterpart funds;
iv. dates of approval, signing, and effectiveness of ADB loan/ GoN grant;
v. original and revised (if applicable) ADB loan and GoN grant losing date and elapsed loan period based on original and revised (if applicable) loan closing dates; and
vi. date of last ADB review mission.

Section B. Utilization of Funds (ADB Loan, GoN grant and Counterpart Funds)

i. Cumulative contract awards financed by the ADB loan, GoN grant and counterpart funds (commitment of funds to date), and comparison with time-bound projections (targets targets – for ADB financing compare the actual contract awards with the contract award curve included in the PAM). Include an analysis of significant variances between planned and actual contract awards.
ii. Cumulative disbursements from the ADB loan, GoN grant and counterpart funds (expenditure to date), and comparison with time-bound projections (targets – for the ADB financing compare the actual disbursement with the disbursement projections as per the S curve included in the PAM), Include an analysis of significant variances between planned and actual disbursements.
iii. Re-estimated costs to completion, need for reallocation within ADB loan categories, and whether an overall project cost overrun is likely.
iv. Reconciliation of project records and ADB disbursement records (LFIS/GFIS) for the reporting period and cumulative from project inception to end of the reporting period. Explain reasons for discrepancies and outline follow-up actions required (if any). Attach a detailed reconciliation by WA as per Appendix 3.

Section C. Project Purpose

i. status of project scope/implementation arrangements compared with those in the Report and Recommendation of the President (RRP), and whether major changes have occurred or will need to be made;
ii. an assessment of the likelihood that the immediate development objectives (project purpose) will be met in part or in full, and whether remedial measures are required based on the current project scope and implementation arrangements; and
iii. an assessment of changes to the key assumptions and risks that affect attainment of the development objectives.

Section D. Implementation Progress

i. provide a brief summary assessment of progress or achievements in implementation since the last progress report;
ii. assessment of the progress of each project component, such as (a) recruitment of consultants and their performance,(b) procurement of goods and works (from preparation of detailed design and bidding documents to contract awards); and (c) the performance of suppliers, manufacturers, and contractors for goods and works contracts;
iii. assessment of progress in implementing the overall project to date in comparison with the original implementation schedule—quantifiable and monitorable target, (include simple charts such as bar or milestone to illustrate progress, a chart showing actual versus planned expenditure, S-curve graph showing the relationship between physical and financial performance, and actual progress in comparison with the original schedules. Include an analysis of significant variances between physical and financial progress; and,
iv. an assessment of outcome/output achievements versus targets – based on project performance monitoring system (PPMS) developed from design and monitoring framework of the project.

Section E. Major Project Issues and Problems

Summarize the major problems and issues affecting or likely to affect implementation progress, compliance with covenants, and achievement of immediate development objectives. Recommend actions to overcome these problems and issues (e.g., changes in scope, changes in implementation arrangements, and reallocation of loan proceeds).

Section F. Compliance with Safeguards and Covenants

i. review the borrower's compliance with policy loan covenants, and, where relevant, provide any reasons for any noncompliance or delay in compliance;
ii. provide a summary assessment of compliance with resettlement and environmental safeguards; and,
iii. Summarize the status of financial covenants (if any) as outlined in the loan and project agreement. If any financial ratios required as part of the financial covenants, then these should be calculated and disclosed using the latest entity level financial statements or reports that are available. Also outline any actions being undertaken as part of ensuring the specified financial ratios are achieved/maintained.

Section G. Financial Management

i. Summarize the status of Financial management in the project including: a) any problems in the existing FM arrangements and /or flow of funds and b) any significant changes occurred during the reporting period (e.g. FM staff turnover, implementation of new financial systems, emerging FM related risks etc.);
ii. Summarize the status of: a) the FM action plan outlined in the PAM, b) recommendations and actions raised by ADB as part of the APFS/AEFS review (if any) and c) FM related recommendations agreed during ADB review missions (if any); and
iii. Summarize the status of Status of past audit observations (resolved/ pending)

Appendixes

Attach the following appendixes to the QPR when submitting it to ADB:

1. Summary Loan Covenant Review

2. Summary Gender Action Plan Progress (separate format available)
3. Statement of Cash Receipts and Payments by Category
4. Detailed reconciliation (by Withdrawal application) of project records and ADB disbursement records (LFIS/GILFIS) for the fiscal year to date and cumulative;
5. List of signed contracts
6. Status of past audit observations (resolved/ pending);
7. Status of FM action plan (complied/ongoing)
8. Status of FM related actions agreed during ADB review missions (if any).

QPR APPENDIXES

Appendix 3: Statement of Cash Receipts and Payments by Category

	Reporting Period (Quarterly/Semi-annually)	Year to date	Cumulative	Hard commitments (contracts signed not paid)
	In the currency of the financial statements			
Cash receipts				
ADB loan Advance/Replenishments	**Q**	**Q***	**Q^**	
ADB loan Direct Payments	**P**	**P***	**P^**	
ADB loan Reimbursement/Retroactive Financing	**U**	**U***	**U^**	
Government	**S**	**S***	**S^**	
GoN Direct Payments	**..**	**..**	**..**	
GoN Advance/Replenishments	**..**	**..**	**..**	
Etc.	**..**	**..**		
Total	**T=Q+P+S+U**	**T*=Q*+P*+S*+U***	**T^=Q^+P^+S^+U^**	
Payments*				
Civil works	A	A*	A^	A**
Consultancy services	B	B*	B^	B**
Project administration	C	C*	C^	C**
Maintenance	D	D*	D^	D**
Total expenditures	**E=A+B+C+D**	**E*=A*+B*+C*+D***	**E^=A^+B^+C^+D^**	**E**=A**+B**+C**+D****
Opening cash balance	**H**	**H***	**H^**	
Closing cash balance	K=H+T-E	K*=H*+T*-E*	K^=H^+T^-E^	

*expenditure categories as outlined in the PAM.

Appendix 4. Detailed Reconciliation (by Withdrawal Application) of Project Records and ADB Disbursement Records (LFIS/GILFIS)
for the Fiscal Year to Date and Cumulative (ADB loan/GoN Grant_

WA Details			**Per project records/APFS (Amount recorded in the project Financial statements as reimbursement, direct payment, etc..)**				**Per ABD disbursement records LFIS/GFIS (actual Paid)**			
Withdrawal application No (WA)	**Disbursement method (reimbursement, direct payment, etc..)**	**Time period covered in the WA**	**Date**	**In local currency (as recorded in project records/ financial statements)**	**exchange rate**	**USD equivalent (A)**	**Value date**	**In USD (B)**	**Difference (A-B)**	**Reason for difference (i.e. timing forex. Pending rejected)**
1 2 3 etc..		1-31.3.2020								
Total										

Appendix 5: List of Signed Contracts

Contract Information										
Description*	**Contract Description**	**Contract Start**	**Contract End**	**Supplier/Contractor Name**	**Contract No.**	**Total Contract Value**	**Total Contract Amount Invoiced to date**	**Total Disbursed on Contract**	**Total Undisbursed Amount**	**Financing source (e.g. ADB loan/ GoN grant)**
1. Civil works										
2: Equipment/ supplies										
3. Consulting services										
Total										

*Classified a per expenditure categories outlined in the PAM.

Appendix 6: Status of External Audit Observations – Cumulative from Inception to End of Reporting Period

Recommendation/ Audit Observation	**External Audit Recommendation**	**Date of the Recommendation**	**Planned Actions to Address the Recommendation**	**Responsibility**	**Current Status of the Planned Action (pending /resolved)**	**Remarks**

Appendix 7: Status of Financial Management Action Plan

Key Risk	Risk Mitigating Activity	Timeline	Responsible Entity	Current status (implemented/Pending)	Remarks (including an action plan in case of noncompliance)

Appendix 8: Status of FM related actions agreed during ADB review missions

Date of the review mission	Agreed actions	Timeline	Responsible Entity	Current status (implemented/Pending)	Remarks

Attachment 4: Procurement Plan

PROCUREMENT PLAN

Basic Data

Project Name: Flood and Riverbank Erosion Risk Management Investment Program - Tranche 2		
Project Number: 44167-015	**Approval Number:**	
Country: Bangladesh	**Executing Agency**: Bangladesh Water Development Board	
Project Procurement Risk: Medium	**Implementing Agency**: Department of Disaster Management	
Project Financing Amount: US$ 212,500,000 **ADB Financing:** US$ 157,000,000 **Cofinancing (ADB Administered):** $17,890,000 **Non-ADB Financing:** US$ 37,610,000	**Project Closing Date:** 26 June 2024	
Date of First Procurement Plan: 29 March 2021	**Date of this Procurement Plan**: 29 March 2021	
Procurement Plan Duration (in months): 18	**Advance Contracting:** No	**e-GP:** Yes [https://www.eprocure.gov.bd/

A. Methods, Review and Procurement Plan

Except as the Asian Development Bank (ADB) may otherwise agree, the following methods shall apply to procurement of goods, works, and consulting services.

Procurement of Goods and Works	
Method	**Comments**
Open Competitive Bidding (OCB) for Goods	International advertising for goods > $1,000,000. To be prior reviewed by ADB. National advertising for goods < $1,000,000. The first OCB is subject to prior review, thereafter post review.
Request For Quotation for Goods	Below $100,000.
Open Competitive Bidding (OCB) for Works	International advertisement for works > $15,000,000. To be prior reviewed by ADB. National advertisement for works < $15,000,000. The first NCB is subject to prior review, thereafter post review.
Request For Quotation for Works	

Consulting Services	
Method	**Comments**
Quality- and Cost-Based Selection for Consulting Firm	For larger NGOs and Consultancy contracts
Quality-Based Selection for Consulting Firm	
Consultant's Qualification Selection for Consulting Firm	For small-size consulting / NGO services
Direct Contracting for Consulting Firm	
Competitive for Individual Consultant	

B. Lists of Active Procurement Packages (Contracts)

The following table lists goods, works, non-consulting and consulting services contracts for which the procurement activity is either ongoing or expected to

commence within the procurement plan duration.

Goods and Works							
Package Number	**General Description**	**Estimated Value (in US$)**	**Procurement Method**	**Review**	**Bidding Procedure**	**Advertisement Date** (quarter/year)	**Comments**
G-01	Geotextile bag supply for Upstream of Chauhali (15.50 km)	21,161,460.00	OCB	Prior	1S1E	Q2 / 2021	Non-Consulting Services: No Advertising: International No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference Applicable: Yes Bidding Document: Goods High Risk Contract: Yes e-GP: No Covid-19 Response? No
G-02	Geotextile bag supply for Enayetpur (7 Km) & Benotia (3.50 Km)	12,399,285.00	OCB	Prior	1S1E	Q2 / 2021	Non-Consulting Services: No Advertising: International No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference Applicable: Yes Bidding Document: Goods High Risk Contract: Yes e-GP: No Covid-19 Response? No
G-03	Geotextile bag supply for Harirampur extension (4 Km)	6,318,037.00	OCB	Prior	1S1E	Q2 / 2021	Non-Consulting Services: No Advertising: International No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference Applicable: Yes Bidding Document: Goods High Risk Contract: No e-GP: No Covid-19 Response? No
G-04	Geotextile bag supply for Adaptation Works of completed works under JMREMP & FRERMIP Tranche-1 Project	8,286,572.00	OCB	Prior	1S1E	Q2 / 2021	Non-Consulting Services: No Advertising: International No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference Applicable: Yes Bidding Document: Goods High Risk Contract: No e-GP: No Covid-19 Response? No

G-05	Geotextile bag supply for Adaptation Works of FRERMIP Project- 2	5,889,998.00	OCB	Prior	1S1E	Q4 / 2021	Non-Consulting Services: No Advertising: International No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference Applicable: Yes Bidding Document: Goods High Risk Contract: No e-GP: No Covid-19 Response? No
G-06	Vehicles including 4 nos. pick up & 4 nos. Jeep vehicles	556,542.00	OCB	Post (Sampling)	1S1E	Q3 / 2021	Non-Consulting Services: No Advertising: National No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference Applicable: No Bidding Document: Goods High Risk Contract: No e-GP: Yes e-GP Type: e-Bidding Covid-19 Response? No
G-07	Office Equipment	111,308.00	OCB	Post (Sampling)	1S1E	Q3 / 2021	Non-Consulting Services: No Advertising: National No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference Applicable: No Bidding Document: Goods High Risk Contract: No e-GP: Yes e-GP Type: e-Bidding Covid-19 Response? No
G-08	Survey Equipment	222,617.00	OCB	Post (Sampling)	1S1E	Q3 / 2021	Non-Consulting Services: No Advertising: National No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference Applicable: No Bidding Document: Goods High Risk Contract: No e-GP: Yes e-GP Type: e-Bidding Covid-19 Response? No
G-09	Office Equipment for DDM	18,811.00	RFQ	Post (Sampling)		Q3 / 2021	Non-Consulting Services: No No. Of Contracts: 1 High Risk Contract: No e-GP: Yes e-GP Type: e-Bidding Covid-19 Response? No
W-01	Benotia underwater	2,223,400.00	OCB	Post (Sampling	1S1E	Q2 / 2021	Non-Consulting Services: No

	riverbank protection with geotextile bags (3.50 km)			)			Advertising: National No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference Applicable: No Bidding Document: Small Works High Risk Contract: No e-GP: Yes e-GP Type: e-Bidding Covid-19 Response? No
W-02	Enayetpur underwater riverbank protection with geotextile bags (7 km)	4,268,054.00	OCB	Post (Sampling)	1S1E	Q3 / 2021	Non-Consulting Services: No Advertising: National No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference Applicable: No Bidding Document: Small Works High Risk Contract: No e-GP: Yes e-GP Type: e-Bidding Covid-19 Response? No
W-03	Upstream Chauhali underwater riverbank protection with geotextile bags (7.5 km)	4,705,905.00	OCB	Prior	1S1E	Q2 / 2021	Non-Consulting Services: No Advertising: National No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference Applicable: No Bidding Document: Small Works High Risk Contract: No e-GP: Yes e-GP Type: e-Bidding Covid-19 Response? No
W-04	Upstream Chauhali underwater riverbank protection with geotextile bags (8 km) including 1 km of dredging on the underwater slope	8,339,419.00	OCB	Prior	1S2E	Q3 / 2021	Non-Consulting Services: No Advertising: National No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference Applicable: No Bidding Document: Small Works High Risk Contract: No e-GP: Yes e-GP Type: e-Bidding Covid-19 Response? No
W-05	Underwater Riverbank protection with geotextile bags at Harirampur Extension (4 km)	3,666,117.00	OCB	Post (Sampling)	1S1E	Q3 / 2021	Non-Consulting Services: No Advertising: National No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference Applicable: No Bidding Document: Small Works High Risk Contract: No e-GP: Yes

							e-GP Type: e-Bidding Covid-19 Response? No
W-06	Adaptation works for riverbank protection with geotextile bags of completed works under JMREMP and FRERMIP Tranche-1 Project	6,002,058.00	OCB	Post (Sampling)	1S1E	Q2 / 2021	Non-Consulting Services: No Advertising: National No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference Applicable: No Bidding Document: Small Works High Risk Contract: No e-GP: Yes e-GP Type: e-Bidding Covid-19 Response? No
W-07	Adaptation Works for riverbank protection with geotextile bags of FRERMIP Project-2	4,128,172.00	OCB	Post (Sampling)	1S1E	Q4 / 2021	Non-Consulting Services: No Advertising: National No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference Applicable: No Bidding Document: Small Works High Risk Contract: No e-GP: Yes e-GP Type: e-Bidding Covid-19 Response? No
W-08	Jamuna River dredging and Salimabad channel choking	14,043,827.00	OCB	Prior	1S1E	Q4 / 2021	Non-Consulting Services: No Advertising: National No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference Applicable: No Bidding Document: Small Works High Risk Contract: No e-GP: Yes e-GP Type: e-Bidding Covid-19 Response? No
W-09	Emergency Works	3,642,223.00	OCB	Post (Sampling)	1S1E	Q3 / 2021	Non-Consulting Services: No Advertising: National No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference Applicable: No Bidding Document: Small Works High Risk Contract: No e-GP: Yes e-GP Type: e-Bidding Covid-19 Response? No
W-10	Shahjadpur Embankment Construction from chainage 21.300 to 29.200 (7.9 km)	6,111,799.00	OCB	Post (Sampling)	1S1E	Q3 / 2021	Non-Consulting Services: No Advertising: National No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference

							Applicable: No Bidding Document: Small Works High Risk Contract: No e-GP: Yes e-GP Type: e-Bidding Covid-19 Response? No
W-11	Maintenance of Embankment Constructed under FRERMIP Tranche-1	885,242.00	OCB	Post (Sampling)	1S1E	Q3 / 2021	Non-Consulting Services: No Advertising: National No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference Applicable: No Bidding Document: Small Works High Risk Contract: No e-GP: Yes e-GP Type: e-Bidding Covid-19 Response? No
W-12	Benotia riverbank temporary wave protection (3.50 km)	1,664,865.00	OCB	Post (Sampling)	1S1E	Q2 / 2022	Non-Consulting Services: No Advertising: National No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference Applicable: No Bidding Document: Small Works High Risk Contract: No e-GP: Yes e-GP Type: e-Bidding Covid-19 Response? No
W-13	Enayetpur riverbank temporary wave protection (7 km)	1,513,583.00	OCB	Post (Sampling)	1S1E	Q2 / 2022	Non-Consulting Services: No Advertising: National No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference Applicable: No Bidding Document: Small Works High Risk Contract: No e-GP: Yes e-GP Type: e-Bidding Covid-19 Response? No
W-14	Upstream Chauhali temporary wave protection (15.5 km)	1,503,618.00	OCB	Prior	1S1E	Q2 / 2022	Non-Consulting Services: No Advertising: National No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference Applicable: No Bidding Document: Small Works High Risk Contract: No e-GP: Yes e-GP Type: e-Bidding Covid-19 Response? No
W-15	Harirampur temporary wave	893,047.00	OCB	Prior	1S1E	Q2 / 2022	Non-Consulting Services: No

	protection (4 km)						Advertising: National No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference Applicable: No Bidding Document: Large Works High Risk Contract: No e-GP: Yes e-GP Type: e-Bidding Covid-19 Response? No

Consulting Services							
Package Number	**General Description**	**Estimated Value (in US$)**	**Selection Method**	**Review**	**Type of Proposal**	**Advertisement Date** (quarter/year)	**Comments**
C-01	Institutional Strengthening and Project Management	15,055,713.00	DC	Prior	FTP	Q2 / 2021	Non-Consulting Services: No Type: Firm Assignment: International e-GP: No Covid-19 Response? No Comments: ISPMC firm for Tranche-1 will be engaged for Project 2 through the single source selection (SSS) modality as per FFA and decision of the meeting held on 01 February 2021.
C-02	Community-based flood risk management support	2,782,712.00	QCBS	Prior	FTP	Q2 / 2021	Non-Consulting Services: No Type: Firm Assignment: National Quality-Cost Ratio: 90:10 e-GP: No Covid-19 Response? No Comments: NGO; As agreed with the government
C-03	Community capacity development support for participatory O&M	417,724.00	CQS	Prior	BTP	Q3 / 2021	Non-Consulting Services: No Type: Firm Assignment: National e-GP: No Covid-19 Response? No Comments: Firm/NGO; As agreed with the government
C-04	Livelihood development support	664,400.00	CQS	Prior	STP	Q3 / 2021	Non-Consulting Services: No Type: Firm Assignment: National e-GP: No Covid-19 Response? No Comments: Firm (QCBS) / NGO (QBS); As agreed with the government

C-05	River survey (including bathymetric, ADCP and float tracking) and multi beam echosounder survey (4 years)	1,660,466.00	DC	Prior	FTP	Q3 / 2021	Non-Consulting Services: No Type: Firm Assignment: National e-GP: No Covid-19 Response? No Comments: This will be directly contracted with the Institute of Water Modelling
C-06	Management information system development	749,217.00	CQS	Prior	STP	Q4 / 2021	Non-Consulting Services: No Type: Firm Assignment: National e-GP: No Covid-19 Response? No
C-07	Environment management and risk mitigation programs	282,724.00	CQS	Prior	BTP	Q4 / 2021	Non-Consulting Services: No Type: Firm Assignment: National e-GP: No Covid-19 Response? No Comments: NGO; As agreed with the government
C-08	Erosion prediction	424,085.00	DC	Prior	BTP	Q3 / 2021	Non-Consulting Services: No Type: Firm Assignment: National e-GP: No Covid-19 Response? No Comments: Center for Environmental and Geographic Information System (CEGIS) will be engaged for the riverbank erosion prediction study
C-09	Geotechnical investigation	130,596.00	DC	Prior	BTP	Q3 / 2021	Non-Consulting Services: No Type: Firm Assignment: National e-GP: No Covid-19 Response? No Comments: This will be directly contracted with the BUET
C-10	Resettlement solutions through NGO	494,766.00	CQS	Prior	BTP	Q3 / 2021	Non-Consulting Services: No Type: Firm Assignment: National e-GP: No Covid-19 Response? No
C-11	Model study for Salimabad channel closure	452,358.00	DC	Prior	BTP	Q3 / 2021	Non-Consulting Services: No Type: Firm Assignment: National e-GP: No Covid-19 Response? No Comments: This will be directly contracted with the Institute of Water Modelling

C-12	Offtake physical modelling	586,651.00	DC	Prior	BTP	Q3 / 2021	Non-Consulting Services: No Type: Firm Assignment: National e-GP: No Covid-19 Response? No Comments: This will be directly contracted with the River Research Institute
C-13	Topographic Survey	163,273.00	CQS	Prior	BTP	Q4 / 2021	Non-Consulting Services: No Type: Firm Assignment: National e-GP: No Covid-19 Response? No Comments: As agreed with the government
C-14	Monitoring of pilot works (grout mattresses installed in Tranche 1)	275,655.00	CQS	Prior	BTP	Q4 / 2021	Non-Consulting Services: No Type: Firm Assignment: National e-GP: No Covid-19 Response? No Comments: As agreed with the government
C-15	Environment/ biodiversity and social baseline impact monitoring and fisheries study	899,061.00	CQS	Prior	STP	Q4 / 2021	Non-Consulting Services: No Type: Firm Assignment: National e-GP: No Covid-19 Response? No
C-16	Socio-economic study of the char people	599,374.00	CQS	Prior	BTP	Q4 / 2021	Non-Consulting Services: No Type: Firm Assignment: National e-GP: No Covid-19 Response? No
C-17	External monitoring of social safeguards	120,157.00	Competitive	Prior		Q3 / 2021	Non-Consulting Services: No Type: Individual Assignment: National Expertise: Resettlement e-GP: No Covid-19 Response? No
C-18	External monitoring of Environmental safeguards	120,157.00	Competitive	Prior		Q3 / 2021	Non-Consulting Services: No Type: Individual Assignment: National Expertise: Environment e-GP: No Covid-19 Response? No

C-19	External monitoring of procurement activities	120,157.00	Competitive	Prior		Q3 / 2021	Non-Consulting Services: No Type: Individual Assignment: National Expertise: Procurement e-GP: No Covid-19 Response? No Comments: As agreed with the government
C-20	External monitoring of Financial Management	111,308.00	Competitive	Prior		Q3 / 2021	Non-Consulting Services: No Type: Individual Assignment: International Expertise: Financial Management e-GP: No Covid-19 Response? No
C-21	Procurement Specialist	77,916.00	Competitive	Prior		Q3 / 2021	Non-Consulting Services: No Type: Individual Assignment: National Expertise: Procurement e-GP: No Covid-19 Response? No
C-22	Resettlement Specialist	66,785.00	Competitive	Prior		Q3 / 2021	Non-Consulting Services: No Type: Individual Assignment: National Expertise: Resettlement e-GP: No Covid-19 Response? No
C-23	Gender Specialist	50,089.00	Competitive	Prior		Q3 / 2021	Non-Consulting Services: No Type: Individual Assignment: National Expertise: Gender e-GP: No Covid-19 Response? No
C-24	Environmental Specialist	50,089.00	Competitive	Prior		Q3 / 2021	Non-Consulting Services: No Type: Individual Assignment: National Expertise: Environment e-GP: No Covid-19 Response? No

C. List of Indicative Packages (Contracts) Required Under the Project

The following table lists goods, works, non-consulting and consulting services contracts for which procurement activity is expected to commence beyond the procurement plan duration and over the life of the project (i.e., those expected beyond the current procurement plan duration).

Goods and Works						
Package Number	**General Description**	**Estimated Value (in US$)**	**Procurement Method**	**Review**	**Bidding Procedure**	**Comments**

W-16	Construction of O&M sheds for Koijuri embankment (7 sheds)	125,730.00	OCB	Post (Sampling)	1S1E	Non-Consulting Services: No Advertising Type: National No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference Applicable: No Bidding Document: Small Works e-GP: Yes Covid-19 Response? No
W-17	Offtake structure- Ghior Khal	9,058,675.00	OCB	Prior	1S1E	Non-Consulting Services: No Advertising Type: National No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference Applicable: No Bidding Document: Small Works e-GP: Yes Covid-19 Response? No
W-18	Fish Sanctuaries	1,745,626.00	OCB	Prior	1S1E	Non-Consulting Services: No Advertising Type: National No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference Applicable: No Bidding Document: Small Works e-GP: Yes Covid-19 Response? No

Consulting Services						
Package Number	**General Description**	**Estimated Value (in US$)**	**Selection Method**	**Review**	**Type of Proposal**	**Comments**
None						

Attachment 5: Consultants' Terms of Reference

Terms of Reference

Institutional Strengthening and Project Management Consulting Services (ISPMC) for Flood and Riverbank Erosion Risk Management Investment Program – Project 2

A. Project Background

1. The livelihoods of people in Bangladesh are affected by water-related disasters including floods, riverbank erosion, droughts, cyclones, and tidal surges, some being directly related to the location of the country on a vast flat floodplain at the confluence of a few of the world largest rivers—the Jamuna, the Ganges, and the Meghna. Climate change impacts exacerbate these disasters.

2. Riverbank erosion is one of the most prominent causes of disasters in Bangladesh due to its highly dynamic river morphology. In the last 40 years, over 80,000 hectares (ha) of agricultural land were lost in the immediate vicinity of the main rivers due to erosion along both riverbanks. This process disproportionately affects the poor, who face significant social hardships, such as loss of homesteads, lands, and crops, and are often displaced to fringe lands or urban slums. Disaster risks increase as the population grows, and the high population density of the country restricts the scope for moving people away from disaster-prone areas.

3. Erosion damage also extends to public infrastructure, including roads and flood embankments, and the high incidence of riverbank erosions hinders construction and rehabilitation of flood embankments. About 20% of the country is inundated on average annually during the monsoon season, resulting in damages and loss of assets and crops. The threat of recurrent floods and riverbank erosion also discourages investment and leads to lower economic growth in the riparian areas. Effective flood and riverbank erosion risk management is therefore essential for economic growth, livelihood improvement, and poverty reduction in these locations. With a growing population as well as the expansion of settlements within the floodplain, future development will need to be carefully managed to protect the population from natural disasters. In addition, the existing system of embankments cannot be relied upon for protection from floods and can often lead to disaster when the embankments breach or overtop during severe flood events. Furthermore, the growing population will demand more reliable protection from riverbank erosion and flooding to safeguard their increasing assets and to sustain economic development.

4. Securing the livelihoods of the floodplain population therefore needs to be addressed through public sector interventions aimed at: (i) mitigating the economic losses and social displacement caused by riverbank erosion, (ii) reducing the economic losses resulting from flooding, and (iii) providing a secure environment to facilitate an increase in agricultural and industrial production and to enhance related economic activities.

5. The multitranche financing facility (MFF) to the People's Republic of Bangladesh for the Flood and Riverbank Erosion Risk Management Investment Program was approved by the Asian Development Bank (ADB) in 2014. The facility increases the reliability and effectiveness of flood and riverbank erosion risk management systems in priority reaches along the Jamuna, Padma and Ganges rivers through structural and nonstructural interventions, policy strengthening, and institutional and knowledge bases.

6. The investment program is a follow-on to the Jamuna–Meghna River Erosion Mitigation Project. It has extended successful technologies of the Jamuna–Meghna project to other geographical areas, with technological improvements. The framework financing agreement (FFA) for the MFF was signed between ADB and Bangladesh in May 2014. In June 2014, the ADB Board approved the provision of loans under an MFF of up to $255 million equivalent with an availability period until June 2023. The investment program implements three subprojects (Jamuna right bank-1 [JRB-1], Jamuna left bank-2 [JLB-2], and Padma left bank-1 [PLB-1]) comprising flood embankments protecting critical riparian productive areas in central Bangladesh and capacity building initiatives.[45] The investment program has the following individual tranche outputs contributing to the facility's outputs: (i) flood and riverbank erosion risk mitigation functioning at priority river reaches, (ii) a strengthened institutional system for flood and riverbank erosion risk management (FRERM), and (iii) an operational program management system.

7. The investment program's executing agency is the Bangladesh Water Development Board (BWDB) under the Ministry of Water Resources. The Department of Disaster Management (DDM) under the Ministry of Disaster Management and Relief is the implementing agency for community-based flood risk management activities.

8. The tranche 1 project (Project 1) was approved for an ADB loan of $65.0 million and a grant of $15.3 million from the Government of the Netherlands (GoN) in July 2014, and became effective in September 2014. Physical activities under Project 1 have been completed since June 2020.

9. Project 1 significantly contributed to progressing the road map supported by the investment program by: (i) preparing a river stabilization approach approved by BWDB aligned with the adaptive delta management approach of the Bangladesh Delta Plan 2100;[46] (ii) assisting in setting up a river management specialized office in BWDB; (iii) supporting DDM with implementing community-based flood risk management activities; (iv) piloting new technologies and construction principles; and (v) expanding the knowledge base with systematic data collection and development of information and asset management systems.

10. Project 1 used innovative and cost-effective approaches for riverbank erosion management and progressive knowledge development. Project 1 financed: (i) 18 km of riverbank erosion protection, and construction or renovation of 21 km of embankments; (ii) community-based flood risk management activities in 40 villages; and (iii) a pilot of new wave protection technology with jute along 4 km of embankment and riverbank slopes.

11. GoN has been supporting the government in the water sector for the last five decades, and most recently in supporting GoB to formulate and create enabling environment including the necessary institutional arrangement to implement the Bangladesh Delta Plan 2100. GoN's expertise in dealing successfully with water management in low-lying deltaic countries such as Bangladesh, in particular flood and erosion management risks, is highly recognized worldwide. Under Project 1, the GoN grant of $15.3 million, fully administered by ADB, contributed to finance consultant services and civil works, in particular: (i) preparing the river stabilization plan and its strategic environmental and social assessment; (ii) developing knowledge-based through pilot works, such as grout-filled jute mattresses as a technology maximizing Bangladesh resources for

[45] Built in 1950–1960, the flood embankments in these areas are in the most critical reaches of the river system, and at risk of being breached by river erosion and overtopped during extreme flood events.

[46] Government of Bangladesh, Planning Commission. 2018. *The Bangladesh Delta Plan 2100*. Dhaka.

wave protection on embankment slopes; and (iii) introducing a new construction technology for flood embankments by using river sand, which not only reduces the environmental footprint of embankment construction, but also decreases construction time. Also, GoN provided support to BWDB on institutional aspects.

12. The tranche 2 project (Project 2) builds upon the achievements of Project 1 and its total cost estimate is about $212 million. Project 2 will apply the same technologies and methodologies as developed during Project 1, except for minor improvements that consider the actual site conditions, such as latest erosion and river morphology, and lessons learned from Project 1. Project 2 is aligned with the following impact: livelihood in the project area improved. Project 2 will have the following outcome: flood and riverbank erosion risks in the subproject areas reduced. Project 2 will have the following three outputs:

13. **Output 1: Flood and riverbank erosion risk mitigation functioning at priority reaches improved.** Project 2 combines structural and nonstructural measures in the three subproject areas to stabilize further the Lower Jamuna river by applying the integrated river stabilization approach developed under Project 1. Specifically, a major eroding channel near the Chauhali channel will be reduced in size through pilot works comprising an innovative combination of dredging and bio-engineering to reduce the riverbank erosion risk along around 15 km of riverbanks, providing an offtake into a distributary, and facilitating the future development of some 6,000 ha of floodplain land from reclaimed char land. [47] The structural measures will include: (i) 30 km of riverbank protection with innovative technologies combined with nature-based solutions for channel closure; (ii) 40 km of riverbank protection adaptation works and 6 km of emergency works; (iii) 7.9 km of climate-resilient flood embankment; (iv) an offtake; and (v) two regulators. Subject to review of project performance at mid-term and as a lesson learned from Project 1, monitoring, adaptive maintenance, and emergency works for 5 years after construction may be included to cope with the highly dynamic morphological processes of the river system. The nonstructural measures will continue the approach used under Project 1 and cover community involvement and community-based flood risk management activities such as (i) establishing at least 160 community disaster management units and developing their capacity; (ii) training 40 disaster units created under Project 1 to enhance sustainability; (iii) raising awareness on FRERM; and (iv) strengthening disaster preparedness and emergency response with a focus on women participation.

14. **Output 2: Institutional system for flood and riverbank erosion risk management strengthened.** Project 2 will continue to strengthen the knowledge base and institutional capacity of BWDB and DDM in sustainable asset and strategic managements of the rivers. Activities will include: (i) supporting the office of the Chief Engineer River Management, BWDB; (ii) carrying out regular and systematic river surveys, including piloting drone flight surveys for O&M needs; (iii) incorporating knowledge base products, such as the river stabilization plan and site information on BWDB's website; and (iv) updating the river stabilization guidelines. Project 2 activities will also include trainings, publications, and study tours (to the delta works in the Netherlands and/or an international conference on scour and erosion, for example) in addition to training/support on Strategic Environmental and Social Assessment (SESA) and Environmental Impact Assessment (EIA) processes.

[47] During the systematic widening of the main rivers over the last five decades valuable floodplain land turned into low lying, sandy char land. With the reduction in widening, accretion takes place in the river corridor, enabling selected chars to re-convert into floodplain land with high value to the economy of Bangladesh as additional cultivable areas.

15. **Output 3: Program management systems operational.** This output ensures the outputs of Project 2 will be timely delivered within budget. Further to the achievements of Project 1, it will reinforce BWDB's management system to ensure (i) the project management office (PMO) and the three subproject management offices (SMOs) are supported by a management information system, quality control systems, accountability measures, and efficient monitoring tools; and (ii) the PMO and SMOs take more ownership of newly introduced concepts and work methods, including participatory process. Support will also be provided for BWDB to produce a feasibility study for the adaptive stabilization of the Jamuna–Ganges confluence area and to prepare fully all necessary GoB and ADB processing documents for a possible follow-on project.

16. For Project 2, it is intended for GoN to provide additional grant cofinancing to the investment program that is equivalent to $17.89 million to be fully administered by ADB.[48] The grant will finance consulting services and pilot works, in particular (i) developing further the knowledge-based of this highly complex river system, including sediment and water discharge measurements and modelling, deriving rating curves, and integrating flood embankments construction innovations into the BWDB river management guidelines with links to upper Jamuna and coastal protection; (ii) supporting studies related to the closure of the Solimabad channel, 'building with nature' technologies, and improving the knowledge about the underwater performance of sand-filled geotextile bags involving physical hydraulic model studies; (iii) supporting the institutional strengthening of BWDB, such as providing support to the office of the Chief Engineer River Management, supervision of SESA trajectories and to develop further asset management and operation and maintenance management information system; (iv) provide supervision advice of the works including piloting new technologies; and (vi) preparation of a potential follow-on project.

B. Objective of the Assignment

17. The consulting services of the institutional strengthening and project management consultant (ISPMC) firm will support the BWDB and DDM to deliver the intended project goals. A consulting team led by an international firm and comprising international and national experts will be engaged in accordance with ADB's Procurement Regulations for ADB Borrowers: Goods, Works, Nonconsulting and Consulting Services (2017, as amended from time to time).

C. Scope of the Services

18. The ISPMC will provide BWDB and DDM with institutional strengthening and project management support through four main themes:

(i) institutional support to strengthen river stabilization along the main rivers in Bangladesh, including, but not limited to, the timely progress and completion of all activities of the sector policy and institutional agenda stated in the FFA, and timely delivery of a facility completion report;

(ii) timely implementation in constant compliance with the Project 2 loan covenants of all structural and nonstructural works under Project 2, including, but not limited to, advice on construction and safeguards, preparation of remaining work packages[49], support to community-based flood risk management measures including O&M activities;

[48] The cofinancing is expected. Letter of intent was received by ADB from GoN end of March 2021.

[49] (i) Solimabad channel choking and offtake structure package depends on preparatory studies; (ii) the upper wave protection requires work packages to be prepared after the bankline is stabilized, its geotechnical characteristics confirmed and land acquisition completed.

(iii) developing and expanding the knowledge base on river stabilization, including but not limited to data collection, management information systems, asset management information systems, and O&M aspects; and

(iv) full preparation, including all necessary GoB and ADB processing and readiness documents, of a bankable follow-on project[50] for the stabilization of the Lower Jamuna and the Jamuna – Ganges confluence area, aligned to the Bangladesh Delta Plan 2100, and with emphasis and linkages with upper and lower river segments in coordination with other donors involved in the sector in the country.[51]

19. The main tasks of the consulting services of ISPMC will include, but will not be limited to, the following items[52]:

Task 1: Institutional capacity strengthening of BWDB for flood, erosion and river management. ISPMC will support BWDB for institutional capacity strengthening of the holistic and strategic management of the main rivers especially in the the program area focusing on Jamuna and Padma.

Task 2: Support BWDB to timely supervise physical works of structural measures and other activities. This includes compliance documentation also for innovations and piloting as initiation of performance monitoring.

Task 3: Support BWDB to implement knowledge base activities. The ISPMC will support BWDB in systematic and regular data collection, data quality review, data storage and retrieval, data analysis and applications for the assessment of river developments to be used for (i) adaptation and maintenance of existing assets, (ii) planning innovative river stabilization measures, and (iii) preparing the follow-on project.

Task 4: Support DDM and BWDB to implement community-based flood risk management activities and participatory regular O&M. The ISPMC will support DDM and BWDB to implement the community-based flood risk management activities in continuation of the procedures established under Project 1 and implementing regular community-based O&M activities in coordination with the nongovernment organization(s) (NGO) or/and others to be engaged by the PMO.

Task 5: Support BWDB to develop and prepare a possible follow-on project. ISPMC will support BWDB to prepare the feasibility study and associated reports for a possible bankable follow-on project, including establishing technical feasibility and economic viability, producing all necessary GoB and ADB processing and readiness documents (including all safeguard documents according to ADB's SPS 2009 or any latest version).

D. Detailed Tasks

[50] The follow-on project will (i) utilize and expand river engineering and flood management methods and techniques developed and established successfully under JMREMP and FRERMIP, and (ii) prioritize the inclusion of outstanding components originally included in the scope of this MFF: around 60 km of flood embankment along subprojects JLB-2 and PLB-1 and around 23.5 km of wave protection above low water level along riverbanks.

[51] It is anticipated to establish a working group to enhance the coordination between donors involved in the sector to which ADB will contribute to or lead. ISPMC will facilitate the organization of the meetings of the working group and prepare the summary of the discussions.

[52] All tasks, detailed tasks, activities and deliverables shall include gender aspects as specified in the DMF, PAM and PFRR of Project 2.

20. **Institutional capacity strengthening of BWDB for flood and river management.** The ISPMC will support BWDB's institutional capacity strengthening particularly for flood and river management of the main rivers, especially for strategic river management (as outlined in the river stabilization plan adopted by BWDB in August 2020) and sustainable asset management. Key activities include:

(i) T1.1: support the Project Management Office, the Site Management Offices, and the office of the Chief Engineer River Management, BWDB;
(ii) T1.2: conduct trainings[53] and support planning of study tours;
(iii) T1.3: support timely progress and special reporting including inception, mid-term review and specialized reports on the use of geotextile bags, and
(iv) T1.4: support project management information systems including regular tracking of project progress[54].
(v) T1.5: support BWDB for developing multi-annual (for 5 years) budgetary and construction material stocking plans for quick response to required O&M and emergency works of riverbank protection works, based on morphology study results.

21. **Support BWDB to timely supervise implementation of structural measures and associated activities.** The ISPMC's activities will include supporting BWDB to implement structural measures for the subprojects ensuring timely completion with quality. The structural measures will include construction of riverbank erosion protection structures using cost effective innovative technology which were developed under JMREMP and Project 1, rehabilitation/construction of flood embankments, construction of ancillary structures, and land recovery/river training measures for stimulating natural/induced sediment to deposit along the main river. The ISPMC's services will cover support for overall project implementation activities, such as construction supervision (T2.1), procurement/ recruitment (T2.2), support safeguard compliance (T2.3) including land acquisition and resettlement, monitoring the environment management plan implementation, the implementation of the gender action plan, and other activities to meet all requirements of ADB and the government. Also, the services will cover supervision of the implementation of livelihood supports to the project affected people, and of environment impact mitigation measures, which will be conducted under separate consulting/NGO service packages. The ISPMC will also support the finalization/preparation until their approval by ADB of resettlement plans for Project 2 riverbank erosion protection works, according to the latest alignment of riverbanks, and embankment construction works, as well as all social safeguards documents for the follow-on project.

22. **Support BWDB to implement knowledge-base activities.** The ISPMC will guide and lead the knowledge base activities focusing on a number of innovative technical and non-technical studies and survey campaigns. Key activities include:

[53] Several ISPMC experts will provide training to staff of BWDB and DDM, including on aspects required for the future operations of the office of the Chief Engineer River Management, such as training on project cycle and project planning, asset management and O&M, procurement, contract management, FRERM, GIS, remote sensing, financial management, accounts, etc. Also, assisted by the training coordinator to plan training activities, ISPMC experts will contribute to capacity development activities accordingly to their field(s) of expertise and/or conduct training, such as specific courses under BUET training modules.

[54] MIS activities to be undertaken by ISPMC will include, but will not be limited to: (i) adding a risk-based O&M module to the Scheme Inventory and Mapping System, (ii) developing the Smart Project Monitoring and Management Information System to include planning of the Annual Development Plan. After enhancing the systems, ISPMC will support the BWDB during rollout and adoption. Also, using standard project management planning software (e.g. MS Project, Primavera, etc.), ISPMC will initiate, guide and train the PMO to develop systematic baselines of all main project activities (including also follow-on project readiness and anticipated implementation), and then to track very regularly project implementation progress that will be reviewed during the ADB missions.

(i) T3.1: regular, large-scale river monitoring and forecasting of morphological developments;
(ii) T3.2: monitoring of ongoing pilot activities;
(iii) T3.3: development of asset management systems, including O&M modules with drone surveys for embankment O&M;
(iv) T3.4: update and expansion of existing guidelines for riverbank protection towards guideline for river management and embankments including climate change adaptation strategies and approaches[55];
(v) T3.5: planning of distributary development;
(vi) T3.6: expand river database and expand to social and environmental (baseline and impact assessment) studies;
(vii) T3.7: provide support during the detailed design phase of innovative and pilot works to be implemented under Project 2, including guiding physical hydraulic model test at the River Research Institute (RRI), Faridpur.
(viii) T3.8: update and detail components of the River Stabilization Plan developed under Tranche 1; and
(ix) T3.9: sediment monitoring & impact on River Stabilization Plan.

23. **Support DDM and BWDB to implement community-based flood risk management activities and participatory regular O&M.** The ISPMC will support implementation of the community-based flood management activities which will consist of mobilization of communities for formation of community-level disaster management units and for capacity enhancement of the community units to be implemented by firms or/and NGOs. The ISPMC will support DDM to engage firms or/and NGOs and supervise and monitor the firms' or/and NGOs' activities and progress. The ISPMC will also support effective coordination between DDM and BWDB. The ISPMC will prepare detailed community mobilization and training programs in consultation with DDM. ISPMC will support the nonstructural measures, building on the approach used under Project 1 and cover community involvement and community-based flood risk management activities such as (i) establishing at least 160 community disaster management units and developing their capacity; (ii) training 40 disaster units created under Project 1 to enhance sustainability; (iii) raising awareness on FRERM; and (iv) strengthening disaster preparedness and emergency response with a focus on women participation. Tentatively, the ISPMC will guide and support supervision of the following community involvement activities by firms or/and NGOs:

- assessment of existing condition of local communities, delineation of geographical boundaries of community-level disaster management units;
- community mobilization for formation of community-level disaster management units, including selection of unit leaders, and the preparation of required documents focusing on flood and erosion disasters, such as disaster risk assessment, community flood disaster risk mitigation plans, and provisional plans;
- raise awareness regarding the effects of climate change on natural disasters and the impact of climate change on the population and provide climate resilience training to disaster management units;
- conducting training in capacity development of newly formulated community disaster management units, such as community flood and erosion warning; and
- assisting communities to prepare flood risk maps of their own areas in a participatory manner.

[55] While the guidelines will be prepared by a working group of BUET and BWDB planning and design engineers, the ISPMC will provide strategic background on technical aspects and the adaptive approach.

24. Also, the ISPMC will support BWDB to develop community involvement and community capacity strengthening programs, to engage firms or/and NGOs and to supervise their activities and progress, which may include awareness campaigns for importance and functions of structures, and practical training of regular O&M of flood and erosion management infrastructure. An O&M committee under a community disaster management unit may be a target group. ISPMC will support the implementation of mitigation measures, including: (i) piloting of five years O&M in works contracts; (ii) strengthening further BWDB's maintenance planning and asset management systems to enhance monitoring and risk-based budget requests; and (iii) training and involving beneficiary communities in routine maintenance.

25. **Support BWDB to develop and prepare a possible follow-on project.** ISPMC will conduct the following for a possible follow-on project (list non-exhaustive):

(i) T5.1: morphological analysis and preliminary sites selection: verify and update selection of sites for the deferred works, technology and design, including assessment of potential up- and downstream interlinkages and integration with other planned works (ie: Jamuna corridor and CEIP 1 and 2 to advocate for integrated and well-coordinated approaches, and take into account, as appropriate, lessons learned from those projects into the design).

(ii) T 5.2: feasibility level designs:

5 conduct technical and social field surveys and update data collection: the ISPMC will collect the latest socio-economic, technical (ie: topographic and bathymetric surveys and relevant geotechnical investigations), and any other necessary for the preparation of the follow-on project;

6 assess potential impacts of proposed project activities on environment, gender, social and other aspects accordingly to ADB SPS (2009 or any latest version);

7 examine technical feasibility and economic viability of interventions in the selected subprojects, including updates on deferred works from the MFF; the analysis will include (i) analysis of socio-economic conditions, (ii) cost estimate based on subproject designs, (iii) detailed economic analysis and cost tables to meet ADB's requirements;

8 prepare feasibility level designs, including all appropriate allowances (ie: climate change, seismic, etc): the ISPMC will assist the BWDB to undertake designs for the follow-on project. Designs will include necessary improvements based on findings and lessons learnt from the previous tranche of the investment program;

9 recommend activities for non-structural measures, such as institutional strengthening and community-based flood risk management and disaster preparedness support, and plan all activities with necessary improvements based on findings and lessons learnt from the previous tranches of the investment program;

10 develop implementation schedule, strategic procurement plan, detailed procurement plan, financing schedule, financing plan, design and monitoring framework, implementation arrangements, and all other necessary data, information, documents required for ADB loan and government processing till approval;

11 support BWDB during detailed design of the proposed riverbank protection, climate resilient flood embankments, and other works;

12 support BWDB to prepare for procurement: the ISPMC will support the BWDB to timely undertake advance actions related to procurement and

recruitment, including supporting BWDB to prepare ToRs and bidding documents for the first 18 months of the follow-on project implementation and also to ensure high project readiness is timely achieved ahead of approval by government and ADB.

(iii) T5.3: economic viability and financing sustainability: ISPMC will identify benefit streams, collect field data and establish the economic viability of the proposed interventions in the selected subprojects and in combination, including climate change mitigation measures;

(iv) T5.4: social safeguards: ISPMC will assess potential social impacts of proposed project activities and prepare all relevant documents, including resettlement plans, gender action plan etc. also considering strategic aspects as formulated in the SESA;

(v) T5.5: environmental safeguards: ISPMC will assess potential impacts of proposed project activities on the environment and prepare relevant documents including IEEs or EIAs, also considering strategic aspects as formulated in the SESA;

(vi) T5.6: gender aspects and poverty assessment: the ISPMC will assess gender, and social aspects, including a detailed poverty analysis and formulate mitigation measures and opportunities, and prepare a summary of poverty reduction and social strategy and a gender action plan;

(vii) T5.7: GoB and ADB processing documents: ISPMC will prepare drafts of all required documents following the most recent templates for approvals by the government and ADB and will provide support to their finalization till approval; they include, not limited to, the DPP, Report and Recommendation of the President to the Board of Directors (RRP) and all its required linked documents, including Project Administration Manual, safeguard documents, and all other documents and information, as necessary, to fully satisfy the government's and ADB's requirements for loan processing, project readiness, and approvals.

(vii) T5.7: also, the ISPMC will be responsible for the organization and minutes preparation of all tripartite review workshops to be organized and conducted by the ISPMC at key milestones of the preparation of the follow-on project (inception, interim, draft final report, final report) to present their work to the government, ADB and GoN.

26. For Project 2, it is anticipated that GoN provides a grant cofinancing of $17.89 million. The grant will contribute to finance consulting services and pilot works, in particular:

(i) developing further the knowledge-based of this highly complex river system, including
   a) sediment and water discharge measurements and deriving rating curves, and
   b) integrating design and construction innovations into the BWDB river management guideline with links up- and downstream protection strategies, as well as an embankment guideline. Both will incorporate climate change adaptation strategies and approaches.
   c) updating the approved Strategic Environment and Social Assessment (SESA) with latest findings from field studies

(ii) supporting studies related to innovative work, piloted under Project 2 such as:
   a) the choking of the Solimabad channel (using building with nature type solutions), and
   b) improving the knowledge about sand-filled geotextile bags underwater movements part of the riverbank protection works and its verification through a physical hydraulic model (at the RRI);

(iii) supporting the institutional strengthening of BWDB, such as providing support to

the office of the Chief Engineer River Management and to develop further asset management and operation and maintenance management information systems, in conjunction with projects/investments implemented in up- and downstream river reaches by other donors. This will also include integrated risk management in coordination with DDM to mitigate the residual risk through CbFRM activities;

(iv) consulting services for construction supervision; and

(v) consulting services for the preparation of a follow-on project.

E. Consultant Inputs and Required Qualifications

27. The ISPMC will be led by an international Team Leader who will have the overall responsibility of all the themes, tasks and activities of the ISPMC team, including quality assurance. The knowledge-base activities will be led by a Unit Leader with relevant academic background. The indicative overall composition of the consultant team is in Table 1.

Table 1 – Summary of Consulting Services Requirements (Indicative)

1 - Main Team (implementation and preparation of follow-on project)	**Person-months**
International	
KEY EXPERTS	
1. Team Leader/ River Management Specialist	28
2. Senior River Engineering Advisor	7
3. Construction/ Quality Control Engineer	18
4. Social Development/Resettlement Specialist	10
NON-KEY EXPERTS	
1. Procurement / Contract Management Specialist	10
2. Environment Specialist	6
3. Climate Change Specialist	5
4. Institutional Development Specialist	4
5. Economist	4
6. Design Engineer	6
7. Geotechnical and Seismic Advisor	1
8. River and Geotechnical Engineer	20
9. Dredging Specialist	2
10. Flood Modelling Specialist	1
11. Publisher and Report Designer	3
Sub-Total International Key Experts (A)	**63**
Sub-Total International Non-Key Experts (B)	**62**
Sub-Total International Inputs (A+B)	**125**
National	
KEY EXPERTS	
1. Flood and Erosion Risk Management Specialist/Deputy Team Leader	28
2. Community-based Flood Risk Management Specialist	22
3. Land Acquisition and Resettlement Specialist	10
4. Senior Construction Engineer	26
NON-KEY EXPERTS	
1. Procurement / Contract Management Specialist	10
2. Institutional Capacity Development Specialist	6
3. River and Flood Management Specialist	12

4. Social Development and Gender Specialist	12
5. Environmental Specialist	16
6. River Engineer	14
7. Hydraulic Design Engineer	12
8. Surveyor	12
9. Geotechnical Engineer	6
10. Site Engineer (3 positions)	66
11. Economist	8
12. Community Organizer	28
13. Financial Management Specialist	14
14. Fisheries Specialist	4
Sub-Total National Key Experts (C)	**86**
Sub-Total National Non-Key Experts (D)	**220**
Sub-Total National Inputs (C+D)	**306**
Sub-Total Key Experts for Main Team (A+C)	**149**
Sub-Total Non-Key Experts for Main Team (B+D)	**282**
Sub-Total for Main Team (A+B+C+D)	**431**
2 – Knowledge-base Team	**Person-months**
International	
KEY EXPERTS	
1. River Engineer / Unit Leader of Knowledge-base Team	10
2. River Morphologist	4
3. Senior River Modeller	2
NON-KEY EXPERTS	
1. Database and MIS Specialist	8
2. Sediment Specialist	3
3. Geotechnical Engineer	4
4. River Engineer	18
5. Dredging Specialist	2
6. River Morphology Modeller	11
7. Social Development Specialist	2
Sub-Total International Key Experts (E)	**16**
Sub-Total International Non-Key Experts (F)	**48**
Sub-Total International Inputs (E+F)	**64**
National	
KEY EXPERTS	
1. Senior Morphologist	4
2. Social Development and Gender Specialist	5
NON-KEY EXPERTS	
1. Environment Specialist	12
2. Training Coordinator	6
3. Database and MIS Operator	12
4. Junior Morphologist	10
5. Regional / Spatial Planner	4
Sub-Total National Key Experts (G)	**9**
Sub-Total National Non-Key Experts (H)	**44**
Sub-Total National Inputs (G+H)	**53**
Sub-Total Key Experts for Knowledge base Team (E+G)	**25**

Sub-Total Non-Key Experts for Knowledge base Team (F+H)	**92**
Sub-Total for Knowledge base Team (E+F+G+H)	**117**
Grand Total International Experts (A+B+E+F)	**189**
Grand Total National Experts (C+D+G+H)	**359**

Notes:

(i) Only biodata of key experts will be evaluated as part of the technical proposal. Biodata of all non-key experts will be submitted with the proposal.
(ii) One expert could be proposed for two or more positions with the same or similar designations in the Main and Knowledge base teams if the qualifications and experience of the expert meet the respective requirements.
(iii) Recent health certificate for experts over 70 years old will be included in the proposal.

28. The minimum required qualifications and experience for each expert are outlined in the following tables, as well as their tasks, responsibilities and outputs. In addition, each member of the ISPMC team will provide timely high quality necessary inputs for reports preparation, preparation of all loan documents to meet all the requirements of ADB and of the government, capacity strengthening activities, preparation and supervision of supporting studies in their relevant specialized field(s), and all other tasks as directed by the Team Leader. The Team Leader will supervise and manage the totality of the services of the ISPMC team and have the overall responsibility of all the outputs and deliverables to be produced by the entire ISPMC team.

Table 2 – Minimum Qualifications and Experience Required, Tasks and Responsibilities of International Key Experts of the Main Team

Main Team	
International – Key Experts	
I-1 Team Leader and River Management Specialist	
Minimum qualifications and experience required	- Bachelor's degree in civil engineering, river engineering or water resources engineering, Master's degree is preferred. - Minimum 20 years of relevant professional experience in flood and river erosion mitigation and management and/or water resources management projects (apart from water supply and wastewater projects), including extensive experience on the concept and application of adaptive delta management principles and climate change adaptation aspects, 7 years of leadership of multidisciplinary teams of international and national experts on project implementation and project preparatory of similar nature, and several years at a senior advisory or managerial level. - Broad-based work experience recognized as an expert either in a broad area of specialization or in a limited specialized field relevant to the assignment. - International assignments in similar geographic area and experience of ADB- and/or the World Bank- financed projects for the main rivers of Bangladesh or major rivers with similar nature in South Asia are preferred. - Track record demonstrating capabilities to direct successfully the work of a number of groups or more junior consultants and to perform a high level of quality control on the work outputs. - Track record demonstrating abilities to coordinate and consolidate contributions of specialists of other disciplines to complete a joint project of high quality. - Full-time employment with the lead firm is preferred.

Tasks and responsibilities	- Lead and guide the team and ensure the high quality and timely submission of all deliverables. - Assist BWDB and DDM in coordinating and integrating project components, and support liaisons with national organizations and external financing institutions. - Assist BWDB to develop their capacity for strategic planning of flood and riverbank erosion risk management measures, including data and asset management. - Advise BWDB on technical aspects of flood and riverbank erosion works: planning, design, implementation, adaptation and maintenance, project preparatory activities. - Lead recruitment and supervise subcontractors and supporting firms, NGOs, for studies and surveys and review and approve their outputs, as appropriate. - Lead the preparation of a follow-on project including site selection, technical feasibility and economic viability, and all safeguard aspects. - Monitor project outcomes and outputs. - Review and approve all deliverables before any submission. - Provide support during all ADB missions.
I-2 Senior River Engineering Advisor	
Minimum qualifications and experience required	- Bachelor's degree in civil engineering or river engineering, Master's degree is preferred. - Minimum 20 years of relevant professional experience in flood and river erosion mitigation and management and/or water resources management projects (apart from water supply and wastewater projects), including climate change adaptation aspects and at least 10 years at a senior advisory or managerial level. - Broad-based work experience recognized as an expert either in a broad area of specialization or in a limited specialized field relevant to the assignment. - International assignments in similar geographic area and experience of ADB- and/or the World Bank- financed projects for the main rivers of Bangladesh or major rivers with similar nature in South Asia are preferred.
Tasks and responsibilities	- Advise BWDB on design changes. - Assist BWDB to detail capacity development activities pertaining to river engineering and design activities. - Contribute to the update of the design guideline including strategies and approaches for climate change adaptation. - Lead data collection for feasibility level designs for a follow-on project. - Lead selection, design and cost estimates for riverbank protection and flood embankment works for the follow-on project. - Lead the feasibility level designs for river training and riverbank protection works, including technical specifications and BOQs for draft bidding documents.
I-3 Construction / Quality Control Engineer	

Minimum qualifications and experience required	- Bachelor's degree in civil engineering or river engineering, Master's degree preferable. - Minimum of 15 years of relevant professional experience in civil engineering or river engineering in similar type of river catchments. - Broad-based work experience recognized as an expert either in a broad area of specialization or in a limited specialized field. - International assignments in similar geographic area and experience of ADB- and/or the World Bank- financed projects for the main rivers of Bangladesh or major rivers with similar nature in South Asia are preferred.
Tasks and responsibilities	- Lead construction supervision and advise on quality control and progress. - Guide and support PMO and SMOs to establish and operationalize efficient and timely construction supervision and quality control mechanisms for all civil work and geotextile bags contracts following international best practice and ADB requirements. - Provide field level operational advice and support to ensure the timely progress and high quality of structural works, including works for the land recovery/river training piloting. - Conduct spot checks of construction quality, review all site documents, and advise PMO and SMOs on improvements. - Review regularly technical compliance for all civil work and geotextile bags contracts with contract requirements. - Provide construction completion reports at the end of each civil work contract summarizing construction progress, issues, and lessons learned. - Provide inputs to reports as instructed by the Team Leader.
I-4 Social Development / Resettlement Specialist	
Minimum qualifications and experience required	- Bachelor's degree in sociology or social science. Master's degree is preferred. - Minimum 10 years of relevant professional experience in social safeguards of river or water resources or rural development projects in developing Asia. - Broad-based work experience recognized as an expert either in a broad area of specialization or in a limited specialized field relevant to the assignment. - International assignments in developing Asia and experience in ADB- and/or the World Bank-financed projects in South Asia are preferred.
Tasks and responsibilities	- Support PMO to timely finalize remaining resettlement plans to be approved by ADB before works can start in these locations. - Support PMO to timely progress monitoring and reporting of activities pertaining to GAP, SPRSS, and resettlement plans in full compliance with ADB SPS (2009) and the loan covenants. - Plan and prepare social development and social safeguards related data collection, including stakeholder consultations, for the follow-on project in full compliance with ADB SPS (2009) or any latest version.

	- Prepare social development and safeguards documents for the follow-on project in line with ADB requirements, including GAP, SPRSS, RPs, in full compliance with ADB SPS (2009) or any latest version. - Contribute to the processing documents, such as DPP and ADB loan documents. - Detail and guide relevant capacity development activities. - Provide inputs to reports as instructed by the Team Leader.

Table 3 – Minimum Qualifications and Experience Required, Tasks and Responsibilities of International Non-key Experts of the Main Team

International – Non-key Experts	
IN-1 Procurement / Contract Management Specialist	
Minimum qualifications and experience required	- Graduate degree, preferably post-graduate degree, in civil engineering. - Additional recent qualifications in procurement and/or contract management through successfully completed certified coursework. - Minimum 10 years of relevant professional work experience. - Minimum 10 years of experience in procurement and contract and claim management for flood/riverbank erosion mitigation and management contracts implemented through national and/or international contractors in developing Asia. - Preference will be given for experience with dredging contracts.
Tasks and responsibilities	- Guide and support PMO and SMO for establishing and operationalizing efficient contract management procedures for civil work contracts. - Assist PMO for preparing bidding documents and the DPP for the follow-on project - Provide field level operational advice on contract management. - Assist the nominated “Engineer” in claim management. - Assist the Construction Quality Control Engineer in reviewing technical compliance with the contract requirements for all civil work contracts. - Contribute to construction completion reports at the end of each civil work contract summarizing construction progress, issues, and lessons learned.
IN-2 Environmental Specialist	
Minimum qualifications and experience required	- Graduate degree, preferably post-graduate degree, in environmental or relevant natural science. - Minimum 10 years of relevant professional work experience in environmental assessments/studies and/or monitoring environment management plan implementation for preparing and/or implementing projects. - Preference will be given to experience with flood and erosion management as well as water resources management projects in developing Asia. - Additional qualification considered advantageous covers experience in preparing environment safeguard related documents for externally aided projects and/or ADB’s

	requirements for environmental safeguard aspects, as well as work experience in Bangladesh.
Tasks and responsibilities	- Guide and monitor the implementation of the environmental management plan, including establishment of a monitoring and reporting system. - Review contributions to regular environmental reports - Assist the PMO in formulating detailed ToR for the biodiversity study and on environmental aspects of other supporting studies. - Liaise with the SESA review team and advise the BWDB on updating the SESA. - Plan and guide field work for environmental aspects of the follow-on study and prepare the related documentation (IEE; EIA) etc. - Contribute to the processing documents of the follow-on project.
IN-3 Climate Change Specialist	
Minimum qualifications and experience required	- Graduate degree, preferably post-graduate degree, in climate science, engineering, water resources management or geography. - Minimum 10 years of relevant professional work experience, - Minimum 5 years of international practice - Preference will be given for experience in South Asia and/or implementation of externally funded projects including climate risk assessments, especially in Bangladesh.
Tasks and responsibilities	- Summarize the latest climate change knowledge update for the monsoon driven climate of the Indian Subcontinent - Lead the development of climate change adaptation strategies and approaches for the updated guidelines for river management and flood embankments. - Assist the flood modelling specialist in identifying climate change scenarios. - Assist the design engineer in assessing the climate change risk and additional design allocations to mitigate the risk. - Lead the preparation of the CRVA and Climate Change Assessment according to latest ADB guidelines.
IN-4 Institutional Development Specialist	
Minimum qualifications and experience required	- Graduate degree in engineering, water resources management, public administration management, or institutional management. - Knowledge of policy and institutional analyses relevant for flood, river, erosion, and water resources management. - Minimum 15 years of relevant professional work experience, - Minimum 7 years of international experience - Preference will be given for experience in project preparation and/or implementation of externally funded projects in Asia, especially in Bangladesh.
Tasks and responsibilities	- Assist the BWDB and MoWR in operationalizing the office of the Chief Engineer River Management - Formulate and support implementation of relevant capacity strengthening programs including coordinate updating of standard training programs with the Chief Engineer Training.

	- Review the BWDB's O&M practices for flood and riverbank erosion risk management, and assist BWDB in formulating strategic O&M plans and budgets. - Guide mainstreaming of climate change adaptation measures within BWDB. - Update the institutional assessment for the follow-on project. - Assist in formulating the DMF for the follow-on project.
IN-5 Economist	
Minimum qualifications and experience required	- Graduate degree, preferably post-graduate degree, in economics. - Minimum 15 years of relevant professional work experience in financial and economic analyses in feasibility studies of flood and erosion mitigation projects, including using for several years COSTAB for development projects. - Broad-based work experience recognized as an expert either in a broad area of specialization or in a limited specialized field relevant to the assignment. - International assignments in similar geographic area and experience in ADB- and/or the World Bank-financed projects in developing Asia are preferred. - Experience of ADB's requirements for project preparation, economic evaluation and economic analysis is highly preferred.
Tasks and responsibilities	- Lead the financial and economic assessment for the follow-on project, including identification of data collection, potential benefit streams, and pre-selection of economically viable sub-projects. - Assist in preparing processing documents for the government and ADB for the follow-on project. - Contribute to the facility completion report.
IN-6 Design Engineer	
Minimum qualifications and experience required	- Graduate degree, preferably post-graduate degree, in civil engineering or river engineering. - Minimum 10 years of relevant professional work experience, - Minimum 7 years of experience in planning, designing, and/or implementing flood and/or riverbank erosion mitigation management projects. - Preference will be given for work experience in developing Asia, and with the main rivers in Bangladesh or major rivers with similar nature. - Additional experience considered advantageous covers design experience with roads, offtake structures, sluice gates, and drainage systems.
Tasks and responsibilities	- Lead data collection for feasibility level designs for a follow-on project. - Prepare feasibility level designs for embankments including roads and regulatory and internal drainage structures. - Prepare technical specifications and BoQs for draft bidding documents. - Provide input during updating of the design guideline including climate change adaptation strategies and approaches.

	- Assist during site selection, preparation of piloting designs, and revision of designs
IN-7 Geotechnical Engineer	
Minimum qualifications and experience required	- Graduate degree, preferably post-graduate degree, in civil engineering with geotechnical engineering specialization. - Minimum 10 years of relevant professional work experience, - Minimum 7 years of experience in planning, designing, and/or implementing flood and/or riverbank erosion mitigation management projects. - Preference will be given for work experience in developing Asia and with the main rivers in Bangladesh or major rivers with similar nature. - Additional qualification considered advantageous covers design experience with roads, offtake structures, sluice gates and drainage systems with special consideration of seepage and liquefaction analysis.
Tasks and responsibilities	- Advise on geotechnical issues, particularly slope stability issues during implementation of Project-2 works - Lead data collection of geotechnical data for feasibility level designs for a follow-on project. - Advise on the geotechnical stability of feasibility level designs for riverbank protection, embankments and drainage structures. - Assist during the preparation of technical specifications and BoQs for draft bidding documents.
IN-8 River and Embankment Engineer	
Minimum qualifications and experience required	- Graduate degree, preferably post-graduate degree, in civil engineering or river engineering. - Minimum 5 years of relevant professional experience. - Minimum 3 years of experience in planning, designing, and/or implementing flood and/or riverbank erosion mitigation management projects. - Preference will be given for work experience in developing Asia and with the main rivers in Bangladesh or major rivers with similar nature.
Tasks and responsibilities	- Support the Senior River Engineering Advisor, Design Engineer, and Geotechnical Engineer during their work. - Supervise and guide field data collection for Project-2 and the follow-on project. - Assist during preparation of feasibility level designs for riverbank protection and embankment works, including consistency check of field data and initial engineering analysis. - Prepare the draft design base and the draft feasibility level design report for the feasibility study.
IN-9 Dredging Specialist	
Minimum qualifications and experience required	- Graduate degree, preferably post-graduate degree, in civil engineering or river engineering. - Minimum 10 years of relevant professional work experience, - Minimum 5 years of experience in planning, designing, and/or implementing dredging projects.

	- Preference will be given for work experience in developing Asia and with the main rivers in Bangladesh or major rivers with similar nature.
Tasks and responsibilities	- Identify scheduling issues during implementation. - Assist the design team for the follow-on project in dredging related matters. - Contribute to the technical specifications and contract documents. - Contribute to reports as required.
IN-10 Flood Modelling Specialist	
Minimum qualifications and experience required	- Graduate degree, preferably post-graduate degree, in civil engineering, river engineering, or numerical modelling. - Minimum 10 years of relevant professional experience. - Minimum 5 years of experience in flood modelling. - Preference will be given for work experience in developing Asia and with the main rivers in Bangladesh or major rivers with similar nature.
Tasks and responsibilities	- Update the existing flood models in line with latest planning and data changes including climate change scenarios. - Prepare alternative simulation runs for different return periods and including climate change scenarios for the feasibility study and the CRVA - Contribute to reports as required.
IN-11 Publisher and Report Designer	
Minimum qualifications and experience required	- Bachelor degree in media/communication design. - Minimum 5 years of relevant professional work experience, - Preference will be given for work experience in preparing final reports/books for externally aided projects and experience in working in developing countries, preferably in Asia. - Additional qualification considered advantageous covers knowledge of printing and book binding and/or photography.
Tasks and responsibilities	- Closely coordinate concept and layout of the book on 'experience with geotextile bags in Bangladesh' with the technical contributions and photographer. - Prepare the book layout from concept to qualified printable files including photography. - Coordinate with suitable printers the production of the book and monitor the quality.

Table 4 – Minimum Qualifications and Experience Required, Tasks and Responsibilities of National Key Experts of the Main Team

National – Key Experts	
N-1 Flood and Erosion Risk Management Specialist / Deputy Team Leader	
Minimum qualifications and experience required	- Bachelor's degree in civil engineering, river engineering or water resources engineering, Master's degree is preferred. - Minimum 20 years of relevant professional experience in flood and river erosion mitigation and management and/or water resources management projects in Bangladesh (apart from water supply and wastewater projects), including climate change adaptation aspects

	and minimum 5 years of leadership of multidisciplinary teams of international and national experts on project implementation and project preparatory of similar nature, and several years at a senior advisory or managerial level. - Broad-based work experience recognized as an expert either in a broad area of specialization or in a limited specialized field relevant to the assignment. - Wide experience of ADB- and/or the World Bank- financed projects for the main rivers of Bangladesh is preferred. - Track record demonstrating capabilities to direct successfully the work of a number of groups or more junior consultants and to perform quality control on the work outputs. - Track record demonstrating abilities to coordinate and consolidate contributions of national specialists of other disciplines to complete a joint project of high quality. - Full-time employment with the one of the firms of the JV is preferred.
Tasks and responsibilities	- Lead and guide the team of national consultants in coordination with the Team Leader and the knowledge-base Unit Leader to ensure the timely submission of all deliverables and their high quality. - Coordinate key activities with PMO, SMOs, and DDM on a day-to-day basis, and support liaison with government institutions, national organizations, local stakeholders, and external financing institutions. - Advise on scheduling of activities and coordination with stakeholders during construction, including on land acquisition and resettlement. - Support BWDB and guide the Training Coordinator to conduct capacity development activities, including workshops, training, and study tours. - Advise BWDB on technical aspects of flood and riverbank erosion works, pertaining to planning, design, implementation, and adaptation and maintenance, in close collaboration with the Team Leader. - Support recruitment and supervision of supporting firms and NGOs services, for studies and surveys. - Support the preparation of a follow-on project to conduct field surveys and studies and provide inputs during the preparation of the project. - Support the Team Leader in monitoring project outcomes and outputs. - Contribute to all reports as required by the Team Leader.
N-2 Community-based Flood Risk Management (CbFRM) Specialist	
Minimum qualifications and experience required	- Bachelor's degree in disaster risk management, natural hazards preparedness or response, sociology or social sciences. Master's degree is preferred. - Minimum 15 years of relevant professional experience disaster risk management, preparedness, response to water-induced hazards at community level in Bangladesh. - Broad-based work experience recognized as an expert either in a broad area of specialization or in a limited specialized field relevant to the assignment. - Wide experience of ADB- and/or the World Bank- financed projects for the main rivers of Bangladesh is preferred.
Tasks and responsibilities	- Lead the guidance and monitoring of the implementation of all CbFRM activities and community O&M and supervise the performance of the implementing firms / NGOs in close collaboration with DDM.

	- Support the information exchange between DDM and PMO, advise on bottlenecks, and facilitate smooth coordination between both organizations. - Coordinate and advise on integrating CbFRM and community O&M activities. - Contribute to CbFRM and community O&M trainings and activities to achieve the DMF related targets. - Support the formulation of CbFRM and community O&M activities for the follow-on project. - Guide the Community Organizer. - Contribute to all reports as required by the Team Leader.
N-3 Land Acquisition and Resettlement Specialist	
Minimum qualifications and experience required	- Bachelor's degree in sociology or social science. Master's degree is preferred. - Minimum 15 years of relevant professional experience in social safeguards, including 10 years in preparation and implementation of resettlement plans and participatory rural appraisal for community development for river or water resources or rural development projects in Bangladesh. - Broad-based work experience recognized as an expert either in a broad area of specialization or in a limited specialized field relevant to the assignment. - Experience in ADB- and/or the World Bank-financed projects in Bangladesh is preferred.
Tasks and responsibilities	- Assist PMO for preparing & finalization of resettlement plans for Project 2 works and for the follow-on project by complying timely with all ADB's observations and comments. - Draft semi-annual social safeguard monitoring reports. - Lead the day-to-day monitoring of land-acquisition and resettlement activities. - Advise PMO, SMOs, and implementing firms / NGOs on compliance issues, bottlenecks, and critical activities with respect to land compensation, payments of resettlement benefits, and the construction schedule. - Contribute to land acquisition and resettlement reporting. - Support the design and coordination of livelihood programs with implementing firms / resettlement NGOs and the PMO. - Guide the field investigations and resettlement plan preparation during the preparation of the follow-on project. - Contribute to all reports as required by the Team Leader.
N-4 Senior Construction Engineer	
Minimum qualifications and experience required	- Bachelor's degree in civil engineering or river engineering, Master's degree is preferable. - Minimum of 15 years of relevant professional experience in civil engineering or river engineering in similar type of river catchments in Bangladesh, including 10 years in construction supervision, design or implementation of river engineering projects. - Broad-based work experience recognized as an expert either in a broad area of specialization or in a limited specialized field. - Experience in ADB- and/or the World Bank-financed projects in Bangladesh and dredging experience is preferred.

Tasks and responsibilities	- Lead the team of Site Engineers in close coordination with the international Construction/ Quality Control Engineer, Procurement / Contract Management Specialist and the Team Leader. - Advise the SMOs and PMO on construction quality issues on a daily basis. - Lead the process of documenting daily progress through the Site Engineers and report summary information to the International Construction/ Quality Control Engineer. - Support the Procurement / Contract Management Specialists with technical certifications and claim management. - Contribute to construction progress information and issues to reports. - Assist the Design Engineer during the preparation of feasibility level designs for the follow-on project. - Contribute to all reports as required by the Team Leader.

Table 5 – Minimum Qualifications and Experience Required, Tasks and Responsibilities of National Non-key Experts of the Main Team

National– Non-key Experts	
NN-1 Procurement / Contract Specialist	
Minimum qualifications and experience required	- Graduate degree in civil engineering, Master's degree is preferable - Minimum 12 years of relevant professional experience, - Minimum 7 years in procurement and contract activities related to flood and/or river and/or water resources management projects. - Preference will be given for experience with project preparation and/or implementation of externally funded projects, especially by ADB.
Tasks and responsibilities	- Assist the PMO/SMOs in procurement document preparation (i.e. bidding documents, DPP etc.), bid evaluation and contract administration for Project 2 works. - Contribute procurement and contract management aspects to progress reports. - Update the procurement plan when required. - Prepare the procurement plan, including SPP and first bidding documents for goods, works, and services for the follow-on project.
NN-2 Institutional Capacity Development Specialist	
Minimum qualifications and experience required	- Graduate degree in civil engineering, water resources management, public administration management, institutional management, Master's degree is preferable. - Minimum 20 years of relevant professional experience, - Minimum 15 years of experience in institutional analyses and institutional capacity development for flood, river, and water resources management. - Preference will be given for work experience in preparation and/or implementation of externally funded projects.
Tasks and responsibilities	- Keep regular contact with the BWDB and MoWR and advise the team on institutional development activities relevant for river and flood management. - Plan, prepare, and organize regular round-table discussions with the BWDB and invited outside organizations to discuss river management progress and issues.

	- Review interactions between BWDB, DDM, and stakeholders at different levels, particularly for CbFRM and community O&M activities as well as for climate risk mainstreaming. - Contribute to regular reporting. - Assist the international Institutional Specialist during the document update for the follow-on project.
NN-3 River and Flood Management Specialist	
Minimum qualifications and experience required	- Graduate degree in civil engineering or river engineering, Master's degree is preferable. - Minimum 15 years of relevant professional experience. - Minimum 10 years of experience in planning, designing, and/or implementing flood, river and/or water resources management projects. - Preference will be given for experience in preparation and/or implementation of externally funded projects, and experience with the main rivers in Bangladesh or major rivers of similar nature.
Tasks and responsibilities	- Review the BWDB capacity in implementing river and flood management infrastructure. - Draft a risk assessment strategy for effective flood and riverbank erosion risk management in line with Delta Plan and River Stabilization Plan principles and international best practice, for example the Levee Handbook. - Prepare 5-year budgetary plans for embankment and riverbank protection O&M. - Support PMO and SMOs in implementing the community O&M component, monitor progress, and advise on bottlenecks. - Advise PMO and DDM on integration and coordination of CbFRM and community O&M activities. - Contribute to the feasibility study for the follow-on project, including conducting field visits, identifying suitable community involvement in flood risk management activities, and quantifying these activities.
NN-4 Social Development and Gender Specialist	
Minimum qualifications and experience required	- Graduate degree in sociology or social sciences, Master's degree is preferable. - Minimum 15 years of relevant professional experience. - Minimum 10 years of experience in participatory rural appraisal for community development, gender, and other social considerations. - Knowledge of social development and gender requirements of externally funded agencies, and ADB's requirements for project preparation.
Tasks and responsibilities	- Guide and monitor the implementation of social and gender activities - Provide support for strengthening the participation of women and vulnerable groups during the CbFRM activities, Participatory O&M, livelihood development etc. - Prepare periodic progress report of GAP and submit to PMO. - Orientation on gender mainstreaming; implementation, monitoring and reporting of the GAP; to the PMO, SMOs, contractors and stakeholder communities. - Organize/facilitate trainings/workshops/consultation/campaign accordingly.

	- Support the development of method and tools for monitoring and reporting including collection of sex-disaggregated data from the field and produce gender analysis-based report regularly. - Participate in loan review missions and provide updated progress status of GAP and join the field visits. - Prepare case studies on the impact of the project's interventions at individual and community levels. - Contribute to the Facility Completion Report, and any other activities, as necessary. - Support the preparation of the follow-on project including contribution to SPRSS and GAP.
NN-5 Environmental Specialist	
Minimum qualifications and experience required	- Graduate degree in environmental science, Master's degree is preferable. - Minimum 15 years of relevant professional experience. - Minimum 10 years of experience in environmental assessment/studies and/or monitoring environmental management plan implementation. - Preference will be given for experience with of flood and river erosion management projects. - Additional qualification considered advantageous covers experience in preparing environmental safeguard related documents for externally aided projects.
Tasks and responsibilities	- Draft semi-annual environmental management plan monitoring reports. - Guide and monitor the implementation of the environmental management plan during Project-2. - Contribute to progress reports including specialist environmental reports. - Assist the procurement specialist by contributing environmental aspects, including TOR, during the preparation of bid documents for supporting studies. - Prepare environmental assessment for the follow-on project including documentation required by the DoE and ADB. - Lead and supervise the field work and field data analysis of the environmental assessment of the follow-on project. - Assist the PMO and training coordinator in planning, preparing, and conducting capacity development activities, including training to contractors and local stakeholders.
NN-6 River Engineer	
Minimum qualifications and experience required	- Graduate degree, in civil engineering or river engineering, Master's degree is preferable. - Minimum 5 years of relevant professional experience. - Minimum 3 years of experience in planning, designing, and/or implementing flood and/or river erosion and/or water resources management projects. - Preference will be given for work experience with externally funded projects, experience with river and flood management along the main rivers of Bangladesh, and knowledge of environmentally friendly river

	training techniques, including the use of vegetation and/or natural materials.
Tasks and responsibilities	- Assess the annual monitoring (river survey) requirements, evaluate the survey data (including multi-beam echosounder data), and prepare draft adaptation plans for the coming dry season. - Assist the BWDB with implementation designs for riverbank protection during Project-2. - Support the data collection for feasibility level designs for the follow-on project and assure their accuracy and quality. - Contribute draft designs to the team of designers for the follow-on project.
NN-7 Hydraulic Design Engineer	
Minimum qualifications and experience required	- Graduate degree in civil engineering, Master's degree is preferable. - Minimum 15 years of relevant professional experience. - Minimum 10 years of experience designing and/or implementing flood, river and/or water management projects. - Preference will be given for experience with water-related infrastructure, especially drainage and intake structures, and knowledge of geotechnical engineering.
Tasks and responsibilities	- Assist the design team during the preparation of the follow-on project in conducting all structural designs for sluice gates, regulators, fish passes, culverts, bridges etc. and assure design compliance with the national building code. - Contribute draft feasibility level structural designs for the follow-on project to the design team. - Supervise the drafting work of the relevant feasibility level design drawings.
NN-8 Surveyor	
Minimum qualifications and experience required	- Graduate degree in geodesic or surveying sciences or engineering, Master's degree is preferable. - Minimum 15 years of relevant professional experience. - Minimum 10 years of experience in topographic and bathymetric survey works.
Tasks and responsibilities	- Lead and monitor all topographic and bathymetric survey works for Project-2 activities and assure its quality and correctness. - Assist data processing and systematic documentation of all survey results. - Plan all survey works for feasibility design level of the follow-on project and assist the procurement specialists during subcontracting. - Contribute survey information and issues to reports.
NN-9 Geotechnical Engineer	
Minimum qualifications and experience required	- Graduate degree in civil engineering, geology, or soil mechanics, Master's degree is preferable. - Minimum 15 years of relevant professional experience. - Minimum 10 years of experience in geological, geotechnical and/or soil mechanical aspects of flood and river erosion management structures.

	- Preference will be given for knowledge of foundation and embankment/dam engineering, dynamic loading, for example under earthquake loads, and structural engineering knowledge.
Tasks and responsibilities	- Plan and supervise all geotechnical field and lab investigations for river training, riverbank protection, and embankment works during Project-2 and in preparation of the follow-on project. - Assure the complete documentation of all results. - In coordination with the international Geotechnical Engineer, conduct geotechnical assessment of embankments and riverbank protection including assessment of climate change alternatives. - Assist in drafting an embankment guideline including climate change adaptation alternatives.
NN-10 Site Engineers (3 positions)	
Minimum qualifications and experience required	- Graduate degree in civil engineering, Master's degree is preferable. - Minimum 10 years of relevant professional experience. - Minimum 7 years of experience in construction supervision, designing and/or implementing river or road infrastructure projects. - Preference will be given to experience in externally aided projects.
Tasks and responsibilities	- Advise the SMOs on a day-to-day basis in contract management and quality assurance at the assigned sites. - Document daily all construction activities for incorporation into registers and construction completion reports, including diving records. - Regularly check quality and document the work quality for SMOs and PMO. - Assist construction quality and contract specialists in technical certification and during claim management.
NN-11 Economist	
Minimum qualifications and experience required	- Graduate degree in economics, Master's degree is preferable. - Minimum 20 years of relevant professional experience. - Minimum 15 years of experience in preparing projects of similar nature. - Preference will be given for work experience with externally funded projects, and ADB's requirements for project preparation.
Tasks and responsibilities	- Lead the field data collection relevant to establish benefit streams for the follow-on project and the final assessment of the MFF. - Assist the international Economist during the calculations of the economic viability. - Assist during the DPP preparation. - Evaluate the developments of socio-economic indicators during Project-2 implementation.
NN-12 Community Organizer	
Minimum qualifications and experience required	- University degree in relevant field. - Minimum 7 years of relevant professional experience. - Minimum 5 years of experience with community organization for participatory water resources, flood, and/or disaster management. - Preference will be given to experience in externally aided projects.

Tasks and responsibilities	- In coordination with the CbFRM Specialist guide and monitor the formation of CDMUs and report on problems. - Assist the BWDB during the formation of the community O&M groups. - Assist in coordinating between CbFRM and community O&M activities.
NN-13 Financial Management Specialist	
Minimum qualifications and experience required	- Graduate degree in public administration management, business administration or financial management, Master's degree is preferable. - Minimum 15 years of relevant professional experience. - Minimum 10 years of experience with externally aided projects and public sector financing. - Preference will be given for knowledge about ADB's financial management requirements.
Tasks and responsibilities	- Review and update financial and risk assessments for Project-2. - Assist PMO, SMOs, and DDM in establishing and operating financial management systems during Project-2 implementation. - Contribute to reports. - Contribute financial management aspects to the documents for the follow-on project.
NN-14 Fisheries Specialist	
Minimum qualifications and experience required	- Graduate degree in aquatic ecology or fisheries, Master's degree is preferable. - Minimum 20 years of relevant professional experience. - Minimum 15 years of experience in research, planning, design or implementing fisheries conservation for development projects. - Preference will be given to experience in externally aided projects and with open water fisheries in the main rivers of Bangladesh.
Tasks and responsibilities	- Guide the implementation of fisheries conservancy measures under Project-2 and document progress and issues. - Support the procurement team members in contributing ToR for supporting studies. - Outline the investigation program and guide and monitor field investigations for the preparation of the follow-on project. - Prepare a fisheries sub-report for the follow-on project.

Table 6 – Minimum Qualifications and Experience Required, Tasks and Responsibilities of International Key Experts of the Knowledge-base Team

Knowledge-base Team	
International – Key Experts	
IK-1 River Engineer / Unit Leader of Knowledge-base Team	
Minimum qualifications and experience required	- Master's degree in civil engineering, river engineering or water resources engineering, PhD degree is preferred. - Minimum 20 years of relevant professional experience in flood and river erosion mitigation and management projects, including research work on large alluvial rivers and climate change adaptation aspects, and minimum 7 years of leadership of multidisciplinary teams of international and national researchers / experts on river and morphology issues of large rivers, and 5 years at a senior advisory or managerial level.

	- Broad-based work experience recognized as an international expert either in a broad area of specialization or in a limited specialized field relevant to the assignment. - International assignments in similar geographic area and experience of ADB- and/or the World Bank- financed projects for the main rivers of Bangladesh or large alluvial rivers of similar nature in South Asia are preferred. - Track record demonstrating capabilities to direct successfully the work of a number of groups or more junior researchers or consultants and to perform a high level of quality control on the work outputs. - Track record demonstrating abilities to coordinate and consolidate contributions of specialists of other disciplines to prepare or implement river research proposals and complete a joint project of high quality. - Full-time employment with one for the firms of the JV is preferred.
Tasks and responsibilities	- Lead the Knowledge-base Team and ensure the timely implementation of the activities and submission of all deliverables. - Lead the preparation of survey and investigation studies, coordinate and monitor the implementation of different knowledge-base activities, and liaise with different research organizations in Bangladesh. - Contribute to regular and special project reports, including their quality review. - Lead the preparation of assessment and preparation of summary reports/papers on outcomes for incorporation into future project designs and broader applications in BWDB. - Support BWDB to conduct capacity development on agreed knowledge-base activities and contribute findings to international conferences. - Support BWDB to update the design guidelines. - Contribute to all reports as required by the Team Leader.
IK-2 River Morphologist	
Minimum qualifications and experience required	- Graduate degree in civil engineering, river engineering or geography, Master's degree is preferable. - Minimum 15 years of relevant professional experience, including 10 years on morphology studies of large alluvial rivers, and climate change adaptation aspects and nature-based solutions. - Broad-based work experience recognized as an expert either in a broad area of specialization or in a limited specialized field relevant to the assignment. - International assignments in similar geographic area and experience of ADB- and/or the World Bank- financed projects for the main rivers of Bangladesh or major rivers with similar nature in developing Asia are preferred.
Tasks and responsibilities	- Lead holistic morphology analysis for long-term river stabilization and assess long-term morphological trends of the main rivers and major distributaries in the project area. - Support the design of innovative river training solutions for Project 2. - Support the construction to respond to river changes and direct construction and adaptation activities in areas of likely future attack. - Lead the monitoring and evaluation of impacts of innovative pilot works on the river morphology and assess potential long-term impacts. - Support BWDB to update the design guideline on river management including scenarios for anthropogenic changes including from climate change.

	- Support the team to select suitable sites for river training interventions. - Contribute to all reports as required by the Team Leader.
IK-3 Senior River Modeller	
Minimum qualifications and experience required	- Graduate degree in engineering, river engineering, or numerical modelling, Master's degree is preferable. - Minimum 15 years of relevant professional experience, including 10 years on numerical hydrology and hydraulic modelling studies of large rivers, and morphology and climate change adaptation aspects. - Broad-based work experience recognized as an expert either in a broad area of specialization or in a limited specialized field relevant to the assignment. - International assignments in similar geographic area and experience of ADB- and/or the World Bank- financed projects for the main rivers of Bangladesh or major rivers with similar nature in developing Asia are preferred.
Tasks and responsibilities	- Lead all numerical modelling activities and guide the team with respect to model setup, parameters, and optimizing model runs. - Review modelling reports. - Provide inputs to pilot works and the follow-on project. - Support relevant capacity development activities for BWDB. - Contribute to all reports as required by the Team Leader.

Table 7 – Minimum Qualifications and Experience Required, Tasks and Responsibilities of International Non-key Experts of the Knowledge-base Team

International – Non-key Experts	
IKN-1 Database and MIS Specialist	
Minimum qualifications and experience required	- Graduate degree in computer science, information technology, or geography, Master's degree is preferable. - Minimum 10 years of relevant professional experience. - Minimum 7 years of experience on database, MIS, and asset management. - Preference will be given for experience with database development in developing countries with some knowledge on management of flood defence assets.
Tasks and responsibilities	- Lead all database development and updates on a day-to-day basis. - Contribute project information to regular (particularly quarterly) reports - Guide the integration of database and MIS. - Guide the update and maintenance of the project webpage. - Train extensively the end-users in BWDB.
IKN-2 Sediment Specialist	
Minimum qualifications and experience required	- Graduate degree in civil engineering, river engineering or geography, Master's degree is preferable. - Minimum 10 years of professional experience. - Minimum 7 years of experience in sediment sampling and analysis. - Preference will be given to experience with large alluvial rivers.
Tasks and responsibilities	- Guide and monitor the sediment sampling program at selected locations along the main rivers in Bangladesh, considering the comparison with historical data. - Analyze data, adjust the sampling program and prepare sediment rating curves.

	- Interact with the Dredging and Environmental Specialists and provide inputs to their work. - Contribute to relevant capacity development activities, including preparation of research papers for international conferences. - Contribute sediment information to the modelling team and interact with the team on modelling results.
IKN-3 Geotechnical Engineer	
Minimum qualifications and experience required	- Graduate degree in civil engineering with geotechnical engineering specialization, Master's degree is preferable. - Minimum 10 years of relevant professional experience. - Minimum 5 years of experience in planning, designing, and/or implementing flood and/or riverbank erosion mitigation management projects. - Preference will be given for work experience in developing Asia, in particular on the main rivers in Bangladesh or major rivers of similar nature. - Additional experience considered advantageous covers design of roads, offtake structures, and sluice gates with special consideration of seepage and liquefaction analysis.
Tasks and responsibilities	- Advise the BWDB on design changes during the implementation of the works and the preparation of additional designs of pilot works. - Assist in preparing technical specifications and BoQ for pilot works. - Lead the development of technical background for the embankment guideline including climate change adaptation strategies and approaches. - Assist BWDB to update the design guideline for river management.
IKN-4 River Engineer	
Minimum qualifications and experience required	- Graduate degree in civil engineering or river engineering, Master's degree is preferable. - Minimum 5 years of relevant professional experience - Minimum 3 years of experience in planning, designing, and/or implementing flood and/or riverbank erosion mitigation management projects. - Preference will be given for work experience in developing Asia, in particular on the main rivers in Bangladesh or major rivers of similar nature.
Tasks and responsibilities	- Prepare draft additional designs for pilot works based on preparatory studies. - Assist the BWDB in detailing capacity development activities pertaining to river engineering and design activities. - Assist the BWDB in updating the design guideline for river management. - Support the Unit Leader, Morphologist, and Sediment Specialist during their work. - Assist during preparation of reports and contribute to regular reporting.
IKN-5 Dredging Specialist	
Minimum qualifications and	- Graduate degree in civil engineering or river engineering, Master's degree is preferable. - Minimum 10 years of relevant professional work experience.

experience required	- Minimum 7 years of experience in planning, designing, and/or implementing dredging projects. - Preference will be given for work experience in developing Asia, in particular on the main rivers in Bangladesh or major rivers of similar nature.
Tasks and responsibilities	- Provide specialist support on dredging issues during the planning and design development of pilot works of Solimabad channel closure and construction of riverbank protection. - Contribute to the technical specifications contract documents. - Provide experts input to the knowledge-base team on sediment transport and dredging issues.
IKN-6 River Morphology Modeller	
Minimum qualifications and experience required	- Graduate degree in engineering, river engineering, geography or numerical modelling, Master's degree is preferable. - Minimum 5 years of relevant professional experience. - Minimum 3 years of morphological modelling experience - Preference will be given for experience for modelling experience for flood and erosion management in large rivers in developing Asia, especially Bangladesh.
Tasks and responsibilities	- Under the supervision of the Senior Modeller, conduct regular morphological modelling of the Lower Jamuna with the Ganges confluence for explaining dominant river processes and morphological forecasting. - Coordinate modelling requirements and outputs with the Project-2 preparation team and the follow-on project team and provide required information. - Conduct modelling for different anthropogenic change scenarios including climate change in support of CRVA, climate change adaptation strategies and design guidelines. - Draft modelling reports and contribute to regular progress reporting.
IKN-7 Social Development Specialist	
Minimum qualifications and experience required	- Bachelor's degree in spatial planning, geography or social science. Master's degree is preferred. - Minimum 10 years of relevant professional experience in spatial planning and social safeguards of river or water resources or rural development projects in developing Asia. - Broad-based work experience recognized as an expert either in a broad area of specialization or in a limited specialized field relevant to the assignment. - International assignments in developing Asia and experience in ADB- and/or the World Bank-financed projects in South Asia are preferred.
Tasks and responsibilities	- Update draft land-use plans including the outcome of interventions from Project 2 in line with the DMF. - Assess the social impacts of the river stabilization measures under the MFF on land-use and the social fabric. - Add a regional planning and development component to the follow-on project, based on the suggested stabilization measures and forecasted socio-economic developments.

Table 8 – Minimum Qualifications and Experience Required, Tasks and Responsibilities of National Key Experts of the Knowledge-base Team

National – Key Experts	
NK-1 Senior Morphologist	
Minimum qualifications and experience required	- Graduate degree in civil engineering, river engineering or geography, Master's degree is preferable. - Minimum 15 years of relevant professional experience, including 7 years on qualitative and numerical morphology studies of large alluvial rivers, and climate change adaptation aspects. - Broad-based work experience recognized as an expert either in a broad area of specialization or in a limited specialized field relevant to the assignment. - Experience of ADB- and/or the World Bank- financed projects for the main rivers of Bangladesh is preferred.
Tasks and responsibilities	- Lead the update of erosion forecasting for the main rivers in the project area including providing advice on changes in erosion patterns affecting the ongoing implementation of the works and requiring adjustments. - Provide a longer-term morphological analysis for the follow-on project sites helping to optimize the investment. - Assess the long-term performance of stabilized distributaries under new flow conditions particularly for the Ghior Khal and downstream Dhaleswari. - Guide the analytical work of the morphologist. - Support BWDB to update the design guideline on river management including scenarios for anthropogenic changes including from climate change. - Contribute to all reports as required by the Team Leader.
NK-2 Social Development and Gender Specialist	
Minimum qualifications and experience required	- Bachelor's degree in sociology or social science. Master's degree is preferred. - Minimum 10 years of relevant professional experience in social safeguards, participatory rural appraisal for community development, and gender aspects of river or water resources or rural development projects in Bangladesh. - Broad-based work experience recognized as an expert either in a broad area of specialization or in a limited specialized field relevant to the assignment. - Experience in ADB- and/or the World Bank-financed projects is preferred.
Tasks and responsibilities	- Lead the monitoring of the implantation of social studies and incorporation of the findings into the SESA. - Provide background on social policy and regulatory framework developments. - Assist in capacity development activities pertaining to social issues. - Contribute to all reports as required by the Team Leader.

Table 9 – Minimum Qualifications and Experience Required, Tasks and Responsibilities of National Non-key Experts of the Knowledge-base Team

National – Non-key Experts	
NKN-1 Environmental Specialist	
Minimum qualifications and	- Graduate degree in environmental science, Master's degree is preferable. - Minimum 15 years of professional experience.

experience required	- Minimum 10 years in environmental assessment/studies and/or monitoring environmental management plan implementation. - Preference will be given for experience with projects in the field of flood, river and/or water resources management with involvement in formulating government's environmental policies or regulatory frameworks.
Tasks and responsibilities	- Lead the monitoring of the implantation of environmental studies and incorporation of the findings into the SESA. - Provide background on environmental policy and regulatory framework developments. - Assist in incorporation new findings into the SESA. - Assist in capacity development activities pertaining to environmental issues.
NKN-2 Training Coordinator	
Minimum qualifications and experience required	- University degree relevant to the assignment. - Minimum 10 years of work experience in administering and coordinating capacity development training for government officials and local communities.
Tasks and responsibilities	- Assist the PMO in planning, preparing, and conducting capacity development activities, including trainings and study tours. - Assist ISPMC team members in conducting trainings or round-table discussions. - Document training activities and contribute to reports.
NKN-3 Database and MIS Operator	
Minimum qualifications and experience required	- University degree in computer science or information technology, Bachelor's degree is preferable. - Minimum 5 years of relevant professional experience. - Minimum 3 years of experience on database, MIS and asset management. - Preference will be given for experience on updating large databases and involvement in externally funded projects.
Tasks and responsibilities	- Operate and develop different databases for the project. - Provide advice on MIS operations to other ISPMC and PMO team members. - Prepare maps and database analyses as directed by team members. - Operate the Project webpage.
NKN-4 Morphologist	
Minimum qualifications and experience required	- Graduate degree in civil engineering, river engineering or geography, Master's degree is preferable. - Minimum 5 years of relevant professional experience, including 3 years on morphological analysis of rivers in Bangladesh using satellite analysis or river morphological prediction.
Tasks and responsibilities	- Conduct morphological analysis through time series analysis of satellite imagery. - Assist the morphological advisor in completing his tasks. - Provide information and analyses to ISPMC team members as directed.
NKN-5 Regional / Spatial Planner	

Minimum qualifications and experience required	- Bachelor's degree in spatial planning or geography. Master's degree is preferred. - Minimum 20 years of relevant professional experience in spatial planning, land use planning, transportation planning on development projects in Bangladesh. - Broad-based work experience recognized as an expert either in a broad area of specialization or in a limited specialized field relevant to the assignment. - Experience in ADB- and/or the World Bank-financed projects in South Asia is preferred.
Tasks and responsibilities	- Review the current status of regional/ spatial planning in Bangladesh. - Assess potential land reclamation within the river corridor with respect to regional/spatial planning. - Contribute to the updating of river stabilization plan documents. - Contribute to future land reclamation concepts, for example for a follow-on project.

F. Implementation

29. BWDB will administer the ISPMC contract and supervise and approve their outputs. The day-to-day activities of the ISPMC team will be supervised by the Project Director of the PMO in BWDB. The consulting services will be implemented over 35 months (1 August 2021 to 26 June 2024). The implementation schedule of the inputs to be rendered will be flexible and in accordance with the current regulations related to COVID-19 pandemic in Bangladesh and the home countries of the international experts or involved companies. The ISPMC core team will be based in Dhaka, and, if permissible under COVID-19 protocols, will conduct frequent field visits to the 3 subproject project areas and other potential sites to be considered for the follow-on project along the Jamuna and Padma rivers in central Bangladesh.

30. To ensure a smooth implementation of the services and the successful achievement of all the objectives, the ISPMC will carry out all its duties and responsibilities with due diligence and efficiency and deliver to the PMO such information related to the services as PMO may reasonably request.

G. Outputs (Deliverables)

31. The consultants will produce the following deliverables. Other deliverables to present their findings or analyses will also be produced, as necessary.

32. In order to gradually minimize the use of paper and costs related to report printing, from the onset of the implementation of Project 2, the ISPMC will set up a cloud repository for all the (draft and final) reports (such as BWDB FRERMIP Google drive or any similar type of cloud), with access tied to their respective position in the PMO to limit access control. Full permanent access to this cloud will be provided to the ADB Project team.

(i) Regular/mandatory reports:

- Inception Report (draft within one month after mobilization – 10 copies, final within two months after mobilization – 20 copies)
- Quarterly Progress Report-(within one month after the end of each quarter) - 20 copies
- Mid-term Report – (by December 2022) - 20 copies

- Annual Report-(within one month after the end of each calendar year)- 20 copies
- Semi-annual Environmental Monitoring Report (including for Project 1 till financial closure of Project 2) (in January and July each year covering the previous two quarters – 5 copies)
- Semi-annual Social Monitoring Report (till financial closure of Project 2) (in January and July each year covering the previous two quarters – 5 copies)
- Contract Completion Report-within two months after completion of each contract-5 copies each contract
- Facility Completion Report (draft report by 15 March 2024 – 10 copies, final report by 31 May 2024 – 20 copies).

(ii) Technical reports and other deliverables:

- innovation and piloting works progress and a specialized report on the use of geotextile bags for riverbank protection in Bangladesh.
- Updated River Stabilization Plan
- Detailed findings of sediment monitoring & impact on River Stabilization Plan
- Background reports supporting updating guidelines for river stabilization and climate change adaptation strategies and approaches.

(Draft reports will be delivered in 10 copies and final reports in 20 copies).

(iii) Feasibility study report for the follow-on project:

- Site Selection Report (draft by November 2021, final by January 2022) (10 copies)
- Draft Feasibility Report (with cost estimates) (by August 2022) (10 copies)
- Final Feasibility Report (with cost estimates) (by October 2022) (15 copies).

(iv) Processing documents for the follow-on project:

- All ADB loan processing documents (draft by August 2023, final by December 2023) – 5 copies
- DPP (draft by August 2023, final by October 2023) (5 copies)

33. Table 10 outlines major outputs and activities pertaining to the follow-on project.

Table 10 – Major Activities and Outputs for the Follow-on Project

Major Activities	Major Outputs
Verification of site and technology selection Feasibility study and project formulation	(i) Update and expand site and technology selection (ii) Technical and social field surveys and data collection (iii) Feasibility level engineering designs (iv) Designs of non-structural measures (v) Safeguards, gender, and poverty assessment (vi) Project cost estimates and feasibility assessment including economic evaluation (vii) Follow-on project formulation, including implementation planning and financial assessment (viii) Final report, including necessary safeguard documents, such as draft EIA or IEE,

Support during preparation of loan processing documents for government and ADB	(i) Draft RRP and other necessary ADB loan approval documents (ii) Draft bid documents for first 18 months packages of the follow-on project (iii) Data and information required for DPP preparation and draft DPP (iv) Other necessary documents satisfying requirements of ADB and government for loan processing, including safeguard documents

34. The ISMPC will be responsible for the quality of deliverables and services provided by all subcontractors ISPMC may engage. The ISPMC will assist the PMO during the preparation and supervision of associated firms/NGO consulting services and of contracts to supporting studies/investigations through third-party consultants, research institutions, and NGOs.

H. Provisional Sums

35. The ISMPC will utilize provisional sums with prior approval of the Project Director, PMO for expenditures above $10,000 or equivalent. Request for no objection from ADB will be needed for any expenditures above US$25,000 or equivalent. Items pertaining to office installation and operation will be procured at the start of the services. The provisional sums are structured in seven categories:

(i) Office rent, furniture and equipment and operation costs for two ISPMC offices. This budget will be used for the financing of the ISPMC Knowledge-base office in Gulshan or Banani, and furniture and equipment as well as office running costs for both ISPMC offices. Eligible costs include:

- Office rent
- Office furniture (for ISPMC's offices)
- Office equipment (i.e., computers, printers, air conditioners, etc. for ISPMC's offices)
- Consumables (i.e., electricity, printer maintenance, office stationery for ISPMC's offices)
- Licenses for specialized software (i.e., AutoCAD, Civil3D, GIS, etc).[56]

(ii) **Workshops, trainings and seminars**

- Three national workshops (one per annum) with up to 150 participants in a representative venue in Dhaka. If restrictions due to the COVID-19 pandemic prohibit a workshop with physical presence, a virtual workshop or partially attended workshop will be considered and the costs will be adjusted accordingly. Eligible costs include:
  a. Rental of the venue including special workshop features for example microphones, video-conferencing facilities, lighting, projector, recording, arrangements for breakout sessions;
  b. Refreshments and one hot meal (for participants and drivers);
  c. Preparation and printing of invitation and banner;
  d. Conference stationary, flyer with project information and background documents in suitable packaging;

[56] Only for software to be handed over to BWDB after project completion. Provision will be up to 2 years' worth of license after project completion.

e. A suitable honorarium and travel costs, if applicable, for invited guests.

- Twelve trainings provided by ISPMC experts in Dhaka for up to 15 professionals from BWDB and/or DDM, conducted in the BWDB conference room or another suitable BWDB venue. Eligible costs include:
  a. Videoconferencing and recording;
  b. Preparation and printing of invitation;
  c. Training material and background documents as hand-outs;
  d. Software licenses for example procurement, accounting, GIS or AutoCAD packages on which participants of the training will be trained;
  e. Training stationary; and
  f. Refreshments and one meal (packet lunch type).
- Round table discussion for BWDB/DDM upper-level management, including MoWR and/or MoDM participants with up to 20 invited participants in a representative venue in Dhaka. If the COVID-19 pandemic restrictions prohibit a meeting with physical presence, this would be conducted as a virtual or partially attended meeting instead. Costs will be adjusted accordingly. Eligible costs include:
  a. Rental of the venue including special features (ie microphones, video-conferencing facilities, projector);
  b. Refreshments and one hot meal (for participants and drivers);
  c. Preparation and printing of invitation;
  d. Training material and background documents as hand-outs; and
  e. Training stationary.
- 15 field level seminars for local stakeholders (including contractors) with participation of the SMOs. Examples are environmental and resettlement training to contractors, SMOs and selected local representatives, and stakeholder consultations prior to or during construction. Eligible costs include:
  a. Rental cost for local venue, including projector, microphone arrangements etc.
  b. Refreshments for participants; and
  c. Government honorarium/per-diem for the BWDB/DDM participants.

(iii) **International and national conferences for institutional capacity strengthening**

- Three international conferences for authors of research papers (co-authored by BWDB/DDM and ISPMC). Eligible costs include:
  a. Conference fees for all participants (including up to two authors each of BWDB/DDM and ISPMC), including for conference proceedings;
  b. Costs for other relevant background documents (technical publications) available at the conference;
  c. Travel costs for the BWDB/DDM co-authors, including visas fees, flights and daily allowances as per government rule (to be used for accommodation and meals);
  d. Travel costs to points of interest in the area, which can be visited as part of a group in conjunction with the conference, including conference tours. These costs include costs for travel arrangements (ie: by train or car rental, connecting flights, resource persons, entrance fees, relevant publications etc.)
- Three national conferences for authors of research papers (co-authored by BWDB/DDM and ISPMC). Eligible costs include:

a. Conference fees for all participants (including authors from BWDB/DDM up to five other members from BWDB/DDM, up to two members of the ISPMC), including for conference proceedings;
b. Costs for other relevant background documents (technical publications) available at the conference; and
c. Government honorarium/per-diem for the BWDB/DDM co-authors.

(iv) **Pool of additional experts, additional studies, research and data collection (for the Main Team)**[57] This budget will be flexibly used, as appropriate, depending on the locations and amount of field work required for the designs of the remaining works and the follow-on project including identified supporting research. If the costs for reasonable minimal surveys and investigations exceed the allocation of this provisional sum, contingencies may be used.

- Pool of additional experts. Eligible costs include:
  a. Fees, travel costs, accommodation for short-term experts to contribute specialist knowledge;
  b. Fees, travel costs, accommodation, local transport allowance for up to three international or national members of a Panel of Experts advising ADB and the BWDB on strategic planning, institutional, and/or implementation issues of Project 2.

Pool of additional international and national Experts (unallocated, e.g. fisheries/wetland specialist, CFD modelling specialist, geotextile specialist, road engineer, member/s for the panel of experts)	
Minimum qualifications and experience required	- Each expert has a relevant bachelor, or preferably post-graduate degree in their field and a minimum number of years of relevant experience in the specialized tasks. - Specialized inputs could become necessary for example with respect to environment, modelling, geotextile, roads.
Tasks and responsibilities	- To be defined during the implementation.

- Additional studies and research. Eligible costs include:
  a. Cost for third-party studies/research to support specific aspects of Project 2 or the follow-on project design (ie: specialized floodplain or wetland biodiversity aspects, technical issues like seismic loading, or water management issues pertaining to distributary flows);
  b. Cost for additional studies/research carried out through the ISPMC, for example on river and/or floodplain fisheries, environmental management issues, building with nature technologies etc, including cost for locally retained specialists and support staff as well as travel and field allowances, and incidental cost for equipment and materials used.
- Data collection. Eligible costs include:
  a. Topographic and bathymetric surveys of floodplain and river reaches, including;
     i. Topographic surveys along the alignment of proposed new embankment lines consisting of either cross-section surveys or drone flights to establish the base digital terrain model;

[57] To be paid on a per survey/study/research basis, with specific outputs per call-out.

ii. Bathymetric surveys of tributaries and distributaries within the influence zone of proposed works, consisting of single-beam echosounder surveys with between 100 and 1000 m line spacing;
iii. Topographic and bathymetric surveys for implementation level designs of riverbank protection and river training works, consisting of single-beam echosounder and RTK GPS or total station surveys with 100 m line spacing covering a width of 200 m in the river and 100 m on the floodplain.

b. Geotechnical investigations, including;
   i. Suitably spaced boreholes along proposed flood embankment alignments and riverbank protection works reaching between 8 and 40 m deep, including SPT and/or CPT;
   ii. Laboratory analysis of soil samples for parameters relevant to feasibility level designs, e.g. sieve analysis, Proctor test, Atterberg limits, shear test.

c. Socioeconomic field work including;
   i. Rapid rural appraisals during site selection;
   ii. Focus group discussion during feasibility study;
   iii. Public meetings with local stakeholders to present project goals and fulfill all consultation requirements of ADB's SPS 2009.

d. Environmental field work and background data, including;
   i. Sampling of relevant environmental parameters (water quality, soil characteristics including harmful elements), including equipment cost;
   ii. Fisheries support study on open water and pond fisheries;
   iii. Fauna including bird and mammal data;
   iv. Flora and other relevant data of the floodplain and/or char characteristics.

e. Resettlement field survey including;
   i. Stakeholder consultation meetings;
   ii. Census survey including photographs of affected persons and inventory of loss, organized in a suitable database;
   iii. Video survey (standard or through drone).
   iv. Collection of administrative (mouza) maps for the preparation of land acquisition plans.

- Team of divers (minimum 2 divers and one helper) with the following qualification / responsibilities:

Minimum qualifications and experience required	- Valid certified degree in professional diving from a widely recognized international institution. - Minimum 10 years of relevant professional experience. - Minimum 5 years of implementing and/or supervising underwater works. - Preference will be given for experience with works the main rivers of Bangladesh or major rivers of similar nature, and implementation of externally funded projects.
Tasks and responsibilities	- Conduct regular diving inspection following all safety precautions.

	- Document the underwater work quality systematically and submit the documents to SMOs and Site Engineers. - Conduct quality control dives with other divers from outside or the team.

(v) **Pool of additional experts, additional studies, research and data collection (for the Knowledge-base Team)**[58] This budget will be flexibly used, as appropriate, depending on the locations and amount of field work required for matters of wider interest including the design of the follow-on project. If the costs for reasonable knowledge-base activities exceed the allocation of this provisional sum, contingencies might be used.

- Pool of additional experts. Eligible costs include:
  a. Fees, travel costs, accommodation for short-term experts to contribute specialized knowledge.

Pool of additional international and national Experts (unallocated, e.g. floodplain wetland specialist, agricultural/irrigation specialist)	
Minimum qualifications and experience required	- Each expert has a relevant bachelor, or preferably post-graduate degree in their field and a minimum number of years of relevant experience in the specialized tasks. - Specialized inputs could become necessary for example with respect to wetland, or agriculture, irrigation.
Tasks and responsibilities	- To be defined during the implementation.

- Additional studies and research. Eligible costs include:
  a. Cost for third-party studies/research to support specific knowledge-base aspects, for example related to pilot works, sediment or water discharge measurements, morphological processes, floodplain and char sedimentation, physical or hydraulic model tests etc.;
  b. Costs for additional studies/research carried out by the ISPMC, for example on river and/or floodplain morphology, performance of technologies (including building with nature) etc., including cost for locally retained specialists and support staff as well as travel and field allowances, and incidental cost for equipment and materials used.
- Data collection. Eligible costs include all aspects (surveyors, field allowances for surveyors, equipment and material, data analysis etc) for example for:
  a. Topographic and bathymetric surveys of floodplain and river reaches at suitable scales;
  b. Historic developments and conditions of assets (including embankments and riverbank protection);
  c. Land-use data;
  d. Sediment or flow data;
  e. Geotechnical data;
  f. Socioeconomic data; and
  g. Environmental data.

[58] To be paid on a per survey/study/research basis, with specific outputs per call-out.

(vi) **Data from Government Agencies including BWDB.** This budget covers the acquisition of data for Project 2 additional design works, the preparation of the follow-on project, and the preparation of the facility completion report. BWDB will facilitate the acquisition and request of data and information from relevant government agencies to enable the ISPMC to prepare the follow-on project in a timely manner. BWDB will provide feedback within two weeks after receipt of the written requests of the ISPMC Team Leader. Data will be used by the ISPMC team solely for Project 2. The provisional sum will be used for example for the following data:

- Data from BWDB: a nominal fee will be required to purchase the latest hydro-meteorological data not older than five years,
- Mouza maps for land acquisition and resettlement purposes,
- meteorological data (wind speed, rainfall etc.),
- flood damage data,
- environmental data (pollution data, water and soil quality data, inventories of flora and fauna etc.),
- agricultural information (cropping patterns, area yields, prices for farm products processed or unprocessed etc.),
- socio-economic data (household income, poverty and gender related etc.),
- multi-modal transport data (vehicle counts, launch passengers etc.).

(vii) Land transport, vehicle hire and diving investigations

- Cars including car leases and rentals, drivers, and fuel for Main and Knowledge-base Teams.

I. Personnel, and Facilities, Data, and Local Services, to be provided by BWDB

36. BWDB will make the following available, free of charge, to the ISPMC during the entire implementation period of Project 2:

(i) Counterpart staff and facilities:

5 BWDB will provide two counterpart engineers on 75% of full-time basis (construction monitoring, regular reporting, feasibility study and processing) at BWDB Head Office to liaise closely daily with the ISPMC team and during documents and reports preparation.

6 It is expected that BWDB will review all draft deliverables and approve final versions submitted by the ISPMC team within two weeks following approval by the government's review committee.

(ii) The BWDB will provide all background data from studies conducted for the BWDB and relevant for remaining Project 2 designs (for example on dredging), the preparation of the follow-on project, and the preparation of the facility completion report in electronic or printed form free of charge. These data will typically cover the project areas along Jamuna, Ganges, and Padma and tributaries/distributaries of interest but specifically subprojects JRB-1 and -2, JLB-1 and -2, PLB-1 and -2, PRB-1 and -2). Data comprises for example::

5 Hydrological data including long-term water level and discharge data, along main rivers, tributaries, and distributaries older than 5 years.

6 Embankment damage data including embankment breach details (length, year, designs, repair cost etc.),

7 Data used for morphological analyses (satellite imagery, digitized banklines, GIS infrastructure data, including eroded infrastructure),
8 Geotechnical data for geotechnical investigations conducted by the BWDB,
9 Study reports pertaining to modelling, morphological analysis, conceptual designs etc.
10 River survey data conducted for BWDB-financed projects also including through third parties (including bathymetries, flow and sediment discharge measurements, water levels). This data is also required to update the survey database.
11 Project reports and documents relevant to river and distributary management in the larger FRERMIP area including project DPPs.
12 Design reports including topographic, bathymetric, geotechnical data and information, and Autocad drawings for existing works (embankments, riverbank protection, river training works) .
13 Historical topographic / infrastructure / river maps (digital format is preferred).
14 GIS data (topography, infrastructure, demographics, environmental parameters) established for BWDB-financed projects (also through third parties).
15 Historical O&M data on embankment and riverbank protection activities.
16 All historical erosion prediction information.
17 Relevant information and reports from other organizations, for example BIWTA, LGED, MoDM, RHD[59] etc. for planning and design purposes as well as economic feasibility considerations.
18 Clearance for drone flights for surveys and documentary purposes (resettlement planning)
19 Other required information as appropriate.

(iii) Local Services:

5 Assigned SMOs counterpart staff at all construction sites.
6 SMOs counterpart staff accompanying the ISPMC technical and non-technical field investigation teams.
7 Organization of local meetings with stakeholders, local organizations, and local government.

J. Proposal Evaluation

37. The consulting firm will be engaged through a single source selection modality with a full technical proposal. The consulting firm is expected to propose an approach, methodology and workplan that will enable all expected tasks of the scope of work to be timely accomplished within the implementation period of Project 2. BWDB and its financing partners (ADB and GoN) expect the firm to take full charge of the management of the ISPMC team and describe its management and quality assurance processes in the approach and methodology section of the technical proposal.

Terms of Reference

Implementing Non-Government Organization (INGO)

[59] Bangladesh Inland Water Transport Authority, Local Government Engineering Department, Ministry of Disaster Management, Roads and Highways Department

Community-based Flood Risk Management (CbFRM)

1. Background

The program entitled 'Flood and Riverbank Erosion Risk Management Investment Program (FRERMIP)' under Multi-tranche Financing Facility (MFF) agreement with the Asian Development Bank (ADB) was started in July 2014. The program is a follow-up program of the ADB assisted Jamuna-Meghna River Erosion Mitigation Project (JMREMP). The program aims to adapt its technologies in other similar geographical areas with necessary improvements. The broad objectives of the project are to (i) Improve livelihood of people in the project area, (ii) Enhance resilience to flood and riverbank erosion risks through improvement of infrastructure, strengthening of institutional capacity and update and expansion of the knowledge base, and (iii) Establish integrated non-structural and structural risk management measures at priority erosion sites and address their sustainability. The executing and implementing agency is Bangladesh Water Development Board (BWDB) under the Ministry of Water Resources of Government of Bangladesh. The first project under the MFF (FRERMIP Tranche-1 was started in July 2014 and is scheduled to be completed in March 2021.

This project is the Project 2 in the MFF. The project aims to expand the river stabilization efforts started under JMREMP and FRERMIP Project-1 and to complete flood protection infrastructure partially provided under Project-1. Main civil work items include (i) rehabilitation of flood embankments along major rivers, (ii) systematic construction of riverbank protection works along the main rivers to control ongoing erosion and to stabilize the overall water course of the river, (iii) closure of an actively eroding near-bank channel and (iv) construction of a flood barrier and offtake structure to a distributary.

The riverine vulnerable population affected by floods and land erosion (about 100,000) will be the direct beneficiaries. They will benefit through avoided loss of land and assets; protection and enhancement of agricultural and fishery production within the embankments; increased economic activity; increased security of population, livestock, and assets; and strengthening of local communities for sustainable risk management in the medium term. Secondary beneficiaries are the people beyond riverine lands. Most of the people are poor and work as daily wage laborers.

The phased investment of Project -1 of the MFF concentrated initially on critically eroding reaches and achieved a number of successes in implementation speed and innovative works piloted. The second project of this MFF investment, provides support for a more predictable river environment in addition to increasing the level of protection for the priority sites selected in Project -1. It provides the necessary flexibility to respond to the unpredictable natural behavior of the main rivers in Bangladesh. In addition, this flexible approach acknowledges the impossibility to foresee and plan distant future developments, as well as provides an element of "learning by doing" to implement technologies that were successful during Project -1 and recognizing the need for development of more innovative technologies on the way towards larger scale river stabilization in Bangladesh.

The Project 2 of FRERMIP is scheduled to be completed in June 2024 covering urgently needed structural and non-structural mitigation measures. The project will follow and expand the technologies, construction principles and planning approaches developed and successfully implemented under JMREMP and refined under FRERMIP Project -1. This includes:

(i) use of geobags for low-cost and sustainable underwater protection,

(ii) application of the adaptive approach for phased strengthening of the underwater works until the design scour is reached and the launched slope is covered with a multi-layered erosion-stable revetment,
(iii) adaptive planning of riverbank protection works to adjust to changing river conditions and to move from an emergency-based approach to a river stabilization approach,
(iv) piloting of dredging to "pre-launch" aprons on flat slopes in reaches with unconsolidated soil to provide additional safety against geotechnical failure, as successfully implemented at Sirajganj town protection and Padma bridge,
(v) piloting of "building with nature" approach to reduce an eroding channel to a manageable offtake to improve perennial flow into a distributary (Ghior Khal) while managing the sediment inflow, and recover char land, and
(vi) use of direct-placement technology for the construction of flood embankment sand cores as successfully implemented under Project -1, resulting in reduced cost and increased implementation speed.

The works under Project -2 are in line and part of the River Stabilization Plan for the Jamuna and the Bangladesh Delta Plan 2100. The works will substantially contribute to the stabilization of the about 60 km long lower Jamuna allowing future development of the adjacent areas.

Structural interventions planned under Project-2 include:
(i) 30 km of riverbank revetment,
(ii) 7.9 km of climate-resilient flood embankment construction,
(iii) 40 km strengthening/adaptation works to secure river protection constructed under Project -1 and previous projects, and maintenance of embankments implemented under Project 1 and other previous projects in the project area
(iv) one channel closure with "building with nature" approach,
(v) one offtake structure,
(vi) 6 km of precautionary and emergency works

Non-structural Works activities:
(i) Community based flood risk management activities will include:
   a. engaging an NGO,
   b. Formation of 160 Community-based Disaster Management Units (CDMUs) comprising some 2,400 Community Volunteers (CVs), with at least 35% of units led by women,
   c. training of CDMU volunteers,
   d. agreement/ adoption of community level flood warning,
   e. establishment of communications between the CDMUs and DDM staff, and
   f. institutionalization of CDMUs. It is anticipated that the CDMUs will share the same "office" facilities that are proposed for embankment WMOs, see below.
(ii) Community Capacity Enhancement for Participatory O&M will include:
   a. formation and registration of 10 Embankment WMOs for O&M with BWDB providing annual maintenance funding,
   b. construction of 7 O&M sheds, complete with facilities and equipment, and stockpiles,

c. piloting bio-engineering solutions to stabilize embankment slopes, both from waves and rainfall (river side) and just rainfall (land side), including use of vetiver grasses, and
d. training, support and monitoring. An NGO will be engaged for WMO establishment, registration, training and support. Ultimately, formation of embankment WMOs with a WMO shed for every 5 km of embankment is envisaged.

(iii) Livelihood support programs and courses will include:
a. Identification of Affected Persons (Aps) and suitable livelihood support activities and interest.
b. Establishment of 12 fish sanctuaries, and
c. Contracting of agencies/NGO who will implement livelihood trainings and support programs.

It is expected that during Project-2, about 2,000 APs will attend on-site 1-day trainings and about 800 APs will attend 2-5-day residential trainings in 14 community groups. Women participation is encouraged and will be kept at a minimum of 50%.

Bangladesh Water Development Board (BWDB) is the Executing Agency (EA) of FRERMIP, under which non-structural project sub-component entitled 'Community-based Flood Risk Management (CbFRM)' will be separately implemented by the Department of Disaster Management (DDM) as Implementing Agency (IA) of the government mandated to work for disaster management in Bangladesh. CbFRM has been designed to ensure and strengthen local community participation in creating awareness and developing capacity of the community to reduce the river flood and flood-induced river erosion risks reinforced by structural mitigation sub-component implemented by BWDB, as well as to accelerate community participation in routine O&M of the flood and erosion mitigation infrastructures built under the above sub-component. In this context a MoU between DDM and BWDB has been signed delineating the collaborative efforts of the two specialized government departments to successfully implement a specific non-structural mitigation project sub-component of FRERMIP.

2. Objective

In order to implement CbFRM, the implementing agency, DDM, will engage an experienced Implementing Non-Government Organization (INGO) with an excellent track record in Flood Risk Management (FRM) capacity development at the community level in similar geographic conditions, preferably with organizations like BWDB. The recruited INGO will be known as INGO-CbFRM. The overall objective of recruiting the INGO-CbFRM is to assist the Project Management Office (PMO) to successfully deliver the outputs of the sub-component through consolidating and enhancing awareness and developing capacity of the vulnerable communities in the project areas of the BAN: Flood and River Erosion Risk Management Investment Program- Project 2 (FRERMIP P2), primarily focusing on community resilience to flood and erosion risks via risk assessment, preparedness and response.

Under the above broad framework of community flood and erosion risk management, INGO-CbFRM should also help implement another project sub-component of FRERMIP on promoting community participation in routine O&M of the newly built/strengthened flood and erosion protection and other allied flood control infrastructures (sluice gates etc.), under the structural mitigation sub-component, being an integral part of the community disaster risk reduction strategies. BWDB with the support of INGO-FRM will carry out the capacity development training

of the grassroots community people by own and/or other resource persons to ensure their effective participation in routine O&M on a sustainable basis by involving the community groups (discussed below) formed under CbFRM in the vicinity of flood and erosion protection and other allied flood control infrastructures (sluice gates etc.).

Scope of Services

Broadly, scope of services of INGO-CbFRM includes designing and implementing CbFRM along and in the vicinity of the three high priority sub-project areas, based on constructive consultations at the institutional and local community levels and expert inputs of the key international and local consultants.

Tasks

Specifically, the selected INGO-CbFRM shall:

(i) report and keep contact with the PMO, as and when required;
(ii) liaise and interact with the relevant government departments/line agencies (emphasizing EA and IA) both at the central and, notably, local levels, local elected bodies (Union and Upazilla Parishads) as well as non-government organizations (NGOs), as necessary;
(iii) report to Upazila Disaster Management Committees (UzDMCs) under DDM;
(iv) form Community Disaster Management Units (CDMUs) including 35% led by women, comprising the 'Community Volunteers (CVs)', to act as the focal point of CbFRM program and participatory routine O&M of the flood and erosion mitigation and other allied infrastructures in the long run;
(v) sensitize the CVs and, through them, communities including women members about the BWDB flood warning system and its implication to disaster management in the subproject areas; similar action may be initiated for bank erosion warnings, if such warnings are available;
(vi) prepare participatory flood maps with and without flood protection infrastructures;
(vii) exchange of ideas with the community members and selected CVs including women on possible non-structural measures to mitigate flood and erosion effects, and reaching to a consensus on measures that would form part of an action plan, covering pre- and post-flood periods, to be prepared by the respective communities;
(viii) adjust action plans in light of the experience gained during the flood events;
(ix) develop a suitable mechanism to provide income opportunities for the CVs, such as, social forestry inside the embankment on the available lands plus the land reclaimed on the riverside flood plain area, which is declared 'Khash' (government land);
(x) build linkage of the same community groups organized under the project and, if possible, also include others most vulnerable and extreme poor including women (also comprising the target population) with another non-structural sub-component on livelihoods development (Income and Livelihood Restoration Program) in Tranche-1 to expedite sustainable impacts of CbFRM; and
(xi) initiate actions for institutionalizing CBFRM at the community (Union level) and local administration levels (minimum Upazila level) to sustain CbFRM outputs in the long-run, etc.

Deliverables

The outputs of the assignment by INGO-FRM will be as follows:

(i) An Inception Report, which has to be submitted within one month of the commencement of the assignment. This report shall summarize the Consultants' initial findings and will present a first assessment of available data. The Inception Report shall also contain:
   (a) Details regarding the methodology to be applied by the INGO during the execution of the project; and
   (b) An outline of activities expected to be completed until the date of the presentation of the subsequent reports.

(ii) A Monthly Progress Report that has to be submitted from the second month of the commencement of assignment and so on up to the final month, outlining the progress of works, problems identified and detailed plan of next month.

(iii) A Mid-Term Report shall also be prepared for the project. This report should summarize up to date progress, present the results of the strategic planning process, identify any potential problems or issues and provide details of the work to be completed over the remaining project period.

(iv) A Final Report has to be submitted in accordance with an agreed program with the PMU and the report shall be a complete document on the implementation of the total CbFRM.

The standard format, frequency and contents of the reports should be decided in consultation with the Project Manager, CbFRM, DDM, Dhaka. The reports should be submitted to the Project Manager, CbFRM, DDM, Dhaka, with a copy to Project Director, FRERMIP, BWDB, Dhaka.

Implementing Non-Government Organization (INGO) for Resettlement Plan (RP) Implementation and Monitoring
Flood and Riverbank Erosion Risk Management Investment Program – Project 2

1. Background

The multitranche financing facility (MFF) to the People's Republic of Bangladesh for the Flood and Riverbank Erosion Risk Management Investment Program (the investment program) was approved in 2014 to improve the livelihoods in the project area along the Jamuna, Padma, and Ganges rivers in Bangladesh.[60] It will reduce flood and riverbank erosion risks in priority erosion reaches through structural and nonstructural interventions, and institutional and knowledge-based strengthening. It extends successful riverbank protection technologies of the Jamuna–Meghna River Erosion Mitigation Project (JMREMP) to other areas, with necessary improvements.[61]

The framework financing agreement (FFA) for the MFF was signed between ADB and Bangladesh on 12 May 2014. The investment program implements three subprojects (Jamuna right bank-1 [JRB-1], Jamuna left bank-2 [JLB-2], and Padma left bank-1 [PLB-1]) comprising flood embankments protecting critical riparian productive areas in central Bangladesh and capacity building initiatives.[62] The investment program's executing agency is the Bangladesh Water Development Board (BWDB) under the Ministry of Water Resources. The Department of Disaster Management (DDM) under the Ministry of Disaster Management and Relief is the implementing agency for community-based flood risk management activities.

On 7 March 2021, ADB received the government's periodic financing request for Project 2, totaling $210.0 million, to continue implementing the investment program. Project 2 envisages acquisition of about 265 hectares of land, effecting an estimated displacement of about 2,850 households and some small business enterprises. In addition to that, the amount of land also includes agricultural land to be lost by some people requiring resettlement.[63] As per the Government of Bangladesh policy on land acquisition and ADB's Safeguard Policy Statement (SPS) requirements on involuntary resettlement, payment of compensation and resettlement mechanisms will be applied for restoration of the social and economic position of the project affected persons (APs).

2. Objectives of the Assignment

BWDB will engage an experienced resettlement plan preparation and implementing non-governmental organization (RP-INGO) to assist in the update, finalization, and implementation of the resettlement plans (RP) in the project areas. Cost of resettlement program will be borne by

---

[60] ADB. 2014. *Report and Recommendation of the President to the Board of Directors: Proposed Multitranche Financing Facility to the People's Republic of Bangladesh: Flood and Riverbank Erosion Risk Management Investment Program.* Manila.

[61] ADB. 2002. *Report and Recommendation of the President to the Board of Directors: Proposed Loan to Bangladesh for the Jamuna–Meghna River Erosion Mitigation Project*. Manila (Loan 1941-BAN, closed on 30 June 2011); and Independent Evaluation Department. 2020. Draft *Project Performance Evaluation Report for Jamuna-Meghna River Erosion Mitigation Project in Bangladesh (Loan 1941)*. Manila: ADB.

[62] Built in 1950–1960, the flood embankments in these areas are in the most critical reaches of the river system, and at risk of being breached by river erosion and overtopped during extreme flood events.

[63] However, during performance of the assignment under implementation the aforementioned number may vary within an estimated range of ±25% (plus/minus twenty-five percent), depending on the field condition and practical necessity. The Project authority will determine the actual allocable man-months for the NGO for performance of the Contract, corresponding to the actual number of displacements and/or resettlement activities required. Payment will be made to the NGO on performance of the allocated man-months.

ADB and Government of Bangladesh. The RP-INGO, to be hired, will be responsible to the Project Director, FRERMIP for performance of tasks. The RP-INGO will implement the RPs as per ADB SPS, ensure stakeholders participation, assist or facilitate grievance redress claims, and provide support in compensating the APs as per RPs. The list of subprojects with RPs are in Table 1 below:

Table 1 List of Subprojects

RP. No.	Resettlement Plan	Components
1	Shahjadpur Embankment under JRB-1	· 7.9 km of Shahjadpur embankment realignment along the Hurasagar and Korotoya rivers · Two vent regulators with fish passes at the chainage of km 18.150 and km 24.200
2	Riverbank Protection work at Enayetpur under JRB-1	· 7 km new works for the Enayetpur – Kaijuri reach
3	Riverbank Protection work at Benotia under JRB-1	· 3.5 km new works at Benotia
4	Riverbank protection works site at Harirampur extension under PLB-1	· 4 km of riverbank protection works extending the works at Harirampur
5	Riverbank protection works site at Upstream Chauhali under JLB-2	· 15.5 km riverbank protection work upstream of Chauhali · Channel closure at Salimabad · one off-take structure in connection with riverbank protection to manage sediment inflow to the Ghior Khal

3. Scope of Services, Tasks (Components) and Expected Deliverables

The RP-INGO will assist BWDB in preparing, updating, finalizing, and implementing the RPs, working closely with (i) BWDB staff, department/line agencies, local government units, and local field offices responsible for the impacted area, (ii) grievance redress mechanism (GRM) team, and (iii) APs.

The RP-INGO will be support BWDB in the following activities: (i) identifying and verifying of APs and assets; (ii) establishing AP MIS database; (iii) preparing and distributing ID cards; (iv) monitoring and progress reporting; (v) updating and finalizing RP; (vi) supporting GRM process; (vii) carrying out meaningful consultation and disseminating information to APs; (viii) preparing and implementing household level micro plans, which includes household profile and contact details, inventory of losses, asset valuation, compensation calculation and payment arrangements, livelihood restoration, household relocation requirements, livelihood training plan; (ix) supporting BWDB in payment of resettlement benefits to APs; (x) assisting APs during relocation as well as with post-relocation and livelihood restoration activities; and (xi) other similar tasks related to implementing the RP.

4. RP Implementation Schedule

Project Director, FRERMIP will allocate manpower and provide time schedule as per the requirement of the Project.

5. **Major Activities to be performed by RP-INGO** The RP-INGO will support BWDB in the following tasks:

A. RP Preparation and Update

(i) Soon after the engineering design is finalized, the selected RP-INGO will conduct baseline socio-economic survey and video-filming of the additional households to finalize and/or update the RP. The RP-INGO will assist (for example, in issuance and delivery of notice, inventory of assets to be affected, etc.) the deputy commissioners (DCs) in the land acquisition process. The RP-INGO will compare the field level data with the established database and check the available video films for any discrepancies.

(ii) Submission of land acquisition (LA) Plans to DCs: The RP-INGO will assist BWDB in the preparation of land acquisition plan (LAP), when required.

(iii) Approval of LA Plan: In consultation with BWDB, RP-INGO will maintain liaison with the DC/Ministry of Land during the process of LA approval.

(iv) Joint Verification and Valuation of Property: The implementing RP-INGO will participate in the assessment of the affected properties and identification of their owners/users by the Joint Verification Team (JVT). Both JVT and the person concerned should sign verification records for each affected person. Disputes will also be recorded. The RP-INGO will compile and process the data with regard to valuation of property by the Property Valuation Advisory Team (PVAT) for determination of replacement market value of property acquired.

(v) Issuance of Notice: In consultation with BWDB, RP-INGO will maintain liaison with DC for issuance of notice in accordance with ARIPA 2017.

(vi) Information Campaign and RP disclosure: The RP-INGO will carry out consultation regarding policies and options and collection of legal documents required to claim compensation. Property owners are advised/helped to gather all required documents. The affected people will be made aware of the Grievance Redress Committee (GRC) procedures for disputes over claims.

(vii) Revision of costs estimate and budget: The RP-INGO will assist BWDB in revising budget in view of the JVT findings and PVAT recommendations, which will be approved by BWDB.

(viii) Preparation of Individual entitlements: RP-INGO will assist BWDB to prepare individual entitlement taking into account the choices of options made by those not covered by the law.

(ix) Issuance of ID Cards to identified APs: APs having no legal disputes involving land and other assets will be identified by the RP-INGO (following the DC list) and ID cards will be issued to them.

(x) Assessment and valuation of the acquired properties: The RP-INGO with local BWDB official will maintain liaison with the DC staff to assess the quantity and value of the properties in accordance with the acquisition law.

(xi) Disbursement of Compensation: Payment of compensation to non-titled owners will be paid by BWDB assisted by RP-INGO.

(xii) Transitional support to APs.

(xiii) Issuance of ID Cards to legally identified owners: The RP-INGO will assist BWDB to issue ID cards to those whose legal ownership are established with DCs and have no further encumbrances/disputes.

(xiv) Disbursement of cash compensation under law (CCL): When DC starts payment of CCL, the RP-INGO will assist legal owners to bring in all required documents at this stage to receive the payment.

(xv) Finalizing Additional Individual Entitlements for those covered by law: BWDB with assistance from RP-INGO will determine additional payment, if any, over the CCL

amounts. Additional compensation over CCL is finalized taking into account options made by the APs.

(xvi) Disbursement of additional grants (difference between replacement market price and CCL, if applicable): BWDB will make payment of grants to the Entitled Persons (EPs) with assistance from the implementing RP-INGO.

(xvii) Land hand-over to BWDB: DC will pay CCL and the land will be handed over to BWDB. RP-INGO will assist BWDB in this respect.

(xviii) Eviction Notice: Given to individual affected persons at completion of payment of all compensation/entitlement from DC and BWDB, RP-INGO & BWDB will keep records of issuance date of eviction notice signed by both BWDB and evictees.

(xix) Land hand-over to contractors: The RP-INGO will assist BWDB to hand over land to contractors. Contractors will move into sites the day following expiration of the eviction notice.

B. Information Dissemination and Feedback

(i) Ensure dissemination of the Project and resettlement policy related information to the Project-affected persons and others (community groups, local administration, etc.) who might be considered instrumental in the effective and transparent implementation of the RP. Even though the RP recommends some dissemination mechanisms, the RP-INGO can suggest innovations in the course of its implementation and would gather information and disseminate it upward to the Project authority. If necessary, the RP-INGO, in close coordination with PMO, will prepare a small booklet to be distributed to the affected people to facilitate information dissemination on RP, including in COVID-19 lockdowns.

(ii) During implementation of the Project, extensive consultation and collaboration with key stakeholders on a continued basis is planned. The selected RP-INGO will be required to assist PMO in organizing such consultation programs and facilitate consultation, with consideration of COVID-19 aware methodologies, with local representatives like ward members/commissioners, participants group etc.

C. Assisting APs in Resettlement Process

(i) The main purpose is to make the APs aware of the acquisition process, assist them to claim the compensation under the law (CUL) to be paid by the DCs as well as those that might be paid by BWDB. Some of the major activities are: (a) ensure receipt of the acquisition notices under ARIPA 2017 by the individual APs and explaining to them the contents and implication of these Notices; (b) inform the APs about the legal documents required for claiming compensation from DCs and check the current status of legal documents, in order to minimize disputes over ownership, use rights and time to make the claims. This includes (1) checking with the APs to make sure that they have all the required documents to claim compensation from DCs; (2) whether or not the ownership records are up-to-date in cases of purchase/sale and inheritance of the property being acquired and advising and assisting the APs to procure them, and (3) whether or not there are usufruct rights of others on the properties under acquisition and informing the people with such rights about the compensation policies.

(ii) Inform the AP households, especially the vulnerable ones, about the “compensation in cash and/or kind” option stipulated in the RP and ensure fulfillment of the choices made by them.

(iii) Assist the APs to receiving any entitlement such as reimbursement of stamp duties related to land purchases.

(iv) Assist the APs not covered by the law but covered under ADB SPS, such as tenant and wage laborers, owners of business on public lands, squatters and such others to get their entitlements from BWDB.
(v) Counseling and helping the households, whose previous incomes have been seriously affected, to find alternative source of income.
(vi) As required by the RP the RP-INGO will participate in the joint physical verification of the affected properties. In this process, the RP-INGO will document all disputes that might be faced and the problem cases that might need special attention by BWDB.
(vii) Together with BWDB, the RP-INGO will pursue the DC and other concerned offices to arrange for on site payment of compensation and organize the APs in groups and accompany them to the concerned offices or the Project sites if DC agrees on site payment.
(viii) Facilitate transitional support to APs through market land assessment, identification of land, linking with available government housing schemes, credit facilities from financial institutions, raising individual plots with sand dredging, a common technique in Bangladesh for re-claiming, low-lying flooded lands, and other activities.

D. Grievances redress procedure

The selected RP-INGO will play vital role in the grievances redress process. The most important preconditions for doing this with maximum effectiveness are that the RP-INGO operatives will build personal rapport and confidence with the APs and will be fully aware of all socioeconomic problems/issues arising from the acquisition. Among other things, the RP-INGO will:

(i) Ensure that the APs are fully aware of the grievance redress procedure and the process of bringing their complaints to the grievance redress committees (GRCs).
(ii) Assist the APs in any usual manner (e.g., preparing applications, accompanying them to the hearing and explaining the grievance to the GRCs and the like) to bring the complaints to the committee.
(iii) Impartially investigate the veracity of the complaints and try to settle them amicably, fairly and transparently before they go to the redress committee or the courts of law.
(iv) For more focused work in this area, the RP-INGO will prepare a list of problem cases (based on ownership and other disputes detected while checking the status of legal documents, information from the APs themselves and other sources) which would be updated as and when necessary, while RP implementation progresses. In doing so, the RP-INGO will pay special attention to the problems and needs of the vulnerable APs.
(v) Whenever RP-INGO receives a complaint from affected people, the RP-INGO has to record and immediately report to the PMO. The report should include action taken or will be taken to resolve the problem. If the grievance is not related with land acquisition or RP, the RP-INGO should highlight the report to PMO to have PMO staff to attend the grievance.

E. Information Management

(i) The selected RP-INGO will collect and computerize all data related to the pre-acquisition condition of the AP households and the nature and magnitude of all categories of losses as well as the compensation thereof to be determined by DCs and the Joint Verification Team (JVT) to be organized by the PMO of the

Project/BWDB. All essential information will have to be generated by using one or more menu-driven MIS.

(ii) Maintain computerized baseline socioeconomic databases and collect supplemental information as and when necessary and update them, during the course of implementation.

(iii) Collect and computerize data on individual losses and the compensation thereof, as determined by DC and JVT for all legally and socially recognized APs.

(iv) Collect and computerize all information on market survey and assessment of property and their owners by the PVAT (Property Valuation Advisory Team), process data and compile reports for the PVAT recommending replacement market price of land and other property.

(v) Collect and computerize all information related to different types of losses incurred due to the payment and additional protection measures and update the APs files.

(vi) Prepare 'entitlement card' for the individual APs as per their types of losses and the amount of compensation due for each type of loss from legal title and the amount of compensation if any, to be paid by BWDB as well as other non-monetary entitlements.

(vii) Prepare and issue Identification Cards for each AP (head of the household-in case of those not covered by the law), containing his/her photograph (to be taken by the RP-INGO itself) and other vital information.

(viii) Collect and maintain details of the issues/ disputes causing delay in the disbursement/receipt of compensation and the persons involved in them, including the cases brought to the courts of law.

(ix) Document information on the cases, with reasons, brought to and resolved by the GRC, with decisions going in favor of or against the complaints. Collect and maintain relocation information on the homestead losers by categories of AP households such as legal owners, squatters and others.

(x) Maintain information on purchase of replacement home lot and other lands as well as the stamp duties reimbursed by the BWDB.

(xi) Collect and maintain information on physical, social and institutional infrastructure and amenities (latrines, tube wells, etc) if any that might be provided by BWDB.

F. Progress Reports

The RP requires that all APs are compensated prior to displacement. Only after payment of compensation may construction work begins. The selected RP-INGO will provide BWDB monthly report on the progress in RP implementation, including any issue that might be hindering progress, separately for each civil works contract. The report will be brief consisting of both quantitative and qualitative information on:

(i) The acquisition process has to be carried out by the DCs. The RP-INGO should reflect in its report status of issuance of the major notices (e.g. 3,6,7) under the acquisition law maintain a land register with valuation of the affected properties, placement of funds with DCs by BWDB, etc.

(ii) Total number of APs identified by DCs for CUL and the cumulative progress made in disbursement of CUL by loss categories.

(iii) Total number of APs (recognized by DCs) also eligible for additional payment from BWDB and cumulative progress made in payment by loss and entitlement categories.

(iv) Number of vulnerable affected households and estimates of the number of such and other households choosing 'compensation in kind' under the 'cash-or-kind'

option specifics of such choices and the progress made in implementing the related policies.

(v) Total number of the APs, who are not covered by the law but covered under ADB SPS, identified for compensation/entitlement from BWDB and cumulative progress made in disbursement by loss and entitlement categories.

(vi) Number of cases received by the Grievance Redress Committee indicating the types of grievance made in favor of or against the complainants.

(vii) Total number of home lot losers needing relocation and relocation provisions are stipulated in the RP.

(viii) Any other issues that is relevant to implementing the policies stipulated in the RP.

(ix) The selected RP-INGO will design tabular and other formats appropriate for reporting on the above information. To the extent possible the tables will have to be pre-programmed in the menu-driven MIS and the quantitative reports will have to be generated directly.

G. Accounts and Records

(i) The RP-INGO shall keep accurate and systematic accounts and records in respect of the services in such form and detail as are customary in its profession and sufficient to establish accurately that the remuneration and reimbursable out-of-pocket expenses have been duly incurred.

(ii) The RP-INGO shall permit duly authorized representatives of the Client, to inspect and make an audit of all such documents, accounts and records in connection with payments made in accordance with this contract.

H. Computer Programs and Equipment

(i) All reports, documents, correspondence, draft publications, maps, drawings, notes, specifications, statistics, work product in any form and, technical data compiled or prepared by the RP-INGO and communicated to the Client in performing the services (in electronic from or otherwise and including computer-disks comprising data) shall be the sole and exclusive property of the Client, and may be made available to the general public at its sole discretion. The RP-INGO may take copies of such documents and data for purpose of use related to the services under terms and conditions acceptable to the client but shall not use the same for any purpose unrelated to the services without the prior written approval of the client.

(ii) All computer programs developed by the RP-INGO under this contract shall be the sole and exclusive property of the client; provided, however, that the RP-INGO may use such programs for their own use with prior written approval of the client.

(iii) Equipment, and materials furnished to the RP-INGO by the Client, or purchased by the RP-INGO wholly or partly with funds supplied or reimbursed by the Client hereunder, shall be the property of the Client. Equipment or materials brought into by the RP-INGO and the personnel and used either for the Project or personal use shall remain the property of the RP-INGO or the personnel concerned, as applicable.

I. Monitoring and Evaluation

The RP-INGO will take care and the supervision consultant will ensure the following issues in implementation of the RPs:

(i) Establishment of Cut-off date. For legal titleholders, the date of publication of the notice by the Deputy Commissioner under Section 4 of ARIPA Act, 2017 will be considered as the cut-off date. While for affected non-titleholders, the date of the updated Detail Measurement Survey (DMS) will be the cut-off-date. Any persons moving into the project area after the cut-off date will not be entitled for compensation or assistance under the project.

(ii) Quantification and valuation of affected property. The RP-INGO will provide all technical support to the Property Valuation Advisory Team (PVAT) to assess the market price through an independent agency and recommend the RC of assets to the Project Director of the PMO for approval. Quantification of loss through joint verification. The Requiring Body (RB) and the Acquiring Body (AB) should consult the Socio-economic Survey data during Joint Verification. The Joint Verification forms should be filled up in the field and signed copies to be given to the parties to check manipulation.

(iii) Valuation of affected property. For Valuation of affected property, formal and informal sources will be explored using the RP-INGO services under supervision of PVAT (a legal body with representatives from acquiring body (AB), requiring body (RB), RP-INGO and local Govt.) to ensure market price. To expedite the work, District administration can make use of this information in calculating CCL for affected property.

(iv) Comparison of data: The RP-INGO should compare SES data with the award data and the JV data. Discrepancy in between databases should be resolved through GRC (a legal body with representatives from RB, the RP-INGO and local Govt.).

(v) Payment of Invoice. Bill for the RP-INGO services will be paid as per the manpower and logistics utilized and progress achieved during the preceding month.

(vi) Identification of Entitled Persons (EPs). ID cards to the EPs will be issued with due certification from the U/P members or Ward Commissioners. BWDB officer involved in implementation of RP will recheck if needed. Authenticity of legal documents to be ascertained and their availability to the RP-INGO has to be ensured by the AB and RB.

J. Resettlement of Vulnerable APs. Special program for vulnerable people will be finalized after detailed consultation with the local people and the BWDB so that it suits with the stakeholders – with special consideration of COVID-19 impacts on livelihoods, access to services and health.

K. Measuring RP Implementation Progress

(i) For monitoring progress of RP-INGO work in RP implementation, an appropriate monitoring format should be prepared with score/weight against each activity and sub-activity. A user-friendly menu driven software should be used to generate progress reports for monitoring the progress instantly. The software will be simultaneously operated by the PMO, the IRP-INGO and the Construction Supervision Consultant (CSC) so that all the organizations are aware of the progress instantly.

(ii) Proper orientation to the BWDB staff is given so that they can supervise the RP-INGO activity appropriately from the very beginning and operate the menu driven MIS to remain updated about the progress and problem. CCL payment records should be collected from DC office regularly and be compared with the payment data of the RP-INGO so that the progress achieved, mistakes made, if any by the stakeholders in the process of RP implementation are checked and verified instantly. Before making payment of compensation, land schedule and census and

socio-economic survey data will be compared with the payable amount, to avoid mistake or fraud.

(iii) Criteria for evaluation: There are number of actions needed in collecting CCL and grants. The RP-INGO operatives will investigate the steps completed so far in collecting compensation for a particular plot. Data collected through focus group discussions/meetings in this connection will be processed in a computerized system to monitor the progress in CCL and grant collection by the APs. Performance evaluation of the RP-INGO operatives, especially the field staff will be judged by that progress. Production and application of RP implementation tools, payment of grants and resettlement of APs should be the basis for calculating RP-INGO performance.

(iv) The RP-INGO will develop monthly progress reporting format as per the requirement of the ADB and BWDB. Based on the quantitative reports generated through the above-mentioned computerized system monthly progress report by RP-INGO will be prepared and submitted to the PMO.

(v) Co-ordination: The RP-INGO will sit with the BWDB on a regular basis, where discussion on progress and constraints of the previous month will be held. Actions to be taken and the key actors for the tasks concerned will be identified as tasks assigned from respective agencies. In case of any items are not covered by the RP, the coordination meeting should come up with recommendations, which should be approved and implemented through executive order of the BWDB.

6. Team Composition & Qualification Requirements for the Key Experts

The RP-INGO will assist in preparing and implementing the RPs in a timely manner, and to ensure that APs will not be worse off due to the project and will be compensated for their losses. APs will have their livelihoods improved, and at least restored following resettlement.

The RP-INGO must be able to present evidence of sufficient experienced and trained qualified manpower to be mobilized to this end. The man months and designation of the staff is stated in Table 2. The RP-INGO should show the duration of their services and limit as per requirement in consultation with the civil works contract. If settlement of legal issues on land acquisition requires longer time, the RP-INGO may have to demobilize for a period as per the request from the executing agency in writing.

Table 2: Staffing for RP Implementation

Sl. No.	Position	Nos. Unit	Estimated Nos. of Man Month
A. Key Experts			
1.	Team Leader (Resettlement Specialist)	1	24
2.	Deputy Team Leader (Resettlement Expert / Communications Officer)	1	18
3.	Land Acquisition Specialist	1	8
4.	Livelihood Coordinator	1	8
	Sub-total	**4**	**58**
B. Non-Key Experts			
1.	Computerized MIS Specialist	1	12
2.	Database manager	1	24
Sub-total		**2**	**36**

	Grand Total	**6**	**94**

Minimum Required Experience of Professional Staff

The professional staff to be proposed by Implementing RP-INGO should have the qualification and experience as shown in Table 3.

Table 3: Qualification of the Key Staff

Position	Academic Qualification	Minimum years of experience in similar position	i. Specific experience
Team Leader (Resettlement Specialist)	MSc/MSS/MA	8	Experience in planning and implementing resettlement program and in (i) leading and supervising multidisciplinary teams engaged in socioeconomic development activities; (ii) multidisciplinary action research/surveys; and thorough knowledge of (iii) Bangladesh land administration system and land acquisition laws; (iv) process and functionaries involved in land administration and acquisition; (v) report writing capability; and ability to demonstrate personal integrity and create a transparent and accountable work environment.
Deputy Team Leader (Resettlement Expert/Comm nunications Officer)	MSc./MSS/MA	5	Experience in (i) leading and supervising multidisciplinary teams engaged in socioeconomic development activities ; (ii) ability to conduct methods; and thorough knowledge of (iii) Bangladesh land administration system and land acquisition laws – specifically the property valuation process; (iv) the process and functionaries involved in land administration and acquisition; and (v) report writing capability;
Land Acquisition Specialist	MSS/MA/LLM/ MSc	6	Thorough knowledge about Bangladesh land administration system and land acquisition laws-specifically the properly valuation process; (i) the process and functionaries involved in land administration and acquisition; and extensive practical experience (ii) examining/identifying legal issues involved in land transaction, inheritance and other issues related to legality of ownership, (iii) working with mouza maps and (iv) advising on resolving legal issues.
Livelihood Coordinator	MSS/MA/ MSc	5	Thorough knowledge and/or experience in implementing rural development livelihood

Position	Academic Qualification	Minimum years of experience in similar position	i. Specific experience
			projects and knowledge of techniques and their applications in mobilizing community participation in development programs; experience and knowledge of livelihood training options in Bangladesh and familiarity with the government social programs; primary responsibility for ensuring that displaced households are able to restore and ideally improve their livelihoods following resettlement; and contribute to the planning and implementation of the livelihood component of the RP.
Computerized MIS Specialist	MSc. in Statistics/ Computer Science/ Mathematics	8	Working experience and knowledge of software, preferably relational, that are most commonly used in Bangladesh; demonstrated ability to design and implement user friendly menu-driven MIS (s) for monitoring progress and generate reports as and when necessary.
Database Manager	MSc. in Statistics/ Physics/ Mathematics/ Computer Science	8	Working experience and knowledge of relational database, design and development of database, data generation, management of data in most commonly used platform.

7. Reporting Requirements and Time Schedule for Deliverables

A. Reporting Requirements

(i) The selected RP-INGO appointed by BWDB for implementation of the RP will report to the Project Director, Project Management Office (PMO)-FRERMIP, BWDB, Dhaka. The selected RP-INGO shall submit the Inception Report within one month of the commencement and shall provide the Final Report within one month from the end of the Project. The monthly progress report will be submitted on or before 7th day of the following month. Each report shall set forth concise statement concerning the activities relevant to the jobs and will include:

a) A clear and complete account of work performed in each Project component;

b) Work planned for the next reporting period;

c) Status of funding and expenditure;

(ii) Identification of any problems encountered or anticipated that would affect the completion of the Project within the time and money constraints set forth in the agreement, together with recommended solution to such problems.

(iii) A mid-term report shall also be prepared for the Project by the RP-INGO. This report should summarize progress, present the results of the strategic planning process, identify any potential problems or issues and provide details of the work to be completed over the remaining Project period. The RP-INGO will be encouraged to produce working papers and technical papers throughout the implementation period after the Project starts.

B. Deliverables

The outputs of the consultancy will be as follows:

(i) **An Inception Report,** which must be submitted within one month of the commencement of the assignment. This report shall summarize the Consultants' initial findings and will present a first assessment of available data. The Inception Report shall also contain:

a) Details regarding the methodology to be applied by the Consultant during the execution of the project; and

b) An outline of activities expected to be completed until the date of the presentation of subsequent reports.

(ii) **A Monthly Progress Report** which has to be submitted from the second month of the commencement of assignment and so on up to the final month, outlining the progress of works outlining problem identification and detail plan of next month.

(iii) **A Final Report** which have to be submitted in accordance with an agreed program with the Project Management Office and the Report shall be a complete document regarding Implementation of Total Resettlement Plan.

(iv) **A Midterm Report** shall also be prepared for the Project by the RP-INGO. This report should summarize up to date progress, present the results of the strategic planning process, identify any potential problems or issues and provide details of the work to be completed over the remaining Project period.

All reports must be submitted in signed hard copy and an electronic copy may also be submitted to the PMO.

The standard format, frequency and contents of reports should be in consultation with the Project Director, FRERMIP time to time before submitting.

The reports should be submitted to the Project Director, FRERMIP, BWDB, Dhaka.

External Environmental Monitoring Expert
Individual (national, 8 person-months)

A. Objective of the consultancy

The objective of the consultancy is to monitor the implementation of the project's environmental management plan (EMP) related to the approved Environmental Impact Assessment (EIA) in compliance with ADB SPS (2009). The expert will report to the Project Management Office (PMO), and share monitoring findings to ADB.

B. Scope of work

The main tasks and responsibilities will include:

- Review the Environmental Impact Assessment (EIA) report, its Environmental Management Plan (EMP), and the contractors' environmental management plan (CEMP) to get a detailed understanding of the environmental issues associated with the project.
- Consult with the Institutional Strengthening and Project Management Consultant (ISPMC) to identify if there are any changes in the project sites of baseline environmental condition, if changes are made, review and assess the outcome and advise updating the EMP;
- Verify that the public awareness campaign on EMP implementation is carried out among residents near construction sites, and that all complaints are promptly resolved in accordance with EMP policy;
- Advise PMO in coordinating the Grievance Redress Mechanism and coordination consultation with local stakeholders, define corrective actions for updating the environmental monitoring report as needed;
- Review bidding documents and contractor materials to ensure all environmental obligations are implemented in accordance with the EMP;
- Provide support to PMO in evaluating all documents related to the implementation of the EMP and assist in improving the quality of the semi-annual environment monitoring report;
- Review monthly EMP implementation report of contractors and its compliance with reality;
- Submit the EMP progress report to PMO and ADB semi-annually which will include project implementation, monitoring results, challenges and measures to be proposed or taken, and action plan until next monitoring, and recommendations;
- Conduct and implement environmental auditing and include measures to be taken;
- Assist PMO, before expiry of the initial EIA clearance, to review and revise (if necessary) to obtain environmental clearances continued approval.

C. Qualifications

The expert shall have a university degree in environmental engineering or similar field, 10 years of work experience with state, public or private organizations in environmental safeguards implementation and public consultations. It would be advantageous if he/she is familiar with Bangladesh regulations and procedures and ADB policies on environmental impact assessment, environmental management and public consultation.

Social Safeguards Specialist (External Monitor)
Individual (national, 8 person-months)

Objective and Purpose of the Assignment
The Flood and Riverbank Erosion Risk Management Investment Program (FRERMIP) aims to improve the livelihoods of people in the country's most flood and erosion prone areas along the Jamuna, Ganges and Padma rivers. Project 2 of the program will finance (i) 30 kilometers (km) of riverbank protection; (ii) 7.9 km of climate-resilient flood embankments; (iii) a distributary offtake with a flood barrier; and (iv) 2 regulators with fish pass to improve drainage. It will also establish 160 community disaster management units and develop their capacity, and strengthen 40 existing disaster units and disaster preparedness and emergency response with a focus on women participation, and gender responsive river management guidelines and project management tools. The land acquisition required for Project 2 will result in physical and economic displacement as well as loss of land, structures, and trees.

ADB's Safeguards Policy Statement (SPS) (2009) requires independent and external monitoring for projects with significant involuntary resettlement impacts. The external monitor will confirm/verify the information presented in the semi-annual social monitoring reports, compliance with loan covenants on social safeguards, assess the resettlement process and timing, adequacy of institutional arrangements for resettlement planning and implementation, and affected persons' status before and after displacement.

Scope of Work:
The external monitor will be responsible for (i) review and verification of progress of resettlement plan implementation; (ii) confirmation and verification of semi-annual monitoring reports prepared by PMO (with the support of ISPMC) since the start of the resettlement plan implementation; (iii) verification of compliance with loan covenants on social safeguards, as well as field data and grievance redress mechanism compliance; (iv) assess resettlement efficiency, effectiveness, impact, and sustainability, and (v) suggest any corrective actions as required. The external monitor will prepare semi-annual external monitoring reports and a final report.[64]

Detailed Tasks:
The social safeguards external monitor will work closely with Bangladesh Water Development Board (the executing agency) and ADB to perform the following tasks:

(i) Verify whether the objectives of resettlement plan(s) have been realized, through review and confirmation of semi-annual monitoring reports;
(ii) Verify whether the project is in compliance with agreed loan covenants related to social safeguards;
(iii) Assess the process of consultation, information disclosure and grievance redress adopted by the project and its effectiveness;
(iv) Assess whether the compensation is adequate to replace the lost assets;
(v) Assess whether the Income and Livelihood Restoration Program is adequate to replace loss of income;
(vi) Assess the perceived benefits and losses of resettlement and perception of the implementation in their living standards;
(vii) Conduct impact assessment which is to be compared with the baseline values for key socioeconomic as given in the RPs. If such information is not available, it

[64] Due to the current COVID-19 pandemic, mission will be virtually conducted until such time it is considered safe to conduct field work as advised by national government and in consultation with ADB.

should be collected on recall basis at the time of survey. A sample of control population (100 affected persons who have not yet received compensation) should also be included for comparison purpose and to help identify the concerns and preferences of those who have not yet been displaced and formulate appropriate recommendations for improved resettlement process;

(viii) Assess the level of satisfaction of the affected persons;
(ix) Undertake field visits and consultations;
(x) Prepare and submit to ADB and BWDB semi-annual external monitoring reports verifying progress of resettlement plan implementation and information in the SMRs. The external monitoring report will be submitted within 2 months from disclosure of SMRs;
(xi) Prepare and submit to ADB and BWDB a final report which includes evaluation of the effectiveness of resettlement plan implementation with comparison to baseline information; and
(xii) Provide/suggest corrective actions if necessary.

Deliverables:

(i) Semi-annual external monitoring reports
(ii) Final report

Qualifications:

The external monitor shall have a university degree, with master's degree in development studies or social science preferred. The expert is preferred to have at least 10 years' experience in social safeguards monitoring for donor-funded projects. Familiarity with ADB SPS, experience in rural development projects, intensive field-based experience in implementing resettlement plans, and effective report writing and communication in English an advantage.

Terms of Reference
External Procurement Monitoring Specialist
Individual (national, 8 person-months)

Objective and Purpose of the Assignment

The Flood and Riverbank Erosion Risk Management Investment Program (FRERMIP) aims to improve the livelihoods of people in the country's most flood and erosion prone areas along the Jamuna, Ganges and Padma rivers. Project 2 of the program will finance (i) 30 kilometers (km) of riverbank protection; (ii) 7.9 km of climate-resilient flood embankments; (iii) a distributary offtake with a flood barrier; and (iv) 2 regulators with fish pass to improve drainage. It will also establish 160 community disaster management units and develop their capacity, and strengthen 40 existing disaster units and disaster preparedness and emergency response with a focus on women participation. The land acquisition required for Project 2 will result in physical and economic displacement as well as loss of land, structures, and trees.

To enhance the capacity of the project management office (PMO) of Bangladesh Water Development Board (BWDB), an External Procurement Monitoring Specialist will be recruited. The consultant will monitor the different procurement-related activities in the project procurement plan to ensure compliance to ADB's Procurement Regulations for ADB Borrowers: Goods, Works, Nonconsulting and Consulting Services (2017, as amended from time to time).

Scope of Work

The External Procurement Monitoring Specialist will support the PMO in ensuring efficient procurement of works, goods and services. The External Procurement Monitoring Specialist will help improve the capacity of the PMO in procurement of works, goods and services; and will monitor the status of procurement of works, goods and services by the PMO, as stated in the procurement plan.

Detailed Tasks and/or Expected Output

The Consultant will ensure that procurement activities are conducted in accordance with ADB's Procurement Regulations for ADB Borrowers: Goods, Works, Nonconsulting and Consulting Services (2017, as amended from time to time) and will support the PMO in:

(i) Monitor, review and update the procurement plan;
(ii) Prepare and review bidding documents, evaluation reports, inquiries and clarifications, pre-bid meetings, contracts, variations, contract terminations, and dispute resolutions;
(iii) Prepare and review terms of reference, qualification criteria, RFPs, EA submissions, pre-proposal meetings, contract negotiations, evaluations, contract variations, contract terminations, and dispute resolutions;
(iv) Provide hands on support to accelerate procurement and recruitment to both ADB and EAs/IAs during the process;
(v) Address procurement related technical matters to ensure consistency and conformity to ADB's Procurement Regulations for ADB Borrowers: Goods, Works, Nonconsulting and Consulting Services (2017, as amended from time to time).;
(vi) Support to EA to resolve contract administration issues and update ADB as appropriate;
(vii) Capacity development of EA/IA in procurement;
(viii) Monitor progress of all procurement and update procurement and consultancy contracts monitoring sheets, with particular attention to the larger open competitive bidding (OCB) contracts;

(ix) Ensure that the project meets its contract awards and disbursement targets; and
(x) Any other task assigned in relation to procurement of goods and works and recruitment of consultants.

Deliverables:

(i) Semi-annual external monitoring reports
(ii) Final report

Qualifications:

The consultant will have a Bachelor's degree in a relevant discipline (e.g., Procurement, Engineering, Law, Management or Business). Master's degree will be an advantage. Minimum of 10 years of relevant professional experience in project implementation management, contract management or procurement-related activities in water or rural development infrastructure projects. Previous assignments in ADB and/or World Bank-finances projects in Bangladesh is preferred. Knowledge of ADB's Procurement Policy and Procurement Regulations for ADB Borrowers will be an advantage.

Attachment 6: EMR Outline

The PMO is required to prepare periodic monitoring reports that describe progress with implementation of the project EMP and compliance issues and corrective actions. A sample outline which can be adapted as necessary is provided below.

1. Introduction
- 1.1. Report Purpose
- 1.2. Project Implementation Progress

2. Incorporation of Environmental Requirements into Project Contractual Arrangements

Manner by which EMP requirements are incorporated into contractual arrangements, such as with contractors or other parties.

3. Summary of Environmental Mitigations and Compensation Measures Implemented

Based on EMP; may include measures related to air quality, water quality, noise quality, pollution prevention, biodiversity and natural resources, health and safety, physical cultural resources, capacity building, and others.

4. Summary of Environmental Monitoring
- 4.1. Compliance Inspections (if relevant)
  - 4.1.1. Summary of Inspection Activities
  - 4.1.2. Mitigation Compliance
  - 4.1.3. Mitigation Effectiveness
- 4.2. Emission Discharge (Source) Monitoring Program (if relevant)
  - 4.2.1. Summary of Monitoring
  - 4.2.2. Results
  - 4.2.3. Assessment
- 4.3. Ambient Monitoring Program (if relevant)
  - 4.3.1. Summary of Monitoring
  - 4.3.2. Results
  - 4.3.3. Assessment

5. Key Environmental Issues
- 5.1.1. Key Issues Identified
- 5.1.2. Action Taken
- 5.1.3. Additional Action Required

6. Conclusion
- 6.1. Overall Progress of Implementation of Environmental Management Measures
- 6.2. Problems Identified and Actions Recommended

Appendixes
1. Site Inspection / Monitoring Reports
2. Ambient Monitoring Results
3. Photographs
4. Other

Attachment 7: Gender Action Plan

Output/Activities	Indicators and Targets	Responsibility	Timeframe
Output 1: Flood and riverbank erosion risk mitigation functioning at priority reaches improved			
1. Women benefit from employment in construction.	1.1. At least 5% of unskilled labor days allocated for women.	PMO and work contractors	Entire P2 implementation period
2. Gender-related aspect of labor standard including equal wage for women and men for equal work ensured.	2.1. All bidding documents incorporated provisions for core labor standards and equal pay. 2.2. At least one awareness program per package on GBV and community-based redress mechanism and disseminate information at worksites on the risks of STIs (including HIV/AIDS) with 30% women participation.		
3. Occupational health and safety, safe water supply, sanitation (including separate toilets) ensured.	3.1. Orientation sessions on gender responsive occupational health and core labor standards conducted for 80 SMO staff (at least one orientation in each SMO and 90% relevant women staff)[a] and contractors/representatives/site managers 3.2. Provisions for either separate toilets for women on the project site or arrangements for use of facilities in nearby communities and/or HH.		
4. 160 community-based disaster management units established and their capacity developed.	4.1. A minimum of 35% of units led by women. 4.2. Community Flood Risk Assessment Report prepared in consultation with community (including 30% women) identifying: (i) risks for women, men, children and vulnerable groups; and (ii) disaster response coping mechanism related to flood and erosion warning. 4.3. Community Risk Reduction Plan (80 plans) specifying roles of women and men in disaster preparedness at HH and community levels; and risk reduction measures. 4.4. At least 30% women participated in public consultations held for location identified to build community flood markers. 4.5. Community-based flood warning procedures initiated with 50% applying flood warning mechanisms building on indigenous techniques and disseminating warning messages in relevant to local context/language in line with national warning network (Source: end-line beneficiary survey). 4.6. 50% of HH, including low-income HH, and poor women, living on the embankment have increased resilience and awareness of preventive measures at HH level [Source: end-line beneficiary survey].	PMU-DDM and community disaster management NGO	By end of P2
5. Training on gender awareness and leadership, and on participatory O&M on the infrastructure built conducted.	5.1. At least 30% women (including management committee members) reported to gain from the gender awareness and leadership training. 5.2. At least 30% women reported additional knowledge from the O&M training. 5.3. Information on GBV and community-based redress mechanism disseminated in every community.	PMO and community disaster management NGO	By end of P2

Output/Activities	Indicators and Targets	Responsibility	Timeframe
6. Due consultation with women in the affected areas on payment and provision of full compensation and transitional support conducted.	6.1. Full compensation for 100% women PAPs, as per resettlement plans entitlements provided. 6.2. Data on PAPs along with entitlement benefits, as per resettlement plans is sex-disaggregated. 6.3. Needs assessment for livelihood training, including for women, conducted. 6.4. At least 14 community groups[b] established and livelihood training conducted with at least 50% women participants.	PMO and Partner NGOs	Entire P2 implementation
Output 2: Institutional System for Flood and Riverbank Erosion Risk Management Strengthened			
7. Gender sensitization training for the BWDB officials conducted.	7.1. Existing gender-specific module updated to include awareness on GBV and community-based redress mechanism, and at least 10% women staff trained on the module.	BWDB	By end of P2
8. Capacity of women staff in BWDB built.	8.1 7 trainings (2 in BWDB HQ, 2 in design office and 3 in 3 SMOs) provided to at least 120 relevant staff in BWDB (at least 10% women staff).		
9. Gender-responsive[c] guideline for river management	9.1. One guideline developed (focus lower Jamuna) developed and submitted for endorsement to BWDB.	BWDB and PMO	By end of P2
Output 3: Program management systems operational			
10. MIS, quality control systems, accountability measures, and gender-sensitive project monitoring tools[d] established and used by PMO and SMOs.	10.1. Explicit gender equality objectives and indicators established at planning stage to strengthen accountability of progress made on gender equality issues and to ensure that gender is fully integrated throughout the system for appropriate collection, compilation, analysis, dissemination, and use of gender data for decision making. 10.2. Gender-sensitive monitoring tools developed to assess qualitative and quantitative data against objectives, measuring Project impacts on gender relations, the different priorities and needs of women and men, and determine gender aspects that need to be integrated into M&E systems. 10.3. The lessons learned and tools developed will be used to inform the design and systems of the follow-on project.	BWDB and PMO	By end of P2
11. Office of the Chief Engineer River Management staff with increased knowledge.	11.1. At least 60% of all staff and a minimum of 60% of female staff have increased knowledge on Adaptive Approach.[e]	BWDB and PMO	By end of P2

BWDB = Bangladesh Water Development Board, DDM = Department of Disaster Management, GAP = gender action plan, GBV = gender-based violence, HH = households, HQ = headquarters, NGO = nongovernment organization, O&M = operation and maintenance, PAP= project-affected persons, PMO=project management office, PMU = project management unit, P2 = Project 2, SMO = subproject management office, STI = sexually transmitted disease.

[a] SDE, Section Officers, surveyors and contractors site manager, site engineers and supervisors

[b] Community groups are comprised of vulnerable people from the Project area.

[c] Including, but not limited to, women's participation in consultations, surveys, accountability mechanisms, and collection and reporting on sex-disaggregated data.

[d] Including explicit gender equality objectives and indicators. The M&E tools developed will assess qualitative and quantitative data measuring accountability of progress made on gender equality issues.

[e] Adaptive Approach" refers to the adoption of flexible implementation to address ongoing morphological changes in the river with protection of riverbanks with launching aprons that are subsequently strengthened and built to the final scour depth with the deepening of the river.

CONTRIBUTION TO STRATEGY 2030 OPERATIONAL PRIORITIES

OP No.	Corporate Results Framework Indicators (Outputs and Outcomes)	Expected Value	Methods and Comments
1.2	Jobs generated (number)	3,000 jobs created (95% male and 95% female between the age of 18 and 30)	People will be employed by contractors during implementation of riverbank protection and embankment construction.
1.3	Poor and vulnerable people with improved standards of living (number)	500,000 people (49% female)	The project will improve the living conditions of about 500,000 people through reduced flood damages. From surveys, the portion of women is at 49%.
2.1	Skilled jobs for women generated (number)	150	5,000 people will be trained through livelihood programs. Number of people trained, and jobs created will be monitored by the ISPMC and the NGO tasked to implement the livelihood programs
2.3	Women represented in decision-making structures and processes (number)	73	Implementation NGO reports BWDB project progress reports
2.5	Women and girls with increased resilience to climate change, disasters, and other external shocks (number)	At least 300	Implementation NGO reports BWDB project progress reports
3.2	People with strengthened climate and disaster resilience (number)	0.5 million protected (49% women)	ISPMC reports, implementation NGO reports, and BWDB project progress reports
5.1.1	Rural infrastructure assets established or improved (number)	1	1 embankment implemented
5.3	Land with higher productivity (hectares)	15,400 ha of land	ISPMC reports BWDB project progress reports
6.2	Entities with improved service delivery (number)	4 (PMO and 3 SMOs)	ISPMC reports BWDB project progress reports

BWDB = Bangladesh Water Development Board, ha = hectare, ISPMC = institutional strengthening and project management consultant, km = kilometer, NGO = nongovernment organization, OP = operational priority, PMO = project management office, SMO = subproject management office.
Source: Asian Development Bank.

ECONOMIC AND FINANCIAL ANALYSIS

A. Introduction

1. The economic and financial analysis examines the viability of investments in riverbank protection works, flood embankments and supporting components being implemented under the Flood and Riverbank Erosion Risk Management Investment Program at three priority subprojects: Jamuna Right Bank 1 (JRB 1), Jamuna Left Bank 2 (JLB 2), and Padma Left Bank 1 (PLB 1) along the banks of the Jamuna and Padma rivers. The program was planned to be implemented in three tranches using ADB's multitranche financing facility (MFF). The MFF modality permits: (i) flexible, phased interventions which are adaptable to the dynamic river morphology in Bangladesh; (ii) long term riverbank erosion and flood protection management planning aimed at future stabilization of the river courses; and (iii) more effective support for enhancing institutional capacity in the sector. However, due to significant delays, the second and third tranches (initially planned in 2014) were combined to accelerate processing and mitigate further postponements to program implementation.

2. The main objectives of the economic analysis are to: (i) estimate the economic costs and benefits of mitigating riverbank erosion and alleviating flooding; (ii) identify additional benefit streams (such as char land reclamation) which are relevant to the shifting focus from riverbank protection works to more active river stabilization; and (iii) assess the economic viability of proposed interventions for each priority subproject and the program as a whole.[1]

3. The estimation of economic benefits has been primarily based on secondary data sources: (i) original economic analysis prepared by the project preparatory technical assistance (PPTA)[2] and (ii) data from relevant departments and district administration offices. A field survey was also conducted in early 2018 to collect data on land and property values in areas vulnerable to erosion. These values were then updated to 2020 prices using a price escalation rate of 5.5% per year.[3]

B. Rationale

4. Riverbank erosion is one of the most devastating natural disasters in Bangladesh. Up to 5,000 hectares (ha) of floodplain land are lost and about 100,000 people are affected annually. The impacts are particularly severe on poor and vulnerable households who face significant social hardships, such as loss of homestead, land, crops and livestock. With a high population density, these adverse socio-economic impacts increase rapidly as the vulnerable population grows. Erosion damage also extends to public infrastructure, including roads and flood embankments, and the high incidence of riverbank erosion hinders construction and rehabilitation of the flood embankments.

5. In addition, about 20% of the country is inundated annually during the monsoon season, resulting in a significant loss of assets and crops. With a growing population and the expansion of settlements within the floodplain, future development will need to be carefully managed to protect the population from these natural disasters. The threat of frequent flooding and riverbank erosion also discourages investment and leads to lower economic growth in the riverine areas.

6. Effective flood and riverbank erosion risk management is therefore essential for economic growth, livelihood improvement, and poverty reduction in these localities. In addition, the existing system of embankments cannot be relied upon for protection from floods and can often lead to disaster when the embankments breach or overtop during severe flood events. Furthermore, the growing population will demand more reliable protection from riverbank erosion and flooding to

---

[1] An accretion in a river, the chars are valuable to the economy of Bangladesh as additional cultivable areas.

[2] ADB. 2013. *Main River Flood and Bank Erosion Risk Management Program*. Consultant's Report. Manila (TA 8054-BAN; Annex G: Economic Assessment).

[3] Based on domestic cost escalation factors for Bangladesh (from ADB's website).

safeguard their increasing assets and to sustain economic development.

7. Securing the livelihoods of the floodplain population therefore needs to be addressed through public sector interventions aimed at: (i) mitigating the economic losses and social displacement caused by riverbank erosion; (ii) reducing the economic losses resulting from flooding; and (iii) providing a secure environment to facilitate an increase in agricultural and industrial production and to enhance related economic activities.

C. Economic Cost Benefit Analysis

8. **Methodology.** An incremental approach was adopted which contrasts the future-with and future-without project scenarios. For each subproject, economic viability was assessed by determining the following economic criteria: economic internal rate of return (EIRR) and economic net present value (ENPV). The minimum EIRR required for economic viability is 9% which is considered the opportunity cost of capital. The analysis followed the ADB Guidelines for the Economic Analysis of Projects.[4]

9. The analysis used the world price numeraire approach and the Bangladesh taka (Tk) was the unit of account with an exchange rate of Tk84.7 per United States dollar. Other key assumptions included: (i) economic life of 30 years with no residual value of capital investment; (ii) constant 2020 prices were used and price contingencies were not included; (iii) taxes and duties were omitted; and (iv) a standard conversion factor (SCF) of 0.9 and a shadow wage rate factor (SWRF) of 0.75 were applied to convert local components of the financial costs, as well as the financial benefits of bank protection and flood mitigation, to economic values. The SCF of 0.9 and SWRF of 0.75 have been consistently used in the economic analysis of projects in Bangladesh for many years. In addition, the economic prices of foreign costs remained unchanged from their financial values.

10. Construction conversion factors were derived from the proportions of foreign costs, local costs (e.g., materials and skilled labor) and unskilled labor costs for each cost item. These factors ranged from 0.84 for flood embankments to 0.86 for bank protection works. Conversion factors for other project components varied from 0.90 for local costs (e.g., land acquisition/resettlement) to 0.95 for costs with a significant foreign component (e.g., consultancy services).

11. **Economic Benefits.** The expected economic benefits of the program are: (i) reduced land loss due to riverbank erosion protection; (ii) mitigation of flood damage and increased agricultural production resulting from embankment construction; and (iii) development of reclaimed char lands.

12. The economic benefits resulting from the ***reduced riverbank erosion*** were based on the estimated areas of agricultural and settlement land which would be lost if bank protection measures were not implemented. At Chauhali (JLB-2) and Harirampur (PLB-1), land and settlements are now being protected from riverbank erosion by the revetment works which were built under Tranche 1. The areas of land vulnerable to erosion vary considerably from year to year, but it has been estimated that the Tranche 1 works are protecting about 1,485 ha of land at JLB-2 and 1,300 ha of land at Harirampur PLB-1 over the 30-year life of the program. The areas expected to be saved by riverbank protection works were estimated based on current rates of land erosion at each location.

13. With regard to riverbank protection under both tranches 1 and 2 of the program, it is problematic to quantify the reduction in riverbank erosion associated with the revetment works and channel closure in the JLB-2 subproject area but, for the purposes of the analysis, it is estimated that a total of 3,270 ha of mainland as well as 2,100 ha of char land on the JLB could be saved from erosion over a 30 year period. While, in the PLB-1 subproject area, a total of 1,720 ha will be

[4] ADB. 2017. *Guidelines for the Economic Analysis of Projects*. Manila.

protected following the construction of an extension to the Tranche 1 revetment works. In addition, about 525 ha of mainland land plus 1,260 ha of char land in the JRB1 subproject area could be saved following the construction of the riverbank protection works under Tranche 2. The economic benefits of erosion mitigation for each subproject are based on the economic value of the land area that would be lost if the riverbank protection works were not constructed. This economic land value can therefore be fully attributed to the riverbank protection works under the program.

14. Based on 2020 prices for agricultural, homestead and market/commercial land, the value of land and assets which will be saved from bank erosion were estimated at an average of Tk5.10 million per ha in PLB-1 (Harirampur), Tk6.89 million per ha in JLB-2 (Chauhali) and Tk8.68 million per ha for JRB-1 (Benotia). For char land areas protected from bank erosion, a land value of Tk1.38 million per ha was used. For each subproject, the different values for agricultural land, residential land and market/commercial land (as well as the proportion of the area within each land use type) were used to derive the composite land value[5].

15. Land markets are reasonably competitive in the areas to be protected from riverbank erosion (i.e. vulnerable areas are rural and primarily used for small scale agriculture and village settlements). The market price of land can therefore be used as a proxy for its economic value, so the SCF was not applied to the financial land values. In addition, to reflect the rising demand for protected land within each subproject area, it has also been assumed that there would be an overall increase in the value of land at the rate of 3% per year (in real terms) for mainland areas. This annual increase in land values is based on the expected expansion in settlements and commercial/industrial developments within the subproject areas.

16. With regard to the ***mitigation of flood damage***, the main types of assets vulnerable to flooding in the JRB-1 subproject area are agricultural crops, buildings and roads. To estimate average annual expected damages from flooding, a minimum of 3 years of flood damage data covering a wide range of return periods needed to be analyzed. Flood damage data was therefore obtained from the Ministry of Disaster Management and Relief (MoDMR) district estimates for the 1988, 2003 and 2007 flood events. The return periods of these flood events were estimated at 100, 2, and 20 years respectively. Including further flood years in the analysis, e.g., 1 in 10 years and 1 in 5 years, would improve the accuracy of average annual expected damage estimates, but may not significantly change the current estimates.[6]

17. The estimates of crop damage were derived from crop areas partially or completely lost due to flooding and the average economic value of production per hectare for the Aman rice crop. Expected annual crop damage values were then estimated by applying the probability of occurrence of the flood events to these crop damage values.

18. With regard to buildings, their number within a subproject area is based on the Bangladesh Bureau of Statistics (BBS) census data, from which estimates for 2020 were derived by applying the average annual growth rate for each type of building (i.e. pucca, semi-pucca and kutcha) over a 10-year period. The proportions of each building category either partially or totally damaged by the 1988, 2003 and 2007 flood events were then applied to the projected number of buildings in 2020. In economic prices, replacement costs were estimated at Tk705, Tk564 and Tk212 per square foot for pucca, semi-pucca and kutcha buildings respectively, and these unit values were multiplied by the number of totally damaged buildings.

19. For roads in a subproject area, the lengths of roads in each flood year were estimated from

[5] Land use and land values in the areas benefiting from protection works in the subprojects are in Table 4.2 of FRERMIP: Economic Analysis of Tranches 1 and 2, Supplementary Report.

[6] Supplementary Report on the FRERMIP Economic Analysis is in Appendix 18 (Estimates of the economic value of damages for various flood events are in Table 4.4, and flood damage exceedance probability curves are in Figure 4.1).

BBS data and the damage to roads in each flood year derived from MoDMR district data. Paved and earthen roads have been analyzed and construction costs (in economic prices) have been based on unit rates of the Local Government Engineering Department. For paved roads, an average rate of Tk11,144,323 per kilometer (km) has been used. While, for earthen roads, a rate of Tk3,179,550 per km has been applied. Expected annual damage values were then derived for each building and road category by applying the probability of occurrence of the flood events to these damage values. Furthermore, an overall increase in the annual value of assets was applied at the rate of 3% per year over the 30-year project life.

20. The method used to calculate average annual expected damage followed the same approach taken in the original economic analysis prepared for the RRP of the MFF and is therefore considered valid.[7] There is a risk of overestimating the benefits of flood protection using this method as it implicitly assumes that all flood damages will be mitigated by the flood embankments. This has been recognized by the institutional strengthening and project management consultants (ISPMC) under Tranche 1 and, in 2020, a hydraulic modelling study was undertaken to identify the areas which will be free from flooding following embankment construction. Based on this flood modelling, the average annual flooded area in JRB-1 was estimated at 32,204 ha without the embankment and 14,636 ha with the embankment, so 17,568 ha (or 55% of the JRB-1 area) are expected to remain free of flooding following embankment construction.

21. In addition to mitigating flood damage, ***increased agricultural production*** is also likely to be gained from reduced flooding. Based on land types by flood depths (i.e., F0, F1, F2, F3 and F4), cropping patterns were determined for both with and without project situations.[8] The changes in cropping patterns would mainly derive from the switch to high yielding rice crops in the monsoon season (i.e. from DW Aman to HYV Aman) as a result of reduced flooding. Furthermore, there would be a decrease in flood duration that would facilitate earlier dry season cropping. The overall cropping intensity is also expected to rise from 217% to 233%.

22. To estimate the economic benefits of reduced flooding, economic crop budgets were prepared in order to estimate the net economic benefits per hectare for each crop in both with and without project situations. The economic net benefits per hectare were then applied to the increase in the areas of F0, F1 and F2 land (resulting from the construction of the flood embankments) and the total net economic benefits were determined. The increases in F0, F1 and F2 land (obtained from the results of the flood modelling) and were estimated at 7,659 ha for the JRB-1 subproject area.

23. At present, char lands are being partially used by local people to grow a range of crops to meet their subsistence requirements, but there is a very high proportion of unused land. There is, however, potential for the ***development of reclaimed char land*** in the JLB-2 subproject area. Following the closure of the channel at Solimabad, the area of char land (estimated at 6,000 ha) will become attached to the mainland; this will facilitate agricultural development on the char. A gradual increase in crop area and production over the next 20 years is therefore anticipated. Economic crop budgets (both with and without project) were prepared to determine the economic net benefits per ha for each crop which were then applied to the crop areas to derive the incremental net economic benefits from crop production. An increase in livestock numbers on the char is also envisaged and the incremental economic benefits from livestock production were also included in the analysis.

24. With the availability of reclaimed char land, there would also be considerable demand, particular from households recently displaced by riverbank erosion and landless households in the

[7] ADB. 2014. *Report and Recommendation of the President to the Board of Directors: Proposed Multitranche Financing Facility to the People's Republic of Bangladesh: Flood and Riverbank Erosion Risk Management Investment Program.* Manila.

[8] Including F0: 0 to 30 cm (high land); F1: 30 to 90 cm (medium high land); F2: 90 to 180 cm (medium low land); F3: 180 to 360 cm (low land); and F4: above 360 cm (very low land).

local areas, for the development of rural settlements on the reclaimed char land. However, without the construction of an embankment to mitigate flood damages, the establishment of houses, shops, public buildings and infrastructure will be very limited. The establishment of settlements on the reclaimed char land has therefore not be included in the economic benefits of char land development.

25. With regard to the economic benefits of tranches 1 and 2, flood mitigation makes a significant contribution accounting for 82% of economic benefits in JRB-1. Riverbank protection also provides substantial economic benefits in PLB-1 (100%), JLB-2 (91%) and JRB-1 (18%). For JLB-2, char land development accounts for 9% of the economic benefits. For the overall program, riverbank protection contributes 60% of the economic benefits, followed by flood mitigation (37%) and char land development (3%).

26. **Other non-quantified benefits.** The interventions will also have a number of non-quantified benefits including: (i) mitigation of injuries and the loss of life (both human and animal) caused by flooding; (ii) mitigation of the disruption to economic activities resulting from riverbank erosion and flooding; (iii) reduction in relocation costs and distress to local people caused by riverbank erosion and flooding; (iv) reduction in the costs of disaster relief and rehabilitation; and (v) environment benefits from the conservation of ecological assets. However, mainly due to the lack of available data to provide reliable estimates, these other benefits have not been included in the analysis.

27. **Economic Costs.** The financial investment costs of tranches 1 and 2 comprised surveys/investigations, civil works, land acquisition/resettlement and vehicles/equipment. Supporting components (i.e., social/environmental management, disaster risk management, capacity development, consultancy services and project/subproject management) were included to ensure the effective implementation and sustainability of the investments. The financial investment costs were then converted to economic values using economic conversion factors for local costs while foreign costs remained unchanged. Total economic costs amounted to Tk7,675 million ($90.6 million) for JRB-1, Tk10,420 million ($123.0 million) for JLB-2 and Tk3,365 million ($39.7 million) for PLB-1 (Table 1).

28. It should, however, be noted that the economic costs of Tranche 2 also included the costs of wave protection for the revetment works with concrete blocks. These works have been deferred to a follow-on project, but included in this economic analysis as the works ensure the economic benefits of riverbank protection will be sustained throughout the 30-year life of the program. It has also been assumed that these additional revetment works would be constructed between 2025 and 2028.

29. Annual operation and maintenance (O&M) cost data from ongoing and completed projects indicated that O&M costs are inadequate so, to ensure that the civil works remain viable throughout the program economic life, annual O&M costs sufficient to maintain the infrastructure in a good condition were included in the analysis. Annual O&M costs as a percentage of capital costs were estimated at the rates of 2% for bank protection works and 5% for embankments and other structures. Annual O&M costs are assumed to start in the year following completion of the works.

Table 1: Economic Investment Costs for Projects 1 and 2

Project Intervention	JRB-1		JLB-2		PLB-1	
	Econ. Cost (Tk, million)	**% of total**	**Econ. Cost** (Tk, million)	**% of total**	**Econ. Cost** (Tk, million)	**% of total**
Riverbank Protection Works	**1,894**	24.7%	**6,166**	59.2%	**2,280**	68.0%
Flood Mitigation Works	**1,391**	18.1%	**810**	7.8%	**-**	-
Land Acquisition/Resettlement	**2,495**	32.5%	**559**	5.4%	**183**	5.4%
Adaptation Works [9]	**480**	6.3%	**1,180**	11.3%	**260**	7.7%
Other Components[a]	**1,461**	18.4%	**1,704**	16.4%	**634**	18.8%

[9] Adaptation works are not allocated to a specific subproject in the financial costs but, for the analysis, these costs have been allocated between subprojects proportionally to the costs of the main protection works.

Project Intervention	JRB-1		JLB-2		PLB-1	
	Econ. Cost (Tk, million)	% of total	Econ. Cost (Tk, million)	% of total	Econ. Cost (Tk, million)	% of total
Total Cost[c]	**7,675**	100%	**10,420**	100%	**3,365**	100%
Total Cost ($, million)	**90.6**		**123.0**		**39.7**	

JLB = Jamuna Left Bank, JRB = Jamuna Right Bank, PLB = Padma Left Bank.
[a] Institutional Strengthening and Project Management.
[b] Including physical contingencies computed at 5% of investment costs.
Source: Supplementary Report on the FRERMIP Economic Analysis is in Appendix 18.

30. **Economic Viability.** The results of the economic analysis undertaken for the investments under Tranches 1 and 2 are in Table 6.1 and indicated that the EIRRs are 13.6% for JRB-1, 13.2% for JLB-2 and 13.2% for PBL-1 with an overall EIRR of 13.4%. This analysis shows that, at a 9% EIRR threshold, the investments under Tranches 1 and 2 are economically viable for all subprojects as well as the overall program.

31. Comparing the economic viability of Tranche 1 with the overall program investments, it is evident that the EIRR for JRB 1 increases from 12.8% to 13.6%. Similarly, it is envisaged that the EIRR for JLB 1 will rise from 12.3% to 13.2%, while the EIRR for PLB-1 would fall from at 14.0% to 12.2%. Furthermore, the EIRR for the overall program is expected to increase from 12.9% to 13.4%.

Table 2: Economic Viability of Investments under Tranches 1 and 2

Investment Tranche	JRB -1		JLB -2		PLB-1		Overall Program	
	EIRR	NPV (Tk, million)	EIRR	NPV (Tk, million)	EIRR	NPV (Tk, million)	EIRR	NPV (Tk, million)
Tranche 1	12.8%	1,232	12.3%	852	14.0%	842	12.9%	2,927
Tranches 1 and 2	13.6%	2,435	13.2%	2,482	13.2%	896	13.4%	5,812

EIRR = economic internal rate of return, JLB = Jamuna Left Bank, JRB = Jamuna Right Bank, NPV = net present value, PLB = Padma Left Bank.
Source: Supplementary Report on the FRERMIP Economic Analysis is in Appendix 18.

32. To account for future risks and uncertainties, sensitivity analysis was undertaken to assess the impact of changes in costs and benefits on economic viability of each subproject and the program. Table 3 shows the results of the sensitivity analysis: if investment costs increased by 15%, the EIRR of the overall program would fall to 11.5%. Similarly, a 25% rise in investment costs would result in an EIRR of 10.4% but the program would still remain economically viable.

33. The sensitivity analysis also considered the possibility of not achieving the economic benefits envisaged and it is evident in Table 3 that if the area and/or value of the land protected from riverbank erosion decreased by 15%, the EIRR for the program would fall to 11.8% Furthermore, a decrease in the value of protected land by 25% would reduce the EIRR to 10.9%. With regard to not achieving the expected average annual flood damage, a 15% decrease in damage values would reduce the EIRR of JRB-1 to 12.2%, while a 25% fall in damage values would result in an EIRR of 11.3%.

34. The sensitivity analysis also assessed the prospect of annual land and property prices in the subproject areas not increasing (in real terms) by 3% per year, and the analysis showed that the EIRR of the overall program would fall to 9.9% but still remain economically viable. Furthermore, if the reclaimed char land was not developed by the local population in the JLB-2 subproject area, the EIRR would fall to 13.0%. Finally, if the costs of wave protection for the revetment works (to be undertaken in a follow-on project) are omitted, the EIRR of the overall project increases to 14.0%.

Table 3: Sensitivity Analysis of Tranches 1 and 2

Sensitivity Test	JRB-1		JLB -2		PLB-1		Overall Program	
	EIRR	ENPV (Tk, million)	EIRR	ENPV (Tk, million)	EIRR	ENPV (Tk, million)	EIRR	ENPV (Tk, million)
Base Case	13.6%	2,435	13.2%	2,482	13.2%	896	13.4%	5,812

Sensitivity Test	JRB-1		JLB -2		PLB-1		Overall Program	
	EIRR	ENPV (Tk, million)	EIRR	ENPV (Tk, million)	EIRR	ENPV (Tk, million)	EIRR	ENPV (Tk, million)
Increase in Investment Costs by 15%	11.8%	1,616	11.3%	1,479	11.2%	533	11.5%	3,628
Increase in Investment Costs by 25%	10.7%	1,070	10.2%	811	10.2%	291	10.4%	2,172
Decrease of Protected Land Value by 15%	13.3%	2,221	11.3%	1,315	10.9%	398	11.8%	3,924
Decrease of Protected Land Value by 25%	13.1%	2,079	10.0%	583	9.3%	67	10.9%	2,729
Decrease in Average Annual Flood Damage Values by 15%	12.2%	1,659	13.2%	2,482	13.2%	826	12.8%	4,967
Decrease in Average Annual Flood Damage Values by 25%	11.3%	1,142	13.2%	2,482	13.2%	896	12.6%	4,520
No annual increase in land and property values	11.5%	1,113	9.3%	144	8.9%	(10)	9.9%	1,247
No char land development	13.6%	2,435	12.3%	1,798	13.2%	896	13.0%	5,129
Excluding wave protection for works	14.1%	2,648	14.0%	2,847	14.1%	1,081	14.0%	6,576

EIRR = economic internal rate of return, ENPV = economic net present value.
Source: Supplementary Report on the FRERMIP Economic Analysis is in Appendix 18.

35. Switching values were also calculated to estimate the percentage by which the economic benefits and costs would need to change to reach an EIRR of 9% and an ENPV of zero. The results, in Table 4, show that the program investments would require a reduction in annual benefits of 28% or an increase in costs of 40% to become economically unviable. JRB-1 investments would need a reduction in benefits of 31% or an increase in costs of 45%, while PLB-1 investments would require a reduction in benefits of 27% or an increase in costs of 37%. JLB-2 would become economically unviable with a decrease in benefits of 28% or an increase in costs of 38%. This clearly shows that the subprojects and the overall program are robust to adverse changes in benefit and cost streams.

Table 4: Switching Values of Tranches 1 and 2

JRB -1		JLB -2		PLB-1		Overall	
% Fall in Benefits	% Rise in Costs	% Fall in Benefits	% Rise in Costs	% Fall in Benefits	% Rise in Costs	% Fall in Benefits	% Rise in Costs
(31%)	+45%	(28%)	+38%	(27%)	+37%	(28%)	+40%

Note: Switching value is the percentage change in benefits or costs required to achieve an EIRR of 9%.
Source: Supplementary Report on the FRERMIP Economic Analysis is in Appendix 18.

D. Financial Sustainability

36. The Bangladesh Water Development Board (BWDB) will be responsible for the maintenance of the infrastructure following completion of the proposed construction works. The assets created under the project will not generate any direct revenue so the annual costs of maintaining the infrastructure will therefore be met through budget support from the Ministry of Water Resources. The financial analysis therefore focused on assessing the capacity of the BWDB to maintain the proposed infrastructure in addition to the network of existing assets.

37. With regard to the financial sustainability of proposed civil works under Tranche 2, the provision of adequate funds for the O&M of civil infrastructure has been a major constraint to effective flood and riverbank erosion risk management in Bangladesh. The government has increased funding for the O&M of riverbank protection works and flood embankments, and it can be seen in Table 5 that the total O&M expenditure increased substantially from Tk3,500 million in 2014/15 to Tk8,105 million in 2018/19 and averaged Tk5,091 million over the 6-year period. Furthermore, all O&M funds received were used for the purpose specified, so the utilisation rate was 100%.

38. Despite this positive trend, the funds received covered less than 15% of BWDB's estimated O&M requirements (Table 5). Even if the past positive trend should continue, the projected O&M allocations will fall short of the required amounts also in the future, as shown in Table 6. Hence, there is a **substantial risk** that adequate maintenance will not be provided by BWDB so the infrastructure

built under the program is likely to deteriorate prematurely.

Table 5: O&M Budgets and Expenditure by BWDB (2013/14 to 2018/19)

	BWDB: O & M Budgets and Expenditure (Tk, million)						
	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	Average
O&M Funds Requested	36,254	37,117	41,979	42,084	42,408	57,370	42,868
O&M Expenditure	3,500	4,211	4,462	4,412	5,854	8,105	5,091
Expenditure as % of Funds Requested	10%	11%	11%	10%	14%	14%	12%

BWDB = Bangladesh Water Development Board, O&M = operation and maintenance.
Source: BWDB (June 2020).

Table 6: Projected O&M allocation and use - with project (Tk, million)

Year	2019/20	2021/22	2023/24	2025/26	2027/28	2029/30
O&M Funds projected requirement	62,885	75,558	90,784	109,545	131,579	158,049
O&M Funds projected use	9,587	13,413	18,767	26,258	36,739	51,403
Coverage (% of requirement)	**15.2%**	**17.8%**	**20.7%**	**24.0%**	**27.9%**	**32.5%**

Source: Asian Development Bank estimates.

39. To mitigate the risk of inadequate maintenance, measures will be integrated in the project:
    (i) The inclusion of 5 years O&M in selected contracts will be piloted under the project.
    (ii) Communities living next to, and benefiting from, the embankments will be trained to undertake day-to-day maintenance. Training activities will be monitored by ADB through quarterly progress reports.
    (iii) The asset management system of BWDB will be further improved to strengthen BWDB's capacity to monitor the condition of its network of assets, prepare robust risk-based budget requests, and prioritise the use of its scarce O&M resources. These improvements will include: (a) upgrading of BWDB's fixed asset register comprising information on the asset location, condition, annual maintenance requirements and past maintenance history; and (b) developing a management information system to monitor the condition of the infrastructure.

40. Furthermore, to reduce the gap between the BWDB's O&M funding requirements and the budgeted funds provided by the Ministry of Water Resources, assurances from the government will be sought as part of the discussion on the covenants for the loan agreement.

41. With regard to maintenance plans, BWDB has a maintenance policy for riverbank protection works and flood embankments. In addition, maintenance manuals are available and regularly updated. BWDB also has extensive experience in the management of maintenance contracts. Annual maintenance plans for the infrastructure built under Tranche 1 and will include a budget with sufficient financial resources to meet the annual costs required for assets management and O&M.

42. BWDB has also developed an asset management system comprising: (i) Geographic Information System Based Digital Land Information System on acquired land; (ii) Smart Project Monitoring and Management Information System which includes project infrastructure, maps, photographs, video clips, recent and historic documents, coordinates of structures, contract information, evaluation reports, functional information, project performance information and management information data which has been stored for 53 ongoing projects and 3 completed projects; and (iii) Hydrological Information Management System for flood forecasting and warning, and feeds from 36 real-time water level gauges. However, there is scope for further improving the asset management system to enable BWDB to better estimate its O&M needs and allocate its resources more efficiently. With regard to asset management activities undertaken during Tranche 1, a management information system (including asset inventories) was completed to ensure that early maintenance is undertaken at minimal costs before serious deterioration of the infrastructure.

SUMMARY POVERTY REDUCTION AND SOCIAL STRATEGY

Country:	Bangladesh	Project Title:	Flood and Riverbank Erosion Risk Management Investment Program – Tranche 2
Lending / Financing Modality:	Multitranche Financing Facility	Department/ Division:	South Asia Department Environment, Natural Resources and Agriculture Division

I. POVERTY AND SOCIAL ANALYSIS AND STRATEGY

Poverty targeting geographic targeting

A. Links to the National Poverty Reduction and Inclusive Growth Strategy and Country Partnership Strategy

Bangladesh has made considerable progress in reducing poverty. According to the Bangladesh Bureau of Statistics (BBS), the population living below the national poverty line was 40% in 2005, 31.5% in 2010, and came down to 24.3% in 2016. The extreme poverty rate was 17.6% in 2010, 12.9% in 2016, and came down to 10.5% in 2019. Despite good progress, poverty remains a dominant problem. Bangladesh is implementing its Eighth Five-Year Plan (fiscal year [FY] 2021–FY2026) which centers on six core themes. Of these, the three relevant themes are (i) gross domestic product growth acceleration, employment generation and rapid poverty reduction: average gross domestic product growth to increase from 7.4% in the previous plan to 8.0% in the current plan and poverty to decline from 20.5% in 2019 to 15.6% in 2025; (ii) a broad-based strategy of inclusiveness with a view to empowering every citizen to participate in full and benefit from the development process; (iii) a sustainable development pathway that is resilient to disaster and climate change, entails sustainable use of natural resources, and successfully manages the inevitable urbanization transition. The economic growth strategy of the plan includes six pivotal themes: (i) promote labor intensive, export-oriented manufacturing-led growth; (ii) promote agricultural diversification; (iii) infuse dynamism in the cottage, micro-, small and medium enterprises; (iv) strengthen and modernize the services sector, push exports of non-factor services; (v) promote ICT-based entrepreneurship; and (vi) strengthen overseas employment. The Asian Development Bank (ADB) has adopted a broad-based approach to respond flexibly to the needs and demand of the country over the country partnership strategy for Bangladesh, 2016–2020. ADB assistance is strongly aligned with the government's Vision 2021 and its plan, which lays out a roadmap for higher, sustainable and inclusive growth. Freeing the country from poverty and inequality remains a major though separate challenge. Unless specific actions are taken, extreme poverty in parts of the country and inequality between regions will likely remain, even as the country's economy continues to grow. Effective implementation of the government's social protection strategy is needed to elevate people out of extreme poverty. Priorities include housing and basic services—including primary health care for the poor, and disaster risk management to reduce vulnerability and build resilience to extreme weather conditions. The proposed Project 2 is directly linked to the government's plan and ADB's country partnership strategy. It will protect riverine erosion and flood-prone fringe lands, which are usually occupied by the landless poor. The proposed Project 2 will directly protect these poor residents along the rivers from riverbank erosion and flood inundation. Institutional strengthening of riverbank erosion and flood risk management will contribute to the sustainability of the risk reduction. Project 2 will also include community level capacity strengthening programs. Labor-intensive construction works will create jobs for the poor and women. It will thus contribute to the improvement of livelihoods and economic conditions of the poor population in the project area, with a total population of about 1.6 million.

B. Results from the Poverty and Social Analysis during PPTA or Due Diligence

1. Key poverty and social issues. Riverbank erosion along the main rivers is a prominent problem in Bangladesh, and is a perennial phenomenon caused by dynamic channels shifting of the rivers. Riverbank erosion annually affects on average more than 10,000 people, who face significant social hardships, such as loss of homestead, lands, crops, and/or livelihoods. It also forces repeated displacement. Riverine fringe lands, which are prone to riverbank erosion and flood disasters, are usually occupied by the landless poor, and the majority of them are erosion victims who had been displaced by past riverbank erosions. Although poverty is falling in Bangladesh, poverty remains extensive in the project areas where poverty incidence (35%–39%) is higher than the national average. **Justification for classification**: *Geographic targeting* is justified as the investment program will improve the livelihoods of people in the project areas along the Jamuna, Padma, and Ganges rivers by reducing flood and riverbank erosion risks. About 70% of project benefits will go to the $2-a-day poor and relates to stability in their livelihood activities and employment in project-related works.

2. Beneficiaries. The riverine vulnerable population affected by floods and land erosion (about 100,000 people) will be the direct beneficiaries. They will benefit through avoided loss of land and assets; protection and enhancement of agricultural and fishery production within the embankments; increased economic activity; increased security of population, livestock, and assets; and strengthening of local communities for sustainable risk management in the medium term. Secondary beneficiaries are the people beyond riverine lands (about 1.5 million people). Most of the people are poor and work as daily wage labor.

3. Impact channels. The impact channels comprise (i) protection against loss of income, crops, and houses; (ii) improved agricultural productivities; (iii) community participation and capacity development support programs; and (iv) new jobs in project-related works for the $2-a-day poor.

4. Other social and poverty issues. Employment opportunities are lacking in the area. Most people work as wage earners in agricultural fields or small-scale weaving establishments. For gender-targeted activities, civil society organizations, funded by development partners, organize women labor groups and secure contracts for them on government infrastructure projects.

5. Design features. Project 2 proposes to address the key poverty and social issues related to food production and income, as indicated in the performance indicators in the design and monitoring framework for Project 2 and the investment program, by increasing by 2028 the monsoon crop average yields in project districts to 3.75 tons per hectare (t/ha) (2.75 t/ha in 2013) and average annual per capita income to Tk136,000 (Tk74,380/capita in 2012). The protection by embankments will increase the income of the poor.

II. PARTICIPATION AND EMPOWERING THE POOR

1. Participatory approaches and project activities. Consultations were held with a focus on women, the landless, and other vulnerable groups in the subproject areas regarding (i) relocation and livelihood issues, including agriculture, and fisheries; (ii) flood and riverbank erosion disaster management; (iii) possible solutions to resolve the constraints identified; and (iv) institutional mechanisms to address those constraints. The performance indicators relating to output 1 of the design and monitoring framework reflect the participatory approach, which is also reflected in the loan agreement and project administration manual (PAM).

2. Civil society will be engaged for the project implementation. Refer to item 3.

3. Civil society organizations. Civil society participation is ensured through (i) carrying out consultations with project displaced persons for their relocation, (ii) income and livelihood restoration, and (iii) facilitating the grievance redress process. In addition to the resettlement plan implementation, nongovernment organizations (NGOs) will be involved (on a competitive basis) in designing and implementing livelihood support for the project displaced households, participatory operation and maintenance of infrastructure, and community-based flood risk management. Adequate resources were allocated for their engagement.

4. The following forms of civil society organization participation are envisaged during project implementation, rated as high (H), medium (M), low (L) or not applicable (NA): (H) Information gathering and sharing; (H) Consultation; (M) Collaboration; (M) Partnership.

5. Participation plan. ☒ Yes. ☐ No.

A participation plan has been prepared as part of the resettlement plan which includes extensive consultation with community people, including women, about the project activities. As part of the resettlement plan implementation, the planning processes will also require consultations with project affected people. NGOs will play a vital role in the implementation of the resettlement plan as well as grievance redress mechanism to assist the vulnerable affected peoples in the consultation. During the implementation period, participation of poor and vulnerable people including women will be ensured by providing project generated employment opportunities and income restoration program as well as awareness raising program.

III. GENDER AND DEVELOPMENT

Gender mainstreaming category: effective gender mainstreaming (EGM)

A. Key issues. The main occupation of women in the project area relates to home and family, and involves tasks related to the immobile assets of house and kitchen garden. They play an important role in agricultural production related to seeds, storing of crops, and domestic livestock. The houses of poor families are built at or near ground level, and experience deep and prolonged inundation during higher floods. During times of flooding, women face multiple challenges—providing for a family from limited food and drinking water supply, heading the household while men search for income opportunities, and being forced to sleep and live in public spaces during evacuation. Erosion of homes and land forces families to change income patterns, with the adult male family members leaving to find work opportunities and leaving the women to head and manage the households. While implementation of civil works provides income generation, gender imparity is a common issue—lower wages, lack of segregated sanitation facilities and health hazards.

B. Key actions. ☒ Gender action plan ☐ Other actions or measures ☐ No action or measure

The program is categorized as *effective gender mainstreaming*. The investment program formulated a gender action plan (GAP) with broad range of measures targeted at achieving higher gender parity: (i) build capacity of women staff (at least 10%) in the executing agency, as staff members and training participants; (ii) obliging contractors to employ minimum 5% women as unskilled labor with equal wage payment (it was narrowed down from 15% to 5% during Project 1 for reasons that the design changed from 125 kilograms to 250 kilograms geo-bags); (iii) establishing 160 community-based disaster management units with 35% units led by women, assuring the inclusion of gender issues in the planning process of preventive and preparedness measures; (iv) providing additional livelihood support for 14 community groups including poor and vulnerable women (minimum 50% female participants) and (v) develop gender responsive river management guidelines and project monitoring tools .

IV. ADDRESSING SOCIAL SAFEGUARD ISSUES

A. Involuntary Resettlement **Safeguard Category:** ☒ A ☐ B ☐ C ☐ FI

1. Key impacts. Extensive consultations with the affected persons were conducted during Project 2 preparation; project information and the resettlement framework were explained to them. The affected persons are direct beneficiaries of the protection works. Land acquisition and resettlement will take place in the three subproject areas: riverbank protection

requires a small strip of land; embankment construction will be only in subprojects JRB-1 and JLB-2. The embankments will go through private cultivated land, commercial land, and pond areas. The project will impact about 728 households (approximately 3,868 affected persons), about 2,652 structures, and approximately 14,024 trees.

2. Strategy to address the impacts. A sample resettlement plan for Shahjadpur flood embankment (JRB-1) provides for compensation at replacement cost and has provisions for grievance redress and was disclosed on ADB's website. In addition, four resettlement plans, to be reviewed by ADB prior to disclosure, will be prepared after initial riverbanks stabilization through underwater works and works setting finalization, after Project 2 approval, but prior to construction of structures, in accordance with the updated resettlement framework, which will guide the preparation of any other plans.

3. Plan or other Actions.

- ☒ Resettlement plan
- ☒ Resettlement framework
- ☐ Environmental and social management system arrangement
- ☐ No action
- ☐ Combined resettlement and indigenous peoples plan
- ☐ Combined resettlement framework and indigenous peoples planning framework
- ☐ Social impact matrix

B. Indigenous Peoples **Safeguard Category:** ☐ A ☐ B ☒ C ☐ FI

1. Key impacts. No impact. No indigenous people are in the project area as defined in the ADB's Safeguard Policy Statement (2009).

Is broad community support triggered? ☐ Yes ☒ No

2. Strategy to address the impacts. Not applicable

3. Plan or other actions.

- ☐ Indigenous peoples plan
- ☐ Indigenous peoples planning framework
- ☐ Environmental and social management system arrangement
- ☐ Social impact matrix
- ☒ No action
- ☐ Combined resettlement plan and indigenous peoples plan
- ☐ Combined resettlement framework and indigenous peoples planning framework
- ☐ Indigenous peoples plan elements integrated in project with a summary

V. ADDRESSING OTHER SOCIAL RISKS

A. Risks in the Labor Market.

1. Relevance of the project for the country's or region's or sector's labor market, indicated as high (H), medium (M), and low or not significant (L): (L) unemployment; (L) underemployment; (L) retrenchment; (L) core labor standards

2. Labor market impact. Significant positive impact. Employment in off-farm activities will be created in the construction of embankment and structure while Contractors will undergo orientation for following core labor standards.

B. Affordability. Not applicable

C. Communicable Diseases and Other Social Risks

1. The impact of the following risks are rated as high (H), medium (M), low (L), or not applicable (NA):
(L) Communicable diseases; (L) Human trafficking

2. Risks to people in project area. Not applicable

VI. MONITORING AND EVALUATION

1. Targets and indicators. By 2029, in the investment program districts, it is anticipated that: (i) per capita income increases to Tk136,000 from Tk74,380 in 2012; and (ii) average transplanted Aman (monsoon rice crop) yield rises from 2.75 t/ha in 2013 to 3.75 t/ha (BBS and other government reports/statistics). By 2025, it is expected that: (i) livelihood support training is provided with a minimum 50% of female participants; and (ii) community-based disaster management training is provided with a minimum 35% of female leader participants.

2. Required human resources. Two gender specialists will support the project management office, and one resettlement and gender expert will be posted in each subproject management office. The consultant team will have social development, gender and resettlement experts to support the implementation of the GAP and resettlement plans. NGOs will be hired for resettlement & livelihood support programs. Resettlement activities will be monitored by external experts.

3. Information in PAM. The PAM indicates the key requirements for monitoring. Regular monitoring will be undertaken by the project management office to ensure the effectiveness and quality of activities. The frequency of project reviews, monitoring, and timing of completion report is included in the PAM.

4. Monitoring tools. A management information system will be developed for monitoring benefits and implementation. The loan agreement and PAM describe the monitoring requirements of the social safeguards and gender issues. The project management office will monitor project performance, including poverty and social indicators.

Source: Asian Development Bank.

PROCUREMENT PLAN

Basic Data

Project Name: Flood and Riverbank Erosion Risk Management Investment Program - Tranche 2		
Project Number: 44167-015	**Approval Number:**	
Country: Bangladesh	**Executing Agency**: Bangladesh Water Development Board	
Project Procurement Risk: Medium	**Implementing Agency**: Department of Disaster Management	
Project Financing Amount: US$ 212,500,000 **ADB Financing:** US$ 157,000,000 **Cofinancing (ADB Administered):** $17,890,000 **Non-ADB Financing:** US$ 37,610,000	**Project Closing Date:** 26 June 2024	
Date of First Procurement Plan: 29 March 2021	**Date of this Procurement Plan**: 29 March 2021	
Procurement Plan Duration (in months): 18	**Advance Contracting:** No	**e-GP:** Yes [https://www.eprocure.gov.bd/

A. Methods, Review and Procurement Plan

Except as the Asian Development Bank (ADB) may otherwise agree, the following methods shall apply to procurement of goods, works, and consulting services.

Procurement of Goods and Works	
Method	**Comments**
Open Competitive Bidding (OCB) for Goods	International advertising for goods > $1,000,000. To be prior reviewed by ADB. National advertising for goods < $1,000,000. The first OCB is subject to prior review, thereafter post review.
Request For Quotation for Goods	Below $100,000.
Open Competitive Bidding (OCB) for Works	International advertisement for works > $15,000,000. To be prior reviewed by ADB. National advertisement for works < $15,000,000. The first NCB is subject to prior review, thereafter post review.
Request For Quotation for Works	

Consulting Services	
Method	**Comments**
Quality- and Cost-Based Selection for Consulting Firm	For larger NGOs and Consultancy contracts
Quality-Based Selection for Consulting Firm	
Consultant's Qualification Selection for Consulting Firm	For small-size consulting / NGO services
Direct Contracting for Consulting Firm	
Competitive for Individual Consultant	

B. Lists of Active Procurement Packages (Contracts)

The following table lists goods, works, non-consulting and consulting services contracts for which the procurement activity is either ongoing or expected to commence within the procurement plan duration.

Goods and Works							
Package Number	**General Description**	**Estimated Value (in US$)**	**Procurement Method**	**Review**	**Bidding Procedure**	**Advertisement Date** (quarter/year)	**Comments**
G-01	Geotextile bag supply for	21,161,460.00	OCB	Prior	1S1E	Q2 / 2021	Non-Consulting Services: No

	Upstream of Chauhali (15.50 km)						Advertising: International No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference Applicable: Yes Bidding Document: Goods High Risk Contract: Yes e-GP: No Covid-19 Response? No
G-02	Geotextile bag supply for Enayetpur (7 Km) & Benotia (3.50 Km)	12,399,285.00	OCB	Prior	1S1E	Q2 / 2021	Non-Consulting Services: No Advertising: International No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference Applicable: Yes Bidding Document: Goods High Risk Contract: Yes e-GP: No Covid-19 Response? No
G-03	Geotextile bag supply for Harirampur extension (4 Km)	6,318,037.00	OCB	Prior	1S1E	Q2 / 2021	Non-Consulting Services: No Advertising: International No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference Applicable: Yes Bidding Document: Goods High Risk Contract: No e-GP: No Covid-19 Response? No
G-04	Geotextile bag supply for Adaptation Works of completed works under JMREMP & FRERMIP Tranche-1 Project	8,286,572.00	OCB	Prior	1S1E	Q2 / 2021	Non-Consulting Services: No Advertising: International No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference Applicable: Yes Bidding Document: Goods High Risk Contract: No e-GP: No Covid-19 Response? No
G-05	Geotextile bag supply for Adaptation Works of FRERMIP Project- 2	5,889,998.00	OCB	Prior	1S1E	Q4 / 2021	Non-Consulting Services: No Advertising: International No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference Applicable: Yes Bidding Document:

							Goods High Risk Contract: No e-GP: No Covid-19 Response? No
G-06	Vehicles including 4 nos. pick up & 4 nos. Jeep vehicles	556,542.00	OCB	Post (Sampling)	1S1E	Q3 / 2021	Non-Consulting Services: No Advertising: National No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference Applicable: No Bidding Document: Goods High Risk Contract: No e-GP: Yes e-GP Type: e-Bidding Covid-19 Response? No
G-07	Office Equipment	111,308.00	OCB	Post (Sampling)	1S1E	Q3 / 2021	Non-Consulting Services: No Advertising: National No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference Applicable: No Bidding Document: Goods High Risk Contract: No e-GP: Yes e-GP Type: e-Bidding Covid-19 Response? No
G-08	Survey Equipment	222,617.00	OCB	Post (Sampling)	1S1E	Q3 / 2021	Non-Consulting Services: No Advertising: National No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference Applicable: No Bidding Document: Goods High Risk Contract: No e-GP: Yes e-GP Type: e-Bidding Covid-19 Response? No
G-09	Office Equipment for DDM	18,811.00	RFQ	Post (Sampling)		Q3 / 2021	Non-Consulting Services: No No. Of Contracts: 1 High Risk Contract: No e-GP: Yes e-GP Type: e-Bidding Covid-19 Response? No
W-01	Benotia underwater riverbank protection with geotextile bags (3.50 km)	2,223,400.00	OCB	Post (Sampling)	1S1E	Q2 / 2021	Non-Consulting Services: No Advertising: National No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference Applicable: No Bidding Document:

							Small Works High Risk Contract: No e-GP: Yes e-GP Type: e-Bidding Covid-19 Response? No
W-02	Enayetpur underwater riverbank protection with geotextile bags (7 km)	4,268,054.00	OCB	Post (Sampling)	1S1E	Q3 / 2021	Non-Consulting Services: No Advertising: National No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference Applicable: No Bidding Document: Small Works High Risk Contract: No e-GP: Yes e-GP Type: e-Bidding Covid-19 Response? No
W-03	Upstream Chauhali underwater riverbank protection with geotextile bags (7.5 km)	4,705,905.00	OCB	Prior	1S1E	Q2 / 2021	Non-Consulting Services: No Advertising: National No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference Applicable: No Bidding Document: Small Works High Risk Contract: No e-GP: Yes e-GP Type: e-Bidding Covid-19 Response? No
W-04	Upstream Chauhali underwater riverbank protection with geotextile bags (7.9 km) including 1 km of dredging on the underwater slope	8,339,419.00	OCB	Prior	1S1E	Q3 / 2021	Non-Consulting Services: No Advertising: National No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference Applicable: No Bidding Document: Small Works High Risk Contract: No e-GP: Yes e-GP Type: e-Bidding Covid-19 Response? No
W-05	Underwater Riverbank protection with geotextile bags at Harirampur Extension (4 km)	3,666,117.00	OCB	Post (Sampling)	1S1E	Q3 / 2021	Non-Consulting Services: No Advertising: National No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference Applicable: No Bidding Document: Small Works High Risk Contract: No e-GP: Yes e-GP Type: e-Bidding Covid-19 Response? No
W-06	Adaptation	6,002,058.00	OCB	Post	1S1E	Q2 / 2021	Non-Consulting

	works for riverbank protection with geotextile bags of completed works under JMREMP and FRERMIP Tranche-1 Project			(Sampling)			Services: No Advertising: National No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference Applicable: No Bidding Document: Small Works High Risk Contract: No e-GP: Yes e-GP Type: e-Bidding Covid-19 Response? No
W-07	Adaptation Works for riverbank protection with geotextile bags of FRERMIP Project-2	4,128,172.00	OCB	Post (Sampling)	1S1E	Q4 / 2021	Non-Consulting Services: No Advertising: National No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference Applicable: No Bidding Document: Small Works High Risk Contract: No e-GP: Yes e-GP Type: e-Bidding Covid-19 Response? No
W-08	Jamuna River dredging and Salimabad channel choking	14,043,827.00	OCB	Prior	1S1E	Q4 / 2021	Non-Consulting Services: No Advertising: National No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference Applicable: No Bidding Document: Small Works High Risk Contract: No e-GP: Yes e-GP Type: e-Bidding Covid-19 Response? No
W-09	Emergency Works	3,642,223.00	OCB	Post (Sampling)	1S1E	Q3 / 2021	Non-Consulting Services: No Advertising: National No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference Applicable: No Bidding Document: Small Works High Risk Contract: No e-GP: Yes e-GP Type: e-Bidding Covid-19 Response? No
W-10	Shahjadpur Embankment Construction from chainage 21.300 to 29.200 (7.9 km)	6,111,799.00	OCB	Post (Sampling)	1S1E	Q3 / 2021	Non-Consulting Services: No Advertising: National No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference Applicable: No Bidding Document:

							Small Works High Risk Contract: No e-GP: Yes e-GP Type: e-Bidding Covid-19 Response? No
W-11	Maintenance of Embankment Constructed under FRERMIP Tranche-1	885,242.00	OCB	Post (Sampling)	1S1E	Q3 / 2021	Non-Consulting Services: No Advertising: National No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference Applicable: No Bidding Document: Small Works High Risk Contract: No e-GP: Yes e-GP Type: e-Bidding Covid-19 Response? No
W-12	Benotia riverbank temporary wave protection (3.50 km)	1,664,865.00	OCB	Post (Sampling)	1S1E	Q2 / 2022	Non-Consulting Services: No Advertising: National No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference Applicable: No Bidding Document: Small Works High Risk Contract: No e-GP: Yes e-GP Type: e-Bidding Covid-19 Response? No
W-13	Enayetpur riverbank temporary wave protection (7 km)	1,513,583.00	OCB	Post (Sampling)	1S1E	Q2 / 2022	Non-Consulting Services: No Advertising: National No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference Applicable: No Bidding Document: Small Works High Risk Contract: No e-GP: Yes e-GP Type: e-Bidding Covid-19 Response? No
W-14	Upstream Chauhali temporary wave protection (15.5 km)	1,503,618.00	OCB	Prior	1S1E	Q2 / 2022	Non-Consulting Services: No Advertising: National No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference Applicable: No Bidding Document: Small Works High Risk Contract: No e-GP: Yes e-GP Type: e-Bidding Covid-19 Response? No
W-15	Harirampur	893,047.00	OCB	Prior	1S1E	Q2 / 2022	Non-Consulting

	temporary wave protection (4 km)						Services: No Advertising: National No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference Applicable: No Bidding Document: Large Works High Risk Contract: No e-GP: Yes e-GP Type: e-Bidding Covid-19 Response? No

Consulting Services							
Package Number	**General Description**	**Estimated Value (in US$)**	**Selection Method**	**Review**	**Type of Proposal**	**Advertisement Date** (quarter/year)	**Comments**
C-01	Institutional Strengthening and Project Management	15,055,713.00	DC	Prior	FTP	Q2 / 2021	Non-Consulting Services: No Type: Firm Assignment: International e-GP: No Covid-19 Response? No Comments: ISPMC firm for Tranche-1 will be engaged for Project 2 through the single source selection (SSS) modality as per FFA and decision of the meeting held on 01 February 2021.
C-02	Community-based flood risk management support	2,782,712.00	QCBS	Prior	FTP	Q2 / 2021	Non-Consulting Services: No Type: Firm Assignment: National Quality-Cost Ratio: 90:10 e-GP: No Covid-19 Response? No Comments: NGO; As agreed with the government
C-03	Community capacity development support for participatory O&M	417,724.00	CQS	Prior	BTP	Q3 / 2021	Non-Consulting Services: No Type: Firm Assignment: National e-GP: No Covid-19 Response? No Comments: Firm/NGO; As agreed with the government
C-04	Livelihood development support	664,400.00	CQS	Prior	STP	Q3 / 2021	Non-Consulting Services: No Type: Firm Assignment: National e-GP: No Covid-19 Response? No Comments: Firm (QCBS) / NGO (QBS); As agreed with the government
C-05	River survey (including	1,660,466.00	DC	Prior	FTP	Q3 / 2021	Non-Consulting Services: No

	bathymetric, ADCP and float tracking) and multi beam echosounder survey (4 years)						Type: Firm Assignment: National e-GP: No Covid-19 Response? No Comments: This will be directly contracted with the Institute of Water Modelling
C-06	Management information system development	749,217.00	CQS	Prior	STP	Q4 / 2021	Non-Consulting Services: No Type: Firm Assignment: National e-GP: No Covid-19 Response? No
C-07	Environment management and risk mitigation programs	282,724.00	CQS	Prior	BTP	Q4 / 2021	Non-Consulting Services: No Type: Firm Assignment: National e-GP: No Covid-19 Response? No Comments: NGO; As agreed with the government
C-08	Erosion prediction	424,085.00	DC	Prior	BTP	Q3 / 2021	Non-Consulting Services: No Type: Firm Assignment: National e-GP: No Covid-19 Response? No Comments: Center for Environmental and Geographic Information System (CEGIS) will be engaged for the riverbank erosion prediction study
C-09	Geotechnical investigation	130,596.00	DC	Prior	BTP	Q3 / 2021	Non-Consulting Services: No Type: Firm Assignment: National e-GP: No Covid-19 Response? No Comments: This will be directly contracted with the BUET
C-10	Resettlement solutions through NGO	494,766.00	CQS	Prior	BTP	Q3 / 2021	Non-Consulting Services: No Type: Firm Assignment: National e-GP: No Covid-19 Response? No
C-11	Model study for Salimabad channel closure	452,358.00	DC	Prior	BTP	Q3 / 2021	Non-Consulting Services: No Type: Firm Assignment: National e-GP: No Covid-19 Response? No Comments: This will be directly contracted with the Institute of Water Modelling
C-12	Offtake physical modelling	586,651.00	DC	Prior	BTP	Q3 / 2021	Non-Consulting Services: No Type: Firm

							Assignment: National e-GP: No Covid-19 Response? No Comments: This will be directly contracted with the River Research Institute
C-13	Topographic Survey	163,273.00	CQS	Prior	BTP	Q4 / 2021	Non-Consulting Services: No Type: Firm Assignment: National e-GP: No Covid-19 Response? No Comments: As agreed with the government
C-14	Monitoring of pilot works (grout mattresses installed in Tranche 1)	275,655.00	CQS	Prior	BTP	Q4 / 2021	Non-Consulting Services: No Type: Firm Assignment: National e-GP: No Covid-19 Response? No Comments: As agreed with the government
C-15	Environment/ biodiversity and social baseline impact monitoring and fisheries study	899,061.00	CQS	Prior	STP	Q4 / 2021	Non-Consulting Services: No Type: Firm Assignment: National e-GP: No Covid-19 Response? No
C-16	Socio-economic study of the char people	599,374.00	CQS	Prior	BTP	Q4 / 2021	Non-Consulting Services: No Type: Firm Assignment: National e-GP: No Covid-19 Response? No
C-17	External monitoring of social safeguards	120,157.00	Competitive	Prior		Q3 / 2021	Non-Consulting Services: No Type: Individual Assignment: National Expertise: Resettlement e-GP: No Covid-19 Response? No
C-18	External monitoring of Environmental safeguards	120,157.00	Competitive	Prior		Q3 / 2021	Non-Consulting Services: No Type: Individual Assignment: National Expertise: Environment e-GP: No Covid-19 Response? No
C-19	External monitoring of procurement activities	120,157.00	Competitive	Prior		Q3 / 2021	Non-Consulting Services: No Type: Individual Assignment: National Expertise: Procurement e-GP: No Covid-19 Response? No Comments: As agreed with the government
C-20	External monitoring of Financial	111,308.00	Competitive	Prior		Q3 / 2021	Non-Consulting Services: No Type: Individual

	Management						Assignment: International Expertise: Financial Management e-GP: No Covid-19 Response? No
C-21	Procurement Specialist	77,916.00	Competitive	Prior		Q3 / 2021	Non-Consulting Services: No Type: Individual Assignment: National Expertise: Procurement e-GP: No Covid-19 Response? No
C-22	Resettlement Specialist	66,785.00	Competitive	Prior		Q3 / 2021	Non-Consulting Services: No Type: Individual Assignment: National Expertise: Resettlement e-GP: No Covid-19 Response? No
C-23	Gender Specialist	50,089.00	Competitive	Prior		Q3 / 2021	Non-Consulting Services: No Type: Individual Assignment: National Expertise: Gender e-GP: No Covid-19 Response? No
C-24	Environmental Specialist	50,089.00	Competitive	Prior		Q3 / 2021	Non-Consulting Services: No Type: Individual Assignment: National Expertise: Environment e-GP: No Covid-19 Response? No

C. List of Indicative Packages (Contracts) Required Under the Project

The following table lists goods, works, non-consulting and consulting services contracts for which procurement activity is expected to commence beyond the procurement plan duration and over the life of the project (i.e., those expected beyond the current procurement plan duration).

Goods and Works						
Package Number	**General Description**	**Estimated Value (in US$)**	**Procurement Method**	**Review**	**Bidding Procedure**	**Comments**
W-16	Construction of O&M sheds for Koijuri embankment (7 sheds)	125,730.00	OCB	Post (Sampling)	1S1E	Non-Consulting Services: No Advertising Type: National No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference Applicable: No Bidding Document: Small Works e-GP: Yes Covid-19 Response? No
W-17	Offtake structure-Ghior Khal	9,058,675.00	OCB	Prior	1S1E	Non-Consulting Services: No

						Advertising Type: National No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference Applicable: No Bidding Document: Small Works e-GP: Yes Covid-19 Response? No
W-18	Fish Sanctuaries	1,745,626.00	OCB	Prior	1S1E	Non-Consulting Services: No Advertising Type: National No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference Applicable: No Bidding Document: Small Works e-GP: Yes Covid-19 Response? No

Consulting Services						
Package Number	**General Description**	**Estimated Value (in US$)**	**Selection Method**	**Review**	**Type of Proposal**	**Comments**
None						

SAFEGUARDS REPORTS

1. Environmental Safeguard

a. Framework

Environmental Assessment and Review Framework for the Flood and Riverbank Erosion Risk Management Investment Program (update)

Updated and disclosed on ADB's website on 24 May 2021.
url: https://www.adb.org/projects/documents/ban-44167-013-earf

b. Environmental Impact Assessment

Environmental Impact Assessment for Project 2

Full draft disclosed on ADB's website on 7 August 2020.
url: https://www.adb.org/projects/documents/ban-44167-015-eia-0

Final disclosed on ADB's website on 24 May 2021.
url: https://www.adb.org/projects/documents/ban-44167-015-eia-0

2. Social Safeguard

a. Framework

Resettlement framework for the Flood and Riverbank Erosion Risk Management Investment Program – Tranche 2

Draft disclosed on ADB's website on 22 September 2020.
url: https://www.adb.org/projects/documents/ban-44167-013-rf

Final disclosed on ADB's website on 24 May 2021.
url: https://www.adb.org/projects/documents/ban-44167-015-rf

b. Resettlement Plans

The riverbank protection and embankments will go through private cultivated land, commercial land, and pond areas, resulting in about (i) 68 ha of land acquisition; and (ii) physical and economical displacement of over 728 households, comprising about 3,868 persons, loss of land, 2,652 structures, and 14,024 trees (timber, medicinal, fruit-bearing) due to involuntary land acquisition. Land acquisition and resettlement will take place in the three subproject areas: riverbank protection requires a small strip of land; embankment construction will be only in subproject JRB-1. Table 1 shows involuntary resettlement details.

Table 1: Involuntary Resettlement Impacts for Project 2

Resettlement Plan	Subproject/Work Item	Scope of Work	Remarks
JRB-1 – subproject			
Subproject JRB-1: RP for Shahjadpur	Shahjadpur flood embankment	7.9 km realignment along the Hurasagar and Korotoya rivers	This is an extension of the flood embankment at Kaijuri built under Project 1 and will close the remaining reach to achieve full benefits of this subproject.

Resettlement Plan	Subproject/Work Item	Scope of Work	Remarks
			LGED may build a road on the top of the embankment and held informal meetings with the BWDB field office on this.
	Regulator with fish pass	2 nos. to the Hurashagar River.	Additional to the DMF of the MFF.
Subproject JRB-1: RP for Riverbank protection works at Benotia	Riverbank protection	3.5 km new works at Benotia in extension of the Koijuri revetment.	1 km of Project 1 work was deferred to Project 2 due to char formation in this area. However, the bankline channel has returned and BWDB provided emergency protection that now needs to be upgraded to 3.5 km of full protection.
Subproject JRB-1: RP for Riverbank protection works at Enayetpur	Riverbank protection	7 km new works at Enayetpur	Out of the 11 km initially planned for Project 2, only 7 km will be required to stabilize the river upstream of Enayetpur.
JLB-2 - subproject			
Subproject JLB-2: RP for Riverbank protection works site at Upstream Chauhali	River training	15.5 km bifurcation stabilization upstream of Chauhali	This work is an extension to the 7 km Chauhali revetment built under Project 1. The works will stabilize the approach channel to the bifurcation and prevent severe bank erosion and merger of Jamuna and Dhaleswari rivers. This is an extension of the 5 km initially planned in the FAM and was adjusted due to unfavorable morphological development.
	Land recovery	Updating model study for Solimabad channel closure with recent morphology Intelligent dredging of the Jamuna to overload the Solimabad channel with sediment and reclaim the Solimabad char	Works downstream of Chauhali as originally planned to recover lost floodplain from the river. This work is part of the river stabilization plan. Approximately 6,000 ha of lost floodplain to be recovered. Works will free about 15 km of bankline along the left bank channels from riverbank erosion. The approach planned in the FAM had to be adjusted to account for changed river situation and incorporate “building with nature” approach.
PLB-1 - subproject			
Subproject PLB-1: RP for Riverbank protection works site at Harirampur extension	Riverbank protection	4 km upstream extension work,	Per original FAM approach, 4 km extension upstream.

BWDB = Bangladesh Water Development Board; DMF = design and monitoring framework; FAM = facility administration manual; JLB = Jamuna left bank; MFF = multitranche financing facility; JRB = Jamuna right bank; km = kilometer; ha = hectare; RBP = riverbank protection; RP = resettlement plan

[a] Government of Bangladesh, Bangladesh Water Development Board. 2020. *Resettlement Plan: Flood and* Riverbank Erosion Risk Management Investment Program – Project 2 *(Shahjadpur Flood Embankment) (prepared for ADB).*

Source: Bangladesh Water Development Board.

Project 2 follows a sector approach. One sample RP (Shahjadpur – JRB-1) will be finalized post project approval, and prior to civil works contracts award, to cope with the restrictions of COVID-19 on implementation of 100% census. Four resettlement plans, to be reviewed by ADB prior to disclosure, will be prepared after initial riverbanks stabilization and works setting finalization, after project approval, but prior to award of civil works contracts in these areas, in accordance with the resettlement framework.[1]

Subproject: Jamuna Right Bank -1

Resettlement Plan for Shahjadpur Flood Embankment

Disclosed on ADB's website on 24 May 2021.

url: https://www.adb.org/projects/documents/ban-44167-015-rp-0

[1] This flexibility enables to cope with riverbank alignment changes induced by progressive erosions.

GENDER ACTION PLAN

Output/Activities	Indicators and Targets	Responsibility	Timeframe
Output 1: Flood and riverbank erosion risk mitigation functioning at priority reaches improved			
1. Women benefit from employment in construction.	1.1. At least 5% of unskilled labor days allocated for women.	PMO and work contractors	Entire P2 implementation period
2. Gender-related aspect of labor standard including equal wage for women and men for equal work ensured.	2.1. All bidding documents incorporated provisions for core labor standards and equal pay. 2.2. At least one awareness program per package on GBV and community-based redress mechanism and disseminate information at worksites on the risks of STIs (including HIV/AIDS) with 30% women participation.		
3. Occupational health and safety, safe water supply, sanitation (including separate toilets) ensured.	3.1. Orientation sessions on gender responsive occupational health and core labor standards conducted for 80 SMO staff (at least one orientation in each SMO and 90% relevant women staff)[a] and contractors/representatives/site managers 3.2. Provisions for either separate toilets for women on the project site or arrangements for use of facilities in nearby communities and/or HH.		
4. 160 community-based disaster management units established and their capacity developed.	4.1. A minimum of 35% of units led by women. 4.2. Community Flood Risk Assessment Report prepared in consultation with community (including 30% women) identifying: (i) risks for women, men, children and vulnerable groups; and (ii) disaster response coping mechanism related to flood and erosion warning. 4.3. Community Risk Reduction Plan (80 plans) - specifying roles, of women and men in disaster preparedness at HH and community levels; and risk reduction measures. 4.4. At least 30% women participated in public consultations held for location identified to build community flood markers. 4.5. Community-based flood warning procedures initiated with 50% applying flood warning mechanisms building on indigenous techniques and disseminating warning messages in relevant to local context/language in line with national warning network (Source: end-line beneficiary survey). 4.6. 50% of HH, including low-income HH, and poor women, living on the embankment have increased resilience and awareness of preventive measures at HH level [Source: end-line beneficiary survey].	PMU-DDM and community disaster management NGO	By end of P2
5. Training on gender awareness and leadership, and on participatory O&M on the infrastructure built conducted.	5.1. At least 30% women (including management committee members) reported to gain from the gender awareness and leadership training. 5.2. At least 30% women reported additional knowledge from the O&M training. 5.3. Information on GBV and community-based redress mechanism disseminated in every community.	PMO and community disaster management NGO	By end of P2
6. Due consultation with women in the affected areas on payment and provision of full compensation and	6.1. Full compensation for 100% women PAPs, as per resettlement plans entitlements provided. 6.2. Data on PAPs along with entitlement benefits, as per resettlement plans is sex-disaggregated.	PMO and Partner NGOs	Entire P2 implementation

Output/Activities	Indicators and Targets	Responsibility	Timeframe
transitional support conducted.	6.3. Needs assessment for livelihood training, including for women, conducted. 6.4. At least 14 community groups[b] established and livelihood training conducted with at least 50% women participants.		
Output 2: Institutional System for Flood and Riverbank Erosion Risk Management Strengthened			
7. Gender sensitization training for the BWDB officials conducted.	7.1. Existing gender specific module updated to include awareness on GBV and community-based redress mechanism and at least 10% women staff trained on the module.	BWDB	By end of P2
8. Capacity of women staff in BWDB built.	8.1 7 trainings (2 in BWDB HQ, 2 in design office and 3 in 3 SMOs) provided to at least 120 relevant staff in BWDB (at least 10% women staff).		
9. Gender responsive[c] guideline for river management	9.1. One guideline developed (focus lower Jamuna) developed and submitted for endorsement to BWDB. .	BWDB and PMO	By end of P2
Output 3: Program management systems operational			
10. MIS, quality control systems, accountability measures, and gender-sensitive project monitoring tools[d] established and used by PMO and SMOs.	10.1. Explicit gender equality objectives and indicators established at planning stage to strengthen accountability of progress made on gender equality issues and to ensure that gender is fully integrated throughout the system for appropriate collection, compilation, analysis, dissemination, and use of gender data for decision making. 10.2. Gender-sensitive monitoring tools developed to assess qualitative and quantitative data against objectives, measuring Project impacts on gender relations, the different priorities and needs of women and men, and determine gender aspects that need to be integrated into M&E systems. 10.3. The lessons learned and tools developed will be used to inform the design and systems of the follow-on project.	BWDB and PMO	By end of P2
11. Office of the Chief Engineer River Management, BWDB staff with increased knowledge.	11.1. At least 60% of all staff and a minimum of 60% of female staff have increased knowledge on Adaptive Approach.[e]	BWDB and PMO	By end of P2

BWDB = Bangladesh Water Development Board, DDM = Department of Disaster Management, GAP = gender action plan, GBV = gender-based violence, HH = households, HQ = headquarters, NGO = nongovernment organization, O&M = operation and maintenance, PAP= project-affected persons, PMO=project management office, PMU = project management unit, P2 = Project 2, SMO=subproject management office, STI = sexually transmitted disease.

[a] SDE, Section Officers, surveyors and contractors site manager, site engineers and supervisors

[b] Community groups are comprised of vulnerable people from the Project area.

[c] Including, but not limited to, women's participation in consultations, surveys, accountability mechanisms, and collection and reporting on sex-disaggregated data.

[d] Including explicit gender equality objectives and indicators. The M&E tools developed will assess qualitative and quantitative data measuring accountability of progress made on gender equality issues.

[e] Adaptive Approach" refers to the adoption of flexible implementation to address ongoing morphological changes in the river with protection of riverbanks with launching aprons that are subsequently strengthened and built to the final scour depth with the deepening of the river.

RISK ASSESSMENT AND RISK MANAGEMENT PLAN

Risk Description	Rating	Mitigation Measures	Responsibility
Technical			
1. Disasters induced by natural hazards exceed the design flood return period which may reduce program benefits	S	In addition to structural works, Project 2 includes support for increasing resilience of communities to flood and riverbank erosion risks through measures such as disaster awareness campaigns, strengthening of disaster preparedness and emergency response, and improvements to flood forecasting and warning systems.	BWDB DDM
2. River morphological changes exceed the anticipated range leading to delays in implementation	S	Project 2 includes (i) implementing adaptive riverbank protection to flexibly adjust to morphological changes; (ii) taking proactive measures driven by erosion forecasting, scour calculations, regular monitoring, and surveys of structure performance; and (iii) replicating the approach, designs and construction methods used under Project 1 and JMREMP as they have demonstrated effective performance for up to 15 flood seasons.	BWDB ISPMC
3. Increased flooding induced by climate change	M	Project 2 includes: 1. Sufficient freeboard in flood embankments on top of design flood levels to increase safety 2. Systematic and regular monitoring of upstream river basin hydrology, land use changes, river morphology 3. Implementation of adaptive measures over the medium to long terms	BWDB
4. Adaptive approach not fully adopted by BWDB	M	Project 2 includes: 1. Training relevant BWDB staff in planning, design and construction principles 2. Capacity strengthening of the office of the Chief Engineer, River Management, BWDB.	BWDB
5. Use of innovative technical solutions	M	Project 2 includes: 1. Full design development process including (numerical and physical) modelling 2. First implementation through pilot works	BWDB
Economic and financial			
6. Weak financial management arrangements at BWDB and the PMO	S	Project 2 includes (i) assigning experienced accounts staff to the PMO and SMOs and engaging a financial management expert for support; (ii) providing frequent training to PMO and accounts staff on disbursement procedures and systems, financial reporting, and audit requirements; (iii) reporting comprehensive financial information in quarterly progress reports and PMO adopting computerized systems to capture receipts and payments; and (iv) ensuring that Project 2 is included in the annual audit plan of BWDB's internal audit team.	BWDB
7. Lack of maintenance funds and asset management plan may cause project assets to deteriorate	S	The project will include 5-year maintenance in selected contracts to ensure better asset quality and improved maintenance. The communities will be involved in maintenance activities and undergo training. The asset management systems of BWDB will be strengthened. The government agreed to increase its budget	MoWR BWDB

Risk Description	Rating	Mitigation Measures	Responsibility
prematurely		allocation to BWDB for operation and maintenance; the agreement is included as a loan covenant.	
8. Late release of counterpart fund	L	1. MoWR to ensure timely release of project and counterpart fund through BWDB and its finance unit as per the proposed funds flow arrangements 2. Firm commitment from the government to be obtained as part of the loan and project agreements that counterpart funds will be timely released. 3. Direct payment mechanisms are to be used for major foreign currency payments for contractors and suppliers for ADB's share. 4. SOE threshold set at $100,000 per individual payment. 5. Quarterly reconciliations of advance account, sub-advance account and SMOs sub-accounts to be conducted.	MoWR BWDB
Governance			
9. Delayed procurement due to multiple approval layers and poor contract management leading to delays in project completion.	M	BWDB and PMO benefit from the experience and lessons learned from Project 1. Project 2 will strengthen contract management skills through regular tailored and on-the-job trainings by involving expertise from ISPMC in these activities. ISPMC to recruit procurement and contract management specialists and BWDB to engage an external procurement monitoring expert with ADB procurement experience. Regular detailed follow-up discussions during ADB's missions.	BWDB ISPMC ADB
10. Lack of staff assigned to the project and trained BWDB staff do not remain in office	M	1. A loan covenant is provided to ensure that BWDB timely fields all PMO and SMOs' staff positions required to successfully implement Project 2 from its current staff resources, including financial officers, and/or through recruitment, as appropriate 2. Ensure BWDB maintain a succession staffing plan and young officers are engaged under the project to strengthen their knowledge about the project and its themes. 3. Report staff strengths in quarterly project reports.	BWDB
11. Poor time and quality management of contractors	M	1. Practical bid pricing based on market rates, including price adjustment mechanism during implementation 2. Sound construction management following ADB standard bid documents 3. PMO and SMOs benefit from the experience and lessons learned from Project 1 4. PMO, SMOs and ISPMC will use modern technologies, such as a management information system to track progress and milestones, identify potential issues proactively, and ensure stringent time and quality management 5. Continuous and intensive capacity development programs also considering	BWDB ISPMC

Risk Description	Rating	Mitigation Measures	Responsibility
		lessons learned from Project 1 6. ISPMC will conduct quality spot checks and independent underwater (diving) investigations of completed works.	
12. Potential discrepancies between required and executed work quantities of underwater riverbank protection works	M	1. Bid documents and civil works contracts include regular underwater surveys during and after the construction and submission of survey results to PMO 2. Regular inspection of completed underwater works by PMO/ISPMC using technologies that can make underwater works visible, such as video recording by divers or high-resolution echo-sounders surveys 3. The SMOs, ISPMC and PMO will ensure systematic and detailed recording of physical progress of underwater works 4. The ISPMC will include adequate inputs of quality control experts and staff will visit sites very regularly	BWDB ISPMC
13. Slow land acquisition/ resettlement leading to delays in project completion	M	1. PMO benefit from the experience and lessons learned from Project 1 in these themes 2. Additional social safeguard experts will be engaged by the PMO under Project 2 3. BWDB and ADB will monitor implementation of a time-bound action plan and initiate corrective measures, if necessary. 4. PMO and SMOs will maintain frequent communication with deputy commissioners' offices and will continue stringent monitoring of progress.	BWDB ADB
14. Resistance to adopt new technologies	M	1. Consultations on effectiveness of new technologies demonstrated locally and elsewhere, including study tours 2. Advice from international and national experts 3. Specialized BUET training	BWDB
15. Inadequate attention to nonstructural measures by BWDB, which is largely oriented toward structural measures	M	1. BWDB is fully aware of the government and ADB's emphasis on nonstructural FRERM measures parts of the project design. 2. The CbFRM activities will be implemented by the government-mandated agency DDM, via an MoU to be reviewed by ADB. 3. ISPMC will assist DDM in implementing the CbFRM activities, maintaining integration of all structural and nonstructural measures.	BWBD DDM
16. Limited capacities of FRERM institutions	L	1. Continuous and intensive capacity development programs taking into account also lessons learned from Project 1 2. DDM continues its development	BWDB DDM
17. Poor performance of consultants and low standard of outputs.	L	1. Administer to PMO training programs to provide guidance on consultant performance evaluation and discuss case studies on consultant performance evaluation. 2. A dedicated person in PMO to be devoted to evaluation and monitoring of consultant's and subconsultant's performance.	BWDB ADB
18. Delayed payment to the consultants	L	1. BWDB, as standard operating procedures of externally aided projects, will apply ADB's	BWDB ADB

Risk Description	Rating	Mitigation Measures	Responsibility
and contractors		direct payment method to international consultants and contractors. 2. ADB will monitor PMO's timely submission of financial documents to ensure timely replenishment of an advance account.	
19. Corruption	L	1. The investment program's undertakings commit BWDB through the government to ensure that anticorruption provisions acceptable to ADB are included in all bidding documents and contracting, including provisions specifying the right of ADB to audit and examine the records and accounts of BWDB and all contractors, suppliers, consultants, and other services providers as they relate to any project under the investment program.	Government BWDB
20. A shift in the government development priority moving away from river stabilization of the main rivers	L	1. The Bangladesh Delta Plan 2100 has made the main rivers a major 'hotspot' with government allocating substantial resources during the next 5-year Plan period. 2. ADB will maintain close dialogue with the government and BWDB to ensure priority remains. 3. ADB will continue close dialogue with other development partners involved in the sector for continued priority of the river stabilization of the main rivers	ADB BWDB
21. Implementation may be delayed due to communicable diseases such as COVID-19, resulting in time and cost overruns.	S	Readiness is high through advance actions. Potential COVID-19 constraints will follow flexible and adaptive management: (i) updating the vulnerability assessment and contingencies for livelihood restoration activities; (ii) conducting additional stakeholder consultations at the onset; (iii) following the latesthealth and safety protocols for all interactions at sites and work processes; (iv) regularly assessing field work and travels risks, and informing project staff; and (v) modifying the project status at midterm review.	BWDB

ADB = Asian Development Bank, BWDB = Bangladesh Water Development Board, CbFRM = community-based flood and riverbank management, CbO&M = community-based operation and maintenance, DDM = Department of Disaster Management, FRERM = flood and riverbank erosion risk management, ISPMC = institutional strengthening and project management consultant, JMREMP = Jamuna–Meghna River Erosion Mitigation Project, L = low, M = moderate, MoWR = Ministry of Water Resources, O&M = operation and maintenance, PMO = project management office, QPR = quarterly project report, S = substantial, SMO = subproject management office.
Source: Asian Development Bank.

Strategic Procurement Planning Report

Project Number: 44167-015

28 April 2021

Bangladesh: Flood and Riverbank Erosion Risk Management Investment Program - Tranche 2

Prepared by:

K.V Dinesh, International Procurement Specialist (Staff Consultant)

and

Muhammed Mahboob-ul-Kabir, National Procurement Specialist (Staff Consultant)

Asian Development Bank

ABBREVIATIONS

ADB	–	Asian Development Bank
BWDB	–	Bangladesh Water Development Board
BER	–	bid evaluation report
CbFRM	–	community-based flood risk management
CCGP	–	Cabinet Committee on Government Purchase
CDMU	–	Community-based disaster management units
CEGIS	–	Centre for Environmental and Geographic Information Services
COVID-19	–	Coronavirus disease
CPTU	–	Central Procurement Technical Unit
CQS	–	Consultants' Qualifications Selection
DDM	–	Department of Disaster Management
e-GP	–	Electronic government procurement
FFA	–	Framework Financing Agreement
FRERM	–	flood and riverbank risk erosion management
FRERMIP	–	Flood and Riverbank Erosion Risk Management Investment Program
ha	–	hectare
HOPE	–	Head of the Procuring Entity
ISPMC	–	institutional strengthening and project management consultant
IWM	–	Institute of Water Modelling
km	–	kilometer
MFF	–	multitranche financing facility
MOU	–	memorandum of understanding
NGO	–	nongovernment organization
OCB	–	open competitive bidding
O&M	–	operation and maintenance
PFR	–	project financing request
PMO	–	project management office
PPA	–	Public Procurement Act
PPR	–	Public Procurement Rules
RRI	–	River Research Institute
SBD	–	standard bidding document
SMO	–	subproject management office
SOR	–	schedule of rates
SSS	–	single source selection

Contents

Strategic Procurement Planning

Section 1: Project Concept

Project Title	**Flood and Riverbank Erosion Risk Management Investment Program – Tranche 2**
Country	Bangladesh
Executing Agency	Bangladesh Water Development Board (BWDB)
Implementing Agency	BWDB
A. Project Development Objectives	The expected impact of the Flood and Riverbank Erosion Risk Management Investment Program (FRERMIP) will be improved livelihoods of people in the project area along the main rivers in Bangladesh. The outcome of the investment program will be reduced flood and riverbank erosion risks in the subproject reaches. The anticipated outputs are: (i) functioning flood and riverbank erosion risk mitigation at priority river reaches; (ii) a strengthened institutional system for flood and riverbank erosion risk management; and (iii) operational program management system. The overall design of the investment program had been developed during the multitranche financing facility (MFF) processing. As per the Framework Financing Agreement (FFA), Project 2 will build on the achievements of Project 1 and cover the same subproject areas. Project 2 is basically a continuation of Project 1 for all project activities, including civil works, institutional capacity strengthening activities, and community-based flood risk management (CbFRM) support. Project 2's impact is livelihood in the project area improved. The outcome is flood and riverbank erosion risks in the subproject areas reduced.
B. Project Description	Approved by the Asian Development Bank (ADB) on 26 June 2014, the MMF for the FRERMIP aims at improving the livelihoods of people in the project area along the Jamuna, Padma, and Ganges rivers in Bangladesh. It will reduce flood and riverbank erosion risks through establishing integrated and sustainable structural and nonstructural risk mitigation systems in priority reaches and establishing flood and riverbank erosion risk management (FRERM) institutional systems. The MFF was originally envisaged to comprise three tranches and the program was to provide about 50 kilometers (km) of riverbank protection structures, 89 km offload embankments (rehabilitation and new) with climate-resilient design, and emergency riverbank protection structures. The investment program was designed to be implemented over 9 years. Project 1 closed on 31 March 2021 and comprised: (i) construction of 18 km of riverbank erosion protection and either the construction or renovation of 21 km of flood embankments; (ii) community-based flood risk management activities in 40 villages; and (iii) piloting new wave protection technology using jute along 4 km of embankment and riverbank slopes. Due to the delay in preparing Project 2, the Government of Bangladesh and ADB are now in discussion to restructure the remaining tranches and combine the priority components of the projects 2 and 3 into a single and final tranche and utilize MFF funds within the maximum 10-year MFF availability period, subject to ADB's President's approval. The remaining activities will be deferred to be implemented by including them in a follow-on project to be prepared by the government during the implementation of the final tranche of

	this MFF. Project 2 was originally scheduled for approval in October 2016; however, its preparation has been delayed due to changes in BWDB leadership that led to lengthy technical reviews to finalize the design approach for riverbank protection adopted under this MFF, rebidding of two packages, and issues with land acquisition. The coronavirus disease (COVID-19) pandemic induced-lockdowns have further exacerbated these delays. ADB finally received the government's periodic financing request (PFR) for Project 2 on 7 March 2021, in which the government proposed to restructure projects 2 and 3 into a single tranche (i.e., Project 2) and implement priority activities by 26 June 2024. The proposed Project 2 is estimated to cost $212.80 million, comprising ADB financing of $157.00 million from ordinary capital resources, cofinancing of $17.89 million from the Government of the Netherlands, and government financing of $37.91 million.[1] In its PFR, the government requested that the Project 2 finances (i) construction of 30 km of riverbank protection; (ii) riverbank protection adaptation works of approximately 40 km and emergency works of 6 km; (iii) climate-resilient flood embankment rehabilitation works of 7.9 km; (iv) a river channel closure and a distributary offtake; (v) 2 regulators with fish pass; (vi) establishing 160 community disaster management units and developing their capacity on disaster preparedness, emergency response, and participatory operation and maintenance (O&M); (vii) livelihood development support; (viii) environment management and risk mitigation programs; and (ix) support to the government develop information systems and to prepare a follow-on project.[2] The required due diligence and assessments for Project 2 have been conducted in accordance with paras. 9, 28, and 29 of the Staff Instructions on MFF. As part of Project 1 activities, a river stabilization plan "River Stabilization and Development: Jamuna–Padma and Dependent Areas" was developed in line with international experiences and the Bangladesh Delta Plan 2100. The Delta Plan was approved by the Government of Bangladesh in September 2018 and the River Stabilization Plan in June 2020. Project 2 will build upon the achievements of Project 1 and initiate the process of implementing the river stabilization plan—stabilizing larger river reaches through a combination of strategically placed riverbank protection and channel reduction and char land reclamation through building with nature approaches. A number of new technologies will be piloted for later replication in other reaches. Project 2 will provide the major works to facilitate reliable dry season navigation to Sirajganj and the necessary resources for substantial adaptive and emergency works for all existing ADB-financed sites in the Lower Jamuna and upper Padma rivers, as well as the works implemented by BWDB at Nagarbari. In addition, Project 2 attempts to reclaim some 6,000 hectares (ha) of char land from the river downstream of Chauhali, Sirajganj Division. The priority riverbank protection structures installed during the initial phase of Project 1 and forthcoming Project 2 will be extended or expanded under future works, to gradually stabilize reaches of the river. Project 2 gives priority to the remaining critically eroded sites and

[1] A letter of intent was received from the Government of the Netherlands on 28 March 2021.

[2] A follow-on project will prioritize the inclusion of outstanding components originally included in the scope of this MFF: 40 km of flood embankment and 23.5 km of wave protection with concrete blocks along riverbanks.

	continuation of Project 1 works to ensure the sustainability of the currently constructed riverbank protection structures. Project 2 sites and innovative technologies have been selected in line with the long-term stabilization plan, so that Project 1 and Project 2 structures will not only initiate the stabilization of the Lower Jamuna but also become an integral part of the long-term stabilization investment plan. The specific outputs of Project 2 are as follows: **Output 1: Flood and riverbank erosion risk mitigation functioning at priority reaches improved.** The proposed Project 2 works attempt to further stabilize the Lower Jamuna in general and the bifurcation area with the upper two main branches of Enayetpur and Chauhali channels in particular. In addition, a major eroding channel near the Chauhali channel will be reduced in size through an innovative combination of dredging and bioengineering to provide an offtake into a distributary and enable future development of some 6,000 ha of new floodplain land from reclaimed char land. The proposed Project 2 includes increased provisions for adaptive and emergency works, as a lesson learned from Project 1 and the earlier ADB-financed Jamuna-Meghna River Erosion Mitigation Project.[3] **Output 2: Institutional system for flood and riverbank erosion risk management strengthened.** The institutional development activities of Project 1 will continue with a focus on: (i) Support to the office of the Chief Engineer River Management, BWDB in developing and operationalizing an asset management system for riverbank stabilization works and flood embankments. The development started during Project 1 will be extended in the subproject areas towards an operational system. This activity includes also piloting embankment surveys through drone flights to objectively assess O&M requirements, and incorporating lessons learned from the adaptation works contract. (ii) Expanding the knowledge base especially on morphological developments, fundamental as baseline and to plan ahead river stabilization measures. Hence, systematic, frequent water and sediment discharge measurements will be undertaken in the Lower Jamuna. Distributaries will be mapped, and the geotechnical properties of the riverbanks investigated. (iii) As part of a communication strategy Project 1 has developed and operated a website incorporated into BWDB's website; the website will be further developed and expanded to knowledge base products, including the river stabilization plan. (iv) To address the residual flood risk, the investment program includes community-based flood risk management activities. While Project 1 developed 40 community-based disaster management units (CDMU) in the three subproject areas, another 160 units will be developed under Project 2. Also, the cooperation between BWDB and the Department of Disaster Management, normalized through a memorandum of understanding (MOU), will be continued. The establishment and training of CDMUs will continue to focus on women participation.

[3] ADB. Bangladesh: Jamuna-Meghna River Erosion Mitigation Project (implemented between November 2002 and October 2011).

	(v) Providing capacity development along the lines of Project 1 through national and international training courses delivered through specialist institutions (such as IHE Delft, or Bangladesh University of Engineering and Technology), study tours, preparing international publications, including for conference with participation. **Output 3: Program management systems operational.** All project management will be led by the project management office (PMO) with a subproject management office (SMO) in each subproject. Reflecting the increased size of Project 2, the PMO and SMOs will be strengthened with additional staff resources and supported by an experienced implementation consultant and specialists for safeguard implementation and monitoring, as well as knowledge base development tasks. The PMO will coordinate with the project management unit (PMU) of DDM for implementation of the CbFRM activities to enhance local residents' preparedness against large flood events. The project area is not located in coastal zones, so it is unlikely to be affected by the sea level rise and associated floods. In particular, activities will include: (i) A focus on construction during the dry season and monitoring during the flood season. Associated activities pertain to land acquisition and resettlement, safeguard monitoring, regular auditing, and reporting. Implementation will be directed at higher level through regular steering committee meetings, which will also address higher level issues. (ii) Preparatory activities for a number of Project 2 works at locations not currently fixed due to geomorphological movements in the river system that will be conducted during the first 2 years, as well as a feasibility study to follow on river stabilization works in the Lower Jamuna and Upper Padma rivers. (iii) Preparation of a follow-on project covering the Lower Jamuna and Upper Padma rivers. The aim of this project will be the continuation of river stabilization efforts and expansion of flood risk management in line with the River Stabilization Plan and the Bangladesh Delta Plan 2100. It is anticipated that Project 2 will be implemented between July 2021 and June 2024.
C. Description of Indicative Contract Packages	Project 2 procurement will be carried out under ADB Procurement Policy 2017 (Policy) and Procurement Regulations for ADB Borrowers 2017 (Procurement Regulations) (as amended from time to time). Project 1 procurement followed the ADB's Procurement Guidelines (2013) and ADB's Guidelines on the Use of Consultants (2015). **Indicative consulting and non-consulting packages:** One international firm, national firms / nongovernment organizations (NGOs), NCS and national individual consultant selections as per the following details: (i) Firm - international, C-01 - Institutional Strengthening and Project Management Consultant: engaged through single source selection (SSS) (ii) Firm - national, C-08 - Erosion prediction Consultant: engaged through SSS as per FAM. (iii) Firm - national, C-05, C-09, C-11 and C-12 - River survey, Geotechnical investigations, Numerical study for channel closure and Offtake physical modelling Consultant: engaged through SSS.

(iv) Firm / NGO - national, C-02 through QCBS
(v) Firm / NGO - national, C-03, C-04, C-06, C-07, C-10, C-13, C-14, C-15 and C-16: selection through CQS (9 packages)
(vi) Individual consultant selection - national. C-17, C-18, C-19, C-21, C-22, C-23, and C-24 (7 packages)
(vii) Individual consultant selection - international. C-20 (1 package).

Goods:

One open competitive bidding (OCB) with international advertising, 2 OCB with national advertising and one request for quotation packages will be procured as per the following details:

(i) G-01, G-02, G-03, G-04 and G-05 (5 packages), OCB - international advertising: geotextile bags supply
(ii) G-06, OCB - national advertising: vehicles
(iii) G-07, OCB - national advertising: office equipment
(iv) G-08, OCB - national advertising: survey equipment
(v) G-09, request for quotation: office equipment

Works:

Several types of OCB packages with national advertising W-01 to W-18 comprising stabilization of the Lower Jamuna and bifurcation area with the upper two main branches of Enayetpur and Chauhali channels, reduction of size of a major channel through an innovative combination of dredging and bioengineering to provide an offtake into a distributary with the exact design for channel reduction and offtake structure dependent on prior studies.

Also, Project 2 includes OCB packages for increased provisions for adaptive and emergency works: packages will include construction of flood embankment and adaptation.

D. Summary of the Financing Agreement

The proposed Project 2 is estimated to cost $212.80 million. The summary financing plan is in **Table 1.**

Table 1. Summary Financing Plan

Source	Amount ($ million)	Share of Total (%)
Asian Development Bank		
Ordinary capital resources (concessional loan)	157.00	73.88
Government of the Netherlands (grant)	17.89[a]	8.42
Government	37.91	17.70
Total	**212.80**	**100.00**

[a] Administered by ADB. Includes 2% of ADB's administration charges.
Source: Asian Development Bank.

The government has requested a concessional loan of $157.00 million from ADB's ordinary capital resources to help finance the project. The loan will have a 25-year term, including a grace period of 5 years.

Section 2: Operating Environment

A. Capacity and Capability Assessment of the Borrower

The following strengths, weaknesses, opportunities and threats analysis summarizes the BWDB's procurement capacity.[4]

Strengths	Weaknesses
• Previous procurement experience of BWDB in ADB-financed projects: FRERMIP Project 1 and Jamuna-Meghna River Erosion Mitigation Project. • BWDB has an established PMO under Project 1 which will be continued under Project 2. • Public Procurement Act (PPA) 2006, Public Procurement Rules (PPR), are Arbitration Act 2001 are in place. • Central Procurement Technical Unit (CPTU) in Ministry of Planning has on its website standard bidding documents (SBDs) substantially similar to those of ADB. BWDB is familiar with SBD of CPTU as well as the SBDs of the previous ADB Procurement Policy. • BWDB has well-established planning and design offices headed by Chief Engineers. • To oversee the procurement, BWDB has an independent procurement office named Contract and Procurement Cell under direct supervision of the Director General of BWDB. • Three specialized national institutes (i) Institute of Water Modelling (IWM), (ii) Centre for Environmental and Geographic Information Services, and (iii) River Research Institute (RRI) are proficient respectively for hydraulic modeling studies, environmental and morphological studies and physical modeling studies. Project 2 can utilize their services. • Large numbers of contractors including foreign contractors operate in the market. Private sector is vibrant and competitive. There are three major geotextile manufacturers in Bangladesh. • Continuation of same institutional strengthening and project management consultant (ISPMC) of Project 1 in Project 2 would help BWDB in expediting implementation of Project 2. • Construction materials supply for BWDB projects is stable and sufficient. • There are a significant number of medium sized (contract size: $10 million) • Construction companies conversant with the type of works proposed under Project 2. • Large projects experience of BWDB will help bring	• Lack of online database of contractors / suppliers / consultants in BWDB. Current electronic government procurement (e-GP) is to be updated to provide such information. • Absence of defined system to monitor performance of the contractual obligations of consultants and of works implementation by contractors; hence an ad-hoc approach is followed. • Frequent turnover of PMO staff due to re-assignments / transfers hampers the continuity of the project design and implementation. • Skill gaps of PMO and SMOs staff in procurement and contract management were identified. • Governance issues such as lengthy administrative procedures, and possible corruption. • While the schedule of rates (SOR) is updated annually and are reliable, use and determination of non SOR item prices is problematic. • Contracts not completed on time cause delays and cost overruns. • Large size (works and goods above $12 million and consultancy above $3.6 million) bid evaluation and contract awards are subject to approval from Minister and the Cabinet Committee on Government Purchase (CCGP) with a multi-tiered clearance/ recommendations process, hence this is a major cause of delays in procurement and implementation (around 75 days) and requires coordination with different tiers and departments of the government, which is a cumbersome lengthy process. • Limited interactions of BWDB with contractors awarded a contract create information and dialogue failures, and cumbersome lengthy contract variation processes. • Lack of skilled resources to provide advisory

[4] A few of the Strengths, Weaknesses, Opportunities, and Threats are from World Bank. 2020. *Assessment of Bangladesh Public Procurement System*.

further funding: government • funding or loan/grant from development partners.	and consultative guidance on complex procurement issues, rules and regulations, and weak capacity of BWDB staff to effectively procure, manage and implement relatively complex contracts.
Opportunities	**Threats**
• Targeted / identified frequent trainings will help develop the capability of the PMO/SMOs staff. • Positive impact on local economy expected due to additional jobs, agriculture and business opportunities resulting from Project 2. • Growth in the construction and infrastructure industry creates opportunities for more contractors to enter the market. • Availability of local labor (skilled and unskilled) and at low cost. • Support / develop long-term ongoing partnership with several multilateral and bilateral development partners. • Strengthen the BWDB zonal e-GP training labs for training of the BWDB staff in procurement procedures.	• Few domestic qualified bidders for large works contracts in river protection (>$20 million). If domestic preference is used for geotextile bags supply, the three national manufacturers may increase prices and create delay in supply Project 2 due to their considerable existing supply commitments for the Padma Bridge construction. • Construction window is limited in the floodplains during the monsoon season leading to tight implementation schedules with the risk of not completing works by June 2024 (when Project 2 and MFF will close). • Risk of cost overruns due to project procurement and implementation delays. • Lengthy judicial framework to resolve any contract disputes. • Natural hazards including floods, and cyclones. • Timely land acquisition is a challenge and created delayed in Project 1 for some of the works. • COVID-19 situation exacerbates uncertainties about timelines of procurement and project implementation. • BWDB will use ADB SBDs and new procurement policy under Project 2: lack of familiarity with these could create issues, however trainings will continue to be provided by ADB.

B. Support Requirements

Procurement Capability and Capacity	**Above Average**, due to established procurement decision making procedures and laws. Procurement risk rating is *moderate* at the country level. Risks remain in the implementation of procurement processes, mainly due to a lack of implementation capacity. Delegation of implementation supervision authority and accountability to the country level has strengthened ADB's interactions with counterpart authorities for improved procurement processes. For enhancing efficiency and transparency in procurement, more capacity building and autonomy needs to be provided to agencies, capacity of the members of the tender evaluation committees improved, and more frequent procurement audits conducted. The government is making efforts to address these aspects with support from development partners.[5]

[5] ADB. 2016. *Country Partnership Strategy: Bangladesh, 2016–2020*. Manila.

	The training and capacity building arrangements for BWDB staff is inadequate and needs further support. There have been delays in procurement due to lack of adequate experience of the PMOs for large and complex projects, including those financed by ADB. The PMO for Project 2 will use ADB's SBDs and change to the new procurement policy in Project 2. The PMO has no experience with OCB with International Advertisement and Non-consulting recruitment process and will require experienced expert support for these. The PMO is not familiar with ADB's New Procurement Framework, training and hands-on experience are needed. BWDB and DDM will benefit from procurement trainings to enhance their understanding of procurement in accordance with ADB's New Procurement Framework. To reduce procurement risks, BWDB is advised to carry out internal peer review (using the PMO, SMO, and consultants) of all major procurement transactions. The e-GP process has been implemented successfully. Until the end of financial year 2019, 1,325 out of 1,362 public organizations in Bangladesh and 65,559 bidders have been registered in the e-GP system. The e-GP system is governed by a comprehensive e-GP guideline clearly establishing the security aspects of the system, responsibility of e-GP users at different levels, O&M protocols of the system, copyright, registration process, etc. CPTU through an outsourced firm manages an e-GP help desk with 24X7 functionality. Bangladesh e-GP platform is cleared by ADB only for OCB-national advertising; it is not yet cleared for OCB-international advertising hampering procurement of OCB-international contracts. Bid evaluation report (BER) approval time by BWDB ranged from 17 to 43 days (based on analysis of 14 contracts of Project 1). For four large contracts of a World Bank funded project implemented by BWDB, BER approval by the Prime Minister on recommendation of the CCGP took 60 to 75 days. At the procuring entity level power for approval of contracts/BERs lies with the Head of the Procuring Entity (HOPE) or project director or authorized officers as per Delegation of Financial Power of BWDB. Contracts between $3.6 million to $12.0 million for goods and works and between $1.0 million to $3.6 million for consulting packages require approval of the ministry. For packages larger than $12 million for works and goods and $3.6 million for consultancies, Prime Minister's approval is required. CCGP recommendation can only be accorded after the procurement proposal has been cleared by the HOPE, the Secretary and the Minister. Hence there is a tendency to keep, as far as possible, package size of works/goods below $12 million and that of consultancies below $3.6 million. e-GP data show that contracts approved at the procuring agency level take on an average 3 days to get approval from the appropriate approving authority within the organization after submission of the BER. ADB needs to continue to provide training for local capacity building for procurement and contract management to strengthen the capacity of BWDB. This would motivate and encourage trained staff to continue working for the particular agencies. ADB template for BERs of ADB-financed projects is in use and is to be continued.
Experience in Implementing	**Good.** BWDB has been involved in implementation of similar river

Similar Projects	protection projects financed by ADB since 2002. Project 1 of FRERMIP is physically complete. However successful delivery of Project 2 will require expediting due to the much larger size of work and less than 4 years being available for implementation. Except for the five works packages of Project 1 (which had to be rebid twice due to high prices and less competition and were awarded in third attempt after simplifying work methodology and specifications), all other works, goods and consulting packages of Project 1 were awarded without having to be rebidded. In the 14 works packages of Project 1, the maximum number of bids received were 8 and the minimum 2; average was 4. There were no contract terminations, performance security or bid security revocations.
Contract Management Capability and Experience	**Average;** requires further training, consultant inputs and support. BWDB carries out inspection, cost and quality control, supervision, processes variation requests and final acceptance of products/ deliverables. Contract implementation periods depend on the type, complexity and size of the contracts. Country level data shows that 70% of contracts are not implemented in a timely manner and within the originally stipulated time. Extensions are granted for a number of reasons but are most commonly due to failure to hand over the site in a timely manner, issues with land acquisition, delays in agreeing variations and design approval, non-availability of day laborers or construction materials (during peak construction season), disasters caused by natural hazards, poor quality of goods, works and services, etc. To avoid delays, the PMO / SMOs need to be proactive, including engaging with other organizations as required. With respect to riverbank protection contracts one reason for variation and extension is associated with river changes requiring to adjust the work to the new conditions arising between contract award and start of implementation. Procurement records have been found to be reasonably complete and accurate and accessible in a single file. Further, the e-GP portal systematically stores all procurement data and documents.
Level of Reliance on External Consultants	**High,** given the complex nature of the Project 2. BWDB has long working experience with international and national consultants in projects financed by development partners like ADB, the World Bank and the Government of the Netherlands. With the support of consultants, a large number of projects have been completed or are under implementation. Project planning, technical design and management aspects have been exchanged and shared between consultants and the BWDB. Uncertainties caused by COVID-19 may affect the ability of international consultants/experts to travel in and out of Bangladesh for Project 2. Intensive consultant support will be required by Project 2 for institutional capacity building, procurement, design adjustments, quality assurance, contract and project management. It is recommended to use individual experts for single domain expertise and consulting firms / NGOs for multiple / complex domain expertise. The ISPMC of Project 1 is expected to be continued for Project 2, subject to their performance being rated satisfactory by BWDB.

	Provision in the Schedule 3 of the facility financing agreement stipulates that *"The project management consultant which will be engaged for the first tranche may be engaged through the single source selection modality for subsequent tranches, at* a *request of the executive agency/government, subject to the performance of the team, to ensure the continuity of the project implementation."* This enables BWDB to avoid the long process needed to recruit a new firm and to benefit directly from the vast experience acquired by the firm during Project 1, as long as BWDB is satisfied with the performance of the ISPMC team. It is recommended that consultant evaluation system and case studies on consultant performance evaluation is to be part of procurement training.
Existence and Description of Complaints Management System	**Good.** Under the PPA, 2006 / PPR, 2008 a functional, easily accessible and effective complaint redress system with an independent appeal mechanism exists in the country. The complaint handling procedure in Bangladesh has two layers: administrative review and independent quasi-judicial review by the review panel. The first level of review consists of three sub-levels: (i) procuring entity; (ii) HOPE; and (iii) secretary of the concerned ministry. At all levels there is a defined time limit to respond and discharge the complaint. The complainant can go to the higher tier if s/he is not satisfied with the response. The PPR, 2008 specifies an appeal mechanism procedure including timelines. The complainant cannot proceed to review panel until reviews of the three administrative levels are exhausted. Despite the relatively tight deadlines imposed by the legislation, in reality it takes 2–3 months to reach to the review panel. Both the bidder and procurement entity can challenge the verdict of review panel in the higher courts, if the procurement entity or bidder remain aggrieved.

C. Key Procurement Conclusions

(i) Major risk for the project is to be able to complete all procurement and implementation of Project 2 (which is about 2 times larger than Project 1) by the closure of Project 2 and MFF in June 2024. Project 1 procurement took time due to delays in associated paperwork and approvals for the 31 procurement packages. As the total number of contract packages in Project 2 is larger and the PMO will have the support of two more procurement experts (from BWDB) than under Project 1 since timely and successful procurement completion is a pre-requisite for timely project completion.

(ii) Continuation with the same ISPMC of Project 1 into Project 2, will help in expediting implementation and better quality of project design adjustments due to river changes requiring to adjust the work to the new conditions.

(iii) BWDB is less familiar with OCB (International) Advertisement and Non-consulting recruitment process, and so will need experienced expert support for these. BWDB is not familiar with ADB's New Procurement Framework and will need training and hands-on support. BWDB and DDM will benefit from procurement trainings to enhance their understanding of procurement in accordance with ADB's New Procurement Framework.

(iv) There are few domestic qualified bidders for large works contracts in river protection (>$20 million), therefore BWDB expressed to keep work contracts below $10 million which would ensure adequate competition from qualified bidders. Medium sized works contracts ($20 million–$30 million) do not attract international bidders generally and instead attracts 'ghost' bidders, i.e., bidders who win and resort to back-to-back subcontracting leading to subsequent project management challenges. This is a key aspect to be considered for procurement packaging.

(v) BWDB has implemented many externally aided projects including those financed by ADB and the World Bank. The PMO and SMOs comprise of staff who have experience in various foreign financed projects. Considering large volume of procurement in Project 2, a separate well-staffed and well-equipped procurement unit is to be established in the PMO. To reduce procurement risks, internal peer review (using PMO, SMOs, and consultants) of all major procurement transactions will be carried out. In addition, the PMO, supported by the ISPMC, will have competent contract management and planning staff.

(vi) Given the long duration taken and uncertainty in contract approval by the Ministry and CCGP, BWDB prefers to keep the size of works and goods contract packages to less than $12 million.

(vii) BWDB has faced difficulties and delays in procurement under Project 1. The engineer's estimate and bill of quantities, prepared in 2000, need to be refined slightly to reflect current market rates before inviting bids. Consultant evaluation system and case studies on consultant performance evaluation are to be part of procurement training.

(viii) There is overall a large number of contractors, including foreign contractors, making the market relatively competitive. However, the large contract segment is dominated by few contractors. All works contracts will be advertised nationally.

(ix) There are three major geotextile manufacturers in Bangladesh and a few others internationally.

(x) e-GP system is well established and widely used.

(xi) COVID-19 situation has the potential to cause uncertainty in procurement and implementation timelines increasing the need for efficient and timely procurement process for project implementation within scheduled time.

(xii) There is a need to further improve quality of project documentation and expedite onsite decisions.

D. External Influences Analysis

Governance[6]	The People's Republic of Bangladesh is a parliamentary republic with a national election cycle of 5 years and the cabinet as supreme decision-making body. The country is governed nationally with division (8) and district (64) administrations only having limited roles in public policy making. The present government has been elected for the third consecutive five-year term in the national parliamentary election of 2018. Currently there are no major internal conflicts. Major governance laws have been made and institutions established. The government enacted the law on Right to Information (2009) and established the Information Commission to improve access to information in the public sector. The government enacted several important governance related laws including Anti-Terrorism Financing Act (2009), Money Laundering

[6] Bertelsmann Stiftung. BTI 2020 Country Report: Bangladesh (accessed 9 May 2021).

	Prevention Act (2012), and Public Money and Budget Management Act (2009). A number of labor related laws/rules have been made in the country. The Eighth Five Year Plan, 2020–2025 focuses on productive employment for the growing labor force and a substantial increase in investment. Other key elements of the plan are to ensure good governance and an environmentally sustainable and socially inclusive development process. In addition, Sustainable Development Goals have a target for implementation of sustainable procurement (goal 12.7). However, sustainable public procurement has not yet found its way into the public procurement legislation and practice. CPTU under the Implementation Monitoring and Evaluation Division of the Ministry of Planning functions as the nodal procurement policy formulation agency of the country. CPTU was established in 2002. The main actors in public procurement are the procuring entities, by law endowed with administrative and financial power. There are about 10,000 procuring entities (units and offices under the organizations) within the 1362 public organizations in the country. Procurement in BWDB is centralized in the head offices, in this case the PMO. Instances of uneven application of law may cause uncertainty for the private sector. For the proposed Project 2 agreement with ADB, the existing PPA, 2006, will be applicable for procurement of Goods, Works or Services. In the case of conflict between PPA and agreement with the ADB, the provision in the agreement with the ADB shall prevail. COVID-19 is causing disruptions and uncertainties. Travel and visa restrictions may affect participation of bidders and pre-bid field visits. Bid prices may be high and in- country support through workers and consultants may be difficult. Bidders working on ongoing projects may benefit. Workers returning from abroad may add to the available workforce.
Economic (footnote 6)	Gross domestic product growth during 2000–2020 has ranged between 4.8% to 8.1%. The poverty situation in the country has improved significantly. Bangladesh has also made progress with regard to human development and was ranked 136th in the Human Development Index in 2018, moving up three notches. In the World Bank's Doing Business 2019 report, Bangladesh was ranked 176th worldwide in terms of the ease of doing business. To start a business, nine procedures, 19.5 days and costs of 21.2% of gross national income per capita are required. Bangladesh has an organized market governed by a set of laws and procedures which are sometimes implemented inconsistently. The government favors market liberalization. However, political considerations play an important role in this respect. Due to the perceived high level of corruption, many of the public banks face a severe bad-loan crisis. Corruption remains a major issue in public life in general. The country's performance in bridging the gender gap was significant, and it was top performer in South Asia in this respect with a rank of 48 in year 2018.
Sustainability (footnote 6)	Bangladesh has mostly achieved Millennium Development Goals. The country is highly prone to floods and cyclones causing damage every year. In addition, the country faces severe impacts induced by climate change.

	The Intergovernmental Panel on Climate Change has classified Bangladesh as one of the countries that will be most affected by climate change. Bangladesh is highly vulnerable to climate change owing to hydro-geological and socioeconomic factors. The catchment areas of the Jamuna and Meghna Rivers have experienced massive annual floods, inundating up to two thirds of the country. Given floods and cyclones accelerate riverbank erosion, it is important to protect the riverbank to mitigate erosion and to minimize the impact of climate change. River instability and morphological changes have affected the livelihood of the people living in the riverine areas where poverty is heavily concentrated. Climate change impacts affect water availability by prolonging periods of dry days, spells of drought, or intense and extreme weather events that cause damage to crop due to longer flood duration. Overbank flows and inefficient drainage result annually in inundation of 20%–25% of the country's area. The 100-year flood is projected to inundate 60% of the country's area and has already become more frequent. The 2019 edition of the Germanwatch Climate Risk Index ranked Bangladesh as the seventh of 180 nations most affected by the impacts of extreme weather events during the period 1998–2017.[7] Exacerbated by climate impacts, recurring disasters significantly affect agriculture and rural livelihoods, and various studies conclude that climate change will pose a serious threat to food security.[8] The assets created by capital expenditure by BWDB suffer from inadequate O&M. The O&M of BWDB projects has been institutionally and financially not satisfactory, it gets from the government only 10%–15% of the budget required for adequate O&M.[9] Emphasis is mostly on awarding contracts based on the lowest evaluated price. However, sustainability issues are part of the Government's Vision 2021[10] and there is interest in the government in applying sustainable procurement principles.[11] This is demonstrated in the amendments currently being considered and proposed to the Bangladesh PPA.
Technology	The Project is based on adaptive approach, using sand-filled geotextile bags riverbank protection technology proven in similar projects, supported by ADB/World Bank/government, to work well in Bangladesh. Some components of the project are still being piloted and time is needed to gather evidence about their success. Use of e-GP (comprising bid invitation, submission, bidder submissions validation and bid evaluation) has been mainstreamed for all government

[7] Germanwatch. 2019. *Global Climate Risk Index 2019*. https://www.germanwatch.org/en/16046.

[8] ADB. 2017. *A Region at Risk*. Manila.

[9] Independent Evaluation Department. 2020. *Project Performance Evaluation Report for Jamuna-Meghna River Erosion Mitigation Project in Bangladesh (Loan 1941)*. Manila: ADB.

[10] Government of Bangladesh, Planning Commission. 2012. *Perspective Plan of Bangladesh 2010–2021: Making vision 2021 a reality*. Dhaka.

[11] Sustainable procurement is about taking social and environmental factors into consideration alongside financial factors in making procurement decisions. It involves looking beyond the traditional economic parameters and making decisions based on the whole life cost, the associated risks, measures of success and implications for society and the environment. Making decisions in this way requires setting procurement into the broader strategic context including value for money, performance management, corporate and community priorities (Source: United Nations Procurement Practitioner's Handbook).

	agencies including BWDB engaged in public procurement. ADB has accepted use of e-GP for OCB national advertised for works and goods, not yet for OCB internationally advertised. For consultant recruitment of ADB supported projects, Consultant Management System website of ADB is used.

E. Key Procurement Conclusions

(i) Politico-economic situation is stable. Evolving COVID-19 situation is causing uncertainty and disruptions which need to be factored in to achieve timely procurement and implementation deadlines. Project cost estimates need to factor in costs of disruption and protection from COVID-19.
(ii) Sustainable public procurement has not yet found its way into the public procurement legislation and practice, inducing a potential risk to the project procurement but mitigated by the fact that the PMO will be supported by international-led ISPMC for all aspects of this project.
(iii) Bangladesh has an organized market governed by a set of laws and procedures which are sometimes implemented inconsistently.
(iv) If there is any conflict between provisions of Bangladesh PPA and Project 2 loan agreement, the provisions in the agreement with ADB shall prevail.
(v) The O&M of BWDB projects has been institutionally and financially not satisfactory.
(vi) Sustainability issues are part of the Government's Vision 2021; government is interested in applying sustainable procurement principles which is demonstrated by the amendments currently being considered and proposed to the Bangladesh PPA.
(vii) Overall, there is adequate information and communication technology connectivity, access and speed of internet is good.
(viii) Use of e-GP (comprising bid invitation, submission, bidder submissions validation and bid evaluation) has been mainstreamed for all government agencies including BWDB engaged in public procurement. Use of e-GP is universal and has proved to provide better competition due to improved access.
(ix) For goods, works and services, government procurement is through e-GP portal. ADB's OCB national advertising for goods and works is by e-GP. For consultant recruitment of ADB supported projects, Consultant Management System website of ADB is used.

F. Stakeholder Analysis and Communication Plan

There are several stakeholders to be considered when procuring under Project 2. The expected stakeholders will have varying degrees of influence and impact on the project. A stakeholder is defined as anyone who (currently or in the future):

(i) has an influence on the Project 2 (including its process and outcomes);
(ii) has a meaningful interest in the Project 2; and
(iii) would be directly or indirectly impacted (positively or negatively) under Project 2.

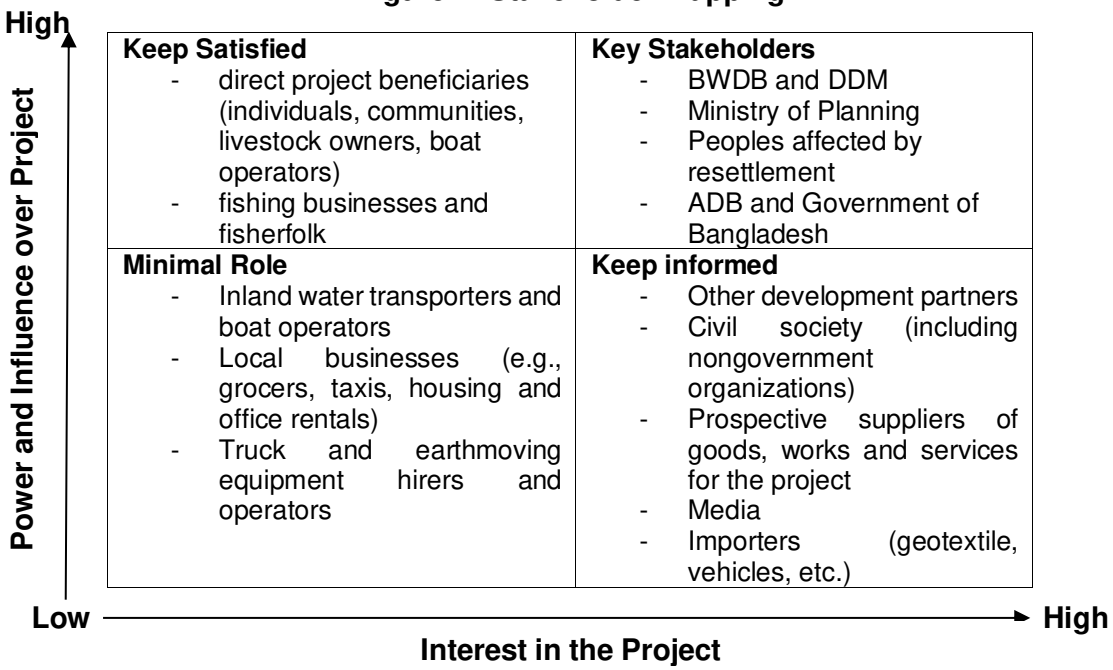
Project 2 stakeholders are:

(i) government agencies, in particular, BWDB and DDM;
(ii) ADB and other development partners (such as the Government of the Netherlands);

(iii) people affected by resettlement;
(iv) direct project beneficiaries (individuals, communities, livestock owners);
(v) civil society (including nongovernment organizations);
(vi) media;
(vii) prospective suppliers of goods, works, and services for the project;
(viii) inland water transporters and boat operators;
(ix) fishing businesses and fisher folk;
(x) importers (geotextile, vehicles, etc.);
(xi) local businesses (e.g., grocers, taxis, housing and office rentals); and
(xii) truck and earthmoving equipment hirers and operators.

Figure 1 shows the main stakeholders who of the project. It categorizes each stakeholder by their level of interest in the project and their power and influence over the project.

Figure 1: Stakeholder Mapping



G. Stakeholder Communication Plan

Quarterly progress reports will be posted on the Project 2 website and ADB website. Involving and consulting stakeholders during project planning and implementation would be undertaken by the PMO and SMOs.

Stakeholder Name and Role	Ministry of Planning
Interest in the Project	- Funding and monitoring of the Project 2.
Support and Influence Level	- High. Supporter.
Objections, Drivers, Needs, and Levers	- Need for expeditious processing of loan agreement and timely solution of financing issues and funding during implementation.
Action	- Maintain timely involvement, be informed and follow up.
Responsible, Accountable, Consulted,	- Consulted and informed

or Informed	
Communicate What, When, and How?	- Communicate by all essential means and keep constantly informed according to its periodic reporting requirements.

Stakeholder Name and Role	**BWDB and DDM**
Interest in the Project	Executing agency and implementing agency
Support and Influence Level	High. Supporter
Objections, Drivers, Needs, and Levers	Timely contracting and disbursement, smooth project implementation, monitoring and evaluation.
Action	Maintain project control, be fully involved and informed and follow project instructions.
Responsible, Accountable, Consulted, or Informed	Responsible and Accountable
Communicate What, When, and How?	Communicate extensively both ways and keep itself constantly and periodically informed.
Stakeholder Name and Role	ADB Project Division and Bangladesh Resident Mission and other development partners
Interest in the Project	Assists and supervises the project based on legal agreements between ADB and Banqladesh.
Support and Influence Level	Hiqh. Supporter.
Objections, Drivers, Needs, and Levers	Need for expeditious processing of loan agreement, funding, assistance, supervision, no-objection to prior review procurement activities
Action	Maintain timeliness involved and keep itself informed. Follow agreed policies, procedures and decisions.
Responsible, Accountable, Consulted, or Informed	Consulted and informed
Communicate What, When, and How?	Communicate well and keep constantly informed according to agreed periodic reporting requirements.

H. Key Procurement Conclusions

(i) Key stakeholders of Project 2 who need to communicate regarding procurement are Ministry of Planning, BWDB, DDM and ADB

(ii) It is important that the project website grievance redress section maintained by the PMO continues to address issues related to procurement.

(iii) BWDB and DDM to inform stakeholders about FRERMIP Project 2 implementation through media, consultations and project website regarding project progress and procurement.

(iv) Communication is an essential part of the procurement process during both the planning stage and the implementation stage. A stakeholder communication plan is to be prepared by PMO and implemented.

Section 3: Market Analysis

A. Porter's Five Forces

Porter's five forces[12] is a tool for analyzing the competitive intensity and attractiveness of an industry's profitability. The "five forces" are those close to a company that affect its ability to serve its customers and make a profit. It defines three forces from "horizontal" competition—the risk of substitute goods or services, the risk of new entrants, and competitive rivalry—and two forces from "vertical" competition—the bargaining power of suppliers and the bargaining power of buyers.[13]

1. Competitive Rivalry

Medium. For goods (primarily geotextile) there are three domestic manufacturers with combined annual geotextile supply capacity of approximately $90 million. They are supplying geotextile to Padma bridge project which may mean their capacity to supply to Project 2 could be constrained. If the total geotextile requirement is tendered as one bid (multiple lots), it would attract international bidders and would lead to high competition and lower prices.

Adequate. Local competition is adequate for planned works procurement. In Project 1, the number of average bidders was 4. International bidders may participate only for very large works packages involving dredging. International bidder participation has been less for works packages in Bangladesh due to the smaller package size (< $20 million) and cost-effective local bidder participation.

Adequate. Competition is expected to be good for consultant packages and adequate for non-consulting services packages (surveys mainly). Two national consulting packages are highly specialized with no domestic competitors likely and hence are proposed for SSS. Echo-sounder for bathymetric surveys have limited number of local qualified firms competing, other surveys would have adequate competition.

2. Bargaining Power of Buyers

High. BWDB / DDM bargaining power is high since procurement volumes are large, contract sizes are medium to large and adequate alternative sources of supply exist. Reliability of payments for Project 2 is assured despite longer procurement processes and delays in counterpart fund availability from government. Market intelligence and understanding of BWDB is good.

3. Bargaining Power of Suppliers

Low. The goods works and services supply market has high number of potential bidders in Bangladesh. The bargaining power of local contractors is low, as there is greater competition, lack of cash flow and many potential sources. There are no constraints on availability of construction materials (some of which are imported from Bhutan and India)

4. Risk of New Entrants

Medium. Barriers to entry for local contractors are low due to favorable economies of scale and low cost of market entry (regulation regarding firm's registration, controlled entry of personnel,

[12] https://en.wikipedia.org/wiki/Porter%27s_five_forces_analysis
[13] ADB. 2018. *Strategic Procurement Planning Guidance Note on Procurement*. Manila (para 4.5).

taxes etc.). A few contractors dominate the high end of the works contracts market. Entry barriers for international goods suppliers and contractors are high due to cumbersome legal and procedural requirements of registration and compliance and comparatively smaller procurement package sizes (except geotextile).

5. Risk of Substitutes

Low. This risk is low due to most of the procurement being supplied by local market, skilled and cheap labor and high competition.

B. Key Procurement Conclusions

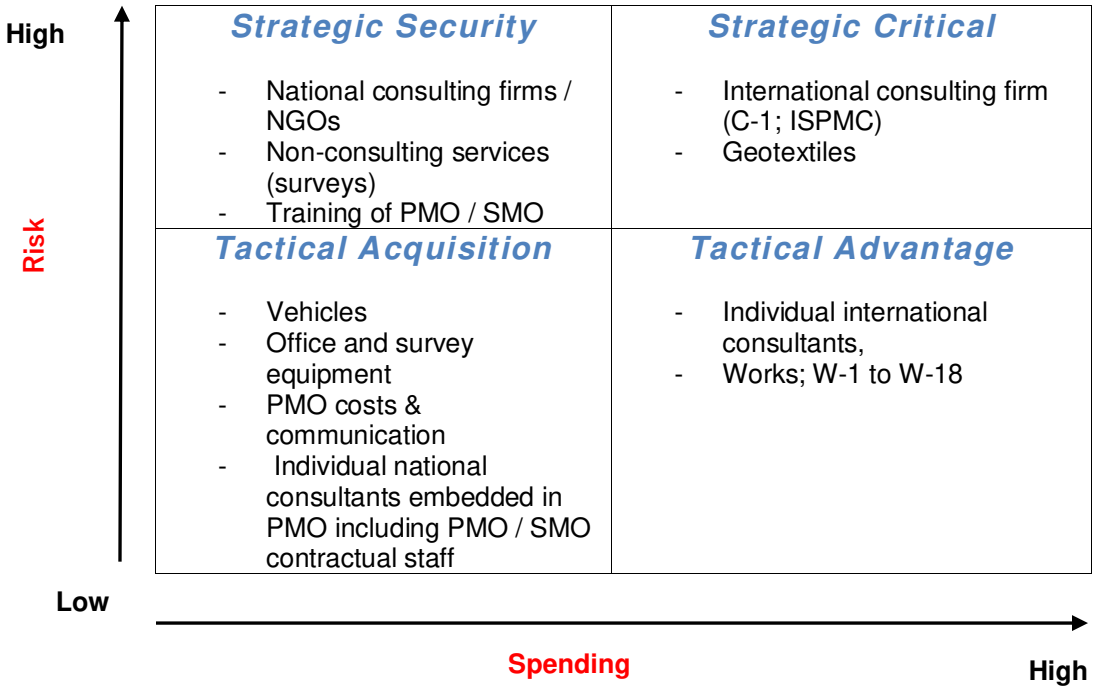
(i) Local market is large providing good competition for small and medium sized civil works However, the local market is less competitive for larger works. There is developed market for consulting and non-consulting services (except very specialized surveys) planned under Project 2. Good competition for geotextile would be ideally ensured if tendered as one large package with multiple lots as ADB proposed to the executing agency. However, the executing agency lacks experience in procuring using *multiple lot contracts* and requested that bidding of the packages be done individually. Competition is expected to be sufficient as the size of the individual packages is sufficiently large and advertisement will be international.
(ii) BWDB / DDM bargaining power is high since procurement volumes are high, contract sizes are medium to large.
(iii) Bargaining power of goods suppliers is low if tendered as one bid with multiple lots since international bidders would participate due to large value contract, prices too would be competitive.
(iv) Bargaining power of local construction contractors and consultants is low.
(v) Barriers to entry for new domestic entrants are low, for international entrants high. Risk of substitutes is low.

C. Supply Positioning

The supply positioning tool[14] (Figure 2) is used to differentiate the procurement approaches for the contract packages in Project 2. Works contracts would be of medium to large size. Procurement of vehicles would be single bid with multiple lots. Geotextiles should preferably be procured as a single bid (with multiple lots) to make them more attractive to large suppliers (domestic and international) and to obtain better prices.

[14] ADB. 2018. Strategic Procurement Planning Guidance Note on Procurement. Manila (para 4.11). The supply positioning tool is used to consider how to differentiate the procurement approaches for the proposed contract packages and lots within any given project. It positions contracts into four groups based on their level of spending and level of risk: strategic security, strategic critical, tactical acquisition, and tactical advantage. The tool also enables the borrower to adopt the correct level of performance metrics and relationship management styles within the project. While the project's procurement risk will have been categorized at project conceptualization, it is worth validating further at this stage, based on the analysis of the market and the operating environment.

Figure 2: Supply Positioning Tool



D. Key Procurement Conclusions

(i) About 26% of total procurement by value is in high risk (strategic critical and strategic security) category.

(ii) Supply constraints (i.e., supply of goods, works and services) of serious nature for Project 2 unlikely. However, any delay in clean and quick procurement of geotextile and large works contracts would have a cascading delay effect on Project 2 since critical work packages require supply of geotextiles and can only be awarded after securing geotextile supply. It is expected ISPMC services would be extended to Project 2 as provided for in the FFA.

E. Supplier Preferencing

Detailed supplier preferencing analysis in terms of positives and negatives was applied to provide an indication of how suppliers may view ADB financed projects in terms of attractiveness of doing business and the behaviors suppliers may exhibit in bidding and delivering contracts.

POSITIVES	NEGATIVES
Assured availability of finance resulting in timely completion of good quality projects.	Decision made based on lowest bid cost may result in poor quality and incomplete work.
Security of Payment. PMO has a track record of making payments in completed and ongoing ADB projects within the period allowed in the contract.	Slow decision-making (by the multi layered PMO, BWDB, Ministry and CCGP) during the procurement process adds costs and increases uncertainty for suppliers and contractors. Big risk to timely complete Project 2.
ADB financed projects can provide a good entry to suppliers for winning business from Governments	Lengthy procurement processes (due to involvement of the multi layered PMO, BWDB,

POSITIVES	NEGATIVES
and other MDBs.	Ministry and CCGP based on procurement value thresholds).
Conditions of contract provide for a reasonable approach to sharing risk.	Low investment in contract management by PMO/SMO increases the resource requirement to support delivery and increases the risks of protracted contractual delays and disputes. As mentioned above, risks completion of Project 2
High value works contracts present opportunity for scaling up of size and competence of domestic contractors, suppliers and consultants. They can join forces through JVs / consortiums; this would help them also for the future on other projects.	Political interference and work disruptions due to political and social unrest. Complications and delays if resettlement and environmental issues are not managed well.
ADB safeguards and overall timely contract delivery are value for money.	Splitting of goods and works contracts to keep below the Ministry or CCGP approval thresholds may keep away the large (international and national) suppliers and bidders.
	Using domestic preference for geotextile package would discourage international bidders from bidding. This may encourage domestic suppliers to increase prices and may lead to delayed supplies since domestic suppliers' supply capacities are stretched due to existing commitments (i.e., Padma bridge).

F. Key Procurement Conclusions

(i) Potential bidders view ADB financed projects favorably, in Project 1, average of 4 bids were received.

(ii) Supplier / bidder preferencing indicates that ADB financed projects, and projects implemented by BWDB are generally attractive to the market and in terms of relative value have much to offer to suppliers and contractors.

(iii) Large suppliers/contractors are likely to view ADB and BWDB projects as core business while smaller subregional suppliers and contractors are likely to see them as a growing opportunity for their business and get experience in delivering an ADB financed project.

(iv) Supplier preferencing is not a major issue for Project 2 (this inference is based on the earlier similar completed projects of Project 1 and similar previous BWDB projects financed by ADB). An exception is geotextile supply; using domestic preference may deter international bidders and BWDB may end up getting higher prices in addition to the potential risk of delays in delivery.

(v) Delays in procurement may induce the risk of the PMO not be able to complete some works before the closure of Project 2 and the MFF on 26 June 2024 (the MFF will not be extended by ADB beyond its 10-year period maximum availability period and will close on 26 June 2024). In that case, the Government of Bangladesh will have to complete the works with their own funds.

(vi) Adequate bidder participation and competitiveness are likely. Only one instance of 4 works packages rebid twice reported in Project 1. No serious contractual disputes / termination in Project 1.

Section 4: Risk Management

Project Procurement Risk Assessment Risk Register

This section summarizes the assessment of project procurement risks in accordance with ADB's procurement risk framework 2017.

Risk assessment involves the following steps:

(i) Estimating the likelihood of the risk being realized
(ii) Estimating the consequence of the risk being realized
(iii) Determining the resulting risk rating
(iv) Prioritizing risks for mitigation

For the Project Procurement Risk Assessment process to be manageable, the assessment is structured around the following key areas:

(i) natural and health hazards
(ii) borrower's experience, including capability and capacity
(iii) business and operating environment
(iv) supplier relationship management
(v) sustainability issues

The following factors have been considered during this process:

(i) previous experience and judgment of the borrower
(ii) information from ADB reports and systems, and discussions during market analysis with PMO of BWDB
(iii) understanding of key decision drivers from the borrower and the supply market
(iv) assessment of the capacity of contractors and suppliers who could potentially bid for packages under the project and analysis of assumptions made during project design

Risk mitigation actions fall into the following four main types:[15]

(i) **Avoid**. Choosing not to accept the risk, e.g., an activity is avoided as the risk is deemed too great.
(ii) **Minimize**. Reduce or control the risk through improved monitoring, process change, new procedures, etc.
(iii) **Spread or transfer**. It may be possible to transfer or share risks using actions, such as subcontracting, outsourcing, public–private partnerships, joint ventures, hedging, insurance, etc.
(iv) **Accept**. Decide that the risk is within an agreed tolerance level.

Based on above considerations, the Risk Register has been prepared and is in Table 2.

[15] ADB. 2018. *Strategic Procurement Planning Guidance Note on Procurement*. Manila (para 4.11).

Table 1: Procurement Risk Assessment Risk Register

Risk Rating: Extreme High Medium Low

Sl. No.	***Risk Description***	***Likelihood (L) (1–5)***	***Impact (I) (1–5)***	***Risk Score (L x I)***	***Proposed Mitigation***	***Risk Owner***
1	Significant environmental event (e.g. floods, cyclone, earthquake, tsunami) impacts project	4	4	**16**	Incorporate in environmental management plans of the Project 2 and in bid document. Contracts to appropriately allocate risk for downtime. Ensure appropriate insurances to be taken by contractor / supplier / service provider are provided for in the bid document.	BWDB, contractor / supplier / service provider
2	Impacts of the coronavirus (COVID-19). The COVID-19 pandemic has imposed significant challenges to (i) the timely procurement of the civil works, consulting and NCS contracts; and (ii) the execution of the civil works in the field.	5	4	**20**	Procurement to be done through e-GP to the extent possible as allowed by ADB. Pre bid meeting, bid submissions to be accepted online. Digital information and detailed engineering designs will enable prospective bidders to undertake technical due diligence for preparing their bids without a pre-bid visit. Provide reasonable time cushion for mobilization by contractor / consultant before actual contract execution starts end of 2020.	All project stakeholders
3	Inadequate PMO and SMOs staff provided by BWDB	4	4	**16**	a) Specific loan covenant is provided to ensure that BWDB fields the full PMO staff complement from its existing staff resources and through additional consultant recruitment, as required. b) PMO and SMOs staff will be supported by experienced project management consultants, and will receive training in ADB procurement, contract management and disbursement procedures. PMO would need to have 2 more procurement experts than in Project 1.	BWDB
4	Potential decline of financial management capacity due to changes of PMO and SMOs staff	4	4	**16**	a) PMO accounting staff will receive training in ADB procedures. b) BWDB will ensure that regular internal and external auditing of the project will be prioritized.	BWDB

Sl. No.	*Risk Description*	*Likelihood (L) (1–5)*	*Impact (I) (1–5)*	*Risk Score (L x I)*	*Proposed Mitigation*	*Risk Owner*
					c) Computerized accounting will be adopted and staff will be trained. Financial information will form part of the management information system to be established under the project.	
5	High turnover of project management team	4	4	**16**	Discuss with BWDB management. Consider including correctives such as paying incentives and deploying similar project experienced staff	PMO, BWDB
6	Gaps in /PMO/SMO procurement and contract management expertise (e.g. resources, technology, skills)	3	5	**15**	Project to recruit additional number of professional procurement experts to support procurement and capacity building.	PMO, BWDB, SMOs
7	Delayed decision making within BWDB and Ministry	4	5	**20**	Simplify decision chain and ensure all decisions are made within time provided for in PPR at every tier.	BWDB, Ministry
8	Too long bid evaluation time	4	4	**16**	a) Provide capacity building training from ADB and procurement professionals b) Involve consultants in bid evaluation	PMO, BWDB
9	Poor contract management	4	4	**16**	Improve capacity of contract management, and ensure consultant support in review of draft contracts before negotiations and administration of the contract	SMO, PMO, BWDB
10	Limited verification of procurement and expenditure practices	3	4	**12**	Include sample procurement check in scope of work of External Auditor. To reduce procurement risks, carry out internal peer review (using PMO, SMO, consultants) of all major procurement transactions	Ministry of Finance, BWDB, ADB
11	Inadequate hands on procurement training	3	3	**9**	Strengthen training of SMO / PMO by providing specific budget in the project. Work with procurement consultants to improve skills.	PMO, SMOs, BWDB, ADB
12	Delayed payment to the consultants and contractors	2	3	**6**	a) Specific loan covenant is provided to ensure that BWDB fields the full staff to the PMO and SMOs, including financial officers. b) BWDB, as per standard operating procedures of externally aided projects, to apply ADB's direct payment method to international consultants and contractors.	BWDB

Sl. No.	Risk Description	Likelihood (L) (1–5)	Impact (I) (1–5)	Risk Score (L x I)	Proposed Mitigation	Risk Owner
					c) ADB to monitor and facilitate PMO's timely submission of financial documents to ensure timely replenishment of imprest account and government allocation and availability of counterpart funds.	
13	Splitting of goods and works contract packages to keep them below the $12 million threshold to avoid requiring approval by Prime Minister's office which may cause significant delays	5	4	**20**	This risk is on the critical path since increased number of packages overloads PMO capacity and delays procurement and Project 2 completion. Either combine similar packages to be tendered in same quarter of the year to reduce and expedite approvals from Prime Minister's office; or ensure PMO has adequate capacity to carry out procurement of 46 packages within the time indicated in procurement plan.	BWDB, ADB, PMO
14	Corruption and nepotism	3	4	**12**	BWDB to adopt procurement checks by peer review from BWDB staff experienced in procurement. Adopt period external audit of procurement. Use project website to disclose project information. Advertise bids on project website / Bangladesh e-GP portal and services on ADB CMS.	SMO, PMO, BWDB, Ministry
15	Stakeholder(s) create delays to project procurement and implementation	3	5	**15**	Early and ongoing stakeholder engagement/consultation to minimize disruptions and surprises. Follow stakeholder communication plan for key stakeholders.	BWDB
16	Specialized works (e.g. geotextile dumping) and low cost estimate may deter or limit the number of bidders, which could increase bid prices or reduce quality	3	4	**12**	Try to attract a wide enough international / national market by reducing risks and uncertainties during the design and due diligence stage.	BWDB, Ministry
17	Inadequate public disclosure of procurement (advertising, results of bidding, contract award cost, contract period, reasons for not qualifying etc.)	3	3	**9**	Use print, visual and electronic media to disclose information periodically. Take all steps to ensure compliance with ADB's public information policy.	ADB, PMO, SMOs, BWDB

Sl. No.	*Risk Description*	*Likelihood (L) (1–5)*	*Impact (I) (1–5)*	*Risk Score (L x I)*	*Proposed Mitigation*	*Risk Owner*
18	Delayed commencement of civil works for flood embankments caused by long delays in land acquisition by deputy commissioners at district level	4	5	**20**	a) Land acquisition and resettlement plan implementation form part of the agreed advance actions to be initiated prior to loan approval. b) Land acquisition in time critical and needs intense efforts by PMO (since MFF cannot be extended, delayed land acquisition would result in incomplete Project 2) c) BWDB and ADB will monitor implementation of the time-bound action plan and initiate corrective measures, if necessary. d) PMO will maintain frequent communication with deputy commissioners' offices, and will continue stringent monitoring of the progress.	PMO, SMOs, BWDB and ADB
19	Ghost bidders (i.e., bidders who win and resort to back-to-back subcontracting)	3	4	**12**	Large package to increase attractiveness of bidding for the contractors / suppliers with the adequate resources. Enforcing contract provisions for contractors' / suppliers' quality, workmanship and supervision.	BWDB, ADB, PMO
20	Abnormally low or abnormally high bids	3	5	**15**	Careful assessment in accordance with provisions in standard bidding documents and strictly following ADB's guidelines during evaluation.	PMO, BWDB
21	Imbalanced bids	3	3	**9**	Seek additional performance security amount.	PMO, BWDB
22	Scope or price variation claims from contractor due to "unforeseeable" conditions	4	4	**16**	Undertake in depth assessments during detailed design to minimize uncertainties during construction. Ensure specifications and contract terms are robust, include all probable work items in bill of quantities in bid document and include appropriate contingency in each contract and Project 2 cost estimates.	BWDB, Ministry
23	The assets created by BWDB suffer from inadequate O&M. The O&M of BWDB projects has been institutionally and financially not satisfactory.	5	5	**25**	Include O&M of assets as part of works contract at least till the end of Project 2 completion.	BWDB

Score of 1 indicates lowest impact / likelihood, 5 indicates highest impact / likelihood

Section 5: Options Analysis

This step of the SPP process generates strategic procurement options that will fulfill the overarching project needs. It considers the project's development objectives, stakeholder objectives, and procurement objectives that have been assessed in the previous steps. The procurement options generated here will influence the procurement strategy and procurement plan in the next step. This will help to ensure that the procurement plan is fit for purpose and will provide the maximum opportunity for the project to deliver value for money sustainably.

This analysis summarizes the procurement options available for the Project 2. It is based on the research and analysis undertaken in the previous steps of the SPP. It is likely there will be different procurement options available to the borrower, so it is important that the options are screened and assessed correctly to ensure the SPP will deliver the most fit-for-purpose approach, to maximize the value for money in Project 2 and contract delivery.[16]

The following key options have been considered for procurement under FRERMIP Project 2:

(i) Contract Packaging and Scheduling
(ii) Procurement Method and Bidding Procedures
(iii) Specifications
(iv) Review Requirements
(v) Contract Form, Pricing Method, and Bidding Documents
(vi) Evaluation and Qualification Criteria
(vii) Contract Management Approach

The following criteria have been used for analysis of options:

(i) **Suitability.** Will the option meet the project's overall development objectives?
(ii) **Feasibility.** Will the option work? Can it be achieved in an acceptable cost and time frame? Does the market have the capacity? Are the required resources available?
(iii) **Acceptability.** Will the identified stakeholders support and buy-in to the option?

Strategic options and their rating for procurement under Project 2 are presented in **Table 3**. S1, S2 etc. are main strategic options. O1, O2…… are sub options. Criteria rating score range from a minimum 1 to maximum 10, 1 denotes lowest score, 10 highest. Strategic options with higher overall score obtained by adding feasibility, suitability and acceptability scores are the better options.

[16] With slight modification from paras 6.1 and 6.2 of Strategic Procurement Planning Guidance Note on Procurement. 2018. ADB.

Table 3: Strategic options and their rating for procurement under Project 2

Strategic Options Description	*Feasibility (1–10)*	*Suitability (1–10)*	*Acceptability (1–10)*	*Overall (3–30)*
S1. Contract Packaging and Scheduling **O1.** Minimum number of works (small or large) packages (in multiple lots), one for each subproject and goods (except vehicles, office and survey equipment). Most packages to be procured through advance contracting.	8	7	1	16
O2. Works (small or large); 23 packages, goods 4 packages (geotextile one tender with 4 lots), each of them packaged below $12 million to avoid delays in approval by CCGP. Procurement schedule aligned with implementation schedule (working season)	7	7	7	21
O3. Consulting or non- consulting services recruitment process for all packages and some individual consultants. All survey packages to be under ISPMC. Most packages to be procured through advance contracting.	5	2	2	9
O4. Continuation of Project 1 ISPMC consulting services, 2 specialized consulting packages through direct contracting, rest 16 services packages through competitive consulting or non-consulting services selection process and some individual consultants. All survey packages to be procured in lots through non-consulting services selection process or included in ISPMC. Timing of services procurement as per need (aligned with implementation schedule).	8	9	8	25
S2. Procurement Method and Bidding Procedures **O1.** OCB with national/international advertising for goods and works (small or large); single-stage one-envelope submissions of technical and financial proposals for works and goods. Continuation through direct contracting of ISCPC, direct contracting of 2 specialized special services consulting packages (C-11 and C-16), OCB national for consulting and non-consulting services of firms/NGOs, submissions of technical and financial proposals. ICS for individual experts. International advertisement for works > $15 million, goods > $1 million. No prequalification.	8	8	9	25

Strategic Options Description	*Feasibility (1–10)*	*Suitability (1–10)*	*Acceptability (1–10)*	*Overall (3–30)*
O2. OCB with national advertising for all goods, works (small or large), consulting and non-consulting services; single-stage two-envelope submissions of technical and financial proposals for works and goods. OCB national for consulting and non-consulting services of firms/NGOs, submissions of technical and financial proposals. ICS for individual experts. Selective prequalification.	8	4	5	17
S3. Specifications **O1.** Conformance specifications for works and goods, time-based contract for consultants, lumpsum contracts for non-consulting services and directly contracted consultants.	8	9	8	25
O2. Performance specifications for works and goods, lumpsum contract for consultants and non-consulting services.	3	4	5	12
S4. Review Requirements **O1.** Prior review of all works, goods, consulting and non-consulting packages.	3	1	3	7
O2. Prior review of only first contract package of works and goods with national advertising, post review of the others. Prior review of all goods packages with international advertising and of consulting and non-consulting packages.	7	7	9	23
O3. Post review (sampling) of all procurement.	7	2	4	13
S5. Contract Form, Pricing Method, and Bidding Documents				
O1. ADB standard bidding documents and contract forms, unit prices.	8	8	9	25
O2. Bangladesh bidding documents and contract forms (issued by CPTU), lumpsum prices.	6	3	5	14
S6. Evaluation and Qualification Criteria **O1.** Include in bid documents, minimum but essential evaluation and qualification criteria. Include qualification criteria for subcontractors. Reject abnormally low bids.	8	8	8	24
O2. Include in bid documents, median level of evaluation and qualification criteria. No qualification criteria for subcontractors Accept abnormally low bids with higher performance guarantee.	5	5	6	16
S7. Contract Management Approach **O1.** Optimize inputs of experts, rely on	8	8	8	24

Strategic Options Description	***Feasibility (1–10)***	***Suitability (1–10)***	***Acceptability (1–10)***	***Overall (3–30)***
consultants for procurement, design and quality of work. Adopt collaborative and transactional relationship with contractors, suppliers and consultants. Make contractors enforce safety, health and environment measures, particularly those related to COVID-19				
O2. Minimize international expert inputs. PMO takes responsibility for contract management, design and quality of work. Contractors enforce safety, health and environment measures, PMO responsible for measures related to COVID-19.	5	2	5	12

Section 6: Procurement Strategy Summary

A. Procurement Packaging and Scheduling

Discussions were held (mainly during a SPP workshop held online on 21 July 2020) with PMO, ADB staff and Project 1 consultants on the following possible options in relation to the indicative packages and options analysis.

(i) Merging of packages to the extent possible so that BWDB's procurement effort is minimized. This was done but only up to a point since the consensus was not to exceed $12 million threshold to avoid delays in contract approval at CCGP and also not to make package sizes larger than $20 million which would reduce competition amongst national bidders. The works package for the reduction of the Solimabad channel and the offtake structure are dependent on prior studies to be conducted at the start of Project 2 but will likely exceed the threshold and hence will be OCB international advertising packages. In summary, the 51 packages are a significant reduction from the 66 packages under Project 1 despite Project 2 being twice the volume.

(ii) Determination of appropriate bidding procedure and extent of ADB review. All works and goods packages would be 1S1E (Except one package W-04 which would be 1S2E[17]) Given BWDB's considerable prior experience, only the first package of each type for works and goods and all consulting and non-consulting services packages shall be prior reviewed by ADB.

(iii) Recommend appropriate form of contract document after analyzing the nature of works which is relatively complex. The bidding should be such that it can be efficiently handled by the PMO. All works and goods packages are unit price, large consulting package contract forms are time based (small consulting package contract forms could be lumpsum) with non-consulting services packages contract forms being lumpsum.

(iv) Despite efforts to merge some of the survey packages to reduce tendering effort, 17 firms / NGOs and 2 individual consultants will be recruited. Of these 4 are by SSS. Surveys are all highly specialized, PMO informed that there is no national firm with expertise in all, hence use of lots to procure surveys as non-consulting services is recommended. Being of small value, they would not attract international bidders.

(v) The assets created by BWDB suffer from inadequate O&M. The O&M of BWDB projects has been institutionally and financially not satisfactory. To mitigate this risk: include O&M of assets and adaptive approach components as part of works contract at least till the end of Project 2 completion.

Based on previous analysis, draft Procurement Plan is presented at the end of this report.

B. Procurement Method

The preferred procurement method for work package is Open Competitive Bidding (OCB) with international advertising for package W-08 and national advertising remaining 17 works

[17] W-04: Upstream Chauhali riverbank protection with geotextile bags (7.9 km), including 1 km of dredging on the underwater slope. The dredging of the underwater slope requires precise shaping to achieve a smooth surface. If this is not achieved, it can result in irregular launching of geobags, creating gaps in the protection and leave the works vulnerable. 1S2E was chosen to allow detailed review of the technical proposal to assess the Contractors ability to achieve this smooth surface.

packages. The geotextile procurement should be OCB with international advertising, 2 goods packages would be OCB national and 1 package RFQ. QCBS and CQS would be used (with Q:C ratio of 90:10 and 80:20 as shown in procurement plan) for consulting services to recruit firms / NGOs. Six firms/ institutions are being recruited through single source selection (SSS) due to justified reasons. Ten individuals will be selected using Individual Consultant Selection method. Survey packages shall be recruited by QCBS or CQS or NCS, if not through SSS.

BWDB has good experience in managing and delivering these types of procurement processes. Current government practice is also based on these processes. There could be potential interest from international bidders to participate in goods contracts and the large works contract (W-5). For all works packages which are comparatively smaller, experience of national contractors can meet the requirements. Survey equipment shall be procured through RFQ.

C. Prequalification

Prequalification is not to be used for any packages of works for Project 2.

The technology-intensive designs (except for one work package) have been done by ISPMC and BWDB during Project 1. Execution of works of fully designed works, mostly of small size, does not require prequalification.

D. Bidding Procedures

Single-Stage, One-Envelope bidding procedure will be used for works packages, as it is consistent with BWDB and Project 1 practice (except W-04 referred earlier which would be 1S2E). The design of the Project 2 will present the market with a familiar requirement for which there are adequately qualified number of bidders.

E. Specifications

Specifications were discussed as being a mixture of both conformance and performance. Conformance is required in relation to the technical, health and safety aspects of the works and compliance to environmental and technical aspects of the project. Performance specifications may be explored in relation to non-consulting services.

F. Review Requirements

Prior review recommended of only first package each of works, goods and non-consulting services, and for all consulting services packages. This will support procurement process efficiency by reducing overall processing time.

BWDB has been successful in implementing Project 1. PMO is familiar with the processes and can shoulder higher responsibility and is expected to benefit from a certain degree of continuity. First package prior reviews are needed since Project 2 would follow ADB's Procurement Framework 2017.

The value of prior review will be to significantly improve the bidding document and ensure all the necessary clauses are there. This would reduce the likelihood of delay in procurement activity of later packages.

G. Standstill Period

A standstill period of 10 working days following the notification of intent to award a contract, during which the bidders may challenge the award decision is recommended.

H. Standard Bidding Documents and Contract Forms

ADB SBD for small works with e-GP and national advertising will be used for work packages costing less than $10 million and large works SBD for packages more than $10 million. SBD for small works have simpler contract conditions. Geotextile procurement would use ADB SBD goods 1S1E.

QCBS (90:10 or 80:20) or CQS selection methods with FTP/STP/BTP (depending on nature of work and estimated cost of services) will be applicable for consulting and non-consulting services procurement. For consulting packages time based (for small packages lumpsum contracts) and for non-consulting services lumpsum forms of contract to be used. This will help in selecting technically competent firms. Individual consultants would be hired using Individual Consultant Selection method.

I. Pricing and Costing Method

For works, unit price bill of quantities will be used. Costing shall be based on updated and most recent Schedule of Rates of BWDB. For goods, unit prices will be used.

For consulting services input time-based contracts (for small packages lumpsum contracts) to be used. For non-consulting services costs would be estimated based on units of work even though lumpsum form of contract is to be used.

J. Key Performance Indicators

(i) Contract awards and disbursement - forecast versus actual.
(ii) Time taken to select and mobilize the consultants benchmarked to ADB's CRAM.
(iii) Time taken from invitation for bid to contract signing for works and goods packages.

K. Evaluation Method

For works, include in bid document minimum but essential evaluation and qualification criteria. Qualification criteria for subcontractors to be included for key work components. Abnormally low bids to be either accepted with higher performance guarantee or rejected. Contracts to be awarded to eligible and qualified, lowest evaluated price bid.

For goods, bid evaluation is on the basis to eligible and qualified, lowest evaluated price bid.

For consulting and non-consulting services, Guidance Notes and Guidelines for proposal evaluation are available and need to be followed.

L. Contract Management Approach

Optimize inputs of experts, rely on consultants for design, quality, reporting and contract management. PMO would need to have two more procurement experts than in Project 1.

PMO to act as Employer and as Engineer. Training and capacity building of PMO and SMOs staff and contractors to be organized by PMO with expert inputs from ISPMC.

Adopt collaborative and transactional relationship with contractors, suppliers and consultants. Make contractors enforce safety, health and environment measures, particularly those related to COVID-19.

M. Value for Money Statement

The value for money will be achieved by:

(i) Using open competitive bidding methods for all procurement.
(ii) Using targeted procurement format for each major package based on the Option Analysis (details in section 5).
(iii) Maximizing opportunities for local suppliers and contractors on the less complex and geographically dispersed distribution line packages based on local capacity and experience on prior similar projects.
(iv) Use of the national e-procurement system to promote efficiency, fairness and transparency in the procurement process, while utilizing the 1S1E bidding procedure and lowest evaluated substantially responsive bid (LESRB) evaluation modality will promote economy and efficiency given the non-complex nature of the works to be undertaken.
(v) Using Prior review mechanism to support process efficiency and capacity building. Only first package of works, goods and non-consulting services will be prior reviewed noting executing agency's procurement experience under Tranche 1 loan.
(vi) Engaging the same project implementation consultant, via advance action SSS, to support the executing agency in all subsequent procurement activities.

PROCUREMENT PLAN

Basic Data

Project Name: Flood and Riverbank Erosion Risk Management Investment Program - Tranche 2		
Project Number: 44167-015	**Approval Number:**	
Country: Bangladesh	**Executing Agency**: Bangladesh Water Development Board	
Project Procurement Risk: Medium	**Implementing Agency**: Department of Disaster Management	
Project Financing Amount: US$ 212,500,000 **ADB Financing:** US$ 157,000,000 **Cofinancing (ADB Administered):** $17,890,000 **Non-ADB Financing:** US$ 37,610,000	**Project Closing Date:** 26 June 2024	
Date of First Procurement Plan: 29 March 2021	**Date of this Procurement Plan**: 29 March 2021	
Procurement Plan Duration (in months): 18	**Advance Contracting:** No	**e-GP:** Yes [https://www.eprocure.gov.bd/

A. Methods, Review and Procurement Plan

Except as the Asian Development Bank (ADB) may otherwise agree, the following methods shall apply to procurement of goods, works, and consulting services.

Procurement of Goods and Works	
Method	**Comments**
Open Competitive Bidding (OCB) for Goods	International advertising for goods > $1,000,000. To be prior reviewed by ADB. National advertising for goods < $1,000,000. The first OCB is subject to prior review, thereafter post review.
Request For Quotation for Goods	Below $100,000.
Open Competitive Bidding (OCB) for Works	International advertisement for works > $15,000,000. To be prior reviewed by ADB. National advertisement for works < $15,000,000. The first NCB is subject to prior review, thereafter post review.
Request For Quotation for Works	

Consulting Services	
Method	**Comments**
Quality- and Cost-Based Selection for Consulting Firm	For larger NGOs and Consultancy contracts
Quality-Based Selection for Consulting Firm	
Consultant's Qualification Selection for Consulting Firm	For small-size consulting / NGO services
Direct Contracting for Consulting Firm	
Competitive for Individual Consultant	

B. Lists of Active Procurement Packages (Contracts)

The following table lists goods, works, non-consulting and consulting services contracts for which the procurement activity is either ongoing or expected to commence within the procurement plan duration.

Goods and Works							
Package Number	**General Description**	**Estimated Value (in US$)**	**Procurement Method**	**Review**	**Bidding Procedure**	**Advertisement Date** (quarter/year)	**Comments**
G-01	Geotextile bag supply for Upstream of	21,161,460.00	OCB	Prior	1S1E	Q2 / 2021	Non-Consulting Services: No Advertising:

	Chauhali (15.50 km)						International No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference Applicable: Yes Bidding Document: Goods High Risk Contract: Yes e-GP: No Covid-19 Response? No
G-02	Geotextile bag supply for Enayetpur (7 Km) & Benotia (3.50 Km)	12,399,285.00	OCB	Prior	1S1E	Q2 / 2021	Non-Consulting Services: No Advertising: International No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference Applicable: Yes Bidding Document: Goods High Risk Contract: Yes e-GP: No Covid-19 Response? No
G-03	Geotextile bag supply for Harirampur extension (4 Km)	6,318,037.00	OCB	Prior	1S1E	Q2 / 2021	Non-Consulting Services: No Advertising: International No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference Applicable: Yes Bidding Document: Goods High Risk Contract: No e-GP: No Covid-19 Response? No
G-04	Geotextile bag supply for Adaptation Works of completed works under JMREMP & FRERMIP Tranche-1 Project	8,286,572.00	OCB	Prior	1S1E	Q2 / 2021	Non-Consulting Services: No Advertising: International No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference Applicable: Yes Bidding Document: Goods High Risk Contract: No e-GP: No Covid-19 Response? No
G-05	Geotextile bag supply for Adaptation Works of FRERMIP Project- 2	5,889,998.00	OCB	Prior	1S1E	Q4 / 2021	Non-Consulting Services: No Advertising: International No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference Applicable: Yes

							Bidding Document: Goods High Risk Contract: No e-GP: No Covid-19 Response? No
G-06	Vehicles including 4 nos. pick up & 4 nos. Jeep vehicles	556,542.00	OCB	Post (Sampling)	1S1E	Q3 / 2021	Non-Consulting Services: No Advertising: National No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference Applicable: No Bidding Document: Goods High Risk Contract: No e-GP: Yes e-GP Type: e-Bidding Covid-19 Response? No
G-07	Office Equipment	111,308.00	OCB	Post (Sampling)	1S1E	Q3 / 2021	Non-Consulting Services: No Advertising: National No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference Applicable: No Bidding Document: Goods High Risk Contract: No e-GP: Yes e-GP Type: e-Bidding Covid-19 Response? No
G-08	Survey Equipment	222,617.00	OCB	Post (Sampling)	1S1E	Q3 / 2021	Non-Consulting Services: No Advertising: National No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference Applicable: No Bidding Document: Goods High Risk Contract: No e-GP: Yes e-GP Type: e-Bidding Covid-19 Response? No
G-09	Office Equipment for DDM	18,811.00	RFQ	Post (Sampling)		Q3 / 2021	Non-Consulting Services: No No. Of Contracts: 1 High Risk Contract: No e-GP: Yes e-GP Type: e-Bidding Covid-19 Response? No
W-01	Benotia underwater riverbank protection with geotextile bags (3.50 km)	2,223,400.00	OCB	Post (Sampling)	1S1E	Q2 / 2021	Non-Consulting Services: No Advertising: National No. Of Contracts: 1 Prequalification of Bidders: No

							Domestic Preference Applicable: No Bidding Document: Small Works High Risk Contract: No e-GP: Yes e-GP Type: e-Bidding Covid-19 Response? No
W-02	Enayetpur underwater riverbank protection with geotextile bags (7 km)	4,268,054.00	OCB	Post (Sampling)	1S1E	Q3 / 2021	Non-Consulting Services: No Advertising: National No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference Applicable: No Bidding Document: Small Works High Risk Contract: No e-GP: Yes e-GP Type: e-Bidding Covid-19 Response? No
W-03	Upstream Chauhali underwater riverbank protection with geotextile bags (7.5 km)	4,705,905.00	OCB	Prior	1S1E	Q2 / 2021	Non-Consulting Services: No Advertising: National No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference Applicable: No Bidding Document: Small Works High Risk Contract: No e-GP: Yes e-GP Type: e-Bidding Covid-19 Response? No
W-04	Upstream Chauhali underwater riverbank protection with geotextile bags (7.9 km) including 1 km of dredging on the underwater slope	8,339,419.00	OCB	Prior	1S2E	Q3 / 2021	Non-Consulting Services: No Advertising: National No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference Applicable: No Bidding Document: Small Works High Risk Contract: No e-GP: Yes e-GP Type: e-Bidding Covid-19 Response? No
W-05	Underwater Riverbank protection with geotextile bags at Harirampur Extension (4 km)	3,666,117.00	OCB	Post (Sampling)	1S1E	Q3 / 2021	Non-Consulting Services: No Advertising: National No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference Applicable: No Bidding Document: Small Works High Risk Contract: No

							e-GP: Yes e-GP Type: e-Bidding Covid-19 Response? No
W-06	Adaptation works for riverbank protection with geotextile bags of completed works under JMREMP and FRERMIP Tranche-1 Project	6,002,058.00	OCB	Post (Sampling)	1S1E	Q2 / 2021	Non-Consulting Services: No Advertising: National No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference Applicable: No Bidding Document: Small Works High Risk Contract: No e-GP: Yes e-GP Type: e-Bidding Covid-19 Response? No
W-07	Adaptation Works for riverbank protection with geotextile bags of FRERMIP Project-2	4,128,172.00	OCB	Post (Sampling)	1S1E	Q4 / 2021	Non-Consulting Services: No Advertising: National No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference Applicable: No Bidding Document: Small Works High Risk Contract: No e-GP: Yes e-GP Type: e-Bidding Covid-19 Response? No
W-08	Jamuna River dredging and Salimabad channel choking	14,043,827.00	OCB	Prior	1S1E	Q4 / 2021	Non-Consulting Services: No Advertising: National No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference Applicable: No Bidding Document: Small Works High Risk Contract: No e-GP: Yes e-GP Type: e-Bidding Covid-19 Response? No
W-09	Emergency Works	3,642,223.00	OCB	Post (Sampling)	1S1E	Q3 / 2021	Non-Consulting Services: No Advertising: National No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference Applicable: No Bidding Document: Small Works High Risk Contract: No e-GP: Yes e-GP Type: e-Bidding Covid-19 Response? No
W-10	Shahjadpur Embankment	6,111,799.00	OCB	Post (Sampling)	1S1E	Q3 / 2021	Non-Consulting Services: No

	Construction from chainage 21.300 to 29.200 (7.9 km)						Advertising: National No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference Applicable: No Bidding Document: Small Works High Risk Contract: No e-GP: Yes e-GP Type: e-Bidding Covid-19 Response? No
W-11	Maintenance of Embankment Constructed under FRERMIP Tranche-1	885,242.00	OCB	Post (Sampling)	1S1E	Q3 / 2021	Non-Consulting Services: No Advertising: National No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference Applicable: No Bidding Document: Small Works High Risk Contract: No e-GP: Yes e-GP Type: e-Bidding Covid-19 Response? No
W-12	Benotia riverbank temporary wave protection (3.50 km)	1,664,865.00	OCB	Post (Sampling)	1S1E	Q2 / 2022	Non-Consulting Services: No Advertising: National No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference Applicable: No Bidding Document: Small Works High Risk Contract: No e-GP: Yes e-GP Type: e-Bidding Covid-19 Response? No
W-13	Enayetpur riverbank temporary wave protection (7 km)	1,513,583.00	OCB	Post (Sampling)	1S1E	Q2 / 2022	Non-Consulting Services: No Advertising: National No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference Applicable: No Bidding Document: Small Works High Risk Contract: No e-GP: Yes e-GP Type: e-Bidding Covid-19 Response? No
W-14	Upstream Chauhali temporary wave protection (15.5 km)	1,503,618.00	OCB	Prior	1S1E	Q2 / 2022	Non-Consulting Services: No Advertising: National No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference Applicable: No

							Bidding Document: Small Works High Risk Contract: No e-GP: Yes e-GP Type: e-Bidding Covid-19 Response? No
W-15	Harirampur temporary wave protection (4 km)	893,047.00	OCB	Prior	1S1E	Q2 / 2022	Non-Consulting Services: No Advertising: National No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference Applicable: No Bidding Document: Large Works High Risk Contract: No e-GP: Yes e-GP Type: e-Bidding Covid-19 Response? No

Consulting Services

Package Number	General Description	Estimated Value (in US$)	Selection Method	Review	Type of Proposal	Advertisement Date (quarter/year)	Comments
C-01	Institutional Strengthening and Project Management	15,055,713.00	DC	Prior	FTP	Q2 / 2021	Non-Consulting Services: No Type: Firm Assignment: International e-GP: No Covid-19 Response? No Comments: ISPMC firm for Tranche-1 will be engaged for Project 2 through the single source selection (SSS) modality as per FFA and decision of the meeting held on 01 February 2021.
C-02	Community-based flood risk management support	2,782,712.00	QCBS	Prior	FTP	Q2 / 2021	Non-Consulting Services: No Type: Firm Assignment: National Quality-Cost Ratio: 90:10 e-GP: No Covid-19 Response? No Comments: NGO; As agreed with the government
C-03	Community capacity development support for participatory O&M	417,724.00	CQS	Prior	BTP	Q3 / 2021	Non-Consulting Services: No Type: Firm Assignment: National e-GP: No Covid-19 Response? No Comments: Firm/NGO; As agreed with the government
C-04	Livelihood	664,400.00	CQS	Prior	STP	Q3 / 2021	Non-Consulting

	development support						Services: No Type: Firm Assignment: National e-GP: No Covid-19 Response? No Comments: Firm (QCBS) / NGO (QBS); As agreed with the government
C-05	River survey (including bathymetric, ADCP and float tracking) and multi beam echosounder survey (4 years)	1,660,466.00	DC	Prior	FTP	Q3 / 2021	Non-Consulting Services: No Type: Firm Assignment: National e-GP: No Covid-19 Response? No Comments: This will be directly contracted with the Institute of Water Modelling
C-06	Management information system development	749,217.00	CQS	Prior	STP	Q4 / 2021	Non-Consulting Services: No Type: Firm Assignment: National e-GP: No Covid-19 Response? No
C-07	Environment management and risk mitigation programs	282,724.00	CQS	Prior	BTP	Q4 / 2021	Non-Consulting Services: No Type: Firm Assignment: National e-GP: No Covid-19 Response? No Comments: NGO; As agreed with the government
C-08	Erosion prediction	424,085.00	DC	Prior	BTP	Q3 / 2021	Non-Consulting Services: No Type: Firm Assignment: National e-GP: No Covid-19 Response? No Comments: Center for Environmental and Geographic Information System (CEGIS) will be engaged for the riverbank erosion prediction study
C-09	Geotechnical investigation	130,596.00	DC	Prior	BTP	Q3 / 2021	Non-Consulting Services: No Type: Firm Assignment: National e-GP: No Covid-19 Response? No Comments: This will be directly contracted with the BUET
C-10	Resettlement solutions through NGO	494,766.00	CQS	Prior	BTP	Q3 / 2021	Non-Consulting Services: No Type: Firm Assignment: National e-GP: No Covid-19 Response? No

C-11	Model study for Salimabad channel closure	452,358.00	DC	Prior	BTP	Q3 / 2021	Non-Consulting Services: No Type: Firm Assignment: National e-GP: No Covid-19 Response? No Comments: This will be directly contracted with the Institute of Water Modelling
C-12	Offtake physical modelling	586,651.00	DC	Prior	BTP	Q3 / 2021	Non-Consulting Services: No Type: Firm Assignment: National e-GP: No Covid-19 Response? No Comments: This will be directly contracted with the River Research Institute
C-13	Topographic Survey	163,273.00	CQS	Prior	BTP	Q4 / 2021	Non-Consulting Services: No Type: Firm Assignment: National e-GP: No Covid-19 Response? No Comments: As agreed with the government
C-14	Monitoring of pilot works (grout mattresses installed in Tranche 1)	275,655.00	CQS	Prior	BTP	Q4 / 2021	Non-Consulting Services: No Type: Firm Assignment: National e-GP: No Covid-19 Response? No Comments: As agreed with the government
C-15	Environment/ biodiversity and social baseline impact monitoring and fisheries study	899,061.00	CQS	Prior	STP	Q4 / 2021	Non-Consulting Services: No Type: Firm Assignment: National e-GP: No Covid-19 Response? No
C-16	Socio-economic study of the char people	599,374.00	CQS	Prior	BTP	Q4 / 2021	Non-Consulting Services: No Type: Firm Assignment: National e-GP: No Covid-19 Response? No
C-17	External monitoring of social safeguards	120,157.00	Competitive	Prior		Q3 / 2021	Non-Consulting Services: No Type: Individual Assignment: National Expertise: Resettlement e-GP: No Covid-19 Response? No
C-18	External monitoring of Environmental safeguards	120,157.00	Competitive	Prior		Q3 / 2021	Non-Consulting Services: No Type: Individual Assignment: National Expertise: Environment e-GP: No

							Covid-19 Response? No
C-19	External monitoring of procurement activities	120,157.00	Competitive	Prior		Q3 / 2021	Non-Consulting Services: No Type: Individual Assignment: National Expertise: Procurement e-GP: No Covid-19 Response? No Comments: As agreed with the government
C-20	External monitoring of Financial Management	111,308.00	Competitive	Prior		Q3 / 2021	Non-Consulting Services: No Type: Individual Assignment: International Expertise: Financial Management e-GP: No Covid-19 Response? No
C-21	Procurement Specialist	77,916.00	Competitive	Prior		Q3 / 2021	Non-Consulting Services: No Type: Individual Assignment: National Expertise: Procurement e-GP: No Covid-19 Response? No
C-22	Resettlement Specialist	66,785.00	Competitive	Prior		Q3 / 2021	Non-Consulting Services: No Type: Individual Assignment: National Expertise: Resettlement e-GP: No Covid-19 Response? No
C-23	Gender Specialist	50,089.00	Competitive	Prior		Q3 / 2021	Non-Consulting Services: No Type: Individual Assignment: National Expertise: Gender e-GP: No Covid-19 Response? No
C-24	Environmental Specialist	50,089.00	Competitive	Prior		Q3 / 2021	Non-Consulting Services: No Type: Individual Assignment: National Expertise: Environment e-GP: No Covid-19 Response? No

C. List of Indicative Packages (Contracts) Required Under the Project

The following table lists goods, works, non-consulting and consulting services contracts for which procurement activity is expected to commence beyond the procurement plan duration and over the life of the project (i.e., those expected beyond the current procurement plan duration).

Goods and Works						
Package Number	**General Description**	**Estimated Value (in US$)**	**Procurement Method**	**Review**	**Bidding Procedure**	**Comments**
W-16	Construction of O&M sheds for Koijuri embankment (7 sheds)	125,730.00	OCB	Post (Sampling)	1S1E	Non-Consulting Services: No Advertising Type: National No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference Applicable: No Bidding Document: Small Works e-GP: Yes Covid-19 Response? No
W-17	Offtake structure-Ghior Khal	9,058,675.00	OCB	Prior	1S1E	Non-Consulting Services: No Advertising Type: National No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference Applicable: No Bidding Document: Small Works e-GP: Yes Covid-19 Response? No
W-18	Fish Sanctuaries	1,745,626.00	OCB	Prior	1S1E	Non-Consulting Services: No Advertising Type: National No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference Applicable: No Bidding Document: Small Works e-GP: Yes Covid-19 Response? No

Consulting Services						
Package Number	**General Description**	**Estimated Value (in US$)**	**Selection Method**	**Review**	**Type of Proposal**	**Comments**
None						

Financial Management Assessment

May 2021

People's Republic of Bangladesh: Flood and Riverbank Erosion Risk Management Investment Program (Tranche 2)

FLOOD AND RIVERBANK EROSION RISK MANAGEMENT INVESTMENT PROGRAM (FRERMIP) – Project 2

Funded by:
Asian Development Bank

Executing Agency:
Bangladesh Water Development Board (BWDB)
under Ministry of Water Resources (MOWR)

Implementing Agency:
Department of Disaster Management (DDM)
Under Ministry of Disaster Management (MODM)

FINANCIAL MANAGEMENT ASSESSMENT

May 2021

Prepared for	**:**	**Asian Development Bank**
Version	**:**	**1**
Creation Date	**:**	**11 May 2020**
Last Updated	**:**	**09 May 2021**

Prepared and Updated by P. R. Devaraj
Financial Management Specialist
Reviewed by Mikael Andersson
Financial Management Specialist
List of Abbreviations

ADB	Asian Development Bank
AEFS	audited entity financial statements
APFS	audited project financial statement
BFRS	Bangladesh Financial Reporting Standards
BWDB	Bangladesh Water Development Board
BSA	Bangladesh Standard on Auditing
CbFRM	community-based flood risk management
CGA	Controller General of Accounts
COVID	coronavirus disease
CPD	client portal for disbursement
CPS	Country Partnership Strategy
DDM	Department of Disaster Management
FAPAD	Foreign Aided Project Audit Department
FMA	Financial Management Assessment
IAS	International Accounting Standard
ISA	International Standards for Auditing
IBAS	Integrated Budgeting and Accounting System
IPC	Interim Payment Certificate
JMREMP	Jamuna-Meghna River Erosion Mitigation Project
LFIS	loan financial information system
MODM	Ministry of Disaster Management
MOF	Ministry of Finance
MOP	Memorandum of Payment
MOWR	Ministry of Water Resources
PEFA	Public Expenditure Financial Accountability
PFM	public financial management
PFS	project financial statement
PMO	project management office
PMU	project management unit
RAC	Regional Accounting Center
SMO	subproject management office
SOE	Statement of Expenditure
SPS	Safeguard Policy Statement

Table of Contents

EXECUTIVE SUMMARY

1. The financial management assessment (FMA) was conducted in April–June 2020 in accordance with ADB's Guidelines: OM G2 and Technical Guidance Note on Financial Management Assessment (2015). The FMA considered the financial management capacity of the Bangladesh Water Development Board (BWDB) and the Department of Disaster Management (DDM) including funds-flow arrangements, governance, staffing, budgeting, accounting and financial reporting systems, internal control procedures, financial information systems, and internal and external auditing arrangements.

2. Due to the lockdown of government offices because of the coronavirus disease (COVID-19) emergency, the FMA was conducted remotely based on the following: (i) assessment of the financial management performance under Project 1, (ii) financial management questionnaire and desk review of documents, (iii) interviews conducted with the staff of the implementing agencies, (iv) lessons learned from ongoing ADB projects in the country, and (v) assessments carried out by the World Bank.[1]

3. The FMA found that BWDB and DDM have adequate financial management capacity to: (i) record the required financial transactions, (ii) provide reliable annual financial statements and audit reports in a timely manner, and (iii) safeguard the financial assets. The assessed pre-mitigation financial management risk is substantial mainly because of the following: (i) limited accounts staff has currently been assigned to the proposed project, (ii) the proposed project may not be covered by the BWDB's internal audit function, iii) there is scope for improving project level financial reporting, and (iv) the use of a manual accounting system to record receipts and payments of ABD's funds at the project level.

4. These risks will be mitigated by the following: (i) assigning experienced accounts officers to the project management office (PMO) by loan effectiveness, (ii) engaging a financial management expert to support the PMO, (iii) providing training in ADB's financial reporting and audit requirements as well as disbursement procedures and systems, (iv) improving the quality and comprehensiveness of annual and quarterly financial reporting, (v) ensuring the project is included in the annual audit plan of BWDB's internal audit function, and (vi) Improving the use of computerized systems in the PMO to capture receipts and payments under ADB financing including regular use of ADB's disbursement systems. Moreover, as per ADB requirements, BWDB will maintain separate books of account in accordance with accounting standards acceptable to ADB and the detailed project financial statement will be audited annually by an independent auditor acceptable to ADB in accordance with International Standards on Auditing.

[1] Including Word Bank assisted project: Safety Net Systems for The Poorest (Additional Financing) March 12, 2020

I. INTRODUCTION

1. The financial management assessment (FMA) was conducted in June and further updated in October 2020 in accordance with the Asian Development Bank's (ADB) Guidelines: OM G2 and Technical Guidance Note on Financial Management Assessment (2015). The FMA considered the financial management capacity of the Bangladesh Water Development Board (BWDB) and Department of Disaster Management (DDM) including its funds-flow arrangements, governance, staffing, budgeting, accounting and financial reporting systems, internal control procedures, financial information systems, and internal and external auditing arrangements.

2. Due to the lockdown of government offices because of the coronavirus disease (COVID-19) emergency, the FMA was conducted remotely based on the following: (i) assessment of the financial management performance under Project 1, (ii) financial management questionnaire and desk review of documents, (iii) interviews conducted with the staff of the implementing agencies, (iv) lessons learned from ongoing ADB projects in the country, and (v) assessments carried out by the World Bank.[2]

II. BRIEF PROJECT DESCRIPTION

3. Bangladesh faces large challenges in providing stable living conditions and development opportunities in the world's largest deltaic environment with one of the highest disaster incidences in the world. The largest disaster incidence in terms of area affected relates to flooding and riverbank erosion particularly along the Brahmaputra–Ganges river courses.

4. The Flood and Riverbank Erosion Risk Management Investment Program is financed by ADB, Government of Netherlands, and Government of Bangladesh to reduce vulnerability against floods and riverbank erosion. BWDB under the Ministry of Water Resources (MOWR) is the executing agency, DDM under the Ministry of Disaster Management (MODM) is the implementing agency for the community-based flood risk management (CbFRM) component. The investment program is financed through a multitranche financing facility.

5. The three subproject areas selected for the program are: Jamuna Right Bank 1, Jamuna Left Bank 2 and Padma Left Bank 1. The program focuses on systematic river training in the three subprojects over successive tranches (projects) resulting in gradually increasing river stability and flood protection. This in turn contributes to flood risk reduction and economic development in the subproject areas.

6. The assessed Project 2 builds upon the achievements from Project 1 in achieving the program objectives to contribute to and enable realization of a more stable river reach, particularly in the Lower Jamuna.

7. The investment program is the follow-on project of the Jamuna-Meghna River Erosion Mitigation Project (JMREMP). It will extend successful technologies of the JMREMP to other geographical areas with necessary improvements. The project outputs include:

(i) **Output 1: Flood and riverbank erosion risk mitigation functioning at priority reaches improved**. Project 2 combines structural and nonstructural measures in the three subproject areas to stabilize further the Lower Jamuna river by applying the integrated river stabilization approach developed under Project 1. Specifically, a major eroding channel near the Chauhali channel will be reduced in size through an

[2] Word bank assisted project: Safety Net Systems for The Poorest (Additional Financing) March 12, 2020

innovative combination of dredging and bio-engineering to provide an offtake into a distributary and enable future development of some 6,000 ha of reclaimed char land. The structural measures will include: (i) 30 km of riverbank protection with innovative technologies, combined with nature-based solutions for channel closure; (ii) 7.9 km of climate-resilient flood embankments; (iii) a distributary offtake with a flood barrier; and (iv) 2 regulators and other hydraulic structures to improve drainage.

(ii) **Output 2: Institutional system for flood and riverbank erosion risk management strengthened**. Project 2 will continue to strengthen the knowledge base and institutional capacity of BWDB and the Department of Disaster Management (DDM) in sustainable asset and strategic managements of the rivers. Activities will include: (i) supporting the office of the Chief Engineer River Management, BWDB, including piloting drone flight surveys for O&M needs; (ii) carrying out river surveys; (iii) incorporating knowledge base products, such as the river stabilization plan and site information on BWDB's website; and (iv) updating the river stabilization guidelines. Project 2 activities will also include trainings, publications, and study tours (to the delta works in the Netherlands and/or an international conference on scour and erosion, for example); and,

(iii) **Output 3: Program management systems operational.** This output ensures the outputs of Project 2 will be timely delivered within budget. Further to the achievements of Project 1, it will reinforce BWDB's management system to ensure (i) the project management office (PMO) and subproject management offices (SMOs) are supported by a management information system, quality control systems, accountability measures, and efficient monitoring tools; and (ii) the PMO and SMOs take more ownership of newly introduced concepts and work methods, including participatory process. Support will also be provided for BWDB to produce a feasibility study for the adaptive stabilization of the Jamuna–Ganges confluence area for a possible follow-on loan.

8. At the time of the FMA, the project is expected to amount to $212.80 million and will be is financed by an ADB loan of $157.00 million, a grant from the Government of Netherlands of $17.89 million and $37.91 million of counterpart financing from the Government of Bangladesh. The base cost includes civil works ($58.5 million), equipment and materials ($53.8 million) consultancies ($24.0 million), land acquisition and resettlement ($20.2 million), survey and investigations ($2.6 million) as well as staff salaries and operating cost. Around 40 contracts are expected to be awarded under the project resulting in a moderate number of transactions.

9. The project will be mainly implemented by BWDB through a project management office (PMO) and three subproject management offices (SMOs). In addition, the CbFRM subcomponent will be implemented by DDM through a project management unit (PMU). This was also the arrangement under project 1. However, the expenditures to be incurred as part of the CbFRM subcomponent represent less than 2% of total project costs.

III. COUNTRY AND SECTOR FINANCIAL MANAGEMENT ISSUES

10. The inherent financial management risk in Bangladesh is substantial. The corruption perception index published by the Transparency International Bangladesh has improved slightly from 25 in 2015 to 26 in 2018. In 2018, Bangladesh ranked as 149 out of 180 countries. To date, three public expenditure and financial accountability (PEFA) assessments have been undertaken for Bangladesh–2006, 2010, and 2016. The 2016 PEFA assessment notes that overall there has been a renewed focus on public financial management (PFM) activities and a continued emphasis on improving PFM processes and procedures and that Bangladesh has made positive strides in developing its PFM systems since the 2010 PEFA assessment.

11. However, important areas such as internal audit, annual financial reports, and external audit continue to score poorly. Indeed, significant delays in finalization of annual financial reports hamper the effectiveness of external audits while the timeliness of the legislature's scrutiny is negatively affected by the backlog of audit reports to be submitted to Parliament. However, the report emphasizes that due to the ongoing reforms at the time of the assessment, the weak score may not do justice to the areas such as procurement, internal audit, oversight of public corporations, and external audit.

12. Based on the experience gained with ADB's past and ongoing projects in the country, the following risks need to be considered during project processing and implementation:

(i) low capacity among accounts staff specifically at the regional and district-level;
(ii) project account staff are not adequately trained in ADB's financial management requirements and in the use of ADB's financial systems (Loan Financial Information Services [LFIS], Grant Financial Information Services and Client Portal for Disbursements [CPD]) to reconcile project accounts with ADB's disbursement.
(iii) manual books of account maintained by the projects, resulting in cumbersome reporting which is prone to errors;
(iv) bridge financing where ADB funds are used to pre-finance expenditures to be financed by the government or other development partner;
(v) inadequate financial information included in the quarterly progress reports submitted to ADB;
(vi) Foreign Aided Project Audit Directorate (FAPAD) may not issue a separate audit opinion on the use of ADB loan/grant proceeds;
(vii) entity auditors may not issue a separate audit opinion in compliance with financial ratios as required by ADB; and,
(viii) lack of follow-up on audit observations, including recurring audit observations.

13. To mitigate the inherent risk with regards to PFM, ADB's country partnership strategy for Bangladesh, 2016–2020 highlights the need to (i) improve the preparation of timely year end accounts; (ii) adhere to international accounting standards; (iii) strengthen internal audit; and (iv) appoint skilled personnel to conduct performance audits. The country partnership strategy also states that ADB will (i) support the strengthening of country systems and counterpart capacity—through financial management action plans, fiduciary reviews, and technical assistance; (ii) continue supporting governance reforms through policy-based lending (e.g., the Good Governance Program); as well as (iii) engage with policy makers and key stakeholders, in collaboration with other development partners, to progress enforcement of laws and implementation of agreed reforms.

IV. PROJECT FINANCIAL MANAGEMENT SYSTEM

A. Bangladesh Water Development Board (BWDB)

14. **Overview.** BWDB, acting as executing agency, is a statutory body created by Presidential Order No. 59 in 1972 (as successor to the East Pakistan Water and Power Development Authority) to develop and manage water resources in the country and reports directly to MOWR. Thereafter, the position and responsibility of BWDB was further enhanced through the national Parliament by the enactment of BWDB Act 2000 and guided by the National Water Policy 1999. DDM under MODM is the implementing agency for the proposed project. A team comprising project director with support staff as PMO established for monitoring and managing the project.

15. **Past financial management performance in implementing ADB-financed projects.** BWDB through its PMO and DDM through its PMU have implemented Tranche/Project 1 under the ongoing program. As at the time of the assessment, the following has been observed with regards to the financial management performance under Tranche/Project1:

(i) The consolidated project financial statements are audited by FAPAD in accordance with ISA;
(ii) The consolidated audited project financial statement (APFS) also includes expenditures incurred by DDM under its subcomponent;
(iii) To date all APFS has been received on time and these have been unqualified with the exception of FY 2017 when the project financial statement (PFS) was qualified due to a misclassification of previous years expenditures leading to an overstatement of the PFS. However, the review of the APFS identified the following issues:
    (a) FAPAD does not issue a separate opinion on the use of funds for the intended purpose;
    (b) The PFS does not include a statement of budgeted vs actual expenditures;
    (c) The Notes to the PFS did not disclose the significant accounting policies;
    (d) The APFS does not reconcile fully with ADB disbursement records;
    (e) There are some inaccuracies and inconsistencies in the PFS;
(iv) With regards to internal controls, the auditors have highlighted the following recurring audit observations some of which are recurring:
    (a) Lack of sound fixed asset management practices and annual inventory exercises;
    (b) No internal audit conducted for the project although the entity has an internal audit directorate;
    (c) Monthly reconciliations between Integrated Budgeting and Accounting System (IBAS)++ and RPA not conducted;
    (d) No annual procurement plan prepared;
    (e) The use and practice of Delegation of financial powers not adequate;
    (f) Civil work payment not made in accordance with financial regulations (e.g. actual work done, bill of quantities, test report)

16. To date no audited entity financial statements (AEFS) has been received by ADB although was required as per the legal agreement under Project 1. However, as part of the FMA it was clarified BWDB is audited by the Office of the Comptroller & Auditor General like a government sector unit/department and is not required to issue Audited Entity Financial Statements. BWDB is currently in the process of being formally changed from a government board to a government

department. A change memo was processed by BRM in 2020 to remove the AEFS requirement from the legal agreement under the ongoing project.

17. **Organization and Staffing.** BWDB, the executing agency and DDM under the Ministry of Disaster Management is the implementing agency. Day to day function is being monitored by the BWDB PMO office. Under the existing organizational structure, BWDB's finance and accounting operations are headed by the Additional Director General (Finance). There is a Comptroller of Finance and Account who oversees three directors - Director of Finance, Director of Accounts and Director of Audit. The details of staffing are given in **Appendix 1**.

18. As part the project, it is expected that PMO will include the following financial staff positions: (i) a Deputy director of accounts, (ii) an Accounts officer and (iii) three senior accounts assistant. In addition, each of the SMO's will include one senior accounts assistant. Of these positions, the Deputy director -accounts, the accounts officer and one senior accounts assistant are currently working for the ongoing project (project 1), are also expected to be assigned to the project 2 by loan effectiveness. The staffing arrangements are expected to be finalized by loan signing and will need to be monitored closely to ensure adequate accounts staff are in place by loan effectiveness.

19. To further strengthen the financial management capacity of the PMO and SMOs to comply with ADB's financial management requirements, including financial reporting audit requirements and disbursement procedures and systems, continuous training will need to be provided. In this regard, the existing eLearning courses might prove to be useful. In addition, the project should be included in the ADB financial management training events as soon as possible. Furthermore, it is recommended that a financial management expert is engaged over the project implementation period to support the PMO.

20. **Accounting Policies and Procedures.** Project finances were managed based on the existing Bangladesh Accounting Standard, IFRS and IAS on modified cash basis. The existing regulations are having adequate control in place concerning the preparation and approval of transactions. Detailed chart of accounts is in place. Cost allocations are done based on chart of account. The books of accounts are maintained in spread sheet and updated manually. Accounts officer is updating the details in the IBAS software for the Government of Bangladesh related transactions done through treasury. The development of IBAS++ is in the process of the government for accounting external aided projects. This is not used in the BWDB. Since the IBAS is used only for treasury and government transactions the implementation in BWDB for other bank transactions is yet to be explored.

21. The receipt of Counterpart Funds is managed through Treasury Account in Controller General Accounts. The counterpart fund will further be credited in the bank account operated by the PMO project director. The payments on these vouchers are made by the concerned PMO director from the Bank Account operated by them. The supporting documents are kept in PMO Office for Audit as well as for future reference.

22. The government procedures followed to safeguard and protect assets from fraud, waste and abuse. There is physical inventory of fixed assets taken during annual audit.

23. In order to ensure project books of accounts reflect correctly ADB's disbursements and are free from material misstatements, it is important that the PMO conducts monthly reconciliations of the advance account and at least quarterly reconciliations of project records and ADB disbursement data as per LFIS. To support the PMO in ensuring full compliance with ADB's requirements at all levels, it is recommended to supplement the Government of Bangladesh's and BWDB's rules and guidelines with additional project specific financial management procedure manual.

24. **Internal Audit**. There is an internal audit department under ADG (Finance). The Director Audit supported by one additional director, three deputy directors, seven audit officers and other staff including junior auditor. Internal Auditor reports their findings to the Director of Audit, who in turn sent to the ADG Finance and then to DG. Internal Audit covers all units of BWDB. However, it is observed that timely Internal Audit is not carried out in the present project. The existence of an effective independent Internal Audit function strengthens the overall internal control framework and reduces fiduciary risk. It is strongly recommended to include the ADB-assisted project in the audit plan of the internal auditor. The internal audit report is to be submitted directly to the Director General for review and shared with BWDB/PMO to implement recommended remedial measures.

25. **External Audit–project level.** BWDB/PMO shall maintain separate accounts for the project and have such accounts and related financial statements audited annually by independent auditors acceptable to ADB and in accordance with the provisions of the Loan Agreement to be signed and as specified in the ADB guidelines. This audit needs to be carried out based on the International Standards for Auditing. The terms of reference (TOR) for the auditing services shall be prepared by BWDB before beginning of the project implementation.

26. FAPAD under the Controller and Auditor General of Bangladesh is conducting audit of accounts of all foreign aided project. FAPAD is conducting the audit based on the Bangladesh Government Auditing Standards which is in line with International Standard for Auditing. The sample format has given as Appendix-3A, 3B, 3C and 3D of this report to be used for APFS along with a Note to financial statement covering accounting policies and explanatory notes.

27. FAPAD shall carry out the audit of the ADB-financed projects in accordance with the ADB guidelines. The project should inform FAPAD about the requirements of the timely audit of the proposed project well before end of the financial year.

28. The APFSs will be submitted in the English language to ADB within 6 months of the end of the fiscal year. The annual audit report should include a separate auditor's opinion on the use of the Advance account, statement of expenditures, compliance with loan covenants and use of loan proceeds in accordance with the loan agreement for intended purposes. The Government of Bangladesh is to be made aware of ADB's approach to delayed submissions, and the requirements for satisfactory and acceptable quality of the audited APFSs.[3]

29. **External audit–entity level.** BWDB's expenditures are audited by the Office of the Comptroller & Auditor General like a government sector unit/department and is not required to issue AEFS. From time to time BWDB engages a chartered accountant firm to support them in compilation of receipts and expenditures. This is however only an additional assurance and the CA firm does not issue an audit opinion as part of the engagement. The previous contract with the CA

[3] ADB's approach and procedures regarding delayed submission of audited project financial statements:

(i) When audited project financial statements are not received by the due date, ADB will write to the executing agency advising that (a) the audit documents are overdue; and (b) if they are not received within the next 6 months, requests for new contract awards and disbursement such as new replenishment of advance accounts, processing of new reimbursement, and issuance of new commitment letters will not be processed.

(ii) When audited project financial statements are not received within 6 months after the due date, ADB will withhold processing of requests for new contract awards and disbursement such as new replenishment of advance accounts, processing of new reimbursement, and issuance of new commitment letters. ADB will (a) inform the executing agency of ADB's actions; and (b) advise that the loan may be suspended if the audit documents are not received within the next 6 months.

(iii) When audited project financial statements are not received within 12 months after the due date, ADB may suspend the loan.

firm covered up the fiscal year of 2017 and at the moment there is no ongoing contract with a CA firm. BWDB is also currently in the process of being formally changed from a government board to a government department. At the time of the FMA, a change memo is also being processed by the Bangladesh Resident Mission to remove the AEFS requirement from the legal agreement of the ongoing project.

30. **Financial reporting**. The BWDB/PMO reports comply with the reporting requirements of the Ministry of Finance (MOF), IMED, MOWR and other government body. These reports are prepared as and when required. The assessment notes that based on the experience from Tranche 1, there is scope for improving the project level financial reporting. As a result, it is recommended that comprehensive financial information will be included in the periodic progress reports to be submitted to ADB on a quarterly basis, within 45 days after the end of the reporting period. The information in the periodic progress reports will include information on the project's financial progress, variance analysis (budgeted vs actual and financial vs physical progress with significant deviations analyzed) as well as a detailed reconciliation with ADB disbursement records/LFIS, status of the financial management action plan, and the status of past audit observations.

31. In addition to the periodic progress reports, the project financial statements will be prepared within 2 months after the end of the fiscal year. As per ADB's requirements, the project financial statements will include the following information (sample template given in the FAM**)**:

(i) statement of cash receipts and payments; showing the funds received by each funding source (ADB loan, Government of Bangladesh, etc.) and expenditures incurred by expenditure category for the current year, prior year, and cumulative from inception to date;
(ii) statement of budget vs. actual expenditures; any significant variance must be sufficiently explained in the notes;
(iii) statement of advance account reconciliation for each advance account;
(iv) statement of disbursement with a breakdown for each funding source;
(v) detailed notes to the financial statements including significant accounting policies. The notes of the financial statements must provide a detailed breakdown of at least the following:
    (a) funds received from the government during the current year, previous year and cumulative to date; and
    (b) list of withdrawal applications submitted to - and the amounts paid by ADB as follows: (1) financing source, (2) withdrawal application number, (3) amount claimed and currency, (4) period when expenditures were incurred, (5) date submitted, (6) disbursement method, (7) amount disbursed by ADB, and (8) the exchange rate as applicable.

32. **Information systems**. Computerized Integrated Budgeting and Accounting System (IBAS) software is used for recording governmental transactions. Steps are taken by the Government of Bangladesh to incorporate the expenditure details by the Foreign Aided Project also in to IBAS system but for now IBAS cannot record payments made from the Advance/sub advance account or direct payments and will have to be recorded manually. Moreover, BWDB's financial management system is using a software package called MS Great Plains Dynamic Accounting software which was adopted in 2006 and needs to be updated or replaced. The system is a stand-alone system and project is using the spread sheet for various reporting purposes. Currently the system is only used for recording only the government expenditure. Moreover, the financial system does not facilitate linking of financial information with physical progress.

33. Based on the above, it is recommended that BWDB to find a solution to effective use of information system in financial management particularly in accounting, reporting and contract management, either by customizing the government IBAS software or by customizing the readymade accounting software like “Tally” available in the market. Moreover, it is important that the PMO gets access to the CPD and LFIS and uses these regularly to track all ADB disbursements including direct payments.

34. **Asset Management system.** BWDB maintains a Fixed Assets Register. The assets are coded based on common government coding method, which is indicated in the register. For capital asset management purposes, BWDB also has the following systems in place:

(i) Geographic Information System (GIS) Based Digital Land Information System on BWDB Acquired Land in Dhaka City and its surrounding.
(ii) Development of Smart Project Monitoring and Management Information System (SPMMIS). Project infrastructure, maps, photographs, video clips, recent and historic documents, GPS locations of structures, contract information, evaluation reports, functional information, project performance information, management information etc data has been stored for 53 numbers ongoing projects and 3 numbers completed projects.
(iii) Hydrological Information Management System used among others for flood forecasting and warning purposes through online browsing (www.hydrology.bwdb.gov.bd).
(iv) 36 numbers Auto Real Time Data Acquisition System Station established for collecting Real Time Water Level data and viewing hydrograph through online scrolling (www.hydrology.bwdb.gov.bd).

35. **Budgeting**. Budgeting in BWDB is done on annual basis. The project budgets are prepared according to project requirements and in line with the approved Development Project Proforma/Proposal. The project budget is scrutinized by BWDB and the line ministry before receiving an inter-ministerial approval which is required for all foreign-aided projects. The consolidated budget of the state is prepared by the Ministry of Finance and the Budget is approved in the State Legislature. There is a system to compare the actual expenditure with the budgeted expenditure. Before incurring any expenditure, the budget provision is considered. Reports on project progress are regularly reported to MOWR, IMED and MOF for development partner funded projects, and other reports will follow donor report requirements to monitor project performance. Actual expenditures are compared to the budgeted expenditures on monthly, quarterly, and annual basis. Any variation thereof will require an explanation to the MOWR and IMED. Explanation for significant variations will be provided by BWDB to MOWR and IMED.

36. The current process of fund disbursement seems satisfactory based on the experience of past and ongoing foreign funded projects executed by BWDB. The Treasury releases the budgetary allocation normally in four quarterly installments. These budgetary releases used for the counterpart payments. In case of any short fall in the budget release the payment will be affected and may lead to delay in execution of the project. Proper budgeting is required at the beginning itself to avoid such instances. It is recommended to BWDB to ensure proper release of counterpart fund from MOF in time.

37. Budgetary utilization for the last 5 years shows a satisfactory picture. **Table 1** shows the past 5 years budget allocation and actual utilization of the capital budget by BWDB.

Table 1: Past 5 Years Budget Allocation and Actual Utilization of the Capital Budget by BWDB

Bangladesh Water Development Board						
						(million Taka)
Capital Fund Performance						
Financial Year	**2014-15**	**2015-16**	**2016-17**	**2017-18**	**2018-19**	**Average**
Original Budget	26,860	29,687	36,569	45,275	53,329	38,344
Revised Budget	21,410	28,589	37,609	46,732	59,728	38,813
Actual Utilization	20,259	27,258	33,975	43,258	57,415	36,433
Utilization rate (% of needs spent)	**95%**	**95%**	**90%**	**93%**	**96%**	**94%**

Source: BWDB

38. **Conclusions (strengths and weaknesses).** The main strength is that BWDB has implemented numerous externally funded projects of ADB, the World Bank and Netherlands. Other donors included the EU, WFP, Canada, and JICA. The main weakness include: (i) the staffing for the PMO under project tow has not been finalized yet and any new staff (once in place) will need training in ADB's financial management requirements as well as disbursement systems and procedures, (ii) less effective use of accounting and monitoring software in the projects in financial management, and (iii) the internal audit function may lack capacity to cover all externally-financed projects.

B. Department of Disaster Management (DDM)

39. **Overview.** DDM will be the implementing agency of the disaster risk management subcomponent. DDM follows government's financial management and accounting systems, procedures and regulations and as a result the country level PFM weaknesses identified in the PEFA report are assumed to apply to DDM's financial management systems as well. DDM has experience in implementing ADB's projects including Project/Tranche 1 under the Flood and Riverbank Erosion Risk Management Investment Program and World Bank-financed projects such as the Safety Net Systems for The Poorest. The World Bank Assessment assessed the financial management risk for DDM as substantial mainly due to limited use of the government's integrated budgeting and accounting system to document project expenditures and the pending resolution of audit observations. However, the assessment also noted that there were no pending audit reports from DDM. These observations are in line with the findings of the ADB's assessment.

40. **Organization.** In line with implementation arrangement of Project 1, a PMU will be established in DDM to implement the subcomponent. DDM through its PMU will:

(i) manage finance accounts, and monitor the use of funds provided by ADB for the sub-component;
(ii) submit statements of expenditures and supporting documentation (as necessary) to PMO, BWDB;
(iii) prepare and submit quarterly physical and financial progress reports in prescribed formats to BWDB; and
(iv) coordinate with BWDB on project related problems and issues and recommendations.

41. **Staffing.** DDM will appoint a Deputy Director/Deputy Secretary as Project Manager and the focal point for subproject implementation. It is envisaged an accountant will be assigned by DDM for the project. It is important that training in ADB's financial management requirements

including financial reporting audit requirements and disbursement procedures and systems is provided to the PMU as soon as possible. In addition, the DDM accountant should be included in the financial management training events as soon as possible.

42. **Budgeting.** The costs of the project are included in a separate Development Project Proforma/Proposal developed by the government which will ensure proper budget controls. Each year, the PMU will prepare a budget and share it with the PMO, BWDB.

43. **Accounting.** The PMU will maintain project accounts in accordance with modified cash basis of accounting under the Bangladesh accounting standard, which are broadly based on the cash-basis International Public Sector Accounting Standards. The government accounting software IBAS++ will be used to record the transactions. However, as IBAS++ can only record transactions done through the government treasury system, ADB direct payments or payments made from the advance account or sub-advance account will not be captured in the system. Instead separate ledgers need to be maintained manually for these payments. As a result, it is important to ensure monthly reconciliation of the advance account and at least quarterly reconciliations of PMO, PMU and ADB disbursement records to ensure the project books of accounts are captured in all of ADB disbursements and are free from material misstatements.

44. **Payment approval.** Like in all government entities, the authority to approve payments may be delegated to heads of administrative ministries, divisions, and directorates, as well as project directors, to approve expenditures subject to budget allocation in the annual development program. For the DDM subcomponent, the PMU project manager is expected to approve the payments. All the payments are normally done through bank transfer.

45. **Record keeping.** All supporting documents (or copy of such documents) to support expenditures claimed from ADB under Statement of Expenditure (SOE) must be sent from the PMU to the PMO regularly. The supporting documentation is to be filed properly at the PMO to support ADB's SOE reviews and annual project audits.

46. **Financial reporting.** Due to the limitations of IBAS++ explained above, the project financial reports and project financial statements are expected to be prepared manually by the PMU. DDM will quarterly financial reports to BWDB, on the financial progress under the sub-component implemented by DDM, including statement of cash receipts and payments, sub-advance account reconciliation (if applicable) statement of budget vs actuals as well as other supporting registers and schedules as necessary. BWDB will through its PMO consolidate the information and provide ADB with quarterly progress reports in the agreed format within 45 days of the end of each quarter. Similarly, DDM will through its PMU prepare annual financial statements for the sub-component implemented by DDM which will be submitted to the PMO for consolidation.

47. As per ADB's requirements, the consolidated project financial statements will include the following information:

(i) statement of cash receipts and payments; showing the funds received by each funding source (ADB ordinary capital resources loan, ADB concessional loan, Government of Bangladesh, etc.) and expenditures incurred by expenditure category for the current year, prior year, and cumulative from inception to date;
(ii) statement of budget vs. actual expenditures; any significant variance must be sufficiently explained in the notes;
(vi) statement of advance account reconciliation for each advance account;
(vii) statement of disbursement with a breakdown for each funding source;

(viii) detailed notes to the financial statements including significant accounting policies. The notes of the financial statements must provide a detailed breakdown of at least the following:
   (a) funds received from the government during the current year, previous year and cumulative to date; and
   (b) list of withdrawal applications submitted to and the amounts paid by ADB as follows: (i) financing source, (ii) withdrawal application number, (iii) amount claimed and currency, (iv) period when expenditures were incurred, (v) date submitted, (vi) disbursement method, (vii) amount disbursed by ADB, and (viii) the exchange rate as applicable.

48. **Internal audit.** In line with the conclusion of the PEFA report, the internal audit function of DDM is not exempted to be effective. Moreover, as externally financed projects are covered by FAPAD, the internal audit function typically tend to exclude these from their audit plan and prioritize other areas.

49. **External audit – project level.** All foreign-aided projects are audited by the FAPAD. The FAPAD is part of the Comptroller and Auditor General, the supreme audit institution of Bangladesh. It conducts the audit based on the International Standard for Auditing. As per ADB's requirements, and in line with the ongoing project the consolidated project accounts will be audited annually in accordance with international standards on auditing. The auditor will be required to issue an opinion on the following: (i) whether the project financial statements present an accurate and fair view or are presented fairly, in all material respects, in accordance with the applicable financial reporting standards; (ii) whether the proceeds of the loan were used only for the purpose of the project; and (iii) whether the borrower or executing agency was in compliance with the financial covenants contained in the legal agreements. In addition, the audit must issue a management letter outlining any observed weaknesses in the internal controls. From the second year onwards, the management letter must also include a follow-up on previous years audit observations.

50. As per the ongoing practice under Project 1, the consolidated PFS including the expenditures incurred by DDM will be audited annually by FAPAD. The APFS, and the management letter will be submitted to ADB within 6 months after the end of the fiscal year.

51. **External audit – entity level.** As a government department, DDM does not issues audited entity financial statements. Moreover, there are no financial ratios expected to be included in the legal agreements, which would require a separate audit opinion.

52. **Information systems.** Budgeting and accounting are executed through the government system IBAS ++. However, as discussed above, the system cannot accommodate ADB direct payments or payments made from the advance/sub-advance account. As a result, it is very important that the PMU coordinates closely with the PMO to get access to the CPD and LFIS records in order to track all disbursements and payments.

53. **Conclusion (Strength and weaknesses).** Overall, there is scope for improvement in DDM's financial management capacity. However, DDM has experience in implementing ADB- and WB-financed projects including project 1 under the investment program and the financial management arrangements are expected to follow the same financial management arrangements as in the past. Moreover, the expenditures incurred by DDM as part of the subcomponent are expected to be limited (less than 2%) of project expenditures.

V. DISBURSEMENT ARRANGEMENTS

54. Detailed funds flow diagram given in **Appendix 2.**

A. Disbursement

55. The ABD loan and the Netherlands grant proceeds will be disbursed in accordance with ADB's *Loan* Disbursement *Handbook* (2017, as amended from time to time),[4] and detailed arrangements agreed upon between the government and ADB. Online training for project staff on disbursement policies and procedures is available.[5] The PMO staff are expected to avail of this training to ensure efficient disbursement and fiduciary control.

56. ADB's disbursement procedures (direct payment, reimbursement, commitment, and/or advance fund procedure) will be used for withdrawal of project funds.

(i) direct payment procedure will be used for foreign currency payments to suppliers and consultants;
(ii) reimbursement will be used for any eligible payments pre-financed by the government, including all expenditures financed under retroactive financing;
(iii) advance fund (liquidation or replenishment) procedures will be mainly utilized for payments to suppliers, contractors when government pre-financing is not feasible; and
(iv) under the commitment procedure, ADB, at the borrower's request, provides an irrevocable undertaking to reimburse a commercial bank for payments made or to be made to a supplier against a letter of credit financed from the loan account

57. BWDB through its PMO will be responsible for (i) preparing disbursement projections, (ii) collecting and retaining supporting documents, and (iii) preparing and sending withdrawal applications to ADB.

58. **Advance fund procedure.** Two separate advance accounts are to be established and maintained by BWDB with the Bangladesh Bank, one for the ADB loan and one for the Netherlands grant. The currency of the advance accounts is the United States dollar. In addition, two sub advance-accounts in Bangladesh Taka will be established in a commercial bank and maintained by BWDB, one for the ADB loan and one for the Netherlands grants. Moreover, one sub advance-account for the ADB loan in Bangladesh Taka will be established in a commercial bank and maintained by DDM. The advance accounts and the sub-accounts are to be used exclusively for ADB's share of eligible expenditures. BWDB and DDM are accountable and responsible for proper use of advances to their respective advance accounts including advances to any sub-account.

59. The total outstanding advance to the advance account should not exceed the estimate of ADB's share of expenditures to be paid through the advance account for the forthcoming 6 months. BWDB may request for initial and additional advances to the advance account based on an estimate of expenditure sheet[6] setting out the estimated expenditures to be financed through the accounts for the forthcoming 6 months. Supporting documents should be submitted to ADB

[4] ADB. 2017. *Loan Disbursement Handbook.* Manila.
[5] Disbursement eLearning: http://wpqr4.adb.org/disbursement_elearning.
[6] Estimate of expenditure sheet is available in Appendix 8A of ADB's *Loan Disbursement Handbook* (2017, as amended from time to time).

or retained by BWDB in accordance with ADB's *Loan Disbursement Handbook* (2017, as amended from time to time) when liquidating or replenishing the advance account.

60. **Statement of expenditure (SOE) procedure.**[7] The SOE procedure may be used for reimbursement of eligible expenditures or liquidation of advances to the advance account. The ceiling of the SOE procedure is equivalent to $150,000 per individual payment. Supporting documents and records for the expenditures claimed under SOE should be maintained and made readily available for review by ADB's disbursement and review missions, upon ADB's request for submission of supporting documents on a sampling basis, and for independent audit. Reimbursement and liquidation for individual payments above the SOE ceiling should be supported by full documentation when submitting the withdrawal application to ADB.

61. Before the submission of the first withdrawal application, the borrower should submit to ADB sufficient evidence of the authority of the persons who will sign the withdrawal applications on behalf of the borrower, together with the authenticated specimen signatures of each authorized person. The minimum value per withdrawal application is stipulated in the ADB's *Loan Disbursement Handbook* (2017, as amended from time to time). Individual payments should be paid (i) by BWDB or DDM and subsequently claimed to ADB through reimbursement, or (ii) through the advance fund procedure, unless otherwise accepted by ADB. The borrower should ensure sufficient category and contract balances before requesting disbursements. Use of ADB's Client Portal for Disbursements (CPD) system[8] is mandatory for submission of withdrawal applications to ADB.

62. No ADB loan proceeds will be withdrawn for the disaster risk management activities under Project 2 until BWDB and DDM have entered into a memorandum of understanding acceptable to ADB, setting out the terms and practical arrangements for their collaboration.

B. Disbursement Arrangements for Counterpart Fund

63. The government will make funds available to BWDB and DDM through budgetary allocation. Disbursement for counterpart funds will be carried out in accordance with guidelines and practices of the government. BWDB will be responsible for preparing the budget and requesting budgetary allocations for counterpart funds to MOF. BWDB ensure that counterpart funding is reflected annually in the approved budget. BWDB shall open and maintain the separate account for government's counterpart funds.

64. The following control mechanism will be applied for payment of resettlement costs: (i) a bank account of Regional Accounting Center (RAC) of BWDB will receive advances from the from POM; (ii) RAC will use the cheque payment from the RAC's bank account for the resettlement compensation costs to resettlers; (iii) Cheques will be signed by RAC, and will be distributed by RAC with the support of SMOs and the resettlement plan implementation nongovernment organizations; (iv) RAC will make payments based on supporting documents to evidence genuine payees, such as photographs of resettlers and with exchange of receipt with a finger print of a resettler which will be retained by RAC; and (v) all necessary forms and supporting documentation will be prepared and compiled by RAC with support from SMOs and nongovernment organizations, and submitted to PMO of BWDB.

---

[7] SOE forms are available in Appendix 7B and 7D of ADB's *Loan Disbursement Handbook 2017* (2017, as amended from time to time).

[8] The Client Portal for Disbursement facilitates online submission of withdrawal applications to ADB, resulting in faster disbursement. The forms to be completed by the Borrower are available online at https://www.adb.org/documents/client-portal-disbursements-guide.

VI. RISK DESCRIPTION AND RATING

65. **Risk Analysis.** During the implementation phase, BWDB might face some risks that can generally be divided in two main categories: (i) country level; and (ii) organization/project level. financial management risks shall need to be considered and updated throughout the life of the Project and Risk mitigation measures shall also be updated accordingly. The overall assessment of the of the project financial management risks and internal control assessment are presented in **Table 2** below:

Table 2: Financial Management and Internal Control Risk Assessment

Risk	Risk Assessment	Risk Description	Mitigation Measures or Action Plans
Inherent Risk			
1. Country-specific Risks	S	Partly weak PFM systems and financial management capacity.	Not applicable for this project
2. Entity-specific Risks	M	BWDB has extensive experience in implementing ADB and other externally financed projects. However, there is scope for improving the financial management arrangements in place.	Specific mitigation actions listed below.
3. Project-specific Risks	S	Project will be implemented in several locations and funds will be advanced to district accounts.	Specific mitigation actions listed below.
Overall Inherent Risk	**S**		
Control Risk			
1. Implementing Entity	S	The PMO/ BWDB and PMU/DDM is proposed to manage and implement the project. Currently, the staffing of PMO and PMU is not complete.	The PMO and PMU must be fully staffed by loan effectiveness.
2. Fund Flow	S	BWDB and DDM have experience with ADB's disbursement procedures. However, the following risks remain: (i) Delay in release of government counterpart funds. (ii) Decentralized flow of funds to the district level.	Firm commitment from the government to be obtained as part of the legal agreement that counterpart funds will be released in a timely fashion. Direct Payment mechanism is to be used for major foreign currency payments for contractors and suppliers for ADB's share. SOE threshold set at $100,000 per individual payment. Quarterly reconciliations of advance account, sub advance account and district sub-accounts to be conducted.

Risk	Risk Assessment	Risk Description	Mitigation Measures or Action Plans
3. Staffing	S	The Accounts staff implementing project 1 are expected to be assigned to the project 2. However, the FM capacity of the PMO may need to be further strengthened to ensure full compliance with ADBs requirements.	- All accounts staff positions in the PMO and the SMOs and in the PMU/DDM will need to be filled by loan effectiveness. - FM experts to be engaged to support the project; - Continuous training to be provided in ADB's financial reporting and audit requirements as well as disbursement procedures and systems.
4. Accounting Policies and Procedures	M	Existing GOB policies and procedures are followed by BWDB and DDM. There is scope for improving project level systems and FM procedures to ensure full compliance with ADB procedures.	To ensure full compliance with ADB's requirements at all levels, the PAM will include detailed FM instructions and templates.
5. Internal Audit	S	There is an Internal Audit function in BWDB. However, the internal audit is only conducted annually and based on experience it may not include the ADB assisted projects in its audit plan. There is no internal audit function in DDM.	The BWDB internal audit unit to conduct semi-annual audits and must include the ADB-financed project in its audit plan and the report is to be shared with the PMO for follow-up.
6. External Audit	M	<u>Project level</u> FAPAD may not issue a separate audit opinion on the use of the ADB financing, which is required by ADB.	- The project will liaise with FAPAD to ensure the proposed project is part of FAPAD's annual audit plan and that ADB's audit requirements are strictly followed. - The audit observations to be resolved in a timely manner. The status of audit observations to be included in the quarterly progress reports.
7.Reporting and Monitoring	S	At the project level, there is scope for improving the quarterly financial reporting as well as the quality of the project financial statements.	Comprehensive financial information to be included in the QPRs in a format agreed with ADB within 45 days after the end of each quarter. The consolidated PFS to be improved by including the following: (i) a statement of budgeted vs actual expenditures, (ii) a WA-wise reconciliation and (iii) comprehensive

Risk	Risk Assessment	Risk Description	Mitigation Measures or Action Plans
			disclosure of used accounting policies, and financial reporting framework in the notes.
8.Information Systems	S	Accounting systems are currently only capturing payments done through the government treasury system while direct payments and payments from the advance account will have to be recorded manually. Moreover, project financial reports are produced manually.	BWDB PMO to explore and implement IT solutions to fully computerize the project accounts and automate financial reporting to the extent possible through modifying the existing systems or through a standalone software. Use of ADB client portal for disbursement to submit and track withdrawal applications to ensure timely availability of funds. Use of LFIS to reconcile ADB disbursement records with project records on a quarterly basis to ensure all withdrawal applications have been correctly reflected in the PFS
Overall Control Risk	**S**		
Overall FM risk	**S**		

H – High, S- Substantial, M – Moderate, L – Low.

66. The disbursement and budgeting mechanisms are adequate. The overall Inherent Risk is *Substantial* and overall financial management and internal control risk is rated as *Substantial*. The Financial Management Risk for ADB-assisted project at the country level is also considered as substantial.

VII. TIME BOUND FINANCIAL MANAGEMENT ACTION PLAN

67. Based on the identified risks, **Table 3** action plan is recommended.

Table 3: Financial Management Action Plan

Area	Agreed Action	Responsibility	Target date
Staffing	Assign adequate and qualified accounts staff to the PMO[9] and SMOs as well as the PMU/DDM.	BWDB and DDM	By Loan effectiveness

[9] The accounts staff assigned to the PMO will include the following full time positions: (i) A Deputy Director -Accounts, (ii) an accounts Officer (iii) three Senior Accountants Assistants. In addition each of the three SMOs will include one Senior Accounts Assistant.

Area	Agreed Action	Responsibility	Target date
	Engage an FM expert to support the project and facilitate compliance with ADB's FM requirements as part of the ISPMC.	BWDB	By Loan effectiveness
FM capacity building	Training provided in ADB's FM requirements and disbursement procedures and systems (LFIS, CPD)	BWDB and ADB	By project inception & continuous throughout project implementation.
Internal audit	Ensure the project is included in the audit plan of the BWDB internal audit function. Internal audit to be conducted on a quarterly basis.	BWDB	By Loan effectiveness
External audit – Project level	-Ensure the project is included in the audit plan of the OCAG/FAPAD; -Cause consolidated project financial statements to be audited separately by FAPAD in accordance with ADB's audit requirements and submit the APFS and management letter to ADB. -Address audit observations in a timely manner.	BWDB	-Within 2 months after loan effectiveness. -Annually throughout project implementation. -Continuous throughout the project.
Financial reporting	Include comprehensive financial information as agreed with ADB in the quarterly progress reports to be submitted to ADB. Prepare PFS in a format agreed with ADB (including statement of budget vs actual, WA-wise reconciliation and comprehensive notes disclosures)	BWDB	Within 45 days after each quarter. Annually -within two months after the end of the fiscal year.
Information systems	Use of ADB disbursement systems (CPD & LFIS) to reconcile project accounts and ADB disbursement records on a quarterly basis. Detailed reconciliation by Withdrawal application to be included in the QPRs and the APFS submitted to ADB.	BWDB	Quarterly from loan first disbursement throughout project implementation.
Information systems	Computerize all accounts including receipts and payments under the ADB loan and automate financial reporting to the extent possible	BWDB	Within the first 6 months of implementation.
Records management	All supporting documents (or copy of such documents) to support expenditures claimed from ADB under SOE must be sent from District Offices to the PMO regularly. The supporting documentation is to be filed properly at the PMO to	BWDB and DDM	Monthly

Area	Agreed Action	Responsibility	Target date
	support ADB's SOE reviews and annual project audits.		

ADB= Asian Development Bank, APFS = audited project financial statement, BWDB = Bangladesh Water Development Board, CPD= client Portal for Disbursement, DDM = Department of Disaster management, FAPAD = Foreign Aided Project Audit Department, FM = financial management, ISPMC = institutional strengthening and project management consultant, LFIS = Loan Financial Information Services, OCAG = Office of the Comptroller & Auditor General, PFS = project financial statement, PMO = project management office, QPR = quarterly progress report, SOE = statement of expenditure, WA = withdrawal application.

VIII. CONCLUSION

68. The financial management arrangements are considered adequate. However, the overall premigration financial management risk is considered as substantial. As a result, it is important that the financial management action plan is implemented in a timely manner and that ADB executes a supervision and implementation support plan as outlined below.

IX. SUPERVISION AND IMPLEMENTATION SUPPORT PLAN

69. In order to ensure sufficient knowledge in ADB's FM requirements, including procedures and related systems, BWDB will ensure that each PMO financial staff assigned to the ADB project undertake the following actions within the first month after working with the project:

(i) become aware of the ADB and national anticorruption policy and whistle blowing mechanisms;
(ii) master loan/grant agreement including the loan covenants and the relevant sections of the project administration manual, as well as the ADB's *Loan Disbursement Handbook* (2017, as amended from time to time);
(iii) obtain user/reader rights (as required) to ADBs systems including the CPD and the LFIS;
(iv) complete the ADB Disbursement eLearning course; and
(v) complete the Cash Basis IPSAS for ADB Project Financial Reporting eLearning course.

70. In addition, the PMO should, on a yearly basis, liaise with ADB to ensure participation in FM and disbursement training events organized by ADB in the region, especially in the first 2 years of project implementation.

71. Moreover, due to the substantial financial management risk, it is recommended that a financial management specialist/officer (ADB staff or consultant) will participate in a mission semi-annually during the first year of implementation to supervise and provide implementation support to the project and follow up the fiduciary risk at various levels including the use of the SOE.

72. In line with the financial management risk assessment, in the first 2 years of implementation, the supervision plan of the project will especially focus on the following actions:

(i) detailed review of the status of the financial management action plan outlined in the FAM;
(ii) detailed review of adequacy of the staffing arrangements at the financial management unit within the PMO, including the TOR and performance of the financial staff and training needs identification;
(iii) detailed review of the project financial management and accounting procedures in use;
(iv) detailed review of the accounting software and financial reports produced by the accounting software and the use of budget controls;
(v) reconciliation of project books of accounts and LFIS as well as reconciliation of the advance account and the sub-advance account;
(vi) review of overall flow of funds (and resolving any bottlenecks) and a detailed review of the operation of the advance account (including monthly reconciliations);
(vii) detailed review of the use of the SOE procedure and the adequacy of supporting documentation;
(viii) detailed review of records management, filing and information back-up;
(ix) follow-up on contracting the project (independent) external auditors and the TORs;
(x) follow-up on audit (internal and external) recommendations; and,
(xi) follow-up on recommendations from past supervision missions.

73. The supervision process will be complemented by periodic desk reviews of financial information included in the quarterly progress reports and APFS.

Appendix 1:Organizational Structure of Finance and Accounts

Under the existing organizational structure, BWDB's finance and accounting operations are headed by the Additional Director General (Finance). There is a Comptroller of Finance and Account who oversees three directors - Director of Finance, Director of Accounts and Director of Audit. Staffing is as follows:

Additional DG – Finance: (No of sanctioned post: 7)

Controller of Finance, Accounts & Audit (No of sanctioned post: 7)

- One Accounts Officer and supporting staff

Director of Accounts (No of sanctioned post: 135)

- Additional Director in charge of RAC-East
- Additional Director in charge of RAC-West
- Six Deputy Directors of Accounts, Fourteen Accounts officer, One System analyst, One Programmer & remaining other staffs.
- Twenty-five Regional Accounting Centre offices, headed by eight Deputy Director & 17 Accounts officer.

Director of Finance (No of sanctioned post: 40)

- Additional Director, Finance
- Three Deputy Directors, six Assistant Director, three Accountant & Other staffs

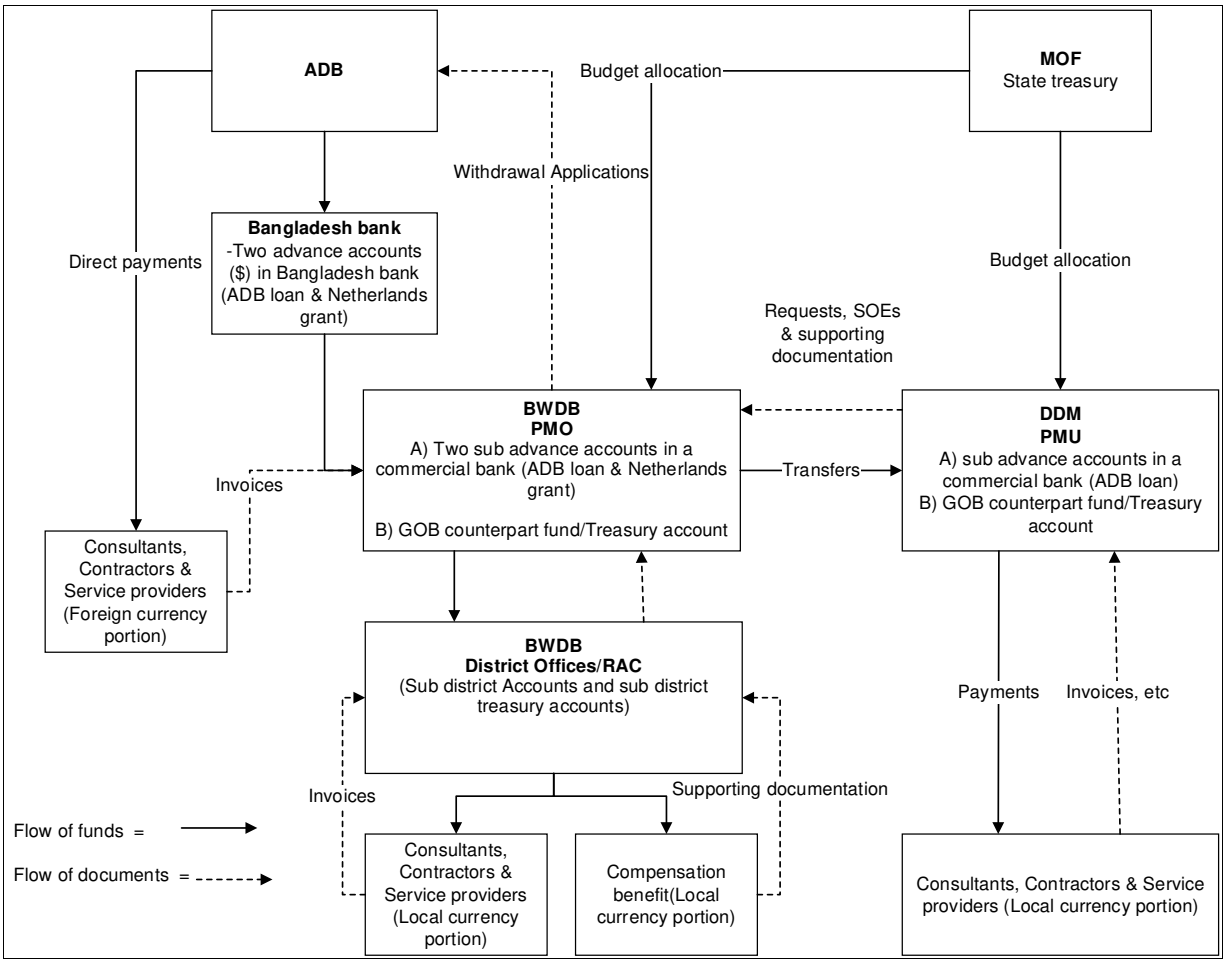
Director of Audit (No of sanctioned post: 46)

- Additional Director, Audit
- Three Deputy Directors, Seven Audit officer & Auditors and support staff

Trustee Board - Staff Welfare (No of Sanctioned post: 8)

- one Deputy Director, One Accounts Officer
- Other support staff

Appendix 2: Funds Flow Diagram



Client Feasibility Studies and Engineering Designs for Project 2

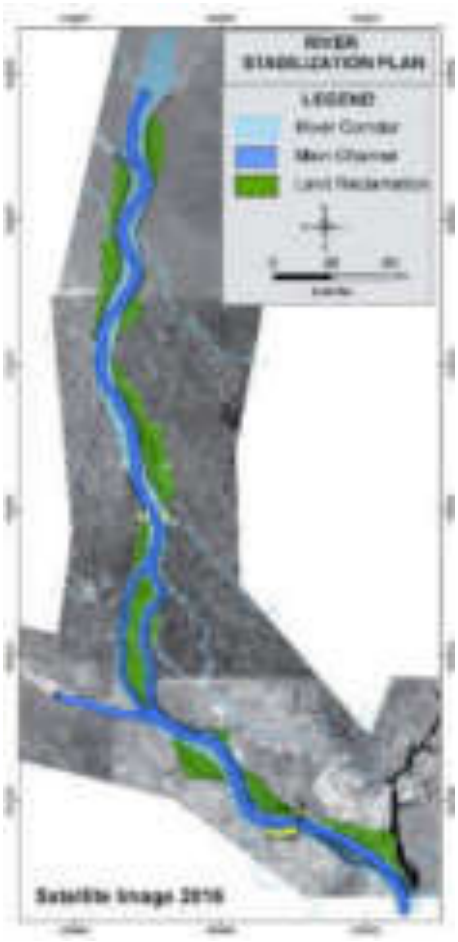
April 2019

People's Republic of Bangladesh: Flood and Riverbank Erosion Risk Management Investment Program (Tranche 2)

Government of the People's Republic of Bangladesh

Bangladesh Water Development Board

Asian Development Bank



Project Loan No 3138-BAN (SF) and Grant No 0396-BAN (EF)

Flood and Riverbank Erosion Risk Management Investment Program

FEASIBILITY REPORT FOR TRANCHE-2

August 2019

nhc northwest hydraulic consultants

MOTT MACDONALD

In association with
DELTARES
RPMC and CEGIS

FRERMIP

Flood and Riverbank Erosion Risk Management Investment Program

Consultant's Report

Flood and Riverbank Erosion Risk Management Investment Program

FEASIBILITY REPORT FOR TRANCHE-2

August 2019

Recommended for Approval.

(MOTAHER HOSSAIN)
Chief Engineer, Design
Bangladesh Water Development Board
Dhaka.

Prepared by

Institutional Strengthening and Project Management Consultant (ISPMC)

Joint Venture of Northwest Hydraulic Consultants Ltd. and Euroconsult Mott MacDonald Ltd. in association with Deltares, Resource Planning and Management Consultants and CEGIS

Approved.

(Md. Mahfuzur Rahman)
Director General
BWDB, Dhaka

Flood and Riverbank Erosion Risk Management Investment Program
ADB Loan No. 3138-BAN (SF) and GRANT No. 0296-BAN (EF)

Institutional Strengthening and Project Management Consultant (ISPMC)

FEASIBILITY STUDY REPORT FOR TRANCHE-2
Main Report

Issue and revision record

Revision	Date	Originator	Checker	Approver	Description
A	Feb 2018	Bruce Walsh with contributions from ISPMC team [a]	Knut Oberhagemann	Knut Oberhagemann	1st draft report
B	23 May 2018	Knut Oberhagemann			Update in line with discussions during the ADB Consultation Mission from 27 February to 5 March 2018
C	April 2019	Knut Oberhagemann	PMO, Design Office BWDB [] May 2019		Update in accordance with Technical Committee meeting, October 2018 and Completion Mission, Nov 2018 as well as designs provided by the BWDB Design Circle
D	June 2019	Hiba Khan	PMO, Design Office BWDB [] May 2019	Knut Oberhagemann	Update following discussions with client
E	August 2019	Hiba Khan	Jesper Mathiesen	Knut Oberhagemann	Update following comments from BWDB Review Committee

[a] contributing Team Members comprise

Wandert Benthem	Environmental Specialist
Dave Burkholder	Flood Disaster Risk Management Specialist / Information and Data Management Specialist
Dan Towfique Islam	Community-Based Flood Risk Management Specialist
Hamida Khatun Popy	GIS Specialist
Jesper Mathiesen	River Engineer
Hiba Khan	River and Construction Engineer
Erik Mosselman	Morphologist
Shamsun Nahar	Resettlement and Gender Specialist
John Roe	Economist
Derek Stuart	Hydrology (Flood Modelling)
Bruce Walsh	River Engineer

DISCLAIMER

Flood and Riverbank Erosion Risk Management Investment Program
ADB Loan No. 3135-BAN (SF) and GRANT No. 0396-BAN (EF)

Institutional Strengthening and Project Management Consultant (ISPMC)

FEASIBILITY STUDY REPORT FOR TRANCHE-2

Main Report

Key Data

Name of Project:	**Flood and Riverbank Erosion Risk Management Investment Program (3 Tranches)**
Borrower, Executing Agency and Implementing Agency:	Government of Bangladesh (GoB) Bangladesh Water Development Board (BWDB) Department of Disaster Management (DDM)
Financing:	Asian Development Bank (US$ 251.1 million for 3 tranches); ADB Loan No. 3135-BAN (SF) Government of the Netherlands (US$ 11.7 for Tranche-1); Grant No 0396-BAN (EF) Government of Bangladesh (US$ 113.6 million for 3 tranches)
Consultant:	Joint Venture of Northwest Hydraulic Consultants Ltd. (Canada) and Euroconsult Mott MacDonald Ltd. (UK) in association with Deltares (The Netherlands), Resource Planning and Management Consultants (Bangladesh) and CEGIS (Bangladesh) Contract Signed: 8th September 2015
Contracting Authority:	PD, FRERMIP, BWDB, Dhaka
Start/ End Dates:	ADB Loan Agreement: 27 June 2014 (approved), 14 August 2014 (signed), 17 September 2014 (effective) Multi tranche financing facility (9 years): June 2014 to June 2023 Dates for FRERMIP (updated): – Tranche-1: August 2014 to June 2020 (± 5.9 years) – Tranche-2: January 2020 to December 2023 (± 4.0 years) – Tranche-3: June 2021 to August 2026 (± 5.2 years)
Beneficiaries:	Local stakeholders directly and indirectly benefitting from river flood protection works and land reclamation and development
Subproject Sites/ Location/ Areas:	Focus of works are along the Jamuna-Padma river corridor, from Bangabandhu (Jamuna) Bridge to confluence with Meghna river at Chandpur i.e. Reaches 3, 4 and 5. Master plan area comprises the three priority subprojects, JRB-1, JLB-2 and PLB-1 which extend over (part of) the following districts: Sirajganj, Tangail, Pabna and Manikganj.

	km²	ha
Total Area of all Sub Projects	9,292.1	929,210
FRERMIP SPs (JRB1, JLB2, PLB1): Total Area	2,473.0	247,300
FRERMIP SPs: Agricultural Benefit Area	1,220.0	122,000
FRERMIP SPs: Population		10.6 million
FRERMIP SPs: Population Density		1,117 km²
FRERMIP SPs: No. of Households		2.03 million
FRERMIP SPs: Average HH Size		5.2
Master Plan Total Area	15,950.0	1,595,000
Master Plan Agricultural Benefit Area (flood risk mitigated)	5,000.0	500,000
Land Reclamation Area in River Corridor, Maximum	1,500.0	150,000
Land Reclamation Area in River Corridor, FRERMIP max.	660.0	66,000

EXECUTIVE SUMMARY

Background

The Role of River Stabilization for Middle Income Status

Bangladesh's main rivers will play an important future development role, constituting a major shift from earlier times when being considered as a primary cause of disaster. The country develops towards leaving the group of least developed nations and aspires to reach middle income status in the early 2030s as formulated in the Bangladesh Delta Plan, 2100, approved in September 2018 (GED, Bangladesh Planning Commission; GoB, 2018). Systematic river stabilization particularly of the Jamuna and Padma rivers will contribute three core elements for a more developed economy: (i) developing up to 1,500km² of recovered floodplain land in the heart of the country, supporting intensified agricultural production as well as peri-urban development, (ii) providing stable flood protection incorporating structures to reliably connect with wetlands and distributary rivers for environmental restoration, and (iii) facilitating transboundary dry-season navigation for more balanced multi-modal transport. The re-orientation towards larger development goals means that while the historic goals of self-sufficiency in food grains (rice) achieved through flood control and irrigation improvement remain valid, the water sector needs to take on additional roles in the field of stabilizing the main rivers and securing reliable dry season flow in dependent distributaries.

The backbone of more stable main rivers, particularly the Jamuna River, provides riverbank protection, which has reached a world-wide unique level of cost effectiveness and sustainability in Bangladesh. Based on a century of experience with river training work for bridge crossings and after systematic piloting a number of innovative solutions during the 1990s, the Bangladesh Water Development Board (BWDB) through the ADB supported JMREMP[1], developed revetments being (i) able to respond to unpredictable river changes through an adaptive or phased approach of construction to deepest erosion levels, while (ii) maintaining cost-effectiveness for the protection of largely agricultural lands with low economic returns. The initial investment cost for these revetments is around USD 3million in 2018 prices and remains unchanged since 15 years. The successful implementation of JMREMP, and the ability to protect nearly 10km of banklines, in places since 15 years, provided a strong rationale for continuation and expansion of the approach during the FRERMIP (2014 – 2023). In addition to riverbank protection and river stabilization, the FRERMIP provides for improving flood protection along stabilized riverbanks, a core element of disaster risk reduction and self-sufficiency in food.

FRERMIP and Tranche-2 in Context

The two ADB financed initiatives in the Lower Jamuna, the JMREMP (2002-2011) and the FRERMIP Tranche-1 (2014 – 2019) have provided first riverbank

[1] Jamuna-Meghna River Erosion Mitigation Project, ADB Loan BAN (SF) 1944, implemented from 2002 to 2011 with a pilot phase for groynette bag revetments from 2004 until 2006.

stabilization measures to the some 60km long Lower Jamuna[2]. The FRERMIP Tranche-1 has also developed a "Strategic Framework for River Stabilization and Development: Jamuna-Padma and Dependent Areas" (NHC/EMM, 2016) to stabilize the main rivers for broad-based value capture including char land development[3], restoring dry-season distributary flows around Dhaka[4], and multimodal transport in a more navigable river combined with improved access to once inaccessible riverbanks and former char lands through roads over climate smart flood embankments[5]. This framework is in line with (i) Government's vision and incorporated into the Bangladesh Delta Plan, 2100 (GED; Bangladesh Planning Commission; GoB, 2018) as well as (ii) the Financing Framework Agreement of 2014 and justifiable through additional benefits streams.

The feasibility for the Tranche-2 project is prepared following a review of status and lessons learned from the first Tranche (NHC/EMM, February 2018), reflecting the latest river situation including changes after two high floods in 2016 and 2017 and, latest Government goals and BWDB recommendations (BWDB, Technical Committee, 2018). Within this context, the proposed FRERMIP Tranche-2 attempts to develop the Tranche-1 work systematically into the backbone of a stable Lower Jamuna river course. An additional benefit stream from developing potentially 6,000 hectares of char land contributes to the economic feasibility.

As of April 2019, the implementing agency Bangladesh Water Development Board (BWDB) has successfully implemented Tranche-1 to some 90% progress, with most of the construction activities near completion, and the Department of Disaster Management contributing non-structural flood risk management activities on community level. Knowledge-base development and institutional strengthening activities are also near completion.

Tranche-2: Balancing Principle Demands

The Framework Financing Agreement provides the flexibility to respond to the fast changing river environment and also allows changes pertaining to the overall country context. To this end, six fundamental requirements have to be balanced for the formulation of Tranche-2:

(i) The program follows the Framework Financing Agreement, having a focus on riverbank and flood protection and agrees with the Strategic Framework (NHC/EMM, Strategic Framework for River Stabilization and Development: Jamuna-Padma and Dependent Areas, 2016).

---

[2] The Lower Jamuna extends from Bangabandhu (Jamuna) Bridge to Aricha at the confluence with the Ganges River. JMREMP provided 17km of riverbank protection at two locations of the right bank (PIRDP and Kazipur), while FRERMIP Tranche-1 provided 9km of riverbank protection in two locations on the left bank (Chauhali and Zafarganj).

[3] FRERMIP Tranche-1 protected some 1,800ha of attached char from erosion and incorporation into the floodplain. Tranche-2 will protect this land from flooding through a new flood protection embankment and is expected to initiate the recovery of some 6,000ha of lost floodplain land through piloting the closure of an eroding channel.

[4] Tranche-2 plans to provide the basis for a stable offtake of the Old Dhaleswari or Ghior Khal river downstream of the protective works built during Tranche-1 at Chauhali.

[5] Tranche-2 will provide for some 17km of new embankment over the recovered land at Harirampur with a modern cross section allowing the incorporation of road connectivity through the Roads and Highways Department or the Local Government.

	(iv) Program goals align with the Bangladesh Delta Plan, 2100, approved in September 2018. (iii) Each tranche and the overall program are economically viable. (iv) Tranche-2 can be implemented within the available timeframe. (v) The proposed work is technically feasible. (vi) The Technical Committee proposes a more risk sensitive approach through a higher level design of riverbank protection, which in ways continues the development process of innovative designs applied in JMREMP and FRERMIP Tranche-1.
	COMPONENT 1 – FLOOD AND RIVERBANK EROSION RISK MANAGEMENT **STRUCTURAL WORKS** Different from all projects implemented on the stable floodplain, work alongside eroding riverbanks or even within the river corridor of the very large, dynamic, and unpredictable rivers of South Asia requires the flexibility to change location and length of the works in line with the morphological developments, sometimes even the types of structure. Successful river stabilization is opportunity driven to capture favorable channel alignments and reduce investment cost. Time gaps between planning and implementation are required to adjust to a different river alignment and therefore the layout of effective protection works asks for adjustment immediately prior to construction. Furthermore, systematic river stabilization of well-defined reaches, once started, depends on a continuous development without time gaps that give the river a chance to develop in undesirable ways. Continuation avoids that earlier investment becomes redundant and needs to be supplanted through costly additional works. With continuous progress, there is a good chance of effectively integrating earlier investments and gradually reducing the unpredictability of the river. The "adaptive approach"[4] formed the basis for the FRERMIP, with the BWDB committing to maintain all implemented works as stated in Section 22 of the project Loan Agreement. To this end the BWDB has implemented adaptive works two times, at the FIRDP in 2006 and at Chauhali in 2018. However, within the context of more systematic river stabilization and particularly for channel locations not expected to change in the mid-term, the BWDB suggests to apply a higher level riverbank protection standard, reducing the uncertainties of future investments for adaptive riverbank protection (BWDB, Technical Committee, 2018). A higher design level is attempted through a composite design consisting of two layers of protection. Geobags form the base layer, later covered with hard materials (either rock or concrete blocks). Physical hydraulic model tests indicate some advantages, and therefore the BWDB has commenced proposing

[4] Adaptive approach refers to a phased construction process depending on the erosion of the river. This process depends on self launching aprons providing temporary protection to deeper levels, subsequently strengthened ("adapted") to permanent protection. This approach was also followed at the world's largest river Bridge, the Padma Bridge, currently under construction at Mawa.

this design in most new DPPs. The additional fund requirement will be supplied through Government as per decision of the Technical Committee meeting. As the design has no history of long-term monitoring, the Tranche-2 provides the means for stringent monitoring through a number of different methods. Based on the additional knowledge gained from the first years of close monitoring Tranche-3 (a) may further adjust the designs and (b) formulate a risk-based design approach during the process of updating the "Guidelines for Riverbank Protection".

River stabilization and flood protection under Tranche-2, including the recovery of a substantial amounts of eroded floodplain, represent a continuation of the work implemented under Tranche-1 (2015 to 2019), with the focus on the Lower Jamuna bifurcation and the left branch at Chauhali. The work will continue at all three priority subprojects defined in the PPTA report (JRB-1, JLB-2 and PLB-1) The study team investigated optional protection for Chandpur Town (sub-project MLB-1), however this is dependent on available contingency funding.

Tranche-1 provided 17.8 km of river bank protection and 21.3 km of flood embankments. In Tranche-2, a further 15.5 km of river bank protection, plus 10.5 km precautionary protection, and 25.3 km of flood embankment are proposed, following the updated designs based on the Technical Committee Meeting[1]. Unless otherwise indicated, all data and discussions in this report are based on the designs recommended by the BWDB, which have been selected as the final option based on Client preference. The designs of the draft feasibility report of March 2018, , prepared by the ISPMC are not discussed in this report.

Work	Tranche-1: PPTA	Tranche-1: complete	Tranche-2: PPTA	Tranche-2: Planned	Tranche-3: PPTA	Tranche-3: Planned
Riverbank revetment	15 km	17.8 km	16 km	15.5 km +10.5 km precautionary	19 km	(8.8 km)
Embankment	23 km	21.3 km a)	43 km	25.3 km	23 km	(43.0 km)
Char recovery	-	1,800 ha	-	6,000 ha	-	-

1. Implementation ongoing, March 2019

In addition, flow redistribution works will extend the self-dredged Chauhali channel along a desired alignment downstream, while encouraging sedimentation in the 15km long eroding Solimabad channel, developing the char land in this area, and providing a stable offtake for the Old Dhaleswari. 10.5 km of precautionary riverbank protection is proposed to secure the riverbank for the intermediate period of closure.

While Tranche-2 focusses at river stabilization and flood protection, it also includes: (i) 40km strengthening/adaptation works to secure river protection

[1] The Technical Committee in October 2018 adjusted the location approved by the Technical Advisory Committee in September 2017 and recommended a new slope treatment. The BWDB Design Office provided the revised designs in early 2019.

constructed under Tranche-1 and previous projects, (ii) 5km of emergency works, (iii) community based flood risk management, and (iv) knowledge base development including advanced underwater and terrain surveys for comprehensive asset and O&M management. The concluding Tranche-1 will focus more on flood embankment construction.

River Stabilization and Dredging

Tranche-2 complies with Government's vision of combining the development of navigable channels with char development resulting in a number of activities involving dredging. Overall, some 28% of the construction cost and some 22% of the total cost involves dredging, primarily to: (i) speed up char land development, and (ii) construct flood embankments.

Non-Structural Works Component

Community based flood risk management activities will include: (i) engaging an NGO, (ii) Formation of 80 Community-based Disaster Management Units (CDMUs) comprising some 1,200 Community Volunteers (CVs), (iii) training of CDMU volunteers, (iv) agreement/ adoption of community level flood warning, (v) establishment of communications between the CDMUs and DDM staff, and (vi) institutionalization of CDMUs. It is anticipated that the CDMUs will share the same "office" facilities that are proposed for embankment WMOs, see below.

Flood Response Plans will be prepared for 18 Upazilas, based on the plan prepared for Shahjadpur under Tranche-1.

Community Capacity Enhancement for Participatory O&M will include: (i) formation and registration of 10 Embankment WMOs for O&M with BWDB providing annual maintenance funding, (ii) construction of 10 O&M sheds complete with facilities and equipment, and stockpiles, (iii) piloting bio-engineering solutions to stabilise embankment slopes, both from waves and rainfall (river side) and just rainfall (land side), including use of vetiver grasses, and (iv) training, support and monitoring. An NGO will be engaged for WMO establishment, registration, training and support. The O&M sheds will be constructed under one or more NCB civil works contracts. Ultimately, formation of embankment WMOs with a WMO "shed" for every 5 km of embankment is envisaged.

Livelihood support programs and courses will be identified for Affected Persons as well as for persons living along the river embankment or on the char lands, and will include vocational skills development and various livelihood trainings, for example: crop and fisheries, homestead small livestock and poultry rearing, handicrafts and tailoring, use of char lands, basic computer skills, establishment of fish sanctuaries, and so on. Participants for the courses will be carefully screened for interests while checking their suitability. Follow up monitoring and training will be provided, as well as start-up equipment and materials. To encourage women's participation care facilities for babies/ children, as well as segregated toilets, will be provided at training venues. In Tranche-2, about 2,000 affected persons shall attend on-site 1-day training, and about 800 persons shall

attend 3-5 day residential trainings. NGO services shall be procured to determine interest in trainings, screen participants, prepare training plans and budgets for approval, provide on-site trainings (in the O&M sites) monitor the effectiveness of the trainings, and provide training reports including for the fisheries support works.

COMPONENT 2 – STRENGTHENED INSTITUTIONAL SYSTEMS FOR FLOOD AND EROSION RISK MANAGEMENT

Institutional Capacity

Training will comprise: (i) local training, primarily for BWDB but also for ODM; (ii) overseas training, and (iii) study tours. There will also be training to facilitate adoption and use of the various management information systems.

While the CO-River Management (CE RM) has been appointed, and staff positions sanctioned, his office is not yet fully operational. The combination of the PMO with the CE RM office could reduce the pressure on the understaffed BWDB. Priority for training will be given to staff from this office.

The website and file manager/ database successfully implemented during Tranche-1 will be further improved under Tranche-2 with a dynamic project map enabling the user to zoom into a specific site to access data from that site. The website database will also continue to be populated. A separate River Survey database containing more than 2,000 surveys since the mid-1990s is operational with a first BWDB engineer trained. It will be further expanded during Tranche-2.

The **Scheme Inventory and Mapping System (SIMS)**, essentially an Asset Inventory, developed under WMP will be further developed by addition of an integrated risk based O&M MIS module under Tranche-2 and then put into operation with the first some 60km of embankment assets added. The embankment survey will make use of latest drone technology.

To facilitate ADF management, it is planned to further assess the **Smart Project Monitoring and Management Information System (SPMMIS)**, under Tranche-2, and then assist in its roll out and adoption by BWDB, subject to any required modification/ improvement after testing.

In addition to the inception workshop, two national stakeholder (annual) workshops are proposed. Each workshop will be a 1-day event and be held at a major hotel in Dhaka. 50-80 persons would be expected to attend each of these workshops.

Senior BWDB / ODM/ GoB staff will be encouraged to contribute to and attend international workshops/ seminars organised by others which are related to larger rivers management.

The project will support preparation of the 5-year budgetary plan for riverbank protection O&M and emergency work for the main rivers, endorsed by BWDB.

Data and Knowledge Base

	During Tranche-2, the data and knowledge based will continue to be improved by a combination of: (i) studies, (ii) piloting, and (iii) surveys. **Studies.** While further technical knowledge is needed, there is sufficient information to proceed with some confidence with river stabilisation works. Tranche-2 studies will be wider in scope and comprise: (i) Regional planning master plan refinement and dissemination, (ii) Main rivers management surveys and studies, (iii) Distributary surveys and studies, (iv) Land reclamation surveys and studies, (v) fishery surveys and studies, and (vi) safeguard studies. **Pilots** initiated under Tranche-1, concerning (i) grout-filled jute mattresses, and (ii) vegetative protection and char land recovery including use of katkin/vetiver grasses will be refined and continued to be monitored into Tranche-2. **Surveys** will support studies, the improvement of the knowledge base, and to prepare designs for future works. Different types of state-of-the-art survey techniques (drone surveys, multi-beam echosounder surveys, advanced sediment measurement techniques) will be applied along the main rivers, as well as along distributaries. **COMPONENT 3 – PROJECT MANAGEMENT** The successful project management team of Tranche-1 will continue for Tranche-2: The Bangladesh Water Development Board (BWDB) will manage the Tranche-2 through its existing Project Management Office (PMO) which performed well in implementing the Tranche-1. However, the PMO needs increased staff strength, the more so as the volume of work is about four times the Tranche-1 work. The PMO will continue being supported by an experienced institutional strengthening and project management consultant fulfilling the role of specialist advisor during (i) implementation, particularly on project management, and construction and strengthening/adaptation aspects, (ii) preparation of Tranche-3, and (iii) specialist advice and guidance for knowledge-base development including a reliable asset management system.
Rationale	River bank erosion and unpredictable and uncontrolled flooding causes loss of land and crops destroying livelihoods of households living along the river and in the flood plain. The project through river bank stabilisation and flood protection will stop loss of land, and eventually contribute to reclamation and development of up to 150,000 ha of char-land in the Jamuna-Padma river corridor. Non-structural and institutional strengthening measures will meanwhile support affected persons (river bank and char-dwellers) to improve their livelihoods, as well as sustainable management and O&M of infrastructure. A stable river and protected flood plain will restore dry season flows to distributaries while controlling extreme flooding, and distributary dredging will increase capacity, addressing declining water tables and flows to the Dhaka metropolis. Connectivity will improve with roads along the flood embankments, as well as improved inland navigation. High value development in the flood plain and reclaimed char land will follow, for peri-urban residential, commercial and industrial use, as well as higher value agriculture.

Project Impact, Outcome and Outputs

The **Impact** (goal) of FRERMIP is for improved livelihoods in the project area, along the main rivers, and poverty alleviation.

The project **Outcome** is reduced vulnerability against flood and riverbank erosion risks in the subproject reaches and char-land reclamation. Targets are to achieve the following by 2023 in subproject areas: (i) 4,500 ha of char and/or main land protected from erosion and loss (43 ha from existing JMREMP work in 2013), (ii) 30,000 ha of main land protected from extreme (river) flooding, including agriculture land and land with assets (homesteads, roads, etc.), (iii) about 1 million persons directly or indirectly protected from extreme flooding (in ILB-1 and PLB-1), (iv) about 6,500 ha of char land recovered from the river for development, and (v) improved roads generating increased traffic and quicker/ easier transportation.

The project outcome will be achieved if the following mutually supporting project **Outputs** are achieved: (i) Output 1: Improved flood and riverbank erosion risk mitigation measures at priority reaches, comprising: (a) Structural Works, and (b) Non-Structural Components, and (ii) Output 2: Strengthened institutional systems for flood and riverbank erosion risk management, comprising (a) Institutional Capacity, and (b) Data and Knowledge base, and (iii) Output 3: Program management systems.

Cost Estimate

Total Tranche-2 project costs are shown below. The investment costs of the Project are expected to total US$ 361.3 million (around BDT 30 billion).

Detailed Categorization by Component	Tranche-1	Tranche-2
A Strengthening Institutional System for Flood and Riverbank Erosion Risk Management	**12.7**	**13.93**
A1 Institutional Capacity Strengthening for Sustainable River Management	1.3	2.42
A2 Knowledge-base Development	11.39	10.45
B Flood and Riverbank Erosion Risk Management Measures at Priority Reaches	**70.54**	**101.58**
B1 Infrastructure Improvement	67.69	295.77
B2 Community-based Flood Risk Management	1.55	1.65
B3 Participatory Regular O&M	0.3	0.36
B4 Livelihood Support for Project Affected People	0.99	3.96
C Project Management	**10.93**	**9.33**
Total Baseline Cost (Subtotal A+B+C)	**94.17**	**123.33**
Physical Contingencies	4.47	3.00
Price Contingencies	2.44	29.48
Total PROJECT COSTS	**101.08**	**155.81**
Interest During Implementation 2%	2.19	5.47
Total Costs to Be Financed	**103.27**	**161.27**

Implementation Institutional Arrangements

The Bangladesh Water Development Board (BWDB) under the Ministry of Water Resources (MOWR) is the Executing Agency. The Department of Disaster Management (DDM) under the Ministry of Disaster Management and Relief is the Implementing Agency for community based flood management activities.

	Goods and works contracts will be procured for supply of geo-bags and items of equipment/ vehicles, and for civil works including revetment, dredging, and flood protection works. Service contracts will pertain to project implementation support particularly the ISPMC and specialist NGOs / firms for the non-structural components of the project, for surveys, studies and pilots and for safeguards, resettlement and environmental work.
Implementation Schedule	The FRERMIP is being implemented over ten years[1], August 2014 to August 2024, in three tranches with around 158 implementation months (due to overlap with previous tranches): • Tranche-1: August 2014 to June 2020 (5.9 years) • Tranche-2: January 2020 to December 2023 (4 years) • Tranche- ii: June 2021 to August 2024 (3.2 years)
Design Features	The main feature of FRERMIP is river stabilization through affordable riverbank protection. An effective River Management Office will conduct all planning, design and implementation of works within the river corridor, including regular monitoring and evaluation for annual implementation designs and strengthening/adaptation designs. Effective measures for implementation and maintenance of flood embankments, for which embankment WMOs and an asset management system with O&M module will play a central role, will continue being the responsibility of the zonal Chief Engineers. Logical implementation of the river stabilization plan is important, for example river reaches should be sufficiently stabilized before works to control flows and sediment entry to off-taking distributaries.
Local Stakeholder Involvement	Local stakeholders firstly comprise local communities along the river banks and in char-lands, and secondly communities in the flood plain. These will be involved: (i) by working with zonal Chief Engineers, BWDB for participatory regular O&M and livelihood support, (ii) by working with DDM for flood warnings and management, (iii) through resettlement and land acquisition consultations and activities, and (iv) through construction works.
3rd Party and Consultancy Services	Third party support services of different durations will be procured from NGOs/ firms for the: (i) non-structural components of the project, (ii) for strengthened institutional systems, particularly for MIS establishment, (iii) knowledge-base development surveys, studies and pilots, and for (iv) safeguards, resettlement and environment. Most of these service contracts will be procured during the processing of Tranche-2. Consultancy services will be engaged for 42 months to support the PMO-BWDB, and PMU-DDM to implement Tranche-2 including: (i) support and advice during

[1] Agreed until 2023, recommended extension to 2024 to complete remaining works

	implementation of river stabilization and flood protection works, (iii) achieving non-structural project components including regional and community flood risk management, community involvement in regular O&M, and improved livelihoods for affected persons, (iii) strengthened BWDB institutional capacity for flood and riverbank erosion risk management through training, further development and adoption of MISs, and planning for O&M, (iv) improved data and knowledge base through studies, pilots and surveys, (v) efficient and effective project management, and (vi) preparation of Tranche-3. These consultancy tasks may be broadly categorised as being: (i) concerned with project implementation, or (ii) with improving the knowledge base. Therefore, as with Tranche-1, the ISPMC will comprise two teams: (i) Project Management and Feasibility Team, and (ii) Knowledge Team. The Team Leader of the project management team will be overall leader for the ISPMC.
Project Monitoring and Reporting	**Project performance monitoring**. The project MIS is based on the program's design and monitoring framework. During Tranche-2, the project database will be further improved with a dynamic project map enabling the user to zoom into a specific site to access data from that site. **Compliance monitoring**. The status of compliance with assurances, conditions and loan covenants—policy, legal, institutional, financial, economic, environmental, social and others— will be reviewed at each ADB review mission and reported in the quarterly progress report. **Safeguards monitoring**. Monitoring and reporting for social safeguards are described in the resettlement framework for the planning of works, and the concerned resettlement plans provide the arrangement for implementation monitoring. **Gender and social dimensions monitoring**. The GAP will be implemented and monitored by BWDB. The status of the implementation of the GAP will be reported in the quarterly progress report. Reporting will include: (i) quarterly progress reports, (ii) consolidated annual reports, and (iii) a project completion report. The DDM will report its monthly progress to PMO, with the PMO, BWDB reporting consolidated progress.
Safeguards, Gender and Social Dimensions	Involuntary resettlement and compensation in Tranche-2 will continue to be in accordance with the Resettlement Framework for the programme, (ADB-GoB, January 2018). The services of 3rd party firms/ NGOs will be procured to prepare Resettlement Plans, one for each site of works, and assist the PMO-BWDB and District Commissioner offices in making entitlement payments to effected persons. In total some 196ha of land will be required, mostly for flood embankment construction (some 170ha), affecting some 890 households. A large portion (about 35 ha) of this is on recovered char land at Hariramput. The (updated) Environmental Assessment Review Framework (EARF), May 2014, sets forth safeguards procedures to be followed in subsequent MFF tranches, as well as safeguards-related criteria to be considered in the selection of subprojects.

	The Tranche-2 project is categorized A for environment, as has been the Tranche-1 project, and an Environmental Impact Assessment report (EIA) has been prepared for the four Tranche -2 sub-reaches, the three covered in the Tranche-1 EIA report (JRB-1, JLB-2 and PLB-1) as well as the provisional works at Chandpur (MLB-2). In total some USD 5million are allocated for environmental mitigation measures, including fish passes and restoration of wetlands/beels. The Gender Action Plan for Tranche-2 includes targets for: (i) women's involvement in construction works, (ii) women's representation (minimum 30%) on committees for CbFRM, and receiving training, (iii) women's involvement in embankment WMOs for regulator O&M, including representation on the Executive Committee, and in doing maintenance work through formation of Labour Construction Societies (LCS) where there should be 30% of women, (iv) receiving livelihood improvement support for project affected people, and (v) women's participation of workshops and training as part of institutional strengthening.
Project Benefits and Economic Viability	Quantified benefits include: (i) reduction of land loss to bank erosion, (ii) reduced flood damage to crops and infrastructure, (iii) increased agriculture production due to reduced extent/ duration of flooding, (iv) char land reclamation and becoming available for development, and (v) improved road linkages. Non-quantified benefits include a reduction in loss of life and distress caused by flooding and loss of land to river erosion. Also not quantified are likely future benefits that arise from: (i) navigation improvements, (ii) improved water supply to Dhaka; (iii) increased surface flows addressing groundwater decline. Despite the steep increase in land acquisition cost, reaching about 40% of the total cost associated with flood embankment construction, flood protection continues contributing a major benefit stream to the economic feasibility. The other two major benefit streams result from riverbank protection and char land development, newly introduced into Tranche-2.

Benefit Stream	JRB-1	JLB-2	PLB-1
Riverbank protection	**8%**	**73%**	**24%**
Flood mitigation	**83%**	**0%**	**37%**
Reduced damage	77%	0%	32%
Incremental agriculture	6%	0%	5%
Char land development	**0%**	**27%**	**29%**
Agriculture & Fisheries	0%	15%	8%
Settlements	0%	12%	21%
Road Transport	**9%**	**0%**	**10%**
Navigation	**0%**	**0%**	**0%**
Total	**100%**	**100%**	**100%**

The Program in its totality, each tranche individually, and combination of tranches are to be economically viable. The results of the economic analysis for Tranche-1, 2 and 3 are presented in the following table and indicate that the

	economic internal rates of return (EIRR) are economically viable with 11.6% after Tranche 2 and 14.9% after completion of all three tranches[a]. **Investment Tranche** / **Total** Tranche-1 / 14.7% Tranche-1 and Tranche-2 / 11.6% Tranche-1 to 3 / 14.9%
Project Financing	The tentative financing arrangements is suggested in the following table. The financing from the Asian Development Bank and Government of the Netherlands was agreed at the start of the project. **Source of Financing** / **Amount** / **Percent** **Asian Development Bank** / **135** / **37** Government of Bangladesh / 223.3 / 62 Government of the Netherlands / 3 / 1 Total / 361.3 / 100
Assumptions and Risks	This feasibility study is based on the following core assumptions and risks: Assumptions: (i) The BWDB recognized the substantial contribution of Tranche-2 to stabilizing 50km of the Lower Jamuna River to develop some 6,000 ha of char land and provide for reliable dry season navigation to Sirajganj. (ii) The Tranche-2 bidding commences in summer 2019 to have suppliers and contractors for first construction mobilized by December 2019. (iii) All work contracts will be updated through implementation designs reflecting the river situation after the 2019 flood season. (iv) The DPP allows flexibility in work location, type of works, and length of works to respond to unpredictable river changes. The PD is empowered to implement the necessary changes without time consuming administrative process. (v) The FFA gets extended by one year to 2024 and Tranche-3 processing starts in 2020. (vi) The land acquisition process starts in summer 2019. Risks: (i) The PMO is not strengthened to implement a yet unprecedented project size of some US$ 100 million (or BDT 800 Crore) per year. (ii) Lack of flexibility in DPP and bidding documents endangers flexible and fast implementation and therefore Government's goal of river stabilization.

[a] The provisional investment at Chandpur (MLB-2) is economically viable on its own, as explained in the March 2018 version of this report.

	(iii) Delays in procurement and work start could delay the Tranche-2 by one year, not only requiring major redesigns in line with river changes but also endangering the completion of the whole Program. (iv) Extensive increase in land acquisition cost, beyond the influence of the BWDB delays the process and requires DPP revisions

TABLE OF CONTENTS

LIST OF APPENDICES

List of Annex

LIST OF TABLES

LIST OF FIGURES

ACRONYMS

ADB	Asian Development Bank
ADM	Adaptive Delta Management (defined in BDP 2100)
ADCP	Acoustic Doppler Current Profiler
BDP	Bangladesh Delta Plan 2100
BDT	Bangladesh Taka
BIWTA	Bangladesh Inland Water Transport Authority
BRE	Brahmaputra Right Embankment
BUET	Bangladesh University for Engineering and Technology
BWDB	Bangladesh Water Development Board
CbFRM	Community-based Flood Risk Management
CDMP	Comprehensive Disaster Management Program
CDP	Capacity Development Plan
CDMU	Community Disaster Management Unit
CEGIS	Center for Environmental and Geographic Information Services
CLP	Chars Livelihood Programme
CQS	Consultant Qualification Selection
DDM	Department of Disaster Management
DEM	Digital Elevation Model
DGPS	Differential Global Positioning System
DMB	Disaster Management Bureau
DPP	Development Project Proforma
DMC	Disaster Management Committee
DMIC	Disaster Management Information Center
DoE	Department of Environment
DoF	Department of Fisheries
DRR	Department of Relief and Rehabilitation
EA	Environmental Assessment
ECNEC	Executive Committee of National Economic Council
EGIS	Environmental and Geographic Information System
EIA	Environmental Impact Assessment
EMM	Euroconsult Mott MacDonald
EMP	Environmental Management/Monitoring Plan
F0 – F5	Land classification categories as per depth of flooding
FAP	Flood Action Plan
FCD	Flood control and drainage
FCDI	Flood control, drainage, and irrigation
FFWC	Flood Forecasting and Warning Centre
FRERMIP	Flood and Riverbank Erosion Risk Management Investment Project (ADB)
GAP	Gender Action Plan
GIS	Geographical Information System
GoB	Government of Bangladesh
HFL	High Flood Level
IEE/EIA	Initial Environmental Examination / Environmental Impact Assessment
IHE	IHE Delft Institute for Water Education
ILRP	Income Livelihood Restoration Program
INGO	Implementation Non-Governmental Organization
IR	Involuntary Resettlement
ISPMC	Institutional Strengthening and Project Management Consultant
IWM	Institute of Water Modelling
IWRM	Integrated Water Resources Management

JBIC/JICA	Japan Bank for International Cooperation / Japan International Cooperation Agency
JLB	Jamuna Left Bank
JRB	Jamuna Right Bank
JMREMP	Jamuna-Meghna River Erosion Mitigation Project, 2002 to 2011 (World Bank)
LCS	Labour Construction Society
LGED	Local Government Engineering Department
LiDAR	Light Detection and Ranging
M&E	Monitoring and Evaluation
MCA	Multi-criteria Assessment
MDG	Millennium Development Goals
MDIP	Meghna Dhonagoda Irrigation Project
MFF	Multi-tranche Financing Facility
MIS	Management Information System
MoLGRDC	Ministry of Local Government, Rural Development and Cooperatives
MoWR	Ministry of Water Resources
MRP	Main Rivers Flood and Bank Erosion Risk Management Program
NCB	National Competitive Bidding
NGO	Non-Governmental Organization
NHC	Northwest Hydraulic Consultants Ltd.
NPDM	National Plan for Disaster Management
NWMP	National Water Resources Management Plan
NWP	National Water Policy
NWRD	National Water Resources Database
NWRC	National Water Resources Council
O&M	Operations and Maintenance
PIRDP	Pabna Irrigation and Rural Development Project
PMO	Project Management Organization (BWDB)
PMU	Project Management Unit (DDM)
PPTA	Program Preparatory Technical Assistance
PWD	Public Works Datum
QC/QA	Quality Control / Quality Assurance
QBS	Quality Based Selection
QCBS	Quality and Cost Based Selection
RAP	Resettlement Action Plan
RBIP	River Bank Improvement Project/ Program (World Bank)
RHD	Roads and Highways Department
RPMC	Resource Planning and Management Consultants (Pvt) Ltd.
RRI	River Research Institute, Faridpur
RSP	River Stabilization Plan
RTIP	River Transport Improvement Project
SDG	Sustainable Development Goals
SESA	Strategic Environmental and Social Assessment
SIA	Social Impact Assessment
SSWRDP	Small Scale Water Resources Development Project
ToR	Terms of Reference
USD	United States Dollar
WARPO	Water Resources Planning Organization
WB	World Bank
wl	Water level
WMF	Water Management Federation
WMG	Water Management Groups

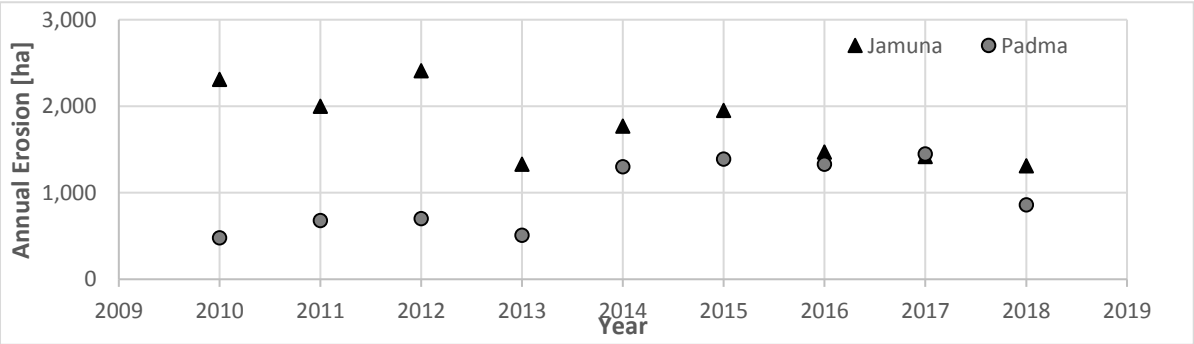
Glossary

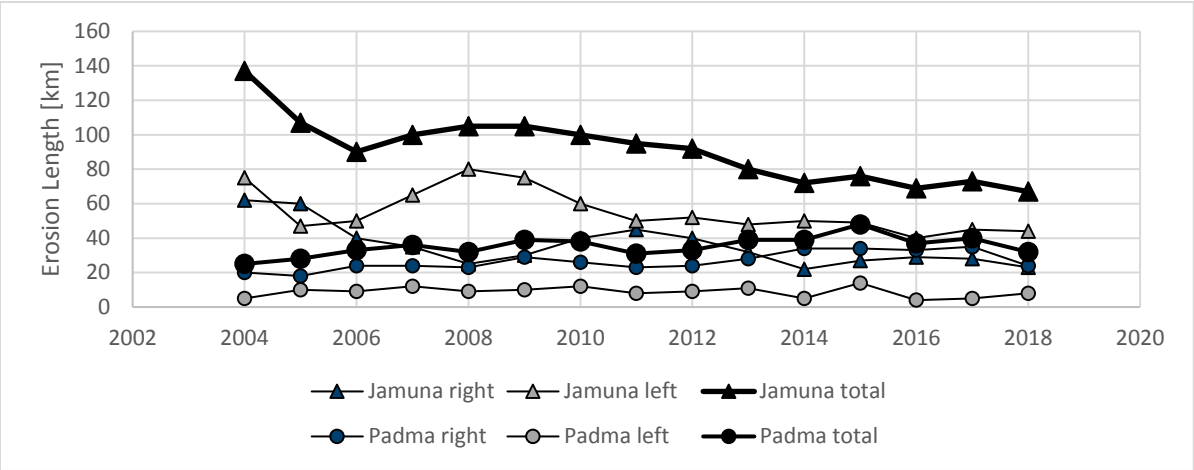
Adaptive management: "*Adaptive management enables participants to set goals, undertake actions, monitor effects of those actions on outcomes, and, most importantly, make adjustments as needed*" (National Research Council 2013).
"*The goals, associated strategies, policies, institutions and investments are moving targets and adaptive in nature. They are adaptive to changing natural events in order to respond appropriately and stay on the course to the path of the long term vision*" (BDP, 2100, 2018)

Brahmaputra System The river system influenced by the braided Brahamputra, starting from Pasighat, India. In Assam, India the main course is referred to as Brahmaputra, while In Bangladesh it changes its names: the reach from the Indian border to its confluence with the Ganges is referred to as Jamuna River, from there to the confluence with the Upper Meghna as Padma, and from then on to the Bay of Bengal as Lower Meghna. The Jamuna is further subdivided into an Upper Jamuna from the Indian border to Sariakandi (corresponding to Reach 1), the Central Jamuna from Sariakandi to the Bangabandhu (Jamuna) Bridge, and from there to the confluence with the Ganges as Lower Jamuna. Major tributaries in Bangladesh are Darla, Dudkumar, Teesta, and Hurashagar/Baral on the Jamuna Right Bank, the distributaries Old Brahmaputra and Dhaleswari (Pungli, Dhaleswari and Ghior Khal or Old Dhaleswari) on the Jamuna left bank, and the Arial Khan on the Padma right bank.

The braided Brahmaputra System

Erosion rate: The amount of land lost annually along the main rivers and segregated per riverbank. It is established through annual erosion prediction and confirmed after the flood through comparing annual bankline changes. Erosion is typically expressed as area, and can be translated into length of riverbank affected in order to establish the investment volume for riverbank protection. The rates for Jamuna and Padma for the last decade are shown below.





No regret: There are two definitions, one per Delta Plan and one by the BWDB:

(i) "*No regret actions are useful and cost-effective on the short term and under a range of future conditions and do not involve hard trade-offs with other policy objectives.*" (BDP 2100, 2018)

(ii) *"adaptation technology along with bank protection with only geo-bags may not be considered in mighty river like Jamuna & Padma river as no regret consideration"* (BWDB, Technical Committee, 2018); *Riverbank protection has to be permanent* (Director General, BWDB); *BWDB prefers a technology that is stable after construction and does not need year-to-year interventions* (Chief Engineer Design). (Aide Memoire Consultation Mission 20 to 27 November, 10 December 2018 page 7, para 21, and page 5 para 15).
On a different level, higher initial investment cost per kilometer consequently reduces the potentially immediately protected length of eroding riverbank proportionately to the cost ratio.

Planform the channel pattern of a river, single (straight or meandering = sinuous), or multi-channel (anabranched = two channels separated by large islands, or braided multiple channels separated by unstable islands or sand bars). Planform shifting between different types are referred to as wandering. The planform is typically derived from low flow satellite imagery.

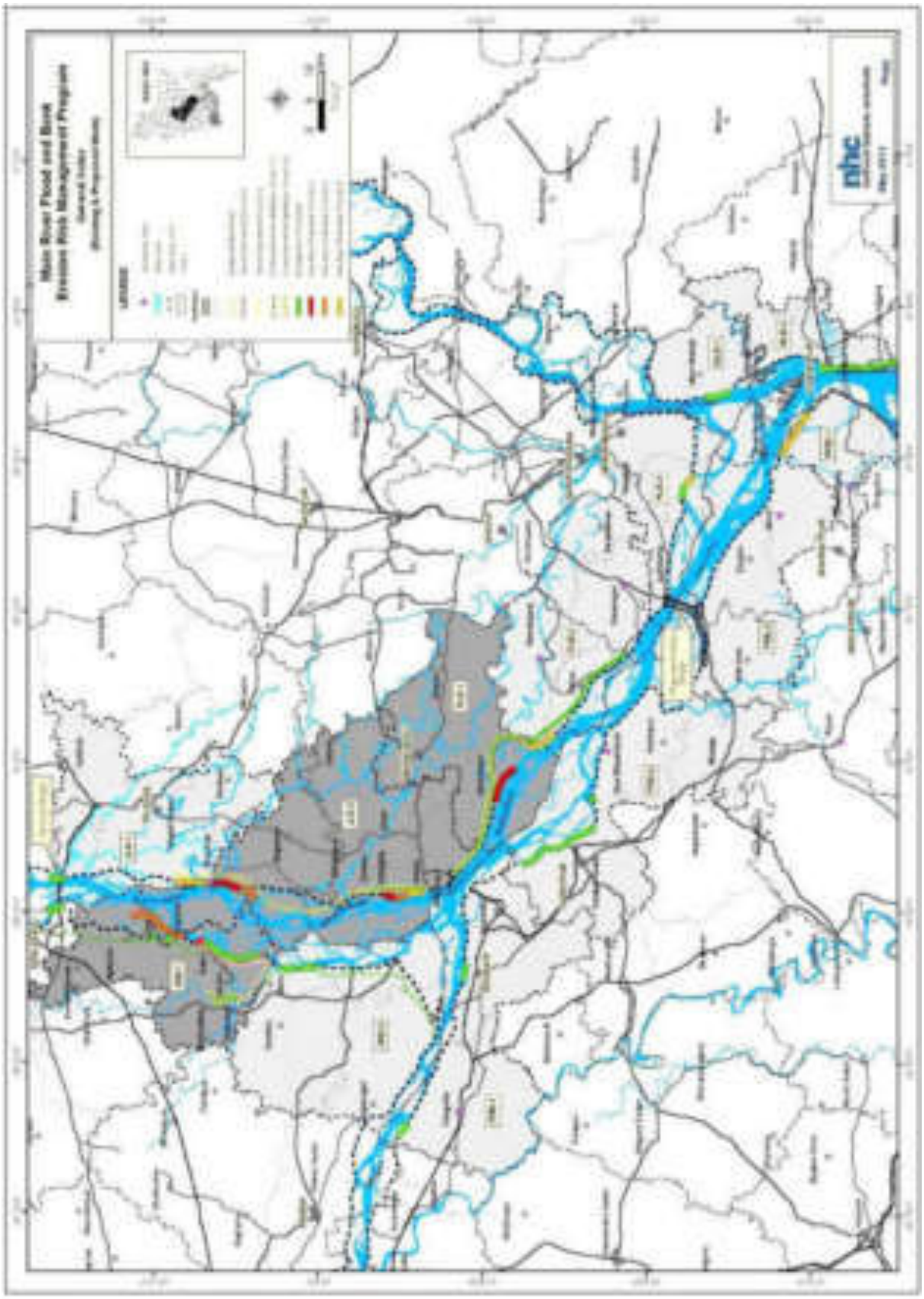


Figure 1-1 Subprojects of FRERMIP Program Area (PPTA 2013)

1 INTRODUCTION

1.1 Background

Bangladesh faces large challenges in providing stable living conditions and development opportunities on the world's largest deltaic environment with one of the highest disaster incidences in the world[10]. The largest disaster incidence in terms of area affected relates to flooding and riverbank erosion particularly along the Brahmaputra – Ganges course[11]. In total 39 districts, covering one quarter of the country are affected (BDP 2100, 2018a). Annual average flooding affects some 20% of the country while extreme floods (like 1998) can inundate up to two thirds of Bangladesh. Satellite image based riverbank erosion analysis since 1973 indicates that up to over 5,000 hectares of floodplain land have been lost annually, affecting an estimated over 55,000 people[12]. A main contributor to this dramatic floodplain erosion was the Great Assam earthquake in 1950, the sediment wave of which has reached Bangladesh in the 1970s with the effect of widening the river corridor by 50% or some 4km. Over the last two decades during the beginning of the 21st century, erosion rates have declined to some 2,000ha per year annually. Two main factors contribute to this decline: (i) the sediment wave has largely passed the country, and (ii) increasing investment into riverbank protection has reduced the vulnerable length of banklines.

The root cause for the unstable environment and major impediment for development is the lack of a stable boundary between river and floodplain, or water and land. The high population density of more than a thousand persons per square kilometer restricts the scope for moving people away from disaster prone areas and consequently depends on the protection of large parts of the floodplain against riverbank erosion. While embankment lines play a major role in avoiding annual flooding, larger scale stability and development are only possible when the river course, particularly of Jamuna and Padma are stabilized. This would not only allow the construction of modern flood embankments, free from erosion risk, but also recover floodplain lost since the 1970s, support dry season navigation in a more stable channel environment, provide stable distributary offtakes for all-year round flow, enhance the environment through well-defined habitats, restore interconnectivity of beels and wetlands with the main rivers through defined openings in the embankment lines, and finally support peri-urban development moving Bangladesh from predominantly agrarian to modern manufacturing and service sector characteristic.

1.2 FRERMIP Location and Subprojects

In 2012/13, the feasibility study (NHC., 2013) selected three priority sites along both banks of the lower Jamuna and upper Padma Rivers in central Bangladesh, specifically JRB1, JLB2 and PLB1 (Figure 1-1), and proposed systematic development at these three sites over three successive tranches (projects) resulting in gradually increasing river stability and flood protection contributing to flood risk reduction and economic development in subproject areas. Consequently, Tranche-2 (and later Tranche-3) will build on the initial developments achieved under Tranche-1. In this way, FRERMIP will contribute to and/ or enable realisation of a more stable river reach, particularly the Lower Jamuna.

[10] Bangladesh is ranked the 6th most vulnerable county in the world in terms of risk from natural disaster (BDP 2100, 2018a)

[11] consisting of Jamuna and Ganges until Goalando, then Padma until Chandpur, and followed by the Lower Meghna estuary

[12] River Study Technical Note 2: Holistic River Morphology Analysis for the Brahmaputra River System

The three priority site areas of FRERMIP are shown on Figure 1-1, and the associated Upazilas and districts are listed in Table 1-1. The three subprojects extend over a total area of about 2,476 km^2, or 247,600 ha mostly in Sirajganj and Manikganj districts, as well as the southwest portion of Tangail. The total area for all 13 subprojects identified along the Jamuna, Padma and Meghna rivers is 9,292.2 km^2, or 929,220 ha (Table 1-2).

Of the total gross area of 247,600 ha, about 128,400 ha can be used agriculturally. Out of this area 93,200 ha are flooded cultivable area without project as opposed to 52,000 ha with project. Without project, F0 and F1 land covers approximately 40,000 ha. After the program interventions are built an additional approximately 56,000 ha will be F0 and F1 land, (NHC., 2013).

Table 1-1 FRERMIP Upazila and Districts

River Reach	BWDB Zone	Sub-project	District	Upazila
3	North West	JRB-1	Sirajganj	Belkuchi
				Kamarkhandi
				Shahjadpur
3	North Central	JLB-2	Manikganj	Daulatpur
				Ghior
				Saturia
				Shibalaya
			Sirajganj	Chauhali
			Tangail	Nagarpur
4	North Central	PLB-1	Manikganj	Harirampur
				ManikganjSadar
				Singair

Table 1-2 Data for Priority Subprojects

Parameters	JRB-1	JLB-2	PLB-1	Total
Population, million	1.5	1.1	0.74	**3.34**
Bankline length, km	37.0	56.0	25.0	**118.0**
Gross Project Area, ha	58,209	121,200	68,200	**247,609**
Adjusted Project Area protected by Embankment, ha	41,067	82,927	52,070	**176,064**
Settlement Areas, ha	8,855	18,491	14,345	**41,691**
Ponds, streams, other non-agricultural land	2,213	2,696	1,082	**5,991**
Net Cultivable Area (NCA)	30,000	61,740	36,643	**128,383**
Total flooded cultivable area without project, ha	22,581	47,844	22,788	**93,213**
Total flooded cultivable area with project, ha	17,568	21,078	13,356	**52,002**
F0 and F1 land w/o project, ha	8,299	17,095	14,563	**39,957**
F0 and F1 land with project, ha	15,958	51,619	28,954	**96,531**

Source: PPTA Final Report, 2013

1.3 FRERMIP Tranche-2 Feasibility Report Preparation

The preparation of Tranche-2 started in 2016 and has undergone several changes:

(i) **Preparatory Activities in 2016:** The Aide Memoire of the Project Review Mission (30 August to 4 September) initiated the process of scoping Tranche-2, however this was affected by the need to reduce the overall loan amount for Tranche-1 and to defer

activities into Trache-2 due to an unfavorable exchange rate development. After presenting the outline of the Tranche-2 works at the national stakeholder workshop on 7 December 2016, the ISPMC submitted the "Site Selection and Initial Economic Assessment Report" (NHC/EMM, May 2017) in May 2017. In parallel the substantial reduction in loan amount, from US$ 65 million equivalent to some US$ 58 million equivalent, was processed, with the related first revised DPP approved on 15 June-2017. This provided substantial clarity about the Tranche-1 activities to be deferred to Tranche-2. The site selection report was discussed during a meeting headed by the Director General, BWDB during the ADB Consultation Mission at the end of July 2017 (Aide Memoire of Consultation Mission from 23 to 30 July 2017).

(ii) **Preparation of draft Feasibility Study 2017/18:** The third technical advisory recommended the site selection for approval on 17 September 2017. Subsequently, during the "National Stakeholder Workshop on the River Stabilization Plan for the Jamuna and Padma Rivers" on 29 November 2017, the Tranche-2 works was presented in the context of the larger river stabilization plan (Figure 1-2). The proposed approach with few small modifications was recorded in the Aide Memoire of the ADB mission at the end of the year[13]. The remaining uncertainty pertaining to the scope of work could be removed after awarding the last major civil works contracts for embankment construction in January 2018. As a result of the fixed DPP budget 1.7km of embankment construction had to be transferred to Tranche-2 and incorporated into the feasibility study. The ISPMC submitted the draft feasibility report on 22 March 2018. During the next months the feasibility designs were discussed with the BWDB design office and modified towards final design level. As Tranche-1 had to be extended by one year to complete the embankment construction, it was planned to overlap Tranche-1 and Tranche-2 during the construction season 2019/20.

(iii) **Revision of Feasibility Study 2018/19:** The Government approved the Bangladesh Delta Plan 2100 on 4 September 2018, which allows the alignment of the Tranche-2 works with the latest strategy towards adaptive delta management. The Technical Committee meeting reviewed the feasibility study on 8 October 2018 and suggested a number of changes, particularly restricting the work to protecting the floodplains as opposed to broader river channelization also on charland (NHC/EMM, draft Feasibility Report for Tanche-2, 2018a), and proposing a heavier riverbank protection design. Subsequently the changes were discussed during an ADB consultation mission (20 to 27 November 2018) with the decision that the BWDB would prepare all designs and provide a background document explaining a new concept of riverbank protection. The design office provided the background document on 11 December 2018 and the designs for three infrastructure package on 15 January 2019 and the fourth provided on 14th March 2019. In parallel to the design work, the ISPMC updated the draft feasibility study for a bankable loan in February 2019, which was subsequently revised in April 2019 to be fully compliant with the BWDB designs.

The feasibility report is prepared following a review of status and lessons learned from the first Tranche (NHC/EMM, February 2018), and with due cognizance of the BWDB recommendations (Technical Committee – Appendix B), recommendations of the river stabilization plan (NHC/EMM,

[13] Aide Memoire of Consultation Mission (26 November – 1 December 2017)

Strategic Framework for River Stabilization and Development: Jamuna-Padma and Dependent Areas, May 2017), the latest actual river situation and predictions, and the vision presented by the river management master plan (NHC/EMM, Februrary 2018).

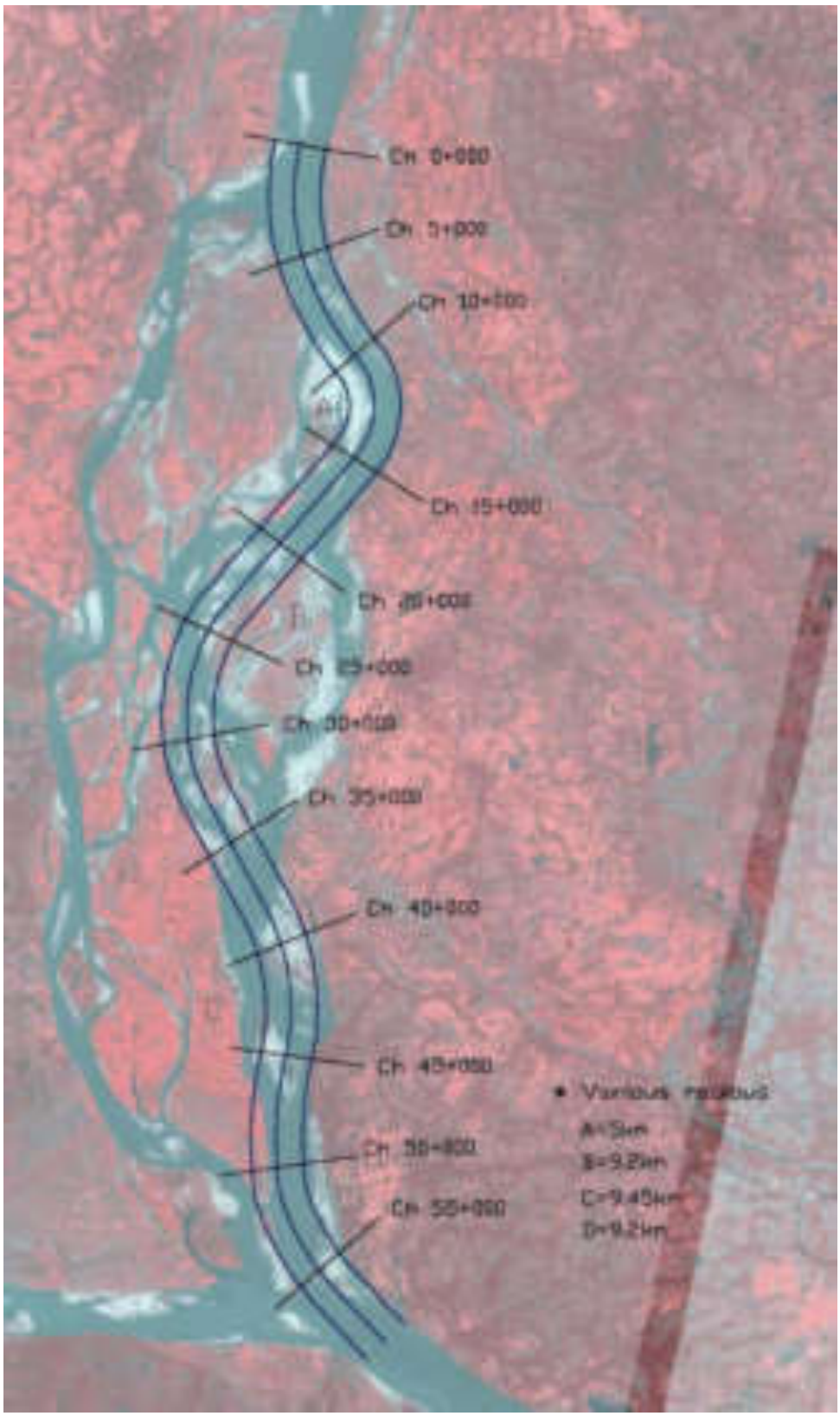


Figure 1-2 Stabilized left branch of the Lower Jamuna River

1.4 Report Structure

Following this Introductory Chapter, Chapter 2 provides background on Tranche-1 developments, the context of river stabilization and modern climate smart flood embankments, morphological developments at the sites, and finally provides structural and non-structural lessons learned.

Chapter 3 provides key criteria and considerations for Tranche-2 formulation and the general considerations for selection of the Tranche-2 works. This includes updates for the Design and Monitoring Framework (DMF) (Appendix A), governing criteria justifying the proposed works, dominated by the agreed Multi-tranche Financing Facility and Government's wider focus on developing the main rivers. Structural and institutional aspects are discussed in relevant subchapters.

Chapter 4 presents the proposed Tranche-2 project[14]. Due to the studies and lessons learnt from Tranche-1, there has been some shift from the original (PPTA) program design, to include for benefits expected to accrue from char-land recovery and development, as well as from increased agricultural production and protection of assets along the river bank. The three project components are discussed in details in separate subchapters.

Chapter 5 provides background on social and environmental safeguards, including resettlement, environmental impact assessment, gender action plan (Appendix E) and summary poverty reduction and social strategy (Appendix F).

Chapter 6 describes Tranche-2 implementation, including institutional arrangements, procurement plan, implementation schedule, and monitoring and stakeholder communications.

Chapter 7 contains the project cost as per provided BWDB designs and the cost for Tranche-3 following the Client's recommendations (see Appendix B). The only substantial change from the March 2018 feasibility report relates to the riverbank protection work. The costs are presented as per ADB components and the categories of the Detailed Project Proforma (DPP).

In Chapter 8 economic benefits are described and economic viability established.

Chapter 9 contains the references.

This main report is accompanied by six Attachments and five annexes:

Annex 1	Background Information
Annex 2	Involuntary Resettlement
Annex 3	Environmental Safeguards and Climate Change
Annex 4	Cost and Economic Assessment, and Implementation Aspects
Annex 5	Design Reports

[14] Supporting Appendices B – E provide background on a number of issues

2 FRERMIP-TRANCHE-1 DEVELOPMENTS, CONTEXT, AND LESSONS LEARNED

2.1 Tranche-1 Progress

The FRERMIP Tranche-1 Loan was signed in August 2014 for an implementation period of five years (until June 2019) and extended on 15 November 2018 by one more year. It is the first of three tranches of a Multi-tranche Financing Facility, with the Framework Financing Agreement approved together with the Tranche-1 loan. The total program duration was scheduled for 9 years (from mid-2014 until mid-2023). Out of the total planned expenditure of US$ 373.7 million, ADB agreed to finance US$ 255 million and the Netherlands US$ 15.3[15]. While the revised Tranche-1 budget increased by US$ 5 to US$ 108 million, the ADB contribution reduced to US$ 58 million from US$ 65million due to the depreciation of the Special Drawing Right (SDR) against the US Dollar. The Netherlands' grant contribution of US$ 15.3 million remains unchanged and Government increased its contribution from US$ 23 million to US$ 35 million (from 22% to 31% of the total Tranche-1 cost). On individual cost items, the largest change relates to the resettlement cost with an increase from the original estimate of US$ 11 million to US$ 26 million, or 11% to 24% of the Tranche-1 budget.

The Tranche-1 physical implementation is satisfactory. As of 25 February 2018[16], overall project progress is 70% against the elapsed time of 72%. The cumulative contract awards for the ADB loan and the Netherlands grant stands at 70% and 65%, respectively.[17] As of June 2019, more than 4.5 years of the total MFF have passed with an overall progress of 88% against the elapsed time of 79% (for the revised closure of implementation activities in June 2020). Tranche-1 has been under implementation for 50% of the total MFF period, or when accounting for the one year start-up delay, 38% in terms of actual implementation time. Total project expenditure as of December 2018 reached around US$ 75 million (or 23% of the total planed MFF).

Amongst others, FRERMIP Tranche-1 added some 18km of riverbank protection and 21km of embankments in the Lower Jamuna and Upper Padma Rivers. Together, FRERMIP is substantially contributing to the stabilization of the Lower Jamuna River, with riverbank protection providing the backbone for a more stable and navigable river to Sirajganj.

2.2 River Stabilization and Development along the Jamuna-Padma Rivers

The Flood and Riverbank Erosion Risk Management Investment Program – Project-1 includes the preparation of a long-term river channel stabilization plan and preliminary river management master plan covering Jamuna and Padma river including the North-central Zone influenced by the main distributaries of the Old Brahmaputra and the Dhaleswari System[18] (NHC/EMM, Inception Report,

[15] The Netherland's government has indicated additional potential financing in the order of US$ 5 million for Tranche-2 (Aide Memoire of Consultation Mission 27 November 2018).

[16] The mid-term review mission was held at this time.

[17] Aide Memoire of Midterm Review Mission (5-26 February 2018)

[18] The consulting team Tranche-1 has prepared the "Strategic Framework for River Stabilization and Development: Jamuna-Padma and Dependent Areas" in November 2016. Subsequently, the framework was presented and discussed in the National Stakeholder workshop in December 2016, and accepted by BWDB during two meetings: (a) in a meeting chaired by the Director General in July 2017 during the ADB Consultation Mission in July 2017 and in the Technical Advisory Committee Meeting chaired by the Chief Planning on 17 September 2017. Both meetings were attended by the development partners. The draft river stabilization plan was presented and discussed at the end of November 2017 in a

2016a). The Study Area is shown in **Figure 2-1**. The Terms of Reference refer of the river stabilization and preliminary river management master plan, which includes a strong regional component for the areas fed by distributaries and are commensurate with two of the six hotspot strategies of the Bangladesh Delta Plan 2100, namely River Systems and Estuary Strategy, and Sustainable Land Use and Spatial Planning.

The Strategic Framework (NHC/EMM, May 2017) focusses on the following five Development Objectives: (i) Reduced Flood and Erosion Risk, (ii) Reclaimed Lost Floodplain, (iii) Development Value Capture in the Study Area resulting from the Stabilized River Environment expressed in terms of poverty reduction, intensified agriculture, peri-urban industrial development, etc., (iv) Restored Navigation, and (v) Restored Riverine Ecology. It emphasizes the need for adaptation and flexibility and emphasizes "hard" interventions in the short-run (to 2030) and socio-economic value capture in the medium run (to 2040 and beyond). The Strategic Framework consists of seven Strategic Thrusts also referenced in the Delta Plan under Strategy RE2 (GED; Bangladesh Planning Commission; GoB, 2018):

(i) ***Stabilizing the River Corridor:*** The first intervention along the Main Jamuna – Padma River Course is to control river bank erosion; it is river bank erosion that makes the river unstable. Stabilizing the river corridor is central to all of the following aspects.

(ii) ***Land Reclamation:*** Land reclamation through erosion protection, primarily based on geobag revetments at critical bends, plus flood embankments, will result in up to 150,000 hectares of land being reclaimed, enough land to settle some 1.8 million people.

(iii) ***Flood Risk Reduction:*** Flood risk reduction through construction of flood embankments will protect livelihoods, provide embankments for improved road accessibility, incentives for more intensive agriculture, and enable high-value urbanization.

(iv) ***Distributaries Restoration:*** Distributaries will be stabilized by carefully designed flow-guiding bank protection structures in the main river, construction of off-take structures to enable increased dry season inflow and controlled flood inflow; thereby improving reliability of water quantity and quality year-round in the Study Area, including the Greater Dhaka Region.

(v) ***Enabling Commercial Navigation:*** Navigation would be restored on the Study Area rivers by establishing and maintaining safe navigation channels during low flow periods, without restricting the cross section of the River during flood discharges, utilizing measures like low spurs and dredging.

National Stakeholder Consultation workshop and was accepted by the audience. Safeguard aspects are summarized in a specific document, in lieu of a policy framework: Strategic Environmental and Social Assessment (SESA), reviewed by the Netherlands Commission for Environmental Assessment. A first review took place in mid-2017 with the second review ongoing in early 2019. The regional plan, focussing on spatial planning and water resources of the North-central region was submitted in September 2018.

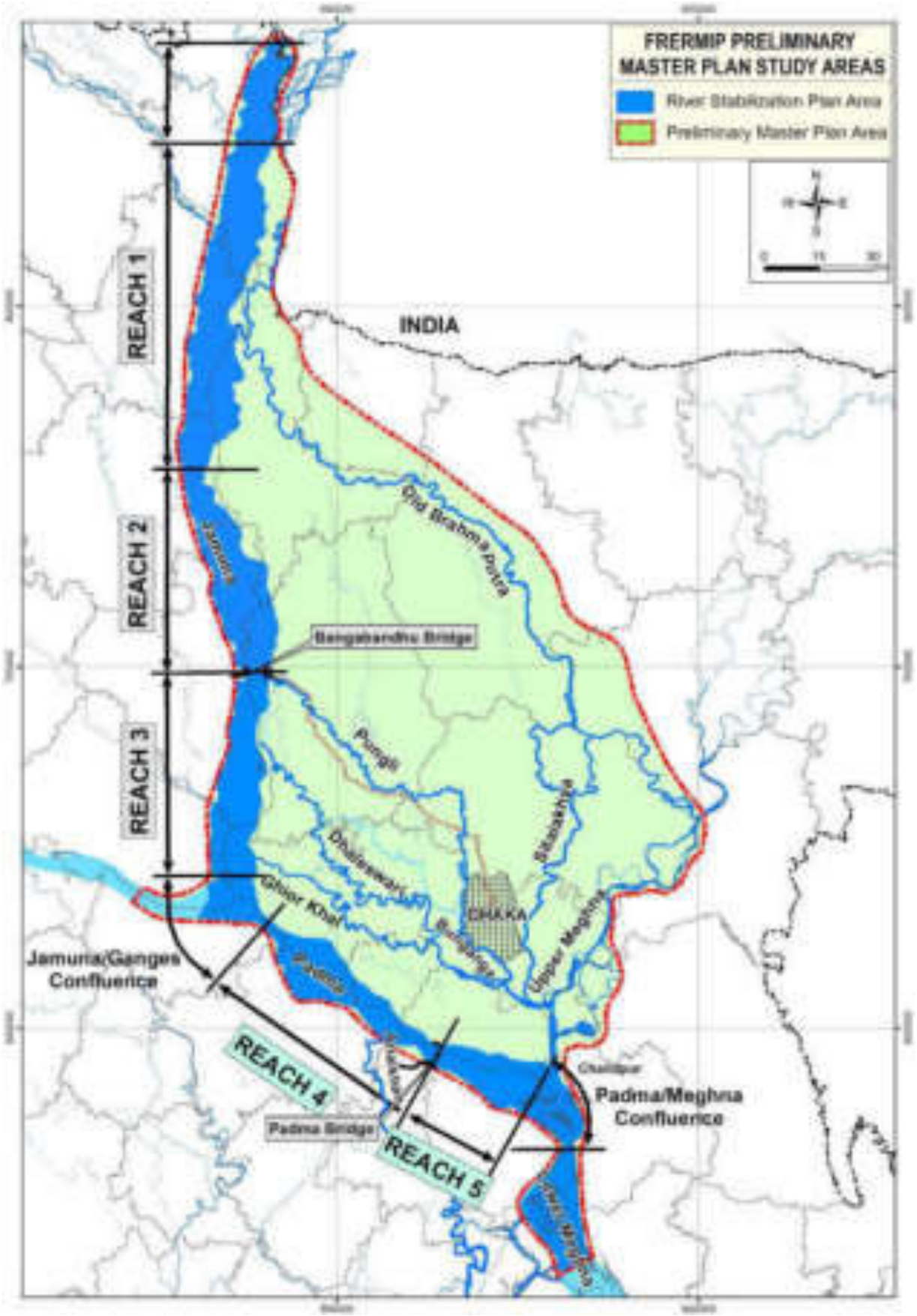


Figure 2-1 River Stabilization Plan and River Management (Regional) Master Plan Areas

(vi) ***Increased Land-Based Productivity:*** The prime benefit of the strategy will be to enable high value economic activity, and commensurate improvements in human well-being on reclaimed land, through intensified agriculture, and very importantly by enabling an industrially driven peri-urban area to be developed south of Dhaka employing up to a million workers in manufacturing, propelling Bangladesh to middle income status. Also, increased agricultural productivity within the 1.3 million ha Master Plan Area, over about 500,000 ha, due to increased water supply and managed flooding, benefitting about six million households. Figure 2-2 provides an overview over the proposed planning structure.

(vii) ***Environmental Enhancement:*** Environmental Protection Zones will be designated along the river courses enabling environmental enhancement, and providing flora and fauna habitat.

Expected Impact is a dramatic improvement of the socio-economic and environmental situation. Benefits will accrue from: (i) development of new, stabilized land within the river corridor for industry, settlement and agriculture, including peri-urban development, (ii) Enhancement of agricultural productivity on flood-free land partly raised from the river, and (iii) restored navigation supporting mass scale container barge, feeder vessels, and tourist cruise boat traffic. Other benefits include (i) enhanced riverine ecology, and (ii) restored water quality of rivers around Dhaka.

2.3 River Stabilization Plan and Tranche-2

River Stabilization of Jamuna and Padma – the Backbone of Development

The River Stabilization Plan draws on conjunctive use of three major implementation technologies:

(i) **Riverbank protection** to establish a fixed boundary between river and floodplain through alternating long-guiding revetment following the internationally proven approach of “bend control” and therefore encouraging a meandering river course. The revetments encourage a more stable channel pattern, and support dry season navigation.

(ii) **Multi-purpose Dredging** for establishing preferred channel alignments and overloading undesired channels for closure, construction of riverbank protection works and flood embankments. Importantly, dredging can only address the limited sand load of the river, transported during the flood season as bed material load and typically deposited as shoals and chars. This sand load constitutes only around one quarter of the overall sediment load and is insufficient to build up all 1,500 km² of land to floodplain level within a reasonable (multiple decades) time scale.

(iii) **Building with Nature** by harvesting sediment during the flood season to build up low lying land to floodplain level. This technology builds on the indigenous techniques of reed plantations, developed into standardized bio-engineering tools, started through pilot applications during Tranche-1. The approach targets the larger portion of the transported suspended sediment, constituting the fertile top layer of the Bangladesh delta.

Stabilization works according to the principle of guided meandering will not transform the braided Brahmaputra-Jamuna River into a fully meandering river, but reduce the braiding intensity and thereby contribute to increased sinuosity and improved navigability. The stabilized river will

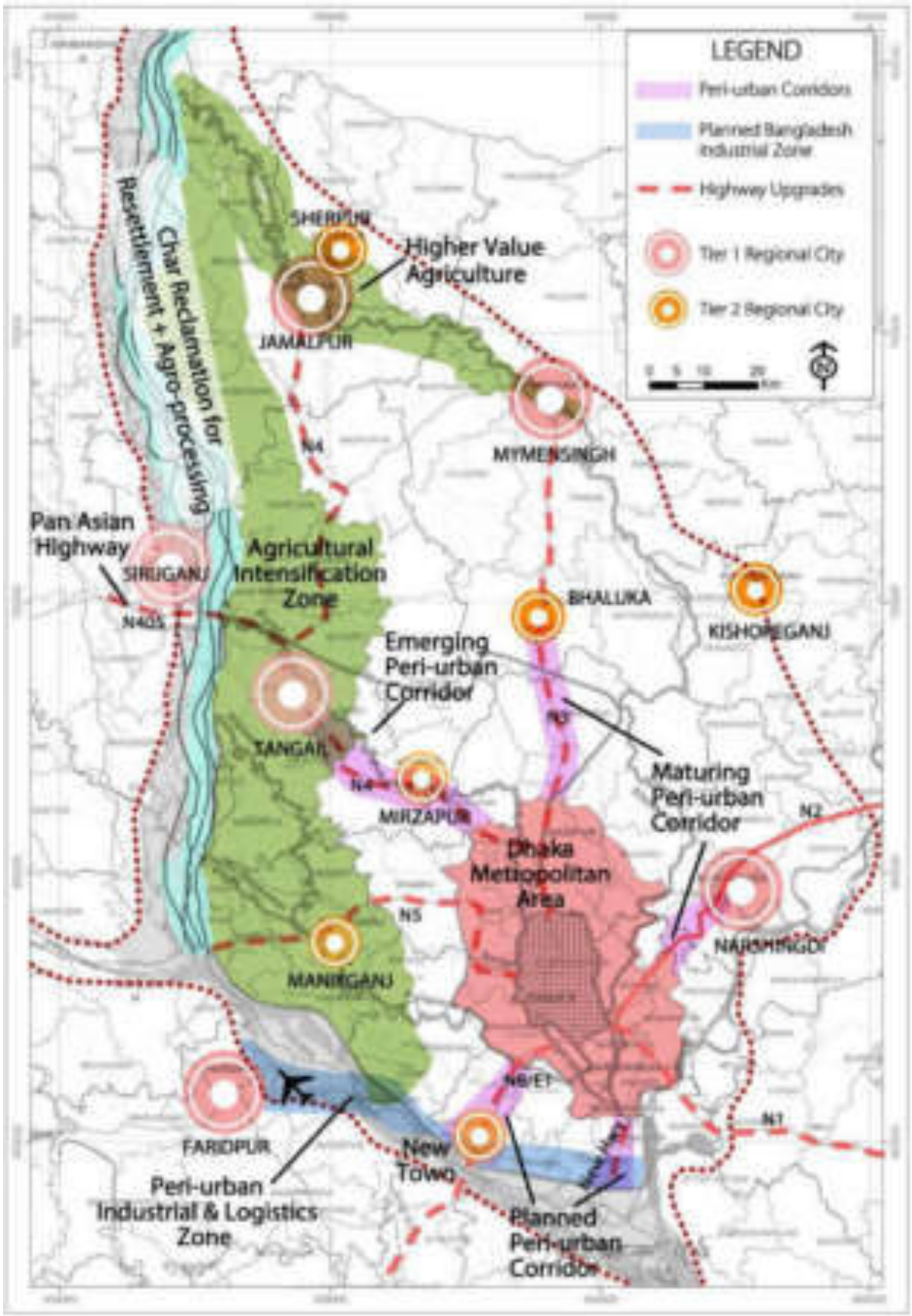


Figure 2-2 Proposed regional planning structure for the North-central region

maintain a dynamic character that can be steered by strategic dredging and dumping. Careful design of structures for guided meandering will reduce the costs of this dredging and dumping by triggering erosion and deposition processes in targeted reaches, also referred to as "self-dredging". In other words, the stabilized river could have long periods with a dominant sinuous channel, favourable for navigation, alternated with episodes of turn-over in which the river would re-assume a more braided character. Considering all periods together, channel sinuosity would increase as an important overall effect that is beneficial.

Inevitably the river stabilization plan retains uncertainties on different levels. With respect to baseline data and knowledge, the plan recognizes the overall sediment deficit, impacting on the amount of land that can be recovered from the river and built up to floodplain level. There is great uncertainty about the actual sediment load, as no reliable data has been collected since the mid-1990s. Uncertainties also relate to the knowledge base and inherent unpredictability of the river system. Therefore, every implementation step will be based on the best estimate according to current knowledge, leaving room for later adjustments and favouring the steps that cause no regrets under a variety of scenarios. Continuous monitoring and updates of predictions will be key ingredients for improvements, via 'learning by doing'. Monitoring and predictions will also be crucial for seizing the opportunities for stabilizing favourable situations created by the river itself during the implementation of the RSP.

In line with the "no-regret" criterion as defined in the Delta Plan 2100, investment into riverbank protection requires careful consideration about the level of investment. The Delta Plan 2100 is strongly based on avoiding expensive "lock-in" situation where high-cost infrastructure not only reduces the flexibility during later plan periods, but also requires continuous high investments for strengthening/adaptation and maintenance. With respect to the designs of riverbank protection, a more phased approach provides more flexibility. This approach introduces the element of risk, however acknowledging that a fully quantified assessment of risk is not possible due to the lack of a broad database on all performance criteria (subsoil, water, and structure). This notwithstanding, FRERMIP proposes a risk management approach which comprises three levels of safety, distinguishing between the common soil conditions of the riverbanks (Table 2-1).

Table 2-1 Probabilistic design approach (also referred to as risk-based design) for riverbank protection

Design level	**Consolidated riverbanks (typically stable at slopes 1V:2H)**	**Unconsolidated riverbanks (typically stable at slopes flatter than 1V:3.5H)**
Emergency works	Mass dumping along the riverbank Implemented under ***JMREMP*** from 2001 to 2006	***Not possible*** as aprons do not launch under these soil conditions
Standard Protection	Multilayer slope coverage with underwater toe protection to design scour level on natural slopes	Same on flat dredged slopes[19] with slope angle and dredging depth determined by soil composition

[19] In the draft feasibility report, March 2018, the ISPMC proposed for weaker soils dredging to around 10 to 15m below low water levels to flat slopes of 1V:6H in order to substantially increase the safety factor. In some cases, particularly for Chauhali the flattering of the slope above water level was proposed. The BWDB applied dredging earlier at Kalitola, Mathurapara, Sariakandi, and Sirajganj during the second half of the 1990s, while the river training for all major bridge constructions in the Ganges, Jamuna , Padma and Meghna rivers built since the second half of the 1990s is built on flat dredged slopes.

	Implemented under ***JMREMP and FRERMIP Tranche-1***	
Highest level Protection	Same as above with wider apron resilient to static flow slides. Approved by the BWDB design office for the ***RBIP*** in 2015	Same on dredged slopes, Under implementation for the ***Padma Bridge*** river training (Part of the feasibility study of March 2018)

Flood Protection Embankments for Defined Structural Flood Risk Management

Flood embankments will continue playing a fundamental role for the protection of agriculture alongside the main rivers. Increasing flood season crop intensity depends on reliable water levels, not influenced by the vagaries of the monsoon flows of the main rivers. The ever growing rural road network only affects flood patterns to a certain return period as these roads can be overtopped and breach during high floods. In addition, the road network leads to delayed drainage. Consequently, systematic flood protection and drainage improvement alongside the main rivers remains a main priority for flood risk reduction. In line with this, the Strategic Framework suggests to close embankment gaps and strengthen existing embankments. Importantly, more than half of the new embankment lines are proposed to be built on recovered char land, starting with FRERMIP.

The demand for higher embankment design standards will rise with increasing assets due to industrialization but also development of high value agriculture. The flood risk is defined as product of probability of exceedance (return period) and assets at risk of damage. Until recently design standards were based on a 30-year economic life and propose a 100-year return period. The accepted aggregate probability of failure during this period is 26% (Table 2-2). For comparison the Padma Bridge design adopted a 500-year flood for an economic life of 100 years, which results in an aggregate probability of failure of 18% (NHC., 2013). Given the rapid development of assets on the floodplain, doubling the assets would require to adopt an around 200-year flood level to arrive at the same aggregate probability of failure as before. Despite the high freeboard of 1.5m currently adopted, this consideration is very relevant as flood levels in a narrowed river corridor will increase more and consequently higher flood embankments will be required in future.

Table 2-2 Aggregate probability of exceedance for different return periods and economic life times

Return period (years)	probability of exceedance in … years lifetime					
	1	10	20	30	50	100
10,000	0.0%	0.1%	0.2%	0.3%	0.5%	1.0%
1,000	0.1%	1.0%	2.0%	3.0%	4.9%	9.5%
500	0.2%	2.0%	3.9%	5.8%	9.5%	**18.1%**
200	0.5%	4.9%	9.5%	**14.0%**	22.2%	39.4%
100	1.0%	9.6%	18.2%	**26.0%**	39.5%	63.4%
50	2.0%	18.3%	33.2%	45.5%	63.6%	86.7%
25	4.0%	33.5%	55.8%	70.6%	87.0%	98.3%
10	10.0%	65.1%	87.8%	95.8%	99.5%	100.0%
5	20.0%	89.3%	98.8%	99.9%	100.0%	100.0%
2	50.0%	99.9%	100.0%	100.0%	100.0%	100.0%
1	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

probability of exceedance higher than 50%

In line with future higher safety requirements and given uncertainties with future flood level increases associated with climate change effects and a narrowed corridor, today's embankments

need to be designed for the future. This includes having sufficient width for future widening to address uncertain water levels in two or three decades from now, while minimizing today's investment. Consequently, Tranche-2 proposes a "climate smart" embankment design. The cost effective adaptable design, in line with international standards, consists of different embankment elements: (i) a flood protection element to cope with design water levels, yet flexible for future adjustments, (ii) a central part, wide enough to address seepage, and (iii) a country side slope for drainage arrangements and as compensation for lost tree plantations. This design was accepted for the first time by the BWDB during the PPTA on 7 February 2012[20].

While the embankments have a number of positive impacts on society, negative impacts on the environment need to be mitigated and, in case of existing embankment lines, the present conditions will be enhanced. The new embankment lines will not only provide flood protection to up to 150,000 ha of recovered char land, but also easy access. For example Tranche-3 will connect Shibalaya (Aricha) at the end of National Highway N5 with Chauhali over some 6,000 ha of recovered char land of the Omarpur and Solimabad upazillas. In future this connection will extend to Tangail. LGED or RHD will build the road connections over the embankment depending on the importance of the road. Negative impacts on natural flood patterns will be compensated in two ways: (i) old and new embankments will be systematically equipped with regulators cum fish passes to reduce the separating effect, and (ii) distributary offtakes will be opened for all-year round flows.

Distributaries Restoration and Offtake Structures

Five important offtakes are present in the Brahmaputra river system; notably the Old Brahmaputra in Reach 1, the three Dhaleswari offtakes in Reach 3 branching off from the Jamuna River, and the Arial Khan branching of from Reach 4 in the Padma River. The four offtakes from the Jamuna system suffer from excessive sedimentation and loss of inflow, whereas the Arial Khan on the average is reasonably stable and functioning. Stabilization and narrowing of the Jamuna and Padma Rivers creates improved conditions for these offtakes, as the river and approach conditions to the offtakes is fixed. The following measures are included in the river stabilisation plan to improve the functioning of the offtakes and will be implemented during Tranche-2 and 3 for the Old Dhaleswari River:

(i) Shift of the offtake to a location at the end of an outer bend.
(ii) Adopt a gentle offtake angle to prevent too much sediment from entering the offtake. If needed additional works will stabilize the offtake geometry.
(iii) A flood barrier will be constructed in all offtake channels to limit the inflow during extreme flood conditions.

Importantly, the restoration of distributaries is proposed only after offtake stabilization, as the then known amounts of water and sediment allow sustainable management. Distributary restoration consists of restoring dry season flow through capital and maintenance dredging and protecting critical meander bends against riverbank erosion that is expected after more flow is introduced.

Implementation Period and Phasing of Works

The River Stabilization Plan works are to be implemented over 25 years, from 2015 to 2040, while FRERMIP is planned to close in 2024. In line with the Delta Plan 2100, two time periods have been identified, Short Term (to 2030) and Medium Term (2030 – 2040). The Short Term covers three Bangladesh national Five Year Plan periods, the plan for each period would provide guidelines for investment in the five-year period in question. Much hard engineering between Bangabandhu

[20] Aide Memoire of the TA Review Mission 11 February 2013

(Jamuna) Bridge and Chandpur could be completed by 2030, thus the Medium Term strategy focuses on: (i) Adaptation and Maintenance in regard to river stabilization, and (ii) Implementing measures to maximize the economic e.g., industrially driven navigation and peri-urbanization, human (e.g. employment), and environmental benefits from the stabilized system and the considerable reclaimed land area.

Institutional Framework for Unprecedented River Management of Jamuna and Padma Rivers

The predictability of the river morphology more than a few years ahead is low. Natural changes in river morphology as well as changes due to already implemented interventions may be different from what could be anticipated beforehand. Therefore, plans and designs have to be reviewed frequently and re-evaluated, responding to close monitoring and using prediction methods to forecast what the river is "about to do". Each intervention will influence river characteristics that must be assessed and analyzed before further works can be planned.

This approach is a challenge to any river management organization and institutional adjustments are required as follows:

(i) The operationalization of the Office of the Chief Engineer River Management (CE-RM). This is included in the "needs based" organizational set-up of BWDB. Main tasks of the CE-RM are to (a) Regularly adjust the long-term master plan framework, (b) Develop medium-term investment plans, and (c) Act as a repository for accumulated knowledge relevant for planning of main river management.

(ii) Assign the responsibility for all design work for the main rivers to a designated and specialized unit under BWDB's CE Design. This will allow for the development of specialized skills and knowledge and promote innovation.

(iii) Continuous monitoring of river characteristics. Continuous monitoring of river flows, riverbank erosion and scour depth is required to plan for subsequent river training works. This monitoring feeds information into the planning and design units mentioned above. A core function especially during the initial 15-year implementation phase, will lie with the Chief Engineer River Management, further supported by an expanded erosion prediction system which is annually updated.

(iv) Survey and monitoring of already implemented structural works. Detailed surveys of the structures to check the designs and check for damages. Measurements of flow velocities, wave heights, and surveys of adjacent river bed provides information about the exposure of the structure. The systematically stored data feeds into future designs for which improved design guidelines may be developed, but also into the planning of structural maintenance.

(v) The Planning Commission may be asked to promote framework DPPs with block allocations for River Management Projects to allow adaptive construction of river management infrastructure. The present rigidity of fund allocation through project DPPs is inconsistent with the dynamics of the main rivers.

(vi) The Ministries of Agriculture and Water Resources are asked to establish platforms for dialogue with key stakeholders for main river management at different levels: (i) The operational level (other GoB departments/units, NGOs, knowledge institutions, and subject matter experts) as well as at (ii) The higher policy level (Ministries).

2.4 Morphological Developments and Protection Strategy for Tranche-2

Morphology

While the conditions at the individual sites at Chauhali, Zaffarganj and Harirampur sites do not require further large-scale physical interventions during Tranche-2, larger river changes at the bifurcation of the Lower Jamuna need a response for the following reasons:

(i) The protection of the Chauhali bend is along a very curved, and therefore much less favourable, channel alignment as found during the PPTA in 2012. Figure 2-3, location 1 shows the dramatic bankline changes at Chauhali over the last ten years. The stronger curvature of the main channels, protected against erosion in 2016, is associated with a higher risk of cut-off formation and larger downstream river changes. In addition, the two extreme floods in 2016 and 17 have changed the channel behaviour from a predicted average. This increases the implementation risk of a river stabilization plan as additional work on the central char will be required and existing work could become redundant.

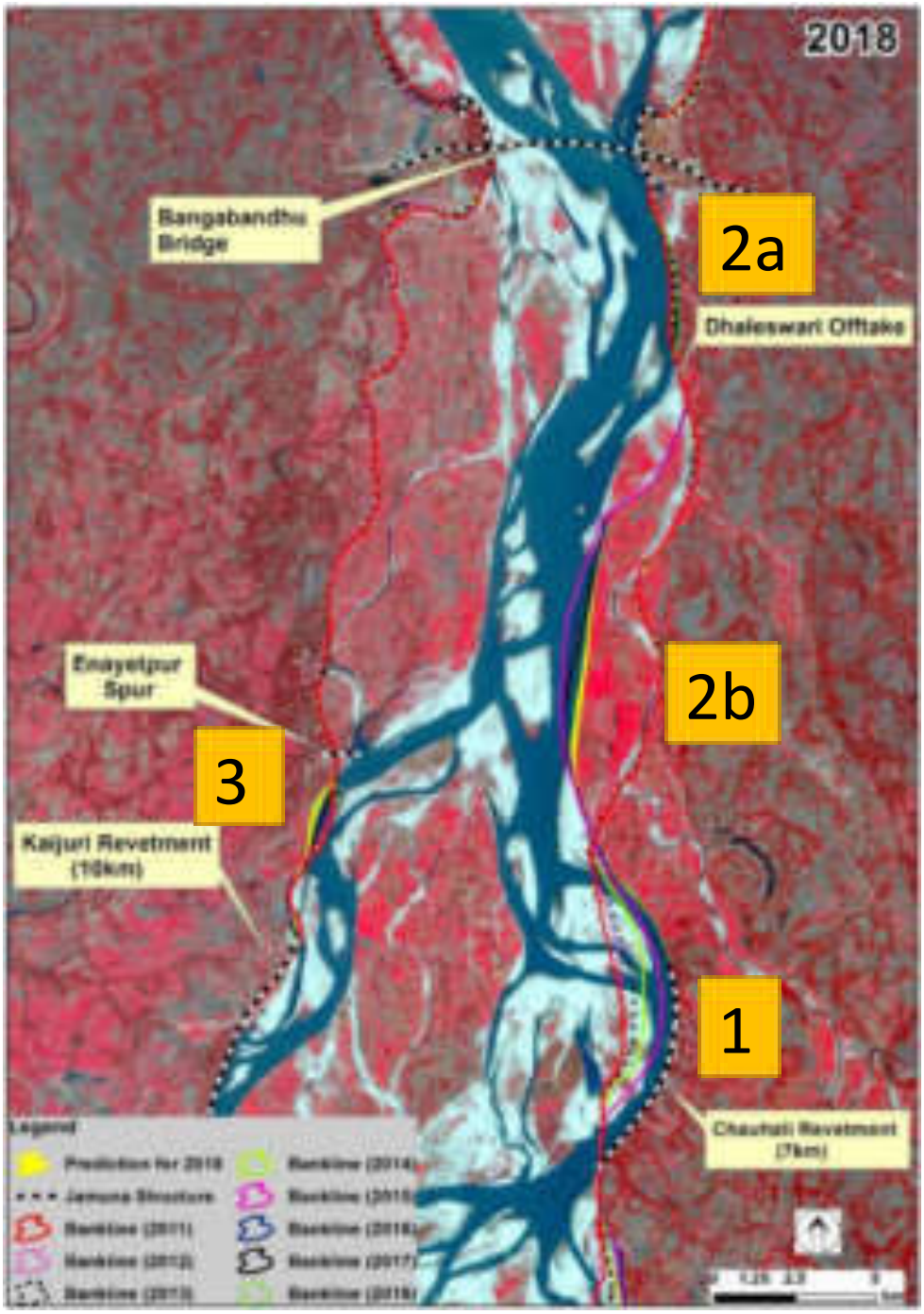


Figure 2-3 Changes in the Lower Jamuna over the last decade with numbers referred to in the document

(ii) The after effects of the capital pilot dredging in the area of the Bangabandhu (Jamuna) Bridge have destabilized the river downstream. While the capital pilot dredging achieved the purpose of protecting against outflanking of the Western Guide Bund, the pilot channel dredged through the stable mid-channel char under the bridge has triggered an unpredictable and major river change and disturbed the stable flow pattern in the downstream, some 15km long straight channel. As a consequence the channel develops a curved alignment with erosion at the Tangail bank immediately downstream of the bridge (Figure 2-3, location 2a), and a general widening tendency further downstream with massive riverbank erosion alongside the left bank (Figure 2-3, location 2b). Further

details can be found in Annexe 1.3. Related impacts are major changes of the offtake of Pungli and Dhaleswari Rivers and the overall stability of the bifurcation.

(iii) Right bank erosion between Enayetpur and Kaijuri (Figure 2-3 location 3), associated with changes in the bifurcation angle will be addressed by the BWDB through a separate DPP from the end of 2019.

Protection Strategy

FRERMIP from its start in 2012 postulated the stabilization of the Lower Jamuna including encouraging a more fixed meandering left (Chauhali) channel, embankment restoration/ construction, and the recovery of lost floodplain land downstream of Chauhali (Figure 2-4). The draft feasibility report (March 2018) reflected this strategy. At the end of 2018, the BWDB proposed modification to the concept (BWDB, Technical Committee, 2018), restricting the work initially to the floodplains before stabilizing also the chars (Figure 2-5).

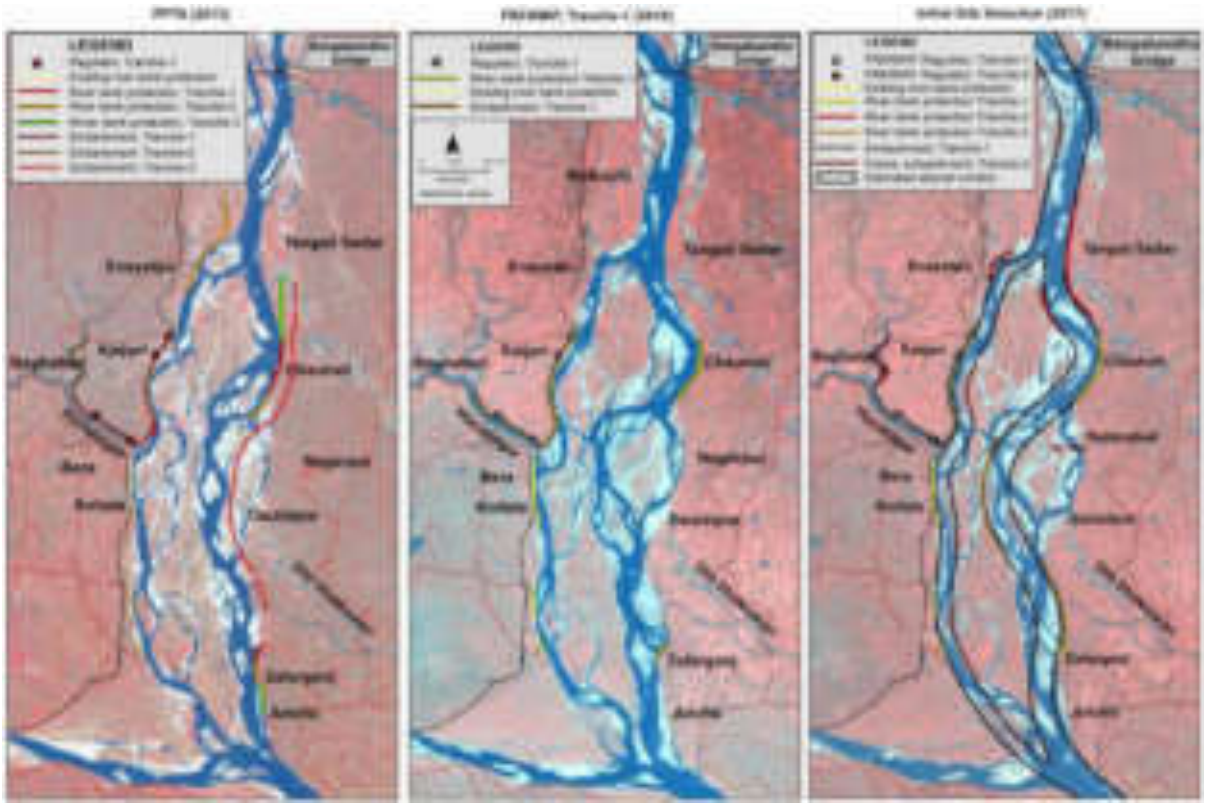


Figure 2-4 Stabilization Strategy for the Lower Jamuna from 2012 to 2017

Figure 2-5 Tranche-2 investment proposal

2.5 FRERMIP Tranche-1 - Summary and Implications for Tranche-2

Project Area update

Work of the study team as well as the main team has provided additional background information used for the preparation of this updated feasibility study.

Infrastructure (Component A1)

Under Tranche-1, construction of 17.8 km of primary (new) river bank protection was completed at three sites, Chauhali, Zafarganj and Harirampur, and contracts for 21.3 km of flood protection embankment at Kaijuri have been awarded in early 2018 for completion by June 2019. FRERMIP has set new benchmarks in terms of construction speed, after contract award: while 16km of riverbank protection were built in one season (2016), the 21km of embankment work will be completed during the 2019 season due to the use of an innovative, in-situ construction technology never used by the BWDB before. Importantly, after initial adaptation works for a short area at Koitala in 2006, FRERMIP built systematic adaptation works at Chauhali over a length of 3.8km prior to the 2018 flood. As opposed to the previous years without adaptation works, the adapted areas showed no damages during the 2018 flood season.

DESIGN ISSUES AND RECOMMENDATIONS

The above water protection with concrete blocks is expensive, slow to build, and more susceptible to damages. At Chauhali major slope instability occurred at the upper slope after replacing temporary, single layer geobag protection with some 25 tons of concrete blocks, the equivalent weight of two loaded trucks, per meter. To improve the above water protection, Tranche-1 has developed and is pilot testing an alternative making use of local jute mattresses filled with grout and directly placed on the slope (Figure 2-6). This alternative, once successfully pilot tested, could reduce the cost for the above water protection, increases the construction speed to one season, and reduces the weight on the slope by some 50%, as such avoiding geotechnical instability problems. The more effective installation would also better support the use of flatter slopes above low water particularly to address weaker soils.

Figure 2-6 Installation of grout-filled jute mattress (Harirampur Feb 2019)

As with all riverbank protection, securing riverbanks against erosion requires regular post construction surveys, determining the river response to the work and the need for adaptive protection, particularly strengthening of the launched apron. Tranche-1 has demonstrated this particularly at Chauhali, where the apron launched beyond the specified performance due to delays in the implementation of strengthening/adaptation works. Typically some 5 to 8m vertical scouring can be allowed prior to adaptation works. At Chauhali angular flow attack during two high flood seasons resulted in up to 22m of vertical scouring and reaching design scour depth over a length of around 1km. Despite failures in the upper wave protection slope above low water level, the resulting underwater launched slope length was up to 49m and protected well across the majority of its length through launched individual bags. This notwithstanding, local imperfection of launching due to buried debris from eroded homesteads (concrete pillars, bamboo clumps etc.) might be the

trigger of some localized deeper slope failures. However, the wide aprons initially placed provided sufficient material to cover the slopes also after localized failure. All launched slope had a consistent angle of 1V:2H, which is geotechnically stable in consolidated sandy soils. Adaptation works took place in early 2018, with much reduced allocations. In the adapted areas no further slope damages were reported during the 2018 flood season.

Tranche-1 has commenced major embankment construction after decades of limiting construction to emergency closure of breaches along the main rivers. Following experience with two failed bids being some two third and one third over engineer's estimate, FRERMIP introduced a modern work design and construction methodology for embankment fill dependant on directly placed and compacted dredged sand-fill for the embankment core (Figure 2-7). This modern design not only increases construction speed, allowing the embankment to be built in one dry season, but also reduces the cost as well as the social and environmental impact, by not mining valuable topsoil used for farming.

Figure 2-7 Embankment construction at JRB-1 with compacted dredged sand (Kaijuri, Feb 2019)

Community-based Flood Risk Management (Component A2 and A3)

Despite initial implementation delays, the Community-based Flood Risk Management component, implemented through the Department of Disaster Management (DDM) has been successful in forming Community Disaster Management Units linked to higher tier Union and Upazila Disaster Management Committees. The formed committees do not only address disaster management aspects but also operation and maintenance of flood risk mitigation infrastructure, for example embankments. Tranche-1 has demonstrated that an integrated approach addressing the flood risk and operation and maintenance is successful and consequently can be continued and expanded during Trache-2.

Safeguards - Livelihood Support for Affected People (Component A3)

The implementing resettlement NGO has led the process of resettlement compensation of affected people. With the exception of few outstanding issues, resettlement activities have come to an end. Affected persons have mostly opted for self-relocation and therefore the PMO has decided not to provide resettlement villages. In general, resettlement and compensation to affected persons was comparatively late for Tranche-1 sites and somewhat compromised by abandoning the proven

JMREMP approach of first stabilizing the existing riverbank under water and temporarily above water, followed by land acquisition and resettlement and finally the replacement of the temporary with permanent protection above water (Ragsdale, 2008). In addition, late resettlement particularly impacted on the start of the embankment construction.

BWDB Institutional Capacity (Component B1)

Tranche-1 made good progress in capacity enhancement of BWDB staff through more than ten national and international training courses, one conference attendance, and four overseas study tours related to river management aspects, financed from the DPP and ISPMC allocations. Importantly, much training was provided to lower level BWDB engineers through BUET and members of the ISPMC team on sustainable riverbank protection. In addition, the ISPMC provided environmental training to BWDB and contractors, but also gender training to women in BWDB. Activities related to sustainable O&M systems were postponed to Tranche-2.

The BWDB has created, as envisaged under the MFF, the office of the Chief Engineer River Management (CE RM), and the position was filled on 22 November 2017 for the first time. This office is expected to be the focal point for coordination, communication and monitoring the progress of stabilizing the Jamuna and Padma rivers. The ISPMC has supported the process by drafting an outline of the functions of the office.

Data and Knowledge Based Development (Component B2)

The ISPMC has worked on a river stabilization study as outlined in Section 2.2 and 2.3 with some of the outcomes currently under review by the Dutch Government and reflected in the design of Tranche-2. Pilot activities related to riverbank protection are reflected in Section 0, those pertaining to river training, particularly the plantation of reeds for suspended sediment harvesting for vertical char-built-up, were planned during the flood season 2019.

The flood and river survey database was developed including providing specialist training to the BWDB. The databased combines nearly 2,300 individual bathymetric surveys mostly of the Jamuna River surveyed since the mid-1990s. In addition, discharge and multi-beam survey data are included and available for analysis. The data base allows users to retrieve and analyze survey data for cross and long sections, point elevations and area volumes. This data base provides the largest consistent set of survey information available for the Brahmaputra System.

The combination of the updated erosion prediction model, updated by CEGIS, and numerical modelling of the whole Lower Jamuna based on flood season surveys allowed broadening of the understanding of the morphological process in the complicated bifurcated river reach and provided annually updated forecasts of major morphological developments. While the CEGIS erosion prediction contract ended in 2018, the ISPMC also conducted numerical modelling for morphological assessment, which is planned to be extended to the 2019 flood season.

Dissemination of FRERMIP operation information took place in two ways: (i) more broadly, a project website informs about key features since November 2017, and (ii) more specifically technical developments were presented at conferences in 2016, 2017 and 2018. Both activities contribute to a broader communication strategy and therefore are recommended to be continued.

3 TRANCHE-2 FORMULATION – CRITERIA AND CONSIDERATIONS

3.1 The Bangladesh Delta Plan, 2100

With the approval of the Delta Plan on 4 September 2018, the government has presented a clear vision, mission, goals and strategies of how to develop Bangladesh to Upper Middle Income Status by 2030 and a prosperous nation by 2041. The Delta Plan acknowledges the fragile deltaic environment shaped by large rivers originating outside of the country, influenced by powerful upstream riparian neighbors, and the generally unpredictable nature further destabilized by climate change. A cornerstone to future development is 'Adaptive Delta Management' (ADM), allowing necessary investments for the development of the country to be done in a flexible manner that remains open to adapt to a changed natural and socio-economic environment in future. The BDP, 2100 states: "By focussing on the short and the long term, the BDP 2100 aims to overcome the well-known pitfall that 'the solutions of today become the problems of tomorrow'." Therefore, ADM is the method of choice for a 'robust' or 'no-regret' approach. 'No regret' is defined as applying measures useful and cost-effective on the short term and under a range of future conditions that do not involve hard trade-offs with other policy objectives. The Plan also recognizes under one of the two end visions – in this case 'Optimized Water Control' - that "long term development for countries with complex and highly variable water and climate regimes, such as Bangladesh, comes through controlling their water systems. Control entails enhancing productive potential on the one hand and ensuring protection against destructive impacts on the other." (BDP 2100, 2018b).

The Framework Financing Agreement for FRERMIP, even though it was signed in May 2014, aligns very well with key goals and the adaptive strategies of the Delta Plan 2100. The Plan's two specific goals, one national and one hotspot specific are directly relevant for FRERMIP and, with respect to the investment component, particularly mentions the FREMRIP approach to erosion control and river stabilization. With respect to the institutional component, the plan specifically recognizes that "the main problem is the weak capacity of all water and water related institutions … an absence of key stakeholder (beneficiaries) in water decision making … inadequate institutional coordination" (BDP 2100, 2018b). Both are comprehensively addressed by the two main FRERMIP components "flood and riverbank erosion risk mitigation measures at priority reaches" and "strengthening institutional system for flood and riverbank erosion risk management". Table 3-1 demonstrates how closely the Delta Plan and FRERMP align.

Table 3-1 Comparison of FRERMIP Components and the Delta Plan

FRERMIP		**Delta Plan**
Component 1: Flood and Riverbank Erosion Risk Management Functioning at Priority Reaches		
1	Infrastructure Improvement	Strategy FR1 Protecting economic strongholds and critical infrastructure
1-1	Construction of riverbank protection structures	Sub-strategy FR2.5 River management, excavation and smart dredging Sub-strategy RE1.4 secure discharge and storage capacity by allowing space for the river ('no regret') Sub-strategy RE2.1 River stabilization and channelization with use of combined river training works and river bank protection

FRERMIP		Delta Plan
1-2	Construction of embankments	Sub-strategy RE2.2 Controlled and accelerated stabilization of newly formed (char) lands and land reclamation Sub-strategy FR 1.1 Develop and improve embankments, barriers and water control structures Sub-strategy FR 2.1 Drainage improvement Sub-strategy FR 2.2 Restoration, redesign and modification of embankments and structures Sub-strategy RE 1.1 Reduce flood risk (preferred short-term strategy)
1-3	Emergency and strengthening/ Adaptation works	
2	Community based flood risk management	Sub-strategy FR 1.4 Extension of the flood warning lead time Sub-strategy FR3.1 Extension of early waring services into the communities
2.1	Formulating CDM units	
2.2	Capacity development for CDM units	
3	Community-based enhancement for participatory O&M	
3	Livelihood support for affected people	
3.1	Construction of resettlement areas	
3.2	Support of project affected people	
Component 2: Strengthened Institutional System for Flood and Riverbank Erosion Risk Management		
1	Institutional capacity strengthening	The BDP 2100 acknowledges institutional weaknesses.
1.1	Capacity enhancement of BWDB	
1.2	Support office of CE River Management	
1.3	Develop sustainable O&M system	Sub-strategy FR2.4 Improve operation & maintenance
2	Data and knowledge base development	"The adaptive nature of delta management puts knowledge at a premium. BDP2100 should be continuously science and knowledge driven."
2.1	Studies for long-term river management	
2.2	land recovery/river training piloting	Sub-strategy RE2.2 Controlled and accelerated stabilization of newly formed (char) lands and land reclamation
2.3	flood and river survey database	Sub-strategy FR 1.3 Adopt spatial planning and flood hazard zoning
2.4	improving knowledge base	
2.5	information dissemination	

3.2 Updated Context for the Design and Monitoring Framework

This study has reviewed impacts, outcomes and outputs and updated the Design and Monitoring Framework for the program as well as prepared one for Tranche-2. The Design and Monitoring Framework as per Facilities Administration Memorandum (ADB, 2014a) is summarised in Appendix A for the original performance targets, and with revised targets and comments. In addition, a draft DMF for Tranche-2 is provided. The Appendix A provides details of the underlying data.

The impacts as stated in the Design and Monitoring Framework (DMF) of the Financing Framework Agreement (FFA) and agreed between Government and ADB, remain valid. Assumptions and risk may consider additional Government priorities and past flood developments. More recently Government has shifted towards consideration of a more comprehensive role for the major rivers in Bangladesh's development as a middle income country, instead of a narrow focus on flood protection. In order to complete the work as planned, it is recommended to extend the program by one year to August 2024.

Refined flood modelling results[21] justify the revision of the original DMF outcomes. While the flood modelling arrives at similar results as the PPTA study, the DMF used different numbers, which justify correction: we recommend reducing the outputs from 122,000 ha of land protected from flooding by 2023, to 75,000ha of land protected from flooding by 2024. The number of people benefitted is some 950,000 people directly, with a larger number being indirectly benefitted. The assumption could be that one third of the total subproject population could be benefitted indirectly[22] and consequently the total would amount to 2million. While the flooded area appeared to be overstated in the original DMF, the area protected against erosion appears to be understated. Overall, it is recommended to increase the present number of erosion protected land from 460ha (with a baseline of 43ha in 2013) to 4,600ha.

The Tranche-2 Project Outcome may be expanded to "*Reduced vulnerability against flood and riverbank erosion risks in the subproject reaches and char land recovery",* i.e. to include for char land recovery benefits. Tranche-2 outcome targets are: (i) 4,500 ha of char and/or main land protected from erosion and loss, (ii) about 30,000 ha[23] of main land in JRB-1 and PLB-1 protected from extreme (river) flooding (some 10,000 ha flood free and additional 20,000 ha with reduced inundation depth caused by embankment breaches or flooding from the river), including agriculture land and land with assets (homesteads, roads, etc.), benefiting about 1 million persons, half indirectly, (iii) 6,000 ha of char land recovered from the river for development[24], and (iv) improved road transport generating increased traffic and quicker/ easier transportation.

Outputs have been updated in line with the proposed work, following the most recent morphological developments particularly after the two high floods of 2016 and 2017, and including the recommendations of the BWDB technical committee (BWDB, 2018). The scope of works, and design of some program components, such as the livelihood support programme and for participation of communities in regular O&M, are modified and firmed up. Data and knowledge base development activities under Tranche-2 continue to be important, but in additional technical knowledge for river training and stabilisation the focus shifts to include land reclamation and development, as well as distributary flows.

Updated outputs for Tranche-2 including performance targets and Indicators with baselines are provided in Table 3-2.

[21] Around 200 different flood scenarios with a refined digital elevation model, conducted for the Climate Risk Variability Assessment, provide a much more refined picture than the original PPTA study, even though the relevant scenario shows similar results (see Annexe 3).

[22] This would allow maintaining the original number of 2 Million people, as the total population borders 3 Million.

[23] 25,000 ha at JRB-1 and 4,740 ha at PLB-1

[24] Under Tranche-2, about 7,000 ha of char lands will be recovered and become available for development, comprising: (i) about 2,000 ha in Harirampur (PLB-1), and (ii) 5,000 in Chauhali char (JLB-2).

Table 3-2 Tranche-2 Output Performance Targets

Outputs	Performance Targets and Indicators with Baselines
1. Improved flood and riverbank erosion risk mitigation measures at priority reaches 1.1 Structural Works	**By June 2023:**
	33.3 km (17.8 from Tr-1 and 15.5 from Tr-2) of riverbank protection revetment constructed applying appropriate technology and methodology. Additional 10.5 km of precautionary protection at Solimabad. Flow redistribution works chokes 15km of the Solimabad channel for navigation channel and char land development (baseline = 0 km)
	46.6 km (21.3 Tr-1 and 25.3 Tr-2) of flood embankment constructed (baseline= 0 km)
	13 regulators/ fish passes constructed (baseline=0)
1.2 Non-Structural Works	100 community-based Disaster Management Units operate disaster-resilience action plan against flood and erosion disasters with minimum 50% of units led by women (baseline=0)
	10 embankment - WMOs/ community organisations set up and active in participating regular O&M works
	2,000 affected persons attend on-site 1-day trainings, and about 800 persons attend 2-5 day residential trainings to support livelihood enhancement activities, with half of these being women. (baseline=0)
2. Strengthened institutional systems for flood and riverbank erosion risk management 2.1 Institutional Capacity	Office of the CE-River Management established, staff trained and office operational for FRERMIP subprojects Information and management systems including: (i) Project Website and Database with sex-disaggregated data as appropriate in use, (ii) Asset web-based database developed and piloted, (iii) ADB/ Smart Project Monitoring and Management Information System (SPMMIS) database refined and piloted. 5-year budgetary plan for riverbank protection O&M and emergency work for the main rivers endorsed by BWDB
2.2 Data and Knowledge base	Studies and pilots add significant to quality of planning and design guidelines, and include for (i) river training, (ii) land reclamation/ development, and (iii) planning of future (Tranche-3) interests
	Flood and river surveys carried out each year with data entered into web-based database
3. Program management systems operational	Tranche-2 outputs completed on time within budget.

3.3 Regulatory Framework for Tranche-2

Framework Financing Agreement

The selection of Tranche-2 activities is defined in the Facility Administration Manual (ADB, 2014a) and the Framework Financing Agreement (ADB, 2014d). The MFF focusses on three selected priority subprojects and suggested systematic development over three successive programme tranches to achieve river stability as a precondition for successful flood risk management arrangements (structural and non-structural), economic development and poverty reduction, as well as institution

building of the executing agency. The Report and Recommendations of the President (ADB, June 2014) states:

"ADB will support the investment program through the MFF modality, which allows (i) flexible phased interventions that are technically appropriate to cope with the dynamic river morphology in Bangladesh; (ii) strategic and systematic interventions that can facilitate longer-term flood and erosion protection management planning; and (iii) longer, more effective , and strategic support for enhancing central-level institutional capacity." (Para 7)

"Subsequent tranches will extend the protection structures and associated non-structural measures to adjacent stretches, and the design will be adjusted to the latest riverbank erosion conditions." (Para 8)

The government and ADB confirmed the arrangements in the Aide Memoire of the Review Mission 9 – 11 November and 4 – 8 December 2016) (para 19):

"The overall approach and draft site selection of Project 2 was presented and agreed at the workshop on 7 December 2016. The priority will be given to the remaining critically eroded sites and continuation of ongoing Project 1 works to ensure the sustainability of the currently constructed riverbank protection structures."

Bangladesh develops towards leaving the group of least developed nations and aspires to reach middle income status over the next decade. Consequently, its development focus shifts, with major rivers playing an important future role. Self-sufficiency in food grains (rice), represented by the traditional focus on flood control, drainage, and irrigation, reduces in importance towards a focus on high-value agricultural products. While the formulated goals of flood disaster risk management and irrigation improvement remain valid, the water sector needs to take on additional roles in the field of stabilizing the main rivers and securing reliable dry season flow in dependent distributaries. Both are justifiable through distinctive benefit streams.

Reflections on project benefits justify minor realignment of the design for FRERMIP, taking into account the strategic framework and thrusts, particularly char land recovery and increased land based productivity not just from agriculture but also accruing from residential and commercial developments. These strategic thrusts represent some departure from the original (PPTA) programme design where the focus was on flood protection of agricultural areas and poverty reduction. The Tranche-2 design reflects this change and prepares for further development during Tranche-3 through different knowledge base components, further improving the understanding of river processes, planning new, yet untested work like distributary offtakes, and contributing to an increased understanding of the performance of innovative stabilization works.

Government Guidance

Decision 9.2 (kha) of the ECNEC, dated 2nd June 2016, states: "*Embankment Construction and River Protection Projects will essentially have provision for Capital Dredging and 50-60% fund allocation of the estimated expenditure will be allotted to Capital Dredging*." Adoption of this directive without due consideration of dredging priorities may result in wasteful dredging in the main rivers. Dredging activities have to be planned carefully and in a coordinated manner for a number of reasons:

(i) To avoid destabilization of the downstream river course. Experience form the capital pilot dredging at the Bangabandhu (Jamuna) Bridge shows that a pilot channel has the potential to destabilize the downstream river course over a distance of some 20 kilometers over decades.

(ii) Man-made dredging is limited to the dry season when the flow conditions allow the operation of dredgers and the sand of the bed material load does not move. Their dredging capacity is orders of magnitude lower than the sediment carrying capacity of the Brahmaputra River, and consequently natural river forces will dominate channel formation during the flood season.

(iii) Dredged pilot channels have the potential to turn into very wide shallow channels, causing unwanted riverbank erosion unless accompanied by riverbank protection works planned in advance.

(iv) The construction of riverbank protection activates self-dredging of the river in response to the protective works. The self-dredging ability can well exceeds machine dredging capacities.

The long-guiding revetment works built at Chauhali under Tranche-1 have protected seven kilometers of riverbank against erosion and stabilized the course of the eastern branch of the Lower Jamuna. The stabilization is also confirmed by substantial self-dredging of the river and formation of a stable deep channel alongside the bank, suitable for navigation. The 7 km long revetment works has developed a 7 km long deep channel extending 2 km beyond the downstream extent of the revetment. The river has self-dredged more than 8.3 million cubic meters of riverbed material (5.4 million during the first year of implementation in 2016 and 2.9 million during the second year in 2017), to a river depth of around 20m during the dry season. The equivalent monetary value of self-dredging amounts to US$ 25 million compared with the investment cost for the revetment of US$ 19 million including strengthening/adaptation works, land acquisition, and resettlement.

Dredging in the context of the strategic framework (ISPMC, 2016) is usually required for the following works: (i) for riverbank protection particularly on weaker soils to establish stable slopes and deeper apron setting levels, (ii) as fill for reclaimed/ protected char lands, particularly in closed channels, (iii) sourcing materials for flood embankments and to fill geo-bags, (iv) to dredge out (annually) low-flow channels, particularly between protected river bank bends for navigation, (v) to ensure low season flows to off-taking distributaries, and (vi) to increase capacity and flows along the distributaries for improved water supply as well as inland navigation.

BWDB's Approach towards River Stabilization and FRERMIP Tranche-2

The BWDB, specifically the Director General, and the ADB mission leader have asked the ISPMC during the first half of 2016 to concentrate on riverbank protection to minimize erosion losses, which is achieved by systematic stabilization of river banks combining the benefits of individual riverbank protection works. The Aide Memoire of the Review Mission (30 August – 4 September 2016) states:

"BWDB requested and the mission agreed that the priority should be given to critically eroding sites and continuation of ongoing Project-1 works to ensure the sustainability of the current constructed structures." (para 19)

This approach is in line with the Strategic Framework (NHC/EMM, 2016) for stabilization of the river corridor, see Section 2.1.

In October 2018, the BWDB reconsidered the site selection (NHC/EMM, May 2017) based on morphological development, approved by the Technical Advisory Committee in September 2017 (BWDB, 2017) and detailed in March 2018 (NHC/EMM, 2018a). During the Technical Committee meeting (BWDB, 2018), the BWDB took the strategic decision to limit Tranche-2 to riverbank

protection along floodplain land proposing a higher level design standard for riverbank protection based on observations from physical hydraulic model studies (RRI, 2016). The experience with the upper slope instability at Chauhali was specifically mentioned as reason for the design change of the underwater slope[25].

With respect to the cover layer of the new design, the Director General suggested the alternatives of concrete blocks or rock, which the committee adopted:

"Riverbank protection works may be implemented considering dumping volume of approximately 75 cum/m (50% CC Blocks/Hard rock and 50% geobags) at apron and 3.25 cum/m at berm (1 cum/m geo-bags & 2.25 cum/m CC blocks)."

Subsequently the Chief Engineer and Superintending Engineer Design II, attending the October meeting, provided the ADB with further substantiation on the need for a higher design standard on 11 December 2018 titled : "Observation on the Design for "Construction of River Bank Protection work at the U/S of Chouhali" proposed by ISPMC under FRERMIP". The document states, amongst others:

(i) The lack of drawings for adaptive works, problems in planning the work ahead of time, the uncertain river environment[26], and fund allocation (also refer to Section 0 and 0 of this report).

(ii) That a higher design standard can be achieved through a double layer underwater protection: *"For a sustainability, BWDB follows "No-regret" approach as it was included in Delta Plan 2100. For better safety, in all other BWDB project, Combination of Geobag (50%) & CC Block (50%) are used for under water protection"*. As proof of better performance of a combination of concrete cubes and geobags, the document provides photographs from a physical hydraulic model study at 1:30 scale, conducted at the RRI in Faridpur in 2016.[27]

---

[25] *"Director General BWDB, Dhaka opposed to apply adaptation technology in case of river bank protection works. He state in the meeting that, from past experience it has observed that capital cost is less in respect to maintenance cost and so many times in many places damages occurred in Chauhali during the flooding period of 2017 along with 3 times damages this year. For this reason, adaptation technology along with bank protection with only geo-bags may not be considered in mighty river like Jamuna & Padma river as no regret consideration. In this context, Mr. Mohammad Harun-Ur-Rashid, Superintending Engineer, Design CirclD-II, BWDB Dhaka stated in the meeting that, total cost in favour of adaptive management not reduces than the permanent bank protection cost as usual practice of BWDB … Mr. Motahar Hossain, Chief Engineer, Design, BWDB Dhaka stated in the meeting that bank protection work with only geo-bags will not applicable further. He also explained that from past experience CC blocks with geo-bags is more effective than only geo-bags as a dumping materials."*

The memo: "Review of bank protection design and bank failures in Chauhali for Chauhali Committee", dated 31 July 2018 identified geotechnical failure of the upper slope after placing a surcharge of 25tons of concrete blocks as the main failure cause for observed failures at Chauhali. The latest failure in February 2019, also relates to this cause – see memo ISPMC-FRERMIP-596, dated 13 March 2019

[26] The Chief Engineer explained during the ADB mission from 20 to 27 November (Aide Memoire para 15 (iii): *"BWDB prefers a technology that is stable after construction and does not need year-to-year interventions. In order to arrive at permanent work, BWDB has conducted a physical hydraulic model study which indicates that a design change, mixing geobags with concrete blocks, would perform better in bank protection works in their opinion. Also, he mentioned that lots of 'angry words' were received from the public and the media when some above surface elements of the riverbank protection works slipped during a flood season. "*

[27] Additional high resolution (multi-beam) underwater surveys on the launching of geobag aprons are available from FRERMIP Tranche-1 (particularly November 2017 at Chauhali and Kaijuri) and Padma Bridge, where the adaptive

3.4 Infrastructure Design

This report follows the designs provided by the BWDB design office in January and February 2019 in line with recommendations from the Technical Committee (BWDB, 2018). Its full implementation will result in a project size of USD 361 million[28].

In line with the agreed MFF concept, the decisions of the Technical Committee on 8 October 2017 (BWDB, 2018), and reflecting recent river changes, the key investment activities of Tranche-2 are (Table 3-3):

(i) Expanding riverbank protection towards larger reach stabilization, focussing on the Lower Jamuna (sub-projects JRB-1 and JLB-2);

(ii) Expanding flood protection works (sub-project JRB-1 and PLB-1)

(iii) Recovering lost flood plain land and stabilizing a larger reach through a combination of innovative, nature-based solutions[29] involving dredging and sediment harvesting through "building with nature" technologies.

The second Technical Committee recommendation to continue the design development process is consistent with the FRERMIP philosophy.

Table 3-3 Summary of investment activities for Tranche-2

Major Work Items	
Embankments	Shajadpur embankment: Approximately 7.9km of embankment along Hurasagar River with 2 regulators (1 to be constructed on Tranche-1 Koijuri embankment as per original PPTA design) Harirampur - Doha embankment: Around 17.4 km of reconstructed Dhaka Southwest embankment with 7 regulators and a bridge at Kartikpur to allow re-opening of previous river closure in early 1970s
Riverbank Protection	Provision of approximately 3.5 km of bank protection at Benotia consisting of 37.5 m^3/m of concrete block protection above 37.5 m^3/m of geobag protection (figures include berm) Provision of approximately 12 km of riverbank protection upstream of the existing Chauhali bank protection consisting of 37.5 m3/m of concrete block protection above 37.5 m^3/m of geobag protection (figures include berm)
River Stabilization	Dumping of sediment downstream of Chauhali following intelligent dredging

approach with geobag aprons has been followed since 2015 (for protection of the construction yard as well as the main bridge).

[28] Deferring some of the investment into Tranche-3 would improve the economic feasibility and is in line with the recommendation of the Technical Committee: "*GoB contribution may be higher or scope of work may be reduced and remaining work may be implemented under Tranche-3 in case of higher DPP cost of Tranche-2 than planned in the PPTA.*"

[29] The Prime Minister mentioned in her speech for the World Water Day on 22 March 2018: *"There are no alternative to nature-based solutions for facing the mounting challenges of water resources management. … We should introduce innovative nature-based solutions for water resources developments and management in addition to the conventional solutions"*

" … Plantation of Doincha along with vetiver grass on the char Solimabad for sedimentation and land development may be adopted." ."[30] (BWDB, Technical Committee, 2018)

Visual inspection indicates that the area coverage of a mix of geobags and concrete blocks is more complete. (RRI, 2016).[31]

Major design development works, conducted during Tranche-2, will pertain to the creation of a stable offtake of the Old Dhaleswari River, as the first stabilized offtake in the Brahmaputra System. This work will consist of innovative dredging, as well as physical and numerical modelling. Dredging will have major focus as key technology to close undesirable channels with a phased pilot approach: during the first year the targeted dredging quantities will be excavated from the desired channel and pumped into the undesired channel (Solimabad channel downstream of Chauhali) in order to establish maximum daily, weekly, and monthly dredging capacities. During the next season the same excavation of the desired channel will be applied but this time for closing the undesired channel to a specific level, allowing the rising discharge of the incoming monsoon to excavate the desired channel further. Only at high water levels the dredged material will be overtopped and breach, allowing the dredged material to be transported downstream. The reduction of channel size will be further supported by systematic reed plantations to increase the char level and reduce the inflowing discharge. Overall this approach attempts to divert the risk of the deep Chauhali channel moving into the Solimabad channel, by reducing the channel size to the size of the Old Dhaleswari, protecting 15km of vulnerable riverbank against erosion and supporting the recovery of several thousand hectares of land from the river.

This approach depends on the morphological development, with the inherent risk that the undesired channel starts opening up and cannot be closed with limited dredging capacity. Recent developments of the Solimabad channel show wide fluctuations of areas and volumes below low water level, with times of channel reduction and opening (Figure 3-1). The channel in 2018 is much deeper than during earlier years.

As per recommendation of the second Technical Committee, Tranche-2 will contain increased provisions for strengthening/adaptation and emergency works, as a lesson learned from Tranche-1

[30] Government and Deltares have signed a MoU on 13 February 2019: *"Deltares will be supporting the Ministry and their sub-ordinate institutes through capacity building, training and advice. Bangladesh faces a challenging future given the impact of climate change and Deltares will particularly support their ability to perform applied research. Particularly through piloting innovative technology and approaches with our Bangladeshi partners. The visit on Wednesday 13 February included a tour of Deltares physical modelling facilities and ID-Lab. The delegation also visited various innovations throughout the Netherlands, such as the Sand Motor, new promenade at Scheveningen and the new composite ship-lock gates at Tilburg."* (https://www.deltares.nl/en/news/deltares-strengthens-ties-government-bangladesh/)

[31] Several aspects of the design could be investigated: (i) the comparative use of rock or concrete blocks as suggested by the DG BWDB during the second Technical Committee meeting, (ii) recent research (Thompson, Oberhagemann, She, & Haque, 2018) indicates large performance differences between very small model bags and real ones, (iii) field measurements of the launched slopes which can vary due to scale effects in physical models, (iv) implications of the launching to design scour depth in one step on the geotechnical stability of the slope (v) and (vi) clarity on the design approach which calculates the thickness of coverage based on theoretical geometry.

Additional controlled piloting and analysis during Tranche-2 would further strengthen the updated Guideline for Riverbank Protection, which then can be based on some 20 years of experience with different types of riverbank protection applied in the large rivers of Bangladesh.

implementation[32]. The recent experience from FRERMIP demonstrates that delays in the strengthening/adaptation of the Chauhali apron meant that it launched more than 5m more than the design launching before adaptation works were carried out. Despite a number of failures of the upper slope, the protection withstood two high flood seasons in 2016 and 2017 to maintain the original bankline. At Kaijuri (constructed from 2009 - 11) the aprons has launched by approximately 15m vertically. About one decade after construction and without any strengthening/adaptation works, local slope failures now occur at an increasing rate. Because of the overall constraint in the BWDB O&M budget (refer to Section 0) and the reduced fund availability under Tranche-1, the required strengthening/adaptation works could not be undertaken when required and consequently 40km of strengthening/adaptation works have been incorporated into the Tranche-2 design, in addition to 5km of emergency works.

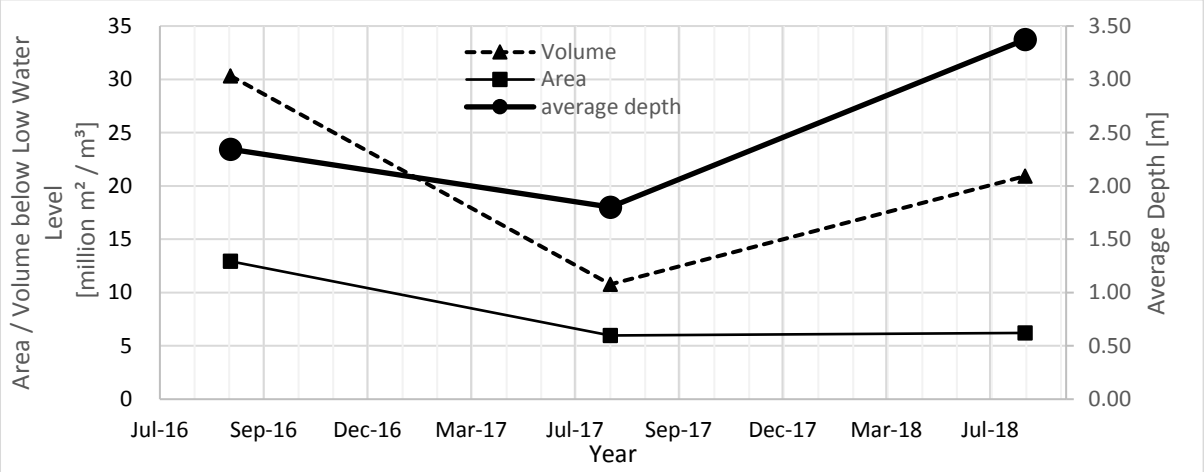


Figure 3-1 Development of Solimabad channel from 2016 to 18

Mitigation of Risks

River stabilization works built into the river are always relatively high risk. The more so as a river of the complexity and magnitude of the Jamuna has never been stabilized before. Consequently, a number of risk reduction mechanisms are part of the tranche 2 design[33]:

(i) Limiting riverbank protection to the existing more consolidated floodplains.
(ii) Introducing a heavier design with concrete blocks that was tested in an RRI 1:30 scale physical model in 2016.
(iii) Assuring a high flexibility in both location and work length in the Government Development Project Pro-forma as opposed to the common fixed definition of work locations that cannot be predicted precisely.
(iv) Extending capacity development activities particularly related to geotechnical engineering especially to the design office,.

[32] The second Technical Committee recommends: "Provision of sufficient maintenance budget for completed works of JMREMP & FRERMIP Tranch-1 project as strengthening/emergency works in the DPP of Tranche-2". In line with the Framework Financing Agreement, the BWDB will provide the funds for maintenance, while the funds allocated under Tranche-2 pertain to 40km of adaptation works (strengthening of launched underwater slopes) and 5km of emergency works financed from loan proceeds. The adaptation works constitutes a continuous under-water construction process towards design depth.

[33] The Delta Plan 2100 is built on the principle of Adaptive Delta Management consisting of a strategic vision of the future, short term action, and a framework to guide future actions. An underlying paradigm is *"that given ignorance about the possible side effects of technologies under development, one should strive for correctability of decisions, extensive monitoring of effects, and flexibility"* (Collingridge, 1980) quoted in (Haasnoot, Kwakkel, Walker, & ter Maat, 2013).

(v) Providing contingencies in the form of additional work items, that can be flexibly applied.

(vi) Adding provisions for emergency and strengthening/adaptation works, independent of the construction contracts, and on long-term bases (on-call contracts).

3.5 Institutional Setting

The Water Sector

Bangladesh has created an institutional framework for water management that extends from the highest levels of government to the grassroots. It comprises policy level organisations (MoWR, NWRC, WARPO and the Joint River Commission), implementing organisations (mainly BWDB and LGED), research organisations (BUET, CEGIS, IWM and RRI), as well as a system of grass root organisations of water users (WMO, WMG and WMF). Numerous consultancy firms and contractors work in water management. Of particular relevance are long-term relationships with Dutch partners (IHE, DELTARES), providing opportunities for sharing world-wide experience[34].

A limited number of International Development Agency partners have supported major interventions in the water sector in Bangladesh over the last decades: in particular, the Asian Development Bank (ADB), the World Bank (WB), the Japan International Cooperation Agency (JICA) and the Kingdom of the Netherlands (KNE). Other development partners contributed smaller amounts or for shorter periods.

Over the years the institutional structure for water resources management has adjusted to different requirements. Functions previously with BWDB are now assigned to different specialised organisations: (i) Macro Planning to WARPO (National Water Management Plan, 2004) and the Planning Commission ("Delta Plan", 2016), (ii) Research and Knowledge Management to CEGIS, IWM and RRI, and (iii) much of the study and planning to private consultants. This has contributed to the build-up of specialised knowledge, but has also complicated coordination and cooperation between the different organisations.

BWDB Budget Allocations

The BWDB budget has greatly increased since two years and exceeded the historic peak of BDT 4,000 Crore (in 2018 prices) of 1998/99 by 2016/17 (Figure 3-2). While donor funds contributed some two-thirds until the end of the 1990, their percentage stabilized at around 20% during the 21st century (Figure 3-3). With the sharp increase in available budget, the waterboard also observed a sharp increase in O&M demand as shown in Figure 3-2.

[34] Also refer to earlier mentioned MoUs between Government and Dutch partner organizations.

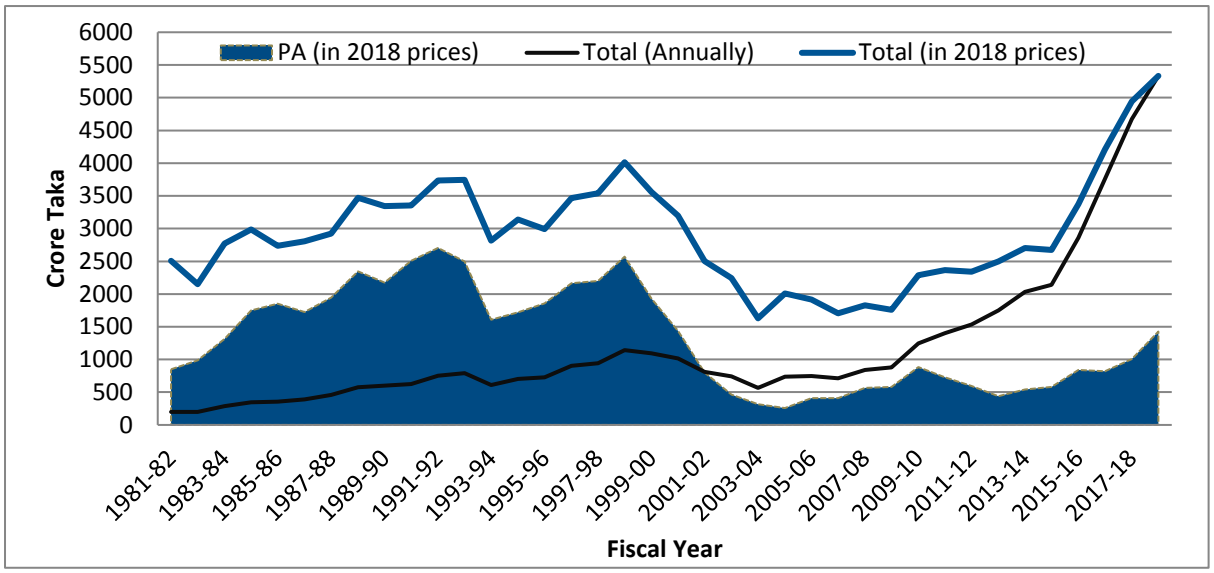


Figure 3-2 Annual BWDB budget in actual and 2018 prices, PA relates to donor contributions

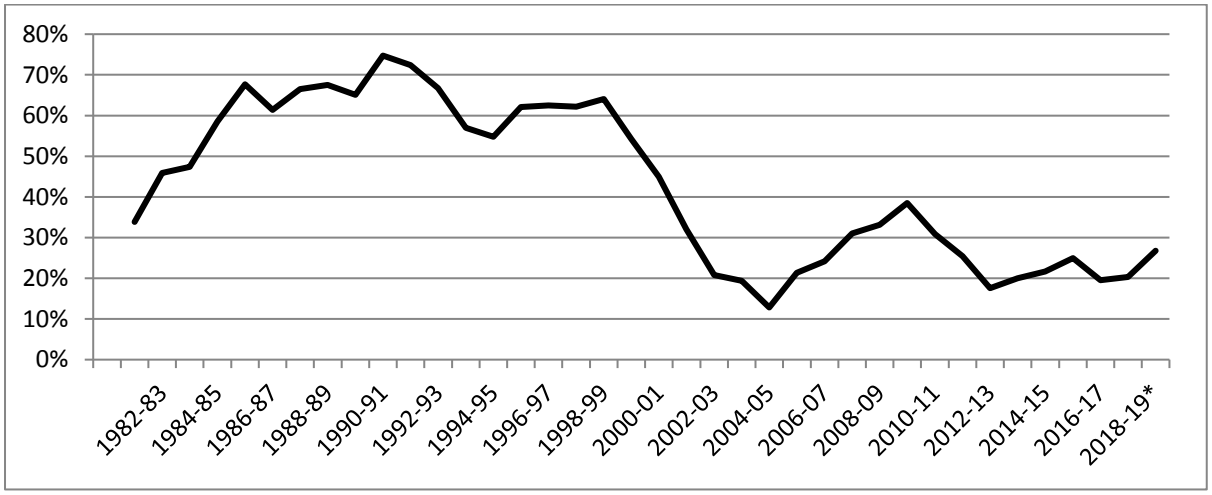


Figure 3-3 Percentage donor contribution to the BWDB (2018 prices)

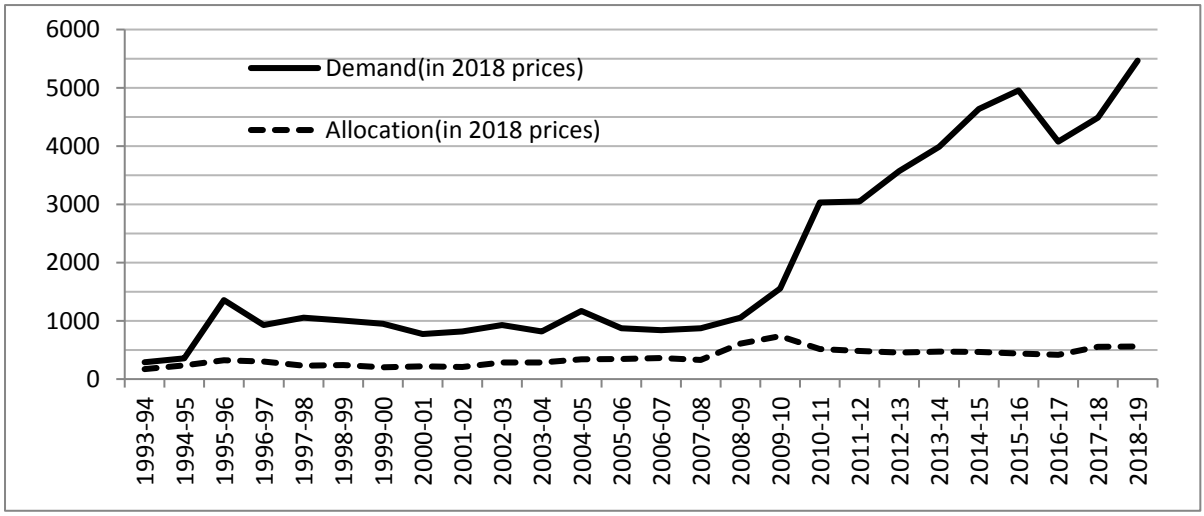


Figure 3-4 O&M demand and budget allocation (in 2018 prices)

FRERMIP Arrangements and a Way to Address Increased Demand for O&M

The FRERMIP program is focussed on main rivers management and with the exception of the relatively small community based flood management component which falls under the DDM, is managed by the BWDB. A Project Management Organisation (PMO) has been set up to execute the project with assistance from an the ISPMC. Construction at the various works sites is supervised by BWDB O&M Division staff where the Superintending Engineer has delegated powers of "the Engineer/ Project Manager" as per FIDIC/ ADB Minor Works contract conditions. Major work was supervised on a day-to-day basis by the Task Force or the regional BWDB staff for Quality Control. The BWDB has taken over the full design responsibility for Tranche-2 works[35]. This notwithstanding, the ISPMC typically provided initial design solutions, and discussed intensively the designs prepared by the BWDB, particularly for including in general international best practice and specifically geotechnical design aspects.

A pragmatic way out of the O&M nexus is the preparation of on-call contracts using investment funds for systematic strengthening/adaptation and maintenance work along river reaches or BWDB zones over a period of multiple years. The core principle is a framework DPPs with block allocations of funds. This approach would not only provide flexibility but is also sensitive to the planning commission requirements for approving new projects and the fact that work pertaining to large and medium rivers in Bangladesh has a high level of uncertainty and unpredictability. This means that it can neither be fully designed in terms of length and cross section as the future river is unknown as well as requires flexibility during implementation to adjust the underwater works to the actual river conditions.

[35] Aide Memoire of Consultation Mission (20 – 27 November 2018), para 18 (iv) *"The Chief Engineer Design confirmed that the Design Office would take full responsibility for the designs."*

4 PROPOSED TRANCHE-2 PROJECT

4.1 Component 1: Infrastructure Improvement

General Approach

Tranche-2 river stabilization depends on three technologies, in line with Government priorities[36]:

(i) Providing a reliable **boundary between floodplain and river**, or land and water through long-guiding revetments acting as "bend control" to encourage a more meandering and stable channel pattern. These revetments have a demonstrated self-dredging ability and result in a more predictable channel pattern even when only built along parts of the riverbank. This technology is classified as structural measure.

(ii) **Multi-purpose dredging** supports a more stable river environment, through navigation dredging during the dry season, supporting the construction of riverbank protection, and providing the source material for revetment and embankment construction[37], and the raising of land above high flood levels. Dredging is limited to the sand fraction of the transported sediment (bed material load) which only constitutes around one quarter of the total sediment load.

(iii) Sediment harvesting extends river stabilization into the flood season by capturing the dominant part of the sediment transport, the suspended sediment. This deposited finer sediment provides Bangladesh's fertile top soil allowing multiple cropping. The suspended sediment can best be attracted through the indigenous technique of reed plantations. Applied systematically, it turns into a bio-engineering technique in "**Building with Nature**".

The combination of above three technologies provides significant advantages as it allows an integrated, phased approach and reduces cost due to actively encouraging natural forces to participate in the stabilization effort. Figure 4-1 provides an overview of the application particularly in line with the sediment transport, which is relevant for two of the technologies. Consistent with FRERMIP Tranche-1, riverbank protection will provide the backbone for stabilizing the Lower Jamuna channel while continuing the development process of long-term sustainable solutions. River stabilization techniques particularly dredging and "building with nature" will be developed and applied for recovering some 6,000 ha of land downstream of Chauhali, Sirajganj District.

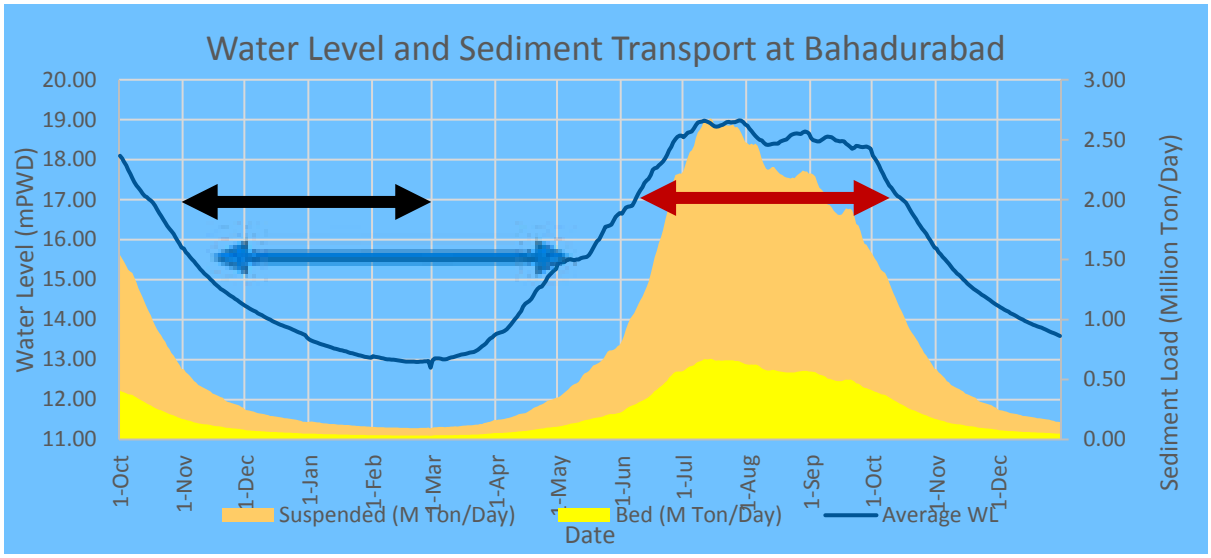
[36] The Prime Minister in her speech for the World Water Day on 22 March 2018, highlighted:

"There is no fixed boundary between river and floodplain. Defining the river course, boundary between land and river, plan form and buffer zones are essential for the management of the major rivers."

"The government since taking over has given special emphasis on the restoration and development of natural wetlands, revival of the river and navigation through dredging … maintaining the connectivity between the river and the floodplain, creating buffer zone along the riverbank for the protection of the environment and ecosystem."

"There are no alternative to nature-based solutions for facing the mounting challenges of water resources management. … We should introduce innovative nature-based solutions for water resources developments and management in addition to the conventional solutions."

[37] The use of compacted dredged sand for 21km of embankment construction at Shahjadpur, Sirajganj Division allowed substantial completion of the embankment in one season at significantly lower cost.



DREDGING **RIVERBANK PROTECTION** **BUILDING WITH NATURE**

Figure 4-1 The three basic technologies for river stabilization and their use during the year

Tranche-2 will build more than 25km of flood embankments in two locations: the work started under Tranche-1 will be completed at Shahjadpur and a new, some 17.4km long embankment will connect Harirampur with Dohar protecting more than 1,500 ha of recovered floodplain land. Embankment construction will use compacted sand, dredged from the river and provide for a number of regulators with fish passes, to connect floodplain water-bodies with the main rivers.

Tranche-2 Civil Works

Following the design decisions of the Technical Committee and confirmed during subsequent discussions between Project Director and Director General Tranche-2 attempts to fully implement the new riverbank protection design as supplied by the BWDB Design Office in February/March 2019[38]. Optional underwater protection at Chandpur will be further deferred for cost reasons. Table 4-1 provides the details of the Tranche-2 works, updating principles agreed in four Aide Memoires between July 2017 and November 2018[39].

[38] While Tranche-1 deferred the implementation of parts of the riverbank protection design provided for Harirampur and the Technical Committee recommendation (point VI): *"GoB contribution may be higher or scope of work may be reduced and remaining work may be implemented under Tranche-3 in case of higher DPP cost of Tranche-2 as planned in the PPTA"* the Director General confirmed his preference for full implementation of all riverbank protection during Tranche-2 as designed in March 2019.

[39] Aide Memoire of (i) Consultation Mission (23 – 30 July 2017); (ii) Consultation Mission (26 November – 1 December 2017); (iii) Consultation Mission (27 February – 5 March 2018); (iv) Consultation Mission (20 – 27 November 2018)

Table 4-1 Summary Tranche-2 civil works

Work Item	Work details	Remark
JRB-1 – priority sub-project		
Kaijuri embankment	Approximately 7.9km of embankment along Hurasagar	The embankment will be completed as per PPTA to achieve the full benefits of this sub-project. Construction of the road has been abandoned in favor of additional river stabilization work
Fish passes	2 Nos., to the Hurashagar and Jamuna River	Expanding the PPTA report. One will be built in the existing embankment where the current regulator size was reduced
Riverbank protection	Provision of some 3.5 km of riverbank protection at Benotia	No riverbank protection is planned along the char
JLB-2 – priority sub-project		
Dredging	Channel choking with sediment downstream of Chauhali	Adjusted PPTA approach to account for changed river situation and incorporate "building with nature" and to ensure sufficient dredging.
Riverbank protection	Provision of some 12 km of riverbank protection upstream of Chauhali and 10.5km of precautionary protection at Solimabad	No protection planned on the central char, but extension of existing river bank protection
PLB-1 – priority sub-project		
Embankment from Harirampur to Dohar	17.4 km reconstructed Dhaka Southwest embankment	Following the PPTA, the reconstructed embankment will provide reliable flood protection from Padma flooding in future. A bridge is proposed to open up a khal, closed during the 1970s upstream of the embankment at Kartikpur
Fish passes	7 regulator / fish passes to connect Ichamoty River and local khals and for drainage	Expanding PPTA report and based on future plans to reopen closed sections of Ichamoty River
Strengthening/Adaptation and emergency		
Strengthening/Adaptation works	40km	Extended from the PPTA incorporating previously built sites
Emergency works	5km	To cover unforeseen developments

Table 4-2 Revised Scope of Primary (new) Works by Tranche

Work	Tranche-1: PPTA	Tranche-1: implemented	Tranche-2: PPTA	Tranche-2: Planned	Tranche-3: PPTA	Tranche-3: Planned
Riverbank revetment	15 km	17.8 km	16 km	15.5 km (+10.5 km precautionary)	19 km	9.0 km
Embankment	23 km	21.3 km *1	43 km	25.3 km	23 km	40.0 km

**1. Construction ongoing, April 2019*

Remaining Tranche-3 Works

Tranche-3 will complete the ongoing activities and therefore, will focus more on flood embankment construction along the Jamuna left bank. Together with flood protection the offtake of the Old Dhaleswari will be stabilized potentially including work upstream and downstream of Chauhali on the central char. The associated land acquisition will focus on the embankment works, with a substantial part expected over recovered floodplain land, similar to the Harirampur embankment proposed for Tranche-2. The embankment includes the fully developed offtake layout and flood barrier for the Old Dhaleswari, including providing a channel along the recovered land to the offtake at the present bankline.

Assessment of Dredging

Dredging within the context of river stabilization may include dredging for:

(i) Underwater slope preparation for riverbank protection works, particularly on unconsolidated loose char soils,
(ii) River training purposes including forming pilot or cut-off channels and choking (overloading with sediment) unwanted channels
(iii) Embankment construction (sand core),
(iv) Low-flow navigation channels,
(v) Speeding up land reclamation of char-lands by filling with dredged material, and
(vi) Speeding up offtake and distributary re-development by increasing capacity and flows along the distributaries for improved water supply as well as inland navigation.

Table 4-3 compares different measures and Table 4-4 demonstrates that Tranche-2 will use five of six possible dredging measures.

Table 4-3 Comparative Assessment of Different Types of Dredging

Purpose	Dredging proportion	Technical feasibility and appropriateness of measure for Tranche-2	Likely economic benefit	Risks/ Uncertainty
For revetment construction particularly on weaker soils to establish stable slopes and deeper apron setting levels	Depending on soil conditions and related apron setting level	Feasible measure and suitable to establish more stable underwater slopes prior to dumping geo-bags. This reduces need for strengthening/adaptation work. Implementation during dry season is demanding as higher dredging requirement is required	• Reduced risk of failure • Reduced maintenance and strengthening/ adaptation works requirements	• Low – this measure reduced risk • Deep water/ high capacity dredging required

Purpose	Dredging proportion	Technical feasibility and appropriateness of measure for Tranche-2	Likely economic benefit	Risks/ Uncertainty
River training measures including (i) pilot channels for leading/ training flow, (ii) sand plug / choking channel ("*building with nature*")	90%	Measure likely suitable for river stabilisation and training, but needs study and piloting for effectiveness. This is planned for Solimabad – downstream of Chauhali (JLB-2)	• Effective stabilisation measure • Dredged material will beused for channel closure	Measure is a pilot and results will be compared against model work and lessons will lead to future refinement/ improvement
Dredging sand for embankment construction	> 60% of construction cost, and depending on volume of wave protection and regulators	Standard measure for modern embankments which minimize the use of fertile, intensively agriculturally used topsoil.	• Reduced environmental impact • Improved bearing capacity for road construction • Contribution to channel stabilization	Low, as technically sound measure also implemented under Tranche 1
Dredging low-flow channels, particularly between protected river bank bends for navigation	100%	Navigation dredging to flow river stabilisation, and likelihood of larger ships needing navigable river in FRERMIP area	• Low at this time due to limited dry season navigation	• Dredging at this time likely to be less economically feasible • Taken up by BIWTA
Speeding up land reclamation of char lands by filling with dredged material	100%	Technically feasibility but depending on (i) social acceptability/ land holding/ resettlement aspects, and feasibility of removing large quantities of sediment from the river with degradation	• Depends on land use after reclamation – not so beneficial for agriculture • suited to land allocated for commercial developments	• River destabilisation due to over dredging locally. • Lack of demand from developers for commercial real estate
Speeding up offtake and distributary re-development by increasing capacity and flows along the	100%	Flood management structure required at head of distributary before dredging initiated for dry season flows.	Likely to be high to: (i) address declining water tables and quality, (ii) increase availability of surface lean season flows for irrigation,	• Increased flows along distributary may lead to some bank instability leading, for

Purpose	Dredging proportion	Technical feasibility and appropriateness of measure for Tranche-2	Likely economic benefit	Risks/ Uncertainty
distributaries for improved water supply as well as inland navigation		Dredging along distributary to increase/ restore dry season flows should ideally follow on from flood management structure construction at head. Disposal of dredged material may be problematic	reducing dependence on tubewells, (iii) increased supply to Dhaka metropolis, (iv) improved navigation, (v) improved connectivity for fisheries, and (v) improved habitats	example, to failure of bridges/ other structures. • Disposal of dredged material • Studies required to firm up desired flows

Table 4-4 Dredging Measures per Tranche

Measure	Tranche-1	Tranche-2
Underwater slope preparation	-	For construction on chars
River training works	-	Channel closure piloting
Embankment construction	For 21.3km	25.3km
Low flow channel	-	Extension of Solimabad channel
Char land build up	-	Estimated up to 14 million m^3
Offtake and distributary restoration	-	-

4.2 Component 1: Non-structural Flood and Erosion Risk Mitigation under Tranche-2

Non-structural, flood and erosion risk mitigation measures include: (i) Community Based Flood Risk Management, (ii) Community Capacity Enhancement for Participatory O&M, and (iii) Livelihood Support. Work. Proposed modifications in the design of these components, as well as associated costs for Tranche-2, are provided below.

Subcomponent 1.2 Community-based and Regional Flood Risk Management

COMMUNITY-BASED FLOOD RISK MANAGEMENT

There is little change to the project design to establish community based flood risk management. Activities will include: (i) engage INGO, (ii) Formation of Community-based Disaster Management Units (CDMUs) comprising Community Volunteers (CVs) in most vulnerable (both physical and economical) wards of the unions, (iii) training of CDMU volunteers, (iv) agreement/ adoption of community level flood warning, such as marks at populated areas to indicate usual and extreme flood water levels, (v) establishment of communications between the CDMUs and DDM staff, and (vi) institutionalization of CDMUs through integration into the mainstream government disaster management framework. It is also anticipated that the DMUs may share the same “office” facilities that are proposed for embankment WMOs (see Sections 0 and 0 below).

Under Tranche-2, 80 CDMUs will be established, and 1,200 volunteers trained.

REGIONAL FLOOD RISK MANAGEMENT

Flood Response Plans will be prepared for each of the 13 Upazilas in collaboration with key Upazila level stakeholders, including staff from DDM, BWDB, Upazila office as well as the Union Parishad Chairmen and representatives from the ward level DMUs. The Plans will be based on the one prepared for Shahjadpur under Tranche-1.

COMPONENT DETAILS

Community-based and Regional Flood Risk Management activities will be implemented by an INGO working as directed by the PMU-DDM. Costs under this component include for the following:

(i) DDM equipment.
(ii) INGO staff costs and expenses (per diems, office equipment, transport, etc). A 30-month INGO contract is planned.
(iii) Capacity development and training costs for community based CDMUs.
(iv) Capacity development and meeting costs for dissemination of regional flood risk management plans at Upazila level. Workshops at the 13 Upazilas in the priority SPs areas are planned.

Subcomponent 1.3 Community Capacity Enhancement for Participatory O&M

The concept for communities along the river banks to take some responsibility for regular O&M of structures and embankments remains unchanged; however it is not considered realistic that this can be managed by reaching agreements for "reward in kind" from lease of embankments for social forestry. The following modifications are therefore proposed under this component:

(i) Form Embankment WMOs registered under the Participatory Water Management Rules (PWMR), 2014[40]. The community DMUs would therefore be separate organisations though members may be common to both, and they may share facilities.

(ii) BWDB to contract out regular maintenance works to the WMOs on an annual basis, following joint inspections. Work item rates and modality of procurement remain to be approved by competent authority. WMOs would open bank accounts to receive payments.

(iii) WMOs may sub-lease embankment land to community members to raise cash for WMO activities. Such leases are to be approved by BWDB.

(iv) O&M sheds for WMOs are to be provided on raised ground along the embankments. These sheds may be used as a venue for WMO meetings, for trainings, storage purpose, for communicating with DDM, BWDB and others (by cellular linked computer) and for livelihood support activities. Each shed will have water supply, separate toilets for men and women, and electric connection. It is expected land for the sheds will be government owned land or donated by the community.

[40] Alternatively they may be registered as a Cooperative under DOC

(v) Materials and equipment will be provided to each Embankment WMO, for O&M including paint/ shovels/ stockpiles such as geotextile bags.

Under Tranche-2, community regular O&M activities will be piloted and assessed. If successful, the pilot will be expanded and rolled out under Tranche-3. The pilot will comprise: (i) formation and registration of 10 Embankment WMOs for O&M, (ii) construction of 10 O&M sheds complete with facilities and equipment, and stockpiles, (iii) piloting bio-engineering solutions to stabilize embankment slopes, both from waves and rainfall (river and country side) and just rainfall (land side), including use of vetiver grasses, and (iii) training, support and monitoring.

An INGO will be engaged for the pilot, particularly for WMO establishment, registration, training and support including embankment stabilisation by bio-engineering. The 1O O&M sheds will be constructed under one or more NCB civil works contracts.

Ultimately, formation of embankment WMOs with a WMO "shed" for every 5 km of embankment is envisaged if the pilot is successful.

COMPONENT DETAILS

Costs under this component include for the following:

(i) Construction of O&M Sheds, BDT 1.8 million each
(ii) O&M shed equipment and stores, BDT 0.2 million each.
(iii) INGO staff costs and expenses (per diems, office equipment, transport, etc). A 30-month INGO contract is planned.
(iv) Capacity development and training costs for Embankment WMOs.

Subcomponent 1.4 Livelihood Support including Fish Sanctuaries

In Tranche-2 livelihood programs and courses will be identified for Affected Persons as well as for persons living along the river embankment or on the char lands, and will include for vocational skills development and various livelihood trainings, for example: crop and fisheries, homestead small livestock and poultry rearing, handicrafts and tailoring, use of char lands, basic computer skills, and so on. Participants for the courses will be carefully screened for interest and check suitability. Follow up monitoring and training will be provided, as well as start-up equipment and materials. To encourage women's participation care facilities for babies/ children, as well as segregated toilets, will be provided at training venues.

In Tranche-2, about 2,000 affected persons shall attend on-site 1-day training, and about 800 persons shall attend 2-5 day residential trainings.

Open water (capture) fisheries support may include for establishment of fish sanctuaries both in main rivers, distributaries/ flood plain, including excavation, planting and fencing/ boundary marking works to establish favourable breeding nurseries.

NGO services shall be procured to determine interest in trainings, screen participants, prepare training plans and budgets for approval, provide on-site trainings (in the O&M sheds) monitor the effectiveness of the trainings, and provide training reports. Also for the fisheries support works. Residential training shall be carried out by the agency appropriate for the course, for example: Rural Development Academy (RDA) in Borgra, the National Agriculture Training Academy (NATA), Department of Livestock Services (DLS), Bangladesh Fisheries Research Institute (BFRI), Mymensingh, and the Fisheries Training and Extension Centre (FTEC), Faridpur as well as a variety of private and

NGO agencies that run handicrafts and tailoring courses. The Embankment WMOs will be central to planning and implementation, particularly for fisheries support activities.

COMPONENT DETAILS

Costs under this component include for the following:

(i) NGO staff costs and expenses (per diems, office equipment, transport, etc). A 30-month contract is planned.
(ii) Support for establishment of fish sanctuaries.
(iii) On-site training in the O&M sheds/ other available, for about 2,000 persons delivered by the NGO.
(iv) Residential training courses; a total of about 40 courses are planned each for 20 persons (800 persons), with each course lasting 2-5 days.

4.3 Component 2: Strengthen the Institutional System for Flood and Riverbank Erosion Risk Management of the Jamuna and Padma Rivers Knowledge Base and Land Development

Subcomponent 2.1: BWDB Institutional Capacity Strengthening and Sustainable Asset Management

Under Tranche-2, proposed activities fall under the following major tasks: (i) Training, (ii) support for Office of CE-River Management, (iii) Further development and support for adoption of various MISs, and (iv) workshops.

TRAINING

Training will comprise: (i) local training, primarily for BWDB but also for DDM, (ii) overseas training, and (iii) study tours. There will also be training to facilitate adoption and use of the MISs – see below.

In-country training for BWDB will focus on design, construction and O&M of river bank and flood protection works, including safeguards, resettlement and environment impact mitigation. Technical courses will include: Technical training for main rivers, O&M major adaptive works, Environmental management, Land acquisition and social safeguards, GIS mapping, Procurement, Survey and data collection, Numerical modelling, DDM capacity development, O&M for WMOs. For regular O&M proposed to be done by embankment WMOs, training will cover formation, registration and working with WMOs. The focus for local training will comprise staff from the Office CE-River Management as well as Zone based staff.

For DDM, training will include the early warning system, the Flood Forecasting Response Plan developed under Tranche-1, and working with the DMU and community volunteers. Higher level staff will have the opportunity for a study tour to get acquainted with disaster management in other neighboring countries, particularly India.

Following Tranche-1, the content of the technical courses will follow the successfully completed training, particularly at BUET. Each course will be for about 10 persons, and duration shall be from 1-5 days.

Tranche-2 will include eleven study tours mostly to large rivers and locations with important developments in river and flood management (four in Asia – one for DDM, two each North America, Europe, South America/Africa, one New Zealand) with ten persons in each tour group.

Participation in international conferences or seminars for a total of 5 persons is planned.

Two M.Sc. courses shall be through the IHE Delft[41].

SUPPORTING OFFICE OF THE CE-RIVER MANAGEMENT

While the Chief Engineer-River Management (CE RM) has been appointed, and staff positions sanctioned, his office is not yet fully operational. Under, Tranche-2, it is suggested that the FRERMIP Project Management Office (PMO) and the office of the CE-RM work closely together.

MANAGEMENT INFORMATION SYSTEMS

The project website and project management database, established under Tranche-1, will be continued during Tranche-2. Both will be further improved under Tranche-2 with a dynamic project map enabling the user to zoom into a specific site to access data from that site. The website database will also continue to be populated. Note: data from river surveys are currently entered into a separate River Survey database (see Section 0 below).

The Scheme Inventory and Mapping System (SIMS), essentially an Asset Inventory, developed under WMIP will be further developed by addition of an integrated risk based O&M MIS module under Tranche-2.

Under Tranche-2, to facilitate Annual Development Plan (ADP) management, it is planned to further assess and improve the Smart Project Monitoring and Management Information System (SPMMIS) recently developed by CEGIS. After any required modification/ improvement and testing, support would be given to facilitate the roll out and adoption by BWDB of the updated system.

Under Tranche-2 one or more third parties will be engaged for the implementation of both the Risk-based O&M Module and the ADP Management MIS. These third parties would provide the following services: (i) MIS systems development/ refinement/ improvement, (ii) for data entry, (iii) for training of BWDB staff, (iv) for workshops, and (v) for MIS system operation and trouble-shooting for at least 12 months. This work will be done under the overall guidance and direction of the ISPM consultants.

WORKSHOPS

In addition to the Inception workshop, two national stakeholder (annual) workshops are proposed. Each workshop will be a 1-day event and be held at a major hotel in Dhaka. 50-80 persons would be expected to attend each of these workshops.

Senior BWDB / DDM/ GoB staff will be encouraged to attend and participate in international workshops/ seminars organised by others which are related to larger rivers management.

COMPONENT DETAILS

Costs under this component include for the following:

(i) Local training courses for BWDB and DDM, several courses, with each course for 10 persons and lasting from 1 to 5 days.
(ii) Two M.Sc. courses for BWDB engineers in IHE Delft, The Netherlands.
(iii) Study Tours, 11 (10 BWDB, 1 DDM) for 10 persons

[41] The Ministry of Water Resources (MoWR) Government of the People's Republic of Bangladesh and IHE Delft signed a Memorandum of Understanding (MoU) on 13 February 2019. The MoU will enable capacity development of future young water professionals from Bangladesh through tailor-made short courses, MSc and PhD programmes, including training courses on basin-wide water resources management.

(iv) For the MISs the services of one or more third parties will be procured for the total duration of the MIS services of 36 months:
   - MIS systems development/ refinement/ improvement,
   - for data entry,
   - for training of BWDB staff,
   - for workshops, and
   - for MIS system operation and trouble-shooting for at least 12 months.

(v) Costs for three 1-day workshops for 50-80 persons held at a major hotel in Dhaka.

(vi) A provisional sum is included for senior BWDB/ DDM/ GoB staff to attend international workshops or seminars.

Subcomponent 2.1 Data and Knowledge Base

During Tranche-2, the data and knowledge based will continue to be improved by a combination of: (i) studies, (ii) piloting, and (iii) surveys. An important element is the extension the BUET involvement from training delivery to research teams, assisting in development and later expansion and maintenance of the knowledge base.

Technical studies conducted under Tranche-1 resulted in about 35 technical reports/ notes. These focussed on studies to improve knowledge base for river training and river bank protection. In addition, key reports were prepared including the Strategic Framework for Development: Jamuna-Padma and Dependent Areas, a river stabilisation plan, a preliminary master or regional plan, and a strategic environment and social assessment, see Section2.2.

It is recognised that while further technical knowledge is still needed, it is now sufficient to proceed with some confidence with river stabilization in the Lower Jamuna River.

Major benefits will accrue from: (i) stabilisation of the river corridor and reclamation and subsequent development of up to 150,000 ha of land in the river corridor, (ii) improved inland waterways for navigation and water supply, and (iii) from agricultural and non-agricultural (e.g. higher value asset and peri-urban) benefits within the 1.6 million ha master plan area.

The river stabilization plan much depends on the understanding of the present **annual sediment load** particularly of the Brahmaputra River. While some historic data are available, no systematic measurements exist since the mid-1990s, when the River Survey Project (FAP 24) ended. This constitutes a serious shortfall in knowledge as not only the development of land, but also all dredging plans depend on a precise understanding of the annual sediment transport. Of particular interest is the yet undetermined bed load mostly consisting of dredgeable sand, with estimates ranging from 10 to 40% of the total sediment load. This sand is of major importance to the development of Bangladesh as it is used for all infrastructure raised above floodplain level including building construction. Major efforts are required to establish sediment rating curves, determine the changes of sediment load to the past, and particularly establish the bed load in a reliable way.

Agricultural benefits will result from main rivers flood protection which will reduce extensive flooding from extreme flood events in the river, and from increased surface supply once off-taking distributaries offtakes are stabilised, controlling sediment and water flow, and the distributaries dredged to increase capacity. The increased water supply will: (i) enable an increase in dry (Rabi) season irrigation with pumping from the distributaries, and (ii) result in an increased recharge to groundwater, reversing a declining water table trend, particularly towards the Dhaka metropolis, so

that farmer operated STWs do not run dry[42]. To maximise agricultural benefits additional investments in FCDI infrastructure will be required.

Urban and commercial **developments on reclaimed as well as protected land** will yield very high returns, but require significant investments by developers. Government is expected to control and support this, partly though Special Economic Zones developed by the Bangladesh Economic Zones Authority under PPPs with private sector, and partly through peri-urban developments, with the Dhaka Metropolitan area expected to develop towards the southwest, towards Mawa, see Figure 2-2. Consideration of priorities for use of scarce (dry season) surface water should influence planning and investment decisions.

The development of Bangladesh much depends on the performance of flood protection infrastructure protecting future high investments on the vulnerable flood plains constituting most of Bangladesh. In order to help maintain the significant new infrastructure being constructed by the BWDB, an asset management system as per those used internationally will raise the awareness of and the insight into the actual annual maintenance requirements to allow for investment to be prioritised based on need and aided by the use of the technology. For example by conducting annual drone flights along existing embankment lines and estimating the difference between designed cross section and actual one, this system can helps to identify particular weak spots to be repaired on priority basis.

While the original program expected to update the design guideline during Tranche-2, extended experience with pilot works and the new concept of double layer protection, suggest that it would be beneficial to move this activity towards the end of Tranche-3. At that time sufficient experience will be available, and through intense involvement of BUET during Tranche-2 a team of well acquainted and reputed researchers will be able to guide the update of the 2010 BRTS guideline for riverbank protection.

Above outlined broader longer-term developments influence the scope for studies and piloting under Tranche-2 and on into Tranche-3, as described below.

STUDIES PROPOSED FOR TRANCHE-2

Technical studies proposed under Tranche-2 will include for the following categories of study:

(i) **Main rivers monitoring and evaluation studies** to further knowledge and design of river stabilization works, and also impact of flow redistribution and charland recovery. Key components include:

- Continuation of erosion prediction through CEGIS for the main rivers in Bangladesh
- Sediment surveys consisting of (survey team with dedicated survey vessel, sedimentologist, and BUET research team)[43]:
  - Discharge measurements (from June to October weekly to daily) at selected cross sections.
  - Systematic sediment surveys in the lower Jamuna and at the Ganges confluence
- Diving investigations of newly constructed and existing works (diving team, river engineer, team leader-diver)

[42] Farmers draw water from STWs using LLPs which can abstract water up to about 7.5 m below ground level.

[43] Service providers are named in brackets

- Channel and scour prediction through continuation of the established Delft 3-D numerical model (river modellers, BUET research team)
- Determination of flow forces on underwater works through CFD modelling as input for design guideline (CFD modeller)
- Review of geotechnical slope stability of launching underwater slopes (geotechnical company, geotechnical specialist, BUET research team)

(ii) **Distributary studies** related to distributaries/river offtakes in the study area, particularly the Old Brahmaputra, Dhaleswari and Arial Khan. The BWDB carried out studies and pilot dredging for the Pungli, the northernmost of the three Dhaleswari offtakes[44]. Tranche-2 will focus on the Old Dhaleswari or Ghior Khal, the southernmost offtake, located downstream of the protective works at Chauhali. Consequently, the Old Dhaleswari – Kaliganga system will be studied in details through numerical (and physical) modelling of the offtake and advancing design of offtake structure and management works to control sediment and flows. Regular (annual) dredging requirement to keep the offtake clear would also be estimated. The study details would comprise:

- Rivers survey will include: (a) for benchmarks and long and cross sections survey over a length of about 120 km, (v) for monthly/ bi-monthly flow monitoring, and sediment sampling at a few (3-5) selected points along the river, through the year. (survey contractor, river engineer);
- Hybrid model study of the Old Dhaleswari Offtake comprising two and three-dimensional numerical modelling for different flow scenarios and physical modelling of the offtake and flood barrier geometry (physical modelling organization, numerical modellers, BUET research team);
- Design of flood barrier including foundation and structural design, hydraulic confirmation with CFD modelling (structural, geotechnical, river, and mechanical engineers).

(iii) **Fisheries studies** to support design and establishment of community managed fish sanctuaries (under livelihoods) and efficacy of fish passes/ other measures to improve production of capture fisheries (fisheries specialist)

(iv) **Safeguard studies** relating to resettlement and the environment. These will: (i) assess need and, if justified, identify a possible location for a resettlement village, and (ii) study environmental aspects, particularly focussing on effects of dredging and dumping of spoil for charland recovery (resettlement specialist, dredging specialist).

These studies will be carried out by 3rd parties (for example CEGIS, IWM, RRI-Faridpur) with strong contribution through the BUET and guided by the Knowledge Base Team[45]. As in Tranche-1, technical notes (reports) would be prepared as deliverables.

A study pertaining to agricultural intensification is proposed during Tranche-3 in conjunction with the planned left bank embankment from Aricha to the Dhaleswari River.

PILOTS FOR TRANCHE-2

[44] An IWM study in 2015 of the Dhaleswari offtake noted that the aim is to divert 245 m^3/s from the Jamuna River into the Dhaleswari/Pungli/Bangshi/Turag/Buriganga river system with 141 m^3/s to the Buriganga river to bring the dissolved oxygen levels up to 4mg/l from the current 1mg/l. The BWDB-GOB with Chinese assistance has studied the Pungli system and has carried out dredging over two years.

[45] As part of the ISPMC, replacing the study team from Tranche-1

Pilots initiated under Tranche-1, concerning grout-filled mattresses, vegetative protection using katkin/ vetiver grasses, and morpho-hydraulic design of an offtake for the Old Dhaleswari river are expected to continue into Tranche-2. Provision sums to extend/ refine/ monitor these pilots are included, most importantly the vegetative piloting related with land reclamation.

SURVEYS DURING TRANCHE-2

Surveys are required to support studies and improvement of the knowledge based, and to prepare designs for future works. Under Tranche-2 surveys along the main rivers, as well as along distributaries are proposed.

Main rivers surveys will be done by 3rd party contractors with the data entered into the web-based river survey database already in use in Tranche-1. Surveys will include: (i) Bathymetric single beam surveys for the Lower Jamuna and alongside all protective works, (ii) Bathymetric multi-beam echosounder surveys of a number of sites[46], (iii) Acoustic Doppler Current Profiles, ADCPs for discharges and flow velocity measurements over protective works, (iv) Float track surface flows along all main channels of the Lower Jamuna. The surveys will follow established principles from Tranche-1 and conducted through third party survey companies guided by the river engineer. The data will be integrated into the survey data base through BWDB staff trained during Tranche-1 with guidance through the MIS specialist.

These surveys will also serve the purpose to check and plan strengthening/adaptation works at subproject sites, assist with resettlement, but also as part of the general river monitoring work to improve the knowledge base. Most of the surveys will be carried out during the flood season when scour and sediment loads are greatest.

Topographic surveys for existing infrastructure alongside the Lower Jamuna, mostly applying drones, will be conducted through specialist companies, guided by the drone surveyor and integrated into the suite of MIS by the MIS specialist[47]. The survey will be used for populating an asset management system and activating the O&M module.

COMPONENT DETAILS

Costs under this component include for the following:

(i) Sums for 3rd party firms/ NGOs to assist the ISMPC- Knowledge Base Team for: (i) Regional planning master plan refinement and dissemination, (ii) Main rivers management surveys and studies, (iii) Distributary surveys and studies, (iv) Land reclamation surveys and studies, (v) fishery surveys and studies, and (vi) safeguard studies.
(ii) A provision sum for continuation and refinement of the pilots carried over from Tranche-1.

4.4 Component 3: Project Management

Implementing arrangements are described in Section 6.1. Project management will be by the BWDB – PMO for most project activities, except for community and regional flood risk management which is managed by the PMU-DDM. The PMO and PMU will be supported by the Institutional Strengthening and Project Management Consultant (ISPMC) in managing and implementing the project. Key management activities comprise the following:

[46] During the initial years, international experts will guide the activities and train BWDB staff in their applications. This follows the principle of the development and handing over of the river survey database during Tranche-1.

[47] Drone 3D topographic and imagery surveys have been used during Tranche-1

i. Planning of tasks/ activities and timely mobilisation and guidance for construction activities, stakeholders and 3rd party services.

ii. Procurement and management of various 3rd party services: (i) contractors to implement the works, (ii) 3rd party firms and NGOs for non-structural tasks including community flood management, regular O&M by local stakeholder WMOs, and livelihood training, (iii) NGOs for resettlement surveys, and (iv) 3rd party firms/ contractors for studies, pilots and surveys.

iii. Coordination with Partner Agencies, and most importantly (i) between BWDB and DDM for flood warning and community disaster action planning, and (ii) between BWDB and DC for resettlement and land acquisition.

iv. Management and use of MIS systems and databases.

v. Tranche-2 activity and progress monitoring and timely and quality reporting covering designs, construction works, non-structural project components, capacity development activities, data and knowledge base studies and surveys, and safeguards including resettlement and environmental impact.

vi. Preparation/ updating documents as required for processing of Tranche-3, including feasibility and safeguards.

vii. Contribution to knowledge through publication on experience with riverbank protection in Bangladesh.

viii. Capacity development of BWDB and DDM, and targeted institutional strengthening through involvement of the office of the CE RM.

5 SAFEGUARDS, GENDER AND SOCIAL DIMENSIONS

5.1 Resettlement

Involuntary resettlement and compensation in Tranche-2 will continue to be in accordance with the Resettlement Framework for the programme (ADB-GoB, January 2018). The resettlement framework has been updated (Annex 2) in order to reflect the updated work locations, as well as the new Land Acquisition Act, September 2017. In addition, to some 15.5 km of permanent riverbank protection and some 25.3km of embankments are planned to be constructed at two locations during Tranche-2 (Table 5-1). While resettlement plans for all riverbank protection works will be prepared after the underwater works is completed, land acquisition and resettlement for embankments will be prepared from the start of Tranche-2 including access channels to regulators and ramps for road crossings. The resettlement process commonly takes one to two years, and for this reason embankment construction is not expected before year 2. The land acquired for riverbank protection is limited to a strip of some 50m width above low water level, where the bank will eventually be sloped and the permanent wave protection be placed. Also as this process takes one to two years, the actual work will be conducted during Tranche-3, while temporary protection will provide stability for the intermediate period of one to two years. This approach further supports quick completion of the remaining investment during the limited period of Tranche-3 (from 2021 to 2024).

Table 5-1 Land Acquisition Requirements for Tranche-2 Sites

Site	Land Acquisition Requirement
JRB-1: Kaitola	• Kaijuri Flood Embankment: 39.6ha for some 7.9km rehabilitation along the Hurasagar River • River bank protection: 50m strip for 3.5 km as downstream extension of the Kaijuri revetment after stabilizing the riverbank
JLB-2: Chauhali	• River bank protection: 50m strip for 12 km on the left bank upstream of Chauhali after stabilizing the riverbank. • Riverbank protection: 7km Chauhali Tranche-1 work for flattening upper slope to 1V:4H, • Optional: 50m strip for 10.5km for Solimabad riverbank protection if closure of channel through dredging does not work. • Flow redistribution and charland development to floodplain level downstream of Chauhali through dredging and building with nature technologies, if required
PLB-1: Harirampur	• Flood Embankment from Harirampur to Dohar: 128ha for some 17.4 km of embankment • Riverbank protection: 5 km upper slope protection already acquired during Tranche-1
Strengthening/ Adaptation and Emergency	• 40 km of adaptation works for all previously implemented work under JMREMP/FRERMIP – under water without any land acquisition • 5km of emergency works – no land acquisition due to work on bank below bankline and under water

Typically an implementing NGO (INGO) prepares Resettlement Plans, and assist the PMO-BWDB and District Commissioner offices during implementation of land acquisition and resettlement in direct contact with affected persons. Experience with Tranche-1 indicates the need for an experienced INGO fielded early during the process. This is time critical, as the works is expected to start from the end of 2019. An alternative arrangement could consist of incorporating the INGO services as

provisional sum into the ISPMC contract, which could be extended into Tranche-2 and would avoid any delays in resettlement activities.

Resettlement requirements for the Tranche-2 sites are summarized in Table 5-2. The recent law requires land is compensated at three times its value, and consequently land acquisition costs are considerably higher than originally estimated at programme preparation. In addition to payments for land, resettlement grants will be made to squatters, and compensation paid for assets including structures, homes, trees and so on.

An External Monitor will be engaged to review and verify the proper and timely implementation of the resettlement plans. Also as lesson learned from Tranche-1 the monitor should be engaged during year 1 to accompany the full resettlement process and not only at the end of the implementation period.

The Resettlement Plans for Tranche-2 as well as due diligence documents for flow redistribution work and precautionary riverbank protection are attached in Annex-2[48].

Table 5-2 Summary estimated Land Acquisition and Resettlement Impact

Sub-project	Land/ House Holds	Tranche-1		Tranche-2		Total T1+T2	
		Land	HH	Land	HH	Land	HH
JRB-1 EMB	Land ha	97.9		39.6		137.5	
	HH Nos.		2322		366		2688
JRB-1 RBP	Land ha			12		12	
	HH Nos.				209		209
JLB-2 RBP	Land ha	13.81		7.5		21.31	
	HH Nos.		191		131		322
	Land ha	4.44				4.44	
	HH Nos.		116				116
PLB-1 RBP	Land ha	13.77				13.77	
	HH Nos.		81				81
PLB-1 EMB	Land ha			128		128	
	HH Nos.				180		180
Total (all sub reach)		**129.92**	**2710**	**187.1**	**886**	**317.02**	**3596**

5.2 Environment

The Environmental Assessment Review Framework (EARF), May 2014, sets forth safeguards procedures to be followed in subsequent MFF tranches, as well as safeguards-related criteria to be considered in the selection of subprojects. The updated EARF is attached in Annex 3.

Initial Environmental Examination

For Tranche-2, an Initial Environmental Examination (IEE) was prepared and provides a preliminary oversight of the relevant regulatory framework, describes in general terms the considered interventions (as far as they were knows at that time), and identifies expected impacts – both

[48] The resettlement plan for Option 1 was reviewed by ADB during the early days of 2018 and the ISPMC incorporated comments from this review in February 2018. The new resettlement plan considers the Client's preference as per decisions of the Technical Committee of the BWDB.

positive and negative – and possible mitigation measures. It also provided the Terms of Reference for a subsequent Environmental Impact Assessment (EIA). The IEE report is included in Annex 3.

Environmental Impact Assessment report

The Tranche-2 project is categorized A for environment, as has been the Tranche-1 project, and an Environmental Impact Assessment report (EIA) is therefore required to be posted on ADB's website 120 days prior to approval of the Project. The (draft) EIA for Tranche-2 for the original option, prepared by the ISPMC at the end of 2017 was reviewed by the ADB in early 2018 and updated in February 2018. The site description has been updated in early 2019 to reflect the updated BWDB design as per decision of the Technical Committee in October 2018 (BWDB, Technical Committee, 2018).

The Tranche-2 EIA report covers the three priority sub-projects covered in the Tranche-1 EIA report (JRB-1, JLB-2 and PLB-1) and in addition the Meghna Left Bank 2 (MLB-2), which is optional. Construction interventions for Tranche-2 are mostly similar to those of Tranche-1 and other sites in Bangladesh, and are conducted in the same or similar environments as the ones of Tranche-1. Therefore, the present EIA for the Tranche-2 works is an update of the EIA for Tranche-1. Pertinent points are summarised below.

Flood Embankment Interventions and Impacts – General

While proposed interventions will result in positive impacts, of reduced flood damage to crops, security of land from river erosion, and improved agricultural and investment conditions, changes in floodplain hydrology due to construction of embankments will result in several negative impacts, despite FREMRIP's approach to systematically provide fish passes in all new embankments, revive wetlands, and restore distributary flows throughout the year, with the exception of capping extreme flood peaks. Restoration of distributary flow and creation of fish passes as mitigation measures will facilitate fish migration which is now significantly impeded by the poor river-floodplain connectivity as found in a recent ISPMC study.

Despite the additional openings in the embankments, some floodplain aquatic (wetland) habitats will be degraded or extirpated due to reduced flooded area, depth, and duration; reduced hydrologic connectivity; and physiochemical / water quality changes. This in turn will adversely affect floodplain-dependent open-water fish species migration, population levels, and catch levels, as well as wetland biodiversity, services, and products more generally. These impacts can in turn adversely affect the nutrition, health, and economic status of poor people. The embankment can impede cross-drainage resulting in drainage congestion, adversely affecting agriculture within the protected area, and block the movement of migrating fish.

Riverbank Protection Interventions and Impacts – General

River changes associated with FRERMIP riverbank protection work have been and are being assessed through specific morphology studies, which conclude among others that river stabilization invites deeper channels and could result in recovery of up to 150,000 km^2 of char lands from the river belt.

The JMREMP, 2007 study found that there were more fish species and higher population numbers at protected banks, as opposed to unprotected banks. The size of the fish depends on the size of the voids in the protection, which means that large voids in concrete blocks tend to attract larger fish, specifically carnivores, but fewer numbers, while geo-bags, having more but smaller voids, attract smaller fish in larger numbers. CEGIS, 2011 identified overall positive impacts of geotextile bag revetments on water resources, fisheries, the algae community, the ecosystem and the socio-economy. A recent ISPMC study also revealed that bank lines with geotextile bag revetments

support growth of vegetation like reeds to create ecosystems beneficial for fish. Important findings are that there is no change in water quality, the terrestrial habitat is protected, and the socio-economic conditions are improved for the local population, including employment opportunities during construction, health and sanitation conditions, fishing opportunities, and especially the situation of women.

Localized stable and deeper channels are more attractive for the endangered dolphins as they provide preferred migration routes, while small fish are the main food for dolphins. The construction season lies outside of the migration season of the dolphins (during the rising and falling of flood waters) and does not overlap much with the surfacing time of the juvenile and neonate dolphins in the morning and afternoon-evening hours.

Environmental Management Plan

The Environmental Management Plan (EMP) sets for the mitigation and monitoring to be undertaken. Four mitigation packages address:

- **Construction-phase impacts**. Management will be through the inclusion of standard environmental safeguard clauses in construction contract bidding packages, Contractor's Environmental Management Plans (CEMPs) and BWDB construction supervision.
- **Impacts on critical habitats and trans-boundary/internationally migrating/threatened species:** The proposed mitigation measures are modelled after the Wetland Biodiversity Rehabilitation Project of GIZ /Department of Fisheries/BWDB, recently concluded in District of Pabna adjacent to the JRB-1 project area.
- **Impacts on open-water fish biodiversity and production**. Measures to mitigate these impacts include (i) open-water fisheries development-related measures like establishment of fish sanctuary and (ii) expansion of aquaculture, particularly in areas benefitting from Project-led reductions in flood and erosion risk.
- **Land acquisition and resettlement impacts**. Management measures will be documented in the Resettlement Action Plan for Tranche-2.

The EMP will be implemented by the PMO supported by the Institutional Strengthening and Project Management Consultant (ISPMC) team that includes environment specialists. Also a 3rd party NGO/ Firm will be contracted to expand the biodiversity database for the study area and outline the establishment of fisheries sanctuaries.

Mitigation measures include construction of fish passes to maintain connectivity between the river and the floodplain, khal (distributary) excavation for the same reason, and installing buoys with the dual purpose to indicate the navigation channel and prevent indiscriminate fishing practice with drift nets.

Design and Implementation Phase Public Consultation

Stakeholder consultation will continue during subproject implementation to provide information to stakeholders about the project and to receive their input and concerns. Meetings will include in particular households and persons affected by resettlement (AHs and APs) and other adverse environmental and social impacts. At these meetings, information about designs, impacts, and mitigation and monitoring measures, including specific resettlement entitlements, will be disclosed verbally and in Bangla-language information handouts.

Grievance Redress Mechanism

At each sub-project location, a local Grievance Redress Committee (GRC) has been set up during Tranche-1 and will continue to be in operation throughout FRERMIP implementation. While the Tranche-1 committees focussed on resettlement aspects, the role will be expanded to incorporate environmental issues during Tranche-2.

Reporting and Monitoring

Environmental monitoring reporting will continue during Tranche-2, and reports will be disclosed on ADB's website. Environmental monitoring reports will be prepared by the PMO under the direction of the nominated environmental officer with the help of the consulting team's environmental specialist.

5.3 Strategic Environmental and Social Assessment

A Strategic Environmental and Social Assessment (SESA) of the MFF was carried out by the ISPMC (NHC/EMM, Strategic Environmental and Social Assessment (SESA) of River Stabilisation, September 2018) and reviewed by the Netherlands' Commission for Environmental Assessment in mid-2017 and a second time in early 2019. The SESA differs from a usual EIA in that it focuses on regional development comprising several interventions over a long period of time rather than on a local site-specific intervention.

The potentially long-term impacts of proposed works as detailed in the River Stabilisation Plan, (NHC/EMM, November 2017), pertain to the river as well as the floodplain and include changes in river morphology and aquatic habitat caused by riverbank revetments; effects on water bodies and associated habitats caused by disruption of hydrological and ecological connectivity between main and internal rivers, *beels* and *khals*, and so on.

Mitigation measures include fish passes and inland waterways (distributary) excavation. To evaluate environmental sustainability, identification of indicators to monitor the following is proposed:

(i) For the river and floodplain: (a) Conservation of biological diversity, (b) Maintenance of a productive river and floodplain fisheries, (c) Maintenance of ecosystem's health and vitality, (d) Conservation and maintenance of wildlife populations, and (e) Legal, institutional and economic framework for conservation and sustainable management.

(ii) For the floodplain: (a) Maintenance of wetlands, (b) Maintenance and enhancement of long-term economic benefits to meet the needs of local communities

5.4 Social Dimension, Poverty and Gender

Riverbank erosion along the main rivers destroys land, assets and infrastructure, and as a consequence poses a threat to people's lives, assets and livelihoods. Uncertainty in the face of frequent floods and riverbank erosion prevents investment in infrastructure, higher value agriculture and small business. As such, poverty is higher in riverine districts. Investments in erosion prevention reduces migration to urban slums.

Gender Actions

The Gender Action Plan for Tranche-2, included as Appendix D, is very similar to that adopted for Tranche-1, and has clear targets and responsibilities. The plan includes targets for: (i) women's involvement in construction works, (ii) women's representation (minimum 30%) on committees for CbFRM, and receiving training, (iii) women's involvement in embankment WMOs for regulator O&M, including representation on the Executive Committee, and in doing maintenance work through

formation of Labour Construction Societies (LCS) where there should be 30% of women, (GoB B. G., 2014), (iv) receiving livelihood improvement support for project affected people, and (v) women's participation of workshops and training as part of institutional strengthening.

Labor, Health, and Social Protection

BWDB will ensure that civil works contracts under each project follow all applicable labor laws of the Government and that these further include provisions to the effect that contractors; (i) carry out HIV/AIDS awareness programs for labor and disseminate information at worksites on risks of sexually transmitted diseases and HIV/AIDS as part of health and safety measures for those employed during construction; (ii) do not use children as labor, and (iii) follow legally mandated provisions of labor (including equal pay for equal work), health, safety, sanitation, welfare and working conditions. The contracts shall also include clauses for termination in case of any breach of these provisions by contractors.

Social Assessment

Latest poverty data are based on recent surveys from the Bangladesh Bureau of Statistics (BBS). Additional information comes from the MDGs as well as information linked with SDG Goals and the 7th Five Year Plan, and the ADB's country partnership strategy (CPS) period (2016–2020), which will adopt a broad-based approach in order to respond flexibly to the needs and demand of the country. ADB assistance is strongly aligned with the government's Vision 2021 and its 7th Five-Year Plan, which lays out a roadmap for higher, sustainable and inclusive growth. Freeing the country from poverty and inequality remains a major though separate challenge. Currently, 12.9% of the population is in extreme poverty. Unless specific actions are taken, extreme poverty in parts of the country and inequality between regions will likely remain, even as the country's economy continues to grow. Effective implementation of the government's social protection strategy is needed to elevate people out of extreme poverty. Priorities include housing and basic services—including primary health care—for the poor, and disaster risk management to reduce vulnerability and build resilience to extreme weather conditions.

The Summary Poverty Reduction and Social Strategy has been updated for Tranche-2 and the draft revised SPRSS is attached in Appendix F.

6 IMPLEMENTATION

6.1 Implementation Arrangements

General

The implementing arrangements for Tranche-2, will remain broadly as established for Tranche-1, described in the FAM, (ADB, Facility Administration Manual. Multi-tranche Financial Facility - Flood and Riverbank Erosion Risk Management Investment Program, 2014a) and summarised in this report in Section 0. The PMO and two ISPMC offices became fully operational in September 2015, and two SMOs, at Tangail and Manikganj, in November 2015. The ISPMC project management team is located together with the PMO-BWDB in the Firoz Tower, 152/3/B Bir Uttam, Kazi Nuruzzaman Road (*Green Road Office*), Dhaka-1205. The ISPMC Study Team was located at House 47 (8th Floor) Road 27, Banani, Dhaka (*Banani Office*).

The successful project management team of Tranche-1 will continue for Tranche-2: The Bangladesh Water Development Board (BWDB) will manage the Tranche-2 through its existing Project Management Office (PMO) which performed well in implementing the Tranche-1. The PMO will continue managing the Tranche-1 remaining activities, and its work volume will more than double with the commencement of Tranche-2 implementation. The supervision of the remaining Tranche-1 activities including the just-commenced five embankment contracts of Tranche-1, plus works under the much larger Tranche-2, will necessitate substantial strengthening of the PMO staff complement at headquarters as well as field levels. The Tranche-1 Mid-term Review Mission already identified the need to fill the vacant professional staff positions in the project and subproject management offices[49]. Additional professional support, particularly during the start-up phase in 2019 and 2020 will be required to avoid delays of works of critical importance including procurement, and safeguards compliance. The situation could be further improved once the office of the Chief Engineer River Management becomes operational. For Tranche-2, to strengthen capability and role of the office of the Chief Engineer - River Management, and to derive synergies in term of staffing[50], it may be considered to integrate the PMO with the office of the CE RM.

Project implementation support will be provided by the ISPMC -Tranche-2 consultancy, with particular focus on construction supervision and preparation of Tranche-3. The ISPMC will include a sub-team with expertise to guide and manage the various service providers for studies and knowledge-base development, pilots, and surveys. Third party support services will be procured from NGOs/ firms for the non-structural components of the project, for surveys, studies and pilots and for safeguards, resettlement and environment.

Implementation Institutional Arrangements

The Bangladesh Water Development Board (BWDB) under the Ministry of Water Resources (MOWR) is the Executing Agency for implementation of FRERMIP. The Department of Disaster Management (DDM) under the Ministry of Disaster Management and Relief is the Implementing Agency for community based flood management activities.

[49] Refer to para 41 in the Aide Memoire of the Mid-term Review Mission 15 – 26 February 2018

[50] The BWDB is seriously understaffed with more than 8,500 approved positions but only little more than 6,000 placed. Temporary Project Management Office contribute to the staff shortage, which has to be drawn from the understaffed pool of regular posts.

The Project Management Office (PMO) is responsible for project implementation, procurement of goods and works and the monitoring of work progress while the BWDB design circle is in charge of design. The Employer (BWDB) designated the Superintending Engineer of the O&M Circle, Mymensingh as the Engineer for the construction supervision of the works packages. The majority of quality control was by the Task Force team of BWDB and the Diving Team recruited under the ISPMC contract, later supplanted by multi-beam echosounder surveys financed through the ISPMC budget. The ISPMC provided an advisory and support role to the BWDB with regards to their documentation of the construction supervision and quality control works. Institutional arrangements are given below, Figure 6-1.

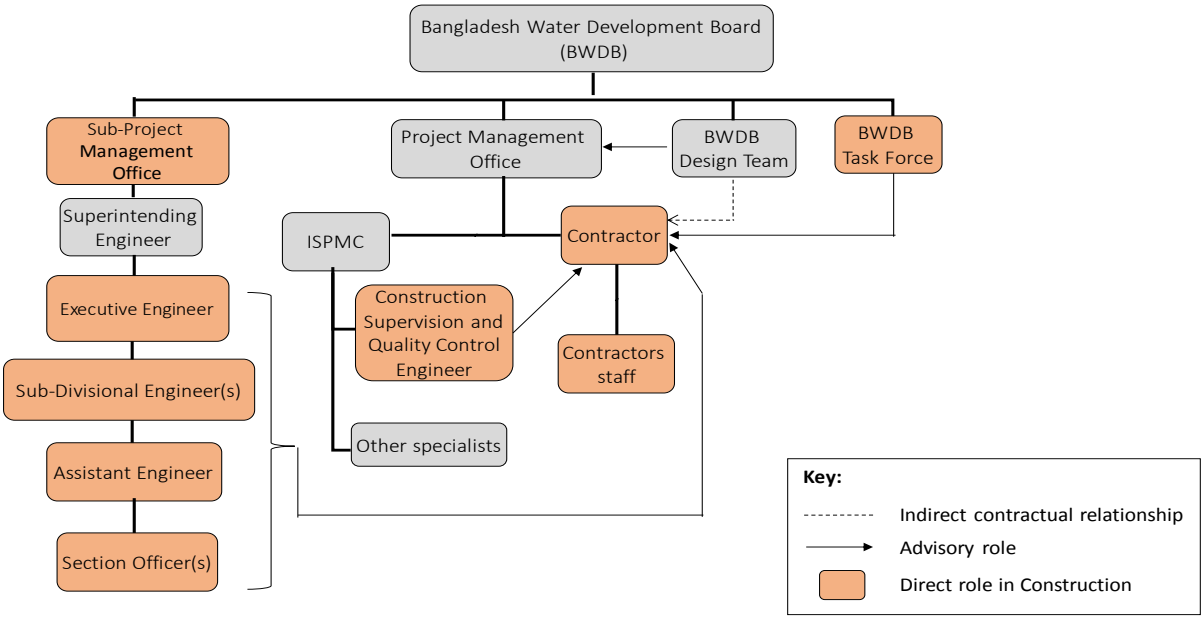


Figure 6-1 Institutional Arrangement for Works Implementation

PMO and SMO Office Costs

Office Operation

Staffing and operational costs for the PMO Office, and for four site management offices (SMO-JRB1, SMO-JLB1, and SMO-PLB1) which are located in the relevant O&M Division offices[51] are detailed in Supplementary Report 3. Costs include for: (i) staff salaries, (ii) office rent, (iii) transport/ vehicle running costs, and (iv) office operational costs including stationary.

In estimating costs, salaries for existing/ required BWDB staff within the offices (PMO and O&M Division Offices) are determined, and the proportion of the time that these staff will be working on the project estimated. These staff include: CE/ ACEs, Superintending Engineer, Executive Engineers, Sub-Divisional Engineer (Civil), Assistant Engineer, Accounts Officer, Accounts Assistant, Typist/ Computer Operator, Drivers, Guards and so on.

Equipment and Vehicles Costs for PMO and SMOs

New office equipment to replace that provided at the beginning of Tranche-1 is required for each SMO, while for the PMO particularly if relocating into the office of the CE-River Management new, additional equipment are required. Details are given in Annex 4 and summarised below.

[51] Tangail and Manikganj on the Jamuna-Padma Left bank, and Kaitola on the Right Bank, the Dhaka division for the embankment at Harirampur

Table 6-1 Equipment Requirement and Costs for PMO and SMO Offices

Item	Unit	No
Desktop PC	No	13
Laptop PC	No	8
A3 Printer / photocopy machine	No	5 / 6
Misc	LS	1

Survey equipment requirements are tabulated below.

Table 6-2 Survey Equipment and Cost

Item	Unit	No
Speed boats	No	3

Vehicle requirements are tabulated below.

Table 6-3 Vehicle Requirements and Costs for PMO and SMO Offices

Item	Unit	No
Pickup truck	No	8
Jeeps	No	4
Microbus	No	2

PMU-DDM Office Costs

Operating Costs

Staffing and operational costs for the PMU are detailed in Annex 4. Costs include for: (i) staff salaries, (ii) office rent, (iii) transport/ vehicle running costs, and (iv) office operational costs including stationary.

In estimating costs, salaries for existing/ required DDU staff within the office are determined, and the proportion of the time that these staff will be working on the project estimated. These staff include: Project Manager/ DS, Assistant Director, Accounts Officer, DEO, MLSS, drivers and guards.

Equipment and Vehicle Costs for PMU

New office equipment to replace that provided at the beginning of Tranche-1 is required. Details are given in Annex 4 and summarised below. Field equipment requirements and other costs associated with the community and regional flood risk management are described in Section 0.

Table 6-4 Office Equipment and Vehicle Requirements and Costs for PMU

Office equipment	Quantity
Desktop computer	3
Laptop	1
Air conditioner	2
Printer cum copier	1
Furniture (table, chair) set	4
Office operation	**Quantity**
Micro bus rent (2)	48

Allowance for POC and PEC members attending meetings	10
Stationaries and consumables	48
Per-diem during field trip	48
Entertainment	48
Telephone/fax internet	48
Filtered water	48
Fuel for vehicles	48
Maintenance	48

Institutional Strengthening and Project Management Consultancy Support

Consultancy services will be engaged for 48 months (January 2020 to December 2023) to support the PMO-BWDB, and PMU-DDU to implement Tranche-2 including: (i) implementation designs and construction of riverbank protection, strengthening/adaptation, and flood protection works, (ii) achieving non-structural project components including regional and community flood risk management, community involvement in regular O&M, and improved livelihoods for affected persons, (iii) strengthened BWDB institutional capacity for flood and riverbank erosion risk management through training, further development and adoption of MISs, and planning for O&M, (iv) improved data and knowledge base through studies, pilots and surveys, (v) efficient and effective project management.

To do this, the tasks of the required Institutional Strengthening and Project Management Consultancy Support (ISPMCS) services have been identified and are tabulated below, grouped under 6 main tasks. These tasks may be broadly categorised as being: (i) concerned with project implementation, (ii) preparing the Tranche-3 project, or (iii) with improving the knowledge base. Therefore, as with Tranche-1, the ISPMC will comprise three teams: (i) Project Management, Implementation and Feasibility Team, and (ii) Knowledge-base Team. The Team Leader of the implementing team will be overall leader for the ISPMC.

Table 6-5 ISPMCS Tasks

A. Project Management and Implementing Team	
T1: Implementation Management Support including Safeguards	T1-1: Planning of tasks/ activities and timely mobilisation and guidance for ISPMC team members, stakeholders and 3rd party services. T1-2 Procurement and management of various 3rd party services from civil works contractors, and from 3rd party firms and NGOs for non-structural components, resettlement, environment and social surveys, and for studies, pilots and surveys. T1-3: Coordination with Partner Agencies, and most importantly (i) between BWDB and DDM for flood warning and community disaster action planning, and (ii) between BWDB and DC for resettlement and land acquisition. T1-4: Management and use of MIS systems and databases. T1-4: Tranche-2 activity and progress monitoring and timely and quality reporting covering designs, construction works, non-structural project components, capacity development activities, data and knowledge base studies and surveys, and safeguards including resettlement and environmental impact. T1-5: Preparation/ updating documents as required for processing of Tranche-3, including feasibility and safeguards.

T2: Support for Structural Works Component	T2-1: Support surveys and implementation of resettlement including land acquisition for construction of works. T2-2: Assist PMO with detailed implementation designs for civil works for river bank protection and river training, flood protection and land reclamation, including new, strengthening/adaptation and repair works. T2-3: Data analysis for updated design guidelines. T2-4: Supporting BWDB for supervision of structural works and ensuring quality control. T2-5: Prepare reports documenting major construction activities, quality and lessons learned.
T3: Support for Non-Structural Works	T3-1: Support PMO-DDM implementing CbFRM and also regional flood risk management, by component design, procurement of 3rd party firm(s), stakeholder consultations, monitoring activities and reporting T3-2: Support participatory regular O&M by component design, procurement of 3rd party firm(s), stakeholder consultations leading to WMO formation, registration and strengthening, monitoring activities and reporting T3-3: Support livelihood support including component design, procurement of 3rd party firm(s), stakeholder consultations, monitoring activities and reporting
T4: Institutional Capacity Support	T4-1: Monitor progress of sector policy and institutional agenda T4-2: Plan, design, conduct or arrange capacity strengthening programs/ training events/ study tours T4-3: Use, improve and extend MISs: (i) Project Website and Database, (ii) Asset web-based database, and (iii) ADB/ Smart Project Monitoring and Management Information System database T4-4: Plan and arrange annual workshops for information sharing
B. Feasibility Team	
T5: Supporting Preparation of Tranche-3 Project	T5-1: Verify and update selection of work sites, technology and designs. T5-2: Technical and social field surveys and updated data collection. T5-3: Basic structural designs for works. T5-4: Updating/ amending designs of non-structural components/ activities. T5-5: Safeguard, gender and poverty assessments. T5-6 Tranche-3 Economic Feasibility. T5-7 Tranche-3 formulation (implementation schedule, procurement packaging, financing plan, etc). T5-8: Detailed design and preparation of procurement documents. T5-9: Support for preparation of project processing documents including DPP and PFR
C. Knowledge Team	
T6: Data and Knowledge Base Development	T6-1: Refine the long-term river stabilization and river management master plans prepared in Tranche-1, including for char land development, and present to BWDB and department/ agencies of other Ministries for wider adoption in project planning. T6-2: Undertake studies, directly or with 3rd parties, to add to quality of planning and design guidelines covering: (i) Offtake modelling and distributaries study, (ii) Fisheries studies, (iii) Main rivers monitoring survey, (iv) Safeguard studies. T6-3: Plan, supervise, monitor and assess developments and pilots, expected to be extension of pilots started in Tranch-1, i.e. concerning grout-filled mattresses, vegetative protection using katkin/ vetiver grasses for flood embankments, river bank slopes and for reclaimed land, and morpho-hydraulic design for distributary off take(s). T6-4: Support procurement and supervision of 3rd parties for flood and river surveys and also distributary surveys, and ensure entry of data into web-based (project) database.

Indicative ISPMC staffing and other requirements and costs are given in Annex 4, and summarised below.

Table 6-6 ISPMC Staffing Details

Item	Unit	Implementing Team and Feasibility Team	Knowledge base update	Total ISMC
International Consultants	Staff-month	162	78	240
National Consultants	Staff-month	510	160	670
Office operation and support services	Month	48	48	96

3rd Party Firm and NGO Services

Third party support services will be procured from NGOs/ firms for the: (i) non-structural components of the project, (ii) for strengthened institutional systems, particularly for MIS establishment and use within the office of the CE-WM, (iii) surveys, studies and pilots, and for (iv) safeguards, resettlement and environment. Amounts and a general description of proposed services contracts are tabulated below. Most of these service contracts will be procured early in Tranche-2.

Details of the services are given in the relevant sections of this report and costs in Annex 4.

Table 6-7 Summary of 3rd Party Services for Tranche-2

	Service Contract	Duration (months)	Description of Service
1	**Community based flood risk management**		
1.1	Regional & Community based Flood risk management	36	Awareness, formation and strengthening of community based DMUs and installation of DDM equipment
2	**Strengthened Institutional Systems – MISs**		
2.1	Scheme inventory and mapping system, SIMS (Asset Inventory with risk based O&M Module)	36	Services of one or more 3rd parties: (i) MIS systems development/ refinement/ improvement, (ii) for data entry, (iii) for training of BWDB staff, (iv) for workshops, and (v) for MIS system operation and trouble-shooting for at least 12 months. The total duration of the MISs services contract(s) would be 36 months
2.2	Smart project monitoring and management information system, SPMMIS	36	As outlined during Tranche-1
3	**Survey for Structural Works Design and Data and Knowledge Base Improvement**		
3.1	Regional planning master plan refinement and dissemination	12	Hire of local expert(s) to assist in plan refinement and dissemination through additional data collection and analysis.
3.2	Main river surveys and studies *(2 survey contracts envisaged)*	40	Surveys will include: (i) Bathymetric Single Beam underwater topographic river cross sections, (ii) Bathymetric Multi-Beam underwater 3D bank surveys, (iii) Float Track surface flows, and (iv) above water topographic/ feature/ imagery surveys using drones/ terrestrial instruments .
3.3	Discharge and sediment survey	42	Surveys will be conducted through a dedicated fully equipped survey vessel and include: (ii) Bathymetric Multi-Beam underwater 3D dune tracking, (iii) Acoustic Doppler Current Profiles, ADCPs for flow and sediment discharge, (vi) sediment sampling,
3.4	Distributary surveys	24	Surveys will include: (i) Establishment of benchmarks and long and cross sections survey at about 200 m intervals

	Service Contract	Duration (months)	Description of Service
	(1 survey contracts envisaged)		over a length of about 120 km, (ii) for monthly/ bi-monthly flow monitoring, and sediment sampling at a few (3-5) selected points along the rivers, through the year.
3.5	Land reclamation surveys & studies (1 contract)	24	Land reclamation study relating to about 7,000 ha of char-land reclamation and development, monitoring effectiveness of measures, including vegetative planting, local stakeholder awareness and information concerning land ownership and registration status
3.6	Drone survey (1 contract)	40	Survey of some 60km of right embankment over three years for inclusion into the asset management database
4	**Safeguards**		
4.1	Resettlement village study	12	Study and surveys for the possible establishment of a resettlement village in reclaimed char land
4.2	Environment/ biodiversity and social baseline and impact monitoring	30	Biodiversity and social baseline and monitoring of impact of works (including dredging) and FRERMIP programme activities
5	**Participatory regular O&M**		
5.1	NGO engaged to implement participatory O&M	30	Support for establishment and strengthening of Embankment WMOs, guidance for regular community O&M including pilots for vegetative protection of embankments
6	**NGO for Livelihood support and training**		
6.1	NGO engaged to implement Livelihood support and training	30	Identification of training requirements and interests, selection of participants, on-site training.
7	**Environmental management**		
7.1	NGO engaged to implement Environmental management plan		Services to include: (i) monitoring of compliance with EMP (as defined in EMP), (ii) Establishment of fish sanctuaries, (iii) Reporting, (iv) identification of issues and impacts of construction
8	**Resettlement INGO**		
8.1	Resettlement and land acquisition plan preparation & implementation (1-2 contracts)	36	Services to include: (i) survey of assets/ other, (ii) stakeholder awareness, (iii) identification of affected persons and issue of identification cards, (iv) monitoring of compensation and compliance, and (v) reporting.
9	**Offtake modelling and distributaries study**		
9.1	Model study for offtake of distributary		Focus most likely on offtake of Old Dhaleswari at Solimabad. Scope to include: (i) hydraulic model of offtake, (ii) feasibility design of offtake structure, (iii) modelling of sediment flows into distributary
9.2	Study on management of distributary		In combination with 9.1, study on effects of offtake arrangement on flows and stability of distributary
10	**Fisheries study**		
10.1	Fisheries study and survey	18	Monitoring and surveys to support design and establishment of community managed fish sanctuaries (under livelihoods) and efficacy of fish passes, and so on

6.2 Implementation Schedule

There are three tranches (projects) within the ten year multi-tranche financing facility, which started with loan signing on 14th August 2014 and ends in August 2024. The proposed Tranche periods are:

- Tranche-1: August 2014 to June 2020 (5.9 years)
- Tranche-2: January 2020 to December 2023 (4.0 years)
- Tranche-3: June 2021 to August 2024 (3.2 years)

Implementation of Tranche-2 will commence during the dry season 2019-20, which will provide some overlap with Tranche-1. Until then, Tranche-1 will implement emergency and strengthening/ adaptation works. Tranche-2 will continue for about 4.0 years, to December 2023. Tranche-3 will overlap minimum one year with Tranche-2, starting in June 2021[52].

The broad implementation schedule is shown below on Figure 6-2.

6.3 Procurement Plan and Contract Packaging

Procurement of Goods, Works and Consulting Services

Procurement of goods, works and consulting services will be in accordance with the Facility Administrative Manual for the Program, (ADB, Facility Administration Manual. Multi-tranche Financial Facility - Flood and Riverbank Erosion Risk Management Investment Program, 2014a), key points of which are summarized below.

Procurement of goods and works. International competitive bidding (ICB) will be followed for civil work contracts costing $15 million or more, to ensure competition. National competitive bidding (NCB) will be applied for civil works contracts costing less than $15 million. For procurement of goods and related services, ICB procedures will be used if the estimated cost is $2 million or more, and NCB if the estimated cost is less than $2 million. Shopping will be used for goods and works, if the estimated cost is less than $0.1 million.

Table 6-8 Procurement Methods and Thresholds

Method	Threshold
International Competitive Bidding (ICB) for Works[1]	$15,000,000 or more
International Competitive Bidding for Goods[1]	$2,000,000 or more
National Competitive Bidding (NCB) for Works[1]	Beneath that stated for ICB, Works
National Competitive Bidding for Goods[1]	Beneath that stated for ICB, Goods
Shopping for Works	$100,000 or less
Shopping for Goods	$100,000 or less

[1] Refer to Para. 3 of PAI 3.04 National Competitive Bidding

Consulting services. All consultants, NGOs, and other institutions will be recruited according to ADB's Guidelines on the Use of Consultants.

The Institutional Strengthening and Project Management Consultants (ISPMC) for Tranche-1 may be engaged for subsequent tranches through single source selection (SSS) modality, at the request of the executing agency/ government and subject to their performance during Tranche-1. This is to ensure continuity of the services throughout the MFF period.

National NGOs will be engaged for: (i implementation of land acquisition and resettlement plans, (ii) community-based flood risk management (CBFRM), (iii) participatory operation and maintenance support, (iv) livelihood supports, and (v) surveys and supporting studies. PMU of DDM will select and engage national NGOs for CBFRM. PMO of BWDB will select and engage other packages.

[52] Based on experience with the land acquisition process during Tranche-2 for embankment works an earlier start could be indicated.

NGO(s) and national consulting firm(s) will be engaged through QCBS, if no NGO is included in a shortlist, or QBS, if one or more NGOs are included in a shortlist, as per ADB's guidelines. Other rather small-size consulting/NGO services will be engaged through consultant qualification selection (CQS) modality or may be through QBS modality, as indicated in the procurement plan.

Figure 6-2 Program Implementation Schedule

Procurement Plan and Packages for Tranche-2

Planned procurement packages for Tranche-2 are provided in Annex 4.

6.4 Monitoring

Program monitoring shall be as described in the FAM, (ADB, Facility Administration Manual. Multi-tranche Financial Facility - Flood and Riverbank Erosion Risk Management Investment Program, 2014a) and summarised below for Tranche-2.

Project performance monitoring: The PMO supported by the ISPMC/ 3rd parties established a project MIS, based on the program's design and monitoring framework. The framework for Tranche-2 is given in Section 6.5. Financial and physical progress is being recorded in this MIS. During Tranche-2, the project database will be further improved with a dynamic project map enabling the user to zoom into a specific site to access data from that site.

Compliance monitoring: Status of compliance with assurances, conditions and loan covenants— policy, legal, institutional, financial, economic, environmental, social and others— will be reviewed at each ADB review mission. All non-compliance issues, if any, will be updated in quarterly progress reports together with remedial actions. PMO will include status of compliance in quarterly progress reports.

Safeguards monitoring: Monitoring and reporting for social safeguards are described in the resettlement framework for the planning of works, and the concerned resettlement plans provide the arrangement for implementation monitoring.

Gender and social dimensions monitoring: The GAP will be implemented and monitored by BWDB. The status of the implementation of the GAP will be reported in BWDB's quarterly progress report. The status will also be discussed at each ADB review mission.

6.5 Monitoring and Reporting Requirements

PMO/BWDB will provide ADB with (i) quarterly progress reports in a format consistent with ADB's project performance reporting system; (ii) consolidated annual reports including (a) progress achieved by output as measured through the indicator's performance targets, (b) key implementation issues and solutions; (c) updated procurement plan and (d) updated implementation plan for next 12 months; and (iii) a project completion report within 6 months of physical completion of the Project. To ensure projects continue to be both viable and sustainable, project accounts and the executing agency AFSs, together with the associated auditor's report, should be adequately reviewed.

DDM reports it's monthly progress to BWDB with support of the project management consultant. BWDB will report consolidated progress to ADB.

Details of requirements which allow for physical and financial progress to be monitored are given in the FAM, were broadly adhered to in Tranche-1 and will continue will little change in Tranche-2.

6.6 Stakeholder Communication Strategy

The primary audiences for the communication strategy are local communities along the project rivers, the general public (NGOs and development partners, key individual decision makers) and Government and authorities (local Upazila administration, institutions and ministries).

The stakeholder communication strategy is built into the design of the investment program, including the non-structural components, resettlement plans, environment monitoring plans and the gender action plan. Details are given in the FAM, (ADB, Facility Administration Manual. Multi-tranche Financial Facility - Flood and Riverbank Erosion Risk Management Investment Program, 2014a).

7 PROJECT COST

7.1 Introduction

Study Area and Main Work Items

The study area and interventions are described earlier, Chapters 1, 2 and 3; particularly Sections 3.4, 4.1, Figure 1-1, Figure 1-2 and Table 4-1. The main interventions are summarized in
Table 7-1.

Table 7-1 Main Interventions at Priority Sub-project under Tranche-1 and 2

Sub-project	River Bank Protection		Flood Embankment		River Stabilization	Charland Develop-ment (T-1&2)
	Recently constructed (T-1)	Proposed (T-2)	Under construction (T-1)	Proposed (T-2)		
JRB-1		3.5 km	21.3 km, 4 regulators	7.9 km 2 regulator/ fish passes	n/a	
JLB-2	9.0 km	12 km, 10.5 km (precautionary)			8km dredged channel	6,000 ha
PLB-1	8.8 km			17.4 km, 7 regulator/ fish passes		1,700 ha
Total	**17.8 km**	**23.5 km**	**21.3 km**	**25.3 km / 9 regulators/ fish passes**	**8km dredged channel**	**7,700 ha ha**

Work Program and Cost

Tranche-2 is scheduled for four construction seasons with the following work items:

(i) Riverbank protection

(ii) Upstream of Chauhali, at Benotia and at Solimabad: dry season 2019/20 and 2020/21. The location and type of works, depends on the 2019 flood.

(iii) Strengthening/Adaptation works is planned for three dry seasons from 2019/20 to 2020/21

(iv) Flow redistribution and char land development in one phase during dry season 2019/20 to 2022/23.

Embankment works is planned from 2019/20 to 2020/21, with the first year to complete the land acquisition and resettlement process.

The optional works at MLB-2 (Chandpur) can be implemented during one dry season, if financing will be available.

Table 7-2 provides an overview of the works and cost for both Tranche-1 and -2 for the BWDB design as per Client preference.

7.2 Programme and Tranche-2 Project Costs

Cost Structure

The cost structure is based on the following parameters:

(i) **Unit Rates:** the unit rates are expressed either for individual units, such as geotextile bags, or as kilometer cost, for example for earthwork of an embankment. Costs follow market rates at the time of preparing the estimates, and for civil works were checked against BWDB's schedule of rates. Cost could be established within reasonable confidence levels, based on past experience with the type of work proposed.

(ii) **Base Cost:** the unit rates for different cost items were increased by the percentage of taxes applicable in Bangladesh, for example deducted at source from contractors' bills. Broadly 5.5% value added tax (VAT) is applicable to work contracts and 15% to service contracts. In several cases taxes vary, e.g. depending on import duty.

(iii) **Physical Contingencies:** In order to reflect uncertainties physical contingencies were applied. Globally 5% physical contingencies were applied as (i) there is recent, practical implementation experience, reducing the uncertainties in terms of volumes of work, and (ii) most of the critical underwater works is expected to be implemented at the beginning of the loan, which reduces the uncertainties related to sudden, unexpected river changes. The exception is pilot works, which do not have any contingency, due to their experimental nature.

(iv) **Price Contingencies:** These are computed on foreign exchange costs at costs at 0% in year 1, 1.9% in year 2 and 1.8% thereafter, and on local currency cost at 0% in year 1, and 6.5% thereafter, including provisions for exchange rate fluctuation under the assumption of a purchasing power parity exchange rate.

(v) **Total Cost:** These consist of the summary of base cost, physical contingencies, and price contingencies.

(vi) **Financing Charges:** These are computed by COSTAB, applying 2% interest on the loan amounts disbursed only during the period of implementation. The Financing charges are computed for each tranche individually.

Structuring the cost for this MFF considers that the ADB loan and the Government DPP use different categories. In order to provide a practical starting point, costs have been structured in a detailed table with line items that can be clearly associated to ADB and DPP investment categories.

Table 7-3 explains the cost structure as per ADB and DPP categories and Table 7-4 provides the breakdown Tranche-wise cost breakdown per project component. Table 7-2 and Table 7-5 in the successive sections detail the investment cost per subproject including dredging allocations.

Table 7-2 Summary of Tranche-1 and 2 Works and Costs

Tranche Period	**Structural Works**	**Estimated Cost**
Tranche-1: August 2014 to June 2020 (+ 5.8 years)	- River bank protection: 17.8 km - Flood embankment: 21.3 km Strengthening/Adaptation and repair works	US$ 108 million
Tranche-2: January 2020 to December 2023 (+ 4.0 years)	- River bank protection: 15.5 km - Precautionary protection: 10.5 km - Flood embankment: 25.3 km - Channel choking with sediment - 9 regulators/fish passes - Strengthening/Adaptation and repair works	US$ 361.3 million
Total	- River bank protection: 33.8 km - Flood embankment: 44.3 km - 8 fish passes and 2 regulators - Strengthening/Adaptation and repair works - Land reclamation: 7,700 ha	**US$ 469.3 million**

Table 7-3 Cost structure: Detailed ADB and DPP investment categories

DETAILED CATEGORIES (ADB)		DPP CATEGORY
A Civil Works		
A1	Riverbank protection work	Riverbank protection
A2	Embankment earth works	Embankment
A3	Embankment pavement works	Embankment
A4	Embankment drainage structure	Embankment
A5	Emergency dumping for Erosion Control	Riverbank protection
A6	Land Recovery Pilot Works	Pilot works
B Materials (Geotextiles)		
B1	Geotextile Materials	Riverbank protection
B2	Geotextile Material (Emergency and Strengthening/Adaptation)	Riverbank protection
C Vehicles and Equipment		
C1	Vehicle (BWDB)	Equipment& Vehicles BWDB
C2	Office Equipment (BWDB)	Equipment & Vehicles BWDB
C3	Survey Equipment (BWDB)	Equipment & Vehicles BWDB
C4	DDM Office Equipment	Equipment & vehicles DDM
D Consultancy		
D1	ISPM Consultant	Consulting Services
	Task 1: Implementation	Surveys and investigations
	Task 2: Knowledge base	Surveys and investigations
	Task 3: Feasibility Study T-3	Surveys and investigations
D2	Livelihood support (INGO)	NGO services
D2	Environmental Mgmt. (INGO)	NGO services
D2	Resettlement (INGO)	NGO services
D3	CbFRM Program (INGO)	NGO services
D4	Multi-beam echo sounder survey	Surveys and investigations
D4	Erosion prediction	Surveys and investigations
E Capacity Development (Training)		
E1	BWDB Training & Study Tours	Capacity development BWDB
E2	DDM Training	Capacity development DDM
E3	MIS Development	Capacity development BWDB
F Land Acquisition and Resettlement		
F1	Land Compensation	Cash Compensation under Law
F2	Resettlement Benefit	Resettlement Benefits
G Program Management		
G1	BWDB PMO&SMO Salaries	Program management BWDB
G2	BWDB PMO&SMO Operation	Program management BWDB
G3	PMU-DDM Operation	Project management DDM
G4	BWDB River Survey	Surveys and Investigations
I Interest during Construction		
I3	Interest during construction	Interest during construction

Table 7-4 Detailed Categorization by Component

Detailed Categorization by Component	Tranche-1	Tranche-2
A Strengthening Institutional System for Flood and Riverbank Erosion Risk Management	**12.7**	**12.92**
A1 Institutional Capacity Strengthening for Sustainable River Management	1.3	2.43
A2 Knowledge-base Development	11.39	10.49
B Flood and Riverbank Erosion Risk Management Measures at Priority Reaches	**70.54**	**301.18**
B1 Infrastructure Improvement	67.69	295.77
B2 Community-based Flood Risk Management	1.58	1.05
B3 Participatory Regular O&M	0.3	0.36
B4 Livelihood Support for Project Affected People	0.96	3.96
C Project Management	**10.93**	**9.23**
Total Baseline Cost (Subtotal A+B+C)	**94.17**	**323.33**
Physical Contingencies	4.47	3.00
Price Contingencies	2.44	29.48
Total PROJECT COSTS	**101.08**	**355.81**
Interest During Implementation 2%	2.19	5.47
Total Costs to be Financed	**103.27**	**361.27**

7.3 Cost Summary

Table 7-5 Total cost of BWDB Design - excluding financial contingencies (in million US$)

Tranche-2						
Sub project	**Work item**	**Length of works**	**Work details**	**Cost M USD**	**Dredging cost**	**Dredging share**
JRB 1	Benotia	3.5	RBP at bank	34.9	1.8	5%
	Shahjadpur	7.9	embankment	6.1	2.4	39%
JLB 2	US Chauhali	12	RBP at bank	119.7	6.7	6%
	Solimabad closure	1	dredging of main channel	33.4	33.4	1.0
	Solimabad protection	10.5	between bank and char	11.1	3.8	34%
PLB 1	Harirampur-Dohar	17.4	embankment	37.4	16.8	45%
Unallocated	Strengthening/ Adaptation	40	CC blocks and geobags	15.3	4.7	0.3
	Emergency	5.0	Emergency works	-	-	-
	Fish sanctuaries		Excavation of sanctuaries	2.2	2.2	100%
Total				**260.0**	**71.8**	**28%**
Other project cost				**63.3**	**0**	**0%**
Interest during implementation 2%				**5.5**	**1.4**	
Total project cost				**323.3**		
Contingencies				**3.0**		
Total cost				**331.80**	**73.2**	

7.4 Estimated Tranche-3 Work Components and Cost

Table 7-6 summarizes the work components and estimated cost for the Tranche-3 works.

Table 7-6 Indicative Tranche-3 work

Work items	Works	Indicative cost
Embankment	40 km	60.7
River bank protection	0 km new protection and 9 km wave protection	8.1
Strengthening/Adaptation and emergency	15 km	4.0

7.5 FRERMIP Cost Estimates as per Program Components

Costs amounts by component and Tranche are tabulated below, (NHC., 2013). The total cost of the FRERMIP project at US$ 676 million, represents less than 15% of the total cost of the River Stabilization Plan with estimated total costs in the order of US$ 4.6 billion, (NHC/EMM, November 2016).

Table 7-7 FRERMIP Program Cost and Funding by Tranche (PPTA 2013)

Component	Cost Amounts [a]				
	Tranche-1	Tranche-2	Tranche-3	Total	%
A. Institutional System for Flood and Riverbank Erosion Risk Management Strengthened	12.70	0.95	0.68	14.33	4.52%
1. Institutional Capacity for Sustainable River Management Strengthened	1.30	0.74	0.45	2.49	
2. Knowledge Base Developed	11.39	0.21	0.23	11.83	
B. Flood and Riverbank Erosion Risk Management Measures at Priority Reaches Implemented	70.54	111.44	93.27	275.25	86.91%
1. Infrastructure Improved	67.69	108.25	90.67	266.61	
2. Community-based Flood Risk Management Developed	1.58	1.76	1.76	5.10	
3. Participatory Regular Operation and Maintenance Developed	0.30	-	-	0.30	
4. Livelihood Support for Project Affected People Implemented	0.96	1.42	0.83	3.21	
C. Program Management Strengthened	10.93	10.28	5.92	27.13	8.57%
Total BASELINE COSTS [b]	**94.17**	**122.67**	**99.86**	**316.70**	**100%**
Physical Contingencies [c]	4.47	6.13	4.99	15.59	4.92%
Price Contingencies [c]	2.44	14.26	17.78	34.48	10.89%
Total PROJECT COSTS	101.08	143.06	122.63	366.77	
Interest During Implementation [d]	2.19	2.27	2.21	6.67	2%
Total Costs to be Financed	**103.27**	**145.33**	**124.84**	**373.44**	**117.81%**

[a.] Including taxes and duties of US$ 54.0 million to be financed by the government.
[b.] In mid-2013 prices.
[c.] Physical contingencies are computed at between 0% and 5%. Price contingencies computed on foreign exchange costs at 0% in year 1, 1.9% in year 2 and 1.8% thereafter, and on local currency cost at 0% in year 1, 6.5% in years 2 and 6.5% thereafter.
[d.] Includes interest computed at 2.0% per year.
Source: PPTA, Final Report 2013

Table 7-8 Updated FRERMIP Program Cost and Funding by Tranche

Detailed Categorization by Component	Tranche-1	Tranche-2	Tranche-3	Total
A Strengthening Institutional System for Flood and Riverbank Erosion Risk Management	**12.7**	**12.92**	**2.86**	**28.5**
A1 Institutional Capacity Strengthening for Sustainable River Management	1.3	2.43	1.26	**5.0**
A2 Knowledge-base Development	11.39	10.49	1.59	**23.5**
B Flood and Riverbank Erosion Risk Management Measures at Priority Reaches	**70.54**	**301.18**	**179.78**	**551.5**
B1 Infrastructure Improvement	67.69	295.77	174.62	**538.1**
B2 Community-based Flood Risk Management	1.58	1.05	0.96	**3.6**
B3 Participatory Regular O&M	0.3	0.36	0.33	**1.0**
B4 Livelihood Support for Project Affected People	0.96	3.96	3.87	**8.8**
C Project Management	**10.93**	**9.23**	**5.54**	**25.7**
Total Baseline Cost (Subtotal A+B+C)	**94.17**	**323.33**	**188.18**	**605.7**
Physical Contingencies	4.47	3.00	5.61	**13.1**
Price Contingencies	2.44	29.48	14.22	**46.1**
Total PROJECT COSTS	**101.08**	**355.81**	**208.01**	**664.9**
Interest During Implementation 2%	2.19	5.47	3.76	**11.4**
Total Costs to be Financed	**103.27**	**361.27**	**211.77**	**676.3**

8 ECONOMIC ANALYSIS AND RISK ASSESSMENT

8.1 Introduction

The main objectives of the economic assessment are to:

(i) Update and revise the economic analysis undertaken by the PPTA in 2013 [53] with respect to the assumptions for the three main benefit streams, i.e. avoided erosion losses, avoided flood losses and incremental agricultural benefits;

(ii) Identify additional benefit streams (such as char land reclamation) which are relevant to the shifting focus from passive riverbank protection works to more active river stabilization;

(iii) Estimate the economic benefits and costs of mitigating riverbank erosion, alleviating flooding, and developing char land at three priority sub-projects along the Jamuna and Padma rivers;

(iv) Assess the economic viability of investments being implemented under Tranche-1 and Tranche-2 of the ADB's Multi-tranche Financing Facility (MFF) (the Program).

Three priority sub-projects were included in the economic assessment, namely: (i) Jamuna Right Bank 1 (JRB-1), (ii) Jamuna Left Bank 2 (JLB-2); and (iii) Padma Left Bank 1 (PLB-1).

- Table 7-1 summarizes the main interventions (client preferred BWDB design) for each priority sub-project under Tranche-2 of the Multi-tranche Financing Facility (MFF). The river bank protection and embankment works constructed along the river reaches at JLB 1 (Chauhali) and PLB 1 (Harirampur) under Tranche-1 of the MFF are also presented.

8.2 Methodology and Key Parameters

In the economic analysis, an incremental approach was adopted which contrasts the "future with" and "future without" project interventions. The analysis evaluated the benefits and costs as well as the economic viability of proposed interventions, e.g. riverbank protection and flood embankments, for each of the three sub-project areas.

For each sub-project, economic viability is assessed by determining the following economic criteria: (i) economic internal rate of return (EIRR) and (ii) net present value (NPV). These economic criteria are also subjected to sensitivity analysis to evaluate the impact of changes in benefits and costs. Switching values are also calculated to estimate the percentage by which project benefits and costs would need to change to reach an EIRR of 12% and an NPV of zero.

The economic analysis uses the domestic price numeraire approach. All domestic financial prices were converted to economic prices by adjusting for transfer payments such as subsidies, taxes, import duty, and VAT. For non-traded local goods, a standard conversion factor (SCF) of 0.9 was used. Where appropriate, the prices of the main internationally traded commodities have been estimated according to import and export parity prices based on border equivalent values.

Other key features of the economic analysis methodology include:

(i) Economic life of the project is 30 years, so EIRRs and NPVs have been estimated on the basis of a 30-year incremental net benefit stream;

[53] Main River Flood and Bank Erosion Risk Management Program, Final Report, Annex G: Economic Assessment, December 2013 (Project Preparatory Technical Assistance 8054 BAN)

(ii) Constant 2017/18 prices have been used for both costs and benefits over the 30 year period, so price contingencies were omitted;

(iii) No residual value of capital investment has been assumed at the end of the period;

(iv) The financial price of unskilled labor engaged in project construction and in farming activities has been converted to an economic value by the application of a shadow wage rate factor (SWRF) of 0.85, while the SCF was applied to the price of skilled labour;

(v) Capital investment and O&M costs have been converted to economic values by the application of specific conversion factors. These are estimated on the basis of the proportions of foreign costs, labor, materials, and transport in financial prices and the application of conversion factors as appropriate (i.e. SCF or SWRF).

(vi) Tax and duty components of financial prices were omitted as they are transfer payments with no economic cost. Economic prices for foreign costs remained unchanged from their financial values; and

(vii) A discount rate of 12% (i.e. opportunity cost of capital in Bangladesh) has been used to estimate NPVs and is the cut-off rate against at which economic viability is assessed.

8.3 Economic Benefits

Economic benefits are expected to be derived from various sources depending on the type and scale of work undertaken in each sub-project area. The benefits of the interventions are both direct and indirect, and comprise: (i) reduction in land and assets lost to riverbank erosion, and (ii) mitigation of flood damages/losses and increased agricultural production, (iii) restoration of char land; (iv) improved road transport, and (v) enhanced navigation.

Riverbank Protection and River Stabilization

At Chauhali and Harirampur, land and settlements are now being protected from riverbank erosion by the revetment works which were built under Tranche-1 and it has been estimated that 1,440 hectares at JLB-2 (Chauhali) and 1,350 hectares of land at Harirampur (PLB-1) will be protected from bank erosion over the 30 year life of the project.

Under Tranche-2, it is estimated that the revetment works and channel closure at JLB-2 would protect a further 2,245 hectares of mainland along the Jamuna right bank, as well as 2,500 hectares of char land, during the project lifetime. Furthermore, the proposed 3.5 km of revetment at JRB-1 is expected to protect about 575 ha of mainland at Benotia.

The value of land and assets which will be saved from bank erosion were estimated at an average of BDT 4.57 million per hectare in PLB 1, BDT 6.18 million per hectare in JLB 2 and BDT 7.28 million per hectare for JRB-1. For charland areas protected from bank erosion at JLB-1, a land value of BDT 1.24 million per hectare was used.

Based on the NPV of annual benefits over a 30 year period, the economic benefits of mitigating riverbank erosion are shown in Table 4.2 and it can be seen that economic benefits from river bank protection works range from BDT 1,160 million at JRB-1 to BDT 6,800 million at JLB-2. While the economic benefits of the proposed river stabilization works at PLB-1 are estimated at BDT 1,889 million.

8.3.1.1 Flood Mitigation

It is estimated that an area of 25,000 hectares at JRB 1 and 12,000 hectares at PLB 1 would benefit from the construction of 28.9 km flood embankment at JRB-1 (under Tranche-1 and 2) and a 17.4 km flood embankment at PLB-1 (under Tranche-2). The economic benefits will be derived from: (i) reduced flood damage, and (ii) increased agricultural and fisheries production.

The proposed embankments are the same as the original project design, so the NPVs of the economic benefits from flood mitigation remain unchanged at BDT 12,431 million for JRB-1 and BDT 2,914 million for PLB-1 (Table 5.2).

8.3.1.2 Char land Development

The economic benefits of char land development will comprise: (i) increased agricultural, livestock and fisheries production, (ii) establishment of rural settlements including houses, shops, schools, health centres and community buildings as well as associated public infrastructure. It is anticipated that the 1,700 ha of char land will be developed at PLB 1 and 6,000 ha at JLB-2 in accordance with the original proposals. However, the development of the Central char at JRB-1 would not be implemented due to the continued risk of riverbank erosion.

The overall economic benefits from char land development at PLB-1 and JLB-2 are therefore assumed to remain the same as the original plan. Calculated on a net present value basis, the economic benefits are estimated at BDT 2,151 million for Solimabad and BDT 2,302 million for Harirampur (Table 4.2).

8.3.1.3 Road Transport

It is envisaged that roads would be constructed on the flood embankments at JRB-1 and PLB-1 following the completion of the embankment works. The design and construction of the roads would be the responsibility of LGED, so this is regarded as an indirect benefit of the project.

With respect to the economic benefits of embankment roads, the vehicle operating costs (VOC) approach (as recommended by the LGED guidelines, 1999) was adopted to determine the benefits of improved accessibility resulting from the construction of paved roads on embankments. The VOC approach is based on the estimated reduction in VOCs of motorized and non-motorized vehicles following the implementation of a road project.

The without project annual average daily traffic flow was estimated for the roads within close proximity of the planned embankment road. A traffic survey was undertake to count the following categories of vehicles: motorized vehicles (auto-rickshaw, taxi, car, motorcycle, pick-up, microbus, bus, minibus, truck, tractor); non-motorized vehicles (bicycle, bullock cart, rickshaw, rickshaw van); and pedestrians.

As the traffic counts were only conducted during the day time (once on a market day and once on a non-market day), the following assumptions were made to derive the annual average daily traffic (AADT). The day-time 12-hour data was converted to 24-hour data using factors of 30 % for night-time traffic on non-hat days and 45% for night-time traffic on hat days. The number of hat and non-hat days per week is assumed to be two and five, respectively. Furthermore, traffic during the wet season is assumed to be 20% less than in the dry season.

The economic benefits of road construction were then derived from: (i) existing traffic on nearby roads which will probably be diverted, and (ii) estimated increases in traffic volume generated by the new embankment road. In addition, an 8% annual increase in the traffic volume is assumed (based on a 5.5 % economic growth rate).

Based on the annual VOC savings, the results of this analysis indicated that the economic benefits from the construction of an embankment road would generate an NPV of BDT 804 million at PLB-1 and BDT 1,266 million at JRB-1, of which about 75% would be generated by existing traffic and 25% would be obtained from new traffic (Table 8-1).

8.3.1.4 Navigation

The bank protection works proposed are not expected to lead to the stabilisation of the Lower Jamuna river in order to facilitate navigation. Consequently, it has been assumed that there would be no economic benefits due to improved navigation.

8.3.1.5 Overall Economic Benefits

The incremental economic benefits from riverbank protection works, flood embankments and char development are combined together in Table 5.2 and it can be seen that total economic benefits are estimated at BDT 7.9 billion for PLB-1, BDT 8.95 billion for JLB-2 and BDT 14.86 billion for JRB-1.

Erosion mitigation makes a significant contribution to the economic benefits in JLB-2 (76%) and PLB-1 (24%). Flood mitigation provides the main benefit (83%) in JRB-1 and accounts 37% of the benefits in PLB-1. For the JLB-2 and PLB-1, char land development is also important and accounts for 24% and 29% of the economic benefits respectively. Improved transport also contributes 9% and 10% to the economic benefits in JRB-1 and PLB-1 respectively.

Table 8-1 Incremental Economic Benefits of Project Interventions

Project Intervention	JRB -1		JLB-2		PLB-1	
	Econ. Benefit (BDT M)	% of total	Econ. Benefit (BDT M)	% of total	Econ. Benefit (BDT M)	% of total
Riverbank protection	**1,160**	**8%**	**5,675**	**73%**	**1,889**	**24%**
Flood mitigation	**12,431**	**83%**	**0**	**0%**	**2,914**	**37%**
Reduced damage	*11,484*	77%	0	**0%**	*2,514*	32%
Incremental agriculture	*947*	6%	0	**0%**	*400*	5%
Char land development	**0**	**0%**	**2,151**	**27%**	**2,302**	**29%**
Agriculture	*0*	0%	*1,200*	15%	*635*	8%
Settlements	*0*	0%	*951*	12%	*1,667*	21%
Road Transport	**1,266**	**9%**	**0**	**0%**	**804**	**10%**
Navigation	**0**	**0%**	**0**	**0%**	**0**	**0%**
Total	**14,857**	**100%**	**7,826**	**100%**	**7,909**	**100%**

N.B. Economic benefits based on net present value (NPV) over 30 years discounted at 10% per annum.

8.3.1.6 Cost Estimates

The financial investment costs of interventions proposed for the design of Tranche-2 were combined with expenditure incurred under Tranche-1 in order to derive the total costs of Tranche-1 and 2 for each sub-project. The detailed financial costs are presented in A4.1: Feasibility Level Cost Estimates. The financial costs for Tranche-1 and 2 were then converted to economic values using economic conversion factors for foreign costs, local materials, skilled labour, unskilled labour,

machinery/transport and taxes/duties (Table 3.8). In addition to the economic costs of the project interventions under Tranche-1 and 2, the economic analysis also included the costs of constructing embankment roads at PLB 1 and JRB 1. With respect to agricultural development on the char lands, the costs of soil improvement measures were also included the investment costs at each location.

The total economic costs of the project interventions as well as associated agricultural and road developments amounted to BDT 9.35 billion (US$ 112.6 million) for JRB-1, BDT 14.40 billion (US$ 173.5 million) for JLB-2 and BDT 7.60 billion (US$ 91.6 million) as indicated in Table 8-2. The costs of bank protection works accounted for the largest proportion of base costs at JLB-2 (90%) and JRB-1 (33%). While bank protection works comprise 15% of total costs at PLB-1. The costs of flood embankments and land acquisition/resettlement accounted for the highest proportion of total costs at PLB-1 with 68%. Support and program management also represent a significant proportion of base costs with between 6% (PLB-1) and 15% (JRB-1).

- Annual operation and maintenance (O&M) costs as a percentage of capital costs have been estimated at the rates of 2% for riverbank protection works and 5% for flood embankments, roads and other structures (e.g. regulators).

Table 8-2 Economic Investment Costs for Tranche-1 and 2

Project Intervention	**JRB -1**		**JLB -2**		**PLB-1**	
	Econ. Cost (BDT M)	**% of total**	**Econ. Cost (BDT M)**	**% of total**	**Econ. Cost (BDT M)**	**% of total**
Land Acquisition/Resettlement	**2,076**	24.0%	**142**	1.1%	**2,322**	33.0%
Flood Embankment Works	**1,334**	15.4%			**2,484**	35.0%
Riverbank Protection Works	**2,834**	32.7%	**12,043**	90.3%	**1,057**	15.1%
Road Development	**725**	8.4%			**429**	6.1%
Soil Fertility Improvement	**0**	0.0%	**236**	1.8%	**79**	1.1%
Vehicles and Equipment	**8**	0.1%	**7**	0.1%	**5**	0.1%
Social & Environmental Mgt	**24**	0.3%	**24**	0.2%	**20**	0.3%
Sub-project Management	**43**	0.5%	**43**	0.3%	**32**	0.4%
Unallocated Protection Works	**250**	2.9%	**277**	2.1%	**170**	2.4%
Disaster Risk Management	**66**	0.8%	**25**	0.3%	**20**	0.3%
Support & Program Management	**1,294**	14.9%	**540**	4.1%	**422**	6.0%
Base Cost	**8,654**	100%	**13,337**	100%	**7,040**	100%
Physical Contingency	**692**		**1,067**		**563**	
Total Cost (BDT million)	**9,346**		**14,404**		**7,603**	
Total Cost (US$ million)	***112.6***		***173.5***		***91.6***	

Economic Viability of Tranche-1 and 2 Investments

The results of the economic analysis for Tranche-1 and 2 indicate an overall EIRR of 11.6% (see Table 8-3). This shows that the investments under Tranche-1 and Tranche-2 are economically viable for the overall project.

Table 8-3 Economic Viability of for Tranche-1 and 2 Investments

Investment Tranche	Overall	
	EIRR	NPV (BDT M)
Tranche-1	14.7%	3,361
Tranche-1 & 2	11.6%	2,899

8.4 Economic Analysis of Tranche-1, 2 and 3

Main Interventions

The following table summarises the main interventions of the design proposed for each sub-project area under Tranche-3 and it can be seen that a 40 km flood embankment would be built from Aricha to Chauhali to protect land within the JLB-2 and PLB-1 sub-project areas from flooding. In addition, 9 km of concrete blocks would be constructed on the bank protection works at PLB-1. No other bank protection works would be required at JLB-2 and JRB-1 as the works would have been completed under Tranche-2.

Table 8-4 Main Interventions at Priority Sub-projects under Tranche-3

Sub-project	River Bank Protection	Flood Embankment	Regulatory Structures
JRB-1	0 km	0 km	
JLB-2	0 km	40.0 km	5 Structures
PLB-1	9.0 km (cc blocks only)	0 km	
Total	9.0 km	40.0 km	

8.4.1.1 Economic Benefits

It is estimated that an area of 62,000 hectares at JLB 2 and 24,500 hectares at PLB 1 would benefit from the construction of a 40 km flood embankment at JLB-2. By applying the methodology used in the Tranche-1 and 2 analysis, the economic benefits of constructing a flood embankment between Aricha and Chauhali were estimated at BDT 22.7 billion at JLB-2 (see Table 8-5).

For the construction of a GFM on the revetment works a PLB-1, it has been assumed that the works would sustain the economic benefits of the bank protection works constructed under Tranche-1 and 2, so no additional benefits were included for the GFM work under Tranche-3 .

Overall, it can be seen from Table 8-5 that the incremental economic benefits of the project interventions under Tranche-1, 2 and 3 are expected to total BDT 14.86 billion at JRB-1, BDT 30.47 billion at JLB-2 and 9.70 billion at PLB-1.

8.4.1.2 Economic Costs

The total economic costs of the project interventions under Tranche-1, 2 and 3 amounted to BDT 9.35 billion (US$ 112.6 million) for JRB-1, BDT 20.76 billion (US$ 250.1 million) for JLB-2, and BDT 8.98 billion (US$ 108.2 million) for PLB-1 as indicated in Table 8-6.

The costs of bank stabilisation and dredging account for the largest proportion of base costs at JLB-2 (64%). While bank protection works comprised 33% at JRB-1 and 21% at PLB-1 respectively. Flood embankments, regulators/fish passes and roads also account for a high proportion of base costs at JRB-1 (24%) and PLB-1 (35%). Land acquisition and resettlement also represents between 24% (JRB-1) and 28% (PLB-1) of base costs.

Table 8-5 Economic Benefits of Interventions under Tranche-1, 2 and 3

Project Intervention	JRB -1		JLB-2		PLB-1	
	Econ. Benefit (BDT M)	% of total	Econ. Benefit (BDT M)	% of total	Econ. Benefit (BDT M)	% of total
Riverbank protection	**1,160**	**8%**	**5,675**	**19%**	**1,889**	**20%**
Flood mitigation	**12,431**	**83%**	**22,647**	**74%**	**4,709**	**48%**
Reduced damage	*11,484*	77%	20,749	68%	*3,910*	40%
Incremental agriculture	*947*	6%	1,898	6%	*799*	8%
Char land development	**0**	**0%**	**2,151**	**7%**	**2,302**	**24%**
Agriculture & Fisheries	*0*	0%	*1,200*	*4%*	*635*	7%
Settlements	*0*	0%	*951*	*3%*	*1,667*	17%
Road Transport	**1,266**	**9%**	**0**	**0%**	**804**	**8%**
Navigation	**0**	**0%**	**0**	**0%**	**0**	**0%**
Total	**14,857**	**100%**	**30,473**	**100%**	**9,704**	**100%**

N.B. Economic benefits based on net present value (NPV) over 30 years discounted at 10% per annum.

Table 8-6 Economic Investment Costs for Tranche-1, 2 and 3

Project Intervention	JRB -1		JLB -2		PLB-1	
	Econ. Cost (BDT M)	% of total	Econ. Cost (BDT M)	% of total	Econ. Cost (BDT M)	% of total
Land Acquisition/Resettlement	**2,076**	24.0%	**1,623**	8.6%	**2,322**	27.9%
Flood Embankment Works	**1,334**	15.4%	**4,029**	21.4%	**2,484**	29.9%
Riverbank Protection Works	**2,834**	32.7%	**12,043**	63.9%	**1,741**	21.0%
Road Development	**725**	8.4%			**429**	5.2%
Soil Fertility Improvement	**0**	0.0%	**236**	1.3%	**79**	0.9%
Vehicles and Equipment	**8**	0.1%	**7**	0.0%	**8**	0.1%
Social & Environmental Mgt	**24**	0.3%	**30**	0.2%	**24**	0.3%
Sub-project Management	**43**	0.5%	**60**	0.3%	**43**	0.5%
Unallocated Protection Works	**250**	2.9%	**431**	2.2%	**354**	4.3%
Disaster Risk Management	**66**	0.8%	**38**	0.2%	**43**	0.5%
Support & Program Management	**1,294**	14.9%	**728**	3.8%	**786**	9.5%
Base Cost	**8,654**	100%	**19,223**	100%	**8,313**	100%
Physical Contingency	**692**		**1,538**		**665**	
Total Cost (BDT million)	**9,346**		**20,761**		**8,978**	
Total Cost (US$ million)	***112.6***		***250.1***		***108.2***	

8.4.1.3 Economic Viability for Tranche-1, 2 and 3 Investments

By combining the economic benefits and costs of Tranche-3 works with the benefits and costs of Tranche-1 and Tranche-2 interventions, the economic viability of Tranche-1, 2 and 3 was

determined. The results of the economic analysis are presented in Table 8-7 and indicate that the EIRRs are 16.7% for JRB-1, 12.9% for JLB-2 and 17.6% for PBL-1. This clearly shows that the investments are economically viable for all three sub-projects and the overall EIRR for the MFF program is 14.9%.

Table 8-7 Economic Viability of Investments under Tranche-1, 2 and 3

Investment Tranche	JRB -1		JLB -2		PLB-1		Overall	
	EIRR	NPV (BDT M)	EIRR	NPV (BDT M)	EIRR	NPV (BDT M)	EIRR	NPV (BDT M)
Tranche-1, 2 & 3	16.7%	4,520	12.9%	3,768	17.6%	3,356	14.9%	11,644

9 BIBLIOGRAPHY

ADB. (2014a). *Facility Administration Manual. Multi-tranche Financial Facility - Flood and Riverbank Erosion Risk Management Investment Program.*

ADB. (2014c). *Report and Recommendation of the President to the Board of Directors. Proposed Multitranche Financing Facility, Peoples Republic of Bangladesh: Flood and Riverbank Erosion Risk Management Investment Program.*

ADB. (2014d). *Framework Financing Agreement.*

ADB. (June 2014). *Report and Recommendations of the President.*

ADB-GoB. (January 2018). *Resettlement Framework, FRERMIP, Project No. 44167-014.*

Best, J. (2019). Anthropogenic stresses on the world's big rivers. *nature geoscience*, 7-21.

BWDB. (2017, September 17). 3rd Technical Advisory Committee. *Meeting Minutes*. Dhaka, Bangladesh.

BWDB. (2018, October 8). Technical Committee. *Meeting Minutes*. Dhaka.

Collingridge, D. (1980). *The Social Control of Technology.* London: Frances Pinter Publisher.

Consultants, J. T. (2001). *Bank Protection and River Training (AFPM) Pilot Project FAP21/22 Final Project Evaluation Report .* Dhaka: Water Resources Planning Organization.

Gales, R. (1938). The Principles of River Training for Railway Bridges and their Application to the Case of the Hardinge Bridge over the Lower Ganges at Sara. *Institution of Civil Engineers (UK)*, p. Paper No. 5167.

GED; Bangladesh Planning Commission; GoB. (2018). *Bangladesh Delta Plan 2100.* Dhaka: General Economics Division, Bangladesh Planning Commission.

GoB. (2014). *Development Project Proforma, Flood and Erosion Risk Management Investment Program - Tranche 1.*

GoB, B. G. (2014). *Participatory Water Management Rules.*

Haasnoot, M., Kwakkel, J. H., Walker, W. E., & ter Maat, J. (2013). Dynamic adaptive policy pathways: A method for crefting robust decisions for a deeply uncertain world. *Global Environmental Change*, 485-498.

Halcrow. (1994). *River Training Studies of the Brahmaputra River, Final Report.* Dhaka: Bangladesh Water Development Board.

Hotopp, D. O. (2008). Scour development alongside riverbank proteciton in a braided river - selected cases from Bangladesh. *4th International Conference on Scour and Erosion.* Tokyo.

ISMPC. (2016). *Draft Preliminary River Management Master Plan.* NHC/EMM.

ISPMC. (2016). *Strategic Framework for River Stabilisation and Development: Jamuna-Padma and Dependent Areas.* NHC/ EMM.

Lauterjung, H., & Schmidt, G. (1989). *Planning of Water and Hydropower Intake Structures.* Eschborn: GTZ.

Maunsell|AECOM. (2011). *Padma Multi-purpose Bridge Design Report, River Training Works, Final Design Report.* Dhaka: Bangladesh Bridge Authority.

NHC. (2006a). *Jamuna-Meghna River Erosion Mitigation Project, Part B; Special Report 11 Physical Model Study (Vancouver, Canada) Final Report.* Dhaka: Bangladesh Water Development Board.

NHC. (2006b). *Jamuna-Meghna River Erosion Mitigation Project, Part B, Special Report 21 Site Data and Details of Work.* Dhaka: Bangladesh Water Development Board.

NHC. (December 2006a). *Jamuna-Meghna River Erosoin Mitiagation Project Part B, Special Report 21 Site Data and Details of Work.* Dhaka: Bangladesh Water Development Board.

NHC. (December 2006b). *Jamuna-Meghna River Erosion Mitigation Project Part B, Special Report 23 Design Brief for Riverbank Protectoin implemented under JMREMP (update).* Dhaka: Bangladesh Water Development Baord.

NHC. (May 2006). *Jamuna-Meghna River Erosion Mitigation Project Part B, Special Report 17 Geobag Revetments .* Dahak: Bangladesh Water Development Board.

NHC., i. a. (2013). *Main River Flood and Bank Erosion Risk Management Program, Final Report. PPTA.*

NHC/EMM. (2016). *Strategic Framework for River Stabilisation and Development: Jamuna-Padma and Dependent Areas.*

NHC/EMM. (2016a). *Inception Report.*

NHC/EMM. (2017). *Chauhali Interim Construction Completion Report, FRERMIP.*

NHC/EMM. (2018a). *draft Feasibility Report for Tanche-2.*

NHC/EMM. (February 2018). *Mid-Term Report, FRERMIP Tranche-1.*

NHC/EMM. (February 2018). *The FRERMIP Preliminary Regional Plan.*

NHC/EMM. (Februrary 2018). *Draft Preliminary Regional Plan, FREMIP.*

NHC/EMM. (July 2016). *Initial Environmental Examination (IEE) of River Stabilisation Works in Tranche-2 Sites.*

NHC/EMM. (June 2016). *Technical Note 9. Planning the Use of Stabilised and Reclaimed Land, Procedure and Issues.*

NHC/EMM. (May 2017). *Site Selection and Initial Economic Assessment.*

NHC/EMM. (May 2017). *Strategic Framework for River Stabilization and Development: Jamuna-Padma and Dependent Areas.*

NHC/EMM. (November 2016). *Strategic Framework for River Stabilisation, FREMIP.*

NHC/EMM. (November 2017). *Environmenal Impact Assessment, Tranche-2.*

NHC/EMM. (November 2017). *Summary River Stabilisation Plan for Jamuna and Padma Rivers in Bangladesh.*

NHC/EMM. (September 2018). *Strategic Environmental and Social Assessment (SESA) of River Stabilisation.*

NHC/EMM. (updated February 2018). *Environmental Impact Assessment, Tranche 2.*

NHC/RPMC. (2015). *Small Scale Water Resources Development Project, Project Completion Report, JICA.*

Oberhagemann, K., & Al-Kamal, S. (19 to 21 October 2004). Geobag Protection in Bangladesh . *4th International Conference on Filters and Drainage in Geotechnical and Environmental Engineering.* Stellenbosch, South Africa.
Oberhagemann, K., & Haque, A. A. (2016). Development of Low Cost Riverbank Protection in Bangladesh. *8th International Conference on Scour and Erosion.* Oxford.
Oberhagemann, K., & Hossain, M. (2010). Geotextile bag revetments for large rivers in Bangladesh. *Geotextiles and Geomembranes*.
Oberhagemann, K., Diggelmann, P., & Mukhles-uz-zaman. (2008). Understanding Falling Aprons - Experience from the Lower Brahmaputra / Jamuna River. *4th International Conference on Scour and Erosion.* Tokyo.
Planning Commission, G. (August 2015). *Bangladesh Delta Plan 2100: Water Resources.*
Planning Commission, G. (September 2015). *Bangladesh Delta Plan 2011: Agriculture and Food Security.*
Ragsdale, e. (2008). *Involuntary Meets Disaster Mitigation Resettlement: A Case Study from Erosion Mitigation on the Lower Brahmaputra/Jamuna River in Bangladesh.* Memphis: The Society for Applied Anthropology.
RRI. (2016, September). Investigation on launching characteristics of different materials to find out the cost-effective and sustainable solution for river bank protection. *Repert No. 01/2014-2016*. Faridpur, Bangladesh.
Thiel, B. (2002). *Behaviour of a falling apron made from 'poorly sorted' material.* Delft: Delft University.
Thompson, A., Oberhagemann, K., She, Y., & Haque, A. (2018). The behavior of self-launching geotextile bag aprons - latest investigatios from the Lower Brahmaputra in Bangladesh. *The 9th International Conference on Scour and Erosion. Taipei,China*: ICSE.
US Army Corps of Engineers, U. (1991). *Engineering Manual 1110-1601.*
van der Hoeven, M. (2002). *Behaviour of a falling apron.* Delft: Delft University.

LIST OF APPENDICES

APPENDIX A

DESIGN AND MONITORING FRAMEWORK FOR TRANCHE-2

FRERMIP PROGRAM DESIGN AND MONITORING FRAMEWORK (ADB, 2014a) **WITH UPDATES**

Design Summary	Original Performance Target	Revised Targets/ Comments
Impact Improved livelihoods in project area	By 2028 in program districts: • Monsoon crop average yields increased to 3.75 t/ha (2.75 t/ha in 2013) • Average annual per capita income increased to Tk136,000 (Tk 74,380/capita in 2012)	By **2029** in program districts: • Monsoon crop average yields increased to 3.75 t/ha (2.75 t/ha in 2013) • Average annual per capita income increased to Tk136,000 (Tk 74,380/capita in 2012)
Outcome Reduced flood and riverbank erosion risks in the subproject areas	By 2023: • 122,000 ha of land protected from inundation damages (baseline = 0) • About 2 million of population protected from inundation damages (baseline = 0) • 461 ha of lands with assets protected from bank erosion (43 ha in 2013)	By **2024**: • **75,000 ha** of land protected from inundation damages (baseline = 0) • About 2 million of population protected **directly or indirectly** from inundation damages (baseline = 0) • **4600** ha of lands with assets protected from bank erosion (43 ha in 2013)
Outputs 1. Flood and riverbank erosion risk mitigation functioning at priority reaches	By 2023 in subproject areas: • 60 km of riverbank protected by applying appropriate technology and methodology (baseline =10 km) • 89 km of climate-resilient flood embankment constructed, rehabilitated, or upgraded against 100-year probable floods (baseline = 0 km in good condition • 66 km of paved roads on embankments (baseline = 0) • 8 regulators and other hydraulic structures installed (baseline = 0) • 200 community-based disaster management units operate disaster-resilience action plan against flood and erosion disasters, with a minimum of 33% of units led by women (baseline = 0) • 11 community groups, with at least 50% women participants, operate livelihood support programs (baseline = 0)	By **2024** in subproject areas: • 60 km of riverbank protected by applying appropriate technology and methodology (baseline =10 km) • **87 km of flood embankment with 65km climate-resilient** constructed, rehabilitated, or upgraded against 100-year probable floods (baseline = 0 km in good condition • 66 km of paved roads on embankments **considered by other agencies** (baseline = 0) • **15** regulators and other hydraulic structures installed (baseline = 0) • 200 community-based disaster management units operate disaster-resilience action plan against flood and erosion disasters, with a minimum of 33% of units led by women (baseline = 0) • 11 community groups, with at least 50% women participants, operate livelihood support programs (baseline = 0)
2. Strengthened Institutional system for flood and riverbank erosion risk management	• MIS for flood and riverbank erosion, with sex-disaggregated data, developed and operated by BWDB by 2021 • 5-year budgetary plan for riverbank protection O&M and emergency work	• MIS for flood and riverbank erosion, with sex-disaggregated data, developed and operated by BWDB by 2021 • 5-year budgetary plan for riverbank protection O&M and emergency

	for the main rivers endorsed by BWDB by 2018 • Long-term strategic river stabilization plan taking climate change impact into account, endorsed by BWDB by 2016 • BWDB project website containing database of flood and river survey and knowledge products by 2023	work for the main rivers endorsed by BWDB by 2018 • Long-term strategic river stabilization plan taking climate change impact into account, endorsed by BWDB by **2017** • BWDB project website containing database of flood and river survey and knowledge products by 2023
3. Operational program Management system	Outputs completed on time within budget	Outputs completed on time within budget
Activities with Milestones		**Current status/ comments**
1. Flood and riverbank erosion risk mitigation functioning at priority reaches *1.1 Infrastructure improvement* 1.1.1 Complete land acquisition (2016, 2018, and 2021) 1.1.2 Complete construction works of structural measures (June 2023) *1.2 Community-based flood risk management* 1.2.1 Engage NGO, and develop project-specific methodologies and instructions for implementation NGOs 1.2.2 Formulate community disaster management units with necessary training (December 2022) *1.3 Community capacity enhancement for participatory regular O&M* 1.3.1 Complete awareness campaign and training (December 2022) *1.4 Livelihood support for project-affected people (June 2023)*		• The start-up delay of one year indicates a shift of deadlines by one year. • Additional resettlement is required particularly at Chauhali, to flatten riverbank slopes above water. Resettlement costs keep increasing, in part due to September 2017 Land Acquisition Act under which compensation for land is set at 3 times the land price (up from 1.5 previously). • Construction of structural measures is proceeding well, except for paved roads which are to be provided by others (LGED/ DRH). • NGO has yet to be engaged/ start work for community based flood risk management. • Community participatory O&M has yet to start, but piloting is planned. • Livelihood support has been postponed to Tranche-2
2. Strengthened institutional system for flood and riverbank erosion risk management *2.1 BWDB institutional capacity strengthening for river management and sustainable asset management* 2.1.1 Conduct training for BWDB staff in river management, and O&M (January 2015–2022). 2.1.2 Support initial setup of Office of Chief Engineer (River Management) (2014–2023). 2.1.3 Develop flood MIS project management module by December 2016, asset inventory by 2016, followed by O&M module by 2018. 2.1.4 Conduct annual workshops for information sharing, inviting other agencies (2015–2023).		• Various trainings have been provided to BWDB staff including study tours. • Many of the sanctioned posts for the office of the Chief Engineer (River Management) are not yet filled. • Dedicated/ specialist design cell for river training and bank protection design work remains to be set up. • MIS system for project/ program management is developed and being used to inform reporting and progress. Designs and ToRs for: (i) a risk based O&M management database, and (ii) an ADP MIS database, have been prepared, taking into account various existing databases. These are to be piloted, and the rolled out under Tranche-2. • 3 annual workshops have been held.

2.2 Data and knowledge base development 2.2.1 Complete studies and preliminary river master planning for long-term strategic river management (June 2016). 2.2.2 Complete land recovery and river training piloting (April 2014–June 2021). 2.2.3 Conduct flood and river surveys (June 2015–June 2023) and establish improved flood and river survey database (December 2017). 2.2.4 Update existing short-term erosion prediction model (September 2016) and guidelines for riverbank protection works (December 2022).	• Studies and preliminary regional (master) plan prepared, and also river stabilisation plan. • Various pilots planned under remaining years of Tranche-1, including grout filled mattress, use of grasses (vetiver) for land recovery/ stabilisation. • Multibeam underwater surveys have been carried out; piloting of sediment monitoring and database planned. • Erosion prediction model being updated (CEGIS).
3. Operational program management systems *3.1 Engage institutional strengthening and project management consultant (2014, 2017, and 2020)* *3.2 Loan processing of Tranche-2 (signed in 2017), and of Tranche-3 (to be signed in 2020)*	• ISPMC for Tranche-1 were engaged in September 2015. • Tranche-2 loan is expected to be processed and signed in October 2018.

SUGGESTED TRANCHE-2 DMF TO JUNE 2022

Design Summary	Performance Targets and Indicators with Baselines	Data Sources and Reporting Mechanisms	Assumptions and Risks
Impact	Not applicable		
Outcome Reduced vulnerability against flood and riverbank erosion risks in the subproject reaches and char land reclamation	By 2023 in subproject areas: 30,000 ha of main land protected from extreme flooding, About 1 million people directly or indirectly protected from extreme flooding (in JLB-1 and PLB-1) 3,000 ha of land protected from erosion and loss (43 ha from existing JMREMP work in 2013). 6,500 ha of char land recovered from the river for development.	Districts' flood damage records BWDB's dry season satellite image analysis (outsourced to CEGIS)	**Assumptions** • BWDB allocates adequate O&M budget **Risks** • Floods exceed design return periods • River morphological change exceeds the planned range
Outputs 1. Improved flood and riverbank erosion risk mitigation measures at priority reaches.	By 2022 in subproject areas: 41.8 km (17.8 from Tr-1 and 23.5 from Tr-2) of riverbank protection constructed applying appropriate technology and methodology. Flow redistribution work chokes 15km of Solimabad channel for development (baseline = 0 km)	BWDB project progress and completion reports	**Risks** • Delay in land acquisition by Deputy Commissioner • Delay in tendering and construction of works • Quality of construction works

Flood and Riverbank Erosion Risk Management Investment Program

Design Summary	Performance Targets and Indicators with Baselines	Data Sources and Reporting Mechanisms	Assumptions and Risks
1.1 Structural Works Component	40km of strengthening/ adaptation works implemented (baseline =0)		• Failure to implement repair and strengthening/ adaptation works in the year(s) following construction of primary bank protection • Failure to carryout regular O&M
	46.8 km (21.3 Tr-1 and 25.5 Tr-2) of flood embankment constructed (baseline= 0 km) 9 regulators/ fish passes constructed (baseline=0)	BWDB project progress and completion reports BWDB project progress and completion reports	
1.2 Non-Structural Component	100 community-based disaster management units operate disaster-resilience action plan against flood and erosion disasters with minimum 50% of units led by women (baseline=0)	Implementation NGO's reports BWDB project progress reports	• Cooperation between PMO-BWDB and PMU-DMM • Interest of local persons living on/ near the river bank
	10 WMOs/ community organisations set up and active in participating regular O&M works,	Implementation NGO's reports BWDB project progress reports	• WMOs/ community organisations can be registered and mechanism is in place for participation in regular O&M • Provision of support to APs following livelihood training.
	2,000 affected persons attend on-site 1-day trainings, and about 800 persons attend 2-5 day residential trainings to support livelihood enhancement activities. Half of the trainees shall be women. Also 12 fish sanctuaries established. (baseline=0)	Implementation NGO's reports BWDB project progress reports	
2. Strengthened institutional systems for flood and riverbank erosion risk management 2.1 Institutional Capacity	Office of the CE-River Management established, staff trained and office operational	BWDB project progress reports	• CE-WM office has support from MoWR-BWDB with operating budget.
	Information and management systems including: (i) Project Website and Database with sex-disaggregated data as appropriate in use, (ii) Asset web-based database developed and piloted, (iii) ADB/ Smart Project Monitoring and Management Information System (SPMMIS) database refined and piloted.	BWDB project progress reports	• Cooperation with others concerned with database development. • Support from BWDB and agreement on database design and rollout. • Staff have access and use data base
	5-year budgetary plan for riverbank protection O&M and	BWDB's annual budgetary plan	• Support for more flexible funding for O&M of bank protection works

Design Summary	Performance Targets and Indicators with Baselines	Data Sources and Reporting Mechanisms	Assumptions and Risks
	emergency work for the main rivers endorsed by BWDB	BWDB's construction material stockade plan	
2.2 Data and Knowledge base	Long-term river stabilization and river management master plans finalised/ refined (including for char lands development), endorsed by BWDB and used for planning projects	BWDB project reports	• Approval of RSP and River Management Master Plans including char lands development plans
	Studies to add to quality of planning and design guidelines for river bank protection and river training, distributaries flows and management, land reclamation and development, modernisation of agriculture, and also concerning fisheries, resettlement and the environment. Pilots focussing on core program activities, river management and training and bank protection.	BWDB project reports	• Support for studies and pilots
	Flood and river surveys carried out each year with data entered into web-based database	BWDB project reports	• Support for comprehensive annual surveys
3. Program management systems operational	Tranche-2 outputs completed on time within budget	BWDB project progress and completion report	

Activities with Milestones	Inputs ($ million)
1. Flood and riverbank erosion risk mitigation measures at priority reaches	
1.1 Infrastructure improvement (1) Complete land acquisition (June 2019) (2) Complete construction works of structural measures (June 2022)	ADB (loan): 135 GoB 223 Netherlands(grant): 3 **Total 207**
1.2A Community-based flood risk management (1) Engage NGO and refine methodologies and guidelines (by April 2019) (2) Form community disaster management units, with necessary training in subproject areas (June 2021)	
1.2B Regional flood risk management (1) Refine and disseminate flood response plan	
1.3 Community capacity enhancement for participatory regular O&M (1) Prepare strategy and plan (April 2019) (2) Form, register and train WMOs/ groups in subproject areas (May 2019-June 2022)	

Activities with Milestones	Inputs ($ million)
(3) WMOs/ groups carrying out regular O&M (June 2021 to June 2022) 1.4 Livelihood support for project affected people in subproject areas (1) Identify APs, suitable livelihood support activities and interest (April 2019) (2) Establish fish sanctuaries, 12 No. (June 2020 – June 2022) (3) Contracted agencies/ NGOs/ others implement livelihood trainings and support (May 2019 – June 2022) **2. Strengthening institutional system for flood and riverbank erosion risk management** 2.1 BWDB institutional capacity strengthening for river management and sustainable asset management (1) Conduct training for BWDB staff with focus on staff for office CE-River Management, in design of river and flood protection works, river management and O&M (May 2019 – June 2022) (2) Support CE River Management office (Oct 2018 – June 2022) (3) Develop, test and rollout MISs: (i) Project Website and Database, (ii) Asset web-based database, and (iii) ADB/ Smart Project Monitoring and Management Information System database (Oct 2018 – June 2022) (4) Conduct annual workshops for information sharing inviting other agencies (2019 – 2022) 2.2 Data and knowledge base development (1) Refine the long-term river stabilization and river management master plans prepared in Tranche-1, including for char lands development, and present to BWDB and department/ agencies of other Ministries for wider adoption in project planning (2019-2020) (2) Undertake studies to add to quality of planning and design guidelines covering: (i) river management, river training and bank protection, (ii) distributary flows and rehabilitation, (iii) land reclamation and development, (iii) modernisation of agriculture (May 2019 – June 2022), (iv) fishery development, and (v) resettlement and environment impact. (3) Extend/ refine pilots started in Tranch-1, i.e. concerning grout-filled mattresses, vegetative protection using katkin/ vetiver grasses for flood embankments, river bank slopes and for reclaimed land, and morpho-hydraulic design for distributary off take(s). (4) Conduct flood and river surveys and also distributary surveys, and enter data into web-based (project) database (2019 – 2022) **3. Program management** (1) Loan processing of Tranche-2 (sign in October 2018). (2) Implementation Arrangements reconfirmed, with institutional set up extended and revised with PMO as part of office of CE-River Management (by October 2018). (3) Engage/ extend services Institutional Strengthening and Project Management Consultant, ISPMC (January 2019). (4) Planning of tasks/ activities.	

Activities with Milestones	Inputs ($ million)
(5) Timely procurement and supervision of works carried out by contractors. (6) Timely procurement and management of services to be delivered by 3rd party firms and NGOs. (7) Coordination with Partner Agencies: BWDB-DDM-DC, etc. (8) Management and use of MIS systems and databases. (9) Activity and progress monitoring and timely and quality reporting. (10) Preparation of documents required for Tranche-3, including feasibility and safeguards, DPP and loan documents.	

ADB = Asian Development Bank, BBS = Bangladesh Bureau of Statistics, BWDB = Bangladesh Water Development Board, CE = Chief Engineer, DAE = Department of Agriculture Extension, DAM = Department of Agricultural Marketing, DDM = Department of Disaster Management, ha = hectare, ISPMC = Institutional Strengthening and Project Management Consultant, MIS = management information system, NGO = nongovernment organization, O&M = operation and maintenance.

1 Review Context for the Design and Monitoring Framework

1.1 Reviewed Impacts, Assumptions and Risks

The currently stated Impact of FRERMIP is for improved livelihoods by 2028. This Impact as stated in the Design and Monitoring Framework (DMF) of the Financing Framework Agreement (FFA) and agreed between Government and ADB, remains valid.

Assumptions and risk may consider additional Government priorities and past flood developments. More recently Government has shifted towards consideration of a more comprehensive role for the major rivers in Bangladesh's development as a middle income country, relevant to the assumptions of the DMF. While government continues to attach high priority to flood and riverbank erosion protection, it looks now at a broader set of benefit streams, including:

(i) The stabilization and development of some 150,000 hectares of floodplain lost during the widening process of the Jamuna from the early 1970s until 2000s, which the river stabilization plan (NHC/EMM, Strategic Framework for River Stabilisation and Development: Jamuna-Padma and Dependent Areas, 2016) suggests can be recovered from the river;

(ii) Improved navigation along the substantially stabilized river corridor of the Padma and Jamuna, often referred to as restoring navigation; and

(iii) Stable dry season flow in the distributaries of the North-central Zone, particularly the Old Brahmaputra and Dhaleswari River System.

With respect to the Outcome risks stated in the DMF, both the 2016 and 2017 flood seasons were high causing larger than average morphological changes. Compounded by a one-year construction delay, the river morphology has changed from the assumptions during the project preparatory study in 2012/13 to an extent that requires an adjustment of the construction program as indicated in the "Site Selection and Initial Economic Assessment" report (NHC/EMM, May 2017) and agreed between Government and ADB during the July and December 2017 Consultation Missions[54], as well as

[54] Aide Memoires of Consultation Mission 23 – 30 July 2017 and Aide Memoire of Consultation Mission 26 November – 1 December 2017

accepted by the Technical Advisory Committee meeting chaired by the Chief Planning on 17 September 2017.

The Design and Monitoring Framework as per Facilities Administration Memorandum (ADB, 2014a) is summarised in Appendix A for the original performance targets, and with revised targets and comments. In addition, a draft DMF for Tranche-2 is provided. Some changes are envisaged, based on reassessment of benefits, lessons, performance under Tranche-1 and reassessment of priorities for Tranches-2 and -3, see Chapter 1. For example:

(i) Adjust the end date to August 2024 to cope with river changes and an initial one-year delay.

(ii) Adjustment to lengths of new erosion protection and flood embankment in different tranches.

(iii) Introduction of innovative technologies, originating from Tranche-1 piloting (grout-filled jut mattresses for permanent wave protection and reed plantation for char land build-up) and introduced during Tranche-2 for river training purposes (specifically flow redistribution and char development by dredging a pilot channel in extension of the channel pattern as per river stabilization plan and using the dredge material for “choking” an eroding bankline channel and building-up the land for future use).

1.2 Reviewed Outcomes – Flood Reduction and Benefitted Population

The currently stated outcomes of FRERMIP focus on reduced flood and river bank erosion risks, with 122,000 ha of land protected from flooding by 2023 (i.e. 49.3% of the total area of JRB1, JLB2 and PLB1), benefitting some 2 million people (some 70% of the population in the priority subprojects), and 460 ha of land with assets protected from bank erosion, up from 43 ha in 2013, (ADB, 2014c). The first two are correlated with the large area impact of flooding. The provided outcomes have been reviewed during the preparation of this updated feasibility study.

The ISPMC has conducted extensive flood modelling to reassess the flood benefits and the total area potentially benefitted. This flood modelling departs from the historic model approach of flooding the floodplain in parallel with the water level increase in the main rivers, established through one dimensional model runs. Historic modelling was typically based on the floodplain topography of the 1964 irrigation maps converted to a digital elevation model with one elevation point for each 300x300m parcel. During the PPTA (NHC., 2013) this historic modelling approach was improved by calibrating the typically overestimated flooded areas against observed flood season inundation areas, derived from RADARSAT satellite imagery. For this study, the flood model has been rebuilt from scratch, using the latest available, complete river cross section for both main river (2013 and 2017) and interior river systems, and, more importantly, an updated digital terrain model derived from NASA’s Shuttle Radar Topography Mission which was flown in February 2000. Recognizing that the floodplain of Bangladesh today is highly fractured through the ever increasing network of highways and local roads, we have conducted an extensive (1300km) survey of the main road network alongside the main rivers at the end of 2017 to establish their locations and crest levels. This road network impacts on the flood patterns, as it retains lower floods but often is overtopped and partly destroyed during higher floods[55]. In addition, the flood modelling has abandoned the earlier approach of replicating observed flood hydrographs, for synthetic hydrographs corresponding

[55] In future the extension of the road network including existing drainage structures would contribute to the development of 2-D flood models that can predict flooding and drainage patterns and help the local population to better plan cropping patterns but also plan for disaster.

with a defined return period. For the computations the both the 1998 and the latest 2017 hydrograph have been applied, scaled to the discharges of the different design events (from 2 to 200-year flood). The results presented in the following are based on the most recent 2017 flood characteristics.

Through some 160 flood model runs for different scenarios, the flood impacts for different development phases could be established:

(i) The scenarios for the combined impact after T-1 + T-2, after T-3, and after T-4 (the implementation of the full embankments in line with the river stabilization plan).

(ii) The return periods of 2, 20, 50, 100, 200, and 500 years, acknowledging the recently increased design water level to a 200-year flood and the need to check the river stabilization plan against a future very high event.

(iii) Different scenarios for distributary closure. While the PPTA assumed that both the Ghior Khal, or Old Dhaleswari, and the Dhaleswari would be equipped with flood barriers at the end of Tranche-3, this assumption has been updated to the Old Dhaleswari only. The reason is that the main channel downstream of Bangabandhu (Jamuna) Bridge has been destabilized and turned from a predictable straight channel into a curved channel with the Dhaleswari now taking off from the outer bend. While this is a positive development in terms of long-term offtake stabilization, it remains unclear how far the bend will develop before it gets stabilized and the offtake finally formed. After Tranche-4, all distributaries will be equipped with flood barriers, including the Old Brahmaputra, and downstream of Bangabandhu (Jamuna) Bridge the Pungli, Dhaleswari and Old Dhaleswari.

The following tables and graphs present two results:

(i) Total flood protected areas (Table A-1 and Figure A-1)

(ii) F0 and F1 land changes (Table A-2 and Figure A-2), in line with the key benefit assumptions of the PPTA.

Table A-1 Summary flood free areas (note that T-1 + T-3 and T-3 are limited to the priority subprojects JRB-1, JLB-2, and PLB-1) (in ha)

Scenario	2-years	20-years	50-years	100-years	200-years
T-1+T-2	5,698	19,438	14,237	11,604	10,688
T-3	23,847	77,234	62,127	59,684	60,272
T-4	146,617	267,058	380,138	482,812	554,618

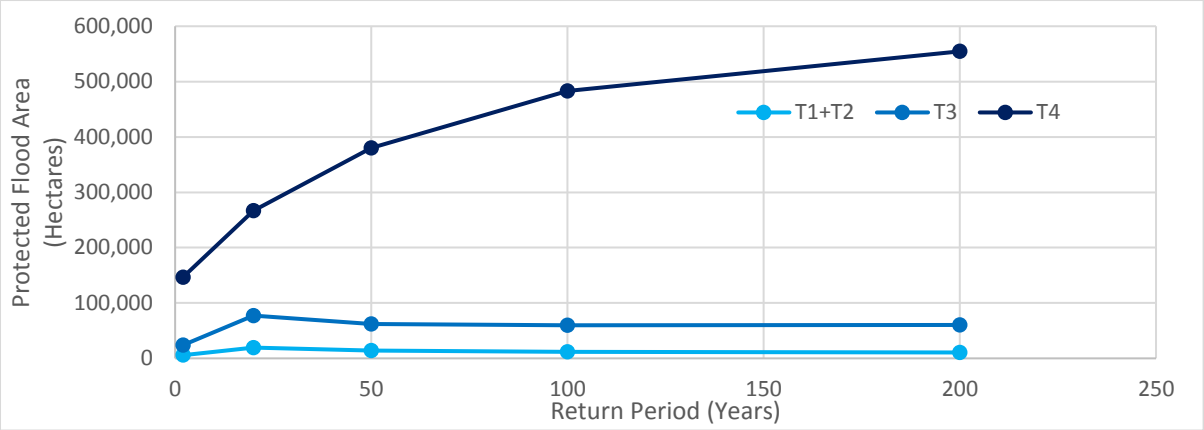


Figure A-1 Total flood protected area for the three priority subprojects (JRB-1, JLB-2, and PLB-1) and different project scenarios and return periods

Table A-2 Summary F0 and F1 land increase (note that T-1 + T-3 and T-3 are limited to the priority subprojects JRB-1, JLB-2, and PLB-1)

Scenario	2-years	20-years	50-years	100-years	200-years
Base Case (total flood free area)	94,209	79,425	69,605	66,927	63,287
T-1+T-2	968	2,255	1,632	1,141	197
T-3	2,497	5,842	10,789	6,357	5,408
T-4	5,756	12,895	14,394	20,030	24,249

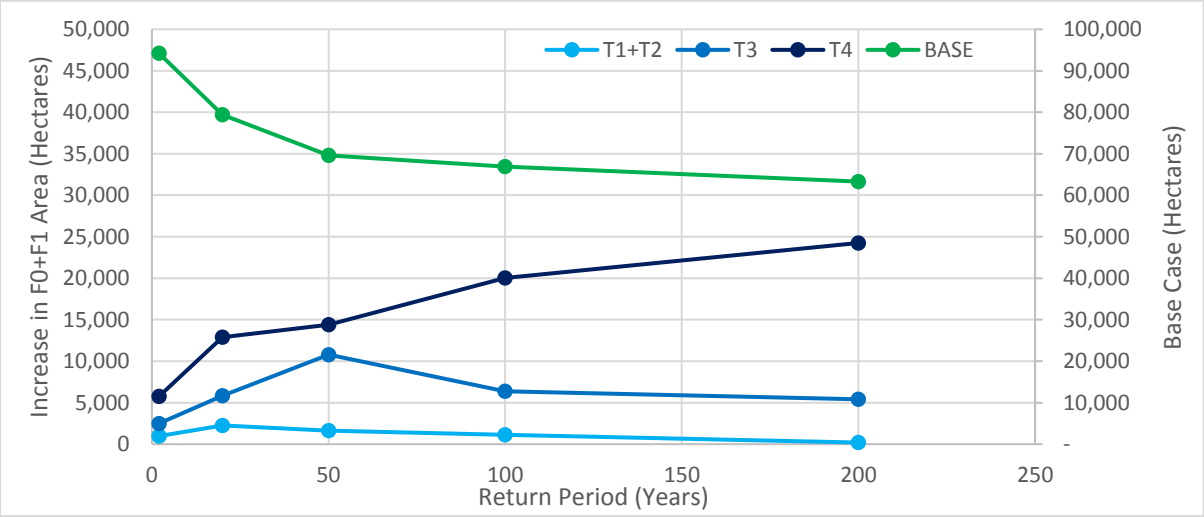


Figure A-2 FO and F1 land – total per priority subprojects (JRB-1, JLB-2, and PLB-1) and changes for different project scenarios and return periods

The PPTA study provides key information on the improvements after project implementation Table A-3). It identified a total increase in F0 and F1 land after Tranche-3 of some 56,000ha for the 2007 moderate flood condition (estimated return period: 20 years). Translating this improvement to the total benefitted area, results in some 830,000 people benefitted, as per 2011 census survey used during the 2012/13 PPTA. For 2024, applying the predicted population increase of the country (Table A-4), roughly 950,000 persons will be benefitted.

Table A-3 Key area information from the PPTA study** (NHC., 2013), **2007 flood condition

Area Classification (ha)	JRB-1	JLB-2	PLB-1	Total

Total area (adjusted project area - APA)	41,067	82,927	52,070	176,064
Net Cultivable Area	30,000	61,740	36,643	128,383
NCA percentage of APA				
F0 + F1 land (without project)	8,299	17,095	14,563	39,957
F0 + F1 land (with project)	15,958	51,619	28,954	96,531
F0+F1 land (improvement)	7,659	34,524	14,391	56,574
Total flooded cultivable area (without project)	22,581	47,844	22,788	93,213
Total flooded cultivable area (with project)	17,568	21,078	13,356	52,002
Cultivable area not flooded with project (2007)	-5,013	-26,766	-9,432	-41,211
Percentage of NCA flooded (2007)	-17%	75%	46%	
Area improvement of total APA	6,862	35,951	13,403	**56,216**
Population density (2011)	2,370	1,340	1,400	
Total population benefitted as per 2011 data	162,636	481,745	187,641	832,023
Population density in 2024 (see Table A-4)	2715	1535	1604	
Total population benefitted as per 2024 extrapolation	186,327	551,920	214,974	**953,221**

Table A-4 Predicted population growth

Year	total population (million)	annual change (%)	JRB-1	JLB-2	PLB-1
2011	152.86		2370	1340	1400
2012	154.7	1.19%	2398	1356	1417
2013	156.6	1.21%	2427	1372	1434
2014	158.22	1.02%	2452	1386	1449
2015	159.86	1.03%	2477	1401	1463
2016	161.51	1.02%	2503	1415	1478
2017	163.19	1.03%	2528	1430	1494
2018	164.88	1.02%	2554	1444	1509
2019	166.59	1.03%	2581	1459	1524
2020	168.31	1.02%	2607	1474	1540
2021	170.06	1.03%	2634	1489	1556
2022	171.82	1.02%	2661	1504	1572
2023		1.02%	2688	1520	1588
2024		1.02%	2715	1535	1604

The comparison of the refined flood modelling results[56] with the PPTA approach (Table A-5) reveals quite a difference between that the order of magnitude of the benefitted area after Tranche-3, an increase to some 75,000ha (from 56,000ha) for the 20-year flood could be justified. The 20-year flood has a higher than three quarter probability of exceedance during the 30-year lifetime of the project (Table 2-2). Selecting a flood of higher return period would not be justified due to the lower aggregate risk of exceedance during the 30-year lifetime and consequently a potential overestimation of economic returns. In summary and in line with the flood modelling results, we recommend updating the outputs from 122,000 ha of land protected from flooding by 2023, to 75,000ha of land protected from flooding. The number of people benefitted is some 950,000 people directly. Indirectly benefitting are: (i) people on chars from char land development (10,000 ha with potentially 50,000 people at a population density of 500/km²), (ii) labour employed in construction works during economic development of the area, and (iii) people indirectly affected by flooding due

[56] Climate change is part of Climate Risk and Vulnerability Assessment.

the disruption to transport network, access to schools, hospitals etc. in the rest of the subproject areas, but also outside. The assumption could be that one third of the total subproject population could be benefitted indirectly[57] and consequently the total would amount to 2million.

Table A-5 Comparison of benefited areas (in hectares): PPTA vs. new flood modelling

Scenario	PPTA 2007 (20-year)	20-year return period[58]	100-year return period	200-year return period
T1 + T2		19,438	11,604	10,688
T3	56,216	77,234	59,684	60,272
T4		267,058	482,812	554,618

We recognize that during intermediate implementation stages, higher flood levels could occur in bordering areas. The partly completed embankment lines could increase the water levels to some extent particularly during very high floods. (Table A-6 and Figure A-3) provide details. While this sound worrying, the overall risk of actually occurring is rather low, given that the river stabilization plan is scheduled for systematic and continuous implementation over a period of some 15 years and that the embankment gaps will exist only for few years at a time. During these few years the occurrence of a 100- or even 200-year flood event is very unlikely (for details also refer to Table 2-2).

Table A-6 Flood area changes for different development stages and return periods

Intervention	Return Period (years)	VALUE1=DRIER (ha)	VALUE2 = NO CHANGE (ha)	VALUE3 = WETTER (ha)	TOTAL AREA (ha)
T1+T2	2	5,698	1,739,862	25,739	1,771,299
T1+T2	20	19,438	1,699,101	52,760	1,771,299
T1+T2	50	14,237	1,725,311	31,751	1,771,299
T1+T2	100	11,604	1,713,210	46,485	1,771,299
T1+T2	200	10,688	1,748,514	12,097	1,771,299
T3	2	23,847	1,718,957	28,494	1,771,299
T3	20	77,234	1,609,478	84,587	1,771,299
T3	50	62,127	1,598,937	110,234	1,771,299
T3	100	59,684	1,582,093	129,522	1,771,299
T3	200	60,272	1,572,092	138,935	1,771,299
T4	2	146,617	1,419,909	204,773	1,771,299
T4	20	267,058	1,329,771	174,470	1,771,299
T4	50	380,138	1,295,668	95,492	1,771,299
T4	100	482,812	1,199,930	88,556	1,771,299
T4	200	554,618	1,131,275	85,406	1,771,299

[57] This would allow maintaining the original number of 2Million people, as the total population borders 3 Million.

[58] Excludes the case of embankment breach at Enayetpur at the subproject JRB-1, which will be prevented through by constructing some 4km of riverbank protection works, and has been estimated during the PPTA to potentially effect some 11,000ha of land.

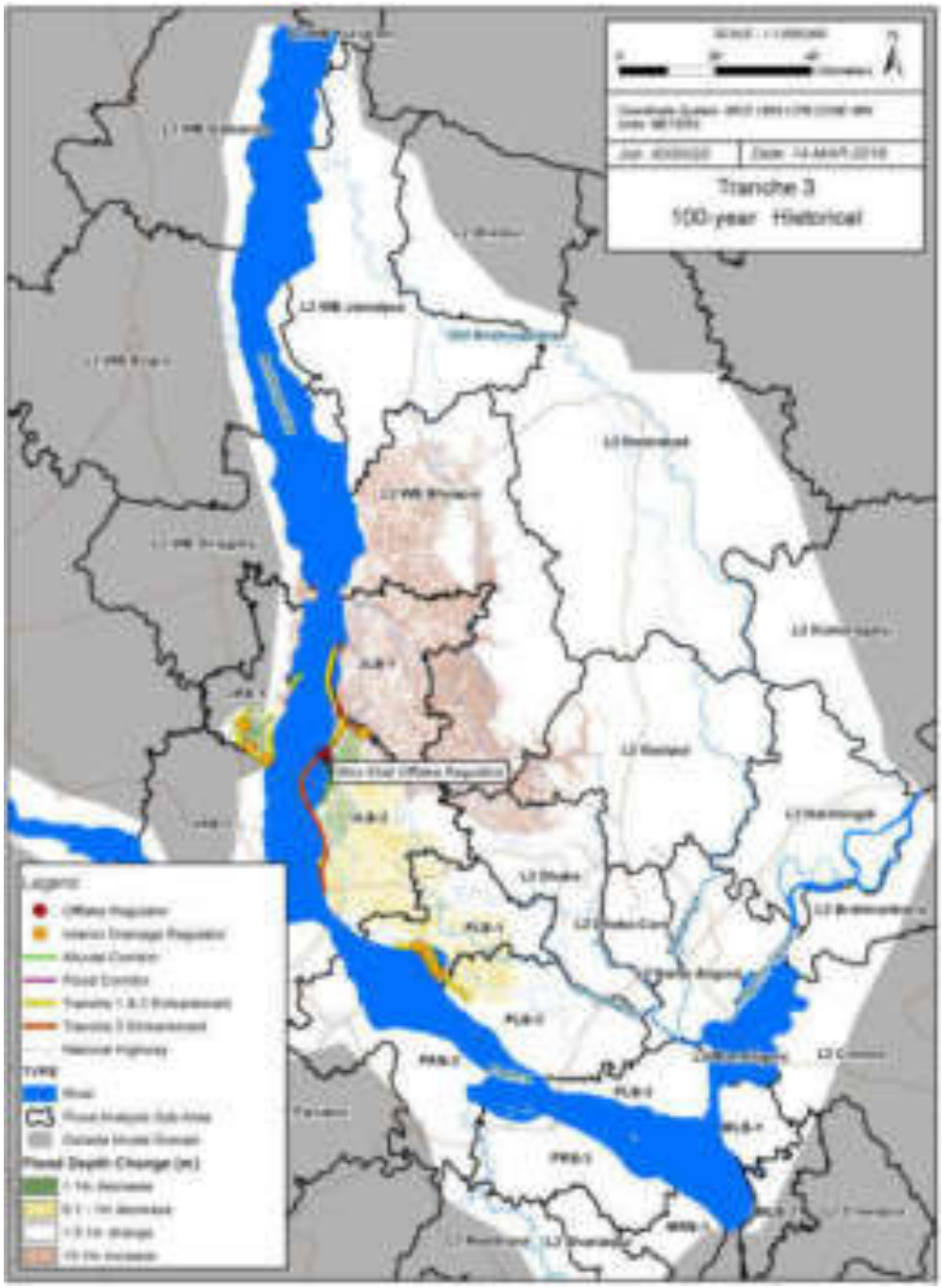


Figure A-3 Flood level differences for T-3 and 100-year flood: light red = greater than 0.1m deeper; cyan/green = greater than 0.1m shallower; Red, mustard, = 0.1m – 1.0m shallower.

1.3 Reviewed Outcomes – Protection against Riverbank Erosion

It is evident that avoided erosion can only be based on past trends without knowing future flood scenarios or even earthquake induced sediment waves that destabilize the river over decades. The PPTA attempted to estimate erosion trends, particularly recurrent erosion intervals based on morphological analysis of the site conditions. This pre-project assessment is still valid, however has been updated to account for the actual bankline at project start (as opposed of the assumption during the PPTA), the work built during Tranche-1 and the plans for Tranche-2 and -3. During Tranche-1 much has been done to stop riverbank erosion, and particularly at Chauhali the success of riverbank protection is visible: despite some surficial failures the bankline has not changed during

the two higher 2016 and 2017 flood season, and despite severe deepening of the channel (from some 5m during the dry season to some 20m depth). At Harirampur the Padma River had started deeply eroding into the attached char between 2012 and 2016, when the work started, and some 1,000ha of land were lost. For the flood season 2016, 165ha of erosion loss were predicted.

The comparison of PPTA data with updated erosion numbers and computation is provided in Table A-7. We have distinguished between the years 2029, the revised date for impact assessment, and 2043 – the end date for the 30-year economic life time. The overall avoided erosion losses after 30-years have reduce marginally from 7,210ha to 6,880ha. By 2029, five years after the project around 4,670ha of erosion have been prevented, or two thirds. This number is explained by the periodic nature of erosion and the fact that FRERMIP responded to critically eroding river reaches.

While the flooded area appeared to be overstated in the DMF, the area protected against erosion appears to be understated. Overall, we recommend to increase the present number of erosion protected land from 460ha (with a baseline of 43ha in 2013) to 4,600ha. This area converts to a strip of some 770m width alongside the total protected banks (including the Solimabad channel), and therefore is a conservative estimate. For comparison the riverbank at Chauhali has shifted by nearly 2km between 2012 and the Tranche-1 work start in 2016. In addition, the support for an overall stabilized river corridor has not been accounted for.

Table A-7 Erosion rates and avoided erosion losses

Parameter	**JRB-1**	**JLB-2**	**PLB-1**	**Total**
Annual Erosion rate	125 m	100m	300m (Harirampur) 50m (Dohar)	
Total planned riverbank protection at PPTA	12km	19km	7km (Harirampur) 5km (Dohar)	43km
Total avoided erosion (ha) until 2028[59]	775ha	1090ha	2,375ha	4,240ha
Total avoided erosion (ha) until 2043	2075ha	2520ha	2615ha	**7,210ha**
Total works built during Tranche-1	0km	9km	9km	18km
Total avoided erosion loss after T-1 (until 2029)	0ha	720ha	1,700ha	2,420ha
Total works planned for Tranche-2	11.5km	12km 15km[60]	0km	23.5km
Total avoided erosion loss after T-2 (until 2029)	720ha	600ha 750ha	0ha	2,070ha
Total works planned for Tranche-3	0km	4km	0km	4km
Total avoided erosion loss after T-3 (until 2029)	0ha	200ha	0ha	200ha
Total work length after Tranche-3	11.5km	25km 15km	9km	**45.5km** **15km**
Total avoided erosion (ha) until 2029	720ha	2,270ha	1,700ha	**4,670ha**
Total avoided erosion (ha) until 2043	2,010ha	3,170ha	1,700ha	**6,880ha**

[59] Five years after the planned end date.

[60] Through choking the Solimabad channel from a combination of dredging and "building with nature"

APPENDIX B

TECHNICAL COMMITTEE OCTOBER 2018

বাংলাদেশ পানি উন্নয়ন বোর্ড

Phone:
Office: [illegible]
Fax: [illegible]

[illegible]

"Flood and Riverbank Erosion Risk Management Investment Program (FRERMIP)-Tranche-2" [illegible] Tranche-2 [illegible] Tranche-2 [illegible] ToR [illegible]

[illegible]	[illegible]	[illegible]
১।	[illegible]	[illegible]
২।	[illegible]	[illegible]
৩।	[illegible]	[illegible]
৪।	[illegible]	[illegible]
৫।	[illegible]	[illegible]
৬।	[illegible]	[illegible]
৭।	[illegible]	[illegible]
৮।	[illegible]	[illegible]
৯।	[illegible]	[illegible]
১০।	[illegible] PMU-FRERMIP, [illegible]	[illegible]

[illegible]

i) Review and finalize Feasibility Study Report of Tranche-2 complying study output the ToR of ISPMC in line with contract agreement.
ii) Review and finalize the detailed structural design of Tranche-2 works.
iii) Advice PMU for preparing DPP of Tranche-2.

[illegible] Soft Copy [illegible] E-mail [illegible]

[illegible]

[illegible]
বাংলাদেশ পানি উন্নয়ন বোর্ড
ঢাকা।

[illegible]

[illegible] PMU-FRERMIP, [illegible]

[illegible]

বাংলাদেশ পানি উন্নয়ন বোর্ড

Bangladesh Water Development Board

Memo no: PMO-FRERMIP/C-2/305 02 December 2018

To

The Team Leader
ISPMC, FRERMIP
BWDB, Dhaka.

Subject: Submission of minutes of the Technical Committee for Proposed FRERMIP (Tranche-2) Project.

Ref: This office Memo No. : PMO-FRERMIP/C-2/299; Date: 16/10/2018.

Dear Team Leader

With reference to above subject, I would like to inform you that a meeting of the Technical Committee for Proposed FRERMIP (Tranche-2) Project was held on 08 October 2018 in the conference room of the Director General, BWDB, Dhaka. In that meeting a detailed discussion was carried out for reviewing of the proposed interventions, Designs and draft Feasibility Study Report of FRERMIP Tranche-2 project. The minutes of the meeting is enclosed herewith. You are hereby requested to follow the minutes during the finalization of the Proposed FRERMIP (Tranche-2) Project.

You are also requested to submit the final version at the earliest with complying all comments/decisions of the meeting.

Please treat it as most important & urgent.

Yours faithfully

(Md. Rafiqul Islam Chowdhury)
Project Director
PMO FRERMIP, BWDB, Dhaka.

Memo no: PMO-FRERMIP/C-2/305(19) Date: 02 December 2018

Copy forwarded for kind information/information and necessary action to:

1) Additional Director General (Western Region), BWDB, Dhaka.
2) Additional Director General (Planning), BWDB, Dhaka.
3) Chief Planning, BWDB, Dhaka.
4) Chief Engineer, Design, 72, Green Road, Dhaka.
5) CSO to DG, BWDB, Dhaka.
6) Country Director, ADB, Asian Development Bank, Dhaka.
7) Mr. Zahir Uddin Ahmad, Team Leader, Water Resources Management, BWA, ADB, Sher-E-Bangla Nagar, Dhaka.
8) Deputy Team Leader, ISPMC FRERMIP, Dhaka.
9) Office Copy

FRERMIP /ISPMC
15 DEC 2018
INCOMING

Project Director
PMO FRERMIP, BWDB, Dhaka.

Minutes of the Technical committee meeting on FRERMIP Tranche-2 Project held on 08 October 2018 in the Conference Room of the Director General, BWDB, Dhaka.

The meeting of the Technical Committee (TC) on Flood and Riverbank Erosion and Risk Management Investment Program (FRERMIP) – Tranche-2 was held in the conference room of the Director General, BWDB, Dhaka at 4.00 PM on 08 October 2018 regarding reviewing & finalization of detailed structural design including Feasibility Study of Tranche-2 Project. Mr. Md. Delwar Hossain, Additional Director General (Planning), BWDB, Dhaka and Chairperson of the TC presided over the meeting. The list of TC members who attended the meeting is furnished in attachment-1. Honorable Director General, BWDB, Dhaka was kind enough to attend the meeting and make the meeting more effective through active participation.

The Chairperson welcomed the participants and invited Mr. Md. Rafiqul Islam Choubey, Project Director, FRERMIP and Member Secretary of TC to shortly describe the project outline and present the detail objectives of today's Technical Committee meeting.

Mr. Md. Rafiqul Islam Choubey, Project Director, FRERMIP described the project in brief, different phases of the project and the objectives of today's meeting. He described that GoB, ADB and GoN agreed a Loan/Grant Agreement to finance a Multi-tranche Financing Facilities investment program named "Flood and Riverbank Erosion Risk Management Investment Program (FRERMIP)" and this investment program will be implemented in 3 tranches. According to the agreement, ADB will provide a loan of 255.00 million USD and GoN will provide a grant of 15.30 million USD for three Tranches. The program will be implemented in three tranches from August 2014 to June 2023 with individual DPP for each tranches. Presently, BWDB is implementing the project of "Flood and Riverbank Erosion Risk Management Investment Program (Tranche-1)" project. Under this project feasibility study for tranche-2 project will be completed. He then stated in the meeting that the River Stabilization Plan of FRERMIP project has been incorporated in the approved Delta Plan and then he explained about the different interventions of FRERMIP project in map of his slide presentation. He stated that according to the received Draft Feasibility Study report of Tranche-2 Project from

ISPMC, they consider River bank protection works at Pukuriya, Chauhali, Salura, Omarpur, Enayetpur & Benotia following River Stabilization Plan. He then mentioned in the meeting that from concern design office's of BWDB, River bank protection works at places of Salura, Omarpur, Enayetpur has been dropped from Tranche-2 as these places are lying on the charland within the mighty Jamuna river and also there is no study report regarding the sustainability of these proposed works. All the members of the committee agreed to exclude charland protection works at Salura, Omarpur, Enayetpur after detailed discussion.

The Project Director then described that Embankment construction works along the right bank of Jamuna river from kaijuri to benotia is going on and Benotia is under immediate threat of erosion, which is approximately 90 meter setback distance from the present alignment. According to the draft Feasibility Study report, ISPMC consultant consider 1 km river bank protection works at Benotia. But at present condition, river bank protection works at Benotia should be increased from 1 km to 3.50 km. Mr. Motahar Hossain, Chief Engineer, Design, BWDB, Dhaka stated in the meeting that at this place 3.50 km river bank protection works should be taken for encounter the erosion along with sustainability of the ongoing Embankment construction works. All the members of the committee agreed with this.

The Project Director then explained briefly about the adaptation works. He stated in the meeting that, adaptive Management Approach means that riverbank protection works will be implemented during the dry period with low cost technology and will be monitored during the flood period through bathymetric/under water survey. If any damage on launching apron is observed from the monitoring report, the damaged/launched portion will be repaired by additional dumping of geo-bags. It will be continued till sustainability. Accordingly, River bank protection works under JMREMP and FREERMP Tranche-1 project has been completed. The ISPMC consultant also consider this adaptation technology in the Feasibility Study report of Tranche-2 Project. According to their proposed design, only sand filled geo-bags will be used in under water as a dumping materials and in above water as a slope protection. They proposed sand filled geo-bags dumping volume of approximately 70.94 cum/m which is consist of approx. 35 cum/m as initial protection, 16.47 cum/m as 1st adaptation, 12.98 cum/m as 2nd adaptation, 6.49 cum/m as 3rd adaptation.

Mr. Md. Mahfuzur Rahman, Director General, BWDB, Dhaka opposed to apply adaptation technology in case of river bank protection works. He stated in the meeting that, from past experience it has observed that capital cost is less in respect to maintenance cost and so many times in many places damages occurred in Chauhali during the flooding period of 2017 along with 3 times damages this year. For this reason, adaptation technology along with bank protection with only geo-bags may not be considered in mighty river like Jamuna & Padma river as no regret consideration. In this context Mr. Mohammad Harun-Ur-Rasheed, Superintending Engineer, Design Circle-II, BWDB, Dhaka stated in the meeting that, total cost in favour of adaptive management not reduces than the permanent bank protection cost as usual practice of BWDB. So, we reviewed the bank protection works design and provide dumping volume of approximately 75 cum/m (50% CC Blocks and 50% geo-bags) at apron and 3.25 cum/m at berm (1 cum/m geo-bags & 2.25 cum/m CC blocks).

Mr. Motahar Hossain, Chief Engineer, Design, BWDB, Dhaka stated in the meeting that bank protection work with only geo-bags will not applicable further. He also explained that, from his past experiences CC blocks with geo-bag is more effective than only geo-bags as a dumping materials.

The Project Director stated in the meeting that, if we use 50% CC Block as a dumping materials the implementation of the work will be very difficult due to crisis of stone chips which will be used for CC block manufacturing purposes and the project cost will also be higher than planned in the PPTA. The Project Director also stated that management of CC blocks normally take more times which causes delaying the project completion. Mr. Md. Mahfuzur Rahman, Director General, BWDB, Dhaka replied in this context that, in this case we may use hard rock instead of CC block although hard rock having more durability and availability. He also stated that in that case, GoB contribution may be higher or scope of work may be reduced and remaining work may be implemented under Tranche-3 in case of higher project cost.

The Project Director stated that according to the received Feasibility Study report of Tranche-2 Project from ISPMC, they proposed char development works with sand plugging at Solimabad following River Stabilization Plan. According to the

discussion with the ISPMC consultant, he described that using the innovative technology of a "sand engine" developed in Holland, basically a sand plug, which could be overtopped to move the sediment into the channel and then rebuild during the next dry season. After some years the bank line channel will be choked and the existing work at Chauhali will be extended in downstream direction to guide the flow along the silted up mouth of the channel. He then mentioned in the meeting that from concern design office's of BWDB consider cross bar at Solimabad and with this huge amount of land will be reclaimed in the downstream of this area. The Project Director also stated that Dr. Mohammad Shariful Islam, Professor, Dept. of Civil Engineering, BUET, Dhaka has been found with vast experience for providing a new view on the technology of vetiver plantations and plantation of vetiver on the Solimabad char will started immediately for sedimentation and land development. In this context Mr. Md. Mahfuzur Rahman, Director General, BWDB, Dhaka suggested to incorporate Doincha tree along with vetiver grass. He also explained that Doincha tree having high capacity to retain sand.

Mr. Md. Aminul Haque, Chief Planning, BWDB, Dhaka described in the meeting that Old Dhaleswari Offtake suffer from substantial variability of flows resulting from erosion or deposition at the mouth. The Old Dhaleswari still falling dry during the lean season as huge sand bar observed at the mouth. He also opined to manage Dhaleswari Offtake by ensuring water during the dry period.

In this context Mr. Md. Mahfuzur Rahman, Director General, BWDB, Dhaka said that we have to reclaim land from river considering the future demand in respect to Government's Vision 2041. He suggested to alive Old Dhaleswari Offtake. He also mentioned that by constructing well planned and proper designed offtake management structures, we can open the channel during flood season and can pump river water to the channel during dry season. He also instructed for conducting detailed hydro-morphological study based on present topographical & hydrographical survey data. In that case, we can contact River Research Institute (RRI) for physical modelling or we can go for numerical/mathematical modelling. The model should run with regular/high flow, proper velocity and with sediment loaded flow. He emphasized that, this structure can be a model structure for future river stabilization activities in Jamuna and Padma rivers. Furthermore, he suggested to incorporate lining work at the upstream & downstream of the offtake

along with radial gated structure, if necessary. He also suggested to prepare DPP of Tranche-2 considering the intervention find out from physical/mathematical model result at solimabad along with other intervention as embankment construction works, regulators/Fish-pass structure, bank protection works etc. & in this DPP there should be a provision for detailed technical study in favor of offtake management by forming a Technical advisory committee. According to him, in this DPP procurement plan should be as Embakment/Regulator/bank protection works started from 1st year and solimabad intervention should started from 2nd year. All the members of the committee agreed with this views.

The Project Director stated that according to the Feasibility Study report of Tranche-2 Project, 17.40 km embankment construction works along with 4 nos. regulator will be implemented from Dohar to Harirumpur. He also stated that, the superintending Engineer, Design Circle-II suggested to include 3(three) more regulator in this area for ensuring proper drainage. Taking a part of the discussion of this issue, Mr. Mohammad Harun-Ur-Rasheed, Superintending Engineer, Design Circle-II, BWDB, Dhaka stated in the meeting that, ISPMC did not consider the local people's demand and they did not discuss with them. There is a demand of local people to construct a regulator over Ichamati river at Kaishakhali Closure point and a regulator over Gosail khal. But they did not consider in their study. He also stated that the demand of the local people is to intrude fresh water during dry season and to ensure adequate drainage facilities. He also stated that detailed depth study is needed in a holistic approach instead of piecemeal way for determination of location, size, number of regulators. Mr. Abdul Matin Sarker, Superintending Engineer, Dhaka O&M Circle, BWDB, Dhaka informed in the meeting that in Dohar area flushing is the main requirement of them & he also stated that local peoples are not so much concern about the project. He also stated that presently the local people wanted a regulator at Kaishakhali closure point. All the member of the committee agreed to conduct detail technical study of this area considering irrigation planning map or DEM data by ISPMC considering with the views of the concern officials of BWDB's O&M Division and local peoples and their representative.

Mr. Md. Mahfuzur Rahman, Director General, BWDB, Dhaka asked the Project Director about the design & specifications of this embankment. The Project

5

Director replied that the height of the embankment is 3.50 m to 9.60 m, top width is 6 m and bottom width is 50 m to 80 m. Then the Director General, BWDB, Dhaka sought to know about the foundation treatment of the embankment due to high sections. Mr. Mohammad Harun-Ur-Rasheed, Superintending Engineer, Design Circle-II, BWDB, Dhaka replied that there is a provision of Perforated Vertical Drain (PVD) for foundation treatment. The Director General, BWDB, Dhaka also wanted to know about the return period of this embankment design. Mr. Mohammad Harun-Ur-Rasheed, Superintending Engineer, Design Circle-II, BWDB, Dhaka informed in the meeting that we consider 100 year return period for protective work. The Director General, BWDB, Dhaka suggested that now we can consider 200 years return period in case of embankment construction & 100 years in case of revetment works in line with the Delta plan of the developed country.

Mr. Abdul Matin Sarker, Superintending Engineer, Dhaka O&M Circle, BWDB, Dhaka informed in the meeting that 8.80 km river bank protection work has been completed under FRERMIP –Tranche-1 project & upstream of this completed work severe bank erosion took place. For this immediate action is required for sustainability of this work, otherwise there is a possibility of outflanking. In this issue, the Project Director replied that there is no scope to consider this part under FRERMIP Tranche-2 project. Mr. Md. Mahfuzur Rahman, Director General, BWDB, Dhaka instructed to the Superintending Engineer, Dhaka O&M Circle, BWDB, Dhaka to form a Technical Committee immediately for preparing a separate DPP from GoB fund.

Mr. Abdul Matin Sarker, Superintending Engineer, Dhaka O&M Circle, BWDB, Dhaka stated in the meeting that placed sand filled geo-bags in some portion of the slope of 8.80 km protection work at Hanirumpur damages due to expose to the sunlight. Mr. Motahar Hossain, Chief Engineer, Design, BWDB, Dhaka opined to remove these geo-bags and to place CC block immediately. Mr. Mohammad Harun-Ur-Rasheed, Superintending Engineer, Design Circle-II, BWDB, Dhaka responses in this regard that there is a provision of CC block placing under FRERMIP Tranche-3 project & he suggested to placing with CC block under Tranche-2. Mr. Md. Mahfuzur Rahman, Director General, BWDB, Dhaka informed that Geo-bags should not be exposed and should be used only under water protection purposes. He then suggested to place geo-bags in slope as a temporary

protection for a period of 1 year only and after that placed geo-bags should be replaced by CC blocks.

The Project Director stated that approximately 100,000 (one lac) CC blocks (placing & dumping) are available at Chauhali work site as stock piles & local peoples are very much worried as stock piles occupied their cultivable land & they did not getting any compensation. He wanted to a decision about the stock piles. Mr. Md. Mahfuzur Rahman, Director General, BWDB, Dhaka instructed to use the stock pile as a placing and dumping & costing may be incurred from the BWDB's O&M budget.

The Project Director wanted to know in the meeting that 17.80 km bank protection work completed under FREMIP Tranche-1 project and 17.00 Km bank protection work completed under JMREMP project , if any damages occur during flooding or receding time how he address? Mr. Md. Mahfuzur Rahman, Director General, BWDB, Dhaka suggested to keep maintenance budget provision as strengthening/emergency works in the DPP of Tranche-2.

The Project Director stated that 2.00 km bank protection work completed at Zafarganj under Tranche-1 & a school building saved from erosion considering humble request from the Deputy Commissioner of Manikganj & other local allied persons. Presently, in front of this school look like a Spur shape & may be threaten in future due to scouring. Mr. Abdul Matin Sarker, Superintending Engineer, Dhaka O&M Circle, BWDB, Dhaka informed in the meeting that we have geo-bags & costing of filling & dumping may be incurred from BWDB's O&M budget. All the members of the committee agreed with this views.

The Project Director stated that construction of 21.30 km embankment started in continuation with BRE embankment along the right bank of Jamuna River and will end at the place named Ahmedpur along the left bank of Hurasagar River. Construction of embankment will continue for 1.70 km length along the left bank of Hurasagar River & another 6.00 km along the left bank of Korotoya to meet the existing Shahzadpur – Koijuri road under Tranche-2 project. So, with the construction of additional 7.70 km under Tranche-2, the construction of embankment will be completed and the flood control benefit will be achieved. He also stated that if 7.70 km is not constructed under Tranche-2 or DPP of Tranche-2 is not taken then purpose of the project will not be achieved. In that case he

7

requested to take another separate DPP from the GoB fund. Mr. Md. Mahfuzur Rahman, Director General, BWDB, Dhaka agreed with his proposal & instructed to form a Technical Committee to prepare a DPP of incomplete work of completed project. Mr. Mohammad Harun-Ur-Rasheed, Superintending Engineer, Design Circle-II, BWDB, Dhaka replied that there is already a report of the Technical Committee.

Supporting the above issues, the chairperson suggested to finalize the draft Feasibility Study report of Tranche-2 Project at the earliest.

The decisions of the meeting were:

i. Proposed river bank protection works at Sakura, Omarpur & Enayetpur may be excluded from Tranche-2 as these are charland protection and there is no study report regarding the sustainability of these works.
ii. Riverbank protection work will be implemented at Chauhali (from Km 7.00 to Km 19.00=12.00 Km) and at Benotia (from Km 10.00 to Km 13.50=3.50 Km) under Trenche-2, as these two points are vulnerable.
iii. Riverbank protection works may be implemented considering dumping volume of approximately 75 cum/m (50% CC Blocks/Hard rock and 50% geo-bags) at apron and 3.25 cum/m at berm (1 cum/m geo-bags & 2.25 cum/m CC blocks).
iv. Plantation of Doincha along with vetiver grass on the char Solimabad for sedimentation and land development may be adapted.
v. prepare a DPP of Tranche-2 considering the intervention according to the result of physical or mathematical model at solimabad along with other intervention as embankment construction works, innovative regulator structure, bank protection works etc. & in this DPP there should be a provision for detailed technical study by forming a Technical advisory committee for Old Dhaleswari offtake management by Conducting a physical/mathmatical model study. In this DPP procurement plan should be as Embakment/Regulator/bank protection works will start from 1st year and solimabad intervention should start from 2nd year.

vi. GoB contribution may be higher or scope of work may be reduced and remaining work may be implemented under Tranche-3 in case of higher DPP cost of Tranche-2 than planned in the PPTA.

vii. ISPMC have to conduct detailed technical study in a holistic approach with inclusion of the opinions of BWDB officials and local representatives for determination of alignment of embankment and location, size, number of innovative regulators including consultation with the stakeholders for Dohar to Harirumpur embankment.

viii. The Draft Feasibility Study Report of Tranche-2 Project may be finalized later subject to comply all comments/observations of the technical committee's.

ix. Committee decided to form a technical committee for implementation of river bank protection works at the upstream of Harirumpur bank protection work for preparing a separate DPP from GoB fund.

x. Placement of geo-bags in slope as a temporary protection will be for a period of 1 year only and after that placed geo-bags must be replaced by CC blocks in Tranche-2 Project.

xi. Stock pile at Chauhali will be used for placing and dumping & costing may be incurred from the BWDB's O&M budget.

xii. Provision of sufficient maintenance budget for completed works of JMREMP & FRERMIP Tranche-1 project as strengthening/emergency works in the DPP of Tranche-2.

xiii. Received geo-bags from FRERMIP under Tranche-1 project may be used at Zafarganj & costing of filling & dumping may be incurred from BWDB's O&M budget.

xiv. If DPP of Tranche-2 is not taken, Committee decided to form a technical committee for implementation of 7.70 km embankment construction work along with other interventions appropriate for better sustainability of Hurasagar Sub-project for preparing a separate DPP from GoB fund.

The meeting was ended with a vote of thanks from the chair.

14/10/2018

(Md. Delwar Hossain)
Additional Director General (Planning)
BWDB, Dhaka.
&
Chairperson, Technical Committee

"Attachment-E"

"Flood and Riverbank Erosion Risk Management Investment Program (Tranche-2)" শীর্ষক প্রস্তাবিত প্রকল্পের সম্ভাব্যতা সমীক্ষা চূড়ান্তকরণসহ পূর্ণ কাজের একনা চূড়ান্ত করণের লক্ষ্যে পরীক্ষা কারিগরী কমিটির সভা।

সূত্র: স্মারক নং- [illegible] তারিখ: [illegible] খ্রিস্টাব্দ এবং স্মারক নং- [illegible] তারিখ: [illegible] খ্রিস্টাব্দ।

তারিখ: [illegible] খ্রিস্টাব্দ।
সময়: বিকাল ৪.০০ ঘটিকা
স্থান: [illegible]

সভায় উপস্থিতির তালিকা:

ক্র. নং	নাম ও পদবী	কমিটির কার্যটির পদবী	স্বাক্ষর
১।	[illegible]		
২।	[illegible]	[illegible]	
৩।	[illegible]	[illegible]	
৪।	[illegible]	[illegible]	
৫।	[illegible]	[illegible]	
৬।	[illegible]	[illegible]	
৭।	[illegible]	[illegible]	
৮।	[illegible]	[illegible]	
৯।	[illegible]	[illegible]	
১০।	[illegible]	[illegible]	
১১।	[illegible]	[illegible]	
১২।	[illegible]	—	

Memo no: PMO-FRERMIP/M-1/199/1(14) Date: 16 October 2018

Copy forwarded for kind information/information and necessary action:

1. Director General, BWDB, Dhaka.
2. Additional Director General (Planning), BWDB, Dhaka.
3. Additional Director General (Western Region), BWDB, Dhaka.
4. Chief Planning, BWDB, Dhaka.
5. Chief Engineer, Design, BWDB, Dhaka.
6. Superintending Engineer, Design Circle-II, BWDB, Dhaka.
7. Superintending Engineer, Pabna O&M Circle, BWDB, Pabna.
8. Superintending Engineer, Mymensingh O&M Circle, BWDB, Mymensingh.
9. Superintending Engineer, Dhaka O&M Circle, BWDB, Dhaka.
10. Dr. Shaymal Chandra Das, Executive Engineer, Office of the Chief Planning, BWDB, Dhaka.
11. Executive Engineer, Tangail O&M Division, BWDB, Tangail.
12. Executive Engineer, Manikganj WD Division, BWDB, Manikganj.
13. Executive Engineer, kotlala Construction Division, FRERMIP, BWDB, Kotlala, Bera, pabna.
14. Office Copy.

16.10.18

(Md. Rafiqul Islam Choudhury)
Project Director
PMO-FRERMIP
BWDB, Dhaka
&
Member-Secretary of the
Technical Committee

Flood and Riverbank Erosion Risk Management Investment Program

Compliance of Technical Committee Recommendations in the updated Feasibility Report Tranche-2

Option 1 designs are designs contained in the April 2018 Feasibility Report

Option 2 designs are designs proposed by the BWDB (January 2019)

Nr	Technical Committee Recommendation	Feasibility Report Action
1	Proposed river bank protection works at Salura, Omarpur & Enayetpur may be excluded from Tranche-2 as these are charland protection and there is no study report regarding the sustainability of these works	Option 2 designs, approved by the Design Office, exclude Charland protection (e.g. Feasibility Study Report (FSR) section 7.1)
2	Riverbank protection works will be implemented at Chauhali (from Km 7.00 to Km 19.00=12.00 Km) and at Benotia (from Km 10.00 to Km 13.50=3.50 Km) under Trenche-2 as these two points are vulnerable	Option 2 includes the riverbank protection at Chauhali and Benotia, which designs are approved by the Design Office (e.g. FSR S. 7.1)
3	Riverbank protection works may be implemented considering dumping volume of approximately 75 cum/m (50% CC Blocks and 50% geo-bags) at apron and 3.25 cum/m at berm (1 cum/m geobags & 2.25 cum/m CC blocks)	Option 2 includes the riverbank protection design approved by the Design Office (e.g. FSR S. 7.1)
4	Plantation of Doincha along with vetiver grass on the char Solimabad for sedimentation and land development may be adopted	The feasibility study considers plantation of different types of vegetation. (e.g. FSR S. 4.1)
5	Prepare a DPP of Tranche-2 considering the intervention according to the physical or mathematical model at Solimabad along with other intervention as embankment construction works, innovative regulator structure, bank protection works etc. & in this DPP there should be a provision for detailed technical study by forming a Technical advisory committee for Old Dhaleswari offtake management by conducting a physical/mathematical model study. In this DPP procurement plan should be as Embankment/Regulator/bank protection works will start from 1st year and Solimabad intervention should start from 2nd year.	Tranche 2 includes provisions for a detailed offtake study in line with the recommendations. The implementation of the works, depending on the study outcome and detailed cost estimate is scheduled for Tranche-3, expected to start one year after Tranche-2. (e.g. FSR S. 4.3)
6	GoB contribution may be higher or scope of work may be reduced and remaining work may be implemented under Tranche-3 in case of higher DPP cost of Tranche-2 than planned in the PPTA	Option 2 contains the full allocation of all work as per approved design of the Design Office. (e.g. FSR S. 7.4)
7	ISPMC have to conduct detailed technical study in a holistic approach with inclusion of BWDB officials and local representatives for determination of alignment of embankment and location, size, number of innovative regulators including consultation with the stakeholders for Dohar to Harirampur embankment	The designs for Tranche-2 are based on a comprehensive stakeholder consultation process. This involves changes of the alignment based on comments from the local population, but also adding additional structures, following discussions with local people and BWDB officials. (e.g. FSR S. 4.1)

8	The draft Feasibility Study Report of Tranche-2 Project may be finalized later subject to comply all comments/observations of the technical committee's.	Feasibility study finalized complying with all comments/ observations of the technical committee related to the Feasibility study report.
9	Committee decided to form a technical committee for implementation for river bank protection works at the upstream of Harirumpur bank protection work for preparing a separate DPP from GoB fund	Not part of this Feasibility Study. BWDB will take action.
10	Placement of geo-bags in slope as a temporary protection will be for a period of 1 year only and after that placed geo-bags must be replaced by CC blocks in Tranche-2 Project	The Feasibility study includes the replacement of the temporary geobag protection at Harirampur by hard protection under Tranche 3. (e.g. FSR S. 4.1)
11	Stock pile at Chauhali will be used for placing and dumping & costing may be incurred from BWDB's O&M budget.	Not part of this Feasibility Study
12	Provision of sufficient maintenance budget for completed works of JMREMP & FRERMIP Tranche-1 project as strengthening/emergency works in the DPP of Tranche-2	Tranche 2 includes provisions for 40 km of adaptation/ strengthening works and 5 km of emergency works (e.g. FSR S. 7.4)
13	Received geo-bags from FRERMIP under Tranche-1 project may be used at Zafarganj & costing of filling & dumping may be incurred from BWDB's O&M budget.	Not part of this Feasibility Study
14	If DPP of Tranche-2 is not taken, Committee decided to form a technical committee for implementation of 7.70 km embankment construction work along with other interventions appropriate for better sustainability of Hurasagar Sub-project for preparing a separate DPP from GoB fund.	Not part of this Feasibility Study

APPENDIX C

COMMENT RESPONSE MATRIX TO OBSERVATIONS FROM REVIEW COMMITTEE

	Comment from Design Office	ISPMC Notes / Reply to Project Management Office	Action	Status
	Decision of Technical Committee: "Draft Feasibility Report for Tranche-2" under Flood and Riverbank Erosion Risk Management Investment Program (FRERMIP) was submitted on March'2018. A meeting on this Draft report was held on October 8, 2018 with ADG (Planning), BWDB in the chair as Chairperson of the Technical Committee. DG, BWDB were also present at that meeting. In that meeting this Draft Report were discussed elaborately and some concrete and definite decision were taken. Some of the decision of that meeting are as follows : a) Charland protection work at Salura, Omarpur & Enayetpur were decided to excluded as there are no study regarding the stability of these char. b) Location of bank protection work was finalized at Chouhali & Benotia for a length of (km 7.00 to km 19.00 =) 12.00km and (km10.00 to km 13.50=) 3.50km respectively. c) Dumping volume of bank protection work was finalized as 75cum/m with 50% CC Block/Hard Rock and 50% Geobag. d) Intervention at Solimabad will be undertaken after physical / mathematical modelling. '	ISPMC is aware of the decisions of the Technical Committee. A comment response matrix showing compliance of the updated report to the decisions of the meeting is included as Appendix B to the Feasibility report.	No action	closed

	Comment from Design Office	**ISPMC Notes / Reply to Project Management Office**	**Action**	**Status**
	e) Old Dhaleswary Offtake Management will be undertaken after physical / mathematical modelling. f) This "Draft Feasibility Report for Tranche-2" are to be finalized subjected to comply all comments/observation of the Technical Committee.			
A1.	When a Feasibility Report submitted to BWDB, BWDB send this Report to relevant offices for their comments. By incorporating those comments, Draft Feasibility Report are finalized. For this "Draft Feasibility Report for Tranche-2", Technical Committee meeting were held in presence of DG, BWDB. In that meeting directives were given to finalized the Draft Report by incorporating comments/observations of the Technical Committee. Instead of incorporating the comments/observations of the Technical Committee of BWDB, the structure of previously submitted Draft Feasibility Report was altered This is an unacceptable approach. As such Final Feasibility Report is not an acceptable one. In the Draft Feasibility Report, there were no Option. Final Feasibility Report was submitted with Two Options without any engineering justification. Benefits or disbenefits of different components of this Two Option were not explained. They have the opportunity to generate many options, if it is needed, during their study. But it was not done. Options have generated after submitting Draft Feasibility Report, although there were no comments for generation of Options. This indicates inefficiency of ISPMC in preparation of Feasibility Report. This is an unacceptable approach. As such Final Feasibility Report is not an acceptable one.	The second updated version does not show alternative options and focusses on the Client preferred option as per October Technical Committee recommendation. Background: The Office of the Chief Engineer Design reviewed and commented on an early version of the updated feasibility study. This version was updated based on comments received from the Superintending Engineer Design II on 6th May 2019. Subsequently comments from the Project Director during the last week of June 2019 were incorporated and the updated version was provided on 1st July 2019. In line with international best-practice, feasibility studies provide alternatives or	No Action	Closed

	Comment from Design Office	**ISPMC Notes / Reply to Project Management Office**	**Action**	**Status**
	Option-I was made with the location of work & which was rejected by Technical Committee. Option-2 was made considering the location of work & design recommended by Technical Committee. Options in a feasibility report cannot made in this way. As such Final Feasibility Report is not an acceptable one. t) Final Feasibility Report does not follow the decisions of Technical Committee. As such Final Feasibility Report is not an acceptable one.	options in justification of the preferred approach. The original feasibility study from March 2018, was based on the principles of the agreed Framework Financing Agreement, 2014, detailed in the approved Site Selection and Initial Economic Assessment report of May 2017 which was approved by the Technical Advisory Committee in September 2017.		
A2.	Comments made on the "Draft Feasibility Report for Tranche-2 from different offices has not been addressed in "Updated Feasibility Report for Tranche-2". As such this Final Feasibility Report is not an acceptable one.	Comments were only received from the BWDB Design Circle 2. These have been incorporated in the Feasibility Study Report	No action	Closed
A3.	One of the major problems with this ISPMC is that they frequently change the length & location of work, since 2012. There is no consistency with different proposal and report submitted by them time to time. So, it is very difficult to make comment or follow their proposal and report.	The length and location of works has to be changed based on the changed morphology of the river. Due to the relatively long time periods under the FRERMIP, changes between tranches can be substantial. This approach is part of the Framework Financing Agreement, agreed by BWDB and ADB in 2014.	No action	Closed

	Comment from Design Office	ISPMC Notes / Reply to Project Management Office	Action	Status
A4.	Jurisdiction of FRERMIP is from D/S of Bangabandhu Bridge to Alicha for Jamuna River and Pangsa to Chandpur for Padma River. FRERMIP taken the responsibility of River Bank Protection with Flood Embankment on both banks, approximately for 168+178 346 km. Total Project period is from 2014 to 2024. Accordingly, the location & length of bank protection work and embankment were proposed & approved for Trench-I, Trench-2 & Trench-3. In the original Feasibility Study, there were no proposal for char protection. FRERMIP taken a vast area with a tiny amount of money. More than 40% of their project period (for 3 Trench) is over. But their progress is very negligible. It indicates the inexperience and incapability of ISPMC. In Trench-I, FRERMIP addressed only 17.80 5.20% by 2018. Out of this 17.80 km, complete protection was provided for 7.00km only. Rest 16.00km is proposed to complete in Trench-3. Chouhali 5.00 km Full Protection, 2.00 km Precautionary Protection (It was not proposed in original FS) Zafargonj 2.00 kn Full Protection, Harirampur 7.00 Ion Full Protection, Temporary protection on above water 1.80 km Precautionary Protection (It was not proposed in original FS)	The feasibility study for FRERMIP, 2013 has selected three priority sites out of 13 in the stated area for priority interventions, namely JRB-1, JLB-2 and PLB-1, and considered the Jamuna and Padma for a river stabilization plan to provide the overall framework for more holistic interventions over a longer time horizon. The outline of this approach is part of the Bangladesh Delta Plan, 2100 In line with the FRERMIP Framework Financing Agreement and the Loan for Tranche-1 agreed by the BWDB and the ADB in 2014, future work for Tranche-2 and 3 shall be adjusted, to: account for morphological changes in the river (see for example Schedule 4 of the Framework Financing Agreement), and reflect the results of the river stabilization plan (see for example the Bangladesh Delta Plan, 2100 for an outline)	No action	Closed

	Comment from Design Office	ISPMC Notes / Reply to Project Management Office	Action	Status
	Hurasagar 21.3 km Embankment, No slope protection work was included in original feasibility Study. Later on, some experimental slope protection work was done. But still slope at some vulnerable location are unprotected. In "Updated Feasibility Report for Tranche-2", ISPMC proposed 11.00km for bank protection work and 14.00 km for Protection Work of Charland under Option 1.	In passing it is noted that the bridge at Harirampur was proposed by the BWDB design office. This will be finalized through the Arial Beel Integrated Development Project, which study is part of the FRERMIP Tranche 2 main consultancy.		

	Comment from Design Office			ISPMC Notes / Reply to Project Management Office	Action	Status
	Chouhali	5.00 km	Full Protection, Temporary protection on above water.			
	Pukuria	5.00 km	Full Protection, Temporary protection on above water Light (Precautionary) Protection			
	Benotia	1.00 km	Full Protection, Temporary protection on above water.			
	Enayetpur	4.00 km	Char Protection, Temporary protection on above water			
	Salura	4.00 km	Char Protection, Temporary protection on above water			
	Omarpur	6.00 km	Char Protection, Temporary protection on above water			
	Hurasagar	7.00 km	Embankment. Still slope at some vulnerable location are unprotected.			
	Harirampur	17.00 km	Embankment. 1 (one) Bridge proposed without any justification. Nothing mentioned about Kaishakhali Closure.			
A4a.	Length & Location proposed for Trench-2 in this Report, are complete deviation from Original Feasibility Study Report of 2013.			Please see explanations provided in comment A4 above	No action	Closed
A4b.	The project was taken for protection of river bank with embankment. ISPMC changed the concept of the project and shifted to Protection Work			In line with the Technical Committee recommendations, the updated feasibility	No action	Closed

	Comment from Design Office	ISPMC Notes / Reply to Project Management Office	Action	Status
	for unstable Char land without any study. There is no demand for char Protection work. This char Protection work is very very less important in comparison to Original land Protection Work at Benotia, Dawn Tarotia, Hatpachil, Pukuria, Solimabad, Daulatpur, Horirampur, Dhulsura, Brah bazar, Majirchar, Noria etc.	study does not include riverbank protection on charland. Background In line with the Framework Financing Agreement and the Loan Document, the river stabilization plan results are to be incorporated into the Tranche-2 and -3 works. Protection works at Salura, Omarpur and Enayetpur as part of a more holistic stabilization effort of the Lower Jamuna in line with the river stabilization plan were approved by the Technical Advisory Committee in 2017 The feasibility study report of 2015 provided details of the requirement and justification for river stabilisation on the bifurcation and at strategic locations in Annexe 5.		
A4c.	The chars of Jamuna are unstable and not permanent. Most of the char lands are submerged during High Water Level.	Noted. Background This statement is correct and the reason for formulating a river stabilization plan as per	No action	Closed

	Comment from Design Office	**ISPMC Notes / Reply to Project Management Office**	**Action**	**Status**
		agreement between BWDB and ADB from 2014. As a consequence, charland will receive riverbank protection in future, as important element to guide the river in a more predictable and navigable form. The BWDB has applied char protection work from 2012 onwards up- and downstream of Sirajganj.		
A4d.	ISPMC proposed protection work at Chouhali, Pukuria, Salura, Omarpur & Enayetpur, But they proposed no embankment at this location. This is a deviation from the concept of originally approved Feasibility Study.	An embankment from Aricha to Chauhali is planned under Tranche 3 as per original project concept. Protection works at Salura, Omarpur and Enayetpur has been excluded from the FSR.	No action	Closed
A4e.	There is serious bank erosion at Benotia & Dawn Tarotia, for a length of at least 3.50 km. The embankment of Hurasagar is within 50 to 100m from river bank at this location. If no protection work was done here, then embankment of Hurasagar Project of Trench-I will be engulfed by Jamuna. ISPMC proposed only 1.00 km protection work at this location, which is very very insufficient and it could not save the embankment of Hurasagar Project.	The proposed protective length is 3.5km. Background Acknowledging the low predictability of the river morphology, the Tranche-2 provides for 5km of emergency works to counter unpredictable erosion. The Benotia erosion happens in a deposition zone downstream of a protected large outer bend. Periodically the meander cuts	No action	Closed

	Comment from Design Office	ISPMC Notes / Reply to Project Management Office	Action	Status
		through this deposition to form a shortcut to the downstream channel influenced by the Hurashagar river flows. The latest survey in this location from 24/25 July 2019 indicates a deep channel of around 1km in length.		
A4f.	In Hurasagar Project, WS slope of embankment at some vulnerable location are unprotected. ISPMC proposed no slope protection here.	Under Tranche 1, already about 3.2 km of wave protection in the form of Grout-filled Jute Mattress has been provided and other reaches have been provided with vetiver plantation to counter wave action. The embankment will be closely monitored during Tranche 2 and if required additional works will be included under Tranche 3, which is timewise overlapping with Tranche 2.	No action	Closed
A4g.	There is serious bank erosion on the U/S Harirampur. If this bank erosion is not addressed now, it will cause outflanking of 9.00km protection work of Trench-I.	The current erosion is being addressed by a separate DPP under the BWDB O&M division Dhaka, which will provide about 4 km of protection upstream of Harirampur.	No action	Closed
A4h.	In Harirampur, 17.00km Embankment was proposed on a charland without any study. Bank erosion are observed at & near Dhulsura. There is a possibility of outflanking of newly build 9.00km protection work. This bank erosion threatened the proposed embankment. ISPMC proposed no	The provided design was approved by the BWDB Design Circle II and Chief Engineer Design on 23/12/2018	No action	Closed

	Comment from Design Office	ISPMC Notes / Reply to Project Management Office	Action	Status
	protection work here. It is foolishness to do a large investment for 17.00km embankment, without doing any bank protection work. It is to be mention here that there is no demand for embankment. This 17.00km Embankment is very very less important in comparison to Bank Protection Work at Benotia, Dawn Tarotia, Hatpachil, Pukuria, Solimabad, Daulatpur, Horirampur, Dhulsura, Brah bazar, Majirchar, Noria etc.	The design for implementation will be finalized during Tranche 2 as part of the Arial Beel study (see Comment A4)		
A4i.	Moreover, ISPMC illogically proposed 14.00km unstable Char Protection, instead of bank protection. There is a possibility of washing out, this 14.00km unstable Char Protection work, after first flood. ISPMC does not provide any proper engineering justification for the selection and objectives of such unstable Char Protection	This has been excluded from the latest version of the report. For background please refer to A4c and A4d	No action	Closed
A4j.	It is to be noted here that alignment of char protection works at Salura & Enayetpur placed in such a way that it will easily outflank from U/S. Moreover, alignment of char protection work at Salura, placed in such a way that it will cause oblique flow towards Bank Protection Work at Chouhall So, alignment of char protection W01k at Sakura & Enayetpur are also not acceptable	See response to Comment A4i	No action	Closed
A4k..	Under the above situation, who will take the responsibility when a. Embankment of Hurasagar Project will be engulfed by Jamuna River. b. Slope of embankment of Hurasagar will be damaged by wave action. c. 9.00 km Protection work of Harirampur will be outflanked from UIS. d. 17.00km Embankment at Harirampur will be eroded by Padma River.	The responsibility for maintenance is stipulated in Schedule 5 of the loan agreement. a. Some emergency works have already been implemented by BWDB over a length of about 1 km. Further 3.5 km of full	No action	Closed

	Comment from Design Office	ISPMC Notes / Reply to Project Management Office	Action	Status
	e. When 14.00km unstable Char Protection work will be washed out after first flood. f. 2.00 km Light Protection at Pukuria be damaged and it will be a cause of damage for the adjacent protection work.	protection is included in Tranche 2 (see response to Comment A4e) b. see response to Comment A4f c. see response to Comment A4g d. see response to Comment A4h e. see response to Comment A4i f. see response to Comment A4i		
A4l.	In the "Updated Feasibility Report", there is no explanation, for selecting very very unimportant unstable char area like Salura, Omarpur & Enayetpur by excluding more imponant and vulnerable original land located at Benotia, Dawn Tarotia, Hatpachil, Pukuria, Solimabad, Daulatpur, Hoffampur, Dhulsura, Brah bazar, Majirchar etc. There is also no explanation, for selecting unimportant 17.00km embankment by excluding the above important and vulnerable area. There is no permanent habitation on the char. People comes here temporarily during Low Water Level period. During High Water Level period, peoples leaves this char. On the other hand, Benotia, Dawn Tarotia, Hatpachil, Pukuria, Solimabad, Daulatpur, Horirampur, Dhulsura, Brah bazar, Majirchar, Noria are original land. Peoples lives here. Homestead, school, college, private & public installation is here. Under no circumstances, unimportant unstable char area like Salura, Omarpur & Enayetpur or 17.00 km embankment can be priorities over protection of original land like Benotia, Dawn Tarotia, Hatpachil, Pukillia,	see response to Comment A4h	No action	Closed

	Comment from Design Office	ISPMC Notes / Reply to Project Management Office	Action	Status
	Solimabad, Daulatpur, Horirampur, Dhulsura, Brah bazar, Majirchar, Noria etc.			
A4m.	Under the above circumstances, Option-I shall be deleted from this "Updated Feasibility Report for Tranche-2"	This option has been deleted.	No action	Closed
A5.	Page viii : Last para: It is that "The adaptive approach formed the basis for the FRERMIP, with the BWDB committing to maintain all implemented work. Observation : BWDB made no such commitment to maintain all of FRERMIP or JMREP work. Such false statement shall be deleted.	This statement is factually incorrect Background: Section 22 (p.21) of the signed Loan Agreement states “The Borrower and BWDB shall ensure that (a) BWDB inspects and maintains the embankments, regulators and riverbank protection works rehabilitated or constructed under the Project” and “(c) the Borrower will allocate in its annual budget adequate resources for BWDB to carry out such maintenance and repair works” The Framework Financing Agreement contains covenants Tranche-2 contains substantial allocations for adaption works, covering a substantial part of what otherwise is considered maintenance, as well as emergency allocations.	No action	Closed

	Comment from Design Office	ISPMC Notes / Reply to Project Management Office	Action	Status
		As per decision of the Technical Committee, double layer protection is included		
A6	Page ix : 3rd para Design recommended by BWDB termed as Option 2 and draft design enclosed in "Draft Feasibility Report for Tranche-2" termed as Option I Observation: A Draft and Lumpsum design were proposed in "Draft Feasibility Report for Tranche-2". This design was reviewed by BWDB. Technical Committee for FRERMIP recommended to include the reviewed drawing in the "Final Feasibility Report". So, newly generated Option 1 & Option 2, on the basis of Draft Drawing and Final Drawing is meaningless. Moreover, it is violation of recommendation of Technical Committee for FRERMIP. Such approaches shall be given up. Option I & Option 2 shall be deleted and Report shall be formulated as per recommendation of Technical Committee.	This option was not included in the most recent version of the feasibility study.	No action	Closed
A7.	Page 6 : 3rd para: It is written that "Trench I built on successful completion of JMREMP". Page 18 : 2nd Line It is written that "geobag revetments confirm their two main and interrelated characteristics : cost-effectiveness and sustainability"	The concept of JMREMP was cost effective during implementation from 2004 to 2013 Attachment 1 shows that the right channel was dominant from 2001 until 2007 – the BWDB asked for the protection work in 2000 and signed the loan in 2002. The right	No action	Closed

	Comment from Design Office	ISPMC Notes / Reply to Project Management Office	Action	Status
	Observation: Still JMREMP cannot be considered as a successful one. Because main flow of Jamuna not yet flown through that channel on which JMREMP work was done. JMREMP work not yet experienced the real scour depth of Jamuna River. At Bera part during implementation, at some section, no Falling Apron was provided, only Areal Coverage was provided. At some section, Falling Apron was placed at -13.00, -4.00, -10.00, -5. 00 m (PWD). Dumping volume was provided 11.50 m^3/m to 22.50 m^3/111 At Shajadpur part during implementation, Falling Apron was placed at 0.83, -1.03, -3.39 m (PVVD)I Bed level at damaged was observed +1.15, -16.50, -13.00, -10.00, -15.00, -11.00 m (ND) during 2017. In Chouhali, scour level was observed as -23.00m(PWD). In Bera or Shajadpur area similar or deeper scour level may be occurred. In that situation, work of JMREMP will not sustain. So, on the basis of unsustainable JMREMP approach, further work cannot be taken up. So, all such line or recommendation shall be deleted	channel only declined substantially after 2012. After implementation, the work performed successfully, proven by the fact that critical parts of the embankments of the two irrigation schemes PIRDP and MDIP are protected against erosion since some 15 years. Neither adaptation nor substantial maintenance has been performed since implementation. Consequently, some parts of the works are damaged today, particularly along the Kaijuri revetment.		
A8.	Page 18 : 2nd & 3rd Line: In 2018 cost, conventional revetments and RCC spurs are a factor of 25 and 10 times more than expensive and typically entail major adaptation or reconstruction works. The work at Chauhali is less costly than the one at the PIRDP built 15 years earlier, despite including 3.8 km of adaptation works, accounting for 10% of the total cost.	This section has been deleted in the updated report.	No action	Closed

	Comment from Design Office	ISPMC Notes / Reply to Project Management Office	Action	Status
	Observation: Here they compared the cost with Sirajganj Hard Point which is not conventional revetment by BWDB. In the table, they have shown the cost as 2,785 million BDT, which is anomalous. Revised DPP cost are only 400 million BDT and they are protecting approx. 5.5 km of riverbank, where protection cost per km is only 72.7 million BDT. Moreover, huge land was reclaimed from the river (apprx 22.5 Ha) which is 1/3 of the cost of JMREP and after all these maintenances, the cost per km of riverbank protection is much less than the JMREP cost			
A9.	Page 18 : para: It is written that "Chouhali is less Costly than one at the PIRDP" Observation: It is not true. In PIRDP dumping volume was 11.50 m^3/m to 22.50 m^3/m. But in Chouhali dumping volume was 32.50 m^3/m. So, such line shall be deleted.	This sentence was deleted from the FSR		
A10.	Page 16 : 1 st Line: "The after effect of Capital Pilot Dredging in the area of Bangabandhu Bridge has destabilized the downstream. While the capital pilot dredging achieved the purpose of protecting against outflanking of the Western Guide Bund, the pilot channel dredged through the stable mid-channel char under the bridge has triggered a major river change and disturbed the stable flow pattern in the downstream, some 15 km long straight channel. As a consequence the channel develops a curved alignment with	The comments confuse the erosion immediately downstream of Bangabandhu Bridge with the erosion triggered by the narrowing of the river through the guide bunds. Background: During the Padma Bridge studies the additional erosion at Chauhali and	12 to be included in the feasibility report to provide justification for statement	Closed

	Comment from Design Office	ISPMC Notes / Reply to Project Management Office	Action	Status
	erosion at the Tangail bank immediately downstream of the bridge (Figure 2-3, location 2a), and a general widening tendency further downstream with massive riverbank erosion alongside the left bank (Figure 2-3, location 2b)". Page 27 : Last Line: "Experience from the Capital Pilot Dredging at the Bangabandhu Bridge shows that a pilot channel to destabilized the downstream river course over a distance of some 20 kilometers over decades. Observation: This is not true. Capital Pilot Dredging was done during 2012-2013. But serious bank erosion on left bank near Chouhali area was observed from 2003 or before, BWDB has made several studies at that time, and undertaken protection work at Chouhali area during 2006 and onward. Such irrelevant comment shall be deleted.	downstream of Enayetpur as a consequence of the narrowing of the river through the guide bunds built from 1996 to 1998 could be established (see for example the Padma Bridge reports and related publications). The erosion immediately downstream of the bridge crossing on the left bank is a consequence of the capital dredging project (refer for example to the background documents for the river stabilization plan). The erosion history at Chauhali can be derived from superimposed historic satellite imagery – see 11 Additional information is available from large-scale river survey data (refer to Annexe 2) demonstrating the destabilization and increased bank erosion alongside both banks of the straight channel upstream of the Enayetpur – Chauhali bifurcation. (see 12)		

	Comment from Design Office	ISPMC Notes / Reply to Project Management Office	Action	Status
A11.	Page 16 : Last Line: "At the end of 2018, BWDB proposed modification to the concept (BWDB, Technical Committee, 2018), restricting the work initially to the floodplains before stabilizing also the chars Observation: This is not true. BWDB does not proposed any modification to the concept. Rather ISPMC deviate from the original Feasibility Report. ISPMC changed the concept of the project and shifted to unnecessary Protection Work for unstable Char land without any study. BWDB Technical Committee, advised and recommend to come back to the concept of original Feasibility Report. ISPMC does not present any proper engineering justification for the selection of unstable Char Protection, which is subjected to washout in one flood	Protection on chars has already been excluded Based on the decision of the Technical Committee, only 2-layer protection is considered Please also refer to A1 and A4b	No action	Closed
A12.	. Page 24 : 3rd para: Here it is mentioned that 30,000 ha main land in JLB-I & PLB-I (25,000 ha in JRB-I & 4740 ha PLB-I) will be protected from flood in Trench-2. Observation: In Trench 2, 17.00 km embankment was proposed along a char land at a distance of 4.00km on the R/S of existing BWDB embankment. This embankment will provide the flood protection for the area (4740 ha)	In compliance with the Client's desire no work on chars is presented. The comment confuses embankment construction in different places with the provision to stabilize the river course and recover lost floodplain land, an activity required before embankment construction.	No action	

	Comment from Design Office	ISPMC Notes / Reply to Project Management Office	Action	Status
	enclosed within existing BWDB embankment and Proposed 17.00 km embankrnent. In Trench 2, no embankment was proposed in JLB-I. So, in this report, there are no explanation how 25,000 ha in JLB-I will be protected from flood in Trench-2. So, this statement shall be corrected and 25,000 ha shall not be considered as benefit for economic analysis.			
A.13.	. Page 30 : Option 2 : 17.00 km embankment : Bridge at Kaftikpur and 7 Regulator: Observation: A Bridge at Kattikpur and 7 Regulator was proposed without any study. In this report nothing mentioned about Kaisllakahli closure, which is the most and buming issue. Issue of Titpal (Bilchari) khal, Joiklisnawpur Khal, Gosail Khal are also not discussed. It indicates that ISPMC has not the capability to perform a Flood management & drainage project. Before including 17.00 km embankment in Harirampur, in Trench-2, ISPMC shall study the whole Arial Beel area, total catchment area oflchamti River from Kaishakahli closure to it's outfall at Dhaleswary River, water logging issue, flood issue, erosion issue Before including 17.00 km embankment in Harirampur, in Trench-2, ISPMC shall study the whole Arial Beel area, total catchment area of lchamti River from Kaishakahli closure to it's outfall at Dhaleswary River, water logging issue,	See response to Comment A4 and Annex 5 of the FSR The studies recommended will be performed as part of the Arial Beel Study in Tranche 2	Clarification if the design office has changed its opinion and revokes the approved design. (The provided design was approved by the BWDB Design Circle II and Chief Engineer	Closed

	Comment from Design Office	ISPMC Notes / Reply to Project Management Office	Action	Status
	flood issue, erosion issue, environmental degradation issue etc. Based on detail study, size and invert level of regular shall be determined, ISPMC shall identify what are the problems of the whole area and what are the solutions. All this issue shall be described in the report elaborately. Before detail study, 17.00 km embankment in Hafirampur cannot be included in Trench-2. There is no demand for this embankment. Moreover, this costly embankment will give benefit to a small char area which is mostly covered by Katkin grass i,e very low benefit. Most of the alignment of embankment is subjected to engulfed by river erosion. To include this 17 00km at least following two things are needed Detail study of whole area. River Bank protection on the UIS and DJS of existing protection work i,e in Gopinathpur, Boyra and Dhulsura. Otherwise selection of this 17.00 Ian embankment in Harirampur cannot be justified.		Design on 23/12/2018)	
A14.	Page 78 : Ali 8.3.1.2 : Flood mitigation : Here it is mentioned that Benefited Area from Flood Embankment in JRB-I is 30,000ha and from PUB-I is 12,000ha. Benefit from Flood Embankment in JRB-I is 12,431 mBDT and from PLB-I is 2,914 mBDT. Observation: In JRB-I, Benefited area from completed and proposed Flood Embankment of Hurasagar Project is 6000ha. In PLB-I, Benefited area	a) In Harirampur, the area is larger as indicated, as the old embankment several meters below the proposed embankment (200 year flood level plus freeboard) and in the downstream part has also breached repeatedly over the past.		

	Comment from Design Office	ISPMC Notes / Reply to Project Management Office	Action	Status
	from proposed Flood Embankment in Harirampur is 4740 ha. As such, the benefit showm here is not correct It shall be corrected accordingly. There is serious river erosion in Benotia & Dawn Tarotia. Embanlanent of Hurasagar Project is within 50m to 100m from river bank. The project life is considered as 30year. In Trench-2, only 1.00 km Bank protection work was proposed, which is insufficient. So, within I or 2 year Embankment at Benotia & Dewan Terotia of Hurasagar Project will be eroded. So, there will be no benefit from the investment for Embankment of Hurasagar Project. The Economic Analysis shall be corrected accordingly, There is serious river erosion on the U/S and DJS of existing protection work i,e in Gopinathpur, Boyra and Dhulsura.. Proposed 17.00 km Embankment of Harirampur is under threat from river bank erosion. The project life is considered as 30year. No Bank protection work was proposed here in Trench-2 & Trench-3. So, there is a possibility that within 3 or 4 year Embankment of Harirampur will be eroded. So, there will be no benefit from the investment for Embankment of Halirampur. The Economic Analysis shall be conected accordingly.	Based on Annex D of the PPTA feasibility study, 2013, the area benefitted by the embankment and river training works Is beyond the area enclosed by the embankment. In this context, benefitted does not mean flood-free, but also refers to a reduction of flood levels with changes of land type, for example from F4 to F3 and therefore increasing the agricultural production. b) refer to Comment A4e c) See response to Comment A4h		
A15.	Benefit from Protection work The project life is considered as 30year. There is a possibility outflanking and damage of Char protection work at Salura (4.00km), Ommpur (6.00km) & Enayetpur (4.00km). There is a possibility outflanking and damage of 1.00km bank protection work at Benotia due to insufficient length.	Bank protection works on chars already has been excluded The considered length is 3.5 km (see comment A4e) See response to comment A4h and g	No action	Closed

<table>
<tr><th></th><th>Comment from Design Office</th><th>ISPMC Notes / Reply to Project Management Office</th><th>Action</th><th>Status</th></tr>
<tr><td></td><td>There is a possibility outflanking and damage of 9.00km bank protection work at Harirampur due to serious erosion on U/S and DJS. All the above protection work will not sustain for 30 years. So, there will be no benefit from the investment. So, Economic analysis shall be corrected accordingly.</td><td></td><td></td><td></td></tr>
<tr><td>A16.</td><td>Table 8-7 of page 84 is misleading. It shall be corrected accordingly.</td><td>Option 1 and the table were removed in the latest version of the feasibility report.</td><td>No action</td><td>Closed</td></tr>
<tr><td>A17.</td><td>Data of Table 8-7, Table 8-9, Table 8-10, Table 8-11, Table 8-15, Table 8-16 shall be matched with one another.</td><td>These tables refer to different types of economic analysis and different design options however are based on the same data. Please confirm which items should be matched with each other. Further, please note that in the latest version of the feasibility report Table 8-11 and Table 8-16 are not included.</td><td>No action</td><td>Open</td></tr>
<tr><td>A18.</td><td>Jurisdiction of FRERMIP is from D/S of Bangabandhu Bridge to Aricha for Jamuna River and Pangsa to Chandpur for Padma River. FRERMIP taken the responsibility of River Bank protection with Flood Embankment on both banks approximately for 168+178 346 Ian. Different Component of FRERMIP is as below :
<table>
<tr><td>Component</td><td>Trench-I</td><td colspan="3">Trench-2</td></tr>
<tr><td>River Bank Protection</td><td>Jafargonj 2.00km (full)</td><td>Chouhali 5.00 km
Pukuria 5.00 km
2.00 IQ1(pre)</td><td>5.00km</td><td>29.00 km
6.00km</td></tr>
</table></td><td>The outputs noted here were agreed by the ADB and the Bangladesh Economic Relations Division in the Framework Financing Agreement (Schedule 2, Page 21) in May 2014.

From an economic point, riverbank protection is often not justifiable due to the high cost and the comparatively small area protected, indicating that resettlement of</td><td>No action</td><td>Closed</td></tr>
</table>

	Comment from Design Office					ISPMC Notes / Reply to Project Management Office	Action	Status
	Work	Horirampur 7.00 km(full) 2.00 Ian (pre) Chouhali 5.00km(full) 2.00 km(pre)			(pre)	affected persons would be a more economic option. Consequently, the economic feasibility study combines the high cost (and low economic benefits) for riverbank protection with the low cost (and high economic benefits for flood protection). To this end, embankment construction is the logical completion of the work, in order to obtain sufficient economic feasibility. During Tranche-2 additional benefit streams were added, for example from improved land transport over more direct embankment lines and the more intensive use of recovered former char land. This has further improved the economic feasibility. From above considerations it is evident that abandoning the planned embankments is not in line with the agreement signed between the BWDB and ADB in 2014.		
	Embankment	Hurasagar 21.3 Ian	Hurasagar 7.9 km H01frampur 17.0km	40km	86km			
	From the above Table, it was found that vast area of FRERMIP, left unprotected against erosion and subjected to flooding. Important and sensitive area like Benotia, Dawn Tarotia, Hatpachil, Pukuria, Solimabad, Daulatpur, Gopinathpur, Boyra, Dhulsura, Brah bazar, Majirchar, etc. left unprotected against erosion. In FRERMIP area River Bank Protection Work is much more essential than embankment. There is no such demand for embankment. But there is serious demand for River Bank Protection Work. But in Trench 2 & 3, ISPMC considered 57.00km embankment which is very very less important Under this situation, it seems that Trench 1, 2 & 3 is not well-planned.							
A19.	Page 33 : Footnote 50 Observation:					Training in the use of the river database of Tranche 1 was provided to the BWDB, more specifically Mr. Masbahul Islam (BWDB	No action	Open

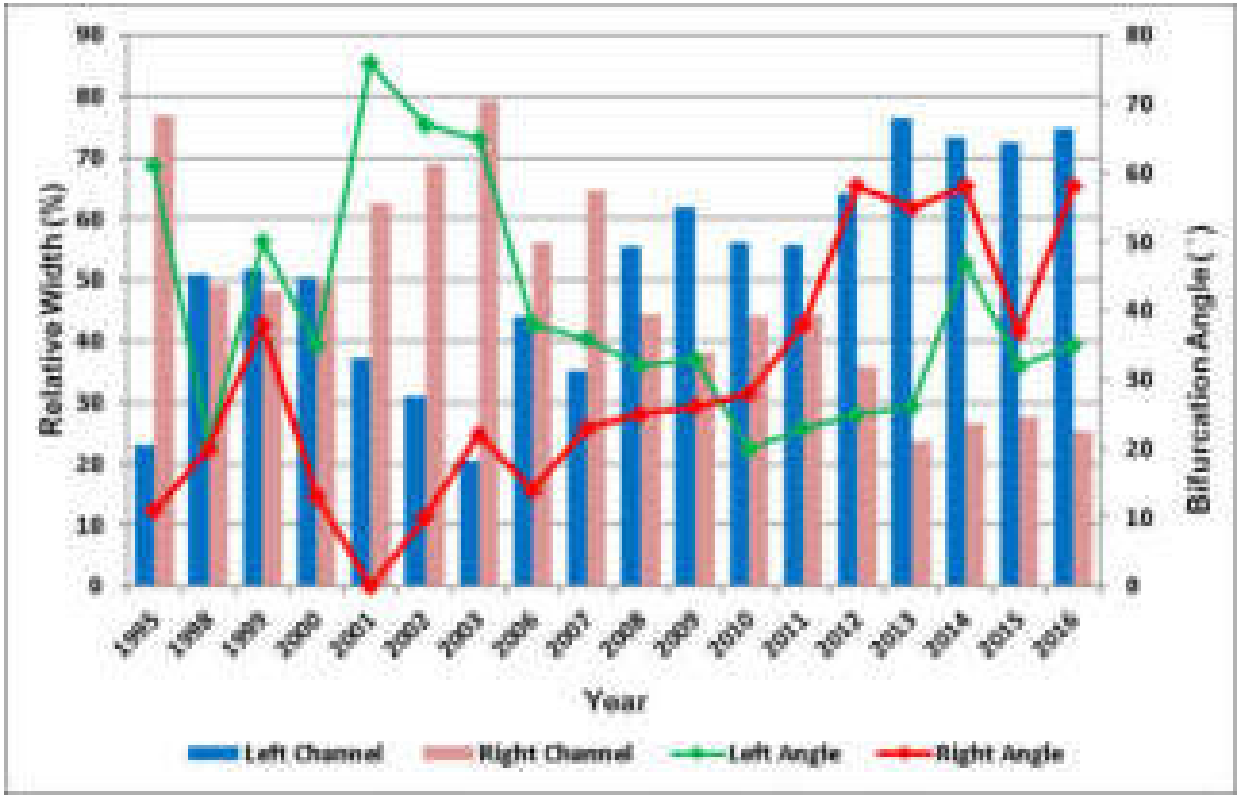
	Comment from Design Office	ISPMC Notes / Reply to Project Management Office	Action	Status
	ISPMC cannot handed over river database of Trench-I to BWDB.	Design Circle II), who was selected following a workshop in January and February 2019. The handover of the river data base will take place in October 2019		
A20.	Page 33 : Para Here it was is written," BWDB remains in favour of strong in-house capacity, particularly with respect to design. While this assures full control over the design process, a rapidly increased workload could lead to overloading and delays". Observation : Strong in-house capacity is essential for a specialized professional organization like BWDB. BWDB as well as other organizations or institutions of Bangladesh are benefited from such "Strong in-house capacity". Moreover, one of the major benefit of this "Strong in-house capacity" goes to consultants who work with BWDB. It is to be mentioned here that all donor aided study report including this "Updated Feasibility Report for Tranche-2" urges and gives special emphasis for the "Capacity Building" and "institutional strengthening" of BWDB and government organization. This urge or approach is contradicting with the above statement. This statement made here in a negative way. Moreover, this statement is not relevant to this Study. So, this statement shall be deleted.	This statement was rephrased in the most recent revision of the report prior to the review through the office of Chief Engineer Design.	No action	Closed
A21.	Page 33 : Footnote 38	This footnote was deleted	No action	Closed

	Comment from Design Office	ISPMC Notes / Reply to Project Management Office	Action	Status
	Here it was is written," BWDB implements work for around 6,000 crore with some 6000 staff, the LGED implements around 20 times the amount of work with double staff. A major reason for achieving around 10-times as much annual tumover per head is systematic outsourcing. Observation : This statement is not true. Nature of activities of BWDB & LGED are not similar. BWDB, RHD, PWD, BPDB, Bangladesh Railway etc. are specialized professional organization work with a specific sector. But LGED is a generalized organization work in many sectors. LGED works almost in all sector such as road, bridge, culveft, building, growth centre etc. but in a small scale. LGED also work in small scale water sector project. BWDB builds a project on their own land, through Land acquisition. Land acquisition is a complex and lengthy process. Most of the cases implementation delays for Land acquisition. LGED needs no Land acquisition. LGED implements projects on others land, e,g BYOB's embankment etc. LGED made carpeting on existing road for which no complex planning or Land acquisition is needed. LGED build Bridge or culvelt over existing Khals or river for which no Land acquisition is needed. LGED build building on the land of respective departments. For the projects of LGED, no complex study is needed It is to be mentioned here that BWDB needs no Land acquisition for Bank Protective work. But for the projects on ADB loan, BWDB had to do Land acquisition, which causes delay in implementation.			

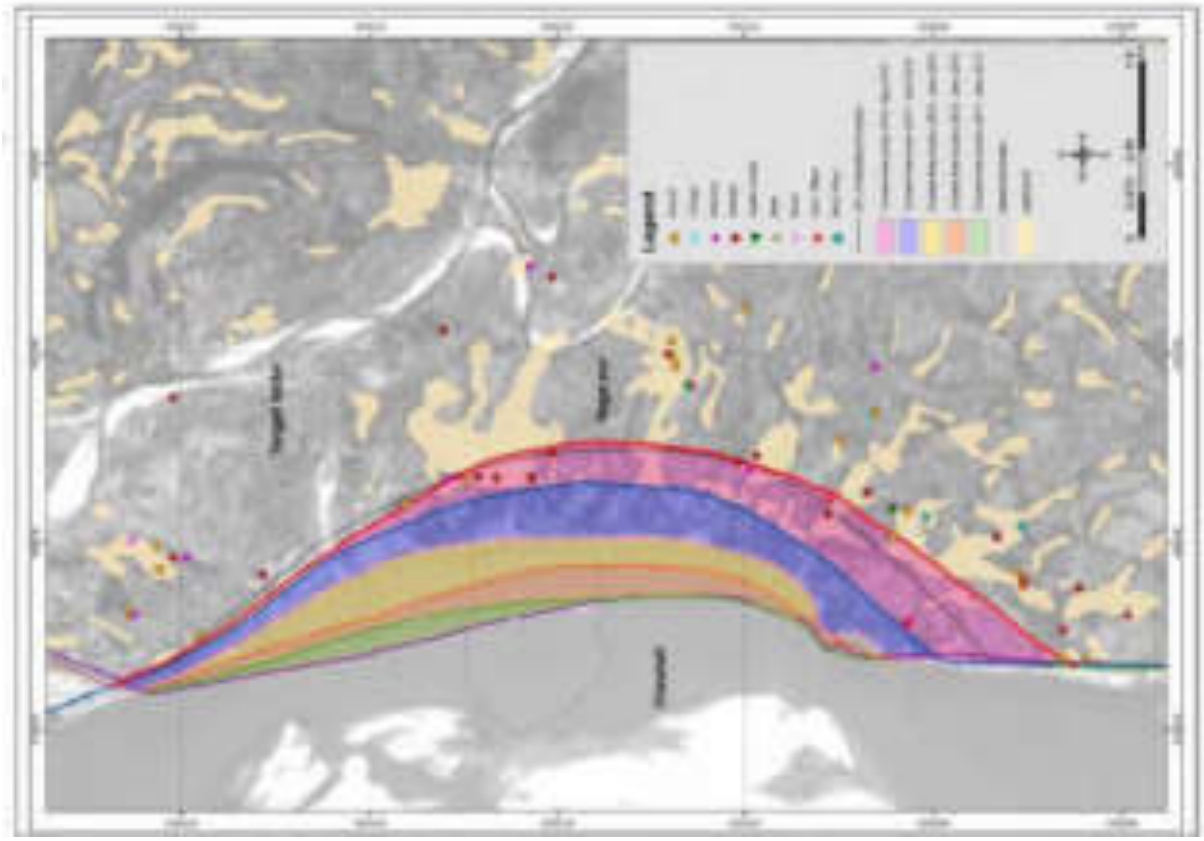
	Comment from Design Office	ISPMC Notes / Reply to Project Management Office	Action	Status
	For the projects on ADB or WB loan re-settlement work had to do. But for the projects of LGED normally no re-settlement is needed, because they need no Land acquisition. LGED can continue their construction work throughout the year. But for implementation BWDB has a very limited time in a year. BWDB has to fight flood, cyclone, tidal surge each year, which LGED had not to do. Moreover, 'Footnote 38' is not relevant to this Study. So, this Footnote shall be deleted.			
A22.	Page 33 : Para . Here it was is written, "The role of local level BWDB staff in Upazila and District coordination committee is limited". Observation : This statement is not true. Moreover, this statement is not relevant to this Study. So, this statement shall be deleted.	This sentence has been deleted from the FSR	No action	Closed
A23.	Page 32 : 3.4.1 (ii.) . Here it was is "Introducing a heavier design with concrete blocks that shows a visual evidence of better launching in a small scale physical model and is termed as "No regret" (Option2)". Observation : Here the statement is very offensive. Whether the consultant is authorized to pass such a comment against the employer? BWDB has been using this combination for a long period in Padma & Brahmaputra	This sentence has been revised to: Visual inspection indicates that the area coverage of a mix of geobags and concrete blocks is more complete. Background	No action	Open

	Comment from Design Office	ISPMC Notes / Reply to Project Management Office	Action	Status
	river and found to be in good condition (Annex-I). Whereas the construction done by the recommendations of the same consultant in JMREP and FRERMIP has got a series of damages with the only 30% flow in Jamuna river (Annex2). Moreover, in one meeting and presentation by Dr. Hybam mentioned that in Europe, Geo-bags are used only for emergency works because of its low durability. Durability or Lifetime of Geotextile (Geobag) not yet fully understood or determined. It is to be mentioned here that "Test for Durability or Lifetime of Geotextile" has not yet passed by Geotextile of Local & Foreign origin. Without assuring "Durability or Lifetime of Geotextile (Geobag)", (later on FRERMIP) recommending to use Geobag in a permanent bank protection work. Until "Durability or Lifetime of Geotextile (Geobag)" are ascertained, we cannot depend on Geobag alone for riverbank Protection Work. It would be better, if we can use hard rock or boulder or CC Block alone as a protection material in bank protection work and have been used worldwide. But availability and cost are an issue. To minimize the cost, combination of CC Block with Geobag is a better solution. RRI model test gives us a basis, to use the combination of CC Block & Geobag.	The ISPMC was only provided with the RRI model study report in support of the better performance of a double layer (mix of concrete blocks and geobags) underwater protection system. Geobags are not used widely in Europe, as rock in large quantities is available. Geobags have been used in places, as well as mega containers. Dr. Heibaum explained that there are latest standards to test the durability of both, PP and PES. The accelerated tests provide clarity about the performance also for longer periods, for example 50 or a 100-year lifetime. Both, single layer geobag protection as well as geotextile bag filter covered with rock are presently implemented for Padma Bridge. The technical specifications stipulate durability tests.		

10 FLOW DISTRIBUTION BETWEEN RIGHT AND LEFT CHANNEL IN THE JAMUNA RIVER

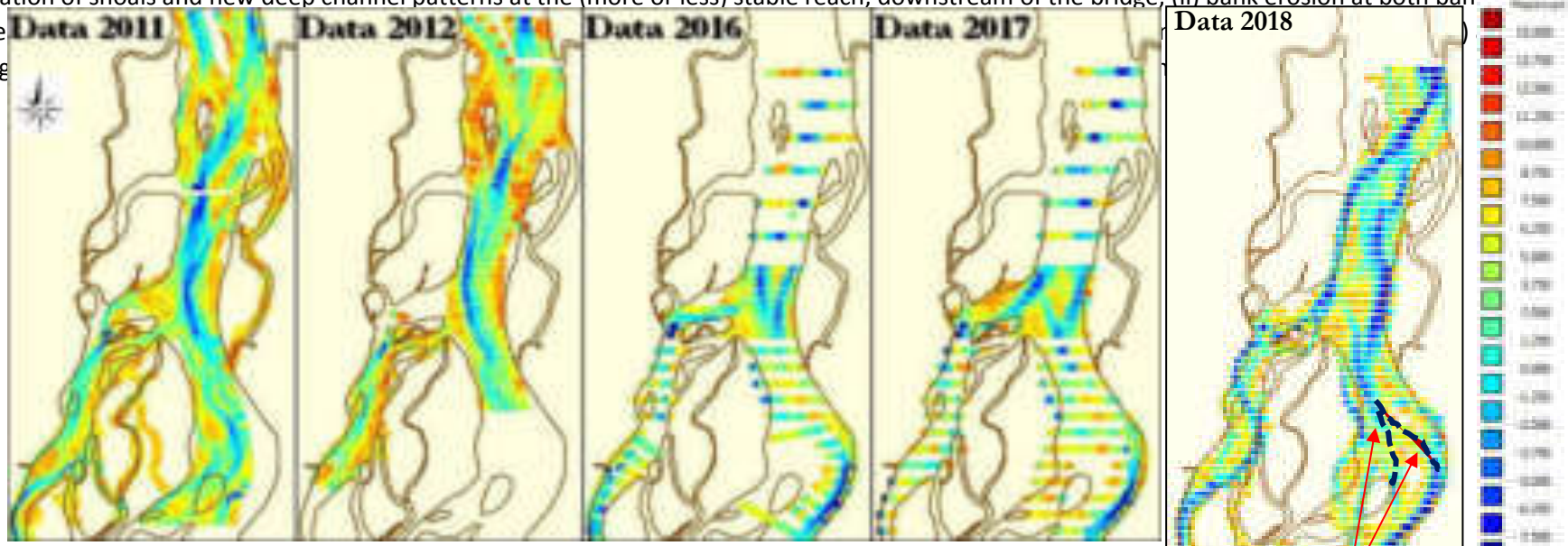


11 DEVELOPMENT OF BANKLINE AT CHAUHALI



12 CAPITAL DREDGING

This dredging trench had worked as expected due to several reasons: (i) favorable approach flow (narrow inflow with higher magnitude and favorable orientation), (ii) short trench, (iii) higher land char, so the low and medium flows could be channelized for longer time that could erode the trench already before rising the flow, (iv) use of sand closure and groynes at the right channel (that led to flow diversion away from the banks towards the direction of dredged trench). It had apparently solved one problem, but it appears to have created some other problems like: (i) large morphological activities, i.e. formation of shoals and new deep channel patterns at the (more or less) stable reach, downstream of the bridge, (ii) bank erosion at both ban[illegible] these [illegible] chang[illegible]



Changes in deep channel alignment

Possible future alignment of deep channels formation

APPENDIX D

GENDER ACTION PLAN FOR TRANCHE-2

Output/Activities		Indicators and Targets	Responsi -bility	Time frame
Output I: Integrated flood and riverbank erosion disaster risk mitigation measures functioning at priority reaches				
Sub-Component A1: Infrastructure improvement				
Activity:	A1-1 Construction of riverbank protection structures using appropriate technology and methods A1-2 Rehabilitation/construction of embankments			
Tasks:	- Ensure women benefit from employment in construction - Ensure gender-related aspect of labor standard including equal wage for women and men for equal work - Ensure Occupational health and safety, safe water supply, sanitation (including separate toilets)	1. Specific condition included in contractors' bid document whereby 5% unskilled labor opportunities be given to women in 2. - Orientation sessions targeting 120 PMO/Design office/SMO staffs (at least one orientation in PMO and one in each SMO and minimum 2 times over the project period) i.e. XEN, design engineers, SDE, Section Officers, surveyors and contractors' site manager, site engineer and supervisors to verify and ensure that conditions are met 3. Provisions for either separate toilets for women or arrangements for use of facilities in nearby communities and/or households 4. Sex disaggregated information in field monitoring reports and contractors' compliance reports quarterly basis	PMO and work contract ors	Entire T-2 period
Sub-Component A2: Community-based Flood Risk Management				
Activity:	**A2-1. Formulating community disaster management units**			
Tasks:	– Form 80 Community Disaster Management Units (CDMUs) – Develop a community flood assessment and	5. CDMUs 80 - consisting of 15 male and female volunteer/each established with minimum 33% units lead by women	PMU-DDM and commun	End of T-2

	community risk reduction plan	6. **Community flood risk assessment report** prepared identifying : (i) risks for women, men, children and vulnerable groups, and (ii) disaster response coping mechanism related to flood and erosion warning; 7. **Community risk reduction plan** (40 plans) prepared for 80 Units through participation of women volunteers specifying roles, provision for women and men in terms of disaster preparedness at HH and community level risk reduction measures; 8. Identified 120 locations and build community flood markers for flood warning information	ity disaster manage ment NGO	
Activity:	A2-2. Capacity development for community disaster management Unit			
Tasks:	- Initiate community-based flood warning dissemination procedures building on indigenous techniques - Disseminate regular warning messages relevant to local context/language in line with the national warning network	9. 50% (40 nos.) of the units have flood warning mechanisms 10. 40 knowledge events held [Target: 200 women] -11. 50% of the households, including low-income households, and poor women living on the embankment participate have increased resilience through preventive measures at household level	PMU-DDM and commun ity disaster manage ment NGO	End of T-2
Sub-Component A3: Participatory Regular O&M				
Activity:	A3-1 Capacity development of communities			
Tasks:	- Training on gender awareness and leadership	12. 30% women including management committee members should receive gender awareness and leadership training	PMO and commun ity disaster manage ment NGO	End of T-2
Sub-Component A4: Livelihood support for project affected people				
Activity:	A4-1. Construction of resettlement areas with basic infrastructure and facilities			

Tasks:	- Ensure effective consultation with women in the affected areas and maintain sex-disaggregated data on Project Affected Persons (PAPs) along with entitlement benefits, as per Resettlement Plan (RP) Ensure that gender issues are considered when planning resettlement villages and community facilities	13. Full compensation for 100% women PAPs, as per RP entitlement. 14. 33% women involved in planning meetings 15. At least 30% women participants will operate livelihood support programs in the community groups in and around resettlement areas.	PMO and Partner NGOs	T-2
Activity:	A4-2. Support for project affected people			
Tasks:	- Build up linkage with government line agencies i.e. Departments of Agriculture, Fisheries, Cooperatives, Women's Affairs, etc. - Provide special training and financial support for women-headed households and for women in ultra-poor households -	16. During any field level training relevant government line agencies must be invited which will lead to buildup linkages for future support 17. Priority needs to be given for special training and financial support to the groups organized having women-headed households and women in ultra-poor households that identified by resettlement surveys,.	PMO and resettlement NGOs	End of T-2
Output II: Strengthening Institutional System for Flood and Riverbank Erosion Risk Management				
Sub- Component B1: Institutional capacity strengthening for flood and riverbank erosion risk management				
Activity:	B1-1 Capacity enhancement of BWDB			
Tasks:	- Integrate a gender-specific module in the BWDB training - - Build capacity of female staff in BWDB	18. Gender aspects integrated in the relevant training program/module and 10% women in training programs 19. Provide 6 training (2 in BWDB HQ, 2 in design office and 2 in 3 SMOs) to at least 120 staff in BWDB on working while minimum 15% must be women	BWDB	End of T-2
Output III: Efficient program management system established				
Component C: Program Management				

Activity:	C-1: Implementation management			
Tasks:	- Establish MIS system with sex disaggregated data base for project reporting	20. Identify gender indicators, incorporate in monitoring system and ensure regular reporting on progress of GAP implementation	BWDB	Entire T-2
Activity:	C1-2: Preparation for Tranches 2 and 3			
Tasks:	- Incorporate gender issues in the planning process	21. Prepare gender action plans for Tranche-3	BWDB	End of T-2

APPENDIX E

DRAFT SUMMARY POVERTY REDUCTION AND SOCIAL ASSESSMENT

Country:	Bangladesh	Project Title:	Flood and Riverbank Erosion Risk Management Implementation Program
Lending / Financing Modality:	Multi-tranche Financing Facility	Department / Division:	South Asia Department Environment, Natural Resources and Agriculture Division (SAER)

I. POVERTY AND SOCIAL ANALYSIS AND STRATEGY

Targeting classification: Geographic dimension of inclusive growth (T1-G)

A. Links to the National Poverty Reduction and Inclusive Growth Strategy and Country Partnership Strategy

Bangladesh has made considerable progress in reducing poverty, and has made good progress toward meeting the Millennium Development Goals and now working towards Sustainable Development Goals (SDGs). The population living below the national poverty line fell to 31.5% in 2010, a decline of 1.7% per annum since 2005. Despite good progress, poverty remains a dominant problem. The Bangladesh Bureau of Statistics conducted the survey between April 2016 and March 2017. The previous survey was done in 2010. According to the latest survey results, the poverty rate in rural areas was 26.4 percent, while urban poverty was 18.9 percent. The current rate of extreme poverty is 12.9 percent, compared to 17.6 percent six years ago.

The first year of the 7th Five Year Plan coincides with the launch of the UN post 2015 Sustainable Development Goals (SDGs). In the backdrop of these factors, the 7th Plan centers on three themes:

- GDP growth acceleration, employment generation and rapid poverty reduction;
- A broad-based strategy of inclusiveness with a view to empowering every citizen to participate full and benefit from the development process.
- A sustainable development pathway that is resilient to disaster and climate change; entails sustainable use of natural resources; and successfully manages the inevitable urbanization transition.

The economic growth strategy of 7th FYP includes four pivotal themes:

- Break out of the sphere of 6% growth and raise the annual average growth rate to 7.4%.
- Growth will be inclusive, pro-poor, adapt well to the urban transition and be environmentally sustainable.
- By the end of the 7th FYP, poverty and extreme poverty will be substantially lowered.
- All the additional labour force will be gainfully employed, including much of the underemployed

. The Asian Development Bank (ADB) will adopt a broad-based approach in order to respond flexibly to the needs and demand of the country over the country partnership strategy (CPS) period (2016–2020). ADB assistance is strongly aligned with the government's Vision 2021 and its Seventh FivD-Year Plan, which lays out a roadmap for higher, sustainable and inclusive growth. Freeing the country from poverty and inequality remains a major though separate challenge. Currently, 12.9% of the population is in extreme poverty. Unless specific actions are taken, extreme poverty in parts of the country and inequality between regions will likely remain, even as the country's economy continues to grow. Effective implementation of the government's social protection strategy is needed to elevate people out of extreme poverty. Priorities include housing and basic services—including primary health care—for the poor, and disaster risk management to reduce vulnerability and build resilience to extreme weather conditions.

The proposed investment program is directly linked to the government's five year plan and ADB's country partnership strategy. It will protect riverine erosion and flood-prone fringe lands, which are usually occupied by the landless poor. The proposed investment program will directly protect these poor residents along the rivers from riverbank erosion and flood inundation. Institutional strengthening of riverbank erosion and flood risk management will contribute to the sustainability of the risk reduction. The investment program will also include community level capacity strengthening programs. Labor-intensive construction works will create jobs for the poor and women. It will thus contribute to the improvement of livelihoods and economic conditions of the poor population in the project area, with a population of about 2 million.

B. Results from the Poverty and Social Analysis during Due Diligence

1. Key poverty and social issues. Riverbank erosion along the main rivers is a prominent problem in Bangladesh, and is a perennial phenomenon caused by dynamic channel shifting of the rivers. Riverbank erosion annually affects about 100,000 people, who face significant social hardships, such as loss of homestead, lands, crops, and/or livelihoods. It also forces repeated displacement. Riverine fringe lands, which are prone to riverbank erosion and flood disasters, are usually occupied by the landless poor, and the majority of them are erosion victims who had been displaced by past riverbank erosions. Although poverty is falling in Bangladesh, poverty remains extensive in the project areas where poverty incidence (35%–39%) is higher than the national average.

Justification for classification: TI-G is justified as the investment program will improve the livelihoods of people in the project areas along the Jamuna, Padma, and Ganges rivers by reducing flood and riverbank erosion risks. About 70% of project benefits will go to the $2-a-day poor, in terms of stability in the livelihood activities and employment in project-related works.

2. Beneficiaries. The riverside vulnerable population affected by floods and land erosion (about 100,000) will be the direct beneficiaries. They will benefit through avoided loss of land and assets; protection and enhancement of agricultural and fishery production within the embankments; increased economic activity; increased security of population, livestock, and assets; and strengthening of local communities for sustainable risk management in the medium term. Secondary beneficiaries are the people beyond riverine lands.

3. Impact channels. The impact channels comprise (i) protection against loss of income, crops, and houses; (ii) improved agricultural productivities; (iii) community participation and capacity development support programs; and (iv) new jobs in project-related works for the $2-a-day poor.

4. Other social and poverty issues. Employment opportunities are lacking in the area. Most people work as wage earners in agricultural fields or small-scale weaving establishments. For gender-targeted activities, civil society organizations, funded by development partners, organize women labor groups and secure contracts for them on government infrastructure projects.

5. Design features. The project proposes to address the key poverty and social issues related to food production and income, as indicated in the performance indicators for the project impact in the design and monitoring framework, by increasing by 2028 the monsoon crop average yields in project districts to 3.75 tons per hectare (t/ha) (2.75 t/ha in 2013) and average annual per capita income to Tk136,000 (Tk74,380/capita in 2012). The protection by embankments will increase the income of the poor.

II. PARTICIPATION AND EMPOWERING THE POOR

1. *Summarize the participatory approaches and the proposed project activities that strengthen inclusiveness and empowerment of the poor and vulnerable in project implementation:* Consultations were held with a focus on women, the landless, and other vulnerable groups in the subproject areas regarding (i) relocation and livelihood issues, including agriculture, and fisheries; (ii) flood and riverbank erosion disaster management; (iii) possible solutions to resolve the constraints identified; and (iv) institutional mechanisms to address those constraints. The performance indicators relating to output 1 of the design and monitoring framework reflect the participatory approach, which is also reflected in the loan agreement and facility administration manual (FAM).

2. *If civil society has a specific role in the project, summarize the actions taken to ensure their participation:*

Civil society will be engaged for the project implementation. Refer to item 4.

3. *Explain how the project ensures adequate participation of civil society organizations in project implementation:* Civil society participation is ensured through (i) carrying out consultations with project displaced persons for their relocation, (ii) income and livelihood restoration, and (iii) facilitating the grievance redress process.

4. *What forms of civil society organization participation is envisaged during project implementation?* In addition to the resettlement plan implementation, nongovernment organizations (NGOs) will be involved (on a competitive basis) in designing and implementing livelihood support for the project displaced households, participatory operation and maintenance of infrastructure, and community-based flood risk management. Adequate resources were allocated for their engagement.

[X] Information gathering and sharing H [X] Consultation H [X] Collaboration M [X] Partnership M

5. *Will a project level participation plan be prepared to strengthen participation of civil society as interest holders for affected persons particularly the poor and vulnerable?*

[X] Yes No

A consultation and participation plan has been prepared as part of the resettlement plan and gender action plan implementation. While the activities in the gender action plan are mainstreamed, adequate resources have been allocated in the resettlement plan for project level consultation and participation.

III. GENDER AND DEVELOPMENT

Gender mainstreaming category: Effective Gender Mainstreaming (EMG)

A. Key issues. While the main occupation of women in the project area relates to home and family, and involves tasks related to the immobile assets of house and kitchen garden, they play an important role in agricultural production related to seeds, storing of crops, and domestic livestock. The houses of poor families are built at or near ground level, and experience deep and prolonged inundation during higher floods. During times of flooding, women face multiple challenges: providing for a family from limited food and drinking water supply, heading the household while men search for income opportunities, and being forced to sleep and live in public spaces during evacuation. Erosion of homes and land forces families to change income patterns, with the adult male family members leaving to find work opportunities and leaving the women to head and manage the households. While implementation of civil works provides income generation, gender imparity is a common issue—lower wages, lack of segregated sanitation facilities, and health hazards (e.g., from carrying heavy loads).

B. Key actions

The investment program formulated a broad range of measures targeted at achieving higher gender parity: (i) increasing women's participation in the executing agency, as staff members and training participants; (ii) obliging contractors to employ 15% women as unskilled labor with equal wage payment (It was narrow down from 15% to 5% during Tranche-1 During ADB's MTR Mission held in February 2018, as most of the activities shifted to Tranche-2 and design changed for geo-bags from 125kg to 250kg and other reasons. Based on those GAP has been revised with ADB's consent during ADB MTR Mission for t-1), and with focusing on reducing the occupational health risk associated with menial work; (iii) establishing community-based disaster management units with 33% women unit heads, assuring the inclusion of gender issues in the planning process of preventive and preparedness measures; and (iv) providing additional livelihood support for special groups, such as women-headed households, and very poor families.

[X] Gender action plan Other actions or measures No action or measure

1. Participatory infrastructure operation and maintenance: 30% women participation in training
2. Conduct early warning dissemination in the community: 30% poor women who live on the embankment
3. Livelihood support training: 50% female participants

IV. ADDRESSING SOCIAL SAFEGUARD ISSUES

A. Involuntary Resettlement **Safeguard Category:** [X] A B C FI

1. Key impacts. For the embankment and riverbank protection construction in the Jamuna Right Bank-1 (JRB-1) subproject area, a total of 148.9 ha of land will be acquired. A total of 2322 households will be

affectedon the embankment. This includes 22 agricultural plot user households; 2131 residential (including title, non-title & tenant HHs); 157 commercial and 12 CPR; Total 40,331 numbers of trees (18240 seedlings, 9132 Non-Fruit bearing & 12918 Fruit-Bearing/Grown Up).will also be affected. For the Tranche-2, in the Padma Left Bank-1 (PLB-1) subproject area, the embankment starts in Harirampur and ends in Dohar at the market; the total length is 17 km and major portion of the embankments will be built on open agriculture land; a total of 112 ha of land need to be acquired while 180 households will be affected.

2. Strategy to address the impacts. A resettlement plan has been prepared based on extensive consultations that provides for compensation at replacement cost, and has provisions for grievance redress. A resettlement framework has been prepared for the entire investment program that will guide the preparation of other resettlement plans as required.

3. *Plan or other Actions.*

[X] Resettlement plan Combined RP and IPP

[X] Resettlement framework Combined RF and IPPF

ESMS Social impact matrix No action

B. Indigenous Peoples **Safeguard Category:** A B [X] C FI

1. Key impacts. No impact. No indigenous peoples, as defined in ADB's Safeguard Policy Statement (2009), reside in the project area.

Is broad community support triggered? Yes [X] No

2. Strategy to address the impacts. Not applicable

3. Plan or other actions.

Indigenous peoples plan

Indigenous peoples planning framework Combined RP and IPP

ESMS Combined RF and IPPF

Social impact matrix IPP elements integrated in project with a summary

[X] No action[61]

V. ADDRESSING OTHER SOCIAL RISKS

A. Risks in the Labor Market

Relevance of the project for the country's or region's or sector's labor market.

L unemployment L underemployment L retrenchment L core labor standards

2. Labor market impact. Not applicable

B. Affordability Not applicable

C. Communicable Diseases and Other Social Risks

1. Indicate the respective risks, if any, and rate the impact as high (H), medium (M), low (L), or not applicable (NA):

L Communicable diseases L Human trafficking

Others (please specify) Not applicable

2. Describe the related risks of the project on people in project area. Not applicable

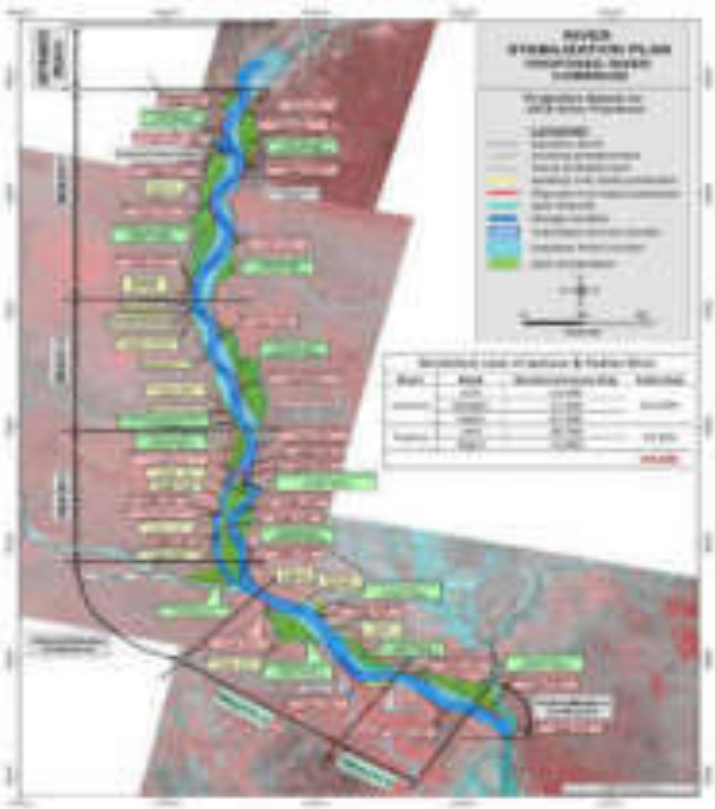
[61] Tranche-1 is categorized C for the indigenous peoples safeguard. As the subsequent tranches would also be categorized C, an indigenous peoples planning framework was not prepared. Source: Asian Development Bank estimates.

VI. MONITORING AND EVALUATION
Targets and indicators: By 2028, in the program districts along the main rivers: (i) per capita income increased to Tk136,000 from Tk74,380 in 2012 (Bangladesh Bureau of Statistic and other government-published reports and statistics); and (ii) average transplanted aman (monsoon season rice crop) yield rises from 2.75 t/ha in 2013 to 3.75 t/ha (Bangladesh Bureau of Statistics, Department of Agriculture Extension, Department of Agricultural Marketing, and other government-published reports and statistics). By 2022 (program completion), under the investment program: (i) livelihood support training provided to totalling 4,000 participants with a minimum 50% of female participants; and (ii) community-based disaster management training provided to 200 groups, with a minimum 33% of female leader participants. (project progress and completion reports, and implementation NGO's reports) 2. Required human resources: (i) implementing NGO for resettlement, (ii) implementing NGO for livelihood support programs, and (ii) individual specialists in the consulting team. 3. Information in FAM: The FAM indicates the key requirements for monitoring. Regular monitoring will be done by the project management office to measure the effectiveness and quality of activities. Quarterly progress will be reported in progress reports. 4. Monitoring tools: A management information system will be developed for monitoring benefits and project implementation. The loan agreement and FAM will describe the monitoring requirements of the social safeguards and gender issues. The project management office will monitor project performance, including poverty and social indicators. Resettlement will also be monitored by external experts.

Government of the People's Republic of Bangladesh

Bangladesh Water Development Board

Asian Development Bank



Project Loan No 3138-BAN (SF) and Grant No 0396-BAN (EF)

Flood and Riverbank Erosion Risk Management Investment Program

Annex 1 BACKGROUND INFORMATION

April 2019

nhc northwest hydraulic consultants

MOTT MACDONALD

In association with
DELTARES
RPMC and CEGIS

List of Annex

Flood and Riverbank Erosion Risk Management Investment Program
ADB Loan No. 3138-BAN (SF) and GRANT No. 0396-BAN (EF)

Institutional Strengthening and Project Management Consultant (ISPMC)

FEASIBILITY STUDY REPORT FOR TRANCHE 2

Annex 1 Background Information

Issue and revision record

Revision	Date	Originator	Checker	Approver	Description
A	Feb 2018	Bruce Walsh with contributions from ISPMC team)[1]	Knut Oberhagemann	Knut Oberhagemann	1st draft report
B	20 Mar 2018	Knut Oberhagemann			Update in line with discussions during the ADB Consultation Mission from 27 February to 5 March 2018

)[1] contributing Team Members comprise

Wandert Benthem	Environmental Specialist
Dave Burkholder	Flood Disaster Risk Management Specialist / Information and Data Management Specialist
Qazi Towfiqul Islam	Community-based Flood Risk Management Specialist
Hamida Khatun Popy	GIS Specialist
Jesper Mathiesen	River Engineer
Erik Mosselman	Morphologist
Shamsun Nahar	Resettlement and Gender Specialist
John Roe	Economist
Derek Stuart	Hydrology (Flood Modelling)
Bruce Walsh	River Engineer

DISCLAIMER

Flood and Riverbank Erosion Risk Management Investment Program
ADB Loan No. 3138-BAN (SF) and GRANT No. 0396-BAN (EF)

Institutional Strengthening and Project Management Consultant (ISPMC)

BACKGROUND INFORMATION

Main Report

Key Data

Name of Project:	**Flood and Riverbank Erosion Risk Management Investment Program (3 Tranches)**
Borrower, Executing Agency and Implementing Agency:	Government of Bangladesh (GoB) Bangladesh Water Development Board (BWDB) Department of Disaster Management (DDM)
Financing:	Asian Development Bank (US$ 251.1 million for 3 tranches). ADB Loan No. 3138-BAN (SF). Government of the Netherlands (US$ 13.7 for Tranche-1). Grant No 0396-BAN (EF). Government of Bangladesh (US$ 113.6 million for 3 tranches)
Consultant:	Joint Venture of Northwest Hydraulic Consultants Ltd. (Canada) and Euroconsult Mott MacDonald Ltd. (UK) in association with Deltares (Germany), Resource Planning and Management Consultants (Bangladesh) and CEGIS (Bangladesh). Contract Signed: 8th September 2015
Contracting Authority:	PD, FREMIP, BWDB, Dhaka
Start/ End Dates:	ADB Loan Agreement: 27 June 2014 (approved), 14 August 2014 (signed), 17 September 2014 (effective) Muti-tranche financing facility (9 years): June 2014 to June 2023 Dates for FREMIP: - Tranche 1: August 2014 to June 2019 (+ 5 years) - Tranche 2: October 2018 to June 2022 (+ 3.7 years) - Tranche 3: June 2020 to June 2023 (+ 3.0 years)
Beneficiaries:	Local stakeholders directly and indirectly benefitting from river flood protection works and land reclamation and development
Subproject Sites/ Location/ Areas	Focus of works are along the Jamuna-Padma river corridor, from Bangabandhu (Jamuna) bridge to confluence with Meghna river at Chandpur; i.e. Reaches 3, 4 and 5. Master plan area comprises the three priority subprojects, JRB-1, JLB-2 and PLB-1 which extend over (part of) the following districts: Sirajganj, Tangail, Pabna and Manikganj.

	km²	ha
Total Area of all SPs	9,292.3	929,230
FREFMIP SPs (JRB1, JLB2,PLB1): Total Area	2,473.9	247,390
FREFMIP SPs: Agricultural Benefit Area	1,220.0	122,000
FRERMIP SPs: Population		10.6 million
FRERMIP SPs: Population Density		1,137 km²
FRERMIP SPs: No. of Households		2.03 million
FRERMIP SPs: Average HH Size		5.2
Master Plan Total Area	15,950.0	1,595,000
Master Plan Agricultural Benefit Area (flood risk mitigated)	5,000.0	500,000
Land Reclamation Area in River Corridor, Total	1,500.0	150,000
Land Reclamation Area in River Corridor, FRERMIP	660.0	66,000

Consultant's Report

Flood and Riverbank Erosion Risk Management Investment Program

A 1.1 Summary Activities Tranche-1

February 2018

Prepared by

Institutional Strengthening and Project Management Consultant (ISPMC)

Joint Venture of Northwest Hydraulic Consultants Ltd. and Euroconsult Mott MacDonald Ltd. in association with Deltares, Resource Planning and Management Consultants and CEGIS

TABLE OF CONTENTS

LIST OF TABLES

A 1.1 Summary Activities Tranche-1

LIST OF FIGURES

ACRONYMS

ADB	Asian Development Bank
ADCP	Acoustic Doppler Current Profiler
BDT	Bangladesh Taka
BIWTA	Bangladesh Inland Water Transport Authority
BRE	Brahmaputra Right Embankment
BUET	Bangladesh University for Engineering and Technology
BWDB	Bangladesh Water Development Board
CbFRM	Community-based Flood Risk Management
CDMP	Comprehensive Disaster Management Program
CDP	Capacity Development Plan
CDMU	Community Disaster Management Unit
CEGIS	Center for Environmental and Geographic Information Services
CLP	Chars Livelihood Programme
CQS	Consultant Qualification Selection
DDM	Department of Disaster Management
DEM	Digital Elevation Model
DGPS	Differential Global Positioning System
DMB	Disaster Management Bureau
DPP	Development Project Proforma
DMC	Disaster Management Committee
DMIC	Disaster Management Information Center
DoE	Department of Environment
DoF	Department of Fisheries
DRR	Department of Relief and Rehabilitation
EA	Environmental Assessment
ECNEC	Executive Committee of National Economic Council
EGIS	Environmental and Geographic Information System
EIA	Environmental Impact Assessment
EMP	Environmental Management/Monitoring Plan
FAP	Flood Action Plan
FCD	Flood control and drainage
FCDI	Flood control, drainage, and irrigation
FFWC	Flood Forecasting and Warning Centre
FRERMIP	Flood and Riverbank Erosion Risk Management Investment Project (ADB)
GAP	Gender Action Plan
GIS	Geographical Information System
GoB	Government of Bangladesh
HFL	High Flood Level
IEE/EIA	Initial Environmental Examination / Environmental Impact Assessment
ILRP	Income Livelihood Restoration Program
INGO	Implementation Non-Governmental Organization
IR	Involuntary Resettlement
ISPMC	Institutional Strengthening and Project Management Consultant
IWM	Institute of Water Modelling
IWRM	Integrated Water Resources Management
JBIC/JICA	Japan Bank for International Cooperation / Japan International Cooperation Agency
JLB	Jamuna Left Bank
JRB	Jamuna Right Bank
JMREMP	Jamuna-Meghna River Erosion Mitigation Project, 2002 to 2011 (World Bank)
LCS	Labour Construction Society

LGED	Local Government Engineering Department
LiDAR	Light Detection and Ranging
M&E	Monitoring and Evaluation
MCA	Multi-criteria Assessment
MDIP	Meghna Dhonagoda Irrigation Project
MFF	Multi-tranche Financing Facility
MIS	Management Information System
MoLGRDC	Ministry of Local Government, Rural Development and Cooperatives
MoWR	Ministry of Water Resources
MRP	Main Rivers Flood and Bank Erosion Risk Management Program
NGO	Non-Governmental Organization
NHC	Northwest Hydraulic Consultants Ltd.
NPDM	National Plan for Disaster Management
NWMP	National Water Resources Management Plan
NWP	National Water Policy
NWRD	National Water Resources Database
O&M	Operations and Maintenance
PIRDP	Pabna Irrigation and Rural Development Project
PMO	Project Management Organization (BWDB)
PMU	Project Management Unit (DDM)
PPTA	Program Preparatory Technical Assistance
PWD	Public Works Datum
QC/QA	Quality Control / Quality Assurance
QBS	Quality Based Selection
QCBS	Quality and Cost Based Selection
RAP	Resettlement Action Plan
RBIP	River Bank Improvement Project/ Program (World Bank)
RPMC	Resource Planning and Management Consultants (Pvt) Ltd.
RSP	River Stabilization Plan
RTIP	River Transport Improvement Project
SESA	Strategic Environmental and Social Assessment
SIA	Social Impact Assessment
SSWRDP	Small Scale Water Resources Development Project
ToR	Terms of Reference
USD	United States Dollar
WARPO	Water Resources Planning Organization
WB	World Bank

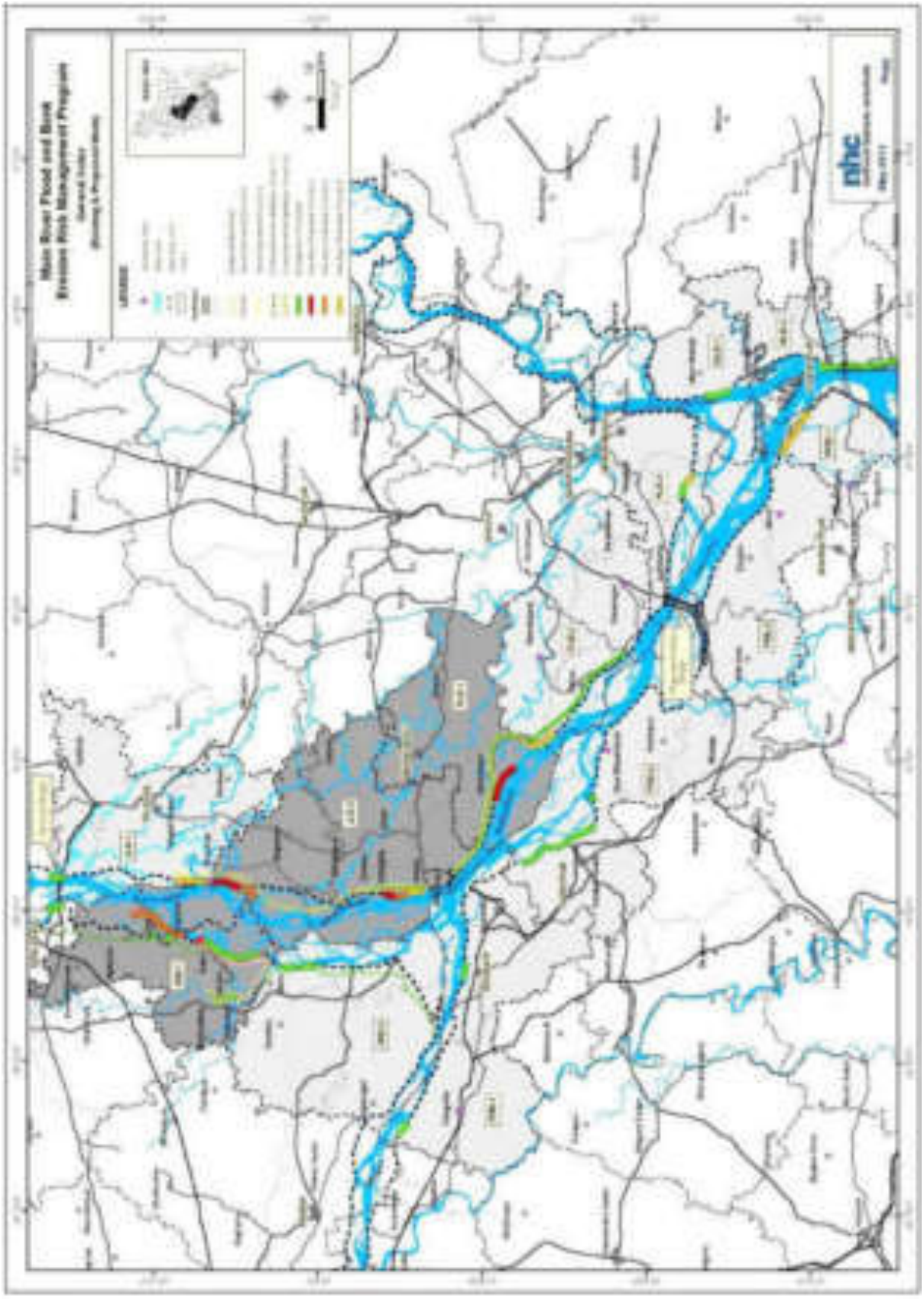


Figure 1 Subprojects of FRERMIP Program Area

1 CONSTRUCTION ACTIVITIES

In this section, the Tranche-1 flood and erosion risk infrastructure improvement works are described, along with lessons and issues. For subprojects and works locations see Figure 1-1.

FRERMIP utilizes the concepts of riverbank protection by dumping of sand filled geotextile bags that was developed during the Jamuna – Meghna River Erosion Mitigation Project (JMREMP), 2002 to 2011. This is followed by construction of a concrete block revetment for wave protection.

The contractual obligation under the contract packages generally requires sequential completion of protection works which are grouped into three categories: (i) Emergency/ immediate protection works, (ii) Main/ primary protection works, and (iii) Adaptation works as required and determined by survey[1] following scour and launching of the geotextile bags.

All the relevant provisions of the Environmental Management Plan (EMP) were incorporated into the contract documents for construction of physical works, including: air quality, road traffic, noise level, water pollution, water supply and sanitation conditions at site. These were monitored on a daily basis, but despite instructions air quality and sanitation requirements were sometimes violated.

1.1 Flood and Riverbank Physical Works at Chauhali, JLB-2

Under Tranche-1, physical works for placing and dumping of cement concrete blocks above low water and geotextile bags below low water along the left bank of Jamuna River Reach was carried out at Chauhali[2] under two works contracts: (i) Package No. W-06-2014-2015 for 2.5 km, and (ii) Package No. W-07-2014-2015 also for 2.5 km. Two associated goods contracts, G-01-2014-15 and G-04-2016-17, were for the fabrication and supply of the required numbers of geotextile bags.

The actual physical coverage of these two contracts extended along 7.2 km of riverbank, with 5.0 km consisting of riverbank protection with (cement concrete) CC blocks, and 2.2 km consisting of temporary wave protection with geotextile bags including repair works, adaptation works and about 1.60 km of emergency protection works at Solimabad, (NHC/EMM, 2017):

Figure 1-1 Riverbank Protection Works at Chauhali

[1] Typically Multibeam Echo Sounding under water Survey

[2] Upzilla Chauhali, District Sirajganj under Tangail O&M Division

Figure 1-2 Existing and Proposed Works under FRERMIP

Construction of works started in October 2015 and completion is 15 April 2018. Both contracts W-07-2014-15 and W-06-2014-15 have been subject to variation orders with W-06 including emergency works at the downstream site at Solimabad. Contract prices and financial progress to June 2017 are tabulated below.

Table 1-1 Contract package prices and expenditure of Chauhali site (in Lakh Tk)

Contract Package no	Original contract price	Revised contract price	Exp. Up to June 2016	Exp. During 2016-17	Total exp. up to June 2017
G-01-2014-15	3,173.65	3,649.70 (15% increase)	2,244.19	897.67	3,141.86
G-04-2016-17	1,746.72	1,746.72		818.61	818.61
W-06-2014-15	3,869.39	3,869.39	1,184.85	2,255.05	3,439.90
W-07-2014-15	3,874.74	4,451.52 (15% increase)	1,649.34	2,323.91	3,973.25
Total	**12,664.50**	**13,717.33**	**5,078.38**	**6,295.24**	**11,373.62**

A total of 1,984,081 geotextile bags were dumped and placed along the 7.20 km length of riverbank out of which 1,607,073 were placed in the 2015-16 working season and 377,008 in the 2016-17 working season. During both seasons diving investigations were conducted from provisions in the ISPMC contract.

The ISPMC independently hired an additional survey team to conduct a Lower Jamuna survey and ongoing monitoring surveys to assess how well the constructed works correspond to the design and to determine how the protection responded to the monsoon floods. The survey activities consisted of bathymetric surveys, topographic surveys, ADCP surveys, flow tracking, and diving surveys.

Slope failures occurred at ten locations in 2017 and at 20 locations in 2017, and were primarily attributed to lack of data to confirm stable design slopes. Repair work consisted of placing two layers of geotextile bags. Design and construction related issues included: (i) lack of geotechnical investigations along the bank to inform final design; and (ii) increases in sizes of CC blocks and consequently the surcharge on the slope, which may have resulted in instability of for design.

As per the practice of the BWDB, a member of Task Force Team was required to witness and certify all dumping works. This proved to result in fully consistent supervision. In future increasing the number of task force members would help increasing the construction progress.

1.2 Flood and Riverbank Physical Works at Zafarganj, JLB-2

Physical works were carried out at Zafarganj[3] under Contract Package No: W-08-2014-2015 for 2.00 km, but extending over 2.3 km of river bank. The main works included dumping of bags to form underwater protection, temporary wave protection, construction of cement concrete (CC) blocks revetment works, dumping CC blocks at the toe of the wave protection, and repair works.

[3] Upazilla Shibalaya, District Manikganj

In addition to a works contract, was a goods contract, No. G-02-2014-15, for the fabrication and supply of the required numbers of geotextile bags to the site.

Construction works started in February 2016 and were for 700 days from the date of contract agreement. Contract prices and financial progress to June 2017 are tabulated below.

Figure 1-3 Riverbank Protection Works at Zaffarganj

Table 1-2 Contract expenditure of Zaffarganj site (in Lakh Tk)

Contract Package no	Original contract price	Revised contract price	Exp. Up to June 2016	Exp. During 2016-17	Total exp. up to June 2017
G-02-2014-15	4,109.95	4,726.45 (15% increase)	2,906.28	1,162.51	4,068.79
W-08-2014-15	5,578.39	5,578.39	557.84	3,675.66	4,233.50
Totals	**9,688.34**	**10,304.84**	**3,464.12**	**4,838.17**	**8,302.29**

A total of 562,276 geotextile bags were used for dumping and placing out of the 601,441 allocated in the contract. Also, a total of 520,312 CC blocks were cast, of which 186,879 were 30 x 30 x 30 cm size, 121,875 were 40 x 40 x 40 cm size and 211,558 were 45 x 45 x 30 cm size. The casting of CC blocks started in November 2016, far behind the schedule. The dumping of CC blocks for the formation of the toe of the revetment slope started in February 2017 and continued to June 2017. The placing of CC blocks started in February 2017 and continues to date, September 2017 (see photo).

Figure 1-4 Placing of CC Blocks

Sand for filling the geotextile bags was taken from the river and the dumping of the filled geotextile bags were carried out by 45 m or 60 m long barges with reference to fixed coordinate positions.

Design and construction related issues included: (i) lack of geotechnical investigations along the bank to inform final design; and (ii) the relocation of Goaria Primary School at Zafarganj which is very close to the riverbank (see photo). The risk of sudden catastrophic failure of the slope cannot be ruled out and has not decreased due to the added weight from concrete slope protection. While the river has silted up during the 2017 flood season, future deep scouring will put the stability of the school to the test.

Figure 1-5 Permanent Protection Works

The ISPMC independently hired an additional survey team to conduct a record survey and ongoing monitoring surveys to assess how well the constructed works correspond to the designed works and to determine how the design responds to the monsoon floods. The survey activities consisted of bathymetric surveys, topographic surveys, ADCP surveys, flow tracking, and diving surveys[4].

1.3 Flood and Riverbank Physical Works at Harirampur, PLB-1

Physical works were carried out at Harirampur[5] under two Contract Packages; (i) Package No: W-09-2014-2015 for 3.60 km, and (ii) W-10-2014-2015 for 5.20 km. The actual works extended over 8.8 km of river bank in agreement with the site conditions at the start of the construction. The main works included dumping of geotextile bags to form underwater protection for the river bank, temporary wave protection and repair works.

In addition to the two works contract, were three goods contracts for the fabrication and supply of the required numbers of geotextile bags to the site.

Construction started in January 2016 and the planned duration for the completion of works was 450 days.

Construction works under contract W-

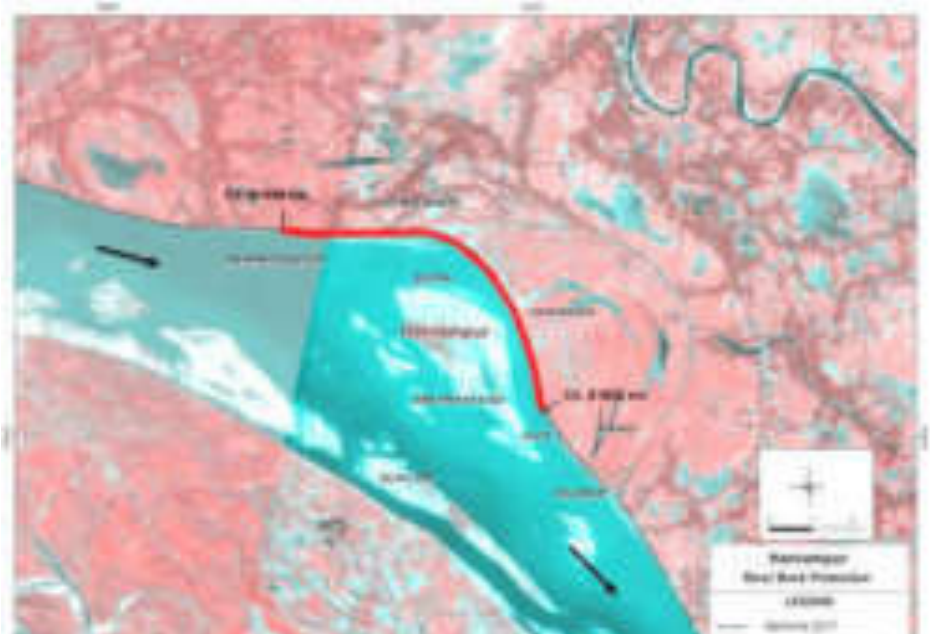


Figure 1-6 Riverbank Protection Works at Harirampur

[4] Despite provision in the contract for a diving team the contractor did not provide one, and therefore the ISPMC hired the diving team.

[5] Upazilla Harirampur, District Manikganj

09-2014-15 have been completed, while works under W-10-2014-15 are still ongoing due to variations to the original contract. Contract prices and financial progress to June 2017 are tabulated below.

Table 1-3 Contract expenditure of Harirampur site (in Lakh Tk)

Contract Package no	Original contract price	Revised contract price	Exp. Up to June 2016	Exp. During 2016-17	Total exp. up to June 2017
G-02-2014-15	4,109.95	4,726.45 (15% increase)	2,906.28	1,162.51	4,068.79
G-03-2014-15	2,740.05	3,151.07 (15% increase)	2,120.48	1,019.49	3,139.97
G-04-2016-17	1,746,72	No revision		818.61	818.61
W-09-2014-15	2,712.79	2,688.52 (0.89% decrease)	1,455.86	1,230.62	2,686.48
W-10-2014-15	2,248.80	2,482.79 (10.41% increase)	1,974.99	479,84	2,454.83
Totals	**13,558.31**	**14,795.55**	**8,457.61**	**4,231.23**	**13,168.68**

A total of 2,537,202 geotextile bags were dumped and placed along the 8.80 km length of riverbank out of which 1,367,946 were placed under Contract No. W-09-2014-15 and 1,169,256 under W-10-2014-15. The majority of the works were carried out in the 2015-16 working season, with only repair works in the 2016-17 season (see photo).

Figure 1-7 Dumping of Geobags

Following the 2016 flood season, *winnowing* failure occurred at Harirampur. This was caused by insufficient thickness of the temporary wave and slope protection, leading to erosion of the riverbank in places, especially in the curved section. In total, about 700m of protection totally failed and several kilometres were partially damaged. Repair works carried out from March to June 2017 consisted of two layers of geotextile bags being placed from the bank and two layers dumped by barge for above and below water repairs. Unfortunately, due to rise in the water level only about 300 m length was repaired and the rest of the repair works still remain to be carried out.

Design and construction related issues included: (i) lack of geotechnical investigations along the bank to inform final design; and (ii) failure of slope protection when only one layer of geotextile bags are placed.

The ISPMC independently hired an additional survey team to conduct a record survey and ongoing monitoring surveys to assess how well the constructed works correspond to the designed works and to determine how the design responds to the monsoon floods. The survey activities carried out in the execution of riverbank protection works consisted of bathymetric surveys, topographic surveys, ADCP surveys, flow tracking, and diving surveys.

1.4 Summary of Primary Construction Works under Tranche-1

To date, February 2018, 18.3 km of river bank protection works have been carried out at the three sites, costing BDT 3,882 million, US$ 48.5 million. This is considerably more than the 15.0 km originally planned for Tranche-1 (NHC Ltd., 2013) and advances some work of Tranche-2.

Five contracts for 23 km of flood protection embankment at Kaijuri, where bank protection was previously constructed under JMREMP, from 2009-2011, have been tendered thrice. Only after chanign the construction methodology the third bid arrived at cost not much above the Engineer's estimate. The 23 km is as originally planned, (NHC Ltd., 2013) will be shortened by 1.7km to accommodate the reduced funding.

Over the two previous flood seasons, 2016 and 2017, some failures occurred to the upper slopes of the riverbank protection, which were largely addressed under the on-going contracts. While adaptation provisions were insufficient during Tranche-1, largely due to the reduction in loan amount, Tranche-2 will require substantial provisions to address the issue of deferred adaptation works at Kaijuri, Kaitoly and Harirampur. Some adaptation works is expected under Tranche-1 at Chauhali. Details are given in Section 2.

Table 1-4 Summary of Primary Construction Works, Tranche-1

	Units	JRB-1	JLB-2		PLB-1	Total	Remarks
		Kaijuri	Chauhali	Zafarganj	Harirampur		
River Bank Protection Quantities and revised contract costs	km	-	7.2	2.3	8.8	**18.3**	**Substantially completed.**
	BDT lakh	-	13,717	10,305	14,796	**38,818**	
	USD million	-	17.14	12.88	18.49	**48.5**	
Flood Embankment Works and estimated costs (Kaijuri)	Km	23.0	-	-	-	**23.0**	**In the process of awarding and contract start**
	BDT lakh		-	-	-		
	USD million		-	-	-		

2 ADAPTATION AND REPAIR WORKS

2.1 Overview

After the initial construction of primary riverbank protection works, **adaptation works** are required in response to often substantial river bed erosion after the first flood seasons. The construction principle is illustrated in Section 2, which shows how the launched apron is secured through additional layers of geo-bags and an additional toe. The toe apron is designed variable in width depending on its vertical distance to the design scour level.

The need for adaptation works is well known and expected. In addition to this, repair works might become necessary, when parts of the constructed protection fail due to unknown/ weak soil conditions, construction flaws or other issues.

Table 2-1 Repair and adaptation works required at Kaijuri, Chauhali and Harirampur

Location	Work item	Description	Tranche	Funds
Kaijuri (JRB-1)	Repair	Repair of local failures of the bank protection works	T1	Additional financing by BWDB
	Adaptation	Adaptation works underwater to following scour and launching of geo-bag apron and to strengthen the works for future flood seasons	T2	FRERMIP Tranche 2
Chauhali (JLB-2)	Repair	Repair of failed slopes above and below water to ensure future stability of protection works	T1	FRERMIP
	Adaptation	Adaptation works underwater to following scour and launching of geobag apron and to strengthen the works for future flood seasons	T1	FRERMIP
	Upstream extension	Extension of the works to prevent outflanking of the main works	T1	FRERMIP
Harirampur (PLB-1)	Upstream extension	Extension of the works upstream to prevent outflanking of the main works and stop erosion	T2	FRERMIP Tranche 2
	Adaptation	Adaptation works underwater to following scour and launching of geobag apron and to strengthen the works for future flood seasons	T2	FRERMIP Tranche 2

During the 2016 and 2017 flood season, various failures occurred in the protection provided at Chauhali, Zafaganj and Harirampur under Tranche-1. These have already largely been repaired through variations to construction contracts. However, adaptation works are still required to secure the bank protection. In addition, during the 2017 flood season, some failures occurred at Kaijuri along the 10 km long bank protection works that were constructed during the JMREMP in the early 2000s. To avoid large scale failures, it is paramount that these failures are repaired as soon as possible.

The repair and adaptation works that still need to be completed[6] are summarised in Table 2-1. Works are required at Kaijuri, Chauhali and Harirampur, but not at Zafarganj. The most urgent works are to be completed within Tranche-1 to avoid further damages under variations to existing works contracts. The works to be carried over into Tranche-2 works will be financed by new works contracts.

2.2 Overview Adaptation and Repair Works Required Works at Kaijuri

During JMREMP, about 10km of bank protection works were built between 2004 and 2008. These works have generally proven reliable and stable overall. However, in some places, local failures of the upper slope have occurred, which have to be repaired to prevent spreading and more extensive failure along the bank. The works required in Kaijuri comprise of:

(i) Repair of the wave protection on the upper slope
(ii) Adaptation works on the lower slope

Repair of wave protection

[6] As of December 2017

In places, the upper slope has failed and the wave protection has been displaced as shown in Figure 2-1. As a repair measure, the CC blocks have to be salvaged from the slope and taken away from the crest and the close vicinity to avoid the loss of further CC blocks. The slope then has to be cut back with a 1V:2H slope and geo-bags placed on top to act as temporary wave protection. This then will be replaced during Tranche-2 works with CC blocks placed on a flatter slope. Before the blocks are placed, a berm has to be cut into the river bank. The total extent of the failures and displaced block sections is about 500m.

2.3 Repair of upper underwater slope

While the repair of the wave protection is necessary to avoid local erosion, resulting in local setback of the bank-line, repair of the underwater slope is crucial to avoid large scale slip failure and erosion along the bank. The repair works consist of three layer of geo-bags should be dumped on areas identified from the multi-beam echo sounder survey of November 2017.

2.4 Adaptation works

Over the last 10 or more flood seasons, the river has deepened and the flow concentrated along the bank, causing launching of the apron. During this time, no significant maintenance or adaptation works have been conducted. To strengthen the works and match the changes that occurred in the river, adaptation works are required. These will be required along about 5km of the existing bank protection works and will be implemented in Tranche-2. The exact extent of the adaptation works will be determined by survey directly prior to the implementation of the works.

Figure 2-1 Failure of upper slope in Kaijuri

2.5 Adaptation and Repair Works Required Works at Chauhali

Following two flood seasons the following adaptation and repair works are now required at Chauhali:

(i) Repair works of above low water level slope, including minor earthworks to create a stable slope for temporary wave protection made of geo-bags
(ii) Salvaging of CC blocks from upper slope and near the low water level
(iii) Repair works of protected underwater slope
(iv) Adaptation works on launched slope and construction of a new apron

2.6 Repair of wave protection

Repair of wave protection on the above low-water slope are necessary because of the slope failures that occurred during the beginning of the 2017 flood season, and include the preparation of the slope to a 1V:2H slope with a berm at low water level cut into the bank, and placing of geo-bags on the above LWL slope. These geo-bags will be placed in two layers and act as a temporary wave protection until the construction of permanent CC block protection in Tranche-2. The 1V:2H slope is suitable for wave protection made of geo-bags. To allow for the additional weight of the CC blocks, a flatter slope has to be defined, as the slope of 1V:3H has proven to be not sufficiently stable.

To avoid future failures of the upper bank, the design office is advised to consider flatter slopes, determined from slope stability computations based on geotechnical investigations. Geotechnical investigations and computations conducted by the ISPMC suggest a slope of 1V:3.5H to 1V:4H to be stable. However, as this analysis is based on only ten boreholes that were conducted along the 5km long bank protection, it is advised to conduct further, more detailed, geotechnical investigations to confirm the findings of the first investigation. The requirement for additional land acquisition will very likely be necessary for the adopted flatter slopes for block protection under Tranche-2.

2.7 Salvaging of CC blocks

In addition to repair of the failed sections, it is advised to remove all CC blocks of the permanent protection that have been placed and dumped in close vicinity to failed sections.

The failure of parts of the permanent wave protection in Chauhali resulted in the loss of an estimated 170,000 CC blocks. For a long lasting revetment repair, CC blocks are required, which can either be obtained by salvaging lost CC blocks or by casting of new blocks.

The cost of salvaged CC blocks depends on accessibility during low water levels (i.e. in the dry, low flow season). Most, about 75% of the CC blocks which were placed on the slope are expected to be accessible and reusable. The CC blocks that were dumped at low water level are expected to be somewhat below low water level, as the berm eroded during the flood season. Therefore, it is only expected to salvage about 50% of these CC blocks. Estimated rates for salvaging concrete blocks is shown in Table 2-2, together with a comparison of the cost of new blocks. The data demonstrate that it is cheaper to salvage as many blocks as possible.

Table 2-2 Cost for salvaging and casting of CC blocks

Block size	Salvaging cost		Cost of block casting
	Above LWL	Below LWL	
30cmx30cmx30cm	26	50	250
40cmx40cmx40cm	120	120	570
45cmx45cmx30cm	115	115	540

2.8 Repair of upper part of underwater slope

During the 2017 flood season, parts of the upper underwater slope failed together with the above water slope, resulting in either:

(i) Holes in the protection, relatively close to the bank, with geo-bag coverage on both sides

(ii) Eroded parts of the apron that reach far into the protected slope

To assess the extent and impact of the failures, a detailed multi-beam echo sounder survey was conducted in November 2017. This survey shows the full river bank, including dumped slope, launched slope and river bed, as opposed to relying on interpolated cross sections, and showed that the upper underwater slope failed at 15 locations. For repair, 3 layers of geo-bags have to be dumped at these locations.

An area of about 105,600m^2 was affected by failures, out of which about 33,600m^2 are on the protected slope and about 72,000m^2 are on the launched slope. The repair work will require about 211,500 geo-bags. Because of the precise survey, repair works can be limited to the affected area instead blanket coverage of larger areas.

2.9 Adaptation works with geo-bags

The scour at Chauhali that has formed over the last two flood seasons has moved downstream and has reached a length of more than 3.5km and maximum depth of 27m below low water level. Here the river self-dredged more than 8 million cubic meters of bed material along the newly established work and created a more than 20m deep channel. However, because a char is moving in from upstream, part of this scour has already filled up. It is expected that the scour will move further downstream but also the upstream channel is deepening as part of an overall morphological change. As soon as sour and geobag launching occurs, and is confirmed by underwater survey, adaptation works should be carried out.

The image in Figure 2-2 shows the result of a multi-beam echo sounder survey, conducted early November 2017 in Chauhali. Together with the cross section, shown in Figure 2-3, the launching behavior and the resulting slope of 1V:2H can be clearly seen. The image also shows the different surfaces as different texture on dumped slope, launched slope and river bed. These images and the length of the resulting slope confirm the previously known launching behavior with a single layer of geo-bags on the launched slope.

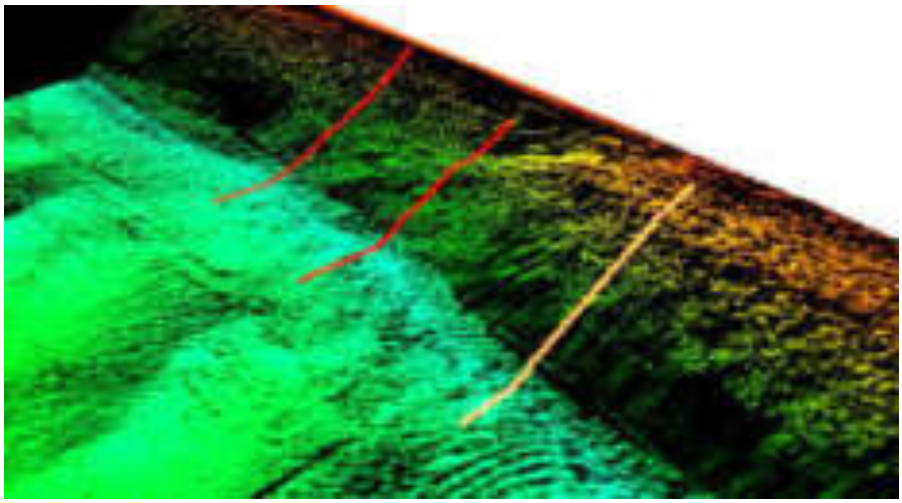


Figure 2-2 Multi-beam image of launched slope in Chauhali

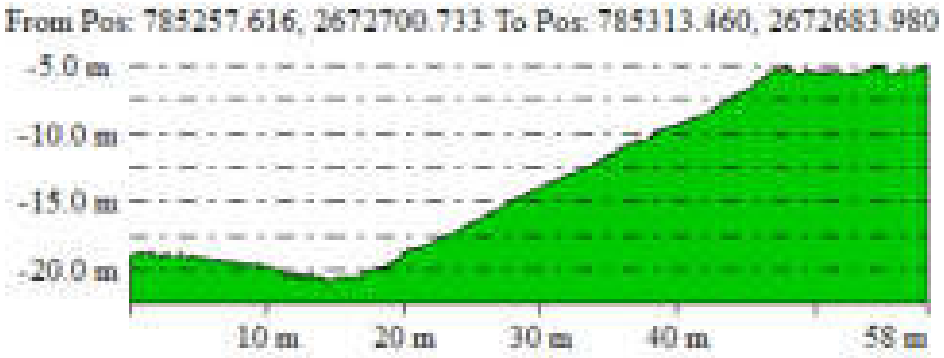


Figure 2-3 Cross section of launched slope showing 1:2 slope

The development of the scour hole is shown in Figure 3-1. The scour got deeper over the first half of the 2017 flood season, but did not move downstream or expand. Between the August and October surveys, the scour moved downstream, causing the apron to launch significantly in the process. At the upstream end of the scour, some sedimentation has occurred, covering part of the launched protection.

The scour has reached the depth of the design scour in some places. To ensure safety of the protection works, a new apron has to be placed at the toe of the launched slope. This apron has to be wide enough to cover the expected launching to the design scour depth and a safety margin. The requirements for adaptation works, including the new apron, are about 288,500 geo-bags.

2.10 Extension of works

To prevent outflanking of the existing works, which would result in a complete failure of the works, the bank protection works should be extended further upstream.

3 ADAPTATION AND REPAIR WORKS REQUIRED WORKS AT HARIRAMPUR

3.1 Extension of works

In Harirampur, severe erosion is occurring upstream of the existing bank protection works, which threatens local settlements and also may result in outflanking of the existing works. To prevent this, the bank protection should be extended in an upstream direction by some 3km.

This would extend the bank protection works to an area of more erosion-resistant soil. In addition, upstream of the bend, the flow is more parallel to the bank and less angular and therefore less erosive.

The design of the extension works should be sufficient to cover the bank for a design scour including a safety margin. For Harirampur, this requires a minimum 20m wide apron with 3 layers of geo-bags. For this, about 250,000 bags are required.

3.2 Adaptation works

In Harirampur, the apron that was dumped in 2016 has launched by more than 20m in places, following river scour. The scour hole is largely filled in already as a char moved in from upstream and large parts of the launched apron are covered with several meters of sediment. Because of two

relatively mild floods in the Padma over the last two years, and because the slope was not additionally loaded with heavy CC blocks, no major failures of the slope have been recorded. While immediate action is desirable, it is considered that this may be deferred, and implemented early in Tranche-2. About 380,000 geo-bags are required for adaptation works, but the exact requirement will be determined following under water survey carried out immediately prior to implementing the works.

3.3 Adaptation and Repair Works Required Works in Kaitola Division

River training works located in the BWDB division Kaitola, constructed under FRERMIP, are now under the BWDB PMO FRERMIP. It is therefore proposed that funds for repair and adaptation totalling BDT 12 crore (USD 1.5 million) be included under Tranche-2 for this Division.

3.4 Summary for Repair and Adaptation Works

Table 4-1 gives an overview of the costs for repair and adaptation works at the various sites, proposed Tranche and the source of funds. A significant factor for the cost is the availability of spare (unused) geo-bags, which may be used, as the cost for the procurement of geo-bags accounts for about 60% of the cost to supply, fill and dumping of a geobag by barge.

Overall, the total cost for repair and adaptation works is about USD 72.4 million, with USD 35.2 million to be implemented under Tranche-1 and USD 37.3 million under Tranche-2.

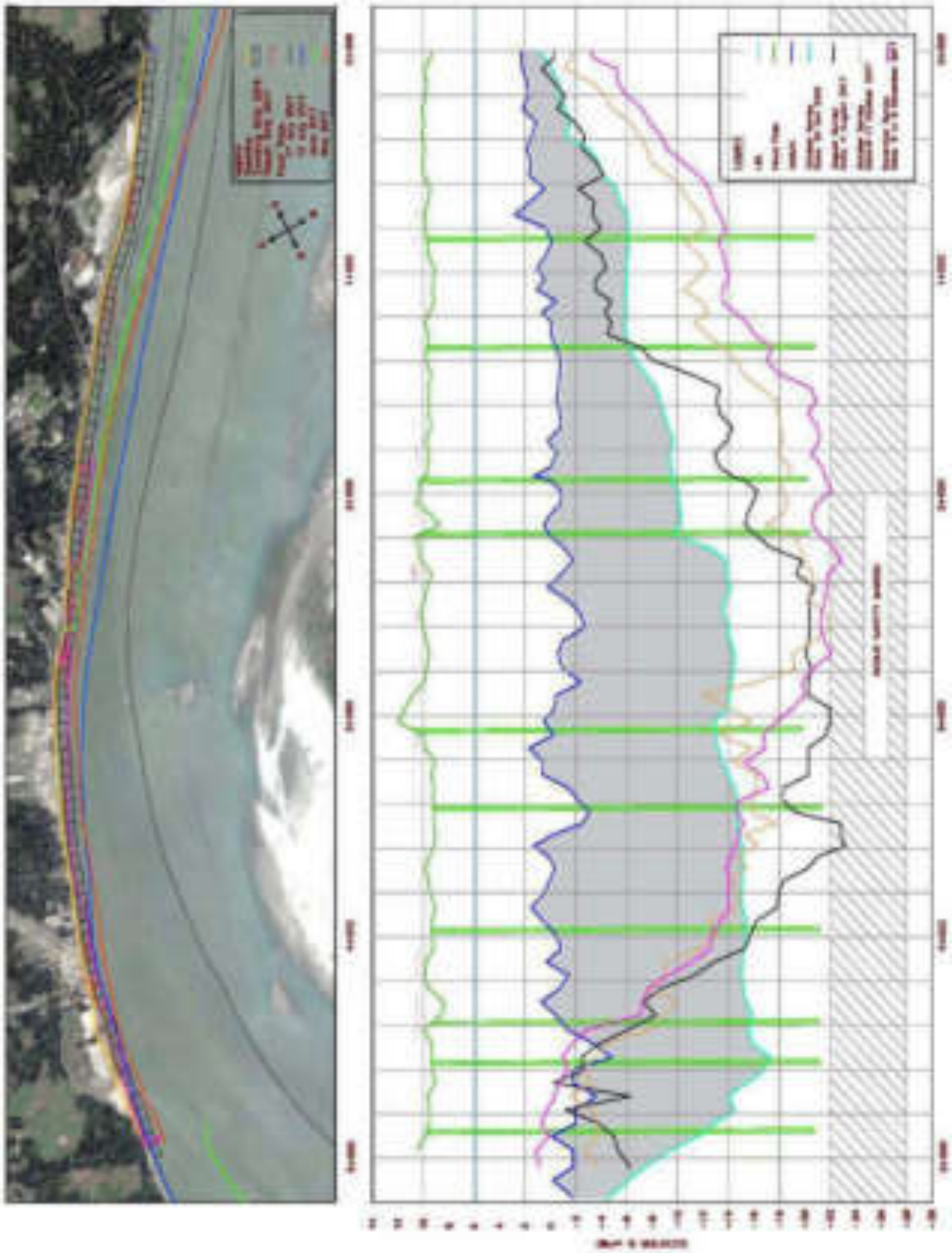


Figure 3-1 Long profile of Chauhali: bed lowering alongside the protected rivebank in year 1 and 2 after construction (2016 and 2017)

4 FLOOD AND RIVERBANK EROSION RISK MITIGATION UNDER TRANCHE-1

Three non-structural measures were adopted by FRERMIP for flood and river bank erosion risk mitigation: (i) community based flood risk management, (ii) community capacity enhancement for participatory regular O&M, and (iii) livelihood support for project affected people.

4.1 Community Based Flood Risk Management

CONCEPT

FREFMIP includes for widespread community flood risk assessment and preparedness, by forming volunteer Disaster Management Units (DMUs) at Ward level with a high level of participation by women. These groups are expected to initiate meetings to identify local risk environment, assess preparedness measures at household level, and emergency response measures. After establishment, the DMUs will be included in existing programs, specifically on flood and erosion warning. Clearly the success of this and associated activities requires that effective communications are established between the Ward based DMUs, the Department of Disaster Management (DDM) as well as with the BWDB.

CbFRM is implemented by the DDM with initial DMU organization by INGOs and focussing on the most vulnerable river bank areas. Activities include: (i) engage INGO, (ii) Formation of Ward based DMUs, (iii) training of DMU members, and (iv) agreement/ adoption of community level flood warning, such as marks on river bank protection to indicate usual and extreme flood water levels. Under Tranche-1, 40 DMUs were to be formed and 600 members trained, (NHC Ltd., 2013).

Table 4-1 Cost Estimate for Repair and Adaptation works

Location	Work item	Component	No of geo-bags	Cost crore BDT	Cost M USD	Tranche	Fund
Chauhali	Repair	Repair of underwater slope Chauhali	174,834	11.91	1.5	T1	W6
		Salvaging of CC blocks Chauhali	0			T1	W6
		Temp. Protection and slope preparation of above water slope Chauhali	67,122			T1	W6
	Adaptation	Adaptation works Chauhali including provision of new apron	162,986	9.13	1.1	T1	W6
	Upstream extension	Extension Chauhali 2km	154,000	7.38	0.9	T1	W6
Kaijuri	Repair	Repair of underwater slope Kaijuri	133,050	5.90	0.7	T1	BWDB
		Salvaging of CC blocks Kaijuri	0	0.22	0.0	T1	BWDB
		Temp. Protection and slope preparation of above water slope Kaijuri	22,400	0.61	0.1	T1	BWDB
	Adaptation	Adaptation works Kaijuri including provision of new apron	300,000	13.31	1.7	T2	T2

Location	Work item	Component	No of geo-bags	Cost crore BDT	Cost M USD	Tranche	Fund
Harirampur	Upstream extension	Extension Harirampur 3km	150,000	7.09	0.9	T2	T2
	Adaptation	Adaptation works Kaijuri including provision of new apron	380,000	16.86	2.1	T2	T2
Kaitola Division	Adaptation and Repair works		-	12.00	1.5	T2	-
Total			**1,544,392**	**84.41**	**10.55**		
Total Tranche-1			**714,392**	**35.16**	**4.39**		
Total Tranche-2			**830,000**	**49.26**	**6.16**		

4.2 Current Status, Issues and Lessons

Flood Risk Management activities have been divided into two separate sub-components: (i) Community-Based, and (ii) Regional Flood Risk Management.

Community-Based Flood Risk Management subcomponent, broadly as conceived and described above, and including for procurement of DDM office equipment, and the engagement of an INGO. The office equipment was procured following ADB guidelines between April and August 2017, but progress in procuring services of an INGO has been very slow. The ISPMC initially prepared a draft Terms of Reference in mid-October 2015 which defined the proposed activities, budget and schedule, and ADB subsequently gave approval to a revised ToR in March 2016. Procurement however has suffered long delays, and bids were only received in late December 2017. The length of the INGO service contract has been reduced from 3 years to just 15 months, to fit within the Tranche-1 period, i.e. to June 2019. It is anticipated that the INGO will commence services in March/ April 2018.

The delays in procurement are attributed to lack of interest and poor coordination between the DMM and BWDB. These delays mean that lessons are not yet known. However, is recognised that linking this DMUs with livelihood support and community participatory O&M activities of FRERMIP would give more of an incentive for volunteers to join and work with the DMUs.

Regional Flood Risk Management. The concept of automatically 'triggering' actions based on flood forecast levels and risk, developed by the BWDB Flood Forecasting and Warning Center, is presently being applied by the German Red Cross in their ongoing "Forecast based Financing Project". Closer collaboration with this project is needed. Meanwhile, a draft ***Flood Response Plan*** was developed for Shahjadpur Upazila, to promote a general Flood Response Template that could be copied in other Upazilas. The plan includes specific people to be contacted and specific actions to be taken by those people. The draft Flood Response Plan was distributed to the Project Manager DDM, and concerned Upazila and BWDB officials in March 2017. It was also presented to senior Shahjadpur Upazila officials, Union Parishad Chairmen, and local BWDB engineers all of whom will play key roles. The Flood Response Plan will be finalized and translated into Bangla in 2018.

4.3 Community Capacity Enhancement for Participatory Regular O&M

CONCEPT

FRERMIP includes for community participation for regular O&M of assets, particular for regulators and bank slopes, possibly through 5-year lease agreements allowing productive community use of the slopes, for example for social forestry. It was envisaged that the O&M groups would be the same as the groups formed for Community Based Flood Risk Management, i.e. the DMUs. Activities under this subcomponent include: (i) confirmation of the DMUs for community O&M activities, and (ii) training in regular O&M to DMU members, and (iii) tripartite meetings between DDM and BWDB field officers and DMU groups. Under Tranche-1, O&M training for 600 DMU members was envisaged.

CURRENT STATUS, ISSUES AND LESSONS

Activities under this subcomponent are delayed pending the establishment of DMU groups, expected in 2018. However, from various discussions the following is noted: (i) benefits from social forestry will take eight years or more to materialise, while 5 year embankment land leases are proposed, (ii) DMU members are not likely to take interest in O&M without any payment, and (iii) various items of equipment are needed including GSP devices and hand tools.

It is therefore proposed, for Tranche-2, that mechanisms for paying for regular O&M be explored, for example framework community maintenance contracts, and that necessary items of equipment be provided to each DMU.

4.4 Livelihood Support for Project Affected Persons

CONCEPT

FRERMIP includes for livelihood support to project affected persons to improve, or at least restore, their income. The livelihood support subcomponent includes for: (i) identification of affected persons, (ii) identification of opportunities for enhanced or alternative livelihoods, and (iii) provision of training and other necessary support including linkages with private sector or government for longer term sustainable support and/ or marketing. In Tranche-1, it was envisaged that two livelihood programs would be identified, and 63 training sessions given for a total of 1185 participants.

CURRENT STATUS, ISSUES AND LESSONS

The ISPMC prepared and submitted the Terms of Reference for an INGO to provide livelihood development services in May 2016, but no approval or official comments have yet been received from ADB. Verbal comments indicate that the ADB may require lump sum payments for INGO deliverables instead of time bound payments. Also, due to the delay, the INGO contact will need to be drastically shortened from 2 years to just 1 year, and scope of work adjusted accordingly.

Adopting lessons from other successful livelihood development program in Bangladesh (see Text Box), indicate that implementation of successful programs takes considerable preparation time, and then framework contracts with various training establishments have to be concluded. Under Tranche-1, it will be possible to identify and plan the training programs, with actual training and follow up carried over to Tranche-2.

Lessons from successful income generation program under SSWRD (NHC/RPMC, 2015)

Lessons include the following: (i) livelihood programs must to identified and tailored to affected persons interest and demand, (ii) a wide range of programs should be considered initially, for example: tailoring, livestock, poultry and duck rearing, fish culture and fish capture, homestead gardening, engraving, embroidery, tailoring, candle making and so on, and reduced to just a few following consultations, (iii) participants to course should be carefully screened for interest and check suitability, (iv) initial and follow-up training, as well as follow up monitoring, is required, (v) provision to supply start up equipment and materials important, or contribute to their costs, and (vi) to encourage women's participation in training, care facilities for babies/ children, as well as segregated toilet facilities, must be provided at training venues.

5 STRENGTHENED INSTITUTIONAL SYSTEMS, DATA AND KNOWLEDGE BASE UNDER TRANCHE-1

Under FRERMIP, two components are supported: (i) BWDB institutional capacity strengthening for river management and sustainable asset management, and (ii) Data and knowledge base development.

5.1 Institutional Capacity Strengthened

Proposed FRERMIP activities associated with BWDB institutional capacity strengthening for river management and sustainable asset management include:

i. Training for BWDB staff in river management and O&M
ii. Supporting the initial setup of Office of Chief Engineer (River Management)
iii. Development of project management, asset inventory and O&M MIS modules.
iv. Conducting annual workshops for information sharing, inviting other agencies (2015–2023).

5.2 Training

There are two training programs: (i): BWDB program (as defined in the revised DPP), and (ii) ISPMC program (under the DPP provisional sum). Under the BWDB program 40 training programs were envisioned, and 11 have been completed: 7 local training programs, 2 overseas training courses and 2 overseas study tours. Under the ISPMC program, 19 training programs were envisioned, and 11 have been conducted: 4 local workshops, 3 local training courses, and Senior BWDB officials or

ISPMC personnel have presented papers at 2 international conferences and 2 local one day conferences. A summary of training is provided in Table 5-1.

Table 5-1 Summary of Capacity Building Progress

Type of Training	Course Implementation Progress				
	Total	Discussed	Prepared	Approved	Completed
Capacity Building PMO					
A. Local Training	34	34	17	7	7
B. Overseas Training	2	2	2	2	2
C. Overseas Tours	4	4	3	2	2
PMO Totals	**40**	**40**	**22**	**11**	**11**
Capacity Building ISPMC					
Line 1:					
A. Workshops	9	5	3	3	3
B. Training	4	4	4	4	4
C. Seminars	1	0	0	0	0
Line- 2:					
A. Conferences	4	4	4	4	4
B. Study Tours	1	1	0	0	0
ISPMC Totals	**19**	**14**	**11**	**11**	**11**

Local training included two courses by BUET, one on river engineering and one on river training. Both courses provided training over 5 days for 40 people each. Participants considered the standard of the lectures to be excellent, but noted that the multimedia projector was poor and no sound system was available.

Training sessions for BWDB design engineers by ISPMC included: i) Presentation and demonstration on the "Use of Grout-Filled Jute Mattress for Permanent Riverbank Protection" (May 2016), (ii) workshop for about 100 junior and mid-level BWDB design engineers, where 3 world-class technical specialists gave presentations on river training and answered questions from participants (2016), and (iii) training for BWDB Task Force personnel on "Quality Control of Sand-filling of Geo-bags" (December 2016.

Overseas training included courses by IHE-UNESCO, Delft, The Netherlands on river morphology and on river training. Each course was for 4 weeks and attended by eight BWDB engineers.

Overseas Study Tours included: (i) 8-day tour in People's Republic of China in August 2016 for nine senior BWDB and

Government officials. The technical program was outsourced to a private organization and reported to be disappointing, with inadequate coverage of riverbank erosion protection works, and (ii) a 2-week study tour of North America in October 2017 for 10 senior BWDB and Government officials where again the technical study aspect was poor, in part due to national holidays in the USA preventing good interaction with the US Army Corp of Engineers. The tour group were however able to visit the Vancouver, Canada office of Northwest Hydraulics (ISPMC consultant) and inspect NHC's numeric and physical hydraulic modeling facilities and learn about a series of innovative flood risk management studies along the Fraser River.

ISPMC Program

Under the ISPMC training program, trainings were given: (i) on the "Environmental Management Plan" at the three construction sites: Chauhali, Harirampur and Zafarganj (April 2016), and (ii) on Gender Awareness (July 2017).

Lessons

A draft report with strategy and budget to complete all the remaining training has been prepared. However, ideally the PMO will delegate a single person to facilitate all the training events planned. Third party training, for example at BUET and overseas by IHE-UNESCO, provides good quality technical knowledge and should be continued. Overseas study tours have proved less useful.

5.2.1 Establishment of the Office of Chief Engineer River Management

River stabilization is a process characterized by considerable uncertainties requiring actions in response to river behaviour, often at relatively short notice, together with continuous monitoring of scour and adoptive works to ensure security of the banks. Current working practices are characterised by rigid and time consuming planning and fund allocation procedures, and traditional and inflexible design practices. Considered pivotal to MOM of river and flood protection works is the establishment of the office of Chief Engineer River Management (CE-RM). This was suggested under the JMREMP project, included in FRERMIP and in the "*needs based organisational structure*" of BWDB. The first Chief Engineer River Management was nominated on 22nd November 2017, but other staff remain to be assigned. Planned staffing is given below.

Table 5-2 Staffing for the Office of the Chief Engineer River Management

Designation	Number of staff
Chief Engineer River Management (civil)	1
Superintending Engineers (civil)	2
Executive Engineers (civil)	4
Sub-divisional Engineers (civil)	1
Assistant Engineers	5
Assistant Director (admin)	1
Senior Data Entry Operator	1
Upper Division Clerk	1
Senior Accounts Assistant	1
Data Entry Operator	1
Support staff (Drivers, Peons, Chowkidar)	8

Source: Office of the Staff Development, BWDB, April 2015

The establishment of the office of Chief Engineer River Management (CE-RM) reflects the importance of the main rivers as a separate hydrological region. Zonal Chief Engineers have jurisdiction on a limited length of river reach and on one bank only, and the office of the CE-RM will: (i) coordinate and monitor activities, (ii) maintain databases and update erosion forecasts (with organisations such as IWM, CEGIS and others), (iii) formulate Framework DPPs and prepare proposals for block allocation of funds, (iv) implement river training works working with Zonal Chief Engineer offices, (v) develop specific knowledge relevant for river management, and (vi) prepare and update design manuals and guidelines.

While the CE-RM is responsible for overall planning and implementation, and knowledge generation, the Zonal Chief Engineers will remain responsible for design, planning and construction of

embankments and associated structures, as well as adaptation works, and their operation and maintenance, in their respective Zones.

None of the BWDB Design Circles is specialised in design of river management works. To promote and establish a high level of expertise establishment of a **River Management Design Circle** is recommended.

Currently FRERMIP is the single most important project for river stabilization. Under, Tranche-2, it is proposed that the Program Management Organisation (PMO) will be situated in the office of the CE-RM, with the Chief Engineer acting as the FRERMIP Project Director.

5.2.2 Management Information Systems

Major activities related to the MIS project component include the following:

- Asset MIS with O&M module
- ADP MIS
- Project Website/ Database
- Computer Server

River surveys and the River Survey Database are discussed in Section 5.3.

Asset MIS. The existing database, **Scheme Inventory and Mapping System** (SIMS), developed under WMIP has some good Asset MIS functionality, but lacks an O&M module based on hazard risk principles. The SIMS is currently being improved by IWM to make the system fully web-based. This will allow any user with an internet connection and proper login parameters to access the system. Terms of Reference for a consultant to develop a **Risk-Based O&M MIS module** which would be fully integrated into the SIMS database were completed in February 2017. The risk-based O&M module will help introduce significant institutional changes in the way that BWDB currently manages O&M including the introduction of vulnerability analyses and asset performance assessments. Development and roll out of the Asset MIS with O&M Module was shifted to Tranche-2 due to fund constraints, for the PMO to acquire a better understanding of project specific needs and to roll out adoption/ use of the database parallel with staffing of the office of CE RM[7].

ADP MIS. Terms of Reference for a consultant to develop an ADP MIS with a variety of budgeting and monitoring and management tools for both BWDB Project Directors and managers have been prepared. However, CEGIS is currently developing the **Smart Project Monitoring and Management Information System** (SPMMIS) which is similar, providing project execution information that would allow senior BWDB managers to monitor project progress. Due to the overlap with SPMMIS the FRERMIP ADP MIS was deferred to Tranche-2 when the completed SPMMIS application will be

[7] Considerable time needs to be spent to promote the concept of risk-based O&M within BWDB, and the donor and local business community. The danger levels established by the BWDB Flood Forecasting and Warning Center are based on risk, and could be a good starting point. Mr. Tahmidul Islam, Superintending Engineer, BWDB could be used as an proponent of MIS work within BWDB. IWM, who initially developed SIMS, and also recently upgraded it to a fully web-based application, would probably be interested in promoting a risk-based O&M module, to make SIMS more beneficial to BWDB field personnel and senior BWDB management.

further reviewed and ADP MIS funds used to add any missing functionality and rectify any limitations[8].

Project Website. Under Tranche-1, a project website that uses data stored in a database was developed. The website currently has five tabs: Home, Events, Projects, Reports and Contacts. The website database uses an open-source (free) database called PostgreSQL and used open-source frameworks Bootstrap and CodeIgnitor to develop the user interface. Sample data were used to test the website database and interface. Material is currently being prepared to populate the website, and it is anticipated that the website will be fully operational by March 2018.

Computer Server. In December 2017 a server was purchased and installed with sufficient processing speed and storage capacity to properly accommodate the various databases and the Project Website and File Manger applications. The server is equipped with two storage devices to provide an immediate backup system in case one storage device fails, and an uninterrupted power system. The File Manager stores project reports and supporting document and enable authorized users to access files. To help maintain the integrity of the data, different user groups have been established to enable or disable access to specific folders[9]. Instead of a simple static project map, it is intended to add a dynamic project map which would enable the user to zoom in to a specific construction site to get additional salient information regarding that site, and possibly download any related memos or reports pertinent to that site.

5.2.3 Annual Workshops and Conferences

Three large national workshops have been conducted: (i) Inception Workshop (9 December 2016), (ii) 2nd National Stakeholder Workshop to present the draft Long-Term Strategic and Holistic River Stabilization and River Training Plan (7th December 2016), and (iii) 3rd National Stakeholder Workshop to present the River Stabilization Plan and the preliminary Master Plan (29th November 2017). These workshops were both attended by over 100 senior BWDB and government officials, donor organizations and other technical specialists, and presided over by top ministerial officials, and international specialists in water resource development. A number of world-class specialists presented papers at the workshops.

A small workshop was held in October 2016 for 30 senior BWDB engineers to assess the needs for capacity strengthening within BWDB.

The BWDB Director General, FRERMIP Project Director (PD), and ISPMC Team Leader participated in the "8th International Conference on Scour and Erosion, Mathematical Institute, Oxford, UK" on 12-15 September 2016. The PD supported by the Team Leader presented a paper on "Development of Low Cost Riverbank Protection in Bangladesh".

[8] A cursory review of the completed SPMMIS indicates that while it does perform using project management functionality, additional funding would be useful to include additional project management tools for senior BWDB managers. Also, the current system only defines project elements on a contract basis, not an individual asset basis (e.g. one contract could include an embankment reach, plus regulators and a fish pass). Additional work would be required to enable SPMMIS to extract salient asset information for input into an separate application like SIMS.

[9] FRERMIP File Server is at: http://files.frermip.cf. Log-in with the following parameters: *user*, *frermip001*

The BWDB was invited to present a paper at the Large Rivers Conference, held in Delhi on 17-22 April 2017. Unfortunately, BWDB officials were unable to attend, and the ISPMC Team Leader and national River Engineer presented papers instead.

Two one-day local conferences have been held: (i) one for BWDB project managers, contractors and other project stakeholders on construction implementation, and (ii) the second for the BWDB Director General and 20 senior BWDB officials as well as concerned ISPMC Specialists on the preliminary Master Plan.

CONCLUSIONS AND LESSONS

National Workshops provide high level exposure to BWDB and the project, and offer a good venue to widely disseminate FRERMIP ideas regarding river stabilization and river training. World-class technical specialists presenting papers at National Workshops should be encouraged to also provide specialized training to junior and mid-level design engineers on specific topics related to their expertise.

The workshop attended by 30 senior BWDB engineers to assess the needs for capacity strengthening within BWDB had various recommendations, including: (i) need for coherent training plan within BWDB, rather than just left to individual projects, (ii) recommendations for BWDB to specialise in, for example, irrigation, coastal protection, and main rivers management.

BWDB officials should be encouraged to present papers at international conferences to promote the transfer of knowledge, and also to promote BWDB as a world-class progressive organization.

5.3 Data and Knowledge Base

Planned data and knowledge base development activities under FRERMIP included:

i. Studies and preliminary river master planning for long-term strategic river management (Tranche-1).

ii. Land recovery and river training piloting (April 2014–June 2021).

iii. Flood and river surveys (June 2015–June 2023) and establishment of improved flood and river survey database (December 2017).

iv. Updating the existing short-term erosion prediction model (September 2016) and guidelines for riverbank protection works (December 2022).

5.3.1 Studies and preliminary river master planning for long-term strategic river management

The following reports have been completed: (i) "Long-Term Strategic and Holistic River Stabilization and River Training Plan" approved by Technical Advisory Committee on 17th September 2017. (ii) "River Stabilization Plan" including investment program for stabilization of the Jamuna and Padma rivers, (iii) "Initial Master Plan" focussing on productive land-use for the north central region including the recovered char areas. Importantly, guided peri-urban development is expected to help propel Bangladesh into a middle income status, and (iv) "Strategic Environment and Social Assessment (SESA)" concerned with environmental aspects of river stabilization and water resources development.

In addition, 37 background Technical Notes associated with different aspects of the River Study are being prepared, of which 24 are substantially completed, and the rest will be completed by early/ mid 2018.

5.3.2 Land recovery and river training piloting

Regarding pilot works, 1.6 km river bank protection work using grout-filled jute mattresses will be implemented in early 2018 at Harirampur, followed by 1.3 km at the Hurashagar River. Design of the proposed work has been completed and procurement process has started. Further pilot works will cover the development of an embankment slope protection layer of katkin (kashful) or vetiver grass to be implemented along the Hurashagar River. In addition, the River Research Institute, Faridpur (RRI) will be asked by ISPMC/BWDB to prepare a proposal on the morpho-hydraulic design of the Old Dhaleswari offtake, including a state-of-the-art flood barrier suitable for navigation, involving light-weight sediment in the model. These pilot works will be initiated during the remaining period of Tranche 1 and continued during Tranche 2.

5.3.3 Flood and River Database and Surveys

A web-based River Survey Database has been developed to store bathymetric data and provide a set of tools to analyse data and display summary results. Tools allow generation of: point elevations, cross-sections, long-sections, areas/volumes, and thalwegs. The database also allows bathymetric survey data (contours and raw point data) and geometric elements to be imported, exported and displayed using the popular and open-source (free) Quantum Geographic Information System (QGIS) application. QGIS provides the useful visual interface to display database entities and analysis results. A separate database module is currently under development to store and analyse velocity data from an Acoustic Doppler Current Profiler (ADCP) which collects a matrix of river velocities at various depths along a river cross-section.

The flood survey monitoring program comprises: (i) general river monitoring, and (ii) site monitoring. The former provides general flow patterns along the protected sites focussing on bathymetric surveys, discharge measurements and float tracking, while site monitoring provides scour development and flow velocity information along protected embankments for design of adaptation works. Surveys carried out in 2016 and 2017 are summarised below.

5.3.4 Erosion Prediction Model and Design Guidelines

The existing short-term erosion prediction model is being updated third party contractor (by CEGIS). The existing guidelines for design and O&M of riverbank protection works are scheduled to be updated by the end of Tranche-3, and encapsulate knowledge gained under the program.

5.3.5 Conclusions and Lessons

Stabilization of the main rivers is best done by bend control (and not capital dredging), constructing revetments works with geo-bags followed by adaptive works following scour and geo-bag launching. Dredging may support of revetment works and ensure navigation in straight reaches between bends. Sedimentation for land reclamation after stabilization requires very substantial quantities of sand and silt or clay and may cause temporary degradation of the river bed and a slowing down of the delta building into the Bay of Bengal.

Table 5-3 Summary of Flood Season Survey Program

Survey Type	Location	2016	2017
Bathymetric Single Beam	Chauhali	8	4
	Zafarganj	7	1
	Harirampur	8	1
	Solimabad	0	2
	Full River	0	1
Bathymetric Multi-Beam	Chauhali	0	1
	Kaijuri	0	1
ADCP Discharge	Chauhali	3	0
	Zafarganj	4	0
	Harirampur	2	0
	Full River	0	4
Float Track	Chauhali	3	4
	Zafarganj	2	0
	Harirampur	1	0
	Solimabad	0	1
	Full River	0	2
Topographic Land Survey	Chauhali	1	1
	Zafarganj	1	0
	Harirampur	1	0
	Solimabad	0	1

Piloting of flow guiding works in the floodplain of the main rivers remains needed and essential for implementation of the planned river stabilization, but involves risks which apparently are not acceptable for BWDB and the donors during the first years of the FRERMIP project. The adopted piloting (grout filled mattress and vetiver grass) are low risk.

The absence of reliable data on discharge, sediment transport and from advanced survey techniques is hampering analyses, understanding and knowledge base.

6 SAFEGUARDS, GENDER AND STAKEHOLDER COMMUNICATIONS

6.1 Resettlement

The resettlement framework details the implementation process and resettlement entitlements, for land acquisition, various structures (homesteads, trees, crops and so on), relocation costs, and special assistance measures, (ADB-GoB, January 2018).

The INGO charged with resettlement, socio-economic and household surveys, resettlement plan preparation and implementation was engaged on 16th March 2016, and works under the direct supervision of Chief Resettlement Officer of the PMO. The ISPMC consultants provide assistance and guidance.

Resettlement including land acquisition / compensation status at Tranche-1 sites is summarised below.

Table 6-1 Resettlement at Tranche-1 Sites

Site	Resettlement Requirement/ Activities	Status, January 2018
JRB-1: Kaitola	Acquisition of land for embankment construction (23 km)	Updated RP approved, resettlement payments to Effected Persons (EPs) yet to be made. Squatters need to be relocated.
JLB-2: Chauhali	Acquisition of strip of land for river bank protection	Compensation to Effected Persons IEPs) is ongoing
JLB-2: Zafarganj	Acquisition of strip of land for river bank protection	Compensation to Effected Persons IEPs) is ongoing
PLB-1: Harirampur	Acquisition of strip of land for river bank protection	Compensation to Effected Persons IEPs) yet to be made

Construction works have not been delayed due to land acquisition issues. However, for riverbank protection, particularly at PLB-1: Harirampur, resettlement plans and land acquisition was done after construction, due to severe erosion potential and local public demand. Also, compensations payments are somewhat delayed and remain on-going for most sites.

6.2 Environment

The ISPMC environmental team: (i) are monitoring contractors' compliance to the Environmental Management Plan at all three construction sites on a quarterly basis during each construction season, and (ii) prepared the Terms of Reference to engage an INGO to provide support services for a Bio-diversity Baseline and Fisheries Development Study. In July 2017, it was decided to defer this study to Tranche-2 due to budgetary constraints. Meanwhile, under Tranche-1, a pilot scale environmental/ fisheries / socio-economic baseline study focussing on Salimabad and Harirampur is planned.

In preparing for Tranche-2, the ISPMC environmental team has completed: (i) an Initial Environmental Examination (IEE) report, (NHC/EMM, July 2016) (ii) an Environmental Impact Assessment (EIA) report, (NHC/EMM, November 2017) and (iii) a Strategic Environmental and Social Assessment (SESA) report, (NHC/EMM, August 2016). The team has conducted fieldwork and collected data to support these reports, monitor impacts of riverbank revetment works, and identify information gaps in the ecosystem and fisheries sector. Also, the team has conducted a study on fish sanctuary status and identified possible sites for establishment of new fish sanctuaries.

Minimal adverse environmental impacts accrue from construction of riverbank protection works which primarily include the collection of sand using dredgers, transport of sand by boat, geo-bag filling and dumping from barge, and the casting and placing of cement concrete (CC) blocks. However, construction camps typically have poor waste management conditions with widespread paper and plastic littering and poor sanitary conditions.

The fisheries sector is of economic and nutritional importance to resource poor communities along the major rivers. While riverbank protection works have minimal adverse impacts, planned land reclamation and embankment construction could reduce fish habitat and connectivity between the main river, tributaries and floodplain. This may be mitigated by fish sanctuaries and fish passes. However, additional studies are needed to firm up data, understanding and mitigation measures.

6.3 Gender and Development

The Gender Action Plan details measures to ensure that women benefit from the on-going project, such as work opportunities at equal wages for equal work, resettlement compensation for women, women's membership in community groups and livelihood trainings for women. Compliance is monitored in the Quarterly progress reports. Adoption of 250 kg geo-bags (rather than 125 kg as originally envisaged) meant that women were largely not involved in geo-bag revetment works. Also, as progress on non-structural aspects of the project has not been as good as on construction works, it remains to early to report on gender compliance for these. Concerning resettlement, women as well as men are receiving compensation.

6.4 Stakeholder Communications

The stakeholder communication strategy is built into the design of the investment program, including the resettlement plans, the gender action plan, and non-structural measures for flood and riverbank erosion risk mitigation, Section 4, but no separate stakeholder communication strategy has been established (ADB, 2014a).

The primary audiences for the communication strategy are local communities along the project rivers, the general public (NGOs and development partners, key individual decision makers) and Government and authorities (local Upazila administration, institutions and ministries).

Consultant's Report

Flood and Riverbank Erosion Risk Management Investment Program

A 1.2 Updated Background Information

April 2019

Prepared by

Institutional Strengthening and Project Management Consultant (ISPMC)

Joint Venture of Northwest Hydraulic Consultants Ltd. and Euroconsult Mott MacDonald Ltd. in association with Deltares, Resource Planning and Management Consultants and CEGIS

TABLE OF CONTENTS

LIST OF FIGURES

ACRONYMS

ADB	Asian Development Bank
ADCP	Acoustic Doppler Current Profiler
BDT	Bangladesh Taka
BIWTA	Bangladesh Inland Water Transport Authority
BRE	Brahmaputra Right Embankment
BUET	Bangladesh University for Engineering and Technology
BWDB	Bangladesh Water Development Board
CbFRM	Community-based Flood Risk Management
CDMP	Comprehensive Disaster Management Program
CDP	Capacity Development Plan
CDMU	Community Disaster Management Unit
CEGIS	Center for Environmental and Geographic Information Services
CLP	Chars Livelihood Programme
CQS	Consultant Qualification Selection
DDM	Department of Disaster Management
DEM	Digital Elevation Model
DGPS	Differential Global Positioning System
DMB	Disaster Management Bureau
DPP	Development Project Proforma
DMC	Disaster Management Committee
DMIC	Disaster Management Information Center
DoE	Department of Environment
DoF	Department of Fisheries
DRR	Department of Relief and Rehabilitation
EA	Environmental Assessment
ECNEC	Executive Committee of National Economic Council
EGIS	Environmental and Geographic Information System
EIA	Environmental Impact Assessment
EMP	Environmental Management/Monitoring Plan
FAP	Flood Action Plan
FCD	Flood control and drainage
FCDI	Flood control, drainage, and irrigation
FFWC	Flood Forecasting and Warning Centre
FRERMIP	Flood and Riverbank Erosion Risk Management Investment Project (ADB)
GAP	Gender Action Plan
GIS	Geographical Information System
GoB	Government of Bangladesh
HFL	High Flood Level
IEE/EIA	Initial Environmental Examination / Environmental Impact Assessment
ILRP	Income Livelihood Restoration Program
INGO	Implementation Non-Governmental Organization
IR	Involuntary Resettlement
ISPMC	Institutional Strengthening and Project Management Consultant
IWM	Institute of Water Modelling
IWRM	Integrated Water Resources Management
JBIC/JICA	Japan Bank for International Cooperation / Japan International Cooperation Agency
JLB	Jamuna Left Bank
JRB	Jamuna Right Bank
JMREMP	Jamuna-Meghna River Erosion Mitigation Project, 2002 to 2011 (World Bank)
LCS	Labour Construction Society

LGED	Local Government Engineering Department
LiDAR	Light Detection and Ranging
M&E	Monitoring and Evaluation
MCA	Multi-criteria Assessment
MDIP	Meghna Dhonagoda Irrigation Project
MFF	Multi-tranche Financing Facility
MIS	Management Information System
MoLGRDC	Ministry of Local Government, Rural Development and Cooperatives
MoWR	Ministry of Water Resources
MRP	Main Rivers Flood and Bank Erosion Risk Management Program
NGO	Non-Governmental Organization
NHC	Northwest Hydraulic Consultants Ltd.
NPDM	National Plan for Disaster Management
NWMP	National Water Resources Management Plan
NWP	National Water Policy
NWRD	National Water Resources Database
O&M	Operations and Maintenance
PIRDP	Pabna Irrigation and Rural Development Project
PMO	Project Management Organization (BWDB)
PMU	Project Management Unit (DDM)
PPTA	Program Preparatory Technical Assistance
PWD	Public Works Datum
QC/QA	Quality Control / Quality Assurance
QBS	Quality Based Selection
QCBS	Quality and Cost Based Selection
RAP	Resettlement Action Plan
RBIP	River Bank Improvement Project/ Program (World Bank)
RPMC	Resource Planning and Management Consultants (Pvt) Ltd.
RSP	River Stabilization Plan
RTIP	River Transport Improvement Project
SESA	Strategic Environmental and Social Assessment
SIA	Social Impact Assessment
SSWRDP	Small Scale Water Resources Development Project
ToR	Terms of Reference
USD	United States Dollar
WARPO	Water Resources Planning Organization
WB	World Bank

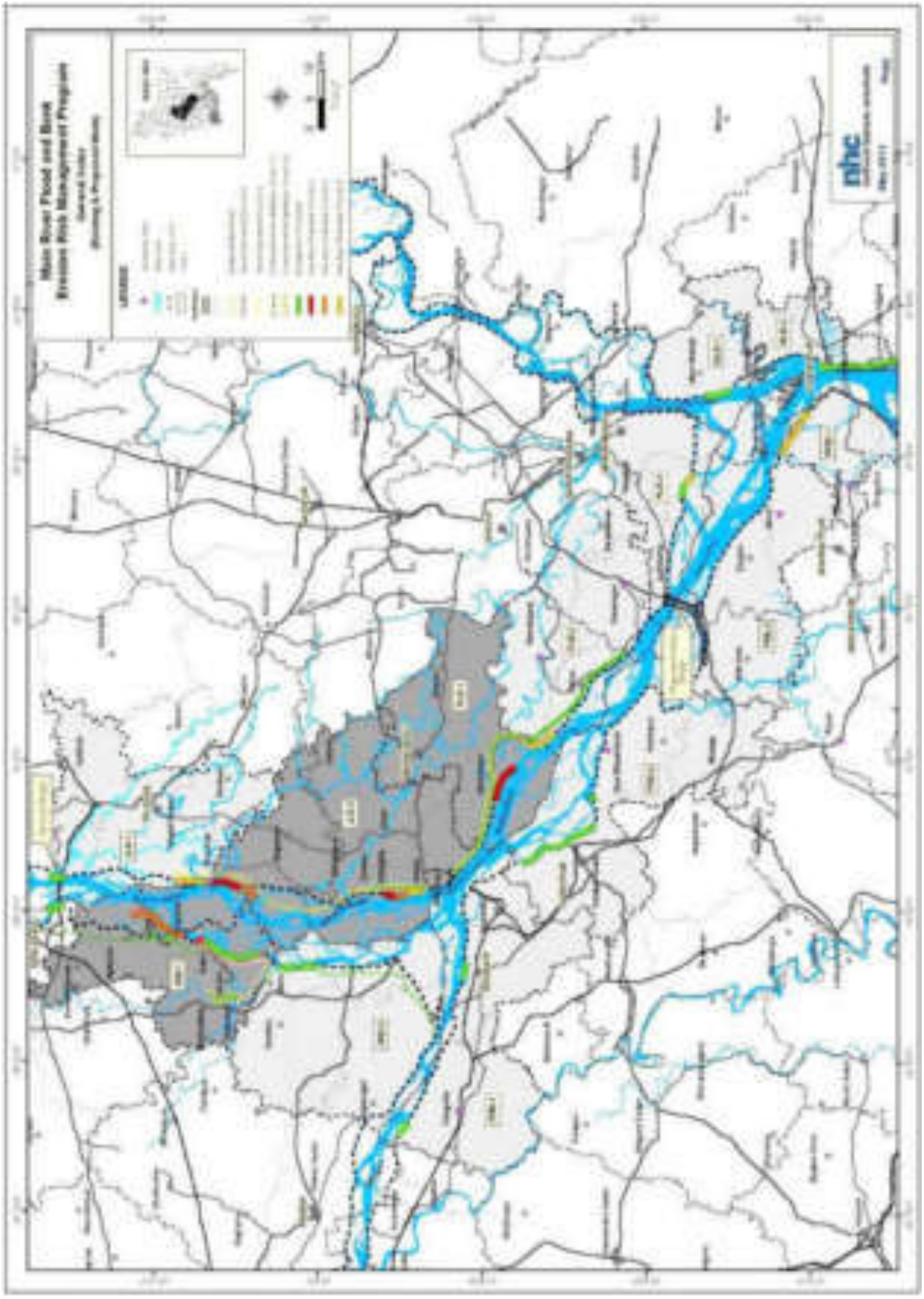


Figure 1 Subprojects of FRERMIP Program Area

1 THE PROJECT AREA IN THE CONTEXT OF THE STRATEGIC FRAMEWORKS

The project area comprises the master plan area of 1.6 million ha, and the river corridor where about 150,000 ha land will be reclaimed with implementation of the river stabilisation plan.

The area more directly associated with FRERMIP comprises the 247,600 ha within the three priority subproject areas, JRB-1, JLB-2 and PLB-1, see Figure 1 and Figure 1-1. The land elevation of the flood plain associated with the priority subproject areas varies from about +3 to +13 m PWD as shown on Figure 1-1.

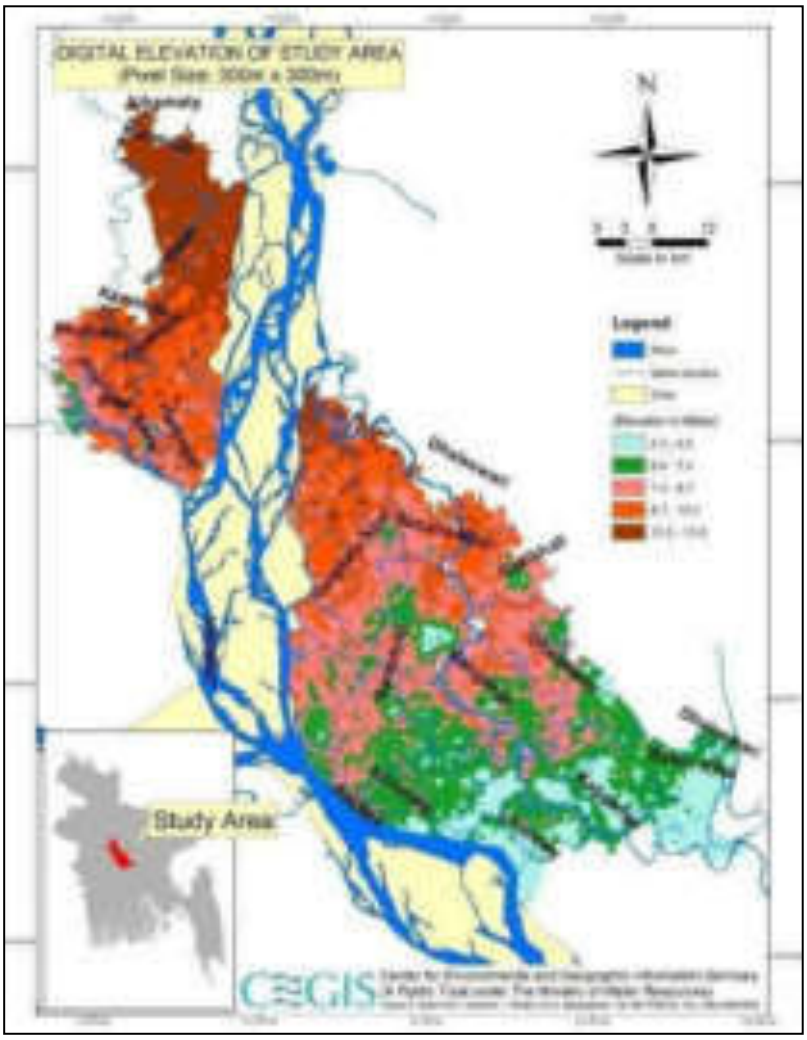


Figure 1-1 Topography of the FRERMIP Subproject Area

1.1 Master Plan Area

The master plan area extends of 1.6 million ha, and essentially comprises the North Central hydrological region, which includes the cities of Dhaka, Gazipur and Tangail. It is a densely populated area, with about 33.6 million people (2011), expected to increase to 50.4 million by 2025, (Planning Commission, Bangladesh Delta Plan 2100: Water Resources, August 2015). Average annual rainfall varies from about 1,850 mm to 2100 mm, with about 80% in the five monsoon months, Figure 1-2.

1.2 Soils and Cropping

The project area has irregular relief and basins. Soils are silt loams on higher and silt-clay loams on lower land – the latter are particularly suited to rice. Limiting factors for crop production are

unpredictable flooding, poor fertility, lack/ cost of irrigation in the dry season, quality and availability of seed and planting material, fertilisers and pesticides, and marketing. Single, double and triple cropping is practiced depending on land elevation (flooding) and availability of irrigation, and ranges from 150% to 186% (2008 agricultural census data). Rice dominates cropping in all three seasons. However, the Aman and Aus cropped areas have slightly reduced, while the area of Boro has massively increased with irrigation by STWs. Areas of non-rice crops are relatively small, and most have declined with the increase in Boro. Non-rice crops include wheat, pulses, sugarcane, oilseed, jute, vegetables, spices, maize and potato.

Figure 1-2 Average Annual Total Rainfall

1.3 Fisheries

Inland capture fisheries is declining due to depletion of the fisheries habitat, reduction in biodiversity and lack of good fisheries management. Depletion habitat is mainly due to diminished floodplain flooding due to the loss of connectivity with the rivers. However, there has been substantial growth in aquaculture production which now dominates inland fishery production.

1.4 Groundwater

Shallow tubewells meet about 83% of irrigation requirements, and deep tubewells about 16% as well as demands from industry and potable supply. Groundwater is mostly arsenic free, except in the southern part of the master plan area, along the Padma river. Contamination from household waste and industry is an increasing issue, particularly in and near Dhaka. Due to the intensive groundwater development since the 1980s, the groundwater table is gradually declining in the master plan area, and particularly in Dhaka where a decline up to 75 m has occurred (Figure 1-3). Specifically, the pre-month average depth to water table in the master plan area (excluding Dhaka) has dropped from about 6m to 8m bgl over 22 years since 1988, while the depth to the water table post monsoon has dropped from 3.8m to 5.2m blg. In many STWs the water table drops below 7.5m and water cannot be pumped by farmers using LLPs, and they have to try and purchase water from DTW owners. Wells located in the Madhupur Tract, with thick clay layers, which extends over much of

Dhaka, Gazipur and Mymensingh districts, show the greatest decline.

Seasonal water table fluctuations are typically 3-6 m or more outside Dhaka(Figure 1-4) and indicate that about 300-600 mm of water is being pumped over the total area. Estimates for sustainable yield vary from about 150 to 500 mm, (Planning Commission, Bangladesh Delta Plan 2100: Water Resources, August 2015).

1.5 Flooding Impact on Crop

The floodplain is flooded mainly by accumulated rainwater and by the raised groundwater table during the monsoon season. Extensive flooding by silty river water can occur in years with high river floods. In 2007 floods damaged aus rice, jute and aman rice crops in Tangail, Dhaka and Faridpur regions. The aman rice area damaged was about 167,950 ha and the estimated loss of production was 119,000 tonnes. Late floods, excessive rain and poor drainage damaged aman rice in Tangail and Pabna regions in 2008.

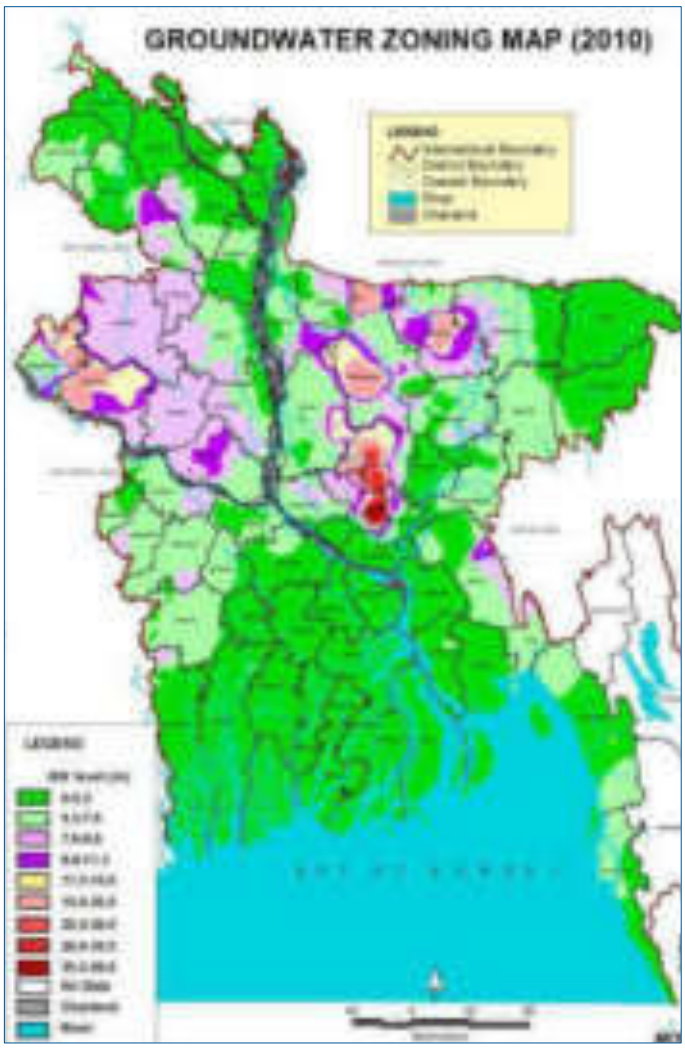


Figure 1-3 Groundwater Zoning Map

1.6 Inland Rivers

The main inland rivers in the master plan area are the Old Brahmaputra, Pungli/ Turag, Dhaleswari and Old Dhaleswari/Kaliganga, see Figure 1-5. The offtakes to these rivers suffer from excessive sedimentation and loss of inflow. Restoring controlled flows would provide water for irrigation and other users, and help reverse declining groundwater trend.

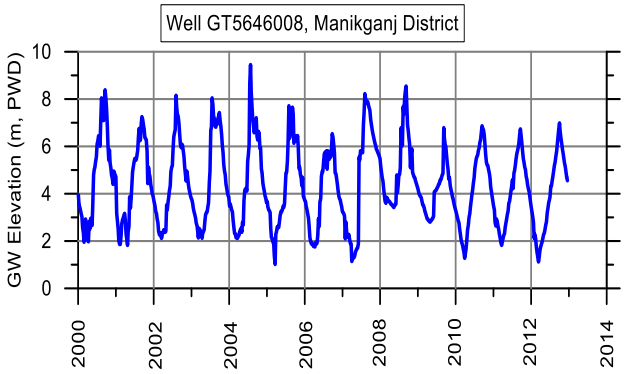


Figure 1-4 Water Table Seasonal Fluctuations

1.7 Urbanisation and Industrial Developments

The Master Plan Area is highly urbanized, and is urbanizing faster than the rest of country, due to the inclusion of the national capital. The Dhaka Metropolitan Area with 17.6 million people (in 2015) is the 11th largest urban agglomeration in the world, (NHC, February 2018). The rural population is expected to decline with increasing urbanisation, but farm sizes will most likely remain small, averaging less than 0.45 ha/ HH. About half (53%) of farms are owner operated, with owner cum tenant holdings accounting for 45%, and tenant holdings the balance (Agriculture Census, 2008).

Industrial developments in the Master Plan area are concentrated in and around the Dhaka Metropolitan area and include the garment and leather industries, as well as higher-value manufacturing (e.g., pharmaceuticals, ceramics, light engineering, shipbuilding) and agro-products. These developments, as well as the service sector and foreign exchange earning are driving economic development. The contribution of the agriculture sector GDP declined rom 62% in 1975 to 19% in 2015, (Planning Commission, September 2015). Also, almost 50% of rural households supplement their earnings with non-farm income (2009 survey).

Extreme poverty rate has fallen rapidly: 16 million people were removed from poverty between 2000 and 2010 according to the World Bank, who forecast Bangladesh's extreme poverty rate to be 3% in 2030.

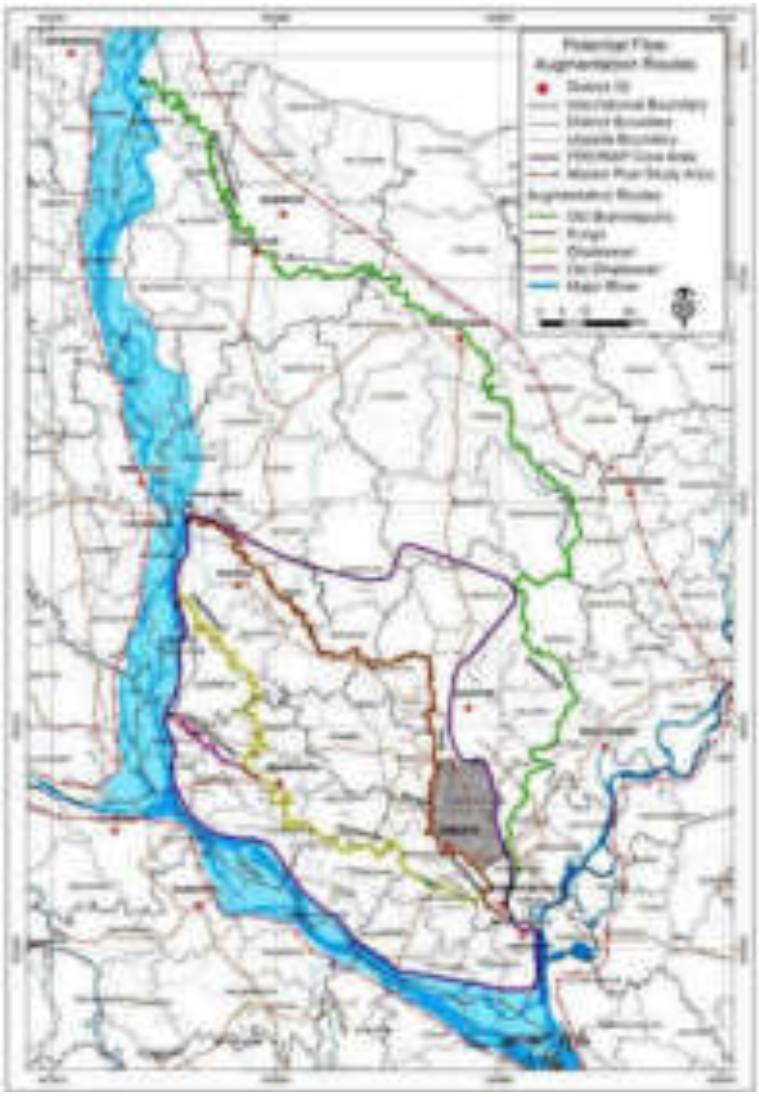


Figure 1-5 Inland Rivers in FRERMIP Master Plan Area

2 RIVER CORRIDOR AND CHAR LANDS

2.1 River Corridor

The Brahmaputra System is characterized by sporadic dramatic changes resulting from extreme floods, high sediment loads from sporadic earthquakes, and avulsions (the process whereby a river changes its course dramatically). The flood season in the Jamuna is from July through September and the low-water season from November through April. Average annual rainfall along the river are in the range of 1,700 to 2,500 mm. Monsoon rainfall is predicted to increase by 5 percent in 2039 and by 13 percent in 2069. The related monsoon flow is expected to increase by 3.6% in 2040 and by 7.8% towards the end of this century.

Since the 1960s, flood embankments have been built along parts of the Jamuna River to protect agricultural land from flooding. Most importantly, about 240 kilometers of the right (west) bank of the Jamuna River has been protected against flooding. However, riverbank erosion often associated with river widening has caused breaches and in turn the embankments have been retired repeatedly.

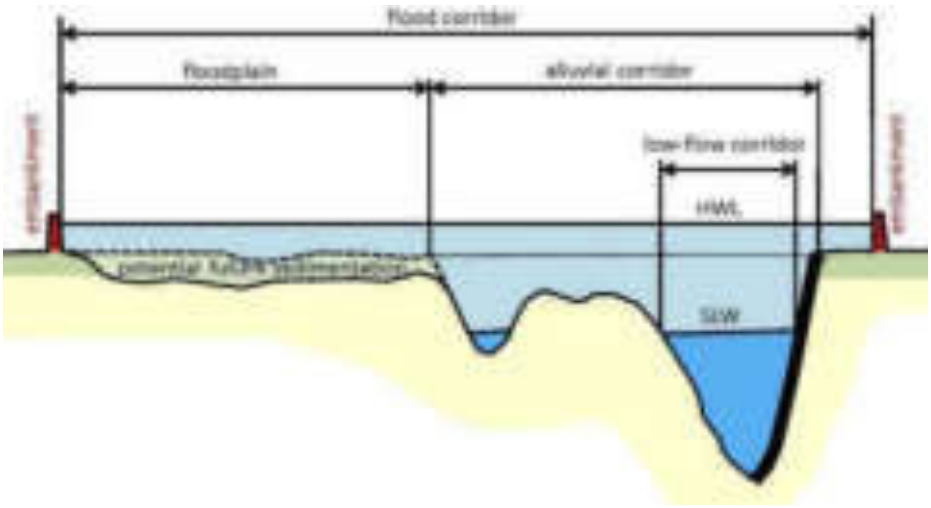


Figure 2-1 Schematic Section of different river corridors

A large number of people reside on the embankments, often families forced into poverty by flooding or after losing their land to erosion. From Sirajganj to the Teesta River some 115,000 people live on embankment slopes and encroach on the crest, causing some damage, restricting access and movement along crest roads and hindering maintenance.

From the early 1970s to early 2000s the average width of the braided system increased by 50%. The Jamuna River corridor widened from about 8 to 12 kilometers, and over 80,000 ha was lost due to erosion along the riverbanks. About half of the land lost was replaced by river channels and infertile sand bars, and the other half by semi-permanent chars (vegetated islands) of lesser agricultural value. This system is now planned to be narrowed into a stable corridor (Figure 2-1).

2.2 River Corridor associated with Priority Subprojects

SUBPROJECT JRB-1. The river corridor associated with JRB-1 has a right (west) bank line length of about 37 km and extends from the Bangabandhu (Jamuna) Bridge and the first major tributary on the west bank, near Kaijuri. Flood embankments constructed in the 1980's have been lost due to significant riverbank erosions. River bank protection was constructed about ten years ago under JMREMP, but repairs/ adaptation works are now required due to slope failures (Figure 2-2). About 23 km of flood embankments are being constructed/ restored under Tranche-1 of FRERMIP[10], and some repair/ adaptation works are expected to be done. Under FRERMIP Tranche-2, remaining river bank adaptation/ repair works will be done, and bank

Figure 2-2 Surficial Failure of Riverbank Protection built in 2010

[10] Bidding for 5 packages for flood embankment construction under way, early 2018

protection extended about 4 km. In addition, about 6 km of additional food embankment is planned along with two fish passes.

SUBPROJECT JLB-2. The river corridor associated with JLB-2 has a bank line length of about 56 km and extends along the left (east) bank of the Jamuna River, between an off-take of the Dhaleswari River and the end of the Jamuna at the confluence with the Ganges. This includes the Chauhali and Zafarganj areas, which have suffered from progressive erosions and frequent flood inundations. Under FRERMIP Tranche-1, 9.5 km of bank protection has been provided, and some repair works remain to be carried out where slopes have failed. Under Tranche-2, adaptation works are planned, along with river training and works to reclaim about 5,000 ha of land. Flood embankments will be provided under Tranche-3, after first securing stable riverbanks.

SUBPROJECT PLB-1. The bank length associated with PLB-1 is about 25 km long on the left bank (east bank) of the Padma River, downstream of the confluence of the Ganges and the Jamuna, near Harirampur. The subproject area has been suffered from progressive erosions and frequent flood inundation. Under Tranche-1, 8.8 km of bank protection was constructed. This will be extended upstream by about 3 km under Tranche-2, together with required adaptation works to secure the embankment, and with permanent concrete block wave protection. About 17km of flood embankment will also be provided together with five fish passes.

2.3 Char Lands

The char lands are characterized by coarser fraction in the upstream and finer materials further downstream. Top soils on newly formed charland consist of sand and silt of approximately the same coarseness as the bed material of the river reach. The sand percentage is high and silt and clay contents are usually low. Water holding capacity is low and residual moisture is quickly depleted so that frequent irrigations are necessary for crop production. Soils usually lack plant nutrient contents, are acidic, highly permeable and subject to deep percolation and run-off. Organic matter content is low, typically below one percent[11]. Under natural processes, it takes several years for the chars to become suited to high value agriculture, starting from stabilisation, deposition of sediments and increase in land level, establishment of grasses, gradual build up of fertility, and so on. However, this can be speeded up combining traditional approaches and scientifically supported methods, including sand filling from dredging, planting of grasses, and integration of green manure crops into farming systems. While agricultural development is possible, the stabilised char lands may be developed for much high economic returns accruing from peri-urban and economic zone developments, with settlements and industry, and inland ports.

[11] Soil with 2.5 percent organic matter in the cultivated layer is considered to be suitable for rice cultivation

2.4 River Stabilization

The on-going stabilization of the Jamuna and Padma rivers will result in stable river banks and flood embankments safe from scour. The width of the river's flood corridor will reduce from about 10-16 km, to about 7 km along the Jamuna, and 8-10 km along the Padma. About 150,000 ha of char/ flood plain land will be recovered and become available for development, (Figure 2-3), (NHC/EMM, November 2017).

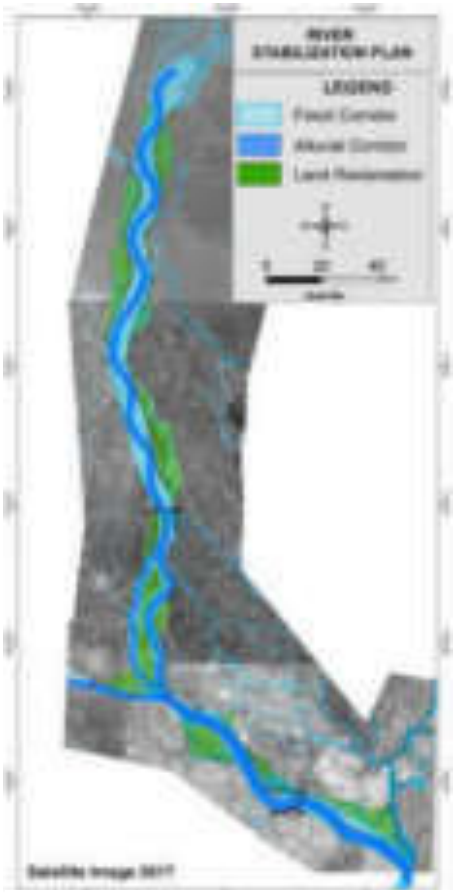


Figure 2-3 River Corridor showing land reclamation

2.5 Land Ownership

Most of the reclaimed areas are char land some of which is privately owned and some is 'khas' or government land managed by the Ministry of Land. There is no accurate inventory of khas land.

The ownership of private land is generally taken to be evidence of a '*khatian'*, an individual land record certificate. However, khatians are not conclusive evidence of ownership merely providing a basis for possession at the time of recording. In law khatians along with deeds and mutation documents are needed for an ownership decision in a civil court. This is a lengthy and complex process. Also, the current administrative protocols often produce multiple khatians administered by four different agencies (Directorate of Land Records & Surveys, DC Record Room, AC (Land), and *Tehsil* Office) which may materially differ, (NHC/EMM, June 2016).

The cadastral information of spatially mapped khatians, or at least plot numbers, is called a mouza map. These date back to colonial times, and were prepared by cadastral survey between 1888 and 1940. In 1927, some 90,000 cadastral (mouza) maps covering the whole of country were published. DLR&S has the mandate to conduct and update mouza maps (Figure 2-4).

Figure 2-4 Geo-referenced mouza map overlain on a satellite image

2.6 Char Land Population and Livelihoods

The Char Livelihoods Programme (2010) estimated the population of riverine chars at 1.0 to 1.4 million, with 65% on the Jamuna chars.

Char people, the *choira*, are highly vulnerable to floods and erosion or the chars. Livelihoods are based in crop agriculture, animal husbandry, small businesses, fishing and daily wage labour. Under-nutrition is widespread due to inadequate diet, poor sanitation and hygiene.

For the choira, land is their most important capital and the whole river bed is considered their property and is passed on to the next generation. Land is traded/ brought and sold, even if it is underwater. Mouza maps are used to determine the location of plots, even under water, and every settlement has an '*amin*', a survey fieldworker who knows the location of plots. According to law, land that has been under water for more than thirty years becomes Government owned land (khas).

In the development of stabilised and reclaimed land there is a need to ensure against marginalisation of char dwellers and possible land grabbing by elites. Initial indications from a social survey of char dwellers perceptions regarding char stabilisation show that they would welcome char stabilisation, they do not want to leave their chars, and would welcome manufacturing/industrial development to provide employment, (NHC/EMM, June 2016).

3 SPECIAL ECONOMIC ZONES

The Bangladesh Economic Zone Act (2010) provides for the establishment of Special Economic Zones (SEZs) to encourage rapid economic growth through industrialisation. The mandate of the Bangladesh Economic Zones Authority (BEZA) is to identify potential zones, acquire land and build the necessary facilities using Public Private Partnerships (PPP) if necessary. The 7th 5-Year Plan includes for development of 100 Special Economic Zones. To date 43 have been established, each spread over, on average, about 30 ha. Establishment of many SEZs on reclaimed land in the river corridor is anticipated.

3.1 Inland Navigation

Bangladesh has around 24,000 km of inland waterways of which around 6,000 km of major routes are maintained by Bangladesh Inland Water Transport Authority (BIWTA) (Figure 3-1). The navigation of many inland rivers has been deteriorating due to sedimentation, obstruction by bridges and other structures, and low dry season flows. Stabilizing and reducing the width of the Jamuna and Padma rivers will be very beneficial for navigation in these rivers. Controlling flows and sediment to major distributaries will also facilitate restoring these to navigation. Periodic (annual) dredging will be required.

Figure 3-1 Bangladesh inland navigation routes

Consultant's Report

Flood and Riverbank Erosion Risk Management Investment Program

A 1.3 Morphology of the Lower Jamuna

April 2019

Prepared by

Institutional Strengthening and Project Management Consultant (ISPMC)

Joint Venture of Northwest Hydraulic Consultants Ltd. and Euroconsult Mott MacDonald Ltd. in association with Deltares, Resource Planning and Management Consultants and CEGIS

TABLE OF CONTENTS

LIST OF TABLES

A 1.1 Summary Activities Tranche-1

LIST OF FIGURES

A 1.1 Summary Activities Tranche-1

ACRONYMS

ADB	Asian Development Bank
ADCP	Acoustic Doppler Current Profiler
BDT	Bangladesh Taka
BIWTA	Bangladesh Inland Water Transport Authority
BRE	Brahmaputra Right Embankment
BUET	Bangladesh University for Engineering and Technology
BWDB	Bangladesh Water Development Board
CbFRM	Community-based Flood Risk Management
CDMP	Comprehensive Disaster Management Program
CDP	Capacity Development Plan
CDMU	Community Disaster Management Unit
CEGIS	Center for Environmental and Geographic Information Services
CLP	Chars Livelihood Programme
CQS	Consultant Qualification Selection
DDM	Department of Disaster Management
DEM	Digital Elevation Model
DGPS	Differential Global Positioning System
DMB	Disaster Management Bureau
DPP	Development Project Proforma
DMC	Disaster Management Committee
DMIC	Disaster Management Information Center
DoE	Department of Environment
DoF	Department of Fisheries
DRR	Department of Relief and Rehabilitation
EA	Environmental Assessment
ECNEC	Executive Committee of National Economic Council
EGIS	Environmental and Geographic Information System
EIA	Environmental Impact Assessment
EMP	Environmental Management/Monitoring Plan
FAP	Flood Action Plan
FCD	Flood control and drainage
FCDI	Flood control, drainage, and irrigation
FFWC	Flood Forecasting and Warning Centre
FRERMIP	Flood and Riverbank Erosion Risk Management Investment Project (ADB)
GAP	Gender Action Plan
GIS	Geographical Information System
GoB	Government of Bangladesh
HFL	High Flood Level
IEE/EIA	Initial Environmental Examination / Environmental Impact Assessment
ILRP	Income Livelihood Restoration Program
INGO	Implementation Non-Governmental Organization
IR	Involuntary Resettlement
ISPMC	Institutional Strengthening and Project Management Consultant
IWM	Institute of Water Modelling
IWRM	Integrated Water Resources Management
JBIC/JICA	Japan Bank for International Cooperation / Japan International Cooperation Agency
JLB	Jamuna Left Bank
JRB	Jamuna Right Bank
JMREMP	Jamuna-Meghna River Erosion Mitigation Project, 2002 to 2011 (World Bank)
LCS	Labour Construction Society

LGED	Local Government Engineering Department
LiDAR	Light Detection and Ranging
M&E	Monitoring and Evaluation
MCA	Multi-criteria Assessment
MDIP	Meghna Dhonagoda Irrigation Project
MFF	Multi-tranche Financing Facility
MIS	Management Information System
MoLGRDC	Ministry of Local Government, Rural Development and Cooperatives
MoWR	Ministry of Water Resources
MRP	Main Rivers Flood and Bank Erosion Risk Management Program
NGO	Non-Governmental Organization
NHC	Northwest Hydraulic Consultants Ltd.
NPDM	National Plan for Disaster Management
NWMP	National Water Resources Management Plan
NWP	National Water Policy
NWRD	National Water Resources Database
O&M	Operations and Maintenance
PIRDP	Pabna Irrigation and Rural Development Project
PMO	Project Management Organization (BWDB)
PMU	Project Management Unit (DDM)
PPTA	Program Preparatory Technical Assistance
PWD	Public Works Datum
QC/QA	Quality Control / Quality Assurance
QBS	Quality Based Selection
QCBS	Quality and Cost Based Selection
RAP	Resettlement Action Plan
RBIP	River Bank Improvement Project/ Program (World Bank)
RPMC	Resource Planning and Management Consultants (Pvt) Ltd.
RSP	River Stabilization Plan
RTIP	River Transport Improvement Project
SESA	Strategic Environmental and Social Assessment
SIA	Social Impact Assessment
SSWRDP	Small Scale Water Resources Development Project
ToR	Terms of Reference
USD	United States Dollar
WARPO	Water Resources Planning Organization
WB	World Bank

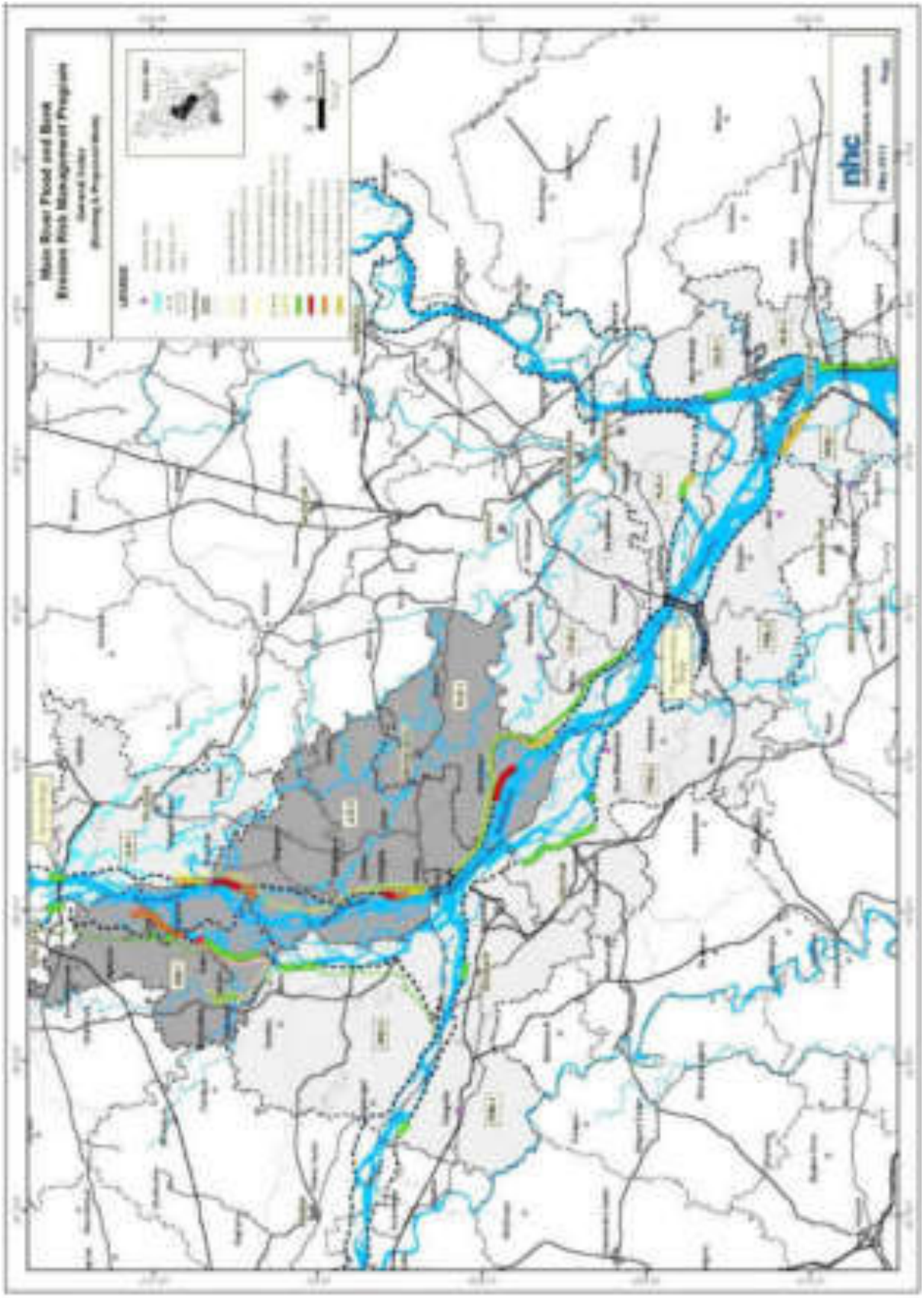


Figure 1 Subprojects of FRERMIP Program Area

1 THE INFLUENCE OF CAPITAL DREDGING AT THE JAMUNA BRIDGE

Assessing the impact of structural interventions in a complex and dynamic fluvial system like a braided river is a serious challenge for river engineers. Relatively few interventions have been carried out in the braided sand-bed Jamuna River. The availability of knowledge on the responses of a braided river to large-scale interventions is limited. Since the mid-1990s, along with the construction of the Bangabandhu Bridge, large interventions were implemented such as the Sirajganj and Bhuapur hardpoints, the hard points of Sariakandi, and pilot interventions at Bahadurabad and Ghutail.

During the construction phase, it was very difficult to assess the impacts of the bridge and the supporting bank protection structures on the morphological processes. Sarker et al. (2011) carried out a post-project assessment of impacts on the morphological processes of the Jamuna River later, during the Detailed Design Phase of the Padma Multi-purpose Bridge.

A reach of the river from 20 km upstream to 50 km downstream of the Bangabandhu Bridge was considered for assessing the impact of the bridge (Figure 1-1). Time-series of multi-spectral satellite images were used to examine the planform development of the study reach before and after constructing the bridge. Dry-season satellite images were classified into land and water within the

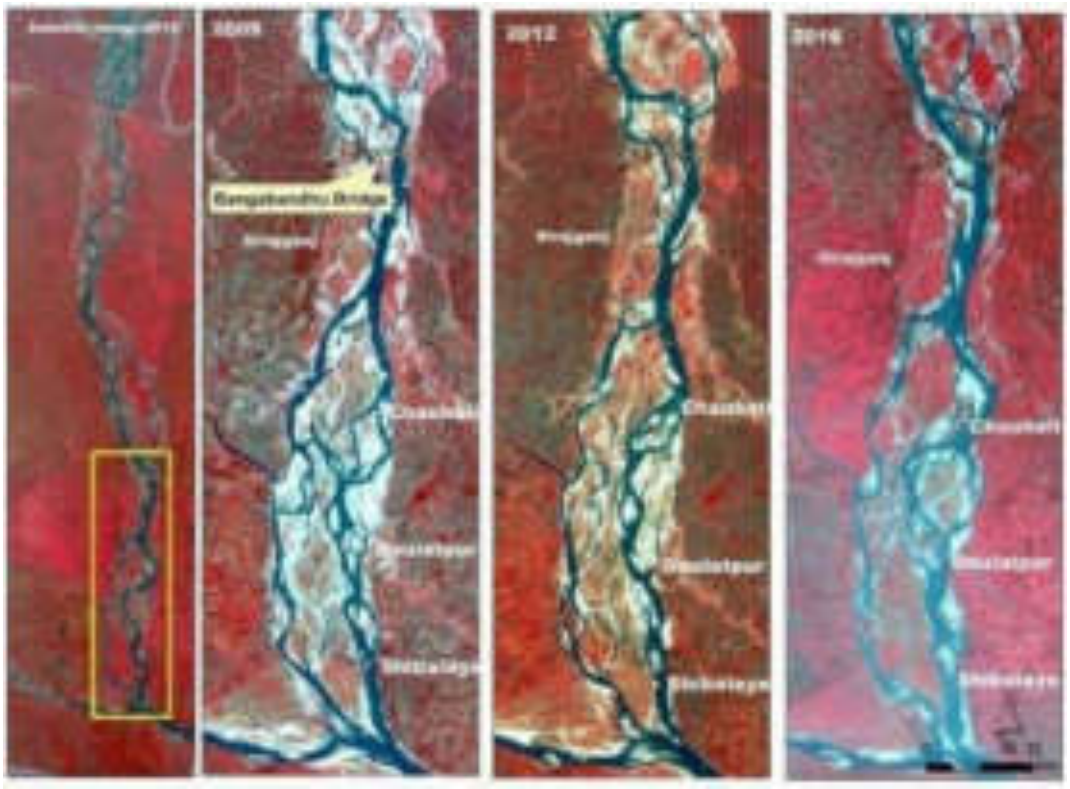


Figure 1-1 Satellite image of 2018 showing a reach of the Jamuna River from 40 km upstream to 50 km downstream of the Bangabandhu Bridge.

braid belt. Changes in the reach-averaged width of the river was also analyzed. Trends of channel shifting, bank erosion and changes in reach-averaged width were identified for the pre-bridge period. These trends were subtracted from the observed changes during the post-bridge period to assess the effects of the bridge.

Within a few years after construction of the bridge, two channels started to flow persistently along the two guide bunds, as a result of flow attraction by deep scour. An analysis demonstrated that the

river started to adjust its planform to the new situation immediately after construction of the guide bunds (4.8 km apart) in 1997. The responses of the river planform to the guide bunds and the revetments at Sirajganj and Bhuapur were first visible in the 2003 dry-season satellite image (Figure 1-2). In the following years up to 2012, the channels of the river followed a similar planform. Two distinct channels from a wider reach converged and aligned along both guide bunds. The convergence reached a maximum at about 8 to 10 km downstream of the bridge (Figure 1-3). A divergent reach developed further downstream.

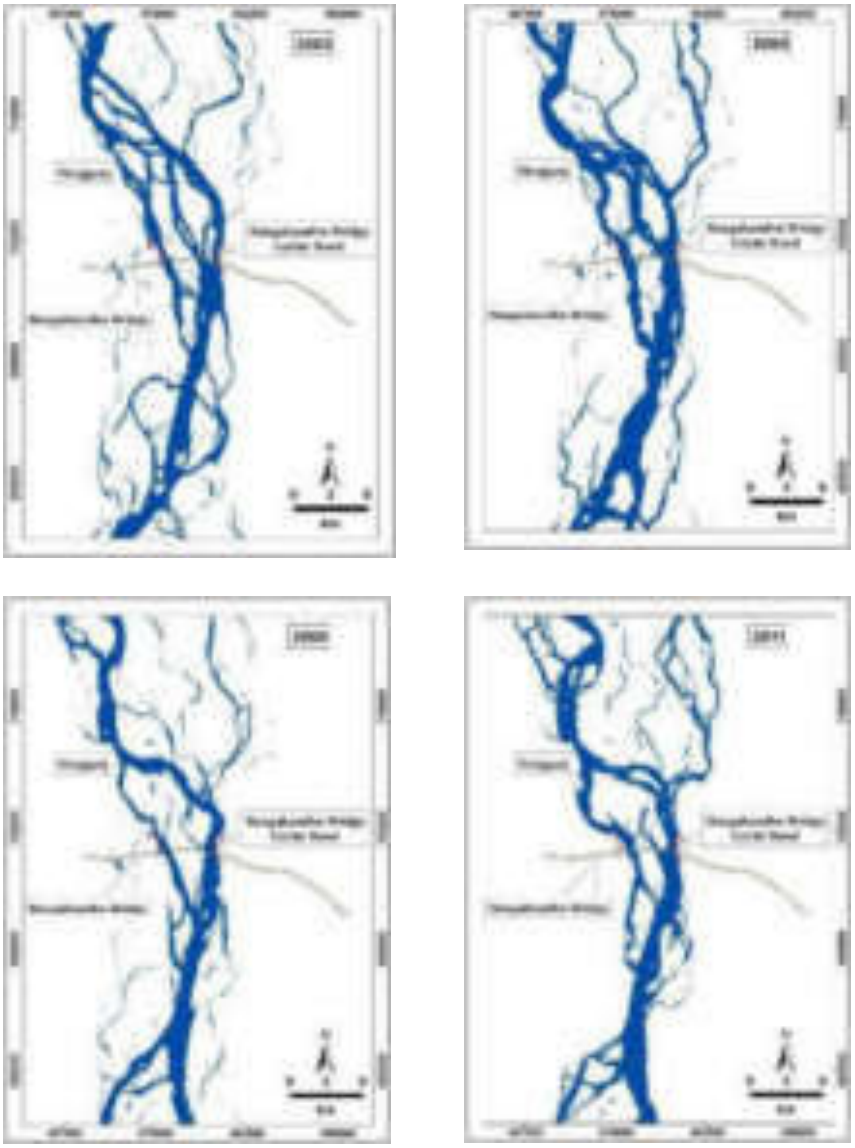


Figure 1-2 Classified satellite images showing the changes of planform after the construction of the Bangabandhu Bridge.

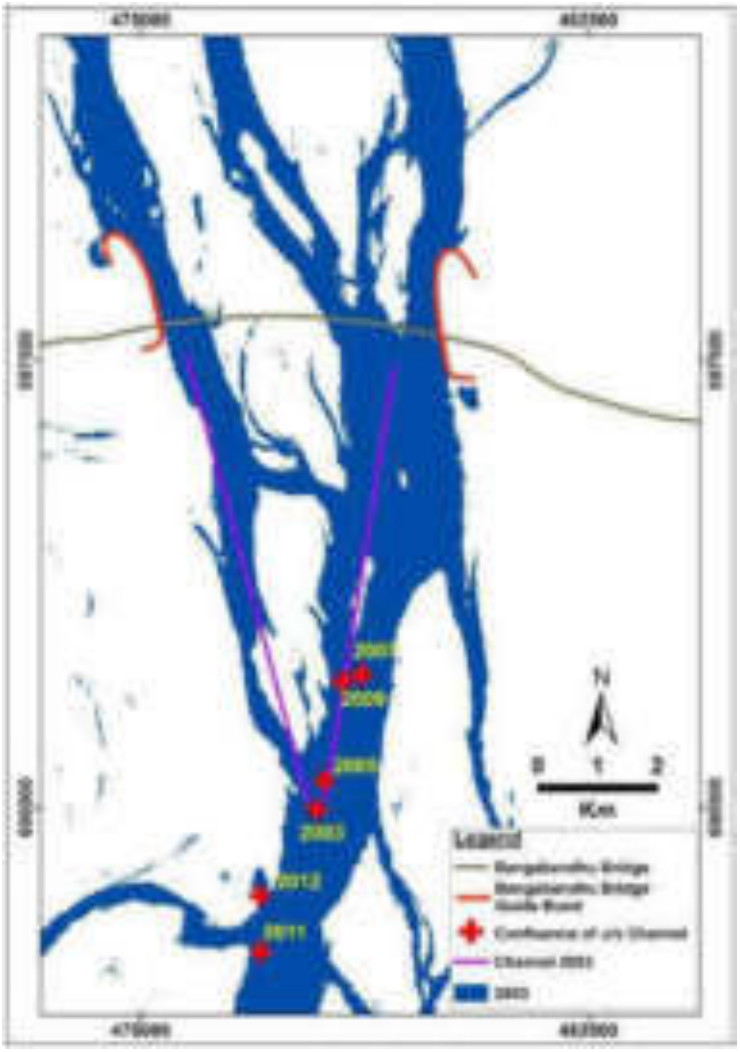


Figure 1-3 Location of maximum convergence after construction of the Bangabandhu Bridge.

Net 2200 ha riverbank erosion occurred in the diverging reach between 25 and 40 km downstream of the bridge from 2000 to 2010, which was also an effect of the bridge. Such a development was not envisaged prior to the construction of the bridge. This finding provided a useful insight for assessing the impacts of the bridge on the Padma River during its Detailed Design Phase.

FRERMIP has drafted a strategic plan for riverbank stabilization of the Jamuna and Padma Rivers. In Tranche 2, it plans to intervene in the Jamuna and Padma Rivers between the Bangabandhu Bridge and Chandpur. Prior to the detailed design, it is important to assess the impacts of the latest interventions in the system.

Time-series of dry-season satellite images were used to assess the impacts of the Pilot Capital Dredging carried out by BWDB at Sirajganj and Bangabandhu Bridge. Pilot interventions in 2011 and 2012 included dredging to develop a 200 m wide channel across the mid-channel bar between the two guide bunds, subsequent closing of the channel along the right guide bund by disposing dredged materials, and bank protection structures (spurs, revetment). The interventions shifted the right channel away from the right guide bund and forced the flow to divert trough the dredged channel (Figure 1-4). As a result, the 200 m wide dredged channel widened more than 700 m during the following monsoon.

The Pilot Capital Dredging and following interventions pushed the channel flowing along the right guide bund to the left, caused a gradual shortening of the maximum converging point from 12 km downstream of the bridge to one km (Figure 1-4 and Figure 1-5). Spur fields upstream and downstream of the Sirajganj revetment force the channel into a straight alignment. Moreover, those interventions pushed the main flow toward left guide bund, resulting in the development of a meandering bend immediate downstream of left guide bund (Figures 1-4 and 1-5). Instead of a multi-channeled converging planform, a 32 km long meandering planform has started to develop from 17 km upstream of the bridge to 15 downstream. Interventions thus reduced the length of maximum convergence (Figure 1-4) and gradually transformed the planform into a single-thread meandering channel (Figure 1-5). Started from 2013 to 2018 this bend eroded 100 ha of left bank (Figure 1-6).

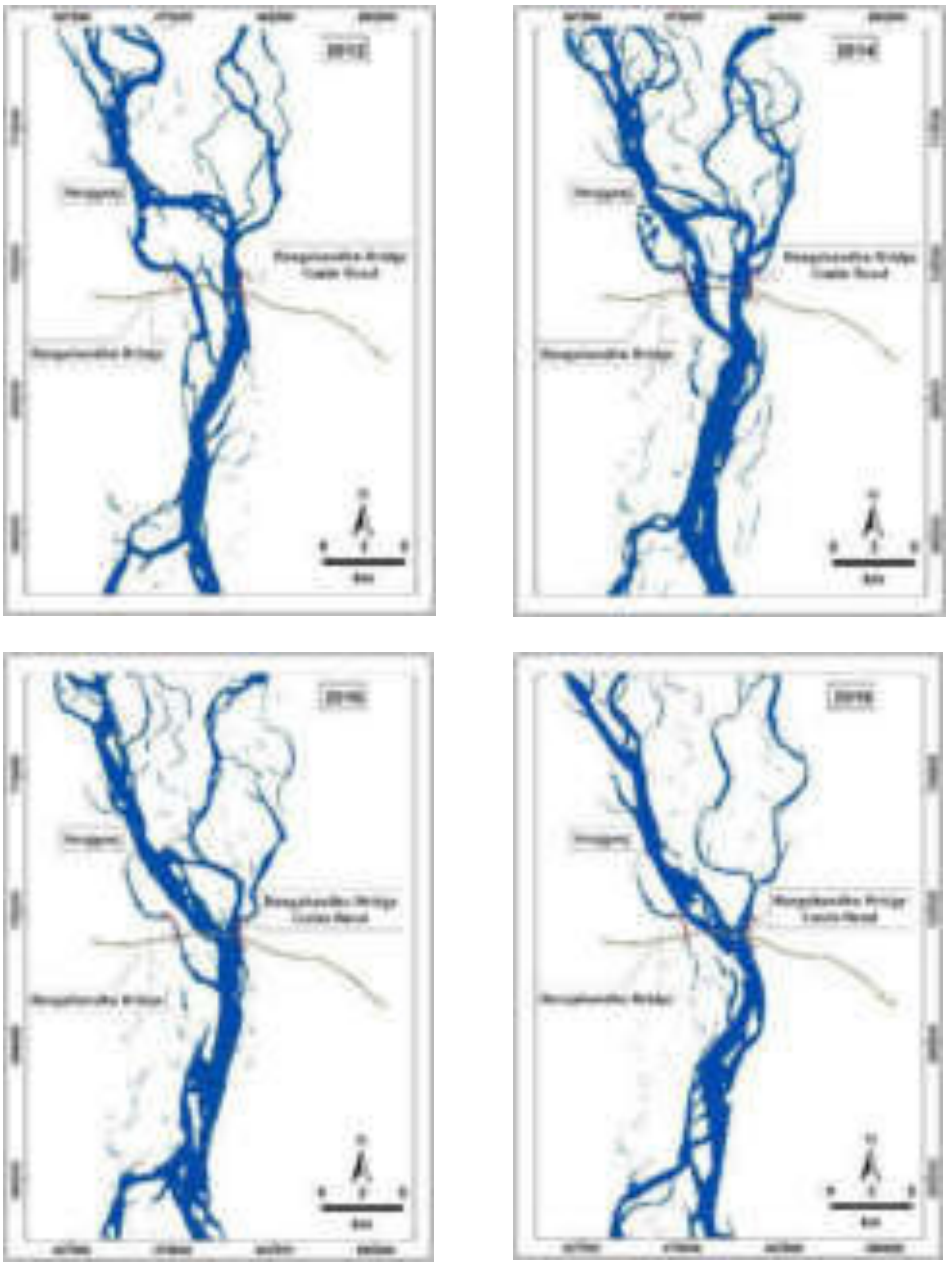


Figure 1-4 Classified satellite images showing the changes of planform after the Pilot Capital Dredging project in the Jamuna River.

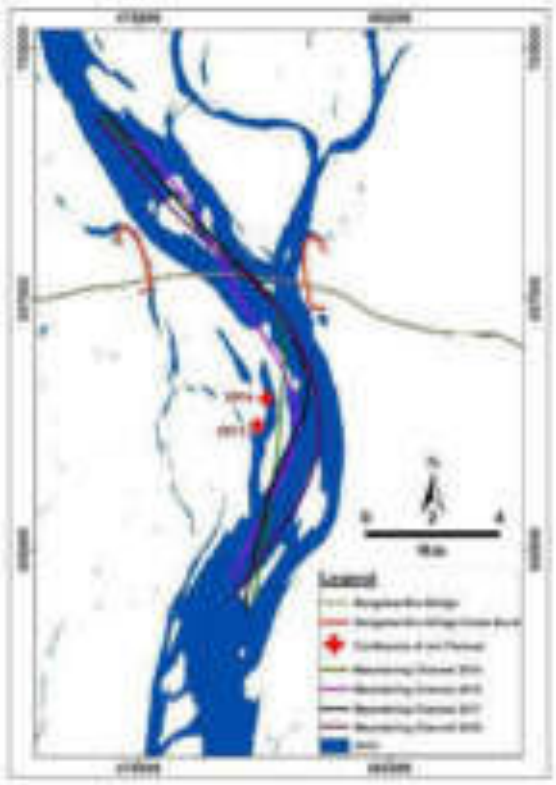


Figure 1-5 Bank erosion (2012-2018) immediate downstream of left guide bund after pilot interventions

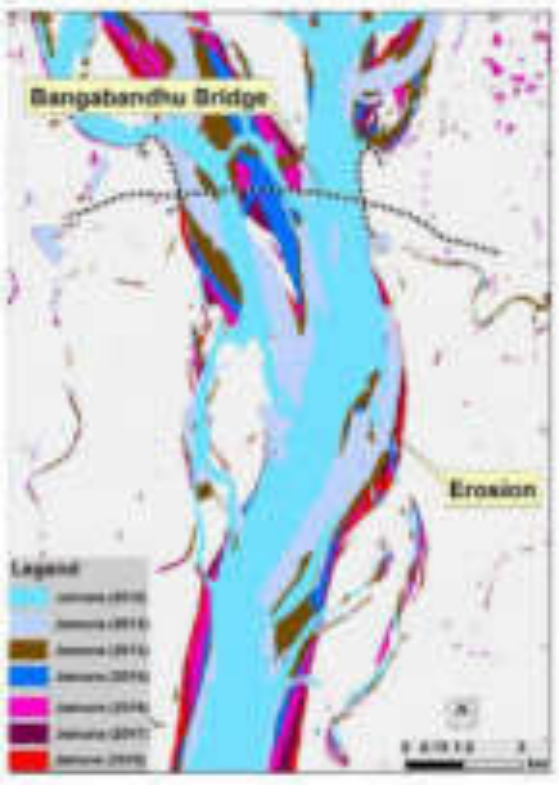


Figure 1-6 Planform development after the Pilot Capital Dredging project

The classified satellite images after the pilot interventions from 2013-2018 shows 1900 ha river bank erosion along the left channel in the reach from the Bangabandhu Bridge up to Chauhali which is much bigger than bank erosion 870 ha occurred from 2003-2012 (Figure 1-7 and Figure 1-8). The left anabranch downstream of the bridge was observed to become larger after the pilot interventions. This change may not solely be due to the pilot interventions. Natural periodic oscillations of enlarging and declining of anabranches may have contributed to the observed changes downstream of the bifurcation.

It can be concluded that the pilot interventions have changed the planform pattern of the lower Jamuna River downstream of the bridge. A converging reach transformed into a reach where a meandering channel caused riverbank erosion along the left bank immediately downstream of the bridge. The high erosion rate along the left bank at Chauhali may be ascribed to the pilot interventions, but these interventions are not necessarily the main actor. Periodic oscillations of enlarging and declining phase among the anabranches may have strong role to play (Figures 16 and 17 in FMISC TN-7)

The effects of pilot interventions continue. Changes in channels upstream of the bridge might have changed the prevailing process of planform transformation downstream of the bridge.

Figure 1-7 Migration of left channel between the Bangabandhu Bridge and Chauhali before the Pilot Capital Dredging project

Figure 1-8 Migration of left channel between Bangabandhu Bridge and Chauhali after the Pilot Capital Dredging project

2 MORPHOLOGICAL MODELLING

The morphology of the core area for Tranche-2 river stabilization activities keeps on changing at a fast pace. To update the PPTA study (NHC Ltd., 2013), we have analyzed morphological changes in the Lower Jamuna since 2011, based on ground data and satellite images, distinguishing two different time intervals, namely 2011 to 2015 and 2015 to 2017. In addition, we have used numerical modelling to predict morphological changes for the period autumn 2017 - autumn 2018 for a normal and a higher flood.

The Lower Jamuna changed from an erosional trend during the period 2011 – 2015 to a sedimentation trend from 2015 to 2017, likely as a result of developments in the 2016 and 2017 flood seasons. Figure 2-1 and Figure 2-2 show the changes based on bathymetric data obtained over the years. In addition to actual large-scale river surveys, satellite imagery processed through Deltares Aqua Monitor and Google Earth further supports this observation (Figure 2-1 to Figure 2-11).

Sand-bar and deep-channel dynamics, particularly upstream of the bifurcation and at the left channel, are unfavorable for the stabilization of the bifurcation and the branches (Figure 2-1 and Figure 2-2). Large amounts of sediment inflow from the upstream reach towards the left branch have decreased the discharge towards this branch and increased the discharge towards the right branch. This has enhanced bed dynamics along the right branch, shifting channels and exchanging flows at the

downstream area near the confluence with Hurasagar. Therefore, the banks and chars have to be protected.

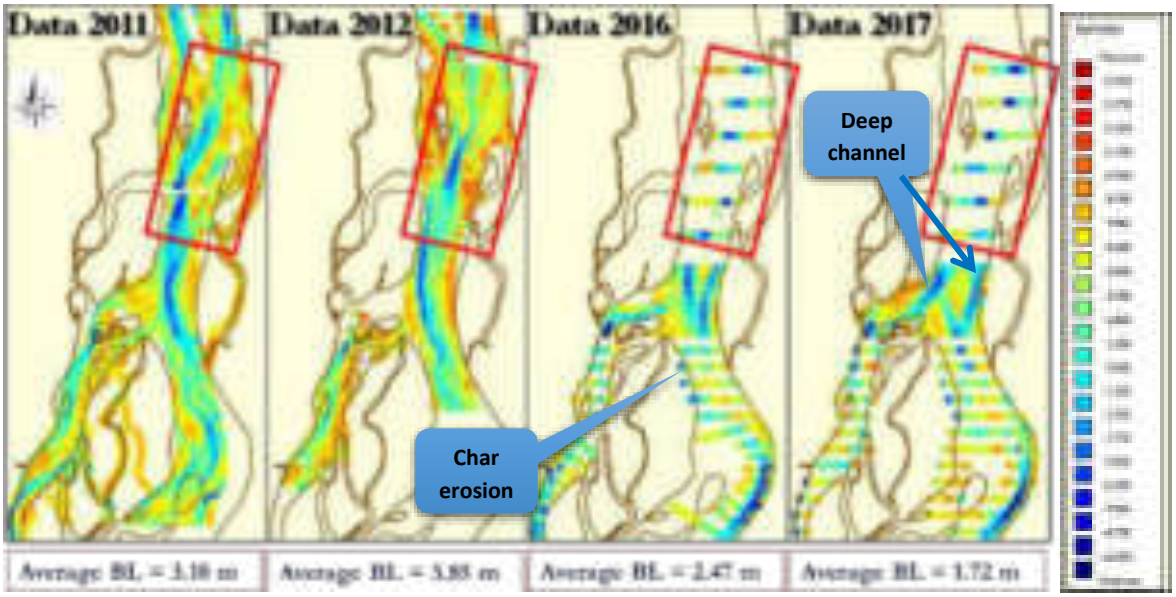


Figure 2-1 Deep channels, sand bars and average bed levels (average in upstream reach, indicated by red rectangle) during 2011-2017. The land boundary in the plots represents the early 2016 situation.

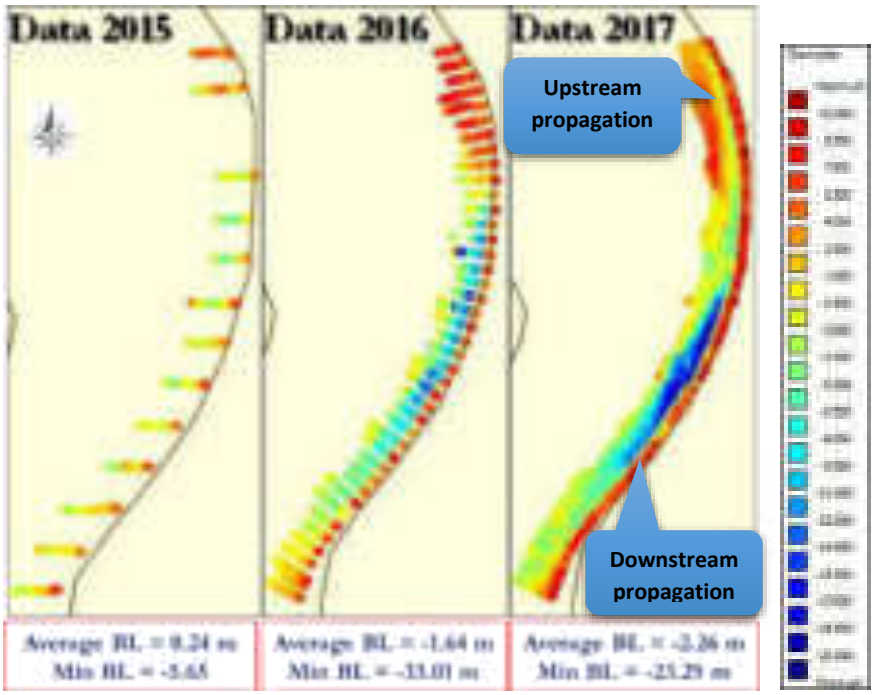


Figure 2-2 Evolution of deep scour in the Chauhali Bend after building a 7 km long riverbank protection in 2016, showing propagation of scour in both upstream and downstream direction.

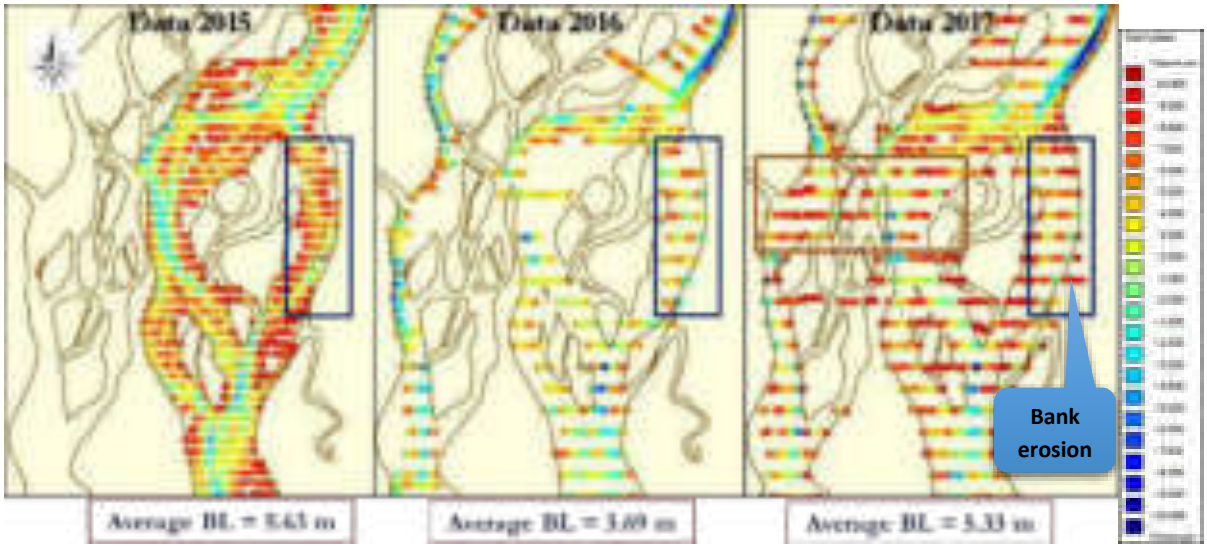


Figure 2-3 Bed level changes in the Salimabad Channel (within the area indicated by a black rectangle), revealing a sedimentation trend in 2017.

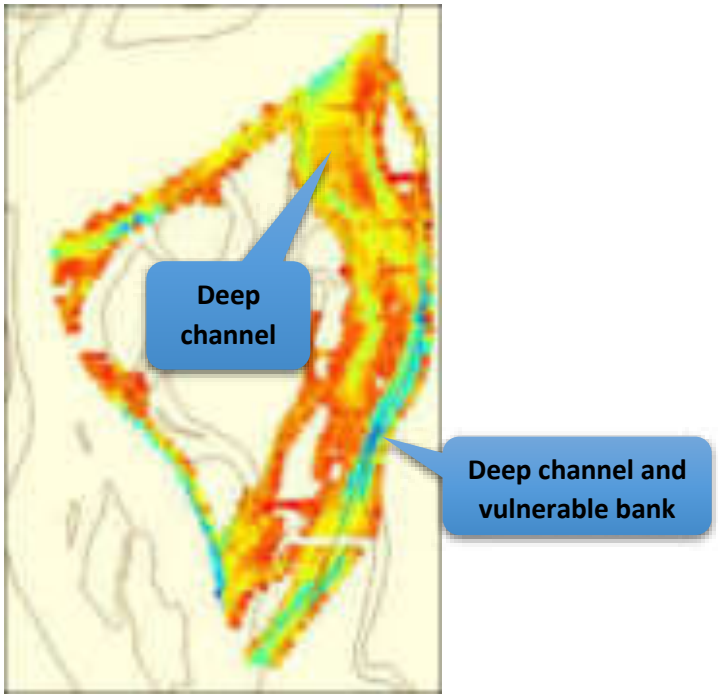


Figure 2-4 High-resolution bathymetry measurement at Salimabad after 2017 floods, revealing deep-channel formation despite overall sedimentation trend.

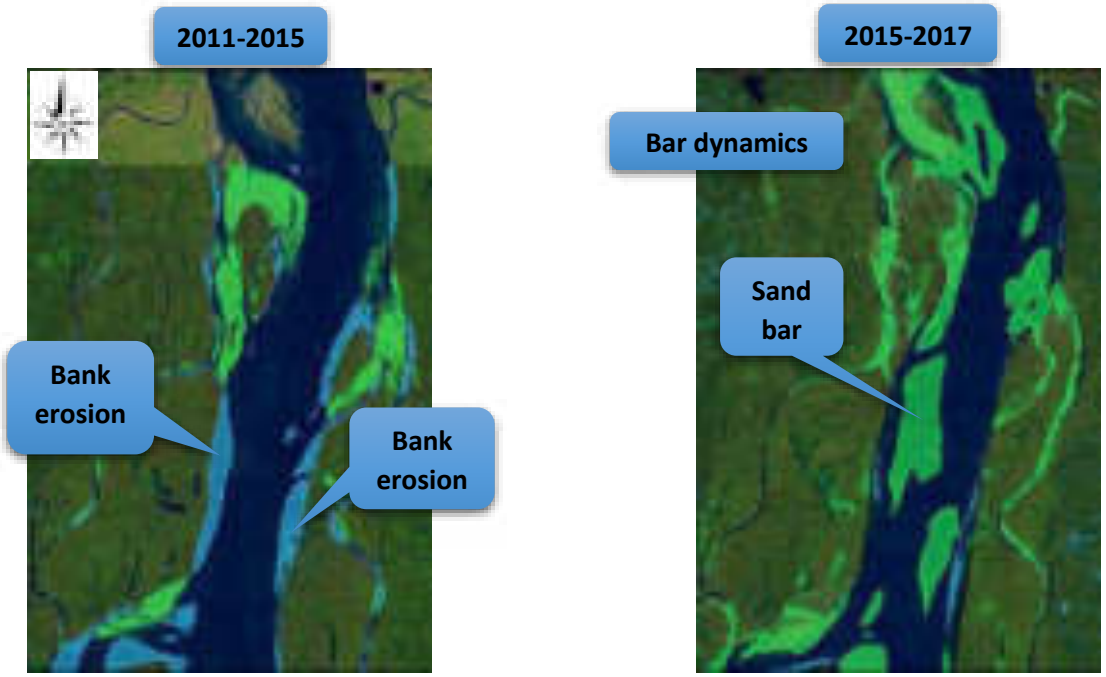


Figure 2-5 Large-scale changes in upstream reach of the bifurcation (green - sedimentation; light blue - erosion; dark blue - no changes).

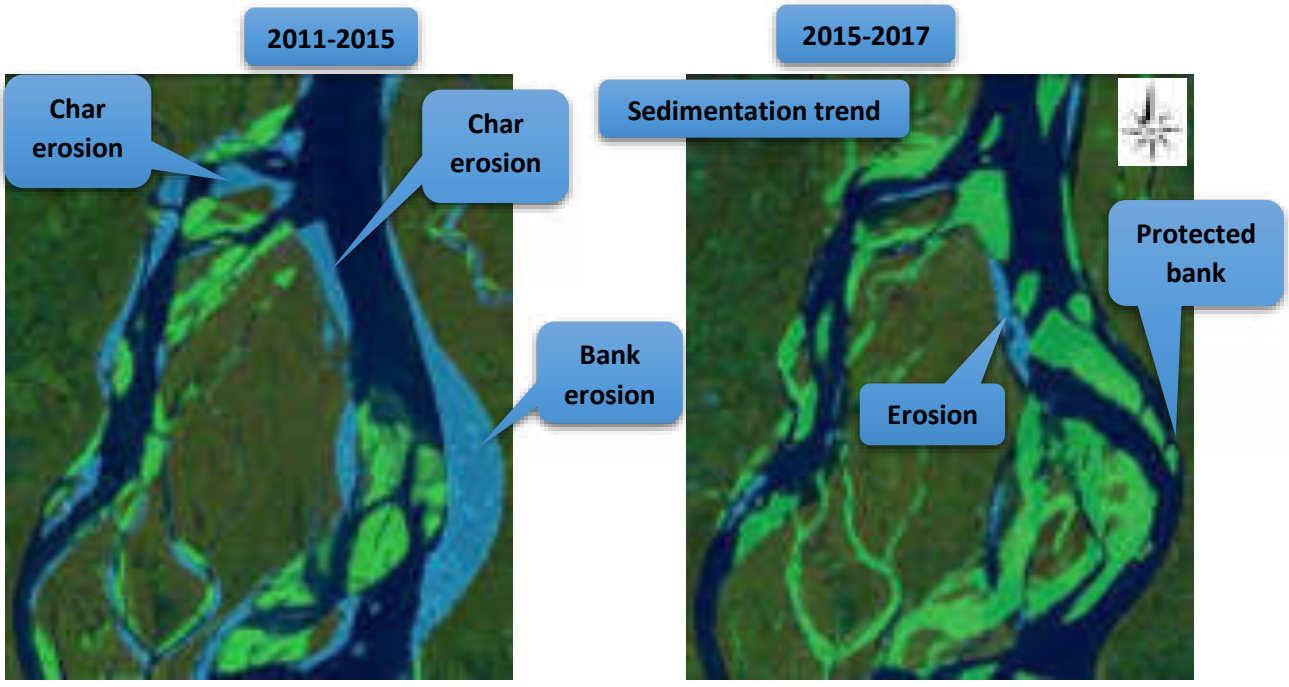


Figure 2-6 Large-scale changes at the bifurcation and in its branches (green - sedimentation; light blue - erosion; dark blue - no changes).

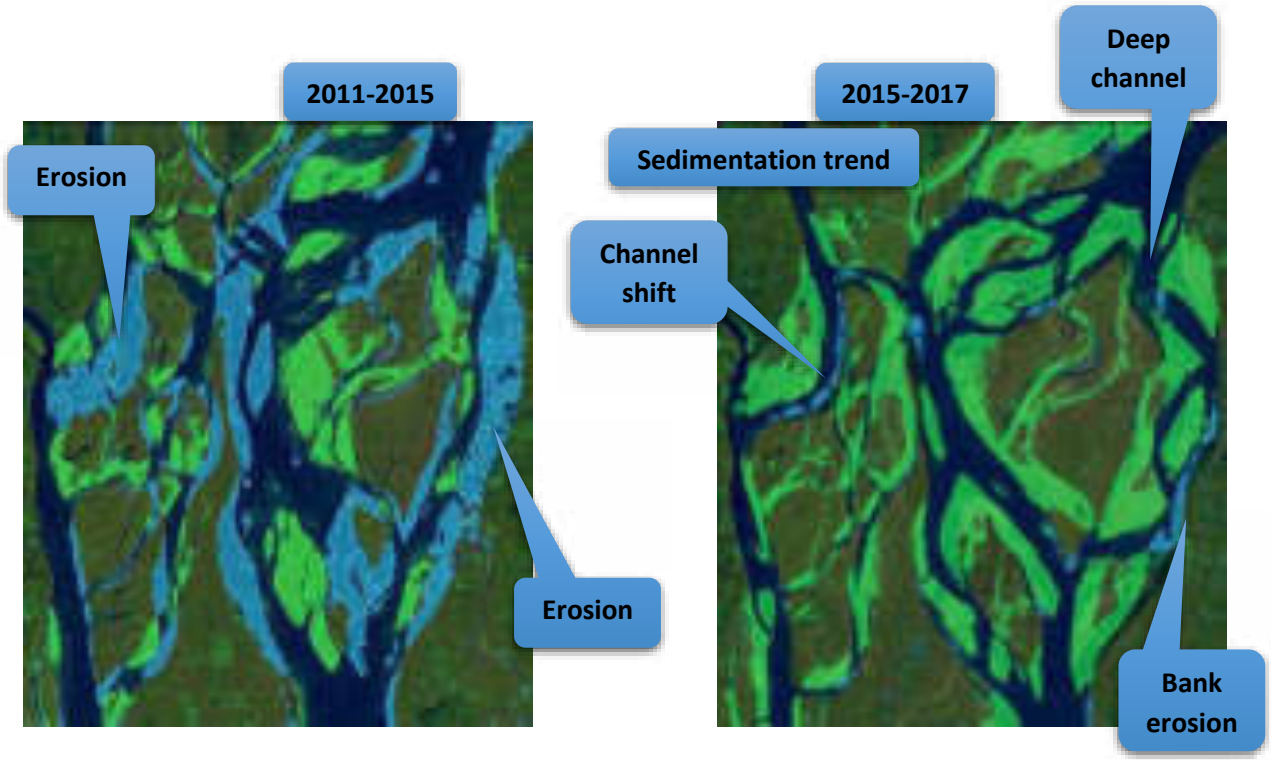


Figure 2-7 Large-scale changes downstream of the major bifurcation (green - sedimentation; light blue - erosion; dark blue -no changes).

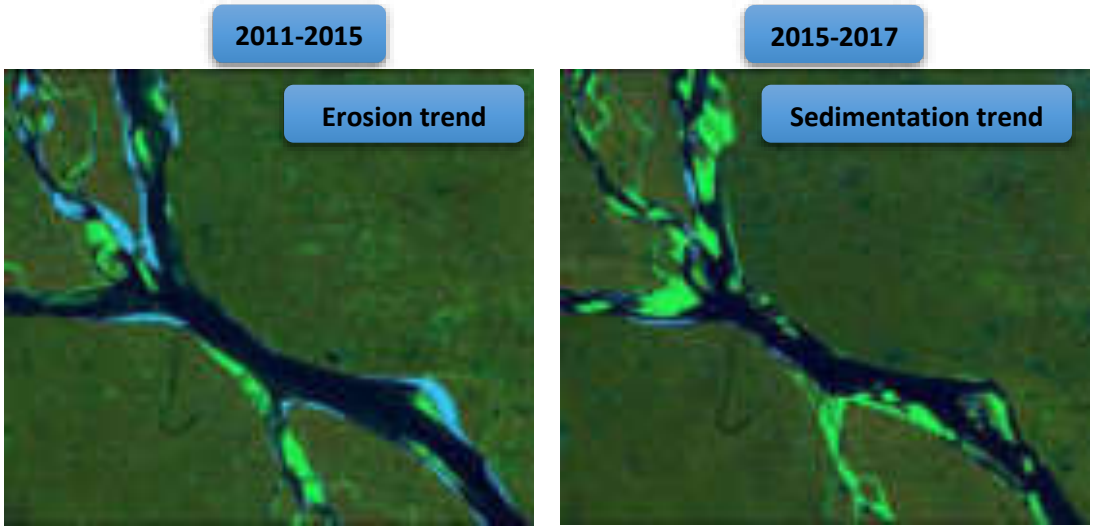


Figure 2-8 Large-scale changes at the confluence with the Ganges (green - sedimentation; light blue - erosion; dark blue -no changes).

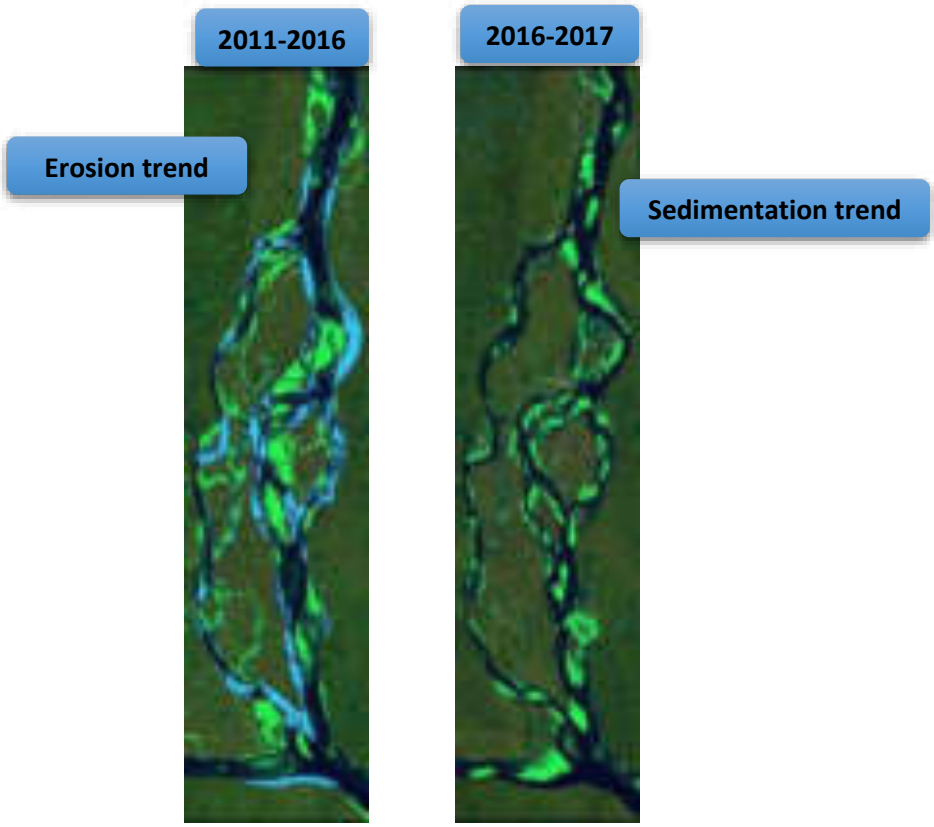


Figure 2-9 Large-scale changes in the Lower Jamuna (green - sedimentation; light blue - erosion; dark blue -no changes).

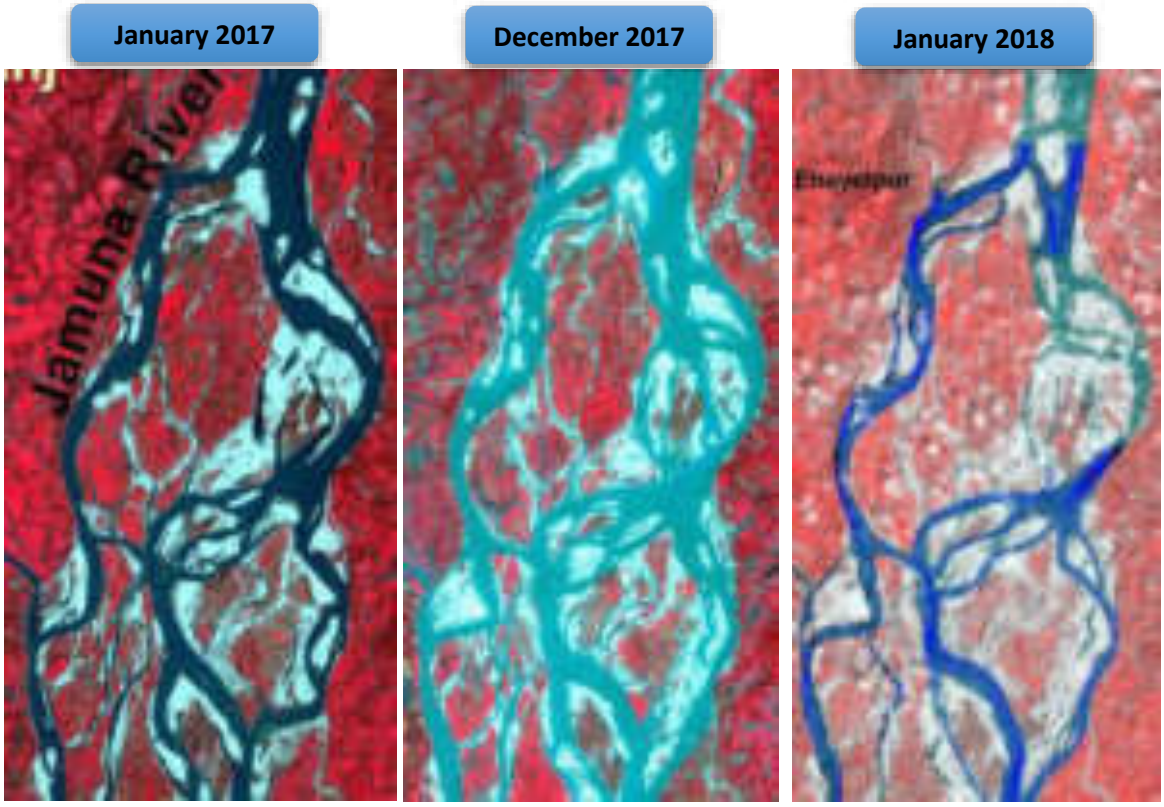


Figure 2-10 Channel changes downstream of the Lower Jamuna bifurcation (Images: CEGIS).

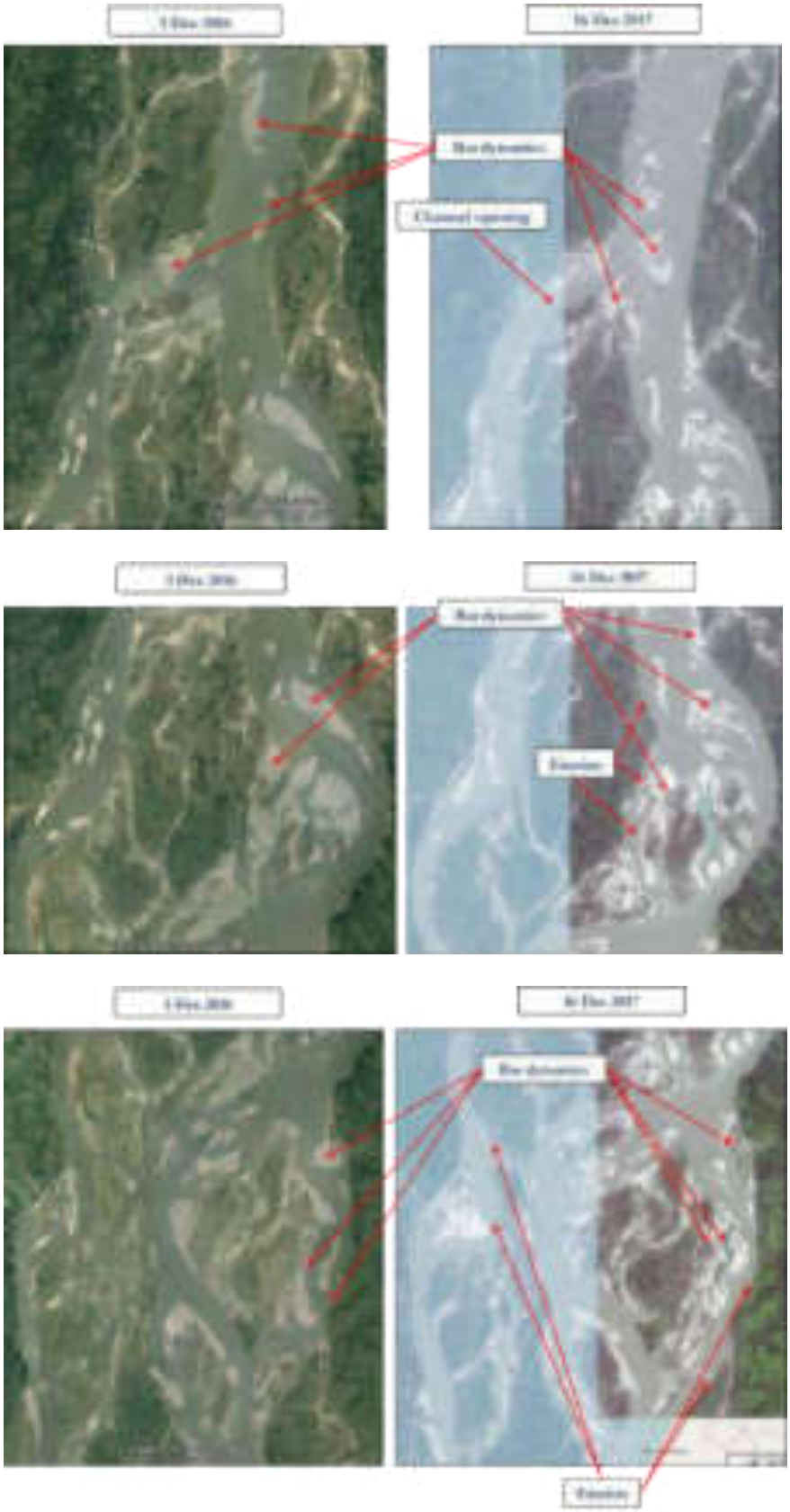


Figure 2-11 Bar and deep-channel dynamics: Analysis of the images (Google Earth and Apollo Mapping).

Numerical modelling supported the analysis of bathymetric surveys and satellite imagery. The numerical model based on the 2016 flood season bathymetry predicting channel patterns for different 2017 flood scenarios was assessed for its accuracy before modelling different 2018 flood scenarios. To assess the model results, the 2016 bed topography was run with the actual 2017 flood season hydrograph. We evaluated the reach-averaged sedimentation and erosion during the 2017 flood, as well as the two-dimensional morphological pattern in terms of the formation and migration of deep channels and sand bars. The following results follow from the reach-averaged analysis for the three selected reaches as depicted in Figure 2-12:

(i) The reach-averaged erosion in the upstream reach in one year, simulated by the 2016 model under the 2016-17 flow conditions, is found to be less than 15 cm. The model seems to underestimate this, because a comparison between the initial bed levels of 2016 and 2017 in the models shows about 30 cm of reach-averaged erosion. Moreover, the comparison of low-resolution data points shows 75 cm of bed lowering in one year. A sensitivity test (not shown here) with a morphological acceleration factor of 5 under higher flow conditions gave a reach-averaged erosion of 43 cm. We used equilibrium sediment transport at the upstream boundary in all these simulations.

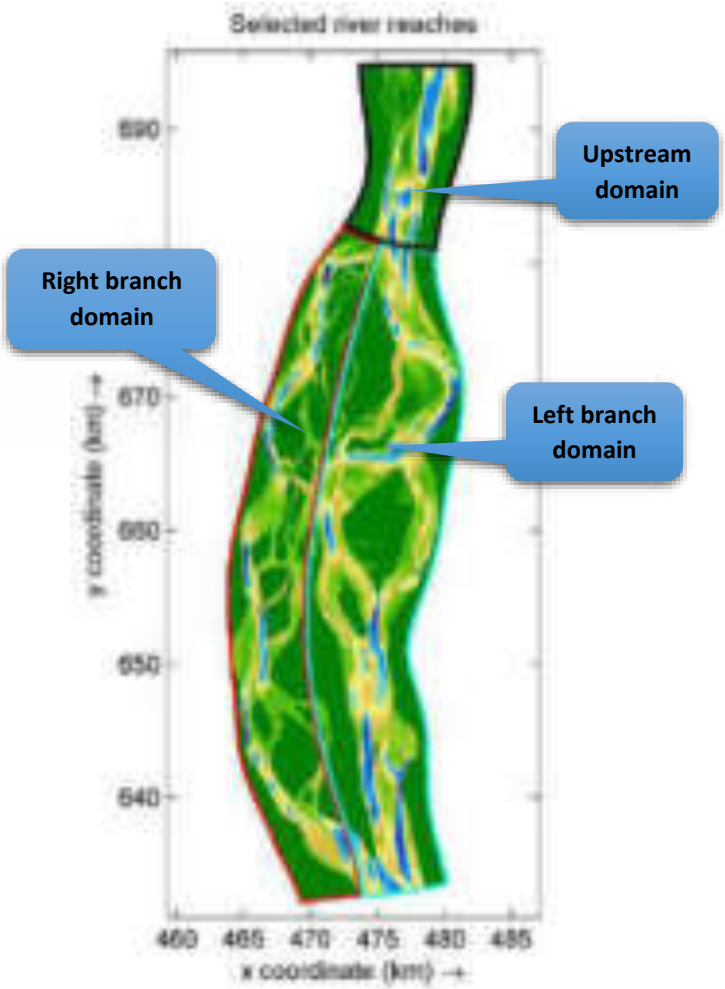


Figure 2-12 Selected reaches (domains) for the analysis of sedimentation and erosion, i.e. upstream (area within black lines), right branch (area within red lines) and left branch (area within green lines)

(ii) The model results show 2 to 3 cm reach-averaged bed level rise for both branch domains, which is not significant (and consistent with upstream erosion). However, comparison of the initial beds of 2016 and 2017 shows 78 cm rise in the left branch and 94 cm rise in the right branch. We ascribe the under-prediction to the lower upstream erosion in the model, resulting in less sediment supply towards the branches. The discrepancies might also be attributed to missing the input of bank erosion material. However, precise information on the volume of material eroded from the riverbanks would require denser and more frequent bathymetric surveys.

(iii) In the Salimabad channel, the model shows 15 cm bed level rise and the difference in initial beds of 2016 and 2017 shows about 1.2 m bed level rise. Again, we ascribe the under-prediction to less upstream supply and the absence of eroded bank material in the model.

(iv) The important outcome is that the model shows a reach-averaged erosion trend in the upstream channel and a deposition trend in both branches. This is consistent with observations.

We also simulated the meso-scale morphological pattern (deep channels and sand bars) and compared the resulting bed topography with the topography derived from the bathymetry measured in 2017. The results are depicted in Figure 2-13. The following can be inferred from these results:

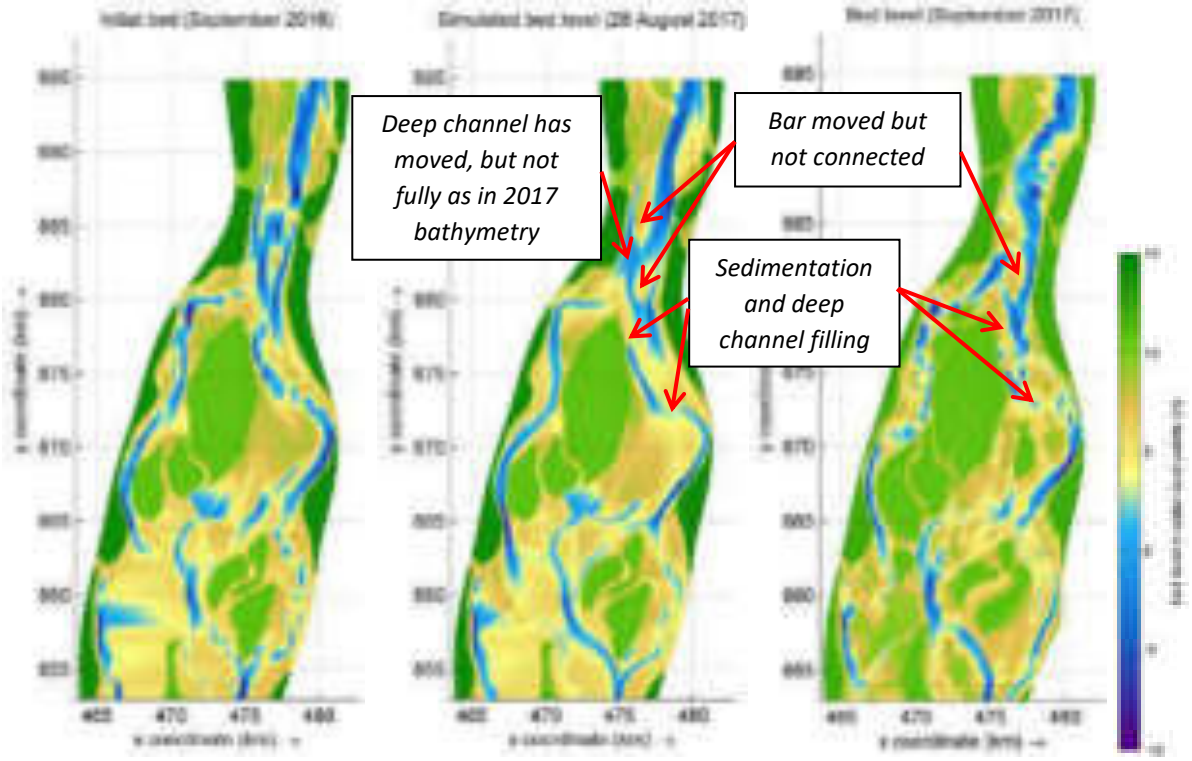


Figure 2-13 Simulation of bed level changes of 2016 model under 2016-17 flow conditions and comparison with the 2017 post-flood bed

(i) The deep channel towards the right branch is not fully developed as seen in the 2017 bathymetry, but it migrates in the right direction in the model (Figure 2-14). Sensitivity tests with morphological acceleration factors show clear formation of this channel (not shown here). The discrepancies can partly be attributed to inaccuracies in the elevations of the

char and sand bars at the entrance of the right channel, as they had not been measured but assumed (based on basic information and Google Earth).

(ii) Migration of upstream sand bars towards the left branch and filling up of the deep channel in the left branch are reproduced by the model. The measured bathymetry of 2017 shows that the deep channel filled up faster than simulated in the model. The speed of sand-bar migration and the filling up of the channel are sensitive to model parameters as well. Discrepancies can partly be attributed to less upstream erosion and less transport towards the left branch in the model. No morphological factor has been used for the simulations.

(iii) Sedimentation in front of the central char is simulated by the model as well.

(iv) The model shows less sedimentation than measured in the Salimabad Channel. The deep channel near the bank is not well reproduced by the model. The measured 2017 bathymetry shows a deep channel near the bank at Salimabad, where the bank erosion occurred. We ascribe this to the poor data resolution of the 2016 bathymetry, which has been used to derive the initial bed topography for the model. The low-resolution bathymetry of 2016 represents the deep channel less well than the high-resolution bathymetry of 2017. Furthermore, the model does not consider the bank erosion that did occur in reality. We recommend exploring this further during the detailed design of the stabilization measure in this channel.

(v) The model does not predict the development of a deeper channel along the Chauhali bank. The first reason could be due to the low resolution of the model that does not capture the low-flow (deeper) channel along the bend (this is important as the model is sensitive to the initial bed). The second reason could be the artefact due to lack of proper representation of the protected toe near the bank. Such a protection may lead to erosion resulting in formation of a deeper channel along the bend. However, the non-erodible protected layer along the toe of the bank cannot be represented properly by a low-resolution model. This needs high-resolution modelling, and shall be improved in future.

(vi) The propagation of sand bars and deep channels in the model depends on the non-linearity of the relation between flow velocity and sediment transport, the variability of bed roughness (we have used Manning's formula), the morphological acceleration factor, etc. Moreover, the initial bed condition, upstream morphology and sediment transport are important as well. There is room for future improvement of the model, for which additional high-resolution data and information will be valuable.

Finally, we have attempted to predict potential meso-scale morphological patterns (deep channels, sand bars and bank erosion) during the 2018 flood season. To this end, we carried out morphological simulations for the 2017 flood season bathymetry model distinguishing two flow conditions, the 2010 and 2017 flow. The model focusses on deep-channel propagation, sand-bar propagation and bank erosion risk. However, there are a few nuances, such as (i) the model cannot predict bank erosion reliably, so we simply consider that the bank is under threat when a deep channel tends to propagate towards an unprotected bank; (ii) the model does not consider the roughness of the protected toe near the bank; (iii) the deep-channel and bar propagation is sensitive to the initial bed, so for more accurate prediction, it is necessary to have higher-resolution measurement and modelling. The following can be inferred from the results (Figure 2-14):

(i) The deep channels are more pronounced for the lower flood in 2010 than for the higher flows under the 2016-17 flow conditions (e.g. propagation of the deep channel towards the Salimabad

Channel). On the other hand, sand-bar propagation appears to be faster during the higher flow of 2017.

(ii) Sedimentation in front of the central char is evident for the simulations under both conditions.

(iii) Banks upstream of the major bifurcation (particularly the left bank) as well as at the Salimabad Channel are vulnerable to erosion.

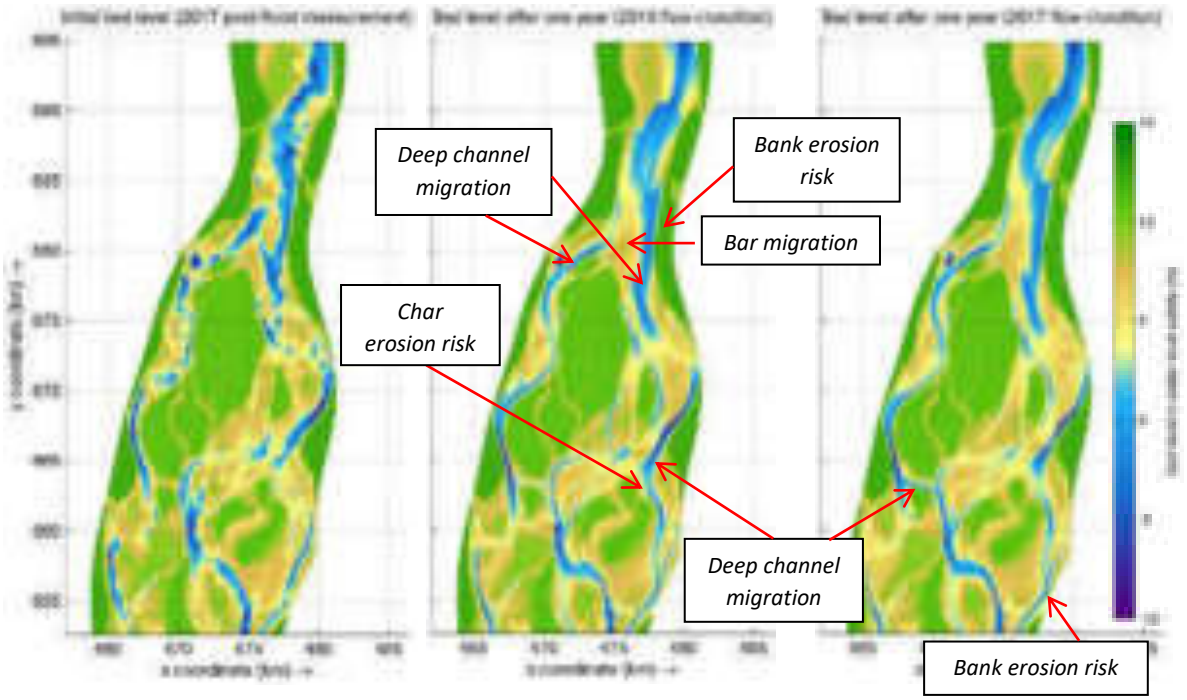


Figure 2-14 Bed level changes in the Lower Jamuna after one year under two flow conditions: (i) 2010 flow, representing about 1-year-return flood (middle plot), and (ii) 2017 flow, representing about 7-year-return flood (right plot).

3 MORPHOLOGICAL PREDICTION

3.1 Prediction for 2017

The Jamuna River has a few anabranching reaches where two channels embed long (more than 20 km) chars (vegetated islands or closely spaced clusters of chars). The anabranching channel itself would be a braided or meandering channel and each of them may possess different characteristics. Over time, the characteristics of those channels are changing. In a certain period, one anabranch may enlarge at the cost of the decline of another anabranch and vice versa. When one anabranch is in an enlarging phase, the riverbank erosion along that channel increases and the stability of the sand bars decreases. Presently the left anabranch dominates, which has been like this already for a couple of years without showing any trend of growth or decline.

There are no tools to predict the development of channels, chars and sand bars in the Jamuna River three years ahead. Morphological changes over a period of three years can have a strong influence on the local morphology, particularly at the selected locations. Moreover, further impacts of the Pilot Capital Dredging project remain uncertain. Whether the impact would expedite the process of enlarging or declining the anabranches is not clear. In such a case, some probable scenarios could be considered for predicting the riverbank erosion and subsequent impacts on the attached chars in the Lower Jamuna.

By combining different types of likely developments, three sets of alternative scenarios were developed to predict the future behaviour: (1) enlargement or remaining the same of the left anabranch without enlargement of the chute channel along the left anabranch; (2) enlargement of the chute channel along the left anabranch without significant changes among the anabranches; and (3) enlargement of the right anabranch, at the expense of a declining left anabranch.

Scenario 1

In the following monsoon, the left anabranch is predicted to be enlarged or to remain the same. This may result in more flow or the same flow through the channel at Chauhali. Hence the floodplain along the left bank at the bifurcation of the anabranches is predicted to be under the threat of erosion. Erosion of 195 ha floodplain is predicted for the 50% probability scenario (Figure 3-1), which may cause further downstream migration of the attached bar at the upstream end of the Chauhali bend. Bank protection work will stop erosion, which is expected to be completed before the coming monsoon. This would restrict further erosion along the Chauhali bend. The intervention itself would alter the local morphology.

The input of bank erosion products from the Chauhali bend will be reduced significantly. This reduction of sediment may stabilize the downstream braided channels and may result in a single-channel planform in the coming years. It is likely that a single-channel planform will replace the braided planform downstream of the protection under construction. In such a case, the flanking channel (CH 2) would become a large meandering channel (Figure 3-3). The presence of the structures would restrict the downstream migration of the attached bar at Location 1 (Chauhali) and contribute to stabilizing the bar. Development of CH2 increases the risk of bank erosion along the left bank of the river. The probable (50%) line of erosion for 2016 is presented in Figure 3-4. The maximum lateral extent of erosion is predicted to be 280 m for this monsoon, taking about 155 ha of land. It is likely that the high extent and rate of erosion along this bend would enlarge the downstream bar at Location 2 (Char Katari). The annual rate of downstream migration of the bar would be in the range of hundreds of metres to a couple of kilometres in the coming 3 years. In such a case, no significant alteration of the bar at Location 3 (Baghutia) is expected. Rather, the bars at Locations 2 and 3 are likely to merge (Figure 3-5).

Under this scenario, channel CH1 is not likely to remain in existence in the coming years. Before declining, it might influence the proximity and size of the bars at Locations 2 and 3, which largely depend on the confluence location of channels CH 2 and CH 1.

Under Scenario 1, the prediction for the bars can be summarized for the following three years:

(i) The bar at Location 1 would be stable considering its rate of downstream migration and its rate of changing its shape and size;

(ii) Downstream migration and enlargement of the bar at Location 2 is expected. It might merge with the downstream bar at Location 3.

Scenario 2

There is a possibility of enlargement of the chute channel of the meandering bend at Chauhali (Figure 3-2). If the chute channel continues to enlarge further, more flow will pass through that channel, resulting in reduction of the flow in the flanking channel at Chauhali. This development would reduce the size and stability of the bar at Location 1. Flow coming through the chute channel would be distributed through the bifurcated channels CH1 and CH2. As a result, CH1 is likely to enlarge as well. The apex of the char or sand bar would move further downstream, eroding a large amount of the downstream char area.

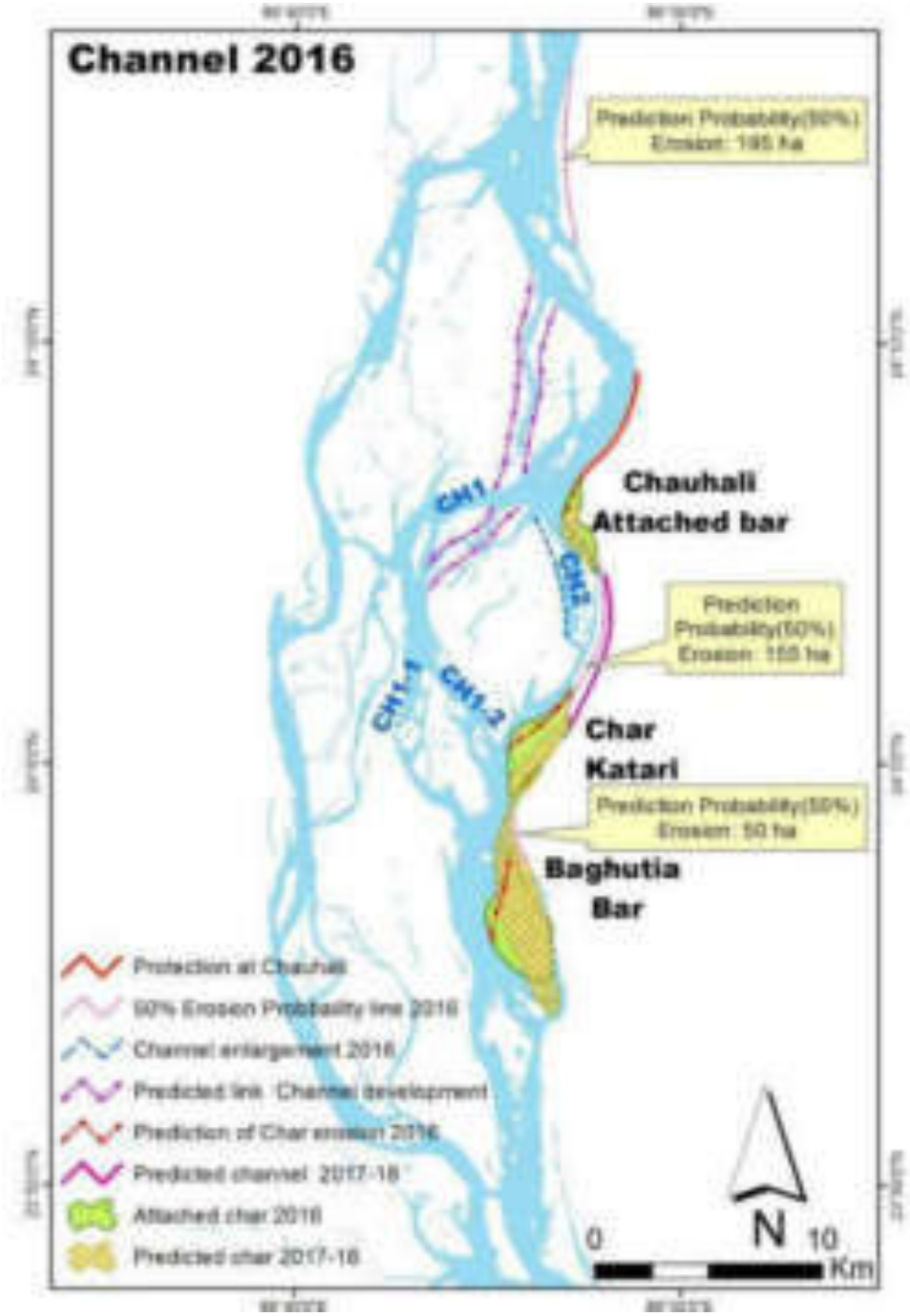


Figure 3-1 Prediction of erosion in downstream channels and attached chars.

The rate of downstream migration and enlargement of the bar at Location 2 would be reduced. On the other hand, the bar at Location 3 would migrate more than what would be the case for Scenario 1.

The summary of the prediction under Scenario 2 is as follows:

(i) The stability of the sand bar at Location 1 would be reduced;

(ii) The enlargement and rate of migration of the bar at Location 2 would be reduced too;

(iii) The probability of merging of the two bars will be reduced.

Scenario 3

Gradual diversion of more flow than present from the left to the right anabranch may be initiated in coming years. Declining and enlarging of anabranches is a slow process compared to similar processes in shorter braided channels. A study on the effects of revetments suggests that the revetment creates a more stable meandering channel immediately downstream of the protected bend. This creation would be rapid in case of a declining anabranch.

The stability of the bar at Location 1 would be increased. It is likely that the rate of erosion along CH2 would be reduced as well, which may decrease the rate of downstream migration of bars at Locations 2 and 3.

Findings

Comparing the predictions under three scenarios, it appears that the bars at Location 2 (Char Katari) and 3 (Baghutia) are under threat of erosion in the next three monsoons whereas Location 1 (Chauhali) would be quite stable. Accordingly, Locations 2 and 3 can be selected for pilot interventions and char stabilization.

3.2 Two-year Prediction for the 2018/19 flood season

The Jamuna River is much more dynamic than the Ganges and the Padma rivers. Average life spans of meandering bends of the Ganges & the Padma rivers are approximately 10 years while they are only 3 to 4 years for the Jamuna River. Therefore, it is more difficult to predict riverbank erosion for a period of two years for the Jamuna River. This notwithstanding, CEGIS has attempted a two-year prediction using time series dry season satellite images. The prediction of riverbank erosion and morphological changes has been developed based on the proven empirical method for the Jamuna River extended to a 2-year time interval. To do so, delineated banklines of different years were analyzed for the selection of typical meandering bends. For these bends, relationships of different parameters (starting & end point of the meandering bend, length of the meandering bend, location and magnitude of the maximum erosion) were developed for two-year riverbank erosion prediction. Four critical locations were selected in the lower Jamuna for predicting riverbank erosion until the dry season 2020. The results are presented in the following figures (Figure 3-2 to Figure 3-5).

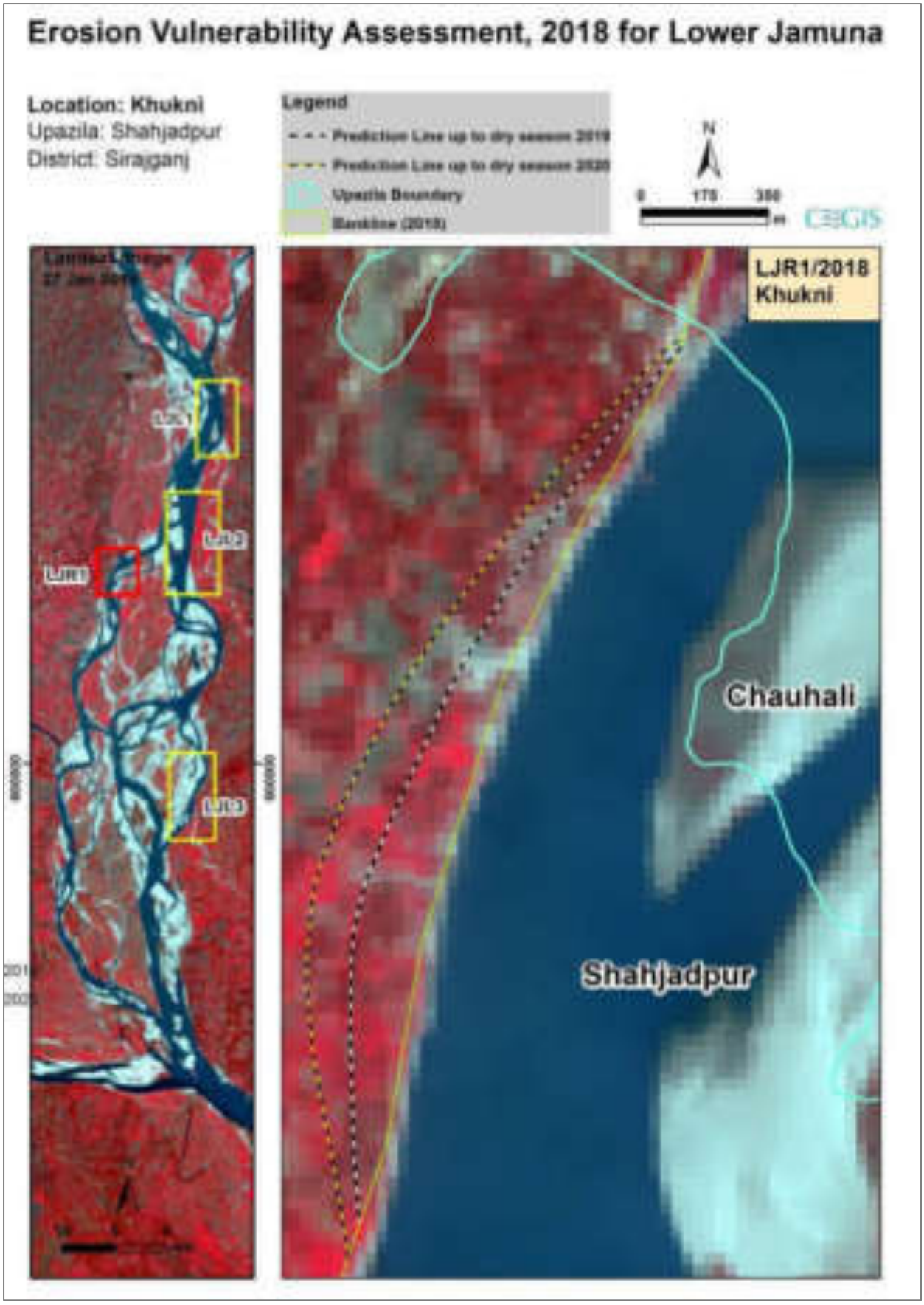


Figure 3-2 Two-year riverbank erosion prediction at Khukni, Sirajganj district

Figure 3-3 Two-year riverbank erosion prediction at Kakua, Tangail district

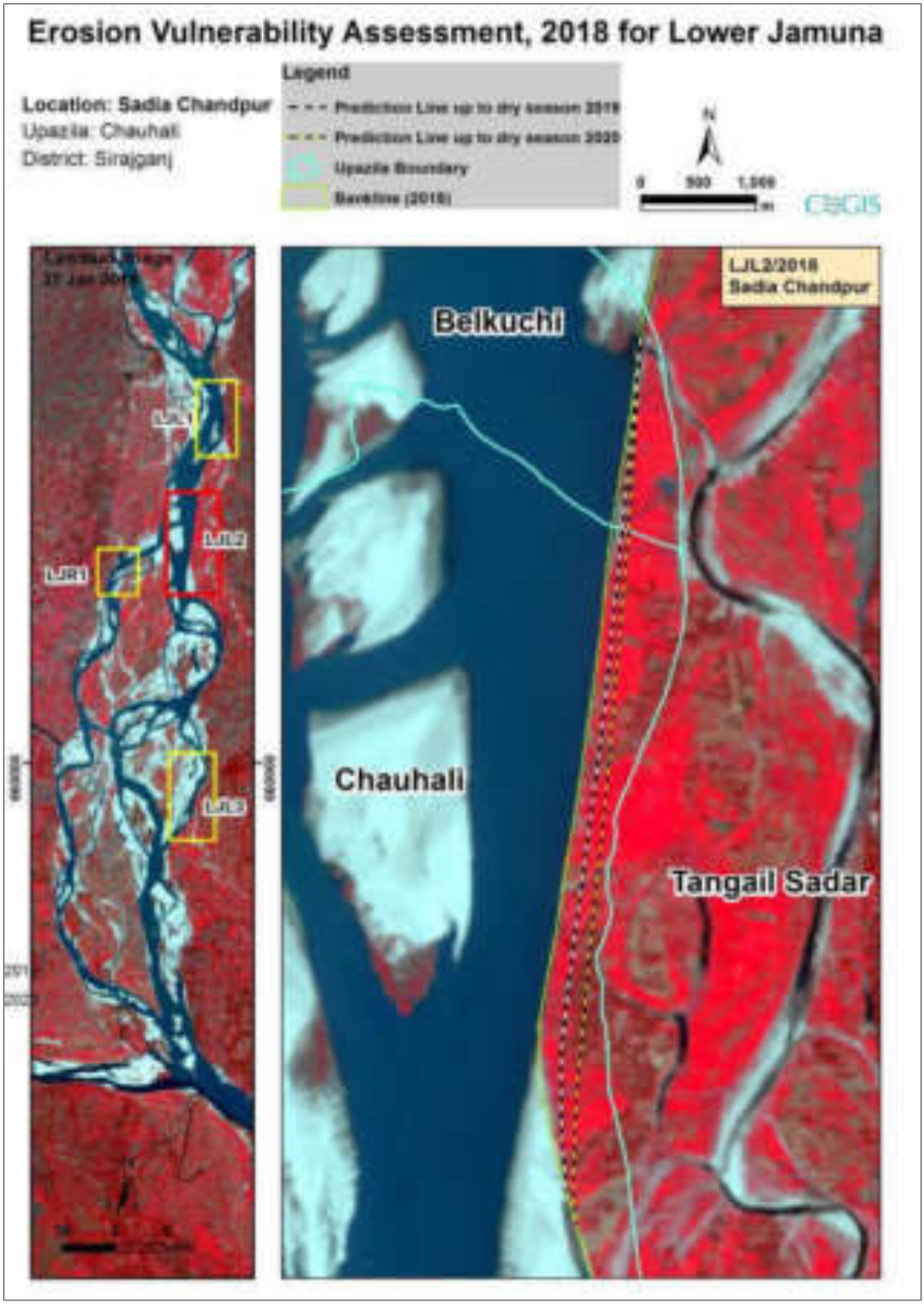


Figure 3-4 Two-year riverbank erosion prediction at Sadia Chandpur, Sirajganj district

Figure 3-5 Two-year riverbank erosion prediction at Mirkutia & Charkatari in Sirajganj & Manikganj districts

4 CHANNEL CLOSURE AT NALIN BAZAR – REVIEW OF PERFORMANCE

4.1 Study area and project description

Nalin Bazar is situated on the left bank of the Jamuna River under Tangail District. Dredging at this location was considered to divert the flow from the existing left anabranch of the Jamuna River and to reduce erosion near Nalin Bazar. This was supposed to save the existing Bhuapur-Tarakandi road embankment, which is the only road communication between Jamuna Fertilizer factory and other districts of the country. The work included dredging for about 2 km and construction of a closure with a length of 1200 m and crest width of 60 m along with the side slope of 1:4. The work was implemented by the Tangail O & M Division in 2010-11. Unfortunately the closure was washed away in the following monsoon and the dredged channel was silted up considerably. This short note will provide the morphological investigation of the site and functioning of the channel closure at Nalin Bazar.

4.2 Morphological development of the Jamuna River along Nalin Bazar

The channel incidence maps (Figure 4-1), prepared by dry season classified satellite images since 1973, provide qualitative information about the change patterns of the channels along the left

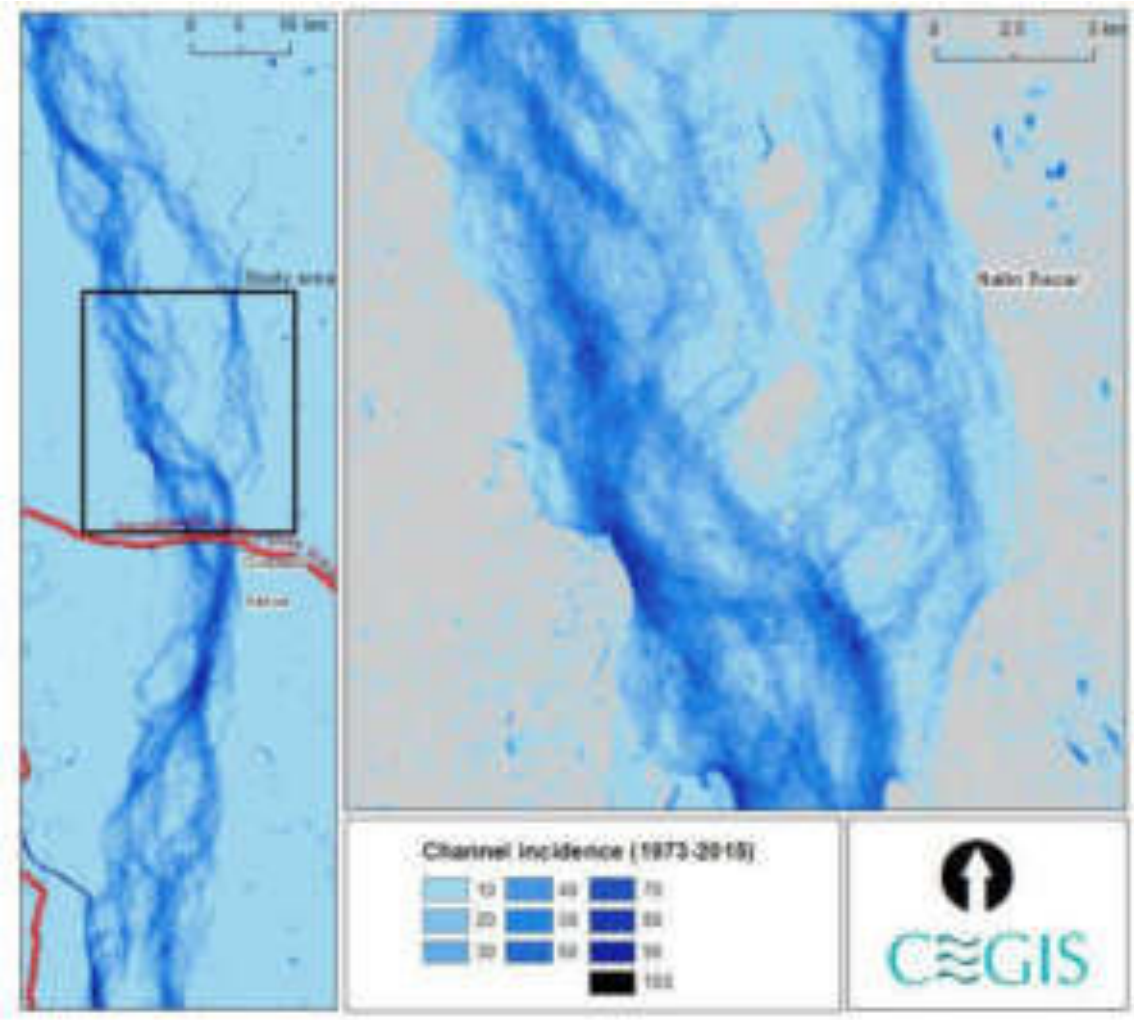


Figure 4-1 Map showing the incidence of channels

anabranch close to Nalin Bazar. In last 40 years, there exists two anabranch systems in the study area. Both the anabranches have been changing over time. In the 1970s, left anabranch was as large as the right anabranch. However, during the last three decades, this anabranch has been sharing smaller amount flow of the Jamuna River. Flow of this anabranch was found to be converged at 7 km upstream of Nalin Bazaar and subsequently diverged downstream (Figure 4-3). Nalin Bazar is situated in the diverged reach, and erosion occurs frequently. In the diverged reach, a 6 to 8 years old char exists in front of Nalin Bazar (Figure 4-2). Like other diverged reach, importance of the braided channel varies over time. The char lands incidence map from 1994 to 2015 (Figure 4-2) shows that the existence of charland adjacent to Nalin Bazaar was not more than 2 years.

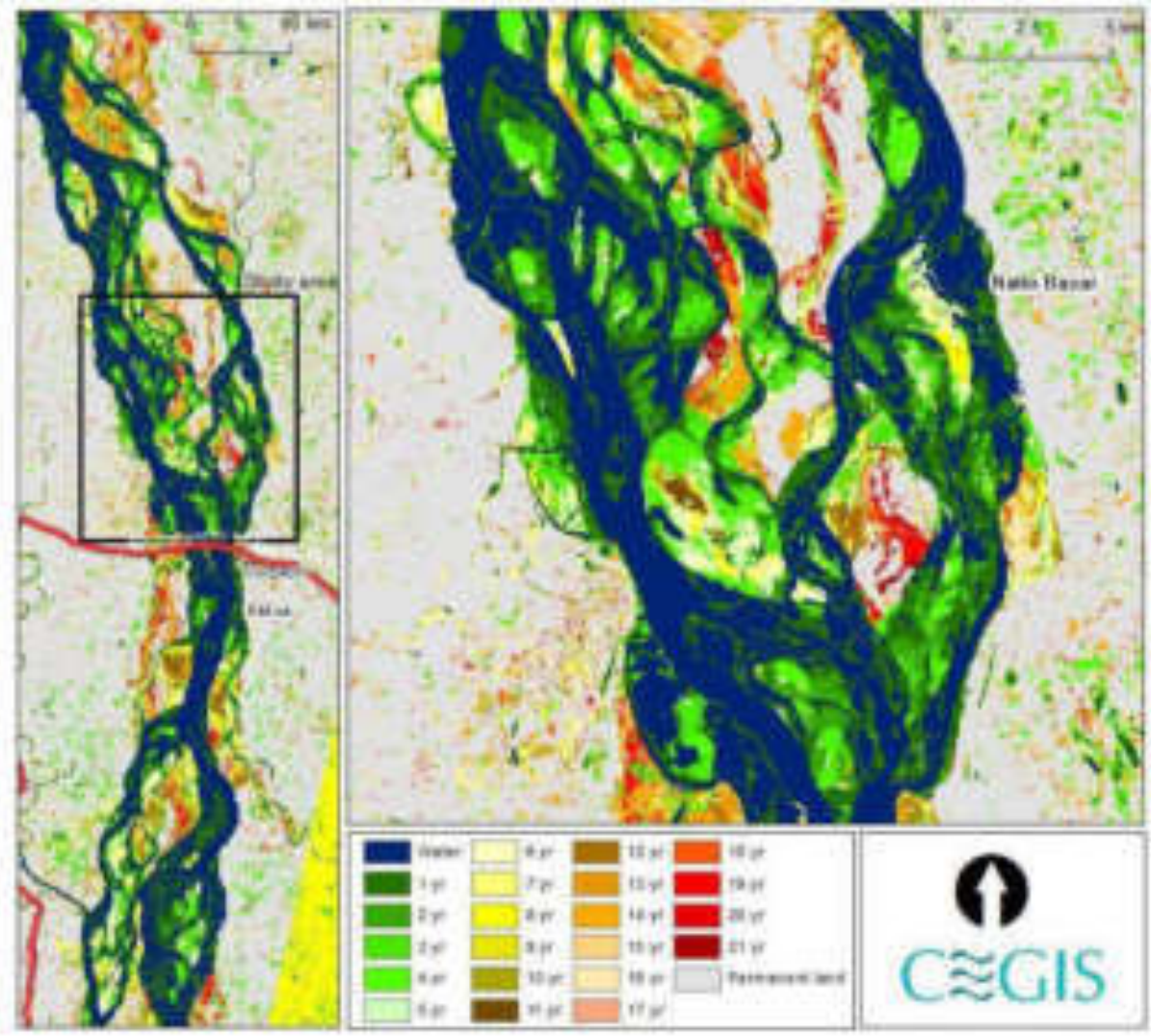


Figure 4-2 Map showing the incidence of char lands at the study location

In the left side of the channel (country-side), just upstream of the Nalin Bazaar, there is one bend developed by translating in the recent past. Hence riverbank erosion is observed every year (Figure 4-3). Before the pilot dredging and construction of the sand dam (2010) at Nalin Bazaar, there was 44 ha main land erosion. In 2011, the same amount of erosion was observed. So, according to river characteristics, major portion of that sediment was supposed to carry through the channel along the Nalin Bazar side. An amount of 53 ha land was eroded in 2012 while it was about 22 ha in 2013. The erosion was 39 ha and 42 ha in 2014 and 2015 respectively. The erosion was very less in the following years in 2016 and 2017.

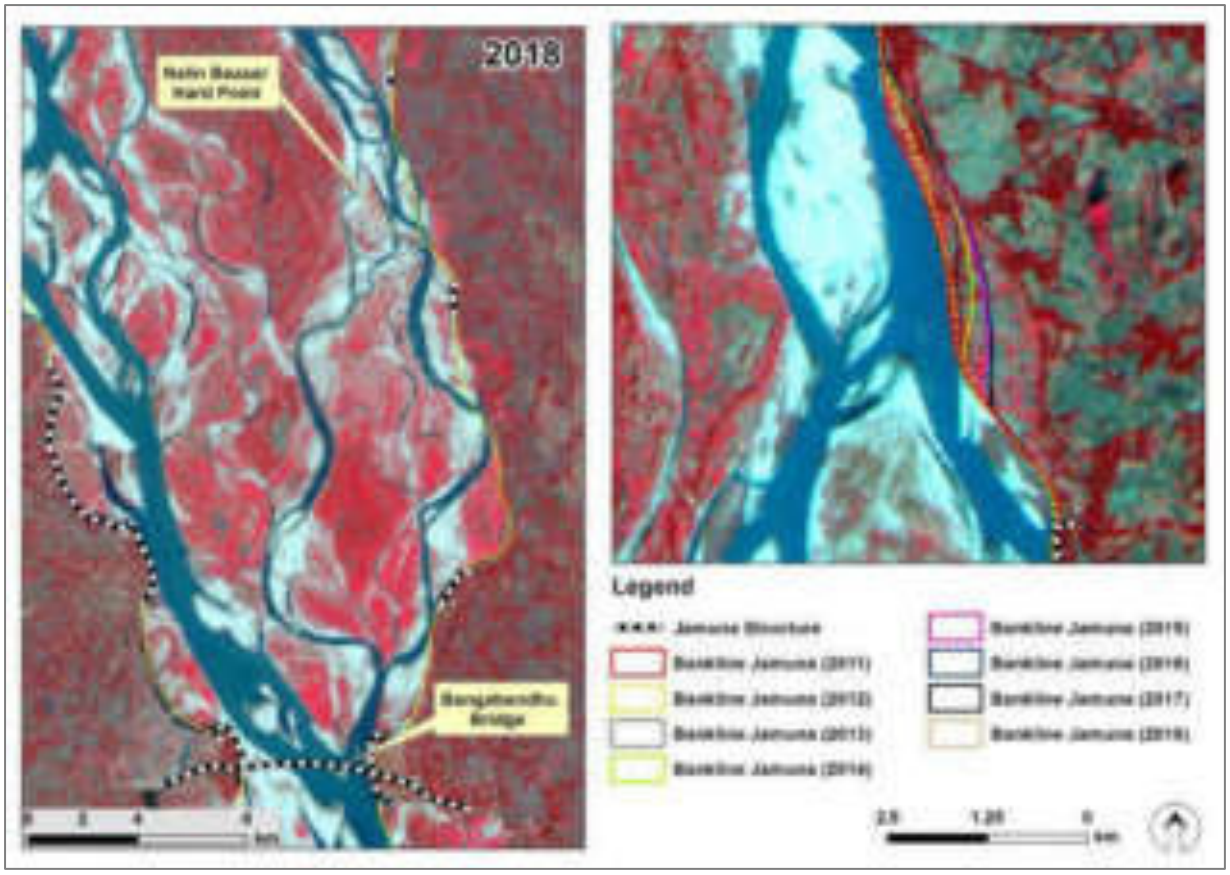


Figure 4-3 Erosion at the left anabranch of Jamuna close to Nalin Bazaar

4.3 Impact on Sand dam

From satellite image analysis the impact of the closure on river morphology of the left anabranch has been assessed. Figure 4-4 shows the chronological development of the branch. In the image of 2011 dry season, there was no closure, which becomes visible in the following year dry season image (2012). Although the sand dam was constructed above flood level, but there was no protection. The sedimentary feature in front of the sand dam indicates that there will be erosion in next flood according to CEGIS' understanding of the Jamuna morphology. For the barrier in the channel, there might create some water level differences upstream and downstream of the dam. At the downstream of the dam, there was almost pool effect and the water level was governed from further downstream. It might be happen that during next monsoon there was small spill in the front of the sand dam. or small amount erosion in the sedimentary feature. Due to high gradient in front of the sand dam, huge water passes through the channel and caused the dam washed away. Hence there was additional sediment (due to construction of the dam, mainly sand) sand spread over the riverbed, as found in 2013 image. This additional sediment also caused the reduction of effective channel in size.

In 2014, the channel protruded to the main land by 200 m and translated further downstream (Figure 4-4). The eroded sand spread over the channel close to Nalin Bazaar hard point. But in 2015, the existing channel developed substantially and become visible in the dry season satellite image, as there was less river bank erosion in the upstream. As a result, along with the existing channel development, another chute channel developed in 2016. The erosion is less in 2017, the chute channel became bigger in width and carried more flow in the dry season (Figure 4-5). In 2018, the

erosion is negligible at the upstream of the Nalin Bazaar and the chute channel is prominent and the right channel close to Nalin Bazaar became narrower (Figure 4-5). It is observed that the channel in 2017 received more flow than in 2018. The reason behind that the left anabranch of the Jamuna River received less flow from upstream in 2018 (Figure 4-6).

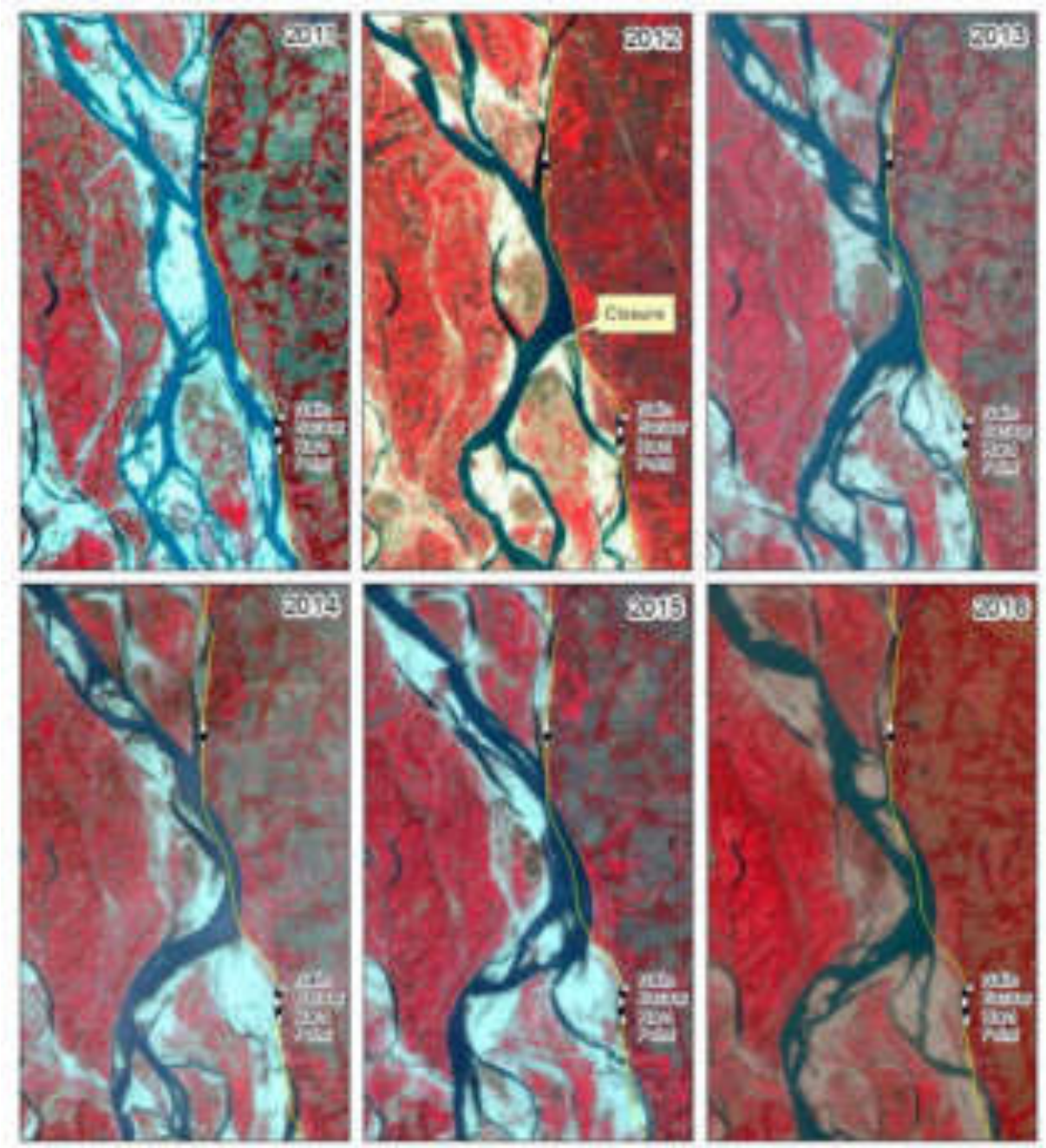


Figure 4-4 Development of left anabranch of Jamuna close to Nalin Bazaar

Finally it can be said that there would sand spread in the Nalin Bazaar side channel even without the dam construction. Additional amount of sand after washing the dam by the monsoon flood in that channel has caused more sand spread in the channel and the land. The west channel of this anabranch was developed slightly after dredging. Mainly erosion in the upstream side is the main contributor for changing the morphology of this reach. The influence of the sand dam is not significant as expected. As a result, as the erosion at upstream was reduced in the recent years and the left channel developed close to Nalin Bazaar.

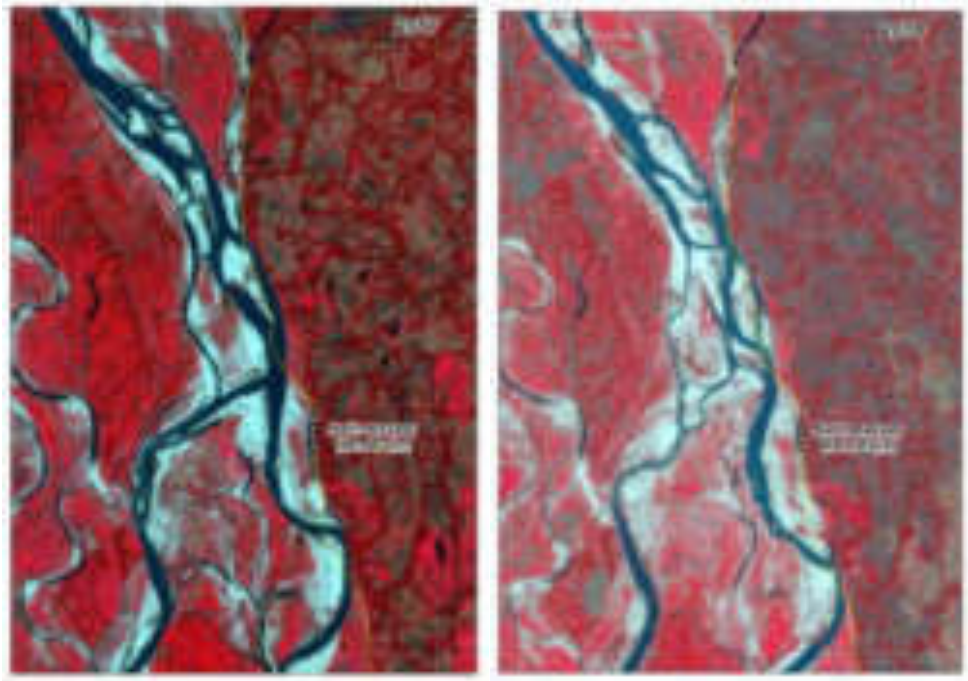


Figure 4-5 Development of left anabranch of Jamuna close to Nalin Bazaar in 2017 and 2018

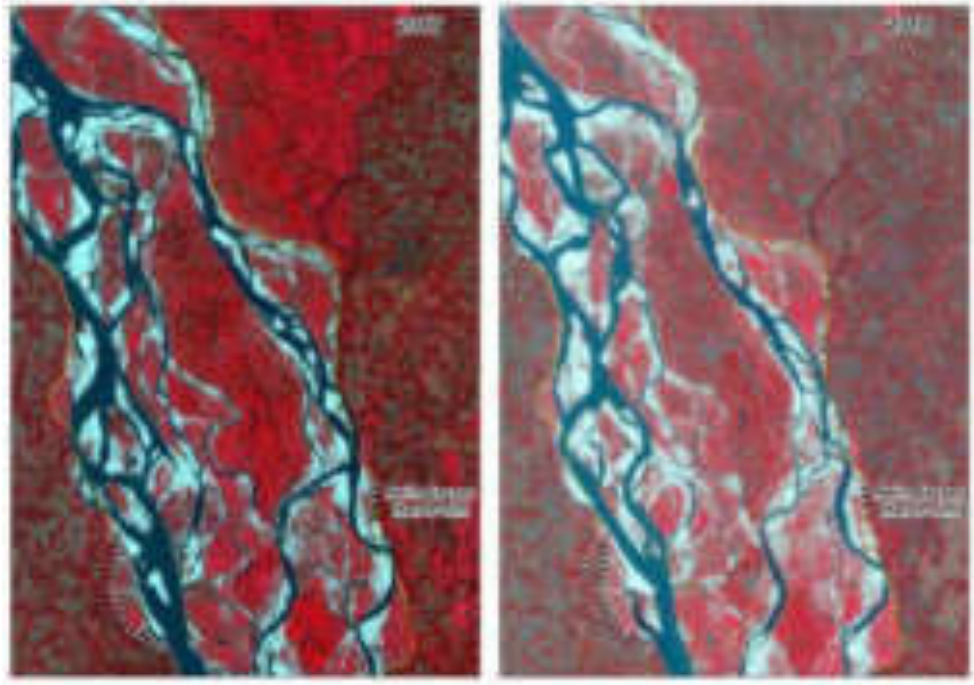
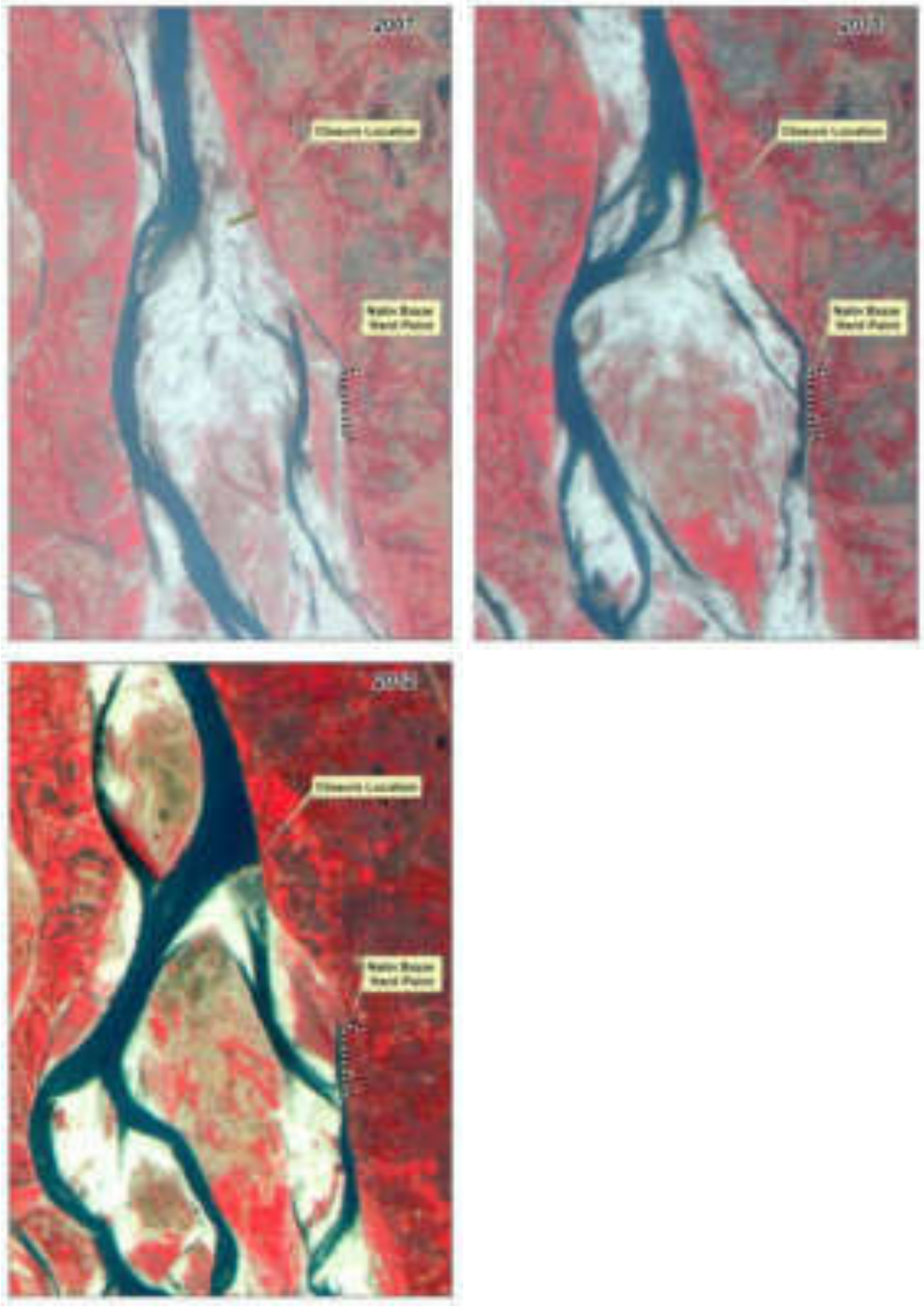


Figure 4-6 Development of left anabranch of Jamuna at the upstream of the Nalin Bazaar

4.4 Assessment of Land-Water Distribution

An attempt has been made to assess the sand-water ratio of the Nalin Bazar channel before and after the construction of the closure. It has been found that the off-take of the Nalin Bazar channel moved several kilometers downstream in the recent years (Figure 4-7). By analyzing the movement of the off-take, a common boundary (Figure 4-8) was delineated to estimate the sand-water ratio.



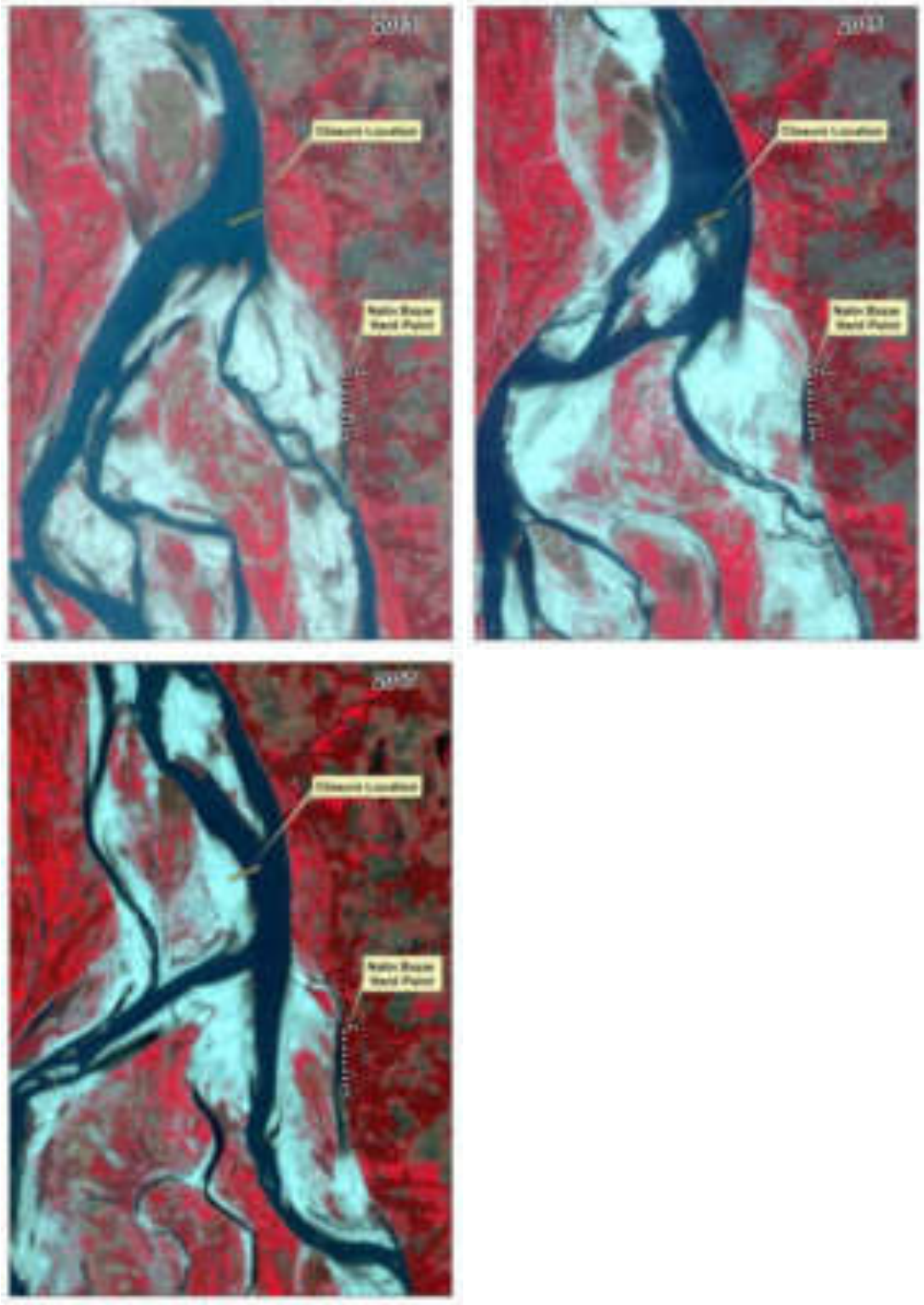


Figure 4-7 Movement of the Nalinbazar offtake before and after the construction of the closure

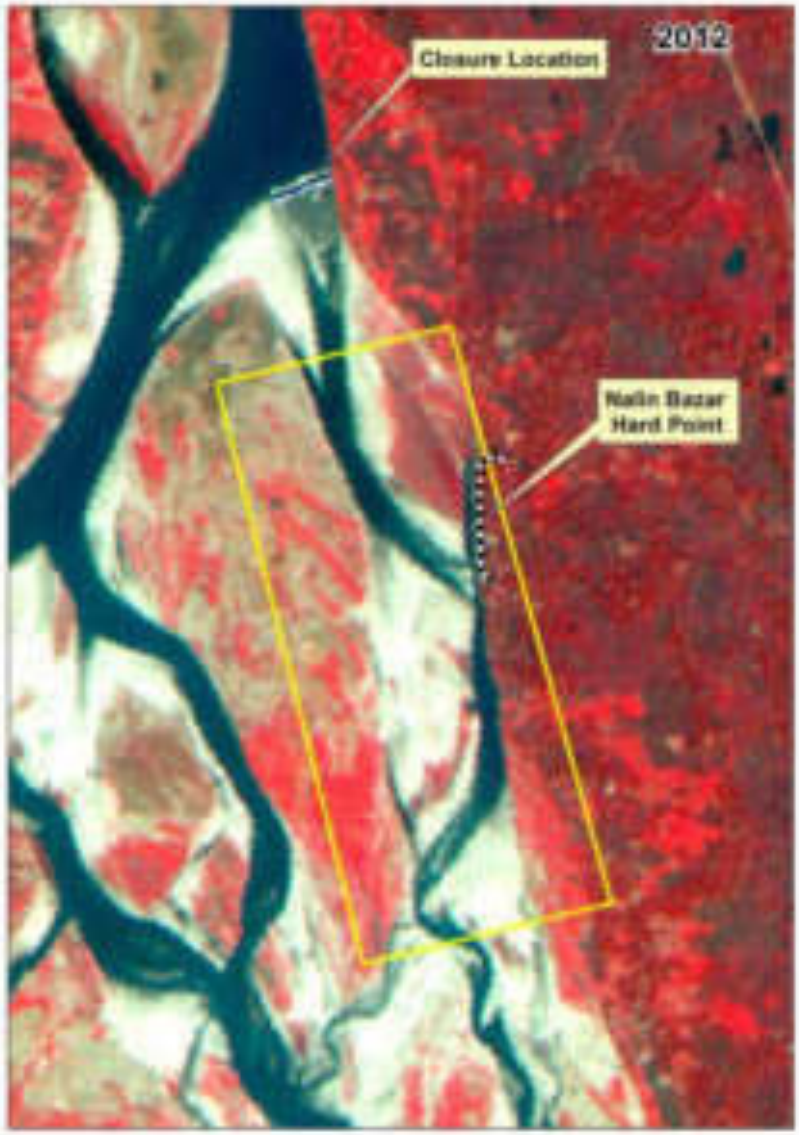


Figure 4-8 The study area of analysis of sand-water ratio of the Nalin Bazar Channel

The sand-water ratio of the Nalin Bazar channel before and after the construction of the closure is presented in Table 4-1.

Table 4-1 Sand-water ratio of the Nalin Bazar channel

SL	Year	Water (ha)	Sand (ha)	Ratio (Sand/Water)
1	2007	346	240	0.69
2	2009	104	574	5.52
3	2010	135	335	2.48
4	2011	246	297	1.21
5	2013	204	460	2.25
6	2015	198	575	2.90
7	2016	174	539	3.10
8	2017	311	431	1.39

5 PROPOSED INTERVENTIONS

Based on the identification of vulnerable locations and possible future trends, the following measures and interventions for Project-2 have been selected:

(i) Two major **river training** interventions for Project-2 have been proposed, namely (a) Salura revetment and sill along the main char at the bifurcation protruding towards the left channel, and (b) sand plug at the Salimabad Channel. Both measures have the purpose to contribute to the creation and stabilization of a fixed meandering planform, providing, along most of its length, sufficient depth for dry-season navigation through self-dredging as a consequence of the implemented works.

(ii) Additional **riverbank protection** will stabilize the left and right banks upstream of the bifurcation, as well as the left bank of the left branch channel upstream of Chauhali, which is currently outflanking.

(iii) **Adaptation works** is paramount to secure launched aprons against winnowing failure: (a) along revetments that have launched and have not yet been adapted to the greater river depth (including JMREMP sites and Harirampur) and (b) for new revetment works built under Tranche-2 that will respond to the river attack through bed level lowering.

Since there is a sedimentation trend at the left branch, particularly near the bank of the central char, the Salura revetment and sill can be deferred to 2019.

As the proposed site locations and interventions are subject to changes, depending on the characteristic of the 2018 flood season, systematic monitoring and evaluation of the developments as well as adjustment of the designs to the post 2018 flood season are required prior to implementation.

Government of the People's Republic of Bangladesh

Bangladesh Water Development Board

Asian Development Bank

Project Loan No 3138-BAN (SF) and Grant No 0396-BAN (EF)

Flood and Riverbank Erosion Risk Management Investment Program

Annex 2 INVOLUNTARY RESETTLEMENT

April 2019

nhc northwest hydraulic consultants

MOTT MACDONALD

In association with
DELTARES
RPMC and CEGIS

List of Annex

Flood and Riverbank Erosion Risk Management Investment Program
ADB Loan No. 3138-BAN (SF) and GRANT No. 0396-BAN (EF)

Institutional Strengthening and Project Management Consultant (ISPMC)

INVOLUNTARY RESETTLEMENT
Main Report

Issue and revision record

Revision	Date	Originator	Checker	Approver	Description
A	2013	Tod Ragsdale	Knut Oberhagemann	ADB	First draft report
B	December 2018	Begum Shamsun Nahar, Jean Louis Leterme	Knut Oberhagemann	ADB	ADB Comments received: 2nd Draft
C	February 2019	Begum Shamsun Nahar , Jean Louis Leterme	Knut Oberhagemann		Final Draft

)[1] contributing Team Members comprise

Jesper Mathiesen	River Engineer
Dave Burkholder	Information and Data Management Specialist
Soelem Aafnan	Junior Engineer
Tahsin Ahmed	Junior Engineer
Faisal Shovon	GIS Specialist
Shohely Sultana	Junior Water Resource Engineer

DISCLAIMER

Flood and Riverbank Erosion Risk Management Investment Program
ADB Loan No. 3138-BAN (SF) and GRANT No. 0396-BAN (EF)

Institutional Strengthening and Project Management Consultant (ISPMC)

INVOLUNTARY RESETTLEMENT
Main Report

Key Data

Name of Project:	**Flood and Riverbank Erosion Risk Management Investment Program (3 Tranches)**
Borrower, Executing Agency and Implementing Agency:	Government of Bangladesh (GoB) Bangladesh Water Development Board (BWDB) Department of Disaster Management (DDM)
Financing:	Asian Development Bank (US$ 251.1 million for 3 tranches). ADB Loan No. 3138-BAN (SF). Government of the Netherlands (US$ 13.7 for Tranche-1). Grant No 0396-BAN (EF). Government of Bangladesh (US$ 113.6 million for 3 tranches)
Consultant:	Joint Venture of Northwest Hydraulic Consultants Ltd. (Canada) and Euroconsult Mott MacDonald Ltd. (UK) in association with Deltares (Germany), Resource Planning and Management Consultants (Bangladesh) and CEGIS (Bangladesh). Contract Signed: 8th September 2015
Contracting Authority:	PD, FREMIP, BWDB, Dhaka
Start/ End Dates:	ADB Loan Agreement: 27 June 2014 (approved), 14 August 2014 (signed), 17 September 2014 (effective) Muti-tranche financing facility (9 years): June 2014 to June 2023 Dates for FREMIP: - Tranche 1: August 2014 to June 2019 (± 5 years) - Tranche 2: October 2018 to June 2022 (± 3.7 years) - Tranche 3: June 2020 to June 2023 (± 3.0 years)
Beneficiaries:	Local stakeholders directly and indirectly benefitting from river flood protection works and land reclamation and development
Subproject Sites/ Location/ Areas	Focus of works are along the Jamuna-Padma river corridor, from Bangabandhu (Jamuna) bridge to confluence with Meghna river at Chandpur; i.e. Reaches 3, 4 and 5. Master plan area comprises the three priority subprojects, JRB-1, JLB-2 and PLB-1 which extend over (part of) the following districts: Sirajganj, Tangail, Pabna and Manikganj.

	km²	ha
Total Area of all SPs	9,292.3	929,230
FREFMIP SPs (JRB1, JLB2,PLB1): Total Area	2,473.9	247,390
FREFMIP SPs: Agricultural Benefit Area	1,220.0	122,000
FRERMIP SPs: Population		10.6 million
FRERMIP SPs: Population Density		1,137 km²
FRERMIP SPs: No. of Households		2.03 million
FRERMIP SPs: Average HH Size		5.2
Master Plan Total Area	15,950.0	1,595,000
Master Plan Agricultural Benefit Area (flood risk mitigated)	5,000.0	500,000
Land Reclamation Area in River Corridor, Total	1,500.0	150,000
Land Reclamation Area in River Corridor, FRERMIP	660.0	66,000

Consultant's Report

Flood and Riverbank Erosion Risk Management

Investment Program

A 2.1 RESETTLEMENT FRAMEWORK

April 2019

Prepared by

Institutional Strengthening and Project Management Consultant (ISPMC)

Joint Venture of Northwest Hydraulic Consultants Ltd. and Euroconsult Mott MacDonald Ltd. in association with Deltares, Resource Planning and Management Consultants and CEGIS

TABLE OF CONTENTS

LIST OF TABLES

A 2.1 Updated Draft Resettlement Framework

LIST OF FIGURES

A 2.1 Updated Draft Resettlement Framework

LIST OF APPENDICES

ACRONYMS

AC	-	Assistant Commissioner
AE	-	Assistant Engineer
A&M	-	Adaptation and Maintenance
AD	-	Alluvial and Diluvial
ADB	-	Asian Development Bank
ADC	-	Additional Deputy Commissioner
ADP		Annual Development Plan (budgetary plan from 1st July to 30 June)
AH		Affected Household
AIFRERMIP		Assam Integrated Flood and Riverbank Erosion Risk Management Investment Project
AP	-	Affected Persons
BAN	-	Bangladesh
BDT	-	Taka (currency of Bangladesh)
BRE	-	Brahmaputra Right Embankment
BWDB	-	Bangladesh Water Development Board
CbFRM	-	Community-based Flood Risk Management
CCL	-	Cash Compensation under Law
CDMP	-	Comprehensive Disaster Management Program
CDMU	-	Community Disaster Management Unit
CDP	-	Capacity Development Plan
CEGIS	-	Centre for Environmental and Geographic Information Services
CPR	-	Common Property Resources
CMP		Current Market price
CRO-RU	-	Chief Resettlement Officer-Resettlement Unit
CSC	-	Construction Supervision Consultant
CSS	-	Census & Socio-Economic Survey
C/S	-	Country Side
DC	-	Deputy Commissioner
DD	-	Detailed Design (Team)
DD	-	Deputy Director
DDM	-	Department of Disaster Management
DPs	-	Displaced Persons same as AP/Affected Persons
DPP	-	Development Project Proforma
EA	-	Executing Agency
EARP	-	Environmental Assessment And Review Procedure.
EIA	-	Environmental Impact Assessment
EMB	-	Embankment
EMP	-	Environmental Management Plan
EP	-	Entitled Persons
FGD	-	Focus Group Discussions
FHH		Female Headed Households
FRERMIP		Flood and Riverbank Erosion Management Investment Program
FS	-	Feasibility Study
GAP	-	Gender Action Plan
GIS	-	Geographic Information System
GOB	-	Government of Bangladesh
GRC	-	Grievances Redress Committee
HRD	-	Human Resources Development
ID	-	Identity Card
IGA	-	Income generating Activities
ILRP	-	Income and Livelihood Restoration Program

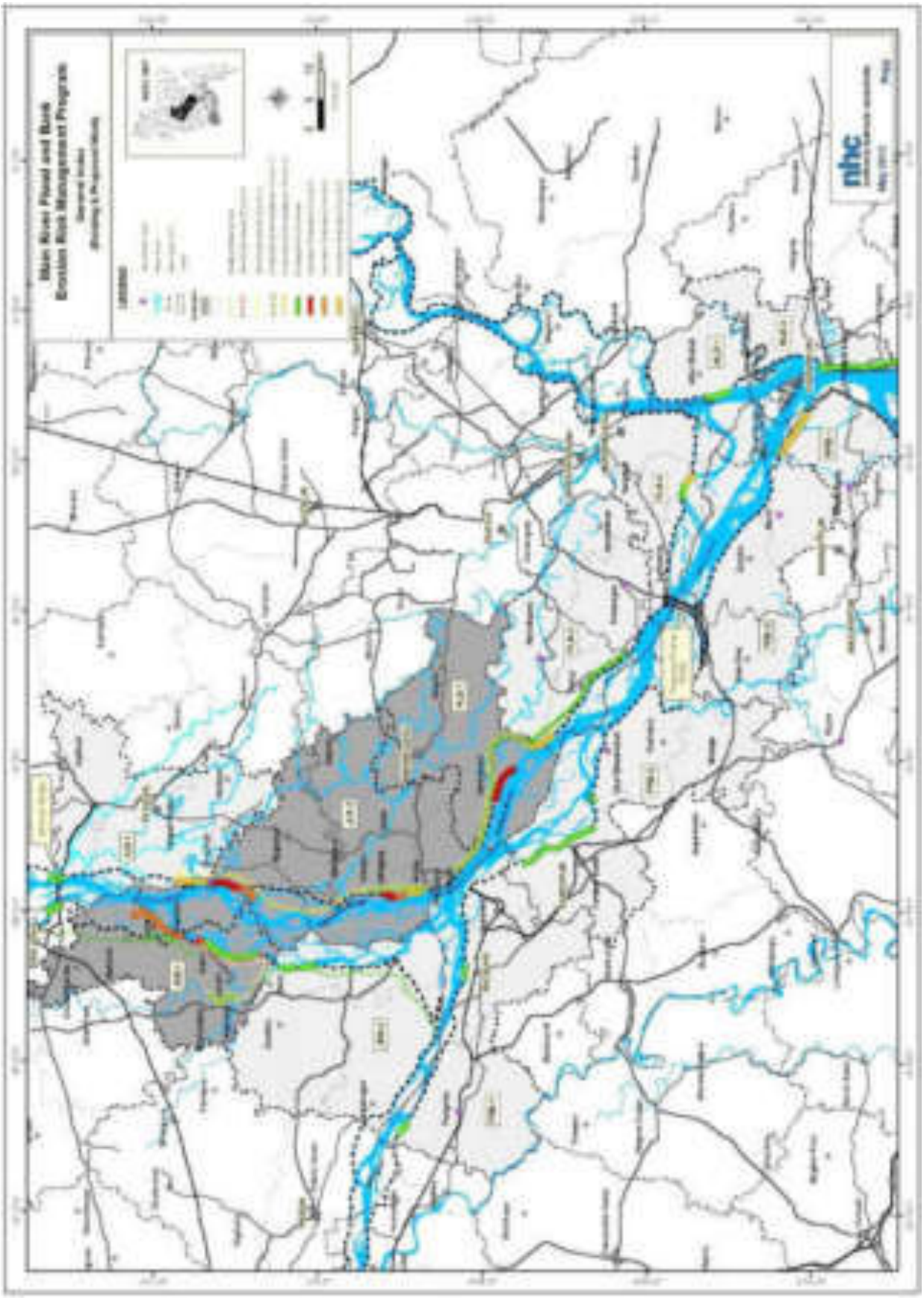
INGO	-	Implementing NGO
IOL	-	Inventory of Losses
IR	-	Involuntary Resettlement
IWRM	-	Integrated Water Resources Management
JMREMP	-	Jamuna-Meghna River Erosion Mitigation Project
JLB	-	Jamuna Left Bank
JRB	-	Jamuna Right Bank
JVT	-	Joint Verification Team
LA	-	Land Acquisition
LAP	-	Land Acquisition Plan
LAR	-	Land Acquisition and Resettlement
LGI	-	Local Government Institutions
LGED	-	Local Government Engineering Department
M&E	-	Monitoring and Evaluation
MFF	-	Multi-tranche Financing Facility
MIS	-	Management Information System
MLB	-	Meghna Left Bank
MRB	-	Meghna Right Bank
MOWR	-	Ministry of Water Resources
MRP	-	Main River Flood and Bank Erosion Risk Management Program (ADB TA 8054-BAN)
NHC	-	Northwest Hydraulic Consultants Ltd.
NGO	-	Non-Government Organization
O&M	-	Operations and Maintenance
OE	-	Old Embankment
PCR	-	Physical Cultural Resources
PD	-	Project Director
PLB	-	Padma Left Bank
PMO	-	Project Management Office
POE	-	Panel of Experts
PPTA	-	Project Preparatory Technical Assistance
PRA	-	Participatory Rapid Appraisal

Currency unit	-	taka (Tk)
Tk1.00	=	$0.01199
$1.00	=	Tk 82.765

Affected Persons (AP): As per the FRERMIP's involuntary resettlement policy, the definition of APs is: "Persons affected directly or indirectly by project-induced changes in use of land, water, or other natural resources are called APs. In other words, a person who as a consequence of the changes sustains (a) damages by reason of severing land, or (b) loss of immovable property in any manner, or (c) experience loss of income and livelihood. Such impacts may be temporary or permanent in nature and most often occurs through land expropriation using eminent domain or direct purchases for development projects. (The FRERMIP policy is not functionally different from ADB's 2009 SPS definition)." **Agricultural laborer:** A person who earns his/her livelihood mainly from manual labor engaged in agriculture practices. The non- agricultural laborer includes artisans and other occupational groups such as masons, potters, cobblers, barbers, etc. **Census Survey:** A survey covering 100% households being affected by the project, irrespective of their ownership into the land. **Char or Charland:** Char is a Bangla word which is a tract of land surrounded by waters along the river course and can be considered as a "by-product" of the hydro-morphological dynamics of rivers. In the dynamics of erosion and accretion in the rivers of Bangladesh, the emergence of island or chars within the river channel often creates new opportunities to establish settlements and pursue agricultural activities on them. Thus, charland is defined as the river island that emerges from the riverbed as a result of accretion. **Community Participation and Consultation:** The active process of sharing information seeking inputs from community about the project, seeking community-wide inputs, and integrating those in the project design as well planning mitigation measures. **Compensation:** Payment in cash or kind (for example land-for-land) to the APs as per LA Act.	**Gender Equity:** Equal recognition of both genders in the provision of entitlements, treatment and other measures under the Resettlement Plan **Indirectly affected people** are those likely to lose subsistence or income due to project intervention without loss of any physical assets. A clear definition of indirectly affected people must be based on a careful review and assessment of indirect impacts of the project. **Joint Verification Team (JVT):** In an erosion- prone area and due to piecemeal acquisition, Inventory of Losses (IOL) prepared for a section of project may change as people move with the erosion and acquisition. The JVT will be composed of: i) Representative from BWDB - Convener (SDE/AE/Equivalent Officer); ii) Representative from concerned DC - Member; and iii) Sub Assistant Engineer from BWDB - Member Secretory ; and iv) Member RP-INGO, and will verify the IOL established through census wherever necessary. **Payment Modality:** The Payment Modality is an administrative manual that presents the guidelines to be followed for payment of resettlement benefits for various types of losses as provisioned in the Project's Resettlement Plans (RP)s, based on the Asian Development Bank's Safeguard Policy Statement (SPS 2009) and the Government of Bangladesh (GOB) Land Acquisition laws. The Objectives of the Payment Modality are to assist concerned GOB officials and the RP Implementing NGO (RP-INGO) to identify Entitled persons (EPs) correctly; accurately calculate their entitlements, and effectively assist EPs.
Cut-off Dates: Date of notification under Section 3 of 1982 Ordinance is the cut-off date for title owners. The end date of the Census will be considered cut-off date for all others, including non-title holders for resettlement benefits.	**Person(s) having usufruct rights:** The right to use land belonging to others - for example, lease from government department or agency or individuals. **Project-Affected Area:** An area under the project,

Displaced Persons: In the context of involuntary resettlement, displaced persons are those who are physically displaced (relocation, loss of residential land, or loss of shelter) and/or economically displaced (loss of land, assets, access to assets, income sources, or means of livelihoods) as a result of (i) involuntary acquisition of land, or (ii) involuntary restrictions on land use or on access to legally designated parks and protected areas. (ADB's SPS 2009)	declared by the Government, where land is being acquired under Acquisition and Requisition of Immovable Property Ordinance - II of 1982 or any other Act in force or an area not acquired, but affected by the project and its related activities. **Poor Women-headed household:** Poor households where a woman decides on the access to and the use of the resources of the family. In resettlement context, women-headed households and/or widows also suffer from lack of labor for relocation purposes.
Entitled Person: EP is an administrative term used in the administrative manual -- the Payment Modality - for designating benefits for APs. There are two types of EP: Direct EPs, who are EPs by virtue of legally recognized entitlements; and Indirect EPs, who are EPs by virtue of socially recognized entitlements, as per ADB Policy and legally agreed between the ADB and GOB through the Loan Agreement. The Direct EPs are the Titleholders recognized by the DC and confirmed through payment of Cash Compensation under Law (CCL). The Direct EPs are identified as per the Final Award information prepared by the DC upon payment of CCL. The list of the Direct EPs will be updated over time, with payment of the CCL. The Indirect EPs are those without legal title to ROW land and/or structures but who were living and/or earning their livelihood within the ROW, and are entitled to Resettlement Benefits under the RP provisions. The RP- INGO is responsible for all groundwork and verification for identification of EPs. **Entitlements:** Range of measures comprising of compensation resettlement benefits, including shifting allowance, subsistence, and relocation which an AP is entitled to, depending on the nature of losses, to restore and/or improve the living standards. **Eminent Domain:** Regulatory authority of the government to obtain land for public purpose use and/or private sector development projects under the 1982 Ordinance or other laws of the land. **Head of Household:** One who makes major decisions within the family structure and generally lead the family as the principal provider.	**Public Disclosure:** Process of disclosing and sharing project impacts with affected people and disseminating amongst them information on their entitlements, compensation, R&R measures and project timeline etc. **Rehabilitation:** Re-establishing incomes, livelihoods, living and social systems. **Relocation:** Rebuilding housing, assets - including productive land, and public infrastructure, in a new location. **Replacement Cost (RC)** The costs of replacing lost assets (e.g., land, houses/structures, trees and crops) and income, including cost of transaction. **Resettlement and Rehabilitation (R&R):** Resettlement refers to rebuilding housing, assets, including productive land and public infrastructure in another location while rehabilitation means restoration of income, livelihoods, and re-establishment of socio-cultural system. **Resettlement Plan (RP):** A time bound action plan with budget setting out resettlement impact strategy, objectives, entitlement, actions, implementation responsibilities, monitoring and evaluation. **Right-of-Way:** Demarcated land proposed for infrastructure development **Social Preparation**: The process of consultation with affected people, undertaken before key resettlement decisions are made, to build their capacity to deal with resettlement. ***Uthuli* (also called *Nodibashi):*** People displaced by flood/erosion, who live on land provided by neighbor or relative free of cost.

Household: A household unit includes family members who share food from the same kitchen. In the project area, it consists of parents with children living together as an economic and production unit. **Host population:** Community residing in or near the area to which affected people are to be relocated. Host communities should also be project beneficiaries for better host- resettlers integration.	group/persons may include (i) persons below nationally defined poverty line; (ii) indigenous people or adibasis; (iii) poor women-headed households; (iv) landless and marginal farmers; (v) people with disability (vi) elderly; (vii) people without legal title to land; (viii) any other groups or persons found to be disproportionately affected by project impacts



1 INTRODUCTION

1.1 Background

The Asian Development Bank supports the feasibility assessment of a potential future flood and riverbank erosion risk management program covering parts of the main rivers of Bangladesh named Flood and Riverbank Erosion Risk Management Investment Program (FRERMIP). The main focus is to reduce the riverbank erosion and flood risks to the adjacent flood plains while maximizing economic activities in a sustainable and environmentally acceptable manner. Existing flood embankments dominantly fail from riverbank erosion, and as such the stabilization of the river pattern is a cornerstone of reducing the flood risk. The FRERMIP builds on and extends the activities of the Jamuna-Meghna River Erosion Mitigation Project (JMREMP) (ADB, 2002), implemented in different phases from January 2003 until June 2011. In addition, a similar project, the Assam Integrated Flood and Riverbank Erosion Risk Management Investment Project (AIFRERMIP) (ADB, 2010) provides important insight into a number of relevant project elements and processes.

The Project will cover the main rivers from Bhangabandhu (Jamuna) Bridge and the proposed Ganges Barrage to Chandpur, as such covering around 60 km of the Jamuna, around 20 km of the Ganges, and the whole around 100 km long Padma reach. Two main confluences are included: the confluence of Ganges and Jamuna and the confluence of Padma and Upper Meghna. Importantly, for flood benefits and, of course, targeting the overarching goal of poverty reduction, the flood plains on both sides of the rivers play a fundamental role as home of a largely poor population depending on agriculture and fisheries. The project area was segregated into sub-reaches with similar river and flood plain characteristics as practical subproject areas. Each sub-reach consists of several upazilas. In total 13 sub-reaches were identified for pre-feasibility assessment: two each at the Jamuna Right and Left Bank (JRB, JLB), three each along the Padma Right and Left Bank (PRB, PLB), one at the Meghna Right Bank (MRB), and two along the Meghna Left Bank (MLB.)

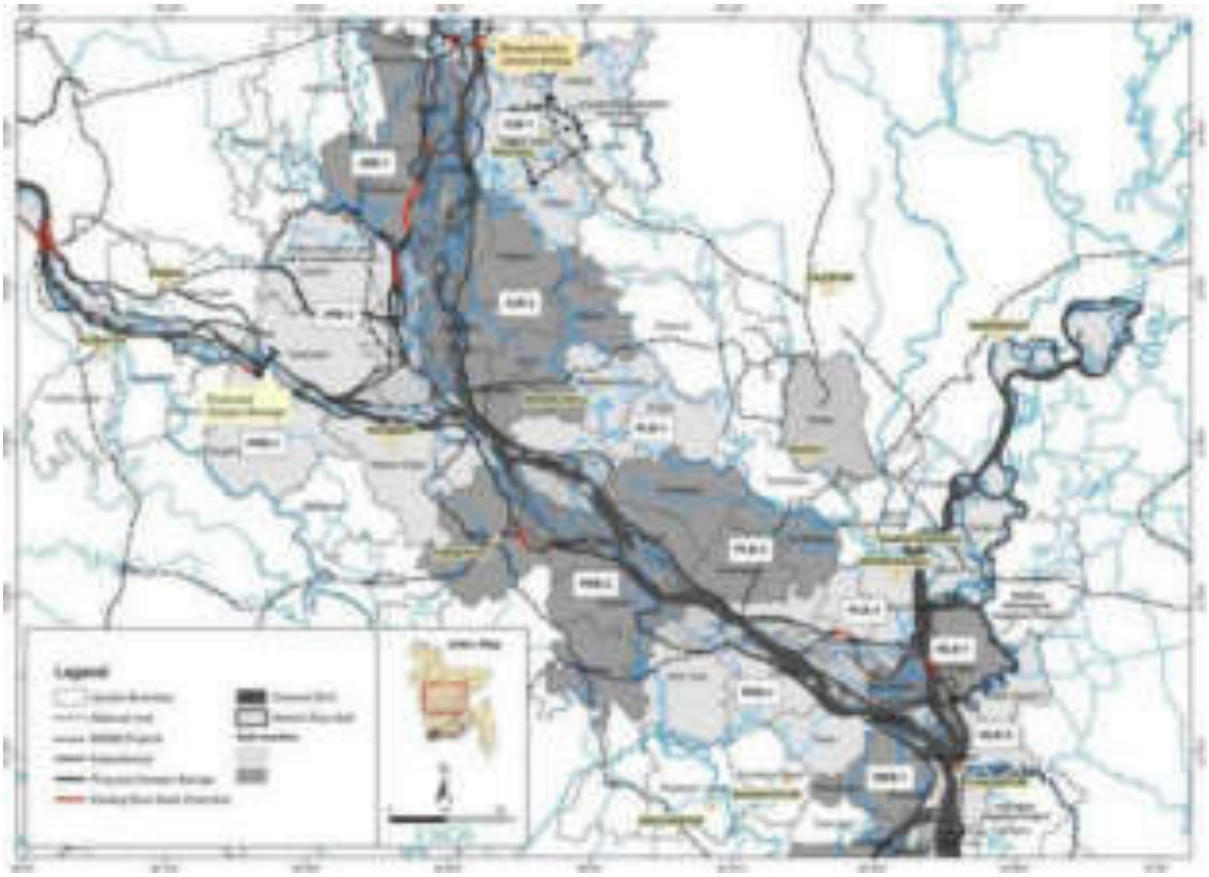


Figure 1-1 Sub-reach division of project Area

Table 1-1 Sub-reaches, Rivers, Districts and Upazilas

River	Subreaches	District	Upazila
Jamuna	JRB-1	I. Sirajganj	1. Belkuchi
		Sirajganj	2. Kamarkhanda
		Sirajganj	3. Shahjadpur
	JRB-2	II. Pabna	4. Bera
		Pabna	5. Santhia
		Pabna	6. Sujanagar
	JLB-1	III. Tangail	7. Delduar
		Tangail	8. Kalihati
		Tangail	9.Tangail Sadar
	JLB-2	IV. Manikganj	10. Daulatpur
		Manikganj	11. Ghior
		Manikganj	12. Saturia
		Manikganj	13. Shibalaya
		Sirajganj	14. Chauhali
		Tangail	15. Nagarpur
Padma	PLB-1	Manikganj	16. Harirampur
		Manikganj	17. Manikganj Sadar
		Manikgani	18. Singair

River	Subreaches	District	Upazila
	PLB-2	V. Dhaka	19. Dohar
		Dhaka	20. Nawabganj
		VI. Munshiganj	21. Serajdikhan
		Munshiganj	22. Sreenagar
	PLB-3	Munshiganj	23. Lohajang
		Munshiganj	24. Munshiganj Sadar
		Munshiganj	25. Tongibari
	PRB-1	VII. Rajbari	26. Goalanda
		Rajbari	27. Pangsha
		Rajbari	28. Rajbari Sadar
	PRB-2	VIII. Faridpur	29. Bhanga
		Faridpur	30. Char Bhadrasan
		Faridpur	31. Faridpur Sadar
		Faridpur	32. Sadarpur
	PRB-3	IX. Madaripur	33. Shib Char
		X. Shariatpur	34. Naria
		Shariatpur	35. Zanjira
Meghna	MLB-1	XI. Chandpur	36. Uttar Matlab
	MLB-2	Chandpur	37. Chandpur Sadar
		Chandpur	38. Matlab Dakshin
	MRB-1	Shariatpur	39. Bhedarganj
		Shariatpur	40. Gosairhat

The feasibility study covered the priority investment during the first Tranche**.** Subsequent tranches will be identified during each previous, on-going tranche. The implementing agency, the Bangladesh Water Development Board (BWDB) (i) has more than 10 years of experience with an adaptive or flexible FRERM approach and has demonstrated successful implementation from three ADB supported project (JMREMP, South-West Area Integrated Water Resources Planning and Management Project, Secondary Towns Integrated Flood Protection Project II), (ii) has approved operation in line with the 'Guidelines for Riverbank Protection', 2010 founded on standardized design and implementation procedures, and (iii) is currently in the process of creating the post of a Chief Engineer River Management as focus point for river stabilization activities and in line with the National Water Management Plan and the PoE recommendations of JMREMP.

1.2 Phased Investment Program

After selecting three priority investment sites from the 13 sub-reaches, an investment plan was prepared. Priority sites were selected though multi-criteria assessment specifically focusing on erosion,

flooding, and poverty in the individual sub-reaches, amongst other parameters. Three high priority sub-reaches (subsequently referred to as subprojects) were selected for immediate interventions from tranche-1 onwards. Other sub-reaches will be considered during follow on tranches based on more detailed river background studies and the identified requirements at the time of planning. The investment plan considers a phased approach in three tranches of around four years each, allowing for

some overlap of subsequent tranches. The first guiding principle is to build riverbank protection along critically eroding areas, in order to stabilize the river course and to provide more stable floodplain conditions for follow-on developments. The second guiding principle is to rehabilitate existing embankments and close strategic gaps in order to reduce the flood risk to the rural population and allow more consistent development in a more predictable environment.. Apart from focusing on riverbank protection and flood embankments in support of stable conditions on the floodplains, the program can contribute to the reclamation of some of the lost floodplain land, especially where there are attached chars which were part of the historic floodplain some 30 years ago, before the river system started widening dramatically.

Consequently, the first and second tranche investments at the three priority sub-reaches (shown in red and orange color in Figure 1-1) are

I) Priority riverbank and embankment Work (Tranche 1 - red color):

- JLB-2: Riverbank Protection alongside the Jamuna Left Bank downstream of the new Dhaleswari offtake at Chouhali and Zafferganj area, where active erosion threatens the existing floodplains. The protection at Chouhali is planned to help guiding the eastern Jamuna channel towards the interior of the braided belt and as such stabilizing an existing large attached char. This char is several kilometers wide and reclamation would somewhat compensate for past erosion losses. The downstream protection at Zafferganj would form part of a more stabilized channel pattern at the confluence.
- JRB-2: Embankment construction alongside the Jamuna Right Bank, from Kaijuri to Baghabari. The area between Enayetpur and Baghabari alongside the Jamuna right bank was protected by the Brahmaputra Right Embankment (BRE) for about 30 years. However, since the embankment was lost due to riverbank erosion in the mid-19901s, the area has remained unprotected from frequent flood inundation. Some morphological analyses indicated that the riverbank erosion in this river reaches could be a consequence of Bangabandhu (Jamuna) Bridge construction, which created a fix narrow river course1 With 10 km of riverbank protection structures provided under the ADB financed JMREMP, the eroded embankment can now be reconstructed to revise the BRE system. In this area a flood control project was situated and the reconstructed embankment would provide the backbone for increased agricultural outputs while again protecting valuable private and public infrastructure from flooding.
- PLB-2: Riverbank Protection alongside the Padma Left Bank between Paturia and Harirampur , where a formerly large meander that periodically erodes has silted up and riverbank protection along the more favorable present river course would save around 30 km2 (3,000 ha) of valuable floodplain from future erosion.
- d. JRB-2: Riverbank protection from Kaijuri to the Hurashagar River. This short stretch will close the gap between the existing 17 km long protection built upstream and downstream under JMREMP.

[1] Refer to Padma Multipurpose Bridge Design Project, Loan No. 2375 BAN, River Training Works, Updated Scheme Design Report, Annex F

II) Follow-up riverbank and embankment works (Tranche 2 and subject to further investigations and background studies as well as detailed designs during Tranche 1 - orange color in Figure 2):

- Riverbank Protection alongside the Jamuna Right Bank from around Enayetpur to Kaijuri. The offtake of the western channel in this area is currently declining due to an unfavorable offtake angle. Building a guiding revetment under a smooth alignment means attracting more flow to the western channel and keeping this important navigation route open.
- Extending the riverbank protection at Chouhali and Zafferganj to provide a more stable river environment along the Jamuna Left Bank. Riverbank protection in this area will be designed exploring the possibility of reclaiming some of the floodplain lost during the widening process of the Jamuna since the 1970s through measures following a building-with-nature concept.
- Embankment construction alongside the Jamuna Left Bank from Dhaleswari to Paturia. The flood plain along the left bank of the Brahmaputra/Jamuna was never provided with a long linear embankment. An embankment, similar to the BRE, has the potential to reduce flood levels in low lying areas and as a consequence reduce future flood damages and trigger more development in the "backyard" of Dhaka.
- Embankment rehabilitation alongside the Padma Left Bank from Paturia to Dohar, in continuation of above embankment works.

In addition to the work at priority sites, further studies under Tranche 1 will prepare more investment for other sub-reaches under Tranche 2. The same study procedure can be followed under Tranche 2 for the extension of sub-reaches during Tranche 3 investment. Natural river developments in some areas are expected to support investments in future, due to a current development towards generally more favorable alignments. The confluence of Upper Meghna and Padma is a critical area depending on the Chandpur town protection as cornerstone for the stability of the whole Lower Meghna. While the Chandpur Town Protection is currently considered to be less critical and substantial riverbank protection has been built downstream (Haimchar), the right bank is largely unprotected. This bank, consisting in parts of more recently deposited soils is highly unstable and requires stabilization in the context of the overall confluence. Any stabilization measure in this area depends on a better understanding of the confluence processes and must consider the influence of Padma Bridge on the downstream confluence geometry.

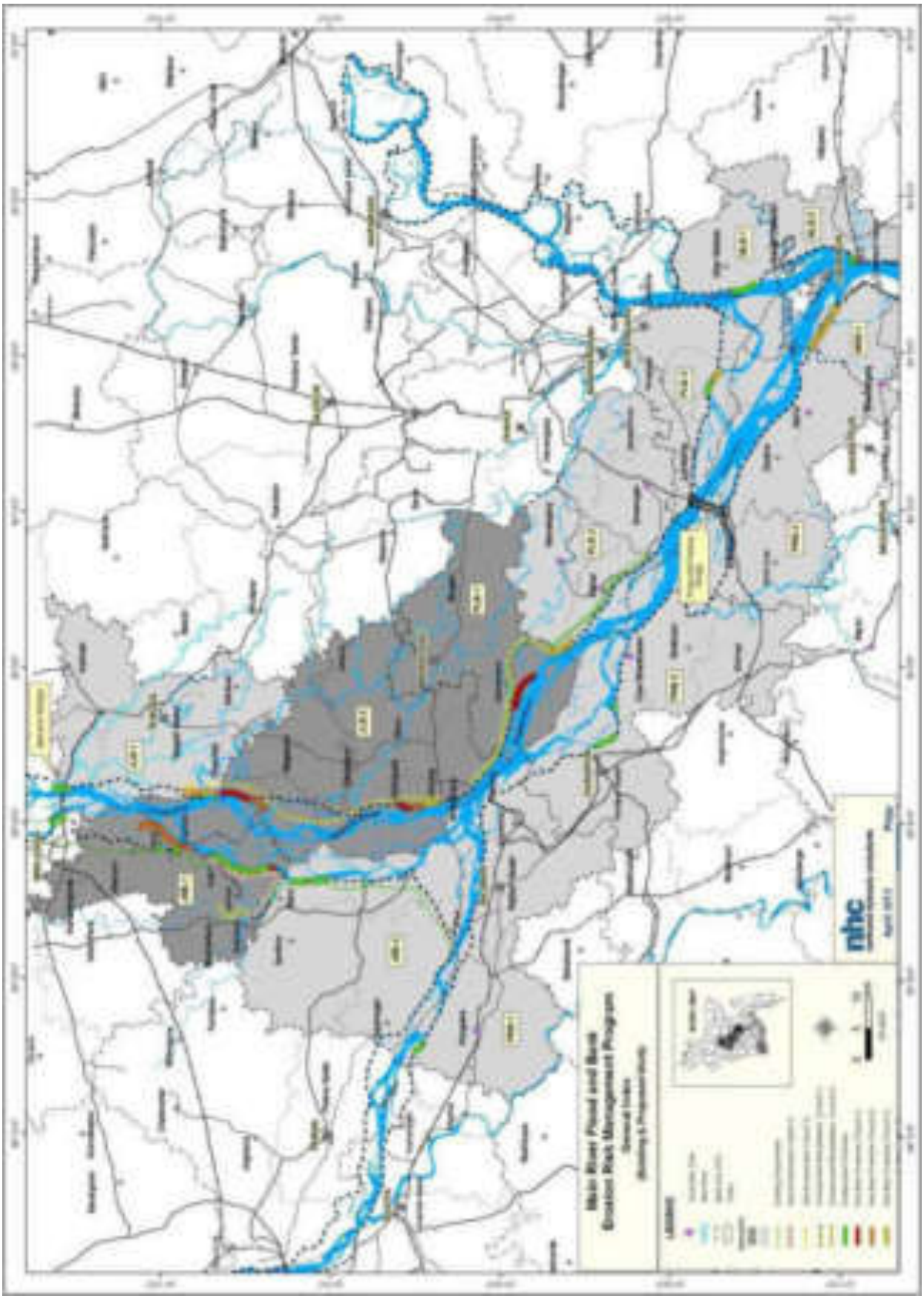


Figure 1-2 Summary Initial investment program

1.3 Project Rationale and Objectives

The Flood and Riverbank Erosion Risk Management Investment Program (FRERMIP) is the follow-on project of the Jamuna-Meghna River Erosion Mitigation Project (JMREMP). It aims to sustain incomes and livelihoods of people living along the three main rivers of Bangladesh - the Jamuna, the Ganges, and the Padma. It will enhance resilience to flood and riverbank erosion risks through strengthening the flood and riverbank erosion management system, including the knowledge base and underlying institutions; and by establishing integrated non- structural and structural risk management measures at priority erosion sites and addressing their sustainability.

The Program may take a sector-type approach to applying the multi-tranche financing facility (MFF) modality, to allow for (i) the flexible, adaptive, phased interventions that are technically most appropriate given the dynamic river morphology, (ii) strategic longer-term FRERM planning, and (iii) longer-term and more effective support for institutional capacity enhancement in the sector.

2 SCOPE AND OBJECTIVES OF THE RF

2.1 GOB Laws on Land Acquisition

The primary objective of the Resettlement Framework (RF) is to provide guidance in i) project resettlement planning on policy and entitlements, ii) resettlement planning for possible project impacts that cannot be determined at this stage during preparation, iii) resettlement planning for any unanticipated impacts, particularly during project construction. It sets out the policy and procedures to be adopted by the Bangladesh Water Development Board (BWDB) for revising and updating any RPs during project implementation. The revised RPs, if any, will be submitted to the ADB for review and approval. One resettlement plan has been prepared for Tranche 1. Around two additional resettlement plans are envisaged to be prepared and implemented for Tranche 1 for the riverbank protection works after the Board approval and just prior to construction, as riverbank alignments may significantly change before the commencement of Tranche 1 due to the dynamic morphology of the Jamuna and Padma rivers. Considering practical situation during implementation of Tranche-1, a total of 4 resettlement plans had been prepared for Tranche 1 which were: approved by ADB on February 2017 for Zafarganj (1.4 km); on April 2017 for Zafarganj (0.6 km); on April 2017 for Chauhali; and on November 2017 for Embankment JRB-1. Another one RP has been prepared and submitted to ADB for approval in December 2017 for Harirampur RBP workLegal and Policy Framework

The principal legal instrument governing land acquisition in Bangladesh is the Acquisition and Requisition of Immovable Property Ordinance II (1982) and subsequent amendments of the Ordinance II (1989/93/94/2017) and other land laws and administrative manuals relevant to alluvion/deluvion land, char and khas land administration in Bangladesh. The 1982 Ordinance requires that compensation be paid for (i) land and assets permanently acquired (including standing crops, trees, houses); and (ii) any other damages caused by such acquisition. The Deputy Commissioner (DC) determines (a) market value of acquired assets on the date of notice of acquisition (based on the registered value of similar property bought and/or sold in the area over the preceding 12 months), and (b) 200% premium as per amendment of 2017 on the assessed value (other than crops) due to compulsory acquisition. However, it is well known in Bangladesh that people devalue land during transactions to pay lower registration fees. As a result, compensation for land paid by DC including premium remains less than the real market

price or 'replacement value' (RV). The 1994 amendment made provisions for payment of crop compensation to tenant cultivators.

In addition to the Ordinance, another relevant law that applies to the Project due to acquisition of bankline for river bank protection (RBP), is the State Acquisition and Tenancy Act 1951 (Section 7) that defines the ownership and use right of alluvion (payosti) and diluvion land (sikosti) in the country. Legally, GOB owns the bankline and eroded land in the river. However, the "original" owner(s) can claim the land if it re-emerges in a natural process within 30 years from the date of erosion.

2.1.1 Inadequacies of 1982 Ordinance

The Ordinance, however, does not cover project-affected persons without title or ownership record, such as informal settler/squatters, occupiers, and informal tenants and lease¬holders (without registration document) and does not ensure replacement market value of the property acquired. The act has no provisions for resettlement of the affected households/businesses or any assistance for restoration of livelihoods of the affected persons. As a result, land acquisition potentially diminishes productive base of farm families and those affected and displaced by development projects.

2.1.2 Harmonization with ADB's Policies

The ADB has its own integrated safeguard policy statement (SPS) to minimize displacement and require time-bound action plans with measures to restore or improve livelihood and income of those affected by development projects. Since the 1982 Ordinance falls short of the requirements of the ADB's safeguard policies on many grounds, the project land acquisition and resettlement policy has been harmonized with ADB's SPS. The harmonization was carried out through a gap analysis involving the 1982 Ordinance II and the ADB's safeguard policies and gap-filling measures. The harmonization has also benefited from the Jamuna Bridge and Jamuna-Meghna River Erosion Mitigation Project (JMREMP) "best practices" in resettlement. The best practices - for example, include Photo ID Card with description of losses and entitlements, geo-reference photos of affected structures on ROW to control fraudulent claims, Resettlement villages (RVs) with civic amenities, multiple relocation options, including "self-managed" resettlement. There is also an option to use Unmanned Aerial Vehicle (UAV) for having more accurate data regarding land acquisition and resettlement of structures and trees during Tranche-2.

The harmonized policy forms the basis for preparation of social safeguard plans for various components of the project. The harmonization and gap-filling measures are in Annex I and Annex II, respectively.

3 POLICY PRINCIPLES AND GUIDELINES

In view of the harmonization, the project will apply the following policy guidelines and procedures to comply with co-financiers' safeguard compliance requirements:

I) Avoid or minimize impact as much as possible through alternative design options;

II) Consult affected people and their communities adequately;

III) Make resettlement plans and other related documents available at the project sites;

IV) full disclosure will be ensured through distribution of a summary RP in Bangla to the affected households and other stakeholders;

V) Determine replacement cost (RC) of assets acquired and compensate at full replacement costs determined by PVAT;

VI) Provide Resettlement assistance to all APs, irrespective of their titles to land;

VII) Establish GRC at the local level for speedy resolutions of disputes;

VIII) Provide additional assistance to poor women-headed AHs and vulnerable groups;

IX) Establish income restoration assistance for alternative income sources and restoration of livelihoods for assisting affected people to restore and/or improve upon their pre-project levels or standards; and

X) Carryout internal/external, including third party monitoring to assess outcome of resettlement operations and evaluate outcomes.

1All affected households and persons, as per the above policy/principles and guidelines, will be eligible for compensation and assistance to be provided by the project. In case of land acquisition the date of notification of section-3 for acquisition will be treated as the cut-off date while people without titles such as nodibhashis (erosion displaced households squatting on others' land, also called uthuli) or informal settlers/squatters living in the acquired area, the date of census or similar designated date by the BWDB will be considered as the cut-off date. Any persons moving into the project area after the cut-off date will not be entitled to any assistance.

4 PLANNING STEPS AND PROCEDURES

To revise and update any RP, the following procedures and steps will be followed. First any additional new impacts will be identified through proper census survey, community consultations and any other tools and techniques necessary to understand the impacts. In such cases a new cut-off date(s) will be established. Second an inventory of losses (IOL) will be established based on the census survey. Third, updating entitlement matrix ensuring all new impacts and related losses are covered. Fourth, disclosure of impacts and entitlements including incorporation of any suggestions from affected groups and communities. Fifth, the valuation of all affected assets will be undertaken and a budget will be prepared for payments of compensation. Finally, the updated RPs will be posted on the ADB's website.

5 ELIGIBILITY AND ENTITLEMENTS

Lack of legal documents for customary rights of occupancy/titles shall not affect eligibility for compensation. The RF stipulates payments of compensation as per the assessed value of the land and structure to the affected persons (APs). In addition to compensation paid by the concerned Deputy Commissioner (DC), the APs will receive additional assistance in cash or kind to match replacement cost (RC), which is the difference between the market value and the assessed value for lost assets (land, houses and trees), transaction costs such as stamps/registration costs (in case of purchase of

replacement land) and other cash grants and resettlement assistance such as shifting and reconstruction grant, resettlement benefit for loss of workdays/income due to dislocation. Socio-economically vulnerable households namely - female-headed households without grown up male in the household, households below poverty line , households headed by disabled, elderly people and those losing more than 10% of income from acquisition will be given additional cash assistance for relocation. Measures such as "host" area benefits - for example, additional class rooms in the existing educational institutions, access roads, improved water supply and sanitation etc- to enhance the carrying capacity will be undertaken so that project benefits are enjoyed both by the host and resettled families, and host-resettlers' are integrated socially and economically.

Annex III provides the entitlement matrix for different types of losses and dislocation established through Inventory of Losses (IOL). The matrix also includes provisions for any unanticipated impacts arising during or post project implementation. The mitigation measures in the matrix are consistent with co-financiers' safeguard requirements. They also reflect "good practice" for examples (e.g., replacement cost (RC) for land, dislocation allowance, transfer grant, relocation at project-sponsored resettlement village (RV), grievance redressal, income and livelihood restoration, third party monitoring etc.) from the Jamuna Bridge Project. Compensation and other assistance will be paid to APs prior to dislocation and dispossession from acquired assets to construction activities. The eligibility for entitlement is limited by a cut-off date, as mentioned in paragraph 16.

6 UNANTICIPATED IMPACTS ON CHARLANDS

Although there are no anticipated negative impacts on charlands, the project will, in case of impacts such as induced flood or erosion caused due to the construction of sub-reach interventions, carry out an assessment of the impacts on chars and char people adjacent to the embankments through socio-economic surveys and mitigate losses using the entitlement matrix in this framework.

7 VALUATION OF ASSETS

DC follows the rules laid down in the 1982 Ordinance updated in 2017 to determine market prices for assets like land, structures and trees/crops, with assistance from other departments such as Public Works.

Department (PWD) for structures, Forest Department for trees, and Department of Agricultural Extension for crops. The assessed value is typically lower than the replacement value. Indeed, there exists confusion over statutory "market value" and compensation at replacement value.

Where (i) markets provide reliable information about process and (ii) comparable assets or acceptable substitutes are available for purchase, replacement cost (RC) is equivalent to "market value" of the replacement land, plus any transaction costs (such as preparation, transfer, and registration fees and taxes).

In Bangladesh's rural setting, the conditions noted above are not present. Therefore, to ensure that APs can replace the lost property, a replacement cost will be provided as determined by a Property Valuation Advisory Team (PVAT), which will be constituted by BWDB at each SMO with (i) Convener - Representative from BWDB (SDE/AE/Equivalent officer); ii) Member – Representative from concerned

District Commissioner's (DC) office; iii) Member Secretary - Sub Assistant Engineer from BWDB concerned branch -, and iv) Member, RP-INGO representative (DTL, Area Manager or Equivalent Officer/Specialist). The RP implementing NGO will provide all technical support to the PVAT to assess the market price through an independent agency and recommend the RC of assets to the Project Director of the PMO for approval. BWDB will pay the difference between the approved RC and the DC payments under the 1982 Ordinance II updated in 2017. In addition, APs will be allowed to take away reusable materials from their dismantled houses and shops at no cost, despite compensation paid by the DC which will NOT be deducted from the RC.

8 CONSULTATION, DISCLOSURE AND GRIEVANCES

Consultations and disclosure were initiated at the project preparation stage. At the detailed design stage, an RP for each of the subproject having IR impacts will be prepared, updated and implemented in close consultation with the stakeholders and will involve focus group discussions (FGDs) and meetings, particularly with the affected households (AHs). In addition, a resettlement information brochure containing information on compensation and resettlement benefits will be made available in Bangla and distributed among the APs. Project design, impact and policies for mitigation of adverse social and environmental impacts will be disclosed to the influence area people particularly the APs. All APs will be provided with information regarding specific entitlements. This framework will be made available in local language(s) during the public meetings at the community level. Summary of draft RPs will be translated in Bangla and will also be made available at the district/upazila office and union parishad (local council). The RPs will be disclosed on the ADB's website, and the consultation will continue throughout the project implementation period.

Each RP will also outline a detailed procedure for community complaints and grievance redresses. The local GRC at each SMO will be composed of: a) Representative from BWDB - Convener (Executive Engineer (Field)/Equivalent); b) Chairman of concerned Union Parishad - Member;

Representative from APs - Member; d) Sub Assistant Engineer from BWDB concerned branch - Member Secretary. The local GRC will, by meeting all the aforementioned participants informally, as well as formally, ensure speedy and out of court settlement of as many disputes as possible. The local GRC shall review and resolve grievances within one month of receiving any complaints and will maintain written records of all the appeals received. Minutes of all the meetings will also be duly recorded and maintained and will also include dated photos of the consultations. Irrespective of the GRC decisions, an aggrieved person will be free to access the country's legal system at any stage of the grievance redress mechanism. In case of any discrepancies regarding quantities and/or quality of affected properties, the Joint Verification Team (JVT) will make an assessment.

9 INCOME AND LIVELIHOOD RESTORATION PROGRAM (ILRP)

The FRERMIP recognizes diminishing income and dislocation of livelihoods during and after relocation. As a result, in addition to providing compensation and resettlement benefits, appropriate supporting measures will be included for income and livelihood restoration of APs. APs will be given preferences for project-related employment - whenever possible. BWDB will make provision in the contract with the contractors for employment of APs (with ID cards) or their dependents/women on a priority basis.

Employment in the project construction will be an added source of income in the income restoration processes of APs.

The sub-reach RPs will budget an Income and Livelihood Restoration Program (ILRP) particularly targeting the poor and the vulnerable groups, including poor female-headed households. The ILRP will include human resource development and occupational skill development trainings and subsequent credit support for undertaking suitable business. The main objective of the ILRP will be to improve or, at least restore, the income and livelihood of all APs. The project will adopt two-fold approach for ILRP. ILRP will be designed, based on needs assessment surveys and available skills, for implementation in post relocation period. Income and livelihood restoration efforts will be extended to APs in the form of both short-term support and long-term program to achieve sustainable livelihood for affected households (AHs).

A gender action plan (GAP) will focus on income and livelihoods issues, including provisions for training, credit and marketing support for income generating activities and enhanced organizational and leadership/advocacy among the poor women for sustainable social development.

Further, the RPs will have provisions to provide assistance to affected businesses to restore their businesses. All businessmen, including renters, will receive a cash grant for loss of access to business premises, including shifting or moving allowance, and one-time cash grant against loss of income. This assistance is intended to supplement the income loss during transitional period to re-establish businesses at new sites. Long-term ILRP for post-relocation activities will be designed and implemented over a period of 4 years.

A national level Livelihood Development NGO (LD-NGO) will be involved for fostering the ILRP activities among the entitled APs. The ILRP will be designed through identification of target group beneficiaries (TGBs) and assessing the needs and feasibility of potential income generating activities.

10 INSTITUTIONAL ARRANGEMENTS

BWDB is the project owner and executing agency (EA) of the Project. A Project Management Office

(PMO), headed by a Project Director (PD), will be set up within BWDB for execution of the Project. One of Executive Engineers under the PMO will serve as Chief Resettlement Officer (CRO), which will be responsible for implementation of the RP - disbursement of compensation through DC and resettlement benefit through its own staff with assistance from Resettlement Implementing NGO and concerned BWDB field division. CRO and his staffs in PMO will work as a Resettlement Unit RU) under the PMO in dual charge. The RU responsibility will include implementation of an Income and Livelihood Restoration Program (ILRP) with the help of a national Livelihood Development NGO (LD-NGO) and a gender action plan during and after resettlement of APs. The RU will be manned by staff with past work experience in land acquisition and resettlement. The concerned field offices of BWDB, headed by Executive Engineers, will act as field offices of RU. The principal functions of the Field Offices will be to facilitate land acquisition and implement the resettlement program with assistance from a resettlement plan implementing NGO (RP-INGO). CRO at RU with the help of field offices will perform Monitoring and Evaluation (M&E) of the implementation of RPs. He/she will create and manage resettlement databank, progress monitoring arrangement and MIS.

CRO-RU and his/her team will carry out the following specific tasks related to land acquisition and resettlement: (i) liaison with district administration with the help of concerned field offices to support land acquisition; (ii) day-to-day management, supervision, monitoring of resettlement work; (iii) ensure timely availability of budget for all activities; (iv) synchronize resettlement activity and handover land as per the construction schedule; (v) develop RP implementation tools and form necessary committees such as Property Valuation Advisory Team (PVAT), Joint Verification Team (JVT), and Grievances Redress Committee (GRC); and (vi) monitor the effectiveness of entitlement packages and payment modality. In sum, the CRO- RU through the field offices, LA Office and the RP-INGO will execute and monitor the progress of the LA and Resettlement implementation. Capacity building of BWDB staff will be carried out on an ongoing basis and dedicated resources will be allocated for it.

The principal task of the RP-INGO is to identify the project affected households/business enterprises and individuals, processing their payment based on an inventory of losses (IOL), established by DC and BWDB, and to assist BWDB in making payments to the APs for their resettlement-related benefits. The RP-INGO will carry out an information campaign and involve APs, including women in the resettlement implementation processes. The RP-INGO will also collect, collate, computerize and process data for identification of eligible persons correctly for resettlement benefits and assess their entitlements as per resettlement policy. Further, the RP- INGO will assist or work with a variety of committees, such as, PVAT, JVT and the local GRCs. Finally, the RP-INGO will also play an important role in ensuring that vulnerable groups, including female-headed households and persons with disabilities (PWDs), are given special attention.

BWDB will form a JVT for the each sub-project through a gazette notification to compare and review the physical verification data collected, comprising i) a representative from BWDB - Convener (SDE/AE/Equivalent officer); ii) a representative from concerned District Commissioner's (DC) Office - Member; and iii) a representative from the INGO - Member secretary. The JVT will be approved by MoWR. The JVT will determine the loss items and their owners, the Entitled Persons (EPs). These include users with title to the land as well as non-titled but socially recognized user. The scope and responsibility of the JVT will be clearly defined in the gazette. The INGO will process the entitlements of the project affected persons using the JVT data as one of the determinants.

The capacity-building activities for the PMO staff may involve on-the-job training, training workshops, and visiting other successful resettlement projects in the countries in the region for practical orientation in RP implementation .The scope of training will include ADB resettlement policy and principles. The training would specifically focus on the differences between the provisions of the ADB policy and Bangladesh country laws. The awareness of these differences and the need to follow the provisions of the ADB policy are critical for successful implementation of the RP. This will be mentioned in the resettlement plans that will follow this RF.

11 RESETTLEMENT BUDGET

Detailed budget estimates for each RP will be prepared considering ADB's principle of replacement cost. In all, the implementation of all RPs for the three tranches including land acquisition and other social development programs is estimated to cost close to dollars at current costs. The budgets will include: (i) detailed costs of land acquisition, relocation, resettlement and the ILRP, public consultations, and grievance redress; (ii) source of funding; (iii) administrative costs; (iv) monitoring cost; (v) cost of hiring

consultants; and (vi) arrangement for approval, and the flow of funds and contingency arrangements. The land acquisition, compensation, relocation and rehabilitation, administrative, monitoring and consultant cost, income and livelihood restoration value will be considered as an integral component of project costs. If there is any other additional cost, the same will be included in the project budget so to ensure timely disbursement of funds for payment to the affected households and individuals.

The following resettlement compensation and assistance payment procedure will be followed. The money for compensation under the law will be transferred to the concerned Deputy Commissioner's account. For resettlement costs (topping up amount, relocation cost, livelihood restoration, consultation, grievance redress, monitoring and evaluation, etc.), the resettlement plan implementation NGO will estimate the resettlement cost for the displaced households on the basis of the approved entitlement matrix (Resettlement Framework). Funds from ADB will be sent to an imprest account for the project in Bangladesh Bank in US Dollars. From the imprest account funds in Taka will be transferred to the project account operated by the Project Director (PD). The PD will release funds from the project account to the concerned Regional Accounting Centre (RAC). The Deputy Director or Assistant Director of the concerned RAC will pay the assistance amount directly to the displaced persons upon approval of the estimate by the PD. The concerned RAC will deliver cheques to the displaced persons. The implementing NGO will assist the displaced persons in receiving the cheques, including assisting with opening of bank accounts. The cheques will be given to the displaced persons before their shifting.

12 RESETTLEMENT DATABANK, MONITORING AND EVALUATION

Computerization of all data related to land acquisition and requisition will be done by a contracted institution, Census data by a contracted institution or consulting company for Cash Compensation under Law (CCL) and resettlement benefits payment data by the implementing NGO and will be made available to BWDB-RU. All the databases together will form LA&R Databank. The data bank will act as the key source of information for implementation, monitoring and evaluation purposes. An automated Entitled Person (EP) files, covering all the losses of individual households, will be prepared for using it as an input towards preparation of entitlement cards and payment statement. These automated files will reflect all the identified losses, all the entitlement, the entitlements paid and the amount pending. There will be a computerized resettlement Management Information System (MIS) which will enhance the institutional capacity of both BWDB and the RP-INGO in land acquisition and resettlement (LA&R) management for the project.

GIS to be established will be used to combat policy abuse establishing geo-referencing of the LA information with plots acquired on the digitized mauza maps as of the cut-off date. The MIS and payment processing tools such as an automated EP file, Payment statement, RC calculation software, stamp duty calculation software, information brochure, administrative manual/payment modality, developed by the RP-INGO will be used with necessary modifications in day-to-day monitoring and evaluation. Use of the MIS will establish transparency, detect manipulation of information, if any, accuracy in payment processing and efficiency in resettlement management and GIS will provide digitized mauza maps and readily available LA information at all levels of management, enhance the capacity to detect fraud, if any, ensure quality and efficiency of resettlement operation and management. All the updated information will be supplied to the databank and fed into the MIS regularly so that BWDB, the external monitoring and evaluation agencies, the co-financiers and the POE will have readily available information at hand,

RP implementation will be supervised and monitored by the CRO in coordination with concerned field divisions and staff of RP-INGO.

The monitoring will be done both internally and externally to provide feedback to BWDB and to assess the effectiveness of the resettlement policy and implementation. The Construction Supervision Consultant (CSC) will conduct regular monitoring of the RP implementation and submit reports to the EA (BWDB) for the EA's required semi-annual monitoring reports to the ADB. Finally, external monitoring will be carried out through an appropriate agency.

APPENDIX A

JAMUNA BRIDGE "BEST PRACTICES" AND LESSONS LEARNED

A1 Introduction

In Bangladesh, the 1982 Ordinance provides the basis for acquisition and compensation for acquired assets (e.g., land, structure, trees and crops). The Ordinance recognizes titled owners only. Informal settlers/squatters are not legally eligible for compensation or any assistance for resettlement. Compensation paid to APs for lost assets are less than replacement cost (RC). Furthermore, the consequences of dislocation and relocation are not considered and no provision or assistance for resettlement and income restore.

The Jamuna Bridge Project, completed in 1998, was the first multi-donor (ADB, JBIC and World Bank) financed project with a detailed resettlement plan. Project-specific additional measures were adopted to deal with the impacts of the project, which affected over 16, 000 families (100,000 persons), of which 4,000 families were required relocation. The Jamuna is now considered a "landmark" project and a "model" in resettlement management. Since the the Jamuna Bridge Project, many donor-funded projects in Bangladesh followed the Jamuna lessons and "best practices" in resettlement project planning and implementation.

The Jamuna-Meghna River Erosion Mitigation Project (JMREMP) October 2002) and the Padma Multipurpose Bridge Project (PMBP) September 2010 Resettlement Frameworks (RF) were highly reliant on the best practices established in the Jamuna Bridge Project.[2] The JMREMP will resettlement experience is also a model for the FRERMIP's RF.

Jamuna Bridge "Best Practices" and Lessons Learned

This brief note summarizes the "best practice" in resettlement in the Jamuna Bridge Project, the experience gained and the "lessons learned" from Jamuna implementation. The "best practices" and lessons from Jamuna have influenced the Padma project resettlement in a major and significantly way. These are highlighted in the matrix.

[2] Bangabandhu Bridge, also called the Jamuna Multi-purpose Bridge (Bengali: যমনু বহুমুখী সেতু Jomuna Bohumukhi Shetu), is a bridge opened in Bangladesh in June 1998. It connects Bhuapur on the Jamuna River's east bank to Sirajganj on its west bank. It was the 11th longest bridge in the world when constructed in 1998[1] and currently the 6th longest bridge in South Asia. It was constructed over the Jamuna River, one of the three major rivers of Bangladesh, and fifth largest in the world in terms of volumetric discharge. The bridge established a strategic link between the eastern and western parts of Bangladesh. It generates multifarious benefits for the people and especially, promotes inter-regional trade in the country. Apart from quick movement of goods and passenger traffic by road and rail, it facilitated transmission of electricity and natural gas, and integration of telecommunication links. The bridge is located on the Asian Highway and the Trans-Asian Railway which, when fully developed, will provide uninterrupted international road and railway links from South-east Asia through Central Asia to North-west Europe. http://en.wikipedia.org/wiki/Jamuna Bridge

Matrix 1 - Jamuna "Best Practices" and Lessons Learned

Sl No.	A. Best Practices in Resettlement Management	
	Jamuna Best Practices	Incorporated in the FRERMIP
1	All affected persons - titled and non-titled - were covered by the project	FRERMIP resettlement policy cover all affected persons, titled and non-titled , direct and indirectly affected persons
2	All types of losses were identified through full census and surveys	All previous data were updated through fresh census/surveys so that everyone affected is covered
3	Detailed entitlement matrix established to compensate for losses, dislocation and resettlement	The FRERMIP entitlement matrix has made improvements on the Jamuna on many respects, particularly on additional payments and grants
4	Photo ID Card with description of losses and entitlements	ID Card for all affected persons
5	Video filming of ROW to control fraudulent claims	Video filming and satellite images of the project boundary to control any fraudulent claims
6	Resettlement sites with civic amenities	resettlement sites will be developed for relocation of the affected households, as necessary, including "self managed" resettlement Affected persons given choices
7	Multiple relocation options, including "self managed" resettlement	Affected persons will be given choices to decide on relocation to project-sponsored sites to self-managed resettlement with assistance from the project
8	Public amenities in host villages	Provision for public amenities in host villages following the Jamuna model
9	Special assistance to vulnerable groups	Special attention to and assistance for vulnerable groups, including female-headed poor households, disabled family members
10	Income restoration and skill training	10-year income restoration and livelihood plan to be implemented by NGOs
11	GRC for dispute resolution	GRCs will be established through gazette notification
12	Public participation in resettlement management	Major initiative undertaken for public consultation, disclosure and participation of the affected persons
13	Field offices in Project site	BWDB will open Field Offices in FRERMIP sites
14	Nine NGOs involved in resettlement operations	Lead NGOs and many local and smaller NGOs will be involved in income restoration, skill training, gender plans, public health, AIDS/HIV awareness and prevention activities
15	MIS software for monitoring and management	MIS to be used for project monitoring purposes
16	Assistance to char villagers for post construction impacts (Erosion and Flood Affected Persons) Plan[1]	A 20-year charland monitoring, management and development framework will be established

Sl No.	A. Best Practices in Resettlement Management	
	B. Lessons from the Jamuna	
1	Jamuna Experience and Lessons	Improvements in FRERMIP Project
2	Excessive land acquisition (3,000 ha) for the 4.58 km long project, including approach roads and RBP	Minimization of land acquisition to extent possible
3	Income restoration was planned for only 3 years with very limited assistance; one-third of displaced families reported “worse-off” than pre-project level	A 10-year income and livelihood restoration plan (both short and long-term plan) has been undertaken beyond the project construction period to be implementation by a separate and experienced NGO in collaboration with local NGOs
4	Lack of concrete plans for “transfer” of the resettlement sites to the resettlers	Resettlement NGO will prepare a plan to transfer any resettlement sites to resettlers after 5 years
5	No external monitoring and evaluation of resettlement during project operations	Provision for third party monitoring arrangements

Beyond Jamuna Bridge Model

The Jamuna "model” of resettlement has been adopted as a "standard” for large and complex projects in Bangladesh. The draft National Policy on Involuntary Resettlement and Rehabilitation (NPIRR) has been very much influenced by the practices and experience of the Jamuna Project.

The Government of Bangladesh is gradually becoming more committed to good resettlement practices and progressive improvements have been noticed in all large projects since the Jamuna Bridge Project. Today, the approach is more towards "development-oriented.” The implementation of the Padma resettlement and social action plan (SAP) will set "new standards” in resettlement management locally and internationally as well.

APPENDIX B

HARMONIZATION WITH ADB'S SAFEGUARD POLICY

Aspect	ADB SPS 2009	Harmonized Policy
Objectives		
1. Avoid involuntary resettlement	Avoid involuntary resettlement wherever possible	Avoid involuntary resettlement and adverse impacts on people and communities, wherever feasible
2. Minimize involuntary resettlement	Minimize involuntary resettlement by exploring project and design alternatives	If displacement is unavoidable, minimize involuntary resettlement by: (i) exploring alternative project designs; (ii) Effective measures to minimize impact in consultation with the people who are affected.
3. Mitigate adverse	To enhance, or at least restore, the livelihoods of all affected persons in real terms relative to pre-project levels; and to improve the standards of living of the displaced poor other vulnerable groups.	Where IR is unavoidable, effective measures to mitigate adverse social and economic impacts on affected persons by:
social		(a) providing compensation for loss of assets at replacement cost (RC[1]); (b) ensuring that resettlement activities are implemented with appropriate disclosure of information, consultation, and the informed participation of those affected
impacts		(c) improve or at least restore the livelihoods and standards of living of displaced persons, and (d) improve living conditions among displaced persons through provision of adequate housing with security of tenure at resettlement sites.
Core Principles		
1. Identify, assess and address the potential social and economic impacts	Screen the project early on to identify past, present and future involuntary resettlement impacts and risks. Determine the scope of resettlement planning through a survey and/or census of displaced persons, including gender analysis, specifically related to resettlement impacts and risks	Assess at an early stage of the project cycle the potential social and economic impacts caused by involuntary taking of land (e.g. relocation or loss of shelter, loss of assets or access to assets, loss of income sources or means of livelihood, whether or not the affected person must move to another location) or involuntary restriction of access to legally designated parks and protected areas and to determine who will be

Aspect	ADB SPS 2009	Harmonized Policy
		eligible for compensation and assistance.
2. Prepare mitigation plans for affected persons	Develop resettlement plan on the basis of assessment during project processing, with the intent that plan will guide refinements of impact estimates and mitigating measures as project parameters are finalized.	Preparation of Resettlement Plan or Resettlement Framework (RF) during Project processing to mitigate the negative impacts of displacement.
		The plan will provide estimate of the extent of total population affected and establish entitlements of all categories of affected persons (including host communities), withparticular attention paid to the needs of the poor and the vulnerable.
3. Consider alternative project design	Explore viable alternative project designs to avoid and/or minimize involuntary resettlement.	Multiple alternative proposals must be examined to avoid or minimize involuntary resettlement and physical, or economic displacement and to choose a better project option while balancing environmental social and financial costs and benefits.
4. Involve and consult with stakeholders	Carry out meaningful consultations with affected persons, host communities, and concerned non-government organizations. Inform all displaced persons of their entitlements and resettlement options. Ensure their participation in planning, implementation and M&E of resettlement programs. Pay particular attention to the needs of the vulnerable groups, especially those below poverty line, the landless, the elderly, women and children and Indigenous people, and those without title to land, and ensure their participation in consultations. Establish a grievance redress mechanism to receive and facilitate resolution of the APs concerns. Support the social and cultural institutions of displaced persons and their host population.	Consult project-affected persons, host communities and local nongovernmental organizations, as appropriate. Provide them opportunities to participate in the planning, implementation, and monitoring of the resettlement program, especially in the process of developing and implementing the procedures for determining eligibility for compensation benefits and development assistance (as documented in a resettlement plan), and for establishing appropriate and accessible grievance mechanisms. Pay particular attention to the needs of vulnerable groups among those displaced, especially those below the poverty line, the landless, the elderly, women and children, Indigenous Peoples, ethnic minorities, or other displaced persons who may not be protected through national land compensation legislation.
5. Disclose and inform APs of RP and mitigation measures	Disclose the resettlement plan and other relevant information in a form and	Disclose the resettlement plan including documentation of the consultation process, in a form and language(s)

Aspect	ADB SPS 2009	Harmonized Policy
	language(s) accessible to key stakeholders, civil society, particularly affected groups and the general public.	accessible to key stakeholders, civil society, particularly affected groups and the general public in an accessible place for a reasonable minimum period.
6. Support existing social and cultural institutions of the affected persons	Ensure that the existing social and cultural institutions are supported and used to the extent possible, including legal, policy and institutional framework of the country to the extent that the intent and spirit of the IR policy is maintained.	Ensure that the existing social and cultural institutions of the resettlers and any host communities are supported and used to the extent possible, including legal, policy and institutional framework of the country to the extent that the intent and spirit of the IR policy is maintained.
		Projects must be adequately coordinated so that they are accepted in manner that is socially appropriate to the country and locality in which the Project is planned.
		The SEA should include an assessment of compliance with applicable host country laws, regulations, and permits, and relevant social and environmental impacts and risks of the project.
7. Build capacity of the borrower(s) in IR implementation	Assist in building capacity of DMCs on best practice on involuntary resettlement planning and implementation	Assist in building capacity of DMCs on best practice on involuntary resettlement planning and implementation.
		Financing of technical assistance to strengthen the capacities of agencies responsible for resettlement, or of affected people to participate more effectively in resettlement operations.
Project Processing Benchmark		
Screening	Every development intervention will be screened, as early as possible in the project cycle, to identify the people who may be beneficially and adversely affected, and to determine the scope of a social assessment to assess those affects and impacts.	Every development intervention will be screened, as early as possible in the project cycle, to identify the people who may be beneficially and adversely affected, and to determine the scope of a social assessment to assess those affects and impacts.
Categorization	The ADB IR requirements apply to full or partial, permanent or temporary physical displacement (relocation, loss of residential land, or loss of shelter) and economic displacement (loss of land, assets access to	Categorize impacts by “significance” and define the scale of impacts - both direct and indirect - with particular attention to economic and livelihood impacts.
		Plan mitigations for all types of losses in the RP

Aspect	ADB SPS 2009	Harmonized Policy
	assets, income sources, or means of livelihoods) resulting from (i) involuntary restrictions on land use or on access to legally designated parks and protected areas.	
Social Assessment	The borrower/client will conduct socioeconomic surveys and a census, with appropriate socioeconomic baseline data to identify all persons who will be displaced by the project and to assess the project's socioeconomic impacts on them. As part of the social impact assessment, the borrower will identify individuals and groups who may be differentially or disproportionately affected by the project because of their disadvantaged or vulnerable status.	Social Assessment be conducted as early as possible, and will specifically consider any impacts upon particularly poor and vulnerable Affected Persons.
Resettlement Plan	The borrower will prepare a resettlement plan, if the proposed project, will have involuntary resettlement impacts. The objective of the Resettlement plans will elaborate on displaced persons entitlements, the income and livelihood restoration strategy, institutional arrangements, monitoring & reporting framework, budget and a time-bound implementation schedule.	For all interventions that involve resettlement or physical or economic displacement, a resettlement plan will be prepared which will establish the entitlements of all categories of affected persons (including host communities), with particular attention paid to the needs of the poor and the vulnerable. The RP will lay down appropriate time-bound actions and budgets, and the full costs of resettlement, compensation, and rehabilitation will be included in the presentation of the costs and benefits of the development intervention.
Supervision		Regular supervision on resettlement implementation to determine compliance with the resettlement instrument.
Monitoring	The borrower will monitor and measure the progress of implementation of the resettlement plan. For projects with significant involuntary resettlement impacts, the borrower will retain qualified and	The borrower is responsible for adequate monitoring & evaluation of the activities set forth in the resettlement instrument.
		It is desirable that the project proponents monitor: (i) whether any situations that were unforeseeable before the project began have arisen; (ii)

Aspect	ADB SPS 2009	Harmonized Policy
	experienced external experts or qualified NGOs to verify the borrowers monitoring information. The borrower will prepare semiannual monitoring reports that describe the progress of the implementation of the resettlement activities and any compliance issues and corrective actions.	the implementation situation and the effectiveness of the mitigation measures prepared in advance, and that they then take appropriate measures based on the results of such monitoring (iii) involve external experts for resettlement monitoring (iv) monitoring reports must be made public and additional steps to be taken, if required.
Evaluation		Mid-term evaluation to assess performance of RP implementation Assess whether the objectives of the resettlement instrument have been achieved, upon completion of the project, taking account of the baseline conditions and the results of resettlement monitoring.

APPENDIX C

GAPS AND GAP FILLING MEASURES TO COMPLY WITH ADB'S SAFEGUARD POLICIES

Aspect	Harmonized Policy	GOB 1982 Ordinance II and other applicable laws/Guidelines/update of 2017	Gaps between Harmonized Policy and GOB	Safeguard Measures Adopted in the Project
Objectives				
1. Avoid involuntary resettlement	Avoid involuntary resettlement and adverse impacts on people and communities, wherever feasible.	Avoidance of resettlement is not specifically mentioned in the 1982 Ordinance - focus on mitigation than avoidance.	Gaps with regard to this principle to avoid resettlement impact thru alternative options.	RF adheres to this principle - i.e., avoid resettlement impacts where feasible
2. Minimize involuntary resettlement	If displacement is unavoidable, minimize involuntary resettlement by - exploring alternative project designs; effective measures to minimize impact in consultation with the people who are affected.	The law only implicitly discourages unnecessary and excess land acquisition, as excess land remains idle and unused and lands acquired for one purpose cannot be used for a different purpose. Land that remains unused should be returned to the original owner(s).	Section 3/under 1982 Ordinance requires notification only; no consultation is required	Minimize displacement of people as much as possible by exploring all viable design alternatives. If unavoidable, provide for prompt payment of just compensation, replacement cost3 (for lost assets and income) and rehabilitation and livelihood assistance, towards better condition than before relocation for all displaced households, regardless of (land) tenure. Unused land be returned back to the original owners through de-acquisition.

[3] The costs of replacing lost assets (e.g., land, houses/structures, trees and crops) and income, including cost of

transaction, equivalent to ADB's SPS definition of replacement cost

Aspect	Harmonized Policy	GOB 1982 Ordinance II and other applicable laws/Guidelines/update of 2017	Gaps between Harmonized Policy and GOB	Safeguard Measures Adopted in the Project
3. Mitigate adverse social impacts	Where IR is unavoidable, effective measures to mitigate adverse social and economic impacts on affected persons by: (a) providing compensation for loss of assets at replacement value (RV4); (b) ensuring that resettlement activities are implemented with appropriate disclosure of information, consultation, and the informed participation of those affected improve or at least restore the livelihoods and standards of living of displaced persons, and improve living conditions among displaced persons through provision of adequate housing with security of tenure at resettlement sites.	The mitigation measures are cash compensation only for lost assets. The complexities of resettlement is not addressed by the Ordinance	Only cash-based compensation for acquired assets. The impacts of loss of land, houses and the need for resettlement are not considered.	Provision for replacement cost (RC) for assets lost (i.e., land, structures, trees etc.) at replacement cost. Resettlement in project sponsored sites with civic amenities. Separate Livelihood and Income Restoration Plan RPs to be disclosed to the community and available in Bangla. The "good practices" are derived from the Jamuna Bridge and JMREMP resettlement "models."
Core Principles				

[4] The costs of replacing lost assets (e.g., land, houses/structures, trees and crops) and income, including cost of transaction, equivalent to ADB's SPS definition of replacement cost

Aspect	Harmonized Policy	GOB 1982 Ordinance II and other applicable laws/Guidelines/update of 2017	Gaps between Harmonized Policy and GOB	Safeguard Measures Adopted in the Project
1. Identify, assess and address the potential social and economic impacts	Assess at an early stage of the project cycle the potential social and economic impacts caused by involuntarily taking of land (e.g. relocation or loss of shelter, loss of assets or access to assets, loss of income sources or means of livelihood	The 1982 Ordinance requires preparation of a Land Acquisition Plan (LAP) for land acquisition and compensation purposes. However GOB environmental rules/guidelines (1997) synchronize various applicable laws and policy frameworks of the country for early identification of impacts on biophysical, Socioeconomic and cultural environment of a project intervention and their mitigation. Requires the assessment of technical alternatives, including the no action alternative to minimize adverse environmental impacts, include impact on human health and safety. EIA identifies measures to minimize the problems and recommends ways to improve the project's sustainability.	Impact assessments are typically done in the case of externally funded projects; otherwise, a land acquisition plan is prepared for acquisition purposes. Project impacts on properties, livelihoods and employment, health and environment are discussed in IEE/EIA reports, but do not provide enough information to determine losses and basis for compensation. Existing laws do not have provision for identification of indigenous people to recognize their particular problem and inconveniences due to a project.	RF requires identification of impacts caused by displacement whether or not through land acquisition (maintaining the principle that lack of formal title to land should not be a bar to compensation and resettlement assistance), including number of affected persons. The Framework also addresses both direct and indirect impacts.

Aspect	Harmonized Policy	GOB 1982 Ordinance II and other applicable laws/Guidelines/update of 2017	Gaps between Harmonized Policy and GOB	Safeguard Measures Adopted in the Project
2. Prepare mitigation plans for affected persons	Preparation of Resettlement Plan or Resettlement Framework (RF) during Project processing to mitigate the negative impacts of displacement. The plan will provide estimate of the extent of total population affected and establish entitlements of all categories of affected persons (including host communities), with particular attention paid to the needs of the poor and the vulnerable.	The Deputy Commissioners (DCs) have the mandate in their respective jurisdiction as per law to acquire land for any requiring person (public agency or private person). The requiring body requests the Deputy Commissioners for acquisition of land for their project/scheme. DCs investigate physically the requirement of land and carry out Joint Verifications of assets and type of land for assessing the quantity of losses (u/s 8(1) of the law). Affected titled holders receive the assessed value and 200% on that for compulsory land acquisition.	Existing law and methods of assessment do not ensure full replacement cost (RC5) of property at current market price. The law does not consider resettlement or rehabilitation of affected persons or their loss of income or livelihood resources. "Market Value" of property is often found low in respect of current market price, it can be raised, if appealed, by a maximum of 10 percent each time which in most case is not sufficient to match with real	RF requires full census and/or updating, where possible, for up-to-date database. RPs will be developed on the updated survey data Provide guidelines to ensure displaced persons and communities' compensation for lost assets at full replacement costs and other assistance to help them improve or at least restore their standard of living at pre-project level. Includes special attention to gender and preparation of gender action plan.

[5] The costs of replacing lost assets (e.g., land, houses/structures, trees and crops) and income, including cost of transaction.

Aspect	Harmonized Policy	GOB 1982 Ordinance II and other applicable laws/Guidelines/update of 2017	Gaps between Harmonized Policy and GOB	Safeguard Measures Adopted in the Project
		Fair compensation is required for acquisition of land which is dependent on recorded data with relevant government agencies (sub registrar's office for land, PWD for structure, DAE for crops, DOF for trees Etc.). Affected owners have the right to appeal on acquisition or on the compensation amounts determined as per law.	market price.	
3. Consider alternative project design	Multiple alternative proposals must be examined to avoid or minimize involuntary resettlement and physical, or economic displacement and to choose a better project option while balancing environmental social and financial costs and benefits.	Feasibility studies including social, political, cultural and environmental impact assessments, detailed engineering surveys as basis for acquisition of private property or rights.	No specific laws for considering project design to avoid or minimize involuntary resettlement. Feasibility study considers cost benefit more from technical than sociocultural considerations.	RF considers feasible alternative project design to avoid or at least minimize physical or economic displacement, while balancing environmental, social, technical and financial costs and benefits.

Aspect	Harmonized Policy	GOB 1982 Ordinance II and other applicable laws/Guidelines/update of 2017	Gaps between Harmonized Policy and GOB	Safeguard Measures Adopted in the Project
4. Involve and consult with stakeholders	Consult project affected persons, host communities and local nongovernmental organizations, as appropriate. Provide them opportunities to participate in the planning, implementation, and monitoring of the	The 1982 Ordinance have provisions (Section 3 and 3/2) to notify the owners of property to be acquired. Any party having any objections can appear to DC for a hearing with 15 days of notification.	There is no provision in the law for consulting the stakeholders but the land allocation committees at district, division and central government level. People have limited scope to negotiate with the	RF has provisions for community consultation and public disclosure of impacts as well as mitigation measures, including disclosure of Resettlement Plan. Further, grievances redressal procedures involving crosssection of people, including representative of
	developing and implementing the procedures for determining eligibility for compensation benefits and development assistance (as documented in a resettlement plan), and for establishing appropriate and accessible grievance mechanisms. Pay particular attention to the needs of vulnerable groups among those displaces, especially those below the poverty line, the landless, the elderly, women and children, Indigenous Peoples,		land, but have no right to refuse acquisition.	established for accountability and democratization of the development process.

Aspect	Harmonized Policy	GOB 1982 Ordinance II and other applicable laws/Guidelines/update of 2017	Gaps between Harmonized Policy and GOB	Safeguard Measures Adopted in the Project
5. Disclose and inform APs of RP and Mitigation measures	Disclose the resettlement plan including documentation of the consultation process, in a form and language(s) accessible to key stakeholders, civil society, particularly affected groups and the general public in an accessible place for a reasonable minimum period.	The 1982 Ordinance requires a "notice" to be published at convenient places on or near the property in a prescribed form and manner stating that the property is proposed to be acquired (u/section 3).	Disclosure takes place in case of donor-funded projects.	RF requires disclosure of Draft RPs to the affected communities in a form or language(s) that are understandable to key stakeholders, civil society, particularly affected groups and the general public in a national workshop. Further, updated RPs will be disclosed based on material changes as a result of the concerns of affected families.

Aspect	Harmonized Policy	GOB 1982 Ordinance II and other applicable laws/Guidelines/update of 2017	Gaps between Harmonized Policy and GOB	Safeguard Measures Adopted in the Project
6. Support existing social and cultural institutions of the affected persons	Ensure that the existing social and cultural institutions of the resettlers and any host communities are supported and used to the extent possible, including legal, policy and institutional framework of the country to the extent that the intent and spirit of the IR policy is maintained. Projects must be adequately coordinated so that they are accepted in manner that is socially appropriate to the country and locality in which the Project is planned. The SEA should include an assessment of compliance with applicable host country laws, regulations, and permits, and relevant social and environmental impacts and risks of		No provision in any existing laws.	The Jamuna Bridge and the follow-up JMREMP established this as "good practice" in resettlement operations. Affected households were given options for relocation in accordance with their choices and support available from existing social networks. Host-resettlers' relation was enhanced by providing civic amenities and infrastructure services to the host villages. The RF has similar provisions to enhance carrying capacity of the host villages in post relocation period.
Supervision	For all interventions that involve resettlement or physical or economic displacement, a resettlement plan will be prepared. The RP	No provision in the 1982 Ordinance.	There is no law or directives on the supervision of the land acquisition process by Deputy Commissioner.	Resettlement supervision in the Project will follow the Jamuna and JMREMP models with ADB's periodic "milestone" meeting, supervision by

Aspect	Harmonized Policy	GOB 1982 Ordinance II and other applicable laws/Guidelines/update of 2017	Gaps between Harmonized Policy and GOB	Safeguard Measures Adopted in the Project
	bound actions and budgets, and the full costs of resettlement, compensation, and rehabilitation will be included in the presentation of the costs and benefits of the development intervention.			specialist, midterm review of resettlement performance and regular supervision of resettlement operations by the Resettlement Unit of BWDB.
Monitoring	Regular supervision on resettlement implementation to determine compliance with the resettlement instrument.	The 1982 Ordinance II has provision that the DC will monitor and submit a statement to the Government annually about the properties acquired for different requiring bodies and mode of utilization of the land.	Existing laws not have any provision for rehabilitation of project affected persons and therefore, no monitoring is done.	RF has provision for internal, external monitoring, plus periodic monitoring by a POE to be hired by ADB's fund. Monitoring results will be shared and findings will be used for enhancement, if needed.

Aspect	Harmonized Policy	GOB 1982 Ordinance II and other applicable laws/Guidelines/update of 2017	Gaps between Harmonized Policy and GOB	Safeguard Measures Adopted in the Project
Evaluation	The borrower is responsible for adequate monitoring & evaluation of the activities set forth in the resettlement instrument. It is desirable that the project proponents monitor: whether any situations that were unforeseeable before the project began have arisen; the implementation situation and the effectiveness of the mitigation measures prepared in advance, and that they then take appropriate measures based on the results of such monitoring involve external experts for resettlement	No provision for evaluations of the post-displaced lives of the affected households and communities		CSC Safeguard Specialist will conduct annual evaluation of the performance of resettlement operations as well as impacts of resettlement during and after implementation of resettlement plans to assess resettlement efficiency, effectiveness, impacts, and sustainability. POE will also conduct evaluations to reflect broadly on the success or weaknesses in RP implementation and "lessons learned."
	monitoring (iv) Monitoring reports must be made public and additional steps to be taken, if required.			

APPENDIX D

PROJECT ENTITLEMENT MATRIX

The entitlement matrix describes major types of losses attached to land acquisition and resettlement. The Project will assist the APs in clustered relocations with community facilities or, alternatively, in self-relocation. APs may be relocated to BWDB land (if available) or to plots purchased (by the APs) for which assistance is provided in the form of homestead land development. In addition to the CCL, Resettlement Benefits as per the entitlement matrix will be provided to the APs.

General Implementation Issues and application Guidelines
PVAT BWDB will setup a Property Valuation Advisory Team (PVAT) at the BWDB Division level. The tasks of this PVAT are: Recommend Resettlement Cost (RC) based on Current Market price (CMP) analysis for Land, Structures, Trees and standing Crops CMP will be assessed for every affected mauza In case of Land averaging (i) minimum approved price of land available at respective Sub-registrars' offices, (ii) reported price, and (iii) transacted price of land at those *mouzas* (CMP should not be less than minimum approved price of land). RC will be obtained by adding the titling cost prorated on the CMP thus obtained (RC=CMP+CMPxa%, where 'a' is the rate of applicable registration cost for purchasing the land for CMP equivalent amount of money). For all private land, the market price will be enhanced by 200% as per amendment of law in 2017 for compensation under law (CCL). For *khas* land (DC is the owner at respective districts on behalf of the government), CCL will be the assessed market price without enhancement. RC for structure considering the cost of materials, labor inputs and land development cost at current market rates. RC will be approved by the Project Director. INGO BWDB will engage a NGO to support implementation of resettlement plan i.e. to support the implementation of all land acquisition and resettlement activities. The NGO (INGO) will Identify all persons who have interest in the lands that will be acquired under the project (owner, tenants, operators etc.; identify all informal occupier/ settler on the right of way of new embankment, rehabilitation embankment and RBP works;

Make the landowners / tenant/ informal occupier aware about details of land acquisition process, compensation entitlement, payment procedure/ mechanism, resettlement benefit offered by the project.

Legal owners will be assisted by INGO to organize legal documents in support of their ownership

INGO will identify loss and entitlement of female owners and co-sharers through share determination at the field upon receipt of payment data from the DC office

The INGO will inform the APs of the details of the land acquisition and compensation process, resettlement package and payment procedure.

The INGO shall encourage Entitled Persons (EPs) to consider purchasing land or investing the money in productive/income generating activities.

JVT

The loss inventory items and quantities as well as the Entitled Persons (EP) shall be verified in the field through Joint Verification Team (JVT) formed by BWDB. The members of PVAT will attend field verification by JVT;

The JVT will verify the socially recognized User as identified by the Census

BWDB field office (Executive Engineer) will do Title updating for usufruct and other rights before issuance of notice with assistance from INGO

DC will pay CCL for the Loss Items. If RC is higher than CCL, the difference will be paid by BWDB with assistance from INGO

Compensation for Structures:

Joint Verification (DC and BWDB) and/or Census will identify (record floor areas and category) of structure

Compensation must be paid before AP dismantle and remove the structures as per civil works requirement

The date of service of notice will be recognized as the cut-off date for structures not recognized by DC. In case of major differences identified between databases, BWDB will verify the data through the Joint Verification Team (JVT)

The owner is allowed to take all salvageable material

Unit of Entitlement	Entitlements	Applicable Law	Additional Services
Loss Item 1: LOSS OF AGRICULTURAL LAND			
Legal owner(s) as identified by DeputyCommissioner (DC) in the process of CCL payment.	1. Replacement Cost (RC[6]) of agricultural land.	ADB SPS 2009 or later version when available LA Act 1982 Sec 8(1)(a), Sec 8(2) LA Rules 1982 LA Act 2017	
Special Implementation Issues and application Guidelines: In Case of any conflict between Government Act/Rules & SPS 2009, later will prevail.			

Loss Item 2: LOSS OF HOMESTEAD, COMMERCIAL, INDUSTRIAL LAND AND COMMON PROPERTY RESOURCES			
Legal owner(s) as identified by DC in the process of CCL payment.	RC of land. A plot in the residential or commercial area of the resettlement village (RV), if required, for the homestead or commercial land losers respectively.	ADB SPS 2009 or later version when available LA Act 1982 Sec 8(1)(a), Sec 8(2) LA Rules 1982 LA Act 2017	1. RVs for the APs of entitled land-owners will be developed on privately-owned purchased land(s) inside the embankment in close proximity to AH population. 2. BWDB will assist purchase of above land(s) jointly with INGO on negotiated price and homestead land development (earth filling, if needed.) with internal

Unit of Entitlement	Entitlements	Applicable Law	Additional Services
Special Implementation Issues and application Guidelines: In Case of any conflict between Government Act/Rules & SPS 2009, later will prevail.			
Loss Item 3: LOSS OF WATER BODIES (PONDS, BOTH CULTIVATED AND NON-CULTIVATED)			
Legal owner(s) as	1. RC of the water body (private land).	LA Act 1982	

[6] The costs of replacing lost assets (e.g., land, houses/structures, trees and crops) and income, including cost of transaction

identified by DC in the process of CCL payment.		ADB SPS 2009 or later version when available LA Act 1982 Sec 8(1)(a), Sec 8(2) LA Rules 1982 LA Act 2017	
Special Implementation Issues and application Guidelines: In Case of any conflict between Government Act/Rules & SPS 2009, later will prevail.			

Loss Item 4: LOSS OF RESIDENTIAL STRUCTURES WITH TITLE TO LAND			
Legal owner(s) as identified by DC in the process of CCL payment.	1. RC of residential structure Transfer Grant @ Tk. 10 per sft of affected structure but not exceeding Tk. 3,000. Reconstruction and Homestead Development Grant (RHDG) of Tk. 8,000.	ADB SPS 2009 or later version when available LA Act1982 Sec 8(1)(d) Sec 8(2) LA Rules 1982 LA Act 2017	Assistance in relocation and reconstruction.
Special Implementation Issues and application Guidelines: In Case of any conflict between Government Act/Rules & SPS 2009, later will prevail.			

Loss Item 5: LOSS OF COMMERCIAL/INDUSTRIAL/COMMON RESOURCE PROPERTY (CPR) STRUCTURES WITH TITLE TO LAND			
Legal owners as identified by DC in the process of CCL payment.	RC of commercial, industrial, CPR structure Transfer Grant @ Tk. 10 per sft of affected structure but not exceeding Tk. 3,000. Reconstruction Grant of Tk.10,000.	ADB SPS 2009 or later version when available LA Act1982 Sec 8(1)(d) Sec 8(2) LA Rules 1982 LA Act 2017	Assistance in relocation and reconstruction.

Special Implementation Issues and application Guidelines: In Case of any conflict between Government Act/Rules & SPS 2009, later will prevail.

Loss Item 6: LOSS OF RESIDENTIAL AND OTHER PHYSICAL STRUCTURES (WITHOUT TITLE TO LAND)			
Socially recognized owners of structures built on the ROW	RC of structure Transfer Grant @ Tk. 15 (fifteen) per sft of affected structure Reconstruction and Homestead Development Grant (RHDG) of Tk.8,000 or @ Tk. 20 per sft plus a provisional option of obtaining a free land, if available, from BWDB in an RV on the ROW with community facilities.	ADB SPS 2009 or later version when available LA Act1982 Sec 8(1)(d) Sec 8(2) LA Rules 1982 LA Act 2017	
Special Implementation Issues and application Guidelines:None In Case of any conflict between Government Act/Rules & SPS 2009, later will prevail.			
1. The 1. The homestead losers will produce documentary evidence and the BWDB through JVT will cross verify the landlessness of the homestead losers for allocation of an RV plot for free. 2. The RP-INGO will assist the APs to move to clustered relocations (resettlement villages) with community facilities or, alternatively, in self-relocation. The APs may be relocated to BWDB land (if available) or plots purchased (by the APs) for which assistance will be provided in the form of homestead land development.			

Loss Item 7: LOSS OF TIMBER AND FRUIT BEARING TREES, BAMBOO AND BANANA GROVES			
Legal owner(s) as identified by the DC in the process of CCL payment. Socially recognized owners of trees grown on public or other land	Timber trees and bamboo: RC of trees and bamboo. Fruit-bearing trees without timber: if the tree is at or near fruit-bearing stage, the estimated current market value of the fruit. Fruit-bearing trees with timber: RC for the timber, and estimated current market value of fruit. Banana groves: RC of all trees	ADB SPS 2009 or later version when available LA Act1982 Sec 8(1)(d) Sec 8(2) LA Rules 1982 As per 21 No. Law of 2017: additional 100% cost	INGO to explain RP policies regarding compensation for the trees of different categories and size and make the EPs aware that they could take the timber and fruits free of cost.
Special Implementation Issues and application Guidelines: In Case of any conflict between Government Act/Rules & SPS 2009, later will prevail.			
The INGO will provide guidance in plantation and post-plantation care.			

Loss Item 8: LOSS OF STANDING CROPS/FISH STOCK			
1. Legal owners identified by the DC in progress of CCL payment 2. Socially recognized owners	1. RC of standing crops/fish stock 2. Owners will be allowed to harvest crops and fish stock.	ADB SPS 2009 or later version when available LA Act1982 Sec 8(1)(d) Sec 8(2) LA Rules 1982 LA Act 2017	INGO will assist APs in the process of claiming compensation from DC offices for organizing necessary documents.
Special Implementation Issues and application Guidelines: None : In Case of any conflict between Government Act/Rules & SPS 2009, later will prevail.			

Loss Item 9: LOSS OF LEASED /MORTGAGED IN LAND/PONDS			
1. Leaseholder with legal papers. 2. Socially recognized lessee or sharecropper, in case of customary informal tenancy arrangements, including socially recognized agreements.	1. RC of crops/fish stock. 2. Outstanding lease money back to the lessee by the owner as per agreement.		1. INGO will assist in ensuring that the lessee receives all eligible payments. 2. INGO will mediate refund of outstanding lease money by the owner to the lessees

Special Implementation Issues and application Guidelines:
1. With legal agreement: legal owner and mortgagee/leaseholder will be paid CCL by DC in accordance by the law 2. With customary tenancy agreements, including socially-recognized verbal agreements: Legal owner will receive CCL from DC. The legal owner will pay the outstanding liabilities to the lessee/mortgagee. Under the following conditions: (i) all contractual liabilities are already paid up; (ii) if not, the legal owner will get the residual payment after all liabilities are paid up. 3. BWDB will ensure RC of crops to the cultivator with direct payment of the difference, if CCL is less than RC, with assistance from INGO. 4. Dislocation Allowance will be paid to the actual cultivator of the acquired land by BWDB with assistance from INGO.

Loss Item 10: LOSS OF INCOME FROM DISPLACED COMMERCIAL/ INDUSTRIAL PREMISES (OWNER OPERATED)			
Any proprietor or businessman or artisan operating in premises	One time Moving Assistance of Tk. 5,000 for tenants 2. Business restoration grant will be an equivalent to 3 months lost income against owners name recorded during the survey 3. Employment in the Project construction work, if possible 4. Option to purchase a plot in the RV, with the assistance of the INGO	ADB SPS 2009 or later version when available LA Act1982 Sec 8(1)(d) Sec 8(2) LA Rules 1982 LA Act 2017	EPs will be brought under income and livelihood regenerating program (ILRP).
Special Implementation Issues and application Guidelines:			
1. All the business operators will be entitled for grant against loss of The onetime moving assistance will be provided to only the tenants.			

Loss Item 11: TEMPORARY LOSS OF INCOME (WAGE EARNERS IN AGRICULTURE, COMMERCE & SMALL BUSINESS AND INDUSTRY)			
Regular wage earners affected by the acquisition.	1. Grant to cover loss of employees /regular wage earners @ TK 400X 90 days per person Tk. 5000 per affected household (AH) 3. Tk. 7000 for AH headed by Women 4. Employment in the Project construction work, if possible		1. EPs will be brought under the ILRP.

	or 5. Poor Female HH will be paid a one time grant of TK 5000 as special assistance EPs to be included in the ILRP		
Special Implementation Issues and application Guidelines:			
EP must have been an employee of landowner or business located in the acquired lands for at least twelve months, as identified by Joint Verification and/or a contracted institution or a consulting company's census			

Loss Item 12: LOSS OF INCOME FROM RENTED -OUT AND ACCESS TO RENTED-IN RESIDENTIAL/ COMMERCIAL PREMISES			
1. Owner of the rented-out premises 2. AH/person rentedin any such structur	Dislocation Allowance of Tk. 8000 for each unit of premises to both the renter and the rentees.	ADB SPS 2009 or later version when available LA Act 1982 Sec 8(1) (a) & Sec 8(2) LA Rules 1982 LA Act 2017	EPs will be brought under the ILRP.
Special Implementation Issues and application Guidelines: In Case of any conflict between Government Act/Rules & SPS 2009, later will prevail.			

Loss Item 13: ADVERSE IMPACT ON HOST POPULATION DUE TO RELOCATION OF APs			
Households self-relocated to the host villages	Enhancement of carrying capacity of common civic amenities/utilities of the host communities as per assessment by BWDB.		Investment in the host area to improve health, education, and other public services. Forestation in the host area.
Special Implementation Issues and application Guidelines:			
Community needs for enhancement of common facilities in host areas will be assessed through a needs assessment survey.			

Loss Item 14: VULNERABLE AHs SPECIAL ASSISTANCE			
Vulnerable AH Assistance: Female-headed households, disabled, elderly, extremely poor and those losing more than 10% of their income to acquisition of land or business.	One-Time Special Assistance Grant of Tk.15,000 Skill training and credit support under ILRP		EPs will be brought under the ILRP.

Special Implementation Issues and application Guidelines:
1. Loss of income will be assessed as per actual loss of productive resources (land and businesses) to the project and the total income of the affected households from all sources through Census of all AHs. 2. JVT will verify the percentage of loss comparing the actual loss and the total income from all sources of the affected households. 3. Households turning into landless due to acquisition of agricultural land will be eligible for larger credit from the ILRP for longer duration.

Loss Item 15: LOSS OF SUBMERGED LAND (ERODED LAND)			
1. Legal owner(s) of land (DC's khas land after legally established AD Line). 2. Previous private owners of land below AD Line.	1. In absence of legally established AD line, all entitlements as provisioned for Loss Item 1. In case of khas land, CCL to respective DCs. RC of khas land to previous owner(s).	ADB SPS 2009 or later version when available LA Act 1982 Sec 8(1)(a), Sec 8(2) LA Rules 1982 LA Act 2017	
Special Implementation Issues and application Guidelines: In Case of any conflict between Government Act/Rules & SPS 2009, later will prevail.			

Loss Item 16: UNFORESEEN ADVERSE IMPACTS			
Households/persons affected by any unforeseen impact identified during RP implementation	Entitlements will be determined as per the resettlement policy		As appropriate
Special Implementation Issues and application Guidelines:			
The unforeseen impacts and affected persons will be identified with due care as per policy framework and proposed to the MoWR and the ADB for approval including quantity of losses, their owners and the entitlements			

DEFINITIONS OF TERMS

Affected Persons (APs): Affected persons shall include (a) persons whose houses, land, structure, business, income/employment or productive assets are affected by the Project.

Household: A household includes all persons living and eating together (sharing the same kitchen and cooking food together as a single-family unit).

Entitled Person: An entitled person (EP) is one who has lost his/her assets or income directly/indirectly due to the Project intervention and is eligible to receive compensation from the DC office and/or cash grant from BWDB.

Structures - Houses and Commercial Enterprises: All structures affected by Project acquisition -living quarters, community infrastructures/roadside shops/businesses -- will be compensated for.

Assistance/Compensation: Compensation for lost assets refers to legal compensation provided through the Land Acquisition section of the Deputy Commissioner's office. Assistance refers to resettlement assistance extended in cash and/or kind over and above the compensation under law as per independent assessment of replacement price of land and physical assets concurred by a Property Valuation Advisory Team (PVAT).[7]

Relocation/Resettlement: Relocation refers to physically moving of the APs from the affected area to a new area/site and rebuilding homes, assets, including productive land/employment while resettlement means re-establishing income, livelihoods, living and social system.

Replacement Land: Those affected by the RoW alignment will receive alternative land, if available, or cash compensation at the replacement price. NGO will assess the market value of land to determine the Maximum Allowable Replacement Value (MARV) and be approved by PVAT.

Project Affected Communities/Host Villages:: Project-affected communities are local villages, markets or townships that may be affected by Project impacts such as loss/dislocation/capacity inadequacy of common property resources, school, mosques etc. Host communities are recipients where APs are to be relocated.

Vulnerable Households: For this Project, vulnerable groups are defined as APs who suffer more - economically and socially - from relocation than other affected population. Based on past experiences from similar projects, the vulnerable groups include (i) women-headed HHs; (ii) landless HHs (those without agricultural land, and depend largely on wage labor for survival); (iii) disabled HHs heads and (iv) HHs having residual agricultural land less than 1 acre or losing more than 10% of their income from agriculture due to acquisition.

Cut-Off Date. The Cut-Off Date is the date after which eligibility for Resettlement Benefits will not be considered. Because of the vagaries of river bank erosion, there are two Cut-Off Dates: *[Month/Day/Year] for Physical Losses* and *[Month/Day/Year] for Income Losses,* subject to verification and clearances as described below.

- *Physical Losses Cut-Off Date.* Because of the ongoing nature of Bank erosion, an *Inventory of Households and Assets between the Embankment and the Bankline* conducted in *[Month-Month, Year]* that indicated all HHs that might possibly be on the ROW by start of construction and so be considered for physical losses due to land acquisition. The Physical Losses Cut-Off Date of *[Month/Day/Year]* includes, therefore, only HHs having houses and establishment within the ROW at the beginning of physical works construction as identified by BWDB's Joint Verification Team (JVT).
- The *Inventory Survey* is subject to verification by the JVT and approval by BWDB, considering not only the original Inventory but the Socioeconomic Survey (SES) and JVT data collected just prior to civil works construction. In case of discrepancies, GRC will determine eligibility for individual HHs for Resettlement Benefits, such as: Replacement Cost (RC) of Structure; Salvaged Material; Transfer Grant; Reconstruction Grant; and Homestead Development Grant.
- *Income Losses Cut-Off Date.* Among the Resettlement Benefits to be given to APs are Subsistence Grants for Loss of Income. The Socioeconomic Surveys (SES) completed *Month/Day/Year]* serve as the Cut-Off Date for eligibility to receive the Income subsistence Grants for: Male And Female HH Heads; Small Business Enterprise (SBE) Proprietors and Employees; and for Tenants/Sharecroppers. As with the Inventory Survey data, the SES Cut-Off Date is subject to verification by BWDB's Inventory Joint Team (JVT) and approval by BWDB.
- *Land Acquisition* is not covered by these Cut-Off Dates. CCL will be paid by the DC as per GOB LA Law; and the RP-INGO, with BWDB approval, will provide Grants for *Replacement Value*[17]

[7] The PVAT will be composed of:i) Representative from BWDB - Convener (SDE/AE/Equivalent Officer); ii) Representative from concerned District (nominated person/Officer)- Member; iii) Sub Assistant Engineer From BWDB - Member Secretory, and iv) Member RP-INGO.

of Land and other properties established by the PVAT and according to the *Resettlement Entitlement Matrix* in Section 4 below.

RP Implementation Guidelines

Since BWDB does not have any set codified rules for payment of grants to the Entitled Persons (EPs) as resettlement of APs, a detailed RP implementation guideline (Payment Modality) will be required to implement the RP at the field level. Both the BWDB and the RP NGO will follow the payment modality after its approval from the Project Director (PD), FRERMIP.

Consultant's Report

Flood and Riverbank Erosion Risk Management Investment Program

A 2.2 DUE DILIGENCE REPORT

April 2019

Prepared by

Institutional Strengthening and Project Management Consultant (ISPMC)

Joint Venture of Northwest Hydraulic Consultants Ltd. and Euroconsult Mott MacDonald Ltd. in association with Deltares, Resource Planning and Management Consultants and CEGIS

TABLE OF CONTENTS

LIST OF TABLES

A 2.1 Updated Draft Resettlement Framework

LIST OF FIGURES

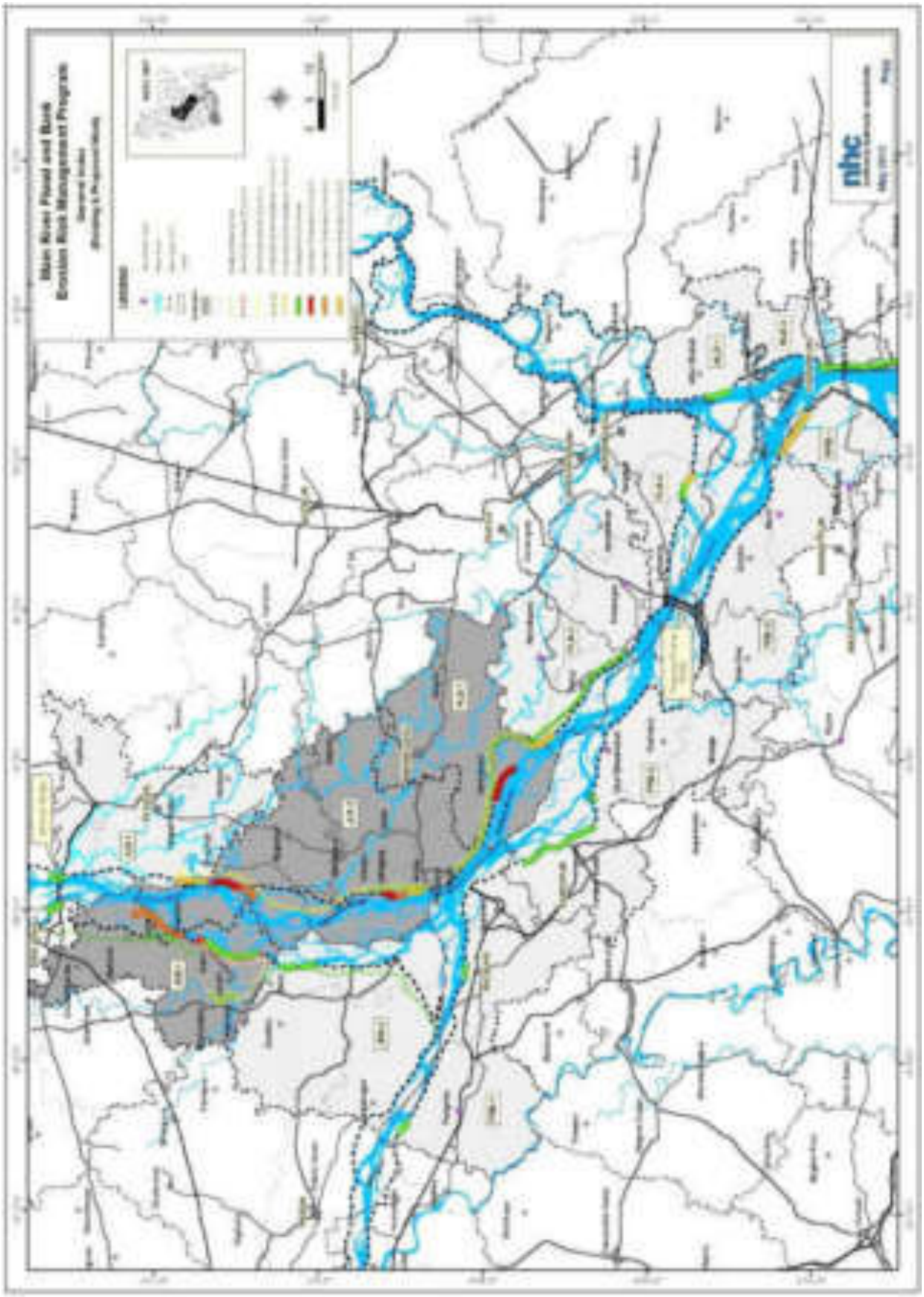
A 2.1 Updated Draft Resettlement Framework

ACRONYMS

AC	-	Assistant Commissioner
AE	-	Assistant Engineer
A&M	-	Adaptation and Maintenance
AD	-	Alluvial and Diluvial
ADB	-	Asian Development Bank
ADC	-	Additional Deputy Commissioner
ADP		Annual Development Plan (budgetary plan from 1st July to 30 June)
AH		Affected Household
AIFRERMIP		Assam Integrated Flood and Riverbank Erosion Risk Management Investment Project
AP	-	Affected Persons
BAN	-	Bangladesh
BDT	-	Taka (currency of Bangladesh)
BRE	-	Brahmaputra Right Embankment
BWDB	-	Bangladesh Water Development Board
CbFRM	-	Community-based Flood Risk Management
CCL	-	Cash Compensation under Law
CDMP	-	Comprehensive Disaster Management Program
CDMU	-	Community Disaster Management Unit
CDP	-	Capacity Development Plan
CEGIS	-	Centre for Environmental and Geographic Information Services
CPR	-	Common Property Resources
CMP		Current Market price
CRO-RU	-	Chief Resettlement Officer-Resettlement Unit
CSC	-	Construction Supervision Consultant
CSS	-	Census & Socio-Economic Survey
C/S	-	Country Side
DC	-	Deputy Commissioner
DD	-	Detailed Design (Team)
DD	-	Deputy Director
DDM	-	Department of Disaster Management
DPs	-	Displaced Persons same as AP/Affected Persons
DPP	-	Development Project Proforma
EA	-	Executing Agency
EARP	-	Environmental Assessment And Review Procedure.
EIA	-	Environmental Impact Assessment
EMB	-	Embankment
EMP	-	Environmental Management Plan
EP	-	Entitled Persons
FGD	-	Focus Group Discussions
FHH		Female Headed Households
FRERMIP		Flood and Riverbank Erosion Management Investment Program
FS	-	Feasibility Study
GAP	-	Gender Action Plan
GIS	-	Geographic Information System
GOB	-	Government of Bangladesh
GRC	-	Grievances Redress Committee
HRD	-	Human Resources Development
ID	-	Identity Card
IGA	-	Income generating Activities
ILRP	-	Income and Livelihood Restoration Program
INGO	-	Implementing NGO
IOL	-	Inventory of Losses
IR	-	Involuntary Resettlement

IWRM	-	Integrated Water Resources Management
JMREMP	-	Jamuna-Meghna River Erosion Mitigation Project
JLB	-	Jamuna Left Bank
JRB	-	Jamuna Right Bank
JVT	-	Joint Verification Team
LA	-	Land Acquisition
LAP	-	Land Acquisition Plan
LAR	-	Land Acquisition and Resettlement
LGI	-	Local Government Institutions
LGED	-	Local Government Engineering Department
M&E	-	Monitoring and Evaluation
MFF	-	Multi-tranche Financing Facility
MIS	-	Management Information System
MLB	-	Meghna Left Bank
MRB	-	Meghna Right Bank
MOWR	-	Ministry of Water Resources
MRP	-	Main River Flood and Bank Erosion Risk Management Program (ADB TA 8054-BAN)
NHC	-	Northwest Hydraulic Consultants Ltd.
NGO	-	Non-Government Organization
O&M	-	Operations and Maintenance
OE	-	Old Embankment
PCR	-	Physical Cultural Resources
PD	-	Project Director
PLB	-	Padma Left Bank
PMO	-	Project Management Office
POE	-	Panel of Experts
PPTA	-	Project Preparatory Technical Assistance
PRA	-	Participatory Rapid Appraisal

Currency unit	-	taka (Tk)
Tk1.00	=	$0.01199
$1.00	=	Tk 82.765



1 PROJECT BACKGROUND

The objective of the Flood and Riverbank Erosion Risk Management Investment Program (FRERMIP) is to mitigate riverbank erosion within the project area and guide the Jamuna from a braided planform towards a stable channel river. This is part of the greater River Stabilization Plan (RSP) to stabilize the entire Jamuna-Padma river system and recover about 150,000 ha of land from the river.

FRERMIP Tranche 2 focuses on the lower Jamuna river reach between the Jamuna Bridge and the Jamuna-Ganges confluence (Reach 3 in the RSP).

The work locations have been prioritized to address recent developments in the river and to maximize the river training as well as the bank protection impact of the works. The total Tranche 2 works include:

- Geobag revetments at two locations on both banks of the Jamuna about 15 km downstream of the Jamuna Bridge;
- A revetment and sill at Salura on the central char in the left channel; and
- A channel closure of the channel downstream of Chauhali at Solimabad.
- Construction of two embankments with fish passes in-land to reduce flood damages

To achieve a fully stabilized river, it is planned to extend the riverbank protection works in future during tranche 3.

2 ACTIVITIES PLANNED AND RESETTLEMENT IMPACTS

An overview of the areas and the activities planned under Tranche 2 are shown in the following Figure 2-1.

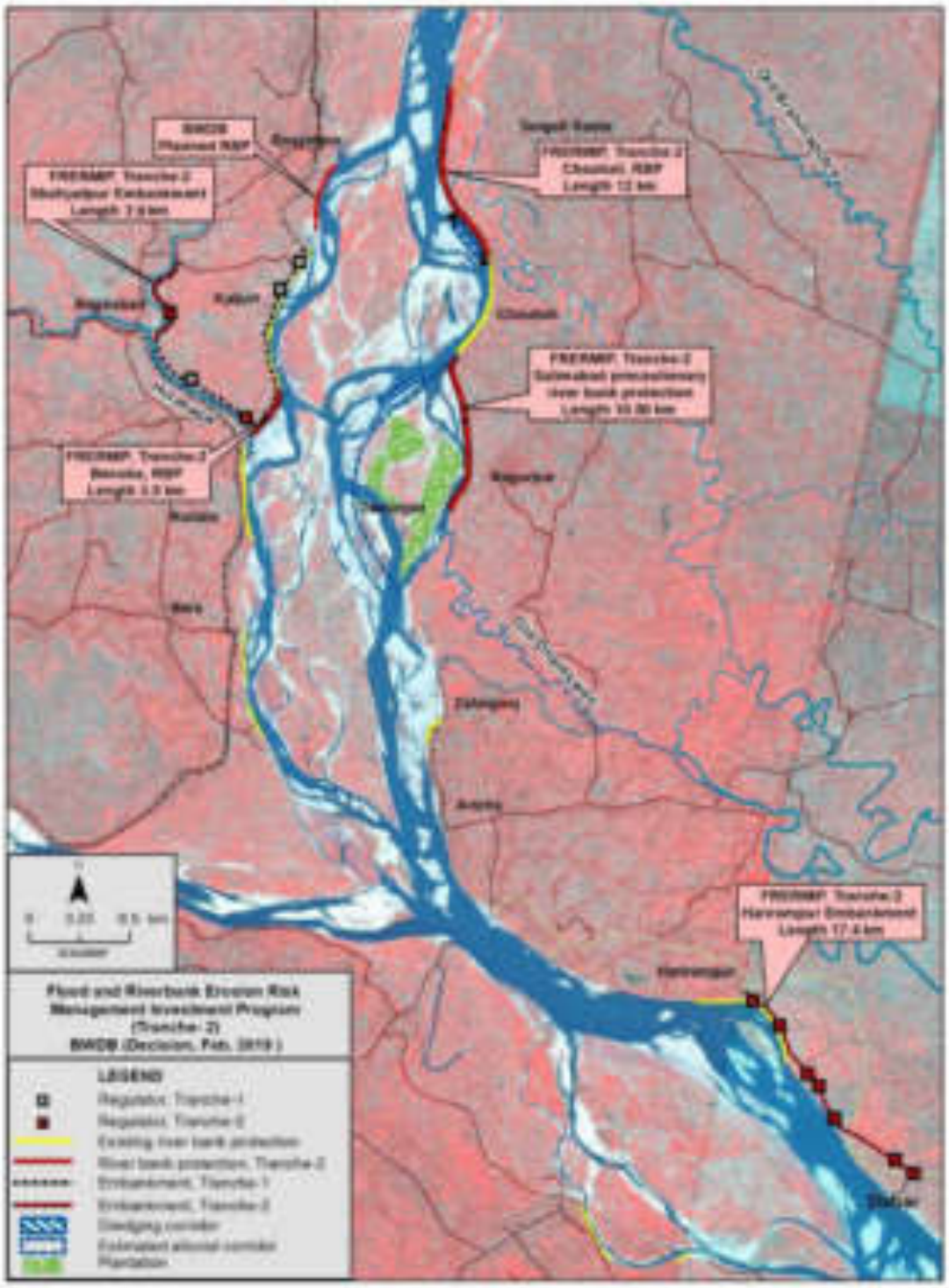


Figure 2-1 Location of works planned under Tranche 2

2.1 Embankment construction

For Tranche 2 two resettlement plans (RP) are prepared for the 2 embankments and presented separately in this Annex. The RPs are prepared based on the ADB Safeguard Policy Statement guidelines. The land required for building the embankments will be acquired in accordance with the Bangladesh Land Acqusition Act-updated in 2017 and the ADB SPS 2009. A revised Resettlement

Framework (RF) has been prepared in compliance with and agreed with specific entitlement matrix fulfilling the gap between the SPS-2009 and the Bangladesh Land Acquisition Act.

For the embankment subprojects in Harirampur and Shahjadpur, the land acquisition in hectares and the number of HH affected with structures are presented in two separate RPs as per ADB guidelines

2.2 Riverbank protection works (under water)

Besides the embankment construction there will be riverbank protection in different locations along the river to maximize the river training as well as to minimize further erosion. These locations have been identified initially although some changes are possible later due to erosion during the flood season. The locations for riverbank protection areas are shown in the figure 1 above.

These areas includes:

- RBP in Benotia for 3.5 km
- RBP in Chauhali for 12 km
- RBP in Salimabad for 10.5 km (precautionary)

Definition of the type of works to be implemented

The alignment of the planned protection follows the existing river bank, the location has been planned during 2018. The purpose of these protection works is to:

I) react to ongoing erosion, which in the case of Upstream Chauhali is triggered by the pilot capital dredging project,

II) prevent the formation of a cut-off channel from the Jamuna to the Dhaleswari at Upstream Chauhali,

III) prevent outflanking of the severely damaged Enayetpur spur,

IV) guide the river flow to form stable char at Salimabad and the Salura (Central) char,

V) guide the river flow towards the Chauhali bend, away from the Salura (Central) char.

Design Cross Section for RBP under Tranche 2

The Figure 2-2 shows the typical placement of 3 layers of 250kg geobags to protect the lower underwater slope and apron on the existing river bed and on an engineered slope down to a depth where the soil is sufficiently consolidated to allow launching of geobags without slope failure.

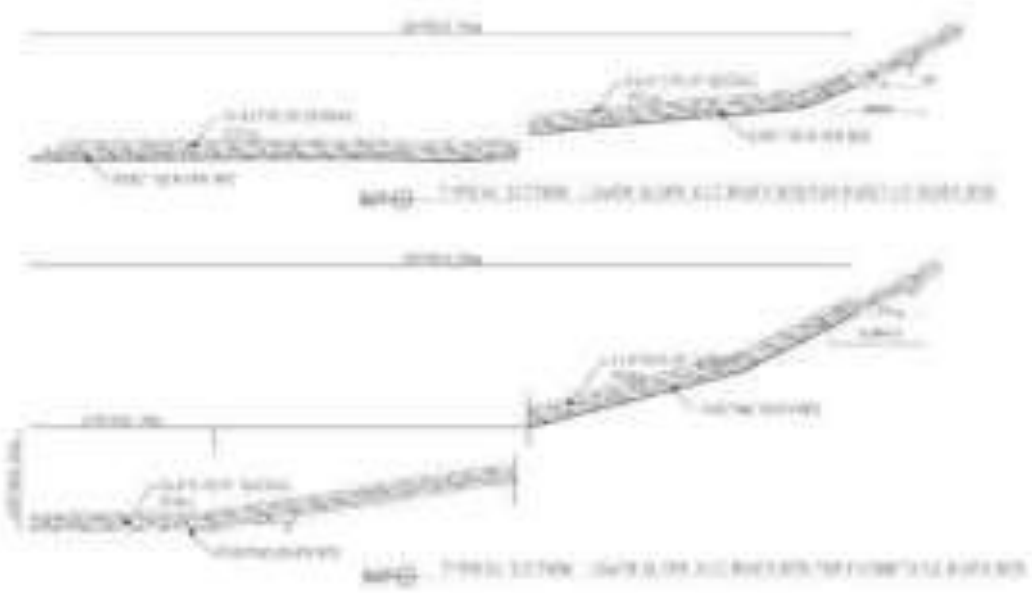


Figure 2-2 Typical cross section of the underwater slope and apron for normal (top) and deep (bottom) placements

The approach and justification of this process is explained further in the Annex 5.

2.3 Dredging and filling in Salimabad (river training)

The work to be undertaken in Salimabad area has as a first objective of reclaiming land and realign the river channel.

The work which is planned in the area is shown the Figure 2-3 below and shown that most of the works dredging and land deposit will take place within the river bed and in new char without any settlements

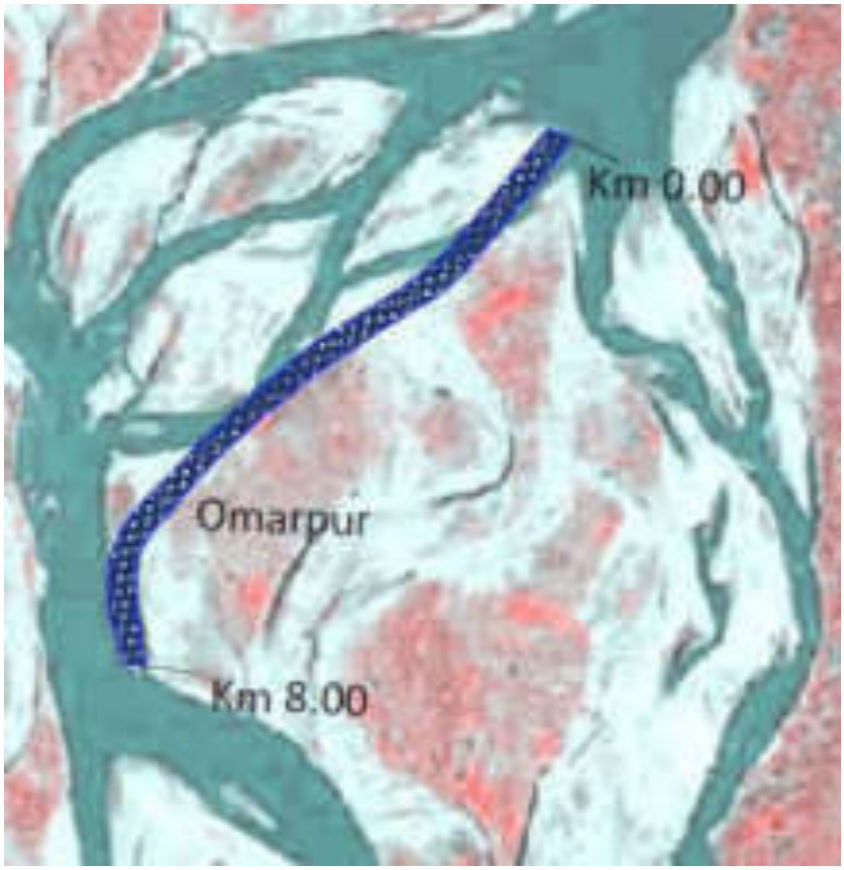


Figure 2-3 Location and works in Salimabad

Photos below to illustrate the areas within the river where the works for dredging and river training will take place.

Figure 2-4 Photos of the areas for dredging and river training

3 LAND ACQUISITION AND RESETTLEMENT IMPACTS FORSEEN IN TRANCHE 2

The land acquisition and resettlement negative impacts for people living along the river bank planned for protection will not happened during Tranche 2 as all the protection works will be to protect the lower area underwater slope and apron on the existing river bed and on an engineered slope down to a depth where the soil is sufficiently consolidated

Table 3-1 The resettlement impacts for RBP to be forseen for Tranche 2

Sl. No.	Location	Type of works	Length (km)	Area affected	Resettlement / land acquisition requirements
1	Chauhali RBP	Full protection	12 km	High land with settlement	Width of 15 meters from AD line inland; sufficient for constructed bank slope of 1V:3H
2	Benotia RBP	Full protection	3.5 km	High land with settlements and Sand bank area with low density of settlements	Width of 15 meters from AD line inland ; sufficient for constructed bank slope of 1V:3H and New land (char) to be surveyed (Negligible impacts)
3	Salimabad RBP	Precautionary proteciton	10.5 km	High land with low density of settlements	Only underwater works planned as precautionary works; no LA/R impacts
4	Salimabad Dredging	Dredging and filling to build up permanent char		River area without settlements	River land, no LA/R impacts

For the works listed above under Tranche 2, the land acquisition/ resettlement requirement or impacts is not possible to surveyed due to likely changes that usually happening during the flood season.

For the RBP protection planned in Chauhali and Benotia, only estimation of impacts and costs could been derived on the basis of Chauhali RBP done last year implemented during Tranche 1. But under Tranche 2 the reasonnable approach is to do the RBP works under water without impacting on the main land.

For Salimabad works the land required will be taken from the river where there is no settlements and no land with title holders is expected.

The land acquisition and resettlement impacts for the RBP in Tranche 2 will be calculated on the basis of the survey to be carried ahead of the implementation and the compensation of the losses to be calculated on the basis of the Bangladesh land acquisition act updated in 2017 and ADB SPS 2009 during Tranche 2.

Institutional Arrangement

Before starting of Tranche 2, an NGO/firm will be hired by the PMU to assess the land requirement and resettlement impacts and prepare the necessary RP implementation activities. The NGO/firm supported by the PMU will prepare the additional required RP and assist in the implementation of the resettlement activities and develop a monitoring information system to follow and ensure the payment of compensation are duly disbursed to the affected people before the civil works start at the river bank areas.

As per the provision of RP, GRC will be constituted in each project district to address all land acquisition related grievances during implementation especially during payment of compensation.

Visualization of the areas to be impacted

Some photographs of the projected project sites are presented in Figure 2-4 for RBP and river training. Most of the works will be done under water and there is no clear evidences through pictures for the area to be impactedunder water.

Explanation and justification of the approach followed

The justification and the impact on resettlement of this approach in two phases has been explained and detailed out in the following Chapter 4.

4 INVOLONTARY MEETS DISASTER RESETTLEMENT

A Case Study from Erosion Mitigation on the lower Brahmaputra/Jamuna River in Bangladesh

RAGSDALE, Tod (MESAS, LLC); OBERHAGEMANN, Knut (nhc); and FAISAL, M. Amir (BWDB, Chief Resettlement Officer)

Abstract: Involuntary Meets Disaster Mitigation Resettlement: A Case Study from Erosion Mitigation on the lower Brahmaputra/Jamuna River in Bangladesh. The paper provides an overview of Bangladesh populations displaced by river erosion. A pilot program is different from the traditional solution in two ways: 1) a lower cost solution protecting larger areas from erosion, allowing stability and development, key elements for poverty reduction and 2) following a phased approach providing emergency protection first and main protection under water. After completing involuntary resettlement, the final protection is build above water. The case study draws on the experience of squatters moving to resettlement villages and turned into land owners. It critically reviews the experience that poor people are necessarily poorer after resettlement.

4.1 Introduction to River Erosion Social Impacts and to the Old Embankment Village on the Jamuna River

In 2003 a community of squatters on what was called the Old Embankment resided on Bangladesh Water Board (BWDB) owned land without hope of an alternative to having its mostly kutcha structures swept during the Jamuna River during succeeding Monsoon seasons. The Old Embankment had been some distance inland at one point, but the Jamuna waters had eroded all lands standing between its waters and the largely earthen embankment. Many of these squatters had once owned land that now lay under the river and so were now landless and without anywhere else to settle in one of the most over-crowded countries in the world.

Figure 4-1 below illustrates the dry channel migration over the decade 1992-2002 in relation to the present Old Embankment community, which may be referred to as the Old Embankment Village in this paper[8]. The Old Embankment Village s plight was far from unique, as it was one of communities along the Jamuna and the other major Bangladesh rivers in a similar situation.

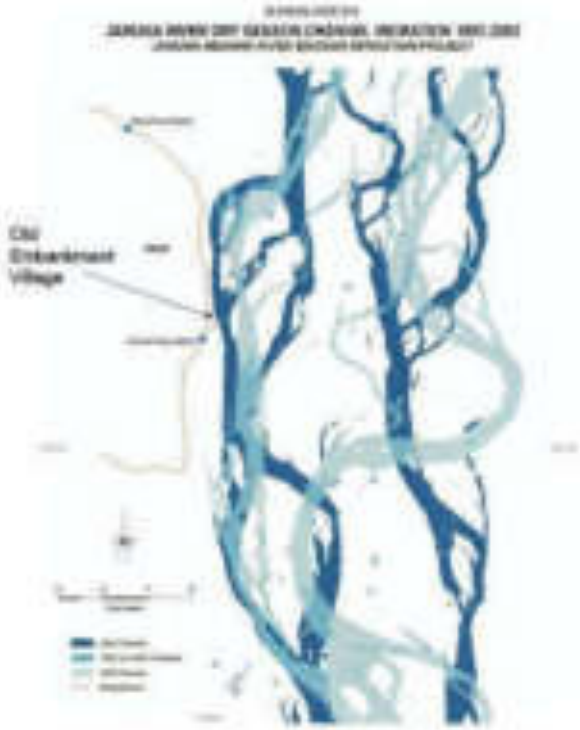


Figure 4-1 Old Embankment Village in Relation to Jamuna River s Dry Season Channel Migration 1992-2002

[8] Actually, while this paper focuses on one community on the Old Embankment, it was only one of several such communities along the approximately 7 km of bankline that received erosion mitigation treatment along the Jamuna River to protect the PIRDP. In a sense this paper, while primarily focusing on the Old Embankment Village, describes the situation of all of these communities. Photographs used, while mostly of the Old Embankment Village in many instances are of other nearby communities, such as the nearby Wave Eroded community, in the same vulnerable situation and similarly assisted by the Project.

Riverbank erosion is a perennial problem in Bangladesh. Large monsoon flows transporting extreme amounts of sediment from the Himalayan Mountains to the sea flow through the delta of Bangladesh formed by the same soils. These fine soils have no resistance to the flowing water and are easily transported and deposited. As a consequence the large rivers have quite an unpredictable behavior with the permanent risk of riverbank erosion. Riverbank erosion can exceed one kilometer per year and poses a substantial risk to floodplain dwellers. The loss of land is accompanied by a loss of infrastructure such as flood embankments, schools, hospitals, cultural and religious monuments and, of course, agricultural lands and assets (Khalequzzaman n.d.).

It has been estimated that tens of thousands of people are displaced annually by river erosion in Bangladesh, possibly up to 100,000. The first immediate relief after erosion is provided by the nearby flood embankments. As a consequence of continuous erosion many embankments are densely occupied by squatters (Faruque 2007). [9]

Old Embankment Village[10] in 2003 consisted of some 223 households, of 1,126 people, along a 600 m stretch of what was left of the original embankment. Only 6 households owned their own homestead land; the others resided without permission on the Bangladesh Water Board Government land. The illegal dwellings are constantly threatened by eviction, putting additional stress especially on the female family members living there. Structures were largely kuccha made with wood often salvaged from their previous homes, bamboo and straw with corrugated CI sheet tin roofs.

Most households earned their income through daily wages in surrounding, more stable communities. A very few ran small businesses; for instance the village had six shops selling tea and sundries. Very few people living on the bankline depended directly on farming as a source of income, as virtually all villagers had been rendered landless by river erosion.

Over seventy percent of households had an income below the official poverty line[11] in Bangladesh and over fifty percent were living below the extreme poverty line, with on average households earning less than a US dollar per day.

The following photographs illustrate the precarious situation of the Old Embankment Village during seasonal high and low waters.

[9] Others move to slums in the bigger cities, especially in the capital Dhaka. While no recent figures are available, historic studies from the mid 1980s indicate that in some slums in Dhaka more than 40% of the population named river erosion as primary cause for their migration into slums. The life on the flood embankments and in slums results in special hardship, such as a lack of minimum services, drinking water, ration cards, schooling for children, health facilities, and attention of the local government (Ibid.). In 2007 nearly 14 Million people (10% of the population) in more than 20 districts were affected by the floods limited to the Brahmaputra River. The flood damages are counted by the billions. Considering the extreme population density of more than 1000 persons per square kilometer (Viswanathan, et al. 2007).

[10] A nearby Cross Dam, Wave Eroded Community of some 113 Affected Persons is subsumed in these population figures. These were included in an ADB-required Resettlement Plan and were enumerated in the socio-economic survey covering both communities and from which socioeconomic data is quoted here. In fact, the OE Village proper was some 110 households, and the two communities in this paper are in instances treated, for illustration purposes, as one. Another, very similar, village on the bank of the Mahananda River also in Bangladesh is described in Viswanathan, et al (2007)

[11] The official poverty line was calculated at 2,122 KCal intake per person per day ensured by a per capita monthly income of about taka 700, approximately US$10

Figure 4-2 Old Embankment Village during High Water Season, 2005

Figure 4-3 Old Embankment Village during Seasonal High Water Season, 2005

Figure 4-4 Walking through Old Embankment Village during Low Water Season, 2005

During the 2004 monsoon other communities nearby lost their primary school and their grave yard from Jamuna erosion. The following photograph shows the location of these two communal properties.

Figure 4-5 Location of Primary School and Grave Yard lost in 2004 Monsoon

4.2 The Jamuna-Meghna River Erosion Mitigation Project (JMREMP)

Without any intervention it is clear that the Old Embankment would have over a short period of years eroded into the Jamuna River and the village people would have once again been forced to relocate, possibly to one of Bangladesh s cities.

As with flood control measures elsewhere in Bangladesh the reliance along this stretch of the Jamuna was on earthen embankments, polders, and drainage. Overall in Bangladesh, there are a total of 5,695 km of such embankments, including 3,433 km in the coastal areas, 1,695 flood control/regulating structures, and 4,310 km of drainage canals that have been constructed by the Bangladesh Water Development Board (BWDB). Unfortunately these earthen embankments can easily breach and can be damaged by riverbank erosion, and most of the embankments in Bangladesh have experienced breaching and erosion more than once since their completion (Viswanathan, et al. 2007).

In November 2002, the Asian Development Bank (ADB) began the Jamuna-Meghna River Erosion Mitigation Project (JMREMP) which aimed to mitigate riverbank erosion seriously threatening two important Flood Control, Drainage, and Irrigation Projects, the Pabna Irrigation and Rural Development Project (PIRDP) and Meghna Dhonagoda Irrigation Project (MDIP). The PIRD is highlighted below in Figure 4-6.

Figure 4-6 Orientation Map of the PIRDP Flood Control, Drainage, and Irrigation Project

The Project was to last six years, being completed at the end of 2008. The immediate and long-term objectives of the Project were to (i) sustain the economic development within PIRDP and MDIP by mitigating the risk of riverbank erosion and flooding from embankment breaches; (ii) contribute to poverty reduction by ensuring that the future benefits of the Flood Control, Drainage, Irrigation and Command Area Development investments were achieved; and (iii) to substantially improve the social and economic conditions of the flood and erosion victims living on and along the embankments through social development programs.

The immediate and first objective of the JMREMP was aimed at assuring the immediate and long term survival of the huge investment made in the irrigation project that the Old Embankment was protecting. Located on the floodplain of the Brahmaputra and Hurasagar Rivers in west-central Bangladesh, the PIRDP had been funded by the ADB and the International Fund for Agricultural Development (IFAD).

The PIRDP was begun in 1972 and ran through 1992 to improve the basic infrastructure of one of the most important and vulnerable agricultural areas in the heart of the country. It was designed to increase agricultural production, generate employment and improve farmers' living conditions by providing flood embankments, improving existing channels and installing drainage pumps to protect an area of about 185,000 ha from annual flooding. The overall cost had been about US$ 85 million, and the Project directly benefited more than 167,000 rural households.

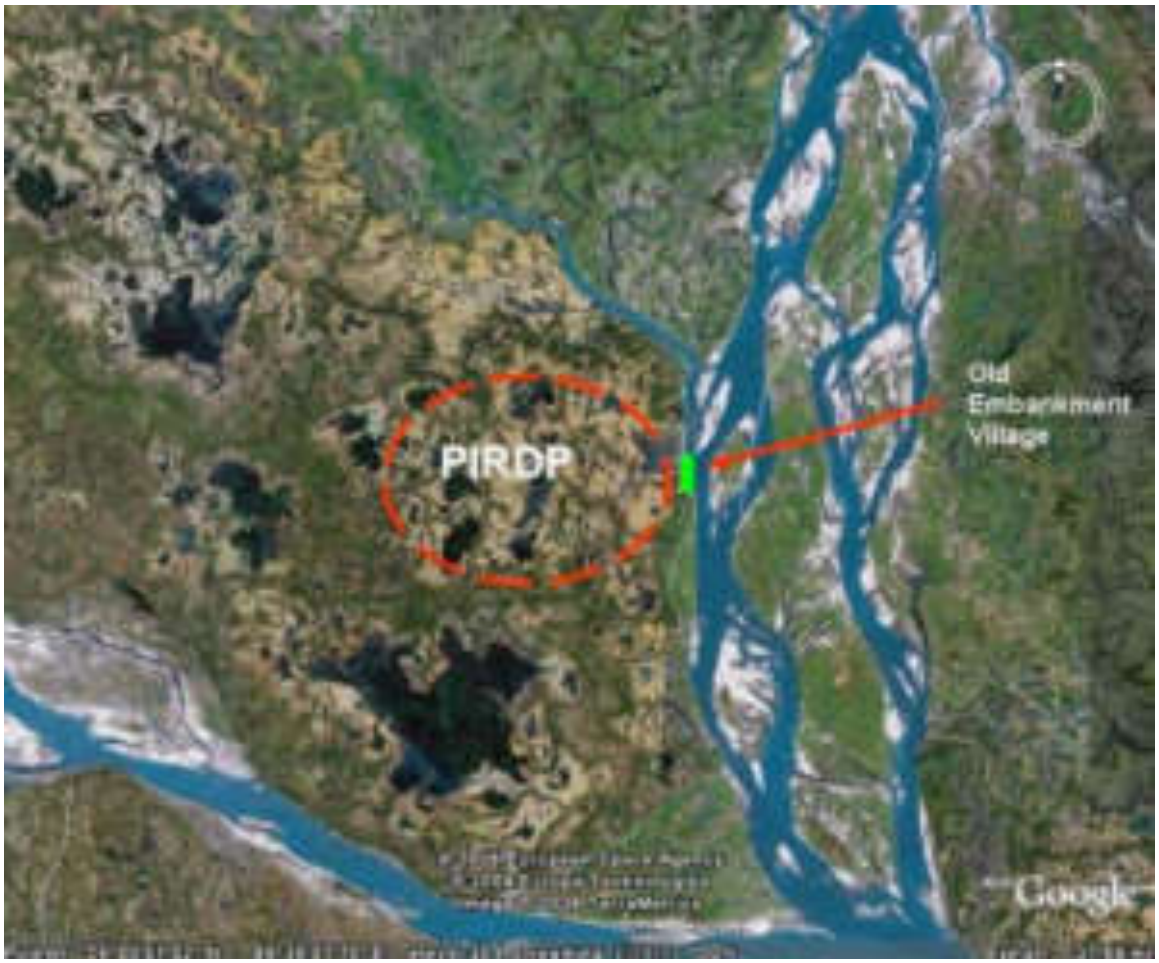


Figure 4-7 The OE Village in Relation to the Pabna Irrigation and Rural Development Project (PIRDP)

By 2000, however, River erosion threatened sections of the traditional earthen flood embankments at the PIRDP. The PIRDP is adjacent to Jamuna River, the most dynamic of all rivers in Bangladesh. The river s progressive westward erosion of more than 1 km over the decade 1990-2000 had placed 5 km of the PIRDP embankment in the path of the Jamuna s migration. In 1997, the embankment (what is currently the old embankment) was breached and was retired in 1998. The emergency construction of the 1.2 km Secondary Defense Line was required to protect critical reaches of the PIRDP against further breaching of the existing old embankment, further highlighting the critical situation the OE Village. But the riverbank was again by 2000 eroded in places to within 130 m of the new embankment. The bank erosion rates in the critical areas had exceeded 100 m per year, so without protection the embankment was at high risk of being breached during the 2001 flood season.

The ADB undertook to finance a search for immediate low-cost measures to protect the critical sections of embankment. The use of bank revetments and permeable spurs were considered, but high capital and O&M costs and low economic returns precluded their use. A phased retirement of the embankment was also considered, assuming that bank erosion would continue as a natural process; however, while this option would have been cheaper, it would have meant continued loss of agricultural and residential land causing major social disruption and possible relocation of about 6,000 households or some 40,000 people, including the OE villagers living as squatters atop the Old Embankment[12].

As mentioned above the now redundant Old Embankment ran along the Jamuna River in a rapidly eroding area. It had been backed up by a Retired Embankment built as an emergency measure and running parallel to it but inland and which became the main line of defense for the PIRDP irrigation command area.

Under the ADB-financed JMREMP, the BWDB began to implement a new type of project that focused on cost reduction of existing riverbank solutions to arrive at an economically feasible solution for the mostly agricultural lands along the Jamuna and Megna Rivers. The BWDB immediately set out to construct a revetment along about 3.0 km of the bankline, a Cross Dam, as an emergency measure to prevent the Jamuna from outflanking part of the protective work just downstream of the old embankment and set out to immediately protect a 600 m section of the Old Embankment where erosion had already required villagers to abandon the area and erosion was threatening the Secondary Defense Line embankment.

The new project developed a number of tools allowing a more reliable planning and implementation approach towards riverbank erosion mitigation measures. As the large rivers in Bangladesh are in a process of widening, this results in permanent riverbank erosion, loss of valuable flood plain land and infrastructure, and erosion of flood embankments with sudden devastating flooding during the monsoon seasons. The constantly changing river characteristic often bypasses or outflanks riverbank protection work. The location of erosion permanently shifts making erosion protection work difficult; and river behavior cannot be predicted many years ahead because the monsoon rainfall is unpredictable. However, prediction for one to two years achieves reasonable accuracy.

[12]http://www.adb.org/Documents/TARs/BAN/R88-01.pdf

One major element, apart from cost-effectiveness, was an adaptive approach to riverbank erosion management. This meant riverbank erosion was tackled in several steps: ranging from a satellite based prediction system to identify priority reaches, emergency measures for stabilizing these priority reaches temporarily before the predicted flooding; upgrading of temporary to main protection after the flooding; and future monitoring programs with the option to provide additional protection if the river erosion should persist.

Under the new JMREMP the protective work was implemented in multiple-steps, which allowed a flexible response to continuous river erosion, taking care of parallel non-technical processes such as land-acquisition and resettlement, and allowing adaptation of the work to the experienced river response to the protection.

Fast erosion rates during major river attack often undermined existing work, leaving no time for reaction. Measured vertical bed erosion could reach 20 m in less than three weeks. For this reason every protective work had to have some contingency quantities at the deepest point at the end of the slope. This toe protection commonly consisted of a falling apron, a layer of loose elements that launched once scouring started. Figure 12 below illustrates this process. Figure 13 is a photo of the eroding bank along the Old Embankment in 2004 when people on portions of the embankment found it necessary to shift their houses due to bank erosion.

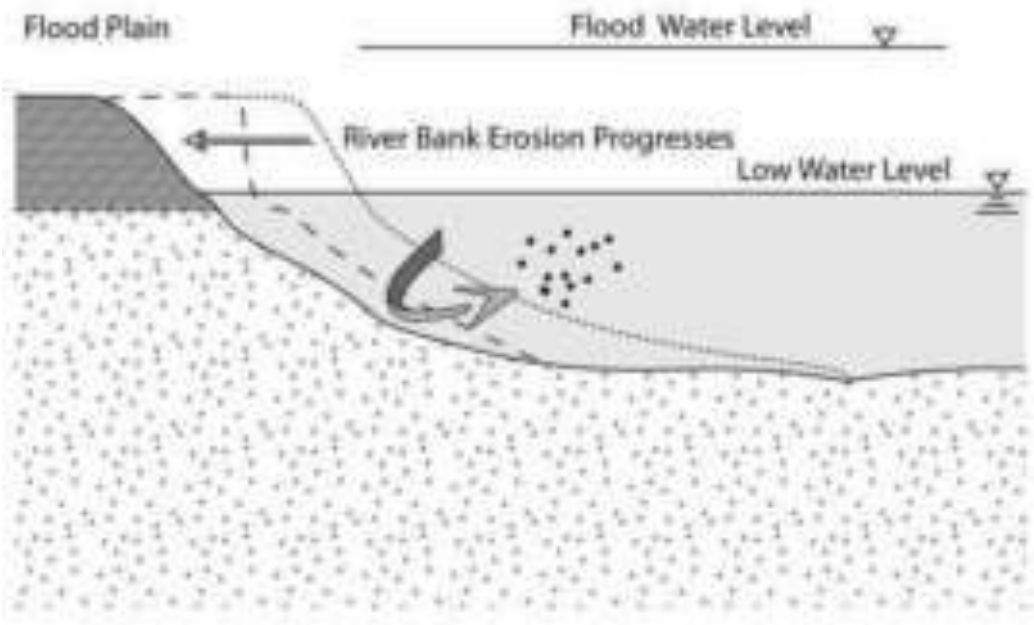


Figure 4-8 Bankline Erosion Illustration

Figure 4-9 Photograph, Results of Bankline Erosion

Immediate protection stabilized the underwater part at locations of acute erosion. *Acute erosion of settlements, flood embankments, or important infrastructure required an immediate response*. The best answer was immediate protection consisting of a heap of loose elements dumped from the riverbank. The erosion undercut this heap and the loose elements launched down the slope, providing a thin protective layer. Figure 4-10 below illustrates this principle using geobags, geo-textile cloth bags filled with local sediment, sand, or concrete.

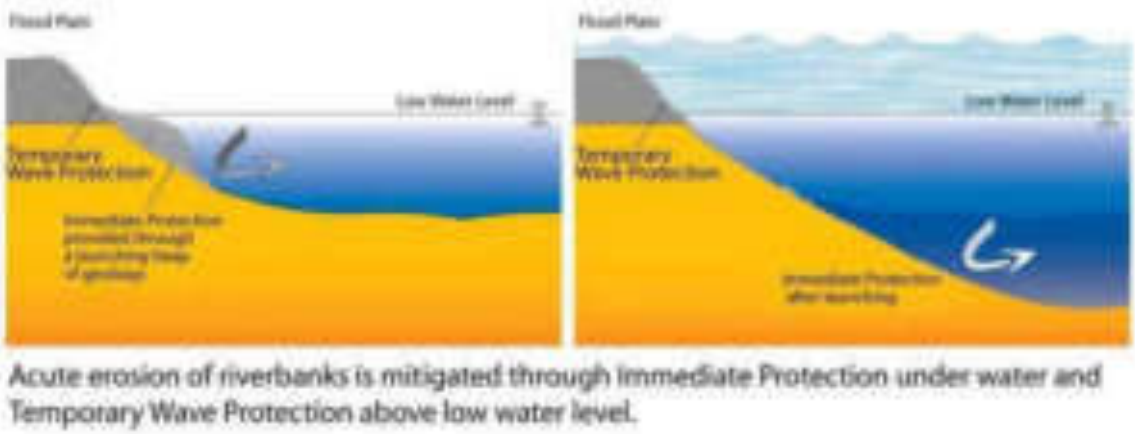


Figure 4-10 Immediate Protection from Acute Erosion through Launching Geobags applied from the Bank Itself

Figures 15 and 16 are photos showing the temporary protection along the Old Embankment Village area at low water. During high water this protection would be largely below water and therefore invisible from shore.

Figure 4-11 Photo of Geobag Temporary Protection along the Old Embankment

Figure 4-12 Photo of Geobag Temporary Protection along the Old Embankment

Within one year after the construction of immediate protection primary protection was built, providing a reliable coverage of the thin layer of launched immediate protection. The primary protection consisted of long revetments being able to respond to future river changes to a certain extent. A wide falling apron completed the work at the toe preventing undercutting of this major protection. To achieve several layers of slope coverage, the work was executed through systematic dumping from the river itself.

Under JMREMP three additional layers of geobags were provided on average onto the launched falling apron. Naturally, the work was built for the actual river situation permanently surveyed during construction, and checked for completeness through diving inspection. Figure 4-14 illustrates the dumping of these three additional layers of geobags.

Figure 4-13 Photograph of Primary Protection through Systematically Dumped Geobags from Barge

Figure 4-14 Photograph of Pulling Geobag Dumping Barge to a new Location

After the completion of main or primary protection a phase of monitoring, evaluation, and adaptation followed to respond to river changes especially in terms of depth changes and movement of river erosion to areas directly upstream or downstream of the eroded reach. This phase was unpredictable in duration as it depended on the morphological patterns of the river; however experience indicated that it should last for minimum five years to address a broad number of issues that could occur during the river response to major protective works. Adaptation meant primarily building the protection to deeper levels to prevent undermining and failure. Also during this phase, and after addressing land acquisition and resettlement, permanent wave protection above low water was built.

The final phase is above water permanent wave erosion protection. Figure 4-15 is a photograph of the above water embankment area after the OE Village was resettled away from the area. The old earthen embankment was then leveled and a new feature, a concrete filled mattress covered an embankment newly re-constructed with cement blocks.

Figure 4-15 Photograph 2007 Old Embankment after Community Resettled and Final (Underwater) Protection Completed

Figure 4-16 Photograph 2007 Old Embankment Newly Re-Constructed with Cement Blocks

Figure 4-17 Photograph 2007 Old Embankment Preparing for Permanent Protection with Cement Filled Mattress

Figure 4-18 Photograph 2007 Old Embankment Finished Permanent Protection with Cement Filled Mattress

Figure 4-19 Photograph 2007 Old Embankment Finished Permanent Protection with Cement Filled Mattress

Figure 4-20 Photograph 2007 Old Embankment Finished Permanent Protection with Cement Filled Mattress

4.3 Acquiring the Land from the Old Embankment Villagers and Resettling the Community to a New Resettlement Village

4.3.1 Problems with Land Acquisition

Simply acquiring the land was a challenging prospect carried out in parallel with the multi-phase construction process described above. Fortunately for the BWDB, the Old Embankment was almost entirely Government land and only a relatively small number of cases of private land acquisition were required. These were some twenty owners, including one tenant contractor, of about a hectare of land where the Old Embankment had already been eroded and previously protected land was now exposed directly to the Jamuna River. In other communities along the river bankline in both the PIRDP and MDIP on the Meghna River, however, this was a concern of larger dimensions.

From legal and revenue point of view, the line that marks the lowest water level with the flood plain during the dry season is considered as the bankline - also called the AD (Alluvial and Diluvial) line, is supposed to be formally declared by Assistant District Commissioner for Land. This land situated above the Lowest Water Line to the floodplain, i.e., the slope required for the bank protection work is private land unless already acquired by BWDB as was the case along the Old Embankment.

Local people cultivate the land above the Lowest Water Line during the Dry Season. In Bangladesh, the AD Line is not usually established by the concerned authority, despite the legal requirement to do so, because of the complexity of the process, which requires dealing every year with thousands of kilometers of shifting river banks affecting the ownership of land.

Therefore for Project design purposes the Lowest Water Line as observed during the Dry Season was considered as the demarcated bankline to be a proxy for the legally required AD Line for 2004 bank protection work that would affect the Old Embankment Village.

The scope of work under water, i.e., below the Lowest Water Line, did not require any relocation, but there were nevertheless issues of acquisition and payment of compensation; and because owners of underwater, eroded land were legally entitled to resume ownership if the submerged land reappeared within a given time frame, these were also compensated in lieu of the erosion mitigation work making the reappearance of their lands less likely.

On the other hand, as per the design, the construction of revetment above Lowest Water Line required the relocation of all the Old Embankment Village structures.

In places even these proxy AD Lines were not established in time for Project related resettlement activities, leading to delays. Acquiring land in advance for subsequent work was very difficult in the dynamic environment, and there was no guarantee that the land would not be eroded before the work started, as land acquisition and resettlement, as well as the physical protection work required time for planning and implementation.

Consequently, the Project followed a parallel approach of constructing riverbank protection under water to stabilize the bankline and provide temporary protection for the part above the Lowest Water Line. Subsequently, all land acquisition and resettlement activities were undertaken before the permanent work was constructed above Lowest Waterline.

The river instability lead to another type of problem: the frequently shifting rivers caused the permanent movement of people displaced through erosion but also moving to areas newly accreted from the river. This movement was unpredictably related to major river changes, for example during large floods, and resulted in difficulties of identifying the number of dynamically changing affected persons requiring relocation. While Project established cut-off dates based on socio-economic surveys of areas where household relocation would be required, these could be out of date by the time of resettlement implementation.

Bangladesh is very densely populated with a population density reaching about 1,000 persons per km†. All land, even that along the instable rivers, is occupied and the population pressure permanently forces people to settle in unstable flood and erosion prone environments. Consequently, land acquisition and resettlement was problematic as new land for resettlement was not readily available.

In addition, stabilization of the environment through Riverbank Protection Works which the Project implemented greatly increased the land value and increased the reluctance of landowners, even those living at the eroding bank, to give up their future stable and valuable land. A related difficulty is that expected protection work leads to speculation on land prices, which increases land acquisition cost.

Another problem was related to the project design of developing a cost effective and innovative type of riverbank protection suitable for economically feasible protection of agricultural lands following an adaptive approach. This meant addressing (i) design changes resulting from a continuous design development process while (ii) only working in those areas the unpredictable river erodes. This required intense follow-up activities from the resettlement staff to stay updated on latest design

developments and river requirements, as without a stabilized environment all land acquisition and resettlement activities would be futile.

The Project also had no direct influence on the land acquisition process other than providing the required funds assessed by the office of the District s Deputy Commissioner. This dependence on the performance of the external administration added an element of uncertainty and unpredictability to the process.

4.3.2 Problems with Resettling the Old Embankment Village Squatters

Squatters are commonly people displaced by river erosion along the banks or in certain cases from river islands (called chars). As with the Old Embankment Villagers, these people had lost all their land and were only able to keep a minimum of property in form of a temporary house consisting mainly of bamboo and corrugated sheets, some furniture and a few lifestock.

On settling on the Old Embankment Government land, the villagers had cut platforms into the existing embankments, further weakening them, to build their houses on an elevation less prone to flooding. As this Government land was required for construction, following Bangladeshi law, the squatters were illegal settlers.

On the other hand, as per the ADB s policy on involuntary resettlement[13] these often hard-core poor were accorded special rights and grants to reduce their poverty during and beyond the resettlement process itself. To begin with, the Project offered to resettle these affected people through self-relocation or through providing cluster relocation. As a sizable community, the Old Embankment Village chose to be relocated to a resettlement village to be developed by the BWDB, as did another close by community in what the Project termed the Wave Eroded area. In contrast, most of the river bank protection civil works were carried out on sparsely or non-populated river banks where the few affected persons chose to selfrelocate from the Project river erosion mitigation construction right of way.

BWDB complied with an ADB loan covenant that it would ensure that counterpart funds for compensation and entitlements under the [Resettlement Framework and Resettlement Plan][14] are fully provided directly to the [Affected Persons] prior to displacement from housing, demolition of structures and ground leveling in an emergency situation in which underwater stabilization was required to stabilize the embankments where the Old Embankment Villagers were residing to prevent further loss of land and structures to ongoing river erosion. This required underwater construction to commence as soon as possible during the annual Dry Season (Nov-Apr), often parallel with resettlement planning and implementation, and in fact year round whenever these embankment communities were put at risk by river erosion.

Once the embankment was stabilized, resettlement planning took place without the immediate risk of the Old Embankment Villagers having their houses, community structures and land eroded away during the Rainy Season (May-Oct). When the resettlement was fully completed, in line with the ADB Loan Agreement, construction to consolidate the embankment stabilization with permanent

[13] http://www.adb.org/Documents/Policies/Involuntary_Resettlement/default.asp

[14] See the ADB website for these detailed resettlement documents, required as a condition of the Project Loan: http://www.adb.org/Documents/Resettlement_Plans/BAN/Jamuna_Meghna_River/default.asp

above water measures was able to take place. In the meantime, underwater construction for bank stabilization continued as a year round activity in the Project area, adaptive to the ongoing river erosion.

With the Old Embankment stabilized through underwater construction work, development of the Resettlement Village of 2.8 acres was undertaken on land procured by the individual villagers themselves. Out of a total of 101 village households relocating from the Old Embankment, 91 of the villagers, or all of those opting to move to the site, bought plots at the nearby Resettlement Village location, and the other 10 opted to self-relocate. Those villagers purchasing land at the Resettlement Village did so from the local Ward Chairman, who had offered to sell his own personal property for a negotiated price. The Old Embankment Villagers were due Resettlement Benefits which were used, by common agreement, for purchasing their Resettlement Village plots.

Most of this land was low lying and required investment by BWDB to raise it as well as provision of basic infrastructure and internal roads. Land for community infrastructure was provided, with compensation by BWDB, by the villagers from the plots they purchased from the Chairman[15].

Figure 4-21 is a photograph of the Old Embankment villagers carrying earth to raise the resettlement village platform. As with the overall erosion mitigation work, which was labor intensive throughout, this was a windfall employment opportunity, which women who seasonally did this kind of construction work took especial advantage of.

Figure 4-21 Photograph of Old Embankment Resettlement Village Construction, Dry Season 2006

[15] A second Resettlement Village was also built for the nearby Cross Dam, Wave Eroded Community of some 113 Affected Persons, on land bought by the Project. These were included in the ADB-required Resettlement Plan and were enumerated in a socio-economic survey covering both communities. The Old Embankment population figures mentioned in para 5 above subsume, for illustrative purposes, both communities.

The Resettlement Village was prepared only a short distance from the Old Embankment. Figure 4-22 shows the earthen platform at near completion, during the Dry Season in 2006. Figure 4-23 is another, wide angle view of the same from a slightly different vantage point on the road seen in Figure 4-22.

Figure 4-22 Photograph of Old Embankment Resettlement Village Platform near Completion, Dry Season 2006

Figure 4-23 Photograph of Old Embankment Resettlement Village Platform near Completion, Dry Season 2006

By the Dry Season, within Jan-Mar 2007, the Old Embankment Resettlement Village had been firmly established and the villagers had made the move to their new home, on homestead land they now legally owned. The new site was now protected behind the river erosion mitigation carried out under the JREMP. Figure 4-24 is a photograph of the new village site, during the flood season showing that the raised platform is above normal inundation level of the floodplain mainly caused by local rainfall. Some key work remained on community infrastructure, such as tube wells, water-seal latrines and electrification the BWDB was committed to providing. A similar and nearby resettlement village had also been constructed for the wave erosion area affected persons, and they had likewise moved to their new village. Local flooding from local rainfall will be further improved through construction of a regulator or control gate in the embankment that allows draining excess water into the Brahmaputra/Jamuna River.

Because the new resettlement village was close by and the move there required minimal disturbance, the villagers sources of income was largely undisturbed. By the end of 2007 and beginning of 2008, the Old Embankment villagers were also becoming beneficiaries of the third Project objective, to substantially improve the social and economic conditions of the flood and erosion victims living on and along the embankments through social development programs. This was undertaken by a Social Development Program (SDP) funded by the Japan Fund for Poverty Reduction (JFPR), an integral component of the JMREMP that covered poor households within the PIRDP as well as all flood and erosion victims living along the river embankments.

Figure 4-24 Photograph of Completed Old Embankment Resettlement Village, Dry Season 2007

4.4 Conclusions

It is clear that had it not been for the involuntary resettlement of the Old Embankment Village, carried out as a requirement to protect the large investment represented by the Pabna Irrigation and Rural Development Project (PIRDP), the squatters would have been left on their own to cope with the inevitable destruction of the embankment by the Jamuna River.

Thanks to the pioneering work by Michael Cernea (2000) and others the impoverishment risks posed by involuntary resettlement are now widely known, and the mitigation of these is now established policy at the ADB, the World Bank and at other international institutions funding large-scale infrastructure projects. However, here is a case study that shows a situation where the impoverishment risk of doing nothing was far greater, and in fact the ADB s involuntary resettlement policy was carried out in an emergency situation where the impacted community faced an impending natural disaster. The unintended consequence was to provide safety to the threatened community and security and benefits that otherwise would never have materialized.

Unlike other linear development projects such as, for instance highways or power lines, in erosion mitigation projects on major rivers such as on the Jamuna River, nature (the ever changing erosion pattern of major rivers) played a vital role in fixing the river erosion mitigation construction right of way as well as the land acquisition and resettlement and construction schedules, requiring a parallel approach of stabilizing the banks through under-water protection and, for above-water activities, temporary wave protection at the same time as the land acquisition and resettlement. Construction

for above water stabilization was, and could only in practicality be, scheduled after all resettlement activities had been carried out.

Figure 4-25 reminds the reader of the emergency nature of the underwater construction work, which had to commence irregardless of the state of resettlement implementation and in any case did not disturb the Old Embankment Villagers residing on the embankment.

Figure 4-25 Old Embankment Villagers Prior to River Erosion Mitigation Work, 2003

This limited case study points out that the situation of other river erosion victims in Bangladesh has not been addressed in any systematic way; and that in fact little is really known about the extent of the problem. This study points to the need to learn more, as such flood/erosion refugees are observed on embankments all over Bangladesh, and the issue remains a largely unaddressed social problem in the country. It took, in this case, an intervention having little to do directly with the villagers themselves to highlight their plight.

There is an associate key issue that came to light in searching for a feasible site for relocating the Old Embankment Village. This is the wide availability of quite extensive BWDB borrow pits at suitably stable locations that can be filled in to provide new resettlement options for flood/erosion refugees. A first pilot squatter relief relocation project using BWDB borrow pits, on the way to a more systematic approach, is planned in the vicinity under the Social Development Program.

The proposed pilot relocation project gives hope for a future policy change on the part of BWDB to use these borrow pits, which are currently not available for such development, as the solution is a straight forward one providing humanitarian assistance to river erosion victims similar to the ones in this case study who -- only by being classified as involuntary resettlement affected persons due to their residing on BWDB embankments -- were afforded refuge from the loss of their homes to the Jamuna River.

5 BIBLIOGRAPHY

Asian Development Bank and International Water Management Institute. 2004. *Pro-poor Interventions in Irrigated Agriculture in Bangladesh: Issues, Options and Proposed Actions*. Manila: ADB and Battaramulla, Sri Lanka: IWMI, http://www.iwmi.cgiar.org/propoor/files/ADB_Project/Country%20briefs/Country%20Brief%20Bangladesh.pdf

Banerjee, Paula; Sabyasachi Basu Ray Chaudhury; and Samir Kumar Das, eds. 2005. *Internal Displacement in South Asia.* New Delhi (India), Thousand Oaks (CA), London: SAGE Publications. 370 pp.

Bangladesh Red Crescent Society (BDRCS). 2000. Appeal no. 20/2000, Situation Report No. 01: Period Covered: 19 August - 23 August 2000.

August 25. *http://www.reliefweb.int/rw/rwb.nsf/AllDocsByUNID/4a40ee0d52510b16c125694b0038a3ff*

Cernea, Michael and Christopher McDowell (eds.) 2000 *Risks and Reconstruction: Experiences of Resettlers and Refugees*. The World Bank: Washington DC. http://www.his.com/~mesas/irr_model/irr_model.htm

Elahi, K. M., 1991, Riverbank Erosion, Flood Hazard and Population Displacement in Bangladesh: An Overview. In Elahi, K. M., Ahmed, K. S., and Mafizuddin, M. (eds), Riverbank Erosion, Flood Hazard and Population Displacement in Bangladesh. Dhaka, Riverbank Erosion Impact Study (REIS), 364 pp [From Khalequzzaman].

Faruque, Ahmed. 2007. *Resettlement Policy Resettlement Policy Development: The Case of Development: The Case of Bangladesh*. Asian Development Bank Asian Development Bank Bangladesh Bangladesh, Resident Mission, PowerPoint Presentation.

http://www.metropolis2007.org/WorkshopTuesday/Ahmned_Faruque_Tues_Mercure_Fig.pdf

Haque, C. E., and Zaman, M. Q., 1993, *Human Response to Riverive Hazards in Bangladesh: A Proposal for Sustainable Floodplain Development*. World Development, v. 21(1), p. 217-29 [From Khalequzzaman].

Haque, C. Emdad. 1997. Hazards in a Fickle Environment: Bangladesh (Advances in Natural and Technological Hazards Research). Dordrecht, the Netherlands: Kluwer Academic Publishers. Article for purchase at: http://links.jstor.org/sici?sici=0004-5608(200112)91%3A4%3C775%3AHIAFEB%3E2.0.CO%3B2-Y

Hutton, David. 2000. Patterns of Psychosocial Coping and Adaptation Among Riverbank Erosion-Induced Displacees in Bangladesh: Implications for Development Programming.

Prehospital and Disaster Medicine: 15(3):s99. Khalequzzaman, Md. n.d. Flood Control in Bangladesh through Best Management Practices. Department of Geology & Physics, Georgia

Southwestern State University, Americus, GA.

http://www.millenniumassessment.org/documents/document.316.aspx.pdf

Mutton, David; Haque, C. Emdad. 2004. *Human Vulnerability, Dislocation and Resettlement: Adaptation Processes of River-bank Erosion-induced Displacees in Bangladesh*. *Disasters*, Volume 28, Number 1, March, pp. 4162(22).

http://www.ingentaconnect.com/content/bpl/disa/2004/00000028/00000001/art00003;jsessionid=2hcpbncdhmb3r.alice?format=print

Saifuzzaman, Md. and Mohd. Shamsul Alam. n.d. *Erosion Induced Hazard Assessment of the Brahmaputra (Jamuna) River Floodplain Using Remote Sensing & GIS Data*. Dhaka: Center for Environmental and Geographic Information Services (CEGIS), and Department of Geography and Environment, Jahangirnagar University.

http://www.cosis.net/abstracts/COSPAR2006/00738/COSPAR2006-A-00738.pdf

Sarker, Maminul Haque; Iffat Huque; and Mustafa Alam. 2003. Rivers, *Chars and Char Dwellers of Bangladesh*. International. Journal of River Basin Management, Vol. 1, No. 1, pp. 61 80.

http://www.jrbm.net/pages/archives/JRBMn1/Sarker.PDF

Viswanathan, Sujatha and Ravi Srivastava. 2007. *Learning from the Poor: Findings from Participatory Poverty Assessments in India.* Manila: Asian Development Bank. *http://www.adb.org/Documents/Books/Learning-From-the-Poor/Learning-From-the-Poor.pdf*

Zaman, M. Q.. 1996. *Development and Displacement in Bangladesh: Toward a Resettlement Policy. Asian Survey,* Vol. 36, No. 7, July. pp. 691-703.

Article for purchase at: http://links.jstor.org/sici?sici=0004-4687(199607)36%3A7%3C691%3ADADIBT%3E2.0.CO%3B2-Z

Consultant's Report

Flood and Riverbank Erosion Risk Management Investment Program

A 2.3 RESETTLEMENT PLAN

HARIRAMPUR

April 2019

Prepared by

Institutional Strengthening and Project Management Consultant (ISPMC)

Joint Venture of Northwest Hydraulic Consultants Ltd. and Euroconsult Mott MacDonald Ltd. in association with Deltares, Resource Planning and Management Consultants and CEGIS

TABLE OF CONTENTS

LIST OF TABLES

A 2.1 Updated Draft Resettlement Framework

LIST OF FIGURES

A 2.1 Updated Draft Resettlement Framework

LIST OF APPENDIXS

GLOSSARY

Agricultural laborer	A person who earns his/her livelihood mainly from manual labor engaged in agriculture practices. The non-agricultural laborer includes artisans and other occupational groups such as masons, potters, cobblers, barbers, etc.
Assistance/Compensation	Compensation for lost assets refers to legal compensation provided through the Land Acquisition section of the Deputy Commissioner's office. Assistance refers to resettlement assistance extended in cash and/or kind over and above the compensation under law as per independent assessment of replacement price of land and physical assets concurred by a Property Valuation Advisory Team (PVAT).
Char	A river island that is vegetated or barren and situated either in the river, surrounded by channels, or at the bank where it is called attached char.
Community Participation and Consultation	The active process of sharing information seeking inputs from community about the project, seeking community-wide inputs, and integrating those in the project design as well planning mitigation measures.
Compensation	Payment in cash or kind (for example land-for-land) to the APs as per LA Act.
Cut-off Dates	Date of notification under Section 3 of 1982 Ordinance is the cut-off date for title owners. The end date of the Census will be considered cut-off date for all others, including non-title holders for resettlement benefits. In this project, the end date of the survey is December, 2017.
Displaced Persons (DPs)	In the context of involuntary resettlement, displaced persons are those who are physically displaced (relocation, loss of residential land, or loss of shelter) and/or economically displaced (loss of land, assets, access to assets, income sources, or means of livelihoods) as a result of (i) involuntary acquisition of land, or (ii) involuntary restrictions on land use or on access to legally designated parks and protected areas. (ADB's SPS 2009 "Persons affected directly or indirectly by project-induced changes in use of land, water, or other natural resources are called APs. In other words, a person who as a consequence of the changes sustains (a) damages by reason of severing land, or (b) loss of immovable property in any manner, or (c) experience loss of income and livelihood. Such impacts may be temporary or permanent in nature and most often occurs through land expropriation using eminent domain or direct purchases for development projects
Entitled Persons (EPs)	EP is an administrative term for designating benefits for affected persons. There are two types of EP: Direct EPs, who are EPs by virtue of legally recognized entitlements; and Indirect EPs, who are EPs by virtue of socially recognized entitlements, as per ADB Policy and legally agreed between the ADB and GOB through the Loan Agreement. The

	Direct EPs are the Titleholders recognized by the DC and confirmed through payment of Cash Compensation under Law (CCL). The Direct EPs are identified as per the Final Award information prepared by the DC upon payment of CCL. The list of the Direct EPs will be updated over time, with payment of the CCL. The Indirect EPs are those without legal title to ROW land and/or structures but who were living and/or earning their livelihood within the ROW, and are entitled to Resettlement Benefits under the RP provisions. The INGO is responsible for all groundwork and verification for identification of EPs.
Eminent Domain	Regulatory authority of the government to obtain land for public purpose use and/or private sector development projects under the 1982 Ordinance or other laws of the land.
Entitled Person (EP)	An entitled person (EP) is one who has lost his/her assets or income directly/indirectly due to the Project intervention and is eligible to receive compensation from the DC office and/or cash grant from BWDB
Entitlements	Range of measures comprising of compensation resettlement benefits, including shifting allowance, subsistence, and relocation which a DP is entitled to, depending on the nature of losses, to restore and/or improve the living standards.
Erosion	Displacement of soil particles due to water or wind action.
Female–headed household	Households where a woman decides on the access to and the use of the resources of the family. In resettlement context, women-headed households and/or widows also suffer from lack of labor for relocation purposes.
Floodplain	A nearly flat, alluvial low land bordering a stream that is subject to frequent inundation by floods.
Gender Equity	Equal recognition of both genders in the provision of entitlements, treatment and other measures under the Resettlement Plan
Geobag	Sand-filled geotextile bags used for the construction of riverbank protection, commonly revetments under water.
Head of Household	One who makes major decisions within the family structure and generally lead the family as the principal provider.
Household	A household includes all persons living and eating together (sharing the same kitchen and cooking food together as a single-family unit)
Host population	Community residing in or near the area to which affected people are to be relocated. Host communities should also be project beneficiaries for better host-resettlers integration.
Indirectly affected people	Indirectly affected people are those likely to lose subsistence or income due to project intervention without loss of any physical assets. A clear definition of indirectly affected people must be based on a careful review and assessment of indirect impacts of the project.
Migration	Change in position of a channel by lateral erosion of one bank and simultaneous accretion of the opposite bank.

Overbank flow	Water movement that overtops the bank either due to stream stage or to overland surface water runoff.
Person(s) having usufruct rights	The right to use land belonging to others – for example, lease from government department or agency or individuals.
Project-Affected Area	An area under the project, declared by the Government, where land is being acquired under Acquisition and Requisition of Immovable Property Ordinance – II of 1982 or any other Act in force or an area not acquired, but affected by the project and its related activities.
Public Disclosure	Process of disclosing and sharing project impacts with affected people and disseminating amongst them information on their entitlements, compensation, R&R measures and project timeline etc.
Rehabilitation	Re-establishing incomes, livelihoods, living and social systems.
Relocation	Rebuilding housing, assets including productive land and public infrastructure, in a new location.
Replacement Cost (RC)	The costs of replacing lost assets (e.g., land, houses/structures, trees and crops) and income, including cost of transaction. (Historically, in Bangladesh involuntary resettlement policy usage, also referred as Replacement Value, or RV)
Resettlement and Rehabilitation (R&R)	Resettlement refers to rebuilding housing, assets, including productive land and public infrastructure in another location while rehabilitation means restoration of income, livelihoods, and re-establishment of sociocultural system.
Resettlement Plan (RP)	A time bound action plan with budget setting out resettlement impact strategy, objectives, entitlement, actions, implementation responsibilities, monitoring and evaluation.
Retired Embankment	An embankment line that is built some distance behind an existing embankment, which is eroded or at the risk of erosion
Right-of-Way	Demarcated land proposed forinfrastructure development
Riverbank Protection	Engineering works for the purpose of protecting streambanks from erosion.
Social Preparation	The process of consultation with affected people, undertaken before key resettlement decisions are made, to build their capacity to deal with resettlement.
Slope (of channel or stream)	Fall per unit length along the channel centerline or thalweg.
Slope protection	Any measure such as riprap, paving, vegetation, revetment, brush or other material intended to protect a slope from erosion, slipping or caving, or to withstand external hydraulic pressure.
Uthuli (also called Nodibashi)	People displaced by flood /erosion, who live on land provided by neighbor or relative free of cost
Vulnerable Person	For this Project, vulnerable groups are defined as dPs who suffer more - economically and socially - from relocation than other affected population. Based on past experiences from similar projects, the vulnerable groups include (i) women-headed HHs; (ii) landless HHs (those without agricultural land, and depend largely on wage labor for

	survival); (iii) disabled HHs heads (iv) Household with family members affected by chronic disease such as TB, asthma, cance etc.) and (v) HHs having residual agricultural land less than 1 acre or losing more than 10% of their income from agriculture due to acquisition.
Project Affected Communities /Host Villages	Project-affected communities are local villages, markets or townships that may be affected by Project impacts such as loss/dislocation/capacity inadequacy of common property resources, school, mosques etc. Host communities are recipients where APs are to be relocated.
Relocation/Resettlement	Relocation refers to physically moving of the APs from the affected area to a new area/site and rebuilding homes, assets, including productive land/employment while resettlement means re-establishing income, livelihoods, living and social system.
Replacement Land	Those affected by the RoW alignment will receive alternative land, if available, or cash compensation at the replacement price. NGO will assess the market value of land to determine the Maximum Allowable Replacement Value (MARV) and be approved by PVAT.
Structures - Houses and Commercial Enterprises	All structures affected by Project acquisition -- living quarters, community infrastructures/roadside shops/businesses -- will be compensated for.

CURRENCY EQUIVALENTS
(as of 10 March 2018)

Currency unit	-	taka (Tk)
Tk1.00	=	$0.01196
$1.00	=	Tk82.745

WEIGHTS AND MEASURES:

1 ha	= 2.47 acre
1 ha	= 10,000 m2
1 acre	= 100 decimal
1 m	= 3.28 ft
1 m2	= 10.76 sft

EXECUTIVE SUMMARY

Project Overview	The Bangladesh Water Development Board (BWDB) is conducting the Flood and Riverbank Erosion Risk Management Investment Program (FRERMIP) covering parts of the main rivers in Bangladesh. The Asian Development Bank (ADB) and the Government of the Bangladesh are financing the project. The FRERMIP will cover the main rivers from Bangabandhu (Jamuna) Bridge and the proposed Ganges Barrage to Chandpur, as such covering around 60 km of the Jamuna, around 20 km of the Ganges, and the whole around 100 km long Padma reach. The FERMIP identified sub-reaches with similar river and flood plain characteristics as practical subproject areas. Each sub-reach consists of several upazilas, which facilitates the data collection. In total 14 sub-reaches were identified: two each at the Jamuna Right and Left Bank (JRB, JLB), 3 along the Padma Right and Left Bank (PRB, PLB), one at the Meghna Right Bank (MRB), and two along the Meghna Left Bank (MLB). The PPTA feasibility study covered the priority investment during the first Tranche and this is revised version for tranche-2. FRERMIP is a multi-tranche financing facility (MFF)[16] with the Bangladesh Water Development Board (BWDB) as the Executing Agency (EA) and the Department of Disaster Management (DDM) as Implementing Agency (IA) for community-based flood risk management measures. The program is implemented in three tranches: Tranche 1 (2014-2018), Tranche 2 (2018-2020) and Tranche 3 (2020-2023). FRERMIP outputs are (i) strengthening the flood and riverbank erosion management system, and (ii) establishing, at priority erosion sites, sustainable, integrated non-structural and structural risk management measures. The ADB MFF provides a loaned amount[17] of approximately $ 250 million; further financing of the program is provided by the Government of Bangladesh ($ 85 million) and the Netherlands Government ($ 15 million), bringing the total program costs at a $ 350 million. TRANCHE-2 PLB-1 COMPONENTS Among the priority projects planned for tranche 2, the construction of the embankment from Harirampur to Dohar from PLB-1 subproject is a major item in terms of land acquisition and resettlement. This RP will identify the impacts and the cost.

[16] The MFF FRERMIP consists of three individual loans, however systematically developing phases (called tranches in ADB's terminology) of interventions at three priority sites along the Lower Jamuna and Upper Padma Rivers. The cascading loans are packaged into a Program with a duration of 9 years, while the three tranches (phases) overlap and are scheduled for typically 4-years duration. Each tranche or loan is called Project with interventions at different Sub-project sites.

[17] Quoted from EIA for Tranche 2

PLB-1 – Priority sub-projects

The existing work will be completed with contingencies for future riverbank stabilization.

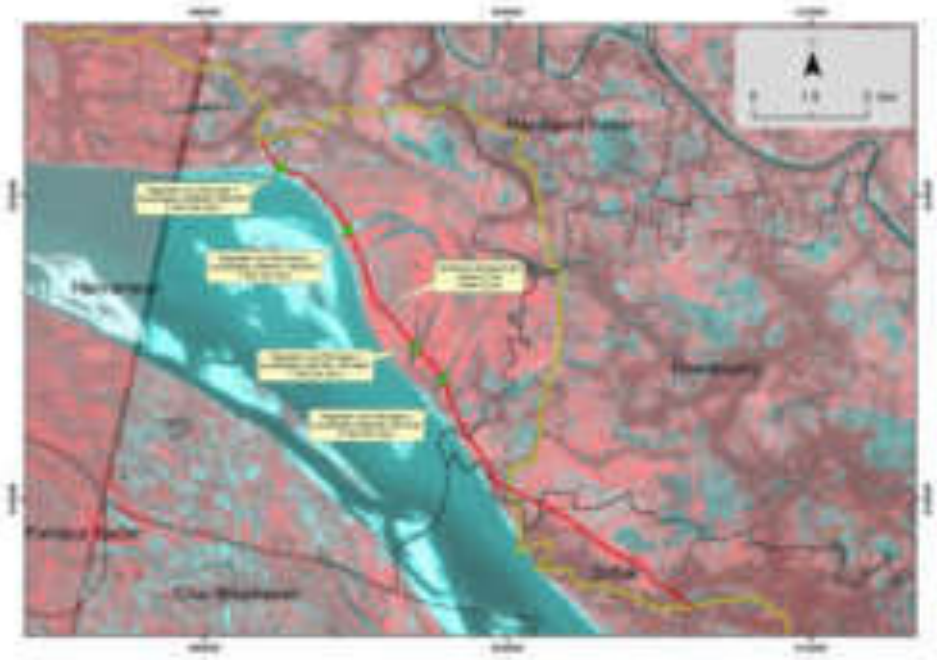
Riverbank protection	9km upper slope protection Provision for 4km	The existing some 9km long riverbank protection will be completed by building permanent wave protection. In addition, contingency quantities are planned for downstream protective works.
Embankment from Hariramp ur to Dohar	17.5 km New Embankment	Construction of a new embankment will provide reliable flood protection from Padma flooding in future.
Fish passes (regulators) with excavation of connecting canals	4 Nos to connect Ichamatty River to be built on the alignement of the embankement (part of this RP)	Along the proposed Embankment alignment within ROW, to control the floodwater within the protected area. Excavation of canals in both sides of regulator to ensure flow of water.
Ramps for road crossing	3 nos of road crossing	Slopping from the embankment top to the road

The River Bank Protection (RBP) will be constructed in Tranche-2, but the changing morphology of J Padma Rivers after two flood seasons before construction can start mean that the configuration of the RBPs will be considerably different by the time of the FRERMIP Tranche-2 bank protection implementation. Therefore, for budget purposes, the 1 Km unit costs of the right bank RBPs will be estimated from average costs of the Tranche-1. Early in implementation, new sub-project RPs will be drafted by the construction supervision consultant (CSC) for ADB's approval before construction will commence, following the project's updated Resettlement Framework (RF),

Measures to Minimize Impacts: All necessary efforts have been made in order to minimize Project impacts on assets and avoid disruption of livelihoods as far as

possible. Extensive consultations have been conducted with the affected communities and people along the Padma Left Bankproposed Embankment to take in their views and concerns and incorporate the same in the proposed alignment, as far as possible. Numbers of changes in the alignment of the embankment have been made to avoid social, religious and academic structures. In these cases, the local people were consulted and design changes made accordingly as well as survey done in new alignment in Harirampur side.

View of the embankment alignment with fish passes from Harirampur to Dohar



The embankment will be built along the Padma River and crossing 3 Upazilas in 2 districts Dhaka and Manikgonj Major area/land (58%) of the embankment is in Harirampur Upazila of Manikgonj District, 28% in Dohar Upazila and 14% in Nawabganj Upazila of Dhaka District.

Socio-economic Profile of the Affected Population

In the Tranche-2 new Embankment (EMB) area at PLB-1, affected households (AHs) losing structures were found on the alignment. The 180 AHs surveyed in the EMB area comprise a 789 population, 407 (52%) of which are male and 382 (48%) are female. Among the 180 affected Households, 25 are Female Headed Households (FHH) and 14 out of them are housewife. Among the affected HHs 63-HHs are vulnerable (FHHs, Disabled, low income, Government support) and 17 out of 26 are vulnerable and poor. The average size of the AHs is 4.51 in the 12 villages surveyed.

Additional 15 HHs are likely to be affected at the crossing with roads.

The primary occupation of the affected household heads are migrant worker and

daily wage earners in Dohar Upazila; Vendors and daily wage earners in Harirampur Upazila and Daily wage earners and unemployed /others in Nawabganj Upazila.

The level of education is low among the affected head of the households. For male only 55 out of 156 (35%) studied above 5th grade and for female 4 out of 25 (16%) studied above 5th grade. The illiterate are 69/156 (44%) male and 13 /25 (50%) female are illiterate.

The level of income was collected from all the affected households while yearly income below TK 50,000 considered as poor HH and yearly income below TK 30,000 considered as vulnerable HH. In this way 6 HHs (12%) of Dohar Upazila are poor and only 1 (one) HH is vulnerable; in Harirampur Upazila 15 HHs (34%) are poor and 5 HHs are vulnerable; in Nawabganj Upazila 21 HHs (31%) are poor and 6 HHs are vulnerable in total length of Embankment having 42 HHs are poor and 12 HHs are vulnerable based on income level. No indigenous people (IP) are living in the EMB area. The gender status, impacts and issues will be further specifically analyzed and documented in a Gender Action Plan (GAP).

Resettlement Impacts of the Tranche-2 PLB-1 Components

The Tranche-2 impacts are based on the findings of the household socio-economic field survey on the alignment of the proposed embankment in November 2017. The information collected during the survey was used for preparing the initial budget.

For the full length of embankment as per proposed design, about 112 ha of land will be acquired, which includes 105 ha of private agriculture land (including marginal areas of khas land that could not yet be assessed). The homestead and business areas are 7 ha that include areas for housing and businessstructures. Along the new embankment and within the ROW 4-fish passes are going to be built that will have additional impacts on the land estimated for the embankment. The Regulators will require some approach canal excavation on both sides to secure water flow. Simlarly the 3 road crossing will require minimal area for slopping. For the 4 regulators (fish pass) additional land to be acquired for excavation of canal on both sides of embankement to ensure water flow, total area for the 4 fishes is 12 ha. For the 3 roads crossing additional land for slopping is 0.64 ha of land.

The land to be acquired will be distributed in 2 districts (Dhaka and Manikganj), 3 Upazilas (Dohar, Nawabganj and Harirampur) and 5 Unions (Khushumhati, Nayabari, Boyra, Dhulsunra and Joykrishnapur). It will affect 180 households and a total population of 789 in the settlement areas.

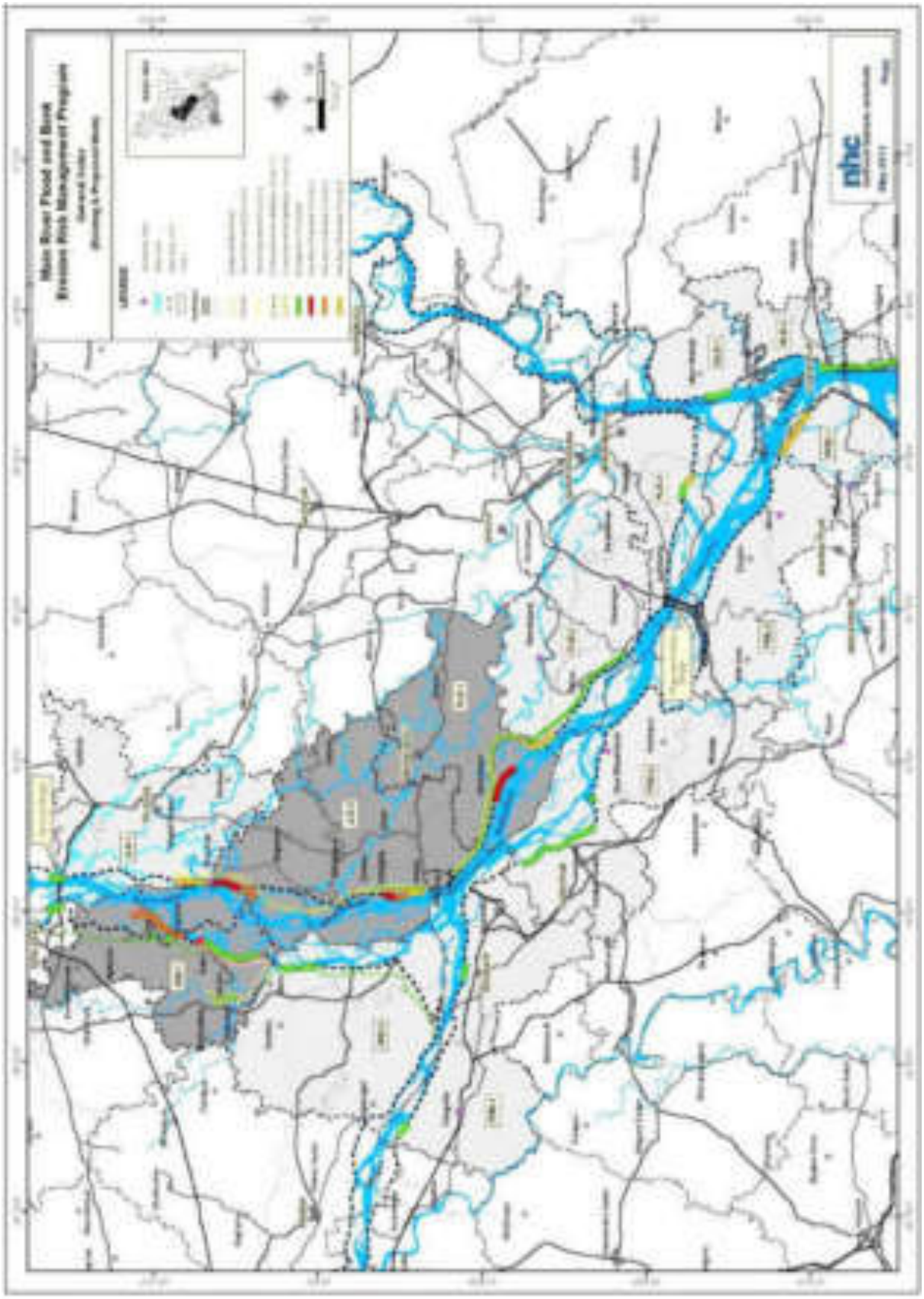
The impact on structures will concern 785 entities (including different types of residence, kitchen, latrine, animal sheds, HTWs and others) and a total floor area affected is of 148086 sft (1.375 ha). From the total structure area affected 28 HH

	will have their business structure affected over an area of 6835 sft (0.063 ha). The inventory of various trees to be affected gives a total of 3371 including 19 samplings, 441 small trees, 271 small trees and 2639 fully grown tress. From the total 1719 are fruit tress, 997 are timber tress and the rest are groves, medicinal, vegetable (sajna). The number of plots to be affected for each mouza maps and area affecetd is provided in the Land Acquisition Plan (Annex V). The number of agricultural plots users to be affected is yet to be finalized on the basis of the Land acquisition plan submission to land registry department for identifying the plot owners. In addition another agricultural plot users survey in the agriculture land affected will be launched and likely have a minor impact of the budget with some additional crop compensation. It needs to be noted that proposed alignment of embankment has been modified several times to minimize the impacts in the settlement areas and wherever possible avoided religious/educational institutions and common properties affected. Although field enumarators visited several times during survey to make sure that all affected people are met while some absentee landowners were not available. So that in some cases partial information recorded. But hope that during implementation further survey will be done to get accurate and current (change from now if any) data and RP will be updated accordingly. **Consultations, Disclosure and Participation** The public consultation process in the project area began in October 2017, as part of the first pre-feasibility study all along the full project. Public Consultation Meetings (PCMs) and Focus Group Discussions (FGDs) have been carried out during the last few months and provided the affected households opportunities to express their concerns about land acquisition, compensation and resettlement. At the detailed design (DD) stage, RPs for the core Tranche-2 subproject(s) will be prepared, updated and implemented in close consultation with the stakeholders and will further involve focus group discussions (FGDs) and meetings, particularly with the affected households. The summary of the RPs will be disclosed on the ADB's website, and the consultation will continue throughout the project implementation period. An information booklet in English (Annex V) has already been designed for approval of the Government for distribution (after translation into bangla) among the DPs as the primary tool for disclosure.

ACRONYMS

AC	Assistant Commissioner
AE	Assistant Engineer
A&M	Adaptation and Maintenance
AD	Alluvial and Dilluvial
ADB	Asian Development Bank
ADP	Annual Development Plan (budgetary plan from 1July to 30 June)
AH	Affected Household
BAN	Bangladesh
BDT	Taka (currency of Bangladesh)
BRE	Brahmaputra Right Embankment
BWDB	Bangladesh Water Development Board
CbFRM	Community-based Flood Risk Management
CCL	Cash Compensation under Law
CDMP	Comprehensive Disaster Management Program
CDMU	Community Disaster Management Unit
CDP	Capacity Development Plan
CEGIS	Center for Environmental and Geographic Information Services
CPR	Common Property Resources
CSC	Construction Supervision Consultant
CSS	Census & Socio-Economic Survey
C/S	Country Side
DC	Deputy Commissioner
DD	Deputy Director
DDM	Department of Disaster Management
DPs	Displaced Persons same as AP Affected Persons
DPP	Development Project Proforma
EA	Executive Agency
EIA	Environmental Impact Assessment
EP	Entitled Person
EMB	Embankment
EMP	Environmental Management Plan
FGD	Focus Group Discussion
FHH	Female Headed Households
FRERMIP	Flood and Riverbank Erosion Risk Management Investment Program
GAP	Gender Action Plan
GIS	Geographic Information System
GoB	Government of Bangladesh
GRC	Grivence Redress Committee
HRD	Human Resources Development
IA	Implementing Agency
ID Card	Identity Card
IGA	Income generating Activities
ILRP	Income and Livelihood Restoration Program
INGO	Implementing NGO

IOL	Inventory of Losses
IR	Involuntary Resettlement
IWRM	Integrated Water Resources Management
JMREMP	Jamuna-Meghna River Erosion Mitigation Project
JLB	Jamuna Left Bank
JRB	Jamuna Right Bank
JVT	Joint Verification Team
LA	Land Acquisition
LAP	Land Acquisition Plan
LAR	Land Acquisition and Resettlement
LGI	Local Government Institution
LGED	Local Government Engineering Department
M&E	Monitoring and Evaluation
MFF	Multi-tranche Financing Facility
MIS	Management Information System
MOWR	Ministry of Water Resources
NHC	Northwest Hydraulic Consultants Ltd.
NGO	Non-Governmental Organization
O&M	Operations and Maintenance
OE	Old Embankment
PD	Project Director
PLB	Padma Left Bank
PMO	Project Management Office
PPTA	Program Preparatory Technical Assistance
PRB	Padma Right Bank
PVAT	Property Valuation Advisory Team
PWD	Public Works Department
RBP	River Bank Protection
RC	Replacement Cost
RF	Resettlement Framework
ROW	Right-of-Way
RP	Resettlement Plan
R/S	River Side
SDE	Sub-divisional Engineer
SIA	Social Impact Assessment
SPS	Safeguard Policy Statement
ToR	Terms of Reference
UP	Union Parishad
XEN	Executive Engineer



1 INTRODUCTION

1.1 The Program Background

Bangladesh faces large challenges in providing stable living conditions on one of the world's largest deltas. The people in the country are detrimentally affected by flooding and riverbank erosion particularly along its four main rivers: Jamuna, Ganges, Padma and Meghna. Over 5,000 hectares (ha) of floodplain land has been lost annually due to riverbank erosion, affecting over 55,000 people[18] . The high population density restricts the scope for moving people away from disaster prone areas and consequently depends on the protection of riverbanks and river stabilization. The development of feasible solutions is compound by (i) the unpredictability of the two dominant natural drivers: annual monsoon and large earthquakes rendering the river behavior very erratic and (ii) compound by the lack of rock, typically used for riverbank protection. In addition, a rapidly increasing population was faced by dramatic widening of the Brahmaputra System (Jamuna, Padma, and Lower Meghna) by some 50% as a consequence of the 1950 Great Assam Earthquake. Until 2010 more than 1,000km² of land had been lost to the rivers.

Protection against riverbank erosion is difficult due to the dimensions of the main rivers[19] , flowing through fine, loose deltaic soils and causing deep scouring. The Bangladesh Water Development Board started developing a number of different approaches since the 1990s and after experiencing more systematic failures of structures protruding into the flow (spurs or groynes) succeeded in controlling riverbank erosion through long guiding revetments in the early 2000s. The revetments use the technology of sand-filled geotextile bags (geobags). The cost effective geobag revetments alongside the existing floodplains can be built for an equivalent of US$ 2.5 to 3 million per km as opposed to US$ 90 million per km for the deeply dredged slopes of the river training works at Padma Bridge. This large cost reduction leads to sustainable works, provided one additional construction step, termed "adaptive works", is added. The initial construction takes place alongside eroding riverbanks with channel depths of typically some 5m during the dry season. Once the riverbank is protected the depth increases to 20m or more. The placed geobags are able to launch down this slope as confirmed through a combination of regular bathymetries, multi-beam echo-sounding and diving. However, the launching material is physically only able to provide single layer coverage.

The Asian Development Bank supports the feasibility study of a potential future flood and riverbank erosion risk management program covering parts of the main rivers of Bangladesh named "Flood and Riverbank Erosion Risk Management Program"(FRERMIP). The main focus is to reduce the riverbank erosion and flood risks to the adjacent flood plains while maximizing economic activities in a sustainable and environmentally acceptable manner. Existing flood embankments dominantly fail from riverbank erosion, and as such the stabilization of the river pattern is a cornerstone of reducing the flood risk. The FRERMIP builds on and extends the activities of the Jamuna-Meghna River Erosion

[18] River Study Technical Note 2: Holistic River Morphology Analysis for the Brahmaputra River System

[19] The Padma River is the thirds largest river in the world in terms of discharge, while the Brahmaputra is ranked amongst the top 10

Mitigation Project (JMREMP) (ADB, 2002), implemented in different phases from January 2003 until June 2011. In addition, a similar project, the Assam Integrated Flood and Riverbank Erosion Risk Management Investment Project (AIFRERMIP) (ADB, 2010) provides important insight into a number of relevant project elements and processes.

The Project will cover the main rivers from Bhangabandhu (Jamuna) Bridge[20] and the proposed Ganges Barrage to Chandpur, as such covering around 60 km of the Jamuna, around 20 km of the Ganges, and the whole around 100 km long Padma reach. Two main confluences are included: the confluence of Ganges and Jamuna and the confluence of Padma and Upper Meghna. Importantly, for flood benefits and, of course, targeting the overarching goal of poverty reduction, the flood plains on both sides of the rivers play a fundamental role as home of a largely poor population depending on agriculture and fisheries. As a consequence we identified sub-reaches with similar river and flood plain characteristics as practical subproject areas. Each sub-reach consists of several upazilas, which facilitates the data collection. In total 13 sub-reaches were identified for pre-feasibility assessment: two each at the Jamuna Right and Left Bank (JRB, JLB), 3 along the Padma Right and Left Bank (PRB, PLB), one at the Meghna Right Bank (MRB), and two along the Meghna Left Bank (MLB).

The feasibility study covered the priority investment during the first Tranche. In Bangladesh the common MFF approach means that only the first tranche investment is identified during the PPTA. Subsequent tranches will be identified during each previous, ongoing tranche. The implementing agency, the Bangladesh Water Development Board (BWDB) (i) has more than 10 years of experience with an adaptive or flexible flood and riverbank erosion risk management approach and has demonstrated successful implementation from three ADB supported projects (JMREMP, South-West Area Integrated Water Resources Planning and Management Project, Secondary Towns Integrated Flood Protection Project II), (ii) has approved operation in line with the 'Guidelines for Riverbank Protection', 2010 founded on standardized design and implementation procedures, and (iii) is currently in the process of creating the post of a Chief Engineer River Management as focus point for river stabilization activities and in line with the National Water Management Plan.

1.2 The Proposed Work for Tranche 2 Overview

Following the proposed river stabilization plan and the spirit of the MFF documents, first river stabilization including the recovery of a substantial amount of eroded floodplain will take place in conjunction with and continuation of the work implemented at Chauhali during Project-1 (2015 to 2017). This work will dominate the construction of Project-2. Notwithstanding the focus on river stabilization, embankments will be built at two sub-projects to complete work started in Project-1 and maintain the economic feasibility projections for the whole program as per PPTA report. The proposed work is summarized in Table 1-1 below and depicted in details and in the following figures to show the location of PLB-1.

[20] Presently the Jamuna Multipurpose Bridge (JMB) is known as Banghabandhu Bridge. For an easier understanding of the location, we maintain the abbreviated form of Jamuna Bridge throughout this report.

Table 1-1 Details of Project-2 work items proposed in December 2017

Work Item	Work details	Remarks
JRB-1 – priority sub-project The PPTA indicated first bifurcation stabilization.		
Kaijuri embankment	Approximately 6km rehabilitation along Hurasagar	The embankment will be completed as per PPTA to achieve the full benefits of this sub-project. Construction of the road has been abandoned in favor of additional river stabilization work
Fish passes	2 Nos., to the Hurashagar River	Expanding the PPTA report
Riverbank protection	Provision of approximately 4km of adaptive allocation for the river reach Enayetpur to Kaijuri	The originally planned work of 12km will be placed on the central char and the opposite bank (JLB-2), which is priority at this moment.
JLB-2 – priority sub-project The PPTA focused more on the upstream Chauhali bank, while the river morphology indicates to include the upstream and downstream char.		
River training	Bifurcation stabilization upstream and downstream for fixed discharge distribution	Adjusted PPTA approach due to morphological developments to substantially stabilize the Jamuna left channel The bifurcation stability is relevant for both downstream channels. Riverbank protection works will not be limited to the banklines but first works will be placed on the central char, protecting some of the char land against erosion for the first time. The combination of works is expected to increase the stability of the downstream channels, improve navigation, and reduce future adaptation and maintenance works.
Land reclamation	Channel closure downstream of Chauhali Katkin plantation for char development	Adjusted PPTA approach to account for changed river situation and incorporate “building with nature” In conjunction with the upstream initial bifurcation stabilization, the downstream channel closure has the potential to free some 15km of bankline along the left bankline channel from riverbank erosion and reclaim some 5,000ha of floodplain lost mostly to Chauhail from the river.
PLB-1 – priority sub-project The existing work will be completed with contingencies for future riverbank stabilization.		
Riverbank protection	9 km upper slope protection Provision for 4km	Following the PPTA, the existing some 9km long riverbank protection will be completed

Work Item	Work details	Remarks
		by building permanent wave protection. In addition, contingency quantities are planned for downstream protective works.
Embankment from Harirampur to Dohar	Around 17.5 km new construction	Following the PPTA, construction of new embankment will provide reliable flood protection from Padma flooding in future.
Fish passes	4 to connect Ichamatty River	Expanding PPTA report

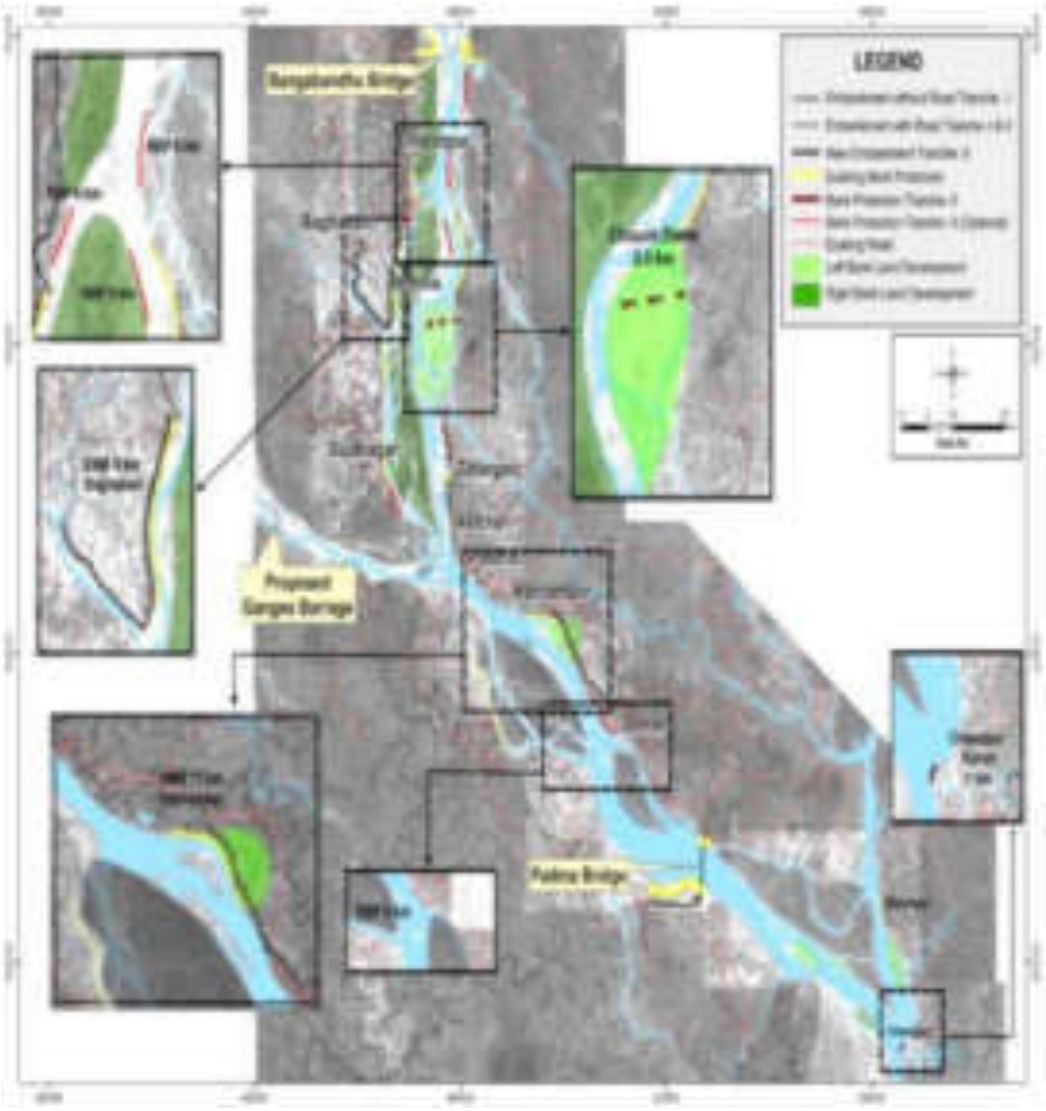


Figure 1-1 Location of the interventions for project 2

1.3 Subproject PLB-1

The river in subproject PLB-1 has been substantially stabilized with 9 km of riverbank protection work built during the first six months of 2016. This work has secured the bankline against erosion, even though parts of the temporary wave protection layer failed locally. Project-2 will establish permanent wave protection along the existing alignment, to secure the above-water part against

erosion, particularly from waves. The floodplain from Harirampur to Dohar, including the reclaimed charland will be secured against future flooding of the combined flow of Jamuna and Ganges through some 17 km of flood embankment. This embankment will incorporate a number of structures, 4 fish passes to connect from the internal river system (Ichamatty) to the Padma River. The embankment length was determined based on initial economic assessment. During this process the section from Paturia to Harirampur has been discarded due to the low economic benefits. The location of the new embankment is shown in the figure below and it will connect existing embankments on both sides to reclaim some lands and provide flood protection besides the riverbank protection. The construction of the embankment will include construction of 4 fish passes within the ROW of embankment and three road crossing therefore the land requirement/acquisition for the fishe passes itself is not required but excavation of canal on both sides which will require additional land. For road crossing in 3 areas limited land acquisition will be required for slopping down the road. (Fishes passes location shown in the figure below).

Figure 1-2 Location of the fish passes along the planned embankement

1.4 Program Rationale and Objectives

The Main River Flood and Bank Erosion Risk Management Program (FERMIP) is the follow on project of the Jamuna-Meghna River Erosion Mitigation Project (JMREMP). It aims to sustain incomes and livelihoods of people living along the three main rivers of Bangladesh – the Jamuna, the Ganges, and the Padma. It will enhance resilience to flood and riverbank erosion risks through strengthening the flood and riverbank erosion management system, including the knowledge base and underlying institutions; and by establishing integrated non-structural and structural risk management measures at priority erosion sites and addressing their sustainability. The Program may take a sector-type

approach to applying the multi-tranche financing facility (MFF) modality, to allow for (i) the flexible, adaptive, phased interventions that are technically most appropriate given the dynamic river morphology, (ii) strategic longer-term FRERM planning, and (iii) Longer-term and more effective support for institutional capacity enhancement in the sector.

1.5 Harirampur to Dohar Embankment with fish passes and road crossing

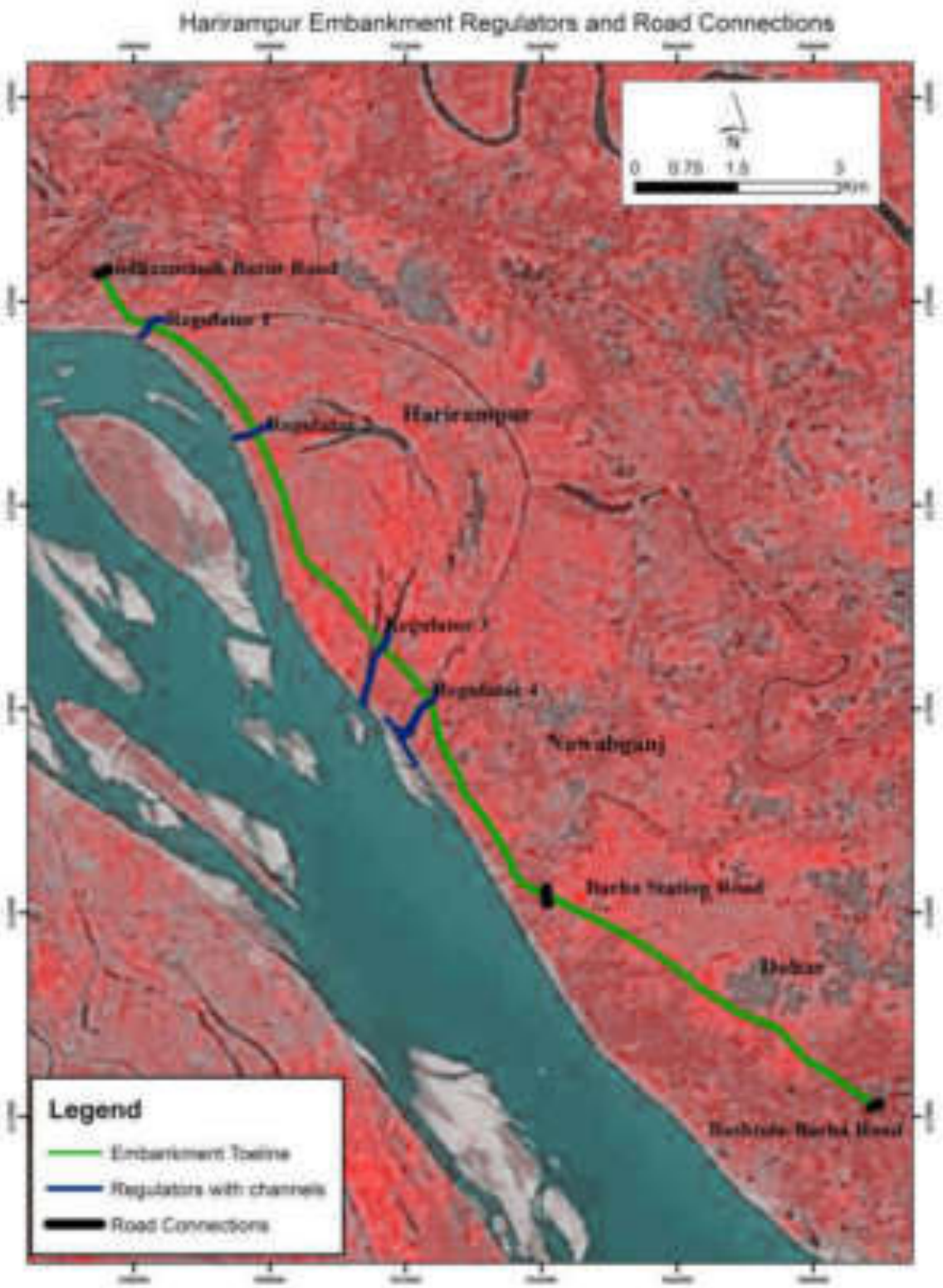


Figure 1-3 Alignment of Harirampur to Dohar Embankment with fishpasses & road crossing

The additional land requirement for the canal excavation on both sides of the fish-pass has been surveyed at field by engineers then calculated to ensure that obstruction will not occur in future during operation of the regulator. The table below shows the area required for each fish pass; and then the figure futher below shows the area to be acquired and the calculation of each regulator.

Table 1-2 Area required for land acquisition for the 4 fish passes and canals

Regulator /fish pass	Land for regulator (ha)	Land riverside (ha)	Land country side (ha)	Total ha
1	0.090	0.703	0.97	1.763
2	0.056	1.155	0.84	2.052
3	0.021	3.504	0.876	4.402
4	0.122	2.73	0.91	3.762
Total				11.979

Figure 1-4 One Fish pass and land requirement lay out for canal excavation both sides

Along the embankement there will be 3 road crossing that will impact on land acquisition for slopping. The roads that will cross the embankment are provided in the table below with the land acquisition requirement and likely impact on households.

The following figure gives a sample design of the road crossing over the embankement.

Table 1-3 Area requirement for road crossing in 3 locations

Road name	Length to be acquired both sides (m)	Land acquisition (ha)	Number of Households (assumption)
Andhar manik bazar road	68	0.187	5
Barha station road	104	0.310	5
Bashtola Barha road	56	0.142	5
Total		0.639	15

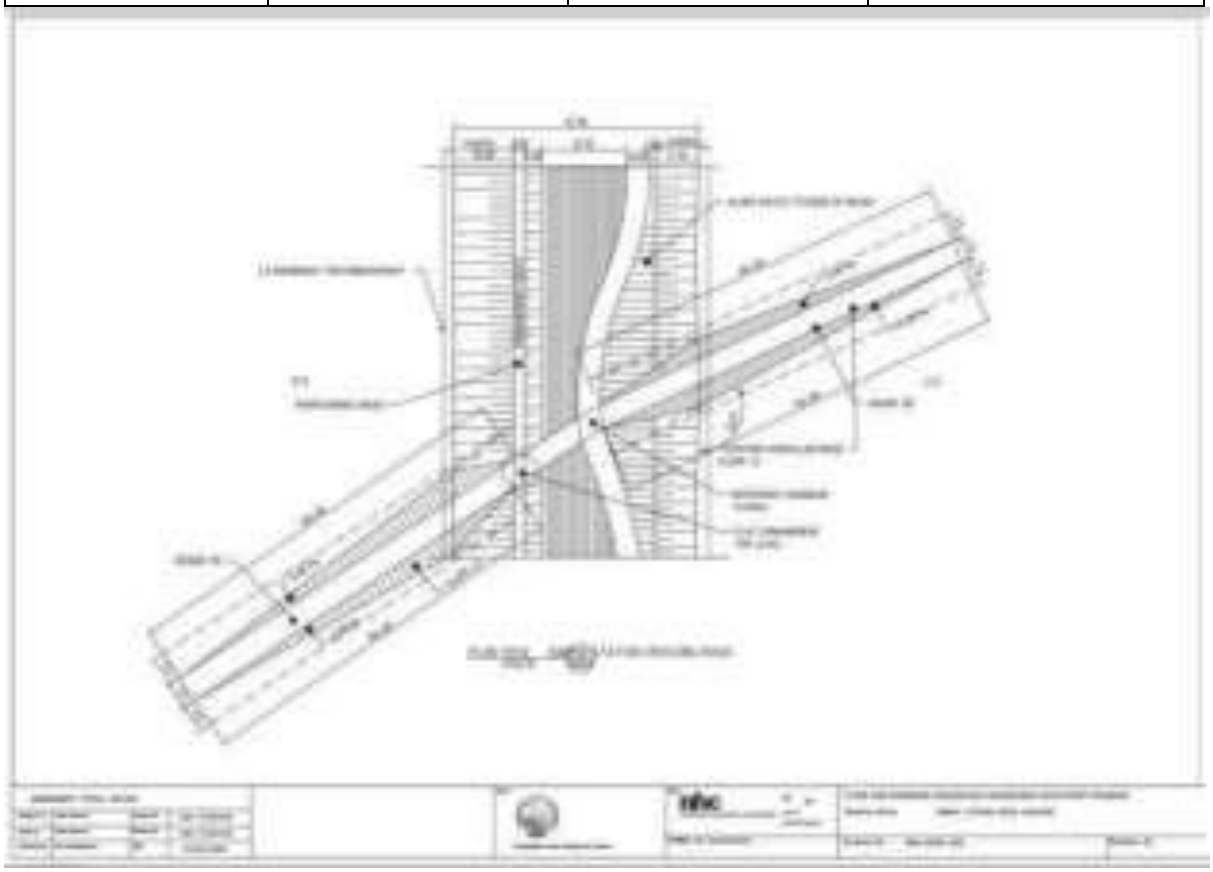


Figure 1-5 Road crossing embankement design in Dohar shows land requirement

The embankment will be constructed along the Padma River with an average cross section of the proposed embankment as shown in the Figure below. No land will be required for borrow pits as the materials for construction will be taken from the river.

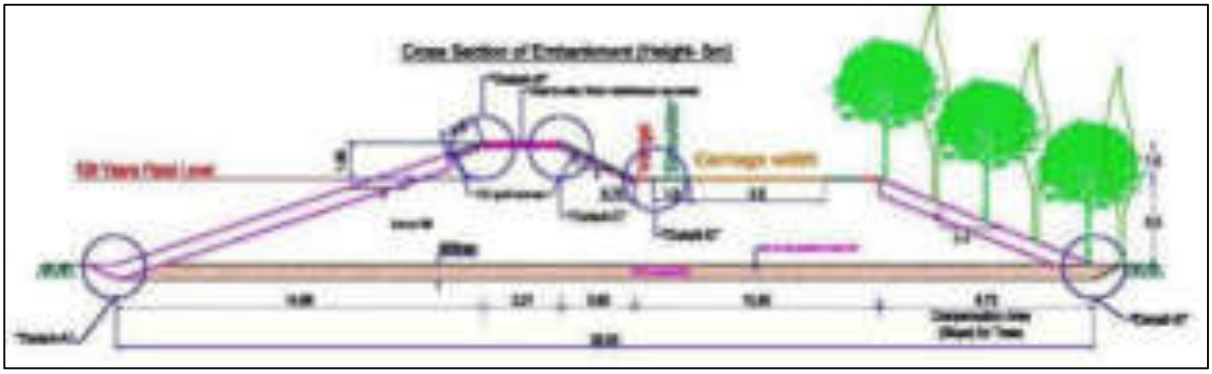


Figure 1-6 Sample Cross Section of the proposed embankment

2 SOCIO-ECONOMIC PROFILE OF THE AFFECTED POPULATION

2.1 Tranche-2 Area for the embankment in Harirampur

The administrative locations of Tranche-2 Harirampur Embankement cover one Division, two Districts, 3 Upazilas, 5 Unions and 11 villages. The embankment starts in Harirampur and ends in Dohar close to a local market place. The total length is 17.5 km and major portion of the embankments will be built on open agriculture land.

2.2 Socio-economic Profile of Affected Population

The following section presents the key findings with regard to the socio-economic profile of the affected population in the Trance-2 PLB-1 Sub-reach, as derived from census and socio-economic (SES) surveys conducted in October-November 2017. The socio-economic survey was carried out on the ROW for the proposed embankment in the settlement areas that will be affected. The identification of the AHHs by agriculture land beyond the settlement areas is yet to be conducted through the agricultural plot owner's survey at the implementation phase. The number of AHHs by land only will also derive from the Land Acquisition Plan (LAP) after identification of land owners from land registry offices and carried out by DC on the basis of the LAP. (See Annex VII, Land Acquisition Plan-LAP).

2.2.1 Demographic Information

Table 2-1 Area Coverage and number of affected population

District	Upazila	Union	Village	Mouza	Affected People		
					Males	Females	Total HHs
Manikganj	Harirampur	Boyra	Karmakarkandi Boyra	Boyra	34	36	15
			Boyra	Boyra	1	1	1
		Dhulsunra	Mohanpur	Mohanpur	6	4	3
			Abidhara	Nilgram	6	5	2
			Abidhara	Abidhara	27	19	11

District	Upazila	Union	Village	Mouza	Affected People		
					Males	Females	Total HHs
			Nilgram	Nilgram	59	56	25
Dhaka	Nawabganj	Joykrishnapur	Kantartek	Batemuri	4	3	1
			Balanga	Rajapur	91	84	40
			Kantartek	Rajapur	58	56	26
	Dohar	Kushumhati	Char Kusai(Part-1)	Chor kushai	26	29	12
			Uttar Silakota	Silakota	1	2	1
			Uttar Silakota	Kushumhati	6	4	2
			Uttar Silakota	Choto basta	18	16	8
			Uttar Silakota	Choto basta	4	3	1
			Kartikpur (Part-1)	Kartikpur	58	52	25
			Kartikpur (Part-1)	Chor kushai	2	4	2
		Nayabari	Dhoair	Dhoair	6	8	5
Total					407	382	180
	Hariramp ur	1Road crossing			Assumption		5
	Dohar	2Road crossing					10
Total Affected Households with road crossing							195

2.2.2 Level of Education

Table 2-2 Level of Education of Household Head by Gender

	Headed household		
Education Range	Male	Female	Total
	2	0	2
10th grade	9	0	9
1st grade	3	0	3
2nd grade	2	1	3
3rd grade	5	0	5
5th grade	22	7	29
6th grade	3	0	3
7th grade	4	1	5
8th grade	7	2	9
9th grade	5	1	6
Graduation or equivalent	4	0	4
Higher secondary or equivalent	10	0	10

No grade passed	69	13	82
Post graduation or equivalent	1	0	1
Secondary level or equivalent	8	0	8
Vocational education	1	0	1
Totals	**155**	**25**	**180**

2.2.3 Occupational Profile

Table 2-3 Primary Occupation of the Affected Household Heads

Upazilla	**Occupation**	**House hold heads**		**Households Nos.**
		Male	Female	
Dohar	Daily wage laborer (Agri)	5	0	5
	Daily wage laborer (Non-agri)	8	0	8
	Housewife	0	7	7
	Migrant Worker	12	2	14
	Other	6	0	6
	Petty trader	1	0	1
	Rickshaw/Rickshaw van driver	1	0	1
	Salaried person in govt/private	1	0	1
	Unemployed/dependent/children	4	0	4
	Unknown	1	1	2
	Vendor	6	1	7
		45	**11**	**56**
Harirampur	Cultivation in owned land	5	0	5
	Daily wage laborer (Agri)	12	0	12
	Daily wage laborer (Non-agri)	4	0	4
	Fisherman	3	0	3
	Homestead gardening	1	0	1
	Housewife	0	2	2
	Migrant Worker	2	0	2
	Other	9	1	10
	Rickshaw/Rickshaw van driver	2	0	2
	Salaried person in govt/private	1	0	1
	Unemployed/dependent/children	2	1	3
	Unknown	5	0	5
	Vendor	7	0	7
		53	**4**	**57**
Nawabganj	Beggar	0	1	1
	Construction worker	4	0	4
	Cultivation in owned land	5	0	5
	Daily wage laborer (Agri)	6	0	6
	Daily wage laborer (Non-agri)	10	1	11
	Housewife	0	4	4

	Migrant Worker	3	1	4
	Other	6	2	8
	Petty trader	4	0	4
	Poultry rearing	1	0	1
	Rickshaw/Rickshaw van driver	2	0	2
	Salaried person in govt/private	1	0	1
	Share cropping	1	0	1
	Tailoring	2	0	2
	Unemployed/dependent/children	7	0	7
	Unknown	2	1	3
	Vendor	3	0	3
		57	**10**	**67**
	Total	**155**	**25**	**180**

2.2.4 Level of Income of Affected Population

Table 2-4 Level of annual income of HH heads

Occupation	M_0-30,000	M_30,000-50,000	M_30,000-50,000	M_50,000-1,00,000	M_1,00,000-1,80,000	M_>1,80,000	M_Tot	F_0-30,000	F_30,000-50,000	F_50,000-1,00,000	F_1,00,000-1,80,000	F_>1,80,000	F_	F_Tot
Beggar	0						0	1						1
Construction worker				4			4				0			0
Cultivation in owned land	2	1	6	1			10	0	0	0	0			0
Daily wage laborer (Agri)	4	5	10	3	1		23	0	0	0	0	0		0
Daily wage laborer (Non-agri)	3	7	6	4	1	1	22	0	0	1	0	0	0	1
Fisherman	2	1					3	0	0					0
Homestead gardening	1						1	0						0
Housewife	0	0			0		0	10	1			2		13
Migrant Worker	0		4	5	8		17	1		1	0	1		3
Other	2	2	5	6	3	3	21	2	0	1	0	0	0	3
Petty trader			2	2	1		5			0	0	0		0
Poultry rearing				1			1				0			0
Rickshaw/ Rickshaw van driver		1	2	2			5		0	0	0			0
Salaried person in govt/private	1		1	1			3	0		0	0			0
Share cropping				1			1				0			0
Tailoring		1		1			2		0		0			0
Unemployed/dependent/ children	4	2	1	3	2	1	13	1	0	0	0	0	0	1
Unknown	1	2	2		1	2	8	1	0	0		0	1	2
Vendor	1	4	4	3	3	1	16	0	0	1	0	0	0	1

Total	21	26	43	37	20	8	155	16	1	4	0	3	1	25

2.2.5 Poverty Status

Table 2-5 Income Level of the affected households

Upazila	Yearly Income level	Number of household	
Dohar		3	
	Vulnerable (0-30,000)	1	
	Poor (30,000-50,000)	5	
	Lower Medium (50,000-1,00,00)	22	
	Medium (1,00,000-1,80,000)	12	
	Rich (>1,80,000)	13	
		Total	56
Harirampur		3	
	Vulnerable (0-30,000)	4	
	Poor (30,000-50,000)	18	
	Lower Medium (50,000-1,00,00)	22	
	Medium (1,00,000-1,80,000)	5	
	Rich (>1,80,000)	5	
		Total	57
Nawabganj	Vulnerable (0-30,000)	6	
	Poor (30,000-50,000)	15	
	Lower Medium (50,000-1,00,00)	26	
	Medium (1,00,000-1,80,000)	16	
	Rich (>1,80,000)	4	
		Total	67
		Total	180

2.2.6 Gender Status

Table 2-6 Numbers of male and female populations

Village	HH	Males	Females	Total	Avg
Abidhara	13	33	24	56	4.31
Balanga	40	91	84	175	4.38
Boyra	1	1	1	2	2
Char Kusai(Part-1)	12	26	29	55	4.58

Village	HH	Males	Females	Total	Avg
Dhoair	5	6	8	14	2.8
Kantartek	27	62	59	120	4.44
Karmakarkandi Boyra	15	34	36	70	4.67
Kartikpur (Part-1)	27	60	56	116	4.3
Mohanpur	3	6	4	10	3.33
Nilgram	25	59	56	115	4.6
Uttar Silakota	12	29	25	53	4.42
Total	180	407	382	786	

2.2.7 Vulnerability of the affected households

The details of the identified as vulnerable are given in appendix G

Table 2-7 Vulnerability of the affected households

Vulnerability criteria	Number of HHs
Female HH	25
Disabled HH	21
Low income	11
Governement support	29
Total of Vulnerable HHs*	63

2.2.8 Details of the Affected Female Headed Households

Table 2-8 Female Headed Households

Location	HH_ Name	HH_Name_Father/ Husband	HH_ Gender	HH_ Age	HH_National_ Card_No	HH_Occup	HHH_Ann_ Income	Land_Use	Ownership _Type1
Dohar; Kushumhati; Char Kusai(Part-1)	Amana khatun	Ansar uddin mollah	Female	52	2611821473026	Housewife	0-30,000	Homestead Structure	Owner
Dohar; Kushumhati; Kartikpur (Part-1)	Anwar hossen		Female	39		Migrant Worker	>1,80,000		
Dohar; Kushumhati; Kartikpur (Part-1)	Hazera begum	Akhter khan	Female	45	2611821468439	Housewife	0-30,000	Homestead Structure	Owner

Location	HH_ Name	HH_Name_Father/ Husband	HH_ Gender	HH_ Age	HH_National_ Card_No	HH_Occup	HHH_Ann_ Income	Land_Use	Ownership _Type1
Dohar; Kushumhati; Kartikpur (Part-1)	Jorna akter		Female	40	2611821468437	Migrant Worker	0-30,000	Homestead Structure	Owner
Dohar; Kushumhati; Uttar Silakota	Abul hossain	Nawab ali sheikh	Female	35		Vendor	50,000-1,00,000	Homestead Structure	Owner
Dohar; Kushumhati; Uttar Silakota	Asia akhter	Sheikh ajhar ali	Female	35	2611821475408	Housewife	0-30,000	Homestead Structure	Owner
Dohar; Kushumhati; Uttar Silakota	Hazira begum	Imtaj khan	Female	49	2611863483864	Housewife	0-30,000	Homestead Structure	Owner
Dohar; Kushumhati; Uttar Silakota	Rayhan khan	Imtaj khan	Female	34		Housewife	>1,80,000	Homestead Structure	Owner
Dohar; Kushumhati; Uttar Silakota	Rokeya begum	Panju sikdar	Female	42	2693622275555	Housewife	0-30,000	Homestead Structure	Khas
Dohar; Kushumhati; Uttar Silakota	Safali begum	Faruk kha	Female	40	2611821475413	Housewife	0-30,000	Homestead Structure	Owner
Harirampur; Boyra; Karmakarkandi Boyra	Milon moni das	Hemonto moni das	Female	49		Housewife	0-30,000	Homestead Structure	
Harirampur; Boyra; Karmakarkandi Boyra	Rita moni das	Susik moni das	Female	26		Maid	0-30,000	Homestead Structure	Owner
Harirampur; Dhulsunra; Nilgram	MST moyna begum	Mrito sheikh hachen	Female	78	5612843804909	Unemployed/dependent/children	0-30,000		Lessee
Harirampur; Dhulsunra; Nilgram	Aysha begum	Sultan	Female	44	5612843805313	Housewife	0-30,000	Homestead Structure	Lessee

Location	HH_ Name	HH_Name_Father/ Husband	HH_ Gender	HH_ Age	HH_National_ Card_No	HH_Occup	HHH_Ann_ Income	Land_Use	Ownership _Type1
Nawabganj; Joykrishnapur; Balanga	Laili begum		Female	60		Beggar	0-30,000	Homestead Structure	Owner
Nawabganj; Joykrishnapur; Balanga	Monjuara begum	Shaik fajal	Female	33		Migrant Worker	50,000-1,00,000	Agriculture	
								Homestead Structure	Owner
Nawabganj; Joykrishnapur; Balanga	Renu begum	Phakupal	Female	41	261626460832	Housewife	0-30,000	Homestead Structure	Owner
Nawabganj; Joykrishnapur; Balanga	Rohima begum	Mohammad chakura	Female	61	2616261460716	Housewife	>1,80,000	Homestead Structure	Owner
Nawabganj; Joykrishnapur; Balanga	Selina begum	Abdul samad	Female	34	2616261460196		0-30,000	Homestead Structure	Owner
Nawabganj; Joykrishnapur; Balanga	Sheikh Shoizzudin	Sheikh jolil	Female	59	2616261460975	Daily wage laborer (Non-agri)	50,000-1,00,000	Homestead Structure	Owner
Nawabganj; Joykrishnapur; Kantartek	Abdul Khaleq	sheikh Jolil	Female	69	2616261460883		50,000-1,00,000		Owner
Nawabganj; Joykrishnapur; Kantartek	Minu Ara begum		Female	40	1965261626100 0005(Latif Khan)		0-30,000	Homestead Structure	Owner
Nawabganj; Joykrishnapur; Kantartek	Rouushon ara	Umid molla	Female	50		Housewife	30,000-50,000		

Location	HH_ Name	HH_Name_Father/ Husband	HH_ Gender	HH_ Age	HH_National_ Card_No	HH_Occup	HHH_Ann_ Income	Land_Use	Ownership _Type1
Nawabganj; Joykrishnapur; Kantartek	Sheuly akter	Omer ali	Female	29	2616261552996	Housewife	0-30,000	Homestead Structure	Khas

3 INVENTORY OF LOSSES AND IMPACTS OF THE EMBANKMENT

The Tranche-2 impacts are based on the findings of the household socio-economic field survey on the alignment of the proposed embankment in November 2017. The information collected during the survey was used for preparing the initial budget. Further detailed information about the households affected by agriculture land will be provided on completion of LAP and identification of the APs owning the agriculture land.

For the full length of embankment as per proposed design 124.64 ha of land will be acquired, which includes 117.64 ha of private agriculture land (including marginal areas of khas land that could not yet be assessed). The homestead and business areas is 7 ha that include areas for housing and business structures.

3.1 Impact on Land

The land will be acquired within the settlements areas in two districts (Dhaka and Manikganj), 3 upazilas (Dohar, Harimpur and Nawabganj) and 5 Unions (Khusumati, Nayabari, Boyra, Dhulunura and Junkiranpur). It will affect 180 families and 740 populations of the total population.

The alignement of the embankement goes mostly on plain land for about 90%, the total land required for acquisition is 124.64 ha.

Table 3-1 Category of Land affected for the household surveyed

Land Use	Nos of Households	Area (Dec)
Fellow or seasonal use	27	111
Agriculture	4	71
Commercial	1	12
Homestead Land	14	488
Homestead Structure	134	1318
Total	180	2000

3.2 Impact on Structures

The impact on structures will concern 820 entities (including different type of residences, kitchen, latrine, animal sheds, TW, and others) and a total floor area is area of 153679 sft (1.43 ha). Details in Table 3-2

From the total structure area affected 30 HH will have their business structures affected over an area of 5986 sft. Table 3-3

Table 3-2 Total Structures Impacted

Structure affected	Qty	Floor size (sqf)		HHs
		Total	Avg	
Animal Shed; Kutcha (sqft)	65	9625	148	53
Animal Shed; Pucca (sqft)	1	200	200	1
Animal Shed; Semi-Pucca (sqft)	1	190	190	1
Animal Shed; Thatched (sqft)	7	1150	164	6
Kitchen; C.I Sheet & Concrete Floor (sqft)	4	1526	382	4
Kitchen; Kutcha (sqft)	88	8447	96	82
Kitchen; Pucca (sqft)	2	550	275	2
Kitchen; Semi-Pucca (sqft)	22	4461	203	21
Kitchen; Thatched (sqft)	37	3116	84	36
Latrine; C.I Sheet & Concrete Floor (sqft)	2	57	29	2
Latrine; Cemented (sqft)	73	2155	30	72
Latrine; Not-Cemented (sqft)	37	899	24	37
Latrine; Slab (sqft)	12	230	19	12
Other	41	6166	150	34
Residence; C.I Sheet & Concrete Floor (sqft)	42	17636	420	30
Residence; Kutcha (sqft)	153	44113	288	98
Residence; Pucca (sqft)	14	12991	928	11
Residence; Semi-Pucca (sqft)	102	35902	352	70
Residence; Thatched (sqft)	4	920	230	3
Well; Big (No.)	1	170	170	1
Well; C.I Sheet & Concrete Floor (sqft)	2	222	111	2
Well; Tube-Well (No.)	110	2953	27	106
Total	**820**	**153679**	**4520**	

Business Structures Impacted

The inventory of the various trees will be affected which are: total of 3542 including 14 samplings, 192 small trees, 318 small trees and 3010 fully grown tress. From the total 1869 are fruit tress, 901 are timber tress and the rest are groves, medicinal, vegetable (sajna). Details are provided in the Table 3-3 below.

Table 3-3 List of Trees affected

Tree Class	Tree Name	Sampling	Small	Medium	Mature	Total
Fruits	Amra	0	1	2	4	7
	Atta	0	8	0	8	16
	Baroi	5	5	3	32	45
	Betel-Nut	0	0	0	13	13
	Coconut	0	3	33	248	284
	Dewaphal	0	0	0	2	2
	Guava	0	8	11	93	112
	Jackfruit	0	15	18	263	297
	Jam	0	4	2	33	39
	Jambura	0	0	0	13	13
	Jamrul	0	0	1	0	1
	Katbel	0	0	0	7	7
	Lychee	0	10	1	16	27
	Mango	9	98	114	767	988
	Palm (Tal)	0	0	0	8	8
	Tamarind	0	0	0	4	4
	Wood Apple	0	0	0	6	6
	Total	14	152	185	1517	1869
Groves	Bamboo	0	0	1	67	68
	Banana	0	3	2	24	29
	Total	0	3	3	91	97
Medicinal	Neem	0	1	2	35	38
Other	Other	5	14	38	572	630
Timber-Fuel	Akashmoni	0	0	0	5	5
	Debdaru	0	0	0	2	2
	Hijal	0	0	0	44	44
	Kadom	0	6	0	70	76
	Koroi	0	3	0	112	115
	Mahogoni	0	13	90	492	596
	Shimul	0	0	0	1	1
	Sisso	0	0	0	6	6
	Ukaliftas	0	0	0	56	56
	Total	0	22	90	788	901
Vegetables	Sajna	0	0	0	7	7
Grand Total		14	192	318	3010	3542

The impact on affected crops will be provided in the revised RP after the agricultural plot user's survey has been carried out and the land acquisition plan identifying plots owners.

During the physical survey, the alignment has been modified to minimize the impacts in the settlement areas and there will be no common properties affected.

The number of agricultural plots users to be affected is yet to be finalized on the basis of Land acquisition plan submission to land registry department for identifying the plot owners of agriland. In addition another agricultural plot users survey in the agriculture land affected will be launched and likely have a minor impact on the budget with some additional crop compensation.

Along the new embankment and within the ROW, 4 fish passes and 3 road crossing are going to be built while additional impacts of the land estimated for the embankment and the amount of land required 12.64 ha as per special survey done in those locations. From the overlay of the embankment alignment on the mouza maps, a Land Acquisition Plan (LAP) has been prepared. The LAP will comprise the list of plots to be affected in the different mouza and lay out of the embankment is given in Appendix G.

4 CONSULTATION, DISCLOSURE AND PARTICIPATION

4.1 Consultation Process

Initial consultation and sharing with local people in the area was done through FGDs to elicit their views and opinions about the proposed project and its ultimate objective of river corridor stabilization and reclamation of land. Then details survey also conduted. So this RP has been prepared based on the findings of consultation, participatory census and Resettlement and Socio-economic Survey (SES) done by a group of staff having social and engineering background which was led by the National Resettlemnet Expert of the project.

4.2 Project Stakeholders

The primary stakeholders of the project include the agriculture farmers, local business community, and as well as the Displaced Households. Secondary stakeholders are the community people, fishermen, boatmen and local government institutions (LGI). Other stakeholders include Bangladesh Water Development Board, under the Ministry of Water Resources as the EA, Department of Forest, ADB and other government agencies. The other stakeholders include the businessmen groups like contractors, sub-contractors and suppliers during the construction period. The local government representatives will also be benefited in gaining peoples support as a result of local development in the area due to better communication and better protection against flood. The local NGOs working in the area will be motivated to work in the areas where activities are developing. One NGO or social consulting firm, with required work experiences, will be engaged to assist BWDB for smooth implementation of the RP.

4.3 Disclosure and Public Consultation (DPC)

Goals and objectives of the project have been disclosed with the affected people and other stakeholders through focus group discussion and public consultation meetings.

Information gathering:

(I) Review of ADB guidelines on disclosure and public consultations

(II) Review of other Donors' guidelines on disclosure and public consultations

(III) Review of available literature on disclosure and consultation method followed in other donor funded infrastructure projects and good practices

Information on disclosure:

(I) Dialogue with local people through public meetings

(II) information and consultation meetings (ICM) in the locality

(III) Disclosure of the project components and other related issues among stakeholders of all levels through conducting public meeting.

(IV) Focus group discussion with local stakeholders with primary focus with the project affected people irrespective of gender and social status.

(V) Disclosure of the Resettlement Issues among the potential affected persons

Consultation:

Consultation of resettlement and rehabilitation issues with all level stakeholders and gather feedback on potential risks and probable mitigation measures. Encourage all level stakeholders to participate in the consultation by receiving views from representatives of different groups including affected shopkeepers, residential structure owners, fishermen, local traders, women and vulnerable groups etc.

4.4 Public Consultation Meetings (PCMs)

The public consultation process in the project area began in January 2017, as part of the first pre-feasibility study. Public Consultation Meetings (PCMs) and Focus Group Discussions (FGD) provided the concerned households opportunities to express their concerns about land acquisition, compensation, and resettlement. The consultation process will be further intensified during the detailed design period through formal and informal meetings, village level workshops, and disclosure of project impacts to the affected households and communities. This chapter presents a summary and overview of the consultations held over the project preparation period.

4.5 Consultation meetings at a glance

The major issues discussed during the consultations are presented below. Description of the topics and discussion held in the meeting are presented in the Table below.

Table 4-1 Topics & discussion of the meeting

Topics/Issues discussed	Description of discussions held
Attitude and perception of the community towards the project including changing/adjustment of alignment Project concept, design and benefits, Cut-off-date of listing the affected properties, ADB policy on involuntary resettlement, Procedure of determination of land price, Adverse effects of the project & mitigation measures,	Policy for Entitlements of the affected people and cut-off-date for listing of the lost properties were explained to the people. The end date of census is the cut-off-date. In this regard 31 December 2017 is the cut-off-date for Harirampur. Structure price at market rates, compensation and other assistance should be paid before displacement;

Compensation payment procedure and entitlements, Major problems relating to the projects and special attention to the vulnerable group etc. Relocation of common property resources	Proper compensation for Structure. Business, etc. should be paid Self relocation of affected households is encouraged, Special assistance for poor and vulnerable households Preferential employment for the affected vulnerable APs during the construction of the project should be ensured Training on income generating activities should be provided to the poor APs and income restoration assistance should be paid Assistance for common property resources (CPRs) to construct a new one

4.6 Focus Group Discussions (FGDs)

The River Stabilisation and Corridor Managment Plan proposes to change the living conditions of people living on chars and within the floodplain of the Jamuna and Padma rivers through stabilisation and narrowing of the main river channel and by the provision of embankments on currently unprotected floodplains. A social impact assessment was therefore needed to find out the current living conditions and what potentially affected people think about the proposed interventions as regards their future aspirations. There are two main groups of affected people: i) Char dwellers and ii) People living in currently unprotected floodplains (left bank of Jamuna & Padma rivers). Focus group discussions (FGDs) were therefore needed with both groups but for slightly different reasons.

The FGDs were undertaken in two tranches. The first on chars in the Padma River was undertaken in May and June 2016 when 7 (seven) FGDs were undertaken in Shibaloy, Harirampur, Sadarpur, Dohar and Shibchar upazilla. Following a hiatus in the project a second tranche of FGDs was undertaken in October-November 2017 a total of 17 (Seventeen) and altogether 24 FGDs.

Following the identification of a possible location the area was visited the day before the FGD to raise awareness and identify a suitable location for the discussion. Ideally FGDs were held with homogeneous groups from the same locality/community on each char with groups of 10-12 people and not more than 15 but this was not always possible.

The FGD was led by the facilitator supported by one or two note takers and participants introduced themselves by name, age and main profession and a comment on why they had come to the meeting. The facilitator introduced the project and the purpose of the FGDs in assessing the acceptability of the project to the group, whether they would want their char to be stabilised or whether they prefer life as it is. The facilitator attempted to avoid domination of the discussion by one or two people with all participants encouraged to give information and views and sometimes asked directly. The notes from the FGDs were very detailed and included some direct quotations. The notes were written up in the evening and translated into English at a later date. The guiding questionnaires changed slightly between tranche I and II.

Socio-economic Profile

It is found that majority (81%) of the flood plain households are vulnerable, over 90% are landless, marginal or small farmers and about half of the total households lost land. A poverty index is 7-10% higher among them compared to the rest of the country. Floodplains those attached to chars are more crowded than main lands. They build house with C.I Sheet as they can move it from one place to another within short time. In flood plain they become landless due to erosion. Urbanization is the most positive thing considered in flood plains. These people do not have enough opportunity to have good occupation and not good access to market.

Impacts

Both negative and positive impacts have been identified through intervention. However, the impacts are very close but have different type of dimension or intensity in flood plain as compared to the char land. Positive impacts are (i) Vulnerability will reduce and will have more secured life by participating in Livelihood Restoration Program (ii) Likely to invest more in livelihood improvement with secured situation; (iii) Will increase employment opportunities; (iv) Will have improved transport and market access for milk and meat and (v) potential rise of land value. However, negative impacts need to be addressed to have the positive benefits. These are (i) Loss of land and livelihood due to embankment construction; (ii) Potential for loss of land within river corridor (iii) Loss of social cohesion due to resettlement; (iv) Potential to loss of livelihood for sharecroppers for construction of embankment and in the river corridor (iv) Less livelihood security for landless if compared with former sharecroppers for work .

Summary Impacts

The study identified both positive and negative impacts would face the char and as well as flood plain with the intervention of the plan. However, it is speculated that the impact of this project on the households living on both char and flood plain areas will enjoy positive impacts outweigh the negative impacts. To make this plan successful flood plain dwellers in river corridor and embankment alignment will need resettlement, it is assumed that these resettlers as well as land owners will face negative impacts. On the other hand the Char dwellers on LSRA are the main beneficiaries of the plan but subsequent land acquisition and land use planning will need great sensitivity. Care must be taken to protect the social cohesiveness while high potentiality is there for land grabbing by the powerful people.

A table and a map attached to show the location and reach of FGDs held mentioned below:

Table 4-2 Focus Group Discussions (FGDs)

Duration of FGDs: May-June 2016 and October- November 2017						
Reach	1	2	3	4	5	Sum
Already reclaimed		1	2	2		5
Attached	1	2		2		5
River	2	2	4	4	2	14
Total						24

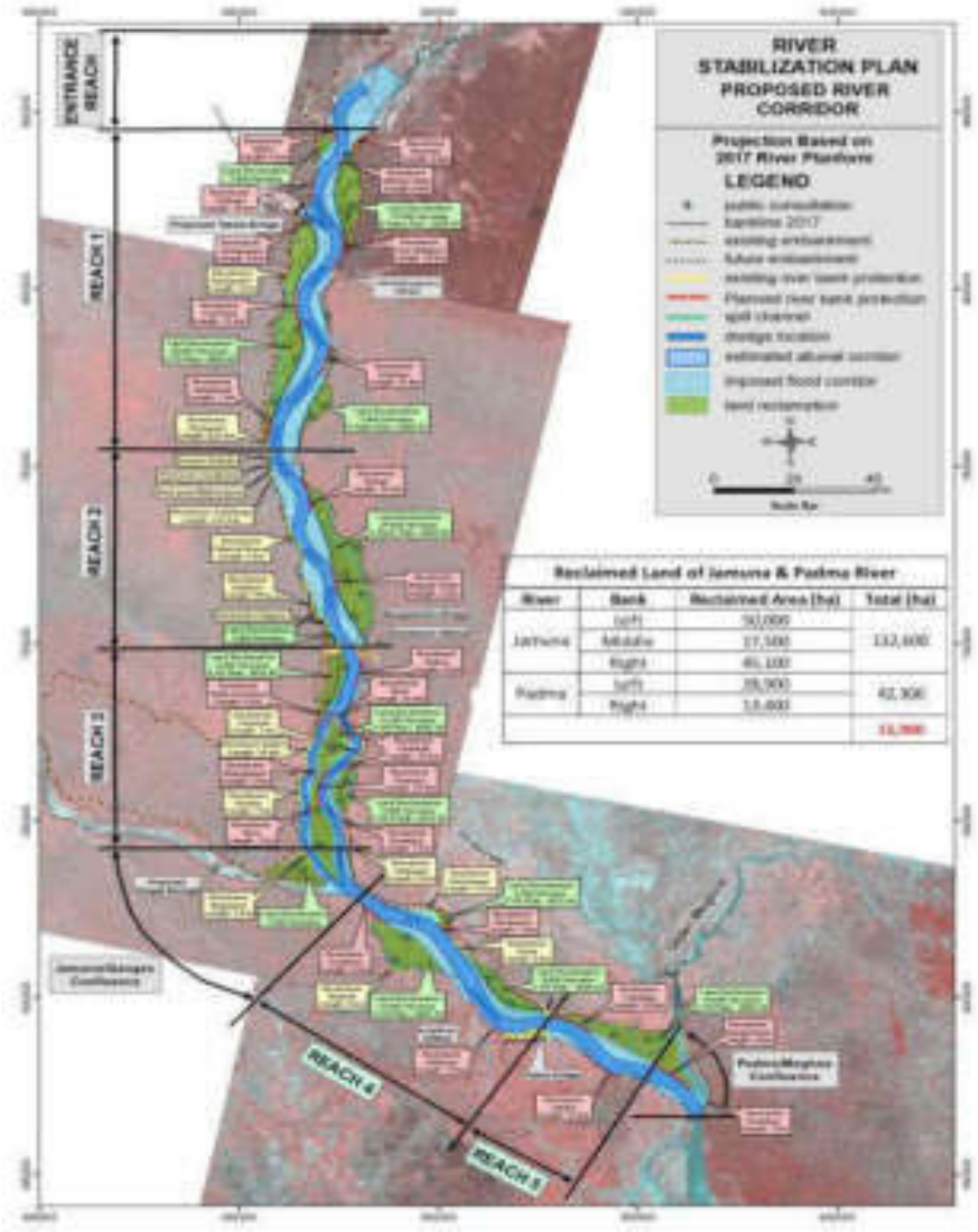


Figure 4-1 Map of FGDs Locations

Perception of the Households

FGDs have been conducted in 24 locations around Jamuna-Meghna-Padma-Brahmaputra. One of the affected people answered to the question “What did you loss?” “Jamuna is like Catfish, it eats everything – so I lost everything including land and belongings”. The perception of the people about Project Acceptability

- High expectations from this plan
- Land Acquisition will be need but should be rational with appropriate compensation
- Overwhelmingly in favour of River Stabilisation Plan
- Loss of land to bank erosion is the major issue, expect to get rid of this situation through this project
- Would invest in land and livelihoods following stabilisation
- Welcome development of industry providing it creates employment
- Char people dream to educate their children as high as he can, even a man of old Chars wants to educate his children until the level of PhD on Char land; many students used to come to chars for their thesis as he experienced and they all are from mainland or from urban area or from big city. He said, “I want my children to have the PhD on Char lives as they are the genuine people of chars”.
- They expect industrialization so they don’t need to move for livelihood and daily consumption with the hope that everything will be available in Chars when it is stabilized and developed.
- There are some negative impacts of floodplain areas especially between land owners as they would loss their land, loss their social cohesion, share croppers are also affected.
- Despite of having new land there are some negative impacts also like govt. will use khas land for industrialization purpose but there are some people living on the khas land they will become homeless.
- New Char lands will be grabbed by the influential or powerful person which is very common; so they want support from government in this regard.
- There are some problems especially Khazna payment, lack of earning opportunity. Almost all people requested us, “Please fix our erosion problem we will do the rest”.
- People welcomed this project very cordially and there is no negative opinion on project acceptability.
- They want a stable char, no erosion and want to get back their lost land
- They use river-water for all purposes so there is a need of proper water supply system that is very important for them.

4.7 Information booklets and disclosure of RP

It may be noted that the information brochure is being prepared and will be distributed among the APs and non-APs as well. The APs are contacted in several times but counted once. DP consultation meeting held with or without resolution.

The main themes and scope of the RP will be disclosed in detail to the affected community, after it has been approved and translated into Bengali. The RP’s provisions will be further explained to DPs in group discussions, personal contact and community level meetings. An English version will be uploaded to ADB’s resettlement website.

This RP will be summarized in an information book which will be circulated among the people in local language (Bengali) and disclosed to APs during implementation of the RP after it has been reviewed and approved/endorsed.

The Implementing Agency (NGO) engaged to assist BWDB in implementing this RP, will update, publish and distribute the booklet explaining the impact of the project, compensation policies for DPs, resettlement options/strategies for households and shops, and tentative implementation schedule of the project. Further steps will be taken to (i) keep the affected persons informed about compensation policy and payments, and (ii) ensure that DPs will be involved in making decisions concerning relocation and implementation of the RP.

4.8 Strategy for Community Consultation and Participation during Implementation

INGO engaged during the next phase will continue the consultation process during the implementation of the RP. Resettlement related brochures, leaflets and other communications materials in the local language (Bangla) will be updated and published for distribution among the affected households. These materials will also be available in the Union Parishad, Upazilas and district offices in the project area. Further steps will be taken to (i) keep the affected people informed about additional land acquisition plan, compensation policies and payments, resettlement plan, schedules and process, and (ii) ensure that project-affected persons are involved in making decisions concerning their relocation and implementation of the RP. The consultation and participation will be instrumented through individual contacts, FGDs, open meetings and workshops. In sum, consultation will remain a hallmark in the project implementation processes. The consultation meetings, issues discussed and outcomes and subsequent follow–up actions will all be recorded for future verification.

Contents of the information brochure

- Project description
- Project Impact/benefits
- Details of rehabilitation and relocation
- The Contents of Compensation Policy
- RP implementation by key functionaries with their responsibilities;
- Some usefull hints for EPs as to how to prepare them for receiving compensation
- Procedure for filling of grievances for redress etc.

See sample of information brochure in Appendix E in English and to be translated in Bangla before implementation.

5 GRIEVANCE REDRESS MECHANISM

The BWDB will constitute RP implementation committees such as Joint Verification Team (JVT),[21]Property Valuation Advisory Committee (PVAT) and a Grievance Redress Committee (GRC) for the various RP implementation activities ensuring Stakeholder participation. A local GRC, gazetted by the GoB, will be composed of: a) Representative from BWDB – Convener (Executive Engineer (Field)/Equivalent); b)Chairman concerned Union Parishad – Member; c)Representative from APs – Member; d) Sub Assistant Engineer From BWDB - Member Secretary. The local GRC will by meeting all the aforementioned participants informally, as well as formally, to ensure speedy and out of court settlement of as many disputes as possible.

The fundamental objectives of GRCs will resolve any resettlement-related grievances locally in consultation with the aggrieved party to facilitate smooth implementation of the RP.Another important objective is to democratize the development process at the local level and to establish accountability to the affected people. The GRC is a project level mechanism for receiving and resolving project related grievances. The costs associated with the GRC will be appropriately budgeted in the RP. Irrespective of the GRC decisions, an aggrieved person will be free to access the country's legal system at any stage of the grievance redress mechanism.

The BWDB will constitute RP implementation committees such as Joint Verification Team (JVT),[22]Property Valuation Advisory Committee (PVAT) and a Grievance Redress Committee (GRC) for the various RP implementation activities ensuring Stakeholder participation. A local GRC, gazetted by the GoB, will be composed of: a) Representative from BWDB – Convener (Executive Engineer (Field)/Equivalent); b)Chairman concerned Union Parishad – Member; c)Representative from APs – Member; d) Sub Assistant Engineer From BWDB - Member Secretary. The local GRC will by meeting all the aforementioned participants informally, as well as formally, to ensure speedy and out of court settlement of as many disputes as possible.

The fundamental objectives of GRCs will resolve any resettlement-related grievances locally in consultation with the aggrieved party to facilitate smooth implementation of the RP.Another important objective is to democratize the development process at the local level and to establish accountability to the affected people. The GRC is a project level mechanism for receiving and resolving project related grievances. The costs associated with the GRC will be appropriately budgeted in the RP. Irrespective of the GRC decisions, an aggrieved person will be free to access the country's legal system at any stage of the grievance redress mechanism.

5.1 Grievance Redress Committee (GRC)

GRCs will be formed at union level for any grievances involving resettlement benefits, relocation, and other assistance. The local GRC shall review and resolve grievances within one month of receiving any complaints and will maintain written records of all the appeals received.

[21]JVT will be constituted of: i) Representative from BWDB - Convener (SDE/AE/Equivalent officer); ii) Representative from concerned DC – Member; iii) Sub Assistant Engineer from BWDB - Member Secretory

[22]JVT will be constituted of: i) Representative from BWDB - Convener (SDE/AE/Equivalent officer); ii) Representative from concerned DC – Member; iii) Sub Assistant Engineer from BWDB - Member Secretory

The GRC have been formed as:

- Representative of BWDB
- (Executive Engineer or equivalent Officer) : Convener
- Union Parishad Chairman of the concern area : Member
- One representative of Affected Persons : Member
- Sub-Assistant Engineer, SMO, BWDB : Member-Secretary

5.2 Grievance Redress Steps

Procedures of resolving grievances are described in Table below.

Table 5-1 Grievance Redress Steps

Step 1	The Implementing Agency informs APs about their losses and entitlements If satisfied, the DP claims resettlement payments to the EA. If confused:
Step 2	The DP approaches the IA field level officials for clarification. The IA will clarify the DPs about their losses & entitlements as per RP. If resolved, the DP claims resettlement payments to the EA. If not resolved:
Step 3	The DP approaches to the GRC. IA staff assists the APs producing the complaints and organize hearing within -21 days of receiving the complaints.
Step 4	GRC to scrutinize applications, cases referred to DC through EA if beyond their mandate as per scope of work
Step 5	If within the mandate, GRC sessions held with aggrieved APs, minutes recorded. If resolved, the Project Director approves. If not resolved:
Step 6	The DP may accept GRC decision, if not, he/she may file a case to the court of law for settlement.
Step 7	The GRC minutes, approved by the Project Director, received at Conveners' office back. The approved verdict is communicated to the complainant DP in writing. The DP then claims resettlement payments to EA

DPs will be able to submit their grievance/complaint about any aspects of Resettlement Plan implementation and compensation. Grievances can be shared with the BWDB verbally or in written form, but in case of the verbal form, the IA representatives in the GRC will write it down in the first instance during the meeting at no cost to APs. The APs will sign and formally produce to the GRCs at respective office of the IA assisting BWDB implementing the RP.

The GRCs will be activated with power to resolve resettlement and compensation issues not to be addressed under legal suit in the courts. The GRCs will receive grievance cases from the affected persons through the Implementing Agency. The IA will assist the APs in lodging their resettlement complaints in a proper format acceptable to the GRCs after they get ID cards from BWDB or informed about their entitlements and losses.

The appeal procedure and conflict resolution will be as follows:

- All complaints from the APs will be received at the field office of the Implementing Agency, the member secretary of the GRCs with a copy to the concerned Local Government Institution representatives.
- The representative of the IA in the GRCs upon receipt of complaints will inform the convener (BWDB representative) of the GRC and the convener will organize a hearing session from the complainants in concerned UP Chairman's office from where the complaint was receipt.
- The GRC will review the proceedings and pass verdicts to convey to the concerned DP through the IA.
- If there are such matters relating to arbitration through the courts, the matter will be referred to the court.
- The GRC will settle the disputes within maximum 21 days of receiving the complaints from the DPs.

Resolution of the GRCs will be final and adopted in the process of resettlement for issuance of ID cards, determination of loss and entitlements and payment.

6 LEGAL AND POLICY FRAMEWORK

6.1 GOB Laws on Land Acquisition

The principal legal instrument governing land acquisition in Bangladesh is the Acquisition and Requisition of Immovable Property Ordinance II (1982) and subsequent amendments of the Ordinance II (1989/93/94/2017) and other land laws and administrative manuals relevant to alluvion/deluvion land, char and khas land administration in Bangladesh.[23] The 1982 Ordinance requires that compensation be paid for (i) land and assets permanently acquired (including standing crops, trees, houses); and (ii) any other damages caused by such acquisition. The Deputy Commissioner (DC) determines (a) market value of acquired assets on the date of notice of acquisition (based on the registered value of similar property bought and/or sold in the area over the preceding 12 months), and (b) 200% premium on the assessed value (other than crops) due to compulsory acquisition. However, it is well known in Bangladesh that people devalue land during transactions to pay lower registration fees. As a result, compensation for land paid by DC including premium remains less than the real market price or replacement value. The 1994 amendment made provisions for payment of crop compensation to tenant cultivators.

In addition to the Ordinance, another relevant law that applies to the Project due to acquisition of bankline for riverbank protection (RBP), is the State Acquisition and Tenancy Act 1951 (Section 7) that defines the ownership and use right of alluvion (*payosti*) and diluvion land (sikosti) in the country. Legally, GOB owns the bankline and eroded land in the river. However, the "original"

[23] Alluvial, deluvial and *char* land survey and settlement (No. 2-2/87/90(1060)/1987; Settlement of char land (No. 2L-3/73/86(19)-R.L/1973; Settlement of Deluviated Lands Reformed in Situ (Memo No. 196(36)-V-177/77-L.S /1978), State Acquisition and Tenancy (Amendment) Act, 1994; Transfer of *Khas* Land between GOB departments (M:/Sha-10/HUD/general-1/94/345(64)/1994 (source: Land Administration Manual, Vol. 1, Ministry of Land, GOB).

owner(s) can claim the land if it re-emerges in a natural process within 30 years from the date of erosion.

6.1.1 Inadequacies of 1982 Ordinance

The Ordinance, however, does not cover project-affected persons without title or ownership record, such as informal settler/squatters, occupiers, and informal tenants and lease-holders (without registration document) and does not ensure replacement market value of the property acquired. The act has no provisions for resettlement of the affected households/businesses or any assistance for restoration of livelihoods of the affected persons. As a result, land acquisition potentially diminishes productive base of farm families and those affected and displaced by development projects.

6.1.2 Harmonization with ADB's Policies

The ADB has its own safeguard policies to minimize displacement and require time-bound action plans with measures to restore or improve livelihood and income of those affected by development projects. Since the 1982 Ordinance falls short of the requirements of the ADB's safeguard policies on many grounds, the project land acquisition and resettlement policy has been harmonized with ADB's ADB's safeguard policies.[24] The harmonization was carried out through a gap analysis involving the 1982 Ordinance II and the ADB's safeguard policies and gap-filling measures. The harmonization has also benefited from the Jamuna Bridge and Jamuna-Meghna River Erosion Mitigation Project (JMREMP) "best practices" in resettlement. The best practices – for example, include Photo ID Card with description of losses and entitlements, Video filming of ROW to control fraudulent claims, Resettlement sites with civic amenities, multiple relocation options, including "self-managed" resettlement.

The harmonized policy forms the basis for preparation of social safeguard plans for various components of the project. The harmonization and gap-filling measures are in Appendix A and Appendix B, respectively.

6.2 Policy Principles and Guidelines

In view of the harmonization, the project will apply the following policy guidelines and procedures to comply with ADB's safeguard compliance requirements:

(i) Avoid or minimize impact as much as possible through alternative design options;

(ii) Consult affected people and their communities adequately;[25]

(iii) Make resettlement plans and other related documents available at the project sites;

(iv) full disclosure will be ensured through distribution of a summary RP in Bangla to the affected households and other stakeholders;

[24] ADB, Safeguard Policy Statement (SPS 2009). http://www.adb.org/documents/safeguard-policy-statement

[25] Adequacy is defined by number of persons covered (minimum 50 in each consultation), attendance of women and vulnerable groups in each consultation, separate consultation on target group like poor and vulnerable and broad community based understanding of project impacts, mitigation and policies.

(v) Determine replacement cost of assets acquired and compensate at full replacement costs determined by Property Valuation Advisory Committee;

(vi) Provide Resettlement assistance to all APs, irrespective of their titles to land;

(vii) Establish grievances redressal committees at the local level for speedy resolutions of disputes;

(viii) Provide additional assistance to poor women-headed affected households (AHs) and vulnerable groups;

(ix) Establish income restoration assistance for alternative income sources and restoration of livelihoods for assisting affected people to restore and/or improve upon their pre-project levels or standards; and

All affected households and person, as per the above policy/principles and guidelines, will be eligible for compensation and assistance to be provided by the project. In case of land acquisition, the date of notification of section-3 for acquisition will be treated as the cut-off date while people without titles such as *nodibhashis* (erosion displaced households squatting on others' land, also called *uthuli*) or informal settlers/squatters living in the acquired area, the date of census or similar designated date by the BWDB will be considered as the cut-off date. Any persons moving into the project area after the cut-off date will not be entitled to any assistance.

6.2.1 Planning Steps and Procedures

To revise and update any RP, the following procedures and steps will be followed. First any additional new impacts and a Detailed Engineering Design (DD) and stake out of the ROW alignment will be identified through proper detailed measurement survey (DMS), including a census survey, and community consultations. In cases where the DD has revised the impacts, a new cut-off date(s) will be established. Second an inventory of losses (IOL) will be established based on the census survey. Third, updating entitlement matrix ensuring all new impacts and related losses are covered. Fourth, disclosure of impacts and entitlements including incorporation of any suggestions from affected groups and communities. Fifth, the valuation of all affected assets will be undertaken and a revised budget will be prepared for payments of compensation. Finally, the updated RPs will be posted on the ADB's website.

7 ELIGIBILITY AND ENTITLEMENTS

Lack of legal documents for customary rights of occupancy/titles shall not affect eligibility for compensation. The RF stipulates payments of compensation as per the assessed value of the land and structure to the affected persons (APs). In addition to compensation paid by the concerned Deputy Commissioner (DC), the APs will receive additional assistance in cash or kind to match replacement costs, which is the difference between the market value and the assessed value for lost assets (land, houses and trees), transaction costs such as stamps/registration costs (in case of purchase of replacement land) and other cash grants and resettlement assistance such as shifting and reconstruction grant, resettlement benefit for loss of workdays/income due to dislocation. Socio-economically vulnerable households namely-female-headed households without grown up male in the household, households below poverty line, households headed by disabled and elderly people will be given additional cash assistance for relocation. The cut-off date for the AHs varies in the area but is within November – December 2017 time of the survey.

7.1 Unanticipated Impacts on Charlands

Although there are no anticipated negative impacts on charlands, the project will monitor the river behavior to assess all unanticipated impacts on chars and char people through the Project's environmental assessment and review procedure (EARP).

7.2 Valuation of Assets

DC follows the rules laid down in the 1982 Ordinance updated in 2017 to determine market prices for assets like land, structures and trees/crops, with assistance from other departments such as Public Works

Public Works Department (PWD) for structures, Department of Forest (DOF) for trees, and Department of Agricultural Extension (DAE) for crops. The assessed value is typically lower than the replacement value. Indeed, there exits confusion over statutory "market value" and compensation at replacement costs.

Where (i) markets provide reliable information about process and (ii) comparable assets or acceptable substitutes are available for purchase, replacement cost is equivalent to "market value" of the replacement land, plus any transaction costs (such as preparation, transfer, and registration fees and taxes). See Appendix B for price valuation (CMV) collected from different Upazela offices during socio-economic field survey in November 2017.

In Bangladesh's rural setting, the conditions noted above are not present. Therefore, to ensure that APs can replace the lost property, a replacement value will be provided as determined by a Property Valuation Advisory Committee (PVAT), which will be constitutedby BWDB with representatives from BWDB, Construction Supervisor Consultant (CSC), concerned DC office, local Upazila (local government). The Construction Supervisor Consultant provided all technical support to the PVAT to assess the market price and recommend the replacement value of assets, which will be approved by the PD in place of the MoWR. BWDB will pay the difference between the approved replacement value and the DC payments under the 1982 Ordinance II modified in 2017. In addition, APs will be allowed to take away the materials salvaged from their dismantled houses and shops at no costs, despite compensation paid by the DCs. The entitlement matrix describes major types of losses attached to land acquisition and resettlement. The Project will assist the APs in clustered relocations with community facilities or, alternatively, in self-relocation. APs may be relocated to BWDB land (if available) or to plots purchased (by the APs) for which assistance is provided in the form of homestead land development.

Table 7-1 Project Eligibility and Entitlement Matrix

General Implementation Issues and application Guidelines
1. PVAT BWDB will setup a Property Valuation Advisory Team (PVAT) at each locality. The tasks of this PVAT are: a) Recommend Replacement Cost (RC) based on Current Market Price (CMP) analysis for Land, Structures, Trees and standing Crops b) CMP will be assessed for every affected mauza

General Implementation Issues and application Guidelines

c) The Land Acquisition price will be determined by the standard procedure according to the land acquisition law. Updated in September 2017.
d) For all private land, the market price will be enhanced by 200% for compensation under law (CCL). For *khas* land (DC is the owner at respective districts on behalf of the government), CCL will be the assessed market price without enhancement.
e) RC for structure considering the cost of materials, labor inputs and land development cost at current market rates**.**
f) RC /CMVwill be approved by the Project Director.

2. INGO

BWDB will engage a NGO to support implementation of resettlement plan i.e. to support the implementation of all land acquisition and resettlement activities. The NGO (INGO) will

a) Identify all persons who have interest in the lands that will be acquired under the project (owner, tenants, operators etc.;
b) identify all informal occupier/ settler on the right of way of new embankment, rehabilitation embankment and RBP works;
c) Make the landowners / tenant/ informal occupier aware about details of land acquisition process, compensation entitlement, payment procedure/ mechanism, resettlement benefit offered by the project.
d) Legal owners will be assisted by INGO to organize legal documents in support of their ownership
e) INGO will identify loss and entitlement of female owners and co-sharers through share determination at the field upon receipt of payment data from the DC office
f) The INGO will inform the APs of the details of the land acquisition and compensation process, resettlement package and payment procedure.
g) The INGO shall encourage Entitled Persons (EPs) to consider purchasing land or investing the money in productive/income generating activities.

3. JVT

a) The loss inventory items and quantities as well as the Entitled Persons (EP) shall be verified in the field through Joint Verification Team (JVT) formed by DC. The members of PVAT will attend field verification by JVT.
b) The JVT will verify the socially recognized User as identified by the Census

4. BWDB field office (Executive Engineer) will do Title updating for usufruct and other rights before issuance of notice with assistance from INGO

5. DC will pay CCL for the Loss Items. If RC is higher than CCL, the difference will be paid by BWDB with assistance from INGO.

6. Compensation for Structures:

a) Joint Verification (DC and BWDB) and/or Census will identify (record floor areas and category) of structure
b) Compensation must be paid before DP dismantle and remove the structures as per civil works requirement
c) The date of service of notice will be recognized as the cut-off date for structures not recognized by DC. In case of major differences identified between databases, BWDB will verify the data through the Joint Verification Team (JVT).
d) The owner is allowed to take all salvageable material
e) The RC will be the cost of the structures at market price

Unit of Entitlement	Entitlements	Applicable Law	Additional Services
Loss Item 1: LOSS OF AGRICULTURAL LAND			
Legal owner(s) as identified by Deputy Commissioner (DC) in the process of CCL payment.	1. Replacement Cost (RC)[26] or Current Market Value (CMV) of agricultural land.	LA Act 1982 Sec 8(1)(a), Sec 8(2) **As per 21 No. Law of 2017 additional 200% cost**	
Special Implementation Issues and application Guidelines:In case of any conflict between Governement Act/Rules & ADB SPS 2009 , later will prevail.			
Loss Item 2: LOSS OF HOMESTEAD, COMMERCIAL, INDUSTRIAL LAND AND COMMON PROPERTY RESOURCES			
Legal owner(s) as identified by DC in the process of CCL payment.	1. CMV of land. 2. 10% of CMV as transaction allowance such as stamp duty and registration cost, VAT etc. No matter whether she/he purchase land or not	LA Act 1982 Sec 8(1)(a), Sec 8(2) **As per 21 No. Law of 2017: additional 200% cost**	1. BWDB will assist purchase of above land(s) jointly with INGO on negotiated price and homestead land development (earth filling, if needed.) with internal road links.
Special Implementation Issues and application Guidelines: Guidelines:In case of any conflict between Governement Act/Rules & ADB SPS 2009 , later will prevail.			
Loss Item 3: LOSS OF WATER BODIES (PONDS, BOTH CULTIVATED AND NON-CULTIVATED)			
Legal owner(s) as identified by DC in the process of CCL payment.	1. CMV of the water body (private land). 2. Allowance of one year fish harvest to be recommended by PVAT	LA Act 1982 Sec 8(1)(a), Sec 8(2) Amendment of Law 2017	.
Special Implementation Issues and application Guidelines: Guidelines:In case of any conflict between Governement Act/Rules & ADB SPS 2009 , later will prevail.			
Loss Item 4: LOSS OF RESIDENTIAL STRUCTURES WITH TITLE TO LAND			
Legal owner(s) as identified by DC in the process of CCL payment.	1. CMV of residential structure 2. Transfer Grant @ Tk. 15 per sft of affected structure but not exceeding 3. Reconstruction and Homestead Development Grant (RHDG) at the rate of 20 TK per sf.	LA Act1982 Sec 8(1)(d) Sec 8(2) Amendment of Law 2017:	Assistance in relocation and reconstruction.

[26]The costs of replacing lost assets (e.g. land, houses/structures, trees and crops) and income, including cost of transaction

Unit of Entitlement	Entitlements	Applicable Law	Additional Services
		additional 100% cost **ADB SPS**	
Special Implementation Issues and application Guidelines: Guidelines:In case of any conflict between Governement Act/Rules & ADB SPS 2009 , later will prevail.			
Loss Item 5: LOSS OF COMMERCIAL/INDUSTRIAL/COMMON RESOURCE PROPERTY (CPR) STRUCTURES WITH TITLE TO LAND			
Legal owners as identified by DC in the process of CCL payment.	1. CMV of commercial, industrial, CPR structure 2. Transfer Grant @ Tk. 10 per sft of affected structure but not exceeding Tk. 3,000. 3. Reconstruction Grant of TK10,000.	LA Act1982 Sec 8(1)(d) Sec 8(2) **As per 21 No. Law of 2017: additional 200% cost**	Assistance in relocation and reconstruction.
Special Implementation Issues and application Guidelines:			
Loss Item 6: LOSS OF RESIDENTIAL AND OTHER PHYSICAL STRUCTURES (WITHOUT TITLE TO LAND)			
Socially recognized owners of structures built on the ROW	1. CMV of structures as determined by PVAT 2. Structure Transfer Grant (STG) @ Tk. 15 (ten) per sft of affected structure for shifting 3. Reconstruction and Homestead Development Grant (RHDG) at the rate of 20 TK per sft	LA Act1982 Sec 8(1)(d) Sec 8(2) **As per 21 No. Law of 2017** **ADB SPS**	
Special Implementation Issues and application Guidelines:			
1. The homestead losers will produce documentary evidence and the BWDB through JVT will cross verify the landlessness of the homestead losers for allocation of an RV plot for free. 2. The RP-INGO will assist the APs to move to clustered relocations (resettlement villages) with community facilities or, alternatively, in self-relocation. The APs may be relocated to BWDB land (if available) or plots purchased (by the APs) for which assistance will be provided in the form of homestead land development.			
Loss Item 7: LOSS OF TIMBER AND FRUIT BEARING TREES, BAMBOO AND BANANA GROVES			
1. Legal owner(s) as identified by the DC in the process of CCL payment. 2. Socially recognized owners of trees grown on public or other land	1. Timber trees and bamboo: CMV of trees and bamboo. 2. Fruit-bearing trees without timber: if the tree is at or near fruit-bearing stage, the estimated current market value of the fruit. 3. Fruit-bearing trees with timber: CMV for the timber, and estimated current market value of fruit.	LA Act1982 Sec 8(1)(b) Sec 8(2) **As per 21 No. Law of 2017: additional 100% cost**	INGO to explain RP policies regarding compensation for the trees of different categories and size and make the EPs aware that they could take the timber and fruits free of cost.

Unit of Entitlement	Entitlements	Applicable Law	Additional Services
	4. Banana groves: CMV of all trees 5. Owners will be allowed to fell trees and take the timber, free of cost after payment of CCL or RC as applicable.		
Special Implementation Issues and application Guidelines:			
1. The INGO will provide guidance in plantation and post-plantation care.			
Loss Item 8: LOSS OF STANDING CROPS/FISH STOCK			
1. Legal owners identified by the DC in progress of CCL payment 2. Socially recognized owners	1. RC of standing crops/fish stock. 2. Owners will be allowed to harvest crops and fish stock.	LA Act1982 Sec 8(1)(b) Sec 8(2) LA act 2017 ADB SPS 2009	INGO will assist APs in the process of claiming compensation from DC offices for organizing necessary documents.
Special Implementation Issues and application Guidelines: Guidelines:In case of any conflict between Governement Act/Rules & ADB SPS 2009 , later will prevail.			
Loss Item 9: LOSS OF LEASED /MORTGAGED IN LAND/PONDS			
1. Leaseholder with legal papers. 2. Socially recognized lessee or sharecropper, in case of customary informal tenancy arrangements, including socially recognized agreements.	1. CMV of crops/ fish stock for one year as compensation. 2. Outstanding lease money back to the lessee by the owner as per agreement. 3. The leaseholder will be allowed to take the crops/fishes free of cost within the date declared by BWDB	ADB SPS 2009	1. INGO will assist in ensuring that the lessee receives all eligible payments. 2. INGO will mediate refund of outstanding lease money by the owner to the lessees.
Special Implementation Issues and application Guidelines:			
1. With legal agreement: DC will pay CCL to legal owner and mortgagee/leaseholder in accordance by the law. With customary tenancy agreements, including socially-recognized verbal agreements: Legal owner will receive CCL from DC. The legal owner will pay the outstanding liabilities to the lessee/mortgagee. Under the following conditions: (i) all contractual liabilities are already paid up; (ii) if not, the legal owner will get the residual payment after all liabilities are paid up.3. BWDB will ensure RC of crops to the cultivator with direct payment of the difference, if CCL is less than RC, with assistance from INGO.4. Dislocation Allowance will be paid to the actual cultivator of the acquired land by BWDB with assistance from INGO.			
Loss Item 10: LOSS OF INCOME FROM DISPLACED COMMERCIAL/ INDUSTRIAL PREMISES			
Any proprietor or businessman or artisan operating in premises	Business restoration grant will be an equivalent to 3 months lost income against owners name recorded during the survey	LA Act1982 Sec 8(1)(d) Sec 8(2)	EPs will be brought under income and livelihood regenerating program (ILRP).

Unit of Entitlement	Entitlements	Applicable Law	Additional Services
	Employment in the Project construction work, if possible Moving assistance (one time) for tenant. Tk 5000.00	**ADB SPS** **LA Act 2017**	
Special Implementation Issues and application Guidelines:			
1. All the business operators will be entitled for grant against loss of wages The one time moving assistance will be provided to the tenants only.			

Loss Item 11: TEMPORARY LOSS OF INCOME (WAGE EARNERS IN AGRICULTURE, COMMERCE & SMALL BUSINESS AND INDUSTRY)			
Regular wage earners affected by the acquisition.	Grant to cover loss of employees /regular wage earners @ TK 400X 90 days per person Allowance of Tk 5,000.00 Per HH Allowance of Tk 7,000.00 per FHH EPs to be included in the ILRP	**ADB SPS 2009**	1. EPs will be brought under the ILRP.
Special Implementation Issues and application Guidelines:			
EP must have been an employee of landowner or business located in the acquired lands for at least twelve months, as identified by Joint Verification and/or a contracted institution or a consulting company's census.			

Loss Item 12: LOSS OF INCOME FROM RENTED -OUT AND ACCESS TO RENTED-IN RESIDENTIAL/COMMERCIAL PREMISES			
1. Owner of the rented-out premises 2. AH/person rented-in any such structure	Dislocation Allowance of Tk. 8,000.00 for each unit of premises to both the renter and the rentees.	LA Act1982 Sec 8(1)(d) Sec 8(2) **ADB SPS 2009** **LA Act 2017**	EPs will be brought under the ILRP.
Special Implementation Issues and application Guidelines:			

Loss Item 13: VULNERABLE AHs SPECIAL ASSISTANCE			
Vulnerable AH Assistance: Female-headed households, disabled, elderly, extremely poor and those losing more than 10% of their	One-Time Special Assistance Grant of Tk 15,000 / AHH Skill training and credit support underILRP. No AH will get the grant if their family members do not participate to the proposed skill training	**ADB SPS**	EPs will be brought under the ILRP.

Unit of Entitlement	Entitlements	Applicable Law	Additional Services
income to acquisition of land or business.			
Special Implementation Issues and application Guidelines:			
1. Loss of income will be assessed as per actual loss of productive resources (land and businesses) to the project and the total income of the affected households from all sources through Census of all AHs. 2. JVT will verify the percentage of loss comparing the actual loss and the total income from all sources of the affected households. 3. Households turning into landless due to acquisition of agricultural land will be eligible for larger credit from the ILRP for longer duration.			

Loss Item 14: UNFORESEEN ADVERSE IMPACTS			
Households/persons affected by any unforeseen impact identified during RPimplementation	Entitlements will be determined as per the resettlement policy framework		As appropriate
Special Implementation Issues and application Guidelines:			
The unforeseen impacts and affected persons will be identified with due care as per policy framework and proposed to the MoWR and the ADB for approval including quantity of losses, their owners and the entitlements.			

8 RESETTLEMENT AND RELOCATION

8.1 Displacement and Relocation

All necessary efforts have been made so as to minimize the Project impacts and to reduce impacts on assets and disruption of livelihood. In order to minimize impacts to the maximum possible extent, adequate provisions have been incorporated into the planning and design of the Project to minimize or mitigate any unavoidable impacts. Technical and Social team has worked closely to reduce the social impacts of the Project by means of both design adaptation and innovative technical solutions. As a result the displacement impact has been reduced as far as possible. During the survey and group discussion the affected HH opted for getting cash as compensation and self relocation.

8.2 Self-Managed Resettlement by Affected Households

The self-managed resettlement could be on their own land in same village or in nearby villages; through purchase of new land for housing and resettlement elsewhere. Most of the affected households preferred to self-relocate themselves in the same or nearby villages after receiving all eligible benefits as per the policy framework and entitlement matrix. In most cases, they would need to develop the new land by filling it about 3-4 meters as the nearby areas, in most cases, are predominantly low-lying. Provision to assist the families for undertaking these tasks (land-filling) has already been included in Resettlement assistance. It is anticipated that the self-managed relocation strategy would limit social disruption by allowing the displaced families to stay around their own social kin groups as per their own choice. Apart from compensation and assistance planned per the project resettlement policy, the project will also assist them in the relocation process in terms of information, consultation with host communities and local government agencies, facilitation of documentation, licensing, and registration as necessary with local governments.

9 INCOME AND LIVELIHOOD RESTORATION PROGRAM (ILRP)

9.1 Income and Livelihood Restoration Strategy

Mitigation of loss of assets and livelihood is the main focus of the Resettlement Plan. Additional measures will be taken to provide appropriate support to the livelihood restoration aspects of APs. According to the known impacts, adequate compensation/resettlement benefits will be provided to these APs before resettlement and through further assessment by the implementing NGO additional support through trainings will be provided to enable them to develop new income generating activities. In addition, vulnerable APs will receive other support and also get preference, for income restoration assistance. This will be through linking resettlement activities with Gender & Livelihood component of the project.

The RP includes the following categories of APs for income restoration and livelihood support:

- Vulnerable households from the project right of way, eligible members of such family will get training on income generating activities (IGA) such as small business, poultry rearing, cow fattening, sewing etc. The RP implementing agency will conduct a need assessment survey among the vulnerable households and select need based training

programs for the particular groups under the project policy. For this, resettlement budget has kept provision for training on IGA for the female headed and vulnerable household mebers. It is assumed that one person from each household will be brought under this training program

- Vulnerable households having no adult male members to shoulder household responsibility (women headed households). The women heading the household will preferably be the eligible member. Vulnerable households losing more than 10% of their income source due to the project.

For additional support to usual income restoration assistance as mentioned above, the agency involved in livelihood restoration will specifically undertake assessment of needs and skill base of vulnerable APs of age between 15 to 45 years. The agency will conduct a need based survey and prepare a list of eligible members of affected vulnerable households with their relevant profile and the short-term livelihood regeneration assistance under the RP and long-term income generation program under the livelihood restoration program will be organized as per the options given the table below:

Table 9-1 Livelihood Restoration Options

1. Eligible members of poor households earning maximum BDT 60000 per year	1.1 Short-term: Compensation for structure, shifting allowance, reconstruction assistance, and priority in employment in construction. 1.2 Long-term: Needs and capacity identification, human development and skill training on IGA.
2. Eligible members from poor female headed households having no adult male members to shoulder household responsibility.	2.1 Short-term: In addition to support as 1.1, additional subsistence allowance. 2.2 Long-term: As 1.2 above.
3. Eligible members of poor households losing more than 10% of their income sources.	6.1 Short-term: Compensation for lost assets, payment of other resettlement benefits and employment in construction. 6.2 Long-term: As 1.2 above.

9.2 Employment in Construction

Local people whose livelihood is impacted by the project will get preference in jobs associated with the project construction. Affected people will form labor contracting society (LCS) with the help of IA and be deployed by the Contractor in any suitable works. Affected persons will get preferential employment in project works based on their eligibility. The jobs, in the semi-skilled and unskilled category, shall be offered to the APs in preference to the other. A clause should be incorporated in the contract documents requiring contractors to give employment, if available, to project affected people having ID cards in preference to other persons.

10 LAND ACQUISITION AND RESETTLEMENT COSTS

10.1 Introduction

The costs for land acquisition and resettlement in the RP have been estimated at current market price of land as per land rates of 2016, physical assets and businesses by enhancing 2016 from Harirampur Riverbank project rates, and additional assistance for loss of income and vulnerabilities as per the resettlement policy framework. This budget is indicative of outlays of different rates applied in similar ADB project in recent years for affected households due to acquisition of agricultural land. These costs will be updated and adjusted once the land acquisition boundaries will be finalized and the government adopts a price of land as per latest GOB ordinance in 2017 and other assets based on recommendations of PVAT for replacement value. Replacement value of land and property will be updated annually if the PVAT at the district level justifies the same at the time of dispossession for any considerable price escalation.

All land acquisition and resettlement funds will be provided by BWDB based on the financing plan agreed by the Government of Bangladesh and the ADB. Relocation of affected persons, squatters,

Encroachers and lessees, their R&R will be considered as an integral component of the project costs.

The rehabilitation and training to the potential affected persons will be provided under the income and livelihood restoration program (ILRP) based on vulnerability and needs assessed through a special census and consultation exercise.

BWDB will ensure that the land acquisition and resettlement budgets are delivered on time to the DCs and resettlement account of the field office of the BWDB-RU respectively. BWDB will also ensure that the RP is submitted to the ADB for concurrence, and that funds for entitlements under the RP is fully provided to APs prior to the award of the civil work contract. Compensation and resettlement funds will be provided to the APs in two separate ways:

- Compensation under law for acquisition of land will be disbursed through the Deputy Commissioners;
- Additional assistance for resettlement of project-affected persons will be disbursed directly by BWDB with assistance from INGO.

10.2 Initial Budget

The RP budget for replacement value of land, structures and other assets, and special assistance will be calculated using the market rates reflecting replacement cost or updating the replacement value of assets at the time of dispossession. The costs for relocation and special assistance will be consistent with the resettlement policy framework and updated entitlement matrix. Other costs involving project disclosure, public consultations and focus group discussions, surveys, training and income and livelihood restoration, and monitoring and evaluation have been included in the RP budget. There is also a budget allocation for RP implementation and a +-10% contingency. The cost estimate in this RP is based on inventory of losses updated as of November 2017 and current compensation rate evaluation. This estimate will be revised based on changes on any additional impacts to be considered. Therefore, the budget will remain as a dynamic process for cost estimate

even during implementation. However, GOB is firmly committed to mobilize additional funds, if necessary.

Table 10-1 Intial Draft Budget Summary

Items		BDT	USD (82tk)
CCL			
Land acquisition +200%+ 20 % extra contingency		1731,216,308	21,112,394
RV of Structures		46,196,730	563,375
RV of Trees/crops		26,586,740	324,229
Resettlement benefits			-
Relocation cost		24,332,847	296,742
Rehabilitation Assistance		1,856,000	22,634
Service and Training		39,061,386	476,358
Contingencies	160,058,328	1,951,931	2,153,483
Total (A+B+C+D+E+G)		**1,760,641,603**	21,471,239

The total budget for the Tranche-2 PLB-1 sub-reach resettlement is Tk **1,760,641,603** or, aboutUS$ 21.5 millions, including +-10 percent contingency.

The larger amount of resettlement cost is for land acquisition (83%), the Replacement Cost (structures and trees) is about (4.1 %) of the total and includes structures as well as trees, crops and perennials. The Relocation Cost is (1.3%) of the total budget and includes transfer grants for affected structures, reconstruction assistance, and a homesteaddevelopment grant. Also it includes the stamp duty and registration cost 10% homestead land owners cost to facilitate buying new land to relocate. The rehabilitation assistance and training for the severally affected HHs (2.3%) of the total budget includes special assistance for vulnerable HHs, relocation assistance for owner-operated businesses and compensationof wage income losses but the major part is for implementation, Service and Training (1.5 percentage of the total budget) that includes hiring an RP-INGO, hiring an LD-NGO, implementing an income and livelihood restorationprogram (ILRP), the costs for an external monitoring agency (EMA), costs for a grievance redressalcommittee (GRC) and public consultation.

11 INSTITUTIONAL ARRANGEMENTS FOR RP IMPLEMENTATION

11.1 Bangladesh Water Development Board (BWDB)

Bangladesh Water Development Board (BWDB) is the owner and executing agency (EA) of the Project. For execution of the project, a Project Management Office (PMO) headed by a Project Director (PD) has been set up within BWDB that is responsible for the overall execution of the Project. All concerned BWDB field division offices headed by Exeutive Engineer have been set up within BWDB as Sub-project Management Office (SMO) and concerned SMO has updated relevant RP before starting implementation work.

A Resettlement Unit (RU) has been established within the PMO headed by Chief Resettlement Officer (CRO) and the PD has recruited and appointed an experienced Implementing Agency (NGO/ Social Consulting Firm) as required for implementation of resettlement activities. The Executing Agency (BWDB) is implementing the RP through setting a Sub-project Management Office (SMO) headed by Executive Engineer under the PMO and implementing NGO (INGO) for resettlement work is playing supporting role. The RU is responsible for implementation of the RP that includes disbursement of compensation through DC; and distribution of resettlement benefit through its own staff with the assistance of SMOs and INGO. All concerned BWDB field divisions will update their RP before starting implementation work. The RU is also responsible for implementation of an Income and Livelihood Restoration Program (ILRP) with the support of a NGO. This project has a Gender Action Plan (GAP) and a national Livelihood Development NGO (LD-NGO) would be recruited to help implementation of ILRP during and after resettlement of DPs.

Bangladesh Water Development Board (BWDB) already established, a Project Management Office (PMO) for the Project, headed by a Project Director (PD) that is responsible for the overall execution of the Project. The SMO, under the overall responsibility of the Project Director, will undertake day-to-day activities with the appointed Implementing Agency. The concerened Sub-Assistant Engineer, SMO or his representatives are actively involved with the JVT and PVAT. The Sub-divisional Engineer of SMO is performing as convener of GRC.

The SMO is coordinating and managing existing resettlement and rehabilitation of the DPs, disburse resettlement benefits, and ensure DP access to development programs adequately. The SMO will carry out the following specific tasks relating to RP implementation;

- Liaison with district administration to support RP implementation activities i.e. appoint JVT and PVAT members etc. ;
- Discharge overall responsibility of planning, management, monitoring and implementation of resettlement and rehabilitation program;
- Ensure availability of budget for all activities;
- Synchronize resettlement activity and handover incumbrance free land to the contractor with construction schedule;
- Develop RP implementation tools and form necessary committees.
- Monitor the effectiveness of entitlement packages and payment modality;

The RP Implementing NGO (INGO named) to be appointed will open field offices, carry out information campaign and involve affected persons including women in the implementation process from the very beginning of new work. The Implementing NGO will collect, collate, computerize and process data for identification of eligible persons correctly for resettlement benefits and assess their entitlements as per RP policy. However, the SMO will effect the payments after necessary scrutiny. The Executive Engineer (XEN) of SMO in charge of the resettlement management will report to the Project Director. He/she will work in close coordination with the respective field-based offices and Implementing Agency on the day-to-day activities of the resettlement implementation

The SMO, LA Office and the Implementing Agency will execute joint verification of the property on the ROW by JVT, valuation of the affected property by PVAT and monitor the progress of the RP

implementation work. The SMO will ensure coordination between the relevant departments, Implementing Agency, the GRC, PVAT and the Project affected people. Apart from the GRC, Joint Verification Team (JVT) for quantification of affected properties and Property Valuation Advisory Team (PVAT) will be formed by the Ministry of Water Resources (MOWR) for valuation of affected property and GRC for resolution reddressal of disputes. The composition and formation of committees and mechanisms for quantification and valuation of properties and grievance resolution will be constituted through government gazette. People's participation will be ensured through recruiting their representatives in these committees. Institutional responsibilities for RP preparation and implementation activities are further shown in the table below:

Table 11-1 Institutional Responsibilities in Resettlement Process

Related Activities and Responsibilities	Responsibility
A. Preparation of RP	
Recruitment of Implementing Agency	PMO
Design and reproduction of RP Information Brochures	SMO/INGO
Disclosure and public consultations	SMO/ INGO
Design and carry out joint verification survey	DC/SMO/ INGO
Market survey on prices of affected structure	INGO /PVAT
Establishment of unit prices	PVAT/PMO
Processing the Joint verification survey data of APs	INGO
Assessing AHs and vulnerable APs to be relocated	INGO /SMO
Determination of entitlements and consultations with individual DPs	SMO/ INGO
Disclosure of RP to BWDB, APs and stakeholders	PMO/SMO/ INGO
Review and concurrence of RP	ADB
Approval of RP	BWDB
B. RP Implementation	
Mobilization of GRC	PMO/SMO/ INGO
Establishment of internal monitoring	BWDB
Budget approval for compensation and resettlement benefits	PMO
Release of funds for payment of compensation/resettlement benefits	BWDB/PMO
Payment of compensation/resettlement benefits	SMO/ INGO
Filing and resolution of complaints of DPs,	SMO/GRCs/ INGO
Confirmation of “No Objection” for the award of civil works contract	ADB
Relocation and livelihood restoration assistance	INGO /SMO/LIRP
C. Monitoring and Evaluation	
Internal monitoring and evaluation	PMO/SMO/ISPMC

11.2 Institutional Capacity Strengthening

There is an established resettlement unit within BWDB with appropriate staffing. The PMO of BWDB already has a Chief Resettlement Officer (CRO) and provides technical support in preparing and implementing the RP. As part of the institutional development program the BWDB as the Executing Agency (EA) for the project loan implementation will need to establish its own resettlement unit

(RU) at PMO to assist PMO assigning the existing staff (CRO) with additional responsibility of managing resettlement. Now the Sectional Officer, SMO will play role as convener of JVT and PVAT. The Sub-Divisional Engineer, SMO will play role as convener of GRC. The BWDB may organize training on involuntary resettlement at the initial stage of implementation of the RP in any suitable venue within Bangladesh by hiring senior level resettlement specialist from home or abroad for BWDB officials involved with the project.

11.3 Other Agencies Involved in the Process

11.3.1 Deputy Commissioners

The DC office will appoint representatives as member(s) of the committees for quantifying losses and determining valuation of the affected properties .The Ministry of Water Resources will constitute three committees i.e. Joint Verification Team (JVT), Property valuation Advisory Team (PVAT) and Grievance Redress Committee (GRC). Among these committees, JVT and PVAT will be constituted with representatives of BWDB, RP implementing agency and Deputy Commissioner (DC). BWDB and IA shall liaise with concerned DC offices to complete the tasks following the notification of the Ministry.

11.3.2 Implementing NGO

BWDB will engage an Implementing Agency (NGO/Social Consulting Firm) for implementation of the RP in the field level. The Implementing Agency will be engaged to assist the BWDB for implementation of the RP. The BWDB together with the consultant will define the tasks of the RP Implementing Agency in detailed Terms of Reference such as consultation /public information campaign for rapport building, issuance of ID cards, payment of eligible benefits to affected households/ individuals, institutional development, skill training/management training, community awareness and empowerment, etc. (See appendix D) The INGO will initially create ID number for each entitled person (EP) as identified during Joint Verification survey by JVT and prepare an ID card for each EP with photograph. Photograph of the EPs will be attested by the concerned UP Chairman and pasted on the ID card. The ID card will comprise information on name, father's/husband's name, mother's name, age, education, identifiable marks, detail address, details of quantity of losses etc.. The ID card will be issued by BWDB with joint signature of the BWDB and INGO representatives and distributed among the EPs by INGO.

The Implementing NGO (INGO) will assist the EPs in preparing documents and opening bank account in their names to receive cheque from BWDB. They will form focus group with the affected people based on homogeneity and/or nearness and hold meetings on regular basis to let them know their right and entitlements as prescribed in the RP. The Implementing INGO will have to establish an MIS section in their central office for record keeping of the DPs, creating individual ID number of the entitled persons, preparing entitled person's (EP) file based on quantity of losses and entitlement card (EC) based on loss type and budget. The INGO will submit monthly progress report to the ISPMC mentioning progress of activities to be carried out by INGO.

Upon fulfillment of criteria i.e. necessary documents to make payment/benefits to the EPs the INGO will prepare payment debit voucher & other documents for payment and BWDB will disburse account payee cheque to the EPs in the public place or Union Parishad (UP) office in presence of the UP Chairman issuing prior notice to the concerned EPs.

11.3.3 Ministry of Water Resources

The Ministry of Water Resources through a gazette notification will form various committees/teams for implementation of the RP at the field level. The Implementing Agency will work as member secretary for all the committees/teams involving representatives from DC, BWDB, LGI and DPs. These committees/teams will ensure stakeholders' participation and uphold the interest of the vulnerable DPs. The powers and jurisdictions of the committees will be clearly defined in the gazette notification.

11.4 Joint Verification Team

BWDB will form a Joint Verification Team (JVT) for the project through a notification to compare and review the physical verification data collected by the Project implementing Agency along with the DCs' assessment of losses of physical assets and their owners. JVT will conduct property assessment and evaluation and both JVT and the concerned party will sign the verification record. Disputes on properly right will be recorded. The implementing NGO will process the entitlements of the project-affected persons using the JVT data as one of the determinants. The JVT is formed as follows.

The JVT has been formed as follows:

1. Representative of BWDB
2. (Sub-Divisional Engineer/Assistant Engineer or equivalent officer) : Convener
3. Representative of concerned Deputy Commissioner : Member
4. Representative of INGO recruited by BWDB
5. (DTL, Area Manager or equivalent Officer of INGO/Specialist) : Member-Secretary

11.5 Property Valuation Advisory Team

The PVAT will review the assessment of the Implementing Agency on the market price of the property affected by the project at their replacement cost. The Implementing Agency will process the entitlements of the project-affected persons using the PVAT data as one of the determinants.

The PVAT has been formed as follows:

1. Representative of BWDB
2. (Executive Engineer/Assistant Engineer or equivalent Officer) : Convener
3. Representative of concerned Deputy Commissioner : Member
4. Sub-Assistant Engineer, concerned SMO, BWDB : Member
5. Representative of INGO recruited by BWDB
6. (DTL, Area Manager or equivalent Officer of INGO/Specialist) : Member-Secretary

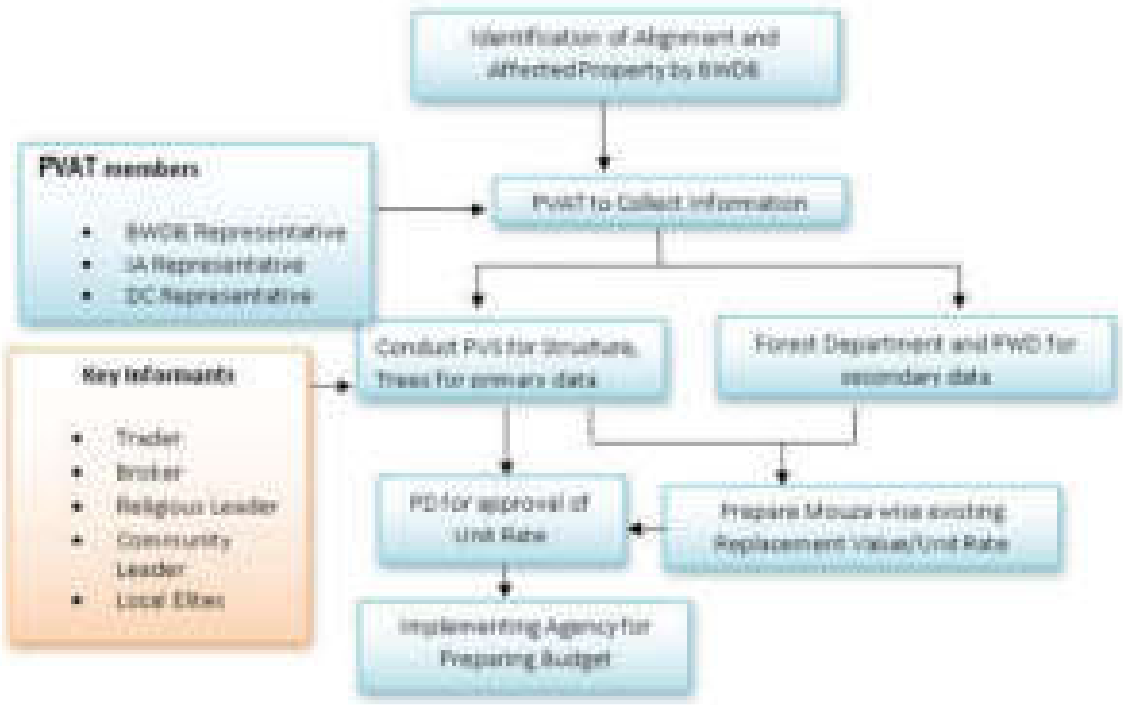


Figure 11-1 Procedure of Determining Valuation of Property

11.6 Women Groups in Resettlement Process

The RP implementation will ensure a gender sensitive approach in planning, management and operations of resettlement. Separate groups of women affected persons will be formed and operated by the Implementing Agency. Feedback from the female APs and female headed AHs will be obtained through these female focused groups for planning relocation and resettlement. The female staff engaged by Implementing Agency will identify needs of female APs for income restoration approaches and implementation of the income restoration component of the RP. Women were consulted during social appraisal and will be further consulted during the process of RP implementation.

12 MONITORING AND EVALUATION

12.1 Supervision, Monitoring and Evaluation

BWDB as the Executing Agency (EA), through the Project Management Office, will establish a monitoring system involving the XEN, SMO for collection, analysis, reporting and use of information about the progress of resettlement, based on the RP policy. These stakeholders will be made responsible to monitor the progress of all aspects of resettlement and income generation. The EA will report to the ADB on resettlement and income regeneration by APs in the quarterly reports, including identification of significant issues. Besides, a project completion report stipulating all efforts and outcome will be sought by the ADB from the BWDB.

The RP implementation monitoring will be done internally to provide feedback to BWDB upon monitoring and evaluation reports and other relevant data to identify any action needed to improve

resettlement performance or respond to the changing circumstances. Evaluation of the resettlement activities will beundertaken during and after implementation of the RP to assess whether the resettlement objectives were appropriate and whether they were met, specifically, whether livelihoods and living standards have been restored or enhanced. An External Monitoring Agency will be engaged as third party monitor during RP implementation. An independent reviewer will be engaged after implementation of the RP to review implementation of the RP. The evaluation will also assess resettlement efficiency, effectiveness, impact and sustainability, drawing lessons as a guide to future resettlement planning. Budgetary provision is kept in this RP for External Monitoring and Independent Review.

12.2 Internal Monitoring

The internal monitoring by BWDB will deal with all aspects of land acquisition and resettlement. The CRO, assisted by the INGO field staff, will establish a monthly monitoring system and prepare monthly progress reports on all aspects of RP. The benchmark data for Project level monitoring will come from the SES database created during the planning and implementation stages. 12.3 External Monitoring

The BWDB upon consent by the ADB committed to recruit an Independent Monitor (IM) for monitoring the performance of the RP implementation. The main task and methodology for the IM agency is to monitor and evaluate all activities relating to resettlement following appropriate methodology to measure the progress and the degree and level of targeted achievement. The specific tasks and methodology for the independent monitoring will include: (i) review of pre-Project baseline data on APs; (ii) identification and selection of an appropriate set of indicators for gathering and analyzing information on resettlement impacts; (iii) use of various formal and informal surveys for impact analysis; and (iv) an assessment of RP strategy, effectiveness, impact and sustainability, drawing lessons as a guide to future Project preparation work. The IM agency will monitor activities over the Project period and submit half yearly reports and a final evaluation report after completion of the RP implementation. The IM will report to the ADB through the BWDB within the stipulated time. (Seee Appendix F) TOR for an External Monitoring Agency (EMA)

12.3 Supervision by Consultants

The Resettlement Specialists will supervise and monitor the implementation of the RP. The supervision and monitoring work shall involve review of resettlement implementation, verification of the results of internal monitoring in the field, and consultation with APs, officials and community leaders for preparing review reports. In addition to regular review missions, ADB will undertake a Mid-Term comprehensive review of the RP implementation.

12.4 Reporting Requirements

BWDB has established a monthly monitoring system involving BWDB and INGO staff, and preparing monthly progress reports on all aspects of resettlement operations with RP wise segregated data. The PD will send status reports on implementation of this RP periodically to ADB and a final report will be prepared and produced once the resettlement is completed. The report will reflect on the resettlement experience and lessons learned for improved management of land acquisition and resettlement in subsequent phases of the subproject. The progress of LA&R will be included in the Quarterly Progress Report.

APPENDIX A

HARMONIZATION WITH ADB's SAFEGAURD POLICY27

Aspect	ADB SPS 2009	Harmonized Policy
Objectives		
1. Avoid involuntary resettlement	Avoid involuntary resettlement wherever possible	Avoid involuntary resettlement and adverse impacts on people and communities, wherever feasible
2. Minimize involuntary resettlement	Minimize involuntary resettlement by exploring project and design alternatives	If displacement is unavoidable, minimize involuntary resettlement by: (i) exploring alternative project designs; (ii) Effective measures to minimize impact in consultation with the people who are affected.
3. Mitigate adverse social impacts	To enhance, or at least restore, the livelihoods of all affected persons in real terms relative to pre-project levels; and to improve the standards of living of the displaced poor other vulnerable groups.	Where IR is unavoidable, effective measures to mitigate adverse social and economic impacts on affected persons by: (a) providing compensation for loss of assets at replacement cost; (b) ensuring that resettlement activities are implemented with appropriate disclosure of information, consultation, and the informed participation of those affected(c) improve or at least restore the livelihoods and standards of living of displaced persons, and (d) improve living conditions among displaced persons through provision of adequate housing with security of tenure at resettlement sites.
Core Principles		
1. Identify, assess and address the potential social and economic impacts	Screen the project early on to identify past, present and future involuntary resettlement impacts and risks. Determine the scope of resettlement planning through a survey and/or census of displaced persons, including gender analysis, specifically related to resettlement impacts and risks	Assess at an early stage of the project cycle the potential social and economic impacts caused by involuntary taking of land (e.g. relocation or loss of shelter, loss of assets or access to assets, loss of income sources or means of livelihood, whether or not the affected person must move to another location) or involuntary restriction of access to legally designated parks and protected areas and to determine who will be eligible for compensation and assistance.
2. Prepare mitigation plans	Develop resettlement plan on the basis of assessment during project processing, with the intent that plan will guide refinements of impact	Preparation of Resettlement Plan or Resettlement Framework (RF) during Project processing to mitigate the negative impacts of displacement. The plan will provide estimate of the extent of total population

[27] ADB, Safeguard Policy Statement (SPS 2009). http://www.adb.org/documents/safeguard-policy-statement

Aspect	ADB SPS 2009	Harmonized Policy
for affected persons	estimates and mitigating measures as project parameters are finalized.	affected and establish entitlements of all categories of affected persons (including host communities), with particular attention paid to the needs of the poor and the vulnerable.
3. Consider alternative project design	Explore viable alternative project designs to avoid and/or minimize involuntary resettlement.	Multiple alternative proposals must be examined to avoid or minimize involuntary resettlement and physical, or economic displacement and to choose a better project option while balancing environmental social and financial costs and benefits.
4. Involve and consult with stakeholders	Carry out meaningful consultations with affected persons, host communities, and concerned non-government organizations. Inform all displaced persons of their entitlements and resettlement options. Ensure their participation in planning, implementation and M&E of resettlement programs. Pay particular attention to the needs of the vulnerable groups, especially those below poverty line, the landless, the elderly, women and children and Indigenous people, and those without title to land, and ensure their participation in consultations. Establish a grievance redress mechanism to receive and facilitate resolution of the APs concerns. Support the social and cultural institutions of displaced persons and their host population.	Consult project-affected persons, host communities and local nongovernmental organizations, as appropriate. Provide them opportunities to participate in the planning, implementation, and monitoring of the resettlement program, especially in the process of developing and implementing the procedures for determining eligibility for compensation benefits and development assistance (as documented in a resettlement plan), and for establishing appropriate and accessible grievance mechanisms. Pay particular attention to the needs of vulnerable groups among those displaced, especially those below the poverty line, the landless, the elderly, women and children, Indigenous Peoples, ethnic minorities, or other displaced persons who may not be protected through national land compensation legislation.
5. Disclose and inform APs of RP and mitigation measures	Disclose the resettlement plan and other relevant information in a form and language(s) accessible to key stakeholders, civil society, particularly affected groups and the general public.	Disclose the resettlement plan including documentation of the consultation process, in a form and language(s) accessible to key stakeholders, civil society, particularly affected groups and the general public in an accessible place for a reasonable minimum period.
6. Support existing social and cultural institutions of the affected persons	Ensure that the existing social and cultural institutions are supported and used to the extent possible, including legal, policy and institutional framework of the country to the extent that the intent and spirit of the IR policy is maintained.	Ensure that the existing social and cultural institutions of the resettlers and any host communities are supported and used to the extent possible, including legal, policy and institutional framework of the country to the extent that the intent and spirit of the IR policy is maintained. Projects must be adequately coordinated so that they are accepted in manner that is socially

Aspect	ADB SPS 2009	Harmonized Policy
		appropriate to the country and locality in which the Project is planned. The SEA should include an assessment of compliance with applicable host country laws, regulations, and permits, and relevant social and environmental impacts and risks of the project.
7. Build capacity of the borrower(s) in IR implementation	Assist in building capacity of DMCs on best practice on involuntary resettlement planning and implementation	Assist in building capacity of DMCs on best practice on involuntary resettlement planning and implementation. Financing of technical assistance to strengthen the capacities of agencies responsible for resettlement, or of affected people to participate more effectively in resettlement operations.
Project Processing Benchmark		
Screening	Every development intervention will be screened, as early as possible in the project cycle, to identify the people who may be beneficially and adversely affected, and to determine the scope of a social assessment to assess those affects and impacts.	Every development intervention will be screened, as early as possible in the project cycle, to identify the people who may be beneficially and adversely affected, and to determine the scope of a social assessment to assess those affects and impacts.
Categorization	The ADB IR requirements apply to full or partial, permanent or temporary physical displacement (relocation, loss of residential land, or loss of shelter) and economic displacement (loss of land, assets access to assets, income sources, or means of livelihoods) resulting from (i) involuntary restrictions on land use or on access to legally designated parks and protected areas.	Categorize impacts by “significance” and define the scale of impacts – both direct and indirect – with particular attention to economic and livelihood impacts. Plan mitigations for all types of losses in the RP
Social Assessment	The borrower/client will conduct socioeconomic surveys and a census, with appropriate socioeconomic baseline data to identify all persons who will be displaced by the project and to assess the project’s socioeconomic impacts on them. As part of the social impact assessment, the borrower will identify individuals and groups who may be differentially or disproportionately affected by the	Social Assessment be conducted as early as possible, and will specifically consider any impacts upon particularly poor and vulnerable Affected Persons.

Aspect	ADB SPS 2009	Harmonized Policy
	project because of their disadvantaged or vulnerable status.	
Resettlement Plan	The borrower will prepare a resettlement plan, if the proposed project, will have involuntary resettlement impacts. The objective of the Resettlement plans will elaborate on displaced persons entitlements, the income and livelihood restoration strategy, institutional arrangements, monitoring & reporting framework, budget and a time-bound implementation schedule.	For all interventions that involve resettlement or physical or economic displacement, a resettlement plan will be prepared which will establish the entitlements of all categories of affected persons (including host communities), with particular attention paid to the needs of the poor and the vulnerable. The RP will lay down appropriate time-bound actions and budgets, and the full costs of resettlement, compensation, and rehabilitation will be included in the presentation of the costs and benefits of the development intervention.
Supervision		Regular supervision on resettlement implementation to determine compliance with the resettlement instrument.
Monitoring	The borrower will monitor and measure the progress of implementation of the resettlement plan. For projects with significant involuntary resettlement impacts, the borrower will retain qualified and experienced external experts or qualified NGOs to verify the borrowers monitoring information. The borrower will prepare semi-annual monitoring reports that describe the progress of the implementation of the resettlement activities and any compliance issues and corrective actions.	The borrower is responsible for adequate monitoring & evaluation of the activities set forth in the resettlement instrument. It is desirable that the project proponents monitor: (i) whether any situations that were unforeseeable before the project began have arisen; (ii) the implementation situation and the effectiveness of the mitigation measures prepared in advance, and that they then take appropriate measures based on the results of such monitoring (iii) involve external experts for resettlement monitoring (iv) monitoring reports must be made public and additional steps to be taken, if required.
Evaluation		Mid-term evaluation to assess performance of RP implementation Assess whether the objectives of the resettlement instrument have been achieved, upon completion of the project, taking account of the baseline conditions and the results of resettlement monitoring.

APPENDIX B

GAPS AND GAP-FILLING MEASURES TO COMPLY WITH ADB'S SAFEGUARD POLICIES

Aspect	Harmonized Policy	GOB 1982 OrdinanceII and otherapplicablelaws/Guidelines (Following amendment of the ordinance in September 2017, some changes in the rate will apply)	Gaps between HarmonizedPolicy and GOB	Safeguard Measures Adopted in the Project
Objectives				
1. Avoidinvoluntaryresettlement	Avoid involuntary resettlementand adverse impacts on peopleand communities, wherever feasible.	Avoidance of resettlement is not specificallymentioned in the 1982 Ordinance– focus on mitigation than avoidance.	Gaps with regard to this principle to avoid resettlement impact thru alternative options.	RF adheres to this principle - i.e., avoid resettlementimpacts where feasible
2. Minimizeinvoluntaryresettlement	If displacement isunavoidable, minimizeinvoluntaryresettlement by – (i) exploring alternativeproject designs; (ii) Effectivemeasures to minimize impact in consultation with the people who are affected.	The law only implicitlydiscouragesunnecessaryand excessland acquisition, as excess land remains idle and unused and lands acquired for one purpose cannot be used for a different purpose. Land that remains unused should be returned to the original owner(s).	Section 3/under 1982 Ordinance requires notification only; no consultation is required	- Minimize displacement of people as much as possible by exploring all viable design alternatives. - If unavoidable, provide for prompt payment of just compensation, replacement cost (for lost assets and income) and rehabilitation and livelihoodassistance, towards better condition than before relocation for all displaced households, regardless of (land) tenure. Unused land be returned back to the original owners through de-acquisition.
3. Mitigate adversesocial impacts	Where IR is unavoidable, effective measures to mitigate adverse social and economic impacts on affected persons by: (a) providing	The mitigation measures are cash compensation only for lost assets. The complexitiesof resettlement	Only cash-based compensation for acquired assets. The impacts of loss	Provision for replacement value for assets lost (i.e., land, structures, trees etc.) at replacement cost.

Aspect	Harmonized Policy	GOB 1982 OrdinanceII and otherapplicablelaws/Guidelines (Following amendment of the ordinance in September 2017, some changes in the rate will apply)	Gaps between HarmonizedPolicy and GOB	Safeguard Measures Adopted in the Project
	compensation for loss of assets at replacement cost;(b) ensuring that resettlement activities are implemented with appropriate disclosure of information, consultation, and the informedparticipation of those affected(c) improve or at least restore the livelihoods and standards of living of displaced persons, and(d) improve living conditions among displacedpersons through provision of adequate housing with security of tenure at resettlement sites.	is not addressed by the Ordinance	of land, houses and the need for resettlement are not considered.	Resettlement in project sponsored sites with civic amenities. Separate Livelihood and IncomeRestoration PlanRPs to be disclosed to the community and available in *Bangla*. The "good practices" are derived from the Jamuna Bridge and JMREMP resettlement "models."
Core Principles				
1. Identify, assessand addressthepotentialsocialandeconomicimpacts	Assess at an early stage of the project cycle the potential social and economic impacts caused by involuntarily taking of land (e.g. relocation or loss of shelter, loss of assets or access to assets, loss of income sources or means of livelihood	The 1982 Ordinance requires preparation of Land Acquisition Plan (LAP) for land acquisitionand compensation purposes. However GOBenvironmental rules/guidelines (1997) synchronize various applicable laws and policy frameworks of the country for early identificationof impacts onbiophysical,Socioeconomic and cultural environment of a project intervention and their mitigation. Requiresthe assessmentof technicalalternatives, including the no action alternative to minimize adverse environmental impacts, include impact on human health and safety. IAidentifies measures to	Impact assessments are typically done in the case of externally fundedprojects; otherwise, a land acquisition plan is prepared for acquisition purposes. Project impacts on properties, livelihoods and employment, health and environment are discussed in IEE/EIA reports, but do not provide enough information to determine losses and basis forcompensation	RF requires identification of impacts caused by displacement whether or not through land acquisition (maintaining the principle that lack of formal title to land should not be a bar to compensationand resettlement assistance), including number of affected persons. The Framework also addresses both direct and indirect impacts.

Aspect	Harmonized Policy	GOB 1982 OrdinanceII and otherapplicablelaws/Guidelines (Following amendment of the ordinance in September 2017, some changes in the rate will apply)	Gaps between HarmonizedPolicy and GOB	Safeguard Measures Adopted in the Project
		minimize the problems and recommends ways to improve the project's sustainability.	.Existing laws do not have provision for identification of indigenous people to recognize their particular problem and inconveniences due to a project.	
2. Prepare mitigation plans for affected persons	Preparation of Resettlement Plan or Resettlement Framework (RF) during Project processing to mitigate the negative impacts of displacement. The plan will provide estimate of the extent of total population affected and establish entitlements of all categories of affected persons (including host communities),with particular attention paid to the needs of the poor and the vulnerable.	The Deputy Commissioners (DCs) have the mandate in theirrespective jurisdiction as per law to acquire land for any requiring person (public agency or private person). The requiringbody requests the Deputy Commissioners for acquisition of land for their project/scheme.DCs investigate physicallythe requirement of land and carry out Joint Verifications of assets and type of land for assessing the quantity of losses (u/s 8(1) of the law). Affected titled holders receive the assessed value and50% on that for compulsory acquisition Fair compensation is required for acquisition of land which is dependenton recorded data with relevant government agencies (sub registrar's office for land, PWD for structure, DAE for crops, DOF for trees Etc.). Affected owners have the right to appeal on acquisition or on the	Existing law and methods of assessment do not ensure full replacement cost of property at current market price. The law does not consider resettlement or rehabilitation of affected persons or their loss of income or livelihood resources. "Market Value" of property is often found low in respect of current market price, it can be raised, if appealed, by a	RF requires full census and/or updating, where possible, for up-to-date database. RPs will be developed on the updated survey data Provide guidelines to ensure displaced persons and communities' compensation for lost assets at full replacement costs and other assistance to help them improve or at least restore their standard of living at pre-project level. Includes special attention to gender and preparation of gender action plan.

Aspect	Harmonized Policy	GOB 1982 OrdinanceII and otherapplicablelaws/Guidelines (Following amendment of the ordinance in September 2017, some changes in the rate will apply)	Gaps between HarmonizedPolicy and GOB	Safeguard Measures Adopted in the Project
		compensation amounts determined as per law.	maximum of 10 percent each time which in most case is not sufficient to match with real market price.	
3. Consider alternative project design	Multiple alternative proposals must be examined to avoid or minimize involuntary resettlementand physical, or economic displacement and to choose a better project option while balancing environmental social and financial costs and benefits.	Feasibility studies including social, political, cultural and environmental impact assessments, detailed engineering surveys as basis for acquisition of private property or rights.	No specific laws for considering project design to avoid or minimize involuntary resettlement. Feasibility study considers cost benefit more from technical than socio-cultural considerations.	RF considers feasible alternative project design to avoid or at least minimize physical or economic displacement, while balancing environmental, social, technical and financial costs and benefits.
4. Involve and consult with stakeholders	Consult project affected persons, host communities and local nongovernmental organizations, as appropriate. Provide them opportunities to participate in the planning, implementation, and monitoring of the resettlement program, especially in the process of developing and implementing the procedures for determining eligibility for compensation benefits anddevelopmentassistance (as documented in are settlement plan),and for establishing appropriate and accessible grievance mechanisms. Pay particular attention to the needs of	The 1982 Ordinance haveprovisions (Section 3 and 3/2) to notify the owners of property to be acquired. Any party having any objections can appear to DC for a hearing with 15 days of notification.	There is no provision in the law for consulting the stakeholders but the land allocation committees at district, division and central government level. People have limited scope to negotiate with the government on the price of land, but have no right to	RF has provisions forcommunity consultation and public disclosure of impacts as well as mitigation measures, including disclosureof ResettlementPlan. Further, grievancesredressal procedures involving cross-section of people, including representative of affected persons, have been established for accountability and

Aspect	Harmonized Policy	GOB 1982 OrdinanceII and otherapplicablelaws/Guidelines (Following amendment of the ordinance in September 2017, some changes in the rate will apply)	Gaps between HarmonizedPolicy and GOB	Safeguard Measures Adopted in the Project
	vulnerablegroups amongthose displaces, especially those below the poverty line, the landless, the elderly, women and children, IndigenousPeoples, ethnic minorities, or other displaced persons who may not be protected through national landcompensationlegislation.		refuse acquisition.	democratization of the development process.
5. Disclose and informAPs of RP andmitigation measures	Disclose the resettlement planincludingdocumentation of the consultation process, in a form and language(s) accessible to key stakeholders, civil society, particularly affected groups and the general public in an accessible place for a reasonable minimum period.	The 1982 Ordinance requires a “notice” to be published at convenient places on or near the property in a prescribed form and manner stating that the property is proposed to be acquired (u/section 3).	Disclosure takes place in case of donor-funded projects.	RF requires disclosure of Draft RPs tothe affected communities in a form or language(s)that are understandable to key stakeholders, civil society, particularly affected groups and the general public in a national workshop. Further, updated RPs will be disclosed based on material changes as result of the concerns of affected families.
6. Support existing social and cultural institutionsof theaffected persons	Ensure that the existing social and cultural institutions of the resettlers and any host communities are supported and used to the extent possible, including legal, policy andinstitutional framework of the country to the extent that the intent and spirit of the IR policy is maintained. Projects must beadequatelycoordinated so that they are accepted in manner that is socially appropriate to the country and locality in which the Project is planned.		No provision in any existing laws.	The Jamuna Bridge and the follow-up JMREMP established this as “good practice” in resettlementoperations. Affected households were given options for relocationin accordance with their choices and support available from existing social networks. Host–resettlers’ relation was enhanced by providing civic amenities and infrastructure services to the host villages. The RF has similar provisions to enhance carrying

Aspect	Harmonized Policy	GOB 1982 OrdinanceII and otherapplicablelaws/Guidelines (Following amendment of the ordinance in September 2017, some changes in the rate will apply)	Gaps between HarmonizedPolicy and GOB	Safeguard Measures Adopted in the Project
	The SEA should includean assessmentof compliancewith applicablehost countrylaws, regulations, and permits, and relevant socialandenvironmentalimpacts and risks of the project.			capacity of the host villages in post-relocation period.
Supervision	For all interventions thatinvolve resettlementor physical or economic displacement, are settlement plan will be prepared. The RP will lay down appropriate time bound actions and budgets, and the full costs of resettlement, compensation, and rehabilitation will be included in the presentation of the costs and benefits of thedevelopment intervention.	No provision in the1982 Ordinance.	There is no law or directives on the supervision of the land acquisition process by Deputy Commissioner.	Resettlement supervision in the Project will follow the Jamuna and JMREMP models with ADB's periodic "milestone" meeting, supervision by CSC safeguard specialist, midterm review of resettlement performance and regular supervision of resettlement operations by the Resettlement Unit of BWDB.
Monitoring	Regular supervision onresettlement implementationto determine compliance with the resettlement instrument.	The 1982 Ordinance II has provision that the DC will monitor and submit a statement totheGovernment annually about the properties acquired for different requiring bodies and mode of utilization of the land.	Existing laws not have any provision for rehabilitation of project affected persons and therefore, no monitoring is done.	RF has provision for internal, external monitoring. Monitoring results will be shared and findings will be used for enhancement, if needed.
Evaluation	The borrower is responsiblefor adequate monitoring& evaluation of the activities set forth in theresettlement instrument. It is desirable that the project proponents monitor: (i) whether any situations that were unforeseeable before the project began have arisen;(ii) the implementation situation and	No provision for evaluations of the post-displaced lives of the affected householdsand communities		CSC Safeguard Specialist will conduct annual evaluation of the performanceof resettlementoperations as well as impacts of resettlement during and after implementation of resettlement plans to assessresettlement efficiency, effectiveness,

Aspect	Harmonized Policy	GOB 1982 OrdinanceII and otherapplicablelaws/Guidelines (Following amendment of the ordinance in September 2017, some changes in the rate will apply)	Gaps between HarmonizedPolicy and GOB	Safeguard Measures Adopted in the Project
	the effectiveness of the mitigation measures prepared in advance, and that they then take appropriate measures based on the results of such monitoring(iii) involve external experts forresettlementmonitoring(iv) Monitoring reports must be made public and additional steps to be taken, if required.			impacts, and sustainability.

APPENDIX C

ASSESSMENT OF REPLACEMENT VALUES

(Prices in Taka per decimal) and percentage of area affected

Upazilla	**Harirampur**						
Mouza name	Land	Pond	Garden	agricultural land/Vitti	House		
Abidhara	2,361/=	1,000/=			2,000/=		
Nilgram	2,955/=	1,000/=			2.000/=		
Mohanpur	4,074/=	1,000/=			3,500/=		
Upazilla	**Nawabganj**						
Mouza Name	Land	pond	garden	Agricultural land/Vitti	House		
Rajapur	10,445/=	1,985/=	325/=	8,325/=	79,799/=		
Upazilla	**Dohar**						
Mouza Name	Land	Pond	Garden	Agricultural land/Vitti	House	chonkhala/ baluchor	bazar
Dhoair	17,220/=	923/=	10,000/=	4732/=	25,461/=		
Char kushai	66,611/=	52,975/=	27,826/=	60,802/=	83,989/=	59,000/=	
Choto basta	34,425/=	3,932/=	7650/=	34,000/=	34,000/=		
kartikpur	49,073/=	2,85,020/=	18,000/=	11,33,333/=	1,68,925/=		5,00,000/=
kusumathi	40,000/=	3,198/=	18,800/=	1,75,000/=	18,800/=	40,000/=	
shilakota	40,617/=	7,235/=	24,050/=	18,321/=	1,56,504/=	56,390/=	

% of area affected in each Upazela — Harirampur 0.58/3500
Average rate in Taka — Nawabganj 0.14/12000
Dohar 0.28/50000

APPENDIX D

DRAFT BUDGET CALCULATION

Harirampur-Dohar Embankment

No.	Expenditure Item							Total BDT	Total US$	%
A.	Land Acquisition (see sheet area-cost for explaination)							1,549,795,639	18,899,947	78.30
		Area Ha	Dec	Unit Cost	BDT	USD				
	Land Acquisition	112.5	27,804	22,500	1,425,758,612	17,387,300				
	Roads and Regulators	16	3,954	22,500	124,037,027	448,670				
B.	Replacement Cost							58,469,100	713,038	2.95
	1 Structure							**46,196,730**	563,375	
	Structures	Units	Type	Sqft	Cost/sft	BDT				
		90	Pukka	15896	1,280	20,346,880				
		178	Semi-Pukka	46949	815	38,263,435				
		343	Kutcha	63084	455	28,703,220				
		96	Thatched	24405	185	4,514,925				
		113	Tubewell	3345	5,000	565,000				
	Re-usable Materials	Tin wall/roof				**46,196,730**				
	2 Trees/Crops/Perennials							**12,272,370**	149,663	
		Units	Type		Unit Cost	BDT				
		166	Fruit	Small	120	19,920				
		185		Medium	2,100	388,500				
		1517		Large	3,500	5,309,500				
						5,717,920				
		22	Timber	Small	200	4,400				
		90		Medium	4,000	360,000				
		788		Large	7,800	6,146,400				
						6,510,800				
		97	Groves		450	43,650				
		38	Medicine			0				
		630	Other			0				
C.	Relocation Cost							161,011,916	1,963,560	8.13
	1 Transfer Grant for Structures							900,000	10,976	
		Units			Unit Cost	BDT				
		180	AH		5,000	900,000				
	2 Reconstruction and Homestead Development Grant							13,120,000	160,000	

		Units			Unit Cost	BDT			
		180	AH		8000	1,440,000			
	3. Stamp duty and registration cost 10% land owners cost to facilitate buying new land						146991916	1,792,584	
		180	AH		10%	146,991,916			
D.	Rehabilitation Assistance for AHs						1,526,000	18,610	0.08
	1 Vulnerable Households						615,000	7,500	
	Units	Type			Unit Cost	BDT			
	41	vulnerable HH			15,000	615,000			
	2 Moving Assistance for Owner operated Business						150,000	1,829	
	Units		Unit Cost			BDT			
	30	Business	5,000			150,000			
	3 Assistance for Affected Wage Earners						761,000	9,280	
	Units	Type	Unit Cost			BDT			
	155	MHH	4,000			620,000			
	25	FHH	5,000			125,000			
	4	Agricultural Land user		4,000		16,000			
E.	Service and Training						28,634,001	349,195	1.45
	1 Implementation of RP						15,000,000	182,927	
	2 Implementation of ILRP						8,334,001	106,846	
				BDT	USD				
	Livelihood Skills Development Training			642,367	7,834				
	Tailoring Training			1,109,567	13,531				
	Livelihood Development NGO			1,740,216	21,222				
	Inputs support for income restoration			5,012,200	64,259				
	3 External Monitoring Agency						5,000,000	60,976	
	4 GRC, Consultation Associated Costs						300,000	3,659	
F.	*Subtotal (A+B+C+D+E)*						1,799,436,657	21,944,349	
G.	*Contingency (10%)*						*179,943,666*	2,194,435	9.09
H.	**TOTAL**						**1,979,380,322**	24,138,784	100.00

Calculation of the land cost according to local market price

Upazila	Mauza	Agriculture	Household	Bazar	Average			Area		
		BDT/dec	BDT/dec	BDT/dec	BDT/dec	BDT/acre	BDT/ha	dec	acre	ha
Hariramp ur	Abidhara	2,361	2,000	0	2,325	232,464	574,431	1,082	11	4
Hariramp ur	Nilgram	2,955	2,000	0	2,882	288,249	712,278	3,622	36	15
Hariramp ur	Mohanpur	4,074	3,500	0	4,074	407,400	1,006,706	45	0	0
Nwabganj	Rajapur	10,445	79,799	0	31,710	3,171,026	7,835,764	3,082	31	12
Dohar	Dhoair	17,220	25,461	0	17,220	1,722,000	4,255,148	2,010	20	8
Dohar	Char kusai	66,611	83,989	0	68,406	6,840,631	16,903,540	1,239	12	5
Dohar	Choto basta	34,425	34,000	0	34,386	3,438,596	8,496,942	860	9	3
Dohar	kartikpur	49,073	168,925	500,000	83,650	8,364,985	20,670,296	534	5	2
Dohar	kusumathi	40,000	18,800		0	0	0	0	0	0
Dohar	Silakota	40,617	156,504	0	41,320	4,132,032	10,210,457	2,472	25	10
Hariramp ur	Boyra	3,130	2,500	0	3,103	310,306	766,782	5,122	51	21
Hariramp ur	Garibpur	3,130	2,500	0	3,130	313,000	773,439	1,284	13	5
Hariramp ur	Harukandi	3,130	2,500	0	3,130	313,000	773,439	4,486	45	18
Hariramp ur	Nababnag ar	3,130	2,500	0	3,130	313,000	773,439	1,010	10	4
Hariramp ur	Piringi	3,130	2,500	0	3,130	313,000	773,439	2,343	23	9
Dohar	Bejora	41,324	81,280	100,000	41,324	4,132,433	10,211,449	168	2	1
Dohar	Dakshin Bahra	41,324	81,280	100,000	41,324	4,132,433	10,211,449	448	4	2
Nwabganj	Bataimuri	10,445	79,799	0	10,445	1,044,500	2,581,012	1,000	10	4
Nwabganj	Kederpur	10,445	79,799	0	10,445	1,044,500	2,581,012	56	1	0
Total								30,863	309	125

based on survey from DC office

based on average per upazila

Average land price		Land use	Area (decimal)	%	Base price	Average price
Bejora	Bejora	Household	0	0%	81,280	41,324

Average land price		Land use	Area (decimal)	%	Base price	Average price
	Bejora	Agriculture	168	100%	41,324	
Char kusai	Char kusai	Household	128	10%	83,989	68,406
	Char kusai	Agriculture	1111	90%	66,611	
Choto basta	Choto basta	Household	79	9%	34,000	34,386
	Choto basta	Agriculture	781	91%	34,425	
Dakshin Bahra	Dakshin Bahra	Household	0	0%	81,280	41,324
	Dakshin Bahra	Agriculture	448	100%	41,324	
Dhoair	Dhoair	Household	0	0%	25,461	17,220
	Dhoair	Agriculture	2010	100%	17,220	
Kartikpur	Kartikpur	Household	154	29%	168,925	83,650
	Kartikpur	Agriculture	380	71%	49,073	
Silakota	Silakota	Household	15	1%	156,504	41,320
	Silakota	Agriculture	2457	99%	40,617	
Abidhara	Abidhara	Household	109	10%	2,000	2,325
	Abidhara	Agriculture	973	90%	2,361	
Boyra	Boyra	Household	219	4%	2,500	3,103
	Boyra	Agriculture	4903	96%	3,130	
Garibpur	Garibpur	Household	0	0%	2,500	3,130
	Garibpur	Agriculture	1284	100%	3,130	
Harukandi	Harukandi	Household	0	0%	2,500	3,130
	Harukandi	Agriculture	4486	100%	3,130	
Mohanpur	Mohanpur	Household	0	0%	3,500	4,074
	Mohanpur	Agriculture	45	100%	4,074	
Nababnagar	Nababnagar	Household	0	0%	2,500	3,130
	Nababnagar	Agriculture	1010	100%	3,130	
Nilgram	Nilgram	Household	275	8%	2,000	2,882
	Nilgram	Agriculture	3347	92%	2,955	
Piringi	Piringi	Household	0	0%	2,500	3,130
	Piringi	Agriculture	2343	100%	3,130	
Bataimuri	Bataimuri	Household	0	0%	79,799	10,445
	Bataimuri	Agriculture	1000	100%	10,445	
Kederpur	Kederpur	Household	0	0%	79,799	10,445
	Kederpur	Agriculture	56	100%	10,445	
Rajapur	Rajapur	Household	945	31%	79,799	31,710
	Rajapur	Agriculture	2137	69%	10,445	

No	Expenditure Item							Total BDT	Total US$	%
A.	Land Acquisition (see sheet area-cost for explaination)							1,462,549,573	17,835,970	77.65
		Area Ha	Dec	Unit Cost	BDT	USD				
	Land Acquisition	112.5	27,804	22,500	1,425,758,612	17,387,300				
		12.61	3,117	22,500	36,790,961	448,670				
B.	Replacement Cost							58,469,100	713,038	3.10
	1 Structure							46,196,730	563,375	
	Structures	Units	Type	Sqft	Cost/sft		BDT			

		90	Pukka	15896	1,280	20,346,880			
		178	Semi-Pukka	46949	815	38,263,435			
		343	Kutcha	63084	455	28,703,220			
		96	Thatched	24405	185	4,514,925			
		113	Tubewell	3345	5,000	565,000			
	Re-usable Materials	Tin wall/roof				46,196,730			
	2 Trees/Crops/Perennials						12,272,370	149,663	
		Units	Type		Unit Cost	BDT			
		166	Fruit	Small	120	19,920			
		185		Medium	2,100	388,500			
		1517		Large	3,500	5,309,500			
						5,717,920			
		22	Timber	Small	200	4,400			
		90		Medium	4,000	360,000			
		788		Large	7,800	6,146,400			
						6,510,800			
		97	Groves		450	43,650			
		38	Medicine			0			
		630	Other			0			
C.	Relocation Cost						161,011,916	1,963,560	8.55
	1 Transfer Grant for Structures						900,000	10,976	
		Units			Unit Cost	BDT			
		180	AH		5,000	900,000			
	2 Reconstruction and Homestead Development Grant						13,120,000	160,000	
		Units			Unit Cost	BDT			
		180	AH		8000	1,440,000			
	3. Stamp duty and registration cost 10% land owners cost to facilitate buying new land						146991916	1,792,584	
		180	AH		10%	146,991,916			

D.	Rehabilitation Assistance for AHs							1,526,000	18,610	0.08
	1 Vulnerable Households							615,000	7,500	
		Units	Type		Unit Cost	BDT				
		41	vulnerable HH		15,000	615,000				
	2 Moving Assistance for Owner operated Business							150,000	1,829	
		Units		Unit Cost		BDT				
		30	Business	5,000		150,000				
	3 Assistance for Affected Wage Earners							761,000	9,280	
		Units	Type	Unit Cost		BDT				
		155	MHH	4,000		620,000				
		25	FHH	5,000		125,000				
		4	Agricultural Land user		4,000	16,000				
E.	Service and Training							28,634,001	349,195	1.52
	1 Implementation of RP							15,000,000	182,927	
	2 Implementation of ILRP							8,334,001	106,846	
						BDT	USD			
	Livelihood Skills Development Training					642,367	7,834			
	Tailoring Training					1,109,567	13,531			
	Livelihood Development NGO					1,740,216	21,222			
	Inputs support for income restoration					5,012,200	64,259			
	3 External Monitoring Agency							5,000,000	60,976	
	4 GRC, Consultation Associated Costs							300,000	3,659	
F.	Subtotal (A+B+C+D+E)							1,712,190,590	20,880,373	
G.	Contingency (10%)							171,219,059	2,088,037	9.09
H.	TOTAL							1,883,409,649	22,968,410	100.00

APPENDIX E

DRAFT INFORMATION BROCHURE RP (ENGLISH VERSION)

Government of the People's Republic of Bangladesh

Ministry of Water Resources
Bangladesh Water Development Board

Flood and Riverbank Erosion Risk Management Investment Program (FERMIP)

Draft Resettlement Information Brochure

Information on entitlement to compensation and resettlement of people affected by land acquisition and river bank protection work

January, 2017

Published by Jamuna Meghna River Erosion Mitigation Project, Bangladesh Water Development Board

Abbreviations

AB	Acquiring Body (the Deputy Commissioner)
AC	Assistant Commissioner
AD	Alluvial and Diluvial
ADB	Asian Development Bank
AP	Affected Person
BWDB	Bangladesh Water Development Board
CCL	Cash Compensation under Law
DC	Deputy Commissioner
EP	Entitled Person
GOB	Government of Bangladesh
GRC	Grievance Redress Committee
ID	Identity
INGO	Implementing NGO
JFPR	Japan Fund for Poverty Reduction
JMREMP	JamunaMeghnaRiver Erosion Mitigation Project
JVT	Joint Verification Team
LA	Land Acquisition
LWL	Lowest Water Level
MARV	Maximum Allowable Replacement Value
MDIP	Meghna Dhonagoda Irrigation Project
MOWR	Ministry of Water Resources
NGO	Non-Government Organization
PIRDP	Pabna Irrigation and Rural Development Project
PVAT	Property Valuation Advisory Team
RB	Requiring Body (Bangladesh Water Development Board)
ROW	Right of Way
RP	Resettlement Plan
RRC	Refund of Registration Cost
SBE	Small Business Enterprise
SDE	Sub-Divisional Engineer
SES	Socio-economic Survey
UP	*Union Parishad* (Local Government Institution)

1. Background

1. The Asian Development Bank supports the feasibility assessment of a potential future flood and riverbank erosion risk management program covering parts of the main rivers of Bangladesh named Main River Flood and Bank Erosion Risk Management Program (FERMIP). The main focus is to reduce the riverbank erosion and flood risks to the adjacent flood plains while maximizing economic activities in a sustainable and environmentally acceptable manner. The FERMIP builds on and extends the activities of the Jamuna-Meghna River Erosion Mitigation Project (JMREMP) (ADB, 2002), implemented in different phases from January 2003 until June 2011. In addition, a similar project, the Assam Integrated Flood and Riverbank Erosion Risk Management Investment Project (AIFRERMIP) (ADB, 2010) provides important insight into a number of relevant project elements and processes.
2. The Project will cover the main rivers from Bhangabandhu (Jamuna) Bridge[28] and the proposed Ganges Barrage to Chandpur, as such covering around 60 km of the Jamuna, around 20 km of the Ganges, and the whole around 100 km long Padma reach. Two main confluences are included: the confluence of Ganges and Jamuna and the confluence of Padma and Upper Meghna. Importantly, for flood benefits and, of course, targeting the overarching goal of poverty reduction, the flood plains on both sides of the rivers play a fundamental role as home of a largely poor population depending on agriculture and fisheries. As a consequence sub-reaches with similar river and flood plain characteristics as practical subproject areas are identified. Each sub-reach consists of several upazilas. In total 14 sub-reaches were identified for pre-feasibility assessment: two each at the Jamuna Right and Left Bank (JRB, JLB), 3 along the Padma Right and Left Bank (PRB, PLB), one at the Meghna Right Bank (MRB), and two along the Meghna Left Bank (MLB).
3. During March-May 2013, a census and inventory of losses survey listed the houses and other structures along the alignment of the new embankment (Jamuna River), rehabilitated embankment on the Baral/Hurashagar River) and on the proposed 1 Km of River Bank Protection (RBP). In addition, a list of the owners of land in the RBP's RoW, including owners of land in the river-bed has been prepared. Those who have lost or will lose land, homestead and other properties, as identified by the Acquiring Body (AB, which is the Deputy Commissioner) and the Requiring Body (RB, which is BWDB), will be entitled to Cash Compensation under Law (CCL) from the respective District administration. They will also be provided with Resettlement Benefits and other support by BWDB according to the guidelines of the ADB so that they can retain their pre-Project socio-economic condition. In addition, persons living within the RoW and earning an income will receive a Subsistence Allowance from BWDB for loss of income or workdays according to Resettlement Plans (RPs) approved by the GoB.
4. For successful implementation of the Resettlement Plan, BWDB requests the attention and support of both national and local social development organizations. An Implementing NGO (INGO) is in place to assist BWDB in the implementation of the resettlement activities.

2 Definitions of Some of the Resettlement Terms

(a) Directly Affected Persons

5. People who were living in the Project Right of Way (RoW) during service of the notice under Section – 3 of the Land Acquisition Act 1982 or during the Inventory of Households and Assets

[28] Presently the Jamuna Multipurpose Bridge (JMB) is known as Banghabandhu Bridge. For an easier understanding of the location, we maintain the abbreviated form of Jamuna Bridge throughout this report.

between the Embankment and the Bankline and Socio-economic Survey (SES) conducted from March 2013 to May 2013 and recognized by BWDB, and will lose their land and property or source of income, will be entitled to Resettlement Benefits from BWDB as the Directly Affected Persons (APs).

(b) Indirectly Affected Persons

6 People who will lose their place of residence or source of income but do not own any land in the Project RoW will also be entitled to Resettlement Benefits from BWDB as indirectly Affected Persons (APs).

(c) Households

7 Generally, parents with children, brothers and sisters who live as a single family and eat from the same hearth are considered as a household; but household servants or regular employees will not be regarded as family members.

(d) Entitled Person (EP)

8 Persons who lose land or other property and/or sources of income opportunity who receive compensation from the District administration and are listed in March-May 2013 Inventory and SES, and recognized by BWDB, will be considered to be Entitled Persons (EPs). Those who are included in the Land Acquisition (LA) Award Book, that is legal owners who receive compensation from the District administration, or their lawful heirs, will be entitled to Resettlement Benefits from BWDB. In the case of joint ownership, the head of the household will receive the resettlement benefits.

(e) People Who Live on Private Land Belonging to Others and Squatters on Public Land

9 *Uthuli*[29] who live on private land belonging to others or carry out business there and squatters who live in Government land temporarily will be regarded as affected if their homestead land is acquired/required. Such families identified in the March-May 2013 Inventory and SES and confirmed by BWDB will be regarded as the EPs.

(f) Affected Income Earner

10 According to the March-May 2013 Inventory and SES, confirmed by BWDB, households living within on acquired or BWDB land will be regarded as Affected Income Earners due to any temporary loss of income through impact on home/business structures.

(g) Affected Tenant/Sharecropper

11 Cultivators of agricultural land which is not their own will, if certified by BWDB and the INGO as such, be regarded as an affected Tenant/Sharecropper. For category (e) above and for category (f), employer and the owners of the plot respectively and /or the Union Parishad[30] (UP) Chairman/Member will jointly certify them.

(h) Purchase of Replacement Land and Refund of Registration Cost

12 An AP is entitled to the replacement price of the agricultural/homestead/commercial land he/she lost to the Project so that he/she may purchase the equivalent amount of land. If he/she cannot find the same amount of land with the compensation money, then he/she can purchase less land of higher quality or more land of lower quality than he/she lost. The AP will get a Refund of Registration Cost (RRC); however, the RRC cannot be more than the stamp

[29] *Uthili* are persons who live on the private land of others with permission.

[30] The *Union Parishad* is the lowest level of local government.

duty needed to purchase land using the replacement value fixed by a Property Valuation Advisory Team (PVAT) established by BWDB and approved by MoWR.

(i) Compensation

13 APs will get Cash Compensation under Law (CCL) and a 50% additional price as premium over the same from the DC. CCL will be fixed by the District administration according to the Land Acquisition Act 1982 and all amendments thereafter.

(j) Resettlement Benefits

14 In addition to the CCL, the RP provides additional Resettlement Benefits in the form of grants to ensure that the APs will receive the current Replacement Market Value for their land and other properties.

(k) Prices of Different Types of Land

15 The legally constituted PVAT will carry out a detailed market survey through the INGO to determine the Maximum Allowable Replacement Value (MARV) of acquired land, and APs will be entitled to the MARV according to their loss

(l) Lowest Water Level and AD Line

16 From a legal and revenue point of view, the line that marks the Lowest Water Level (LWL) with the Flood Plain during the Dry Season is considered as the Bankline - also called the AD Line (Alluvial and Dilluvial Line) when declared formally by Assistant Commissioner of Land. Land above the LWL to the floodplain is private land unless already acquired by BWDB. For the Project purposes, the LWL will be considered as the demarcated Bankline or AD line.

17 The eroded land beyond the AD line goes under GoB ownership through a chained procedure that ends with the declaration as Khas31land by the Additional Deputy Commissioner. If Khas land, (underwater land32) is acquired, the DC will be paid the CCL as required by the Land Acquisition Act 1982, but not the additional 50% as premium.

18 In such a case, because of the Project's stabilization of the Bankline, the previous private owners will be identified and a Resettlement Benefit paid to them as APs losing their legal opportunity of regaining the land if it re-emerges within 30 years of erosion.33

(m) Vulnerable Households

6. Vulnerable Households are defined as APs who suffer more - economically and socially - from relocation than other APs. Based on past experiences from similar projects, the vulnerable households include (i) women-headed households; (ii) landless households (those without agricultural land, and depend largely on wage labor for survival); (iii) disabled households heads and (iv) households having residual agricultural land less than 1 acre or losing more than 10% of their income from agriculture due to acquisition. Such households will receive priority assistance in the Social Development Program (SDP) and employment in the Project construction work, if available.

3 Cut Off Dates

---

[31] Eroded land is considered to be *Khas* land. *Land Administration Manual*, GOB. page 384

[32] The value of eroded land is only 25 percent of land in the floodplain (QualityLand). *Land Administration Manual*, GOB. page 660

[33] *East Bengal State Acquisition and Tenancy Act* (1951, Revised 1998) and *Land Administration Manual*, GOB. pages 240, 243,

7. As defined in the RP, the Cut Off Date is the date after which eligibility for resettlement benefits will not be considered. The date of notification under section 3 for acquisition of land is treated as cut-off date for the project affected legal land owners. The cut-off date usually for non-titled APs such as informal settlers/squatters and encroachers is considered as the commencement date of census. The cut-off date, therefore, for the non-titled APs under this project is November 2017.

8. *Physical Losses Cut Off Date*. Because of the ongoing nature of Bank erosion, an Inventory of Households and Assets between the Embankment and the Bankline conducted in October-November 2017 that indicated all HHs that might possibly be on the RoW by start of construction and so be considered for physical losses due to land acquisition. The Physical Losses Cut Off Date of November, 2017 includes, therefore, only HHs having houses and establishment within the RoW at the beginning of physical works construction as identified by BWDB's Joint Verification Team (JVT).

9. *The Inventory Survey*is subject to verification by the JVT and approval by BWDB, considering not only the original Inventory but the Socio-economic Survey (SES) and JVT data collected just prior to civil works construction. In case of discrepancies, GRC will determine eligibility for individual HHs for Resettlement Benefits, such as: Replacement Value of Structure; Salvaged Material Free of Cost; Transfer Grant; Reconstruction Grant; and Homestead Development Grant.

10. *Income Losses Cut Off Date*. Among the Resettlement Benefits to be given to APs are Subsistence Grants for Loss of Income. The Census, Inventory of Losses, and Socio-economic Survey (SES), completed November 2017, serve as the Cut Off Date for eligibility to receive the Income subsistence Grants for: Male and Female HH Heads; Small Business Enterprise (SBE) Proprietors and Employees; and for Tenants/Sharecroppers. As with the Inventory of Losses Survey data, the SES Cut Off Date is subject to verification by BWDB's Joint Verification Team (JVT) and approval by BWDB.

11. *Land Acquisition* is not covered by these Cut Off Dates. CCL will be paid by the DC as per GoB LA Law; and the INGO, with BWDB approval, will provide Grants for Replacement Value of Land and other properties established by the PVAT and according to the Resettlement in Section 4 below.

4. The Resettlement Entitlement Matrix

12. Through the District Administration and the INGO, the BWDB will provide the CCL + 50% additional cost as premium and Resettlement Benefits respectively in accordance with the Land Acquisition Act and the Resettlement Entitlement Matrix of the RP, as legally agreed between the GoB and the ADB. The Resettlement Entitlement Matrix is shown below:

Resettlement Entitlement Matrix

General Implementation Issues and application Guidelines
7. PVAT BWDB will setup a Property Valuation Advisory Team (PVAT) at each District The tasks of this PVAT are: g) Recommend Replacement Cost (RC) based on Current Market price (CMP) analysis for Land, Structures, Trees and standing Crops h) CMP will be assessed for every affected mauza i) The Land Acquisition price will be determined by the standard procedure according to the land acquisition law. Updated in September 2017. j) For all private land, the market price will be enhanced by 200% for compensation under law (CCL). For *khas* land (DC is the owner at respective districts on behalf of the government), CCL will be the assessed market price without enhancement.

k) RC for structure considering the cost of materials, labor inputs and land development cost at current market rates**.**

l) RC /CMVwill be approved by the Project Director.

8. INGO

BWDB will engage a NGO to support implementation of resettlement plan i.e. to support the implementation of all land acquisition and resettlement activities. The NGO (INGO) will

h) Identify all persons who have interest in the lands that will be acquired under the project (owner, tenants, operators etc.;

i) identify all informal occupier/ settler on the right of way of new embankment, rehabilitation embankment and RBP works;

j) Make the landowners / tenant/ informal occupier aware about details of land acquisition process, compensation entitlement, payment procedure/ mechanism, resettlement benefit offered by the project.

k) Legal owners will be assisted by INGO to organize legal documents in support of their ownership

l) INGO will identify loss and entitlement of female owners and co-sharers through share determination at the field upon receipt of payment data from the DC office

m) The INGO will inform the APs of the details of the land acquisition and compensation process, resettlement package and payment procedure.

n) The INGO shall encourage Entitled Persons (EPs) to consider purchasing land or investing the money in productive/income generating activities.

9. JVT

c) The loss inventory items and quantities as well as the Entitled Persons (EP)shall be verified in the field through Joint Verification Team (JVT) formed by DC. The members of PVAT will attend field verification by JVT.

d) The JVT will verify the socially recognized User as identified by the Census

10. BWDB field office (Executive Engineer) will do Title updating for usufruct and other rights before issuance of notice with assistance from INGO

11. DC will pay CCL for the Loss Items. If RC is higher than CCL, the difference will be paid by BWDB with assistance from INGO.

12. Compensation for Structures:

f) Joint Verification (DC and BWDB) and/or Census will identify (record floor areas and category) of structure

g) Compensation must be paid before DP dismantle and remove the structures as per civil works requirement

h) The date of service of notice will be recognized as the cut-off date for structures not recognized by DC. In case of major differences identified between databases, BWDB will verify the data through the Joint Verification Team (JVT).

i) The owner is allowed to take all salvageable material

j) The RC will be the cost of the structures at market price

Unit of Entitlement	Entitlements	Applicable Law	Additional Services
Loss Item 1: LOSS OF AGRICULTURAL LAND			

Unit of Entitlement	Entitlements	Applicable Law	Additional Services
Legal owner(s) as identified by Deputy Commissioner (DC) in the process of CCL payment.	1. Replacement Cost (RC)[34] or Current Market Value (CMV) of agricultural land.	LA Act 1982 Sec 8(1)(a), Sec 8(2) **As per 21 No. Law of 2017** **ADB SPS**	
Special Implementation Issues and application Guidelines:			
Loss Item 2: LOSS OF HOMESTEAD, COMMERCIAL, INDUSTRIAL LAND AND COMMON PROPERTY RESOURCES			
Legal owner(s) as identified by DC in the process of CCL payment.	1. CMV of land. 2. 10% of CMV as transaction allowance such as stamp duty and registration cost, VAT etc. No matter whether she/he purchase land or not	LA Act 1982 Sec 8(1)(a), Sec 8(2) **As per 21 No. Law of 2017: additional 200% cost** **ADB SPS**	1. BWDB will assist purchase of above land(s) jointly with INGO on negotiated price and homestead land development (earth filling, if needed.) with internal road links.
Special Implementation Issues and application Guidelines:			
Loss Item 3: LOSS OF WATER BODIES (PONDS, BOTH CULTIVATED AND NON-CULTIVATED)			
Legal owner(s) as identified by DC in the process of CCL payment.	1. CMV of the water body (private land). 2. Allowance of one year fish harvest to be recommended by PVAT	LA Act 1982 Sec 8(1)(a), Sec 8(2) **As per 21 No. Law of 2017** **ADB SPS**	.
Special Implementation Issues and application Guidelines:			
Loss Item 4: LOSS OF RESIDENTIAL STRUCTURES WITH TITLE TO LAND			
Legal owner(s) as identified by DC in the process of CCL payment.	1. CMV of residential structure 2. Transfer Grant @ Tk. 15 per sft of affected structure but not exceeding 3. Reconstruction and Homestead Development Grant (RHDG) at the rate of 20 TK per sf.	LA Act1982 Sec 8(1)(d) Sec 8(2) **As per 21 No. Law of 2017: additional 100% cost** **ADB SPS**	Assistance in relocation and reconstruction.

[34]The costs of replacing lost assets (e.g., land, houses/structures, trees and crops) and income, including cost of transaction.

Unit of Entitlement	Entitlements	Applicable Law	Additional Services
Special Implementation Issues and application Guidelines:			
Loss Item 5: LOSS OF COMMERCIAL/INDUSTRIAL/COMMON RESOURCE PROPERTY (CPR) STRUCTURES WITH TITLE TO LAND			
Legal owners as identified by DC in the process of CCL payment.	1. CMV of commercial, industrial, CPR structure 2. Transfer Grant @ Tk. 20 per sft of affected structure but not exceeding Tk. 4,500. 3. Reconstruction Grant of TK10,000.	LA Act1982 Sec 8(1)(d) Sec 8(2) **As per 21 No. Law of 2017: additional 200% cost** **ADB SPS**	Assistance in relocation and reconstruction.
Special Implementation Issues and application Guidelines:			
Loss Item 6: LOSS OF RESIDENTIAL AND OTHER PHYSICAL STRUCTURES (WITHOUT TITLE TO LAND)			
Socially recognized owners of structures built on the ROW	1. CMV of structures as determined by PVAT 2. Structure Transfer Grant (STG) @ Tk. 15 (ten) per sft of affected structure for shifting 3. Reconstruction and Homestead Development Grant (RHDG) at the rate of 20 TK per sft	LA Act1982 Sec 8(1)(d) Sec 8(2) **As per 21 No. Law of 2017:** **ADB SPS**	
Special Implementation Issues and application Guidelines:			
1. The homestead losers will produce documentary evidence and the BWDB through JVT will cross verify the landlessness of the homestead losers for allocation of an RV plot for free. 2. The RP-INGO will assist the DPs to move to clustered relocations (resettlement villages) with community facilities or, alternatively, in self-relocation. The DPs may be relocated to BWDB land (if available) or plots purchased (by the DPs) for which assistance will be provided in the form of homestead land development.			
Loss Item 7: LOSS OF TIMBER AND FRUIT BEARING TREES, BAMBOO AND BANANA GROVES			
1. Legal owner(s) as identified by the DC in the process of CCL payment. 2. Socially recognized owners of trees grown on public or other land	1. Timber trees and bamboo: CMV of trees and bamboo. 2. Fruit-bearing trees without timber: if the tree is at or near fruit-bearing stage, the estimated current market value of the fruit. 3. Fruit-bearing trees with timber: CMV for the timber, and estimated current market value of fruit. 4. Banana groves: CMV of all trees 5. Owners will be allowed to fell trees and take the timber, free of cost after payment of CCL or RC as applicable.	LA Act1982 Sec 8(1)(b) Sec 8(2) **As per 21 No. Law of 2017: additional 100% cost**	INGO to explain RP policies regarding compensation for the trees of different categories and size and make the EPs aware that they could take the timber and fruits free of cost.

Unit of Entitlement	Entitlements	Applicable Law	Additional Services
Special Implementation Issues and application Guidelines:			
1. The INGO will provide guidance in plantation and post-plantation care.			
Loss Item 8: LOSS OF STANDING CROPS/FISH STOCK			
1. Legal owners identified by the DC in progress of CCL payment 2. Socially recognized owners	1. RC of standing crops/fish stock. 2. Owners will be allowed to harvest crops and fish stock.	LA Act1982 Sec 8(1)(b) Sec 8(2) **ADB SPS**	INGO will assist APs in the process of claiming compensation from DC offices for organizing necessary documents.
Special Implementation Issues and application Guidelines:			
Loss Item 9: LOSS OF LEASED /MORTGAGED IN LAND/PONDS			
1. Leaseholder with legal papers. 2. Socially recognized lessee or sharecropper, in case of customary informal tenancy arrangements, including socially recognized agreements.	1. CMV of crops/ fish stock for one year as compensation. 2. Outstanding lease money back to the lessee by the owner as per agreement. 3. The leaseholder will be allowed to take the crops/fishes free of cost within the date declared by BWDB		1. INGO will assist in ensuring that the lessee receives all eligible payments. 2. INGO will mediate fund of outstanding lease money by the owner to the lessees.
Special Implementation Issues and application Guidelines:			
1. With legal agreement: legal owner and mortgagee/leaseholder will be paid CCL by DC in accordance by the law2. With customary tenancy agreements, including socially-recognized verbal agreements: Legal owner will receive CCL from DC. The legal owner will pay the outstanding liabilities to the lessee/mortgagee. Under the following conditions: (i) all contractual liabilities are already paid up; (ii) if not, the legal owner will get the residual payment after all liabilities are paid up.3. BWDB will ensure RC of crops to the cultivator with direct payment of the difference, if CCL is less than RC, with assistance from INGO.4. Dislocation Allowance will be paid to the actual cultivator of the acquired land by BWDB with assistance from INGO.			
Loss Item 10: LOSS OF INCOME FROM DISPLACED COMMERCIAL/ INDUSTRIAL PREMISES (OWNER OPERATED)			
Any proprietor or businessman or artisan operating in premises	Business restoration grant will be an equivalent to 3 months lost income against owners name recorded during the survey Employment in the Project construction work, if possible	LA Act1982 Sec 8(1)(d) Sec 8(2) **ADB SPS**	EPs will be brought under income and livelihood regenerating program (ILRP).
Special Implementation Issues and application Guidelines:			
1. All the business operators will be entitled for grant against loss of income and one time moving assistance will be provided to only the tenants.			

Loss Item 11: TEMPORARY LOSS OF INCOME (WAGE EARNERS IN AGRICULTURE, COMMERCE & SMALL

Unit of Entitlement	Entitlements	Applicable Law	Additional Services
BUSINESS AND INDUSTRY)			
Regular wage earners affected by the acquisition.	Grant to cover loss of employees /regular wage earners @ TK 400X 90 days per person Poor Female HH will be paid a one time grant of TK 5000 as special assistance EPs to be included in the ILRP	**ADB SPS**	1. EPs will be brought under the ILRP.
Special Implementation Issues and application Guidelines:			
EP must have been an employee of landowner or business located in the acquired lands for at least twelve months, as identified by Joint Verification and/or a contracted institution or a consulting company's census.			

Loss Item 12: LOSS OF INCOME FROM RENTED -OUT AND ACCESS TO RENTED-IN RESIDENTIAL/COMMERCIAL PREMISES			
1. Owner of the rented-out premises 2. AH/person rented-in any such structure	Dislocation Allowance of Tk. 6,000 for each unit of premises to both the renter and the rentees.	LA Act1982 Sec 8(1)(d) Sec 8(2) **ADB SPS**	EPs will be brought under the ILRP.
Special Implementation Issues and application Guidelines:			

Loss Item 13: VULNERABLE AHs SPECIAL ASSISTANCE			
Vulnerable AH Assistance: Female-headed households, disabled, elderly, extremely poor and those losing more than 10% of their income to acquisition of land or business.	One-Time Special Assistance Grant of Tk 15,000 / AHH Skill training and credit support underILRP. No AH will get the grant if their family members do not participate to the proposed skill training	**ADB SPS**	EPs will be brought under the ILRP.
Special Implementation Issues and application Guidelines:			
1. Loss of income will be assessed as per actual loss of productive resources (land and businesses) to the project and the total income of the affected households from all sources through Census of all AHs. 2. JVT will verify the percentage of loss comparing the actual loss and the total income from all sources of the affected households. 3. Households turning into landless due to acquisition of agricultural land will be eligible for larger credit from the ILRP for longer duration.			

Loss Item 14: UNFORESEEN ADVERSE IMPACTS			
Households/persons affected by any	Entitlements will be determined as per the resettlement policy framework		As appropriate

Unit of Entitlement	Entitlements	Applicable Law	Additional Services
unforeseen impact identified during RP implementation			
Special Implementation Issues and application Guidelines:			
The unforeseen impacts and affected persons will be identified with due care as per policy framework and proposed to the MoWR and the ADB for approval including quantity of losses, their owners and the entitlements.			

5 Procedures for Receiving Resettlement and Other Grants

(a) Identity (ID) Card

13. APs that get paid CCL by the District Administration and/or Resettlement Benefits from the BWDB will be termed as Entitled Persons (EPs). Each AP household head or EP will be given an Identity (ID) Card.

(b) Entitled Person's File (EP File) & Entitlement Card

14. All the losses of an EP will be computerized to an electronic EP File that can then, based on the Resettlement Entitlement Matrix, automatically summarize the EP's total losses and benefits at any point in time. This will be produced into a standardized report, the Entitlement Card; and the EP will be provided with all the benefits according to his/her loss as shown in the Entitlement Card. The INGO will distribute one (1) copy of their final Entitlement Card to each EP.

(c) Purchase of Replacement Land

15. If an EP chooses replacement land, the EP will, with the assistance of the INGO, scrutinize the replacement land owner's relevant documents. If the EP is satisfied, he/she will fix the price and register it. The EP then has to submit the relevant documents to BWDB for receiving the Resettlement Benefit.
16. All influential persons are requested to persuade owners of landed property in their own areas to sell their land to the EPs for the area's greater good.

(d) Grievance Redress Committees (GRCs)

17. The FERMIP will have one Grievance Redress Committee (GRC). The GRC have been constituted, and will be gazetted, to assist the resettlement activities. The GRC will consist of Sub-Divisional Engineer (SDE)/Assistant Engineer or any official with the same status from BWDB; the Area Manager/Deputy Team leader or equivalent officer/specialist of the INGO; the UP Chairman or a member of the concerned local government; and a representative of the APs. The BWDB representative will chair the GRC, and the INGO representative will act as Member Secretary.
18. The functions of the GRC will be to:

- Receive applications and hold hearings on AP grievances concerning the Project, in particular regarding resettlement issues.
- Refer APs to the concerned authority/Deputy Commissioner if the grievance can be dealt with through conventional law or by arbitration.
- Make decisions to resolve AP grievances following RP policy if outside conventional law and if the grievance does not lend itself to arbitration.

- Prepare recommendations according to the procedure described by the GRC in resolving AP complaints.

19. The GRCs will receive AP grievances and resolve them in the following manner:
    - The written AP grievance will be lodged with the GRC within a month of the receipt of ID Card or from when the AP is informed of their entitlement.
    - The GRC will meet to resolve the AP grievance within 10 days of its receipt and will preserve the records and procedure of the meeting. The GRC will mention the basis of its resolutions in the written record of its meetings.
    - The GRC will publicize its decisions regarding AP grievances through local community meetings and through the distribution of leaflets to the public.
    - All the GRC activities will take place in the office of the GRC Chairman.

(e) Joint Verification Team (JVT):

20. Joint Verification Team (JVT) will also be constituted at the FERMIP. The JVT members will include the SDE/Assistant Engineer or any official with the same status from BWDB; a representative of the concerned Deputy Commissioner; and Area Manager/Deputy Team Leader or equivalent officer/specialist of the INGO. The BWDB representative will chair the JVT, and the INGO representative will act as Member Secretary.
21. The JVT will:
    - Reconcile data after scrutinizing the AP lists and affected physical asset quantities, as prepared, with assistance from consultants, by the BWDB.
    - Confirm the list of long-term residents on BWDB or GoB land within the Project ROW, submitting the list to the Project Director, BWDB
    - Assess and finalize the AP lists and affected physical asset quantities, through joint verification as per GoB law.
    - Sign all documents relevant to the above and submit them to the Project Director, BWDB
    - Submit all necessary documents/reports to the concerned officials, as per the Project's construction schedule

f) Property Valuation Advisory Team (PVAT)

22. A Property Valuation Advisory Team (PVAT) will be constituted by BWDB for FERMIP to determine the current market price and replacement cost of acquired land, physical structures, trees and other property. The PVAT is comprised of the SDE)/Assistant Engineer or any official with the same status from BWDB; a representative of the Deputy Commissioner concerned; and the Area Manager/Deputy Team Leader or equivalent officer/specialist of the INGO. The BWDB representative chairs the PVAT, and the INGO representative acts as Member Secretary.
23. The PVAT will:
    - Assist the relevant legal authority to determine the Replacement Cost of affected land and other physical property under acquisition, at the Market Price.
    - Assist the relevant legal authority to determine Replacement Cost of property of the APs on the BWDB or other GoB land, at Market Price.

- Submit necessary documents/reports to the Project Director, BWDB and to the Deputy Commissioner concerned, following the Project's construction schedule.

g) Other Information/Procedures for Entitled Persons (EPs)

- In order to receive their CCL, EPs must produce at the DC's office their ownership deed, record, rent receipt, mutation document, share document, or other relevant proof of ownership.
- Until and unless the legal owners receive the CCL from the Deputy Commissioner, BWDB cannot provide the Resettlement Benefit grants through the INGO for the relevant plot.
- If replacement land is purchased within the period of RP implementation, and the evidence of properly used stamp duty and other relevant documents is produced in the INGO's field office, the stamp duty and registration cost will be refundable at the rate provisioned in the RP.
- The EPs will receive an ID Card bearing ID number and photograph of the EP, signed by BWDB's and the INGO's assigned representatives. The EP will need to produce their ID Card to receive Resettlement Benefits.
- The entitlement determined by BWDB through the INGO as per RP provision will be disbursed through a 'Crossed Bank Cheque[35] on the date declared earlier and in the presence of local *UP* chairman/member. For this purpose, the EP must open a bank account.
- The BWDB or INGO field offices at FERMIP may be contacted for any additional information regarding acquisition and resettlement. The INGO will provide necessary assistance to all EP.
- Affected tenants/sharecroppers will be identified by the JVT and certified by the relevant landowner and the UP chairman/member.
- The major responsibility for RP implementation rests with BWDB. The INGO will, on BWDB's behalf, actually carry out the RP implementation activities as per BWDB's instruction. If there is any change suggested by GoB and/or the Donors, the APs will duly be informed.
- Note: APs will get compensation as per 1982 Act and resettlement benefit according to the Resettlement Entitlement Matrix shown above in Section 3. This Resettlement Information Brochure is amendable as per requirement and approval of BWDB and the ADB.

[35]A '*Crossed Bank Cheque* 'can only be cashed through being deposited in the EP's account first.

APPENDIX F

TERMS OF REFERENCE FOR EXTERNAL MONITORING AGENCY (EMA)

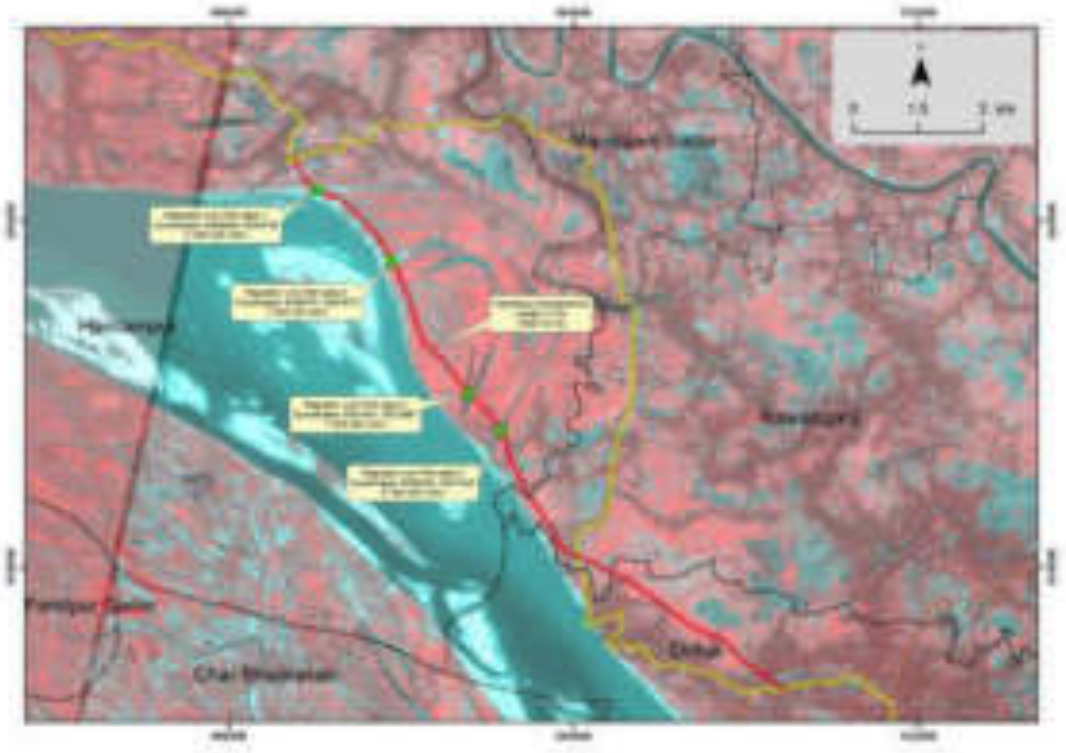
BACKGROUND

1. The Asian Development Bank supports the feasibility assessment of a potential future flood and riverbank erosion risk management program covering parts of the main rivers of Bangladesh named Main River Flood and Bank Erosion Risk Management Program (FERMIP). The main focus is to reduce the riverbank erosion and flood risks to the adjacent flood plains while maximizing economic activities in a sustainable and environmentally acceptable manner. Existing flood embankments dominantly fail from riverbank erosion, and as such the stabilization of the river pattern is a cornerstone of reducing the flood risk. The FERMIP builds on and extends the activities of the Jamuna-Meghna River Erosion Mitigation Project (JMREMP) (ADB, 2002), implemented in different phases from January 2003 until June 2011. The Project will cover the main rivers from Bhangabandhu (Jamuna) Bridge and the proposed Ganges Barrage to Chandpur, as such covering around 60 km of the Jamuna, around 20 km of the Ganges, and the whole around 100 km long Padma reach.

2. Two main confluences are included: the confluence of Ganges and Jamuna and the confluence of Padma and Upper Meghna. Importantly, for flood benefits and, of course, targeting the overarching goal of poverty reduction, the flood plains on both sides of the rivers play a fundamental role as home of a largely poor population depending on agriculture and fisheries. As a consequence we identified sub-reaches with similar river and flood plain characteristics as practical subproject areas. Each sub-reach consists of several upazilas, which facilitates the data collection. In total 14 sub-reaches were identified for pre-feasibility assessment: two each at the Jamuna Right and Left Bank (JRB, JLB), 3 along the Padma Right and Left Bank (PRB, PLB), one at the Meghna Right Bank (MRB), and two along the Meghna Left Bank (MLB). The feasibility study covered the priority investment during the first Tranche**.** In Bangladesh the common MFF approach means that only the first tranche investment is identified during the PPTA. Subsequent tranches will be identified during each previous, ongoing tranche.

3. A Resettlement Plan for Tranche-2, Main River Flood and Bank Erosion Risk Management Program (FERMIP), December 2017 has been prepared. The RP is only for Tranche-2 Jamuna Right Bank's first Sub-Reach (JRB-1):

Proposed JLB-1 Interventions	**KM**
a) Harirampur new New Jamuna Embankment (with 4 fish passes)	17.0



Sub-Reach Area - Proposed Component

4. In Tranche-2, there are other proposed Riverbank Protection (RBP) interventions on the Jamuna's left and right bank :

Proposed JRB-1 Intervention	**KM**
1. Koijuri - Bagabari embankement extension	6

5. BWDB will have mobilised a resettlement plan implementing NGO (RP-INGO) to implement the FERMIP Tranche-2 RP for phase-wise components. The RP-INGO will implement the RAPs as per the resettlement policy, ensure stakeholders participation as per the project need, and provide technical assistance for compensation and assistance to the APs. A monitoring mechanism has also been framed and adopted in the RPsinvolving the BWDB, the RP-INGO, consultants and the ADB.
6. BWDB seeks to engage an independent External Monitoring Agency (EMA) to review the internal monitoring and undertake third party monitoring & evaluation of the RP implementation process for the Government of Bangladesh and the ADB.

KEY OBJECTIVE OF EXTERNAL MONITORING

7. The primary objective for engaging an external monitor is to review monitor and measure the progress of implementation of the resettlement plan. In addition to recording the progress in compensation payment and other resettlement activities, the External Monitoring Agency (EMA) will prepare monitoring reports to ensure that the implementation of the resettlement plan has produced the desired outcomes. The (EMA) will review implementation process as per set policies in the RPs and assess the achievement of resettlement objectives, the changes in living standards and livelihoods, restoration of the economic and social base of the affected people, the

effectiveness, impact and sustainability of entitlements, the need for further mitigation measures if any, and to learn strategic lessons for future policy formulation and planning.

8. The EMA will prepare semi-annual monitoring reports that describe the progress of the implementation of resettlement activities and any compliance issues and corrective actions. These reports will closely follow the involuntary resettlement monitoring indicators agreed at the time of resettlement plan approval. The costs of internal and external resettlement monitoring requirements will be included in the project budget.

SCOPE OF WORK

9. The scope of work of the External Monitoring Agency (EMA) will include the following tasks:

(1) To develop specific monitoring indicators for undertaking monitoring for Resettlement Plans (RPs), Gender Action Plan (GAP) and the Income& Livelihood Restoration Plan (ILRP).

(2) To review and verify the progress in land acquisition/resettlement implementation of the Project.

(3) Identify the strengths and weaknesses of the land acquisition/resettlement objectives and approaches, implementation strategies.

(4) Evaluate and assess the adequacy of compensation given to the APs and the livelihood opportunities and incomes as well as the quality of life of APs of project-induced changes.

(5) Identification of the categories of impacts and evaluation of the quality and timeliness of delivering entitlements (compensation and rehabilitation measures) for each category and how the entitlements were used and their impact and adequacy to meet the specified objectives of the Plans. The quality and timeliness of delivering entitlements, and the sufficiency of entitlements as per approved policy.

(6) To analyze the pre-and post-project socio-economic conditions of the affected people. In the absence of baseline socio-economic data on income and living standards, and given the difficulty of APs having accurate recollection of their pre-project income and living standards, develop some quality checks on the information to be obtained from the APs. Such quality checks could include verification by neighbors and local village leaders. The methodology for assessment should be very explicit, noting any qualifications.

(7) Review results of internal monitoring and verify claims through sampling check at the field level to assess whether land acquisition/resettlement objectives have been generally met. Involve the affected people and community groups in assessing the impact of land acquisition for monitoring and evaluation purposes.

(8) To monitor and assess the adequacy and effectiveness of the consultative process with affected APs, particularly those vulnerable, including the adequacy and effectiveness of grievance procedures and legal redress available to the affected parties, and dissemination of information about these.

(9) Identify, quantify, and qualify the types of conflicts and grievances reported and resolved and the consultation and participation procedures.

(10) Provide a summary of whether involuntary resettlement was implemented (a) in

accordance with the RPs, and (b) in accordance with the stated policy.

(11) To review the quality and suitability of the relocation sites from the perspective of the both affected and host communities (if any).

(12) Verify expenditure & adequacy of budget for resettlement activities.

(13) Describe any outstanding actions that are required to bring the resettlement activities in line with the policy and the RP. Describe further mitigation measures needed to meet the needs of any affected person or families judged and/or perceiving themselves to be worse off as a result of the Project. Provide a timetable and define budget requirements for these supplementary mitigation measures.

(14) Describe any lessons learned that might be useful in developing the new national resettlement policy and legal/institutional framework for involuntary resettlement.

D. Methodology and Approach

10. The general approach to be used is to monitor activities and evaluate impacts ensuring participation of all stakeholders especially women and vulnerable groups. Monitoring tools should include both quantitative and qualitative methods. The external monitor should reach out to cover:

- 100% APs who had property, assets, incomes and activities severely affected by Project works and had to relocate either to resettlement sites or who chose to self-relocate, or whose source of income was severely affected.
- % of persons who had property, assets, incomes and activities marginally affected by Project works and did not have to relocate;
- 10% of those affected by off-site project activities by contractors and sub-contractors, including employment, use of land for contractor's camps, pollution, public health etc.;

11. Supplemented by Focused Group Discussions (FGD) which would allow the monitors to consult a range of stakeholders (local government, resettlement field staff, NGOs, community leaders, and, most importantly, APs), community public meetings: Open public meetings at resettlement sites to elicit information about performance of various resettlement activities.

E. Other Stakeholders and their Responsibility

1. Responsibility of BWDB

12. The Bangladesh Water Development Board (BWDB) through its Project Management Office (PMO) at headquarters and in the RU-field offices will ensure timely supply of background references, data and project options to the independent monitor. It will ensure uninterrupted access to work sites, relevant offices of the GOB and BWDB in particular. The independent external monitor will sit in quarterly coordination meetings with the BWDB in presence of the supervision consultant and the BWDB should organize that at PMO or Field level as appropriate.

13. Recommendation based on the result of the monitoring should be offered to BWDB to cover up the deficiencies identified by the external monitor. BWDB will accept the recommendations of the external monitor if it is within the scope of work and there is nothing incorrect in the report.

2. Responsibility of Supervision Consultant

14. The supervision consultant will provide appropriate protocol at site or at its Project Office for the mission of the EMA. It will on behalf of BWDB ensure free access to work sites, impact areas and the database on resettlement and civil works. The supervision consultant will ensure timely intimation of its civil works planning as and when made or updated during the construction period and keep the external monitoring and evaluation consultant informed.

3. Responsibility of the RP Implementing NGO

15. The RP Implementing NGO will assist and cooperate the external monitor through providing free access to its database and the automated management information system (MIS). It will provide copies of the progress reports and other reports as requested by the external monitor. The RP-INGO may have to carry out surveys as well for fulfilment of the requirements of the external monitoring.

TEAM COMPOSITION OF THE EXTERNAL MONITORING AGENCY

16. The EMA should focus on field based research on institutional arrangement, implementation strategy, policy objectives, and the targets. Data collection, processing and analysis to pin point problem areas and weaknesses, and to light on deserving measures to achieve the objectives on schedule are the special interest of the subject. Thus, there is a need for a dedicated monitoring team with adequate gender representation. Further, it is essential that the central team or field level coordinators responsible for monitoring, are skilled and trained in data base management, interview technique, and social and economic/finance. Keeping in mind these criteria, the team should ideally include:

Position/expertise	Qualification and experience
1. Team Leader/ Implementation Specialist	Masters in socialsciencewith15 years working background in planning, implementation and monitoring of involuntary resettlement for infrastructure projects. Experience in institutional capacity analysis and implementation arrangement for preparation and implementation of resettlement plans, and knowledge in latest social safeguard policies of the international development financing in situations in Bangladesh are preferred.
2. Social Impact Specialist	Masters insocialsciencewith15yearsworkingexperience in social impact assessment including census and socioeconomic surveys, stakeholders' consultation, and analyzing social impacts to identify mitigation measures in compliance with social safeguard policies of the international development financing institutions and national legislations. Experience of preparing resettlement framework and action plans and implementation of plans for externally financed projects is essential.
3. Gender Specialist	Masters insocialsciencewith15yearsworkingexperience in relevant field; Thorough knowledge of gender issues and their implications in development projects; research and work experience relating to gender issues; and knowledge of techniques and their applications in mobilizing community participation in development programs.
Data Analyst	Graduate with working experience and knowledge of software, preferably relational, those are most commonly used in Bangladesh; demonstrated ability to design and implement automated MIS(s) for monitoring progress, comparing targets with achieved progress and the procedural steps.

TIME FRAME AND REPORTING

17. The EMA will be employed over a period of 4years with intermittent inputs from the professional team to continue one year after completion of the RP implementation.
18. Quarterly and annual monitoring reports should be submitted to the BWDB with copies to the international co-financiers. An evaluation report at the end of the project should be submitted to the BWDB and concerned parties with critical analysis of the achievement of the program and performance of BWDB and RP-INGO.
19. The external monitors will provide monitoring and evaluation report covering the following aspects:
    a. Whether the resettlement activities have been completed as planned and budgeted;
    b. The extent to which the specific objectives and the expected outcomes/results have been achieved and the factors affecting their achievement or non-achievement;
    c. The extent to which the overall objective of the Resettlement Plan, pre project or improved social and economic status, livelihood status, have been achieved and the reasons for achievement / non achievement;
    d. Major areas of improvement and key risk factors;
    e. Major lessons learnt; and
    f. Recommendations.
20. Formats for collection and presentation of monitoring data will be designed in consultation with
21. BWDB, and consultants

QUALIFICATION OF THE EXTERNAL MONITORING AGENCY

22. The EMA will have at least 10 years of experience in resettlement planning and implementation of resettlement plans. Further, work experience and familiarity with all aspects of resettlement operations would be desirable. NGOs, Consulting Firms or University Departments (consultant organization) having requisite capacity and experience as follows can qualify for services of and external monitor for the project.
    a. NGOs registered with the Social Welfare Department of the GOB, Consulting Firms registered with the Joint Stock Company or Departments of any recognized university.
    b. The applicant should have prior experience in social surveys in land based infrastructure projects and preparation of resettlement plans (RPs) as per guidelines on involuntary resettlement of the ADB.
    c. The applicant should have extensive experience in implementation and monitoring of resettlement plans, preparation of implementation tools, and development and operation of automated MIS for monitoring.
    d. The applicant should be able to produce evidences of monitoring using structured instruments and computerized MIS with set criteria for measuring achievement.
    e. The applicant should have adequate manpower with capacity and expertise in the field of planning, implementation and monitoring of involuntary resettlement projects as per donor's guidelines.
23. Interested agencies should submit proposal for the work with a brief statement of the approach, methodology, and relevant information concerning previous experience on monitoring of resettlement implementation and preparation of reports.

24. The profile of consultant agency, along with full CVs of the team to be engaged, must be submitted along with the proposal.

BUDGET AND LOGISTICS

25. The budget should include all expenses such as staff salary, office accommodation, training, computer/software, transport, field expenses and other logistics necessary for field activities, data collection, processing and analysis for monitoring and evaluation work. Additional expense claims whatsoever outside the proposed and negotiated budget will not be entertained. VAT, Income Tax and other charges admissible will be deducted at source as per GOB laws.

Project Director

FERMIP Project Management Office
(PMO) BWDB, Dhaka

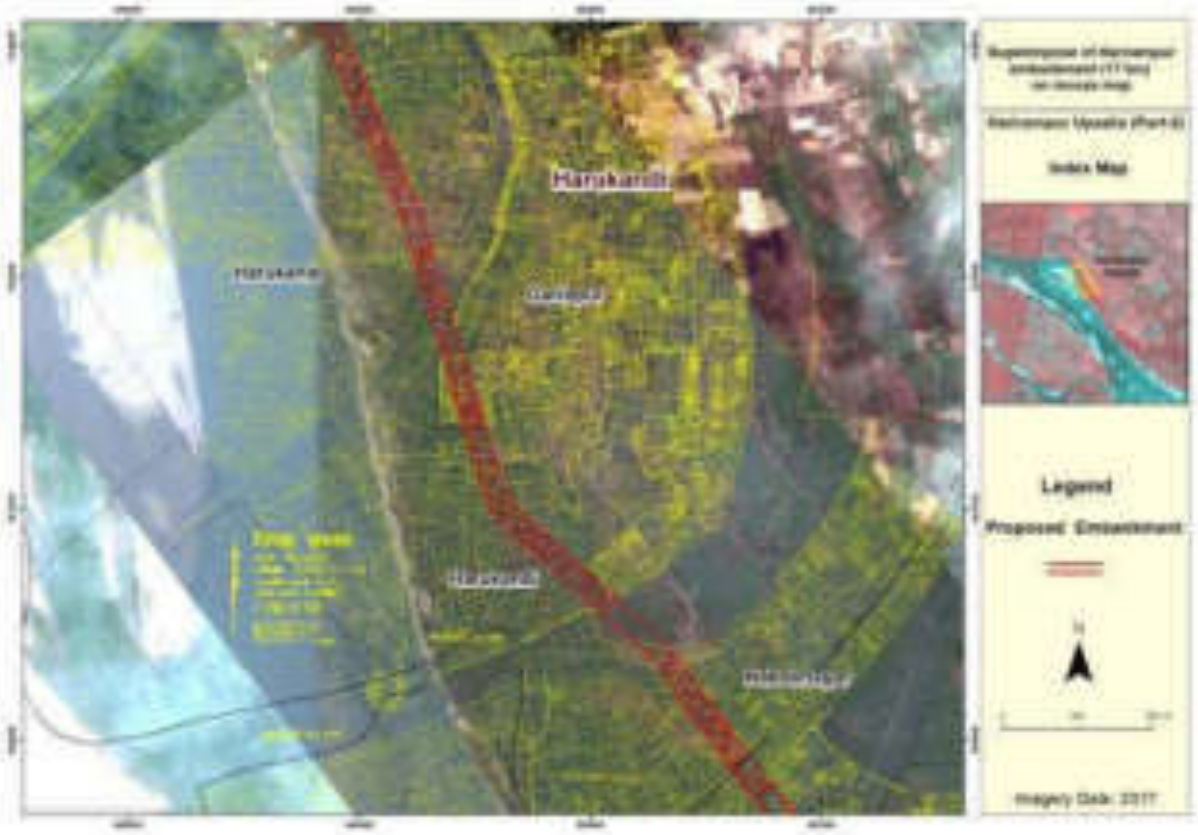
APPENDIX G

LAND ACQUISITION PLAN (PLOTS AND MAPS)

1 For the embankement only

1 Harirampur Upazela Alignement

Satellite maps and mouza maps overlay (3 parts)


Index Map
Legend
Proposed Embankment


Index Map
Legend
Proposed Embankment

List of affected plots in the Harirampur Upazila

LAP **Harirampur Upazila** 99999

Khal/halot

Upazila name	Union Name	Mouza name	Plot No	Full Plot_Area m²	Affected Area m²
Harirampur	Dhulsunra	Abidhara	997	1358	16
Harirampur	Dhulsunra	Abidhara	994	1210	365
Harirampur	Dhulsunra	Abidhara	993	680	680
Harirampur	Dhulsunra	Abidhara	992	668	363
Harirampur	Dhulsunra	Abidhara	989	1774	580
Harirampur	Dhulsunra	Abidhara	988	1395	1301
Harirampur	Dhulsunra	Abidhara	987	195	195
Harirampur	Dhulsunra	Abidhara	986	210	210
Harirampur	Dhulsunra	Abidhara	985	628	628
Harirampur	Dhulsunra	Abidhara	984	538	538
Harirampur	Dhulsunra	Abidhara	983	748	460
Harirampur	Dhulsunra	Abidhara	981	869	52
Harirampur	Dhulsunra	Abidhara	980	4022	2987
Harirampur	Dhulsunra	Abidhara	977	1835	582
Harirampur	Dhulsunra	Abidhara	935	7340	3850
Harirampur	Dhulsunra	Abidhara	925	977	435
Harirampur	Dhulsunra	Abidhara	924	653	282
Harirampur	Dhulsunra	Abidhara	923	936	62
Harirampur	Dhulsunra	Abidhara	920	1163	976
Harirampur	Dhulsunra	Abidhara	918	1264	1
Harirampur	Dhulsunra	Abidhara	862	510	89
Harirampur	Dhulsunra	Abidhara	861	1276	211
Harirampur	Dhulsunra	Abidhara	852	1172	567
Harirampur	Dhulsunra	Abidhara	850	1558	1558
Harirampur	Dhulsunra	Abidhara	849	691	186
Harirampur	Dhulsunra	Abidhara	848	683	294
Harirampur	Dhulsunra	Abidhara	846	1554	1302
Harirampur	Dhulsunra	Abidhara	845	1630	980
Harirampur	Dhulsunra	Abidhara	815	1442	370
Harirampur	Dhulsunra	Abidhara	814	1452	1102
Harirampur	Dhulsunra	Abidhara	813	1390	1390
Harirampur	Dhulsunra	Abidhara	812	1256	782
Harirampur	Dhulsunra	Abidhara	809	824	1
Harirampur	Dhulsunra	Abidhara	806	3542	3090
Harirampur	Dhulsunra	Abidhara	805	737	545
Harirampur	Dhulsunra	Abidhara	804	711	409
Harirampur	Dhulsunra	Abidhara	802	674	422

Upazila name	Union Name	Mouza name	Plot No	Full Plot_Area m²	Affected Area m²
Harirampur	Dhulsunra	Abidhara	769	910	3
Harirampur	Dhulsunra	Abidhara	768	1716	889
Harirampur	Dhulsunra	Abidhara	767	1433	1263
Harirampur	Dhulsunra	Abidhara	766	699	371
Harirampur	Dhulsunra	Abidhara	765	646	41
Harirampur	Dhulsunra	Abidhara	763	904	562
Harirampur	Dhulsunra	Abidhara	762	910	910
Harirampur	Dhulsunra	Abidhara	761	1532	1463
Harirampur	Dhulsunra	Abidhara	760	531	531
Harirampur	Dhulsunra	Abidhara	759	506	506
Harirampur	Dhulsunra	Abidhara	758	884	627
Harirampur	Dhulsunra	Abidhara	757	670	369
Harirampur	Dhulsunra	Abidhara	756	1396	53
Harirampur	Dhulsunra	Abidhara	746	1431	272
Harirampur	Dhulsunra	Abidhara	745	1328	1023
Harirampur	Dhulsunra	Abidhara	744	1312	1169
Harirampur	Dhulsunra	Abidhara	743	1514	77
Harirampur	Dhulsunra	Abidhara	741	1430	370
Harirampur	Dhulsunra	Abidhara	740	1089	498
Harirampur	Dhulsunra	Abidhara	726	1343	204
Harirampur	Dhulsunra	Abidhara	725	438	421
Harirampur	Dhulsunra	Abidhara	724	688	632
Harirampur	Dhulsunra	Abidhara	723	780	581
Harirampur	Dhulsunra	Abidhara	722	544	544
Harirampur	Dhulsunra	Abidhara	721	1149	1149
Harirampur	Dhulsunra	Abidhara	720	302	302
Harirampur	Dhulsunra	Abidhara	719	331	114
Harirampur	Dhulsunra	Abidhara	718	1008	378
Harirampur	Boyra	Boyra	99999	1632	686
Harirampur	Boyra	Boyra	8136	1817	97
Harirampur	Boyra	Boyra	6759	1112	47
Harirampur	Boyra	Boyra	6755	245	245
Harirampur	Boyra	Boyra	6753	615	34
Harirampur	Boyra	Boyra	6752	657	257
Harirampur	Boyra	Boyra	6751	1483	1262
Harirampur	Boyra	Boyra	6750	536	536
Harirampur	Boyra	Boyra	6749	591	591
Harirampur	Boyra	Boyra	6748	570	570
Harirampur	Boyra	Boyra	6747	500	474
Harirampur	Boyra	Boyra	6746	489	345
Harirampur	Boyra	Boyra	6744	347	347
Harirampur	Boyra	Boyra	6743	125	125
Harirampur	Boyra	Boyra	6742	347	315

Upazila name	Union Name	Mouza name	Plot No	Full Plot_Area m²	Affected Area m²
Harirampur	Boyra	Boyra	6741	1128	14
Harirampur	Boyra	Boyra	6740	2659	440
Harirampur	Boyra	Boyra	6739	1168	551
Harirampur	Boyra	Boyra	6735	2092	33
Harirampur	Boyra	Boyra	6732	955	448
Harirampur	Boyra	Boyra	6731	1145	1145
Harirampur	Boyra	Boyra	6730	1169	981
Harirampur	Boyra	Boyra	6729	1156	383
Harirampur	Boyra	Boyra	6728	3056	2828
Harirampur	Boyra	Boyra	6727	1090	374
Harirampur	Boyra	Boyra	6724	2957	980
Harirampur	Boyra	Boyra	6674	748	204
Harirampur	Boyra	Boyra	6615	2087	295
Harirampur	Boyra	Boyra	6614	1189	1
Harirampur	Boyra	Boyra	6613	867	399
Harirampur	Boyra	Boyra	6612	357	357
Harirampur	Boyra	Boyra	6611	343	139
Harirampur	Boyra	Boyra	6610	411	257
Harirampur	Boyra	Boyra	6609	436	436
Harirampur	Boyra	Boyra	6608	479	479
Harirampur	Boyra	Boyra	6607	409	386
Harirampur	Boyra	Boyra	6606	875	874
Harirampur	Boyra	Boyra	6605	701	641
Harirampur	Boyra	Boyra	6604	1107	889
Harirampur	Boyra	Boyra	6603	1896	607
Harirampur	Boyra	Boyra	6602	2721	1002
Harirampur	Boyra	Boyra	6598	621	292
Harirampur	Boyra	Boyra	6595	1641	29
Harirampur	Boyra	Boyra	6571	3065	1121
Harirampur	Boyra	Boyra	6570	2602	952
Harirampur	Boyra	Boyra	6569	1146	522
Harirampur	Boyra	Boyra	6568	1457	848
Harirampur	Boyra	Boyra	6567	4644	4007
Harirampur	Boyra	Boyra	6566	5470	1152
Harirampur	Boyra	Boyra	6564	592	575
Harirampur	Boyra	Boyra	6563	520	520
Harirampur	Boyra	Boyra	6562	1173	1169
Harirampur	Boyra	Boyra	6561	321	321
Harirampur	Boyra	Boyra	6560	1211	869
Harirampur	Boyra	Boyra	6559	915	332
Harirampur	Boyra	Boyra	6558	1772	102
Harirampur	Boyra	Boyra	6514	2697	753
Harirampur	Boyra	Boyra	6506	4345	8
Harirampur	Boyra	Boyra	6504	888	297

Upazila name	Union Name	Mouza name	Plot No	Full Plot_Area m²	Affected Area m²
Harirampur	Boyra	Boyra	6503	1065	776
Harirampur	Boyra	Boyra	6502	668	668
Harirampur	Boyra	Boyra	6501	663	286
Harirampur	Boyra	Boyra	6500	2064	2020
Harirampur	Boyra	Boyra	6499	1288	818
Harirampur	Boyra	Boyra	6498	1213	632
Harirampur	Boyra	Boyra	6497	1199	99
Harirampur	Boyra	Boyra	6496	990	963
Harirampur	Boyra	Boyra	6495	726	726
Harirampur	Boyra	Boyra	6494	1502	212
Harirampur	Boyra	Boyra	6493	480	86
Harirampur	Boyra	Boyra	6492	1242	407
Harirampur	Boyra	Boyra	6491	1784	850
Harirampur	Boyra	Boyra	6490	652	178
Harirampur	Boyra	Boyra	6489	619	619
Harirampur	Boyra	Boyra	6488	1696	985
Harirampur	Boyra	Boyra	6485	5317	3064
Harirampur	Boyra	Boyra	6482	3737	1719
Harirampur	Boyra	Boyra	6481	3951	1388
Harirampur	Boyra	Boyra	6478	576	565
Harirampur	Boyra	Boyra	6475	806	21
Harirampur	Boyra	Boyra	6473	469	378
Harirampur	Boyra	Boyra	6462	891	50
Harirampur	Boyra	Boyra	6461	802	338
Harirampur	Boyra	Boyra	6460	861	679
Harirampur	Boyra	Boyra	6459	1665	1665
Harirampur	Boyra	Boyra	6458	1182	1126
Harirampur	Boyra	Boyra	6457	600	380
Harirampur	Boyra	Boyra	6456	546	220
Harirampur	Boyra	Boyra	6454	709	61
Harirampur	Boyra	Boyra	6453	329	201
Harirampur	Boyra	Boyra	6452	1341	1310
Harirampur	Boyra	Boyra	6451	2847	1565
Harirampur	Boyra	Boyra	6433	1141	146
Harirampur	Boyra	Boyra	4649	397	98
Harirampur	Boyra	Boyra	3752	1419	73
Harirampur	Boyra	Boyra	3751	1522	560
Harirampur	Boyra	Boyra	3750	1976	1926
Harirampur	Boyra	Boyra	3749	522	386
Harirampur	Boyra	Boyra	3748	450	450
Harirampur	Boyra	Boyra	3747	2033	1021
Harirampur	Boyra	Boyra	3746	1275	1275
Harirampur	Boyra	Boyra	3745	915	163

Upazila name	Union Name	Mouza name	Plot No	Full Plot_Area m²	Affected Area m²
Harirampur	Boyra	Boyra	3741	1422	717
Harirampur	Boyra	Boyra	3740	1533	18
Harirampur	Boyra	Boyra	3728	6193	750
Harirampur	Boyra	Boyra	3727	1240	473
Harirampur	Boyra	Boyra	3726	1650	1024
Harirampur	Boyra	Boyra	3725	992	761
Harirampur	Boyra	Boyra	3724	930	816
Harirampur	Boyra	Boyra	3723	1044	1013
Harirampur	Boyra	Boyra	3722	1026	867
Harirampur	Boyra	Boyra	3721	954	729
Harirampur	Boyra	Boyra	3720	1296	835
Harirampur	Boyra	Boyra	3718	616	524
Harirampur	Boyra	Boyra	3717	1293	466
Harirampur	Boyra	Boyra	3716	1560	268
Harirampur	Boyra	Boyra	3706	3545	218
Harirampur	Boyra	Boyra	3702	2471	586
Harirampur	Boyra	Boyra	3701	2962	1142
Harirampur	Boyra	Boyra	3682	1187	329
Harirampur	Boyra	Boyra	3681	3488	448
Harirampur	Boyra	Boyra	3680	3526	3385
Harirampur	Boyra	Boyra	3679	1188	956
Harirampur	Boyra	Boyra	3678	1276	1276
Harirampur	Boyra	Boyra	3677	1251	661
Harirampur	Boyra	Boyra	3676	2586	2561
Harirampur	Boyra	Boyra	3675	911	780
Harirampur	Boyra	Boyra	3674	786	786
Harirampur	Boyra	Boyra	3673	676	636
Harirampur	Boyra	Boyra	3672	769	146
Harirampur	Boyra	Boyra	3671	3151	37
Harirampur	Boyra	Boyra	3633	6339	2067
Harirampur	Boyra	Boyra	3621	4505	275
Harirampur	Boyra	Boyra	3620	1603	677
Harirampur	Boyra	Boyra	3619	697	697
Harirampur	Boyra	Boyra	3618	680	246
Harirampur	Boyra	Boyra	3617	2129	1611
Harirampur	Boyra	Boyra	3616	2504	2201
Harirampur	Boyra	Boyra	3615	841	841
Harirampur	Boyra	Boyra	3614	749	176
Harirampur	Boyra	Boyra	3610	970	418
Harirampur	Boyra	Boyra	3609	640	513
Harirampur	Boyra	Boyra	3605	3593	1937
Harirampur	Boyra	Boyra	3594	1231	60
Harirampur	Boyra	Boyra	3584	1240	775
Harirampur	Boyra	Boyra	3583	1552	1176

Upazila name	Union Name	Mouza name	Plot No	Full Plot_Area m²	Affected Area m²
Harirampur	Boyra	Boyra	3582	844	652
Harirampur	Boyra	Boyra	3581	728	547
Harirampur	Boyra	Boyra	3578	5497	2212
Harirampur	Boyra	Boyra	3576	1364	570
Harirampur	Boyra	Boyra	3575	702	531
Harirampur	Boyra	Boyra	3569	700	96
Harirampur	Boyra	Boyra	3568	1143	838
Harirampur	Boyra	Boyra	3567	966	566
Harirampur	Boyra	Boyra	3566	1203	610
Harirampur	Boyra	Boyra	3565	2512	1331
Harirampur	Boyra	Boyra	3564	1815	827
Harirampur	Boyra	Boyra	3563	641	226
Harirampur	Boyra	Boyra	3562	1254	168
Harirampur	Boyra	Boyra	2123	963	340
Harirampur	Boyra	Boyra	2122	273	140
Harirampur	Boyra	Boyra	2083	411	17
Harirampur	Boyra	Boyra	2081	307	147
Harirampur	Boyra	Boyra	2080	724	698
Harirampur	Boyra	Boyra	2079	291	291
Harirampur	Boyra	Boyra	2078	920	748
Harirampur	Boyra	Boyra	2077	839	293
Harirampur	Boyra	Boyra	2061	2336	682
Harirampur	Boyra	Boyra	2061	2336	0
Harirampur	Boyra	Boyra	2060	1075	1075
Harirampur	Boyra	Boyra	2059	456	414
Harirampur	Boyra	Boyra	1934	373	59
Harirampur	Boyra	Boyra	1933	353	353
Harirampur	Boyra	Boyra	1932	345	265
Harirampur	Boyra	Boyra	1931	2528	1881
Harirampur	Boyra	Boyra	1930	331	308
Harirampur	Boyra	Boyra	1929	269	164
Harirampur	Boyra	Boyra	1928	806	740
Harirampur	Boyra	Boyra	1928	440	438
Harirampur	Boyra	Boyra	1927	550	550
Harirampur	Boyra	Boyra	1926	649	551
Harirampur	Boyra	Boyra	1925	638	638
Harirampur	Boyra	Boyra	1923	347	121
Harirampur	Boyra	Boyra	1922	734	128
Harirampur	Boyra	Boyra	1920	1083	202
Harirampur	Boyra	Boyra	1919	2303	407
Harirampur	Boyra	Boyra	1918	896	567
Harirampur	Boyra	Boyra	1917	1065	778
Harirampur	Boyra	Boyra	1916	978	973

Upazila name	Union Name	Mouza name	Plot No	Full Plot_Area m²	Affected Area m²
Harirampur	Boyra	Boyra	1915	949	889
Harirampur	Boyra	Boyra	1914	2805	2006
Harirampur	Boyra	Boyra	1913	3534	42
Harirampur	Boyra	Boyra	1867	1172	34
Harirampur	Boyra	Boyra	1608	314	221
Harirampur	Boyra	Boyra	1607	540	84
Harirampur	Boyra	Boyra	1606	687	8
Harirampur	Boyra	Boyra	1597	1149	1149
Harirampur	Boyra	Boyra	1596	1410	770
Harirampur	Boyra	Boyra	1584	4071	230
Harirampur	Boyra	Boyra	1583	358	358
Harirampur	Boyra	Boyra	1582	328	294
Harirampur	Boyra	Boyra	1581	554	20
Harirampur	Boyra	Boyra	1579	2157	529
Harirampur	Boyra	Boyra	1578	1892	1515
Harirampur	Boyra	Boyra	1577	2096	2063
Harirampur	Boyra	Boyra	1576	536	536
Harirampur	Boyra	Boyra	1575	1007	498
Harirampur	Boyra	Boyra	1574	372	372
Harirampur	Boyra	Boyra	1573	1855	1832
Harirampur	Boyra	Boyra	1572	628	628
Harirampur	Boyra	Boyra	1571	871	159
Harirampur	Boyra	Boyra	1563	4881	1414
Harirampur	Boyra	Boyra	1545	469	58
Harirampur	Boyra	Boyra	1544	222	205
Harirampur	Boyra	Boyra	1543	507	105
Harirampur	Boyra	Boyra	1542	394	384
Harirampur	Boyra	Boyra	1541	522	522
Harirampur	Boyra	Boyra	1540	1857	1855
Harirampur	Boyra	Boyra	1539	1919	1592
Harirampur	Boyra	Boyra	1538	1280	879
Harirampur	Boyra	Boyra	1537	2780	618
Harirampur	Boyra	Boyra	1534	1109	684
Harirampur	Boyra	Boyra	1533	961	758
Harirampur	Boyra	Boyra	1532	357	357
Harirampur	Boyra	Boyra	1531	404	404
Harirampur	Boyra	Boyra	1530	369	308
Harirampur	Boyra	Boyra	1529	127	6
Harirampur	Boyra	Boyra	1520	172	35
Harirampur	Boyra	Boyra	1519	310	161
Harirampur	Boyra	Boyra	1518	1475	482
Harirampur	Boyra	Boyra	1517	1578	1312
Harirampur	Boyra	Boyra	1517	1578	0
Harirampur	Boyra	Boyra	1516	1724	1530

Upazila name	Union Name	Mouza name	Plot No	Full Plot_Area m²	Affected Area m²
Harirampur	Boyra	Boyra	1515	2564	2540
Harirampur	Boyra	Boyra	1514	1905	948
Harirampur	Boyra	Boyra	1512	4688	482
Harirampur	Boyra	Boyra	1498	1061	320
Harirampur	Boyra	Boyra	1495	1481	506
Harirampur	Boyra	Boyra	1494	1282	219
Harirampur	Boyra	Boyra	1493	1255	19
Harirampur	Boyra	Boyra	1086	2067	634
Harirampur	Boyra	Boyra	1085	1018	672
Harirampur	Boyra	Boyra	1077	1473	910
Harirampur	Boyra	Boyra	1076	1678	1249
Harirampur	Boyra	Boyra	1076	682	624
Harirampur	Boyra	Boyra	1075	869	799
Harirampur	Boyra	Boyra	1074	1618	795
Harirampur	Boyra	Boyra	1072	1971	1258
Harirampur	Boyra	Boyra	1069	554	554
Harirampur	Boyra	Boyra	1067	686	113
Harirampur	Boyra	Boyra	1066	726	726
Harirampur	Boyra	Boyra	1065	630	630
Harirampur	Boyra	Boyra	1064	450	450
Harirampur	Boyra	Boyra	1063	399	283
Harirampur	Boyra	Boyra	1063	535	535
Harirampur	Boyra	Boyra	1061	841	568
Harirampur	Boyra	Boyra	1060	4003	137
Harirampur	Boyra	Boyra	1055	1459	411
Harirampur	Boyra	Boyra	1054	446	446
Harirampur	Boyra	Boyra	1053	468	468
Harirampur	Boyra	Boyra	1052	1436	1436
Harirampur	Boyra	Boyra	1051	1446	1412
Harirampur	Boyra	Boyra	1050	10906	2182
Harirampur	Boyra	Boyra	1049	628	628
Harirampur	Boyra	Boyra	1048	660	419
Harirampur	Boyra	Boyra	1047	735	1
Harirampur	Boyra	Boyra	1044	2130	643
Harirampur	Boyra	Boyra	1042	571	32
Harirampur	Boyra	Boyra	1041	1281	1264
Harirampur	Boyra	Boyra	1040	632	579
Harirampur	Boyra	Boyra	1038	2635	216
Harirampur	Boyra	Boyra	1026	1500	429
Harirampur	Boyra	Boyra	1025	1476	641
Harirampur	Boyra	Boyra	1024	1243	1243
Harirampur	Boyra	Boyra	1023	1898	301
Harirampur	Boyra	Boyra	1022	1449	1449

Upazila name	Union Name	Mouza name	Plot No	Full Plot_Area m²	Affected Area m²
Harirampur	Boyra	Boyra	1022	1306	353
Harirampur	Boyra	Boyra	1020	1025	580
Harirampur	Boyra	Boyra	1019	1368	1368
Harirampur	Boyra	Boyra	1018	2044	753
Harirampur	Boyra	Boyra	65	1201	681
Harirampur	Nayabari	Dakshin Bahra	1498	833	810
Harirampur	Nayabari	Dakshin Bahra	1091	12232	4821
Harirampur	Nayabari	Dakshin Bahra	649	636	117
Harirampur	Nayabari	Dakshin Bahra	439	544	544
Harirampur	Harukandi	Garibpur	1609	1552	686
Harirampur	Harukandi	Garibpur	1609	1552	0
Harirampur	Harukandi	Garibpur	1607	1192	4
Harirampur	Harukandi	Garibpur	1277	279	6
Harirampur	Harukandi	Garibpur	1276	770	69
Harirampur	Harukandi	Garibpur	1274	2050	267
Harirampur	Harukandi	Garibpur	1273	2219	437
Harirampur	Harukandi	Garibpur	1250	2584	1801
Harirampur	Harukandi	Garibpur	1249	1068	1068
Harirampur	Harukandi	Garibpur	1248	2527	1180
Harirampur	Harukandi	Garibpur	1246	753	529
Harirampur	Harukandi	Garibpur	1245	672	672
Harirampur	Harukandi	Garibpur	1244	1173	1133
Harirampur	Harukandi	Garibpur	1243	1322	103
Harirampur	Harukandi	Garibpur	1239	1311	789
Harirampur	Harukandi	Garibpur	1238	1061	1061
Harirampur	Harukandi	Garibpur	1237	968	968
Harirampur	Harukandi	Garibpur	1236	5083	4382
Harirampur	Harukandi	Garibpur	1235	2679	3
Harirampur	Harukandi	Garibpur	1226	718	366
Harirampur	Harukandi	Garibpur	1225	710	198
Harirampur	Harukandi	Garibpur	1224	607	31
Harirampur	Harukandi	Garibpur	1223	843	832
Harirampur	Harukandi	Garibpur	1222	947	947
Harirampur	Harukandi	Garibpur	1221	926	926
Harirampur	Harukandi	Garibpur	1220	813	813
Harirampur	Harukandi	Garibpur	1219	1208	281
Harirampur	Harukandi	Garibpur	1218	1061	325
Harirampur	Harukandi	Garibpur	1217	1157	376
Harirampur	Harukandi	Garibpur	1216	1089	372
Harirampur	Harukandi	Garibpur	1215	1057	437
Harirampur	Harukandi	Garibpur	1214	655	0
Harirampur	Harukandi	Garibpur	1213	630	25
Harirampur	Harukandi	Garibpur	1212	1128	149
Harirampur	Harukandi	Garibpur	1211	1045	1033

Upazila name	Union Name	Mouza name	Plot No	Full Plot_Area m²	Affected Area m²
Harirampur	Harukandi	Garibpur	1210	982	982
Harirampur	Harukandi	Garibpur	1209	973	973
Harirampur	Harukandi	Garibpur	1208	1122	231
Harirampur	Harukandi	Garibpur	1207	988	147
Harirampur	Harukandi	Garibpur	1206	1352	1335
Harirampur	Harukandi	Garibpur	1205	1401	1245
Harirampur	Harukandi	Garibpur	1204	1404	649
Harirampur	Harukandi	Garibpur	1203	3608	2583
Harirampur	Harukandi	Garibpur	1202	2041	1459
Harirampur	Harukandi	Garibpur	1201	1960	1180
Harirampur	Harukandi	Garibpur	783	6715	2098
Harirampur	Harukandi	Garibpur	782	3715	167
Harirampur	Harukandi	Harukandi	99999	68	47
Harirampur	Harukandi	Harukandi	99999	1272	772
Harirampur	Harukandi	Harukandi	99999	932	580
Harirampur	Harukandi	Harukandi	9999	270	270
Harirampur	Harukandi	Harukandi	5551	1207	1040
Harirampur	Harukandi	Harukandi	5550	1525	1499
Harirampur	Harukandi	Harukandi	5549	769	702
Harirampur	Harukandi	Harukandi	5548	323	323
Harirampur	Harukandi	Harukandi	5547	130	130
Harirampur	Harukandi	Harukandi	5546	1496	1195
Harirampur	Harukandi	Harukandi	5545	2202	1180
Harirampur	Harukandi	Harukandi	5544	870	390
Harirampur	Harukandi	Harukandi	5541	3487	1052
Harirampur	Harukandi	Harukandi	5540	851	851
Harirampur	Harukandi	Harukandi	5539	1202	1202
Harirampur	Harukandi	Harukandi	5538	2202	1036
Harirampur	Harukandi	Harukandi	5537	1538	1006
Harirampur	Harukandi	Harukandi	5536	2289	364
Harirampur	Harukandi	Harukandi	5535	2850	40
Harirampur	Harukandi	Harukandi	5528	2028	295
Harirampur	Harukandi	Harukandi	5527	1621	939
Harirampur	Harukandi	Harukandi	5526	342	342
Harirampur	Harukandi	Harukandi	5525	362	359
Harirampur	Harukandi	Harukandi	5525	362	4
Harirampur	Harukandi	Harukandi	5524	2440	2365
Harirampur	Harukandi	Harukandi	5523	820	803
Harirampur	Harukandi	Harukandi	5523	820	4
Harirampur	Harukandi	Harukandi	5523	820	0
Harirampur	Harukandi	Harukandi	5523	820	4
Harirampur	Harukandi	Harukandi	5522	1608	459
Harirampur	Harukandi	Harukandi	5522	1608	4

Upazila name	Union Name	Mouza name	Plot No	Full Plot_Area m²	Affected Area m²
Harirampur	Harukandi	Harukandi	5521	2648	2594
Harirampur	Harukandi	Harukandi	5521	2648	0
Harirampur	Harukandi	Harukandi	5520	2519	2227
Harirampur	Harukandi	Harukandi	5519	2202	1270
Harirampur	Harukandi	Harukandi	5519	2202	0
Harirampur	Harukandi	Harukandi	5435	1827	49
Harirampur	Harukandi	Harukandi	5435	2819	490
Harirampur	Harukandi	Harukandi	5434	3271	752
Harirampur	Harukandi	Harukandi	5433	1232	800
Harirampur	Harukandi	Harukandi	5432	923	922
Harirampur	Harukandi	Harukandi	5431	433	92
Harirampur	Harukandi	Harukandi	5425	1811	37
Harirampur	Harukandi	Harukandi	5422	3354	1066
Harirampur	Harukandi	Harukandi	5421	702	411
Harirampur	Harukandi	Harukandi	5420	610	168
Harirampur	Harukandi	Harukandi	5419	1131	1129
Harirampur	Harukandi	Harukandi	5418	1201	1155
Harirampur	Harukandi	Harukandi	5417	1914	1829
Harirampur	Harukandi	Harukandi	5416	2143	1884
Harirampur	Harukandi	Harukandi	5415	964	535
Harirampur	Harukandi	Harukandi	5414	999	176
Harirampur	Harukandi	Harukandi	5412	930	927
Harirampur	Harukandi	Harukandi	5411	889	889
Harirampur	Harukandi	Harukandi	5410	1854	1854
Harirampur	Harukandi	Harukandi	5409	749	453
Harirampur	Harukandi	Harukandi	5408	782	782
Harirampur	Harukandi	Harukandi	5407	1508	231
Harirampur	Harukandi	Harukandi	5368	642	522
Harirampur	Harukandi	Harukandi	5306	6601	333
Harirampur	Harukandi	Harukandi	5293	1922	94
Harirampur	Harukandi	Harukandi	5290	2033	335
Harirampur	Harukandi	Harukandi	5289	1822	484
Harirampur	Harukandi	Harukandi	5288	1922	713
Harirampur	Harukandi	Harukandi	5287	1862	958
Harirampur	Harukandi	Harukandi	5286	3801	2725
Harirampur	Harukandi	Harukandi	5285	3600	2790
Harirampur	Harukandi	Harukandi	5284	4929	754
Harirampur	Harukandi	Harukandi	5283	2769	1724
Harirampur	Harukandi	Harukandi	5282	3129	947
Harirampur	Harukandi	Harukandi	5281	1318	1191
Harirampur	Harukandi	Harukandi	5280	1371	880
Harirampur	Harukandi	Harukandi	5279	2558	1497
Harirampur	Harukandi	Harukandi	5278	4584	1415
Harirampur	Harukandi	Harukandi	5265	1404	592

Upazila name	Union Name	Mouza name	Plot No	Full Plot_Area m²	Affected Area m²
Harirampur	Harukandi	Harukandi	5264	1250	1236
Harirampur	Harukandi	Harukandi	5263	675	674
Harirampur	Harukandi	Harukandi	5262	609	609
Harirampur	Harukandi	Harukandi	5261	370	121
Harirampur	Harukandi	Harukandi	5258	664	272
Harirampur	Harukandi	Harukandi	5257	619	389
Harirampur	Harukandi	Harukandi	2375	1618	708
Harirampur	Harukandi	Harukandi	2374	1867	1279
Harirampur	Harukandi	Harukandi	2357	1585	118
Harirampur	Harukandi	Harukandi	2353	1342	1104
Harirampur	Harukandi	Harukandi	2336	302	137
Harirampur	Harukandi	Harukandi	2335	690	24
Harirampur	Harukandi	Harukandi	2334	224	115
Harirampur	Harukandi	Harukandi	2333	245	139
Harirampur	Harukandi	Harukandi	2332	148	148
Harirampur	Harukandi	Harukandi	2331	164	164
Harirampur	Harukandi	Harukandi	2330	581	454
Harirampur	Harukandi	Harukandi	2328	827	444
Harirampur	Harukandi	Harukandi	2327	1162	784
Harirampur	Harukandi	Harukandi	2326	443	432
Harirampur	Harukandi	Harukandi	2325	983	865
Harirampur	Harukandi	Harukandi	2324	1957	1427
Harirampur	Harukandi	Harukandi	2323	2990	2839
Harirampur	Harukandi	Harukandi	2321	4489	106
Harirampur	Harukandi	Harukandi	2321	2013	1243
Harirampur	Harukandi	Harukandi	2316	2907	143
Harirampur	Harukandi	Harukandi	2315	2676	1738
Harirampur	Harukandi	Harukandi	2315	2676	0
Harirampur	Harukandi	Harukandi	2275	965	769
Harirampur	Harukandi	Harukandi	2274	306	305
Harirampur	Harukandi	Harukandi	2273	2529	78
Harirampur	Harukandi	Harukandi	2272	1280	749
Harirampur	Harukandi	Harukandi	2271	982	958
Harirampur	Harukandi	Harukandi	2270	888	881
Harirampur	Harukandi	Harukandi	2269	308	202
Harirampur	Harukandi	Harukandi	2268	1111	4
Harirampur	Harukandi	Harukandi	2266	2490	782
Harirampur	Harukandi	Harukandi	2264	2095	892
Harirampur	Harukandi	Harukandi	2263	1607	820
Harirampur	Harukandi	Harukandi	2262	1061	707
Harirampur	Harukandi	Harukandi	2262	1554	399
Harirampur	Harukandi	Harukandi	2261	1245	1236
Harirampur	Harukandi	Harukandi	2260	1080	355

Upazila name	Union Name	Mouza name	Plot No	Full Plot_Area m²	Affected Area m²
Harirampur	Harukandi	Harukandi	2246	2194	257
Harirampur	Harukandi	Harukandi	2246	483	219
Harirampur	Harukandi	Harukandi	2245	1892	1701
Harirampur	Harukandi	Harukandi	2245	654	125
Harirampur	Harukandi	Harukandi	2241	1761	1611
Harirampur	Harukandi	Harukandi	2241	1761	3
Harirampur	Harukandi	Harukandi	2241	1761	0
Harirampur	Harukandi	Harukandi	2240	1865	1850
Harirampur	Harukandi	Harukandi	2240	1865	3
Harirampur	Harukandi	Harukandi	2239	4642	783
Harirampur	Harukandi	Harukandi	2238	2055	69
Harirampur	Harukandi	Harukandi	2237	2208	8
Harirampur	Harukandi	Harukandi	2215	1090	81
Harirampur	Harukandi	Harukandi	2214	965	343
Harirampur	Harukandi	Harukandi	2213	923	643
Harirampur	Harukandi	Harukandi	1879	1527	149
Harirampur	Harukandi	Harukandi	1730	2306	741
Harirampur	Harukandi	Harukandi	1729	1283	367
Harirampur	Harukandi	Harukandi	1729	477	283
Harirampur	Harukandi	Harukandi	1728	3041	2601
Harirampur	Harukandi	Harukandi	1727	1077	1071
Harirampur	Harukandi	Harukandi	1726	709	704
Harirampur	Harukandi	Harukandi	1725	179	38
Harirampur	Harukandi	Harukandi	1724	1521	763
Harirampur	Harukandi	Harukandi	1720	558	118
Harirampur	Harukandi	Harukandi	1719	711	711
Harirampur	Harukandi	Harukandi	1718	954	954
Harirampur	Harukandi	Harukandi	1718	581	570
Harirampur	Harukandi	Harukandi	1717	1833	1194
Harirampur	Harukandi	Harukandi	1716	1605	438
Harirampur	Harukandi	Harukandi	1715	2189	27
Harirampur	Harukandi	Harukandi	1577	498	228
Harirampur	Harukandi	Harukandi	1575	2446	1341
Harirampur	Harukandi	Harukandi	1561	2715	1426
Harirampur	Harukandi	Harukandi	1560	2027	1695
Harirampur	Harukandi	Harukandi	1559	2111	1793
Harirampur	Harukandi	Harukandi	1558	697	697
Harirampur	Harukandi	Harukandi	1556	2393	1129
Harirampur	Harukandi	Harukandi	1555	2737	22
Harirampur	Harukandi	Harukandi	1550	1253	412
Harirampur	Harukandi	Harukandi	1549	1166	943
Harirampur	Harukandi	Harukandi	1548	1851	1851
Harirampur	Harukandi	Harukandi	1547	1693	732
Harirampur	Harukandi	Harukandi	1546	1836	437

Upazila name	Union Name	Mouza name	Plot No	Full Plot_Area m²	Affected Area m²
Harirampur	Harukandi	Harukandi	1545	3022	461
Harirampur	Harukandi	Harukandi	1533	984	140
Harirampur	Harukandi	Harukandi	1531	2994	2805
Harirampur	Harukandi	Harukandi	1530	3027	2280
Harirampur	Harukandi	Harukandi	1529	2667	851
Harirampur	Harukandi	Harukandi	1527	852	852
Harirampur	Harukandi	Harukandi	1526	3928	2590
Harirampur	Harukandi	Harukandi	1525	4450	1977
Harirampur	Harukandi	Harukandi	1523	3594	361
Harirampur	Harukandi	Harukandi	1522	1317	1063
Harirampur	Harukandi	Harukandi	1521	659	650
Harirampur	Harukandi	Harukandi	1520	642	642
Harirampur	Harukandi	Harukandi	1517	534	489
Harirampur	Harukandi	Harukandi	1516	510	432
Harirampur	Harukandi	Harukandi	1515	929	905
Harirampur	Harukandi	Harukandi	1514	1267	648
Harirampur	Harukandi	Harukandi	1513	1300	103
Harirampur	Harukandi	Harukandi	1512	2506	95
Harirampur	Harukandi	Harukandi	1511	2267	882
Harirampur	Harukandi	Harukandi	1510	783	520
Harirampur	Harukandi	Harukandi	1494	592	245
Harirampur	Harukandi	Harukandi	1493	613	49
Harirampur	Harukandi	Harukandi	1489	1746	619
Harirampur	Harukandi	Harukandi	1487	474	87
Harirampur	Harukandi	Harukandi	1486	593	489
Harirampur	Harukandi	Harukandi	1486	1040	1018
Harirampur	Harukandi	Harukandi	1485	636	74
Harirampur	Harukandi	Harukandi	1484	901	238
Harirampur	Harukandi	Harukandi	1483	542	520
Harirampur	Harukandi	Harukandi	1482	635	635
Harirampur	Harukandi	Harukandi	1482	2575	2480
Harirampur	Harukandi	Harukandi	1481	555	555
Harirampur	Harukandi	Harukandi	1480	885	366
Harirampur	Harukandi	Harukandi	1479	676	637
Harirampur	Harukandi	Harukandi	1478	754	754
Harirampur	Harukandi	Harukandi	1477	452	452
Harirampur	Harukandi	Harukandi	1470	292	163
Harirampur	Harukandi	Harukandi	1467	1361	28
Harirampur	Harukandi	Harukandi	1466	716	98
Harirampur	Harukandi	Harukandi	1465	812	170
Harirampur	Harukandi	Harukandi	1464	1097	999
Harirampur	Harukandi	Harukandi	1463	1032	1032
Harirampur	Harukandi	Harukandi	1462	365	365

Upazila name	Union Name	Mouza name	Plot No	Full Plot_Area m²	Affected Area m²
Harirampur	Harukandi	Harukandi	1461	496	496
Harirampur	Harukandi	Harukandi	1460	644	617
Harirampur	Harukandi	Harukandi	1459	1079	757
Harirampur	Harukandi	Harukandi	1457	1749	55
Harirampur	Harukandi	Harukandi	1303	1733	21
Harirampur	Harukandi	Harukandi	1302	1299	346
Harirampur	Harukandi	Harukandi	1244	1407	828
Harirampur	Harukandi	Harukandi	481	1113	12
Harirampur	Harukandi	Harukandi	480	3318	1831
Harirampur	Harukandi	Harukandi	479	5122	767
Harirampur	Harukandi	Harukandi	478	1346	1331
Harirampur	Harukandi	Harukandi	477	290	290
Harirampur	Harukandi	Harukandi	476	2048	1952
Harirampur	Harukandi	Harukandi	475	654	331
Harirampur	Harukandi	Harukandi	474	803	202
Harirampur	Harukandi	Harukandi	473	923	923
Harirampur	Harukandi	Harukandi	472	591	591
Harirampur	Harukandi	Harukandi	471	216	216
Harirampur	Harukandi	Harukandi	470	324	320
Harirampur	Harukandi	Harukandi	469	675	446
Harirampur	Harukandi	Harukandi	468	975	69
Harirampur	Dhulsunra	Mohonpur	189	525	170
Harirampur	Dhulsunra	Mohonpur	188	625	625
Harirampur	Dhulsunra	Mohonpur	187	941	480
Harirampur	Dhulsunra	Mohonpur	185	624	173
Harirampur	Dhulsunra	Mohonpur	184	1090	180
Harirampur	Dhulsunra	Mohonpur	182	803	167
Harirampur	Dhulsunra	Mohonpur	181	477	22
Harirampur	Harukandi	Nababnagar	1192	1595	906
Harirampur	Harukandi	Nababnagar	1191	821	821
Harirampur	Harukandi	Nababnagar	1190	789	789
Harirampur	Harukandi	Nababnagar	1189	691	691
Harirampur	Harukandi	Nababnagar	1187	739	579
Harirampur	Harukandi	Nababnagar	1186	779	568
Harirampur	Harukandi	Nababnagar	1185	751	491
Harirampur	Harukandi	Nababnagar	1184	818	818
Harirampur	Harukandi	Nababnagar	1183	889	889
Harirampur	Harukandi	Nababnagar	1182	838	838
Harirampur	Harukandi	Nababnagar	1120	1403	224
Harirampur	Harukandi	Nababnagar	1119	1991	450
Harirampur	Harukandi	Nababnagar	878	876	523
Harirampur	Harukandi	Nababnagar	877	278	278
Harirampur	Harukandi	Nababnagar	876	562	113
Harirampur	Harukandi	Nababnagar	875	2606	7

Upazila name	Union Name	Mouza name	Plot No	Full Plot_Area m²	Affected Area m²
Harirampur	Harukandi	Nababnagar	874	911	689
Harirampur	Harukandi	Nababnagar	873	1015	60
Harirampur	Harukandi	Nababnagar	872	2888	1916
Harirampur	Harukandi	Nababnagar	871	2901	2627
Harirampur	Harukandi	Nababnagar	870	3587	2696
Harirampur	Harukandi	Nababnagar	869	1566	107
Harirampur	Harukandi	Nababnagar	861	2292	622
Harirampur	Harukandi	Nababnagar	860	951	552
Harirampur	Harukandi	Nababnagar	859	1149	994
Harirampur	Harukandi	Nababnagar	843	117	41
Harirampur	Harukandi	Nababnagar	842	2270	625
Harirampur	Harukandi	Nababnagar	841	563	227
Harirampur	Harukandi	Nababnagar	840	2347	1972
Harirampur	Harukandi	Nababnagar	839	1562	1562
Harirampur	Harukandi	Nababnagar	838	1362	1362
Harirampur	Harukandi	Nababnagar	837	943	83
Harirampur	Harukandi	Nababnagar	836	2188	671
Harirampur	Harukandi	Nababnagar	836	778	105
Harirampur	Harukandi	Nababnagar	835	1699	318
Harirampur	Harukandi	Nababnagar	834	2726	2244
Harirampur	Harukandi	Nababnagar	831	553	553
Harirampur	Harukandi	Nababnagar	830	922	555
Harirampur	Harukandi	Nababnagar	826	1617	562
Harirampur	Harukandi	Nababnagar	825	1329	1329
Harirampur	Harukandi	Nababnagar	824	1220	1220
Harirampur	Harukandi	Nababnagar	823	1774	1774
Harirampur	Harukandi	Nababnagar	822	665	483
Harirampur	Harukandi	Nababnagar	822	611	419
Harirampur	Harukandi	Nababnagar	821	4761	3618
Harirampur	Harukandi	Nababnagar	820	1580	1580
Harirampur	Harukandi	Nababnagar	515	389936	16672
Harirampur	Harukandi	Nababnagar	442	605	451
Harirampur	Harukandi	Nababnagar	441	292	178
Harirampur	Harukandi	Nababnagar	440	833	527
Harirampur	Harukandi	Nababnagar	438	1079	724
Harirampur	Harukandi	Nababnagar	188	759	366
Harirampur	Dhulsunra	Nilgram	2320	359	359
Harirampur	Dhulsunra	Nilgram	2319	1707	1017
Harirampur	Dhulsunra	Nilgram	2318	419	43
Harirampur	Dhulsunra	Nilgram	2316	944	497
Harirampur	Dhulsunra	Nilgram	2307	1366	29
Harirampur	Dhulsunra	Nilgram	2306	1571	1320
Harirampur	Dhulsunra	Nilgram	2305	395	395

Upazila name	Union Name	Mouza name	Plot No	Full Plot_Area m²	Affected Area m²
Harirampur	Dhulsunra	Nilgram	2304	465	242
Harirampur	Dhulsunra	Nilgram	2303	1234	904
Harirampur	Dhulsunra	Nilgram	2302	385	384
Harirampur	Dhulsunra	Nilgram	2301	1323	1323
Harirampur	Dhulsunra	Nilgram	2300	1796	1746
Harirampur	Dhulsunra	Nilgram	2299	275	67
Harirampur	Dhulsunra	Nilgram	2298	566	305
Harirampur	Dhulsunra	Nilgram	2297	497	390
Harirampur	Dhulsunra	Nilgram	2295	460	352
Harirampur	Dhulsunra	Nilgram	2294	692	690
Harirampur	Dhulsunra	Nilgram	2293	2170	84
Harirampur	Dhulsunra	Nilgram	2258	5015	571
Harirampur	Dhulsunra	Nilgram	2251	584	12
Harirampur	Dhulsunra	Nilgram	2250	511	469
Harirampur	Dhulsunra	Nilgram	2249	528	528
Harirampur	Dhulsunra	Nilgram	2248	763	535
Harirampur	Dhulsunra	Nilgram	2247	1440	1188
Harirampur	Dhulsunra	Nilgram	2246	732	732
Harirampur	Dhulsunra	Nilgram	2245	474	474
Harirampur	Dhulsunra	Nilgram	2244	401	401
Harirampur	Dhulsunra	Nilgram	2243	959	959
Harirampur	Dhulsunra	Nilgram	2242	1014	1005
Harirampur	Dhulsunra	Nilgram	2241	800	783
Harirampur	Dhulsunra	Nilgram	2240	1051	157
Harirampur	Dhulsunra	Nilgram	2216	625	173
Harirampur	Dhulsunra	Nilgram	2215	2278	1982
Harirampur	Dhulsunra	Nilgram	2214	496	496
Harirampur	Dhulsunra	Nilgram	2213	1455	698
Harirampur	Dhulsunra	Nilgram	2209	3018	1427
Harirampur	Dhulsunra	Nilgram	2208	621	543
Harirampur	Dhulsunra	Nilgram	2207	1112	1107
Harirampur	Dhulsunra	Nilgram	2205	1184	201
Harirampur	Dhulsunra	Nilgram	2204	1051	738
Harirampur	Dhulsunra	Nilgram	2203	1405	830
Harirampur	Dhulsunra	Nilgram	2200	1086	374
Harirampur	Dhulsunra	Nilgram	2199	727	1
Harirampur	Dhulsunra	Nilgram	2197	2252	2036
Harirampur	Dhulsunra	Nilgram	2196	519	397
Harirampur	Dhulsunra	Nilgram	2195	749	247
Harirampur	Dhulsunra	Nilgram	2167	1565	255
Harirampur	Dhulsunra	Nilgram	2166	574	456
Harirampur	Dhulsunra	Nilgram	2164	3368	3106
Harirampur	Dhulsunra	Nilgram	2163	2260	1460
Harirampur	Dhulsunra	Nilgram	2159	2565	250

Upazila name	Union Name	Mouza name	Plot No	Full Plot_Area m²	Affected Area m²
Harirampur	Dhulsunra	Nilgram	2148	517	235
Harirampur	Dhulsunra	Nilgram	2147	534	534
Harirampur	Dhulsunra	Nilgram	2146	2760	567
Harirampur	Dhulsunra	Nilgram	2145	2352	2143
Harirampur	Dhulsunra	Nilgram	2144	238	238
Harirampur	Dhulsunra	Nilgram	2143	607	607
Harirampur	Dhulsunra	Nilgram	2142	388	388
Harirampur	Dhulsunra	Nilgram	2141	373	152
Harirampur	Dhulsunra	Nilgram	2117	1600	22
Harirampur	Dhulsunra	Nilgram	2073	579	272
Harirampur	Dhulsunra	Nilgram	2072	706	706
Harirampur	Dhulsunra	Nilgram	2071	1674	355
Harirampur	Dhulsunra	Nilgram	2069	1275	196
Harirampur	Dhulsunra	Nilgram	2068	995	364
Harirampur	Dhulsunra	Nilgram	2030	536	258
Harirampur	Dhulsunra	Nilgram	2029	570	9
Harirampur	Dhulsunra	Nilgram	2026	958	363
Harirampur	Dhulsunra	Nilgram	2025	1863	1672
Harirampur	Dhulsunra	Nilgram	2024	1308	427
Harirampur	Dhulsunra	Nilgram	2023	307	307
Harirampur	Dhulsunra	Nilgram	2022	557	556
Harirampur	Dhulsunra	Nilgram	2021	297	297
Harirampur	Dhulsunra	Nilgram	2020	363	363
Harirampur	Dhulsunra	Nilgram	2019	479	479
Harirampur	Dhulsunra	Nilgram	2018	388	388
Harirampur	Dhulsunra	Nilgram	2017	381	378
Harirampur	Dhulsunra	Nilgram	2016	790	335
Harirampur	Dhulsunra	Nilgram	2015	735	183
Harirampur	Dhulsunra	Nilgram	2014	1446	364
Harirampur	Dhulsunra	Nilgram	2013	1068	1068
Harirampur	Dhulsunra	Nilgram	2012	473	392
Harirampur	Dhulsunra	Nilgram	2011	484	484
Harirampur	Dhulsunra	Nilgram	2010	2460	2460
Harirampur	Dhulsunra	Nilgram	2009	1318	1221
Harirampur	Dhulsunra	Nilgram	2008	1513	386
Harirampur	Dhulsunra	Nilgram	1547	2314	557
Harirampur	Dhulsunra	Nilgram	1546	961	953
Harirampur	Dhulsunra	Nilgram	1545	281	281
Harirampur	Dhulsunra	Nilgram	1544	929	532
Harirampur	Dhulsunra	Nilgram	1542	916	55
Harirampur	Dhulsunra	Nilgram	1541	1895	1569
Harirampur	Dhulsunra	Nilgram	1540	1891	1815
Harirampur	Dhulsunra	Nilgram	1539	633	16

Upazila name	Union Name	Mouza name	Plot No	Full Plot_Area m²	Affected Area m²
Harirampur	Dhulsunra	Nilgram	1515	1948	30
Harirampur	Dhulsunra	Nilgram	1514	717	100
Harirampur	Dhulsunra	Nilgram	1513	643	165
Harirampur	Dhulsunra	Nilgram	1511	315	244
Harirampur	Dhulsunra	Nilgram	1510	537	301
Harirampur	Dhulsunra	Nilgram	1509	1327	1308
Harirampur	Dhulsunra	Nilgram	1508	681	681
Harirampur	Dhulsunra	Nilgram	1507	1053	688
Harirampur	Dhulsunra	Nilgram	1505	575	15
Harirampur	Dhulsunra	Nilgram	1504	1014	698
Harirampur	Dhulsunra	Nilgram	1503	990	334
Harirampur	Dhulsunra	Nilgram	1502	1490	1490
Harirampur	Dhulsunra	Nilgram	1501	1958	1779
Harirampur	Dhulsunra	Nilgram	1500	1058	351
Harirampur	Dhulsunra	Nilgram	1499	2270	427
Harirampur	Dhulsunra	Nilgram	1497	867	70
Harirampur	Dhulsunra	Nilgram	1495	411	6
Harirampur	Dhulsunra	Nilgram	1492	894	58
Harirampur	Dhulsunra	Nilgram	1491	257	103
Harirampur	Dhulsunra	Nilgram	1490	5331	4755
Harirampur	Dhulsunra	Nilgram	1489	587	262
Harirampur	Dhulsunra	Nilgram	1483	970	57
Harirampur	Dhulsunra	Nilgram	1482	743	664
Harirampur	Dhulsunra	Nilgram	1481	599	282
Harirampur	Dhulsunra	Nilgram	1481	847	210
Harirampur	Dhulsunra	Nilgram	1480	894	39
Harirampur	Dhulsunra	Nilgram	1479	1486	72
Harirampur	Dhulsunra	Nilgram	1478	849	755
Harirampur	Dhulsunra	Nilgram	1477	803	803
Harirampur	Dhulsunra	Nilgram	1476	1015	968
Harirampur	Dhulsunra	Nilgram	1475	1109	402
Harirampur	Dhulsunra	Nilgram	1474	1354	89
Harirampur	Dhulsunra	Piringi	1090	157	157
Harirampur	Dhulsunra	Piringi	1089	459	343
Harirampur	Dhulsunra	Piringi	1088	478	9
Harirampur	Dhulsunra	Piringi	922	636	17
Harirampur	Dhulsunra	Piringi	921	1277	459
Harirampur	Dhulsunra	Piringi	915	1414	111
Harirampur	Dhulsunra	Piringi	914	668	161
Harirampur	Dhulsunra	Piringi	913	862	365
Harirampur	Dhulsunra	Piringi	912	1626	1040
Harirampur	Dhulsunra	Piringi	911	544	544
Harirampur	Dhulsunra	Piringi	910	451	451
Harirampur	Dhulsunra	Piringi	909	441	185

Upazila name	Union Name	Mouza name	Plot No	Full Plot_Area m²	Affected Area m²
Harirampur	Dhulsunra	Piringi	907	519	216
Harirampur	Dhulsunra	Piringi	906	451	444
Harirampur	Dhulsunra	Piringi	905	1184	1184
Harirampur	Dhulsunra	Piringi	904	1190	1175
Harirampur	Dhulsunra	Piringi	903	1384	1030
Harirampur	Dhulsunra	Piringi	902	943	880
Harirampur	Dhulsunra	Piringi	901	867	17
Harirampur	Dhulsunra	Piringi	900	1597	487
Harirampur	Dhulsunra	Piringi	899	1408	196
Harirampur	Dhulsunra	Piringi	898	667	27
Harirampur	Dhulsunra	Piringi	864	1742	1026
Harirampur	Dhulsunra	Piringi	863	1542	1052
Harirampur	Dhulsunra	Piringi	859	463	32
Harirampur	Dhulsunra	Piringi	858	1017	933
Harirampur	Dhulsunra	Piringi	857	1718	1409
Harirampur	Dhulsunra	Piringi	856	4992	1143
Harirampur	Dhulsunra	Piringi	855	5793	5092
Harirampur	Dhulsunra	Piringi	855	5793	0
Harirampur	Dhulsunra	Piringi	853	395	239
Harirampur	Dhulsunra	Piringi	852	497	8
Harirampur	Dhulsunra	Piringi	840	773	5
Harirampur	Dhulsunra	Piringi	838	416	240
Harirampur	Dhulsunra	Piringi	837	953	755
Harirampur	Dhulsunra	Piringi	836	872	869
Harirampur	Dhulsunra	Piringi	836	872	2
Harirampur	Dhulsunra	Piringi	835	1423	1236
Harirampur	Dhulsunra	Piringi	835	1423	2
Harirampur	Dhulsunra	Piringi	835	1423	0
Harirampur	Dhulsunra	Piringi	835	1423	15
Harirampur	Dhulsunra	Piringi	833	571	517
Harirampur	Dhulsunra	Piringi	831	585	403
Harirampur	Dhulsunra	Piringi	830	623	12
Harirampur	Dhulsunra	Piringi	829	570	457
Harirampur	Dhulsunra	Piringi	828	284	284
Harirampur	Dhulsunra	Piringi	827	319	319
Harirampur	Dhulsunra	Piringi	826	603	603
Harirampur	Dhulsunra	Piringi	825	1460	1099
Harirampur	Dhulsunra	Piringi	825	1460	15
Harirampur	Dhulsunra	Piringi	823	126	72
Harirampur	Dhulsunra	Piringi	822	214	8
Harirampur	Dhulsunra	Piringi	821	164	127
Harirampur	Dhulsunra	Piringi	820	130	130
Harirampur	Dhulsunra	Piringi	819	739	739

Upazila name	Union Name	Mouza name	Plot No	Full Plot_Area m²	Affected Area m²
Harirampur	Dhulsunra	Piringi	818	660	660
Harirampur	Dhulsunra	Piringi	817	683	683
Harirampur	Dhulsunra	Piringi	816	492	487
Harirampur	Dhulsunra	Piringi	815	573	431
Harirampur	Dhulsunra	Piringi	814	636	636
Harirampur	Dhulsunra	Piringi	813	269	269
Harirampur	Dhulsunra	Piringi	812	107	75
Harirampur	Dhulsunra	Piringi	811	142	0
Harirampur	Dhulsunra	Piringi	810	1929	107
Harirampur	Dhulsunra	Piringi	808	3060	625
Harirampur	Dhulsunra	Piringi	648	667	622
Harirampur	Dhulsunra	Piringi	647	489	489
Harirampur	Dhulsunra	Piringi	646	1038	372
Harirampur	Dhulsunra	Piringi	645	437	223
Harirampur	Dhulsunra	Piringi	631	4941	59
Harirampur	Dhulsunra	Piringi	629	496	42
Harirampur	Dhulsunra	Piringi	628	1367	754
Harirampur	Dhulsunra	Piringi	627	450	450
Harirampur	Dhulsunra	Piringi	626	934	934
Harirampur	Dhulsunra	Piringi	625	381	381
Harirampur	Dhulsunra	Piringi	624	395	395
Harirampur	Dhulsunra	Piringi	623	448	448
Harirampur	Dhulsunra	Piringi	622	919	866
Harirampur	Dhulsunra	Piringi	621	441	441
Harirampur	Dhulsunra	Piringi	620	536	536
Harirampur	Dhulsunra	Piringi	619	570	570
Harirampur	Dhulsunra	Piringi	618	844	766
Harirampur	Dhulsunra	Piringi	617	772	772
Harirampur	Dhulsunra	Piringi	616	722	722
Harirampur	Dhulsunra	Piringi	615	1143	881
Harirampur	Dhulsunra	Piringi	614	1256	40
Harirampur	Dhulsunra	Piringi	590	4256	218
Harirampur	Dhulsunra	Piringi	587	564	160
Harirampur	Dhulsunra	Piringi	586	1327	901
Harirampur	Dhulsunra	Piringi	585	200	200
Harirampur	Dhulsunra	Piringi	584	215	215
Harirampur	Dhulsunra	Piringi	583	168	168
Harirampur	Dhulsunra	Piringi	582	168	168
Harirampur	Dhulsunra	Piringi	581	165	165
Harirampur	Dhulsunra	Piringi	580	1324	1323
Harirampur	Dhulsunra	Piringi	579	514	494
Harirampur	Dhulsunra	Piringi	578	520	191
Harirampur	Dhulsunra	Piringi	576	850	677
Harirampur	Dhulsunra	Piringi	575	804	804

Upazila name	Union Name	Mouza name	Plot No	Full Plot_Area m²	Affected Area m²
Harirampur	Dhulsunra	Piringi	574	733	733
Harirampur	Dhulsunra	Piringi	573	421	421
Harirampur	Dhulsunra	Piringi	572	403	403
Harirampur	Dhulsunra	Piringi	571	379	379
Harirampur	Dhulsunra	Piringi	570	381	381
Harirampur	Dhulsunra	Piringi	569	497	290
Harirampur	Dhulsunra	Piringi	568	606	606
Harirampur	Dhulsunra	Piringi	567	473	473
Harirampur	Dhulsunra	Piringi	566	297	297
Harirampur	Dhulsunra	Piringi	565	260	260
Harirampur	Dhulsunra	Piringi	564	1462	858
Harirampur	Dhulsunra	Piringi	563	1665	1539
Harirampur	Dhulsunra	Piringi	562	1459	1459
Harirampur	Dhulsunra	Piringi	561	653	388
Harirampur	Dhulsunra	Piringi	560	493	493
Harirampur	Dhulsunra	Piringi	559	589	324
Harirampur	Dhulsunra	Piringi	558	556	556
Harirampur	Dhulsunra	Piringi	557	668	668
Harirampur	Dhulsunra	Piringi	556	527	527
Harirampur	Dhulsunra	Piringi	555	1523	1509
Harirampur	Dhulsunra	Piringi	554	1361	1070
Harirampur	Dhulsunra	Piringi	553	1139	663
Harirampur	Dhulsunra	Piringi	552	1025	306
Harirampur	Dhulsunra	Piringi	551	1512	45
Harirampur	Dhulsunra	Piringi	546	916	131
Harirampur	Dhulsunra	Piringi	458	7058	312
Harirampur	Dhulsunra	Piringi	457	2137	1176
Harirampur	Dhulsunra	Piringi	449	2348	742
Harirampur	Dhulsunra	Piringi	448	2374	344
Harirampur	Dhulsunra	Piringi	447	7621	174
Harirampur	Dhulsunra	Piringi	445	743	318
Harirampur	Dhulsunra	Piringi	444	634	588
Harirampur	Dhulsunra	Piringi	444	7229	6617
					646842

2 Nawabganj Upazela

Satellite map and mouza maps overlay

List of affected plots in Nawabganj Upozela

LAP **Nwabganj Upazila** 99999

Khal/halot

Upazila name	Union Name	Mouza name	Plot No	Full Plot Area m²	Affected Area m²
Nawabganj	Joykrishnapur	Bataimuri	141	3449	327
Nawabganj	Joykrishnapur	Bataimuri	149	1273	301
Nawabganj	Joykrishnapur	Bataimuri	147	2667	2667
Nawabganj	Joykrishnapur	Bataimuri	148	2579	1612
Nawabganj	Joykrishnapur	Bataimuri	139	5429	253
Nawabganj	Joykrishnapur	Bataimuri	142	5357	3218
Nawabganj	Joykrishnapur	Bataimuri	145	930	837
Nawabganj	Joykrishnapur	Bataimuri	137	1177	237
Nawabganj	Joykrishnapur	Bataimuri	143	1481	1481
Nawabganj	Joykrishnapur	Bataimuri	141	868	303
Nawabganj	Joykrishnapur	Bataimuri	146	1816	26

Upazila name	Union Name	Mouza name	Plot No	Full Plot Area m²	Affected Area m²
Nawabganj	Joykrishnapur	Bataimuri	133	2091	750
Nawabganj	Joykrishnapur	Bataimuri	180	1336	1139
Nawabganj	Joykrishnapur	Bataimuri	135	3154	1190
Nawabganj	Joykrishnapur	Bataimuri	181	1410	842
Nawabganj	Joykrishnapur	Bataimuri	182	512	351
Nawabganj	Joykrishnapur	Bataimuri	185	634	245
Nawabganj	Joykrishnapur	Bataimuri	187	1698	1680
Nawabganj	Joykrishnapur	Bataimuri	186	1394	1394
Nawabganj	Joykrishnapur	Bataimuri	164	2442	1558
Nawabganj	Joykrishnapur	Bataimuri	165	823	124
Nawabganj	Joykrishnapur	Bataimuri	167	280	280
Nawabganj	Joykrishnapur	Bataimuri	168	330	330
Nawabganj	Joykrishnapur	Bataimuri	166	637	349
Nawabganj	Joykrishnapur	Bataimuri	169	607	607
Nawabganj	Joykrishnapur	Bataimuri	170	606	241
Nawabganj	Joykrishnapur	Bataimuri	156	1152	620
Nawabganj	Joykrishnapur	Bataimuri	171	3201	830
Nawabganj	Joykrishnapur	Bataimuri	155	4403	2626
Nawabganj	Joykrishnapur	Bataimuri	40	535	239
Nawabganj	Joykrishnapur	Bataimuri	39	1076	890
Nawabganj	Joykrishnapur	Bataimuri	35	1707	1483
Nawabganj	Joykrishnapur	Bataimuri	32	2630	750
Nawabganj	Joykrishnapur	Bataimuri	34	1680	903
Nawabganj	Joykrishnapur	Bataimuri	27	2403	1247
Nawabganj	Joykrishnapur	Bataimuri	26	401	401
Nawabganj	Joykrishnapur	Bataimuri	33	6177	1801
Nawabganj	Joykrishnapur	Bataimuri	25	4037	2849
Nawabganj	Joykrishnapur	Bataimuri	23	1209	865
Nawabganj	Joykrishnapur	Bataimuri	24	1234	541
Nawabganj	Joykrishnapur	Bataimuri	188	1459	437
Nawabganj	Joykrishnapur	Bataimuri	143	1481	0
Nawabganj	Joykrishnapur	Bataimuri	0	0	0
Nawabganj	Joykrishnapur	Bataimuri	0	0	0
Nawabganj	Joykrishnapur	Bataimuri	141	868	0
Nawabganj	Joykrishnapur	Bataimuri	0	0	0
Nawabganj	Joykrishnapur	Bataimuri	180	1336	0
Nawabganj	Nayabari	Dakshin Bahra	196	500	500
Nawabganj	Nayabari	Dakshin Bahra	87	635	629
Nawabganj	Nayabari	Dakshin Bahra	87	635	6
Nawabganj	Joykrishnapur	Kederpur	19	1630	854
Nawabganj	Joykrishnapur	Kederpur	41	465	15
Nawabganj	Joykrishnapur	Kederpur	17	1237	1011
Nawabganj	Joykrishnapur	Kederpur	18	1502	1

Upazila name	Union Name	Mouza name	Plot No	Full Plot Area m²	Affected Area m²
Nawabganj	Joykrishnapur	Kederpur	16	1165	404
Nawabganj	Joykrishnapur	Kederpur	13	2126	9
Nawabganj	Joykrishnapur	Kederpur	1002	4630	1662
Nawabganj	Joykrishnapur	Rajapur	2444	3006	796
Nawabganj	Joykrishnapur	Rajapur	2402	773	96
Nawabganj	Joykrishnapur	Rajapur	2401	624	419
Nawabganj	Joykrishnapur	Rajapur	2395	5066	4134
Nawabganj	Joykrishnapur	Rajapur	2403	708	615
Nawabganj	Joykrishnapur	Rajapur	2398	985	951
Nawabganj	Joykrishnapur	Rajapur	2409	948	9
Nawabganj	Joykrishnapur	Rajapur	2408	993	272
Nawabganj	Joykrishnapur	Rajapur	2404	801	801
Nawabganj	Joykrishnapur	Rajapur	2407	1005	372
Nawabganj	Joykrishnapur	Rajapur	2406	1034	507
Nawabganj	Joykrishnapur	Rajapur	2384	585	585
Nawabganj	Joykrishnapur	Rajapur	2394	3247	43
Nawabganj	Joykrishnapur	Rajapur	2405	920	881
Nawabganj	Joykrishnapur	Rajapur	2385	602	602
Nawabganj	Joykrishnapur	Rajapur	2383	640	640
Nawabganj	Joykrishnapur	Rajapur	23400	1360	1061
Nawabganj	Joykrishnapur	Rajapur	1970	1501	106
Nawabganj	Joykrishnapur	Rajapur	2380	3632	1522
Nawabganj	Joykrishnapur	Rajapur	2399	1065	511
Nawabganj	Joykrishnapur	Rajapur	2396	3528	1877
Nawabganj	Joykrishnapur	Rajapur	2381	2354	2050
Nawabganj	Joykrishnapur	Rajapur	2382	1021	491
Nawabganj	Joykrishnapur	Rajapur	2386	878	244
Nawabganj	Joykrishnapur	Rajapur	1979	1206	43
Nawabganj	Joykrishnapur	Rajapur	1967	1609	1302
Nawabganj	Joykrishnapur	Rajapur	2387	2010	131
Nawabganj	Joykrishnapur	Rajapur	1969	3253	3090
Nawabganj	Joykrishnapur	Rajapur	1965	1299	1054
Nawabganj	Joykrishnapur	Rajapur	1908	3742	47
Nawabganj	Joykrishnapur	Rajapur	2313	4498	1981
Nawabganj	Joykrishnapur	Rajapur	2019	783	636
Nawabganj	Joykrishnapur	Rajapur	1912	1293	320
Nawabganj	Joykrishnapur	Rajapur	2018	1013	1013
Nawabganj	Joykrishnapur	Rajapur	2017	243	243
Nawabganj	Joykrishnapur	Rajapur	1980	3009	1587
Nawabganj	Joykrishnapur	Rajapur	1964	1745	773
Nawabganj	Joykrishnapur	Rajapur	2020	760	760
Nawabganj	Joykrishnapur	Rajapur	1968	2108	853
Nawabganj	Joykrishnapur	Rajapur	1983	1031	921
Nawabganj	Joykrishnapur	Rajapur	1982	2483	1806

Upazila name	Union Name	Mouza name	Plot No	Full Plot Area m²	Affected Area m²
Nawabganj	Joykrishnapur	Rajapur	2026	1436	1217
Nawabganj	Joykrishnapur	Rajapur	2028	2214	781
Nawabganj	Joykrishnapur	Rajapur	2021	703	703
Nawabganj	Joykrishnapur	Rajapur	2016	788	572
Nawabganj	Joykrishnapur	Rajapur	2033	2196	1288
Nawabganj	Joykrishnapur	Rajapur	2022	452	257
Nawabganj	Joykrishnapur	Rajapur	2034	799	799
Nawabganj	Joykrishnapur	Rajapur	2050	3789	1058
Nawabganj	Joykrishnapur	Rajapur	2025	843	787
Nawabganj	Joykrishnapur	Rajapur	2035	1029	1029
Nawabganj	Joykrishnapur	Rajapur	2292	1401	467
Nawabganj	Joykrishnapur	Rajapur	2024	1329	628
Nawabganj	Joykrishnapur	Rajapur	2048	654	654
Nawabganj	Joykrishnapur	Rajapur	2049	614	614
Nawabganj	Joykrishnapur	Rajapur	2051	1050	1043
Nawabganj	Joykrishnapur	Rajapur	2036	574	412
Nawabganj	Joykrishnapur	Rajapur	2279	3124	363
Nawabganj	Joykrishnapur	Rajapur	2290	1292	1271
Nawabganj	Joykrishnapur	Rajapur	2289	312	312
Nawabganj	Joykrishnapur	Rajapur	2039	1792	48
Nawabganj	Joykrishnapur	Rajapur	2038	1220	203
Nawabganj	Joykrishnapur	Rajapur	2047	1157	479
Nawabganj	Joykrishnapur	Rajapur	2278	1407	657
Nawabganj	Joykrishnapur	Rajapur	2052	1622	1404
Nawabganj	Joykrishnapur	Rajapur	2288	694	694
Nawabganj	Joykrishnapur	Rajapur	2053	549	36
Nawabganj	Joykrishnapur	Rajapur	2100	1933	541
Nawabganj	Joykrishnapur	Rajapur	2618	1011	610
Nawabganj	Joykrishnapur	Rajapur	2280	737	565
Nawabganj	Joykrishnapur	Rajapur	2079	612	379
Nawabganj	Joykrishnapur	Rajapur	2069	578	326
Nawabganj	Joykrishnapur	Rajapur	2282	870	834
Nawabganj	Joykrishnapur	Rajapur	2282	1056	1050
Nawabganj	Joykrishnapur	Rajapur	2099	1710	1701
Nawabganj	Joykrishnapur	Rajapur	2102	1537	724
Nawabganj	Joykrishnapur	Rajapur	2214	2658	36
Nawabganj	Joykrishnapur	Rajapur	2084	341	341
Nawabganj	Joykrishnapur	Rajapur	2055	1900	380
Nawabganj	Joykrishnapur	Rajapur	2073	914	207
Nawabganj	Joykrishnapur	Rajapur	2211	1287	227
Nawabganj	Joykrishnapur	Rajapur	2085	1096	716
Nawabganj	Joykrishnapur	Rajapur	2103	1596	1565
Nawabganj	Joykrishnapur	Rajapur	2097	1074	956

Upazila name	Union Name	Mouza name	Plot No	Full Plot Area m²	Affected Area m²
Nawabganj	Joykrishnapur	Rajapur	2086	1479	28
Nawabganj	Joykrishnapur	Rajapur	2096	639	425
Nawabganj	Joykrishnapur	Rajapur	2210	4389	1236
Nawabganj	Joykrishnapur	Rajapur	2104	2062	1724
Nawabganj	Joykrishnapur	Rajapur	2094	669	33
Nawabganj	Joykrishnapur	Rajapur	2109	395	395
Nawabganj	Joykrishnapur	Rajapur	2118	1186	6
Nawabganj	Joykrishnapur	Rajapur	2110	2118	1595
Nawabganj	Joykrishnapur	Rajapur	2106	570	53
Nawabganj	Joykrishnapur	Rajapur	2108	1263	893
Nawabganj	Joykrishnapur	Rajapur	2093	3174	10
Nawabganj	Joykrishnapur	Rajapur	2112	3866	2493
Nawabganj	Joykrishnapur	Rajapur	2119	1604	886
Nawabganj	Joykrishnapur	Rajapur	2111	1843	1792
Nawabganj	Joykrishnapur	Rajapur	184	440	315
Nawabganj	Joykrishnapur	Rajapur	183	606	279
Nawabganj	Joykrishnapur	Rajapur	160	1024	523
Nawabganj	Joykrishnapur	Rajapur	181	602	105
Nawabganj	Joykrishnapur	Rajapur	161	2836	2010
Nawabganj	Joykrishnapur	Rajapur	189	6933	1218
Nawabganj	Joykrishnapur	Rajapur	157	2001	123
Nawabganj	Joykrishnapur	Rajapur	167	3054	2592
Nawabganj	Joykrishnapur	Rajapur	165	2096	47
Nawabganj	Joykrishnapur	Rajapur	169	1152	385
Nawabganj	Joykrishnapur	Rajapur	170	1609	206
Nawabganj	Joykrishnapur	Rajapur	153	4281	1122
Nawabganj	Joykrishnapur	Rajapur	155	668	668
Nawabganj	Joykrishnapur	Rajapur	154	610	610
Nawabganj	Joykrishnapur	Rajapur	152	5063	944
Nawabganj	Joykrishnapur	Rajapur	173	4883	2260
Nawabganj	Joykrishnapur	Rajapur	176	1411	1411
Nawabganj	Joykrishnapur	Rajapur	178	719	715
Nawabganj	Joykrishnapur	Rajapur	140	375	62
Nawabganj	Joykrishnapur	Rajapur	177	504	504
Nawabganj	Joykrishnapur	Rajapur	179	319	319
Nawabganj	Joykrishnapur	Rajapur	137	1720	1086
Nawabganj	Joykrishnapur	Rajapur	135	714	610
Nawabganj	Joykrishnapur	Rajapur	136	1065	1065
Nawabganj	Joykrishnapur	Rajapur	182	877	488
Nawabganj	Joykrishnapur	Rajapur	86	1578	1262
Nawabganj	Joykrishnapur	Rajapur	185	1656	198
Nawabganj	Joykrishnapur	Rajapur	88	930	367
Nawabganj	Joykrishnapur	Rajapur	91	1197	938
Nawabganj	Joykrishnapur	Rajapur	92	1084	1084

Upazila name	Union Name	Mouza name	Plot No	Full Plot Area m²	Affected Area m²
Nawabganj	Joykrishnapur	Rajapur	40	3447	1878
Nawabganj	Joykrishnapur	Rajapur	90	1790	311
Nawabganj	Joykrishnapur	Rajapur	99999	572	143
Nawabganj	Joykrishnapur	Rajapur	93	529	235
Nawabganj	Joykrishnapur	Rajapur	94	1429	189
Nawabganj	Joykrishnapur	Rajapur	39	1989	1945
Nawabganj	Joykrishnapur	Rajapur	29	2040	942
Nawabganj	Joykrishnapur	Rajapur	2593	1255	84
Nawabganj	Joykrishnapur	Rajapur	30	1372	1253
Nawabganj	Joykrishnapur	Rajapur	38	1575	779
Nawabganj	Joykrishnapur	Rajapur	31	756	756
Nawabganj	Joykrishnapur	Rajapur	32	2871	2104
Nawabganj	Joykrishnapur	Rajapur	36	3088	584
Nawabganj	Joykrishnapur	Rajapur	6	1022	86
Nawabganj	Joykrishnapur	Rajapur	35	2356	1280
Nawabganj	Joykrishnapur	Rajapur	30	954	904
Nawabganj	Joykrishnapur	Rajapur	121	6014	1548
Nawabganj	Joykrishnapur	Rajapur	2397	1209	483
Nawabganj	Joykrishnapur	Rajapur	1981	1921	945
Nawabganj	Joykrishnapur	Rajapur	2098	1012	1001
Nawabganj	Joykrishnapur	Rajapur	2113	1142	164
Nawabganj	Joykrishnapur	Rajapur	168	1607	1043
Nawabganj	Joykrishnapur	Rajapur	166	814	813
Nawabganj	Joykrishnapur	Rajapur	2107	295	291
Nawabganj	Joykrishnapur	Rajapur	180	849	81
Nawabganj	Joykrishnapur	Rajapur	1910	582	98
Nawabganj	Joykrishnapur	Rajapur	33	972	951
Nawabganj	Joykrishnapur	Rajapur	2099	1710	0
Nawabganj	Joykrishnapur	Rajapur	2098	1012	0
Nawabganj	Joykrishnapur	Rajapur	2102	1537	1
Nawabganj	Joykrishnapur	Rajapur	2098	1012	1
Nawabganj	Joykrishnapur	Rajapur	2103	1596	7
Nawabganj	Joykrishnapur	Rajapur	2098	1012	7
Nawabganj	Joykrishnapur	Rajapur	2097	1074	3
Nawabganj	Joykrishnapur	Rajapur	2098	1012	3
Nawabganj	Joykrishnapur	Rajapur	0	0	0
Nawabganj	Joykrishnapur	Rajapur	2109	395	0
Nawabganj	Joykrishnapur	Rajapur	0	0	0
Nawabganj	Joykrishnapur	Rajapur	2112	3866	0
Nawabganj	Joykrishnapur	Rajapur	99999	572	6
Nawabganj	Joykrishnapur	Rajapur	185	1656	2
Nawabganj	Joykrishnapur	Rajapur	99999	572	2
Nawabganj	Joykrishnapur	Rajapur	88	930	1

Upazila name	Union Name	Mouza name	Plot No	Full Plot Area m²	Affected Area m²
Nawabganj	Joykrishnapur	Rajapur	99999	572	1
					165004

3 Dohar Upazila

Satellite map and mouza maps overlay

List of affected plots in Dohar Upazela

Land Accusation of Harirampur Embankment (Dohar Upazila)

Mouza_name	Plot_No	Upazila	Plot_Area m²	Effected Area m²
Silakota	10	Dohar	787	0.0026
Silakota	6	Dohar	1896	0.0026
Dakshin Bahra	242	Dohar	1680	0.0026
Dakshin Bahra	241	Dohar	1265	0.0026
Dakshin Bahra	234	Dohar	1181	0.0027
Dakshin Bahra	231	Dohar	5534	0.0027
Dakshin Bahra	231	Dohar	5534	0.0027
Dakshin Bahra	1014	Dohar	698	0.0027
Dakshin Bahra	224	Dohar	1214	0.0027
Dakshin Bahra	193	Dohar	2909	0.0027
Dakshin Bahra	189	Dohar	1308	0.0027

Mouza_name	Plot_No	Upazila	Plot_Area m^2	Effected Area m^2
Dhoair	797	Dohar	1350	0.0027
Dhoair	850	Dohar	1371	0.0027
Dhoair	851	Dohar	2563	0.0027
Dhoair	830	Dohar	1495	0.0027
Dhoair	1022	Dohar	1249	0.0027
Dhoair	533	Dohar	983	0.0027
Dhoair	394	Dohar	1592	0.0027
Dhoair	135	Dohar	1513	0.0027
Dhoair	25	Dohar	3079	0.0027
Silakota	500	Dohar	8455	0.0028
Silakota	495	Dohar	2352	0.0028
Silakota	514	Dohar	344	0.0028
Silakota	512	Dohar	3554	0.0028
Silakota	508	Dohar	1300	0.0028
Silakota	507	Dohar	2301	0.0028
Silakota	529	Dohar	1927	0.0028
Silakota	532	Dohar	1068	0.0028
Silakota	311	Dohar	1548	0.0028
Silakota	309	Dohar	1228	0.0028
Silakota	108	Dohar	1429	0.0028
Silakota	101	Dohar	925	0.0028
Silakota	97	Dohar	1888	0.0028
Silakota	145	Dohar	1029	0.0028
Silakota	147	Dohar	1703	0.0028
Silakota	148	Dohar	2395	0.0028
Dhoair	847	Dohar	1701	0.0028
Dhoair	136	Dohar	1467	0.0028
Dhoair	73	Dohar	4167	0.0028
Dhoair	86	Dohar	970	0.0028
Dhoair	90	Dohar	1486	0.0028
Dhoair	26	Dohar	1214	0.0028
Silakota	500	Dohar	8455	0.0029
Silakota	500	Dohar	8455	0.0029
Silakota	500	Dohar	8455	0.0029
Silakota	495	Dohar	2352	0.0029
Silakota	507	Dohar	2301	0.0029
Silakota	529	Dohar	1927	0.0029
Silakota	532	Dohar	1068	0.0029
Silakota	148	Dohar	2395	0.0029
Dhoair	397	Dohar	1271	0.0029
Dhoair	397	Dohar	1271	0.0029
Dhoair	403	Dohar	821	0.0029
Dhoair	403	Dohar	821	0.0029
Dhoair	405	Dohar	697	0.0029

Mouza_name	Plot_No	Upazila	Plot_Area m^2	Effected Area m^2
Dhoair	405	Dohar	697	0.0029
Dhoair	438	Dohar	2358	0.0029
Dhoair	438	Dohar	2358	0.0029
Dhoair	435	Dohar	728	0.0029
Dhoair	435	Dohar	728	0.0029
Dhoair	429	Dohar	494	0.0029
Dhoair	429	Dohar	494	0.0029
Dhoair	461	Dohar	579	0.0029
Dhoair	461	Dohar	579	0.0029
Dhoair	136	Dohar	1467	0.0029
Dhoair	73	Dohar	4167	0.0029
Dhoair	76	Dohar	2360	0.0029
Dhoair	76	Dohar	2360	0.0029
Silakota	514	Dohar	344	0.003
Silakota	512	Dohar	3554	0.003
Silakota	508	Dohar	1300	0.003
Silakota	311	Dohar	1548	0.003
Silakota	309	Dohar	1228	0.003
Silakota	108	Dohar	1429	0.003
Silakota	101	Dohar	925	0.003
Silakota	97	Dohar	1888	0.003
Silakota	145	Dohar	1029	0.003
Silakota	147	Dohar	1703	0.003
Dakshin Bahra	231	Dohar	5534	0.003
Dakshin Bahra	231	Dohar	5534	0.003
Dakshin Bahra	1014	Dohar	698	0.003
Dakshin Bahra	224	Dohar	1214	0.003
Dakshin Bahra	193	Dohar	2909	0.003
Dakshin Bahra	189	Dohar	1308	0.003
Dhoair	797	Dohar	1350	0.003
Dhoair	850	Dohar	1371	0.003
Dhoair	851	Dohar	2563	0.003
Dhoair	847	Dohar	1701	0.003
Dhoair	830	Dohar	1495	0.003
Dhoair	1022	Dohar	1249	0.003
Dhoair	533	Dohar	983	0.003
Dhoair	394	Dohar	1592	0.003
Dhoair	135	Dohar	1513	0.003
Dhoair	86	Dohar	970	0.003
Dhoair	90	Dohar	1486	0.003
Dhoair	26	Dohar	1214	0.003
Dhoair	25	Dohar	3079	0.003
Silakota	6	Dohar	1896	0.0031
Dakshin Bahra	234	Dohar	1181	0.0031

Mouza_name	Plot_No	Upazila	Plot_Area m^2	Effected Area m^2
Silakota	10	Dohar	787	0.0032
Dakshin Bahra	242	Dohar	1680	0.0032
Dakshin Bahra	241	Dohar	1265	0.0032
Silakota	2962	Dohar	1565	0.0173
Silakota	2996	Dohar	2032	0.0173
Silakota	507	Dohar	2301	0.0179
Silakota	522	Dohar	2293	0.0179
Char kusai	137	Dohar	634	0.0186
Char kusai	99999	Dohar	412	0.0186
Silakota	523	Dohar	2085	0.0222
Silakota	522	Dohar	2293	0.0222
Silakota	521	Dohar	2197	0.0277
Silakota	508	Dohar	1300	0.0277
Dakshin Bahra	529	Dohar	1417	0.0324
Choto basta	319	Dohar	869	0.0324
Char kusai	21	Dohar	1627	0.0588
Char kusai	22	Dohar	921	0.1444
Char kusai	138	Dohar	807	0.2417
Char kusai	99999	Dohar	412	0.2417
Char kusai	139	Dohar	1344	0.3729
Char kusai	99999	Dohar	412	0.3729
Dhoair	458	Dohar	577	0.5298
Dhoair	427	Dohar	606	0.5298
Silakota	507	Dohar	2301	0.5396
Silakota	508	Dohar	1300	0.5396
Silakota	2965	Dohar	389	0.559
Char kusai	49	Dohar	992	0.6983
Char kusai	37	Dohar	706	0.8191
Dhoair	459	Dohar	567	0.8667
Dhoair	427	Dohar	606	0.8667
Char Kusai	141	Dohar	814	1.0522
Char kusai	99999	Dohar	412	1.0522
Choto basta	313	Dohar	2413	1.1353
Choto basta	309	Dohar	1265	1.1353
Silakota	321	Dohar	650	1.1792
Dakshin Bahra	541	Dohar	3672	1.266
Silakota	2944	Dohar	2991	1.3804
Silakota	2951	Dohar	2869	1.3804
Char kusai	181	Dohar	1736	1.3966
Char kusai	33	Dohar	3400	1.8429
Char Kusai	121	Dohar	1830	1.9786
Char kusai	99999	Dohar	412	1.9786
Char kusai	282	Dohar	1863	2.161
Choto basta	309	Dohar	1265	2.7017

Mouza_name	Plot_No	Upazila	Plot_Area m^2	Effected Area m^2
Choto basta	310	Dohar	1846	2.7017
Dhoair	420	Dohar	1220	2.9652
Char kusai	31	Dohar	2048	3.5314
Dhoair	142	Dohar	952	3.6644
Dhoair	426	Dohar	550	3.7113
Dhoair	427	Dohar	606	3.7113
Char kusai	137	Dohar	634	3.7575
Char kusai	5	Dohar	959	3.9334
Char kusai	50	Dohar	498	4.041
Silakota	2976	Dohar	3976	4.1784
Silakota	498	Dohar	3014	4.7332
Dakshin Bahra	1011	Dohar	791	5.7271
Dhoair	1032	Dohar	1634	6.2508
Dakshin Bahra	999	Dohar	706	8.2604
Dhoair	404	Dohar	1636	8.7733
Dakshin Bahra	517	Dohar	790	9.1634
Choto basta	138	Dohar	1677	9.3632
Char kusai	456	Dohar	462	10.0063
Char kusai	35	Dohar	1778	10.1271
Dhoair	461	Dohar	579	11.0938
Silakota	492	Dohar	1164	13.5382
Dhoair	344	Dohar	822	13.7182
Dakshin Bahra	524	Dohar	1655	15.1959
Dhoair	797	Dohar	1350	15.6529
Char kusai	127	Dohar	686	16.147
Choto basta	319	Dohar	869	17.0567
Silakota	8	Dohar	701	18.1494
Dakshin Bahra	189	Dohar	1308	18.6817
Char kusai	50	Dohar	498	20.1976
Choto basta	266	Dohar	955	20.2742
Char Kusai	46	Dohar	344	20.403
Silakota	308	Dohar	835	20.6661
Choto basta	315	Dohar	1573	20.9823
Dhoair	1018	Dohar	783	23.6879
Char Kusai	141	Dohar	814	24.2634
Char kusai	140	Dohar	176	24.2634
Silakota	2928	Dohar	1362	27.1647
Choto basta	309	Dohar	1265	27.584
Char kusai	99999	Dohar	222	28.4211
Silakota	109	Dohar	2440	29.4099
Choto basta	297	Dohar	1727	31.2199
Char kusai	22	Dohar	921	31.2384
Dhoair	441	Dohar	1469	31.9024
Dhoair	462	Dohar	591	33.1017

Mouza_name	Plot_No	Upazila	Plot_Area m^2	Effected Area m^2
Char kusai	4	Dohar	559	37.6188
Char Kusai	287	Dohar	2590	39.288
Dhoair	435	Dohar	728	40.7929
Char kusai	178	Dohar	227	41.3287
Char Kusai	453	Dohar	371	44.0793
Choto basta	11	Dohar	886	45.2802
Silakota	3122	Dohar	3112	46.7588
Dhoair	350	Dohar	1191	48.7975
Dhoair	74	Dohar	1436	49.0236
Char Kusai	557	Dohar	80	50.5845
Char Kusai	455	Dohar	466	60.8861
Silakota	303	Dohar	643	61.7786
Char Kusai	555	Dohar	694	62.4135
Choto basta	136	Dohar	559	63.248
Silakota	510	Dohar	1277	65.8005
Silakota	320	Dohar	609	68.1873
Silakota	486	Dohar	1612	71.2003
Dakshin Bahra	199	Dohar	1406	71.3826
Silakota	96	Dohar	1013	71.5667
Choto basta	258	Dohar	425	77.6507
Char kusai	3	Dohar	676	83.6479
Silakota	2941	Dohar	526	88.7968
Silakota	514	Dohar	344	89.0956
Dhoair	850	Dohar	1371	90.2302
Char kusai	2	Dohar	443	92.1542
Silakota	101	Dohar	925	96.9852
Dhoair	70	Dohar	870	105.3556
Dhoair	429	Dohar	494	115.4189
Silakota	99	Dohar	817	115.8286
Dhoair	27	Dohar	271	116.0452
Silakota	3126	Dohar	1930	117.7581
Dhoair	141	Dohar	1029	118.0906
Dhoair	416	Dohar	739	122.1666
Dhoair	430	Dohar	1169	123.8218
Silakota	2964	Dohar	430	124.5858
Choto basta	277	Dohar	1333	127.8565
Char kusai	53	Dohar	3879	133.4341
Choto basta	153	Dohar	559	134.0901
Choto basta	180	Dohar	867	137.324
Silakota	4	Dohar	1758	139.8431
Choto basta	286	Dohar	1545	141.9352
Char Kusai	454	Dohar	485	143.4863
Dakshin Bahra	1002	Dohar	313	144.4333
Char kusai	140	Dohar	176	151.2705

Mouza_name	Plot_No	Upazila	Plot_Area m^2	Effected Area m^2
Dhoair	872	Dohar	1502	152.8188
Dhoair	1030	Dohar	741	160.3017
Silakota	3058	Dohar	838	164.9675
Dhoair	843	Dohar	1372	169.9692
Dhoair	460	Dohar	275	171.2857
Silakota	519	Dohar	1633	174.3982
Dhoair	90	Dohar	1486	177.5917
Choto basta	4	Dohar	897	179.8631
Silakota	7	Dohar	464	183.0239
Dakshin Bahra	1014	Dohar	698	184.3561
Dhoair	830	Dohar	1495	185.4586
Char Kusai	196	Dohar	206	205.6438
Dhoair	134	Dohar	3282	205.733
Silakota	318	Dohar	1648	206.0599
Choto basta	162	Dohar	409	209.4371
Char Kusai	188	Dohar	1210	209.9073
Choto basta	293	Dohar	1015	212.686
Silakota	2989	Dohar	687	217.913
Char Kusai	194	Dohar	218	218.4855
Choto basta	152	Dohar	324	222.5579
Dhoair	861	Dohar	1254	229.568
Choto basta	146	Dohar	1428	234.8835
Dakshin Bahra	260	Dohar	238	237.9763
Silakota	532	Dohar	1068	245.0859
Dhoair	846	Dohar	248	248.4174
Char kusai	37	Dohar	706	250.3275
Dhoair	458	Dohar	577	253.4014
Silakota	314	Dohar	1915	255.229
Dhoair	533	Dohar	983	258.0778
Silakota	516	Dohar	258	258.3233
Dakshin Bahra	521	Dohar	721	258.7879
Char kusai	21	Dohar	1627	258.881
Dhoair	1020	Dohar	269	258.9549
Silakota	2951	Dohar	2869	259.0387
Silakota	2974	Dohar	1186	260.2577
Silakota	145	Dohar	1029	263.1536
Silakota	515	Dohar	264	264.341
Silakota	102	Dohar	369	269.3112
Char kusai	32	Dohar	411	272.5045
Dakshin Bahra	44	Dohar	278	278.1935
Silakota	95	Dohar	283	282.6874
Char kusai	99999	Dohar	412	283.536
Silakota	2957	Dohar	1842	286.5538
Silakota	16	Dohar	287	287.0647

Mouza_name	Plot_No	Upazila	Plot_Area m^2	Effected Area m^2
Dhoair	392	Dohar	288	287.7655
Char kusai	177	Dohar	337	288.5144
Dhoair	867	Dohar	291	290.6365
Dakshin Bahra	1003	Dohar	600	290.7378
Char kusai	182	Dohar	1206	295.0329
Dhoair	86	Dohar	970	298.2511
Char kusai	284	Dohar	981	300.2532
Dhoair	411	Dohar	1135	305.2146
Dakshin Bahra	539	Dohar	2166	307.6363
Dhoair	852	Dohar	312	312.1241
Dhoair	87	Dohar	314	313.6141
Char kusai	99999	Dohar	593	313.729
Silakota	494	Dohar	816	321.3086
Silakota	496	Dohar	1013	325.3555
Silakota	2959	Dohar	3739	328.5583
Dakshin Bahra	530	Dohar	2034	333.9085
Dhoair	868	Dohar	341	336.325
Char kusai	138	Dohar	807	337.0958
Dhoair	397	Dohar	1271	338.6354
Dhoair	349	Dohar	1018	340.4939
Silakota	2992	Dohar	523	342.6595
Dhoair	845	Dohar	701	353.9949
Dhoair	853	Dohar	354	354.3177
Dhoair	860	Dohar	634	363.5033
Silakota	2938	Dohar	373	372.6844
Choto basta	289	Dohar	664	375.6932
Dhoair	425	Dohar	727	382.2594
Dakshin Bahra	194	Dohar	382	382.4045
Char kusai	92	Dohar	530	383.0209
Dakshin Bahra	525	Dohar	577	383.5101
Bejora	99999	Dohar	691	387.1408
Silakota	10	Dohar	787	390.3585
Dakshin Bahra	999999	Dohar	611	391.5673
Silakota	531	Dohar	1020	393.9932
Char kusai	446	Dohar	2206	394.4137
Choto basta	143	Dohar	1037	394.6242
Dakshin Bahra	528	Dohar	396	396.409
Char Kusai	121	Dohar	1830	397.7908
Dhoair	853	Dohar	399	398.6448
Silakota	507	Dohar	2301	411.9217
Char kusai	175	Dohar	796	411.9228
Dhoair	856	Dohar	900	414.985
Char Kusai	142	Dohar	1377	419.2965
Char kusai	39	Dohar	4099	420.2768

Mouza_name	Plot_No	Upazila	Plot_Area m^2	Effected Area m^2
Silakota	99999	Dohar	801	425.3165
Dhoair	432	Dohar	426	425.9664
Choto basta	5	Dohar	822	433.6773
Dakshin Bahra	854	Dohar	435	434.5606
Dhoair	844	Dohar	487	439.5518
Dakshin Bahra	198	Dohar	1120	439.8431
Silakota	517	Dohar	440	440.2837
Dhoair	423	Dohar	1511	441.3603
Dakshin Bahra	240	Dohar	582	442.5874
Char Kusai	452	Dohar	599	446.3318
Bejora	140	Dohar	750	447.5638
Char kusai	49	Dohar	992	448.6647
Dhoair	832	Dohar	573	449.249
Choto basta	296	Dohar	889	455.2564
Dakshin Bahra	526	Dohar	463	463.3818
Silakota	2939	Dohar	464	464.2793
Dakshin Bahra	527	Dohar	468	468.3473
Bejora	150	Dohar	1898	469.5672
Dhoair	431	Dohar	486	471.4165
Dakshin Bahra	195	Dohar	478	478.1476
Char kusai	34	Dohar	480	479.6675
Dhoair	405	Dohar	697	479.8365
Dhoair	864	Dohar	686	485.1365
Choto basta	311	Dohar	485	485.484
Silakota	2986	Dohar	2194	494.7436
Dhoair	354	Dohar	1488	499.0981
Bejora	138	Dohar	739	501.6837
Dhoair	436	Dohar	636	503.1421
Silakota	481	Dohar	977	504.6119
Char Kusai	451	Dohar	512	507.239
Dhoair	428	Dohar	547	511.8533
Silakota	99999	Dohar	1235	515.1372
Choto basta	294	Dohar	526	515.8171
Choto basta	316	Dohar	2166	517.0716
Silakota	316	Dohar	1998	518.4222
Dhoair	433	Dohar	521	520.9094
Silakota	97	Dohar	1888	522.1121
Dakshin Bahra	1010	Dohar	627	531.5135
Char kusai	176	Dohar	535	535.4431
Choto basta	312	Dohar	556	537.1808
Char kusai	48	Dohar	546	538.0668
Silakota	309	Dohar	1228	539.22
Char kusai	122	Dohar	541	541.1214
Dakshin Bahra	159	Dohar	859	543.7159

Mouza_name	Plot_No	Upazila	Plot_Area m^2	Effected Area m^2
Dhoair	426	Dohar	550	545.8969
Dhoair	139	Dohar	1009	556.5699
Dakshin Bahra	258	Dohar	725	558.3255
Silakota	529	Dohar	1927	561.8097
Dhoair	831	Dohar	564	564.0056
Dhoair	459	Dohar	567	565.7618
Dhoair	409	Dohar	566	566.4691
Char kusai	199	Dohar	1681	569.568
Dhoair	403	Dohar	821	575.1365
Dhoair	71	Dohar	1614	576.5073
Silakota	11	Dohar	710	576.5382
Dhoair	463	Dohar	813	580.2208
Dhoair	80	Dohar	1135	580.4012
Dhoair	346	Dohar	581	580.7436
Silakota	2944	Dohar	2991	582.9455
Char Kusai	440	Dohar	4669	582.9913
Dhoair	1022	Dohar	1249	584.129
Char kusai	183	Dohar	1171	588.0415
Silakota	91	Dohar	1441	590.4764
Silakota	94	Dohar	591	591.0147
Choto basta	291	Dohar	594	594.4275
Dhoair	410	Dohar	609	595.2236
Silakota	105	Dohar	873	596.311
Char Kusai	186	Dohar	699	600.1812
Dhoair	427	Dohar	606	601.3661
Silakota	2996	Dohar	2032	603.2867
Char kusai	124	Dohar	617	612.5069
Bejora	151	Dohar	618	617.9153
Dakshin Bahra	1009	Dohar	627	621.0193
Char Kusai	185	Dohar	622	621.6305
Silakota	98	Dohar	627	622.1779
Dhoair	844	Dohar	775	623.8534
Silakota	17	Dohar	1034	624.2802
Dhoair	852	Dohar	624	624.3463
Dhoair	390	Dohar	636	624.826
Dakshin Bahra	197	Dohar	637	637.1539
Char kusai	43	Dohar	2402	638.6285
Char Kusai	510	Dohar	1289	641.237
Silakota	18	Dohar	994	646.8844
Dhoair	82	Dohar	1871	647.1016
Dhoair	407	Dohar	749	656.9533
Dakshin Bahra	520	Dohar	659	659.1678
Char kusai	36	Dohar	661	661.0404
Dhoair	348	Dohar	981	665.699

Mouza_name	Plot_No	Upazila	Plot_Area m^2	Effected Area m^2
Silakota	13	Dohar	1586	673.9923
Silakota	520	Dohar	2339	674.1347
Silakota	2995	Dohar	1322	676.3823
Dhoair	1029	Dohar	1321	680.8273
Dhoair	391	Dohar	688	687.7697
Char Kusai	286	Dohar	2851	692.614
Dhoair	75	Dohar	913	696.7564
Char Kusai	289	Dohar	3828	702.845
Dhoair	406	Dohar	710	710.0454
Dhoair	855	Dohar	952	710.4515
Bejora	139	Dohar	1062	716.7968
Dakshin Bahra	223	Dohar	999	717.6486
Dhoair	408	Dohar	768	718.4961
Silakota	19	Dohar	1647	718.9948
Silakota	313	Dohar	726	726.0251
Dakshin Bahra	536	Dohar	1081	729.1156
Silakota	2946	Dohar	1613	729.818
Bejora	152	Dohar	733	732.6828
Silakota	148	Dohar	2395	737.7014
Char Kusai	195	Dohar	1776	741.4489
Choto basta	144	Dohar	859	745.3442
Choto basta	149	Dohar	895	746.3623
Choto basta	320	Dohar	1310	746.7518
Dhoair	847	Dohar	1701	747.7426
Char Kusai	141	Dohar	814	749.9607
Silakota	31	Dohar	767	759.2994
Choto basta	290	Dohar	1230	760.5022
Silakota	147	Dohar	1703	761.279
Dakshin Bahra	538	Dohar	2128	765.8345
Silakota	103	Dohar	767	766.601
Dakshin Bahra	239	Dohar	950	772.6761
Silakota	93	Dohar	776	775.5129
Silakota	107	Dohar	1371	778.2254
Choto basta	148	Dohar	788	787.9959
Bejora	153	Dohar	861	795.6242
Dhoair	88	Dohar	798	798.1135
Silakota	317	Dohar	800	799.6055
Choto basta	145	Dohar	811	811.0018
Char kusai	47	Dohar	914	822.3089
Dakshin Bahra	224	Dohar	1214	823.9743
Dakshin Bahra	1004	Dohar	1511	825.4343
Dhoair	1028	Dohar	1334	830.0623
Dhoair	421	Dohar	1277	835.1041
Dhoair	135	Dohar	1513	835.6663

Mouza_name	Plot_No	Upazila	Plot_Area m^2	Effected Area m^2
Silakota	2940	Dohar	1017	842.1502
Dakshin Bahra	234	Dohar	1181	865.4095
Dhoair	845	Dohar	871	870.6276
Char Kusai	450	Dohar	953	871.1115
Silakota	104	Dohar	878	878.2377
Silakota	478	Dohar	1314	888.1604
Dakshin Bahra	193	Dohar	2909	907.0638
Dhoair	401	Dohar	1319	909.1888
Dhoair	389	Dohar	2195	911.2013
Choto basta	7	Dohar	913	913.2736
Char kusai	123	Dohar	914	913.6271
Dakshin Bahra	1008	Dohar	2581	914.8838
Choto basta	6	Dohar	964	918.8039
Dakshin Bahra	222	Dohar	1201	937.217
Dakshin Bahra	317	Dohar	1141	937.9486
Silakota	512	Dohar	3554	938.2879
Char Kusai	9999	Dohar	1801	943.3267
Dhoair	865	Dohar	1031	954.7911
Silakota	2962	Dohar	1565	955.7059
Char Kusai	187	Dohar	1000	963.0942
Silakota	480	Dohar	964	964.2314
Dhoair	81	Dohar	965	965.2528
Dhoair	345	Dohar	1351	986.115
Silakota	3119	Dohar	3915	986.939
Dakshin Bahra	532	Dohar	1708	989.2245
Choto basta	292	Dohar	1159	990.332
Char Kusai	447	Dohar	1887	994.3869
Dhoair	393	Dohar	1568	995.7625
Choto basta	150	Dohar	1432	1001.5489
Char Kusai	288	Dohar	1024	1004.1182
Silakota	106	Dohar	1478	1004.549
Choto basta	9	Dohar	1409	1014.3204
Char kusai	35	Dohar	1778	1016.0674
Bejora	137	Dohar	1330	1017.3253
Dakshin Bahra	241	Dohar	1265	1021.9917
Char Kusai	285	Dohar	1035	1025.3826
Silakota	143	Dohar	1029	1028.8916
Silakota	521	Dohar	2197	1033.6439
Silakota	310	Dohar	1139	1039.8333
Dhoair	434	Dohar	1057	1045.5843
Dakshin Bahra	1005	Dohar	1623	1047.0578
Dakshin Bahra	537	Dohar	1842	1047.1098
Dhoair	396	Dohar	1611	1055.51
Silakota	2937	Dohar	2756	1061.5084

Mouza_name	Plot_No	Upazila	Plot_Area m^2	Effected Area m^2
Silakota	92	Dohar	1072	1072.4
Dhoair	833	Dohar	1074	1073.9695
Dakshin Bahra	548	Dohar	2326	1088.3928
Choto basta	261	Dohar	1134	1090.6651
Silakota	508	Dohar	1300	1093.1949
Char kusai	125	Dohar	1450	1097.6438
Silakota	3120	Dohar	1127	1099.2179
Dhoair	438	Dohar	2358	1100.0824
Silakota	525	Dohar	1430	1105.1464
Choto basta	1	Dohar	2309	1106.181
Dhoair	89	Dohar	1328	1110.0416
Silakota	2973	Dohar	1120	1119.7823
Bejora	156	Dohar	2143	1120.7161
Dhoair	26	Dohar	1214	1127.9896
Silakota	108	Dohar	1429	1134.8383
Char kusai	31	Dohar	2048	1139.726
Silakota	2943	Dohar	2838	1149.8342
Dhoair	869	Dohar	5027	1161.0194
Silakota	479	Dohar	1169	1168.8418
Char Kusai	449	Dohar	1589	1170.3752
Dhoair	72	Dohar	1847	1170.4165
Choto basta	147	Dohar	1570	1206.6931
Silakota	2936	Dohar	2287	1211.4445
Choto basta	313	Dohar	2413	1222.4562
Dakshin Bahra	540	Dohar	1235	1227.2143
Dakshin Bahra	192	Dohar	1248	1231.1537
Dhoair	422	Dohar	1232	1231.5213
Silakota	3125	Dohar	2454	1239.472
Silakota	2947	Dohar	1345	1241.6082
Choto basta	10	Dohar	1317	1251.2774
Choto basta	8	Dohar	3015	1254.1915
Silakota	2972	Dohar	2621	1255.2366
Dhoair	137	Dohar	1261	1256.9341
Silakota	518	Dohar	1257	1257.2279
Silakota	2993	Dohar	1258	1257.9382
Dhoair	24	Dohar	1581	1274.1902
Silakota	311	Dohar	1548	1275.9248
Silakota	2994	Dohar	1418	1281.1816
Dakshin Bahra	533	Dohar	1958	1283.5834
Dhoair	138	Dohar	1668	1297.8323
Dhoair	848	Dohar	1629	1298.7255
Dhoair	1027	Dohar	1319	1318.5173
Dakshin Bahra	531	Dohar	2935	1325.5413
Dakshin Bahra	536	Dohar	1866	1332.9062

Mouza_name	Plot_No	Upazila	Plot_Area m^2	Effected Area m^2
Char kusai	139	Dohar	1344	1341.2663
Silakota	2990	Dohar	1950	1348.151
Dakshin Bahra	243	Dohar	1584	1348.2525
Dhoair	437	Dohar	1348	1348.351
Char kusai	184	Dohar	1427	1349.5279
Choto basta	265	Dohar	1884	1352.9112
Silakota	2963	Dohar	1720	1356.7266
Dhoair	136	Dohar	1467	1367.5714
Dakshin Bahra	529	Dohar	1417	1383.9824
Silakota	12	Dohar	1389	1384.4689
Char Kusai	193	Dohar	1911	1402.2548
Choto basta	264	Dohar	2216	1422.1638
Char Kusai	299	Dohar	7940	1464.6635
Silakota	522	Dohar	2293	1477.5106
Dhoair	76	Dohar	2360	1505.9915
Dhoair	394	Dohar	1592	1513.6258
Dhoair	347	Dohar	1555	1554.5102
Silakota	3462	Dohar	1570	1561.694
Choto basta	151	Dohar	1570	1568.4917
Silakota	2945	Dohar	1584	1583.5731
Silakota	5	Dohar	1946	1584.436
Choto basta	135	Dohar	2084	1588.7362
Dakshin Bahra	242	Dohar	1680	1616.5882
Char Kusai	448	Dohar	1629	1629.1369
Dakshin Bahra	231	Dohar	5534	1633.2421
Silakota	2949	Dohar	2579	1635.3495
Silakota	523	Dohar	2085	1652.863
Dakshin Bahra	541	Dohar	3672	1662.0391
Silakota	499	Dohar	1938	1696.9738
Silakota	15	Dohar	2721	1710.0284
Choto basta	310	Dohar	1846	1710.6199
Dhoair	25	Dohar	3079	1804.5129
Silakota	6	Dohar	1896	1867.22
Silakota	495	Dohar	2352	1870.6082
Silakota	319	Dohar	1926	1881.9688
Silakota	2958	Dohar	1919	1918.5601
Choto basta	518	Dohar	3709	1931.3955
Choto basta	318	Dohar	2681	1953.5887
Char kusai	45	Dohar	2017	1974.3758
Silakota	493	Dohar	2789	2005.8856
Choto basta	295	Dohar	2342	2007.9242
Dhoair	395	Dohar	2110	2029.4191
Dhoair	851	Dohar	2563	2037.2659
Silakota	3117	Dohar	2658	2037.6595

Mouza_name	Plot_No	Upazila	Plot_Area m^2	Effected Area m^2
Dakshin Bahra	535	Dohar	2661	2043.9199
Dakshin Bahra	191	Dohar	2597	2046.1436
Silakota	2975	Dohar	3079	2169.7752
Silakota	3121	Dohar	2569	2279.9616
Silakota	524	Dohar	2451	2304.7079
Char kusai	198	Dohar	3599	2361.8455
Silakota	2948	Dohar	2639	2464.8943
Char Kusai	9999	Dohar	6945	2621.3409
Char Kusai	441	Dohar	3904	2872.0018
Char Kusai	197	Dohar	3823	2965.1232
Char kusai	33	Dohar	3400	2976.912
Dakshin Bahra	1015	Dohar	3238	3182.3478
Dhoair	73	Dohar	4167	3510.8179
Silakota	500	Dohar	8455	3673.4483

2. Additional areas for the 4 fish pass canal excavation and 3 road crossing

APPENDIX F

DETAILED OF THE PROJECT AFFECTED HOUSEHOLD

Table 28: List of Household heads with category of losses (Owners and Business Persons)

Location	HH Head Name	Father/ Husband Name	Gender	Age	National Card No.	Occupation	Annual Income	Land Use	Ownership
Dohar; Kushumhati; Char Kusai(Part-1)	Amana khatun	Ansar uddin mollah	Female	52	2611821473026	Housewife	0-30,000	Homestead Structure	Owner
Dohar; Kushumhati; Char Kusai(Part-1)	Azhar mollah	Kudus mollah	Male	50		Migrant Worker	50,000-1,00,000	Homestead Structure	Owner
Dohar; Kushumhati; Char Kusai(Part-1)	Badal Bepari	Nowab Ali Bepari	Male	55	2611821474238	Daily wage laborer (Agri)	1,00,000-1,80,000	Homestead Structure	Owner
Dohar; Kushumhati; Char Kusai(Part-1)	Mamun	Hayet ali member	Male	35		Migrant Worker	1,00,000-1,80,000	Homestead Structure	Owner
Dohar; Kushumhati; Char Kusai(Part-1)	Masud rana	Hayet ali member	Male	35		Migrant Worker	>1,80,000	Homestead Structure	Owner
Dohar; Kushumhati; Char Kusai(Part-1)	Mohammad Lutfor Rahman	Sheikh Kosimuddin	Male	55		Migrant Worker	>1,80,000	Homestead Structure	Owner
Dohar; Kushumhati; Char Kusai(Part-1)	Monir khan	Moti khan	Male	57	2611821474112	Daily wage laborer (Non-agri)	30,000-50,000	Homestead Structure	Owner
Dohar; Kushumhati; Char Kusai(Part-1)	Nurul islam	Motiur rahman mollah	Male	50		Migrant Worker	>1,80,000	Homestead Land Homestead Structure	Owner Owner
Dohar; Kushumhati; Char Kusai(Part-1)	Shekh abdul khalak	Shekh abdul samsu	Male	42	2611821474114	Rickshaw/Rickshaw van driver	30,000-50,000	Homestead Structure	Owner
Dohar; Kushumhati; Char Kusai(Part-1)	Younus molla		Male	50		Salaried person in govt/private	50,000-1,00,000	Homestead Structure	Owner
Dohar; Kushumhati; Kartikpur (Part-1)	Atoar khan	Jolil khan	Male	30		Migrant Worker	1,00,000-1,80,000	Homestead Structure	Owner
Dohar; Kushumhati; Kartikpur (Part-1)	Hakim Khan	Goppor Khan	Male	45		Daily wage laborer (Agri)	1,00,000-1,80,000	Homestead Structure	Owner
Dohar; Kushumhati; Kartikpur (Part-1)	Hazera begum	Akhter khan	Female	45	2611821468439	Housewife	0-30,000	Homestead Structure	Owner
Dohar; Kushumhati; Kartikpur (Part-1)	Jorna akter		Female	40	2611821468437	Migrant Worker	0-30,000	Homestead Structure	Owner
Dohar; Kushumhati; Kartikpur (Part-1)	Khelaram sarkar	Khetromohon sarkar	Male	56	2611821468469		>1,80,000	Homestead Structure	Owner
Dohar; Kushumhati; Kartikpur (Part-1)	Kibriya miya	Sultan miya	Male	38		Vendor	>1,80,000	Homestead Structure	Owner
Dohar; Kushumhati; Kartikpur (Part-1)	Md. ratan	Rafik sardar	Male	26	1992261182100	Daily wage laborer (Non-agri)	30,000-50,000	Homestead Structure	Owner
Dohar; Kushumhati; Kartikpur (Part-1)	Mohammad afzal	Sheikh jamal	Male	47	2611821468270	Daily wage laborer (Agri)	>1,80,000	Dairy-Livestock Farm Homestead Structure	Business Owner
Dohar; Kushumhati; Kartikpur (Part-1)	Mohammad Azharul Islam	Ibrahim molla	Male	65	2611821468492	Teacher	0-30,000		Owner
Dohar; Kushumhati; Kartikpur (Part-1)	Mohammad shahidul islam	Mohammad motiur rahma	Male	45		Daily wage laborer (Non-agri)	>1,80,000	Homestead Structure	Owner
Dohar; Kushumhati; Kartikpur (Part-1)	Mojibur Rahman	Wazuddin Molla	Male	60	2611821468618	Unemployed/dependent/children	>1,80,000	Homestead Structure	Owner
Dohar; Kushumhati; Kartikpur (Part-1)	Moktar khan	Nurul Islam khan	Male	60	2611821468549	Daily wage laborer (Non-agri)	50,000-1,00,000	Homestead Structure	Owner
Dohar; Kushumhati; Kartikpur (Part-1)	Mozid dewan	Nalu dewan	Male	50	2611821468520	Daily wage laborer (Agri)	0-30,000	Dairy-Livestock Farm	Business

Table 29: List of household heads with category of losses (Non-Owners)

Location	HH Head Name	Father/ Husband Name	Gender	Age	National Card No.	Occupation	Annual Income	Land Use	Ownership
Dohar; Kushumhati; Kartikpur (Part-1)	Kalipod sarker	Ramdol matobbor	Male	60		Daily wage laborer (Non-agri)	50,000-1,00,000		Lessee
Dohar; Kushumhati; Uttar Silakota	Rokeya begum	Panju sikdar	Female	42	2693622275555	Housewife	0-30,000	Homestead Structure	Khas
Harirampur; Dhulsunra; Abidhara	Choked Uddin	Raihan	Male	45	5612843806993	Daily wage laborer (Agri)	50,000-1,00,000	Homestead Structure	Khas
Harirampur; Dhulsunra; Abidhara	Faruk hossain	Omar ali	Male	42	5612843833512	Vendor	30,000-50,000	Homestead Structure	Khas
Harirampur; Dhulsunra; Abidhara	Malek Molla	Kanu Mollah	Male	60		Carpenter	30,000-50,000	Homestead Land	Lessee
Harirampur; Dhulsunra; Abidhara	Meher ali	Omar ali	Male	30	5612811817407	Press worker (Dhaka)	50,000-1,00,000	Homestead Structure	Khas
Harirampur; Dhulsunra; Abidhara	Shanti malo	Nitai malo	Male	44	5618225448358	Fisherman	0-30,000	Homestead Structure	Khas
Harirampur; Dhulsunra; Abidhara	Shikha Awlad		Male	53		Daily wage laborer (Agri)	30,000-50,000	Homestead Land	Lessee
Harirampur; Dhulsunra; Nilgram	MST moyna begum	Mrito sheikh hachen	Female	78	5612843804909	Unemployed/dependent/children	0-30,000		Lessee
Harirampur; Dhulsunra; Nilgram	Aysha begum	Sultan	Female	44	5612843805313	Housewife	0-30,000	Homestead Structure	Lessee
Harirampur; Dhulsunra; Nilgram	Narayan chandra roy	Mrito rakhal chandra roy	Male	49	5612843805642	School teacher	50,000-1,00,000	Homestead Structure	Lessee
Harirampur; Dhulsunra; Nilgram	Sekandr	Sheikh siddik	Male	25	1992561284300	Carpenter	30,000-50,000		Lessee
Harirampur; Dhulsunra; Nilgram	Sunil Chandra das	Genindro das	Male	69	5612843805232	Vendor	0-30,000	Homestead Structure	Lessee
Nawabganj; Joykrishnapur; Balanga	Md. Arif	Sheikh Binod	Male	30		Migrant Worker	>1,80,000	Homestead Structure	Lessee
Nawabganj; Joykrishnapur; Kantartek	Aabdul razzaque	siraj bapery	Male	70	2611863478598	Tailoring	30,000-50,000		Lessee
Nawabganj; Joykrishnapur; Kantartek	Abdur rob dewan	Alep dewan	Male	54	2611863477743	Daily wage laborer (Non-agri)	0-30,000	Homestead Structure	Khas
Nawabganj; Joykrishnapur; Kantartek	Amer Uddin molla	Korman molla	Male	70	2616261552605	Daily wage laborer (Agri)	0-30,000	Homestead Structure	Khas
Nawabganj; Joykrishnapur; Kantartek	Ballal	Sheikh dburddin	Male	52	2616261552875	Daily wage laborer (Agri)	0-30,000		Khas
Nawabganj; Joykrishnapur; Kantartek	mohammad ahsan molla	Noimuddin molla	Male	54	2611863478219	Share cropping	1,00,000-1,80,000	Homestead Structure	Lessee
Nawabganj; Joykrishnapur; Kantartek	Sheuly akter	Omer ali	Female	29	2616261552996	Housewife	0-30,000	Homestead Structure	Khas
Nawabganj; Joykrishnapur; Kantartek	yousuf molla	Khoyaz molla	Male	54		Daily wage laborer (Non-agri)	50,000-1,00,000	Homestead Structure	Lessee

Location	HH Head Name	Father/ Husband Name	Gender	Age	National Card No.	Occupation	Annual Income	Land Use	Ownership
Dohar; Kushumhati; Kartikpur (Part-1)	**Mozid dewan**	Nalu dewan	Male	50	2611821468520	Daily wage laborer (Agri)	0-30,000	Homestead Structure	Owner
Dohar; Kushumhati; Kartikpur (Part-1)	**Nitai talukder**	Rakhal talukdar	Male	58	2611821468441	Daily wage laborer (Non-agri)	50,000-1,00,000	Homestead Structure	Owner
Dohar; Kushumhati; Kartikpur (Part-1)	**Nithi chondro sorkar**	Horimol sarkar	Male	57	261182146984	Businessmen	50,000-1,00,000	Homestead Structure	Owner
Dohar; Kushumhati; Kartikpur (Part-1)	**Radheshyam**	Rakhalbashi Talukdar	Male	55		Carpenter	1,00,000-1,80,000	Homestead Structure	Owner
Dohar; Kushumhati; Kartikpur (Part-1)	**Sakiruddin bishass**	Mainuddin bishass	Male	70		Unemployed/dependent/children	0-30,000	Dairy-Livestock Farm	Business
								Homestead Structure	Owner
Dohar; Kushumhati; Kartikpur (Part-1)	**Shonkor Talukdar**	Rakhalbashi Talukdar	Male	40	2611821468542	Petty trader	1,00,000-1,80,000	Homestead Structure	Owner
Dohar; Kushumhati; Kartikpur (Part-1)	**Sudher Sarkar**	Gourango Sarker	Male	30	1987261182100	Carpenter	>1,80,000	Homestead Structure	Owner
Dohar; Kushumhati; Kartikpur (Part-1)	**Sunil sarker**	Brindabon sarker	Male	48		Daily wage laborer (Non-agri)	30,000-50,000	Homestead Structure	Owner
Dohar; Kushumhati; Kartikpur (Part-1)	**Syed Momtaz Ali**	Syed Faiyaz Ali	Male	65	2611821468498	Unemployed/dependent/children	1,00,000-1,80,000	Homestead Structure	Owner
Dohar; Kushumhati; Uttar Silakota	**Abul hossain**	Nawab ali sheikh	Female	35		Vendor	50,000-1,00,000	Homestead Structure	Owner
Dohar; Kushumhati; Uttar Silakota	**Asia akhter**	Sheikh ajhar ali	Female	35	2611821475408	Housewife	0-30,000	Homestead Structure	Owner
Dohar; Kushumhati; Uttar Silakota	**Hazira begum**	Imtaj khan	Female	49	2611863483864	Housewife	0-30,000	Homestead Structure	Owner
Dohar; Kushumhati; Uttar Silakota	**Milon shikder**	Panju shikder	Male	40		Migrant Worker	1,00,000-1,80,000		Owner
Dohar; Kushumhati; Uttar Silakota	**Miraz Khan**	Falu Khan	Male	40	2611863486753	Migrant Worker	1,00,000-1,80,000	Homestead Structure	Owner
Dohar; Kushumhati; Uttar Silakota	**Mostofa**		Male	35		Migrant Worker	>1,80,000	Dairy-Livestock Farm	Business
Dohar; Kushumhati; Uttar Silakota	**Nannu Mollik**	Gendu Mollik	Male	50		Migrant Worker	1,00,000-1,80,000	Homestead Structure	Owner
Dohar; Kushumhati; Uttar Silakota	**Rayhan khan**	Imtaj khan	Female	34		Housewife	>1,80,000	Homestead Structure	Owner
Dohar; Kushumhati; Uttar Silakota	**Safali begum**	Faruk kha	Female	40	2611821475413	Housewife	0-30,000	Homestead Structure	Owner
Dohar; Nayabari; Dhoair	**Mohammad Ariful Islam**	Late of Sheikh Fairuddin	Male	35			1,00,000-1,80,000		Owner
Dohar; Nayabari; Dhoair	**Monir mollah**	Aynal mollah	Male	34	2611863490595	Daily wage laborer (Non-agri)	30,000-50,000	Homestead Structure	Owner
Dohar; Nayabari; Dhoair	**Shahidul islam**	Sheikh khairuddin	Male	40		Vendor	50,000-1,00,000	Homestead Structure	Owner
Dohar; Nayabari; Dhoair	**Sheikh shahidul islam**	Late alhaz nasiruddin ahme	Male	65		Vendor			Owner
Harirampur; Boyra; Boyra	**Ramjan bepary**		Male	60		Vendor	50,000-1,00,000	Homestead Structure	Owner
Harirampur; Boyra; Karmakarkandi Boyra	**Bhabani karmakar**	Mommihon karmaker	Male	65		Vendor	30,000-50,000	Homestead Structure	Owner
Harirampur; Boyra; Karmakarkandi Boyra	**Halim bepari**	Ramjan bepari	Male	29	5612829753538	Daily wage laborer (Agri)	1,00,000-1,80,000	Agricultural	Business
								Homestead Structure	Owner

Location	HH Head Name	Father/ Husband Name	Gender	Age	National Card No.	Occupation	Annual Income	Land Use	Ownership
Harirampur; Boyra; Karmakarkandi Boyra	**Jiten muni das**	Shamlal muni das	Male	53	5612829753700	Singer	0-30,000	Homestead Structure	Owner
Harirampur; Boyra; Karmakarkandi Boyra	**Md. mojnu mondol**	Latif mondol	Male	55		Cultivation in owned land	50,000-1,00,000	Dairy-Livestock Farm	Business
								Homestead Structure	Owner
Harirampur; Boyra; Karmakarkandi Boyra	**Md. siddik biswas**	Oyachel biswas	Male	62	5612829755227	Daily wage laborer (Non-agri)	0-30,000	Agricultural	Business
								Homestead Structure	Owner
Harirampur; Boyra; Karmakarkandi Boyra	**Mogrob ali**	Hachen Ali	Male	57	5612829753541	Daily wage laborer (Agri)	50,000-1,00,000	Homestead Structure	Owner
Harirampur; Boyra; Karmakarkandi Boyra	**Mohammad billaal hossen**	Mohammad abdul hamid b	Male	49	5612829753437	Daily wage laborer (Agri)	30,000-50,000		Owner
Harirampur; Boyra; Karmakarkandi Boyra	**Mohammad dolil uddin**	Late shamiz uddin	Male	60		Cultivation in owned land	50,000-1,00,000	Agricultural	Business
								Homestead Structure	Owner
Harirampur; Boyra; Karmakarkandi Boyra	**Nirmol karmakar**	Nibaron karmakar	Male	62		Vendor	1,00,000-1,80,000	Homestead Structure	Owner
Harirampur; Boyra; Karmakarkandi Boyra	**Parish moni das**	Hemonto moni das	Male	52	5612829753485	Rickshaw/Rickshaw van driver	50,000-1,00,000	Dairy-Livestock Farm	Business
								Homestead Structure	Owner
Harirampur; Boyra; Karmakarkandi Boyra	**Rita moni das**	Susik moni das	Female	26		Maid	0-30,000	Homestead Structure	Owner
Harirampur; Boyra; Karmakarkandi Boyra	**Shonjit kumar das**	Mahendro moni das	Male	40		Daily wage laborer (Non-agri)	50,000-1,00,000	Homestead Structure	Owner
Harirampur; Dhulsunra; Abidhara	**Dalal Chandra Sarkar**	Ram Lal Sarkar	Male	42	5612811816988	Unknown	50,000-1,00,000	Homestead Structure	Owner
Harirampur; Dhulsunra; Abidhara	**Kanchan bapary**	Ainuddin bepary	Male	55		Migrant Worker	50,000-1,00,000	Homestead Structure	Owner
Harirampur; Dhulsunra; Abidhara	**Romesh haldar**	Bhubon haldar	Male	60		Fisherman	30,000-50,000	Homestead Land	Owner
Harirampur; Dhulsunra; Abidhara	**Shankar chandra sarkar**	Ramlal sarkar	Male	40	5612811817108	Vendor	1,00,000-1,80,000	Homestead Structure	Owner
Harirampur; Dhulsunra; Abidhara	**Sheikh monir hossen**	Sheikh kabir uddin	Male	60		Homestead gardening	0-30,000	Agricultural	Business
								Homestead Structure	Owner
Harirampur; Dhulsunra; Mohanpur			Male			Unknown			Business
Harirampur; Dhulsunra; Mohanpur	**Abul hashem**	Mrito abdul samad	Male	60	5612843804901	Cultivation in owned land	30,000-50,000	Homestead Structure	Owner
Harirampur; Dhulsunra; Mohanpur	**Abul kashem**	Mrito Abdul samad	Male	58	5612843804903	Daily wage laborer (Agri)	50,000-1,00,000	Homestead Structure	Owner
Harirampur; Dhulsunra; Nilgram	**Abdul Latif mridah**	Shahjuddin mridah	Male	47		Cultivation in owned land	50,000-1,00,000	Homestead Structure	Owner
Harirampur; Dhulsunra; Nilgram	**Abdul mannan**	Mrito gendu paunadar	Male	40	5612843805824	Daily wage laborer (Agri)	30,000-50,000	Dairy-Livestock Farm	Business
								Homestead Structure	Owner
Harirampur; Dhulsunra; Nilgram	**Abul kashem**	Sheikh Koizuddin	Male	40	5612843804588	Migrant Worker	50,000-1,00,000	Homestead Structure	Owner

Location	HH Head Name	Father/ Husband Name	Gender	Age	National Card No.	Occupation	Annual Income	Land Use	Ownership
Harirampur; Dhulsunra; Nilgram	**Aysha begum**	Sultan	Female	44	5612843805313	Housewife	0-30,000	Dairy-Livestock Farm	Business
Harirampur; Dhulsunra; Nilgram	**Elon**	Sajuddin mondol	Male	45		Daily wage laborer (Agri)	30,000-50,000	Homestead Land	Owner
Harirampur; Dhulsunra; Nilgram	**Md Azahar Mirja**	Akbar mirja	Male	65		Unemployed/dependent/children	50,000-1,00,000	Homestead Structure	Owner
Harirampur; Dhulsunra; Nilgram	**Md Habibur Rahman**	Zohir Uddin	Male	60		Cultivation in owned land	0-30,000		Owner
Harirampur; Dhulsunra; Nilgram	**Md Jahangir**	Abdul Malek Khan	Male	42	671579338705	Unknown	>1,80,000	Homestead Structure	Owner
Harirampur; Dhulsunra; Nilgram	**Md Sunet Khan**	Late Mobjel Khan	Male	65	5612843805874	Unemployed/dependent/children	1,00,000-1,80,000	Dairy-Livestock Farm	Business
								Homestead Structure	Owner
Harirampur; Dhulsunra; Nilgram	**Minhaz uddin**	Moynaz uddin	Male	75		Imam		Commercial	Owner
Harirampur; Dhulsunra; Nilgram	**Moslem kha**	Tenure kha	Male	50	5612843805862	Daily wage laborer (Agri)	50,000-1,00,000	Homestead Land	Owner
Harirampur; Dhulsunra; Nilgram	**Motiur Rahman**		Male			Business man		Homestead Structure	Owner
Harirampur; Dhulsunra; Nilgram	**Muslim kha**	Mugdon kha	Male			Daily wage laborer (Agri)	50,000-1,00,000	Homestead Land	Owner
Harirampur; Dhulsunra; Nilgram	**Niranjon**	Nittanondo	Male	75		Daily wage laborer (Agri)	30,000-50,000	Homestead Land	Owner
Harirampur; Dhulsunra; Nilgram	**Seikh akkas**	Seikh arseth	Male	50		Daily wage laborer (Agri)	50,000-1,00,000	Homestead Land	Owner
Harirampur; Dhulsunra; Nilgram	**Sheikh Habib**	Sheikh Abdul	Male	33		Construction Worker	1,00,000-1,80,000	Homestead Structure	Owner
Harirampur; Dhulsunra; Nilgram	**Sheikh tushar**	Sheikh bacchu mia	Male	29		Salaried person in govt/private	0-30,000	Dairy-Livestock Farm	Business
								Homestead Structure	Owner
Harirampur; Dhulsunra; Nilgram	**Sunil Chandra das**	Genindro das	Male	69	5612843805232	Vendor	0-30,000	Other	Business
Harirampur; Dhulsunra; Nilgram	**Utpal hossain**	Abul hashem	Male	37		Daily wage laborer (Non-agri)	30,000-50,000	Homestead Land	Owner
Nawabganj; Joykrishnapur; Balanga	**Abdul hashem munshi**	Lotim munsi	Male	60		Daily wage laborer (Non-agri)	1,00,000-1,80,000	Homestead Structure	Owner
Nawabganj; Joykrishnapur; Balanga	**Abdul monnaf**	Latif munshi	Male	65	2616261460955	Unemployed/dependent/children	30,000-50,000	Homestead Structure	Owner
Nawabganj; Joykrishnapur; Balanga	**Abdur Razzak**	Sheikh Barek	Male	60	2616261460191	Construction worker	1,00,000-1,80,000	Homestead Structure	Owner
Nawabganj; Joykrishnapur; Balanga	**Aslam bissas**	Mainuddin bissas	Male	56	2616261460270	Daily wage laborer (Non-agri)	1,00,000-1,80,000	Homestead Structure	Owner
Nawabganj; Joykrishnapur; Balanga	**Idris Ali**	Habibur Rahman	Male	60	2616261460813	Construction worker	1,00,000-1,80,000	Agricultural	Business
								Homestead Land	Owner
Nawabganj; Joykrishnapur; Balanga	**Jaynal bishass**	Jomsher Ali bishass	Male	82	2616261460711	Cultivation in owned land	0-30,000	Homestead Structure	Owner
Nawabganj; Joykrishnapur; Balanga	**Joinuddin bepari**		Male	70		Unemployed/dependent/children	0-30,000	Homestead Structure	Owner
Nawabganj; Joykrishnapur; Balanga	**Laili begum**		Female	60		Beggar	0-30,000	Homestead Structure	Owner

Location	HH Head Name	Father/ Husband Name	Gender	Age	National Card No.	Occupation	Annual Income	Land Use	Ownership
Nawabganj; Joykrishnapur; Balanga	Md jamir molla	Moslem molla	Male	38	260277460870	Poultry rearing	1,00,000-1,80,000	Homestead Structure	Owner
Nawabganj; Joykrishnapur; Balanga	Md. Raja	Abdul Barek	Male	40	2616261460188	Construction worker	1,00,000-1,80,000	Homestead Structure	Owner
Nawabganj; Joykrishnapur; Balanga	Mobarok Molla	Fazal Molla	Male	30		Migrant Worker	50,000-1,00,000	Homestead Structure	Owner
Nawabganj; Joykrishnapur; Balanga	Mohammad ayub ali	Abul kalam	Male	43	2616261460169	Vendor	>1,80,000	Homestead Structure	Owner
Nawabganj; Joykrishnapur; Balanga	Mohammad shafiuddim	Habibur rahmam munshi	Male	50		Construction worker	1,00,000-1,80,000	Agricultural	Business
								Homestead Structure	Owner
Nawabganj; Joykrishnapur; Balanga	Mohiuddin molla	Shahed molla	Male	40		Vendor	50,000-1,00,000	Homestead Structure	Owner
Nawabganj; Joykrishnapur; Balanga	Monir hossen	Abul kalam	Male	60		Unknown	50,000-1,00,000		Owner
Nawabganj; Joykrishnapur; Balanga	Monju ara begum	Shaik fajal	Female	33		Migrant Worker	50,000-1,00,000	Homestead Structure	Owner
Nawabganj; Joykrishnapur; Balanga	Nur Islam	Sheikh Ansar	Male	28	2616261460974	Daily wage laborer (Non-agri)	1,00,000-1,80,000	Homestead Structure	Owner
Nawabganj; Joykrishnapur; Balanga	Nurul Islam	Fazal Molla	Male	42		Salaried person in govt/private	1,00,000-1,80,000	Homestead Structure	Owner
Nawabganj; Joykrishnapur; Balanga	Renu begum	Phaku pal	Female	41	261626460832	Housewife	0-30,000	Homestead Structure	Owner
Nawabganj; Joykrishnapur; Balanga	Rohima begum	Mohammad chakura	Female	61	2616261460716	Housewife	>1,80,000	Homestead Structure	Owner
Nawabganj; Joykrishnapur; Balanga	Romjan bapari	Moinuddin bapari	Male	60		Cultivation in owned land	50,000-1,00,000	Dairy-Livestock Farm	Business
								Homestead Structure	Owner
Nawabganj; Joykrishnapur; Balanga	Romjan bisshash	Mainuddin bisshash	Male	45		Migrant Worker	>1,80,000	Homestead Structure	Owner
Nawabganj; Joykrishnapur; Balanga	Sahajuddin bishass	Johuruddin bishass	Male	80	2616261460262	Unemployed/dependent/children	0-30,000	Agricultural	Business
								Agriculture	Owner
								Homestead Structure	Owner
Nawabganj; Joykrishnapur; Balanga	Samad Bissas	Jolil Bissas	Male	65	2616261460278	Petty trader	1,00,000-1,80,000	Homestead Structure	Owner
Nawabganj; Joykrishnapur; Balanga	Samad Mollah	Gendu Mollah	Male	60	1974261626100	Cultivation in owned land	1,00,000-1,80,000	Homestead Land	Owner
Nawabganj; Joykrishnapur; Balanga	Selina begum	Abdul samad	Female	34	2616261460196	Unknown	0-30,000	Homestead Structure	Owner
Nawabganj; Joykrishnapur; Balanga	Shake kafil uddin	Shake nayan	Male	79	2616261460192	Unemployed/dependent/children	30,000-50,000	Homestead Structure	Owner
Nawabganj; Joykrishnapur; Balanga	Sheikh alamgir	Sheikh shakibuddi	Male	44	2616261460924	Rickshaw/Rickshaw van driver	1,00,000-1,80,000		Owner
Nawabganj; Joykrishnapur; Balanga	Sheikh Billal	Sheikh Noyon	Male	65	2616261460183	Unemployed/dependent/children	1,00,000-1,80,000	Homestead Land	Owner
Nawabganj; Joykrishnapur; Balanga	Sheikh Ershad	Sheikh Irfan	Male	55	2616261460186	Rickshaw/Rickshaw van driver	1,00,000-1,80,000	Homestead Structure	Owner
Nawabganj; Joykrishnapur; Balanga	Sheikh farid	Sheikh kofil uddin	Male	35	2616261460195		1,00,000-1,80,000	Homestead Structure	Owner

Location	HH Head Name	Father/ Husband Name	Gender	Age	National Card No.	Occupation	Annual Income	Land Use	Ownership
Nawabganj; Joykrishnapur; Balanga	**Sheikh hanif**	Sheikh ekramuddin	Male	39		Bamboo seller	>1,80,000	Homestead Structure	Owner
Nawabganj; Joykrishnapur; Balanga	**Sheikh ibrahim**	Sheikh tufajuddin	Male	65		Cultivation in owned land	50,000-1,00,000	Dairy-Livestock Farm	Business
								Homestead Structure	Owner
Nawabganj; Joykrishnapur; Balanga	**Sheikh Raton**	Sheikh Ansar	Male	29		Daily wage laborer (Non-agri)	1,00,000-1,80,000	Homestead Structure	Owner
Nawabganj; Joykrishnapur; Balanga	**Sheikh Shoizzudin**	Sheikh jolil	Female	59	2616261460975	Daily wage laborer (Non-agri)	50,000-1,00,000	Agricultural	Business
								Homestead Structure	Owner
Nawabganj; Joykrishnapur; Balanga	**Shekh habul**	Shekh rifajuddin	Male	40	2616261460706		50,000-1,00,000	Dairy-Livestock Farm	Business
								Homestead Structure	Owner
Nawabganj; Joykrishnapur; Balanga	**Ukil uddin bisshas**	Mainuddin bisshas	Male	60		Unemployed/dependent/children	>1,80,000	Homestead Structure	Owner
Nawabganj; Joykrishnapur; Kantartek	**Abdul Aziz**	Nowab Ali	Male	70		Petty trader	50,000-1,00,000	Homestead Structure	Owner
Nawabganj; Joykrishnapur; Kantartek	**Abdul Khaleq**	sheikh Jolil	Female	69	2616261460883		50,000-1,00,000		Owner
Nawabganj; Joykrishnapur; Kantartek	**Goldman Mostofa**	Abdul Shukur	Male	65	2616274331446	Tailoring	1,00,000-1,80,000	Homestead Land	Owner
Nawabganj; Joykrishnapur; Kantartek	**hamid mollah**	Anis molla	Male	59		Unemployed/dependent/children	0-30,000		Owner
Nawabganj; Joykrishnapur; Kantartek	**Md badshah khan**	Md nosuruddin khan	Male	51	2616261552553	Electrician	1,00,000-1,80,000	Homestead Structure	Owner
Nawabganj; Joykrishnapur; Kantartek	**Md. Anowar hossain**	Faroj ali	Male	45	2616261552586	Cultivation in owned land	50,000-1,00,000	Dairy-Livestock Farm	Business
								Homestead Structure	Owner
Nawabganj; Joykrishnapur; Kantartek	**Md. Motion Khan**	Nuru Khan	Male	40	2695435086448	Petty trader	>1,80,000	Homestead Structure	Owner
Nawabganj; Joykrishnapur; Kantartek	**Md. parves Ali Dawon**	Abbas Ali Dawon	Male	48	2616261552643	Vendor	50,000-1,00,000	Agricultural	Business
								Homestead Structure	Owner
Nawabganj; Joykrishnapur; Kantartek	**Md. Wasek Khan**	Aleb Khan	Male	45		Daily wage laborer (Agri)	50,000-1,00,000	Homestead Structure	Owner
Nawabganj; Joykrishnapur; Kantartek	**Minu Ara begum**		Female	40	1965261626100		0-30,000	Homestead Structure	Owner
Nawabganj; Joykrishnapur; Kantartek	**mohammad ahsan molla**	Noimuddin molla	Male	54	2611863478219	Share cropping	1,00,000-1,80,000	Dairy-Livestock Farm	Business
Nawabganj; Joykrishnapur; Kantartek	**mosharraf**	Nosiruddin kha	Male	40			50,000-1,00,000	Homestead Structure	Owner
Nawabganj; Joykrishnapur; Kantartek	**Searjon khan**	Hossain khan	Male	56	2616261552645	Unknown	0-30,000	Homestead Structure	Owner
Nawabganj; Joykrishnapur; Kantartek	**shahid khan**	Jani kha	Male	48		Daily wage laborer (Agri)	50,000-1,00,000	Homestead Structure	Owner
Nawabganj; Joykrishnapur; Kantartek	**Sheikh Abdul Jabbar**	Sheikh Rohom Ali	Male	48	2611863480642	Daily wage laborer (Agri)	50,000-1,00,000	Homestead Structure	Owner
Nawabganj; Joykrishnapur; Kantartek	**Sheikh Masum**	Sheikh Toijuddin	Male	48		Petty trader	50,000-1,00,000	Homestead Structure	Owner

Location	HH Head Name	Father/ Husband Name	Gender	Age	National Card No.	Occupation	Annual Income	Land Use	Ownership
Nawabganj; Joykrishnapur; Kantartek	**Sheikh motalab**	Sheikh Rahamat ali	Male	5177	2616261552538	Daily wage laborer (Non-agri)	0-30,000	Homestead Structure	Owner

Consultant's Report

Flood and Riverbank Erosion Risk Management

Investment Program

A 2.3 RESETTLEMENT PLAN

SHAHJADPUR

April 2019

Prepared by

Institutional Strengthening and Project Management Consultant (ISPMC)

Joint Venture of Northwest Hydraulic Consultants Ltd. and Euroconsult Mott MacDonald Ltd. in association with Deltares, Resource Planning and Management Consultants and CEGIS

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDIXS

ACRONYMS

AC	-	Assistant Commissioner
AE	-	Assistant Engineer
A&M	-	Adaptation and Maintenance
AD	-	Alluvial and Diluvial
ADB	-	Asian Development Bank
ADC	-	Additional Deputy Commissioner
ADP		Annual Development Plan (budgetary plan from 1st July to 30 June)
AH		Affected Household
AIFRERMIP		Assam Integrated Flood and Riverbank Erosion Risk Management Investment Project
AP	-	Affected Persons
BAN	-	Bangladesh
BDT	-	Taka (currency of Bangladesh)
BRE	-	Brahmaputra Right Embankment
BWDB	-	Bangladesh Water Development Board
CbFRM	-	Community-based Flood Risk Management
CCL	-	Cash Compensation under Law
CDMP	-	Comprehensive Disaster Management Program
CDMU	-	Community Disaster Management Unit
CDP	-	Capacity Development Plan
CEGIS	-	Centre for Environmental and Geographic Information Services
CPR	-	Common Property Resources
CMP		Current Market price
CRO-RU	-	Chief Resettlement Officer-Resettlement Unit
CSC	-	Construction Supervision Consultant
CSS	-	Census & Socio-Economic Survey
C/S	-	Country Side
DC	-	Deputy Commissioner
DD	-	Detailed Design (Team)
DD	-	Deputy Director
DDM	-	Department of Disaster Management
DPs	-	Displaced Persons same as AP/Affected Persons
DPP	-	Development Project Proforma
EA	-	Executing Agency
EARP	-	Environmental Assessment And Review Procedure.
EIA	-	Environmental Impact Assessment
EMB	-	Embankment
EMP	-	Environmental Management Plan
EP	-	Entitled Persons
FGD	-	Focus Group Discussions
FHH		Female Headed Households
FRERMIP		Flood and Riverbank Erosion Management Investment Program
FS	-	Feasibility Study
GAP	-	Gender Action Plan
GIS	-	Geographic Information System
GOB	-	Government of Bangladesh
GRC	-	Grievances Redress Committee
HRD	-	Human Resources Development
ID	-	Identity Card
IGA	-	Income generating Activities
ILRP	-	Income and Livelihood Restoration Program
INGO	-	Implementing NGO
IOL	-	Inventory of Losses
IR	-	Involuntary Resettlement

IWRM	-	Integrated Water Resources Management
JMREMP	-	Jamuna-Meghna River Erosion Mitigation Project
JLB	-	Jamuna Left Bank
JRB	-	Jamuna Right Bank
JVT	-	Joint Verification Team
LA	-	Land Acquisition
LAP	-	Land Acquisition Plan
LAR	-	Land Acquisition and Resettlement
LGI	-	Local Government Institutions
LGED	-	Local Government Engineering Department
M&E	-	Monitoring and Evaluation
MFF	-	Multi-tranche Financing Facility
MIS	-	Management Information System
MLB	-	Meghna Left Bank
MRB	-	Meghna Right Bank
MOWR	-	Ministry of Water Resources
MRP	-	Main River Flood and Bank Erosion Risk Management Program (ADB TA 8054-BAN)
NHC	-	Northwest Hydraulic Consultants Ltd.
NGO	-	Non-Government Organization
O&M	-	Operations and Maintenance
OE	-	Old Embankment
PCR	-	Physical Cultural Resources
PD	-	Project Director
PLB	-	Padma Left Bank
PMO	-	Project Management Office
POE	-	Panel of Experts
PPTA	-	Project Preparatory Technical Assistance
PRA	-	Participatory Rapid Appraisal

Currency unit	-	taka (Tk)
Tk1.00	=	$0.01199
$1.00	=	Tk 82.765

GLOSSARY

Agricultural laborer	A person who earns his/her livelihood mainly from manual labor engaged in agriculture practices. The non-agricultural laborer includes artisans and other occupational groups such as masons, potters, cobblers, barbers, etc.
Assistance/Compensation	Compensation for lost assets refers to legal compensation provided through the Land Acquisition section of the Deputy Commissioner's office. Assistance refers to resettlement assistance extended in cash and/or kind over and above the compensation under law as per independent assessment of replacement price of land and physical assets concurred by a Property Valuation Advisory Team (PVAT).
Char	A river island that is vegetated or barren and situated either in the river, surrounded by channels, or at the bank where it is called attached char.
Community Participation and Consultation	The active process of sharing information seeking inputs from community about the project, seeking community-wide inputs, and integrating those in the project design as well planning mitigation measures.
Compensation	Payment in cash or kind (for example land-for-land) to the APs as per LA Act.
Cut-off Dates	Date of notification under Section 3 of 1982 Ordinance is the cut-off date for title owners. The end date of the Census will be considered cut-off date for all others, including non-title holders for resettlement benefits. In this project, the end date of the survey is December, 2017.
Displaced Persons (DPs)	In the context of involuntary resettlement, displaced persons are those who are physically displaced (relocation, loss of residential land, or loss of shelter) and/or economically displaced (loss of land, assets, access to assets, income sources, or means of livelihoods) as a result of (i) involuntary acquisition of land, or (ii) involuntary restrictions on land use or on access to legally designated parks and protected areas. (ADB's SPS 2009 "Persons affected directly or indirectly by project-induced changes in use of land, water, or other natural resources are called APs. In other words, a person who as a consequence of the changes sustains (a) damages by reason of severing land, or (b) loss of immovable property in any manner, or (c) experience loss of income and livelihood. Such impacts may be temporary or permanent in nature and most often occurs through land expropriation using eminent domain or direct purchases for development projects
Entitled Persons (EPs)	EP is an administrative term for designating benefits for affected persons. There are two types of EP: Direct EPs, who are EPs by virtue of legally recognized entitlements; and Indirect EPs, who are EPs by virtue of socially recognized entitlements, as per ADB Policy and legally agreed between the ADB and GOB through the Loan Agreement. The

	Direct EPs are the Titleholders recognized by the DC and confirmed through payment of Cash Compensation under Law (CCL). The Direct EPs are identified as per the Final Award information prepared by the DC upon payment of CCL. The list of the Direct EPs will be updated over time, with payment of the CCL. The Indirect EPs are those without legal title to ROW land and/or structures but who were living and/or earning their livelihood within the ROW, and are entitled to Resettlement Benefits under the RP provisions. The INGO is responsible for all groundwork and verification for identification of EPs.
Eminent Domain	Regulatory authority of the government to obtain land for public purpose use and/or private sector development projects under the 1982 Ordinance or other laws of the land.
Entitled Person (EP)	An entitled person (EP) is one who has lost his/her assets or income directly/indirectly due to the Project intervention and is eligible to receive compensation from the DC office and/or cash grant from BWDB
Entitlements	Range of measures comprising of compensation resettlement benefits, including shifting allowance, subsistence, and relocation which a DP is entitled to, depending on the nature of losses, to restore and/or improve the living standards.
Erosion	Displacement of soil particles due to water or wind action.
Female–headed household	Households where a woman decides on the access to and the use of the resources of the family. In resettlement context, women-headed households and/or widows also suffer from lack of labor for relocation purposes.
Floodplain	A nearly flat, alluvial low land bordering a stream that is subject to frequent inundation by floods.
Gender Equity	Equal recognition of both genders in the provision of entitlements, treatment and other measures under the Resettlement Plan
Geobag	Sand-filled geotextile bags used for the construction of riverbank protection, commonly revetments under water.
Head of Household	One who makes major decisions within the family structure and generally lead the family as the principal provider.
Household	A household includes all persons living and eating together (sharing the same kitchen and cooking food together as a single-family unit)
Host population	Community residing in or near the area to which affected people are to be relocated. Host communities should also be project beneficiaries for better host-resettlers integration.
Indirectly affected people	Indirectly affected people are those likely to lose subsistence or income due to project intervention without loss of any physical assets. A clear definition of indirectly affected people must be based on a careful review and assessment of indirect impacts of the project.
Migration	Change in position of a channel by lateral erosion of one bank and simultaneous accretion of the opposite bank.

Overbank flow	Water movement that overtops the bank either due to stream stage or to overland surface water runoff.
Person(s) having usufruct rights	The right to use land belonging to others – for example, lease from government department or agency or individuals.
Project-Affected Area	An area under the project, declared by the Government, where land is being acquired under Acquisition and Requisition of Immovable Property Ordinance – II of 1982 or any other Act in force or an area not acquired, but affected by the project and its related activities.
Public Disclosure	Process of disclosing and sharing project impacts with affected people and disseminating amongst them information on their entitlements, compensation, R&R measures and project timeline etc.
Rehabilitation	Re-establishing incomes, livelihoods, living and social systems.
Relocation	Rebuilding housing, assets including productive land and public infrastructure, in a new location.
Replacement Cost (RC)	The costs of replacing lost assets (e.g., land, houses/structures, trees and crops) and income, including cost of transaction. (Historically, in Bangladesh involuntary resettlement policy usage, also referred as Replacement Value, or RV)
Resettlement and Rehabilitation (R&R)	Resettlement refers to rebuilding housing, assets, including productive land and public infrastructure in another location while rehabilitation means restoration of income, livelihoods, and re-establishment of sociocultural system.
Resettlement Plan (RP)	A time bound action plan with budget setting out resettlement impact strategy, objectives, entitlement, actions, implementation responsibilities, monitoring and evaluation.
Retired Embankment	An embankment line that is built some distance behind an existing embankment, which is eroded or at the risk of erosion
Right-of-Way	Demarcated land proposed forinfrastructure development
Riverbank Protection	Engineering works for the purpose of protecting streambanks from erosion.
Social Preparation	The process of consultation with affected people, undertaken before key resettlement decisions are made, to build their capacity to deal with resettlement.
Slope (of channel or stream)	Fall per unit length along the channel centerline or thalweg.
Slope protection	Any measure such as riprap, paving, vegetation, revetment, brush or other material intended to protect a slope from erosion, slipping or caving, or to withstand external hydraulic pressure.
Uthuli (also called Nodibashi)	People displaced by flood /erosion, who live on land provided by neighbor or relative free of cost
Vulnerable Person	For this Project, vulnerable groups are defined as dPs who suffer more - economically and socially - from relocation than other affected population. Based on past experiences from similar projects, the vulnerable groups include (i) women-headed HHs; (ii) landless HHs (those without agricultural land, and depend largely on wage labor for

	survival); (iii) disabled HHs heads (iv) Household with family members affected by chronic disease such as TB, asthma, cance etc.) and (v) HHs having residual agricultural land less than 1 acre or losing more than 10% of their income from agriculture due to acquisition.
Project Affected Communities /Host Villages	Project-affected communities are local villages, markets or townships that may be affected by Project impacts such as loss/dislocation/capacity inadequacy of common property resources, school, mosques etc. Host communities are recipients where APs are to be relocated.
Relocation/Resettlement	Relocation refers to physically moving of the APs from the affected area to a new area/site and rebuilding homes, assets, including productive land/employment while resettlement means re-establishing income, livelihoods, living and social system.
Replacement Land	Those affected by the RoW alignment will receive alternative land, if available, or cash compensation at the replacement price. NGO will assess the market value of land to determine the Maximum Allowable Replacement Value (MARV) and be approved by PVAT.
Structures - Houses and Commercial Enterprises	All structures affected by Project acquisition -- living quarters, community infrastructures/roadside shops/businesses -- will be compensated for.

CURRENCY EQUIVALENTS

(as of 10 March 2018)

Currency unit	-	taka (Tk)
Tk1.00	=	$0.01196
$1.00	=	Tk82.745

WEIGHTS AND MEASURES:

1 ha	= 2.47 acre
1 ha	= 10,000 m2
1 acre	= 100 decimal
1 m	= 3.28 ft
1 m2	= 10.76 sft

EXECUTIVE SUMMARY

Project Overview	The Bangladesh Water Development Board (BWDB) is conducting the Flood and Riverbank Erosion Risk Management Investment Program (FRERMIP) covering parts of the main rivers in Bangladesh. The Asian Development Bank (ADB) and the Government of the Bangladesh are financing the project. The FRERMIP will cover the main rivers from Bangabandhu (Jamuna) Bridge and the proposed Ganges Barrage to Chandpur, as such covering around 60 km of the Jamuna, around 20 km of the Ganges, and the whole around 100 km long Padma reach. The FERMIP identified sub-reaches with similar river and flood plain characteristics as practical subproject areas. Each sub-reach consists of several upazilas, which facilitates the data collection. In total 14 sub-reaches were identified: two each at the Jamuna Right and Left Bank (JRB, JLB), 3 along the Padma Right and Left Bank (PRB, PLB), one at the Meghna Right Bank (MRB), and two along the Meghna Left Bank (MLB). The PPTA feasibility study covered the priority investment during the first Tranche and this is revised version for tranche-2. FRERMIP is a multi-tranche financing facility (MFF)[36] with the Bangladesh Water Development Board (BWDB) as the Executing Agency (EA) and the Department of Disaster Management (DDM) as Implementing Agency (IA) for community-based flood risk management measures. The program is implemented in three tranches: Tranche 1 (2014-2018), Tranche 2 (2018-2020) and Tranche 3 (2020-2023). FRERMIP outputs are (i) strengthening the flood and riverbank erosion management system, and (ii) establishing, at priority erosion sites, sustainable, integrated non-structural and structural risk management measures. The ADB MFF provides a loaned amount[37] of approximately $ 250 million; further financing of the program is provided by the Government of Bangladesh ($ 85 million) and the Netherlands Government ($ 15 million), bringing the total program costs at a $ 350 million.

[36] The MFF FRERMIP consists of three individual loans, however systematically developing phases (called tranches in ADB's terminology) of interventions at three priority sites along the Lower Jamuna and Upper Padma Rivers. The cascading loans are packaged into a Program with a duration of 9 years, while the three tranches (phases) overlap and are scheduled for typically 4-years duration. Each tranche or loan is called Project with interventions at different Sub-project sites.

[37] Quoted from EIA for Tranche 2

Tranche-2 JRB-1 Components

Among the priority projects planned for tranche 2, the construction of the embankment in Shahjadpur from JRB-1 subproject is a major item in terms of land acquisition and resettlement. This RP will identify the impacts and the cost.

Work Item	Scope of Works	Remarks
JRB-1 – priority sub-project (Jamuna Right Bank		
Shahzadpur embankment	7.7km realignment along the Hurasagar and Bengali River	The embankment will be completed as per the P achieve the full benefits of this sub-project. LG expected to build the road rather than BWDB wl additional river stabilization works to be carried
Fish passes	1 at the Hurashagar River	Additional to the PPTA
River protection	4km new works for the Enayetpur – Kaijuri reach	The originally planned works of 12km length will on the central char and the opposite bank (JLB-2 change in river morphology and therefore the er location
JLB-2 – priority subproject (Jamuna Left Bank)		
River training	12 km bifurcation stabilization upstream and downstream (5km full revetment, 7km emergency type revetment)	Bifurcation stability for both downstream chann First riverbank protection works will be placed o central char, protecting some of the char land ag erosion for the first time and stabilizing the east branch at Chauhali. The combined works are expected to increase th of the downstream channels, improve navigatio reduce future adaptation and maintenance work Adjusted PPTA approach due to morphological development.
Flow redistribution and char land development	Channel development and choking the bankline channel downstream of Chauhali through dredging. Katkin and vetiver plantation to build up and develop the charland	Approximately 6,000 ha of lost floodplain land to recovered. Potential to free some 15km of bankline along th channels from riverbank erosion. Adjusted PPTA approach to account for changed situation and incorporate “building with nature”

The River Bank Protection (RBP) will be constructed in Tranche-2, but the changing morphology of J Padma Rivers after two flood seasons before construction can start mean that the configuration of the RBPs will be considerably different by the time of

[38] PPTA = Project Preparatory Technical Assistance or Feasibility Study 2012/13

	the FRERMIP Tranche-2 bank protection implementation. Therefore, for budget purposes, the 1 Km unit costs of the right bank RBPs will be estimated from average costs of the Tranche-1. Early in implementation, the construction supervision consultant (CSC) for ADB's approval will draft new sub-project RPs before construction will commence, following the project's updated Resettlement Framework (RF),
Measures to Minimize Impacts	All necessary efforts have been made in order to minimize Project impacts on assets and avoid disruption of livelihoods as far as possible. Extensive consultations have been conducted with the affected communities and people along the Padma Left Bank proposed Embankment to take in their views and concerns and incorporate the same in the proposed alignment, as far as possible. Numbers of changes in the alignment of the embankment have been made to avoid social, religious and academic structures. In these cases, the local people were consulted and design changes made accordingly as well as survey done in new alignment in Harirampur side. **View of the Shahjadpur embankment alignment**

The embankment will be built along the Hurasagar and Bengali River in one District (Sirajganj), 1 Upazila, and crossing 3 Unions and 12 villages.

Socio-economic Profile of the Affected Population	In the Tranche-2, the extension of Kaijuri Embankment (EMB) in Shahjadpur at PLB-1, affected households (AHs) losing structures were found on the alignment. The 366 AHs surveyed in the EMB area comprise a 1944 population, 987 (52%) of which are male and 957 (48%) are female. Among the 366 affected Households, 21 are Female Headed Households (FHH) and 14 out of them are housewife. Among the 366 affected HHs, 126-HHs are poor and among poor 17 HHs are vulnerable (FHHs, Disabled, low income, Government support). The average size of the AHs is 4.51 in the 12 villages surveyed. The primary occupation of majority of the affected household heads are daily wage earners for agriculture and others. The level of education is low among the affected head of the households. For male only 35 out of 366 (10%) studied above grade 10 and only 87 ((21%) studied grade 5 and above including 2 females. The illiterate rate is about 60% and above and more for women. The level of income was collected from all the affected households while yearly income below TK 50,000 considered as poor HH and yearly income below TK 30,000 considered as vulnerable HH. In this way 126 HHs are vulnerable and 11 HHs are more vulnerable being widow, handicaped; and women headed household. No indigenous people (IP) are living in the EMB area. The gender status, impacts and issues will be further specifically analyzed and documented in a Gender Action Plan (GAP).

Resettlement Impacts of the Tranche-2 PLB-1 Components	The Tranche-2 impacts are based on the findings of the household socio-economic field survey on the alignment of the proposed embankment in December 2017. The information collected during the survey was used for preparing the initial budget. For the full length of embankment as per proposed design, about 36 ha of land will be acquired, which includes homestead, agriculture, commercial land (including some areas that overlaps with an old existing embankment. Along the new embankment and within the ROW 1-fish passe is going to be built that will have marginal impacts on the land estimated for the embankment. The land to be acquired will be distributed in 1 district (Sirajganj), 1 Upazila (Shahjadpur) and 3 Unions (Habibuli, Potalia, Rupabati). It will affect 366 households and a total population of 1944 in the settlement areas. Average family size is 5.3. The impact on structures will concern 1333 entities (including different type of residences, kitchen, latrine, animal sheds, TW, and others) and a total floor area is area of 229019 sft. From the total structure area affected 149 HH will have their business structures affected over an area of 19383 sft The inventory of the various trees will be affected which are: total of 7048 including 1008 samplings, 131 small trees, 603 small trees and 5306 fully grown tress. From the total 2066 are fruit tress, 2395 are timber tress and the rest are groves, medicinal, vegetable (sajna) The number of plots to be affected for each mouza maps and area affected will be provided in the Land Acquisition Plan (Annex Vii). The number of agricultural plots users to be affected is yet to be finalized on the basis of the Land acquisition plan submission to land registry department for identifying the plot owners. In addition another agricultural plot users survey in the agriculture land affected will be launched and likely have a minor impact of the budget with some additional crop compensation. It needs to be noted that proposed alignment of embankment has been modified several times to minimize the impacts in the settlement areas and wherever possible avoided religious/educational institutions and common properties affected. Although field enumarators visited several times during survey to make sure that all affected people are met while some absentee landowners were not available. So those in some cases partial information are recorded. Before implementation further survey will be done to get accurate and current (change from now if any) data and RP will be updated accordingly.

Consultations, Disclosure and Participation	The public consultation process in the project area began in December 2017, as part of the first pre-feasibility study all along the full project. Public Consultation Meetings (PCMs) and Focus Group Discussions (FGDs) were carried out to limited extent during surveys and provided the affected households opportunities to express their concerns about land acquisition, compensation and resettlement. At the detailed design (DD) stage, RPs for the core Tranche-2 subproject(s) will be prepared, updated and implemented in close consultation with the stakeholders and will further involve focus group discussions (FGDs) and meetings, particularly with the affected households. The summary of the RPs will be disclosed on the ADB's website, and the consultation will continue throughout the project implementation period. An information booklet in English (Annex V) has already been designed for approval of the Government for distribution (after translation into bangla) among the DPs as the primary tool for disclosure.
Grievance Redress Mechanism	A project level GRC will be composed with two representatives from BWDB, concerned Union Parishad Chairman, and a representative from DPs. The GRC will be meeting all DPs who have grievances informally as well as formally to ensure speedy and out of court settlement as many disputes as possible. Irrespective of the GRC decisions, an aggrieved person will be free to access the country's legal system at any stage of the grievance redress mechanism.
Legal and Policy Framework	The principal legal instrument governing land acquisition in Bangladesh is the Acquisition and Requisition of Immovable Property Ordinance-II (1982). The amendments of the Ordinance-II subsequently held in 1989/93/94 and lastly held in recent times in September 2017. In addition 'other land laws' and 'administrative manuals relevant to allusion/delusion land' 'char and khas land administration' of Bangladesh will be considered. The 1982 Ordinance requires that compensation be paid for (i) land and assets permanently acquired (including standing crops, trees, houses); and (ii) any other damages caused by such acquisition. The act has no provisions for resettlement of the affected households/businesses or any assistance for restoration of livelihoods of the affected persons. However the ADB has its own integrated "Safeguard Policy Statement of 2009" (SPS-2009) to minimize displacement and require time-bound action plans with measures to restore or improve livelihood and income of those affected by development projects. Since the 1982 Ordinance falls short of the requirements of the ADB's safeguard policies on many grounds, the project's "Resettlement Framework" has been harmonized with ADB's SPS. However, very recently (on September 2017) Government of Bangladesh has gazetted a new law about "Acquisition and Requisition of Immovable Property Ordinance" (ARIPO) in Bangla and the changes have been considered in the cost estimate; which may need further review during updating of the RP.

Income and Livelihood Restoration Program (ILRP)	The FRERMIP recognizes diminishing income and dislocation of livelihoods during and after relocation of DPs. As a result, in addition to providing compensation and resettlement benefits, appropriate supporting measures will be included for income and livelihood restoration of DPs. DPs will be given preferences for project-related employment whenever possible. BWDB will make provision in the contract with the contractors for employment of DPs (with ID cards) or their dependents and women on a priority basis, provided. The sub-reach RPs will budget an Income and Livelihood Restoration Program (ILRP) particularly targeting the poor and the vulnerable groups, including poor female-headed households. The ILRP will include human resource development and occupational skill development trainings and subsequent credit support for undertaking suitable business. The main objective of the ILRP will be to improve or, at least restore, the income and livelihood of all DPs.
Institutional Arrangements for RP Implementation	BWDB is the owner and executing agency (EA) of the Project. For execution of the project, a Project Management Office (PMO) headed by a Project Director (PD) has been set up within BWDB. All concerned BWDB field division offices headed by Exeutive Engineer have been set up within BWDB as Sub-project Management Office (SMO) and concerned SMO has updated relevant RP before starting implementation work. A Resettlement Unit (RU) has been established within the PMO headed by Chief Resettlement Officer (CRO) and an Implementing NGO (INGO) for resettlement work wil be appointed by the PMO. The RU is responsible for implementation of the RPs that includes disbursement of compensation through DC; and distribution of resettlement benefit through its own staff with the assistance of SMOs and INGO. All concerned BWDB field divisions will update their RP before starting implementation work. The RU is also responsible for implementation of an Income and Livelihood Restoration Program (ILRP) with the support of a NGO. This project has a Gender Action Plan (GAP) and a national Livelihood Development NGO (LD-NGO) that would be recruited to help implementation of ILRP during and after resettlement of the DPs.

Implementation Schedule

A time-bound implementation schedule for the RP will be prepared in accordance with the project construction schedule. The overall schedule of implementation is based on the principle that people affected by the project are paid their due resettlement benefits prior to displacement. The INGO will assist the DPs in the process of relocation and resettlement. Individual entitlements (resettlement benefits as per ADB policy and agreed entitlement matrix outside CCL) on a household basis will be processed by the NGO. Each DP will receive an ID card and an entitlement card. The ID card will be issued by BWDB to the DPs as identified during JVS with joint signature of the BWDB representative and Field Coordinator of the Implementing NGO. Photograph of the EPs will be attested by the concerned UP Chairman and pasted on the ID card.

The total RP implementation period is estimated over a period of 3 years. The Implementing NGO contract will be awarded at least 9 months before starting construction work so that they can update RP and arrange payment of compensation/resettlement benefits phase by phase to the DPs prior to displacement. Implementation of RP will continue during construction (3 years) and 3 months after construction work for entertaining claims/grievances of the EPs regarding payment of compensation and other resettlement benefits. However, some of the activities for the RP implementation may extend further. The preliminary time bound implementation schedule is placed in the Table below.

Table of Implementation schedule: (to be updated)

Sl No.	Land Acquisition & Resettlement Activities	Start Date	Completion Date
1.	Contracting & Orientation of INGO	Jan 01, 2019	Jan 31, 2019
2.	Information Campaign	Feb 01, 2019	Mar 31, 2019
3	Consultation and focused group discussion	Feb 01, 2019	Mar 31, 2019
4.	Formation of Committees by MOWR	Mar 01, 2019	Mar 31, 2019
5.	Design/Development of RP Implementation Tools	Feb 01, 2018	Feb 28, 2018
6.	Joint Verification Survey by JVT	Feb 01, 2019	July 31, 2019
7.	Property Valuation Survey and determination of unit rate by PVAT	Mar 01, 2019	Mar 31, 2019
8.	Data Processing and Determination of Individual Entitlements	Oct 01, 2019	Dec 31, 2019
9.	Preparation & Submission of Resettlement Budget and individual entitlement to BWDB	Nov 01, 2019	Dec 31, 2019
10.	Approval of Resettlement Budget by BWDB	Jan 01, 2020	Feb 15, 2020

	11.	Payment of compensation/resettlement benefits to DPs by BWDB	Feb 01, 2020	Dec 31, 2020
	12.	Redress of Grievances	Dec 01, 2019	June 30, 2021
	13.	Payment of other Resettlement benefits based on GRC decision	Jan 01, 2020	Dec 31, 2021
	14.	Training and Income Generation Programs	Apr 01, 2019	Dec 31, 2020
	15.	Submission of project completion report	Dec 01, 2021	Dec 31, 2021
	16.	Monitoring and Evaluation	Jan 01, 2019	Dec 31, 2021

Resettlement and self-relocation

Land acquisition impacting the livelihood of DPs has been avoided as much as possible and the affected HHs has opted for self-relocation with the cash compensation. But there is a need of some land acquisition for access roads that will be a short as possible. For self-relocation, BWDB will assist as far as feasible (depending on location) raising individual plots with sand dredging, a common technique in Bangladesh for re-claiming, low-lying flooded lands.

Land Acquisition and Resettlement Costs

The total budget for the Tranche-2 JRB-1 sub-reach resettlement is Tk. 834,395,757 or about US$ 10.2 millions, including +- 10 percent contingency.

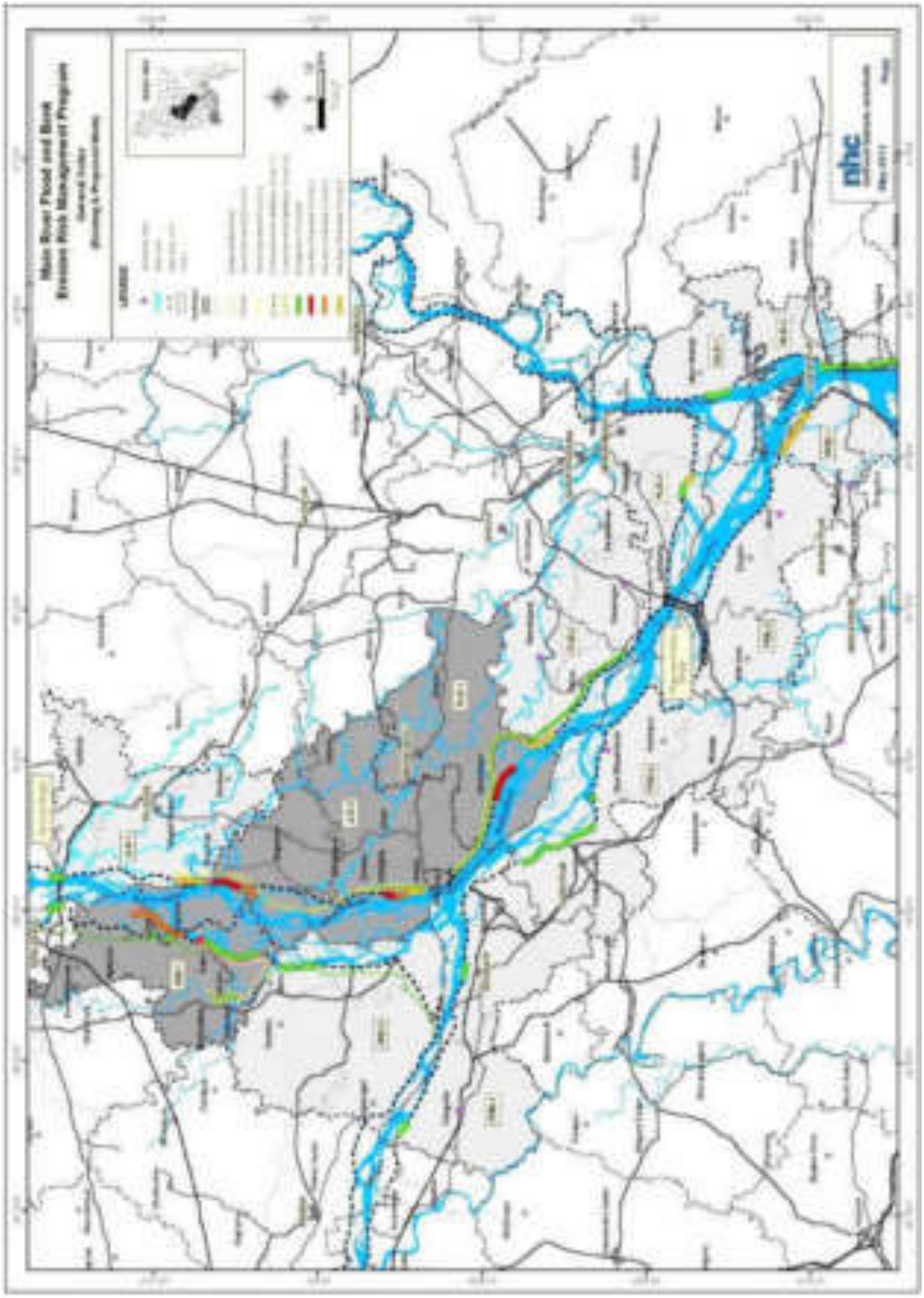
The total budget for Tranche 2 embankment in Shahjadpur has been calculated considering the new GoB Ordinance on land acquisition that is to calculate the land value for compensation adding 200% above the current price. Details in APPENDIX D

Total draft budget summary

Items		**BDT**	**USD (82tk)**
CCL			
Land acquisition +200%		578,200,983	7,051,232
RV of Structures		66,339,175	809,014
RV of Trees/crops		20,661,340	251,968
Resettlement benefits			-
Relocation cost		62,578,098	763,148
Rehabilitation Assistance		2,128,000	25,951
Service and Training		28,634,001	349,195
Contingencies	10%	*75,854,160*	925,051
Total		**834,395,757**	10,175,558

The land Acquisition and Replacement Costs will be paid according to the Land Acquisition law of 1982/amended 2017, and the other costs will be paid according to the Entitlement Matrix of Tranche-2.

Monitoring and Evaluation	Carrying out land acquisition and related resettlement under the project, will involve information and data including detailed information and data on land parcels, standing structures, trees, ownership (including all kind of interest), loss quantities etc. On the other hand, quite a number of agencies, including BWDB (PMO and SMOs) Deputy Commissioner, implementation NGOs will be involved in the implementation of the activities. Considering large quantity of data and processing need, it would be sensible to establish a computerized databank. The PPTA team has already carried out surveys and developed a database of census and losses. This database and information to be collected in future together will form LA&R Databank. The data bank will act as the key source of information for implementation, monitoring and evaluation purposes. An automated Entitled Person (EP) files, covering all the losses of individual households, will be prepared for using it as an input towards preparation of entitlement cards and payment statement. These automated files will reflect all the identified losses, all the entitlement, the entitlements paid and the amount pending. There will be a computerized resettlement Management Information System (MIS) which will enhance the institutional capacity of both BWDB and the INGO in land acquisition and resettlement (LA&R) management for the project. RP implementation will be supervised and monitored by the CRO in coordination with concerned field divisions and staff of RP-INGO. The monitoring will be done both internally and externally to provide feedback to BWDB and to assess the effectiveness of the resettlement policy and implementation. The monitoring will use appropriate indicators as developed by BWDB with assistance from the construction supervision consultant (CSC). The Construction Supervision Consultant (CSC) will conduct regular monitoring of the RP implementation and submit reports to the EA (BWDB) for the EA's required semi-annual monitoring reports to the ADB. Finally, an external monitoring will be carried out through an appropriate agency during implementation



1 INTRODUCTION

1.1 The Program Background

The Asian Development Bank supports the feasibility study of a potential future flood and riverbank erosion risk management program covering parts of the main rivers of Bangladesh named "Flood and Riverbank Erosion Risk Management Program"(FRERMIP). The main focus is to reduce the riverbank erosion and flood risks to the adjacent flood plains while maximizing economic activities in a sustainable and environmentally acceptable manner. Existing flood embankments dominantly fail from riverbank erosion, and as such the stabilization of the river pattern is a cornerstone of reducing the flood risk. The FRERMIP builds on and extends the activities of the Jamuna-Meghna River Erosion Mitigation Project (JMREMP) (ADB, 2002), implemented in different phases from January 2003 until June 2011. In addition, a similar project, the Assam Integrated Flood and Riverbank Erosion Risk Management Investment Project (AIFRERMIP) (ADB, 2010) provides important insight into a number of relevant project elements and processes.

The Project will cover the main rivers from Bhangabandhu (Jamuna) Bridge[39] and the proposed Ganges Barrage to Chandpur, as such covering around 60 km of the Jamuna, around 20 km of the Ganges, and the whole around 100 km long Padma reach. Two main confluences are included: the confluence of Ganges and Jamuna and the confluence of Padma and Upper Meghna. Importantly, for flood benefits and, of course, targeting the overarching goal of poverty reduction, the flood plains on both sides of the rivers play a fundamental role as home of a largely poor population depending on agriculture and fisheries. As a consequence we identified sub-reaches with similar river and flood plain characteristics as practical subproject areas. Each sub-reach consists of several upazilas, which facilitates the data collection. In total 13 sub-reaches were identified for pre-feasibility assessment: two each at the Jamuna Right and Left Bank (JRB, JLB), 3 along the Padma Right and Left Bank (PRB, PLB), one at the Meghna Right Bank (MRB), and two along the Meghna Left Bank (MLB).

The feasibility study covered the priority investment during the first Tranche. In Bangladesh the common MFF approach means that only the first tranche investment is identified during the PPTA. Subsequent tranches will be identified during each previous, ongoing tranche. The implementing agency, the Bangladesh Water Development Board (BWDB) (i) has more than 10 years of experience with an adaptive or flexible flood and riverbank erosion risk management approach and has demonstrated successful implementation from three ADB supported projects (JMREMP, South-West Area Integrated Water Resources Planning and Management Project, Secondary Towns Integrated Flood Protection Project II), (ii) has approved operation in line with the 'Guidelines for Riverbank Protection', 2010 founded on standardized design and implementation procedures, and (iii) is currently in the process of creating the post of a Chief Engineer River Management as focus point for river stabilization activities and in line with the National Water Management Plan.

[39] Presently the Jamuna Multipurpose Bridge (JMB) is known as Banghabandhu Bridge. For an easier understanding of the location, we maintain the abbreviated form of Jamuna Bridge throughout this report.

1.2 The Proposed Work for Tranche 2- Overview

Following the proposed river stabilization plan and the spirit of the MFF documents, first river stabilization including the recovery of a substantial amount of eroded floodplain will take place in conjunction with and continuation of the work implemented at Chauhali during Project-1 (2015 to 2017). This work will dominate the construction of Tranche -2. Notwithstanding the focus on river stabilization, embankments will be built at two sub-projects to complete work started in Project-1 and maintain the economic feasibility projections for the whole program as per PPTA report. The proposed work is summarized in Table 1-1 below and depicted in details and in the following figures to show the location of PLB-1.

Table 1-1 Details of works under Tranche-2 (Option 1)

Work Item	Work details	Remark
JRB-1 – priority sub-project		
Kaijuri embankment	Approximately 7.9km of embankment along Hurasagar	The embankment will be completed as per PPTA to achieve the full benefits of this sub-project. Construction of the road has been abandoned in favor of additional river stabilization work A bridge is proposed to open up a khal, closed during the 1970s upstream of the embankment at Kartikpur
Fish passes	2 Nos., to the Hurashagar and Jamuna River	Expanding the PPTA report. One will be built in the existing embankment where the current regulator size was reduced prior to construction
Riverbank protection	Provision of approximately 3.5 km of bank protection at Benotia	No riverbank protection is planned along the char
JLB-2 – priority sub-project		
Dredging	Channel choking with sediment downstream of Chauhali	Adjusted PPTA approach to account for changed river situation and incorporate “building with nature” and to ensure sufficient dredging.

Riverbank protection	Provision of approximately 12 km of adaptive allocation upstream of the existing Chauhali bank protection and 10.5km of precautionary protection in the Solimabad channel	No protection planned on the central char, but extension of existing river bank protection
PLB-1 – priority sub-project		
Embankment from Harirampur to Dohar	17.4 km reconstructed Dhaka Southwest embankment	Following the PPTA, the reconstructed embankment will provide reliable flood protection from Padma flooding in future.
Fish passes	7 regulator fish passes to connect Ichamatty River and local khals and 1 regulator without a fish pass for drainage	Expanding PPTA report and based on future plans to reopen closed sections of Ichamoti river
Adaptation and emergency		
Adaptation works	40km	Extended from the PPTA to incorporate the necessary works at previously built sites, as well as expected works at Tranche-1 and 2 sites
Emergency works	5km	To cover unforeseen developments
MLB-2 – Chandpur (Meghna Left Bank) this additional site is subject to financing availability		
Scour apron	2km	The apron will help reducing future deep scouring risk near the bank, hence will increase substantially the safety of Chandpur and will contribute to the stabilization downstream. Additional to PPTA

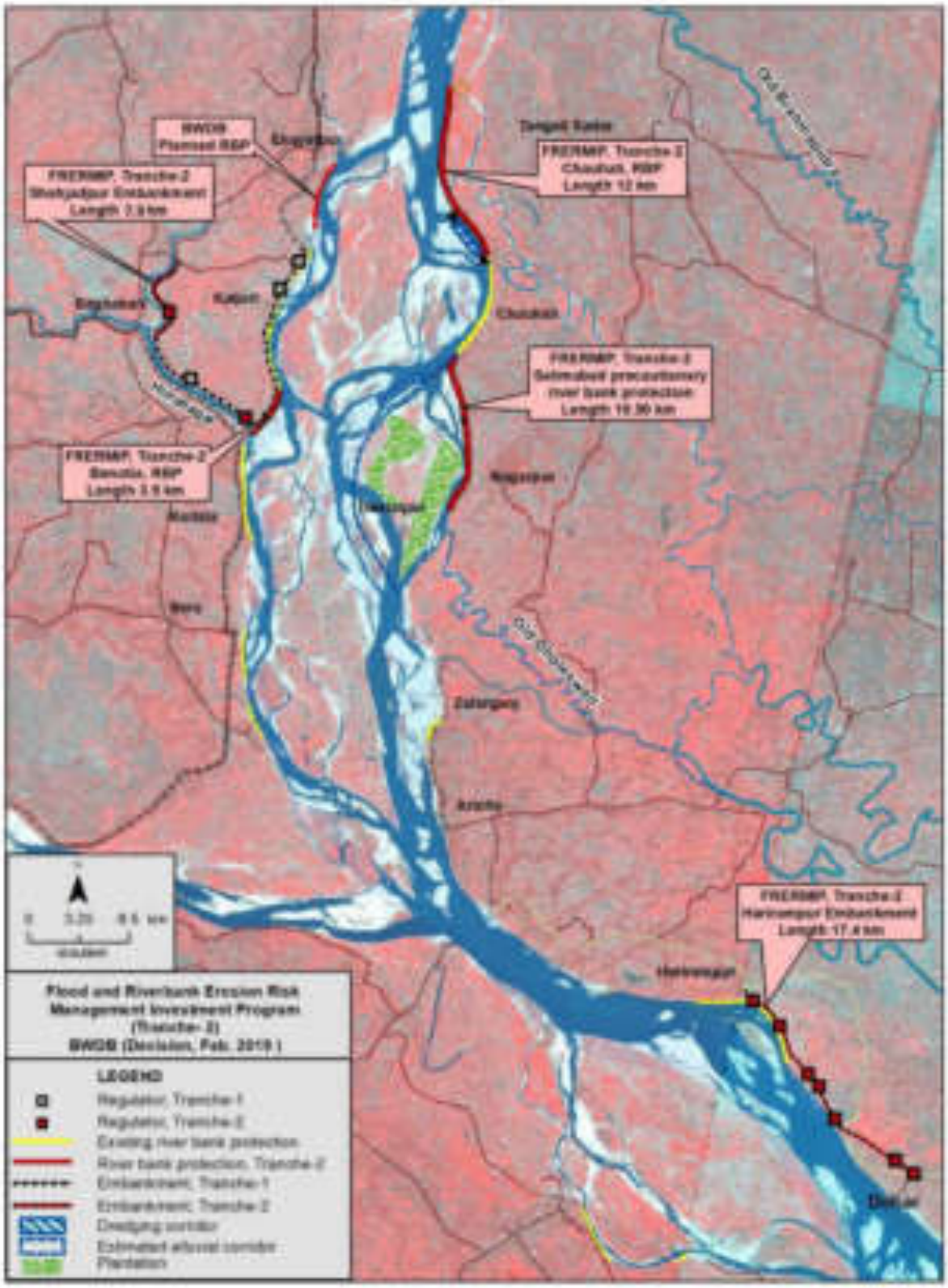


Figure 1-1 Location of the interventions for tranche 2

1.3 Program Rationale and Objectives

The Main River Flood and Bank Erosion Risk Management Program (FERMIP) is the follow on project of the Jamuna-Meghna River Erosion Mitigation Project (JMREMP). It aims to sustain incomes and livelihoods of people living along the three main rivers of Bangladesh – the Jamuna, the Ganges, and the Padma. It will enhance resilience to flood and riverbank erosion risks through strengthening the flood and riverbank erosion management system, including the knowledge base and underlying institutions; and by establishing integrated non-structural and structural risk management measures at priority erosion sites and addressing their sustainability. The Program may take a sector-type approach to applying the multi-tranche financing facility (MFF) modality, to allow for (i) the flexible, adaptive, phased interventions that are technically most appropriate given the dynamic river morphology, (ii) strategic longer-term FRERM planning, and (iii) Longer-term and more effective support for institutional capacity enhancement in the sector.

The embankment will be constructed along the Hurasagar and Bengali Rivers with an average cross section of the proposed embankment as shown in the Figure below. No land will be required for borrow pits as the materials for construction will be taken from the rivers.

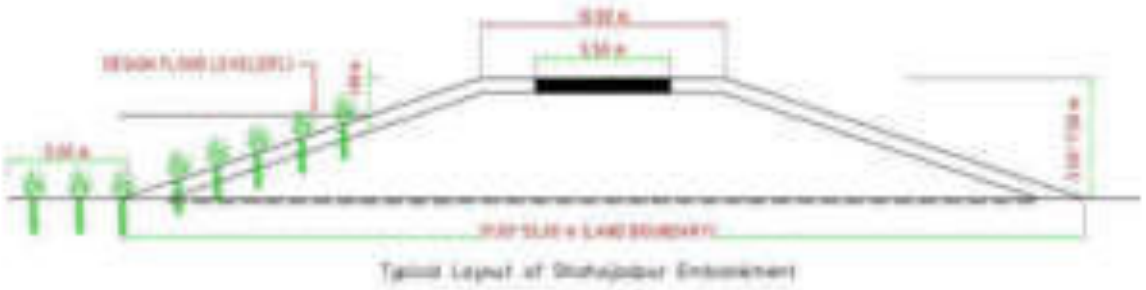


Figure 1-2 Sample Cross Section of the proposed embankment

2 SOCIO-ECONOMIC PROFILE OF THE AFFECTED POPULATION

2.1 Tranche-2 Area for the embankment in Harirampur

The administrative locations of Shahajdpur embankment Tranche-2 covers one Division, one Districts, 1 Upazilas, 3 Unions and 12 villages. The total length is 7.7 km and some portion of the embankments will be built on open agriculture land and includes some rebuilding portion of an old embankment.

2.2 Socio-economic Profile of Affected Population

The following section presents the key findings with regard to the socio-economic profile of the affected population in the Trance-2 JRB-1 Sub-reach, as derived from census and socio-economic (SES) survey conducted in December 2017. The socio-economic survey was carried out on the ROW for the proposed embankment in the settlement areas that will be affected. The identification of the AHHs by agriculture land beyond the settlement areas is yet to be conducted through the agricultural plot owner's survey at the implementation phase. The number of AHHs by land only will

also derive from the Land Acquisition Plan (LAP) after identification of landowners from land registry offices and carried out by DC on the basis of the LAP. (See Appendix G, Land Acquisition Plan-LAP).

2.2.1 Demographic Information

Table 2-1 Area Coverage and number of affected population

District	Upazila	Union	Village	Mouza	Affected People		
					Males	Females	HH
Sirajganj	Shahjadpur	Habibull	Kumir Goalia	Ishardiya	2	2	1
			Kumir Goalia	Kumir Goalia	19	12	7
			Kumir Goalia	Nagardala	3	3	2
			Nagardala	Ishardiya	7	2	5
			Rotonkandi (Part)	Ishardiya	7	6	2
			Rotonkandi (Part)	Nundaha	1	1	1
			Rotonkandi (Part)	Rotonkandi	302	302	132
			Badalbari	Ishardiya	43	33	18
Sirajganj	Shahjadpur	Potajia	Nundaha	Nundaha	55	56	24
			Gangaprassad	Potajia	52	57	25
			Nundaha	Potajia	107	112	41
			Nundaha	Rotonkandi	5	6	3
			Nundaha	Sheila	3	2	1
			Potajia	Potajia	12	8	4
			Boyra	Potajia	2	2	1
Sirajganj	Shahjadpur	Rupabati	Selachapri	Selachapri	145	132	46
			Ahmedpur	Ahmedpur	104	98	29
			Ahmedpur	Dombaria	104	113	21
			Rupabati	Selachapri	14	10	3
Totals					987	957	366

2.2.2 Level of Education

Table 2-2 Level of Education of Household Head by Gender

Village	Males	Females	Total
10th grade	19	0	19
1st grade	9	0	9
2nd grade	3	0	3
3rd grade	4	0	4
4th grade	8	0	8
5th grade	28	2	30
6th grade	7	0	7
7th grade	6	0	6
8th grade	11	0	11

Village	Males	Females	Total
9th grade	7	0	7
Graduation or equivalent	9	0	9
Higher secondary or	7	0	7
No grade passed	204	18	222
No Reply	9	1	10
Secondary level or equivalent	14	0	14
Totals	345	21	366

2.2.3 Occupational Profile

Table 2-3 Primary Occupation of the Affected Household Heads

Upazila	Occupation	Household Heads		
		Males	Females	HH
Shahjadpur	Cultivation in owned land	9	0	9
	Daily wage laborer (Agri)	120	4	124
	Daily wage laborer (Non-agri)	48	2	50
	Fisherman	4	0	4
	Housewife	0	7	7
	Mechanic (rickshaw	2	0	2
	Migrant Worker	7	0	7
	No Reply	16	3	19
	Other	47	1	48
	Petty trader	13	0	13
	Poultry rearing	4	0	4
	Rickshaw/Rickshaw van driver	15	0	15
	Salaried person in govt/private	5	0	5
	Unemployed/dependent/children	23	2	25
	Vendor	16	0	16
	Weaver	16	2	18
		345	21	366
Totals		345	21	366

2.2.4 Level of Income of Affected Population

Table 2-4 Level of annual income of HH heads

Occupation	Male Household Head							Female Household Head						
	0-30,000	30,000-50,000	50,000-1,00,000	1,00,000 -	>1,80,000	No Response	Total	0-30,000	0,000-50,000	50,000-1,00,000	1,00,000 -	>1,80,000	No Response	Total
Cultivation in owned land	1	5	2	0	1	0	**9**	0	0	0	0	0	0	**0**
Daily wage laborer (Agri)	11	50	50	3	4	2	**120**	0	1	3	0	0	0	**4**
Daily wage laborer (Non-agri)	4	17	18	6	2	1	**48**	2	0	0	0	0	0	**2**
Fisherman	0	3	1	0	0	0	**4**	0	0	0	0	0	0	**0**
Housewife	0	0	0	0	0	0	**0**	4	0	2	0	1	0	**7**
Mechanic (rickshaw	0	**0**	0	2	**0**	0	**2**	0	0	0	0	0	0	**0**
Migrant Worker	0	0	1	**2**	4	0	**7**	**0**	0	0	0	0	0	**0**
No Reply	0	4	5	1	0	**6**	**16**	3	0	0	0	0	0	**3**
Other	3	12	8	12	8	4	**47**	1	0	0	0	0	0	**1**
Petty trader	0	0	3	**7**	3	0	**13**	**0**	0	0	0	0	0	**0**
Poultry rearing	0	2	1	**1**	0	0	**4**	**0**	0	0	0	0	0	**0**
Rickshaw/Rickshaw van driver	0	5	9	**1**	0	0	**15**	**0**	0	0	0	0	0	**0**
Salaried person in govt/private	0	2	2	**0**	1	0	**5**	**0**	0	0	0	0	0	**0**
Unemployed/dependent/childre	19	1	2	0	**1**	0	**23**	1	1	0	0	0	0	**2**
Vendor	0	3	4	4	**5**	0	**16**	0	0	0	0	0	0	**0**
Weaver	0	3	11	1	**1**	0	**16**	0	1	**1**	0	0	0	**2**
	38	**107**	**117**	**40**	**30**	**13**	**345**	**11**	**3**	**6**	**0**	**1**	**0**	**21**

2.2.5 Poverty Status

Table 2-5 Income Level of the affected households

Upazila	Yearly Income Level	Number of HH
Shahjadpur	No Reply	12
	Vulnerable (0-30,000)	11
	Poor (30,000-50,000)	126
	Lower Medium (50,000-1,00,00)	165
	Medium (1,00,000-1,80,000)	36
	Rich (>1,80,000)	16
	Totals	366

2.2.6 Gender Status

Table 2-6 Numbers of male and female populations

Village	Headed Households		
	Males	Females	Total
Ahmedpur	46	4	50
Badalbari	18	0	18
Boyra	1	0	1
Gangaprassad	23	2	25
Kumir Goalia	9	1	10
Nagardala	5	0	5
Nundaha	64	5	69
Potajia	4	0	4
Rotonkandi (Part)	129	6	135
Rupabati	3	0	3
Selachapri	43	3	46
Totals	345	21	366

2.2.7 Vulnerability of the affected households

The details of the identified as vulnerable are given in appendix H.

Table 2-7 Number vulnerable households

Vulnerability Component	HHs
Total Vulnerable HHs	104
Female Household Head	21
Disabled HHs	43
Ethnic Minority	0
Hindu Caste Untouchable	0
Low Income Rate (Tk 0 - 30,000/yr)	11
Government Support	52

* Some HHs have more than one criteria of vulnerability

2.2.8 Details of the Affected Female Headed Households

Table 2-8 Female Headed Households with category of losses

Location	Father / HH Head Name	Husband Name	Gender	Age	National ID Card No.	Occupation	Annual Income	Land Use	Ownership
Shahjadpur ; Habibullah Nagar; Kumir Goalia	Joybanu	Kashem ali akondo	Female	51	8816787427502	Daily wage laborer (Non-agri)	0-30,000	Homestead Structure	Owner

Location	Father / HH Head Name	Husband Name	Gender	Age	National ID Card No.	Occupation	Annual Income	Land Use	Ownership
Shahjadpur; Habibullah Nagar; Rotonkandi (Part)	Fatema khatun	Mrito romjan ali	Female	36	8816787420448	Unemployed/ dependent / children	30,000-50,000	Homestead Land	Owner
Shahjadpur; Habibullah Nagar; Rotonkandi (Part)	Majeda	Late abul hossain	Female	45		Housewife	>1,80,000	Homestead Structure	Owner
Shahjadpur; Habibullah Nagar; Rotonkandi (Part)	Mohammad Afzal	Lobu sarker	Female	37	8816787439662	Daily wage laborer (Agri)	50,000-1,00,000	Agriculture	Owner
Shahjadpur; Habibullah Nagar; Rotonkandi (Part)	Mrs. Salima begum	Asiruddin ahmed	Female	75		Housewife	50,000-1,00,000	Homestead Structure	Owner
Shahjadpur; Habibullah Nagar; Rotonkandi (Part)	MST. Sufia khatun	Mohammad abdur rouf	Female	41	8816787425030	Housewife	0-30,000	Homestead Structure	Owner
Shahjadpur; Habibullah Nagar; Rotonkandi (Part)	Yasin molla	Fayjal molla	Female	49	8816787420621	Daily wage laborer (Agri)	50,000-1,00,000	Homestead Structure	Owner
Shahjadpur; Potajia; Gangaprassad	Md abdul matin	Mr bakkar molla	Female	51	8816773312855	Daily wage laborer (Agri)	30,000-50,000	Homestead Structure	Owner
Shahjadpur; Potajia; Gangaprassad	Shamo khatoon	Sattar sordar	Female	60	8816773323542	No Reply	0-30,000	Homestead Land	Owner
Shahjadpur; Potajia; Nundaha	Anwara khatun	Nosher paramanik	Female	70		Housewife	0-30,000	0-30,000	Khas

Location	Father / HH Head Name	Husband Name	Gender	Age	National ID Card No.	Occupation	Annual Income	Land Use	Ownership
Shahjadpur; Potajia; Nundaha	MST moriam khatun	Mrito Hossain pramanik	Female	49	8816773312848	No Reply	0-30,000	Homestead Land	Owner
Shahjadpur; Potajia; Nundaha	MST. Lailee khatun	Mrito abdul kader	Female	53	8816773312352	Unemployed/ dependent / children	0-30,000	Homestead Land	Owner
Shahjadpur; Potajia; Nundaha	Reta	Ajger bepari	Female	45		Weaver	30,000-50,000	Homestead Land	Khas
Shahjadpur; Potajia; Nundaha	Rezia		Female	40		No Reply	0-30,000	Homestead Structure	Owner
Shahjadpur; Rupabati; Ahmedpur	Julekha khatun	Alim uddin molla	Female	48		Daily wage laborer (Non-agri)	0-30,000	Bamboo Garden	Owner
Shahjadpur; Rupabati; Ahmedpur	Mojir pramanik	Yakub pramanik	Female	50	8816780336565	Daily wage laborer (Agri)	50,000-1,00,000	Homestead Structure	Owner
Shahjadpur; Rupabati; Ahmedpur	Mrs Salma Kbatun		Female	65	8816780335698	Housewife	50,000-1,00,000	Homestead Structure	Owner
Shahjadpur; Rupabati; Ahmedpur	Mst hasina khatun	Mrito mofiz mondol	Female	56	8816780335762	Housewife	0-30,000	Homestead Structure	Owner
Shahjadpur; Rupabati; Selachapri	Anwar	Shukur ali	Female	30		Weaver	50,000-1,00,000	Agriculture	
Shahjadpur; Rupabati; Selachapri	Mrs moniza khatun mazida		Female	60	8816780333531	Housewife	0-30,000	Homestead Structure	Owner

3 INVENTORY OF LOSSES AND IMPACTS OF THE EMBANKMENT

The Tranche-2 impacts are based on the findings of the household socio-economic field survey on the alignment of the proposed embankment in December 2017. The information collected during the survey was used for preparing the initial budget. Further detailed information about the households affected by agriculture land will be provided on completion of LAP and identification of the APs owning the agriculture land.

For the full length of embankment as per proposed design 36 ha of land will be required, which includes homestead, agriculture, commercial, orchard land and pond area.

3.1 Impact on Land

The land will be acquired within the settlements areas in one district (Sirajganj), One upazila (Shahjadpur) and 3 Unions (Habibuli, Potalia, Rupabati). It will affect 366 families and 19s44 populations.

The alignement of the embankement goes through private cultivated land, commercial land and pond areas which is the total land required for acquisition is 6,956.4 Decimales (28.14 ha). Some land from the old embankement will be part of the new embankment for an area of about 8 hectares.

Table 3-1 Category of Land affected for the household surveyed

Division	District	Upazila	Union	Land Use	Affected Area (Dec)	Total
Rajshahi	Sirajganj	Shahjadpur	Habibullah	Agriculture	2,688.50	5,155.60
				Commercial	20.3	
				Flower/Teak Garden	3.5	
				Homestead Land	883.3	
				Homestead Structure	1,555.00	
				Pond	5	
			Potajia	Commercial	120	654.8
				Agriculture	127.3	
				Homestead Land	220	
				Homestead Structure	177.5	
				Orchard	10	
			Rupabati	Homestead Structure	554.1	1146.1
				Agriculture	173	
				Bamboo Garden	5	
				Homestead Land	414	
Sub Total						6,956.40

3.2 Impact on Structures

The impact on structures will concern 1333 entities (including different type of residences, kitchen, latrine, animal sheds, TW, and others) and a total floor area is area of 229019 sft. Details are provided in Table 3-2.

From the total structure area affected 149 HH will have their business structures affected over an area of 19383 sft. Details in Table 3-3.

Table 3-2 Total Structures Impacted

Land Use	Qnty	Floor Size (sqft)		
		Total	Avg	HHs
Animal Shed; Kutcha (sqft)	109	19,686	181	96
Animal Shed; Pucca (sqft)	2	204	102	2
Animal Shed; Thatched (sqft)	21	4,190	200	20
Kitchen; C.I Sheet & Concrete Floor (sqft)	2	500	250	2
Kitchen; Kutcha (sqft)	192	13,679	71	166
Kitchen; Pucca (sqft)	4	335	84	4
Kitchen; Semi-Pucca (sqft)	1	350	350	1
Kitchen; Thatched (sqft)	48	5,493	114	48
Latrine; C.I Sheet & Concrete Floor (sqft)	12	520	43	11
Latrine; Cemented (sqft)	72	2,677	37	70
Latrine; Not-Cemented (sqft)	65	1,736	27	65
Latrine; Slab (sqft)	22	563	26	21
Other	33	2,585	78	24
Residence; C.I Sheet & Concrete Floor (sqft)	32	12,785	400	28
Residence; Kutcha (sqft)	446	132,043	296	282
Residence; Pucca (sqft)	22	9,720	442	21
Residence; Semi-Pucca (sqft)	78	19,840	254	52
Residence; Thatched (sqft)	1	250	250	1
Well; Tube-Well (No.)	171	1,863	11	167
Total	1333	229019	3216	1081

Table 3-3 Business Structures Impacted

Business Class	Affected	
	Housholds	Size (sq ft)
Agricultural	15	2,917
Dairy-Livestock Farm	82	8,480
Fish Pond	1	300
Handloom Factory	7	2,500
Other	33	2,500
Poultry Farm	3	930

Business Class	Affected	
	Housholds	Size (sq ft)
Restaurant-Tea Stall	2	150
Shop-Store	6	1,506
Total	149	19,283

3.3 Impact on Trees

The inventory of the various trees will be affected which are: total of 7048 including 1008 samplings, 131 small trees, 603 small trees and 5306 fully grown tress. From the total 2066 are fruit tress, 2395 are timber tress and the rest are groves, medicinal, vegetable (sajna). Details are provided in the Table 3-4 below.

Table 3-4 List of Trees affected

Tree Class	Tree Name	Sampling	Small	Medium	Fully Growth	Total
Fruit	Amra	0	0	1	15	**16**
	Atta	1	0	6	17	**24**
	Baroi	0	0	7	68	**75**
	Betel-Nut	0	0	0	19	**19**
	Coconut	0	10	22	176	**208**
	Guava	0	15	36	146	**197**
	Jackfruit	0	21	23	347	**391**
	Jalpai	0	1	0	11	**12**
	Jam	0	4	3	16	**23**
	Jambura	0	0	0	2	**2**
	Jamrul	0	0	0	3	**3**
	Kamranga	0	0	0	12	**12**
	Katbel	0	1	0	2	**3**
	Lychee	0	2	6	10	**18**
	Mango	5	39	101	840	**985**
	Papaya	0	2	15	53	**70**
	Tamarind	0	0	0	1	**1**
	Wood Apple	0	1	0	6	**7**
		6	***96***	***220***	***1,744***	***2,066***
Groves	Bamboo	0	0	2	119	**121**
	Banana	0	0	21	316	**337**
		0	***0***	***23***	***435***	***458***
Medicinal	Arjun	0	0	0	4	**4**
	Eucalyptus	0	0	0	62	**62**
	Neem	0	0	8	55	**63**
		0	***0***	***8***	***121***	***129***
Other	Other	2	16	42	1,412	**1,472**
		2	***16***	***42***	***1,412***	***1,472***

Tree Class	Tree Name	Sampling	Small	Medium	Fully Growth	Total
Timber-Fuel	Banyan	0	0	0	4	**4**
	Debdaru	0	0	5	18	**23**
	Hijal	0	0	0	7	**7**
	Kadom	0	0	23	56	**79**
	Koroi	0	0	2	11	**13**
	Mahogoni	0	10	130	243	**383**
	Shimul	0	0	0	3	**3**
	Sisso	0	0	0	16	**16**
	Ukaliftas	1,000	9	150	1,236	**2,395**
		1,000	***19***	***310***	***1,594***	***2,923***
Vegetables	Sajna	0	0	0	35	**35**

The impact on affected crops will be provided in the revised RP after the agricultural plot user's survey has been carried out and the land acquisition plan identifying plots owners.

During the physical survey, the alignment has been modified to minimize the impacts in the settlement areas and there will be no common properties affected.

The number of agricultural plots users to be affected is yet to be finalized on the basis of Land acquisition plan submission to land registry department for identifying the plot owners of agriland. In addition another agricultural plot users survey in the agriculture land affected will be launched and likely have a minor impact on the budget with some additional crop compensation.

Along the new embankment and within the ROW, 1 fish passes in Selachapri Mouza (2.7ha) is going to be built with marginal impacts on the land estimated for the embankment. From the overlay of the embankment alignment on the mouza maps, a Land Acquisition Plan (LAP) will be prepared. The LAP will comprise the list of plots to be affected in the different mouza and lay out of the embankment to be given in Appendix H.

4 CONSULTATION, DISCLOSURE AND PARTICIPATION

4.1 Consultation Process

Initial consultation and sharing with local people in the area was done through the different surveys to elicit the views and opinions about the proposed project and its ultimate objective of river corridor stabilization and reclamation of land. So this RP has been prepared based on the findings of consultation, participatory census and Resettlement and Socio-economic Survey (SES) done by a group of staff having social and engineering background that was led by the National Resettlemnet Expert of the project.

4.2 Project Stakeholders

The primary stakeholders of the project include the agriculture farmers, local business community, and as well as the Displaced Households. Secondary stakeholders are the community people, fishermen, boatmen and local government institutions (LGI). Other stakeholders include Bangladesh Water Development Board, under the Ministry of Water Resources as the EA, Department of Forest,

ADB and other government agencies. The other stakeholders include the businessmen groups like contractors, sub-contractors and suppliers during the construction period. The local government representatives will also be benefited in gaining peoples support as a result of local development in the area due to better communication and better protection against flood. The local NGOs working in the area will be motivated to work in the areas where activities are developing. One NGO or social consulting firm, with required work experiences, will be engaged to assist BWDB for smooth implementation of the RP.

Consultation of resettlement and rehabilitation issues with all level stakeholders and gather feedback on potential risks and probable mitigation measures. Encourage all level stakeholders to participate in the consultation by receiving views from representatives of different groups including affected shopkeepers, residential structure owners, fishermen, local traders, women and vulnerable groups etc.

4.3 Public Consultation Meetings

The public consultation process in the project area began in January 2018 during the socio-economic survey carried out to measure the impacts and the conditions of the households to be affected. The consultation process will be further intensified during the detailed design period through formal and informal meetings, village level workshops, and disclosure of project impacts to the affected households and communities. The following sub-chapter presents a summary and overview of the consultations held over the project preparation period.

The following pictures taken in December 2017 show the discussions with the local people to gather their opinions and information about the land that will need to be acquired. Also the opinions of the women were collected as well as from the weavers that will have their area affected.

4.4 Consultation meetings at a glance

The major issues discussed during the consultations are presented below. Description of the topics and discussion held in the meeting are presented in the Table below.

Table 4-1 Topics & discussion of the meeting

Topics/Issues discussed	Description of discussions held
a. Attitude and perception of the community towards the project including changing/adjustment of alignment b. Project concept, design and benefits, c. Cut-off-date of listing the affected properties, d. ADB policy on involuntary resettlement, e. Procedure of determination of land price, f. Adverse effects of the project & mitigation measures,	a. Policy for Entitlements of the affected people and cut-off-date for listing of the lost properties were explained to the people. b. The end date of census is the cut-off-date. In this regard 31 December 2017 is the cut-off-date for Harirampur. c. Structure price at market rates, compensation and other assistance should be paid before displacement; d. Proper compensation for Structure. Business, etc. should be paid e. Self relocation of affected households is encouraged, f. Special assistance for poor and vulnerable households

Topics/Issues discussed	Description of discussions held
g. Compensation payment procedure and entitlements, h. Major problems relating to the projects and special attention to the vulnerable group etc. i. Relocation of common property resources	g. Preferential employment for the affected vulnerable APs during the construction of the project should be ensured h. Training on income generating activities should be provided to the poor APs and income restoration assistance should be paid i. Assistance for common property resources (CPRs) to construct a new one

4.4.1 Focus Group Discussions (FGDs)

The River Stabilisation and Corridor Managment Plan proposes to change the living conditions of people living on chars and within the floodplain of the Jamuna and Padma rivers through stabilisation and narrowing of the main river channel and by the provision of embankments on currently unprotected floodplains. A social impact assessment was therefore needed to find out the current living conditions and what potentially affected people think about the proposed interventions as regards their future aspirations. There are two main groups of affected people: i) Char dwellers and ii) People living in currently unprotected floodplains (left bank of Jamuna & Padma rivers). Focus group discussions (FGDs) were therefore needed with both groups but for slightly different reasons.

The FGDs were undertaken in two tranches. The first on chars in the Padma River was undertaken in May and June 2016 when 7 (seven) FGDs were undertaken in Shibaloy, Harirampur, Sadarpur, Dohar and Shibchar upazilla. Following a hiatus in the project a second tranche of FGDs was undertaken in October-November 2017 a total of 17 (Seventeen) and altogether 24 FGDs.

Following the identification of a possible location the area was visited the day before the FGD to raise awareness and identify a suitable location for the discussion. Ideally FGDs were held with homogeneous groups from the same locality/community on each char with groups of 10-12 people and not more than 15 but this was not always possible.

The FGD was led by the facilitator supported by one or two note takers and participants introduced themselves by name, age and main profession and a comment on why they had come to the meeting. The facilitator introduced the project and the purpose of the FGDs in assessing the acceptability of the project to the group, whether they would want their char to be stabilised or whether they prefer life as it is. The facilitator attempted to avoid domination of the discussion by one or two people with all participants encouraged to give information and views and sometimes asked directly. The notes from the FGDs were very detailed and included some direct quotations. The notes were written up in the evening and translated into English at a later date. The guiding questionnaires changed slightly between tranche I and II.

4.4.1.1 Socio-economic Profile

It is found that majority (81%) of the flood plain households are vulnerable, over 90% are landless, marginal or small farmers and about half of the total households lost land. A poverty index is 7-10% higher among them compared to the rest of the country. Floodplains those attached to chars are more crowded than main lands. They build house with C.I Sheet as they can move it from one place to another within short time. In flood plain they become landless due to erosion. Urbanization is the

most positive thing considered in flood plains. These people do not have enough opportunity to have good occupation and not good access to market.

4.4.1.2 Impacts

Both negative and positive impacts have been identified through intervention. However, the impacts are very close but have different type of dimension or intensity in flood plain as compared to the char land. Positive impacts are (i) Vulnerability will reduce and will have more secured life by participating in Livelihood Restoration Program (ii) Likely to invest more in livelihood improvement with secured situation; (iii) Will increase employment opportunities; (iv) Will have improved transport and market access for milk and meat and (v) potential rise of land value. However, negative impacts need to be addressed to have the positive benefits. These are (i) Loss of land and livelihood due to embankment construction; (ii) Potential for loss of land within river corridor (iii) Loss of social cohesion due to resettlement; (iv) Potential to loss of livelihood for sharecroppers for construction of embankment and in the river corridor (iv) Less livelihood security for landless if compared with former sharecroppers for work .

4.4.1.3 Summary Impacts

The study identified both positive and negative impacts would face the char and as well as flood plain with the intervention of the plan. However, it is speculated that the impact of this project on the households living on both char and flood plain areas will enjoy positive impacts outweigh the negative impacts. To make this plan successful flood plain dwellers in river corridor and embankment alignment will need resettlement, it is assumed that these resettlers as well as land owners will face negative impacts. On the other hand the Char dwellers on LSRA are the main beneficiaries of the plan but subsequent land acquisition and land use planning will need great sensitivity. Care must be taken to protect the social cohesiveness while high potentiality is there for land grabbing by the powerful people.

A table and a map attached to show the location and reach of FGDs held mentioned below:

Table 4-2 Focus Group Discussions (FGDs)

Duration of FGDs: May-June 2016 and October- November 2017						
Reach	1	2	3	4	5	Sum
Already reclaimed		1	2	2		5
Attached	1	2		2		5
River	2	2	4	4	2	14
Total						24

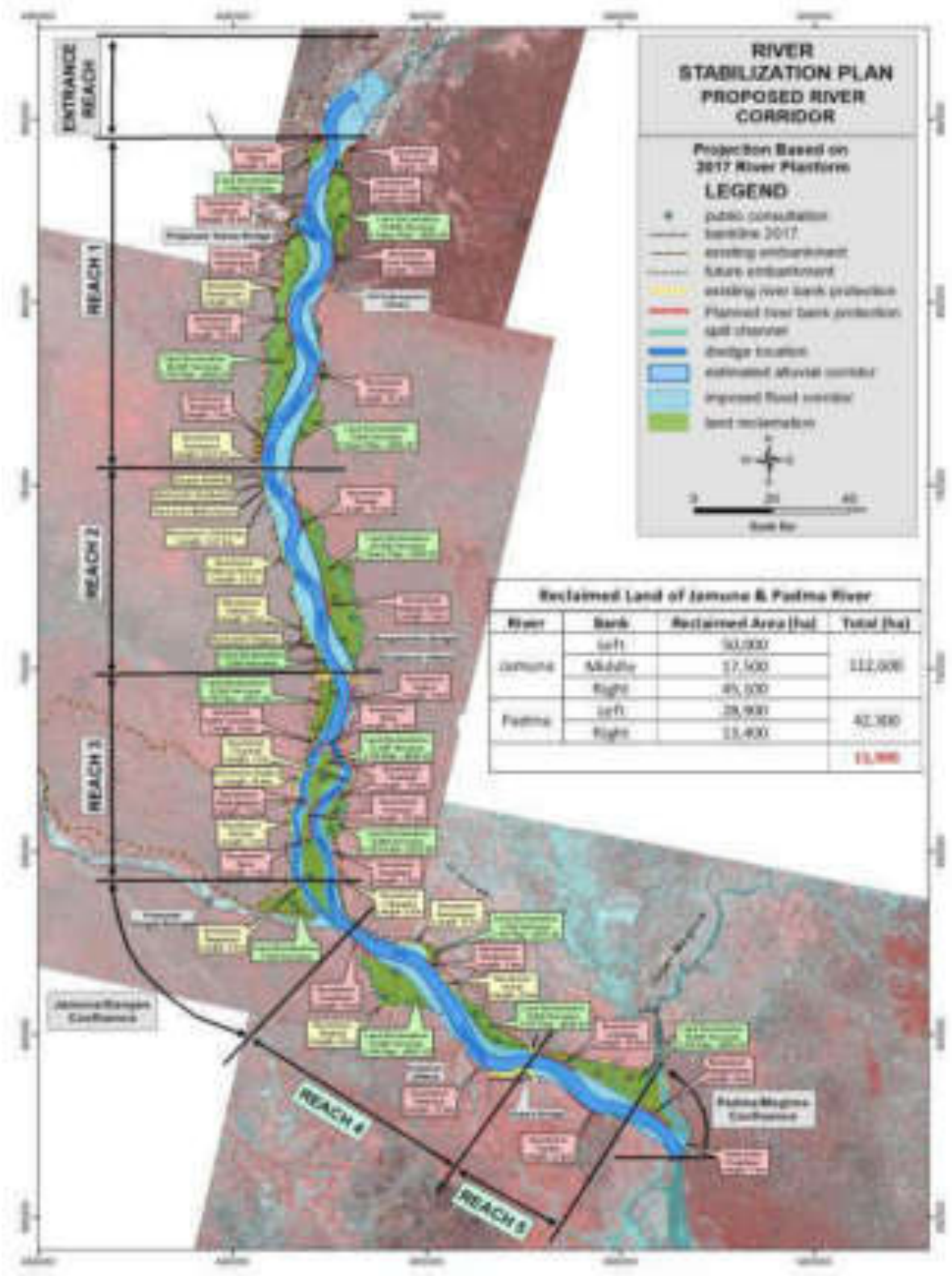


Figure 4-1 Map of FGDs Locations

4.4.1.4 Perception of the Households

FGDs have been conducted in 24 locations around Jamuna-Meghna-Padma-Brahmaputra. One of the affected people answered to the question “What did you loss?” “Jamuna is like Catfish, it eats

everything – so I lost everything including land and belongings". The perception of the people about the project and its acceptability is presented below:

4.4.1.5 Project Acceptability

- High expectations from this plan
- Land Acquisition will be need but should be rational with appropriate compensation
- Overwhelmingly in favour of River Stabilisation Plan
- Loss of land to bank erosion is the major issue, expect to get rid of this situation through this project
- Would invest in land and livelihoods following stabilisation
- Welcome development of industry providing it creates employment
- Char people dream to educate their children as high as he can, even a man of old Chars wants to educate his children until the level of PhD on Char land; many students used to come to chars for their thesis as he experienced and they all are from mainland or from urban area or from big city. He said, "I want my children to have the PhD on Char lives as they are the genuine people of chars".
- They expect industrialization so they don't need to move for livelihood and daily consumption with the hope that everything will be available in Chars when it is stabilized and developed.
- There are some negative impacts of floodplain areas especially between land owners as they would loss their land, loss their social cohesion, share croppers are also affected.
- Despite of having new land there are some negative impacts also like govt. will use khas land for industrialization purpose but there are some people living on the khas land they will become homeless.
- New Char lands will be grabbed by the influential or powerful person which is very common; so they want support from government in this regard.
- There are some problems especially Khazna payment, lack of earning opportunity. Almost all people requested us, "Please fix our erosion problem we will do the rest".
- People welcomed this project very cordially and there is no negative opinion on project acceptability.
- They want a stable char, no erosion and want to get back their lost land
- They use river-water for all purposes so there is a need of proper water supply system that is very important for them.

4.4.2 Information booklets and disclosure of RP

It may be noted that the information brochure that has been prepared (annexed) and will be distributed among the APs and non-APs as well during the forthcoming consultation meetings to be held with or without resolution.

The main themes and scope of the RP will be disclosed in detail to the affected community, after it has been approved and translated into Bengali. The RP's provisions will be further explained to DPs

in group discussions, personal contact and community level meetings. An English version will be uploaded to ADB's resettlement website.

This RP will be summarized in an information book which will be circulated among the people in local language (Bengali) and disclosed to APs during implementation of the RP after it has been reviewed and approved/endorsed.

The Implementing Agency (NGO) engaged to assist BWDB in implementing this RP, will update, publish and distribute the booklet explaining the impact of the project, compensation policies for DPs, resettlement options/strategies for households and shops, and tentative implementation schedule of the project. Further steps will be taken to (i) keep the affected persons informed about compensation policy and payments, and (ii) ensure that DPs will be involved in making decisions concerning relocation and implementation of the RP.

4.5 Strategy for Community Consultation and Participation during Implementation

INGO engaged during the next phase will continue the consultation process during the implementation of the RP. Resettlement related brochures, leaflets and other communications materials in the local language (Bangla) will be updated and published for distribution among the affected households. These materials will also be available in the Union Parishad, Upazilas and district offices in the project area. Further steps will be taken to (i) keep the affected people informed about additional land acquisition plan, compensation policies and payments, resettlement plan, schedules and process, and (ii) ensure that project-affected persons are involved in making decisions concerning their relocation and implementation of the RP. The consultation and participation will be instrumented through individual contacts, FGDs, open meetings and workshops. The consultation meetings, issues discussed and outcomes and subsequent follow–up actions will all be recorded for future verification.

Contents of the information brochure

- Project description
- Project Impact/benefits
- Details of rehabilitation and relocation
- The Contents of Compensation Policy
- RP implementation by key functionaries with their responsibilities;
- Some use full hints for EPs as to how to prepare them for receiving compensation
- Procedure for filling of grievances for redress etc.

See sample of information brochure in Appendix E in English and to be translated in Bangla before implementation.

5 GRIEVANCE REDRESS MECHANISM

The BWDB will constitute RP implementation committees such as Joint Verification Team (JVT),[40]Property Valuation Advisory Committee (PVAT) and a Grievance Redress Committee (GRC) for the various RP implementation activities ensuring Stakeholder participation. A local GRC, gazetted by the GoB, will be composed of: a) Representative from BWDB – Convener (Executive Engineer (Field)/Equivalent); b)Chairman concerned Union Parishad – Member; c)Representative from APs – Member; d) Sub Assistant Engineer From BWDB - Member Secretary. The local GRC will by meeting all the aforementioned participants informally, as well as formally, to ensure speedy and out of court settlement of as many disputes as possible.

The fundamental objectives of GRCs will resolve any resettlement-related grievances locally in consultation with the aggrieved party to facilitate smooth implementation of the RP.Another important objective is to democratize the development process at the local level and to establish accountability to the affected people. The GRC is a project level mechanism for receiving and resolving project related grievances. The costs associated with the GRC will be appropriately budgeted in the RP. Irrespective of the GRC decisions, an aggrieved person will be free to access the country's legal system at any stage of the grievance redress mechanism.

The functions of the GRCs will be to:

- Receive applications and hold hearings on DP grievances concerning the
- Project, in particular regarding resettlement issues.
- Refer APs to the concerned authority/Deputy Commissioner if the grievance can be dealt through conventional law or by arbitration.
- Make decisions to resolve DP grievancesfollowing RP policy if outside conventional law and if the grievance does not lend itself to arbitration.
- Prepare recommendations according to the procedure described by the GRCin resolving DP complaints.

The GRCs will receive DP grievances and resolve grievances in the following manner:

- The GRC will meet to resolve the DP grievance within 10 days of its receipt and will preserve the records and procedure of the meeting. The GRC will mention the basis of its resolutions in the written record of its meetings.
- The GRC will publicize its decisions regarding DP grievances through local community meetings and through the distribution of leaflets to the public.
- All the GRC activities will take place in the office of the GRC chairperson.

All GRC members will attend a training and orientation meeting prior to commencement of their work. Project staff and the CSC's resettlement experts will conduct the training. The GRC members (except for BWDB and RP-INGO representatives) will be entitled to Tk. 1000/- (One thousand) per

[40]JVT will be constituted of: i) Representative from BWDB - Convener (SDE/AE/Equivalent officer); ii) Representative from concerned DC – Member; iii) Sub Assistant Engineer from BWDB - Member Secretory

day as honorarium from the implementing RP-INGO budget (i.e., reimbursable head). Light snacks/refreshments will be provided during the meetings under the NGO budget. In case of day-long meeting, GRC members may also be served lunch. Necessary stationery and other logistics will be made available by the NGO.

Grievances Redress Committees (GRCs) will be established to ensure that the APs are are getting fair compensation in the implementation process. Through public consultations, the APs will be informed that they have a right to grievance redress from the BWDB. The DPs can also call upon the support of the Implementing Agency (IA) engaged to implement the RP to assist them in presenting their grievances or queries to the GRC. Other than disputes relating to ownership right and award of compensation by the Deputy Commissioner under the court of law, GRCs will review grievances involving all resettlement assistances, relocation and other supports. Grievances will be redressed within 21 days from the date of lodging the complaints.

The GRCs will be formed and activated during RP implementation process to allow DPs sufficient time to lodge complaints and safeguard their recognized interests. Where land acquisition will not be involved but relocation of structures or vacating land from cultivation will be required, the GRCs will facilitate resolution of complaints regarding categorization of vulnerable affected persons, types of structures and eligibility for compensation and assistance within the set guidelines and provisions of the Resettlement Plan. Any complaints of ownership or other suits, to be resolved by judiciaries system, will not be resolved in GRCs

5.1 Grievance Redress Committee (GRC)

GRCs will be formed at union level for any grievances involving resettlement benefits, relocation, and other assistance. The local GRC shall review and resolve grievances within one month of receiving any complaints and will maintain written records of all the appeals received.

The GRC have been formed as:

a)	Representative of BWDB (Executive Engineer or equivalent Officer)	: Convener
b)	Union Parishad Chairman of the concern area	: Member
c)	One representative of Affected Persons	: Member
d)	Sub-Assistant Engineer, SMO, BWDB	: Member-Secretary

5.2 Grievance Redress Steps

Procedures of resolving grievances are described in Table below.

Table 5-1 Grievance Redress Steps

Step 1	The Implementing Agency informs APs about their losses and entitlements If satisfied, the DP claims resettlement payments to the EA. If confused:
Step 2	The DP approaches the IA field level officials for clarification. The IA will clarify the DPs about their losses & entitlements as per RP. If resolved, the DP claims resettlement payments to the EA. If not resolved:

Step 3	The DP approaches to the GRC. IA staff assists the APs producing the complaints and organize hearing within -21 days of receiving the complaints.
Step 4	GRC to scrutinize applications, cases referred to DC through EA if beyond their mandate as per scope of work
Step 5	If within the mandate, GRC sessions held with aggrieved APs, minutes recorded. If resolved, the Project Director approves. If not resolved:
Step 6	The DP may accept GRC decision, if not, he/she may file a case to the court of law for settlement.
Step 7	The GRC minutes, approved by the Project Director, received at Conveners' office back. The approved verdict is communicated to the complainant DP in writing. The DP then claims resettlement payments to EA

DPs will be able to submit their grievance/complaint about any aspects of Resettlement Plan implementation and compensation. Grievances can be shared with the BWDB verbally or in written form, but in case of the verbal form, the IA representatives in the GRC will write it down in the first instance during the meeting at no cost to APs. The APs will sign and formally produce to the GRCs at respective office of the IA assisting BWDB implementing the RP.

The GRCs will be activated with power to resolve resettlement and compensation issues not to be addressed under legal suit in the courts. The GRCs will receive grievance cases from the affected persons through the Implementing Agency. The IA will assist the APs in lodging their resettlement complaints in a proper format acceptable to the GRCs after they get ID cards from BWDB or informed about their entitlements and losses.

The appeal procedure and conflict resolution will be as follows:

- All complaints from the APs will be received at the field office of the Implementing Agency, the member secretary of the GRCs with a copy to the concerned Local Government Institution representatives.
- The representative of the IA in the GRCs upon receipt of complaints will inform the convener (BWDB representative) of the GRC and the convener will organize a hearing session from the complainants in concerned UP Chairman's office from where the complaint was receipt.
- The GRC will review the proceedings and pass verdicts to convey to the concerned DP through the IA.
- If there are such matters relating to arbitration through the courts, the matter will be referred to the court.
- The GRC will settle the disputes within maximum 21 days of receiving the complaints from the DPs.

Resolution of the GRCs will be final and adopted in the process of resettlement for issuance of ID cards, determination of loss and entitlements and payment.

6 LEGAL AND POLICY FRAMEWORK

6.1 GOB Laws on Land Acquisition

The principal legal instrument governing land acquisition in Bangladesh is the Acquisition and Requisition of Immovable Property Ordinance II (1982) and subsequent amendments of the Ordinance II (1989/93/94/2017) and other land laws and administrative manuals relevant to alluvion/deluvion land, char and khas land administration in Bangladesh.[41] The 1982 Ordinance requires that compensation be paid for (i) land and assets permanently acquired (including standing crops, trees, houses); and (ii) any other damages caused by such acquisition. The Deputy Commissioner (DC) determines (a) market value of acquired assets on the date of notice of acquisition (based on the registered value of similar property bought and/or sold in the area over the preceding 12 months), and (b) 200% premium on the assessed value (other than crops) due to compulsory acquisition. However, it is well known in Bangladesh that people devalue land during transactions to pay lower registration fees. As a result, compensation for land paid by DC including premium remains less than the real market price or replacement value. The 1994 amendment made provisions for payment of crop compensation to tenant cultivators.

In addition to the Ordinance, another relevant law that applies to the Project due to acquisition of bankline for riverbank protection (RBP), is the State Acquisition and Tenancy Act 1951 (Section 7) that defines the ownership and use right of alluvion (*payosti*) and diluvion land (sikosti) in the country. Legally, GOB owns the bankline and eroded land in the river. However, the "original" owner(s) can claim the land if it re-emerges in a natural process within 30 years from the date of erosion.

6.1.1 Inadequacies of 1982 Ordinance

The Ordinance, however, does not cover project-affected persons without title or ownership record, such as informal settler/squatters, occupiers, and informal tenants and lease-holders (without registration document) and does not ensure replacement market value of the property acquired. The act has no provisions for resettlement of the affected households/businesses or any assistance for restoration of livelihoods of the affected persons. As a result, land acquisition potentially diminishes productive base of farm families and those affected and displaced by development projects.

6.1.2 Harmonization with ADB's Policies

The ADB has its own safeguard policies to minimize displacement and require time-bound action plans with measures to restore or improve livelihood and income of those affected by development projects. Since the 1982 Ordinance falls short of the requirements of the ADB's safeguard policies on many grounds, the project land acquisition and resettlement policy has been harmonized with ADB's ADB's safeguard policies.[42] The harmonization was carried out through a gap analysis involving the

[41] Alluvial, deluvial and *char* land survey and settlement (No. 2-2/87/90(1060)/1987; Settlement of char land (No. 2L-3/73/86(19)-R.L/1973; Settlement of Deluviated Lands Reformed in Situ (Memo No. 196(36)-V-177/77-L.S /1978), State Acquisition and Tenancy (Amendment) Act, 1994; Transfer of *Khas* Land between GOB departments (M:/Sha-10/HUD/general-1/94/345(64)/1994 (source: Land Administration Manual, Vol. 1, Ministry of Land, GOB).

[42] ADB, Safeguard Policy Statement (SPS 2009). http://www.adb.org/documents/safeguard-policy-statement

1982 Ordinance II and the ADB's safeguard policies and gap-filling measures. The harmonization has also benefited from the Jamuna Bridge and Jamuna-Meghna River Erosion Mitigation Project (JMREMP) "best practices" in resettlement. The best practices – for example, include Photo ID Card with description of losses and entitlements, Video filming of ROW to control fraudulent claims, Resettlement sites with civic amenities, multiple relocation options, including "self-managed" resettlement.

The harmonized policy forms the basis for preparation of social safeguard plans for various components of the project. The harmonization and gap-filling measures are in Appendix A and Appendix B, respectively.

6.2 Policy Principles and Guidelines

In view of the harmonization, the project will apply the following policy guidelines and procedures to comply with ADB's safeguard compliance requirements:

(i) Avoid or minimize impact as much as possible through alternative design options;

(ii) Consult affected people and their communities adequately;

(iii) Make resettlement plans and other related documents available at the project sites;

(iv) full disclosure will be ensured through distribution of a summary RP in Bangla to the affected households and other stakeholders;

(v) Determine replacement cost of assets acquired and compensate at full replacement costs determined by Property Valuation Advisory Committee;

(vi) Provide Resettlement assistance to all APs, irrespective of their titles to land;

(vii) Establish grievances redressal committees at the local level for speedy resolutions of disputes;

(viii) Provide additional assistance to poor women-headed affected households (AHs) and vulnerable groups;

(ix) Establish income restoration assistance for alternative income sources and restoration of livelihoods for assisting affected people to restore and/or improve upon their pre-project levels or standards; and

All affected households and person, as per the above policy/principles and guidelines, will be eligible for compensation and assistance to be provided by the project. In case of land acquisition, the date of notification of section-3 for acquisition will be treated as the cut-off date while people without titles such as *nodibhashis* (erosion displaced households squatting on others' land, also called *uthuli*) or informal settlers/squatters living in the acquired area, the date of census or similar designated date by the BWDB will be considered as the cut-off date. Any persons moving into the project area after the cut-off date will not be entitled to any assistance.

6.2.1 Planning Steps and Procedures

To revise and update any RP, the following procedures and steps will be followed. First any additional new impacts and a Detailed Engineering Design (DD) and stake out of the ROW alignment will be identified through proper detailed measurement survey (DMS), including a census survey, and community consultations. In cases where the DD has revised the impacts, a new cut-off date(s)

will be established. Second an inventory of losses (IOL) will be established based on the census survey. Third, updating entitlement matrix ensuring all new impacts and related losses are covered. Fourth, disclosure of impacts and entitlements including incorporation of any suggestions from affected groups and communities. Fifth, the valuation of all affected assets will be undertaken and a revised budget will be prepared for payments of compensation. Finally, the updated RPs will be posted on the ADB's website.

7 ELIGIBILITY AND ENTITLEMENTS

Lack of legal documents for customary rights of occupancy/titles shall not affect eligibility for compensation. The RF stipulates payments of compensation as per the assessed value of the land and structure to the affected persons (APs). In addition to compensation paid by the concerned Deputy Commissioner (DC), the APs will receive additional assistance in cash or kind to match replacement costs, which is the difference between the market value and the assessed value for lost assets (land, houses and trees), transaction costs such as stamps/registration costs (in case of purchase of replacement land) and other cash grants and resettlement assistance such as shifting and reconstruction grant, resettlement benefit for loss of workdays/income due to dislocation. Socio-economically vulnerable households namely-female-headed households without grown up male in the household, households below poverty line, households headed by disabled and elderly people will be given additional cash assistance for relocation. The cut-off date for the AHs varies in the area but is within December 2017 time of the survey.

7.1 Unanticipated Impacts on Charlands

Although there are no anticipated negative impacts on charlands, the project will monitor the river behavior to assess all unanticipated impacts on chars and char people through the Project's environmental assessment and review procedure (EARP).

7.2 Valuation of Assets

DC follows the rules laid down in the 1982 Ordinance updated in 2017 to determine market prices for assets like land, structures and trees/crops, with assistance from other departments such as Public Works

Public Works Department (PWD) for structures, Department of Forest (DOF) for trees, and Department of Agricultural Extension (DAE) for crops. The assessed value is typically lower than the replacement value. Indeed, there exits confusion over statutory "market value" and compensation at replacement costs.

Where (i) markets provide reliable information about process and (ii) comparable assets or acceptable substitutes are available for purchase, replacement cost is equivalent to "market value" of the replacement land, plus any transaction costs (such as preparation, transfer, and registration fees and taxes). See Appendix B for price valuation (CMV) collected from different Upazela offices during socio-economic field survey in December 2017.

In Bangladesh's rural setting, the conditions noted above are not present. Therefore, to ensure that APs can replace the lost property, a replacement value will be provided as determined by a Property

Valuation Advisory Committee (PVAT), which will be constitutedby BWDB with representatives from BWDB, Construction Supervisor Consultant (CSC), concerned DC office, local Upazila (local government). The Construction Supervisor Consultant provided all technical support to the PVAT to assess the market price and recommend the replacement value of assets, which will be approved by the PD in place of the MoWR. BWDB will pay the difference between the approved replacement value and the DC payments under the 1982 Ordinance II modified in 2017. In addition, APs will be allowed to take away the materials salvaged from their dismantled houses and shops at no costs, despite compensation paid by the DCs. The entitlement matrix describes major types of losses attached to land acquisition and resettlement. The Project will assist the APs in clustered relocations with community facilities or, alternatively, in self-relocation. APs may be relocated to BWDB land (if available) or to plots purchased (by the APs) for which assistance is provided in the form of homestead land development.

Table 7-1 Project Eligibility and Entitlement Matrix

General Implementation Issues and application Guidelines

1. PVAT

BWDB will setup a Property Valuation Advisory Team (PVAT) at each locality. The tasks of this PVAT are:

a) Recommend Replacement Cost (RC) based on Current Market Price (CMP) analysis for Land, Structures, Trees and standing Crops
b) CMP will be assessed for every affected mauza
c) The Land Acquisition price will be determined by the standard procedure according to the land acquisition law. Updated in September 2017.
d) For all private land, the market price will be enhanced by 200% for compensation under law (CCL). For *khas* land (DC is the owner at respective districts on behalf of the government), CCL will be the assessed market price without enhancement.
e) RC for structure considering the cost of materials, labor inputs and land development cost at current market rates**.**
f) RC /CMVwill be approved by the Project Director.

2. INGO

BWDB will engage a NGO to support implementation of resettlement plan i.e. to support the implementation of all land acquisition and resettlement activities. The NGO (INGO) will

a) Identify all persons who have interest in the lands that will be acquired under the project (owner, tenants, operators etc.;
b) identify all informal occupier/ settler on the right of way of new embankment, rehabilitation embankment and RBP works;
c) Make the landowners / tenant/ informal occupier aware about details of land acquisition process, compensation entitlement, payment procedure/ mechanism, resettlement benefit offered by the project.
d) Legal owners will be assisted by INGO to organize legal documents in support of their ownership
e) INGO will identify loss and entitlement of female owners and co-sharers through share determination at the field upon receipt of payment data from the DC office
f) The INGO will inform the APs of the details of the land acquisition and compensation process, resettlement package and payment procedure.
g) The INGO shall encourage Entitled Persons (EPs) to consider purchasing land or investing the money in productive/income generating activities.

3. **JVT**
   a) The loss inventory items and quantities as well as the Entitled Persons (EP) shall be verified in the field through Joint Verification Team (JVT) formed by DC. The members of PVAT will attend field verification by JVT.
   b) The JVT will verify the socially recognized User as identified by the Census
4. BWDB field office (Executive Engineer) will do Title updating for usufruct and other rights before issuance of notice with assistance from INGO
5. DC will pay CCL for the Loss Items. If RC is higher than CCL, the difference will be paid by BWDB with assistance from INGO.
6. Compensation for Structures:
   a) Joint Verification (DC and BWDB) and/or Census will identify (record floor areas and category) of structure
   b) Compensation must be paid before DP dismantle and remove the structures as per civil works requirement
   c) The date of service of notice will be recognized as the cut-off date for structures not recognized by DC. In case of major differences identified between databases, BWDB will verify the data through the Joint Verification Team (JVT).
   d) The owner is allowed to take all salvageable material
   e) The RC will be the cost of the structures at market price

Unit of Entitlement	Entitlements	Applicable Law	Additional Services
Loss Item 1: LOSS OF AGRICULTURAL LAND			
Legal owner(s) as identified by Deputy Commissioner (DC) in the process of CCL payment.	1. Replacement Cost (RC)[43] or Current Market Value (CMV) of agricultural land.	LA Act 1982 Sec 8(1)(a), Sec 8(2) **As per 21 No. Law of 2017 additional 200% cost**	
Special Implementation Issues and application Guidelines:In case of any conflict between Governement Act/Rules & ADB SPS 2009 , later will prevail.			
Loss Item 2: LOSS OF HOMESTEAD, COMMERCIAL, INDUSTRIAL LAND AND COMMON PROPERTY RESOURCES			
Legal owner(s) as identified by DC in the process of CCL payment.	1. CMV of land. 2. 10% of CMV as transaction allowance such as stamp duty and registration cost, VAT etc. No matter whether she/he purchase land or not	LA Act 1982 Sec 8(1)(a), Sec 8(2) **As per 21 No. Law of 2017: additional 200% cost**	1. BWDB will assist purchase of above land(s) jointly with INGO on negotiated price and homestead land development (earth filling, if needed.) with internal road links.

[43]The costs of replacing lost assets (e.g. land, houses/structures, trees and crops) and income, including cost of transaction

Unit of Entitlement	Entitlements	Applicable Law	Additional Services
Special Implementation Issues and application Guidelines: Guidelines:In case of any conflict between Governement Act/Rules & ADB SPS 2009 , later will prevail.			
Loss Item 3: LOSS OF WATER BODIES (PONDS, BOTH CULTIVATED AND NON-CULTIVATED)			
Legal owner(s) as identified by DC in the process of CCL payment.	1. CMV of the water body (private land). 2. Allowance of one year fish harvest to be recommended by PVAT	LA Act 1982 Sec 8(1)(a), Sec 8(2) Amendment of Law 2017	.
Special Implementation Issues and application Guidelines: Guidelines:In case of any conflict between Governement Act/Rules & ADB SPS 2009 , later will prevail.			
Loss Item 4: LOSS OF RESIDENTIAL STRUCTURES WITH TITLE TO LAND			
Legal owner(s) as identified by DC in the process of CCL payment.	1. CMV of residential structure 2. Transfer Grant @ Tk. 15 per sft of affected structure but not exceeding 3. Reconstruction and Homestead Development Grant (RHDG) at the rate of 20 TK per sf.	LA Act1982 Sec 8(1)(d) Sec 8(2) Amendment of Law 2017: additional 100% cost **ADB SPS**	Assistance in relocation and reconstruction.
Special Implementation Issues and application Guidelines: Guidelines:In case of any conflict between Governement Act/Rules & ADB SPS 2009 , later will prevail.			
Loss Item 5: LOSS OF COMMERCIAL/INDUSTRIAL/COMMON RESOURCE PROPERTY (CPR) STRUCTURES WITH TITLE TO LAND			
Legal owners as identified by DC in the process of CCL payment.	1. CMV of commercial, industrial, CPR structure 2. Transfer Grant @ Tk. 10 per sft of affected structure but not exceeding Tk. 3,000. 3. Reconstruction Grant of TK10,000.	LA Act1982 Sec 8(1)(d) Sec 8(2) **As per 21 No. Law of 2017: additional 200% cost**	Assistance in relocation and reconstruction.
Special Implementation Issues and application Guidelines:			
Loss Item 6: LOSS OF RESIDENTIAL AND OTHER PHYSICAL STRUCTURES (WITHOUT TITLE TO LAND)			
Socially recognized owners of structures built on the ROW	1. CMV of structures as determined by PVAT 2. Structure Transfer Grant (STG) @ Tk. 15 (ten) per sft of affected structure for shifting	LA Act1982 Sec 8(1)(d) Sec 8(2)	

Unit of Entitlement	Entitlements	Applicable Law	Additional Services
	3. Reconstruction and Homestead Development Grant (RHDG) at the rate of 20 TK per sft	**As per 21 No. Law of 2017** **ADB SPS**	
Special Implementation Issues and application Guidelines:			
1. The homestead losers will produce documentary evidence and the BWDB through JVT will cross verify the landlessness of the homestead losers for allocation of an RV plot for free. 2. The RP-INGO will assist the APs to move to clustered relocations (resettlement villages) with community facilities or, alternatively, in self-relocation. The APs may be relocated to BWDB land (if available) or plots purchased (by the APs) for which assistance will be provided in the form of homestead land development.			
Loss Item 7: LOSS OF TIMBER AND FRUIT BEARING TREES, BAMBOO AND BANANA GROVES			
1. Legal owner(s) as identified by the DC in the process of CCL payment. 2. Socially recognized owners of trees grown on public or other land	1. Timber trees and bamboo: CMV of trees and bamboo. 2. Fruit-bearing trees without timber: if the tree is at or near fruit-bearing stage, the estimated current market value of the fruit. 3. Fruit-bearing trees with timber: CMV for the timber, and estimated current market value of fruit. 4. Banana groves: CMV of all trees 5. Owners will be allowed to fell trees and take the timber, free of cost after payment of CCL or RC as applicable.	LA Act1982 Sec 8(1)(b) Sec 8(2) **As per 21 No. Law of 2017: additional 100% cost**	INGO to explain RP policies regarding compensation for the trees of different categories and size and make the EPs aware that they could take the timber and fruits free of cost.
Special Implementation Issues and application Guidelines:			
1. The INGO will provide guidance in plantation and post-plantation care.			
Loss Item 8: LOSS OF STANDING CROPS/FISH STOCK			
1. Legal owners identified by the DC in progress of CCL payment 2. Socially recognized owners	1. RC of standing crops/fish stock. 2. Owners will be allowed to harvest crops and fish stock.	LA Act1982 Sec 8(1)(b) Sec 8(2) LA act 2017 ADB SPS 2009	INGO will assist APs in the process of claiming compensation from DC offices for organizing necessary documents.
Special Implementation Issues and application Guidelines: Guidelines:In case of any conflict between Governement Act/Rules & ADB SPS 2009 , later will prevail.			
Loss Item 9: LOSS OF LEASED /MORTGAGED IN LAND/PONDS			
1. Leaseholder with legal papers. 2. Socially recognized lessee or	1. CMV of crops/ fish stock for one year as compensation.	ADB SPS 2009	1. INGO will assist in ensuring that the lessee receives all eligible payments.

Unit of Entitlement	Entitlements	Applicable Law	Additional Services
sharecropper, in case of customary informal tenancy arrangements, including socially recognized agreements.	2. Outstanding lease money back to the lessee by the owner as per agreement. 3. The leaseholder will be allowed to take the crops/fishes free of cost within the date declared by BWDB		2. INGO will mediate refund of outstanding lease money by the owner to the lessees.
Special Implementation Issues and application Guidelines:			
1. With legal agreement: DC will pay CCL to legal owner and mortgagee/leaseholder in accordance by the law. With customary tenancy agreements, including socially-recognized verbal agreements: Legal owner will receive CCL from DC. The legal owner will pay the outstanding liabilities to the lessee/mortgagee. Under the following conditions: (i) all contractual liabilities are already paid up; (ii) if not, the legal owner will get the residual payment after all liabilities are paid up.3. BWDB will ensure RC of crops to the cultivator with direct payment of the difference, if CCL is less than RC, with assistance from INGO.4. Dislocation Allowance will be paid to the actual cultivator of the acquired land by BWDB with assistance from INGO.			
Loss Item 10: LOSS OF INCOME FROM DISPLACED COMMERCIAL/ INDUSTRIAL PREMISES			
Any proprietor or businessman or artisan operating in premises	Business restoration grant will be an equivalent to 3 months lost income against owners name recorded during the survey Employment in the Project construction work, if possible Moving assistance (one time) for tenant. Tk 5000.00	LA Act1982 Sec 8(1)(d) Sec 8(2) **ADB SPS** **LA Act 2017**	EPs will be brought under income and livelihood regenerating program (ILRP).
Special Implementation Issues and application Guidelines:			
1. All the business operators will be entitled for grant against loss of wages The one time moving assistance will be provided to the tenants only.			

Loss Item 11: TEMPORARY LOSS OF INCOME (WAGE EARNERS IN AGRICULTURE, COMMERCE & SMALL BUSINESS AND INDUSTRY)			
Regular wage earners affected by the acquisition.	Grant to cover loss of employees /regular wage earners @ TK 400X 90 days per person Allowance of Tk 5,000.00 Per HH Allowance of Tk 7,000.00 per FHH EPs to be included in the ILRP	**ADB SPS 2009**	1. EPs will be brought under the ILRP.
Special Implementation Issues and application Guidelines:			
EP must have been an employee of landowner or business located in the acquired lands for at least twelve months, as identified by Joint Verification and/or a contracted institution or a consulting company's census.			

Unit of Entitlement	Entitlements	Applicable Law	Additional Services
Loss Item 12: LOSS OF INCOME FROM RENTED -OUT AND ACCESS TO RENTED-IN RESIDENTIAL/COMMERCIAL PREMISES			
1. Owner of the rented-out premises 2. AH/person rented-in any such structure	Dislocation Allowance of Tk. 8,000.00 for each unit of premises to both the renter and the rentees.	LA Act1982 Sec 8(1)(d) Sec 8(2) **ADB SPS 2009** **LA Act 2017**	EPs will be brought under the ILRP.
Special Implementation Issues and application Guidelines:			

Loss Item 13: VULNERABLE AHs SPECIAL ASSISTANCE			
Vulnerable AH Assistance: Female-headed households, disabled, elderly, extremely poor and those losing more than 10% of their income to acquisition of land or business.	One-Time Special Assistance Grant of Tk 15,000 / AHH Skill training and credit support underILRP. No AH will get the grant if their family members do not participate to the proposed skill training	**ADB SPS**	EPs will be brought under the ILRP.
Special Implementation Issues and application Guidelines:			
1. Loss of income will be assessed as per actual loss of productive resources (land and businesses) to the project and the total income of the affected households from all sources through Census of all AHs. 2. JVT will verify the percentage of loss comparing the actual loss and the total income from all sources of the affected households. 3. Households turning into landless due to acquisition of agricultural land will be eligible for larger credit from the ILRP for longer duration.			

Loss Item 14: UNFORESEEN ADVERSE IMPACTS			
Households/persons affected by any unforeseen impact identified during RPimplementation	Entitlements will be determined as per the resettlement policy framework		As appropriate
Special Implementation Issues and application Guidelines:			
The unforeseen impacts and affected persons will be identified with due care as per policy framework and proposed to the MoWR and the ADB for approval including quantity of losses, their owners and the entitlements.			

8 RESETTLEMENT AND RELOCATION

8.1 Displacement and Relocation

All necessary efforts have been made so as to minimize the Project impacts and to reduce impacts on assets and disruption of livelihood. In order to minimize impacts to the maximum possible extent, adequate provisions have been incorporated into the planning and design of the Project to minimize or mitigate any unavoidable impacts. Technical and Social team has worked closely to reduce the social impacts of the Project by means of both design adaptation and innovative technical solutions. As a result the displacement impact has been reduced as far as possible. During the survey and group discussion the affected HH opted for getting cash as compensation and self relocation.

8.2 Self-Managed Resettlement by Affected Households

The self-managed resettlement could be on their own land in same village or in nearby villages; through purchase of new land for housing and resettlement elsewhere. Most of the affected households preferred to self-relocate themselves in the same or nearby villages after receiving all eligible benefits as per the policy framework and entitlement matrix. In most cases, they would need to develop the new land by filling it about 3-4 meters as the nearby areas, in most cases, are predominantly low-lying. Provision to assist the families for undertaking these tasks (land-filling) has already been included in Resettlement assistance. It is anticipated that the self-managed relocation strategy would limit social disruption by allowing the displaced families to stay around their own social kin groups as per their own choice. Apart from compensation and assistance planned per the project resettlement policy, the project will also assist them in the relocation process in terms of information, consultation with host communities and local government agencies, facilitation of documentation, licensing, and registration as necessary with local governments.

9 INCOME AND LIVELIHOOD RESTORATION PROGRAM (ILRP)

9.1 Income and Livelihood Restoration Strategy

Mitigation of loss of assets and livelihood is the main focus of the Resettlement Plan. Additional measures will be taken to provide appropriate support to the livelihood restoration aspects of APs. According to the known impacts, adequate compensation/resettlement benefits will be provided to these APs before resettlement and through further assessment by the implementing NGO additional support through trainings will be provided to enable them to develop new income generating activities. In addition, vulnerable APs will receive other support and also get preference, for income restoration assistance. This will be through linking resettlement activities with Gender & Livelihood component of the project.

The RP includes the following categories of APs for income restoration and livelihood support:

- Vulnerable households from the project right of way, eligible members of such family will get training on income generating activities (IGA) such as small business, poultry rearing, cow fattening, sewing etc. The RP implementing agency will conduct a need assessment survey among the vulnerable households and select need based training

programs for the particular groups under the project policy. For this, resettlement budget has kept provision for training on IGA for the female headed and vulnerable household mebers. It is assumed that one person from each household will be brought under this training program

- Vulnerable households having no adult male members to shoulder household responsibility (women headed households). The women heading the household will preferably be the eligible member. Vulnerable households losing more than 10% of their income source due to the project.

For additional support to usual income restoration assistance as mentioned above, the agency involved in livelihood restoration will specifically undertake assessment of needs and skill base of vulnerable APs of age between 15 to 45 years. The agency will conduct a need based survey and prepare a list of eligible members of affected vulnerable households with their relevant profile and the short-term livelihood regeneration assistance under the RP and long-term income generation program under the livelihood restoration program will be organized as per the options given the table below:

Table 9-1 Livelihood Restoration Options

1. Eligible members of poor households earning maximum BDT 60000 per year	1.1 Short-term: Compensation for structure, shifting allowance, reconstruction assistance, and priority in employment in construction. 1.2 Long-term: Needs and capacity identification, human development and skill training on IGA.
2. Eligible members from poor female headed households having no adult male members to shoulder household responsibility.	2.1 Short-term: In addition to support as 1.1, additional subsistence allowance. 2.2 Long-term: As 1.2 above.
3. Eligible members of poor households losing more than 10% of their income sources.	6.1 Short-term: Compensation for lost assets, payment of other resettlement benefits and employment in construction. 6.2 Long-term: As 1.2 above.

9.2 Employment in Construction

Local people whose livelihood is impacted by the project will get preference in jobs associated with the project construction. Affected people will form labor contracting society (LCS) with the help of IA and be deployed by the Contractor in any suitable works. Affected persons will get preferential employment in project works based on their eligibility. The jobs, in the semi-skilled and unskilled category, shall be offered to the APs in preference to the other. A clause should be incorporated in the contract documents requiring contractors to give employment, if available, to project affected people having ID cards in preference to other persons.

10 LAND ACQUISITION AND RESETTLEMENT COSTS

10.1 Introduction

The costs for land acquisition and resettlement in the RP have been estimated at current market price of land as per land rates of 2016, physical assets and businesses by enhancing 2016 from Shahjadpur area project rates, and additional assistance for loss of income and vulnerabilities as per the resettlement policy framework. This budget is indicative of outlays of different rates applied in similar ADB project in recent years for affected households due to acquisition of agricultural land. These costs will be updated and adjusted once the land acquisition boundaries will be finalized and the government adopts a price of land as per latest GOB ordinance in 2017 and other assets based on recommendations of PVAT for replacement value. Replacement value of land and property will be updated annually if the PVAT at the district level justifies the same at the time of dispossession for any considerable price escalation.

All land acquisition and resettlement funds will be provided by BWDB based on the financing plan agreed by the Government of Bangladesh and the ADB. Relocation of affected persons, squatters,

encroachers and lessees, their R&R will be considered as an integral component of the project costs.

The rehabilitation and training to the potential affected persons will be provided under the income and livelihood restoration program (ILRP) based on vulnerability and needs assessed through a special census and consultation exercise.

BWDB will ensure that the land acquisition and resettlement budgets are delivered on time to the DCs and resettlement account of the field office of the BWDB-RU respectively. BWDB will also ensure that the RP is submitted to the ADB for concurrence, and that funds for entitlements under the RP is fully provided to APs prior to the award of the civil work contract. Compensation and resettlement funds will be provided to the APs in two separate ways:

- Compensation under law for acquisition of land will be disbursed through the Deputy Commissioners;
- Additional assistance for resettlement of project-affected persons will be disbursed directly by BWDB with assistance from INGO.

10.2 Initial Budget

The RP budget for replacement value of land, structures and other assets, and special assistance will be calculated using the market rates reflecting replacement cost or updating the replacement value of assets at the time of dispossession. The costs for relocation and special assistance will be consistent with the resettlement policy framework and updated entitlement matrix. Other costs involving project disclosure, public consultations and focus group discussions, surveys, training and income and livelihood restoration, and monitoring and evaluation have been included in the RP budget. There is also a budget allocation for RP implementation and a +-10% contingency. The cost estimate in this RP is based on inventory of losses updated as of December 2017 and current compensation rate evaluation. This estimate will be revised based on changes on any additional impacts to be considered. Therefore, the budget will remain as a dynamic process for cost estimate

even during implementation. However, GOB is firmly committed to mobilize additional funds, if necessary.

Table 10-1 Initial Draft Budget Summary

Items	BDT	USD (82tk)
CCL		
Land acquisition +200%	578,200,983	7,051,232
RV of Structures	66,339,175	809,014
RV of Trees/crops	20,661,340	251,968
Resettlement benefits		-
Relocation cost	62,578,098	763,148
Rehabilitation Assistance	2,128,000	25,951
Service and Training	28,634,001	349,195
Contingencies 10%	75,854,160	925,051
Total	**834,395,757**	**10,175,558**

The total resettlement budget for the Tranche-2 JRB-1 Shahjadpur Embankment is Tk 834,395,757.00 or, about US$ 10.2 millions, including +-10 percent contingency.

The larger amount of resettlement cost is for land acquisition (69%), the Replacement Cost (structures and trees) is about (18 %) of the total and includes structures as well as trees, crops and perennials. The Relocation Cost is (7.5%) of the total budget and includes transfer grants for affected structures, reconstruction assistance, and a homestead development grant. Also it includes the stamp duty and registration cost 10% homestead land owners cost to facilitate buying new land to relocate. The rehabilitation assistance and training for the severally affected HHs (0.5%) of the total budget includes special assistance for vulnerable HHs, relocation assistance for owner-operated businesses and compensation of wage income losses but the major part is for implementation, Service and Training (3.4 percentage of the total budget) that includes hiring an RP-INGO, hiring an LD-NGO, implementing an income and livelihood restoration program (ILRP), the costs for an external monitoring agency (EMA), costs for a grievance redressal committee (GRC) and public consultation. Details of budget in Appendix G.

11 INSTITUTIONAL ARRANGEMENTS FOR RP IMPLEMENTATION

11.1 Bangladesh Water Development Board (BWDB)

Bangladesh Water Development Board (BWDB) is the owner and executing agency (EA) of the Project. For execution of the project, a Project Management Office (PMO) headed by a Project Director (PD) has been set up within BWDB that is responsible for the overall execution of the Project. All concerned BWDB field division offices headed by Executive Engineer have been set up within BWDB as Sub-project Management Office (SMO) and concerned SMO has updated relevant RP before starting implementation work.

A Resettlement Unit (RU) has been established within the PMO headed by Chief Resettlement Officer (CRO) and the PD has recruited and appointed an experienced Implementing Agency (NGO/

Social Consulting Firm) as required for implementation of resettlement activities. The Executing Agency (BWDB) is implementing the RP through setting a Sub-project Management Office (SMO) headed by Executive Engineer under the PMO and implementing NGO (INGO) for resettlement work is playing supporting role. The RU is responsible for implementation of the RP that includes disbursement of compensation through DC; and distribution of resettlement benefit through its own staff with the assistance of SMOs and INGO. All concerned BWDB field divisions will update their RP before starting implementation work. The RU is also responsible for implementation of an Income and Livelihood Restoration Program (ILRP) with the support of a NGO. This project has a Gender Action Plan (GAP) and a national Livelihood Development NGO (LD-NGO) would be recruited to help implementation of ILRP during and after resettlement of DPs.

Bangladesh Water Development Board (BWDB) already established, a Project Management Office (PMO) for the Project, headed by a Project Director (PD) that is responsible for the overall execution of the Project. The SMO, under the overall responsibility of the Project Director, will undertake day-to-day activities with the appointed Implementing Agency. The concerned Sub-Assistant Engineer, SMO or his representatives are actively involved with the JVT and PVAT. The Sub-divisional Engineer of SMO is performing as convener of GRC.

The SMO is coordinating and managing existing resettlement and rehabilitation of the DPs, disburse resettlement benefits, and ensure DP access to development programs adequately. The SMO will carry out the following specific tasks relating to RP implementation;

- Liaison with district administration to support RP implementation activities i.e. appoint JVT and PVAT members etc. ;
- Discharge overall responsibility of planning, management, monitoring and implementation of resettlement and rehabilitation program;
- Ensure availability of budget for all activities;
- Synchronize resettlement activity and handover incumbrance free land to the contractor with construction schedule;
- Develop RP implementation tools and form necessary committees.
- Monitor the effectiveness of entitlement packages and payment modality;

The RP Implementing NGO (INGO named) to be appointed will open field offices, carry out information campaign and involve affected persons including women in the implementation process from the very beginning of new work. The Implementing NGO will collect, collate, computerize and process data for identification of eligible persons correctly for resettlement benefits and assess their entitlements as per RP policy. However, the SMO will effect the payments after necessary scrutiny. The Executive Engineer (XEN) of SMO in charge of the resettlement management will report to the Project Director. He/she will work in close coordination with the respective field-based offices and Implementing Agency on the day-to-day activities of the resettlement implementation

The SMO, LA Office and the Implementing Agency will execute joint verification of the property on the ROW by JVT, valuation of the affected property by PVAT and monitor the progress of the RP implementation work. The SMO will ensure coordination between the relevant departments, Implementing Agency, the GRC, PVAT and the Project affected people. Apart from the GRC, Joint Verification Team (JVT) for quantification of affected properties and Property Valuation Advisory

Team (PVAT) will be formed by the Ministry of Water Resources (MOWR) for valuation of affected property and GRC for resolution reddressal of disputes. The composition and formation of committees and mechanisms for quantification and valuation of properties and grievance resolution will be constituted through government gazette. People's participation will be ensured through recruiting their representatives in these committees. Institutional responsibilities for RP preparation and implementation activities are further shown in the table below:

Table 11-1 Institutional Responsibilities in Resettlement Process

Related Activities and Responsibilities	Responsibility
A. Preparation of RP	
Recruitment of Implementing Agency	PMO
Design and reproduction of RP Information Brochures	SMO/INGO
Disclosure and public consultations	SMO/ INGO
Design and carry out joint verification survey	DC/SMO/ INGO
Market survey on prices of affected structure	INGO /PVAT
Establishment of unit prices	PVAT/PMO
Processing the Joint verification survey data of APs	INGO
Assessing AHs and vulnerable APs to be relocated	INGO /SMO
Determination of entitlements and consultations with individual DPs	SMO/ INGO
Disclosure of RP to BWDB, APs and stakeholders	PMO/SMO/ INGO
Review and concurrence of RP	ADB
Approval of RP	BWDB
B. RP Implementation	
Mobilization of GRC	PMO/SMO/ INGO
Establishment of internal monitoring	BWDB
Budget approval for compensation and resettlement benefits	PMO
Release of funds for payment of compensation/resettlement benefits	BWDB/PMO
Payment of compensation/resettlement benefits	SMO/ INGO
Filing and resolution of complaints of DPs,	SMO/GRCs/ INGO
Confirmation of “No Objection” for the award of civil works contract	ADB
Relocation and livelihood restoration assistance	INGO /SMO/LIRP
C. Monitoring and Evaluation	
Internal monitoring and evaluation	PMO/SMO/ISPMC

BWDB, upon approval of the project from ADB and Government and finalization of the detailed design and the RP will engage an experienced RP implementing NGO as sub-consultant either NGO or consultancy firm. They will prepare ID cards, EPEC and other documents for assisting BWDB in making payment and the BWDB will disburse account payee cheque to the entitled persons in open space or in office of the UP Chairman issuing prior notice. The RP implementing agency will assist the EPs and as well as BWDB in all aspects. During determination of unit rate of the affected structure, the PVAT will collect information sources with a structured questionnaire by interviewing different categories of people such as Imam, Teacher, Community Leader, trader, broker, elected representatives of the local government etc.

11.2 Institutional Capacity Strengthening

There is an established resettlement unit within BWDB with appropriate staffing. The PMO of BWDB already has a Chief Resettlement Officer (CRO) and provides technical support in preparing and implementing the RP. As part of the institutional development program the BWDB as the Executing Agency (EA) for the project loan implementation will need to establish its own resettlement unit (RU) at PMO to assist PMO assigning the existing staff (CRO) with additional responsibility of managing resettlement. Now the Sectional Officer, SMO will play role as convener of JVT and PVAT. The Sub-Divisional Engineer, SMO will play role as convener of GRC. The BWDB may organize training on involuntary resettlement at the initial stage of implementation of the RP in any suitable venue within Bangladesh by hiring senior level resettlement specialist from home or abroad for BWDB officials involved with the project.

11.3 Other Agencies Involved in the Process

11.3.1 Deputy Commissioners

The DC office will appoint representatives as member(s) of the committees for quantifying losses and determining valuation of the affected properties .The Ministry of Water Resources will constitute three committees i.e. Joint Verification Team (JVT), Property valuation Advisory Team (PVAT) and Grievance Redress Committee (GRC). Among these committees, JVT and PVAT will be constituted with representatives of BWDB, RP implementing agency and Deputy Commissioner (DC). BWDB and IA shall liaise with concerned DC offices to complete the tasks following the notification of the Ministry.

11.3.2 Implementing NGO

BWDB will engage an Implementing Agency (NGO/Social Consulting Firm) for implementation of the RP in the field level. The Implementing Agency will be engaged to assist the BWDB for implementation of the RP. The BWDB together with the consultant will define the tasks of the RP Implementing Agency in detailed Terms of Reference such as consultation /public information campaign for rapport building, issuance of ID cards, payment of eligible benefits to affected households/ individuals, institutional development, skill training/management training, community awareness and empowerment, etc. (See appendix D) The INGO will initially create ID number for each entitled person (EP) as identified during Joint Verification survey by JVT and prepare an ID card for each EP with photograph. Photograph of the EPs will be attested by the concerned UP Chairman and pasted on the ID card. The ID card will comprise information on name, father's/husband's name, mother's name, age, education, identifiable marks, detail address, details of quantity of losses etc.. The ID card will be issued by BWDB with joint signature of the BWDB and INGO representatives and distributed among the EPs by INGO.

The Implementing NGO (INGO) will assist the EPs in preparing documents and opening bank account in their names to receive cheque from BWDB. They will form focus group with the affected people based on homogeneity and/or nearness and hold meetings on regular basis to let them know their right and entitlements as prescribed in the RP. The Implementing INGO will have to establish an MIS section in their central office for record keeping of the DPs, creating individual ID number of the entitled persons, preparing entitled person's (EP) file based on quantity of losses and entitlement card (EC) based on loss type and budget. The INGO will submit monthly progress report to the ISPMC mentioning progress of activities to be carried out by INGO.

Upon fulfillment of criteria i.e. necessary documents to make payment/benefits to the EPs the INGO will prepare payment debit voucher & other documents for payment and BWDB will disburse account payee cheque to the EPs in the public place or Union Parishad (UP) office in presence of the UP Chairman issuing prior notice to the concerned EPs.

11.3.3 Ministry of Water Resources

The Ministry of Water Resources through a gazette notification will form various committees/teams for implementation of the RP at the field level. The Implementing Agency will work as member secretary for all the committees/teams involving representatives from DC, BWDB, LGI and DPs. These committees/teams will ensure stakeholders' participation and uphold the interest of the vulnerable DPs. The powers and jurisdictions of the committees will be clearly defined in the gazette notification.

11.4 Joint Verification Team

BWDB will form a Joint Verification Team (JVT) for the project through a notification to compare and review the physical verification data collected by the Project implementing Agency along with the DCs' assessment of losses of physical assets and their owners. JVT will conduct property assessment and evaluation and both JVT and the concerned party will sign the verification record. Disputes on properly right will be recorded. The implementing NGO will process the entitlements of the project-affected persons using the JVT data as one of the determinants. The JVT is formed as follows.

The JVT will be formed as follows:

- Representative of BWDB
- (Sub-Divisional Engineer/Assistant Engineer or equivalent officer): Convener
- Representative of concerned Deputy Commissioner : Member
- Representative of INGO recruited by BWDB

  (DTL, Area Manager or equivalent Officer of INGO/Specialist) : Member-Secretary

11.5 Property Valuation Advisory Team

The PVAT will review the assessment of the Implementing Agency on the market price of the property affected by the project at their replacement cost. The Implementing Agency will process the entitlements of the project-affected persons using the PVAT data as one of the determinants.

The PVAT will be formed as follows:

a) Representative of BWDB

(Executive Engineer/Assistant Engineer or equivalent Officer) : Convener

b) Representative of concerned Deputy Commissioner : Member

c) Sub-Assistant Engineer, concerned SMO, BWDB : Member

d) Representative of INGO recruited by BWDB

(DTL, Area Manager or equivalent Officer of INGO/Specialist) : Member-Secretary

Procedure of determining replacement value is described in the Figure- below:

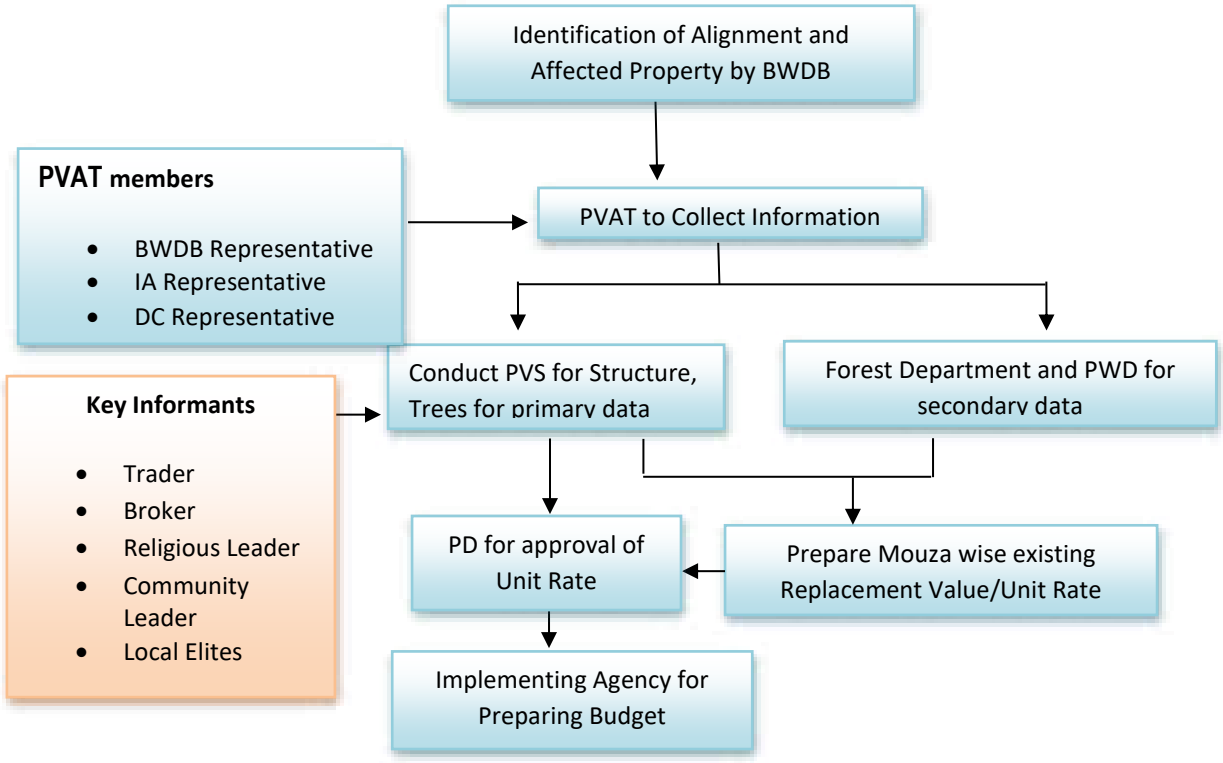


Figure 11-1 Procedure of Determining Valuation of Property

11.6 Women Groups in Resettlement Process

The RP implementation will ensure a gender sensitive approach in planning, management and operations of resettlement. Separate groups of women affected persons will be formed and operated by the Implementing Agency. Feedback from the female APs and female headed AHs will be obtained through these female focused groups for planning relocation and resettlement. The female staff engaged by Implementing Agency will identify needs of female APs for income restoration approaches and implementation of the income restoration component of the RP. Women were consulted during social appraisal and will be further consulted during the process of RP implementation.

12 MONITORING AND EVALUATION

12.1 Supervision, Monitoring and Evaluation

BWDB as the Executing Agency (EA), through the Project Management Office, will establish a monitoring system involving the XEN, SMO for collection, analysis, reporting and use of information about the progress of resettlement, based on the RP policy. These stakeholders will be made responsible to monitor the progress of all aspects of resettlement and income generation. The EA will report to the ADB on resettlement and income regeneration by APs in the quarterly reports,

including identification of significant issues. Besides, a project completion report stipulating all efforts and outcome will be sought by the ADB from the BWDB.

The RP implementation monitoring will be done internally to provide feedback to BWDB upon monitoring and evaluation reports and other relevant data to identify any action needed to improve resettlement performance or respond to the changing circumstances. Evaluation of the resettlement activities will beundertaken during and after implementation of the RP to assess whether the resettlement objectives were appropriate and whether they were met, specifically, whether livelihoods and living standards have been restored or enhanced. An External Monitoring Agency will be engaged as third party monitor during RP implementation. An independent reviewer will be engaged after implementation of the RP to review implementation of the RP. The evaluation will also assess resettlement efficiency, effectiveness, impact and sustainability, drawing lessons as a guide to future resettlement planning. Budgetary provision is kept in this RP for External Monitoring and Independent Review.

12.2 Internal Monitoring

The internal monitoring by BWDB will deal with all aspects of land acquisition and resettlement. The CRO, assisted by the INGO field staff, will establish a monthly monitoring system and prepare monthly progress reports on all aspects of RP. The benchmark data for Project level monitoring will come from the SES database created during the planning and implementation stages. 12.3 External Monitoring

The BWDB upon consent by the ADB committed to recruit an Independent Monitor (IM) for monitoring the performance of the RP implementation. The main task and methodology for the IM agency is to monitor and evaluate all activities relating to resettlement following appropriate methodology to measure the progress and the degree and level of targeted achievement. The specific tasks and methodology for the independent monitoring will include: (i) review of pre-Project baseline data on APs; (ii) identification and selection of an appropriate set of indicators for gathering and analyzing information on resettlement impacts; (iii) use of various formal and informal surveys for impact analysis; and (iv) an assessment of RP strategy, effectiveness, impact and sustainability, drawing lessons as a guide to future Project preparation work. The IM agency will monitor activities over the Project period and submit half yearly reports and a final evaluation report after completion of the RP implementation. The IM will report to the ADB through the BWDB within the stipulated time. (Seee Appendix F) TOR for an External Monitoring Agency (EMA)

12.3 Supervision by Consultants

The Resettlement Specialists will supervise and monitor the implementation of the RP. The supervision and monitoring work shall involve review of resettlement implementation, verification of the results of internal monitoring in the field, and consultation with APs, officials and community leaders for preparing review reports. In addition to regular review missions, ADB will undertake a Mid-Term comprehensive review of the RP implementation.

12.4 Reporting Requirements

BWDB has established a monthly monitoring system involving BWDB and INGO staff, and preparing monthly progress reports on all aspects of resettlement operations with RP wise segregated data.

The PD will send status reports on implementation of this RP periodically to ADB and a final report will be prepared and produced once the resettlement is completed. The report will reflect on the resettlement experience and lessons learned for improved management of land acquisition and resettlement in subsequent phases of the subproject. The progress of LA&R will be included in the Quarterly Progress Report.

APPENDIX A

HARMONIZATION WITH ADB'S SAFEGUARD POLICY9

Aspect	ADB SPS 2009	Harmonized Policy
Objectives		
1. Avoid involuntary resettlement	Avoid involuntary resettlement wherever possible	Avoid involuntary resettlement and adverse impacts on people and communities, wherever feasible
2. Minimize involuntary resettlement	Minimize involuntary resettlement by exploring project and design alternatives	If displacement is unavoidable, minimize involuntary resettlement by: (i) exploring alternative project designs; (ii) Effective measures to minimize impact in consultation with the people who are affected.
3. Mitigate adverse social impacts	To enhance, or at least restore, the livelihoods of all affected persons in real terms relative to pre-project levels; and to improve the standards of living of the displaced poor other vulnerable groups.	Where IR is unavoidable, effective measures to mitigate adverse social and economic impacts on affected persons by: (a) providing compensation for loss of assets at replacement cost; (b) ensuring that resettlement activities are implemented with appropriate disclosure of information, consultation, and the informed participation of those affected(c) improve or at least restore the livelihoods and standards of living of displaced persons, and (d) improve living conditions among displaced persons through provision of adequate housing with security of tenure at resettlement sites.
Core Principles		
1. Identify, assess and address the potential social and economic impacts	Screen the project early on to identify past, present and future involuntary resettlement impacts and risks. Determine the scope of resettlement planning through a survey and/or census of displaced persons, including gender analysis, specifically related to resettlement impacts and risks	Assess at an early stage of the project cycle the potential social and economic impacts caused by involuntary taking of land (e.g. relocation or loss of shelter, loss of assets or access to assets, loss of income sources or means of livelihood, whether or not the affected person must move to another location) or involuntary restriction of access to legally designated parks and protected areas and to determine who will be eligible for compensation and assistance.
2. Prepare mitigation plans for affected persons	Develop resettlement plan on the basis of assessment during project processing, with the intent that plan will guide refinements of impact estimates and mitigating measures as project parameters are finalized.	Preparation of Resettlement Plan or Resettlement Framework (RF) during Project processing to mitigate the negative impacts of displacement. The plan will provide estimate of the extent of total population affected and establish entitlements of all categories of affected persons (including host

Aspect	ADB SPS 2009	Harmonized Policy
		communities), with particular attention paid to the needs of the poor and the vulnerable.
3. Consider alternative project design	Explore viable alternative project designs to avoid and/or minimize involuntary resettlement.	Multiple alternative proposals must be examined to avoid or minimize involuntary resettlement and physical, or economic displacement and to choose a better project option while balancing environmental social and financial costs and benefits.
4. Involve and consult with stakeholders	Carry out meaningful consultations with affected persons, host communities, and concerned non-government organizations. Inform all displaced persons of their entitlements and resettlement options. Ensure their participation in planning, implementation and M&E of resettlement programs. Pay particular attention to the needs of the vulnerable groups, especially those below poverty line, the landless, the elderly, women and children and Indigenous people, and those without title to land, and ensure their participation in consultations. Establish a grievance redress mechanism to receive and facilitate resolution of the APs concerns. Support the social and cultural institutions of displaced persons and their host population.	Consult project-affected persons, host communities and local nongovernmental organizations, as appropriate. Provide them opportunities to participate in the planning, implementation, and monitoring of the resettlement program, especially in the process of developing and implementing the procedures for determining eligibility for compensation benefits and development assistance (as documented in a resettlement plan), and for establishing appropriate and accessible grievance mechanisms. Pay particular attention to the needs of vulnerable groups among those displaced, especially those below the poverty line, the landless, the elderly, women and children, Indigenous Peoples, ethnic minorities, or other displaced persons who may not be protected through national land compensation legislation.
5. Disclose and inform APs of RP and mitigation measures	Disclose the resettlement plan and other relevant information in a form and language(s) accessible to key stakeholders, civil society, particularly affected groups and the general public.	Disclose the resettlement plan including documentation of the consultation process, in a form and language(s) accessible to key stakeholders, civil society, particularly affected groups and the general public in an accessible place for a reasonable minimum period.
6. Support existing social and cultural institutions of the affected persons	Ensure that the existing social and cultural institutions are supported and used to the extent possible, including legal, policy and institutional framework of the country to the extent that the intent and spirit of the IR policy is maintained.	Ensure that the existing social and cultural institutions of the resettlers and any host communities are supported and used to the extent possible, including legal, policy and institutional framework of the country to the extent that the intent and spirit of the IR policy is maintained. Projects must be adequately coordinated so that they are accepted in manner that is socially appropriate to the country and locality in which the Project is planned.

Aspect	ADB SPS 2009	Harmonized Policy
		The SEA should include an assessment of compliance with applicable host country laws, regulations, and permits, and relevant social and environmental impacts and risks of the project.
7. Build capacity of the borrower(s) in IR implementation	Assist in building capacity of DMCs on best practice on involuntary resettlement planning and implementation	Assist in building capacity of DMCs on best practice on involuntary resettlement planning and implementation. Financing of technical assistance to strengthen the capacities of agencies responsible for resettlement, or of affected people to participate more effectively in resettlement operations.
Project Processing Benchmark		
Screening	Every development intervention will be screened, as early as possible in the project cycle, to identify the people who may be beneficially and adversely affected, and to determine the scope of a social assessment to assess those affects and impacts.	Every development intervention will be screened, as early as possible in the project cycle, to identify the people who may be beneficially and adversely affected, and to determine the scope of a social assessment to assess those affects and impacts.
Categorization	The ADB IR requirements apply to full or partial, permanent or temporary physical displacement (relocation, loss of residential land, or loss of shelter) and economic displacement (loss of land, assets access to assets, income sources, or means of livelihoods) resulting from (i) involuntary restrictions on land use or on access to legally designated parks and protected areas.	Categorize impacts by "significance" and define the scale of impacts – both direct and indirect – with particular attention to economic and livelihood impacts. Plan mitigations for all types of losses in the RP
Social Assessment	The borrower/client will conduct socioeconomic surveys and a census, with appropriate socioeconomic baseline data to identify all persons who will be displaced by the project and to assess the project's socioeconomic impacts on them. As part of the social impact assessment, the borrower will identify individuals and groups who may be differentially or disproportionately affected by the project because of their disadvantaged or vulnerable status.	Social Assessment be conducted as early as possible, and will specifically consider any impacts upon particularly poor and vulnerable Affected Persons.
Resettlement Plan	The borrower will prepare a resettlement plan, if the proposed	For all interventions that involve resettlement or physical or economic displacement, a resettlement plan will be prepared which will establish the

Aspect	ADB SPS 2009	Harmonized Policy
	project, will have involuntary resettlement impacts. The objective of the Resettlement plans will elaborate on displaced persons entitlements, the income and livelihood restoration strategy, institutional arrangements, monitoring & reporting framework, budget and a time-bound implementation schedule.	entitlements of all categories of affected persons (including host communities), with particular attention paid to the needs of the poor and the vulnerable. The RP will lay down appropriate time-bound actions and budgets, and the full costs of resettlement, compensation, and rehabilitation will be included in the presentation of the costs and benefits of the development intervention.
Supervision		Regular supervision on resettlement implementation to determine compliance with the resettlement instrument.
Monitoring	The borrower will monitor and measure the progress of implementation of the resettlement plan. For projects with significant involuntary resettlement impacts, the borrower will retain qualified and experienced external experts or qualified NGOs to verify the borrowers monitoring information. The borrower will prepare semi-annual monitoring reports that describe the progress of the implementation of the resettlement activities and any compliance issues and corrective actions.	The borrower is responsible for adequate monitoring & evaluation of the activities set forth in the resettlement instrument. It is desirable that the project proponents monitor: (i) whether any situations that were unforeseeable before the project began have arisen; (ii) the implementation situation and the effectiveness of the mitigation measures prepared in advance, and that they then take appropriate measures based on the results of such monitoring (iii) involve external experts for resettlement monitoring (iv) monitoring reports must be made public and additional steps to be taken, if required.
Evaluation		Mid-term evaluation to assess performance of RP implementation Assess whether the objectives of the resettlement instrument have been achieved, upon completion of the project, taking account of the baseline conditions and the results of resettlement monitoring.

APPENDIX B: Gaps and Gap-Filling Measures to Comply with ADB's Safeguard Policies

Aspect	Harmonized Policy	GOB 1982 OrdinanceII and otherapplicablelaws/Guidelines (Following amendment of the ordinance in September 2017, some changes in the rate will apply)	Gaps between HarmonizedPolicy and GOB	Safeguard Measures Adopted in the Project
Objectives				
1. Avoidinvoluntaryresettlement	Avoid involuntary resettlementand adverse impacts on peopleand communities, wherever feasible.	Avoidance of resettlement is not specificallymentioned in the 1982 Ordinance– focus on mitigation than avoidance.	Gaps with regard to this principle to avoid resettlement impact thru alternative options.	RF adheres to this principle - i.e., avoid resettlementimpacts where feasible
2. Minimizeinvoluntaryresettlement	If displacement isunavoidable, minimizeinvoluntaryresettlement by – (i) exploring alternativeproject designs; (ii) Effectivemeasures to minimize impact in consultation with the people who are affected.	The law only implicitlydiscouragesunnecessaryand excessland acquisition, as excess land remains idle and unused and lands acquired for one purpose cannot be used for a different purpose. Land that remains unused should be returned to the original owner(s).	Section 3/under 1982 Ordinance requires notification only; no consultation is required	- Minimize displacement of people as much as possible by exploring all viable design alternatives. - If unavoidable, provide for prompt payment of just compensation, replacement cost (for lost assets and income) and rehabilitation and livelihoodassistance, towards better condition than before relocation for all displaced households, regardless of (land) tenure. Unused land be returned back to the original owners through de-acquisition.
3. Mitigate adversesocial impacts	Where IR is unavoidable, effective measures to mitigate adverse social and economic impacts on affected persons by: (a) providing compensation for loss of assets at replacement cost;(b) ensuring that resettlement activities are implemented with appropriate disclosure of information, consultation, and the informedparticipation of those affected(c) improve or at least restore the	The mitigation measures are cash compensation only for lost assets. The complexitiesof resettlement is not addressed by the Ordinance	Only cash-based compensation for acquired assets. The impacts of loss of land, houses and the need for resettlement are not considered.	Provision for replacement value for assets lost (i.e., land, structures, trees etc.) at replacement cost. Resettlement in project sponsored sites with civic amenities. Separate Livelihood and IncomeRestoration PlanRPs to be disclosed to the community and available in *Bangla*. The "good practices" are derived from the Jamuna

Aspect	Harmonized Policy	GOB 1982 Ordinancell and otherapplicablelaws/Guidelines (Following amendment of the ordinance in September 2017, some changes in the rate will apply)	Gaps between HarmonizedPolicy and GOB	Safeguard Measures Adopted in the Project
	livelihoods and standards of living of displaced persons, and(d) improve living conditions among displacedpersons through provision of adequate housing with security of tenure at resettlement sites.			Bridge and JMREMP resettlement "models."
Core Principles				
1. Identify, assessand addressthepotentialsocialandeconomicimpacts	Assess at an early stage of the project cycle the potential social and economic impacts caused by involuntarily taking of land (e.g. relocation or loss of shelter, loss of assets or access to assets, loss of income sources or means of livelihood	The 1982 Ordinance requires preparation of Land Acquisition Plan (LAP) for land acquisitionand compensation purposes. However GOBenvironmental rules/guidelines (1997) synchronize various applicable laws and policy frameworks of the country for early identificationof impacts onbiophysical,Socioeconomic and cultural environment of a project intervention and their mitigation. Requiresthe assessmentof technicalalternatives, including the no action alternative to minimize adverse environmental impacts, include impact on human health and safety. IAidentifies measures to minimize the problems and recommends ways to improve the project's sustainability.	Impact assessments are typically done in the case of externally fundedprojects; otherwise, a land acquisition plan is prepared for acquisition purposes. Project impacts on properties, livelihoods and employment, health and environment are discussed in IEE/EIA reports, but do not provide enough information to determine losses and basis forcompensation .Existing laws do not have provision for identification of indigenous people to recognize their particular problem and inconveniences due to a project.	RF requires identification of impacts caused by displacement whether or not through land acquisition (maintaining the principle that lack of formal title to land should not be a bar to compensationand resettlement assistance), including number of affected persons. The Framework also addresses both direct and indirect impacts.

Aspect	Harmonized Policy	GOB 1982 Ordinancell and otherapplicablelaws/Guidelines (Following amendment of the ordinance in September 2017, some changes in the rate will apply)	Gaps between HarmonizedPolicy and GOB	Safeguard Measures Adopted in the Project
2. Prepare mitigation plans for affected persons	Preparation of Resettlement Plan or Resettlement Framework (RF) during Project processing to mitigate the negative impacts of displacement. The plan will provide estimate of the extent of total population affected and establish entitlements of all categories of affected persons (including host communities),with particular attention paid to the needs of the poor and the vulnerable.	The Deputy Commissioners (DCs) have the mandate in theirrespective jurisdiction as per law to acquire land for any requiring person (public agency or private person). The requiringbody requests the Deputy Commissioners for acquisition of land for their project/scheme.DCs investigate physicallythe requirement of land and carry out Joint Verifications of assets and type of land for assessing the quantity of losses (u/s 8(1) of the law). Affected titled holders receive the assessed value and50% on that for compulsory acquisition Fair compensation is required for acquisition of land which is dependenton recorded data with relevant government agencies (sub registrar's office for land, PWD for structure, DAE for crops, DOF for trees Etc.). Affected owners have the right to appeal on acquisition or on the compensation amounts determined as per law.	Existing law and methods of assessment do not ensure full replacement cost of property at current market price. The law does not consider resettlement or rehabilitation of affected persons or their loss of income or livelihood resources. "Market Value" of property is often found low in respect of current market price, it can be raised, if appealed, by a maximum of 10 percent each time which in most case is not sufficient to match with real market price.	RF requires full census and/or updating, where possible, for up-to-date database. RPs will be developed on the updated survey data Provide guidelines to ensure displaced persons and communities' compensation for lost assets at full replacement costs and other assistance to help them improve or at least restore their standard of living at pre-project level. Includes special attention to gender and preparation of gender action plan.
3. Consider alternative project design	Multiple alternative proposals must be examined to avoid or minimize involuntary resettlementand physical, or economic displacement and to choose a better project option while balancing	Feasibility studies including social, political, cultural and environmental impact assessments, detailed engineering surveys as basis for acquisition of private property or rights.	No specific laws for considering project design to avoid or minimize involuntary resettlement. Feasibility study	RF considers feasible alternative project design to avoid or at least minimize physical or economic displacement, while balancing environmental, social,

Aspect	Harmonized Policy	GOB 1982 OrdinanceII and otherapplicablelaws/Guidelines (Following amendment of the ordinance in September 2017, some changes in the rate will apply)	Gaps between HarmonizedPolicy and GOB	Safeguard Measures Adopted in the Project
	environmental social and financial costs and benefits.		considers cost benefit more from technical than socio-cultural considerations.	technical and financial costs and benefits.
4. Involve and consult with stakeholders	Consult project affected persons, host communities and local nongovernmental organizations, as appropriate. Provide them opportunities to participate in the planning, implementation, and monitoring of the resettlement program, especially in the process of developing and implementing the procedures for determining eligibility for compensation benefits anddevelopmentassistance (as documented in are settlement plan),and for establishing appropriate and accessible grievance mechanisms. Pay particular attention to the needs of vulnerablegroups amongthose displaces, especially those below the poverty line, the landless, the elderly, women and children, IndigenousPeoples, ethnic minorities, or other displaced persons who may not be protected through national landcompensationlegislation.	The 1982 Ordinance haveprovisions (Section 3 and 3/2) to notify the owners of property to be acquired. Any party having any objections can appear to DC for a hearing with 15 days of notification.	There is no provision in the law for consulting the stakeholders but the land allocation committees at district, division and central government level. People have limited scope to negotiate with the government on the price of land, but have no right to refuse acquisition.	RF has provisions forcommunity consultation and public disclosure of impacts as well as mitigation measures, including disclosureof ResettlementPlan. Further, grievancesredressal procedures involving cross-section of people, including representative of affected persons, have been established for accountability and democratization of the development process.
5. Disclose and informAPs of RP andmitigation measures	Disclose the resettlement planincludingdocumentation of the consultation process, in a form and language(s) accessible to key stakeholders, civil society, particularly affected groups and the general public in an	The 1982 Ordinance requires a “notice” to be published at convenient places on or near the property in a prescribed form and manner stating that the property is	Disclosure takes place in case of donor-funded projects.	RF requires disclosure of Draft RPs tothe affected communities in a form or language(s)that are understandable to key stakeholders, civil society, particularly affected groups and the general public in a

Aspect	Harmonized Policy	GOB 1982 Ordinancell and otherapplicablelaws/Guidelines (Following amendment of the ordinance in September 2017, some changes in the rate will apply)	Gaps between HarmonizedPolicy and GOB	Safeguard Measures Adopted in the Project
	accessible place for a reasonable minimum period.	proposed to be acquired (u/section 3).		national workshop. Further, updated RPs will be disclosed based on material changes as result of the concerns of affected families.
6. Support existing social and cultural institutionsof theaffected persons	Ensure that the existing social and cultural institutions of the resettlers and any host communities are supported and used to the extent possible, including legal, policy andinstitutional framework of the country to the extent that the intent and spirit of the IR policy is maintained. Projects must beadequatelycoordinated so that they are accepted in manner that is socially appropriate to the country and locality in which the Project is planned. The SEA should includean assessmentof compliancewith applicablehost countrylaws, regulations, and permits, and relevant socialandenvironmentalimpacts and risks of the project.		No provision in any existing laws.	The Jamuna Bridge and the follow-up JMREMP established this as "good practice" in resettlementoperations. Affected households were given options for relocationin accordance with their choices and support available from existing social networks. Host–resettlers' relation was enhanced by providing civic amenities and infrastructure services to the host villages. The RF has similar provisions to enhance carrying capacity of the host villages in post-relocation period.
Supervision	For all interventions thatinvolve resettlementor physical or economic displacement, are settlement plan will be prepared. The RP will lay down appropriate time bound actions and budgets, and the full costs of resettlement, compensation, and rehabilitation will be included in the presentation of the costs and benefits of thedevelopment intervention.	No provision in the1982 Ordinance.	There is no law or directives on the supervision of the land acquisition process by Deputy Commissioner.	Resettlement supervision in the Project will follow the Jamuna and JMREMP models with ADB's periodic "milestone" meeting, supervision by CSC safeguard specialist, midterm review of resettlement performance and regular supervision of resettlement operations by the Resettlement Unit of BWDB.

Aspect	Harmonized Policy	GOB 1982 OrdinanceII and otherapplicablelaws/Guidelines (Following amendment of the ordinance in September 2017, some changes in the rate will apply)	Gaps between HarmonizedPolicy and GOB	Safeguard Measures Adopted in the Project
Monitoring	Regular supervision onresettlement implementationto determine compliance with the resettlement instrument.	The 1982 Ordinance II has provision that the DC will monitor and submit a statement totheGovernment annually about the properties acquired for different requiring bodies and mode of utilization of the land.	Existing laws not have any provision for rehabilitation of project affected persons and therefore, no monitoring is done.	RF has provision for internal, external monitoring. Monitoring results will be shared and findings will be used for enhancement, if needed.
Evaluation	The borrower is responsiblefor adequate monitoring& evaluation of the activities set forth in theresettlement instrument. It is desirable that the project proponents monitor: (i) whether any situations that were unforeseeable before the project began have arisen;(ii) the implementation situation and the effectiveness of the mitigation measures prepared in advance, and that they then take appropriate measures based on the results of such monitoring(iii) involve external experts forresettlementmonitoring(iv) Monitoring reports must be made public and additional steps to be taken, if required.	No provision for evaluations of the post-displaced lives of the affected householdsand communities		CSC Safeguard Specialist will conduct annual evaluation of the performanceof resettlementoperations as well as impacts of resettlement during and after implementation of resettlement plans to assessresettlement efficiency, effectiveness, impacts, and sustainability.

APPENDIX B

ASSESSMENT OF REPLACEMENT VALUES

Per decimal land price

mouza name	agricultural land	home structure
shelachapri	19,643	5,000
ishardiya	46,154	12,667
nundaha	12,604	4,000
nagardala	31,955	17,500
potajia	28,403	41,482
shahjadpur	30,093	7,142
ratankandi	27,109	50,000
Dombaria	21,583	3000
Kumir Goalia	32807	16888
	Average	22,668

APPENDIX C

DRAFT BUDGET CALCULATION

Baghabari Embankment										
No.	Expenditure Item							Total BDT	Total US$	%
A.	Land Acquisition (see sheet area-cost for explaination)							635,067,468	7,744,725	70.31
		Area(Ha)	Unit Cost		BDT	USD				
	Land Acquisition	36	5,601,784		578,200,983	7,051,232				
	Regulators and Road Crossing	3.6	5,601,784		56,866,485	693,494				
B.	Replacement Cost							87,000,515	1,060,982	9.63
	1 Structure							**66,339,175**	809,014	
	Structures	Units	Type	Sqft	Cost/sft		BDT			
		100	Pukka	12936	1,280		16,558,080			
		135	Semi-Pukka	34038	815		27,740,970			
		845	Kutcha	169729	455		77,226,695			
		70	Thatched	9933	185		1,837,605			
		171	Tubewell	1863	5,000		9,315,000			
	Re-usable Materials	Tin wall/roof					**66,339,175**			
	2 Trees/Crops/Perennials							**20,661,340**	251,968	
		Units	Type		Unit Cost		BDT			
		102	Fruit	Small	120		12,240			
		220		Medium	2,100		462,000			
		1744		Large	3,500		6,104,000			
							6,578,240			
		1019	Timber	Small	200		203,800			
		310		Medium	4,000		1,240,000			
		1594		Large	7,800		12,433,200			
							13,877,000			
		458	Groves		450		206,100			
		129	Medicine				0			
		7083	Vegetables				0			
		1472	Other				0			
C.	Relocation Cost							68,264,747	832,497	7.56
	1 Transfer Grant for Structures							1,830,000	22,317	
		Units			Unit Cost		BDT			
		366	AH		5,000		1,830,000			
	2 Reconstruction and Homestead Development Grant							2,928,000	35,707	
		Units			Unit Cost		BDT			
		366	AH		8000		2928000			
	3. Stamp duty and registration cost 10% land owners cost to facilitate buying new land							63,506,747	774,473	
		366	AH		10%		63,506,747			

D.	Rehabilitation Assistance for AHs											2,128,000	25,951	0.24
		1 Vulnerable Households										480,000	5,854	
		Units	Type			Unit Cost		BDT						
		32	vulnerable HH			15,000		480,000						
		2 Moving Assistance for Owner operated Business										140,000	1,707	
		Units		Unit Cost				BDT						
		28	Business	5,000				140,000						
		3 Assistance for Affected Wage Earners										1,508,000	18,390	
		Units	Type	Unit Cost				BDT						
		306	MHH	4,000				1,224,000						
		20	FHH	5,000				100,000						
		46	Agricultural Land user			4,000		184,000						
E.	Service and Training											28,634,001	349,195	3.17
		1 Implementation of RP										15,000,000	182,927	
		2 Implementation of ILRP										8,334,001	106,846	
								BDT	USD					
		Livelihood Skills Development Training						642,367	7,834					
		Tailoring Training						1,109,567	13,531					
		Livelihood Development NGO						1,740,216	21,222					
		Inputs support for income restoration						5,012,200	64,259					
		3 External Monitoring Agency										5,000,000	60,976	
		4 GRC, Consultation Associated Costs										300,000	3,659	
F.	*Subtotal (A+B+C+D+E)*											821,094,731	10,013,350	
G.	*Contingency (10%)*											*82,109,473*	1,001,335	9.09
H.	**TOTAL**											**903,204,204**	11,014,685	100.00

Calculation of the land cost according to local market price

			Agriculture	Household	Bazar	Average			Area			Cost
	Upazila	Mauza	BDT/dec	BDT/dec	BDT/ dec	BDT/dec	BDT/acre	BDT/ha	dec	acre	ha	BDT
1	Shahajadpur	shelachapri	19,643	5,000	0	16,978	1,697,838	4,195,443	1,476	15	6	25,051,601
2		ishardiya	46,154	12,667	0	43,980	4,397,952	10,867,559	770	8	3	33,864,230
3		nundaha	12,604	4,000	0	10,186	1,018,554	2,516,898	631	6	3	6,431,977

4		nagardala	31,955	17,500	0	27,492	2,749,162	6,793,316	259	3	1	7,122,693
5		potajia	28,403	41,482	0	29,096	2,909,626	7,189,831	1,858	19	8	54,069,576
6		shahjadpur	30,093	7,142	0	14,779	1,477,916	3,652,006	2,008	20	8	29,680,577
7		ratankandi	27,109	50,000	0	27,657	2,765,708	6,834,202	710	7	3	19,637,079
		Dombaria	21,583	3,000	0	14,531	1,453,092	3,590,662	1,146	11	5	16,656,384
		Kumir Goalia	32,807	16,888	0	16,888	1,688,800	4,173,109	13	0	0	219,544
	#REF!	**Total**							**8,872**	**89**	**36**	**192,733,661**

based on survey from DC office

based on average at upazila

Average land price		Land use	Area (decimal)	%	Base price	Average price
shelachapri	shelachapri	Household	269	18%	5,000	16,978
	shelachapri	Agriculture	1,207	82%	19,643	
ishardiya	ishardiya	Household	50	6%	12,667	43,980
	ishardiya	Agriculture	720	94%	46,154	
nundaha	nundaha	Household	178	28%	4,000	10,186
	nundaha	Agriculture	454	72%	12,604	
nagardala	nagardala	Household	80	31%	17,500	27,492
	nagardala	Agriculture	179	69%	31,955	
potajia	potajia	Household	99	5%	41,482	29,096
	potajia	Agriculture	1,760	95%	28,403	
shahjadpur	shahjadpur	Household	1,340	67%	7,142	14,779
	shahjadpur	Agriculture	668	33%	30,093	
ratankandi	ratankandi	Household	17	2%	50,000	27,657
	ratankandi	Agriculture	693	98%	27,109	
Dombaria	Dombaria	Household	435	38%	3,000	14,531
	Dombaria	Agriculture	711	62%	21,583	
Kumir Goalia	Kumir Goalia	Household	13	100%	16,888	16,888
	Kumir Goalia	Agriculture	0	0%	32,807	

APPENDIX D

DRAFT INFORMATION BROCHURE RP (ENGLISH VERSION)

Government of the People's Republic of Bangladesh

Ministry of Water Resources

Bangladesh Water Development Board

Flood and Riverbank Erosion Risk Management Investment Program (FERMIP)

Draft Resettlement Information Brochure

Information on entitlement to compensation and resettlement of people affected by land acquisition and river bank protection work

January, 2017

Published by Jamuna Meghna River Erosion Mitigation Project, Bangladesh Water Development Board

Abbreviations

AB	Acquiring Body (the Deputy Commissioner)
AC	Assistant Commissioner
AD	Alluvial and Diluvial
ADB	Asian Development Bank
AP	Affected Person
BWDB	Bangladesh Water Development Board
CCL	Cash Compensation under Law
DC	Deputy Commissioner
EP	Entitled Person
GOB	Government of Bangladesh
GRC	Grievance Redress Committee
ID	Identity
INGO	Implementing NGO
JFPR	Japan Fund for Poverty Reduction
JMREMP	JamunaMeghnaRiver Erosion Mitigation Project
JVT	Joint Verification Team
LA	Land Acquisition
LWL	Lowest Water Level
MARV	Maximum Allowable Replacement Value
MDIP	Meghna Dhonagoda Irrigation Project
MOWR	Ministry of Water Resources
NGO	Non-Government Organization
PIRDP	Pabna Irrigation and Rural Development Project
PVAT	Property Valuation Advisory Team
RB	Requiring Body (Bangladesh Water Development Board)
ROW	Right of Way
RP	Resettlement Plan
RRC	Refund of Registration Cost
SBE	Small Business Enterprise
SDE	Sub-Divisional Engineer
SES	Socio-economic Survey
UP	Union Parishad (Local Government Institution)

1. Background

24. The Asian Development Bank supports the feasibility assessment of a potential future flood and riverbank erosion risk management program covering parts of the main rivers of Bangladesh named Main River Flood and Bank Erosion Risk Management Program (FERMIP). The main focus is to reduce the riverbank erosion and flood risks to the adjacent flood plains while maximizing economic activities in a sustainable and environmentally acceptable manner. The FERMIP builds on and extends the activities of the Jamuna-Meghna River Erosion Mitigation Project (JMREMP) (ADB, 2002), implemented in different phases from January 2003 until June 2011. In addition, a similar project, the Assam Integrated Flood and Riverbank Erosion Risk Management Investment Project (AIFRERMIP) (ADB, 2010) provides important insight into a number of relevant project elements and processes.

25. The Project will cover the main rivers from Bhangabandhu (Jamuna) Bridge[44] and the proposed Ganges Barrage to Chandpur, as such covering around 60 km of the Jamuna, around 20 km of the Ganges, and the whole around 100 km long Padma reach. Two main confluences are included: the confluence of Ganges and Jamuna and the confluence of Padma and Upper Meghna. Importantly, for flood benefits and, of course, targeting the overarching goal of poverty reduction, the flood plains on both sides of the rivers play a fundamental role as home of a largely poor population depending on agriculture and fisheries. As a consequence sub-reaches with similar river and flood plain characteristics as practical subproject areas are identified. Each sub-reach consists of several upazilas. In total 14 sub-reaches were identified for pre-feasibility assessment: two each at the Jamuna Right and Left Bank (JRB, JLB), 3 along the Padma Right and Left Bank (PRB, PLB), one at the Meghna Right Bank (MRB), and two along the Meghna Left Bank (MLB).

26. During March-May 2013, a census and inventory of losses survey listed the houses and other structures along the alignment of the new embankment (Jamuna River), rehabilitated embankment on the Baral/Hurashagar River) and on the proposed 1 Km of River Bank Protection (RBP). In addition, a list of the owners of land in the RBP's RoW, including owners of land in the river-bed has been prepared. Those who have lost or will lose land, homestead and other properties, as identified by the Acquiring Body (AB, which is the Deputy Commissioner) and the Requiring Body (RB, which is BWDB), will be entitled to Cash Compensation under Law (CCL) from the respective District administration. They will also be provided with Resettlement Benefits and other support by BWDB according to the guidelines of the ADB so that they can retain their pre-Project socio-economic condition. In addition, persons living within the RoW and earning an income will receive a Subsistence Allowance from BWDB for loss of income or workdays according to Resettlement Plans (RPs) approved by the GoB.

27. For successful implementation of the Resettlement Plan, BWDB requests the attention and support of both national and local social development organizations. An Implementing NGO (INGO) is in place to assist BWDB in the implementation of the resettlement activities.

2 Definitions of Some of the Resettlement Terms

(a) Directly Affected Persons

[44] Presently the Jamuna Multipurpose Bridge (JMB) is known as Banghabandhu Bridge. For an easier understanding of the location, we maintain the abbreviated form of Jamuna Bridge throughout this report.

28. People who were living in the Project Right of Way (RoW) during service of the notice under Section – 3 of the Land Acquisition Act 1982 or during the Inventory of Households and Assets between the Embankment and the Bankline and Socio-economic Survey (SES) conducted from March 2013 to May 2013 and recognized by BWDB, and will lose their land and property or source of income, will be entitled to Resettlement Benefits from BWDB as the Directly Affected Persons (APs).

(b) Indirectly Affected Persons

29. People who will lose their place of residence or source of income but do not own any land in the Project RoW will also be entitled to Resettlement Benefits from BWDB as indirectly Affected Persons (APs).

(c) Households

30. Generally, parents with children, brothers and sisters who live as a single family and eat from the same hearth are considered as a household; but household servants or regular employees will not be regarded as family members.

(d) Entitled Person (EP)

31. Persons who lose land or other property and/or sources of income opportunity who receive compensation from the District administration and are listed in March-May 2013 Inventory and SES, and recognized by BWDB, will be considered to be Entitled Persons (EPs). Those who are included in the Land Acquisition (LA) Award Book, that is legal owners who receive compensation from the District administration, or their lawful heirs, will be entitled to Resettlement Benefits from BWDB. In the case of joint ownership, the head of the household will receive the resettlement benefits.

(e) People Who Live on Private Land Belonging to Others and Squatters on Public Land

32. *Uthuli*[45] who live on private land belonging to others or carry out business there and squatters who live in Government land temporarily will be regarded as affected if their homestead land is acquired/required. Such families identified in the March-May 2013 Inventory and SES and confirmed by BWDB will be regarded as the EPs.

(f) Affected Income Earner

33. According to the March-May 2013 Inventory and SES, confirmed by BWDB, households living within on acquired or BWDB land will be regarded as Affected Income Earners due to any temporary loss of income through impact on home/business structures.

(g) Affected Tenant/Sharecropper

34. Cultivators of agricultural land which is not their own will, if certified by BWDB and the INGO as such, be regarded as an affected Tenant/Sharecropper. For category (e) above and for category (f), employer and the owners of the plot respectively and /or the Union Parishad[46] (UP) Chairman/Member will jointly certify them.

(h) Purchase of Replacement Land and Refund of Registration Cost

35. An AP is entitled to the replacement price of the agricultural/homestead/commercial land he/she lost to the Project so that he/she may purchase the equivalent amount of land. If he/she

[45] *Uthili* are persons who live on the private land of others with permission.

[46] The *Union Parishad* is the lowest level of local government.

cannot find the same amount of land with the compensation money, then he/she can purchase less land of higher quality or more land of lower quality than he/she lost. The AP will get a Refund of Registration Cost (RRC); however, the RRC cannot be more than the stamp duty needed to purchase land using the replacement value fixed by a Property Valuation Advisory Team (PVAT) established by BWDB and approved by MoWR.

(i) Compensation

36. APs will get Cash Compensation under Law (CCL) and a 50% additional price as premium over the same from the DC. CCL will be fixed by the District administration according to the Land Acquisition Act 1982 and all amendments thereafter.

(j) Resettlement Benefits

37. In addition to the CCL, the RP provides additional Resettlement Benefits in the form of grants to ensure that the APs will receive the current Replacement Market Value for their land and other properties.

(k) Prices of Different Types of Land

38. The legally constituted PVAT will carry out a detailed market survey through the INGO to determine the Maximum Allowable Replacement Value (MARV) of acquired land, and APs will be entitled to the MARV according to their loss

(l) Lowest Water Level and AD Line

39. From a legal and revenue point of view, the line that marks the Lowest Water Level (LWL) with the Flood Plain during the Dry Season is considered as the Bankline - also called the AD Line (Alluvial and Dilluvial Line) when declared formally by Assistant Commissioner of Land. Land above the LWL to the floodplain is private land unless already acquired by BWDB. For the Project purposes, the LWL will be considered as the demarcated Bankline or AD line.

40. The eroded land beyond the AD line goes under GoB ownership through a chained procedure that ends with the declaration as Khas[47]land by the Additional Deputy Commissioner. If Khas land, (underwater land[48]) is acquired, the DC will be paid the CCL as required by the Land Acquisition Act 1982, but not the additional 50% as premium.

41. In such a case, because of the Project's stabilization of the Bankline, the previous private owners will be identified and a Resettlement Benefit paid to them as APs losing their legal opportunity of regaining the land if it re-emerges within 30 years of erosion.[49]

(m) Vulnerable Households

42. Vulnerable Households are defined as APs who suffer more - economically and socially - from relocation than other APs. Based on past experiences from similar projects, the vulnerable households include (i) women-headed households; (ii) landless households (those without agricultural land, and depend largely on wage labor for survival); (iii) disabled households heads

[47]Eroded land is considered to be *Khas* land. *Land Administration Manual*, GOB. page 384

[48] The value of eroded land is only 25 percent of land in the floodplain (QualityLand). *Land Administration Manual*, GOB. page 660

[49]*East Bengal State Acquisition and Tenancy Act* (1951, Revised 1998)and*Land Administration Manual*, GOB. pages 240, 243,

and (iv) households having residual agricultural land less than 1 acre or losing more than 10% of their income from agriculture due to acquisition. Such households will receive priority assistance in the Social Development Program (SDP) and employment in the Project construction work, if available.

3 Cut Off Dates

43. As defined in the RP, the Cut Off Date is the date after which eligibility for resettlement benefits will not be considered. The date of notification under section 3 for acquisition of land is treated as cut-off date for the project affected legal land owners. The cut-off date usually for non-titled APs such as informal settlers/squatters and encroachers is considered as the commencement date of census. The cut-off date, therefore, for the non-titled APs under this project is November 2017.

44. *Physical Losses Cut Off Date*. Because of the ongoing nature of Bank erosion, an Inventory of Households and Assets between the Embankment and the Bankline conducted in October-November 2017 that indicated all HHs that might possibly be on the RoW by start of construction and so be considered for physical losses due to land acquisition. The Physical Losses Cut Off Date of November, 2017 includes, therefore, only HHs having houses and establishment within the RoW at the beginning of physical works construction as identified by BWDB's Joint Verification Team (JVT).

45. *The Inventory Survey*is subject to verification by the JVT and approval by BWDB, considering not only the original Inventory but the Socio-economic Survey (SES) and JVT data collected just prior to civil works construction. In case of discrepancies, GRC will determine eligibility for individual HHs for Resettlement Benefits, such as: Replacement Value of Structure; Salvaged Material Free of Cost; Transfer Grant; Reconstruction Grant; and Homestead Development Grant.

46. *Income Losses Cut Off Date*. Among the Resettlement Benefits to be given to APs are Subsistence Grants for Loss of Income. The Census, Inventory of Losses, and Socio-economic Survey (SES), completed November 2017, serve as the Cut Off Date for eligibility to receive the Income subsistence Grants for: Male and Female HH Heads; Small Business Enterprise (SBE) Proprietors and Employees; and for Tenants/Sharecroppers. As with the Inventory of Losses Survey data, the SES Cut Off Date is subject to verification by BWDB's Joint Verification Team (JVT) and approval by BWDB.

47. *Land Acquisition* is not covered by these Cut Off Dates. CCL will be paid by the DC as per GoB LA Law; and the INGO, with BWDB approval, will provide Grants for Replacement Value of Land and other properties established by the PVAT and according to the Resettlement in Section 4 below.

4. The Resettlement Entitlement Matrix

48. Through the District Administration and the INGO, the BWDB will provide the CCL + 50% additional cost as premium and Resettlement Benefits respectively in accordance with the Land Acquisition Act and the Resettlement Entitlement Matrix of the RP, as legally agreed between the GoB and the ADB. The Resettlement Entitlement Matrix is shown below:

Resettlement Entitlement Matrix

General Implementation Issues and application Guidelines

13. PVAT

BWDB will setup a Property Valuation Advisory Team (PVAT) at each District The tasks of this PVAT are:

m) Recommend Replacement Cost (RC) based on Current Market price (CMP) analysis for Land, Structures, Trees and standing Crops

n) CMP will be assessed for every affected mauza

o) The Land Acquisition price will be determined by the standard procedure according to the land acquisition law. Updated in September 2017.

p) For all private land, the market price will be enhanced by 200% for compensation under law (CCL). For *khas* land (DC is the owner at respective districts on behalf of the government), CCL will be the assessed market price without enhancement.

q) RC for structure considering the cost of materials, labor inputs and land development cost at current market rates**.**

r) RC /CMVwill be approved by the Project Director.

14. INGO

BWDB will engage a NGO to support implementation of resettlement plan i.e. to support the implementation of all land acquisition and resettlement activities. The NGO (INGO) will

o) Identify all persons who have interest in the lands that will be acquired under the project (owner, tenants, operators etc.;

p) identify all informal occupier/ settler on the right of way of new embankment, rehabilitation embankment and RBP works;

q) Make the landowners / tenant/ informal occupier aware about details of land acquisition process, compensation entitlement, payment procedure/ mechanism, resettlement benefit offered by the project.

r) Legal owners will be assisted by INGO to organize legal documents in support of their ownership

s) INGO will identify loss and entitlement of female owners and co-sharers through share determination at the field upon receipt of payment data from the DC office

t) The INGO will inform the APs of the details of the land acquisition and compensation process, resettlement package and payment procedure.

u) The INGO shall encourage Entitled Persons (EPs) to consider purchasing land or investing the money in productive/income generating activities.

15. JVT

e) The loss inventory items and quantities as well as the Entitled Persons (EP)shall be verified in the field through Joint Verification Team (JVT) formed by DC. The members of PVAT will attend field verification by JVT.

f) The JVT will verify the socially recognized User as identified by the Census

16. BWDB field office (Executive Engineer) will do Title updating for usufruct and other rights before issuance of notice with assistance from INGO

17. DC will pay CCL for the Loss Items. If RC is higher than CCL, the difference will be paid by BWDB with assistance from INGO.

18. Compensation for Structures:

k) Joint Verification (DC and BWDB) and/or Census will identify (record floor areas and category) of structure

l) Compensation must be paid before DP dismantle and remove the structures as per civil works requirement

m) The date of service of notice will be recognized as the cut-off date for structures not recognized by DC. In case of major differences identified between databases, BWDB will verify the data through the Joint Verification Team (JVT).
n) The owner is allowed to take all salvageable material
o) The RC will be the cost of the structures at market price

Unit of Entitlement	Entitlements	Applicable Law	Additional Services
Loss Item 1: LOSS OF AGRICULTURAL LAND			
Legal owner(s) as identified by Deputy Commissioner (DC) in the process of CCL payment.	1. Replacement Cost (RC)[50] or Current Market Value (CMV) of agricultural land.	LA Act 1982 Sec 8(1)(a), Sec 8(2) **As per 21 No. Law of 2017** **ADB SPS**	
Special Implementation Issues and application Guidelines:			
Loss Item 2: LOSS OF HOMESTEAD, COMMERCIAL, INDUSTRIAL LAND AND COMMON PROPERTY RESOURCES			
Legal owner(s) as identified by DC in the process of CCL payment.	1. CMV of land. 2. 10% of CMV as transaction allowance such as stamp duty and registration cost, VAT etc. No matter whether she/he purchase land or not	LA Act 1982 Sec 8(1)(a), Sec 8(2) **As per 21 No. Law of 2017: additional 200% cost** **ADB SPS**	1. BWDB will assist purchase of above land(s) jointly with INGO on negotiated price and homestead land development (earth filling, if needed.) with internal road links.
Special Implementation Issues and application Guidelines:			
Loss Item 3: LOSS OF WATER BODIES (PONDS, BOTH CULTIVATED AND NON-CULTIVATED)			
Legal owner(s) as identified by DC in the process of CCL payment.	1. CMV of the water body (private land). 2. Allowance of one year fish harvest to be recommended by PVAT	LA Act 1982 Sec 8(1)(a), Sec 8(2) **As per 21 No. Law of 2017** **ADB SPS**	.
Special Implementation Issues and application Guidelines:			
Loss Item 4: LOSS OF RESIDENTIAL STRUCTURES WITH TITLE TO LAND			

[50]The costs of replacing lost assets (e.g., land, houses/structures, trees and crops) and income, including cost of transaction.

Unit of Entitlement	Entitlements	Applicable Law	Additional Services
Legal owner(s) as identified by DC in the process of CCL payment.	1. CMV of residential structure 2. Transfer Grant @ Tk. 15 per sft of affected structure but not exceeding 3. Reconstruction and Homestead Development Grant (RHDG) at the rate of 20 TK per sf.	LA Act1982 Sec 8(1)(d) Sec 8(2) **As per 21 No. Law of 2017: additional 100% cost** **ADB SPS**	Assistance in relocation and reconstruction.
Special Implementation Issues and application Guidelines:			
Loss Item 5: LOSS OF COMMERCIAL/INDUSTRIAL/COMMON RESOURCE PROPERTY (CPR) STRUCTURES WITH TITLE TO LAND			
Legal owners as identified by DC in the process of CCL payment.	1. CMV of commercial, industrial, CPR structure 2. Transfer Grant @ Tk. 20 per sft of affected structure but not exceeding Tk. 4,500. 3. Reconstruction Grant of TK10,000.	LA Act1982 Sec 8(1)(d) Sec 8(2) **As per 21 No. Law of 2017: additional 200% cost** **ADB SPS**	Assistance in relocation and reconstruction.
Special Implementation Issues and application Guidelines:			
Loss Item 6: LOSS OF RESIDENTIAL AND OTHER PHYSICAL STRUCTURES (WITHOUT TITLE TO LAND)			
Socially recognized owners of structures built on the ROW	1. CMV of structures as determined by PVAT 2. Structure Transfer Grant (STG) @ Tk. 15 (ten) per sft of affected structure for shifting 3. Reconstruction and Homestead Development Grant (RHDG) at the rate of 20 TK per sft	LA Act1982 Sec 8(1)(d) Sec 8(2) **As per 21 No. Law of 2017:** **ADB SPS**	
Special Implementation Issues and application Guidelines:			
1. The homestead losers will produce documentary evidence and the BWDB through JVT will cross verify the landlessness of the homestead losers for allocation of an RV plot for free. 2. The RP-INGO will assist the DPs to move to clustered relocations (resettlement villages) with community facilities or, alternatively, in self-relocation. The DPs may be relocated to BWDB land (if available) or plots purchased (by the DPs) for which assistance will be provided in the form of homestead land development.			
Loss Item 7: LOSS OF TIMBER AND FRUIT BEARING TREES, BAMBOO AND BANANA GROVES			
1. Legal owner(s) as identified by the DC	1. Timber trees and bamboo: CMV of trees and bamboo.	LA Act1982 Sec 8(1)(b)	INGO to explain RP policies regarding compensation for the trees of different

Unit of Entitlement	Entitlements	Applicable Law	Additional Services
in the process of CCL payment. 2. Socially recognized owners of trees grown on public or other land	2. Fruit-bearing trees without timber: if the tree is at or near fruit-bearing stage, the estimated current market value of the fruit. 3. Fruit-bearing trees with timber: CMV for the timber, and estimated current market value of fruit. 4. Banana groves: CMV of all trees 5. Owners will be allowed to fell trees and take the timber, free of cost after payment of CCL or RC as applicable.	Sec 8(2) **As per 21 No. Law of 2017: additional 100% cost**	categories and size and make the EPs aware that they could take the timber and fruits free of cost.
Special Implementation Issues and application Guidelines:			
1. The INGO will provide guidance in plantation and post-plantation care.			
Loss Item 8: LOSS OF STANDING CROPS/FISH STOCK			
1. Legal owners identified by the DC in progress of CCL payment 2. Socially recognized owners	1. RC of standing crops/fish stock. 2. Owners will be allowed to harvest crops and fish stock.	LA Act1982 Sec 8(1)(b) Sec 8(2) **ADB SPS**	INGO will assist APs in the process of claiming compensation from DC offices for organizing necessary documents.
Special Implementation Issues and application Guidelines:			
Loss Item 9: LOSS OF LEASED /MORTGAGED IN LAND/PONDS			
1. Leaseholder with legal papers. 2. Socially recognized lessee or sharecropper, in case of customary informal tenancy arrangements, including socially recognized agreements.	1. CMV of crops/ fish stock for one year as compensation. 2. Outstanding lease money back to the lessee by the owner as per agreement. 3. The leaseholder will be allowed to take the crops/fishes free of cost within the date declared by BWDB		1. INGO will assist in ensuring that the lessee receives all eligible payments. 2. INGO will mediate fund of outstanding lease money by the owner to the lessees.
Special Implementation Issues and application Guidelines:			
1. With legal agreement: legal owner and mortgagee/leaseholder will be paid CCL by DC in accordance by the law2. With customary tenancy agreements, including socially-recognized verbal agreements: Legal owner will receive CCL from DC. The legal owner will pay the outstanding liabilities to the lessee/mortgagee. Under the following conditions: (i) all contractual liabilities are already paid up; (ii) if not, the legal owner will get the residual payment after all liabilities are paid up.3. BWDB will ensure RC of crops to the cultivator with direct payment of the difference, if CCL is less than RC, with assistance from INGO.4. Dislocation Allowance will be paid to the actual cultivator of the acquired land by BWDB with assistance from INGO.			
Loss Item 10: LOSS OF INCOME FROM DISPLACED COMMERCIAL/ INDUSTRIAL PREMISES (OWNER			

Unit of Entitlement	Entitlements	Applicable Law	Additional Services
OPERATED)			
Any proprietor or businessman or artisan operating in premises	Business restoration grant will be an equivalent to 3 months lost income against owners name recorded during the survey Employment in the Project construction work, if possible	LA Act1982 Sec 8(1)(d) Sec 8(2) **ADB SPS**	EPs will be brought under income and livelihood regenerating program (ILRP).
Special Implementation Issues and application Guidelines:			
1. All the business operators will be entitled for grant against loss of income and one time moving assistance will be provided to only the tenants.			

Loss Item 11: TEMPORARY LOSS OF INCOME (WAGE EARNERS IN AGRICULTURE, COMMERCE & SMALL BUSINESS AND INDUSTRY)			
Regular wage earners affected by the acquisition.	Grant to cover loss of employees /regular wage earners @ TK 400X 90 days per person Poor Female HH will be paid a one time grant of TK 5000 as special assistance EPs to be included in the ILRP	**ADB SPS**	1. EPs will be brought under the ILRP.
Special Implementation Issues and application Guidelines:			
EP must have been an employee of landowner or business located in the acquired lands for at least twelve months, as identified by Joint Verification and/or a contracted institution or a consulting company's census.			

Loss Item 12: LOSS OF INCOME FROM RENTED -OUT AND ACCESS TO RENTED-IN RESIDENTIAL/COMMERCIAL PREMISES			
1. Owner of the rented-out premises 2. AH/person rented-in any such structure	Dislocation Allowance of Tk. 6,000 for each unit of premises to both the renter and the rentees.	LA Act1982 Sec 8(1)(d) Sec 8(2) **ADB SPS**	EPs will be brought under the ILRP.
Special Implementation Issues and application Guidelines:			

Loss Item 13: VULNERABLE AHs SPECIAL ASSISTANCE			
Vulnerable AH Assistance: Female-headed households, disabled, elderly, extremely poor and those losing more than 10% of their	One-Time Special Assistance Grant of Tk 15,000 / AHH Skill training and credit support underILRP.	**ADB SPS**	EPs will be brought under the ILRP.

Unit of Entitlement	Entitlements	Applicable Law	Additional Services
income to acquisition of land or business.	No AH will get the grant if their family members do not participate to the proposed skill training		
Special Implementation Issues and application Guidelines:			
1. Loss of income will be assessed as per actual loss of productive resources (land and businesses) to the project and the total income of the affected households from all sources through Census of all AHs. 2. JVT will verify the percentage of loss comparing the actual loss and the total income from all sources of the affected households. 3. Households turning into landless due to acquisition of agricultural land will be eligible for larger credit from the ILRP for longer duration.			

Loss Item 14: UNFORESEEN ADVERSE IMPACTS			
Households/persons affected by any unforeseen impact identified during RP implementation	Entitlements will be determined as per the resettlement policy framework		As appropriate
Special Implementation Issues and application Guidelines:			
The unforeseen impacts and affected persons will be identified with due care as per policy framework and proposed to the MoWR and the ADB for approval including quantity of losses, their owners and the entitlements.			

5 Procedures for Receiving Resettlement and Other Grants

(a) Identity (ID) Card

49. APs that get paid CCL by the District Administration and/or Resettlement Benefits from the BWDB will be termed as Entitled Persons (EPs). Each AP household head or EP will be given an Identity (ID) Card.

(b) Entitled Person's File (EP File) & Entitlement Card

50. All the losses of an EP will be computerized to an electronic EP File that can then, based on the Resettlement Entitlement Matrix, automatically summarize the EP's total losses and benefits at any point in time. This will be produced into a standardized report, the Entitlement Card; and the EP will be provided with all the benefits according to his/her loss as shown in the Entitlement Card. The INGO will distribute one (1) copy of their final Entitlement Card to each EP.

(c) Purchase of Replacement Land

51. If an EP chooses replacement land, the EP will, with the assistance of the INGO, scrutinize the replacement landowner's relevant documents. If the EP is satisfied, he/she will fix the price and register it. The EP then has to submit the relevant documents to BWDB for receiving the Resettlement Benefit.

52. All influential persons are requested to persuade owners of landed property in their own areas to sell their land to the EPs for the area's greater good.

(d) Grievance Redress Committees (GRCs)

53. The FERMIP will have one Grievance Redress Committee (GRC). The GRC have been constituted, and will be gazetted, to assist the resettlement activities. The GRC will consist of Sub-Divisional Engineer (SDE)/Assistant Engineer or any official with the same status from BWDB; the Area Manager/Deputy Team leader or equivalent officer/specialist of the INGO; the UP Chairman or a member of the concerned local government; and a representative of the APs. The BWDB representative will chair the GRC, and the INGO representative will act as Member Secretary.

54. The functions of the GRC will be to:
    - Receive applications and hold hearings on AP grievances concerning the Project, in particular regarding resettlement issues.
    - Refer APs to the concerned authority/Deputy Commissioner if the grievance can be dealt with through conventional law or by arbitration.
    - Make decisions to resolve AP grievances following RP policy if outside conventional law and if the grievance does not lend itself to arbitration.
    - Prepare recommendations according to the procedure described by the GRC in resolving AP complaints.

55. The GRCs will receive AP grievances and resolve them in the following manner:
    - The written AP grievance will be lodged with the GRC within a month of the receipt of ID Card or from when the AP is informed of their entitlement.
    - The GRC will meet to resolve the AP grievance within 10 days of its receipt and will preserve the records and procedure of the meeting. The GRC will mention the basis of its resolutions in the written record of its meetings.
    - The GRC will publicize its decisions regarding AP grievances through local community meetings and through the distribution of leaflets to the public.
    - All the GRC activities will take place in the office of the GRC Chairman.

(e) Joint Verification Team (JVT):

56. Joint Verification Team (JVT) will also be constituted at the FERMIP. The JVT members will include the SDE/Assistant Engineer or any official with the same status from BWDB; a representative of the concerned Deputy Commissioner; and Area Manager/Deputy Team Leader or equivalent officer/specialist of the INGO. The BWDB representative will chair the JVT, and the INGO representative will act as Member Secretary.

57. The JVT will:
    - Reconcile data after scrutinizing the AP lists and affected physical asset quantities, as prepared, with assistance from consultants, by the BWDB.
    - Confirm the list of long-term residents on BWDB or GoB land within the Project ROW, submitting the list to the Project Director, BWDB
    - Assess and finalize the AP lists and affected physical asset quantities, through joint verification as per GoB law.
    - Sign all documents relevant to the above and submit them to the Project Director, BWDB
    - Submit all necessary documents/reports to the concerned officials, as per the Project's construction schedule

f) Property Valuation Advisory Team (PVAT)

58. A Property Valuation Advisory Team (PVAT) will be constituted by BWDB for FERMIP to determine the current market price and replacement cost of acquired land, physical structures, trees and other property. The PVAT is comprised of the SDE)/Assistant Engineer or any official

with the same status from BWDB; a representative of the Deputy Commissioner concerned; and the Area Manager/Deputy Team Leader or equivalent officer/specialist of the INGO. The BWDB representative chairs the PVAT, and the INGO representative acts as Member Secretary.

59. The PVAT will:
    - Assist the relevant legal authority to determine the Replacement Cost of affected land and other physical property under acquisition, at the Market Price.
    - Assist the relevant legal authority to determine Replacement Cost of property of the APs on the BWDB or other GoB land, at Market Price.
    - Submit necessary documents/reports to the Project Director, BWDB and to the Deputy Commissioner concerned, following the Project's construction schedule.

g) Other Information/Procedures for Entitled Persons (EPs)

- In order to receive their CCL, EPs must produce at the DC's office their ownership deed, record, rent receipt, mutation document, share document, or other relevant proof of ownership.
- Until and unless the legal owners receive the CCL from the Deputy Commissioner, BWDB cannot provide the Resettlement Benefit grants through the INGO for the relevant plot.
- If replacement land is purchased within the period of RP implementation, and the evidence of properly used stamp duty and other relevant documents is produced in the INGO's field office, the stamp duty and registration cost will be refundable at the rate provisioned in the RP.
- The EPs will receive an ID Card bearing ID number and photograph of the EP, signed by BWDB's and the INGO's assigned representatives. The EP will need to produce their ID Card to receive Resettlement Benefits.
- The entitlement determined by BWDB through the INGO as per RP provision will be disbursed through a 'Crossed Bank Cheque[51] on the date declared earlier and in the presence of local *UP* chairman/member. For this purpose, the EP must open a bank account.
- The BWDB or INGO field offices at FERMIP may be contacted for any additional information regarding acquisition and resettlement. The INGO will provide necessary assistance to all EP.
- Affected tenants/sharecroppers will be identified by the JVT and certified by the relevant landowner and the UP chairman/member.
- The major responsibility for RP implementation rests with BWDB. The INGO will, on BWDB's behalf, actually carry out the RP implementation activities as per BWDB's instruction. If there is any change suggested by GoB and/or the Donors, the APs will duly be informed.
- Note: APs will get compensation as per 1982 Act and resettlement benefit according to the Resettlement Entitlement Matrix shown above in Section 3. This Resettlement Information Brochure is amendable as per requirement and approval of BWDB and the ADB.

[51]A '*Crossed Bank Cheque* 'can only be cashed through being deposited in the EP's account first.

APPENDIX E

TERMS OF REFERENCE FOR EXTERNAL MONITORING AGENCY (EMA)

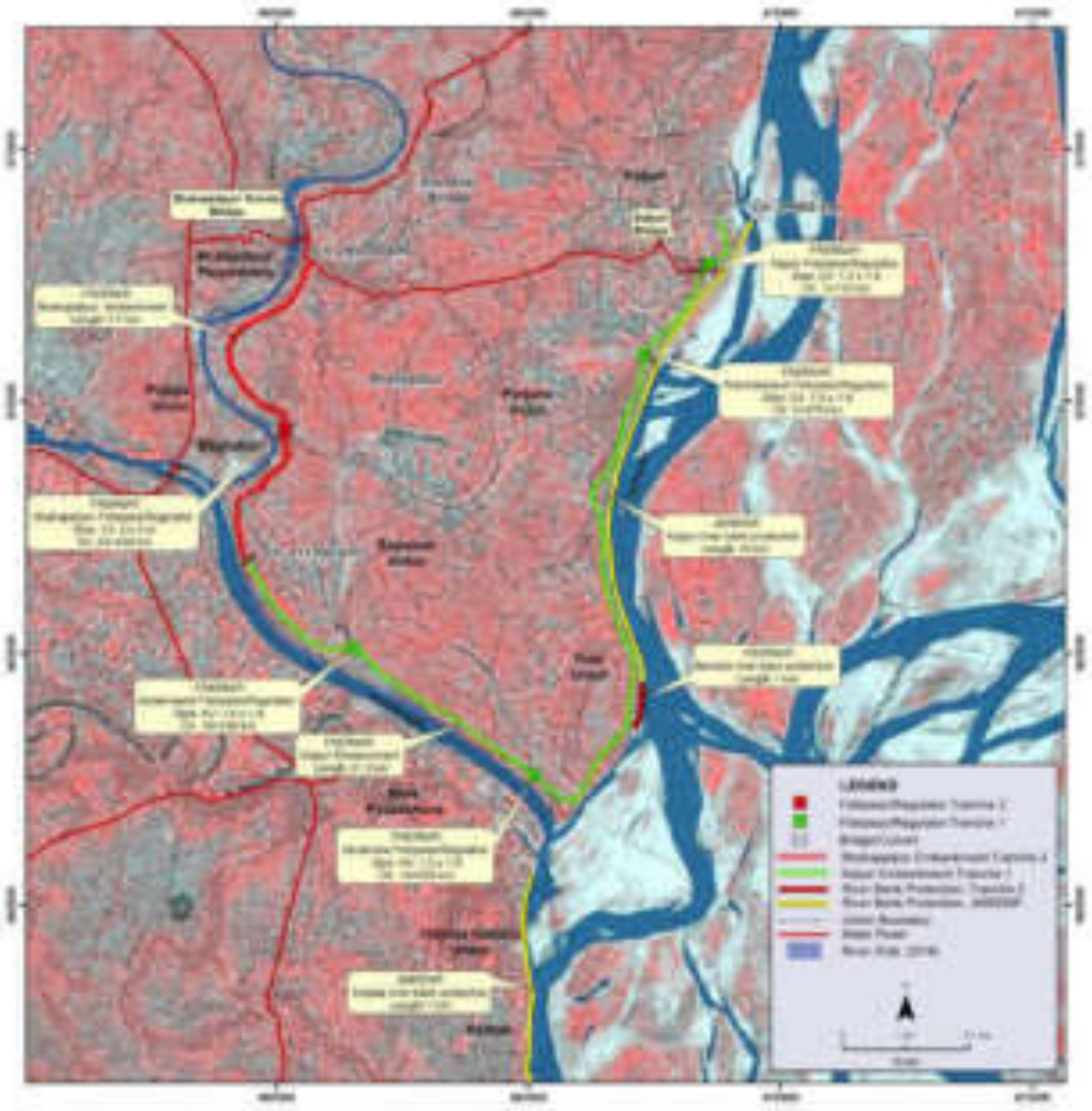
BACKGROUND

26. The Asian Development Bank supports the feasibility assessment of a potential future flood and riverbank erosion risk management program covering parts of the main rivers of Bangladesh named Main River Flood and Bank Erosion Risk Management Program (FERMIP). The main focus is to reduce the riverbank erosion and flood risks to the adjacent flood plains while maximizing economic activities in a sustainable and environmentally acceptable manner. Existing flood embankments dominantly fail from riverbank erosion, and as such the stabilization of the river pattern is a cornerstone of reducing the flood risk. The FERMIP builds on and extends the activities of the Jamuna-Meghna River Erosion Mitigation Project (JMREMP) (ADB, 2002), implemented in different phases from January 2003 until June 2011. The Project will cover the main rivers from Bhangabandhu (Jamuna) Bridge and the proposed Ganges Barrage to Chandpur, as such covering around 60 km of the Jamuna, around 20 km of the Ganges, and the whole around 100 km long Padma reach.

27. Two main confluences are included: the confluence of Ganges and Jamuna and the confluence of Padma and Upper Meghna. Importantly, for flood benefits and, of course, targeting the overarching goal of poverty reduction, the flood plains on both sides of the rivers play a fundamental role as home of a largely poor population depending on agriculture and fisheries. As a consequence we identified sub-reaches with similar river and flood plain characteristics as practical subproject areas. Each sub-reach consists of several upazilas, which facilitates the data collection. In total 14 sub-reaches were identified for pre-feasibility assessment: two each at the Jamuna Right and Left Bank (JRB, JLB), 3 along the Padma Right and Left Bank (PRB, PLB), one at the Meghna Right Bank (MRB), and two along the Meghna Left Bank (MLB). The feasibility study covered the priority investment during the first Tranche**.** In Bangladesh the common MFF approach means that only the first tranche investment is identified during the PPTA. Subsequent tranches will be identified during each previous, ongoing tranche.

28. A Resettlement Plan for Tranche-2, Main River Flood and Bank Erosion Risk Management Program (FERMIP), December 2017 has been prepared. The RP is only for Tranche-2 Jamuna Right Bank's first Sub-Reach (JRB-1):

Proposed JLB-1 Interventions	**KM**
a) Shazadpur Embankment (with one fish passe)	17.0



Sub-Reach Area - Proposed Component

29. In Tranche-2, there is construction of 2 embankments and other proposed Riverbank Protection (RBP) interventions on the Jamuna's left and right bank :

Proposed Interventions	**KM**
2. Harirampur –Dohar new embankment (PLB)	13
3. Koijuri - Bagabari embankement extension (JRB)	7

30. BWDB will have mobilised a resettlement plan implementing NGO (RP-INGO) to implement the FERMIP Tranche-2 RP for phase-wise components. The RP-INGO will implement the RAPs

as per the resettlement policy, ensure stakeholders participation as per the project need, and provide technical assistance for compensation and assistance to the APs. A monitoring mechanism has also been framed and adopted in the RPsinvolving the BWDB, the RP-INGO, consultants and the ADB.

31. BWDB seeks to engage an independent External Monitoring Agency (EMA) to review the internal monitoring and undertake third party monitoring & evaluation of the RP implementation process for the Government of Bangladesh and the ADB.

KEY OBJECTIVE OF EXTERNAL MONITORING

32. The primary objective for engaging an external monitor is to review monitor and measure the progress of implementation of the resettlement plan. In addition to recording the progress in compensation payment and other resettlement activities, the External Monitoring Agency (EMA) will prepare monitoring reports to ensure that the implementation of the resettlement plan has produced the desired outcomes. The (EMA) will review implementation process as per set policies in the RPs and assess the achievement of resettlement objectives, the changes in living standards and livelihoods, restoration of the economic and social base of the affected people, the effectiveness, impact and sustainability of entitlements, the need for further mitigation measures if any, and to learn strategic lessons for future policy formulation and planning.

33. The EMA will prepare semi-annual monitoring reports that describe the progress of the implementation of resettlement activities and any compliance issues and corrective actions. These reports will closely follow the involuntary resettlement monitoring indicators agreed at the time of resettlement plan approval. The costs of internal and external resettlement monitoring requirements will be included in the project budget.

SCOPE OF WORK

34. The scope of work of the External Monitoring Agency (EMA) will include the following tasks:

(1) To develop specific monitoring indicators for undertaking monitoring for Resettlement Plans (RPs), Gender Action Plan (GAP) and the Income& Livelihood Restoration Plan (ILRP).

(2) To review and verify the progress in land acquisition/resettlement implementation of the Project.

(3) Identify the strengths and weaknesses of the land acquisition/resettlement objectives and approaches, implementation strategies.

(4) Evaluate and assess the adequacy of compensation given to the APs and the livelihood opportunities and incomes as well as the quality of life of APs of project-induced changes.

(5) Identification of the categories of impacts and evaluation of the quality and timeliness of delivering entitlements (compensation and rehabilitation measures) for each category and how the entitlements were used and their impact and adequacy to meet the specified objectives of the Plans. The quality and timeliness of delivering entitlements, and the sufficiency of entitlements as per approved policy.

(6) To analyze the pre-and post-project socio-economic conditions of the affected people. In

the absence of baseline socio-economic data on income and living standards, and given the difficulty of APs having accurate recollection of their pre-project income and living standards, develop some quality checks on the information to be obtained from the APs. Such quality checks could include verification by neighbors and local village leaders. The methodology for assessment should be very explicit, noting any qualifications.

(7) Review results of internal monitoring and verify claims through sampling check at the field level to assess whether land acquisition/resettlement objectives have been generally met. Involve the affected people and community groups in assessing the impact of land acquisition for monitoring and evaluation purposes.

(8) To monitor and assess the adequacy and effectiveness of the consultative process with affected APs, particularly those vulnerable, including the adequacy and effectiveness of grievance procedures and legal redress available to the affected parties, and dissemination of information about these.

(9) Identify, quantify, and qualify the types of conflicts and grievances reported and resolved and the consultation and participation procedures.

(10) Provide a summary of whether involuntary resettlement was implemented (a) in accordance with the RPs, and (b) in accordance with the stated policy.

(11) To review the quality and suitability of the relocation sites from the perspective of the both affected and host communities (if any).

(12) Verify expenditure & adequacy of budget for resettlement activities.

(13) Describe any outstanding actions that are required to bring the resettlement activities in line with the policy and the RP. Describe further mitigation measures needed to meet the needs of any affected person or families judged and/or perceiving themselves to be worse off as a result of the Project. Provide a timetable and define budget requirements for these supplementary mitigation measures.

(14) Describe any lessons learned that might be useful in developing the new national resettlement policy and legal/institutional framework for involuntary resettlement.

D. Methodology and Approach

35. The general approach to be used is to monitor activities and evaluate impacts ensuring participation of all stakeholders especially women and vulnerable groups. Monitoring tools should include both quantitative and qualitative methods. The external monitor should reach out to cover:

- 100% APs who had property, assets, incomes and activities severely affected by Project works and had to relocate either to resettlement sites or who chose to self-relocate, or whose source of income was severely affected.

- % of persons who had property, assets, incomes and activities marginally affected by Project works and did not have to relocate;

- x 10% of those affected by off-site project activities by contractors and sub-contractors, including employment, use of land for contractor's camps, pollution, public health etc.;

36. Supplemented by Focused Group Discussions (FGD) which would allow the monitors to consult a range of stakeholders (local government, resettlement field staff, NGOs, community leaders, and, most importantly, APs), community public meetings: Open public meetings at resettlement sites to elicit information about performance of various resettlement activities.

E. Other Stakeholders and their Responsibility

1. Responsibility of BWDB

37. The Bangladesh Water Development Board (BWDB) through its Project Management Office (PMO) at headquarters and in the RU-field offices will ensure timely supply of background references, data and project options to the independent monitor. It will ensure uninterrupted access to work sites, relevant offices of the GOB and BWDB in particular. The independent external monitor will sit in quarterly coordination meetings with the BWDB in presence of the supervision consultant and the BWDB should organize that at PMO or Field level as appropriate.

38. Recommendation based on the result of the monitoring should be offered to BWDB to cover up the deficiencies identified by the external monitor. BWDB will accept the recommendations of the external monitor if it is within the scope of work and there is nothing incorrect in the report.

2. Responsibility of Supervision Consultant

39. The supervision consultant will provide appropriate protocol at site or at its Project Office for the mission of the EMA. It will on behalf of BWDB ensure free access to work sites, impact areas and the database on resettlement and civil works. The supervision consultant will ensure timely intimation of its civil works planning as and when made or updated during the construction period and keep the external monitoring and evaluation consultant informed.

3. Responsibility of the RP Implementing NGO

40. The RP Implementing NGO will assist and cooperate the external monitor through providing free access to its database and the automated management information system (MIS). It will provide copies of the progress reports and other reports as requested by the external monitor. The RP-INGO may have to carry out surveys as well for fulfilment of the requirements of the external monitoring.

TEAM COMPOSITION OF THE EXTERNAL MONITORING AGENCY

41. The EMA should focus on field based research on institutional arrangement, implementation strategy, policy objectives, and the targets. Data collection, processing and analysis to pin point problem areas and weaknesses, and to light on deserving measures to achieve the objectives on schedule are the special interest of the subject. Thus, there is a need for a dedicated monitoring team with adequate gender representation. Further, it is essential that the central team or field level coordinators responsible for monitoring, are skilled and trained in data base management, interview technique, and social and economic/finance. Keeping in mind these criteria, the team should ideally include:

Position/expertise	Qualification and experience
1. Team Leader/ Implementation Specialist	Masters in socialsciencewith15 years working background in planning, implementation and monitoring of involuntary resettlement for infrastructure projects. Experience in institutional capacity analysis and implementation arrangement for preparation and implementation of resettlement plans, and knowledge in latest social safeguard policies of the international development financing in situations in Bangladesh are preferred.
2. Social Impact Specialist	Masters insocialsciencewith15yearsworkingexperience in social impact assessment including census and socioeconomic surveys, stakeholders' consultation, and analyzing social impacts to identify mitigation measures in compliance with social safeguard policies of the international development financing institutions and national legislations. Experience of preparing resettlement framework and action plans and implementation of plans for externally financed projects is essential.
3. Gender Specialist	Masters insocialsciencewith15yearsworkingexperience in relevant field; Thorough knowledge of gender issues and their implications in development projects; research and work experience relating to gender issues; and knowledge of techniques and their applications in mobilizing community participation in development programs.
Data Analyst	Graduate with working experience and knowledge of software, preferably relational, those are most commonly used in Bangladesh; demonstrated ability to design and implement automated MIS(s) for monitoring progress, comparing targets with achieved progress and the procedural steps.

TIME FRAME AND REPORTING

42. The EMA will be employed over a period of 4years with intermittent inputs from the professional team to continue one year after completion of the RP implementation.
43. Quarterly and annual monitoring reports should be submitted to the BWDB with copies to the international co-financiers. An evaluation report at the end of the project should be submitted to the BWDB and concerned parties with critical analysis of the achievement of the program and performance of BWDB and RP-INGO.
44. The external monitors will provide monitoring and evaluation report covering the following aspects:
    a. Whether the resettlement activities have been completed as planned and budgeted;
    b. The extent to which the specific objectives and the expected outcomes/results have been achieved and the factors affecting their achievement or non-achievement;
    c. The extent to which the overall objective of the Resettlement Plan, pre project or improved social and economic status, livelihood status, have been achieved and the reasons for achievement / non achievement;
    d. Major areas of improvement and key risk factors;
    e. Major lessons learnt; and
    f. Recommendations.
45. Formats for collection and presentation of monitoring data will be designed in consultation with

46. BWDB, and consultants

QUALIFICATION OF THE EXTERNAL MONITORING AGENCY

47. The EMA will have at least 10 years of experience in resettlement planning and implementation of resettlement plans. Further, work experience and familiarity with all aspects of resettlement operations would be desirable. NGOs, Consulting Firms or University Departments (consultant organization) having requisite capacity and experience as follows can qualify for services of and external monitor for the project.
    a. NGOs registered with the Social Welfare Department of the GOB, Consulting Firms registered with the Joint Stock Company or Departments of any recognized university.
    b. The applicant should have prior experience in social surveys in land based infrastructure projects and preparation of resettlement plans (RPs) as per guidelines on involuntary resettlement of the ADB.
    c. The applicant should have extensive experience in implementation and monitoring of resettlement plans, preparation of implementation tools, and development and operation of automated MIS for monitoring.
    d. The applicant should be able to produce evidences of monitoring using structured instruments and computerized MIS with set criteria for measuring achievement.
    e. The applicant should have adequate manpower with capacity and expertise in the field of planning, implementation and monitoring of involuntary resettlement projects as per donor's guidelines.

48. Interested agencies should submit proposal for the work with a brief statement of the approach, methodology, and relevant information concerning previous experience on monitoring of resettlement implementation and preparation of reports.

49. The profile of consultant agency, along with full CVs of the team to be engaged, must be submitted along with the proposal.

BUDGET AND LOGISTICS

50. The budget should include all expenses such as staff salary, office accommodation, training, computer/software, transport, field expenses and other logistics necessary for field activities, data collection, processing and analysis for monitoring and evaluation work. Additional expense claims whatsoever outside the proposed and negotiated budget will not be entertained. VAT, Income Tax and other charges admissible will be deducted at source as per GOB laws.

Project Director

FERMIP Project Management
Office (PMO) BWDB, Dhaka

APPENDIX F

LAND ACQUISITION PLAN (PLOTS AND MAPS)

Maps showing the alignement of the plots to be affected by the embankment areas.


LEGEND
Proposed Embankment


LEGEND
Proposed Embankment

Mouza plot wise area of Shahjadpur embankment (7.7 km)

Upazila name	Union name	Mouza name	Plot number	Plot area ha	Affected plot area ha
Shahjadpur	Rupabati	Chayra	403	0.05	0.04
Shahjadpur	Rupabati	Chayra	405	0.03	0.03
Shahjadpur	Rupabati	Chayra	426	0.20	0.02
Shahjadpur	Rupabati	Chayra	431	0.06	0.01
Shahjadpur	Rupabati	Chayra	432	0.04	0.04
Shahjadpur	Rupabati	Chayra	433	0.18	0.01
Shahjadpur	Rupabati	Chayra	434	0.36	0.05
Shahjadpur	Rupabati	Chayra	436	0.45	0.09
Shahjadpur	Rupabati	Chayra	437	0.04	0.04
Shahjadpur	Rupabati	Chayra	438	0.02	0.02
Shahjadpur	Rupabati	Chayra	439	0.46	0.12
Shahjadpur	Rupabati	Chayra	440	0.25	0.05
Shahjadpur	Rupabati	Chayra	444	0.23	0.01
Shahjadpur	Rupabati	Chayra	445	0.11	0.09
Shahjadpur	Rupabati	Chayra	446	0.38	0.09
Shahjadpur	Rupabati	Chayra	447	0.10	0.01
Shahjadpur	Rupabati	Chayra	448	0.13	0.07
Shahjadpur	Rupabati	Chayra	449	0.13	0.07
Shahjadpur	Rupabati	Chayra	455	0.14	0.04
Shahjadpur	Rupabati	Chayra	456	0.20	0.09
Shahjadpur	Rupabati	Chayra	459	0.08	0.01
Shahjadpur	Rupabati	Chayra	460	0.14	0.07
Shahjadpur	Rupabati	Chayra	463	0.37	0.11
Shahjadpur	Rupabati	Chayra	464	0.28	0.07
Shahjadpur	Rupabati	Chayra	468	0.78	0.19
Shahjadpur	Rupabati	Chayra	470	0.11	0.06
Shahjadpur	Rupabati	Chayra	471	0.17	0.06
Shahjadpur	Rupabati	Chayra	475	0.17	0.04
Shahjadpur	Rupabati	Chayra	476	0.16	0.04
Shahjadpur	Rupabati	Chayra	478	0.71	0.17
Shahjadpur	Rupabati	Chayra	482	0.89	0.19
Shahjadpur	Rupabati	Chayra	489	0.30	0.08
Shahjadpur	Rupabati	Chayra	492	0.20	0.09
Shahjadpur	Rupabati	Chayra	500	0.69	0.22
Shahjadpur	Rupabati	Chayra	501	0.45	0.34
Shahjadpur	Rupabati	Chayra	502	0.61	0.06
Shahjadpur	Rupabati	Chayra	564	0.17	0.05
Shahjadpur	Rupabati	Chayra	565	0.19	0.08
Shahjadpur	Rupabati	Chayra	567	0.22	0.07
Shahjadpur	Rupabati	Chayra	568	0.14	0.04
Shahjadpur	Rupabati	Chayra	569	0.16	0.05

Upazila name	Union name	Mouza name	Plot number	Plot area ha	Affected plot area ha
Shahjadpur	Rupabati	Chayra	570	0.09	0.03
Shahjadpur	Rupabati	Chayra	571	0.23	0.08
Shahjadpur	Rupabati	Chayra	572	0.16	0.05
Shahjadpur	Rupabati	Chayra	585	0.21	0.00
Shahjadpur	Rupabati	Dombaria	16	0.14	0.01
Shahjadpur	Rupabati	Dombaria	18	0.05	0.03
Shahjadpur	Rupabati	Dombaria	19	0.11	0.01
Shahjadpur	Rupabati	Dombaria	20	0.09	0.08
Shahjadpur	Rupabati	Dombaria	21	0.07	0.07
Shahjadpur	Rupabati	Dombaria	22	0.09	0.03
Shahjadpur	Rupabati	Dombaria	23	0.06	0.03
Shahjadpur	Rupabati	Dombaria	24	0.06	0.06
Shahjadpur	Rupabati	Dombaria	25	0.14	0.10
Shahjadpur	Rupabati	Dombaria	26	0.13	0.08
Shahjadpur	Rupabati	Dombaria	27	0.13	0.07
Shahjadpur	Rupabati	Dombaria	28	0.15	0.08
Shahjadpur	Rupabati	Dombaria	29	0.28	0.13
Shahjadpur	Rupabati	Dombaria	30	0.27	0.12
Shahjadpur	Rupabati	Dombaria	31	0.05	0.05
Shahjadpur	Rupabati	Dombaria	32	0.07	0.06
Shahjadpur	Rupabati	Dombaria	33	0.09	0.00
Shahjadpur	Rupabati	Dombaria	64	0.06	0.06
Shahjadpur	Rupabati	Dombaria	65	0.12	0.09
Shahjadpur	Rupabati	Dombaria	66	0.04	0.02
Shahjadpur	Rupabati	Dombaria	67	0.04	0.01
Shahjadpur	Rupabati	Dombaria	68	0.04	0.00
Shahjadpur	Rupabati	Dombaria	70	0.07	0.06
Shahjadpur	Rupabati	Dombaria	71	0.08	0.03
Shahjadpur	Rupabati	Dombaria	72	0.09	0.01
Shahjadpur	Rupabati	Dombaria	262	0.05	0.00
Shahjadpur	Rupabati	Dombaria	263	0.01	0.01
Shahjadpur	Rupabati	Dombaria	264	0.03	0.02
Shahjadpur	Rupabati	Dombaria	265	0.01	0.00
Shahjadpur	Rupabati	Dombaria	266	0.11	0.11
Shahjadpur	Rupabati	Dombaria	267	0.10	0.06
Shahjadpur	Rupabati	Dombaria	268	0.06	0.00
Shahjadpur	Rupabati	Dombaria	278	0.13	0.00
Shahjadpur	Rupabati	Dombaria	279	0.60	0.34
Shahjadpur	Rupabati	Dombaria	280	0.08	0.05
Shahjadpur	Rupabati	Dombaria	281	0.05	0.05
Shahjadpur	Rupabati	Dombaria	282	0.05	0.05
Shahjadpur	Rupabati	Dombaria	283	0.04	0.04
Shahjadpur	Rupabati	Dombaria	284	0.03	0.03

Upazila name	Union name	Mouza name	Plot number	Plot area ha	Affected plot area ha
Shahjadpur	Rupabati	Dombaria	285	0.03	0.03
Shahjadpur	Rupabati	Dombaria	286	0.09	0.07
Shahjadpur	Rupabati	Dombaria	287	0.11	0.06
Shahjadpur	Rupabati	Dombaria	288	0.12	0.04
Shahjadpur	Rupabati	Dombaria	289	0.08	0.02
Shahjadpur	Rupabati	Dombaria	290	0.10	0.03
Shahjadpur	Rupabati	Dombaria	303	0.04	0.02
Shahjadpur	Rupabati	Dombaria	304	0.10	0.10
Shahjadpur	Rupabati	Dombaria	305	0.06	0.06
Shahjadpur	Rupabati	Dombaria	306	0.02	0.02
Shahjadpur	Rupabati	Dombaria	307	0.10	0.00
Shahjadpur	Rupabati	Dombaria	308	0.05	0.01
Shahjadpur	Rupabati	Dombaria	317	0.07	0.01
Shahjadpur	Rupabati	Dombaria	318	0.10	0.03
Shahjadpur	Rupabati	Dombaria	319	0.02	0.02
Shahjadpur	Rupabati	Dombaria	320	0.03	0.00
Shahjadpur	Rupabati	Dombaria	321	0.02	0.00
Shahjadpur	Rupabati	Dombaria	322	0.04	0.04
Shahjadpur	Rupabati	Dombaria	323	0.14	0.14
Shahjadpur	Rupabati	Dombaria	324	0.16	0.11
Shahjadpur	Rupabati	Dombaria	325	0.10	0.00
Shahjadpur	Rupabati	Dombaria	329	0.19	0.02
Shahjadpur	Rupabati	Dombaria	330	0.08	0.04
Shahjadpur	Rupabati	Dombaria	331	0.04	0.02
Shahjadpur	Rupabati	Dombaria	333	0.01	0.01
Shahjadpur	Rupabati	Dombaria	334	0.05	0.05
Shahjadpur	Rupabati	Dombaria	335	0.06	0.06
Shahjadpur	Rupabati	Dombaria	336	0.12	0.01
Shahjadpur	Rupabati	Dombaria	339	0.07	0.03
Shahjadpur	Rupabati	Dombaria	340	0.14	0.04
Shahjadpur	Rupabati	Dombaria	341	0.17	0.04
Shahjadpur	Rupabati	Dombaria	342	0.15	0.04
Shahjadpur	Rupabati	Dombaria	343	0.27	0.09
Shahjadpur	Rupabati	Dombaria	344	0.06	0.06
Shahjadpur	Rupabati	Dombaria	345	0.13	0.04
Shahjadpur	Rupabati	Dombaria	417	0.07	0.02
Shahjadpur	Rupabati	Dombaria	418	0.07	0.06
Shahjadpur	Rupabati	Dombaria	419	0.20	0.03
Shahjadpur	Rupabati	Dombaria	420	0.21	0.18
Shahjadpur	Rupabati	Dombaria	653	0.19	0.00
Shahjadpur	Rupabati	Dombaria	666	0.10	0.03
Shahjadpur	Rupabati	Dombaria	667	0.20	0.17
Shahjadpur	Rupabati	Dombaria	709	0.44	0.01

Upazila name	Union name	Mouza name	Plot number	Plot area ha	Affected plot area ha
Shahjadpur	Rupabati	Dombaria	710	0.10	0.02
Shahjadpur	Rupabati	Dombaria	711	0.07	0.03
Shahjadpur	Rupabati	Dombaria	712	0.09	0.04
Shahjadpur	Rupabati	Dombaria	713	0.09	0.08
Shahjadpur	Rupabati	Dombaria	714	0.09	0.08
Shahjadpur	Rupabati	Dombaria	715	0.18	0.06
Shahjadpur	Rupabati	Dombaria	716	0.07	0.05
Shahjadpur	Rupabati	Dombaria	717	0.21	0.01
Shahjadpur	Rupabati	Dombaria	718	0.17	0.12
Shahjadpur	Rupabati	Dombaria	720	0.14	0.01
Shahjadpur	Rupabati	Dombaria	741	0.09	0.01
Shahjadpur	Rupabati	Dombaria	742	0.10	0.02
Shahjadpur	Rupabati	Dombaria	743	0.44	0.08
Shahjadpur	Rupabati	Dombaria	744	0.18	0.18
Shahjadpur	Rupabati	Dombaria	745	0.06	0.05
Shahjadpur	Rupabati	Dombaria	746	0.07	0.00
Shahjadpur	Rupabati	Dombaria	747	0.14	0.10
Shahjadpur	Rupabati	Dombaria	750	0.16	0.02
Shahjadpur	Rupabati	Dombaria	751	0.17	0.06
Shahjadpur	Rupabati	Dombaria	752	0.10	0.09
Shahjadpur	Rupabati	Dombaria	753	0.09	0.09
Shahjadpur	Rupabati	Dombaria	754	0.08	0.08
Shahjadpur	Rupabati	Dombaria	755	0.09	0.08
Shahjadpur	Rupabati	Dombaria	756	0.14	0.13
Shahjadpur	Rupabati	Dombaria	757	0.05	0.02
Shahjadpur	Rupabati	Dombaria	759	0.10	0.05
Shahjadpur	Rupabati	Dombaria	762	0.15	0.02
Shahjadpur	Rupabati	Dombaria	763	0.13	0.06
Shahjadpur	Rupabati	Dombaria	764	0.12	0.07
Shahjadpur	Rupabati	Dombaria	765	0.09	0.07
Shahjadpur	Rupabati	Dombaria	766	0.09	0.07
Shahjadpur	Rupabati	Dombaria	767	0.11	0.10
Shahjadpur	Rupabati	Dombaria	768	0.09	0.08
Shahjadpur	Rupabati	Dombaria	769	0.12	0.08
Shahjadpur	Rupabati	Dombaria	773	0.24	0.12
Shahjadpur	Rupabati	Dombaria	774	0.13	0.04
Shahjadpur	Rupabati	Dombaria	775	0.09	0.02
Shahjadpur	Rupabati	Dombaria	776	0.10	0.01
Shahjadpur	Rupabati	Dombaria	777	0.09	0.00
Shahjadpur	Rupabati	Dombaria	878	0.10	0.09
Shahjadpur	Rupabati	Dombaria	879	0.09	0.09
Shahjadpur	Rupabati	Dombaria	880	0.21	0.20
Shahjadpur	Rupabati	Dombaria	99999	0.15	0.06

Upazila name	Union name	Mouza name	Plot number	Plot area ha	Affected plot area ha
Shahjadpur	Shahjadpur	Ishwardia	31	0.17	0.08
Shahjadpur	Shahjadpur	Ishwardia	32	0.15	0.15
Shahjadpur	Shahjadpur	Ishwardia	33	0.07	0.07
Shahjadpur	Shahjadpur	Ishwardia	34	0.17	0.05
Shahjadpur	Shahjadpur	Ishwardia	39	0.08	0.03
Shahjadpur	Shahjadpur	Ishwardia	40	0.08	0.07
Shahjadpur	Shahjadpur	Ishwardia	41	0.08	0.08
Shahjadpur	Shahjadpur	Ishwardia	42	0.13	0.12
Shahjadpur	Shahjadpur	Ishwardia	43	0.03	0.03
Shahjadpur	Shahjadpur	Ishwardia	44	0.08	0.02
Shahjadpur	Shahjadpur	Ishwardia	45	0.04	0.00
Shahjadpur	Shahjadpur	Ishwardia	100	0.09	0.04
Shahjadpur	Shahjadpur	Ishwardia	117	0.20	0.16
Shahjadpur	Shahjadpur	Ishwardia	118	0.34	0.26
Shahjadpur	Shahjadpur	Ishwardia	119	0.24	0.06
Shahjadpur	Shahjadpur	Ishwardia	120	0.34	0.10
Shahjadpur	Shahjadpur	Ishwardia	123	0.21	0.14
Shahjadpur	Shahjadpur	Ishwardia	124	0.14	0.14
Shahjadpur	Shahjadpur	Ishwardia	125	0.17	0.15
Shahjadpur	Shahjadpur	Ishwardia	126	0.07	0.03
Shahjadpur	Shahjadpur	Ishwardia	129	0.18	0.14
Shahjadpur	Shahjadpur	Ishwardia	141	0.24	0.20
Shahjadpur	Shahjadpur	Ishwardia	142	0.29	0.18
Shahjadpur	Shahjadpur	Ishwardia	144	0.07	0.04
Shahjadpur	Shahjadpur	Ishwardia	148	0.16	0.09
Shahjadpur	Shahjadpur	Ishwardia	149	0.19	0.15
Shahjadpur	Shahjadpur	Ishwardia	150	0.08	0.08
Shahjadpur	Shahjadpur	Ishwardia	151	0.09	0.09
Shahjadpur	Shahjadpur	Ishwardia	152	0.09	0.07
Shahjadpur	Shahjadpur	Ishwardia	153	0.15	0.04
Shahjadpur	Shahjadpur	Ishwardia	158	0.08	0.02
Shahjadpur	Shahjadpur	Ishwardia	159	0.13	0.01
Shahjadpur	Shahjadpur	Ishwardia	160	0.17	0.01
Shahjadpur	Shahjadpur	Ishwardia	173	0.16	0.04
Shahjadpur	Shahjadpur	Ishwardia	213	0.16	0.16
Shahjadpur	Shahjadpur	Nagardala	75	0.07	0.02
Shahjadpur	Shahjadpur	Nagardala	76	0.03	0.03
Shahjadpur	Shahjadpur	Nagardala	77	0.24	0.22
Shahjadpur	Shahjadpur	Nagardala	78	0.15	0.10
Shahjadpur	Shahjadpur	Nagardala	92	0.06	0.03
Shahjadpur	Shahjadpur	Nagardala	94	0.14	0.08
Shahjadpur	Shahjadpur	Nagardala	95	0.14	0.14
Shahjadpur	Shahjadpur	Nagardala	96	0.07	0.07

Upazila name	Union name	Mouza name	Plot number	Plot area ha	Affected plot area ha
Shahjadpur	Shahjadpur	Nagardala	97	0.09	0.07
Shahjadpur	Shahjadpur	Nagardala	98	0.16	0.13
Shahjadpur	Shahjadpur	Nagardala	99	0.17	0.12
Shahjadpur	Shahjadpur	Nagardala	100	0.19	0.02
Shahjadpur	Shahjadpur	Nagardala	103	0.31	0.02
Shahjadpur	Shahjadpur	Nagardala	135	0.14	0.08
Shahjadpur	Potajia	Nundaha	3	0.07	0.01
Shahjadpur	Potajia	Nundaha	55	0.14	0.13
Shahjadpur	Potajia	Nundaha	57	0.08	0.02
Shahjadpur	Potajia	Nundaha	58	0.05	0.03
Shahjadpur	Potajia	Nundaha	59	0.06	0.04
Shahjadpur	Potajia	Nundaha	60	0.02	0.02
Shahjadpur	Potajia	Nundaha	61	0.03	0.03
Shahjadpur	Potajia	Nundaha	62	0.07	0.07
Shahjadpur	Potajia	Nundaha	72	0.16	0.00
Shahjadpur	Potajia	Nundaha	85	0.34	0.17
Shahjadpur	Potajia	Nundaha	90	0.06	0.02
Shahjadpur	Potajia	Nundaha	91	0.19	0.06
Shahjadpur	Potajia	Nundaha	93	0.08	0.01
Shahjadpur	Potajia	Nundaha	94	0.06	0.06
Shahjadpur	Potajia	Nundaha	95	0.10	0.10
Shahjadpur	Potajia	Nundaha	96	0.07	0.01
Shahjadpur	Potajia	Nundaha	97	0.08	0.03
Shahjadpur	Potajia	Nundaha	98	0.09	0.09
Shahjadpur	Potajia	Nundaha	99	0.11	0.07
Shahjadpur	Potajia	Nundaha	100	0.12	0.10
Shahjadpur	Potajia	Nundaha	101	0.10	0.10
Shahjadpur	Potajia	Nundaha	102	0.12	0.03
Shahjadpur	Potajia	Nundaha	103	0.09	0.00
Shahjadpur	Potajia	Nundaha	104	0.13	0.13
Shahjadpur	Potajia	Nundaha	105	0.11	0.09
Shahjadpur	Potajia	Nundaha	108	0.20	0.07
Shahjadpur	Potajia	Nundaha	110	0.12	0.03
Shahjadpur	Potajia	Nundaha	111	0.12	0.03
Shahjadpur	Potajia	Nundaha	112	0.06	0.05
Shahjadpur	Potajia	Nundaha	115	0.02	0.02
Shahjadpur	Potajia	Nundaha	116	0.02	0.02
Shahjadpur	Potajia	Nundaha	117	0.03	0.03
Shahjadpur	Potajia	Nundaha	118	0.04	0.00
Shahjadpur	Potajia	Nundaha	119	0.04	0.04
Shahjadpur	Potajia	Nundaha	120	0.05	0.01
Shahjadpur	Potajia	Nundaha	135	0.12	0.00
Shahjadpur	Potajia	Nundaha	136	0.24	0.03

Upazila name	Union name	Mouza name	Plot number	Plot area ha	Affected plot area ha
Shahjadpur	Potajia	Nundaha	137	0.16	0.02
Shahjadpur	Potajia	Nundaha	138	0.26	0.07
Shahjadpur	Potajia	Nundaha	139	0.11	0.04
Shahjadpur	Potajia	Nundaha	140	0.11	0.05
Shahjadpur	Potajia	Nundaha	141	0.16	0.11
Shahjadpur	Potajia	Nundaha	142	0.16	0.13
Shahjadpur	Potajia	Nundaha	252	0.05	0.00
Shahjadpur	Potajia	Nundaha	253	0.07	0.00
Shahjadpur	Potajia	Nundaha	254	0.14	0.04
Shahjadpur	Potajia	Nundaha	255	0.10	0.10
Shahjadpur	Potajia	Nundaha	256	0.13	0.04
Shahjadpur	Potajia	Nundaha	257	0.03	0.03
Shahjadpur	Potajia	Nundaha	259	0.10	0.07
Shahjadpur	Potajia	Nundaha	260	0.02	0.01
Shahjadpur	Potajia	Nundaha	261	0.02	0.01
Shahjadpur	Potajia	Nundaha	262	0.09	0.03
Shahjadpur	Potajia	Nundaha	263	0.11	0.09
Shahjadpur	Potajia	Nundaha	264	0.13	0.02
Shahjadpur	Potajia	Nundaha	9999	0.08	0.06
Shahjadpur	Potajia	Potazia	9999	0.14	0.05
Shahjadpur	Potajia	Potazia	14443	0.51	0.00
Shahjadpur	Potajia	Potazia	14444	0.92	0.40
Shahjadpur	Potajia	Potazia	14445	0.37	0.33
Shahjadpur	Potajia	Potazia	14446	0.17	0.16
Shahjadpur	Potajia	Potazia	14447	0.09	0.08
Shahjadpur	Potajia	Potazia	14448	0.05	0.04
Shahjadpur	Potajia	Potazia	14449	0.39	0.00
Shahjadpur	Potajia	Potazia	14454	0.08	0.05
Shahjadpur	Potajia	Potazia	14455	0.38	0.21
Shahjadpur	Potajia	Potazia	14483	0.37	0.16
Shahjadpur	Potajia	Potazia	14484	0.11	0.05
Shahjadpur	Potajia	Potazia	14485	0.13	0.07
Shahjadpur	Potajia	Potazia	14486	0.16	0.01
Shahjadpur	Potajia	Potazia	14487	0.28	0.11
Shahjadpur	Potajia	Potazia	14488	0.20	0.06
Shahjadpur	Potajia	Potazia	14489	0.11	0.05
Shahjadpur	Potajia	Potazia	14494	0.08	0.01
Shahjadpur	Potajia	Potazia	14495	0.30	0.18
Shahjadpur	Potajia	Potazia	14880	0.23	0.00
Shahjadpur	Potajia	Potazia	14881	0.24	0.04
Shahjadpur	Potajia	Potazia	14882	0.28	0.14
Shahjadpur	Potajia	Potazia	14883	0.24	0.18
Shahjadpur	Potajia	Potazia	14884	0.10	0.07

Upazila name	Union name	Mouza name	Plot number	Plot area ha	Affected plot area ha
Shahjadpur	Potajia	Potazia	14885	0.10	0.04
Shahjadpur	Potajia	Potazia	14886	0.12	0.05
Shahjadpur	Potajia	Potazia	14897	0.08	0.00
Shahjadpur	Potajia	Potazia	14898	0.68	0.51
Shahjadpur	Potajia	Potazia	14899	0.06	0.05
Shahjadpur	Potajia	Potazia	14900	0.07	0.01
Shahjadpur	Potajia	Potazia	14901	0.59	0.28
Shahjadpur	Potajia	Potazia	14904	0.24	0.00
Shahjadpur	Potajia	Potazia	14905	0.09	0.05
Shahjadpur	Potajia	Potazia	14906	0.15	0.00
Shahjadpur	Potajia	Potazia	14966	0.11	0.11
Shahjadpur	Potajia	Potazia	14967	0.18	0.06
Shahjadpur	Potajia	Potazia	14968	0.26	0.06
Shahjadpur	Potajia	Potazia	15001	0.10	0.02
Shahjadpur	Potajia	Potazia	15003	0.14	0.06
Shahjadpur	Potajia	Potazia	15004	0.27	0.23
Shahjadpur	Potajia	Potazia	15005	0.22	0.15
Shahjadpur	Potajia	Potazia	15006	0.35	0.00
Shahjadpur	Potajia	Potazia	15008	0.22	0.09
Shahjadpur	Potajia	Potazia	15009	0.14	0.14
Shahjadpur	Potajia	Potazia	15010	0.03	0.02
Shahjadpur	Potajia	Potazia	15011	0.05	0.05
Shahjadpur	Potajia	Potazia	15012	0.08	0.05
Shahjadpur	Potajia	Potazia	15013	0.40	0.01
Shahjadpur	Potajia	Potazia	15041	0.09	0.00
Shahjadpur	Potajia	Potazia	15042	0.15	0.04
Shahjadpur	Potajia	Potazia	15063	0.03	0.00
Shahjadpur	Potajia	Potazia	15066	0.11	0.04
Shahjadpur	Potajia	Potazia	15067	0.30	0.23
Shahjadpur	Potajia	Potazia	15068	0.25	0.19
Shahjadpur	Potajia	Potazia	15069	0.09	0.03
Shahjadpur	Potajia	Potazia	15070	0.07	0.01
Shahjadpur	Potajia	Potazia	15071	0.16	0.00
Shahjadpur	Potajia	Potazia	15099	0.25	0.00
Shahjadpur	Potajia	Potazia	15100	0.26	0.12
Shahjadpur	Potajia	Potazia	15108	0.34	0.22
Shahjadpur	Potajia	Potazia	15110	0.09	0.00
Shahjadpur	Potajia	Potazia	15111	0.12	0.12
Shahjadpur	Potajia	Potazia	15112	0.08	0.07
Shahjadpur	Potajia	Potazia	15113	0.58	0.13
Shahjadpur	Potajia	Potazia	15114	0.36	0.18
Shahjadpur	Potajia	Potazia	15116	1.09	0.21
Shahjadpur	Potajia	Potazia	15117	1.50	0.23

Upazila name	Union name	Mouza name	Plot number	Plot area ha	Affected plot area ha
Shahjadpur	Potajia	Potazia	15118	0.28	0.12
Shahjadpur	Potajia	Potazia	15123	0.13	0.01
Shahjadpur	Potajia	Potazia	15124	0.22	0.09
Shahjadpur	Potajia	Potazia	15125	0.25	0.22
Shahjadpur	Potajia	Potazia	15126	0.15	0.13
Shahjadpur	Potajia	Potazia	15127	0.27	0.01
Shahjadpur	Potajia	Potazia	15136	0.08	0.08
Shahjadpur	Potajia	Potazia	15139	0.06	0.04
Shahjadpur	Potajia	Potazia	15140	0.11	0.07
Shahjadpur	Potajia	Potazia	15142	0.10	0.07
Shahjadpur	Potajia	Potazia	15143	0.05	0.03
Shahjadpur	Potajia	Potazia	15144	0.13	0.12
Shahjadpur	Potajia	Potazia	15153	0.15	0.02
Shahjadpur	Potajia	Potazia	99999	0.09	0.03
Shahjadpur	Rupabati	Ramkharua	859	0.16	0.14
Shahjadpur	Rupabati	Ramkharua	866	0.11	0.02
Shahjadpur	Rupabati	Ramkharua	867	0.11	0.09
Shahjadpur	Rupabati	Ramkharua	868	0.10	0.10
Shahjadpur	Rupabati	Ramkharua	869	0.08	0.08
Shahjadpur	Rupabati	Ramkharua	870	0.08	0.08
Shahjadpur	Rupabati	Ramkharua	871	0.12	0.12
Shahjadpur	Rupabati	Ramkharua	872	0.28	0.16
Shahjadpur	Rupabati	Ramkharua	873	0.12	0.01
Shahjadpur	Rupabati	Ramkharua	877	0.08	0.04
Shahjadpur	Rupabati	Ramkharua	878	0.11	0.09
Shahjadpur	Rupabati	Ramkharua	879	0.12	0.12
Shahjadpur	Rupabati	Ramkharua	880	0.13	0.08
Shahjadpur	Rupabati	Ramkharua	881	0.15	0.00
Shahjadpur	Rupabati	Ramkharua	901	0.04	0.00
Shahjadpur	Rupabati	Ramkharua	904	0.04	0.02
Shahjadpur	Rupabati	Ramkharua	905	0.12	0.06
Shahjadpur	Rupabati	Ramkharua	906	0.03	0.02
Shahjadpur	Rupabati	Ramkharua	907	0.03	0.03
Shahjadpur	Rupabati	Ramkharua	908	0.04	0.04
Shahjadpur	Rupabati	Ramkharua	909	0.04	0.04
Shahjadpur	Rupabati	Ramkharua	910	0.04	0.04
Shahjadpur	Rupabati	Ramkharua	911	0.04	0.04
Shahjadpur	Rupabati	Ramkharua	912	0.01	0.01
Shahjadpur	Rupabati	Ramkharua	913	0.01	0.01
Shahjadpur	Rupabati	Ramkharua	914	0.01	0.01
Shahjadpur	Rupabati	Ramkharua	915	0.01	0.01
Shahjadpur	Rupabati	Ramkharua	916	0.19	0.09
Shahjadpur	Rupabati	Ramkharua	917	0.19	0.01

Upazila name	Union name	Mouza name	Plot number	Plot area ha	Affected plot area ha
Shahjadpur	Shahjadpur Paurashava	Ratankandi	0	0.09	0.07
Shahjadpur	Shahjadpur Paurashava	Ratankandi	725	0.03	0.01
Shahjadpur	Shahjadpur Paurashava	Ratankandi	726	0.16	0.16
Shahjadpur	Shahjadpur Paurashava	Ratankandi	727	0.19	0.02
Shahjadpur	Shahjadpur Paurashava	Ratankandi	729	0.03	0.01
Shahjadpur	Shahjadpur Paurashava	Ratankandi	730	0.05	0.02
Shahjadpur	Shahjadpur Paurashava	Ratankandi	732	0.10	0.05
Shahjadpur	Shahjadpur Paurashava	Ratankandi	733	0.16	0.11
Shahjadpur	Shahjadpur Paurashava	Ratankandi	734	0.07	0.07
Shahjadpur	Shahjadpur Paurashava	Ratankandi	735	0.24	0.24
Shahjadpur	Shahjadpur Paurashava	Ratankandi	736	0.05	0.05
Shahjadpur	Shahjadpur Paurashava	Ratankandi	737	0.07	0.07
Shahjadpur	Shahjadpur Paurashava	Ratankandi	738	0.05	0.00
Shahjadpur	Shahjadpur Paurashava	Ratankandi	739	0.04	0.01
Shahjadpur	Shahjadpur Paurashava	Ratankandi	743	0.06	0.02
Shahjadpur	Shahjadpur Paurashava	Ratankandi	744	0.04	0.01
Shahjadpur	Shahjadpur Paurashava	Ratankandi	804	0.10	0.00
Shahjadpur	Shahjadpur Paurashava	Ratankandi	805	0.05	0.01
Shahjadpur	Shahjadpur Paurashava	Ratankandi	806	0.06	0.04
Shahjadpur	Shahjadpur Paurashava	Ratankandi	807	0.04	0.04
Shahjadpur	Shahjadpur Paurashava	Ratankandi	808	0.08	0.08
Shahjadpur	Shahjadpur Paurashava	Ratankandi	809	0.06	0.06

Upazila name	Union name	Mouza name	Plot number	Plot area ha	Affected plot area ha
Shahjadpur	Shahjadpur Paurashava	Ratankandi	810	0.10	0.04
Shahjadpur	Shahjadpur Paurashava	Ratankandi	813	0.06	0.01
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1403	0.08	0.02
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1637	0.29	0.10
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1638	0.04	0.02
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1639	0.05	0.02
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1640	0.05	0.02
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1641	0.03	0.01
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1642	0.03	0.01
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1643	0.03	0.00
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1644	0.08	0.01
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1661	0.05	0.00
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1662	0.07	0.02
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1663	0.03	0.00
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1664	0.03	0.03
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1665	0.06	0.04
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1666	0.11	0.10
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1667	0.03	0.03
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1668	0.03	0.03
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1669	0.06	0.06
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1670	0.27	0.22
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1672	0.14	0.00

Upazila name	Union name	Mouza name	Plot number	Plot area ha	Affected plot area ha
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1673	0.11	0.01
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1674	0.12	0.02
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1675	0.04	0.01
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1683	0.02	0.01
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1684	0.02	0.00
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1685	0.04	0.03
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1686	0.04	0.04
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1687	0.04	0.04
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1688	0.08	0.08
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1689	0.04	0.04
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1690	0.04	0.02
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1691	0.08	0.07
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1692	0.08	0.08
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1693	0.04	0.02
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1719	0.16	0.10
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1720	0.05	0.03
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1721	0.05	0.05
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1722	0.05	0.05
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1723	0.19	0.06
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1763	0.05	0.00
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1764	0.08	0.01
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1765	0.04	0.02

Upazila name	Union name	Mouza name	Plot number	Plot area ha	Affected plot area ha
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1766	0.08	0.05
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1767	0.03	0.01
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1768	0.03	0.03
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1769	0.03	0.03
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1770	0.03	0.03
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1771	0.03	0.03
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1772	0.04	0.04
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1773	0.07	0.03
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1785	0.03	0.00
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1786	0.03	0.02
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1787	0.05	0.01
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1791	0.04	0.03
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1792	0.04	0.04
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1793	0.03	0.03
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1794	0.02	0.01
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1796	0.03	0.00
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1797	0.03	0.02
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1798	0.03	0.03
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1799	0.04	0.04
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1800	0.06	0.06
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1801	0.04	0.04
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1802	0.02	0.02

Upazila name	Union name	Mouza name	Plot number	Plot area ha	Affected plot area ha
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1803	0.02	0.02
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1804	0.04	0.04
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1805	0.04	0.03
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1806	0.05	0.03
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1807	0.04	0.02
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1808	0.05	0.01
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1809	0.12	0.01
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1810	0.03	0.01
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1811	0.04	0.04
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1812	0.04	0.04
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1813	0.04	0.04
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1814	0.03	0.03
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1815	0.04	0.04
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1816	0.03	0.03
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1817	0.04	0.02
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1818	0.07	0.07
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1819	0.09	0.00
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1820	0.18	0.13
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1821	0.11	0.06
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1822	0.04	0.04
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1823	0.05	0.05
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1824	0.05	0.05

Upazila name	Union name	Mouza name	Plot number	Plot area ha	Affected plot area ha
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1825	0.04	0.04
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1826	0.04	0.02
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1828	0.02	0.00
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1861	0.03	0.01
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1960	0.12	0.01
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1961	0.23	0.05
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1964	0.14	0.01
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1965	0.10	0.03
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1966	0.04	0.04
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1967	0.05	0.05
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1968	0.05	0.05
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1969	0.03	0.01
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1971	0.05	0.05
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1972	0.04	0.04
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1973	0.12	0.11
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1974	0.13	0.10
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1975	0.03	0.03
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1976	0.07	0.02
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1977	0.09	0.03
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1978	0.22	0.17
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1979	0.06	0.00
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2053	0.13	0.07

Upazila name	Union name	Mouza name	Plot number	Plot area ha	Affected plot area ha
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2054	0.08	0.07
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2060	0.06	0.03
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2061	0.23	0.13
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2062	0.04	0.03
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2063	0.05	0.03
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2064	0.19	0.01
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2112	0.17	0.02
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2113	0.04	0.04
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2114	0.05	0.05
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2115	0.09	0.05
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2117	0.05	0.01
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2122	0.10	0.05
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2123	0.10	0.10
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2124	0.08	0.08
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2125	0.09	0.09
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2126	0.09	0.03
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2127	0.09	0.09
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2128	0.07	0.07
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2129	0.09	0.01
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2130	0.12	0.12
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2131	0.17	0.12
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2132	0.11	0.03

Upazila name	Union name	Mouza name	Plot number	Plot area ha	Affected plot area ha
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2138	0.07	0.00
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2633	0.08	0.01
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2634	0.07	0.04
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2636	0.13	0.05
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2637	0.08	0.08
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2638	0.05	0.05
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2639	0.14	0.12
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2640	0.09	0.00
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2644	0.10	0.02
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2646	0.13	0.08
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2647	0.14	0.14
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2648	0.06	0.06
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2649	0.05	0.04
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2650	0.05	0.02
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2651	0.07	0.00
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2652	0.14	0.12
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2653	0.15	0.02
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2795	0.02	0.00
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2796	0.17	0.02
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2797	0.08	0.06
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2798	0.07	0.03
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2799	0.08	0.08

Upazila name	Union name	Mouza name	Plot number	Plot area ha	Affected plot area ha
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2800	0.15	0.07
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2801	0.49	0.12
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2803	0.18	0.03
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2816	0.04	0.00
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2817	0.05	0.02
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2818	0.15	0.13
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2819	0.08	0.01
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2822	0.05	0.03
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2823	0.07	0.05
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2824	0.38	0.29
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2825	0.10	0.09
Shahjadpur	Shahjadpur Paurashava	Ratankandi	3995	0.10	0.00
Shahjadpur	Shahjadpur Paurashava	Ratankandi	4763	0.04	0.04
Shahjadpur	Shahjadpur Paurashava	Ratankandi	6181	0.36	0.01
Shahjadpur	Shahjadpur Paurashava	Ratankandi	6182	0.08	0.02
Shahjadpur	Shahjadpur Paurashava	Ratankandi	6183	0.09	0.03
Shahjadpur	Shahjadpur Paurashava	Ratankandi	6185	0.16	0.09
Shahjadpur	Shahjadpur Paurashava	Ratankandi	6186	0.06	0.02
Shahjadpur	Shahjadpur Paurashava	Ratankandi	6187	0.08	0.02
Shahjadpur	Shahjadpur Paurashava	Ratankandi	6188	0.06	0.02
Shahjadpur	Shahjadpur Paurashava	Ratankandi	6189	0.16	0.06
Shahjadpur	Shahjadpur Paurashava	Ratankandi	6190	0.15	0.08

Upazila name	Union name	Mouza name	Plot number	Plot area ha	Affected plot area ha
Shahjadpur	Shahjadpur Paurashava	Ratankandi	6191	0.30	0.08
Shahjadpur	Shahjadpur Paurashava	Ratankandi	6192	0.52	0.11
Shahjadpur	Shahjadpur Paurashava	Ratankandi	6195	0.12	0.07
Shahjadpur	Shahjadpur Paurashava	Ratankandi	6196	0.13	0.08
Shahjadpur	Shahjadpur Paurashava	Ratankandi	6197	0.40	0.30
Shahjadpur	Shahjadpur Paurashava	Ratankandi	6198	0.08	0.07
Shahjadpur	Shahjadpur Paurashava	Ratankandi	6199	0.08	0.08
Shahjadpur	Shahjadpur Paurashava	Ratankandi	6200	0.07	0.00
Shahjadpur	Shahjadpur Paurashava	Ratankandi	6201	0.08	0.01
Shahjadpur	Shahjadpur Paurashava	Ratankandi	6223	0.05	0.04
Shahjadpur	Shahjadpur Paurashava	Ratankandi	6224	0.04	0.04
Shahjadpur	Shahjadpur Paurashava	Ratankandi	6225	0.14	0.07
Shahjadpur	Shahjadpur Paurashava	Ratankandi	6241	0.11	0.09
Shahjadpur	Shahjadpur Paurashava	Ratankandi	6242	0.07	0.05
Shahjadpur	Shahjadpur Paurashava	Ratankandi	6243	0.19	0.11
Shahjadpur	Shahjadpur Paurashava	Ratankandi	6246	0.14	0.02
Shahjadpur	Shahjadpur Paurashava	Ratankandi	6247	0.16	0.02
Shahjadpur	Shahjadpur Paurashava	Ratankandi	6248	0.04	0.04
Shahjadpur	Shahjadpur Paurashava	Ratankandi	6249	0.07	0.07
Shahjadpur	Shahjadpur Paurashava	Ratankandi	6250	0.09	0.09
Shahjadpur	Shahjadpur Paurashava	Ratankandi	6252	0.06	0.06
Shahjadpur	Shahjadpur Paurashava	Ratankandi	6253	0.05	0.03

Upazila name	Union name	Mouza name	Plot number	Plot area ha	Affected plot area ha
Shahjadpur	Shahjadpur Paurashava	Ratankandi	6254	0.13	0.08
Shahjadpur	Shahjadpur Paurashava	Ratankandi	6255	0.13	0.01
Shahjadpur	Shahjadpur Paurashava	Ratankandi	7453	0.03	0.00
Shahjadpur	Shahjadpur Paurashava	Ratankandi	7455	0.08	0.01
Shahjadpur	Shahjadpur Paurashava	Ratankandi	7456	0.06	0.05
Shahjadpur	Shahjadpur Paurashava	Ratankandi	7457	0.05	0.05
Shahjadpur	Shahjadpur Paurashava	Ratankandi	7458	0.05	0.04
Shahjadpur	Shahjadpur Paurashava	Ratankandi	7459	0.02	0.00
Shahjadpur	Shahjadpur Paurashava	Ratankandi	7460	0.04	0.03
Shahjadpur	Shahjadpur Paurashava	Ratankandi	7461	0.09	0.09
Shahjadpur	Shahjadpur Paurashava	Ratankandi	7462	0.02	0.02
Shahjadpur	Shahjadpur Paurashava	Ratankandi	7464	0.09	0.02
Shahjadpur	Shahjadpur Paurashava	Ratankandi	7465	0.05	0.02
Shahjadpur	Shahjadpur Paurashava	Ratankandi	7466	0.06	0.02
Shahjadpur	Shahjadpur Paurashava	Ratankandi	7467	0.06	0.02
Shahjadpur	Shahjadpur Paurashava	Ratankandi	7468	0.20	0.05
Shahjadpur	Shahjadpur Paurashava	Ratankandi	7469	0.29	0.03
Shahjadpur	Shahjadpur Paurashava	Ratankandi	7470	0.21	0.01
Shahjadpur	Shahjadpur Paurashava	Ratankandi	7471	0.09	0.00
Shahjadpur	Shahjadpur Paurashava	Ratankandi	7474	0.16	0.14
Shahjadpur	Shahjadpur Paurashava	Ratankandi	7475	0.35	0.20
Shahjadpur	Shahjadpur Paurashava	Ratankandi	7476	0.03	0.00

Upazila name	Union name	Mouza name	Plot number	Plot area ha	Affected plot area ha
Shahjadpur	Shahjadpur Paurashava	Ratankandi	9999	0.22	0.07
Shahjadpur	Shahjadpur Paurashava	Ratankandi	99999	0.11	0.00
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1638	0.01	0.01
Shahjadpur	Rupabati	Selachapri	858	0.10	0.04
Shahjadpur	Rupabati	Selachapri	1115	0.04	0.01
Shahjadpur	Rupabati	Selachapri	1116	0.04	0.03
Shahjadpur	Rupabati	Selachapri	1117	0.05	0.03
Shahjadpur	Rupabati	Selachapri	1118	0.14	0.03
Shahjadpur	Rupabati	Selachapri	1119	0.18	0.16
Shahjadpur	Rupabati	Selachapri	1120	0.25	0.25
Shahjadpur	Rupabati	Selachapri	1121	0.04	0.04
Shahjadpur	Rupabati	Selachapri	1122	0.21	0.05
Shahjadpur	Rupabati	Selachapri	1136	0.11	0.00
Shahjadpur	Rupabati	Selachapri	1137	0.11	0.02
Shahjadpur	Rupabati	Selachapri	1138	0.13	0.06
Shahjadpur	Rupabati	Selachapri	1139	0.05	0.05
Shahjadpur	Rupabati	Selachapri	1140	0.05	0.05
Shahjadpur	Rupabati	Selachapri	1141	0.05	0.04
Shahjadpur	Rupabati	Selachapri	1142	0.13	0.03
Shahjadpur	Rupabati	Selachapri	1143	0.11	0.07
Shahjadpur	Rupabati	Selachapri	1144	0.17	0.17
Shahjadpur	Rupabati	Selachapri	1145	0.11	0.11
Shahjadpur	Rupabati	Selachapri	1146	0.09	0.09
Shahjadpur	Rupabati	Selachapri	1147	0.14	0.10
Shahjadpur	Rupabati	Selachapri	1148	0.16	0.02
Shahjadpur	Rupabati	Selachapri	1201	0.03	0.01
Shahjadpur	Rupabati	Selachapri	1210	1.07	0.01
Shahjadpur	Rupabati	Selachapri	1212	0.14	0.02
Shahjadpur	Rupabati	Selachapri	1213	0.28	0.01
Shahjadpur	Rupabati	Selachapri	1214	0.14	0.14
Shahjadpur	Rupabati	Selachapri	1215	0.11	0.02
Shahjadpur	Rupabati	Selachapri	1244	0.56	0.43
Shahjadpur	Rupabati	Selachapri	1245	0.20	0.15
Shahjadpur	Rupabati	Selachapri	1246	0.04	0.03
Shahjadpur	Rupabati	Selachapri	1247	0.05	0.05
Shahjadpur	Rupabati	Selachapri	1248	0.09	0.05
Shahjadpur	Rupabati	Selachapri	1249	0.31	0.02
Shahjadpur	Rupabati	Selachapri	1250	0.04	0.00
Shahjadpur	Rupabati	Selachapri	1251	0.09	0.06
Shahjadpur	Rupabati	Selachapri	1252	0.13	0.13

Upazila name	Union name	Mouza name	Plot number	Plot area ha	Affected plot area ha
Shahjadpur	Rupabati	Selachapri	1253	0.10	0.06
Shahjadpur	Rupabati	Selachapri	1254	0.06	0.01
Shahjadpur	Rupabati	Selachapri	1265	0.19	0.00
Shahjadpur	Rupabati	Selachapri	1266	0.14	0.07
Shahjadpur	Rupabati	Selachapri	1267	0.12	0.12
Shahjadpur	Rupabati	Selachapri	1268	0.06	0.06
Shahjadpur	Rupabati	Selachapri	1269	0.06	0.05
Shahjadpur	Rupabati	Selachapri	1270	0.06	0.01
Shahjadpur	Rupabati	Selachapri	1286	0.18	0.01
Shahjadpur	Rupabati	Selachapri	1287	0.02	0.02
Shahjadpur	Rupabati	Selachapri	1288	0.02	0.02
Shahjadpur	Rupabati	Selachapri	1289	0.19	0.10
Shahjadpur	Rupabati	Selachapri	1290	0.11	0.11
Shahjadpur	Rupabati	Selachapri	1291	0.04	0.02
Shahjadpur	Rupabati	Selachapri	1292	0.07	0.03
Shahjadpur	Rupabati	Selachapri	1293	0.08	0.08
Shahjadpur	Rupabati	Selachapri	1294	0.07	0.02
Shahjadpur	Rupabati	Selachapri	1305	0.30	0.18
Shahjadpur	Rupabati	Selachapri	1306	0.07	0.07
Shahjadpur	Rupabati	Selachapri	1307	0.08	0.07
Shahjadpur	Rupabati	Selachapri	1309	0.10	0.02
Shahjadpur	Rupabati	Selachapri	1310	0.09	0.09
Shahjadpur	Rupabati	Selachapri	1311	0.10	0.04
Shahjadpur	Rupabati	Selachapri	1397	0.03	0.03
Shahjadpur	Rupabati	Selachapri	1408	0.18	0.09
Shahjadpur	Rupabati	Selachapri	1409	0.18	0.18
Shahjadpur	Rupabati	Selachapri	1410	0.14	0.07
Shahjadpur	Rupabati	Selachapri	1411	0.30	0.03
Shahjadpur	Rupabati	Selachapri	1412	0.09	0.07
Shahjadpur	Rupabati	Selachapri	1413	0.06	0.06
Shahjadpur	Rupabati	Selachapri	1414	0.05	0.05
Shahjadpur	Rupabati	Selachapri	1415	0.12	0.09
Shahjadpur	Rupabati	Selachapri	1416	0.10	0.03
Shahjadpur	Rupabati	Selachapri	1417	0.05	0.01
Shahjadpur	Rupabati	Selachapri	1418	0.17	0.00
Shahjadpur	Rupabati	Selachapri	1421	0.25	0.05
Shahjadpur	Rupabati	Selachapri	1618	0.11	0.03
Shahjadpur	Rupabati	Selachapri	1624	0.05	0.00
Shahjadpur	Rupabati	Selachapri	1625	0.08	0.06
Shahjadpur	Rupabati	Selachapri	1626	0.11	0.09
Shahjadpur	Rupabati	Selachapri	1627	0.10	0.00
Shahjadpur	Rupabati	Selachapri	1628	0.14	0.10
Shahjadpur	Rupabati	Selachapri	1630	0.07	0.02

Upazila name	Union name	Mouza name	Plot number	Plot area ha	Affected plot area ha
Shahjadpur	Rupabati	Selachapri	1631	0.06	0.05
Shahjadpur	Rupabati	Selachapri	1632	0.04	0.04
Shahjadpur	Rupabati	Selachapri	1633	0.07	0.07
Shahjadpur	Rupabati	Selachapri	1634	0.05	0.05
Shahjadpur	Rupabati	Selachapri	1635	0.07	0.07
Shahjadpur	Rupabati	Selachapri	1636	0.08	0.08
Shahjadpur	Rupabati	Selachapri	1637	0.07	0.07
Shahjadpur	Rupabati	Selachapri	1639	0.06	0.02
Shahjadpur	Rupabati	Selachapri	1642	0.07	0.00
Shahjadpur	Rupabati	Selachapri	1644	0.07	0.04
Shahjadpur	Rupabati	Selachapri	1645	0.02	0.02
Shahjadpur	Rupabati	Selachapri	1646	0.91	0.12
Shahjadpur	Rupabati	Selachapri	1649	0.07	0.02
Shahjadpur	Rupabati	Selachapri	1650	0.10	0.05
Shahjadpur	Rupabati	Selachapri	1651	0.09	0.04
Shahjadpur	Rupabati	Selachapri	1652	0.16	0.03
Shahjadpur	Rupabati	Selachapri	1658	0.27	0.01
Shahjadpur	Rupabati	Selachapri	1659	0.10	0.00
Shahjadpur	Rupabati	Selachapri	1660	0.08	0.08
Shahjadpur	Rupabati	Selachapri	1661	0.06	0.06
Shahjadpur	Rupabati	Selachapri	1662	0.07	0.06
Shahjadpur	Rupabati	Selachapri	1663	0.06	0.06
Shahjadpur	Rupabati	Selachapri	1664	0.05	0.05
Shahjadpur	Rupabati	Selachapri	1665	0.06	0.06
Shahjadpur	Rupabati	Selachapri	1666	0.06	0.06
Shahjadpur	Rupabati	Selachapri	1667	0.07	0.05
Shahjadpur	Rupabati	Selachapri	1668	0.23	0.10
Shahjadpur	Rupabati	Selachapri	1669	0.08	0.00
Shahjadpur	Rupabati	Selachapri	1671	0.23	0.15
Shahjadpur	Rupabati	Selachapri	1698	0.19	0.19
Shahjadpur	Rupabati	Selachapri	1699	0.17	0.17
Shahjadpur	Rupabati	Selachapri	1700	0.10	0.01

2 The mouza map showing the plots affected and overlayed on the satellite map, the name of the mouza and the plot Number is listed with the area affected for each plot.

Mouza plot wise area of Shahjadpur embankment (7.7 km)

Upazila name	Union name	Mouza name	Plot number	Plot area ha	Affected plot area ha
Shahjadpur	Rupabati	Chayra	403	0.05	0.04
Shahjadpur	Rupabati	Chayra	405	0.03	0.03
Shahjadpur	Rupabati	Chayra	426	0.20	0.02
Shahjadpur	Rupabati	Chayra	431	0.06	0.01
Shahjadpur	Rupabati	Chayra	432	0.04	0.04
Shahjadpur	Rupabati	Chayra	433	0.18	0.01
Shahjadpur	Rupabati	Chayra	434	0.36	0.05
Shahjadpur	Rupabati	Chayra	436	0.45	0.09
Shahjadpur	Rupabati	Chayra	437	0.04	0.04
Shahjadpur	Rupabati	Chayra	438	0.02	0.02
Shahjadpur	Rupabati	Chayra	439	0.46	0.12
Shahjadpur	Rupabati	Chayra	440	0.25	0.05
Shahjadpur	Rupabati	Chayra	444	0.23	0.01
Shahjadpur	Rupabati	Chayra	445	0.11	0.09
Shahjadpur	Rupabati	Chayra	446	0.38	0.09
Shahjadpur	Rupabati	Chayra	447	0.10	0.01
Shahjadpur	Rupabati	Chayra	448	0.13	0.07
Shahjadpur	Rupabati	Chayra	449	0.13	0.07
Shahjadpur	Rupabati	Chayra	455	0.14	0.04
Shahjadpur	Rupabati	Chayra	456	0.20	0.09
Shahjadpur	Rupabati	Chayra	459	0.08	0.01
Shahjadpur	Rupabati	Chayra	460	0.14	0.07
Shahjadpur	Rupabati	Chayra	463	0.37	0.11
Shahjadpur	Rupabati	Chayra	464	0.28	0.07
Shahjadpur	Rupabati	Chayra	468	0.78	0.19
Shahjadpur	Rupabati	Chayra	470	0.11	0.06
Shahjadpur	Rupabati	Chayra	471	0.17	0.06
Shahjadpur	Rupabati	Chayra	475	0.17	0.04
Shahjadpur	Rupabati	Chayra	476	0.16	0.04
Shahjadpur	Rupabati	Chayra	478	0.71	0.17
Shahjadpur	Rupabati	Chayra	482	0.89	0.19
Shahjadpur	Rupabati	Chayra	489	0.30	0.08
Shahjadpur	Rupabati	Chayra	492	0.20	0.09
Shahjadpur	Rupabati	Chayra	500	0.69	0.22
Shahjadpur	Rupabati	Chayra	501	0.45	0.34
Shahjadpur	Rupabati	Chayra	502	0.61	0.06
Shahjadpur	Rupabati	Chayra	564	0.17	0.05
Shahjadpur	Rupabati	Chayra	565	0.19	0.08
Shahjadpur	Rupabati	Chayra	567	0.22	0.07

Upazila name	Union name	Mouza name	Plot number	Plot area ha	Affected plot area ha
Shahjadpur	Rupabati	Chayra	568	0.14	0.04
Shahjadpur	Rupabati	Chayra	569	0.16	0.05
Shahjadpur	Rupabati	Chayra	570	0.09	0.03
Shahjadpur	Rupabati	Chayra	571	0.23	0.08
Shahjadpur	Rupabati	Chayra	572	0.16	0.05
Shahjadpur	Rupabati	Chayra	585	0.21	0.00
Shahjadpur	Rupabati	Dombaria	16	0.14	0.01
Shahjadpur	Rupabati	Dombaria	18	0.05	0.03
Shahjadpur	Rupabati	Dombaria	19	0.11	0.01
Shahjadpur	Rupabati	Dombaria	20	0.09	0.08
Shahjadpur	Rupabati	Dombaria	21	0.07	0.07
Shahjadpur	Rupabati	Dombaria	22	0.09	0.03
Shahjadpur	Rupabati	Dombaria	23	0.06	0.03
Shahjadpur	Rupabati	Dombaria	24	0.06	0.06
Shahjadpur	Rupabati	Dombaria	25	0.14	0.10
Shahjadpur	Rupabati	Dombaria	26	0.13	0.08
Shahjadpur	Rupabati	Dombaria	27	0.13	0.07
Shahjadpur	Rupabati	Dombaria	28	0.15	0.08
Shahjadpur	Rupabati	Dombaria	29	0.28	0.13
Shahjadpur	Rupabati	Dombaria	30	0.27	0.12
Shahjadpur	Rupabati	Dombaria	31	0.05	0.05
Shahjadpur	Rupabati	Dombaria	32	0.07	0.06
Shahjadpur	Rupabati	Dombaria	33	0.09	0.00
Shahjadpur	Rupabati	Dombaria	64	0.06	0.06
Shahjadpur	Rupabati	Dombaria	65	0.12	0.09
Shahjadpur	Rupabati	Dombaria	66	0.04	0.02
Shahjadpur	Rupabati	Dombaria	67	0.04	0.01
Shahjadpur	Rupabati	Dombaria	68	0.04	0.00
Shahjadpur	Rupabati	Dombaria	70	0.07	0.06
Shahjadpur	Rupabati	Dombaria	71	0.08	0.03
Shahjadpur	Rupabati	Dombaria	72	0.09	0.01
Shahjadpur	Rupabati	Dombaria	262	0.05	0.00
Shahjadpur	Rupabati	Dombaria	263	0.01	0.01
Shahjadpur	Rupabati	Dombaria	264	0.03	0.02
Shahjadpur	Rupabati	Dombaria	265	0.01	0.00
Shahjadpur	Rupabati	Dombaria	266	0.11	0.11
Shahjadpur	Rupabati	Dombaria	267	0.10	0.06
Shahjadpur	Rupabati	Dombaria	268	0.06	0.00
Shahjadpur	Rupabati	Dombaria	278	0.13	0.00
Shahjadpur	Rupabati	Dombaria	279	0.60	0.34
Shahjadpur	Rupabati	Dombaria	280	0.08	0.05
Shahjadpur	Rupabati	Dombaria	281	0.05	0.05
Shahjadpur	Rupabati	Dombaria	282	0.05	0.05

Upazila name	Union name	Mouza name	Plot number	Plot area ha	Affected plot area ha
Shahjadpur	Rupabati	Dombaria	283	0.04	0.04
Shahjadpur	Rupabati	Dombaria	284	0.03	0.03
Shahjadpur	Rupabati	Dombaria	285	0.03	0.03
Shahjadpur	Rupabati	Dombaria	286	0.09	0.07
Shahjadpur	Rupabati	Dombaria	287	0.11	0.06
Shahjadpur	Rupabati	Dombaria	288	0.12	0.04
Shahjadpur	Rupabati	Dombaria	289	0.08	0.02
Shahjadpur	Rupabati	Dombaria	290	0.10	0.03
Shahjadpur	Rupabati	Dombaria	303	0.04	0.02
Shahjadpur	Rupabati	Dombaria	304	0.10	0.10
Shahjadpur	Rupabati	Dombaria	305	0.06	0.06
Shahjadpur	Rupabati	Dombaria	306	0.02	0.02
Shahjadpur	Rupabati	Dombaria	307	0.10	0.00
Shahjadpur	Rupabati	Dombaria	308	0.05	0.01
Shahjadpur	Rupabati	Dombaria	317	0.07	0.01
Shahjadpur	Rupabati	Dombaria	318	0.10	0.03
Shahjadpur	Rupabati	Dombaria	319	0.02	0.02
Shahjadpur	Rupabati	Dombaria	320	0.03	0.00
Shahjadpur	Rupabati	Dombaria	321	0.02	0.00
Shahjadpur	Rupabati	Dombaria	322	0.04	0.04
Shahjadpur	Rupabati	Dombaria	323	0.14	0.14
Shahjadpur	Rupabati	Dombaria	324	0.16	0.11
Shahjadpur	Rupabati	Dombaria	325	0.10	0.00
Shahjadpur	Rupabati	Dombaria	329	0.19	0.02
Shahjadpur	Rupabati	Dombaria	330	0.08	0.04
Shahjadpur	Rupabati	Dombaria	331	0.04	0.02
Shahjadpur	Rupabati	Dombaria	333	0.01	0.01
Shahjadpur	Rupabati	Dombaria	334	0.05	0.05
Shahjadpur	Rupabati	Dombaria	335	0.06	0.06
Shahjadpur	Rupabati	Dombaria	336	0.12	0.01
Shahjadpur	Rupabati	Dombaria	339	0.07	0.03
Shahjadpur	Rupabati	Dombaria	340	0.14	0.04
Shahjadpur	Rupabati	Dombaria	341	0.17	0.04
Shahjadpur	Rupabati	Dombaria	342	0.15	0.04
Shahjadpur	Rupabati	Dombaria	343	0.27	0.09
Shahjadpur	Rupabati	Dombaria	344	0.06	0.06
Shahjadpur	Rupabati	Dombaria	345	0.13	0.04
Shahjadpur	Rupabati	Dombaria	417	0.07	0.02
Shahjadpur	Rupabati	Dombaria	418	0.07	0.06
Shahjadpur	Rupabati	Dombaria	419	0.20	0.03
Shahjadpur	Rupabati	Dombaria	420	0.21	0.18
Shahjadpur	Rupabati	Dombaria	653	0.19	0.00
Shahjadpur	Rupabati	Dombaria	666	0.10	0.03

Upazila name	Union name	Mouza name	Plot number	Plot area ha	Affected plot area ha
Shahjadpur	Rupabati	Dombaria	667	0.20	0.17
Shahjadpur	Rupabati	Dombaria	709	0.44	0.01
Shahjadpur	Rupabati	Dombaria	710	0.10	0.02
Shahjadpur	Rupabati	Dombaria	711	0.07	0.03
Shahjadpur	Rupabati	Dombaria	712	0.09	0.04
Shahjadpur	Rupabati	Dombaria	713	0.09	0.08
Shahjadpur	Rupabati	Dombaria	714	0.09	0.08
Shahjadpur	Rupabati	Dombaria	715	0.18	0.06
Shahjadpur	Rupabati	Dombaria	716	0.07	0.05
Shahjadpur	Rupabati	Dombaria	717	0.21	0.01
Shahjadpur	Rupabati	Dombaria	718	0.17	0.12
Shahjadpur	Rupabati	Dombaria	720	0.14	0.01
Shahjadpur	Rupabati	Dombaria	741	0.09	0.01
Shahjadpur	Rupabati	Dombaria	742	0.10	0.02
Shahjadpur	Rupabati	Dombaria	743	0.44	0.08
Shahjadpur	Rupabati	Dombaria	744	0.18	0.18
Shahjadpur	Rupabati	Dombaria	745	0.06	0.05
Shahjadpur	Rupabati	Dombaria	746	0.07	0.00
Shahjadpur	Rupabati	Dombaria	747	0.14	0.10
Shahjadpur	Rupabati	Dombaria	750	0.16	0.02
Shahjadpur	Rupabati	Dombaria	751	0.17	0.06
Shahjadpur	Rupabati	Dombaria	752	0.10	0.09
Shahjadpur	Rupabati	Dombaria	753	0.09	0.09
Shahjadpur	Rupabati	Dombaria	754	0.08	0.08
Shahjadpur	Rupabati	Dombaria	755	0.09	0.08
Shahjadpur	Rupabati	Dombaria	756	0.14	0.13
Shahjadpur	Rupabati	Dombaria	757	0.05	0.02
Shahjadpur	Rupabati	Dombaria	759	0.10	0.05
Shahjadpur	Rupabati	Dombaria	762	0.15	0.02
Shahjadpur	Rupabati	Dombaria	763	0.13	0.06
Shahjadpur	Rupabati	Dombaria	764	0.12	0.07
Shahjadpur	Rupabati	Dombaria	765	0.09	0.07
Shahjadpur	Rupabati	Dombaria	766	0.09	0.07
Shahjadpur	Rupabati	Dombaria	767	0.11	0.10
Shahjadpur	Rupabati	Dombaria	768	0.09	0.08
Shahjadpur	Rupabati	Dombaria	769	0.12	0.08
Shahjadpur	Rupabati	Dombaria	773	0.24	0.12
Shahjadpur	Rupabati	Dombaria	774	0.13	0.04
Shahjadpur	Rupabati	Dombaria	775	0.09	0.02
Shahjadpur	Rupabati	Dombaria	776	0.10	0.01
Shahjadpur	Rupabati	Dombaria	777	0.09	0.00
Shahjadpur	Rupabati	Dombaria	878	0.10	0.09
Shahjadpur	Rupabati	Dombaria	879	0.09	0.09

Upazila name	Union name	Mouza name	Plot number	Plot area ha	Affected plot area ha
Shahjadpur	Rupabati	Dombaria	880	0.21	0.20
Shahjadpur	Rupabati	Dombaria	99999	0.15	0.06
Shahjadpur	Shahjadpur	Ishwardia	31	0.17	0.08
Shahjadpur	Shahjadpur	Ishwardia	32	0.15	0.15
Shahjadpur	Shahjadpur	Ishwardia	33	0.07	0.07
Shahjadpur	Shahjadpur	Ishwardia	34	0.17	0.05
Shahjadpur	Shahjadpur	Ishwardia	39	0.08	0.03
Shahjadpur	Shahjadpur	Ishwardia	40	0.08	0.07
Shahjadpur	Shahjadpur	Ishwardia	41	0.08	0.08
Shahjadpur	Shahjadpur	Ishwardia	42	0.13	0.12
Shahjadpur	Shahjadpur	Ishwardia	43	0.03	0.03
Shahjadpur	Shahjadpur	Ishwardia	44	0.08	0.02
Shahjadpur	Shahjadpur	Ishwardia	45	0.04	0.00
Shahjadpur	Shahjadpur	Ishwardia	100	0.09	0.04
Shahjadpur	Shahjadpur	Ishwardia	117	0.20	0.16
Shahjadpur	Shahjadpur	Ishwardia	118	0.34	0.26
Shahjadpur	Shahjadpur	Ishwardia	119	0.24	0.06
Shahjadpur	Shahjadpur	Ishwardia	120	0.34	0.10
Shahjadpur	Shahjadpur	Ishwardia	123	0.21	0.14
Shahjadpur	Shahjadpur	Ishwardia	124	0.14	0.14
Shahjadpur	Shahjadpur	Ishwardia	125	0.17	0.15
Shahjadpur	Shahjadpur	Ishwardia	126	0.07	0.03
Shahjadpur	Shahjadpur	Ishwardia	129	0.18	0.14
Shahjadpur	Shahjadpur	Ishwardia	141	0.24	0.20
Shahjadpur	Shahjadpur	Ishwardia	142	0.29	0.18
Shahjadpur	Shahjadpur	Ishwardia	144	0.07	0.04
Shahjadpur	Shahjadpur	Ishwardia	148	0.16	0.09
Shahjadpur	Shahjadpur	Ishwardia	149	0.19	0.15
Shahjadpur	Shahjadpur	Ishwardia	150	0.08	0.08
Shahjadpur	Shahjadpur	Ishwardia	151	0.09	0.09
Shahjadpur	Shahjadpur	Ishwardia	152	0.09	0.07
Shahjadpur	Shahjadpur	Ishwardia	153	0.15	0.04
Shahjadpur	Shahjadpur	Ishwardia	158	0.08	0.02
Shahjadpur	Shahjadpur	Ishwardia	159	0.13	0.01
Shahjadpur	Shahjadpur	Ishwardia	160	0.17	0.01
Shahjadpur	Shahjadpur	Ishwardia	173	0.16	0.04
Shahjadpur	Shahjadpur	Ishwardia	213	0.16	0.16
Shahjadpur	Shahjadpur	Nagardala	75	0.07	0.02
Shahjadpur	Shahjadpur	Nagardala	76	0.03	0.03
Shahjadpur	Shahjadpur	Nagardala	77	0.24	0.22
Shahjadpur	Shahjadpur	Nagardala	78	0.15	0.10
Shahjadpur	Shahjadpur	Nagardala	92	0.06	0.03
Shahjadpur	Shahjadpur	Nagardala	94	0.14	0.08

Upazila name	Union name	Mouza name	Plot number	Plot area ha	Affected plot area ha
Shahjadpur	Shahjadpur	Nagardala	95	0.14	0.14
Shahjadpur	Shahjadpur	Nagardala	96	0.07	0.07
Shahjadpur	Shahjadpur	Nagardala	97	0.09	0.07
Shahjadpur	Shahjadpur	Nagardala	98	0.16	0.13
Shahjadpur	Shahjadpur	Nagardala	99	0.17	0.12
Shahjadpur	Shahjadpur	Nagardala	100	0.19	0.02
Shahjadpur	Shahjadpur	Nagardala	103	0.31	0.02
Shahjadpur	Shahjadpur	Nagardala	135	0.14	0.08
Shahjadpur	Potajia	Nundaha	3	0.07	0.01
Shahjadpur	Potajia	Nundaha	55	0.14	0.13
Shahjadpur	Potajia	Nundaha	57	0.08	0.02
Shahjadpur	Potajia	Nundaha	58	0.05	0.03
Shahjadpur	Potajia	Nundaha	59	0.06	0.04
Shahjadpur	Potajia	Nundaha	60	0.02	0.02
Shahjadpur	Potajia	Nundaha	61	0.03	0.03
Shahjadpur	Potajia	Nundaha	62	0.07	0.07
Shahjadpur	Potajia	Nundaha	72	0.16	0.00
Shahjadpur	Potajia	Nundaha	85	0.34	0.17
Shahjadpur	Potajia	Nundaha	90	0.06	0.02
Shahjadpur	Potajia	Nundaha	91	0.19	0.06
Shahjadpur	Potajia	Nundaha	93	0.08	0.01
Shahjadpur	Potajia	Nundaha	94	0.06	0.06
Shahjadpur	Potajia	Nundaha	95	0.10	0.10
Shahjadpur	Potajia	Nundaha	96	0.07	0.01
Shahjadpur	Potajia	Nundaha	97	0.08	0.03
Shahjadpur	Potajia	Nundaha	98	0.09	0.09
Shahjadpur	Potajia	Nundaha	99	0.11	0.07
Shahjadpur	Potajia	Nundaha	100	0.12	0.10
Shahjadpur	Potajia	Nundaha	101	0.10	0.10
Shahjadpur	Potajia	Nundaha	102	0.12	0.03
Shahjadpur	Potajia	Nundaha	103	0.09	0.00
Shahjadpur	Potajia	Nundaha	104	0.13	0.13
Shahjadpur	Potajia	Nundaha	105	0.11	0.09
Shahjadpur	Potajia	Nundaha	108	0.20	0.07
Shahjadpur	Potajia	Nundaha	110	0.12	0.03
Shahjadpur	Potajia	Nundaha	111	0.12	0.03
Shahjadpur	Potajia	Nundaha	112	0.06	0.05
Shahjadpur	Potajia	Nundaha	115	0.02	0.02
Shahjadpur	Potajia	Nundaha	116	0.02	0.02
Shahjadpur	Potajia	Nundaha	117	0.03	0.03
Shahjadpur	Potajia	Nundaha	118	0.04	0.00
Shahjadpur	Potajia	Nundaha	119	0.04	0.04
Shahjadpur	Potajia	Nundaha	120	0.05	0.01

Upazila name	Union name	Mouza name	Plot number	Plot area ha	Affected plot area ha
Shahjadpur	Potajia	Nundaha	135	0.12	0.00
Shahjadpur	Potajia	Nundaha	136	0.24	0.03
Shahjadpur	Potajia	Nundaha	137	0.16	0.02
Shahjadpur	Potajia	Nundaha	138	0.26	0.07
Shahjadpur	Potajia	Nundaha	139	0.11	0.04
Shahjadpur	Potajia	Nundaha	140	0.11	0.05
Shahjadpur	Potajia	Nundaha	141	0.16	0.11
Shahjadpur	Potajia	Nundaha	142	0.16	0.13
Shahjadpur	Potajia	Nundaha	252	0.05	0.00
Shahjadpur	Potajia	Nundaha	253	0.07	0.00
Shahjadpur	Potajia	Nundaha	254	0.14	0.04
Shahjadpur	Potajia	Nundaha	255	0.10	0.10
Shahjadpur	Potajia	Nundaha	256	0.13	0.04
Shahjadpur	Potajia	Nundaha	257	0.03	0.03
Shahjadpur	Potajia	Nundaha	259	0.10	0.07
Shahjadpur	Potajia	Nundaha	260	0.02	0.01
Shahjadpur	Potajia	Nundaha	261	0.02	0.01
Shahjadpur	Potajia	Nundaha	262	0.09	0.03
Shahjadpur	Potajia	Nundaha	263	0.11	0.09
Shahjadpur	Potajia	Nundaha	264	0.13	0.02
Shahjadpur	Potajia	Nundaha	9999	0.08	0.06
Shahjadpur	Potajia	Potazia	9999	0.14	0.05
Shahjadpur	Potajia	Potazia	14443	0.51	0.00
Shahjadpur	Potajia	Potazia	14444	0.92	0.40
Shahjadpur	Potajia	Potazia	14445	0.37	0.33
Shahjadpur	Potajia	Potazia	14446	0.17	0.16
Shahjadpur	Potajia	Potazia	14447	0.09	0.08
Shahjadpur	Potajia	Potazia	14448	0.05	0.04
Shahjadpur	Potajia	Potazia	14449	0.39	0.00
Shahjadpur	Potajia	Potazia	14454	0.08	0.05
Shahjadpur	Potajia	Potazia	14455	0.38	0.21
Shahjadpur	Potajia	Potazia	14483	0.37	0.16
Shahjadpur	Potajia	Potazia	14484	0.11	0.05
Shahjadpur	Potajia	Potazia	14485	0.13	0.07
Shahjadpur	Potajia	Potazia	14486	0.16	0.01
Shahjadpur	Potajia	Potazia	14487	0.28	0.11
Shahjadpur	Potajia	Potazia	14488	0.20	0.06
Shahjadpur	Potajia	Potazia	14489	0.11	0.05
Shahjadpur	Potajia	Potazia	14494	0.08	0.01
Shahjadpur	Potajia	Potazia	14495	0.30	0.18
Shahjadpur	Potajia	Potazia	14880	0.23	0.00
Shahjadpur	Potajia	Potazia	14881	0.24	0.04
Shahjadpur	Potajia	Potazia	14882	0.28	0.14

Upazila name	Union name	Mouza name	Plot number	Plot area ha	Affected plot area ha
Shahjadpur	Potajia	Potazia	14883	0.24	0.18
Shahjadpur	Potajia	Potazia	14884	0.10	0.07
Shahjadpur	Potajia	Potazia	14885	0.10	0.04
Shahjadpur	Potajia	Potazia	14886	0.12	0.05
Shahjadpur	Potajia	Potazia	14897	0.08	0.00
Shahjadpur	Potajia	Potazia	14898	0.68	0.51
Shahjadpur	Potajia	Potazia	14899	0.06	0.05
Shahjadpur	Potajia	Potazia	14900	0.07	0.01
Shahjadpur	Potajia	Potazia	14901	0.59	0.28
Shahjadpur	Potajia	Potazia	14904	0.24	0.00
Shahjadpur	Potajia	Potazia	14905	0.09	0.05
Shahjadpur	Potajia	Potazia	14906	0.15	0.00
Shahjadpur	Potajia	Potazia	14966	0.11	0.11
Shahjadpur	Potajia	Potazia	14967	0.18	0.06
Shahjadpur	Potajia	Potazia	14968	0.26	0.06
Shahjadpur	Potajia	Potazia	15001	0.10	0.02
Shahjadpur	Potajia	Potazia	15003	0.14	0.06
Shahjadpur	Potajia	Potazia	15004	0.27	0.23
Shahjadpur	Potajia	Potazia	15005	0.22	0.15
Shahjadpur	Potajia	Potazia	15006	0.35	0.00
Shahjadpur	Potajia	Potazia	15008	0.22	0.09
Shahjadpur	Potajia	Potazia	15009	0.14	0.14
Shahjadpur	Potajia	Potazia	15010	0.03	0.02
Shahjadpur	Potajia	Potazia	15011	0.05	0.05
Shahjadpur	Potajia	Potazia	15012	0.08	0.05
Shahjadpur	Potajia	Potazia	15013	0.40	0.01
Shahjadpur	Potajia	Potazia	15041	0.09	0.00
Shahjadpur	Potajia	Potazia	15042	0.15	0.04
Shahjadpur	Potajia	Potazia	15063	0.03	0.00
Shahjadpur	Potajia	Potazia	15066	0.11	0.04
Shahjadpur	Potajia	Potazia	15067	0.30	0.23
Shahjadpur	Potajia	Potazia	15068	0.25	0.19
Shahjadpur	Potajia	Potazia	15069	0.09	0.03
Shahjadpur	Potajia	Potazia	15070	0.07	0.01
Shahjadpur	Potajia	Potazia	15071	0.16	0.00
Shahjadpur	Potajia	Potazia	15099	0.25	0.00
Shahjadpur	Potajia	Potazia	15100	0.26	0.12
Shahjadpur	Potajia	Potazia	15108	0.34	0.22
Shahjadpur	Potajia	Potazia	15110	0.09	0.00
Shahjadpur	Potajia	Potazia	15111	0.12	0.12
Shahjadpur	Potajia	Potazia	15112	0.08	0.07
Shahjadpur	Potajia	Potazia	15113	0.58	0.13
Shahjadpur	Potajia	Potazia	15114	0.36	0.18

Upazila name	Union name	Mouza name	Plot number	Plot area ha	Affected plot area ha
Shahjadpur	Potajia	Potazia	15116	1.09	0.21
Shahjadpur	Potajia	Potazia	15117	1.50	0.23
Shahjadpur	Potajia	Potazia	15118	0.28	0.12
Shahjadpur	Potajia	Potazia	15123	0.13	0.01
Shahjadpur	Potajia	Potazia	15124	0.22	0.09
Shahjadpur	Potajia	Potazia	15125	0.25	0.22
Shahjadpur	Potajia	Potazia	15126	0.15	0.13
Shahjadpur	Potajia	Potazia	15127	0.27	0.01
Shahjadpur	Potajia	Potazia	15136	0.08	0.08
Shahjadpur	Potajia	Potazia	15139	0.06	0.04
Shahjadpur	Potajia	Potazia	15140	0.11	0.07
Shahjadpur	Potajia	Potazia	15142	0.10	0.07
Shahjadpur	Potajia	Potazia	15143	0.05	0.03
Shahjadpur	Potajia	Potazia	15144	0.13	0.12
Shahjadpur	Potajia	Potazia	15153	0.15	0.02
Shahjadpur	Potajia	Potazia	99999	0.09	0.03
Shahjadpur	Rupabati	Ramkharua	859	0.16	0.14
Shahjadpur	Rupabati	Ramkharua	866	0.11	0.02
Shahjadpur	Rupabati	Ramkharua	867	0.11	0.09
Shahjadpur	Rupabati	Ramkharua	868	0.10	0.10
Shahjadpur	Rupabati	Ramkharua	869	0.08	0.08
Shahjadpur	Rupabati	Ramkharua	870	0.08	0.08
Shahjadpur	Rupabati	Ramkharua	871	0.12	0.12
Shahjadpur	Rupabati	Ramkharua	872	0.28	0.16
Shahjadpur	Rupabati	Ramkharua	873	0.12	0.01
Shahjadpur	Rupabati	Ramkharua	877	0.08	0.04
Shahjadpur	Rupabati	Ramkharua	878	0.11	0.09
Shahjadpur	Rupabati	Ramkharua	879	0.12	0.12
Shahjadpur	Rupabati	Ramkharua	880	0.13	0.08
Shahjadpur	Rupabati	Ramkharua	881	0.15	0.00
Shahjadpur	Rupabati	Ramkharua	901	0.04	0.00
Shahjadpur	Rupabati	Ramkharua	904	0.04	0.02
Shahjadpur	Rupabati	Ramkharua	905	0.12	0.06
Shahjadpur	Rupabati	Ramkharua	906	0.03	0.02
Shahjadpur	Rupabati	Ramkharua	907	0.03	0.03
Shahjadpur	Rupabati	Ramkharua	908	0.04	0.04
Shahjadpur	Rupabati	Ramkharua	909	0.04	0.04
Shahjadpur	Rupabati	Ramkharua	910	0.04	0.04
Shahjadpur	Rupabati	Ramkharua	911	0.04	0.04
Shahjadpur	Rupabati	Ramkharua	912	0.01	0.01
Shahjadpur	Rupabati	Ramkharua	913	0.01	0.01
Shahjadpur	Rupabati	Ramkharua	914	0.01	0.01
Shahjadpur	Rupabati	Ramkharua	915	0.01	0.01

Upazila name	Union name	Mouza name	Plot number	Plot area ha	Affected plot area ha
Shahjadpur	Rupabati	Ramkharua	916	0.19	0.09
Shahjadpur	Rupabati	Ramkharua	917	0.19	0.01
Shahjadpur	Shahjadpur Paurashava	Ratankandi	0	0.09	0.07
Shahjadpur	Shahjadpur Paurashava	Ratankandi	725	0.03	0.01
Shahjadpur	Shahjadpur Paurashava	Ratankandi	726	0.16	0.16
Shahjadpur	Shahjadpur Paurashava	Ratankandi	727	0.19	0.02
Shahjadpur	Shahjadpur Paurashava	Ratankandi	729	0.03	0.01
Shahjadpur	Shahjadpur Paurashava	Ratankandi	730	0.05	0.02
Shahjadpur	Shahjadpur Paurashava	Ratankandi	732	0.10	0.05
Shahjadpur	Shahjadpur Paurashava	Ratankandi	733	0.16	0.11
Shahjadpur	Shahjadpur Paurashava	Ratankandi	734	0.07	0.07
Shahjadpur	Shahjadpur Paurashava	Ratankandi	735	0.24	0.24
Shahjadpur	Shahjadpur Paurashava	Ratankandi	736	0.05	0.05
Shahjadpur	Shahjadpur Paurashava	Ratankandi	737	0.07	0.07
Shahjadpur	Shahjadpur Paurashava	Ratankandi	738	0.05	0.00
Shahjadpur	Shahjadpur Paurashava	Ratankandi	739	0.04	0.01
Shahjadpur	Shahjadpur Paurashava	Ratankandi	743	0.06	0.02
Shahjadpur	Shahjadpur Paurashava	Ratankandi	744	0.04	0.01
Shahjadpur	Shahjadpur Paurashava	Ratankandi	804	0.10	0.00
Shahjadpur	Shahjadpur Paurashava	Ratankandi	805	0.05	0.01
Shahjadpur	Shahjadpur Paurashava	Ratankandi	806	0.06	0.04
Shahjadpur	Shahjadpur Paurashava	Ratankandi	807	0.04	0.04
Shahjadpur	Shahjadpur Paurashava	Ratankandi	808	0.08	0.08

Upazila name	Union name	Mouza name	Plot number	Plot area ha	Affected plot area ha
Shahjadpur	Shahjadpur Paurashava	Ratankandi	809	0.06	0.06
Shahjadpur	Shahjadpur Paurashava	Ratankandi	810	0.10	0.04
Shahjadpur	Shahjadpur Paurashava	Ratankandi	813	0.06	0.01
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1403	0.08	0.02
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1637	0.29	0.10
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1638	0.04	0.02
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1639	0.05	0.02
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1640	0.05	0.02
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1641	0.03	0.01
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1642	0.03	0.01
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1643	0.03	0.00
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1644	0.08	0.01
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1661	0.05	0.00
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1662	0.07	0.02
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1663	0.03	0.00
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1664	0.03	0.03
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1665	0.06	0.04
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1666	0.11	0.10
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1667	0.03	0.03
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1668	0.03	0.03
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1669	0.06	0.06
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1670	0.27	0.22

Upazila name	Union name	Mouza name	Plot number	Plot area ha	Affected plot area ha
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1672	0.14	0.00
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1673	0.11	0.01
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1674	0.12	0.02
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1675	0.04	0.01
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1683	0.02	0.01
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1684	0.02	0.00
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1685	0.04	0.03
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1686	0.04	0.04
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1687	0.04	0.04
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1688	0.08	0.08
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1689	0.04	0.04
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1690	0.04	0.02
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1691	0.08	0.07
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1692	0.08	0.08
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1693	0.04	0.02
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1719	0.16	0.10
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1720	0.05	0.03
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1721	0.05	0.05
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1722	0.05	0.05
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1723	0.19	0.06
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1763	0.05	0.00
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1764	0.08	0.01

Upazila name	Union name	Mouza name	Plot number	Plot area ha	Affected plot area ha
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1765	0.04	0.02
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1766	0.08	0.05
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1767	0.03	0.01
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1768	0.03	0.03
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1769	0.03	0.03
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1770	0.03	0.03
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1771	0.03	0.03
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1772	0.04	0.04
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1773	0.07	0.03
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1785	0.03	0.00
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1786	0.03	0.02
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1787	0.05	0.01
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1791	0.04	0.03
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1792	0.04	0.04
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1793	0.03	0.03
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1794	0.02	0.01
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1796	0.03	0.00
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1797	0.03	0.02
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1798	0.03	0.03
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1799	0.04	0.04
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1800	0.06	0.06
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1801	0.04	0.04

Upazila name	Union name	Mouza name	Plot number	Plot area ha	Affected plot area ha
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1802	0.02	0.02
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1803	0.02	0.02
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1804	0.04	0.04
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1805	0.04	0.03
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1806	0.05	0.03
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1807	0.04	0.02
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1808	0.05	0.01
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1809	0.12	0.01
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1810	0.03	0.01
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1811	0.04	0.04
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1812	0.04	0.04
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1813	0.04	0.04
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1814	0.03	0.03
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1815	0.04	0.04
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1816	0.03	0.03
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1817	0.04	0.02
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1818	0.07	0.07
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1819	0.09	0.00
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1820	0.18	0.13
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1821	0.11	0.06
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1822	0.04	0.04
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1823	0.05	0.05

Upazila name	Union name	Mouza name	Plot number	Plot area ha	Affected plot area ha
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1824	0.05	0.05
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1825	0.04	0.04
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1826	0.04	0.02
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1828	0.02	0.00
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1861	0.03	0.01
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1960	0.12	0.01
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1961	0.23	0.05
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1964	0.14	0.01
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1965	0.10	0.03
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1966	0.04	0.04
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1967	0.05	0.05
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1968	0.05	0.05
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1969	0.03	0.01
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1971	0.05	0.05
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1972	0.04	0.04
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1973	0.12	0.11
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1974	0.13	0.10
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1975	0.03	0.03
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1976	0.07	0.02
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1977	0.09	0.03
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1978	0.22	0.17
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1979	0.06	0.00

Upazila name	Union name	Mouza name	Plot number	Plot area ha	Affected plot area ha
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2053	0.13	0.07
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2054	0.08	0.07
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2060	0.06	0.03
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2061	0.23	0.13
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2062	0.04	0.03
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2063	0.05	0.03
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2064	0.19	0.01
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2112	0.17	0.02
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2113	0.04	0.04
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2114	0.05	0.05
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2115	0.09	0.05
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2117	0.05	0.01
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2122	0.10	0.05
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2123	0.10	0.10
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2124	0.08	0.08
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2125	0.09	0.09
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2126	0.09	0.03
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2127	0.09	0.09
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2128	0.07	0.07
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2129	0.09	0.01
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2130	0.12	0.12
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2131	0.17	0.12

Upazila name	Union name	Mouza name	Plot number	Plot area ha	Affected plot area ha
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2132	0.11	0.03
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2138	0.07	0.00
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2633	0.08	0.01
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2634	0.07	0.04
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2636	0.13	0.05
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2637	0.08	0.08
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2638	0.05	0.05
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2639	0.14	0.12
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2640	0.09	0.00
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2644	0.10	0.02
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2646	0.13	0.08
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2647	0.14	0.14
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2648	0.06	0.06
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2649	0.05	0.04
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2650	0.05	0.02
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2651	0.07	0.00
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2652	0.14	0.12
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2653	0.15	0.02
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2795	0.02	0.00
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2796	0.17	0.02
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2797	0.08	0.06
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2798	0.07	0.03

Upazila name	Union name	Mouza name	Plot number	Plot area ha	Affected plot area ha
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2799	0.08	0.08
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2800	0.15	0.07
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2801	0.49	0.12
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2803	0.18	0.03
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2816	0.04	0.00
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2817	0.05	0.02
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2818	0.15	0.13
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2819	0.08	0.01
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2822	0.05	0.03
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2823	0.07	0.05
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2824	0.38	0.29
Shahjadpur	Shahjadpur Paurashava	Ratankandi	2825	0.10	0.09
Shahjadpur	Shahjadpur Paurashava	Ratankandi	3995	0.10	0.00
Shahjadpur	Shahjadpur Paurashava	Ratankandi	4763	0.04	0.04
Shahjadpur	Shahjadpur Paurashava	Ratankandi	6181	0.36	0.01
Shahjadpur	Shahjadpur Paurashava	Ratankandi	6182	0.08	0.02
Shahjadpur	Shahjadpur Paurashava	Ratankandi	6183	0.09	0.03
Shahjadpur	Shahjadpur Paurashava	Ratankandi	6185	0.16	0.09
Shahjadpur	Shahjadpur Paurashava	Ratankandi	6186	0.06	0.02
Shahjadpur	Shahjadpur Paurashava	Ratankandi	6187	0.08	0.02
Shahjadpur	Shahjadpur Paurashava	Ratankandi	6188	0.06	0.02
Shahjadpur	Shahjadpur Paurashava	Ratankandi	6189	0.16	0.06

Upazila name	Union name	Mouza name	Plot number	Plot area ha	Affected plot area ha
Shahjadpur	Shahjadpur Paurashava	Ratankandi	6190	0.15	0.08
Shahjadpur	Shahjadpur Paurashava	Ratankandi	6191	0.30	0.08
Shahjadpur	Shahjadpur Paurashava	Ratankandi	6192	0.52	0.11
Shahjadpur	Shahjadpur Paurashava	Ratankandi	6195	0.12	0.07
Shahjadpur	Shahjadpur Paurashava	Ratankandi	6196	0.13	0.08
Shahjadpur	Shahjadpur Paurashava	Ratankandi	6197	0.40	0.30
Shahjadpur	Shahjadpur Paurashava	Ratankandi	6198	0.08	0.07
Shahjadpur	Shahjadpur Paurashava	Ratankandi	6199	0.08	0.08
Shahjadpur	Shahjadpur Paurashava	Ratankandi	6200	0.07	0.00
Shahjadpur	Shahjadpur Paurashava	Ratankandi	6201	0.08	0.01
Shahjadpur	Shahjadpur Paurashava	Ratankandi	6223	0.05	0.04
Shahjadpur	Shahjadpur Paurashava	Ratankandi	6224	0.04	0.04
Shahjadpur	Shahjadpur Paurashava	Ratankandi	6225	0.14	0.07
Shahjadpur	Shahjadpur Paurashava	Ratankandi	6241	0.11	0.09
Shahjadpur	Shahjadpur Paurashava	Ratankandi	6242	0.07	0.05
Shahjadpur	Shahjadpur Paurashava	Ratankandi	6243	0.19	0.11
Shahjadpur	Shahjadpur Paurashava	Ratankandi	6246	0.14	0.02
Shahjadpur	Shahjadpur Paurashava	Ratankandi	6247	0.16	0.02
Shahjadpur	Shahjadpur Paurashava	Ratankandi	6248	0.04	0.04
Shahjadpur	Shahjadpur Paurashava	Ratankandi	6249	0.07	0.07
Shahjadpur	Shahjadpur Paurashava	Ratankandi	6250	0.09	0.09
Shahjadpur	Shahjadpur Paurashava	Ratankandi	6252	0.06	0.06

Upazila name	Union name	Mouza name	Plot number	Plot area ha	Affected plot area ha
Shahjadpur	Shahjadpur Paurashava	Ratankandi	6253	0.05	0.03
Shahjadpur	Shahjadpur Paurashava	Ratankandi	6254	0.13	0.08
Shahjadpur	Shahjadpur Paurashava	Ratankandi	6255	0.13	0.01
Shahjadpur	Shahjadpur Paurashava	Ratankandi	7453	0.03	0.00
Shahjadpur	Shahjadpur Paurashava	Ratankandi	7455	0.08	0.01
Shahjadpur	Shahjadpur Paurashava	Ratankandi	7456	0.06	0.05
Shahjadpur	Shahjadpur Paurashava	Ratankandi	7457	0.05	0.05
Shahjadpur	Shahjadpur Paurashava	Ratankandi	7458	0.05	0.04
Shahjadpur	Shahjadpur Paurashava	Ratankandi	7459	0.02	0.00
Shahjadpur	Shahjadpur Paurashava	Ratankandi	7460	0.04	0.03
Shahjadpur	Shahjadpur Paurashava	Ratankandi	7461	0.09	0.09
Shahjadpur	Shahjadpur Paurashava	Ratankandi	7462	0.02	0.02
Shahjadpur	Shahjadpur Paurashava	Ratankandi	7464	0.09	0.02
Shahjadpur	Shahjadpur Paurashava	Ratankandi	7465	0.05	0.02
Shahjadpur	Shahjadpur Paurashava	Ratankandi	7466	0.06	0.02
Shahjadpur	Shahjadpur Paurashava	Ratankandi	7467	0.06	0.02
Shahjadpur	Shahjadpur Paurashava	Ratankandi	7468	0.20	0.05
Shahjadpur	Shahjadpur Paurashava	Ratankandi	7469	0.29	0.03
Shahjadpur	Shahjadpur Paurashava	Ratankandi	7470	0.21	0.01
Shahjadpur	Shahjadpur Paurashava	Ratankandi	7471	0.09	0.00
Shahjadpur	Shahjadpur Paurashava	Ratankandi	7474	0.16	0.14
Shahjadpur	Shahjadpur Paurashava	Ratankandi	7475	0.35	0.20

Upazila name	Union name	Mouza name	Plot number	Plot area ha	Affected plot area ha
Shahjadpur	Shahjadpur Paurashava	Ratankandi	7476	0.03	0.00
Shahjadpur	Shahjadpur Paurashava	Ratankandi	9999	0.22	0.07
Shahjadpur	Shahjadpur Paurashava	Ratankandi	99999	0.11	0.00
Shahjadpur	Shahjadpur Paurashava	Ratankandi	1638	0.01	0.01
Shahjadpur	Rupabati	Selachapri	858	0.10	0.04
Shahjadpur	Rupabati	Selachapri	1115	0.04	0.01
Shahjadpur	Rupabati	Selachapri	1116	0.04	0.03
Shahjadpur	Rupabati	Selachapri	1117	0.05	0.03
Shahjadpur	Rupabati	Selachapri	1118	0.14	0.03
Shahjadpur	Rupabati	Selachapri	1119	0.18	0.16
Shahjadpur	Rupabati	Selachapri	1120	0.25	0.25
Shahjadpur	Rupabati	Selachapri	1121	0.04	0.04
Shahjadpur	Rupabati	Selachapri	1122	0.21	0.05
Shahjadpur	Rupabati	Selachapri	1136	0.11	0.00
Shahjadpur	Rupabati	Selachapri	1137	0.11	0.02
Shahjadpur	Rupabati	Selachapri	1138	0.13	0.06
Shahjadpur	Rupabati	Selachapri	1139	0.05	0.05
Shahjadpur	Rupabati	Selachapri	1140	0.05	0.05
Shahjadpur	Rupabati	Selachapri	1141	0.05	0.04
Shahjadpur	Rupabati	Selachapri	1142	0.13	0.03
Shahjadpur	Rupabati	Selachapri	1143	0.11	0.07
Shahjadpur	Rupabati	Selachapri	1144	0.17	0.17
Shahjadpur	Rupabati	Selachapri	1145	0.11	0.11
Shahjadpur	Rupabati	Selachapri	1146	0.09	0.09
Shahjadpur	Rupabati	Selachapri	1147	0.14	0.10
Shahjadpur	Rupabati	Selachapri	1148	0.16	0.02
Shahjadpur	Rupabati	Selachapri	1201	0.03	0.01
Shahjadpur	Rupabati	Selachapri	1210	1.07	0.01
Shahjadpur	Rupabati	Selachapri	1212	0.14	0.02
Shahjadpur	Rupabati	Selachapri	1213	0.28	0.01
Shahjadpur	Rupabati	Selachapri	1214	0.14	0.14
Shahjadpur	Rupabati	Selachapri	1215	0.11	0.02
Shahjadpur	Rupabati	Selachapri	1244	0.56	0.43
Shahjadpur	Rupabati	Selachapri	1245	0.20	0.15
Shahjadpur	Rupabati	Selachapri	1246	0.04	0.03
Shahjadpur	Rupabati	Selachapri	1247	0.05	0.05
Shahjadpur	Rupabati	Selachapri	1248	0.09	0.05
Shahjadpur	Rupabati	Selachapri	1249	0.31	0.02
Shahjadpur	Rupabati	Selachapri	1250	0.04	0.00

Upazila name	Union name	Mouza name	Plot number	Plot area ha	Affected plot area ha
Shahjadpur	Rupabati	Selachapri	1251	0.09	0.06
Shahjadpur	Rupabati	Selachapri	1252	0.13	0.13
Shahjadpur	Rupabati	Selachapri	1253	0.10	0.06
Shahjadpur	Rupabati	Selachapri	1254	0.06	0.01
Shahjadpur	Rupabati	Selachapri	1265	0.19	0.00
Shahjadpur	Rupabati	Selachapri	1266	0.14	0.07
Shahjadpur	Rupabati	Selachapri	1267	0.12	0.12
Shahjadpur	Rupabati	Selachapri	1268	0.06	0.06
Shahjadpur	Rupabati	Selachapri	1269	0.06	0.05
Shahjadpur	Rupabati	Selachapri	1270	0.06	0.01
Shahjadpur	Rupabati	Selachapri	1286	0.18	0.01
Shahjadpur	Rupabati	Selachapri	1287	0.02	0.02
Shahjadpur	Rupabati	Selachapri	1288	0.02	0.02
Shahjadpur	Rupabati	Selachapri	1289	0.19	0.10
Shahjadpur	Rupabati	Selachapri	1290	0.11	0.11
Shahjadpur	Rupabati	Selachapri	1291	0.04	0.02
Shahjadpur	Rupabati	Selachapri	1292	0.07	0.03
Shahjadpur	Rupabati	Selachapri	1293	0.08	0.08
Shahjadpur	Rupabati	Selachapri	1294	0.07	0.02
Shahjadpur	Rupabati	Selachapri	1305	0.30	0.18
Shahjadpur	Rupabati	Selachapri	1306	0.07	0.07
Shahjadpur	Rupabati	Selachapri	1307	0.08	0.07
Shahjadpur	Rupabati	Selachapri	1309	0.10	0.02
Shahjadpur	Rupabati	Selachapri	1310	0.09	0.09
Shahjadpur	Rupabati	Selachapri	1311	0.10	0.04
Shahjadpur	Rupabati	Selachapri	1397	0.03	0.03
Shahjadpur	Rupabati	Selachapri	1408	0.18	0.09
Shahjadpur	Rupabati	Selachapri	1409	0.18	0.18
Shahjadpur	Rupabati	Selachapri	1410	0.14	0.07
Shahjadpur	Rupabati	Selachapri	1411	0.30	0.03
Shahjadpur	Rupabati	Selachapri	1412	0.09	0.07
Shahjadpur	Rupabati	Selachapri	1413	0.06	0.06
Shahjadpur	Rupabati	Selachapri	1414	0.05	0.05
Shahjadpur	Rupabati	Selachapri	1415	0.12	0.09
Shahjadpur	Rupabati	Selachapri	1416	0.10	0.03
Shahjadpur	Rupabati	Selachapri	1417	0.05	0.01
Shahjadpur	Rupabati	Selachapri	1418	0.17	0.00
Shahjadpur	Rupabati	Selachapri	1421	0.25	0.05
Shahjadpur	Rupabati	Selachapri	1618	0.11	0.03
Shahjadpur	Rupabati	Selachapri	1624	0.05	0.00
Shahjadpur	Rupabati	Selachapri	1625	0.08	0.06
Shahjadpur	Rupabati	Selachapri	1626	0.11	0.09
Shahjadpur	Rupabati	Selachapri	1627	0.10	0.00

Upazila name	Union name	Mouza name	Plot number	Plot area ha	Affected plot area ha
Shahjadpur	Rupabati	Selachapri	1628	0.14	0.10
Shahjadpur	Rupabati	Selachapri	1630	0.07	0.02
Shahjadpur	Rupabati	Selachapri	1631	0.06	0.05
Shahjadpur	Rupabati	Selachapri	1632	0.04	0.04
Shahjadpur	Rupabati	Selachapri	1633	0.07	0.07
Shahjadpur	Rupabati	Selachapri	1634	0.05	0.05
Shahjadpur	Rupabati	Selachapri	1635	0.07	0.07
Shahjadpur	Rupabati	Selachapri	1636	0.08	0.08
Shahjadpur	Rupabati	Selachapri	1637	0.07	0.07
Shahjadpur	Rupabati	Selachapri	1639	0.06	0.02
Shahjadpur	Rupabati	Selachapri	1642	0.07	0.00
Shahjadpur	Rupabati	Selachapri	1644	0.07	0.04
Shahjadpur	Rupabati	Selachapri	1645	0.02	0.02
Shahjadpur	Rupabati	Selachapri	1646	0.91	0.12
Shahjadpur	Rupabati	Selachapri	1649	0.07	0.02
Shahjadpur	Rupabati	Selachapri	1650	0.10	0.05
Shahjadpur	Rupabati	Selachapri	1651	0.09	0.04
Shahjadpur	Rupabati	Selachapri	1652	0.16	0.03
Shahjadpur	Rupabati	Selachapri	1658	0.27	0.01
Shahjadpur	Rupabati	Selachapri	1659	0.10	0.00
Shahjadpur	Rupabati	Selachapri	1660	0.08	0.08
Shahjadpur	Rupabati	Selachapri	1661	0.06	0.06
Shahjadpur	Rupabati	Selachapri	1662	0.07	0.06
Shahjadpur	Rupabati	Selachapri	1663	0.06	0.06
Shahjadpur	Rupabati	Selachapri	1664	0.05	0.05
Shahjadpur	Rupabati	Selachapri	1665	0.06	0.06
Shahjadpur	Rupabati	Selachapri	1666	0.06	0.06
Shahjadpur	Rupabati	Selachapri	1667	0.07	0.05
Shahjadpur	Rupabati	Selachapri	1668	0.23	0.10
Shahjadpur	Rupabati	Selachapri	1669	0.08	0.00
Shahjadpur	Rupabati	Selachapri	1671	0.23	0.15
Shahjadpur	Rupabati	Selachapri	1698	0.19	0.19
Shahjadpur	Rupabati	Selachapri	1699	0.17	0.17
Shahjadpur	Rupabati	Selachapri	1700	0.10	0.01

APPENDIX G

DETAILED OF THE PROJECT AFFECTED HOUSEHOLDS

The detailed information for each affected Household is to be further reveiwed

Table 28: List of Household heads with category of losses (Owners and Business

Location No.	HH Head Name Occupation	Father/ Husband Name Annual Income	Gender Land Use	Age	National Card Ownership
Shahjadpur; Habibullah Nagar; Badalbari Petty trader	**Abdul kuddus** 1,00,000-1,80,000	Mohammad kismet ali Homestead Land	Male Owner		
Other					
Business					
Shahjadpur; Habibullah Nagar; Badalbari Petty trader	**Abdur Rashid** 1,00,000-1,80,000	Alhaz kismat ali Commercial	Male Owner	70	
Homestead Structure					
Owner					
Other					
Business					
Shahjadpur; Habibullah Nagar; Badalbari Petty trader	**Abu saeed** >1,80,000	Keshmot hazi Homestead Structure	Male Owner	40	
Shahjadpur; Habibullah Nagar; Badalbari 8816787427490 Owner	**Afsar ali** Daily wage laborer (Non-agri)	Hamid ali sarker >1,80,000	Male Homestead Structure	67	
Shahjadpur; Habibullah Nagar; Badalbari Petty trader	**Goutam ray** >1,80,000	Gopinath ray Homestead Land	Male Owner		
Shahjadpur; Habibullah Nagar; Badalbari 8816787427503 Land	**Haroon ur rashid** Unemployed/dependent/children Owner	Full Chand sarkar	Male 0-30,000Homestead	58	
Shahjadpur; Habibullah Nagar; Badalbari 8816787427472 Owner	**Ibne sawad** Vendor	Mohammad afjal hossain >1,80,000	Male Homestead Structure	40	
Other					
Business					
Shahjadpur; Habibullah Nagar; Badalbari >1,80,000	**Ismail Hazi and Icha Haque** Homestead Structure		Male Owner		

Shahjadpur; Habibullah Nagar; Badalbari **Md. samim sorkar** Noushad Ali Male 31
8816787427475 Daily wage laborer (Non-agri) 50,000-1,00,000 Homestead Structure
Owner

Other

Business

Shahjadpur; Habibullah Nagar; Badalbari **Mohammad ibrahim** Alhaj Mohammad keshmot Male 45
Vendor 1,00,000-1,80,000 Homestead Structure Owner

Other

Business

Shahjadpur; Habibullah Nagar; Badalbari **Mukul hossain** Sunbathing ali Male 30
8816787427224 Daily wage laborer (Non-agri) 50,000-1,00,000 Homestead Structure
Owner

Other

Business

Shahjadpur; Habibullah Nagar; Badalbari **Rayan ali** Hamid sharkar Male 55
8816787427491 Unemployed/dependent/children 0-30,000Homestead
Land Owner

Shahjadpur; Habibullah Nagar; Badalbari **Saiful islam** Abdul Hamid sarkar Male 47
8816787427485 Daily wage laborer (Non-agri) 30,000-50,000 Homestead Land
Owner

Shahjadpur; Habibullah Nagar; Badalbari **Shahajahan Ali** Fulchan sarkar Male 60
Daily wage laborer (Non-agri) 50,000-1,00,000 Homestead Structure Owner

Other

Business

Shahjadpur; Habibullah Nagar; Badalbari **Sree choitonno ray** Gopalchandra ray Male 60
Painter Homestead Structure Owner

Other

Business

Shahjadpur; Habibullah Nagar; Kumir Goalia **Hafizur Rahman** Md Abdul Aziz Male 45
8816787425515 Teacher >1,80,000 AgriculturalBusiness

Homestead Land

Owner

Location No.	HH Head Name Occupation	Father/ Husband Name Annual Income	Gender Age Card Land Use Ownership
Shahjadpur; Habibullah Nagar; Kumir Goalia 8816787425515 Owner	**Hafizur Rahman** Teacher	Md Abdul Aziz >1,80,000	Male 45 Homestead Structure
Shop-Store			
Business			
Shahjadpur; Habibullah Nagar; Kumir Goalia 8816787427118 Owner	**Haran kumar madak** Vendor	Sree shubol chandra madak >1,80,000	Male 32 Homestead Land
Shahjadpur; Habibullah Nagar; Kumir Goalia 8816787427502 Owner	**Joybanu** Daily wage laborer (Non-agri)	Kashem ali akondo 0-30,000	Female 51 Homestead Structure
Shahjadpur; Habibullah Nagar; Kumir Goalia 8816787427500 Owner	**Saherul islam** Daily wage laborer (Non-agri)	Fulchan sharkar 1,00,000-1,80,000	Male 26 Homestead Land
Shahjadpur; Habibullah Nagar; Kumir Goalia Barber	**Shuvash chandra shil** 30,000-50,000	Shadhu chandra shil Dairy-Livestock Farm	Male 43 Business
Homestead Structure			
Owner			
Shahjadpur; Habibullah Nagar; Kumir Goalia 8816787427121 Owner	**Spree suvas chandra mooak** Daily wage laborer (Non-agri)	Sree subal chandra mooak 0-30,000	Male 41 Homestead Structure
Shahjadpur; Habibullah Nagar; Kumir Goalia 8816787427171 Owner	**Sree susen chandra ray** Vendor	Ram mohan ray >1,80,000	Male 44 Homestead Structure
Shahjadpur; Habibullah Nagar; Kumir Goalia 199288167870 Owner	**Sumon chondro modok** Migrant Worker	Shubol chondro modok 50,000-1,00,000	Male 30 Homestead Structure
Shahjadpur; Habibullah Nagar; Kumir Goalia Daily wage laborer (Non-agri)	**Udaychandra shutradhat** 1,00,000-1,80,000	Genis Chandra sutradhar Homestead Land	Male 40 Owner
Shahjadpur; Habibullah Nagar; Nagardala Petty trader	**Abdul motin** 1,00,000-1,80,000	Moniruddin Commercial	Male 47 Owner
Shop-Store			
Business			
Shahjadpur; Habibullah Nagar; Nagardala Daily wage laborer (Agri)	**Abdur razzak** 50,000-1,00,000	Riaz uddin Homestead Land	Male 65 Owner

Shahjadpur; Habibullah Nagar; Nagardala Aluminium shop	**Guljar hossain** Shop-Store	Harun sheikh Business	Male	27
Shahjadpur; Habibullah Nagar; Nagardala Cycle repair shop	**Rofikul islam** 0-30,000	Mohammad khobir uddin Shop-Store	Male Business	49
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) Daily wage laborer (Agri) Owner			Male Homestead Structure	
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) No Reply Business			Male Agricultural	

Homestead Structure

Owner

Shahjadpur; Habibullah Nagar; Rotonkandi (Part) No Reply Owner			Male Homestead Land	
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) 8816787599401	**Matin ali** Rickshaw/Rickshaw van driver	Late lalchaf mia 50,000-1,00,000	Male AgricultureOwner	47

Other

Business

Shahjadpur; Habibullah Nagar; Rotonkandi (Part) 8816787438592	**abdul bari** Teacher	Sohrab Uddin Sarket 1,00,000-1,80,000	Male AgriculturalBusiness	57

Agriculture

Owner

Dairy-Livestock Farm

Business

Fish Pond

Business

Homestead Structure

Owner

Location No.	HH Head Name Occupation	Father/ Husband Name Annual Income	Gender Land Use	Age	National Card Ownership
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) Daily wage laborer (Agri)	**Abdul Hamid** 30,000-50,000	Lal chad mia Agriculture	Male Owner	55	
Other					
Business					
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) >1,80,000	**Abdul hamid** Agriculture	Abdul jabbar Owner	Male	37	
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) Daily wage laborer (Agri)	**Abdul jabbar** >1,80,000	Chan poramanik Homestead Land	Male Owner	55	
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) Rickshaw/Rickshaw van driver	**Abdul Jalil** 30,000-50,000	Amjad Homestead Structure	Male Owner	45	
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) 8816787420465 Owner	**Abdul latif** Daily wage laborer (Non-agri)	Ismail hossain 50,000-1,00,000	Male Homestead Land	40	
Homestead Structure					
Owner					
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) Cultivation in owned land	**Abdul Majid** 30,000-50,000	Nobu porayon Dairy-Livestock Farm	Male Business	60	
Homestead Structure					
Owner					
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) 8816787420429 Business	**Abdul majid** Daily wage laborer (Agri)	Mofiz uddin 30,000-50,000	Male Dairy-Livestock Farm	42	
Homestead Structure					
Owner					
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) 8816787421139 Business	**Abdul malek** Daily wage laborer (Non-agri)	Gaher Ali 30,000-50,000	Male Dairy-Livestock Farm	34	
Homestead Structure					
Owner					

Shahjadpur; Habibullah Nagar; Rotonkandi (Part) **Abdul Matin** Mofuz Uddin Male 62
8816787420427 Unemployed/dependent/children 50,000-1,00,000
Homestead Structure Owner

Shahjadpur; Habibullah Nagar; Rotonkandi (Part) **Abdul rashid** Kosimuddin sarkar Male 50
8816787420699 Daily wage laborer (Agri) 50,000-1,00,000 Homestead Land
Owner

Shahjadpur; Habibullah Nagar; Rotonkandi (Part) **Abdur gafur** Iman ali Male 51
8816787421173 Unemployed/dependent/children 0-30,000Homestead
Structure Owner

Other

Business

Shahjadpur; Habibullah Nagar; Rotonkandi (Part) **Abduss sattar** Safaz uddin Male 43
8816787420647 Daily wage laborer (Non-agri) 50,000-1,00,000 AgricultureOwner

Homestead Land

Owner

Shahjadpur; Habibullah Nagar; Rotonkandi (Part) **Abu hanif mia** Kakil vokto Male 63
8816787420486 Gowala >1,80,000 Dairy-Livestock Farm
Business

Homestead Structure

Owner

Shahjadpur; Habibullah Nagar; Rotonkandi (Part) **Abu sayeed** Safaz uddin Male 65
8816787420687 Petty trader 50,000-1,00,000 AgricultureOwner

Homestead Land

Owner

Other

Business

Shahjadpur; Habibullah Nagar; Rotonkandi (Part) **Abu taleb** Sheikhen poramanik Male 50
Cultivation in owned land 30,000-50,000 Homestead Structure Owner

Shahjadpur; Habibullah Nagar; Rotonkandi (Part) **Abusayeed** Foyzol poramanik Male
Daily wage laborer (Agri) Other Business

Shahjadpur; Habibullah Nagar; Rotonkandi (Part) **Aksed molla** Shahid molla late Male 39
8816787421187 Variety 30,000-50,000 AgriculturalBusiness

Location	HH Head Name	Father/ Husband Name	Gender	Age	National Card
No.	Occupation	Annual Income	Land Use	Ownership	
Shahjadpur; Habibullah Nagar; Rotonkandi (Part)	**Aksed molla**	Shahid molla late	Male	39	
8816787421187	Variety	30,000-50,000	Homestead Structure		
Owner					
Poultry Farm					
Business					
Shahjadpur; Habibullah Nagar; Rotonkandi (Part)	**Almas sarkar**	Labu sarkar	Male	40	
Daily wage laborer (Non-agri)	30,000-50,000	Agriculture	Owner		
Homestead Structure					
Owner					
Shahjadpur; Habibullah Nagar; Rotonkandi (Part)	**Amir praamanik**	Mohammad tausir	Male		
Daily wage laborer (Non-agri)	30,000-50,000	Dairy-Livestock Farm	Business		
Homestead Structure					
Owner					
Shahjadpur; Habibullah Nagar; Rotonkandi (Part)	**Amirul**		Male	22	
Weaver	50,000-1,00,000		Homestead Structure		
Owner					
Shahjadpur; Habibullah Nagar; Rotonkandi (Part)	**Ansar ali**	Mogreb ali	Male	58	
8816787420469	Daily wage laborer (Non-agri)	30,000-50,000	Homestead Structure		
Owner					
Other					
Business					
Shahjadpur; Habibullah Nagar; Rotonkandi (Part)	**Aual molla**		Male	55	
Daily wage laborer (Agri)	50,000-1,00,000		Homestead Structure		
Owner					
Shahjadpur; Habibullah Nagar; Rotonkandi (Part)	**Aynal molla**	Lalu molla	Male		
Daily wage laborer (Agri)	30,000-50,000	Agriculture	Owner		
Homestead Land					
Owner					
Shahjadpur; Habibullah Nagar; Rotonkandi (Part)	**Azad**	Shahid Molla	Male	28	
Carpenter	30,000-50,000	Homestead Structure	Owner		

Shahjadpur; Habibullah Nagar; Rotonkandi (Part) Daily wage laborer (Agri)	**Azad fokir** 30,000-50,000	Joni uddin fakir Homestead Structure	Male Owner	35
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) Daily wage laborer (Agri)	**Azimuddin** 30,000-50,000	Shahid Ali Homestead Structure	Male Owner	36
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) 8816787420343 Business	**Babu Hossen** Daily wage laborer (Agri)	Md Afaz 50,000-1,00,000	Male Dairy-Livestock Farm	43

Homestead Structure

Owner

Shahjadpur; Habibullah Nagar; Rotonkandi (Part) Weaver	**Ershad** 50,000-1,00,000	Aynal mollah Homestead Land	Male Owner	
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) 8816787420448 Homestead Land	**Fatema khatun** Unemployed/dependent/children Owner	Mrito romjan ali	Female 30,000-50,000	36

Homestead Structure

Owner

Shahjadpur; Habibullah Nagar; Rotonkandi (Part) No Reply	**Fazlul karim Chowdhury** 50,000-1,00,000	Mrito abdul jabbar sarkar Homestead Structure	Male Owner	70
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) 8816787420457 Owner	**Fozlal haque** Rickshaw/Rickshaw van driver	Bosir poramanik 1,00,000-1,80,000	Male Homestead Land	48
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) 8816787439628 Owner	**Habibur rahman** Daily wage laborer (Agri)	Umid ali poramanik 0-30,000	Male Homestead Land	70
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) 8816787599407	**Hamid sarker** Daily wage laborer (Agri)	Khadem 30,000-50,000	Male AgricultureOwner	69

Homestead Structure

Owner

Other

Business

Shahjadpur; Habibullah Nagar; Rotonkandi (Part) 1,00,000-1,80,000	**Hasan ali** Homestead Land	Bosir Uddin sarkar Owner	Male

Location No.	HH Head Name Occupation	Father/ Husband Name Annual Income	Gender Age Card National Land Use Ownership
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) Weaver	**Helal** 50,000-1,00,000	Bosir Homestead Land	Male 38 Owner
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) Rickshaw/Rickshaw van driver	**Hijat** 50,000-1,00,000	Bosir poramanik Homestead Land	Male 30 Owner
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) Poultry rearing	**Hobibar sharkar** 30,000-50,000	Komir uddin sharkar Homestead Land	Male 70 Owner
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) 8816773312744 Structure	**Hobibor Rahman Sarker** Unemployed/dependent/children Owner	Late Samed Ali Sarker	Male 83 0-30,000 Homestead
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) Rickshaw/Rickshaw van driver	**Islam** 30,000-50,000	Enayet ali Homestead Structure	Male 30 Owner
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) Rickshaw/Rickshaw van driver Owner	**Jahangir** 50,000-1,00,000		Male 36 Homestead Structure
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) 88167842044 Owner	**Jalal molla** Petty trader	Shamsod molla 1,00,000-1,80,000	Male 48 Homestead Structure
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) 8816787420441 Homestead Land	**Journal abedin** Unemployed/dependent/children Owner	Sham at ali molla	Male 0-30,000
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) 8816787420584 Business	**Joynul hoque** Daily wage laborer (Non-agri)	Foyjal mollah 1,00,000-1,80,000	Male 50 Dairy-Livestock Farm

Homestead Structure

Owner

Shahjadpur; Habibullah Nagar; Rotonkandi (Part) Vendor	**liton** 50,000-1,00,000	Mofiz uddin Homestead Structure	Male 45 Owner
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) 8816787421206 Owner	**Lokman hossain** Daily wage laborer (Agri)	Iman ali 30,000-50,000	Male 40 Homestead Structure
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) Housewife	**Majeda** >1,80,000	Late abul hossain Homestead Structure	Female 45 Owner
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) 8816787439531 Owner	**Md abdul alim** Daily wage laborer (Agri)	Shona molla 30,000-50,000	Male 59 Homestead Structure
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) 8816787439663	**Md Alhaz** Weaver	Md labu Sarker 50,000-1,00,000	Male 39 Agriculture Owner

Homestead Structure

Owner

Shahjadpur; Habibullah Nagar; Rotonkandi (Part)	**Md Azad**	Abdur Rashid	Male	24	
199388167870	Fisherman	30,000-50,000	Other	Business	
Shahjadpur; Habibullah Nagar; Rotonkandi (Part)	**Md bablu**	Md abdur tahir	Male	33	
8816787420493	Daily wage laborer (Non-agri)	1,00,000-1,80,000	Agricultural	Business	

Dairy-Livestock Farm

Business

Homestead Land

Owner

Homestead Structure

Owner

Shahjadpur; Habibullah Nagar; Rotonkandi (Part)	**Md Juel**	Md Shahadat	Male	32	
8816787439761	Migrant Worker	>1,80,000	Homestead Structure		
Owner					
Shahjadpur; Habibullah Nagar; Rotonkandi (Part)	**Md moktar**	Abdur rashid	Male	35	
8816787439535	Fisherman	30,000-50,000	Other	Business	
Shahjadpur; Habibullah Nagar; Rotonkandi (Part)	**Md mozammel**	Enayet paramanik	Male	55	
Migrant Worker	>1,80,000	Agricultural	Business		

Dairy-Livestock Farm

Business

Homestead Structure

Owner

Shahjadpur; Habibullah Nagar; Rotonkandi (Part)	**Md Sanoar**	Abdur rashid	Male	32	
8816787439539	Fisherman	30,000-50,000	Other	Business	

Location No.	HH Head Name Occupation	Father/ Husband Name Annual Income	Gender Age Card Land Use Ownership
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) 8816787439525 Business	**Md. abdur rajjak** Dairy livestock	Mohammad khorshed ali 0-30,000	Male 50 Dairy-Livestock Farm
Homestead Structure			
Owner			
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) 8816787420477 Owner	**Md. fazlul karim** Puri bikreta	Aynal pramanik 0-30,000	Male 51 Homestead Structure
Other			
Business			
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) 8816787599397	**Md. fokrul** Daily wage laborer (Non-agri)	Mrito bagan molla 30,000-50,000	Male 47 AgricultureOwner
Homestead Land			
Owner			
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) 8816787439660	**Md. joynal sharkar** Daily wage laborer (Non-agri)	Mohammad labu sarkar 50,000-1,00,000	Male 47 AgricultureOwner
Dairy-Livestock Farm			
Business			
Homestead Structure			
Owner			
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) 199188167870 Homestead Structure	**Md. lal chand** Salaried person in govt/private Owner	Mohammad akkel ali	Male 26 50,000-1,00,000
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) Daily wage laborer (Non-agri)	**Md. manik molla** 0-30,000	Hazrat ali Other	Male 29 8816 Business
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) 8816787420451 Business	**Md. nur hossain** Daily wage laborer (Agri)	Mohammad akkel Ali 50,000-1,00,000	Male 32 Dairy-Livestock Farm
Homestead Structure			

Owner

Shahjadpur; Habibullah Nagar; Rotonkandi (Part)	**Md. nur Islam**	Sona Ullah	Male	40
8816787439592	Migrant Worker	>1,80,000	Dairy-Livestock Farm	
Business				

Homestead Structure

Owner

Shahjadpur; Habibullah Nagar; Rotonkandi (Part)	**Md. nuruzzamal**	Mohammad akkel ali	Male	46
8816787420450	Rickshaw/Rickshaw van driver	50,000-1,00,000	Dairy-Livestock Farm	
Business				

Homestead Structure

Owner

Restaurant-Tea Stall

Business

Shahjadpur; Habibullah Nagar; Rotonkandi (Part)	**Md. saiful islam**	Ainal pramanik	Male	41
8816787420479	Salaried person in govt/private		30,000-50,000	
Homestead Structure	Owner			

Pond

Owner

Shop-Store

Business

Shahjadpur; Habibullah Nagar; Rotonkandi (Part)	**Md. ujjal Hossain**	Akkel pramanik	Male	41
8816787420432	Daily wage laborer (Agri)	50,000-1,00,000	Dairy-Livestock Farm	
Business				

Homestead Structure

Owner

Shahjadpur; Habibullah Nagar; Rotonkandi (Part)	**Md. yunus ali**	Aynal pramanik	Male	50
8816787420478	Daily wage laborer (Agri)	30,000-50,000	Homestead Structure	
Owner				

Other

Business

Shahjadpur; Habibullah Nagar; Rotonkandi (Part) Daily wage laborer (Agri)	**Mohammad abdur rashid** 50,000-1,00,000	nobu porayon Dairy-Livestock Farm	Male Business	55

Homestead Structure

Owner

Shahjadpur; Habibullah Nagar; Rotonkandi (Part) Daily wage laborer (Non-agri)	**Mohammad Abu daut** 50,000-1,00,000	Nefaz molla Agriculture	Male Owner	45

Location No.	HH Head Name Occupation	Father/ Husband Name Annual Income	Gender Age Card Land Use Ownership
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) 8816787439662	**Mohammad Afzal** Daily wage laborer (Agri)	Lobu sarker 50,000-1,00,000	Female 37 Agriculture Owner
Dairy-Livestock Farm Business			
Homestead Structure Owner			
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) Daily wage laborer (Agri)	**Mohammad ali** 50,000-1,00,000	Sera bepari Homestead Land	Male 45 Owner
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) Salaried person in govt/private	**Mohammad babul akhter** >1,80,000	Jiman molla Homestead Structure	Male 36 Owner
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) 8816787599396 Owner	**Mohammad chan** Daily wage laborer (Non-agri)	Began molla 50,000-1,00,000	Male 53 Flower/Teak Garden
Homestead Structure Owner			
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) 199188167870 Owner	**Mohammad fulchand** Vendor	Akkel pramanik >1,80,000	Male 26 Homestead Structure
Restaurant-Tea Stall Business			
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) 8816787421176	**Mohammad helal molla** Daily wage laborer (Non-agri)	Latu molla 50,000-1,00,000	Male 39 Agricultural Business
Agriculture Owner			
Homestead Structure Owner			

Shahjadpur; Habibullah Nagar; Rotonkandi (Part) 8816787439529 Business	**Mohammad menaj ali** Vendor	Mohammad khorshed ali 30,000-50,000	Male Dairy-Livestock Farm	45

Homestead Structure

Owner

Shahjadpur; Habibullah Nagar; Rotonkandi (Part) Daily wage laborer (Non-agri)	**Mohammad nur islam** 50,000-1,00,000	Mohammad Hossain ali Homestead Land	Male Owner	

Homestead Structure

Owner

Other

Business

Shahjadpur; Habibullah Nagar; Rotonkandi (Part) Businessman	**Mohammad Rasel** 1,00,000-1,80,000	Mohammad Giashuddin Agricultural	Male Business	35

Homestead Structure

Owner

Shahjadpur; Habibullah Nagar; Rotonkandi (Part) No Reply	**Mohammad tarab ali** 30,000-50,000	Bagan molla Agriculture	Male Owner	50

Homestead Land

Owner

Shahjadpur; Habibullah Nagar; Rotonkandi (Part) 8816787439519 Owner	**Mojibor sarkar** Daily wage laborer (Agri)	Hossain sarkar 50,000-1,00,000	Male Homestead Land	50
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) 8816787439624 Business	**Mojnu mia** Daily wage laborer (Non-agri)	Yousuf ali >1,80,000	Male Handloom Factory	30
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) 188188167870	**Monirul Sarker** Weaver	Palan sarker 30,000-50,000	Male Other Business	28
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) Migrant Worker Owner	**Moslem** >1,80,000		Male Homestead Structure	40
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) 8816787430752 Business	**Motin Molla** Daily wage laborer (Non-agri)	Md. abdul malek 50,000-1,00,000	Male Dairy-Livestock Farm	45

Homestead Structure

Owner

Shahjadpur; Habibullah Nagar; Rotonkandi (Part)	**Motiur rahman**	Kosim sarkar	Male	53
8816787420697	Daily wage laborer (Agri)	50,000-1,00,000	Homestead Land	
Owner				

Location No.	HH Head Name Occupation	Father/ Husband Name Annual Income	Gender Land Use	Age	National Card Ownership
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) Housewife	**Mrs. Salima begum** 50,000-1,00,000	Asiruddin ahmed Homestead Structure	Female Owner	75	
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) 8816787425030 Owner	**MST. Sufia khatun** Housewife	Mohammad abdur rouf 0-30,000	Female Homestead Structure	41	
Other					
Business					
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) Daily wage laborer (Non-agri)	**Mukul Hossain** 50,000-1,00,000	Bagan molla Agriculture	Male Owner	42	
Homestead Structure					
Owner					
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) Daily wage laborer (Agri)	**Nannu** 0-30,000	Akhmot Homestead Structure	Male Owner	55	
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) Petty trader	**Nur mohammad** 1,00,000-1,80,000	Chan poramanik Homestead Land	Male Owner	50	
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) Daily wage laborer (Agri)	**Polan** 30,000-50,000	Mohammad khadem ali Other	Male Business	55	
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) 115081301021 Owner	**Rafiqul islam** Daily wage laborer (Agri)	Hobibor sharkar 30,000-50,000	Male Homestead Land	32	
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) Rickshaw/Rickshaw van driver	**Ramjan** 30,000-50,000	Jodu Sheikh Homestead Structure	Male Owner	30	
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) 8816787420612 Owner	**Razu ahmad Chowdhury** Member	Chattar Chowdhury 30,000-50,000	Male Homestead Structure	50	
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) 8816787420431 Owner	**Ripon ahmed** Clerk	Mofiz Uddin 50,000-1,00,000	Male Homestead Structure	35	
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) 8826701213662 Owner	**Rohiz pramanik** Daily wage laborer (Agri)	Amjat pramanik 30,000-50,000	Male Homestead Structure	50	
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) Rickshaw/Rickshaw van driver	**Saidul pramanik** 50,000-1,00,000	Azullo pramanik Homestead Land	Male Owner	26	
Homestead Structure					

Owner

Shahjadpur; Habibullah Nagar; Rotonkandi (Part) 198988167870	**Saiod abdul karim** Immam	Kalim uddin 30,000-50,000	Male Agricultural	28 Business

Homestead Structure

Owner

Shahjadpur; Habibullah Nagar; Rotonkandi (Part) 8816787439670 Business	**Sajahan mollah** Petty trader	Yousuf mollah 1,00,000-1,80,000	Male Dairy-Livestock Farm	55
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) Unemployed/dependent/children	**Salam sarkar** 0-30,000	Surhab sarkar Agriculture	Male Owner	55

Homestead Structure

Owner

Shahjadpur; Habibullah Nagar; Rotonkandi (Part) 197588167870 Homestead Structure	**Selim** Mechanic (rickshaw van/rickshaw) Owner	Shona.molla	Male 1,00,000-1,80,000	65
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) Daily wage laborer (Agri)	**Shafiqul islam** 30,000-50,000	Hobibor sharkar Homestead Land	Male Owner	
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) Soil cropper	**Shaheb Ali** 50,000-1,00,000	Ismail pramanik Dairy-Livestock Farm	Male Business	

Homestead Structure

Owner

Shahjadpur; Habibullah Nagar; Rotonkandi (Part) Rickshaw/Rickshaw van driver	**Shahin** 50,000-1,00,000	Sona molla Homestead Land	Male Owner	30
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) Petty trader	**Shamim** 50,000-1,00,000	Sohrab Uddin sarkar Owner	Male	
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) 8816787420468 Business	**Shamim Ahmed** Daily wage laborer (Agri)	Late Ak at Fakir 50,000-1,00,000	Male Dairy-Livestock Farm	34

Location No.	HH Head Name Occupation	Father/ Husband Name Annual Income	Gender Age Card Land Use Ownership
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) 8816787420468 Owner	**Shamim Ahmed** Daily wage laborer (Agri)	Late Ak at Fakir 50,000-1,00,000	Male 34 Homestead Structure
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) No Reply	**shamsul** Agricultural		Male Business
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) 88167420673	**Shofet ali** Daily wage laborer (Non-agri)	Shafazuddin 1,00,000-1,80,000	Male 50 Agriculture Owner

Homestead Land

Owner

Shahjadpur; Habibullah Nagar; Rotonkandi (Part) Mechanic (rickshaw van/rickshaw)	**Shona molla** 1,00,000-1,80,000	Shamu molla Dairy-Livestock Farm	Male 65 Business

Homestead Land

Owner

Shahjadpur; Habibullah Nagar; Rotonkandi (Part) 8816787439531 Business	**Shona mollah** No Reply	Nozie paramanik 30,000-50,000	Male 59 Dairy-Livestock Farm

Homestead Structure

Owner

Shahjadpur; Habibullah Nagar; Rotonkandi (Part) Vendor	**Sobahan mollah** 1,00,000-1,80,000	Faizal mollah Homestead Structure	Male 40 Owner
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) Daily wage laborer (Agri)	**Sobuj molla** 50,000-1,00,000	Heyal molla Agriculture	Male 26 Owner
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) 8816787439589 Owner	**Sonaullah** Unemployed/dependent/children	Omed ali pramanik	Male 78 0-30,000 Agriculture

Homestead Structure

Owner

Other

Business

Shahjadpur; Habibullah Nagar; Rotonkandi (Part) Cultivation in owned land	**Taher vokto** >1,80,000	Kakil vokto Dairy-Livestock Farm	Male Business	70

Homestead Structure

Owner

Shahjadpur; Habibullah Nagar; Rotonkandi (Part) Daily wage laborer (Non-agri)	**Umar** Homestead Structure		Male Owner	
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) Daily wage laborer (Agri)	**Usuf ali** 1,00,000-1,80,000	Lalu molla Agriculture	Male Owner	56

Homestead Land

Owner

Shahjadpur; Habibullah Nagar; Rotonkandi (Part) 8816787420621 Owner	**Yasin molla** Daily wage laborer (Agri)	Fayjal molla 50,000-1,00,000	Female Homestead Structure	49
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) Daily wage laborer (Agri)	**Zamat ali** 50,000-1,00,000	Shonamaji Homestead Land	Male Owner	47
Shahjadpur; Potajia; Boyra 8816773323550 Business	**Abdul latif sarkar** Daily wage laborer (Non-agri)	Abujol Sarkar 30,000-50,000	Male Dairy-Livestock Farm	35

Homestead Structure

Owner

Shahjadpur; Potajia; Gangaprassad Daily wage laborer (Agri)	**Abdul Rahamat ali** 30,000-50,000	Ashon sardar Homestead Land	Male Owner	29
Shahjadpur; Potajia; Gangaprassad Daily wage laborer (Agri)	**Ajmot pramanik** 30,000-50,000	Mrito sekendar pramanik Dairy-Livestock Farm	Male Business	40

Homestead Structure

Owner

Shahjadpur; Potajia; Gangaprassad Vendor	**Anchar sarkar** 30,000-50,000		Male AgricultureOwner	64

Homestead Land

Owner

Location No.	HH Head Name Occupation	Father/ Husband Name Annual Income	Gender Age Card Land Use Ownership
Shahjadpur; Potajia; Gangaprassad Vendor Owner	**Anchar sarkar** 30,000-50,000		Male 64 Homestead Structure
Shahjadpur; Potajia; Gangaprassad 881677332332 Owner	**Babu Sarker** Daily wage laborer (Agri)	Anjad Sarker 50,000-1,00,000	Male 33 Homestead Structure
Shahjadpur; Potajia; Gangaprassad Daily wage laborer (Agri)	**Bacchu** 50,000-1,00,000	Shahid mollah Homestead Land	Male 45 Owner
Shahjadpur; Potajia; Gangaprassad Daily wage laborer (Agri) Business	**Gulzar sarker** 30,000-50,000		Male 30 Dairy-Livestock Farm
Homestead Structure Owner			
Shahjadpur; Potajia; Gangaprassad 8816773323672 Owner	**Kuddus Sarker** Daily wage laborer (Agri)	Anjad Sarker 50,000-1,00,000	Male 52 Homestead Structure
Shahjadpur; Potajia; Gangaprassad Unemployed/dependent/children Business	**Liton Sarker** 30,000-50,000		Male 35 Dairy-Livestock Farm
Homestead Structure Owner			
Shahjadpur; Potajia; Gangaprassad Daily wage laborer (Non-agri)	**Malek pramanik** 0-30,000	Khalil pramanik Homestead Structure	Male 40 Owner
Shahjadpur; Potajia; Gangaprassad 8816773312855 Business	**Md abdul matin** Daily wage laborer (Agri)	Mr bakkar molla 30,000-50,000	Female 51 Dairy-Livestock Farm
Homestead Structure Owner			
Shahjadpur; Potajia; Gangaprassad 8816773323598 Owner	**Minhaz porama** Weaver	Jabbar pora 30,000-50,000	Male 32 Homestead Land
Shahjadpur; Potajia; Gangaprassad 8816773312878 Business	**Monsur pramanik** Daily wage laborer (Agri)	Late ebadyllah pramanik 50,000-1,00,000	Male 45 Dairy-Livestock Farm

Homestead Structure

Owner

Orchard

Owner

Shahjadpur; Potajia; Gangaprassad 8816773323572 Business	**Rahom molla** Daily wage laborer (Agri)	Abed molla 0-30,000	Male 61 Dairy-Livestock Farm
Shahjadpur; Potajia; Gangaprassad Driver Business	**Roizul sarker** 50,000-1,00,000		Male 42 Dairy-Livestock Farm

Homestead Structure

Owner

Shahjadpur; Potajia; Gangaprassad Daily wage laborer (Agri)	**Ronju sarkar** 30,000-50,000	Jolil sarkar Homestead Land	Male 50 Owner
Shahjadpur; Potajia; Gangaprassad Daily wage laborer (Agri)	**Salam Sarker** 30,000-50,000	Abujol Sarker Agricultural	Male 55 Business

Dairy-Livestock Farm

Business

Homestead Structure

Owner

Shahjadpur; Potajia; Gangaprassad 8816773323542 Owner	**Shamo khatoon** No Reply	Sattar sordar 0-30,000	Female 60 Homestead Land
Shahjadpur; Potajia; Gangaprassad 8816787422347	**Tarek** Weaver	Amir Ali 50,000-1,00,000	Male 28 Other Business
Shahjadpur; Potajia; Nundaha Unemployed/dependent/children	**Abdul kader sheikh** 0-30,000	Bahor ali sheikh Homestead Structure	Male 70 Owner
Shahjadpur; Potajia; Nundaha 8816773312356 Owner	**Abdul Salam sarkar** Daily wage laborer (Agri)	Nuro bepari 30,000-50,000	Male 50 Homestead Land
Shahjadpur; Potajia; Nundaha 8816773312360 Business	**Abdul Salam seikh** Weaver	Shahid ali s >1,80,000	Male 60 Handloom Factory

National Location No.	HH Head Name Occupation	Father/ Husband Name Annual Income	Gender Age Card Land Use Ownership
Shahjadpur; Potajia; Nundaha 8816773312360 Owner	**Abdul Salam seikh** Weaver	Shahid ali s >1,80,000	Male 60 Homestead Structure
Shahjadpur; Potajia; Nundaha 8816773312757	**Abdul Wahab** Poultry rearing	Late md shahajahan ali 30,000-50,000	Male 55 Poultry FarmBusiness
Shahjadpur; Potajia; Nundaha Truck driver	**Almach bapari** 30,000-50,000	Moylal bapari Agriculture	Male 33 Owner

Homestead Structure

Owner

Shahjadpur; Potajia; Nundaha 8816787421902	**Anisur Rahman** Daily wage laborer (Non-agri)	Joynal sarkar 0-30,000	Male 60 AgriculturalBusiness
Shahjadpur; Potajia; Nundaha 8816773312851 Business	**Azgar pramanik** Daily wage laborer (Agri)	Fayzal pramanik 50,000-1,00,000	Male 53 Dairy-Livestock Farm
Shahjadpur; Potajia; Nundaha 8816773312887 Business	**Delwar ali** Daily wage laborer (Agri)	Late fayzal pramanik 30,000-50,000	Male 36 Dairy-Livestock Farm
Shahjadpur; Potajia; Nundaha Daily wage laborer (Agri)	**Golam hoaain** 0-30,000	Abdur Rashid sarkar Homestead Land	Male 75 Owner
Shahjadpur; Potajia; Nundaha 8816787421904	**Hasen Ali** Rickshaw/Rickshaw van driver	Anichur Rahman 30,000-50,000	Male 34 AgriculturalBusiness
Shahjadpur; Potajia; Nundaha 8816773312889 Business	**Helal Pramanik** Daily wage laborer (Agri)	Fayzal pramanik 30,000-50,000	Male 36 Dairy-Livestock Farm
Shahjadpur; Potajia; Nundaha Poultry rearing	**Lutfor Rahman** 1,00,000-1,80,000	Md Jafar Ali Sheikh Poultry Farm	Male 61 Business
Shahjadpur; Potajia; Nundaha 8816773312824 Business	**Md ansar ali** Daily wage laborer (Agri)	Abul kashem pramanik 50,000-1,00,000	Male 60 Dairy-Livestock Farm
Shahjadpur; Potajia; Nundaha 8816773312805 Business	**Md younus ali** Daily wage laborer (Agri)	Md mazir pramanik 30,000-50,000	Male 43 Dairy-Livestock Farm
Shahjadpur; Potajia; Nundaha 8816773312721 Business	**Md. Abdul alim sarkar** Daily wage laborer (Non-agri)	Mohammad golam Hossain 30,000-50,000	Male 41 Dairy-Livestock Farm

Homestead Land

Owner

Homestead Structure

Owner

Shahjadpur; Potajia; Nundaha	**Md. abdur razzak pramanik**	Jenat pramanik	Male	53
8816773312818	Daily wage laborer (Agri)	30,000-50,000	Dairy-Livestock Farm	
Business				

Homestead Land

Owner

Shahjadpur; Potajia; Nundaha	**Md. abul Hossain**	Lokman pramanik	Male	34
8816773312804	Daily wage laborer (Non-agri)	50,000-1,00,000	AgricultureOwner	
Shahjadpur; Potajia; Nundaha	**Md. abul kashem pramanik**	Ebadullah pramanik	Male	82
8816773312820	Unemployed/dependent/children		0-30,000	Dairy-
Livestock Farm	Business			
Shahjadpur; Potajia; Nundaha	**Md. azam pramanik**	Mrito yachin pramanik	Male	38
8816773312882	Daily wage laborer (Non-agri)	30,000-50,000	Handloom Factory	
Business				
Shahjadpur; Potajia; Nundaha	**Md. chad mia sarker**	Mrito abdul kader	Male	53
8816773312354	Daily wage laborer (Agri)	0-30,000	Homestead Structure	
Owner				

Other

Business

Shahjadpur; Potajia; Nundaha	**Md. joynal sheikh**	Abdul kader sheikh	Male	46
8816773312864	Daily wage laborer (Agri)	30,000-50,000	Homestead Structure	
Owner				
Shahjadpur; Potajia; Nundaha	**Md. mostafa pramanik**	Khalil pramanik	Male	41
8816773312816	Daily wage laborer (Non-agri)	30,000-50,000	Dairy-Livestock Farm	
Business				
Shahjadpur; Potajia; Nundaha	**Md. nazim uddin**	Lokman pramanik	Male	36
8816773312800	Daily wage laborer (Non-agri)	30,000-50,000	AgricultureOwner	
Shahjadpur; Potajia; Nundaha	**Md. rowshan sarker**	Mrito Abdul kader	Male	30
8816773312353	Daily wage laborer (Agri)	0-30,000	Homestead Structure	
Owner				

Location No.	HH Head Name Occupation	Father/ Husband Name Annual Income	Gender Land Use	Age Ownership	Card National
Shahjadpur; Potajia; Nundaha 8816773312822	**Md. shamsul pramanik** Dairy-livestock	Md. abul kashem pramanik 30,000-50,000	Male Agriculture	48 Owner	
Dairy-Livestock Farm					
Business					
Shahjadpur; Potajia; Nundaha 8816773312873	**Md. wajed ali** Cultivation in owned land	Mrito yusub ali 30,000-50,000	Male Agriculture	64 Owner	
Shahjadpur; Potajia; Nundaha 197488167730 Owner	**Md. yeasin shaikh** Daily wage laborer (Agri)	Abdul kader sheikh 30,000-50,000	Male Homestead Structure	41	
Shahjadpur; Potajia; Nundaha 8816773312789 Owner	**Mohammad forid** Daily wage laborer (Non-agri)	Munnat poramanik 50,000-1,00,000	Male Homestead Land	18	
Shahjadpur; Potajia; Nundaha Daily wage laborer (Agri) Business	**Monirul** 50,000-1,00,000		Male Dairy-Livestock Farm	30	
Shahjadpur; Potajia; Nundaha 8816773312352 Land	**MST. Lailee khatun** Unemployed/dependent/children Owner	Mrito abdul kader	Female 0-30,000	53 Homestead	
Shahjadpur; Potajia; Nundaha 8816773312884 Business	**nekbar ali** Daily wage laborer (Agri)	Fayzal pramanik 1,00,000-1,80,000	Male Dairy-Livestock Farm	39	
Shahjadpur; Potajia; Nundaha 8816773312871 Business	**Nizam uddin sheikh** Daily wage laborer (Non-agri)	Abdul kader sheikh 30,000-50,000	Male Dairy-Livestock Farm	32	
Homestead Structure					
Owner					
Shahjadpur; Potajia; Nundaha 8816773312794 Business	**Rafiqul islam** Petty trader	Sayeed ali seikh 50,000-1,00,000	Male Handloom Factory	35	
Homestead Land					
Owner					
Shahjadpur; Potajia; Nundaha Weaver	**Reta** 30,000-50,000	Ajger bepari Homestead Land	Female Owner	45	
Shahjadpur; Potajia; Nundaha Daily wage laborer (Non-agri)	**Rofikul islam** 50,000-1,00,000	Muzaffar ali seikh Homestead Land	Male Owner	38	

Shahjadpur; Potajia; Nundaha Vendor Business	**Rojob Ali** 50,000-1,00,000		Male 50 Dairy-Livestock Farm

Homestead Structure

Owner

Shahjadpur; Potajia; Nundaha Service Owner	**Selim** 50,000-1,00,000		Male 35 Homestead Structure
Shahjadpur; Potajia; Nundaha 8816773312755 Business	**Shamim sheikh** No Reply	Md lutfar sheikh 50,000-1,00,000	Male 32 Dairy-Livestock Farm

Homestead Structure

Owner

Shahjadpur; Potajia; Nundaha 8816773312822	**Shamsul alam** No Reply	Abul kashem Commercial	Male Owner
Shahjadpur; Potajia; Nundaha Weaver	**Shobuj** 50,000-1,00,000	Zelhak sheikh Homestead Land	Male 22 Owner
Shahjadpur; Potajia; Nundaha 8816773312798	**Siddique Ali** Builder	Lokman Pramanik 50,000-1,00,000	Male 38 AgricultureOwner
Shahjadpur; Potajia; Nundaha 8816773312868 Business	**Suzam sheikh** Daily wage laborer (Agri)	Md. abdul kader sheikh 30,000-50,000	Male 39 Dairy-Livestock Farm

Homestead Structure

Owner

Shahjadpur; Potajia; Potajia 8816773323628	**Bacchu bepari** Weaver	Fotik bepari 50,000-1,00,000	Male 34 Other Business
Shahjadpur; Potajia; Potajia Daily wage laborer (Agri) Business	**Saidul Sarker** 30,000-50,000		Male 46 Dairy-Livestock Farm
Shahjadpur; Potajia; Potajia 8816773323564 Owner	**Sanoar Pramanik** Daily wage laborer (Agri)	Late Raju Pramanik 30,000-50,000	Male 57 Homestead Structure

Location No.	HH Head Name Occupation	Father/ Husband Name Annual Income	Gender	Age	National Card Land Use	Ownership
Shahjadpur; Rupabati; Ahmedpur Petty trader	**Abdul motin** >1,80,000	Wahab poramanik Homestead Land	Male	47	Owner	
Shop-Store						
Business						
Shahjadpur; Rupabati; Ahmedpur Unemployed/dependent/children	**Abdur sattar molla** 50,000-1,00,000	Mrito anowar Hossain Homestead Structure	Male	60	Owner	
Shahjadpur; Rupabati; Ahmedpur Daily wage laborer (Agri)	**Abu Hossain molla** 30,000-50,000	Rahman molla Homestead Land	Male	70	Owner	
Shahjadpur; Rupabati; Ahmedpur 198288167803	**Arif hossen** 30,000-50,000	Md jalal uddin Dairy-Livestock Farm	Male	35	Business	
Shahjadpur; Rupabati; Ahmedpur Daily wage laborer (Agri)	**Atahar sarkar** 50,000-1,00,000	Rohom sarkar Homestead Land	Male	35	Owner	
Shahjadpur; Rupabati; Ahmedpur 8816780335790	**Aynal haque** Unemployed/dependent/children	Rohmot ali	Male	80	0-30,000	Homestead Land
Shahjadpur; Rupabati; Ahmedpur Job holder	**Aynal haque** >1,80,000	Fakir chan bepari Homestead Land	Male	73	Owner	
Shahjadpur; Rupabati; Ahmedpur Daily wage laborer (Agri)	**Chad mia** 30,000-50,000	Mrito azhar Homestead Structure	Male	40	Owner	
Shahjadpur; Rupabati; Ahmedpur No Reply	**Firoz ahamad mukul** 1,00,000-1,80,000	Mrito jajal uddin Homestead Structure	Male	40	Owner	
Shahjadpur; Rupabati; Ahmedpur Daily wage laborer (Agri)	**Golam mostofa** 30,000-50,000	Nauru molla Homestead Land	Male	65	Owner	
Shahjadpur; Rupabati; Ahmedpur Unemployed/dependent/children	**Habibur rahman** 0-30,000	Hydar pramanik Dairy-Livestock Farm	Male	50	Business	
Homestead Structure						
Owner						
Shahjadpur; Rupabati; Ahmedpur 8816780336569	**Ibrahim mondol** Unemployed/dependent/children	Mahi mondol	Male	75	0-30,000	Homestead Land
Shahjadpur; Rupabati; Ahmedpur Daily wage laborer (Agri)	**Imarot mondol** 30,000-50,000	Shaheb ali mondol Homestead Land	Male	35	Owner	
Shahjadpur; Rupabati; Ahmedpur Daily wage laborer (Non-agri)	**Julekha khatun** 0-30,000	Alim uddin molla Homestead Structure	Female	48	Owner	

Shahjadpur; Rupabati; Ahmedpur Daily wage laborer (Non-agri)	**Ketu chandra shill** 30,000-50,000	Haran chandra shill Homestead Structure	Male 38 Owner
Shahjadpur; Rupabati; Ahmedpur Daily wage laborer (Agri)	**Liakot ali** 50,000-1,00,000	Hoydar poramanik Homestead Land	Male Owner
Shahjadpur; Rupabati; Ahmedpur 8816780335980 Business	**Md Abdul Kafer** Daily wage laborer (Agri)	Late Iman molla >1,80,000	Male 71 Dairy-Livestock Farm

Homestead Structure

Owner

Shahjadpur; Rupabati; Ahmedpur 8816780334899 Owner	**Md Aiyub Ali Mondal** Daily wage laborer (Agri)	Md Shaheb Ali 50,000-1,00,000	Male 48 Homestead Structure
Shahjadpur; Rupabati; Ahmedpur 8816780336421 Owner	**Md Alam Molla** Daily wage laborer (Agri)	Late Wased Molla 50,000-1,00,000	Male 50 Homestead Structure
Shahjadpur; Rupabati; Ahmedpur 8816780336618 Business	**Md Aual mondal** Daily wage laborer (Agri)	Late Habib mondal 50,000-1,00,000	Male 60 Dairy-Livestock Farm

Homestead Structure

Owner

Shahjadpur; Rupabati; Ahmedpur 8816780336243 Business	**Md Bablu** Daily wage laborer (Agri)	Md jelen pramanik 1,00,000-1,80,000	Male 30 Dairy-Livestock Farm

Homestead Structure

Owner

Shahjadpur; Rupabati; Ahmedpur 8816780336629 Owner	**Md mofiz mondal** Fish businessman	Late habil mondal >1,80,000	Male 50 Homestead Structure

National No.	Location	HH Head Name Occupation	Father/ Husband Name Annual Income	Gender Land Use	Age Ownership	Card
	Shahjadpur; Rupabati; Ahmedpur 8816780336629	**Md mofiz mondal** Fish businessman	Late habil mondal >1,80,000	Male Other	50 Business	
	Shahjadpur; Rupabati; Ahmedpur 8816780335966 Owner	**Md moniruzzaman molla** Daily wage laborer (Agri)	Late shakim molla 30,000-50,000	Male Homestead Structure	46	
	Shahjadpur; Rupabati; Ahmedpur Medical	**Md Saddam Hossain** 1,00,000-1,80,000	Md Samad Pramanik Agriculture	Male Owner	25	
	Dairy-Livestock Farm					
	Business					
	Homestead Structure					
	Owner					
	Shahjadpur; Rupabati; Ahmedpur 8816780336274 Business	**Md. abdul quddus pramanik** Daily wage laborer (Agri)	Mrito Mohammad keshmot 30,000-50,000	Male Dairy-Livestock Farm	62	
	Homestead Structure					
	Owner					
	Shahjadpur; Rupabati; Ahmedpur 8816780336660 Owner	**Md. arju sheikh** Vendor	Anchar sheikh 50,000-1,00,000	Male Homestead Structure	39	
	Shahjadpur; Rupabati; Ahmedpur 8816780336112 Owner	**Md. bachu mia** Daily wage laborer (Agri)	Mrito Mohammad 30,000-50,000	Male Homestead Structure	57	
	Shahjadpur; Rupabati; Ahmedpur 8816780336675 Owner	**Md. lebu** Daily wage laborer (Non-agri)	Mohammad shamchul 30,000-50,000	Male Homestead Structure	32	
	Shahjadpur; Rupabati; Ahmedpur Daily wage laborer (Agri)	**Md. monnaf pramanik** 30,000-50,000	Shahid pramanik Homestead Land	Male Owner	42	
	Homestead Structure					
	Owner					
	Shahjadpur; Rupabati; Ahmedpur Daily wage laborer (Agri)	**Mohammad abdur razzak** 30,000-50,000	Mohammad joynal mondol Dairy-Livestock Farm	Male Business	40	

Homestead Structure

Owner

Shahjadpur; Rupabati; Ahmedpur Unemployed/dependent/children	**Mohammad Billal Molla** >1,80,000	LateChad Ullah Dairy-Livestock Farm	Male Business	65

Homestead Structure

Owner

Shahjadpur; Rupabati; Ahmedpur 8816780335976 Business	**Mohammad insab mollah** Daily wage laborer (Agri)	Mrito mokched molla 30,000-50,000	Male Dairy-Livestock Farm	55

Homestead Structure

Owner

Shahjadpur; Rupabati; Ahmedpur 8816780335826 Business	**Mohammad roich uddin** Daily wage laborer (Agri)	Mrito menaj mondol 0-30,000	Male Dairy-Livestock Farm	53

Homestead Structure

Owner

Shahjadpur; Rupabati; Ahmedpur Business man	**Mojid molla** 30,000-50,000	Jilhak molla Homestead Land	Male Owner	45
Shahjadpur; Rupabati; Ahmedpur 8816780336565 Owner	**Mojir pramanik** Daily wage laborer (Agri)	Yakub pramanik 50,000-1,00,000	Female Bamboo Garden	50

Dairy-Livestock Farm

Business

Homestead Land

Owner

Homestead Structure

Owner

Shahjadpur; Rupabati; Ahmedpur Daily wage laborer (Agri)	**Monjir pramanik** 50,000-1,00,000	Shahid pramanik Homestead Land	Male Owner	45

Homestead Structure

Owner

Shahjadpur; Rupabati; Ahmedpur	**Monnaf fa,ir**	Romjan hazi	Male	50
Rickshaw/Rickshaw van driver	50,000-1,00,000	Agriculture	Owner	

Location No.	HH Head Name Occupation	Father/ Husband Name Annual Income	Gender Age Card Land UseOwnership
Shahjadpur; Rupabati; Ahmedpur Daily wage laborer (Agri)	**Mozammel haque** 50,000-1,00,000	Abul kashem molla Homestead Land	Male 70 Owner
Shahjadpur; Rupabati; Ahmedpur 8816780335698 Homestead Structure	**Mrs Salma Kbatun** Housewife Owner		Female 65 50,000-1,00,000
Shahjadpur; Rupabati; Ahmedpur 8816780335762 Owner	**Mst hasina khatun** Housewife	Mrito mofiz mondol 0-30,000	Female 56 Homestead Structure
Shahjadpur; Rupabati; Ahmedpur Daily wage laborer (Agri)	**Nikbar ali chowdhury** 30,000-50,000	Romjan ali chowdhury Homestead Land	Male 43 Owner
Shahjadpur; Rupabati; Ahmedpur 8816780336617 Business	**Ramjan Ali mondal** Daily wage laborer (Agri)	Habil mondal 50,000-1,00,000	Male 62 Dairy-Livestock Farm
Homestead Structure			
Owner			
Shahjadpur; Rupabati; Ahmedpur Daily wage laborer (Agri)	**Rana** 50,000-1,00,000	Shohic poramanik Homestead Land	Male Owner
Shahjadpur; Rupabati; Ahmedpur 8816780334193 Business	**Rezaul mandal** Daily wage laborer (Agri)	Joynal mondal 50,000-1,00,000	Male 42 Dairy-Livestock Farm
Homestead Structure			
Owner			
Other			
Business			
Shahjadpur; Rupabati; Ahmedpur Daily wage laborer (Agri)	**Sajahan molla** 30,000-50,000	Boyatulla Homestead Land	Male 70 Owner
Shahjadpur; Rupabati; Ahmedpur 8816780336624 Owner	**Saroar Mondal** Daily wage laborer (Agri)	Late Sorman Mondal 50,000-1,00,000	Male 40 Homestead Structure
Shahjadpur; Rupabati; Ahmedpur Daily wage laborer (Agri)	**Shah alam bapari** 30,000-50,000	Monsur ali bapari Dairy-Livestock Farm	Male 50 Business
Homestead Structure			
Owner			

Shahjadpur; Rupabati; Ahmedpur 8816780334904 Owner	**Shahidul Islam** Driver	Md Shaheb Ali >1,80,000	Male Homestead Structure	37
Shahjadpur; Rupabati; Ahmedpur Daily wage laborer (Agri)	**Shahjahan molla** 50,000-1,00,000	Kobad molla Homestead Land	Male Owner	55
Shahjadpur; Rupabati; Ahmedpur Daily wage laborer (Agri)	**Shukur Mondal** 50,000-1,00,000	Sohrab mondal Homestead Structure	Male Owner	35
Shahjadpur; Rupabati; Rupabati 8816780335260	**Bikom ali** Migrant Worker	Shahid fakir 1,00,000-1,80,000	Male AgricultureOwner	35
Shahjadpur; Rupabati; Rupabati 8816780335154 Land	**Kader molla** Unemployed/dependent/children Owner	Logor molla	Male 0-30,000Homestead	74
Shahjadpur; Rupabati; Selachapri 8816780335211 Owner	**Abdul Salam poramanik** Village leader	Abdul hamid 1,00,000-1,80,000	Male Homestead Land	60
Shahjadpur; Rupabati; Selachapri 8816780333033 Owner	**Abdur rahim** Daily wage laborer (Agri)	Wahab poramanik 50,000-1,00,000	Male Homestead Land	
Shahjadpur; Rupabati; Selachapri Rickshaw/Rickshaw van driver Business	**Anisur** 50,000-1,00,000		Male Dairy-Livestock Farm	22

Homestead Structure

Owner

Shahjadpur; Rupabati; Selachapri Weaver	**Anwar** 50,000-1,00,000	Shukur ali Dairy-Livestock Farm	Female Business	30

Homestead Structure

Owner

Shahjadpur; Rupabati; Selachapri Ghat shordar	**Del mamood** 1,00,000-1,80,000	Azhar bepari Homestead Land	Male Owner	35
Shahjadpur; Rupabati; Selachapri Daily wage laborer (Agri)	**Fotik mollah** >1,80,000	Bokkar molla Homestead Land	Male Owner	

Location No.	HH Head Name Occupation	Father/ Husband Name Annual Income	Gender Age National Card Land Use Ownership
Shahjadpur; Rupabati; Selachapri 8816780335138	**Hashor Fakir** Daily wage laborer (Agri)	Ramjan ali fakir 50,000-1,00,000	Male 31 Agriculture Owner
Homestead Structure Owner			
Shahjadpur; Rupabati; Selachapri Petty trader	**Lokman hossain** 1,00,000-1,80,000	Hozrot mollah Homestead Land	Male 47 Owner
Shahjadpur; Rupabati; Selachapri 8816780332866 Business	**Md jalal uddin prang** Vendor	Late hazrat ali 30,000-50,000	Male 62 Dairy-Livestock Farm
Homestead Structure Owner			
Shahjadpur; Rupabati; Selachapri 199288167800 Owner	**Md sattar fakir** Port worker	Shukur ali sheikh 30,000-50,000	Male 25 Homestead Structure
Shahjadpur; Rupabati; Selachapri 8816780332827 Business	**Md Tahaz Ali** Daily wage laborer (Agri)	Md samad pramanik 50,000-1,00,000	Male 41 Dairy-Livestock Farm
Homestead Structure Owner			
Shahjadpur; Rupabati; Selachapri 881670333018	**Md yakub Sheikh** Lorry Driver	Abu Shoummo Sheikh 1,00,000-1,80,000	Male 33 Agriculture Owner
Homestead Structure Owner			
Shahjadpur; Rupabati; Selachapri 8816780332860	**Md. abdur razzak** Vendor	Mohammad oyajed ali >1,80,000	Male 40 Agriculture Owner
Homestead Structure Owner			
Shahjadpur; Rupabati; Selachapri 8816780333510 Business	**Md. ali molla** Cultivation in owned land	Mohammad kala chad molla 30,000-50,000	Male 33 Dairy-Livestock Farm

Shahjadpur; Rupabati; Selachapri 8816780332837 Business	**Md. anawar hossen** Owner of tat mil	Mohammad ajhar sarkar 1,00,000-1,80,000	Male Handloom Factory	48

Homestead Structure

Owner

Shahjadpur; Rupabati; Selachapri 8816780333933 Owner	**Md. asraf ali** Daily wage laborer (Agri)	Mrito hazrat ali sheikh 0-30,000	Male Homestead Structure	34
Shahjadpur; Rupabati; Selachapri 8816780333927 Owner	**Md. dulal sheikh** Daily wage laborer (Agri)	Mrito hazrat sheikh 0-30,000	Male Homestead Structure	60
Shahjadpur; Rupabati; Selachapri 8816780333471 Owner	**Md. mahtab bepari** Daily wage laborer (Non-agri)	Roimuddin bepari 50,000-1,00,000	Male Homestead Structure	60
Shahjadpur; Rupabati; Selachapri 8816780332846 Homestead Structure	**Md. razaul sarker** Salaried person in govt/private Owner	Iman sarker	Male 50,000-1,00,000	40
Shahjadpur; Rupabati; Selachapri 8816780333474 Owner	**Md. sabuj bepari** Owner of powerloom factory	Mohammad mahatab 1,00,000-1,80,000	Male Homestead Structure	33

Other

Business

Shahjadpur; Rupabati; Selachapri 8816780332833 Owner	**Md. sarapat ali** Boatman	Mohammad abdul latif 50,000-1,00,000	Male Homestead Land	38

Homestead Structure

Owner

Shahjadpur; Rupabati; Selachapri 198388167800	**Md. shahdad hossain** Cultivation in owned land	Hazi Mohammad kalchad 0-30,000	Male Owner	35
Shahjadpur; Rupabati; Selachapri 8816780333935 Business	**Md. shahdat hossain** Daily wage laborer (Agri)	Mrito hazrot sheikh 0-30,000	Male Dairy-Livestock Farm	56

Homestead Structure

Owner

Shahjadpur; Rupabati; Selachapri 8816780333473 Owner	**Mohammad abdul nomin** Daily wage laborer (Non-agri)	Mohammad mahtab bepari 50,000-1,00,000	Male Homestead Structure	35

Location No.	HH Head Name Occupation	Father/ Husband Name Annual Income	Gender Land Use	Age	National Card Ownership
Shahjadpur; Rupabati; Selachapri 8816780335176	**Mohammad ali molla** Daily wage laborer (Agri)	Bokkar Molla 50,000-1,00,000	Male Agriculture	46	Owner
Dairy-Livestock Farm					
Business					
Homestead Structure					
Owner					
Shahjadpur; Rupabati; Selachapri 8816780333513	**Mohammad alomgir** Cultivation in owned land	Mohammad kalachad molla 50,000-1,00,000	Male Agriculture	41	Owner
Dairy-Livestock Farm					
Business					
Homestead Structure					
Owner					
Shahjadpur; Rupabati; Selachapri 8816780332831 Owner	**Mohammad barkat ali** Vendor	Mohammad abdul latif 1,00,000-1,80,000	Male Homestead Structure	46	
Shahjadpur; Rupabati; Selachapri Weaver	**Mohammad Delwar hossain** 50,000-1,00,000	Koser gayan Agriculture	Male Owner	55	
Dairy-Livestock Farm					
Business					
Homestead Structure					
Owner					
Shahjadpur; Rupabati; Selachapri 8816780332844 Owner	**Mohammad lokman sharker** Cultivation in owned land	Mrito iman sarker 50,000-1,00,000	Male Homestead Structure	51	
Shahjadpur; Rupabati; Selachapri 8816780333507	**Mohammad shamchul haq** Cultivation in owned land	Mohammad kala chad molla 30,000-50,000	Male Agriculture	52	Owner
Dairy-Livestock Farm					

Business

Homestead Structure

Owner

Shahjadpur; Rupabati; Selachapri 8816780333527 Owner	**Mohon molla** Daily wage laborer (Non-agri)	Aual molla 1,00,000-1,80,000	Male 40 Homestead Land
Shahjadpur; Rupabati; Selachapri 8816765389748 Owner	**Mojammel** Street food seller	Hasan ali 30,000-50,000	Male 30 Homestead Land
Shahjadpur; Rupabati; Selachapri 8816780335227 Owner	**Moktom drivet** Migrant Worker	Ramjan Hazi 1,00,000-1,80,000	Male 36 Homestead Structure
Shahjadpur; Rupabati; Selachapri No Reply	**Montu Driver** 50,000-1,00,000	Ramjan hazi Homestead Land	Male 50 Owner
Shahjadpur; Rupabati; Selachapri 8816780333531 Livestock Farm	**Mrs moniza khatun mazida** Housewife Business		Female 60 0-30,000 Dairy-

Homestead Structure

Owner

Shahjadpur; Rupabati; Selachapri 8816780333561	**Munzer Molla** Weaver	Abdur rahim molla 1,00,000-1,80,000	Male 38 AgricultureOwner

Homestead Structure

Owner

Other

Business

Shahjadpur; Rupabati; Selachapri House maid	**Nazma** 0-30,000	Tofiz paramanik Homestead Structure	Female 35 Owner
Shahjadpur; Rupabati; Selachapri Daily wage laborer (Agri)	**Nikhat sarkar** 50,000-1,00,000	Ajhar sarkar Homestead Land	Male 47 Owner
Shahjadpur; Rupabati; Selachapri 199488167800 Owner	**Saddam seikh** Daily wage laborer (Agri)	Bablu seikh 50,000-1,00,000	Male Homestead Land
Shahjadpur; Rupabati; Selachapri 8816780332877 Business	**Safikul Islam** Weaver	Tafiz pramanik 50,000-1,00,000	Male 28 Dairy-Livestock Farm

Homestead Structure

Owner

Location No.	HH Head Name Occupation	Father/ Husband Name Annual Income	Gender	Age	National Card	Land Use	Ownership
Shahjadpur; Rupabati; Selachapri 8816780332863	**Sazzak pramanik** Weaver	Mrito majed ali pramanik 30,000-50,000	Male	37		Agriculture	Owner

Handloom Factory

Business

Homestead Structure

Owner

Shahjadpur; Rupabati; Selachapri 8816780332873 Owner	**Shahjahan ali** Service holder	Suleman seikh 30,000-50,000	Male	28		Homestead Land	

Table 29: List of household heads with category of losses (Non-

Location No.	HH Head Name Occupation	Father/ Husband Name Annual Income	Gender Land Use	Age	Card Ownership
Shahjadpur; Habibullah Nagar; Kumir Goalia Unemployed/dependent/children	**Jayden Chandra modok** 0-30,000	Panu Chandra modok Homestead Land	Male Lessee		
Shahjadpur; Habibullah Nagar; Nagardala Aluminium shop	**Guljar hossain** Lessee	Harun sheikh	Male	27	
Shahjadpur; Habibullah Nagar; Nagardala Furniture shop	**Malek fokir** Lessee	Dulal fakir	Male	35	
Shahjadpur; Habibullah Nagar; Nagardala Cycle repair shop	**Rofikul islam** 0-30,000	Mohammad khobir uddin Lessee	Male	49	
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) 8816787599401 Khas	**Matin ali** Rickshaw/Rickshaw van driver	Late lalchaf mia 50,000-1,00,000	Male Homestead	47	Structure
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) Daily wage laborer (Agri)	**Abdul Hamid** 30,000-50,000	Lal chad mia Khas	Male	55	
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) Daily wage laborer (Agri)	**Abdul khalek** 30,000-50,000	Fakir chan mollah Khas	Male	59	
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) 8816787439548 Khas	**Abdul Malek** Fish business	yousuf ali 1,00,000-1,80,000	Male Homestead	32	Structure
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) Daily wage laborer (Agri)	**Abdul malek** 50,000-1,00,000	Fakir chan Homestead Land	Male Khas	57	
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) 16787599405 Khas	**Abdul rahman** Daily wage laborer (Agri)	Khajem ali sarkar 50,000-1,00,000	Male Homestead	43	Structure
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) 8816787439534 Structure	**Abdur Radhid** Unemployed/dependent/children Khas	Late Jochon	Male 0-30,000	68	Homestead
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) Daily wage laborer (Non-agri)	**Chan mia** 30,000-50,000	Sahjaha Homestead Land	Male Khas	30	
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) 8816780338669	**Josna** Weaver	Osman poramanik 50,000-1,00,000	Male Khas	45	
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) Fish business Khas	**Khaleq** 50,000-1,00,000		Male Homestead	37	Structure
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) 199388167870 Khas	**Md Azad** Fisherman	Abdur Rashid 30,000-50,000	Male Homestead	24	Structure
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) 8816787439535 Khas	**Md moktar** Fisherman	Abdur rashid 30,000-50,000	Male Homestead	35	Structure

Shahjadpur; Habibullah Nagar; Rotonkandi (Part) 8816787439539 Khas	**Md Sanoar** Fisherman	Abdur rashid 30,000-50,000	Male Homestead	32 Structure	
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) Daily wage laborer (Non-agri)	**Md. manik molla** 0-30,000	Hazrat ali Homestead Structure	Male Khas	29	8816
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) 8816787439624	**Mojnu mia** Daily wage laborer (Non-agri)	Yousuf ali >1,80,000	Male Khas	30	
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) 188188167870 Khas	**Monirul Sarker** Weaver	Palan sarker 30,000-50,000	Male Homestead	28 Structure	
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) Daily wage laborer (Agri)	**Polan** 30,000-50,000	Mohammad khadem ali Homestead Structure	Male Khas	55	
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) Job holder	**Ron Jan** >1,80,000	Kashem Homestead Land	Male Khas	60	
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) 8816787439670 Khas	**Sajahan mollah** Petty trader	Yousuf mollah 1,00,000-1,80,000	Male Homestead	55 Land	
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) 8816787599450 Khas	**Shahadat Molla** Poultry rearing	Late md yousuf molla 50,000-1,00,000	Male Homestead	59 Structure	
Shahjadpur; Potajia; Gangaprassad No Reply			Male 30,000-50,000	30 Khas	

Location No.	HH Head Name Occupation	Father/ Husband Name Annual Income	Gender Land Use	Age	National Card Ownership
Shahjadpur; Potajia; Gangaprassad Daily wage laborer (Agri)	**Joynal abedin** 30,000-50,000	Shomaj poramanik Homestead Land	Male Khas	72	
Shahjadpur; Potajia; Gangaprassad 8816773323675 Khas	**Md Mahmud Ali Pramanik** Daily wage laborer (Non-agri)	Noker Ali Pramanik 50,000-1,00,000	Male Homestead Structure	39	
Shahjadpur; Potajia; Gangaprassad 8816773323613 Structure	**Md. arshad ali sarkar** Unemployed/dependent/children Khas	Mrito echak ali sarkar	Male 0-30,000	63	Homestead
Shahjadpur; Potajia; Gangaprassad 8816773323572 Khas	**Rahom molla** Daily wage laborer (Agri)	Abed molla 0-30,000	Male Homestead Structure	61	
Shahjadpur; Potajia; Gangaprassad Daily wage laborer (Non-agri)	**Rejaul karim** 30,000-50,000	Waijal fakir Homestead Structure	Male Khas	35	
Shahjadpur; Potajia; Gangaprassad Daily wage laborer (Agri)	**Shahadot** 0-30,000	Kuddus fakir Khas	Male	25	
Shahjadpur; Potajia; Gangaprassad 8816787422347 Khas	**Tarek** Weaver	Amir Ali 50,000-1,00,000	Male Homestead Structure	28	
Shahjadpur; Potajia; Nundaha 8816773312668	**Abdul mannan** Daily wage laborer (Agri)	Mojir poramanik 50,000-1,00,000	Male Khas	56	
Shahjadpur; Potajia; Nundaha 8816773312757 Khas	**Abdul Wahab** Poultry rearing	Late md shahajahan ali 30,000-50,000	Male Homestead Structure	55	
Shahjadpur; Potajia; Nundaha 8816773312849 Khas	**Akbar ali** Daily wage laborer (Agri)	Foyzal poramanik 50,000-1,00,000	Male Homestead Land		
Shahjadpur; Potajia; Nundaha Daily wage laborer (Agri)	**Aladdin bepari** 30,000-50,000	Mola bepari Khas	Male		
Shahjadpur; Potajia; Nundaha 198688167730	**Alal Uddin pramanik** Daily wage laborer (Non-agri)	Late fayjal pramanik 30,000-50,000	Male Khas	31	
Shahjadpur; Potajia; Nundaha 8816773312839 Khas	**Almas** Daily wage laborer (Agri)	Usuf poramanik 30,000-50,000	Male Homestead Land		
Shahjadpur; Potajia; Nundaha 881677331792 Khas	**Amir hamza** Daily wage laborer (Agri)	Abdul kha 30,000-50,000	Male Homestead Structure	37	
Shahjadpur; Potajia; Nundaha No Reply Khas	**Anis** 50,000-1,00,000		Male Homestead Structure	35	
Shahjadpur; Potajia; Nundaha 8816787421902 Khas	**Anisur Rahman** Daily wage laborer (Non-agri)	Joynal sarkar 0-30,000	Male Homestead Structure	60	

Shahjadpur; Potajia; Nundaha	**Anwar**		Male	45
No Reply	50,000-1,00,000		Homestead Structure	
Khas				
Shahjadpur; Potajia; Nundaha	**Azgar pramanik**	Fayzal pramanik	Male	53
8816773312851	Daily wage laborer (Agri)	50,000-1,00,000	Khas	
Shahjadpur; Potajia; Nundaha	**Darog Ali**	Rahima khatun	Male	57
8816773312765	Daily wage laborer (Agri)	50,000-1,00,000	Homestead Structure	
Khas				
Shahjadpur; Potajia; Nundaha	**Fazlul haque**	Mozaffor ali sheikh	Male	65
195988167733	Laboratory assistant	1,00,000-1,80,000	Homestead Structure	
Khas				
Shahjadpur; Potajia; Nundaha	**Fullchad**	Wazed	Male	35
8816773312875	Weaver	50,000-1,00,000	Khas	
Shahjadpur; Potajia; Nundaha	**Hanif Sheikh**	Mozafar Sheiikh	Male	52
8816773312774	Daily wage laborer (Agri)	30,000-50,000	Homestead Land	
Khas				
Shahjadpur; Potajia; Nundaha	**Hasen Ali**	Anichur Rahman	Male	34
8816787421904	Rickshaw/Rickshaw van driver	30,000-50,000	Homestead Structure	
Khas				
Shahjadpur; Potajia; Nundaha	**Jolil poramanik**	Saber	Male	
Unemployed/dependent/children	0-30,000	Homestead Land	Khas	
Shahjadpur; Potajia; Nundaha	**Liton molla**	Somir molla	Male	
88167599115	Daily wage laborer (Agri)	50,000-1,00,000	Khas	
Shahjadpur; Potajia; Nundaha	**Lokman pramanik**	Loba pramanik	Male	78
8816773312796	Unemployed/dependent/children		0-30,000	Khas
Shahjadpur; Potajia; Nundaha	**Majed**	Joyan munshi	Male	45
16773312839	Daily wage laborer (Agri)	50,000-1,00,000	Khas	

Location No.	HH Head Name Occupation	Father/ Husband Name Annual Income	Gender Land Use	Age	National Card Ownership
Shahjadpur; Potajia; Nundaha 8816773312824	**Md ansar ali** Daily wage laborer (Agri)	Abul kashem pramanik 50,000-1,00,000	Male Khas	60	
Shahjadpur; Potajia; Nundaha 8816773312805 Khas	**Md younus ali** Daily wage laborer (Agri)	Md mazir pramanik 30,000-50,000	Male Homestead Structure	43	
Shahjadpur; Potajia; Nundaha 8816773312818	**Md. abdur razzak pramanik** Daily wage laborer (Agri)	Jenat pramanik 30,000-50,000	Male Khas	53	
Shahjadpur; Potajia; Nundaha 8816773312804	**Md. abul Hossain** Daily wage laborer (Non-agri)	Lokman pramanik 50,000-1,00,000	Male Khas	34	
Shahjadpur; Potajia; Nundaha 8816773312820 Structure	**Md. abul kashem pramanik** Unemployed/dependent/children Khas	Ebadullah pramanik	Male 0-30,000	82	Homestead
Shahjadpur; Potajia; Nundaha 8816773312882	**Md. azam pramanik** Daily wage laborer (Non-agri)	Mrito yachin pramanik 30,000-50,000	Male Khas	38	
Shahjadpur; Potajia; Nundaha 8816773312816	**Md. mostafa pramanik** Daily wage laborer (Non-agri)	Khalil pramanik 30,000-50,000	Male Khas	41	
Shahjadpur; Potajia; Nundaha 8816773312800 Khas	**Md. nazim uddin** Daily wage laborer (Non-agri)	Lokman pramanik 30,000-50,000	Male Homestead Structure	36	
Shahjadpur; Potajia; Nundaha 8816773312822	**Md. shamsul pramanik** Dairy-livestock	Md. abul kashem pramanik 30,000-50,000	Male Khas	48	
Shahjadpur; Potajia; Nundaha 8816773312873 Khas	**Md. wajed ali** Cultivation in owned land	Mrito yusub ali 30,000-50,000	Male Homestead Structure	64	
Shahjadpur; Potajia; Nundaha 8816773312829 Khas	**Mojam pramanik** Rickshaw/Rickshaw van driver	Hajrat ali pramanik 50,000-1,00,000	Male Homestead Structure	48	
Shahjadpur; Potajia; Nundaha Salaried person in govt/private	**Mojibar pramanik** 30,000-50,000	Hazrat ali pramanik Khas	Male	40	
Shahjadpur; Potajia; Nundaha Daily wage laborer (Agri)	**Moksed ali** 50,000-1,00,000	Ibadullah poramanik Homestead Land	Male Khas	45	
Shahjadpur; Potajia; Nundaha Daily wage laborer (Agri) Khas	**Monirul** 50,000-1,00,000		Male Homestead Structure	30	
Shahjadpur; Potajia; Nundaha 8816773312848	**MST moriam khatun** No Reply	Mrito Hossain pramanik 0-30,000	Female Khas	49	
Shahjadpur; Potajia; Nundaha 8816773312884 Khas	**nekbar ali** Daily wage laborer (Agri)	Fayzal pramanik 1,00,000-1,80,000	Male Homestead Structure	39	

Shahjadpur; Potajia; Nundaha No Reply Khas	**Rezia** 0-30,000		Female Homestead Land	40
Shahjadpur; Potajia; Nundaha Fisherman	**Sharif mollah** 50,000-1,00,000	Rohom mollah Homestead Structure	Male Khas	40
Shahjadpur; Potajia; Nundaha 8816773312798 Khas	**Siddique Ali** Builder	Lokman Pramanik 50,000-1,00,000	Male Homestead Structure	38
Shahjadpur; Potajia; Potajia 8816773323628 Khas	**Bacchu bepari** Weaver	Fotik bepari 50,000-1,00,000	Male Homestead Structure	34
Shahjadpur; Rupabati; Rupabati Milkman	**Mizan Sarker** 1,00,000-1,80,000	Azad Sarker Homestead Structure	Male Khas	46
Shahjadpur; Rupabati; Selachapri 8816780332825 Khas	**Md Shahadat Hossen** No Reply	Chamu prang 30,000-50,000	Male Homestead Structure	44
Shahjadpur; Rupabati; Selachapri 8816780332851 Khas	**Sohrab poramanik** Daily wage laborer (Agri)	Sanaullah poramanik 50,000-1,00,000	Male Homestead Land	45

Table 30: List of household heads with category of losses (Female Household

Location No.	HH Head Name Occupation	Father/ Husband Name Annual Income	Gender Age National Card Land Use Ownership
Shahjadpur; Habibullah Nagar; Kumir Goalia 8816787427502 Owner	**Joybanu** Daily wage laborer (Non-agri)	Kashem ali akondo 0-30,000	Female 51 Homestead Structure
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) 8816787420448 Homestead Land	**Fatema khatun** Unemployed/dependent/children Owner	Mrito romjan ali	Female 36 30,000-50,000
Homestead Structure Owner			
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) Housewife	**Majeda** >1,80,000	Late abul hossain Homestead Structure	Female 45 Owner
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) 8816787439662	**Mohammad Afzal** Daily wage laborer (Agri)	Lobu sarker 50,000-1,00,000	Female 37 AgricultureOwner
Homestead Structure Owner			
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) Housewife	**Mrs. Salima begum** 50,000-1,00,000	Asiruddin ahmed Homestead Structure	Female 75 Owner
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) 8816787425030 Owner	**MST. Sufia khatun** Housewife	Mohammad abdur rouf 0-30,000	Female 41 Homestead Structure
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) 8816787420621 Owner	**Yasin molla** Daily wage laborer (Agri)	Fayjal molla 50,000-1,00,000	Female 49 Homestead Structure
Shahjadpur; Potajia; Gangaprassad 8816773312855 Owner	**Md abdul matin** Daily wage laborer (Agri)	Mr bakkar molla 30,000-50,000	Female 51 Homestead Structure
Shahjadpur; Potajia; Gangaprassad 8816773323542 Owner	**Shamo khatoon** No Reply	Sattar sordar 0-30,000	Female 60 Homestead Land
Shahjadpur; Potajia; Nundaha Housewife	**Anwara khatun** 0-30,000	Nosher paramanik	Female 70
Shahjadpur; Potajia; Nundaha 8816773312848	**MST moriam khatun** No Reply	Mrito Hossain pramanik 0-30,000	Female 49 Khas

Shahjadpur; Potajia; Nundaha 8816773312352 Land	**MST. Lailee khatun** Unemployed/dependent/children Owner	Mrito abdul kader	Female 0-30,000	53 Homestead
Shahjadpur; Potajia; Nundaha Weaver	**Reta** 30,000-50,000	Ajger bepari Homestead Land	Female Owner	45
Shahjadpur; Potajia; Nundaha No Reply Khas	**Rezia** 0-30,000		Female Homestead Land	40
Shahjadpur; Rupabati; Ahmedpur Daily wage laborer (Non-agri)	**Julekha khatun** 0-30,000	Alim uddin molla Homestead Structure	Female Owner	48
Shahjadpur; Rupabati; Ahmedpur 8816780336565 Owner	**Mojir pramanik** Daily wage laborer (Agri)	Yakub pramanik 50,000-1,00,000	Female Bamboo Garden	50

Homestead Land

Owner

Homestead Structure

Owner

Shahjadpur; Rupabati; Ahmedpur 8816780335698 Homestead Structure	**Mrs Salma Kbatun** Housewife Owner		Female 50,000-1,00,000	65
Shahjadpur; Rupabati; Ahmedpur 8816780335762 Owner	**Mst hasina khatun** Housewife	Mrito mofiz mondol 0-30,000	Female Homestead Structure	56
Shahjadpur; Rupabati; Selachapri Weaver	**Anwar** 50,000-1,00,000	Shukur ali Homestead Structure	Female Owner	30
Shahjadpur; Rupabati; Selachapri 8816780333531	**Mrs moniza khatun mazida** Housewife		Female 0-30,000	60 Agriculture

Homestead Structure

Owner

Table 31: List of household heads with category of losses (Vulnerable; Households with Tk 0-30,000 Annual

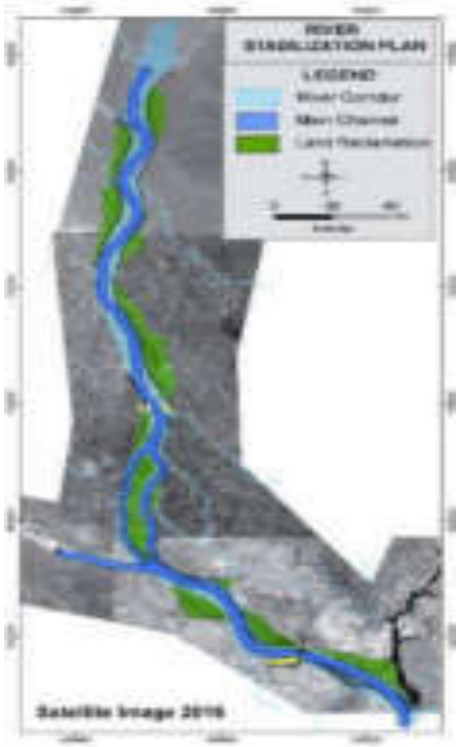
Location No.	HH Head Name Occupation	Father/ Husband Name Annual Income	Gender Age National Card Land Use Ownership
Shahjadpur; Habibullah Nagar; Kumir Goalia 8816787427502 Owner	**Joybanu** Daily wage laborer (Non-agri)	Kashem ali akondo 0-30,000	Female 51 Homestead Structure
Shahjadpur; Habibullah Nagar; Kumir Goalia 8816787427121 Owner	**Spree suvas chandra mooak** Daily wage laborer (Non-agri)	Sree subal chandra mooak 0-30,000	Male 41 Homestead Structure
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) 8816787439534 Structure	**Abdur Radhid** Unemployed/dependent/children Khas	Late Jochon	Male 68 0-30,000 Homestead
Shahjadpur; Habibullah Nagar; Rotonkandi (Part) Unemployed/dependent/children	**Lobu sarkar** 0-30,000		Male 75
Shahjadpur; Potajia; Gangaprassad 8816773323613 Structure	**Md. arshad ali sarkar** Unemployed/dependent/children Khas	Mrito echak ali sarkar	Male 63 0-30,000 Homestead
Shahjadpur; Potajia; Nundaha 8816787421902 Khas	**Anisur Rahman** Daily wage laborer (Non-agri)	Joynal sarkar 0-30,000	Male 60 Homestead Structure
Shahjadpur; Potajia; Nundaha Housewife	**Anwara khatun** 0-30,000	Nosher paramanik	Female 70
Shahjadpur; Potajia; Nundaha 8816773312848	**MST moriam khatun** No Reply	Mrito Hossain pramanik 0-30,000	Female 49 Khas
Shahjadpur; Potajia; Nundaha 8816773312352 Land	**MST. Lailee khatun** Unemployed/dependent/children Owner	Mrito abdul kader	Female 53 0-30,000 Homestead
Shahjadpur; Rupabati; Selachapri 8816780333531	**Mrs moniza khatun mazida** Housewife		Female 60 0-30,000 Agriculture
Homestead Structure			
Owner			
Shahjadpur; Rupabati; Selachapri House maid	**Nazma** 0-30,000	Tofiz paramanik Homestead Structure	Female 35 Owner

Location No.	HH Head Name Occupation	Father/ Husband Name Annual Income	Gender	Age	National Card Land Use	Ownership
Shahjadpur; Rupabati; Selachapri	**Nazma**	Tofiz paramanik	Female	35		
House maid	0-30,000	Homestead Structure			Owner	

Government of the People's Republic of Bangladesh

Bangladesh Water Development Board

Asian Development Bank



Project Loan No 3138-BAN (SF) and Grant No 0396-BAN (EF)

Flood and Riverbank Erosion Risk Management Investment Program

Annex 4 Economic Assessment and Implementation Aspects

August 2019

nhc northwest hydraulic consultants

MOTT MACDONALD

In association with
DELTARES
RPMC and CEGIS

List of Annex

Flood and Riverbank Erosion Risk Management Investment Program
ADB Loan No. 3138-BAN (SF) and GRANT No. 0396-BAN (EF)
Institutional Strengthening and Project Management Consultant (ISPMC)

FEASIBILITY STUDY REPORT FOR TRANCHE 2

Annex 4 ECONOMIC FEASIBILITY

Issue and revision record

Revision	Date	Originator	Checker	Approver	Description
A	March 2018	John Roe with contributions from Jesper Mathiesen, Aminul Islam and Soelem Aafnan	Knut Oberhagemann	Knut Oberhagemann	1st draft report
B	April 2019	John Roe with contributions from Jesper Mathiesen, Hiba Khan and Aminul Islam	Knut Oberhagemann	Knut Oberhagemann	2nd draft report
C	August 2019	Jesper Mathiesen	Knut Oberhagemann	Knut Oberhagemann	Draft final report

DISCLAIMER

Flood and Riverbank Erosion Risk Management Investment Program
ADB Loan No. 3138-BAN (SF) and GRANT No. 0396-BAN (EF)

Institutional Strengthening and Project Management Consultant (ISPMC)

BACKGROUND INFORMATION

Main Report

Key Data

Name of Project:	**Flood and Riverbank Erosion Risk Management Investment Program (3 Tranches)**
Borrower, Executing Agency and Implementing Agency:	Government of Bangladesh (GoB) Bangladesh Water Development Board (BWDB) Department of Disaster Management (DDM)
Financing:	Asian Development Bank (US$ 251.1 million for 3 tranches). ADB Loan No. 3138-BAN (SF). Government of the Netherlands (US$ 13.7 for Tranche-1). Grant No 0396-BAN (EF). Government of Bangladesh (US$ 113.6 million for 3 tranches)
Consultant:	Joint Venture of Northwest Hydraulic Consultants Ltd. (Canada) and Euroconsult Mott MacDonald Ltd. (UK) in association with Deltares (Germany), Resource Planning and Management Consultants (Bangladesh) and CEGIS (Bangladesh). Contract Signed: 8th September 2015
Contracting Authority:	PD, FREMIP, BWDB, Dhaka
Start/ End Dates:	ADB Loan Agreement: 27 June 2014 (approved), 14 August 2014 (signed), 17 September 2014 (effective) Muti-tranche financing facility (9 years): June 2014 to June 2023 Dates for FREMIP: - Tranche 1: August 2014 to June 2019 (+ 5 years) - Tranche 2: October 2018 to June 2022 (+ 3.7 years) - Tranche 3: June 2020 to June 2023 (+ 3.0 years)
Beneficiaries:	Local stakeholders directly and indirectly benefitting from river flood protection works and land reclamation and development
Subproject Sites/ Location/ Areas	Focus of works are along the Jamuna-Padma river corridor, from Bangabandhu (Jamuna) bridge to confluence with Meghna river at Chandpur; i.e. Reaches 3, 4 and 5. Master plan area comprises the three priority subprojects, JRB-1, JLB-2 and PLB-1 which extend over (part of) the following districts: Sirajganj, Tangail, Pabna and Manikganj.

	km²	ha
Total Area of all SPs	9,292.3	929,230
FREFMIP SPs (JRB1, JLB2,PLB1): Total Area	2,473.9	247,390
FREFMIP SPs: Agricultural Benefit Area	1,220.0	122,000
FRERMIP SPs: Population		10.6 million
FRERMIP SPs: Population Density		1,137 km²
FRERMIP SPs: No. of Households		2.03 million
FRERMIP SPs: Average HH Size		5.2
Master Plan Total Area	15,950.0	1,595,000
Master Plan Agricultural Benefit Area (flood risk mitigated)	5,000.0	500,000
Land Reclamation Area in River Corridor, Total	1,500.0	150,000
Land Reclamation Area in River Corridor, FRERMIP	660.0	66,000

TABLE OF CONTENTS

LIST OF TABLES

LIST OF APPENDICES

Consultant's Report

Flood and Riverbank Erosion Risk Management Investment Program

A 4.1 FEASIBILITY LEVEL COST ESTIMATES

August 2019

Prepared by

Institutional Strengthening and Project Management Consultant (ISPMC)

Joint Venture of Northwest Hydraulic Consultants Ltd. and Euroconsult Mott MacDonald Ltd. in association with Deltares, Resource Planning and Management Consultants and CEGIS

1 INTRODUCTION

Purpose of this Document

This document provides the cost of individual work items used for cost estimates of Tranche 2 and the subsequent economic analysis, establishing economic internal rates of return and switching values.

1.1 Detailed Cost Structure

Terms and Packaging

The cost structure is based on the following parameters:

(i) **Unit Rates:** the unit rates are expressed either for individual units, such as geotextile bags, or as kilometer cost, for example for riverbank protection. Costs follow market rates at the time of preparing the estimates, and for civil works were checked against BWDB's schedule of rates. Cost could be established within reasonable confidence levels, based on past experience with the type of work proposed.

(ii) **Base Cost:** the unit rates for different cost items were increased by the percentage of taxes applicable in Bangladesh, for example deducted at source from BWDB contractors. Broadly 5.5% value added tax (VAT)is applicable to work contracts and 15% to service contracts. In several cases taxes vary, depending on import duty etc.

(iii) **Physical Contingencies:** In order to reflect uncertainties physical contingencies were applied. Globally 5% physical contingencies were applied as (i) there is recent, practical implementation experience, reducing the uncertainties in terms of volumes of work, and (ii) most of the critical underwater works is expected to be implemented at the beginning of Tranche 2, which reduces the uncertainties related to sudden, unexpected river changes. The exception is pilot works, which do not have any contingency, due to the unspecified nature.

(iv) **Price Contingencies**: These are computed on foreign exchange costs at 0% in year 1, 1.9% in year 2 and 1.8% thereafter, and on local currency cost at 0% in year 1, 6.5% thereafter, including provisions for exchange rate fluctuation under the assumption of a purchasing power parity exchange rate.

(v) **Total Cost:** These consist of the summary of base cost, physical contingencies, and price contingencies.

(vi) **Financing Charges:** These are computed by COSTAB, applying 2% interest on the loan amounts disbursed only during the period of implementation. The Financing Charges are computed for each tranche individually.

The costs are presented in a number of different ways, or packaging. This is necessary as ADB and Government require different categorization. While this document works on the basic categorization, individual line items can be shifted according to the desires of ADB or Government. The principle difference relates to the presentation of the consulting cost: for ADB purposes all consulting cost are combined as one consulting company is expected to be retained, whereas for government purposes it is necessary to explain that only a fraction of the consulting cost is required for the implementation of the works, while the remaining cost relates to studies leading to and preparing future work, in line with government's vision of stabilizing the main rivers of Bangladesh.

2 COST ASSUMPTIONS

Project costs are based upon prevailing market prices for items of expenditure to be financed under the program. For civil works and land acquisition these have, in general, been obtained from Bangladesh Water Development Board (BWDB) rates. For other expenditure categories, prices have been obtained from field investigations. All price data were collected in early 2019. In detailed costs estimates these prices have been applied to annual quantity estimates to derive annual base costs for each expenditure item. Alternatively, for some expenditure items annual lump sum amounts have been estimated. Physical contingencies have been applied at typically 5% of the base costs, reflecting the level of uncertainty[1] in cost estimates, and to allow for a potential increase in costs for each expenditure item.

Each expenditure category has been broken down into estimated foreign currency, local currency and taxes and duties components. Price contingencies have been computed on foreign exchange costs at 0% in 2018, 1.9% in 2019, 1.8% in 2020 and 2.0% thereafter, and on local currency cost at 0% in 2018 and and 6.3% thereafter. A constant market exchange rate of BDT 83 : US $ 1 (dated January 2019) has been assumed. Foreign currency price escalation rates are based on the World Bank projections of the annual % change in the US GDP deflator (dated October 2018). Local currency price contingencies are based on Asian Development Bank projections of the CPI annual inflation rate in Bangladesh (dated September 2018).

Taxes and duties have been estimated on the basis of prevailing customs duties for imported items and VAT rates published by the Bangladesh customs and taxation authorities. To estimate foreign currency and tax components as a percentage of prices used for unit cost estimates, it has been assumed that domestic value added (transport and handling, dealer margins, etc.) is equivalent to 20% of the pre-VAT cost. VAT at the relevant rate for each item of expenditure is added to the combined pre-VAT and domestic value added price to derive the unit cost. Foreign exchange and total taxes and duties which form part of the final unit price have been estimated as a percentage of the final price of each item of expenditure. These percentages have been used in cost estimates to determine estimated foreign and local currency and taxes and duties for each item.[2]

3 COST SUMMARY

Costs have been broken down into 9 categories with nearly 400 individual line items for Tranche-2 and 700 items overall to allow the categorization for ADB loan processing purposes and the government detailed project pro-forma (DPP).

Table 3-1 Total cost for Tranche 2 and 3 including contingencies and taxes, (in million US$)

Tranche 2						
Sub project	**Work item**	**Length**	**Work details**	**Cost M USD**	**Dredging cost**	**Dredging share**
JRB 1	Benotia	3.5	RBP at bank	34.9	1.8	5%
	Shahjadpur	7.9	embankment	6.1	2.4	39%
JLB 2	US Chauhali	12	RBP at bank	119.7	6.7	6%

[1] Uncertainties are commonly associated with underwater works. This is mostly implemented from year one, as such reducing the risk of dramatic river changes from the time of bidding. In addition bidding documents include an implementation design based on the actual river situation, and the program has substantial provisions for adaptation and emergencies, further reducing the risk of sudden unexpected changes that require large adjustments of the work contracts. The work above water, namely embankments have less risk of quantity changes, as the bidding documents will be based on an agreed alignment for which detailed topographic data are available.

[2] All cost estimates were prepared using COSTAB software, by which all cost tables were generated.

	Solimabad closure	1		33.4	33.4	1.0
	Solimabad protection	10.5	between bank and char	11.1	3.8	34%
PLB 1	Harirampur-Dohar	17.4	embankment	37.4	16.8	45%
Unallocated	Adaptation	40.0	CC blocks and geobags	15.3	4.7	0.3
	Emergency	5.0	Emergency works	-	-	-
	Fish sanctuaries		Excavation of fish sanctuaries	2.2	2.2	100%
Total				**260.0**	**71.8**	**28%**
Other project cost				**63.3**	**0**	**0%**
Interest during implementation 2%				**5.5**	**1.4**	
Total project cost				**323.3**		
Contingencies				**3.0**		**0%**
Total cost				**331.80**	**73.2**	**22%**
Tranche 3						
Sub project	**Work item**	**Length**	**Work details**	**Cost**	**Dredging cost**	**Dredging share**
JLB 2	Aricha - Chauhali	40	40km embankment	60.66	35.6	59%
PLB 1	Harirampur	9	CC blocks on slope	8.15	0.2	2%
All	Adaptation		Geobags for 15km	4.01	1.3	31%
Total				**72.8**	**37.0**	**51%**
Other project cost				**62.4**		**0%**
Interest during implementation 2%				**2.7**	**0.7**	
Total project cost				**135.2**		
Physical contingencies			**Adaptation 15km and emergency 5km**	**5.6**	**1.8**	**31%**
Total cost				**140.8**	**39.5**	**28%**
Tranche 2+3				**472.6**	**112.7**	**24%**
Tranche 1, 2 and 3				**577.6**		

4 BREAKDOWN OF BASE COST

All cost conversions between BDT and dollars are based on 82 BDT per dollar as agreed in the Feasibility Study.

Table 4-1 Cross referencing cost structure and subsequent section with cost breakdown

Detailed Categorization	Section								
A Survey and Investigations (BWDB)	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8	4.9
Underwater River Surveys	X								
Topographic Survey and Geotechnical Investigations	X								
Erosion Prediction	X								
Distributaries survey	X								
Monitoring of pilot works	X								
B Land Acquisition and Resettlement		X							
Cash Compensation under Law		X							
Resettlement Benefits		X							
Implementation Support (NGO)		X							
C Civil Works (BWDB)			X						
Geotextile Materials			X						
Riverbank Protection Works underwater			X						
Riverbank Protection Works above low water			X						
Embankment construction works			X						
Embankments Drainage Structures incl. Fish passes and fish sanctuaries			X						
Adaptation works			X						
D Equipment and Vehicles for PMO				X					
Office Equipment				X					
Survey Equipment				X					
Transport Vehicles				X					
E Social and Environm. Management					X				
Livelihood Support (NGO)					X				
Participatory community regular O&M					X				
Environmental Management and fisheries					X				
F Comm.-based Dis. Risk Mgmt (DDM)						X			
Project implementation unit						X			
Capacity Devt & Study Tour for DDM						X			
INGO package						X			
G Capacity Development (BWDB)							X		
Training							X		
International training and capacity development							X		
MIS services							X		
H Consulting Services								X	
Inst. Strength. &Proj. Mgmt. Consultant (BWDB & DDM)								X	
Knowledgebase update								X	
Pilot studies and works and third party studies								X	
I PMO Operation									X
Salaries BWDB Staff									X
Other Operational Expenses									X

4.1 Surveys and Investigations

4.1.1 Underwater River Survey

4.1.1.1 Multi-beam Echo-sounder Survey

Multi-beam echo sounder surveys are to be tendered under a Service Contract with competitive bidding among survey companies for a contract period of three years.

The cost estimate is based on the Multi-beam Echo-sounder Survey conducted under Tranche 1 and expands the program that is covered under the 2018 flood season survey. It is up to the survey consultant to either procure the necessary instruments or to lease the equipment for the time necessary to undertake the surveys. The surveys will mainly cover locations in the Jamuna and Padma during the flood seasons where bank protection works have been implemented in the past, under Tranche 1 or are planned under Tranche 2 and 3. The surveys will serve for monitoring of existing works as well as pre-work surveys for design.

Sl. No	**Cost component**	**Amount (BDT)**	**Amount (USD)**
A. Competitive component			
1	Staff Remuneration	20,240,000	246,829
2	Out of Pocket expenses	35,435,880	432,145
B. Non-Competitive component			
3	Provisional Sum	5,740,000	70,000
4	Contingency	0	0
D. Local Taxes			
5	IT 10%	6,141,588	74,897
6	VAT 15%	9,212,382	112,346
E. Budget contingencies		3,838,493	46,811
Total Budget		**80,608,343**	**983,029**

1. Staff Remuneration

Sl. No	Name of position of the expert	No of position	Rate (per month)	Person month per position	Total person month	Total (BDT)
Professional Staff						
International						
Key						
	International lead surveyor	1	2,075,000	6	6	12,450,000
Non-Key						
	-	0	0	0	0	0
National						
Key						
	Survey Specialist	1	365,000	6	6	2,190,000
	Assistant Surveyor	2	140,000	20	40	5,600,000
Non-Key						
	-	0	0	0	0	0
					Sub-Total	**20,240,000**

2. Out of Pocket Expenses

Sl. No	**Item**	**Unit**	**Unit cost/Rate**	**Quantity**	**Total (BDT)**

Support staff				
1 Boat operator	day	700	360	252,000
2 Boat Helper	day	700	360	252,000
Per diem and airfares				
3 Per diem international lead surveyor	day	9,840	132	1,298,880
4 Airfare International lead surveyor (return)	no	164,000	6	984,000
5 Per diem Survey Specialist	day	2,000	132	264,000
6 Per diem Assistant Surveyor	day	1,000	880	880,000
Equipment				
3 Boat rental	day	5,000	360	1,800,000
4 Multi-beam echo sounder rental	day	60,000	360	21,600,000
5 RTK rental	day	12,000	360	4,320,000
6 DGPS rental	day	2,000	360	720,000
7 Laptop rental	day	1,000	720	720,000
8 Misc	LS	20,000	1	20,000
Training				
9 Preparation of training modules with lesson plans	LS	50,000	3	150,000
10 Food and venue cost for 5-day training (3 days Dhaka and 2 days Mawa, 20 persons)	LS	35,000	3	105,000
11 Food and venue cost for 3-day refresher training (Mawa, 10 persons)	LS	25,000	3	75,000
12 Conveyance allowance for 5-day training (Mawa, 20 person, 2days)	LS	20,000	3	60,000
13 Stationary folder and handout bag	LS	10,000	3	30,000
Reporting				
14 Inception report preparation	no	10,000	3	30,000
15 Training report preparation	no	10,000	3	30,000
16 Site survey report preparation including data processing and analysis	no	75,000	24	1,800,000
17 Final report preparation	no	15,000	3	45,000
			Subtotal	**35,435,880**

The system would consist of the following items:

- High resolution multibeam system
  - Minimum 400 kHz Frequency.
  - Minimum 240 beams per ping (per head)
  - Maximum opening angle of 1.0° by 0.5° per beam
  - Swath width up to 140°
  - Tilted transducer to achieve maximum coverage up to the waterline
  - SV measurement at multibeam transducer
- Sub-bottom profiler
  - Frequency between 3.5 kHz and 30 kHz
  - Beam width up to 55°
- Motion and heading sensors
  - 0.1° secant latitude (RMS Heading accuracy
  - 0.01° roll and pitch accuracy
  - 0.05 or 5% heave accuracy
- Positioning System

    - RTK GPS system with shore based base station, 5cm accuracy in the vertical and horizontal plane
- Online Software.
    - Provide the operator with a complete overview of the survey works;
    - Monitor sensor operations, including synchronization to Coordinated Universal Time (UTC). This shall include comparison of all duplicate sensors and include the generation of reasonable alarms for sensor performance out of specification. The alarm levels must be carefully judged to ensure that important messages are detected and understood by the operator;
    - Perform quality checks and statistics, including real-time comparison of all GPS solutions for the vessel;
    - The stored data shall contain all required information to enable re-processing without loss of accuracy;
    - Have sufficient capacity to log data from all sensors at the required rate;
    - Enable the input of offsets for sensors, vehicles and vessels;
    - Enable the input for corrections for sensors resulting from calibrations;
- Offline Software.
    - Allow reading and interpretation of all relevant data files created by the 'Online' system and have the capacity to allow processing of large batches of files;
    - Allow application of corrections to data and editing of data (edit = outlier detection and removal by data flagging). All editing and modification to the data shall be tracked and stored in a suitable log file;
    - Allow re-computation of data with different parameter settings;
    - Allow re-computation of data with different parameter settings;
- Velocity Sensor for determining the variation in velocity in the water column
    - Typical example being the Odom Digibar or similar
- Boat
    - Stable platform – most likely catamaran, Aluminum hull
    - Permanent mounting of multibeam processor, computers, screens
    - On-board power
    - Air conditioned
    - Engine system to be determined. Must have primary and secondary engines. Possibilities include outboards (2 * 75 hp), inboard/out board diesel, Diesel jet drive. Cost or purchase and operation will vary significantly based on engine configuration
- Expatriate training and supervision

4.1.1.2 Sediment monitoring

Sediment monitoring is conducted to update the sediment measurements that were last conducted in the early 1990s under FAP 21.

The sediment monitoring is to be carried out under a Service Contract with competitive bidding among survey companies and to last for a period of three years. The monitoring will mainly be conducted during the flood season. It will be possible to either procure the instruments or to lease them for the time of the survey. The cost estimate assumes the procurement of the technical instruments and leasing of supporting equipment as boats etc.

Sediment monitoring	**Amount Procurement 2018 - 2022**	
Item	**USD**	**BDT**
Equipment		
Horizontal-ADCP	20,000	1,600,000
Vertical-ADCP	23,485	1,878,800
Bedload sampler	1,265	101,200
Bed material sampler	5,000	400,000
B-reel	2,500	200,000
Misc sed. sampl. equip.	1,000	80,000
Davit (per boat)	1,500	120,000
GPS receiver	6,200	496,000
RTK satellite subscription (per 3 mnth)	2,550	204,000
Subtotal	**63,500**	**5,080,000**
Transport		
Car transport	48,000	768,000
Boat hire	30,000	480,000
Boat operation (fuel)	4,725	75,600
Subtotal	**82,725**	**1,323,600**
Personnel		
International surveyor	125,000	10,000,000
International surveyor per diem	22,500	1,800,000
International surveyor flight	10,000	800,000
Local surveyor	18,750	1,500,000
Local surveyor per diem	1,875	150,000
Local surveyor assistant	7,500	600,000
Local surveyor assistant per diem	1,313	105,000
Support staff	9,375	750,000
Support staff per diem	4,688	375,000
Contingencies	150,000	12,300,000
Subtotal	**351,000**	**16,080,000**
Total	**497,225**	**22,483,600**

4.1.1.3 River Survey (Flood Season)

River surveys would be tendered under a Service contract with BWDB divisions as available, or National Competitive Bidding. The cost estimates are based on surveys conducted during Tranche 1.

River survey	Description	Quantity	Unit	Rate (BDT)	Cost (BDT)	Cost (USD)
Bathymetric survey full river	2 times per year, 4 years, 500m XS spacing with single beam echo sounder	630	km	3,500	17,640,000	215,122
ADCP Full river	3 times per year, 4 years, 12 transects	36	no	30,000	8,640,000	105,366
ADCP work sites	3 times per year, 4 years, 9 transects	27	no	30,000	6,480,000	79,024
Float tracks	various sites	480	km	1,500	5,760,000	70,244
				Total	38,520,000	469,756

4.1.1.4 Divers survey

During implementation 2 diving teams are proposed with a total of 24 months of provisions for diving surveys.

Item	Unit	No	Rate (BDT)	Amount (BDT)	Amount (USD)
Diving surveys per month	month	24	600,000	14,400,000	175,610
			Total	**14,400,000**	**175,610**

4.1.2 Topographic survey and Geotechnical Testing

4.1.2.1 UAV (Drone) Survey

The UAV contract will be a service Contract tendered under competitive bidding among survey companies with a contract duration of three years

The topographic survey shall be carried out in the form of a UAV (drone) survey and the costs are developed using the costs for the UAV survey carried out in Tranche 1.

The UAV surveys shall cover any embankments, river banks, distributaries required for planning and monitoring of works, repair works and studies for the creation of digital elevation models. The rates are based on UAV surveys conducted under Tranche 1.

Topography	Description	Unit	Rate	Quantity	Amount (BDT)	USD
UAV survey of embankment alignment	Survey along planned and constructed embankment alignment with min 100m on both sides	km	75,000	70.5	5,287,500	64,482
UAV survey of banklines	as necessary for modelling, repair works etc	km	75,000	50	3,750,000	45,732
UAV survey of topography along distributaries	as necessary for modelling, assessment of flow, design etc 200m strip along 120km	km	75,000	100	7,500,000	91,463
Total				**221**	**16,537,500**	**201,677**

4.1.2.2 Geotechnical Testing

The cost estimate for geotechnical testing was provided by the ISPMC national geotechnical expert and has been rounded to USD 175,000 for the full budget.

Item	Unit	Quantity	Unit cost	Amount
Mobilization	LS	1	100,000	100,000
Boring				
15m deep	m	1200	1,000	1,200,000
40m deep	m	1200	1,100	1,320,000
Shifting platform	no	110	4,500	495,000
SPT	no	1600	250	400,000
Undisturbed sample	no	800	400	320,000
Laboratory tests				
Particle size distribution, sieve and hydrometer	no	1200	700	840,000
Moisture content	no	110	400	44,000
Specific gravity	no	110	500	55,000
Atterberg limits	no	165	1,100	181,500
Unit weight	no	110	1,000	110,000
Direct shear	no	1200	2,500	3,000,000
Consolidation	no	110	4,000	440,000

Item	Unit	Quantity	Unit cost	Amount
Unconfined compression	no	110	1,200	132,000
CPT testing	no	10	80,000	800,000
Reporting	LS	1	300,000	300,000
Subtotal				9,737,500
VAT and AIT	25%			2,434,375
Total BDT				**12,171,875**
Total USD				**148,438**
Additional provision	15%			22,266
Total USD				**170,703**
Total USD to be used for cost estimate				**175,000**

4.1.3 Erosion Prediction

Erosion predicted will be under a Service Contract with the Centre for Environmental and Geographical Information Systems (CEGIS). This specialized organization that has done this work in the past mostly under the Jamuna-Meghna River Erosion Mitigation Project (JMREMP) and this current project FRERMIP.

The cost estimate of USD 240,000 includes 15% VAT.

Item	Unit	No	Rate	Amount (USD)
Annual erosion prediction (following previous contracts under FRERMIP)	years	4	60,000	240,000
			Total	**240,000**

4.1.4 Survey of Distributaries

The surveys of distributaries will be carried out under a Service Contract with competitive bidding among survey companies for a duration of three years. The surveys will include bathymetry, discharge and velocity, water levels and sediment along the selected distributary. The rates are based on previously conducted surveys at rivers with comparable size.

Survey of Distributaries	Unit	Rate BDT	Quantity	Amount (BDT)	Remark
Mobilization	LS	100,000	1	100,000	
Bathymetric Survey cross sections	no	5,000	240	1,200,000	
ADCP	no	100,000	120	12,000,000	5 locations, 6 times per year, over 4 years
Float tracking	no	15,000	24	360,000	6 per year over 4 years
Water level gauges	no	10,000	120	1,200,000	5 locations, 6 times per year, over 4 years
Sediment sampling					
Collection	No	1,500	24	36,000	3 locations, 2 times per year over 4 years
Analysis	no	10,000	24	240,000	
Total				15,136,000	
			USD	**184,585**	

4.1.5 Monitoring of Pilot Works

Monitoring of previously installed and new pilot works implemented under Tranche 1 will take place under a Service Contract with competitive bidding among survey companies over a duration of four years. The monitoring includes monitoring of grout filled jute mattress and reed plantations. The cost estimate is based on monitoring surveys conducted under Tranche 1.

Description	Quantity	Unit Price	Total
per year		(BDT)	(BDT)
Monitoring of Inclinometer	24	15,000	360,000
Installation of Live monitoring of Piezometer (two-weekly for 4 years)	1	6,500,000	6,500,000
Sub Total=			6,860,000
Tax=			686,000
Vat=			1,029,000
Total per year			8,575,000
for 4 years			15,435,000
Maintenance of monitoring equipment	10%		1543500
Total cost			**16,978,500**
		USD	**207,055**

Item	Unit	Quantity	Unit Cost (BDT)	AIT, VAT, Overhead (BDT)	Cost (BDT)	USD
Engagement of BUET Expert to prepare the design and supervise the field works	Month	1.5	400,000	178,000	867,000	
Research Assistants for site monitoring, supervision etc.	Month	32	30,000	13,350	1,387,200	
Testing of Soils at BUET Laboratory	LS	1	50,000	22,250	72,250	
Office stationeries and report preparation	LS	1	50,000	22,250	72,250	
Miscellaneous	LS	1	50,000	22,250	72,250	
Total					**2,470,950**	**30,133**

4.2 Land Acquisition and Resettlement

Land acquisition is paid through the Deputy Commissioner who makes an independent assessment. In addition to government compensation, resettlement benefits will be paid in accordance with ADB guidelines. Finally, the cost for the implementing NGO are included under this category.

The process of resettlement budget calculation is based on government declared mouza rates collected from AC land office of each Upazila. The rate calculated for all private land, the market price has been enhanced by 200% for compensation under law (CCL). For khas land (DC is the owner at respective districts on behalf of the government), CCL will be the assessed market price without enhancement. The Land Acquisition price is and will be determined by the standard procedure according to the land acquisition law which is LA Act 1982 Sec 8(1)(a), Sec 8(2) As per 21 No. Law of September 2017 additional 200% cost.

Following these calculations, a 30% contingency is applied to values based on previous resettlement experience.

- The RP budget for replacement value of land, structures and other assets, and special assistance will be calculated using the market rates reflecting replacement cost or updating the replacement value of assets at the time of dispossession.

- The costs for relocation and special assistance will be consistent with the resettlement policy framework and updated entitlement matrix.

- Other costs involving project disclosure, public consultations and focus group discussions, surveys, training and income and livelihood restoration, and monitoring and evaluation have been included in the RP budget.

- The cost estimate in this RP is based on inventory of losses updated as of November 2017 and current compensation rate evaluation. This estimate will be revised based on changes on any additional impacts to be considered. Therefore, the budget will remain as a dynamic process for cost estimate even during implementation.

A detailed breakdown is found in the resettlement plan.

The following tables are derived from the resettlement plan and provide estimates for the following three categories:

Resettlement budget (USD)					
Cash compensation under law	**Harirampur-Dohar**	**Shahjadpur**	**Benotia**	**US Chauhali**	**Total**
Land acquisition	21,112,394	7,210,987	1,051,602	3,605,494	32,980,477
Replacement value of structures	473,135	151,403	22,080	75,702	722,319
Replacement value of trees and crops	130,574	41,784	6,093	20,892	199,342
Subtotal	**21,716,102**	**7,404,174**	**1,079,775**	**3,702,087**	**33,902,138**
Resettlement Benefits					
Relocation cost	298,764	100,856	14,708	50,428	464,757
Rehabilitation Assistance	12,451	3,984	581	1,992	19,009
Service and Training	349,195	111,742	16,296	55,871	533,105
Subtotal	**660,410**	**216,583**	**31,585**	**108,292**	**1,016,870**
Implementation Support (NGO)					
Subtotal	**399,404**	**127,809**	**18,639**	**63,905**	**609,756**
Total	**22,775,916**	**7,748,566**	**1,129,999**	**3,874,283**	**35,528,765**

4.3 Civil Works

4.3.1 Geotextile Materials

The cost estimate is based on the BWDB's schedule of rates, which considers rather small procurement packages. As this program procures geotextile materials in large package sizes between BDT 300 to 500 million the economy of scale indicates that the actual bidding prices will be lower. This estimate is supported by actual bidding cost for JMREMP and for FRERMIP Tranche 1, where in

all cases the bid prices were less than the estimates. In order to be sufficiently conservative, 5% cost reduction has been assumed, or 95% of the estimated base cost.

Given that the geotextile costs are relatively stable and predictable in Bangladesh and the contracts will be awarded at the beginning of the program without much uncertainties related to future flood season, 5% contingencies are sufficient to cover future uncertainties.

Site	Item	Unit	Rate	Quantity	Amount (BDT)
Benotia	250 kg geobag	no	313.58	920,646	288,696,203
US Chauhali	250 kg geobag	no	313.58	3,156,501	989,815,554
Solimabad protection	250 kg geobag	no	313.58	1,858,588	582,815,903
Subtotal				**5,935,735**	**1,861,327,661**

4.3.2 Riverbank Protection Works underwater

Procurement of underwater riverbank protection works shall be through national competitive bidding. The cost estimates follow the BWDB schedule of rates whenever available or an engineers estimate and in built into these rates are taxes and VAT.

Site	Unit	No	Rate (BDT)	Amount (BDT)	Amount (USD)
Benotia	m	3.5	5,604.79	1,974,026,155.51	23,783,447.66
US Chauhali	m	12.0	5,684.01	7,028,568,819.00	84,681,552.04
Solimabad protection	m	10.5	5,684.01	315,671,717.17	3,803,273.70
Solimabad closure	no	1.0	157.80	2,774,020,221.26	33,421,930.38
Subtotal				**12,092,286,913**	**145,690,204**

The quantities adopted are:

Site	Item	Unit	Rate	Quantity	Amount (BDT)	Amount (USD)
Benotia	Filling and dumping of geobag	no	168.64	908,862	153,270,418	1,846,632
Benotia	CC block 1 45x45x45cm	no	1204.86	916,049	1,103,711,259	13,297,726
Benotia	CC block 2 35x35x35cm	no	519.83	1,297,959	674,718,122	8,129,134
Benotia	CC block dumping <200m	m3	1530.52	11,404	17,454,407	210,294
Benotia	CC block dumping >200m	m3	2180.94	11,404	24,871,949	299,662
US Chauhali	Filling and dumping of geobag	no	178.58	3,116,097	556,472,578	6,704,489
US Chauhali	CC block 1 45x45x45cm	no	1248.09	3,140,741	3,919,927,111	47,228,037
US Chauhali	CC block 2 35x35x35cm	no	545.88	4,450,146	2,429,245,574	29,268,019
US Chauhali	CC block dumping <200m	m3	1530.52	33,120	50,690,822	610,733
US Chauhali	CC block dumping >200m	m3	2180.94	33,120	72,232,733	870,274
Solimabad protection	Filling and dumping of geobag	no	178.58	1,767,677	315,671,717	3,803,274

Solimabad protection	CC block 1 45x45x45cm	no	1248.09	0	0	0
Solimabad protection	CC block 2 35x35x35cm	no	545.88	0	0	0
Solimabad protection	CC block dumping <200m	m3	1530.52	0	0	0
Solimabad protection	CC block dumping >200m	m3	2180.94	0	0	0
Solimabad closure	Dredging	m3	157.8	17,579,342	2,774,020,221	33,421,930
Subtotal					**12,092,286,913**	**145,690,204**

4.3.3 Riverbank Protection Works above low water

Procurement of works through national competitive bidding.

The cost estimates follow the BWDB schedule of rates whenever available or an engineers estimate and include contractors profit as well as taxes and VAT.

Site	Unit	No	Rate (BDT)	Amount (BDT)	Amount (USD)
Benotia	m	3.5	16,249.45	631,566,243.18	7,609,231.85
US Chauhali	m	12.0	14,787.71	1,919,985,488.01	23,132,355.28
Solimabad protection	m	10.5	14,787.71	20,911,683.08	251,947.99
Subtotal				**2,572,463,414**	**30,993,535**

The quantities adopted are:

Site	Item	Unit	Rate	Quantity	Amount (BDT)	Amount (USD)
Benotia	Excavation	m3	167.65	205,065	34,379,147	414,207
Benotia	Filling and placing of geobags	no	150.43	10,500	1,579,515	19,030
Benotia	Sand filter	m3	1059.1	7,445	7,885,341	95,004
Benotia	Khoa filter 40 to 20 mm	m3	5048.13	3,723	18,792,477	226,415
Benotia	Khoa filter 20 to 5 mm	m3	5167.64	3,723	19,237,373	231,776
Benotia	Geotextile	m2	229.73	75,503	17,345,355	208,980
Benotia	CC block 3 45x45x30cm	no	733.64	375,448	275,443,679	3,318,599
Benotia	CC block placement <200m	m3	1328.01	69,563	92,379,696	1,113,008
Benotia	CC block placement >200m	m3	2365.12	69,563	164,523,660	1,982,213
US Chauhali	Excavation	m3	167.65	146,280	24,523,842	295,468
US Chauhali	Filling and placing of geobags	no	160.37	36,000	5,773,320	69,558
US Chauhali	Sand filter	m3	1220.45	21,540	26,288,493	316,729
US Chauhali	Khoa filter 40 to 20 mm	m3	4071.31	10,770	43,848,009	528,289
US Chauhali	Khoa filter 20 to 5 mm	m3	4474.47	10,770	48,190,042	580,603
US Chauhali	Geotextile	m2	229.73	219,000	50,310,870	606,155

US Chauhali	CC block 3 45x45x30cm	no	770.6	1,090,370	840,239,407	10,123,366
US Chauhali	CC block placement <200m	m3	1328.01	238,500	316,730,385	3,816,029
US Chauhali	CC block placement >200m	m3	2365.12	238,500	564,081,120	6,796,158
Solimabad protection	Excavation	m3	167.65	47,250	7,921,463	95,439
Solimabad protection	Filling and placing of geobags	no	160.37	81,002	12,990,221	156,509
Subtotal					**2,572,463,414**	**30,993,535**

4.3.4 Embankment construction works

The cost estimate for the embankments is calculated using the survey data from the topographical survey and shall be updated with the drone survey topography during the detailed design stage. This data is then used to calculate the embankment height in this location and so the volume of earthworks that will be required from 0-3m up to 0 -11m as shown in the detailed cost estimate.

The cost estimates follows the BWDB schedule of rates whenever available or an engineers estimate and include contractors profit as well as taxes and VAT.

Site	Unit	No	Rate (BDT)	Amount (BDT)	Amount (USD)
Harirampur-Dohar	m	17.4	2,061,428.38	2,437,861,440	29,371,825
Shahjadpur	m	7.9	1,723.76	378,836,468	4,564,295
Subtotal				**2,816,697,909**	**33,936,119**

The quantities adopted are:

Site	Item	Unit	Rate	Quantity	Amount (BDT)	Amount (USD)
Harirampur-Dohar	Earthworks construction	m3	318.57	4,370,460	1,392,278,702	16,774,442
Harirampur-Dohar	Excavation	m3	213.08	939,000	200,082,120	2,410,628
Harirampur-Dohar	Cladding	m3	500.20	370,890	185,519,178	2,235,171
Harirampur-Dohar	Drainage	m	10,208.01	17,300	176,598,616	2,127,694
Harirampur-Dohar	Soil pavers and turfing	m2	184.62	906,290	167,319,484	2,015,897
Harirampur-Dohar	Wave protection	m2	2,911.38	80,200	233,492,361	2,813,161
Harirampur-Dohar	Special provisions	m	180.53	105,895	19,116,708	230,322
Harirampur-Dohar	Road crossings	no	2,046,912.00	31	63,454,272	764,509
Subtotal					**2,437,861,440**	**29,371,825**
Shahjadpur	Earthworks construction	m3	249.82	783,795	195,810,844	2,359,167
Shahjadpur	Excavation	m3	202.80	154,650	31,363,020	377,868
Shahjadpur	Cladding	m3	485.79	81,030	39,363,564	474,260
Shahjadpur	Drainage	m	566.33	15,922	9,017,355	108,643

Shahjadpur	Soil pavers and turfing	m2	200.26	509,900	102,110,421	1,230,246
Shahjadpur	Wave protection	m2	18.76	62,434	1,171,265	14,112
Shahjadpur	Road crossings	m	0.00	0	0	0
Subtotal					**378,836,468**	**4,564,295**
Total					**2,816,697,909**	**33,936,119**

4.3.5 Embankments Drainage Structures incl. Fish passes and fish sanctuaries

The cost estimates follows the BWDB schedule of rates whenever available or an engineers estimate and include contractors profit as well as taxes and VAT.

The second drainage regulator proposed at Shahjadpur is to be constructed on the embankment which is currently under construction as part of Tranche 1 and which was undersized. Regulator 2 proposed below is therefore to be constructed in parallel with the regulator which is currently being constructed under package W-04. A 10% allowance over the cost of Shahjadpur regulator 1 has been used as an initial cost estimate in order to allow for foundation improvement works.

Site	Unit	No	Rate (BDT)	Amount (BDT)	Amount (USD)
Harirampur-Dohar	no	7.0	271,086,521.74	482,051,107	5,807,845
Shahjadpur	no	2.0	60,121,936.42	129,262,163	1,557,375
Subtotal				**611,313,270**	**7,365,220**

4.3.6 Adaptation/ phased Strengthening Works

Procurement of works through national competitive bidding, as an on-call contract for the duration of 3 years. The cost estimate is based on adaptation works requirements in Tranche 1 and on rates from the Schedule of Rates of BWDB.

For Tranche 2, phased strengthening of existing and newly constructed bank protection works is planned for a total of 40 km, covering the locations outlined below. The strengthening required is based on survey data and river morphology. The total amount of strengthening proposed is approximately 75% of the total length of works. This is based on experience from Chauhali in Tranche 1 where 75% of the length of works launched more than 10m.

Location of works		Length of works	Strengthening implemented (km)	Strengthening required (km)
Existing	Kaijuri	10		7
	PIRDP	7		4
	Nagarbari	6		6
	Chauhali	7	3.5	4
	Zafarganj	2		
	Harirampur	9		6
	Subtotal	**41**	**3.5**	**27**
new	US Chauhali	12		10
	Benotia	3.5		3
	Subtotal	**15.5**	**0**	**13**
	Total	**56.5**	**3.5**	**40**

The estimated required quantities assume an average launching depth of 10m with a coverage of the launched slope with two layers and provision of a new apron with 8m width and three layers coverage. This amounts to 70 bags/m and to 2.8 million bags for 40 km, as shown in the table below.

Length	km	40
Av. Launching depth	m	10
Res. Length of slope	m	22.4
No of geobags on slope	no	23
Layers on slope	no	2
New apron width	m	8
New apron layers	no	3
No of geobags per m	no	70
Total no of bags	no	2,800,000

Experience from Chauhali and other locations has shown that some places launch more than 10m and up to 17 m in one season, but the average depth is about 10 m.

Site	Item	No	Rate (BDT)	Amount (BDT)	Amount (USD)
Adaptation	Filling and Dumping of geobag	40.0	139.06	389,368,000	4,691,181
Adaptation	250 kg geobag	40.0	313.77	878,556,000	10,585,012
				1,267,924,000	**15,276,193**

4.4 Equipment and Vehicles

Equipment and vehicles procurement will be in accordance with the procurement method shopping.

Item	Unit	No	Rate (US$]	Amount(US$)	Amount (BDT)
Pickup truck	No	8	30,000	240,000	19,680,000
Jeeps	No	4	30,000	120,000	9,840,000
Microbus	No	2	20,000	40,000	3,280,000
			Total	**400,000**	**32,800,000**

4.4.1 Office Equipment

All cost estimates are based on market rates and include the VAT of 5.5%, which translates into a tax rate of 5.21% of the base cost. 5% physical contingencies are deemed sufficient. Procurement method of these goods is shopping.

Item	Unit	No	Rate (US$)	Amount (US$)	Amount (BDT)
Desktop PC	No	13	750	9,750	799,500
Laptop PC	No	8	1,250	10,000	820,000
A3 Printer	No	5	1,250	6,250	512,500
Photocopier	No	6	1,250	7,500	615,000
Misc	LS	1	20,000	20,000	1,640,000
			Total	**53,500**	**4,387,000**

JRB1

Item	Qnty	Rate	Amount (US$)	Amount (BDT)
Desktop PC	1	750	750	61500
Laptop PC	1	1,250	1250	102500
Photocopier	1	1,250	1250	102500
Misc	1	LS	2000	164000
Total			5250	430500

JLB2

Item	Qnty	Rate	Amount(US$)	Amount (BDT)
Desktop PC	1	750	750	61500
Laptop PC	1	1,250	1250	102500
Photocopier	1	1,250	1250	102500
Misc	1	LS	2000	164000
Total			5250	430500

PLB1

Item	Qnty	Rate	Amount(US$)	Amount (BDT)
Desktop PC	1	750	750	61500
Laptop PC	1	1,250	1250	102500
Photocopier	1	1,250	1250	102500
Misc	1	LS	2000	164000
Total			5250	430500

PMO

Item	Qnty	Rate	Amount(US$)	
Desktop PC	10	750	7500	615000
Laptop PC	5	1,250	6250	512500
A3 Printer	5	1,250	6250	512500
Photocopier	3	1,250	3750	307500
Misc	1	LS	14000	1148000
Total			37750	3095500

4.4.2 Survey Equipment

All cost estimates include the VAT of 5.5%, which translates into a tax rate of 5.21% of the base cost. The procurement method is shopping

Item	Unit	No	Rate(US$)	Amount(US$)	Amount (BDT)
Speed boats	No	3	30,000	90,000	7,380,000
			Total	90,000	7,380,000

4.5 Social and Environmental Management

4.5.1 Livelihood support and training

The NGO recruitment method is QCBS for a national NGO.

NGO for livelihood support and training	Unit	Quantity	Rate	Amount	Amount USD
NGO cost	month	30	500,000	15,000,000	182,927
Training on site (Target about 2000 people)	no	160	150,000	24,000,000	292,683
Training residential (course for 20people each)	no	40	200,000	8,000,000	97,561
				47,000,000	**573,170.73**

4.5.2 Participatory community regular O&M

The cost for the participatory community regular O&M follows market prices and is explained in more details in the main feasibility study report however a high level cost breakdown is presented below.

Embankment WMOs	Unit	Unit cost	Quantity	Amount	USD
O&M sheds	no	1,800,000	10	18,000,000	219,512
O&M shed equipment	LS	200,000	10	2,000,000	24,390
INGO staff	month	200,000	48	9,600,000	117,073
INGO expenses	month	250,000	1	250,000	3,049
Total				**29,850,000**	**364,024**

4.5.3 Environmental Management and fisheries

The cost for the environmental management plan are based on market prices and the procurement method is QCBS. A detailed cost breakdown can be found in the EIA.

Mitigation/Enhancement	**EMP Cost**	**Cost in USD**	**Construction cost**		**Cost minus construction**
Item	(lac Tk.)	(M)		(M)	(M)
1. Fish Sanctuary (River-100km, Flood Plain-12nos.	3582	4.37	50%	2.18	2.18
Regulator with fish pass -9 nos. (35% of Construction cost is considered for fish pass)	2520	3.07	100%	3.07	0.00
2. Tree plantation	200	0.24	0%	0.00	0.24
3. Katkin/ Vetiver plantation on reclaimed land	200	0.24	0%	0.00	0.24
4. Environmental management	200	0.24	0%	0.00	0.24
5. Biodiversity baseline study & fisheries development study	440	0.54	0%	0.00	0.54
6. Contractors camp shed	200	0.24	0%	0.00	0.24
7. Water quality test and others	10	0.01	0%	0.00	0.01
Total	7352	9.0		5.26	3.71

4.6 Community-based Disaster Risk Management

The community-based disaster risk management includes a Project implementation unit, Capacity development and Study tours and an INGO package. The procurement method is QCBS for the PIU and INGO.

Component	Item	Description	Unit	Quantity	Rate (BDT)	Amount (BDT)	Amount (USD)
PIU (See below breakdown)	Allowance/ Salaries	Allowance/Salaries for PIU staff	LS	1	4,380,000	4,380,000	53,415
	Office equipment	Computer, air-con, printer, furniture etc	LS	1	1,690,000	1,690,000	20,610
	Operation cost	Cars, fuel, maintenance, communication etc.	LS	1	9,490,000	9,490,000	115,732
	Subtotal					**15,560,000**	**189,756**
Capacity Devt & Study Tour for DDM	Capacity devt training	Overseas for 20 persons	per person	0	595,000	0	0
	Study tour	Europe by Project Manager	LS	0	1,300,000	0	0
	Subtotal					**0**	**0**
INGO package	CbFRM project implementation		Year	3.6	20,000,000	72,000,000	878,049
	Subtotal					**72,000,000**	**878,049**
Total						**87,560,000**	**1,067,805**

4.7 Capacity Development (BWDB)

4.7.1 Local Training

Local training will be conducted in Dhaka with a number of training modules. Cost are in USD. The costs include 15% VAT as a large part is the cost for the resource persons, such as prominent professors from BUET. The defined scope limits the contingency to 5%.

Local training					
Item	Trainees	Number	unit	Rate (US$)	Amount (US$)
Technical training for main rivers	10	3	Course	20,000	60,000
O&M major adaptive works	10	2	Course	14,000	28,000
Environmental management	10	1	Course	14,000	14,000
Land acquisition and social safeguards	10	1	Course	14,000	14,000
GIS mapping	10	1	Course	14,000	14,000
Procurement	10	1	Course	14,000	14,000
Survey and data collection	10	1	Course	30,000	30,000
Numerical modeling	10	1	Course	14,000	14,000
DDM capacity development	10	2	Course	14,000	28,000
O&M for WMOs	10	2	Course	14,000	28,000
				Total	244,000

[1] river training techniques, riverbank stability, environment etc

[2] survey and evaluation, underwater investigations etc

4.7.2 International capacity development

International capacity development includes international training, international seminars and study tours.

International training					
Item	Trainees	Number	unit	Rate (US$)	Sum (US$)
Procurement	8	1	Course	140,000	140,000
River training techniques	10	1	Course	160,000	160,000
				Subtotal	**300,000**
International seminars	5	1	Conference / seminar	6,000	6,000
				Subtotal	**6,000**
Study tours					
North America	10	2	Tour	250,000	500,000
Europe	10	2	Tour	100,000	200,000
New Zealand	10	1	Tour	100,000	100,000
South America/ South Africa	10	2	Tour	100,000	200,000
Asia	10	4	Tour	60,000	240,000
				Subtotal	**1,240,000**
Total					**1,546,000**

4.7.3 Management Information Systems

The costs for all components include 15% VAT for the service provider. As the work will be started at the beginning of the program, contingency can be limited to 5%.

The procurement method is QCBS

MIS services	Unit	Rate	Amount BDT	Amount USD
1. Project website and database	LS	5,000,000	5,000,000	60,976
2. Scheme inventory and mapping system (Asset inventory)	LS	35,000,000	35,000,000	426,829
3. Smart project monitoring and management information system	LS	13,000,000	13,000,000	158,537
Total			**53,000,000**	**646,341**
*includes cost for MIS systems development/refinement/improvement, Data entry, Training of BWDB staff, Workshops and Operation and troubleshooting				

4.8 Project Management Consultant

The Project management consultant will continue the implementation of the works that were started in Tranche 1 and expand and maintain the knowledge base that has been built in the River study in Tranche 1.

(i) Implementation Support
(ii) River Stabilization Study
(iii) Land Recovery Pilot
(iv) Feasibility Study and Detailed Design of Tranche-3 works

The base cost includes 15% VAT, the foreign component of which will be provided by Government in line with common consulting recruitment practice.

The total consultancy is about US$11M, consisting of the ISPMC team which includes the Tranche 3 preparation team and the Knowledgebase update. Another US$4M is allocated for studies on various subjects as outlined below.

Detailed Cost Estimates

ISPMC and Tranche 3 preparation

ISPMC & T3			
Item	**Quantity**	**Rate**	**Budget**
International Consultants Salary (month)	162	-	3,725,000
Flights (number)	69	4,000	276,000
Allowances (days)	3,572	150	535,813
National Consultants Salary (month)	510	-	1,709,000
Office operation and support (Month)	48	4,800	230,400
Reporting (LS)	1	25,000	25,000
Cars (Procurement and operation)	48	6,200	297,600
Workshops and seminars (LS)	1	50,000	50,000
Supporting studies (LS)	1	225,000	225,000
Contingencies	1	180,000	180,000
Subtotal			**7,073,813**

Knowledgebase update

Knowledgebase update (KBU)			
Item	**Quantity**	**Rate**	**Budget**
International Consultants Salary (month)	76	-	1,785,000
Flights (number)	33	4,000	132,000
Allowances (days)	1,672	150	250,800
National Consultants Salary (month)	159	-	883,000
Office operation and support (Month)	48	4,800	230,400
Reporting (LS)	1	11,000	11,000
Cars (Procurement and operation)	48	6,200	297,600
Workshops and seminars (LS)	1	26,000	26,000
Contingencies	1	85,000	85,000
Subtotal			**3,700,800**

Pilot studies and works and third party studies

Pilot studies and works and third party studies			
Item	**Quantity**	**Rate**	**Budget**
Offtake modeling and distributaries study	1	1,500,000	1,500,000
Fisheries studies	1	750,000	750,000
Main rivers monitoring survey	1	500,000	500,000
Safeguard studies	1	500,000	500,000
Subtotal			**3,250,000**

Suggested Teams:

ISPMC

International	***National***
Team leader	Deputy Team Leader
Database and MIS specialist	Social/ gender specialist
Social/ Resettlement specialist	Environmental specialist
Environmental specialist	Institutional specialist
Institutional specialist	Training coordinator
River engineer	MIS operator
Senior Morphologist	River engineer
Senior Modeller	Design engineer
Morphologist	Surveyor
River modeller	Geotechnical engineer
Sediment specialist	Senior morphologist
Construction engineer	Junior morphologist
Quality control specialist	Senior construction engineer
Economist	Site engineer RBP
Design engineer	Site engineer EMB
Geotechnical engineer	Site engineer Sand plug
Pool of engineers	Divers
	Economist
	Financial specialist
	Procurement/ Contract specialist
	DDM lead
	DDM organizer

Knowledgebase update

International	***National***
Database and MIS specialist	Social/ gender specialist
Environmental specialist	Environmental specialist
River engineer	MIS operator
Morphologist	River engineer
River modeller	Design engineer
Sediment specialist	Surveyor
Pool of engineers	Geotechnical engineer
	Senior morphologist
	Junior morphologist
	Junior engineers
	Office manager

4.9 PMO BWDB Operation

BWDB will operate a project management office in Dhaka and four sub-project management offices at the sites. One of the four offices is the established Kaitola division under the PD JMREMP, while the other offices will be part of the existing divisional offices. No taxes have been applied to the cost estimates.

PMO/SMO	Description	Unit	Qnty	Unit (US$)	Amount (US$)
PMO	Salaries	Year	4	50,084	200,337
	Office rent incl electricity, internet etc	month	48	2,439	117,073
	Operation	Year	1	506,825	481,484
	Subtotal				681,821
SMO, Kaitola	Salaries	Year	4	32,408	129,630
	Operation	Year	4	47,025	178,695
	Subtotal				308,325
SMO, Tangail	Salaries	Year	4	32,408	129,630
	Operation	Year	4	47,025	178,695
	Subtotal				308,325
SMO,Manikganj	Salaries	Year	4	32,408	129,630
	Operation	Year	4	47,025	178,695
	Subtotal				308,325
	Salaries				589,227
	Operation				1,134,642
					1,723,869

Breakdown of staff cost [BDT]

Item	Unit	No	Rate	Amount
PMO			USD	
Salary of Officer & Staff	Year	4	50,084	200,337
House rent	Year	4	90,000	360,000
Fuel for vehicles	Year	4	9,375	37,500
Vehicle maintenance	Year	4	9,375	37,500
Stationaries	Year	4	12,500	50,000
SMO JRB-1				
Salary of Officer & Staff	Year	4	32,408	129,630
Vehicle maintenance	Year	4	3,750	15,000
Fuel for vehicles	Year	4	3,750	15,000
Stationaries	Year	4	3,750	15,000
SMO JLB-2				
Salary of Officer & Staff	Year	4	32,408	129,630
Vehicle maintenance	Year	4	3,750	15,000
Fuel for vehicles	Year	4	3,750	15,000
Stationaries	Year	4	3,750	15,000

Item	Unit	No	Rate	Amount
SMO PLB-1				
Salary of Officer & Staff	Year	4	32,408	129,630
Vehicle maintenance	Year	4	3,750	15,000
Fuel for vehicles	Year	4	3,750	15,000
Stationaries	Year	4	3,750	15,000
				1,209,227

Breakdown of SMO Staff

Designation	No	Annual Salary
Project Director (CE/ACE)	1	917,880
Superintending Engineer	2	1,708,800
Executive Engineer	4	3,352,800
Sub-Divisional Engineer (Civil)	4	3,216,480
Asstt. Engineer/AD	1	643,200
DD/Accounts Officer	1	480,000
UD Asstt.	1	150,000
Sr. Accounts Asstt.	2	300,000
LD Asstt. Cum Typist/DEO	1	145,000
DEO(PA to PD)	1	145,000
Driver	3	420,000
Guard	2	200,000
MLSS	4	400,000
Total:	**27**	**12,079,160**

4.10 Contingencies

The contingencies are of the form of emergency dumping works for 15 km and additional dredging to choke the Solimabad channel.

APPENDIX A

Evolution of riverbank protection designs

The design for riverbank protection revetments has undergone a series of developments from the first application in the 1990s with just CC blocks under the FAP programs, the low-cost designs of JMREMP and FRERMIP Tranche-1 to the designs proposed in the original study from 2018 and ultimately the now proposed works for FRERMIP Tranche 2 based on the recommendations of the Technical committee 2 meeting from October 2018. Alongside differences in performance and implementation, which are not covered here, the changes in design had an impact on the cost.

This appendix provides a short comparison of the recent designs in terms of cost and cost development.

1. Below-low water protection

The table below summarizes some key parameters and average cost per km. In both options, the protection material along floodplain banks is directly dumped onto the existing underwater slope. Protection along chars is dumped onto a dredged slope, dredged to 10 m below low water level under a very flat angle of 1V:6H. This increases the safety of the protection as it is "pre-launched" and the additional launching occurs in deeper depths in more consolidated soils and also further away from the river bank, mitigating the risk of slope failures affecting the upper slope. The cost of composite is about 520% of the geobag-only cost for the protection along floodplain banks and about 210% for the "pre-launched" protection along char banks.

Parameter	**Geobag-only**	**Composite**
Material placed	228 geobags/m for 76 m* 306 geobags/m for 102 m*	205 geobags/m under 34 m³ of CC blocks/m
Design scour	-27 mPWD	-27 mPWD
Dredged slope	Along chars at 1V:6H to 10 m below low water level	none
Cost per km	about $1.5 M without dredging about $3.7 M with 10 m dredging about $5.8 M with 15 m dredging	about $7.8 M along floodplain

*37 and 62 m long slope without and with dredging respectively and additional 40 m wide apron

2. Above-low water protection

To protect the banks from erosion through wave impact and because the use of geobags without cover is not possible due to degradation of the material through UV radiation, hard protection is recommended to be placed on the bank above low water level. Traditionally, CC blocks have been used, which are cast and then placed on a constructed slope on a khoa and geotextile filter. During FRERMIP Tranche-1, the use of grout-filled jute mattresses has been piloted for the use as wave protection. This technology has the advantage of fast implementation, minimal land use otherwise required for the casting of CC blocks and reduced cost due to smaller thicknesses compared to CC blocks.

The table below compares some key parameters of grout-filled jute mattress and CC block wave protection. The cost per kilometer for the grout-filled jute mattress is about 74% of the traditional protection using CC blocks.

Parameter	Grout-filled Jute Mattress (GFJM)	CC blocks
Material placed	Grout-filled mattresses	CC blocks with thickness of 300 mm
Design slope	1V:3H (to be confirmed after geotechnical investigation)	1V:3H
Berm	3 and 5 m width (to be determined after geotechnical investigation), cut into bankline	3 m wide berm
Cost per km	about $1.6 M	about $2.16 M

3. Overall cost comparison

Bank protection using composite underwater protection and CC block wave protection cost about $10 million per kilometer, as opposed to between $3.7 and $6 million for protection along consolidated floodplains and along chars using geobag-only underwater and GfJM as wave protection respectively. Providing a “pre-launched” dredged slope increases the geotechnical stability, as further launching to design scour depth results in a shorter slope compared to launching from the original river bed. Geotechnical investigations prior to the implementation of wave protection is advised to mitigate the risk of overloading the slope.

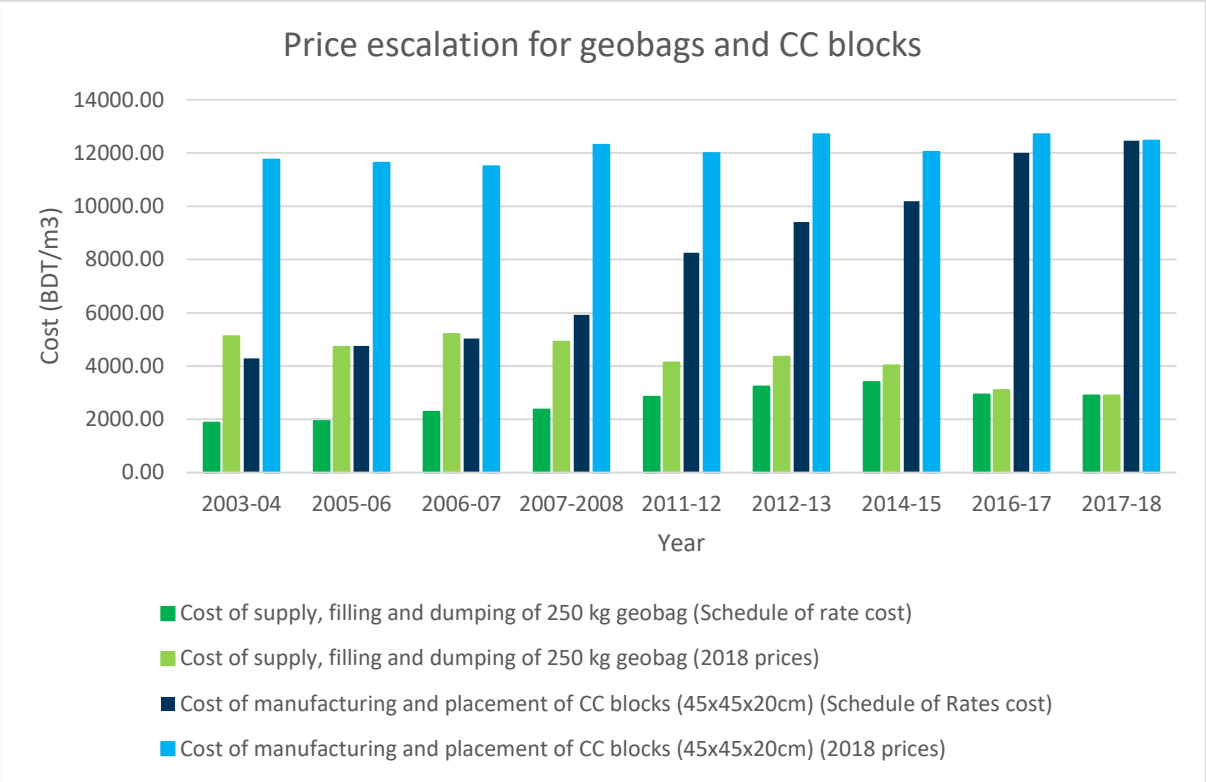
4. Development of cost

The cost of every infrastructure measure is depending on the material cost and the implementation cost, mostly associated with the labour intensity of the work. Both factors are culminated in the schedule of rates prepared by the BWDB design office for commonly used items and updated annually. This gives the opportunity to compare cost developments over time, based on a consistent methodology for estimation of prices and work effort, making the rates comparable. For a meaningful comparison, historic prices have to be adjusted for inflation to eliminate effects of normal cost escalation and to assess the cost escalation of an individual item.

In below table and graph, the price escalation for the two most important protection elements, geobags and CC blocks are summarized for a 15-year period from 2003/04 to 2017/18. As geobags and CC blocks have very different volumes, all numbers have been calculated for one cubic meter.

Description	2003-04	2005-06	2006-07	2007-2008	2011-12	2012-13	2014-15	2016-17	2017-18
Cost of supply, filling and dumping of 250 kg geobag (Schedule of rate cost)	1868.33	1930.95	2279.39	2364.48	2843.87	3225.36	3403.91	2934.01	2892.13
Cost of supply, filling and dumping of 250 kg geobag (2018 prices)	5120.34	4718.61	5205.68	4913.58	4132.91	4352.20	4021.28	3103.60	2892.13
Cost of manufacturing and placement of CC blocks (45x45x20cm) (Schedule of Rates cost)	4288.88	4761.78	5036.78	5921.66	8253.70	9411.32	10191.20	12007.53	12466.03
Cost of manufacturing and placement of CC blocks (45x45x20cm) (2018 prices)	11754.09	11636.22	11503.02	12305.65	11994.86	12699.33	12039.61	12701.57	12466.03

The comparison shows that CC blocks are not only more expensive than geobags, but that also the increase in cost has been higher than for geobags, which have gotten cheaper over time. Geobags show an average inflation of about 4.55%, about half of CC blocks with 8.70%, at an overall average inflation rate in Bangladesh of 7.37%.



Consultant's Report

Flood and Riverbank Erosion Risk Management Investment Program

A 4.2 ECONOMIC FEASIBILITY

August 2019

Prepared by

Institutional Strengthening and Project Management Consultant (ISPMC)

Joint Venture of Northwest Hydraulic Consultants Ltd. and Euroconsult Mott MacDonald Ltd. in association with Deltares, Resource Planning and Management Consultants and CEGIS

TABLE OF CONTENTS

ACRONYMS

ADB	-	Asian Development Bank
BBS	-	Bangladesh Bureau of Statistics
BDT	-	Bangladesh Taka
BDTM	-	Bangladesh Taka Million
BEZA	-	Bangladesh Economic Zone Authority
DDM	-	Department of Disaster Management
EIRR	-	Economic Internal Rate of Return
EZ	-	Economic Zone
FRERMIP	-	Flood and Riverbank Erosion Management Investment Program
GoB	-	Government of Bangladesh
GFM	-	Grout Filled Mattress
Ha	-	Hectare
Km	-	Kilometer
LGED	-	Local Government Engineering Department
MFF	-	Multi-tranche Financing Facility
NPV	-	Net Present Value
O&M	-	Operation and Maintenance
PPP	-	Public Private Partnership
PPTA	-	Project Preparation Technical Assistance
SCF	-	Standard Conversion Factor
SWRF	-	Shadow Wage Rate Factor

1 INTRODUCTION

1.1 Study Objectives

The main objectives of the economic assessment are to:

- Update and revise the economic analysis undertaken by the PPTA in 2013 [3] with respect to assumptions for the three main benefit streams, i.e. avoided erosion losses, avoided flood losses, and incremental agricultural benefits;
- Identify additional benefit streams (such as char land reclamation) which are relevant to the shifting focus from passive riverbank protection works to more active river stabilization;
- Estimate the economic benefits and costs of mitigating riverbank erosion, alleviating flooding, and developing char land at three priority sub-projects along the Jamuna and Padma rivers; and
- Assess the economic viability of investments in riverbank protection works, flood embankments, dredging and char land development being implemented under Tranche-1 and Tranche-2 of the ADB's Multi-tranche Financing Facility (MFF) (the Program).

With respect to the revision of PPTA economic analysis, it should be noted that:

- Incremental agricultural benefits likely to result from the construction of the flood embankment along the Padma Left Bank (PLB-1) were overstated. The expected increases in cropping intensity and crop yields were too high and, due to the limitations to the flood modelling, the area benefited area did not adequately take account of the likelihood of flooding from the Jamuna River. This was acknowledged during the ADB appraisal of the PPTA and this agricultural benefit stream was omitted from the final economic analysis;
- PPTA analysis of the flood damage to crops, buildings and roads was also modified during the ADB appraisal and the present study has used the final ADB analysis as the basis for the assessing the economic benefits of flood protection. However, this analysis does not take account of the loss of building contents and vehicles as well as loss of life;
- Value of land lost due to riverbank erosion was underestimated in the PPTA and the present study has used prices for agricultural, settlement and commercial land based on field investigations in 2018;
- In contrast to the PPTA analysis, the present study has also taken account of the future expansion of settlements and infrastructure in areas vulnerable to flooding and erosion over the next 30 years. This has also increased the economic benefits of flood embankments and riverbank protection works;
- In the present study, char land reclamation has now been included in the economic analysis of sub-project areas where char land will be converted back to floodplain land[4] and protected from riverbank erosion.

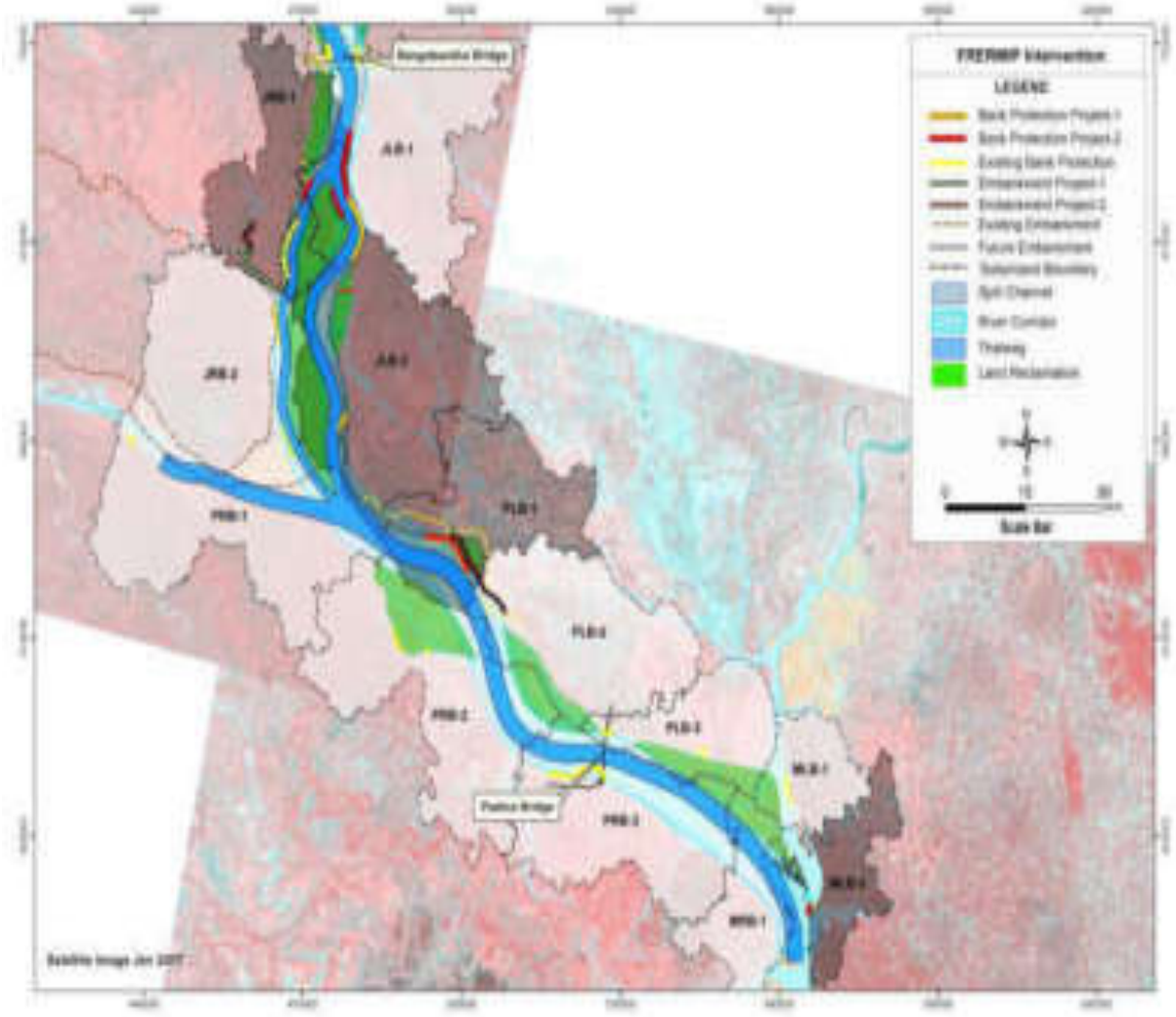
[3] Main River Flood and Bank Erosion Risk Management Program, Final Report, Annex G: Economic Assessment, December 2013 (Project Preparatory Technical Assistance 8054 BAN)

[4] The widening of the Jamuna River over the last 40 years has converted on average 4km of floodplain land into lower value char land and sandbars, which FRERMIP attempts to recover to a small extent. As such, char land development pertains to the reconstruction of lost floodplain land with respect to: (i) protecting the char land against future erosion to make it a stable and integral part of the floodplain, and (ii) allows the river to build up the char land in height to reach the former floodplain level. This vertical accretion process takes mostly place during the first five years after stabilization. Therefore, char land protected against erosion during Tranche 1 and 2 can receive flood protection during a following Tranche. An

1.1 Study Area

The following three priority sub-projects were included in the economic assessment: (i) Jamuna Right Bank 1 (JRB-1), (ii) Jamuna Left Bank 2 (JLB-2); and (iii) Padma Left Bank 1 (PLB-1). The locations of the priority sub-projects are shown in Figure 1-1.

Figure 1-1 Location of Priority Sub-projects



1.2 Data Availability

For the purposes of this economic analysis, the estimation of economic benefits has been mainly based on secondary data, particularly the PPTA economic analysis, as well as more recent field surveys. Further studies will therefore be required to undertake a more detailed assessment of the economic benefits of mitigating riverbank erosion and flooding including: (i) analysis of changes in river morphology and riverbank erosion resulting from protection works, and (ii) collection of primary data from the areas likely to benefit from the riverbank protection and flood mitigation measures.

example is the char at Harirampur, which was protected against erosion during Tranche-1 and will receive flood protection during Tranche-2.

Furthermore, the development of char land will also require detailed land use planning as well as the preparation of agricultural and rural development programs.

In addition, given the unpredictable nature of flooding and frequent changes in river morphology, riverbank stabilisation and flood mitigation works requires continual revision. Consequently, the cost estimates for proposed interventions are preliminary and detailed sub-project costs (including engineering works, land acquisition/resettlement and environmental mitigation) will depend on the designs finalised immediately prior implementation. These cost estimates also include additional funds for emergency works.

2 ECONOMIC ANALYSIS OF TRANCHE 1 AND 2

2.1 Main Interventions

The following table summarises the main interventions proposed for each priority sub-project area under Tranche 2 of the MFF. The river bank protection works constructed along the river reaches at JLB 1 and PLB 1 under Tranche 1 are also presented. Similarly, the flood embankment being constructed at JRB-1 under Tranche 1 is also shown.

Table 2-1 Main Interventions at Sub-projects under Tranche 1 and 2

Sub-project	River Bank Protection		Flood Embankment		Closure Dam & Regulatory Structures (Tranche 2)	Char land Develop-ment (Tranche 2)
	Constructed (Tranche 1)	Proposed (Tranche 2)	Constructed (Tranche 1)	Proposed (Tranche 2)		
JRB-1		3.5 km	21.3 km	7.9 km		
JLB-2	10.0 km	12.0 km			Channel	6,000
PLB-1	8.8 km			17.4 km	7 structures	1,700 ha
Total	18.8 km	15.5 km	21.3 km	25.3 km		7,700

N.B. 10.5 km of emergency river bank protection works would also be built at Solimabad (JLB-2) under Tranche 2.

Under Tranche 2, the design for JRB 1 proposes the construction of bank protection works at Benotia (3.5 km), but no protection works at Enayetpur or on the Central Char at Salura. At JLB-2, 12.0 km of revetment works are proposed to be built upstream of Chauhali and 10.5 km of emergency protections works would be constructed at Solimabad. In addition, a closure will also be built to close off the bank line channel downstream of Chauhali and this will facilitate the reclamation of about 6,000 ha of char land at Solimabad.

With regard to flood protection, the original proposals remain unchanged with 17.4 km of flood embankment to be built at PLB-1 and a further 7.9 km of flood embankment to be reconstructed at JRB-1. In addition to protecting a significant area of the mainland from flooding, 1,700 hectares of char land at Harirampur will also be reclaimed for agricultural and residential development.

Under Tranche 2, it is anticipated that the proposed riverbank stabilisation and flood protection works at JRB-1 as well as the revetment works and channel closure at JLB-2 would be constructed over a period of 3 years, while the proposed flood embankment at PLB-1 would be undertaken over 2 years (excluding the time required for land acquisition and resettlement).

2.2 Economic Benefits

2.2.1 Riverbank Protection and River Stabilization

At Chauhali and Harirampur, land and settlements are now being protected from riverbank erosion by the revetment works which were built under Tranche 1 and it has been estimated that 1,440 hectares at JLB-2 (Chauhali) and 1,350 hectares of land at Harirampur (PLB-1) will be protected from bank erosion over the 30 year life of the project.

Under Tranche 1 and 2, it is estimated that the revetment works and channel closure at JLB-2 would protect 2,910 hectares of mainland along the Jamuna right bank, as well as 2,300 hectares of char land, during the project lifetime. Furthermore, the proposed 3.5 km of revetment at JRB-1 is expected to protect about 575 ha of mainland at Benotia.

The value of land and assets which will be saved from bank erosion were estimated at an average of BDT 4.57 million per hectare in PLB 1, BDT 6.18 million per hectare in JLB 2 and BDT 7.28 million per hectare for JRB-1. For charland areas protected from bank erosion at JLB-1, a land value of BDT 1.24 million per hectare was used.

It has been assumed that the economic benefits of the bank protection works begin when the works are completed and there is no risk of further erosion. For the channel closure at Solimabad, the economic benefits start when the closure is built and the channel is closed. In addition, it has also been assumed that there would be an overall increase in the value of land at the rate of 3% per annum for mainland areas.

Based on the NPV of annual benefits over a 30 year period, the economic benefits of mitigating riverbank erosion are shown in Table **2**-**1** and it can be seen that economic benefits from river bank protection works range from BDT 1,160 million at JRB-1 to BDT 5,675 million at JLB-2. While the economic benefits of the proposed river stabilization works at PLB-1 are estimated at BDT 1,889 million.

2.2.2 Flood Mitigation

Reduced Flood Damage

The economic benefits of constructing a 28.9 km flood embankment at JRB-1 (under Tranche 1 and 2) and a 17.4 km flood embankment at PLB-1 (under Tranche-2) were estimated on the basis of the number and value of the main assets located within the vulnerable area to be protected from future flooding, and the probability of damage under various flood scenarios. It is estimated that an area of 30,000 hectares at JRB 1 and 12,000 hectares at PLB 1 would benefit from the construction of flood embankments.

Agricultural crops, buildings and roads are the major types of assets vulnerable to flooding in the sub-project areas. Data on these assets were obtained from the economic analysis undertaken for the PPTA in 2013[5]. The flood damage data in the PPTA analysis were obtained from the Department of Disaster Management (DDM) upazila estimates for the 1988, 2003 and 2007 flood events. The

[5] Main River Flood and Bank Erosion Risk Management Program, Final Report, Annex G: Economic Assessment, December 2013.

probabilities (return periods) for these flood events were estimated at 0.01 (100 years), 0.5 (2 years), and 0.05 (20 years) respectively. The estimates of the expected annual damage values for specific assets were derive from:

- Crop areas which were partially or completely lost due to floods in the sub-project areas, and the average value of production per hectare for the Aman rice crop were used to estimate the overall value of crop losses;

- Number of buildings within the sub-project area was based on data reported in the BBS surveys in 1991 and 2001, from which estimates for 2018 were derived by applying the average annual growth rate for three categories of building (i.e. urban, rural and municipal). The proportions of each building category either partially or totally damaged by the 1988, 2003 and 2007 flood events were then applied to the projected number of buildings in 2018. The replacement costs were estimated at BDT 635, BDT 505 and BDT 190 per ft^2 for municipal, urban and rural buildings respectively and these unit values were multiplied by the number of totally damaged buildings. The value of damage for partially damaged buildings was assumed to be 50% of replacement cost. Expected annual damage values were then derived for each building category by applying the probability of the flood events to the damage values.

- For roads, the lengths of roads in a sub-project area in each flood year were derived from BBS data, and the damage to roads in each flood year was derived from DRR upazila data. The annualized value of road damage has also been estimated based on the probability of damage for the three flood events. Two types of roads have been analysed (paved and earthen) and construction costs have been based on unit rates of the Local Government Engineering Department (LGED). For paved roads, in the absence of a breakdown of BBS and DRR data for upazila and union type roads, an average of the LGED rate of BDT 11,128,500 per km has been used. While, for earthen roads, the LGED rate of BDT 3,175,000 per km has been applied.

- Overall increase in the value of assets at the rate of 3% per annum was applied. This annual increase is based on the expected rate of development, e.g. house construction and infrastructural improvements, within the sub-project areas.

Based on the above analysis, the NPV of the economic benefits generated by flood embankments at JRB-1 (under Tranche 1 and 2) and PLB-1 (under Tranche 2) were estimated at BDT 12,431 million for JRB-1 and BDT 2,914 million for PLB-1. The economic benefits of flood mitigation at PLB-1 are notably lower than the benefits at JRB-1, because it is anticipated that, prior to the construction of the flood embankment along the JLB-2 river reach (under Tranche 3), flooding from the Jamuna River will continue inundate a significant proportion of the area within PLB-1.

Increased Agricultural Production

In addition to mitigating flood damage, increases in crop production are likely to be gained from reduced flooding in JRB-1 and PLB-1. Based on land types by flood depths (i.e. F1, F2, F3 and F4), cropping patterns were determined for both with and without flood embankment situations. The changes in cropping patterns are shown in Table **2**-**2** and it is evident that an increase in crop production would mainly derive from the switch to high yielding rice crops in the monsoon season (i.e. from DW Aman to HYV Aman) as a result of reduced flooding. Furthermore, there would be a decrease

in flood duration which would facilitate earlier dry season cropping. The cropping intensity is also expected to rise from 217% to 233%.

Table 2-2 Cropping Patterns With and Without Flood Protection

Crop	% of Cultivated Area	
	Without Flood Protection	With Flood Protection
Aus	4%	4%
HYV Aman	26%	52%
DW Aman	49%	34%
HYV Boro	53%	54%
Jute	9%	9%
Pulses	10%	8%
Wheat	5%	5%
Potato	3%	3%
Oilseeds	26%	32%
Maize	10%	10%
Chili & Water Melon	9%	9%
Vegetables	13%	13%
Total Cropped Area	217%	233%

To estimate the economic benefits of reduced flooding, economic crop budgets[6] were prepared in order to estimate the net economic benefits per hectare for each crop in both the with and without project situations. The economic net benefits per ha were then applied to the crop areas and the total net economic benefits were estimated. By deducting without project net benefits from with project net benefits, incremental net economic benefits from crop production were derived. It was also assumed that these incremental net benefits would be fully achieved three years after completion of the flood embankments.

The NPV of the incremental annual net benefits from crop production over a 30 year period were estimated at BDT 562 million for JRB-1 and BDT 274 million for PLB-1.

In addition to increasing crop production, it is also anticipated that a reduction in flooding would facilitate an increase in culture fish production through both an expansion of fish ponds and an improvement in fish productivity. To estimate the economic benefits of reduced flooding, the net economic benefits from culture fish farming (in both with and without project situations) were estimated. The economic net benefits per hectare from fish ponds were then applied to the with and without project fish pond areas. By deducting without project net benefits from with project net benefits, incremental net economic benefits from culture fish production were derived. The NPV of the incremental economic net benefits from culture fish production was estimated at BDT 385 and BDT 126 million for JRB-1 and PLB-1 respectively.

[6] Crop budgets were prepared using information on crop yields, crop inputs, labour and machinery requirements, as well as produce prices, input price, wage rates and machinery hire charges, relevant to the study areas.

2.2.3 Char land Development

Land Use Plan

At present, char lands are being partially used by local people to grow a range of crops to meet their subsistence requirements, but there is a high proportion of unutilised land. Soil fertility and water retention are poor, and farmers use traditional practices to improve soil structure and fertility over a long period of time. As char land is also subject to extensive flooding during the monsoon season, cropping intensity and crop productivity are therefore very low.

However, following riverbank stabilisation and the attachment of the chars to the mainland, there is considerable potential for the development of reclaimed char land. For the purposes of the economic analysis, preliminary land use plans for char land development at JLB-2 (Solimabad), PLB-1 (Harirampur) and JRB-1 (Central char) were therefore prepared (see Table **2**-**3**) and theses plans provided the basis for future land development.

Table 2-3 Preliminary Land Use Plans for Selected Char lands [1/]

Land Use	JRB-2 (Central char)		JLB-2 (Solimabad)		PLB-1 (Harirampur)	
	Area (ha)	% of Total	Area (ha)	% of Total	Area (ha)	% of Total
Agriculture	1,700	85%	4,500	75%	1,020	60%
Fisheries/Ecology	200	10%	600	10%	85	5%
Forestry	100	5%	300	5%	85	5%
Settlement	0	0%	600	10%	510	30%
Total	2,000	100%	6,000	100%	1,700	100%

1/ Land use plan for char land areas expected to be achieved by Year 20.

Agricultural, Livestock and Fisheries Production

To achieve sustainable crop production, improve methods of soil amelioration would be adopted. These methods include sesbania cultivation, mulching, green manuring, fertiliser use, contour ploughing over a period of 10 years. Recommended mixed cropping system (including legumes) would be initiated after 5 years and there would be a very gradual increase in rice production over the next 15 years. By Year 20, it is anticipated that productive, mixed cropping systems would be fully established. The future cropping pattern is given in Table **2**-**4** and it is evident that high cropping intensity would be reached (i.e. 260%) at Harirampur. However, due to the lack of flood protection at Solimabad, it has been assumed that a cropping intensity of 200% would be obtained, i.e. similar to the existing mainland area which remains unprotected. This cropping pattern and cropping intensity was also used for the unprotected Central char area.

Table 2-4 Future Cropping Patterns on Char lands [1/]

Crop	JRB-2 (Central char)		JLB-2 (Solimabad)		PLB-1 (Harirampur)	
	Area (ha)	% of Total	Area (ha)	% of Total	Area (ha)	% of Total
Local/HYV	340	10%	450	10%	357	35%
HYV Aman	850	25%	1,125	25%	510	50%
DW Aman	1,700	50%	2,250	50%	0	0%
Groundnut	1,700	50%	2,250	50%	204	20%
Water Melon	170	5%	225	5%	255	25%
Chili	170	5%	225	5%	306	30%
Wheat	170	5%	225	5%	102	10%
Potato	170	5%	225	5%	51	5%
Oilseeds	850	25%	1,125	25%	51	5%
Maize	340	10%	450	10%	255	25%
Vegetables	340	10%	450	10%	561	55%
Total	**3,400**	200%	**9,000**	200%	**2,652**	**260%**
Cultivated Area	1,700		4,500		1,020	

1/ Cropping patterns for char land areas expected to be achieved by Year 20.

On the basis of the expected crop yields, crop inputs, labour and machinery requirements as well as produce/input prices and wage rates, economic crop budgets were prepared in order to determine the economic net returns per hectare for each crop. The economic net returns per ha were then applied to the crop areas to derive the total net economic benefits from crop production.

As a result of an increase in the supply of cereals and fodder (mainly from crop by-products), it is anticipated the number of cattle, buffalo, sheep, goats and poultry would gradually increase. Livestock are a source of a wide range of products including milk, meat, and manure, as well as cash income, but productivity is very low. However, an improvement in livestock productivity is expected to arise due to the adoption of better livestock husbandry practices, particularly with respect to nutrition and animal health care. Based on future increases in livestock numbers and economic net returns per head (from improved productivity), the economic benefits from livestock production were estimated.

Following the construction of flood embankments, it is also envisaged that there would be an increase in capture fish production from khals, rivers, beels and other water bodies. Similarly, the flood-free environment would encourage the development of fish ponds and the gradual uptake of culture fish production. Based on future increases in the net value of capture fisheries, as well as the expected development of fish ponds and the net returns from aquaculture, the economic benefits of capture and culture fisheries were estimated.

Settlements

With the availability of reclaimed char land, there would be considerable demand (particular from households recently displaced by riverbank erosion as well as landless households in the local areas) at both Chauhali and Harirampur for the development of rural settlements on stabilised char land. Settlements would include houses, shops, schools, health centres and community buildings as well as associated public infrastructure such as rural roads, electricity supply and telecoms.

With the provision of serviced plots for residential use, households would be able to establish houses and shops in settlement areas with the government providing public buildings and infrastructure. It is envisaged that settlements would require between 10% (Solimabad) and 30% (Harirampur) of the reclaimed char land area, and it is assumed that the settlements would be developed over a period of 10 years in Solimabad following completion of the river protection works and 5 years in Harirampur following completion of the riverbank protection and flood embankment works.

In the economic analysis, the benefits of settlements on reclaimed land have be estimated by valuing the char land area allocated to settlements at the incremental economic value of land, i.e. the difference between settlement land value per hectare and the value of char land per hectare under current conditions. The incremental economic value of settlement land was estimated at BDT 4.94 million per ha in PLB-1, BDT 3.71 million per ha in JLB-2.

Economic Benefits of Char land Development

Based on the estimates of the economic benefits which are likely to be derived from agricultural development (i.e. crop, livestock and fisheries production) as well as the establishment of rural settlements, the overall economic benefits from char land development were determined. The incremental economic benefits of char land development at Solimabad, Harirampur and the Central char are presented in Table **2**-**5** and it is can be seen that char land development would generate significant economic benefits. Calculated on a net present value (NPV) basis, the economic benefits range from BDT 769 million at Central char to BDT 2,151 million at Solimabad and 2,302 million at Harirampur. It is also evident that the development of settlement areas in Solimabad and Harirampur would generate a high proportion of the economic benefits with settlements providing 45% to 72% of the benefits from char development, respectively.

Although agricultural development appears to make a smaller contribution to the economic benefits, it should be noted that the very long period (20 years) needed to achieve full crop production, due to the necessary soil amelioration measures, significantly reduces the NPV at an annual discount rate of 10%. Consequently, a productive agricultural area would make a significant contribution to the economic benefits of char land development in the long term.

Table 2-5 Incremental Economic Benefits of Char land Development (BDT million)

Sector	JRB-2 (Central char)		JLB-2 (Solimabad)		PLB-1 (Harirampur)	
	Benefit (BDT M)	% of total	Benefit (BDT M)	% of total	Benefit (BDT M)	% of total
Crop	582	76%	697	32%	385	17%
Livestock	67	9%	154	7%	73	3%
Fisheries	120	15%	349	16%	177	8%
Settlement	0	0%	951	45%	1,667	72%
Total	**769**	**100%**	**2,151**	**100%**	**2,302**	**100%**

N.B. Economic benefits based on net present value (NPV) over 30 years discounted at 10% per annum.

2.2.4 Road Transport

It is envisaged that roads would be constructed on the flood embankments at JRB-1 and PLB-1 following the completion of the embankment works. The design and construction of the roads would be the responsibility of LGED, so this is regarded as an indirect benefit of the project.

With respect to the economic benefits of embankment roads, the vehicle operating costs (VOC) approach (as recommended by the LGED guidelines, 1999) was adopted to determine the benefits of improved accessibility resulting from the construction of paved roads on embankments. The VOC approach is based on the estimated reduction in VOCs of motorized and non-motorized vehicles following the implementation of a road project.

The without project annual average daily traffic flow was estimated for the roads within close proximity of the planned embankment road. A traffic survey was undertake to count the following categories of vehicles: motorized vehicles (auto-rickshaw, taxi, car, motorcycle, pick-up, microbus, bus, minibus, truck, tractor); non-motorized vehicles (bicycle, bullock cart, rickshaw, rickshaw van); and pedestrians.

As the traffic counts were only conducted during the day time (once on a market day and once on a non-market day), the following assumptions were made to derive the annual average daily traffic (AADT). The day-time 12-hour data was converted to 24-hour data using factors of 30 % for night-time traffic on non-hat days and 45% for night-time traffic on hat days. The number of hat and non-hat days per week is assumed to be two and five, respectively. Furthermore, traffic during the wet season is assumed to be 20% less than in the dry season.

The economic benefits of road construction were then derived from: (i) existing traffic on nearby roads which will probably be diverted, and (ii) estimated increases in traffic volume generated by the new embankment road. In addition, an 8% annual increase in the traffic volume is assumed (based on a 5.5 % economic growth rate).

Based on the annual VOC savings, the results of this analysis indicated that the economic benefits from the construction of an embankment road would generate an NPV of BDT 804 million at PLB-1 and BDT 1,266 million at JRB-1, of which about 75% would be generated by existing traffic and 25% would be obtained from new traffic.

2.2.5 Navigation

The bank protection works proposed under Tranche 2 are not expected to lead to the stabilisation of the Lower Jamuna river in order to facilitate navigation. Consequently, it has been assumed that there would be no economic benefits due to improved navigation.

2.2.6 Overall Economic Benefits

The incremental economic benefits from riverbank protection works, flood embankments and char development are combined together in Table **2**-**6** and it can be seen that total economic benefits are estimated at BDT 7.91 billion for PLB-1, BDT 7.83 billion for JLB-2 and BDT 14.86 billion for JRB-1.

Erosion mitigation makes a significant contribution to the economic benefits in JLB-2 (73%) and PLB-1 (24%). Flood mitigation provides the main benefit (83%) in JRB-1 and accounts 37% of the benefits in PLB-1. For the JLB-2 and PLB-1, char land development is also important and accounts for 27% and

29% of the economic benefits respectively. Improved transport also contributes 9% and 10% to the economic benefits in JRB-1 and PLB-1 respectively.

Table 2-6 Incremental Economic Benefits of Project Interventions

Project Intervention	JRB -1		JLB-2		PLB-1	
	Econ. Benefit (BDT M)	% of total	Econ. Benefit (BDT M)	% of total	Econ. Benefit (BDT M)	% of total
Riverbank protection	**1,160**	**8%**	**5,675**	**73%**	**1,889**	**24%**
Flood mitigation	**12,431**	**83%**	**0**	**0%**	**2,914**	**37%**
Reduced damage	*11,484*	77%	0	**0%**	*2,514*	32%
Incremental agriculture	*947*	6%	0	**0%**	*400*	5%
Char land development	**0**	**0%**	**2,151**	**27%**	**2,302**	**29%**
Agriculture	*0*	0%	*1,200*	15%	*635*	8%
Settlements	*0*	0%	*951*	12%	*1,667*	21%
Road Transport	**1,266**	**9%**	**0**	**0%**	**804**	**10%**
Navigation	**0**	**0%**	**0**	**0%**	**0**	**0%**
Total	**14,857**	**100%**	**7,826**	**100%**	**7,909**	**100%**

N.B. Economic benefits based on net present value (NPV) over 30 years discounted at 10% per annum.

2.3 Cost Estimates

The financial investment costs of interventions proposed for the design of Tranche 2 were combined with expenditure incurred under Tranche 1 in order to derive the total costs of Tranche 1 and 2 for each sub-project. The detailed financial costs for Tranche 2 are presented in A4.1: Feasibility Level Cost Estimates. The financial costs for Tranche 1 and 2 were then converted to economic values using economic conversion factors for foreign costs, local materials, skilled labour, unskilled labour, machinery/transport and taxes/duties (Table 2-7). In addition to the economic costs of the project interventions under Tranche 1 and 2, the economic analysis also included the costs of constructing embankment roads at PLB 1 and JRB 1. With respect to agricultural development on the char lands, the costs of soil improvement measures were also included the investment costs at each location.

The total economic costs of the project interventions as well as associated agricultural and road developments amounted to BDT 9.35 billion (US$ 112.6 million) for JRB-1, BDT 14.40 billion (US$ 173.5 million) for JLB-2 and BDT 7.60 billion (US$ 91.6 million) as indicated in Table 2-7. The costs of bank protection works accounted for the largest proportion of base costs at JLB-2 (90%) and JRB-1 (33%). While bank protection works comprise 15% of total costs at PLB-1. The costs of flood embankments and land acquisition/resettlement accounted for the highest proportion of total costs at PLB-1 with 68%. Support and program management also represent a significant proportion of base costs with between 6% (PLB-1) and 15% (JRB-1).

Annual operation and maintenance (O&M) costs as a percentage of capital costs have been estimated at the rates of 2% for riverbank protection works and 5% for flood embankments, roads and other structures (e.g. regulators).

Table 2-7 Economic Investment Costs for Tranche 1 and 2

Project Intervention	JRB -1		JLB -2		PLB-1	
	Econ. Cost (BDT M)	% of total	Econ. Cost (BDT M)	% of total	Econ. Cost (BDT M)	% of total
Land Acquisition/Resettlement	**2,076**	24.0%	**142**	1.1%	**2,322**	33.0%
Flood Embankment Works	**1,334**	15.4%			**2,484**	35.0%
Riverbank Protection Works	**2,834**	32.7%	**12,043**	90.3%	**1,057**	15.1%
Road Development	**725**	8.4%			**429**	6.1%
Soil Fertility Improvement	**0**	0.0%	**236**	1.8%	**79**	1.1%
Vehicles and Equipment	**8**	0.1%	**7**	0.1%	**5**	0.1%
Social & Environmental Mgt	**24**	0.3%	**24**	0.2%	**20**	0.3%
Sub-project Management	**43**	0.5%	**43**	0.3%	**32**	0.4%
Unallocated Protection Works	**250**	2.9%	**277**	2.1%	**170**	2.4%
Disaster Risk Management	**66**	0.8%	**25**	0.3%	**20**	0.3%
Support & Program	**1,294**	14.9%	**540**	4.1%	**422**	6.0%
Base Cost	**8,654**	100%	**13,337**	100%	**7,040**	100%
Physical Contingency	**692**		**1,067**		**563**	
Total Cost (BDT million)	**9,346**		**14,404**		**7,603**	
***Total Cost** (US$ million)*	***112.6***		***173.5***		***91.6***	

2.4 Economic Viability of Tranche 1 and 2 Investments

Comparing the economic viability of Tranche 1 investments with Tranche 1 and 2 investments, it is evident from Table 2-8 that the EIRR is will be 14.7% under Tranche 1 and 11.6% under Tranche 1 and 2.

Table 2-8 Economic Viability for Tranche 1 and 2 Investments

Investment Tranche	Overall	
	EIRR	NPV (BDT
Tranche 1	14.7%	3,361
Tranche 1 & 2	11.6%	2,899

3 ECONOMIC ANALYSIS OF TRANCHE 1, 2 AND 3

3.1 Main Interventions

The following table summarises the main interventions proposed for each sub-project area under Tranche 3 and it can be seen that a 40 km flood embankment would be built from Aricha to Chauhali to protect land within the JLB-2 and PLB-1 sub-project areas from flooding. In addition, 9 km of concrete blocks would be constructed on the bank protection works at PLB-1. No other bank protection works would be required at JLB-2 and JRB-1 as the works would have been completed under Tranche 2.

Table 3-1 Main Interventions at Priority Sub-projects under Tranche 3

Sub-project	River Bank Protection	Flood Embankment	Regulatory Structures
JRB-1	0 km	0 km	
JLB-2	0 km	40.0 km	5 Structures
PLB-1	9.0 km (cc blocks only)	0 km	
Total	9.0 km	40.0 km	

3.2 Economic Benefits

It is estimated that an area of 62,000 hectares at JLB 2 and 24,500 hectares at PLB 1 would benefit from the construction of a 40 km flood embankment at JLB-2. By applying the methodology used in the Tranche 1 and 2 analysis, the economic benefits of constructing a flood embankment between Aricha and Chauhali were estimated at BDT 22.7 billion at JLB-2 (see Table **3-2**).

For the construction of a GFM on the revetment works a PLB-1, it has been assumed that the works would sustain the economic benefits of the bank protection works constructed under Tranche 1 and 2, so no additional benefits were included for the GFM work under Tranche 3 .

Overall, it can be seen from Table **3-2** that the incremental economic benefits of the project interventions under Tranche 1, 2 and 3 are expected to total BDT 14.86 billion at JRB-1, BDT 30.47 billion at JLB-2 and 9.70 billion at PLB-1.

Table 3-2 Economic Benefits of Interventions under Tranche 1, 2 and 3

Project Intervention	JRB -1		JLB-2		PLB-1	
	Econ. Benefit (BDT M)	% of total	Econ. Benefit (BDT M)	% of total	Econ. Benefit (BDT M)	% of total
Riverbank protection	**1,160**	**8%**	**5,675**	**19%**	**1,889**	**20%**
Flood mitigation	**12,431**	**83%**	**22,647**	**74%**	**4,709**	**48%**
Reduced damage	*11,484*	77%	20,749	68%	*3,910*	40%
Incremental agriculture	*947*	6%	1,898	6%	*799*	8%
Char land development	**0**	**0%**	**2,151**	**7%**	**2,302**	**24%**
Agriculture & Fisheries	*0*	0%	*1,200*	*4%*	*635*	*7%*
Settlements	*0*	0%	*951*	*3%*	*1,667*	17%
Road Transport	**1,266**	**9%**	**0**	**0%**	**804**	**8%**
Navigation	**0**	**0%**	**0**	**0%**	**0**	**0%**
Total	**14,857**	**100%**	**30,473**	**100%**	**9,704**	**100%**

N.B. Economic benefits based on net present value (NPV) over 30 years discounted at 10% per annum.

3.3 Economic Costs

The total economic costs of the project interventions under Tranche 1, 2 and 3 amounted to BDT 9.35 billion (US$ 112.6 million) for JRB-1, BDT 20.76 billion (US$ 250.1 million) for JLB-2, and BDT 8.98 billion (US$ 108.2 million) for PLB-1 as indicated in Table 3-3.

The costs of bank stabilisation and dredging account for the largest proportion of base costs at JLB-2 (64%). While bank protection works comprised 33% at JRB-1 and 21% at PLB-1 respectively. Flood embankments, regulators/fish passes and roads also account for a high proportion of base costs at JRB-1 (24%) and PLB-1 (35%). Land acquisition and resettlement also represents between 24% (JRB-1) and 28% (PLB-1) of base costs.

Table 3-3 Economic Investment Costs for Tranche 1, 2 and 3

Project Intervention	JRB -1		JLB -2		PLB-1	
	Econ. Cost (BDT M)	% of total	Econ. Cost (BDT M)	% of total	Econ. Cost (BDT M)	% of total
Land Acquisition/Resettlement	**2,076**	24.0%	**1,623**	8.6%	**2,322**	27.9%
Flood Embankment Works	**1,334**	15.4%	**4,029**	21.4%	**2,484**	29.9%
Riverbank Protection Works	**2,834**	32.7%	**12,043**	63.9%	**1,741**	21.0%
Road Development	**725**	8.4%			**429**	5.2%
Soil Fertility Improvement	**0**	0.0%	**236**	1.3%	**79**	0.9%
Vehicles and Equipment	**8**	0.1%	**7**	0.0%	**8**	0.1%
Social & Environmental Mgt	**24**	0.3%	**30**	0.2%	**24**	0.3%
Sub-project Management	**43**	0.5%	**60**	0.3%	**43**	0.5%
Unallocated Protection Works	**250**	2.9%	**431**	2.2%	**354**	4.3%
Disaster Risk Management	**66**	0.8%	**38**	0.2%	**43**	0.5%
Support & Program	**1,294**	14.9%	**728**	3.8%	**786**	9.5%
Base Cost	**8,654**	100%	**19,223**	100%	**8,313**	100%
Physical Contingency	**692**		**1,538**		**665**	
Total Cost (BDT million)	**9,346**		**20,761**		**8,978**	
Total Cost *(US$ million)*	***112.6***		***250.1***		***108.2***	

3.4 Economic Viability of Tranche 1, 2 and 3 Investments

By combining the economic benefits and costs of Tranche 3 works with the benefits and costs of Tranche 1 and Tranche 2 interventions, the economic viability of Tranche 1, 2 and 3 was determined. The results of the economic analysis are presented in Table 3-4 and indicate that the EIRRs are 16.7% for JRB-1, 12.9% for JLB-2 and 17.6% for PBL-1. This clearly shows that the investments are economically viable for all three sub-projects and the overall EIRR for the MFF program is 14.9%.

Table 3-4 Economic Viability of Investments under Tranche 1, 2 and 3

Investment Tranche	JRB -1		JLB -2		PLB-1		Overall	
	EIRR	NPV (BDT M)	EIRR	NPV (BDT M)	EIRR	NPV (BDT M)	EIRR	NPV (BDT M)
Tranche 1, 2 & 3	16.7%	4,520	12.9%	3,768	17.6%	3,356	14.9%	11,644

3.5 Sensitivity Analysis of Tranche 1, 2 and 3

In order to take account of future risks and uncertainties, switching values were also calculated to estimate the percentage by which the economic benefits and costs would need to change in order to reach an EIRR of 10% and an NPV of zero. The results, presented in Table **3-5** below, show that the overall investments under Tranche 1 and 2 would require a reduction in annual benefits of 11% or an increase in costs of 12% to become economically unviable. JRB-1 investments would need the largest changes with a reduction in benefits of 40% or an increase in costs of 66%, while PLB-1 investments would require a reduction in benefits of 12% or an increase in costs of 13%. However, for JLB -2, an *increase* in benefits of 31% or a *reduction* in costs of 24% would be needed for the investments to become economically viable.

With regard to Tranche 1, 2 and 3, the overall project investments would require a reduction in annual benefits of 30% or an increase in costs of 44% to become economically unviable. JRB-1 investments would need the smallest changes with a reduction in benefits of 21% or an increase in costs of 35%, while PLB-1 investments would require a reduction in benefits of 35% or an increase in costs of 53%.

Table 3-5 Switching Values of Investments under Tranche 1, 2 and 3

Investment Tranche	JRB -1		JLB -2		PLB-1		Overall	
	% Change in Benefits	% Change in Costs	% Change in Benefits	% Change in Costs	% Change in Benefits	% Change in Costs	% Change in Benefits	% Change in Costs
Tranche 1 and 2	-40%	+66%	+31%	-24%	-12%	+13%	-11%	+12%
Tranche 1, 2 & 3	-40%	+66%	-21%	+27%	-35%	+53%	-30%	+44%

N.B. Switching value is the percentage change in benefits or costs required to achieve an EIRR of 10%.

APPENDIX A

Land Prices in Sub-project Areas Vulnerable to Bank Erosion and Flooding

The purpose of an economic feasibility study is to demonstrate the net benefit of a proposed project for accepting or disbursing funds, taking into consideration the results of cost-benefit analysis. For the FRERMIP program, the economic feasibility of the proposed interventions is very dependent on land prices. The fluctuations in the land prices near the project areas depend on some major factors such as the presence of riverbank protection works and flood embankments, distance from the protective structures, and the duration and stability of the structures.

For the purpose of the analysis, land prices were collected from different project locations (shown in Figure 1). The data collection locations included the governmental sub-registry offices for the official rates as well as locations where the protective work has already been built, currently being built or with no protective work. The survey was conducted by orally communicating with the local population. The tentative land prices per decimal area are summarized in Table **3**-**6** for two different work sites.

Table 3-6 Comparison of Land Prices Before and After Bank Protection and Embankment Works

Location	Tentative Land Price Per Decimal (BDT) Before and After Bank Protection/Embankment Works					
	Agricultural		Household		Market	
	Before	After	Before	After	Before	after
PLB 1 (Harirampur)	3,000	15,000	3,500	25,000	N/A	70,000
JLB 2 (Zaffarganj)	10,000	30,000	20,000	35,000	40,000	100,000
JLB 2 (Chauhali)	20,000	20,000	30,000	30,000	50,000	50,000
JLB 2 (Char Solimabad)	10,000	10,000	20,000	20,000	30,000	30,000
JRB 1 (Koijuri)	50,000	80,000	70,000	120,000	100,000	150,000
JRB 1 (Belkuchi-Betil-Enayetpur)	20,000	40,000	50,000	100,000	100,000	200,000
JRB 1 (Bera)	2,000	20,000	20,000	120,000	30,000	150,000
Jamuna Charlands	1,000	N/A	N/A	N/A	N/A	N/A

Some insights about the land prices are described below:

Koijuri: The existing conditions in the Koijuri sub-project area differs considerably from the other project sites. The site already had existing embankments and protective works from presumably JMREMP and PIRDP projects of BWDB. The building of new embankment is currently going on there. The prices of land were also significantly higher than the other protective work sites. And the prices are in the increasing trend because of the construction of current embankment. One of the respondents of the survey there, MD. Jamshed Amin (a local land surveyor) specifically mentioned that the construction of the new embankment has played a major role behind the recent price hike, as the local population have an increasing sense of safety about their belongings around the riverbanks. The survey data showed that the effect of construction of embankment/protective work on the land prices wears off considerably in the places which are more than 2-3 kilometers away from the embankment. Some other factors come into play in those places like the distance from a major road, distance from the nearby marketplace etc.

Chauhali: Situated in the Jamuna Left Bank sub-project area, Chauhali was critically vulnerable to riverbank erosion not long ago. The survey showed that due to the erosion vulnerability, the land price near Chauhali riverbank depleted at some point. The protective work there has been mostly successful dealing with the severe erosion, but the land prices remained more or less stagnant and have not gone up since.

Belkuchi-Betil-Enayetpur: The noteworthy feature of this area is the presence of an embankment for a long time. The elderly people of the area remember the building of an embankment a long time ago, which is now a major local highway which connects 3 upzillas to the rest of the country. The local inhabitants recall the building of the embankment and the land prices before the construction of the embankment. Although the average land prices differed significantly for the riverside and countryside of the embankment immediately after the construction, the present rates don't differ much as the bankline is nearly stable now.

Bera (Pabna): The local population recalls the construction of embankment from as early as 1970s, when the first embankment constructed was known as "Mujib embankment". After the construction of protective work for JMREMP project and with an existing embankment, the land prices have gone up as much as 20 times for some places. Like the other similar projects, the countryside and the riverside land prices differs slightly.

Brahmaputra Charlands: The charlands inside the main river of Brahmaputra are yet so see any sort of protective work or stabilization plan. Thus, the land price there is significantly low. Building of protective works to stabilize those lands is very much likely to increase the land value as it will offer a greater sense of security for the belongings of the local population.

Char Solimabad (Chauhali): Being severely affected by riverbank erosion, Char Solimabad of Chauhali has only seen some temporary protective measures very recently. Thus, the land prices around those areas have remained stagnant for the recent years, while some places have experiences depletion in the prices.

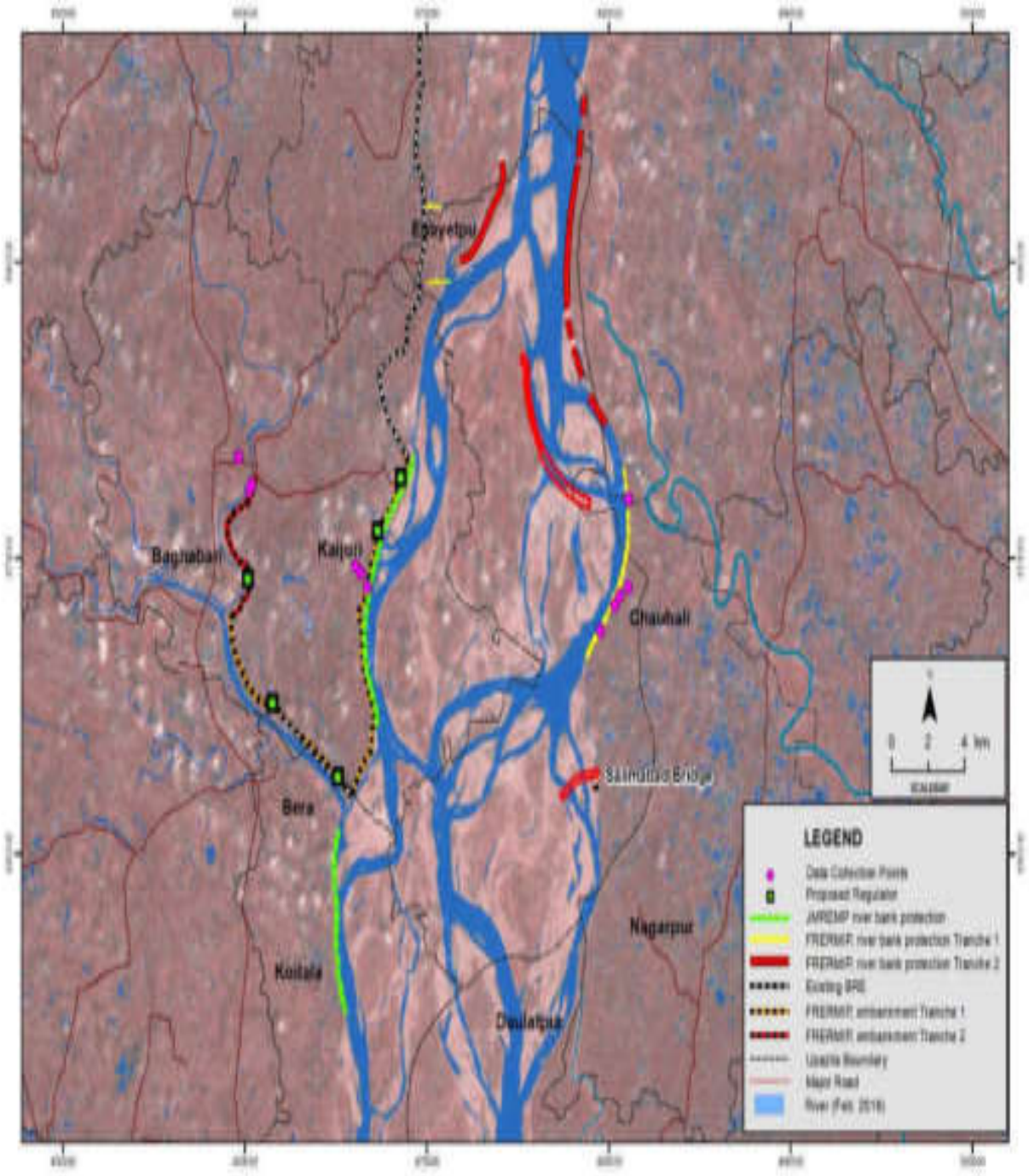


Figure 1: Location of Data Collection

APPENDIX B

Economic Methodology and Key Parameters

In the economic analysis, an incremental approach was adopted which contrasts the "future with" and "future without" project interventions. The analysis evaluated the benefits and costs as well as the economic viability of proposed interventions, e.g. riverbank protection and flood embankments for each of the four sub-project areas.

For each sub-project, economic viability is assessed by determining the following economic criteria: (i) economic internal rate of return (EIRR) and (ii) net present value (NPV). These economic criteria are also subjected to sensitivity analysis to evaluate the impact of changes in benefits and costs. Switching values are also calculated to estimate the percentage by which project benefits and costs would need to change to reach an EIRR of 10% and an NPV of zero.

The economic analysis uses the world price numeraire approach. All financial prices were converted to economic prices by adjusting for transfer payments such as subsidies, taxes, import duty, VAT, etc. For non-traded goods, a standard conversion factor (SCF) of 0.9 was used. Where appropriate, the prices of the main internationally traded commodities have been estimated according to import and export parity prices based on border equivalent values.

Other key features of the economic analysis methodology include:

- Economic life of the project is 30 years, so EIRRs and NPVs have been estimated on the basis of a 30-year incremental net benefit stream;
- Constant 2018 prices have been used for both costs and benefits over the 30 year period and so price contingencies were omitted;
- No residual value of capital investment has been assumed at the end of the period;
- The financial price of unskilled labor engaged in project construction and in farming activities has been converted to an economic value by the application of a shadow wage rate factor (SWRF) of 0.85, while the SCF was applied to the price of skilled labour;
- Capital investment and O&M costs have been converted to economic values by the application of specific conversion factors. These are estimated on the basis of the proportions of foreign costs, labor, materials, and transport in financial prices and the application of conversion factors as appropriate (i.e. SCF or SWRF).
- Tax and duty components of financial prices were omitted as they are transfer payments with no economic cost. Economic prices for foreign costs remained unchanged from their financial values; and
- A discount rate of 10% (i.e. opportunity cost of capital in Bangladesh) has been used to estimate NPVs and is the cut-off rate against at which economic viability is assessed.

Consultant's Report

Flood and Riverbank Erosion Risk Management Investment Program

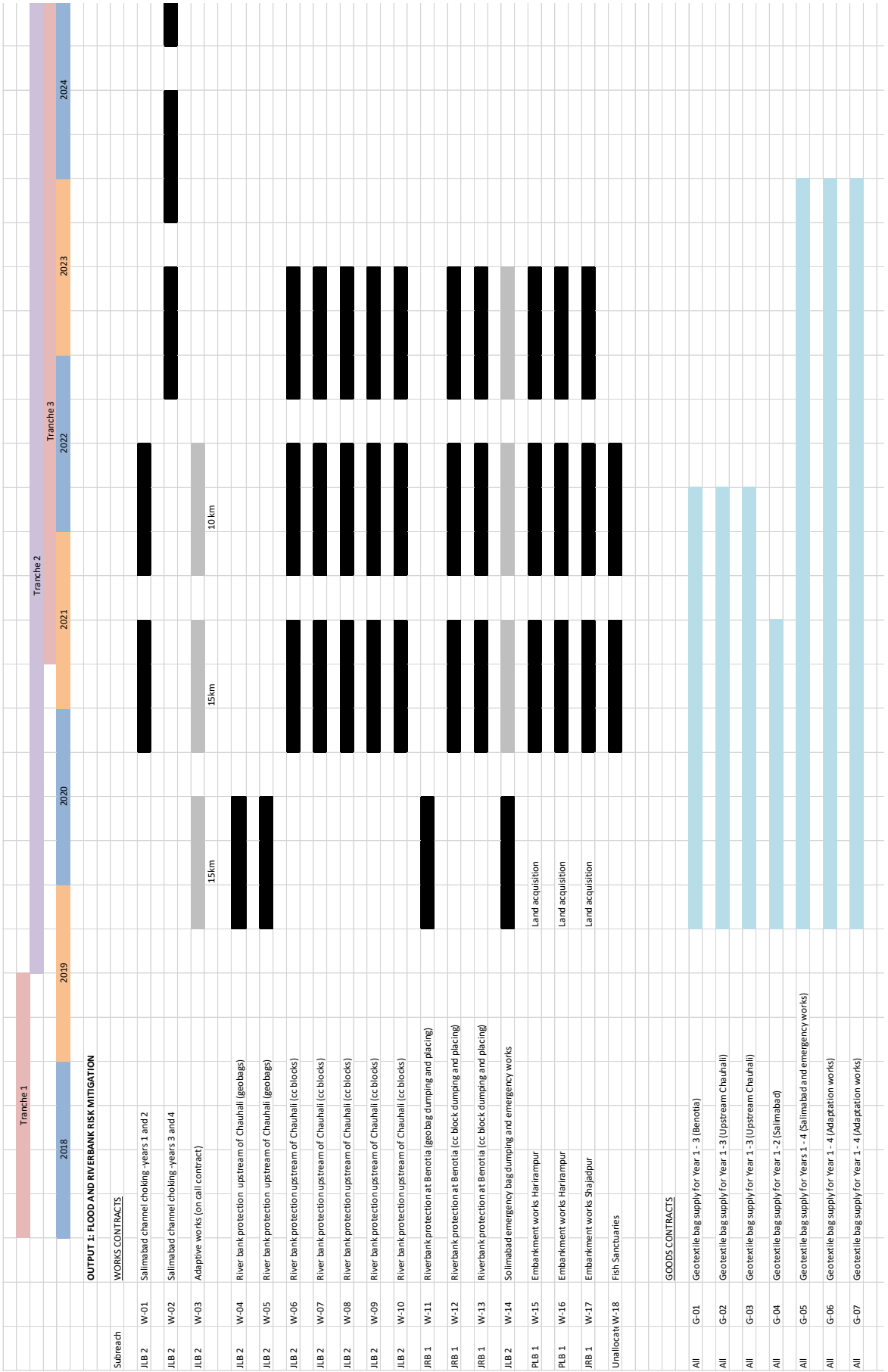
A 4.3 IMPLEMENTATION SCHEDULE

August 2019

Prepared by

Institutional Strengthening and Project Management Consultant (ISPMC)

Joint Venture of Northwest Hydraulic Consultants Ltd. and Euroconsult Mott MacDonald Ltd. in association with Deltares, Resource Planning and Management Consultants and CEGIS


Tranche 1
Tranche 2
Tranche 3
2018
2019
2020
2021
2022
2023
2024
OUTPUT 1: FLOOD AND RIVERBANK RISK MITIGATION
Subreach
WORKS CONTRACTS
JLB 2 W-01 Salimabad channel choking -years 1 and 2
JLB 2 W-02 Salimabad channel choking -years 3 and 4
JLB 2 W-03 Adaptive works (on call contract)
15km
15km
10 km
JLB 2 W-04 River bank protection upstream of Chauhali (geobags)
JLB 2 W-05 River bank protection upstream of Chauhali (geobags)
JLB 2 W-06 River bank protection upstream of Chauhali (cc blocks)
JLB 2 W-07 River bank protection upstream of Chauhali (cc blocks)
JLB 2 W-08 River bank protection upstream of Chauhali (cc blocks)
JLB 2 W-09 River bank protection upstream of Chauhali (cc blocks)
JLB 2 W-10 River bank protection upstream of Chauhali (cc blocks)
JRB 1 W-11 Riverbank protection at Benotia (geobag dumping and placing)
JRB 1 W-12 Riverbank protection at Benotia (cc block dumping and placing)
JRB 1 W-13 Riverbank protection at Benotia (cc block dumping and placing)
JLB 2 W-14 Solimabad emergency bag dumping and emergency works
PLB 1 W-15 Embankment works Hariramput
Land acquisition
PLB 1 W-16 Embankment works Hariramput
Land acquisition
JRB 1 W-17 Embankment works Shajadpur
Land acquisition
Unallocat W-18 Fish Sanctuaries
GOODS CONTRACTS
All G-01 Geotextile bag supply for Year 1 - 3 (Benotia)
All G-02 Geotextile bag supply for Year 1 -3 (Upstream Chauhali)
All G-03 Geotextile bag supply for Year 1 -3 (Upstream Chauhali)
All G-04 Geotextile bag supply for Year 1 -2 (Salimabad)
All G-05 Geotextile bag supply for Years 1 - 4 (Salimabad and emergency works)
All G-06 Geotextile bag supply for Year 1 - 4 (Adaptation works)
All G-07 Geotextile bag supply for Year 1 - 4 (Adaptation works)

		SURVEYS	
All	S-01	Underwater river survey	[redacted]
All	S-02	Multi beam echo sounder survey – 4 years	[redacted]
All	S-03	Sediment surveys	[redacted]
		OUTPUT 2: INSTITUTIONAL STRENGTHENING	
	I-01	Livelihood development support	
	I-02	Community capacity development support for participatory O&M	
	I-03	Community-based flood risk management support	
	I-04	Management information system development	
	I-05	Environment management and risk mitigation programs	
		OUTPUT 3: PROJECT MANAGEMENT	
	P-01	ISPMC	

Consultant's Report

Flood and Riverbank Erosion Risk Management Investment Program

A 4.4 DRAFT PROCUREMENT PLAN

August 2019

Prepared by

Institutional Strengthening and Project Management Consultant (ISPMC)

Joint Venture of Northwest Hydraulic Consultants Ltd. and Euroconsult Mott MacDonald Ltd. in association with Deltares, Resource Planning and Management Consultants and CEGIS

TABLE OF CONTENTS

1 DRAFT PROCUREMENT PLAN

Basic Data

Project Name: Flood and Riverbank Erosion Risk Management Investment Program - Tranche 2	
Project Number: 44167	**Approval Number**: XXX
Country: BANGLADESH	**Executing Agency**: Bangladesh Water Development Board
Project Procurement Classification: B **Procurement Risk:** Moderate	**Implementing Agency:** Department for Disaster Management
Project Financing Amount: $ 217m **ADB Financing:** $ 135m **Cofinancing (ADB Administered):** Government $ 71m Government of the Netherlands $ 11m	**Project Closing Date:** June 2022
Date of First Procurement Plan {loan/grant approval date}:	**Date of this Procurement Plan**: 12th January 2019

2 METHODS, THRESHOLDS, REVIEW AND 18-MONTH PROCUREMENT PLAN

2.1 Procurement and Consulting Methods and Thresholds

Except as the Asian Development Bank (ADB) may otherwise agree, the following process thresholds shall apply to procurement of goods and works.

Procurement of Goods and Works		
Method	**Threshold**	**Comments**
International Competitive Bidding (ICB) for Works	$15,000,000	Prior review
International Competitive Bidding for Goods	$2,000,000	Prior review
National Competitive Bidding (NCB) for Works	Beneath that stated for ICB, Works	The first NCB is subject to prior review, thereafter post review.
National Competitive Bidding for Goods	Beneath that stated for ICB, Goods	The first NCB is subject to prior review, thereafter post review
Shopping for Works	Below $100,000	
Shopping for Goods	Below $100,000	

Consulting Services	
Method	**Comments**

Quality and Cost Based Selection (QCBS)	Prior review
Quality Based Selection	Prior review
Consultants' Qualifications Selection	Prior review
Least-Cost Selection	Prior review
Fixed Budget Selection	Prior review
Single Source Selection for Consulting Firm	Prior review
Individual Consultants Selection for Individual Consultant	Prior review

2.2 Goods and Works Contracts Estimated to Cost $1 Million or More

The following table lists goods and works contracts for which the procurement activity is either ongoing or expected to commence within the next 18 months.

Package Number	General Description	Estimated Value	Procurement Method	Review [Prior / Post/Post (Sampling)]	Bidding Procedure	Advertisement Date (quarter/year)	Comments
W-01	Salimabad flow redistribution and char development (years 1 and 2)	16.7	NCB	Prior (first package)	1S1E	Q2 / 2020	Prequalification of Bidders: N Domestic Preference Applicable: N Bidding Document: Others Comments: e-GP documents
W-02	Salimabad flow redistribution and char development (years 3 and 4)	16.7	NCB	Post	1S1E	Q2 / 2022	As above
W-03	Adaptive works (on call contract)	4.7	NCB	Post	1S1E	Q2 / 2019	As above

W-04	River bank protection upstream of Chauhali (geobag dumping and placing)	3.5	NCB	Post	1S1E	Q2 / 2019	As above
W-05	River bank protection upstream of Chauhali (geobag dumping)	3.5	NCB	Post	1S1E	Q2 / 2019	As above
W-06	River bank protection upstream of Chauhali (cc blocks)	20.1	NCB	Post	1S1E	Q2 / 2020	As above
W-07	River bank protection upstream of Chauhali (cc blocks)	20.1	NCB	Post	1S1E	Q2 / 2020	As above
W-08	River bank protection upstream of Chauhali (cc blocks)	20.1	NCB	Post	1S1E	Q2 / 2020	As above
W-09	River bank protection upstream of Chauhali (cc blocks)	20.1	NCB	Post	1S1E	Q2 / 2020	As above

W-10	River bank protection upstream of Chauhali (cc blocks)	20.1	NCB	Post	1S1E	Q2 / 2020	As above
W-11	Riverbank protection at Benotia (geobag dumping and placing)	2.3	NCB	Post	1S1E	Q2 / 2019	As above
W-12	Riverbank protection at Benotia (cc block dumping and placing)	14.6	NCB	Post	1S1E	Q2 / 2020	As above
W-13	Riverbank protection at Benotia (cc block dumping and placing)	14.6	NCB	Post	1S1E	Q2 / 2020	As above
W-14	Solimabad emergency bag dumping and emergency works	5.2	NCB	Post	1S1E	Q2 / 2019	As above
W-15	Embankment works Harirampur	18.7	NCB	Post	1S1E	Q2 / 2020	As above
W-16	Embankment works Harirampur	18.7	NCB	Post	1S1E	Q2 / 2020	As above
W-17	Embankment works Shajadpur	6.1	NCB	Post	1S1E	Q2 / 2020	As above
W-18	Fish Sanctuaries	2.2	NCB	Post	1S1E	Q2 / 2019	As above

G-01	Geotextile bag supply for Year 1 -3 (Benotia)	3.5	ICB	Post	1S1E	Q2 / 2019	Prequalification of Bidders: N Domestic Preference Applicable: N Bidding Document: Goods
G-02	Geotextile bag supply for Year 1 -3 (upstream Chauhali)	6.0	ICB	Prior	1S1E	Q2 / 2019	As above
G-03	Geotextile bag supply for Year 1 -3 (upstream Chauhali)	6.0	ICB	Prior	1S1E	Q2 / 2019	As above
G-04	Geotextile bag supply for Year 1 - 2 (Salimabad)	3.5	ICB	Prior	1S1E	Q2 / 2019	As above
G-05	Geotextile bag supply for Year 1 - 4 (Salimabad and emergency works)	5.4	ICB	Prior	1S1E	Q2 / 2019	As above
G-06	Geotextile bag supply for Year 1 - 4 (Adaptation works)	5.3	ICB	Prior	1S1E	Q2 / 2019	As above
G-07	Geotextile bag supply for Year 1 - 4 (Adaptation works)	5.3	ICB	Prior	1S1E	Q2 / 2019	As above

2.3 Consulting Services Contracts Estimated to Cost $100,000 or More

The following table lists consulting services contracts for which the recruitment activity is either ongoing or expected to commence within the next 18 months.

Package Number	General Description	Estimated Value	Recruitment Method	Review (Prior / Post)	Advertisement Date (quarter/year)	Type of Proposal	Comments
C-01	Institutional Strengthening and Project Management		Single Source Selection[7]		N/A		
C-02	Community-based flood risk management support	1,200,000	QCBS	Prior	Q3 / 2019	STP	Assignment: National Quality-Cost Ratio: 90:10
C-03	Community capacity development support for participatory O&M	370,000	QCBS	Prior	Q3 / 2019	BTP	Assignment: National
C-04	Livelihood development support	600,000	QCBS	Prior	Q3 / 2019	STP	Assignment: National Quality-Cost Ratio: 80:20
C-05	Underwater river survey	500,000	CQS	Prior	Q3 / 2019	BTP	Assignment: National
C-06	Multi beam echosounder survey – 4 years	1,000,000	QCBS	Prior	Q3 / 2019	BTP	Assignment: National
C-07	Sediment surveys	500,000	CQS	Prior	Q3 / 2019	BTP	Assignment: National

[7] ISPMC team for Tranche-1 to be engaged for subsequent tranches through the single source selection (SSS) modality, at the request of the executing agency/government and subject to its performance during Tranche-1. This is to ensure continuity of the services throughout the MFF period and for smooth implementation of the subsequent tranches.

C-08	Management information system development	650,000	QCBS	Prior	Q3 / 2019	BTP	Assignment: National
C-09	Environment management and risk mitigation programs	3,710,000	QCBS	Prior	Q3 / 2019	BTP	Assignment: National
C-10	Topographic survey	500,000	CQS	Prior	Q3 / 2019	BTP	Assignment: National
C-11	Distributaries Survey	185,000	CQS	Prior	Q2 / 2019	BTP	Assignment: National
C-12	Monitoring of pilot works	210,000	CQS	Prior	Q2 / 2019	BTP	Assignment: National

2.4 Goods and Works Contracts Estimated to Cost Less than $1 Million and Consulting Services Contracts Less than $100,000 (Smaller Value Contracts)

The following table groups smaller-value goods, works and consulting services contracts for which the activity is either ongoing or expected to commence within the next 18 months.

Goods and Works								
Package Number	**General Description**	**Estimated Value**	**Number of Contracts**	**Procurement Method**	**Review** [Prior / Post/Post (Sampling)]	**Bidding Procedure**	**Advertisement Date** (quarter / year)	**Comments**
G-09	Gunny bag and geotube supply for Solimabad Years 1 and 2	0.6	ICB	Prior	1S1E	Q2 / 2019	As above	G-09

G-10	Gunny bag and geotube supply for Solimabad Years 3 and 4	0.6	ICB	Prior	1S1E	Q2 / 2021	As above	G-10

3 INDICATIVE LIST OF PACKAGES REQUIRED UNDER THE PROJECT

The following table provides an indicative list of goods, works and consulting services contracts over the life of the project, other than those mentioned in previous sections (i.e., those expected beyond the current period).

Goods and Works							
Package Number	**General Description**	**Estimated Value (cumulative)**	**Estimated Number of Contracts**	**Procurement Method**	**Review** [Prior / Post/Post (Sampling)]	**Bidding Procedure**	**Comments**
G-04	8nr pick up trucks	240,000	1	Shopping	Post		Q3 2019
G-05	2nr micro buses	120,000	1	Shopping	Post		Q3 2019
G-06	4nr jeeps	60,000	1	Shopping	Post		Q3 2019
G-07	Office Equipment	550,000	1	Shopping	Post		Q3 2019
G-08	Survey Equipment	90,000	1	Shopping	Post		Q3 2019

4 LIST OF AWARDED AND ON-GOING, AND COMPLETED CONTRACTS

The following tables list the awarded and on-going contracts, and completed contracts.

4.1 Awarded and On-going Contracts

Goods and Works							
Package Number	**General Description**	**Estimated Value**	**Awarded Contract Value**	**Procurement Method**	**Advertisement Date** (quarter/ year)	**Date of ADB Approval of Contract Award**	**Comments**

Consulting Services							
Package Number	**General Description**	**Estimated Value**	**Awarded Contract Value**	**Recruitment Method**	**Advertisement Date** (quarter/year)	**Date of ADB Approval of Contract Award**	**Comments**

1. Completed Contracts

Goods and Works								
Package Number	**General Description**	**Estimated Value**	**Contract Value**	**Procurement Method**	**Advertisement Date** (quarter/ year)	**Date of ADB Approval of Contract Award**	**Date of Completion**	**Comments**

Consulting Services								
Package Number	**General Description**	**Estimated Value**	**Contract Value**	**Recruitment Method**	**Advertisement Date** (quarter/ year)	**Date of ADB Approval of Contract Award**	**Date of Completion**	**Comments**

5 NON-ADB FINANCING

The following table lists goods, works and consulting services contracts over the life of the project, financed by Non-ADB sources.

Goods and Works				
General Description	**Estimated Value (cumulative)**	**Estimated Number of Contracts**	**Procurement Method**	**Comments**

Consulting Services				
General Description	**Estimated Value (cumulative)**	**Estimated Number of Contracts**	**Recruitment Method**	**Comments**

6 NATIONAL COMPETITIVE BIDDING

A. Regulation and Reference Documents

1. The procedures to be followed for national competitive bidding shall be those set forth for the National Open Tendering Method in *The Public Procurement Rules, 2008* (as updated and pursuant to *The Public Procurement Act, 2006* issued by the Government of Bangladesh) with the clarifications and modifications described in the following paragraphs required for compliance with the provisions of the Procurement Guidelines.

B. Procurement Procedures

1. Eligibility

2. The eligibility of bidders shall be as defined under section I of the Procurement Guidelines; accordingly, no bidder or potential bidder should be declared ineligible for reasons other than those provided in section I of the Guidelines, **as amended from time to time**.

2. Advertising

3. The posting of NCB specific notices for contracts valued at less than $1 million on ADB's website is not required but is highly recommended.

3. Location of Bid Submission

4. Submission of bids to 'primary' and 'secondary' locations, or 'multiple droppings' of bids, shall not be required or allowed. Advertisements and bidding documents shall specify only one location for delivery of bids.

4. Bid Price as Percentage of Estimate

5. Bids shall not be invited on the basis of percentage above or below the estimated cost, and contract award shall be based on the lowest evaluated bid price of responsive bid from eligible and qualified bidder.

5. Lottery

6. A lottery system shall not be used to determine a successful bidder, including for the purpose of resolving deadlocks.

6. Rejection of All Bids and Rebidding

7. Bids shall not be rejected and new bids solicited without ADB's prior concurrence.

C. Bidding Documents

7. Anti-Corruption

8. Definitions of corrupt, fraudulent, collusive and coercive practices shall reflect the latest ADB Board-approved Anti-Corruption Policy definitions of these terms and related additional provisions (such as conflict of interest, etc.).

8. Qualification Requirements

9. Qualification criteria and specific requirements must be explicitly stated in the bidding documents and applied consistently during bid evaluation.

9. Rejection of Bids

10. A bid shall not be rejected on the grounds that its bid price is not within a percentage range above or below the contract estimate.

10. ADB Policy Clauses

11. A provision shall be included in all NCB works and goods contracts financed by ADB requiring suppliers and contractors to permit ADB to inspect their accounts and records and other documents relating to the bid submission and the performance of the contract, and to have them audited by auditors appointed by ADB.
12. A provision shall be included in all bidding documents for NCB works and goods contracts financed by ADB stating that the Borrower shall reject a proposal for award if it determines that the bidder recommended for award has, directly or through an agent, engaged in corrupt, fraudulent, collusive, coercive or obstructive practices in competing for the contract in question.
13. A provision shall be included in all bidding documents for NCB works and goods contracts financed by ADB stating that ADB will declare a firm or individual ineligible, either indefinitely or for a stated period, to be awarded a contract financed by ADB, if it at any time determines that the firm or individual has, directly or through an agent, engaged in corrupt, fraudulent, collusive, coercive or obstructive practices or any integrity violation in competing for, or in executing, ADB-financed contract

Annex 5
(available upon request)

CLIMATE CHANGE ASSESSMENT

I. BASIC PROJECT INFORMATION

Project Title:	Flood and Riverbank Erosion Risk Management Investment Program - Project 2
Project Cost ($ million)**:**	212.8
Location:	Bangladesh, Districts Manikganj, Tangail, Sirajganj and Bera
Sector:	Agriculture, natural resources, and rural development
Theme:	Inclusive economic growth
Brief Description:	The main goal of the project is to reduce flood and riverbank erosion risk along the Jamuna and Padma rivers in Bangladesh. Works under Project 1 have been physically completed in June 2020 and comprises about 18 kilometers (km) of riverbank protection and 21.3 km of flood embankment. Proposed work under Project 2 will include: (i) 30 km of riverbank protection works with innovative technologies, combined with "building with nature" approaches for channel closure; (ii) 7.9 km of climate-resilient flood embankment; (iii) building a stable distributary offtake; and (iv) 2 regulators to improve drainage and flows between river and floodplain. Riverbank protection works are subject to the forces of the river, mainly impacted by flow velocities, waves and scour depths. With changes in sea level, precipitation and wind, the design parameters were reviewed and adapted as necessary. Flood embankments act as a barrier to floods and provide controlled openings for water intake and drainage. Changes in flood water levels, precipitation and wind may impact the required dimensioning of the structure and/or the durability and stability of the structure.

Source: Climate Risk and Vulnerability Assessment of the Flood and Riverbank Erosion Risk Management Investment Program – Tranche 2.

II. SUMMARY OF CLIMATE CHANGE FINANCE

Project Financing		**Climate Finance**	
Source	**Amount** ($ million)	**Adaptation** ($ million)	**Mitigation** ($ million)
Asian Development Bank			
Ordinary capital resources (concessional loan)	157.0	47.4	0

Source: Asian Development Bank.

III. SUMMARY OF CLIMATE RISK SCREENING AND ASSESSMENT

A. Sensitivity of Project Component(s) to Climate or Weather Conditions and the Sea Level

1. **Embankment crest elevations.** An increase in flood levels would require an increase in embankment crest level to prevent overtopping.
2. **Embankment crest elevations.** An increase in wind speeds could require an increased embankment crest elevation to mitigate wave overtopping.
3. **Embankment seepage.** An increase in sea water level will cause flood waves to be slower, leading to a longer time of peak water levels.
4. **Interior flooding.** An increase in precipitation during monsoon season at high river water levels could require increased drainage capacities through the embankment.
5. **Outflanking of bank protection works.** Uncertainty in morphological developments is likely exacerbated through climate change impacts, leading to an increased morphological unpredictability.
6. **Stability of wave protection.** An increase in wave heights through increased wind speeds and fetch lengths (at higher water levels) may require a higher level of wave protection standard.
7. **Stability of underwater bank protection.** Increased water levels, flow velocities and discharges will lead to higher forces on protection elements, which may require larger protection elements. An increase in scour depth may require additional protection material.

B. Climate Risk Screening

1. Flooding
2. Onshore Category 1 storms
3. **Sea level rise**. An increase in sea water level is likely to cause higher and slower floods, which may impact (i) the embankment freeboard, which may become insufficient, (ii) the embankment width through increased seepage over a longer time, (iii) the internal drainage through longer period of high water levels in the main rivers, (iv) larger scour depth due to higher flow velocities, and (v) protection element, which may be insufficient at higher flow velocities.
4. **Precipitation increase**. Increased monsoon rainfalls are likely to cause (i) higher floods in the main rivers with impact on embankment freeboards and scour depths and (ii) interior flooding, which may require increased drainage capacities.
5. **Wind speed increase**. An increase in wind speed may cause larger waves, which may cause the wave protection element size and embankment freeboard insufficient.
6. **Morphology changes:** Climate change impacts increase the river discharge and sediment freight through heavier rainfall, leading to a higher morphological uncertainty requiring longer revetments.

(i) The AWARE tool evaluates risks for 16 individual hydroclimatic factors and provides a first screening of risk potentially posed by those factors to the project. AWARE also provides a first screening of geological hazard risk.

(ii) AWARE rated the overall climate risk as "high" and the overall geological hazard risk as "medium." In terms of geological hazard, although the overall AWARE risk rating was "medium," the earthquake risk was rated as "high." The AWARE report is annexed to the Climate Risk and Vulnerability Assessment.

The hydroclimatic factors receiving a "high" risk rating were the following:

- Flooding
- Onshore Category 1 storms
- Sea level rise

The AWARE screening also assessed the following hydroclimatic factors as posing a "medium" risk:

- Temperature rise
- Precipitation increase
- Precipitation decrease
- Windspeed increase
- Windspeed decrease
- Solar radiation change

However, temperature rise, precipitation decrease, and wind speed decrease would have no impact on Project 2 subprojects. Projected increases in temperature could have a broad range of adverse impacts, not related to Project 2 interventions, on human health, crop productivity, and agricultural water demand.

Climate Risk Classification: **High**

C. Climate Risk and Adaptation Assessment

The main impacts identified for the project area are listed in table below. All projections relating to climate change and the hydrological impacts bear a certain level of uncertainty as detailed in Appendix 17.

Parameter	Expected impact
Peak flows	The projected mean flow increases are larger than the precipitation increase in all three river basins, in the order of 10% for the Brahmaputra and Ganges, and 20% in the Meghna, in the near future time frame (2015–2039). In the far future, these flow increases reach 20%, 36%, and 42% for the Brahmaputra, Ganges, and Meghna, respectively.
Sea level rise	The estimated sea-level rise *relative* to land for year 2040 is approximately 40 cm (as detailed in Appendix 17).
Project Area Precipitation	Mean seasonal precipitation projections are for a 7% increase during the monsoon season, and a 9% decline in the dry season, compared to the reference period 1980-2004.

Project Area Wind Speed	It was found that the stronger winds (>10 meters per second) are projected to intensify by approximately 10% in both wind variables. Given the uncertainty associated with climate model projections at the desired high spatial and temporal resolution, the possibility of a 20% increase in maximum wind speed was also considered for wave height calculations:
Storm Surge	A storm surge with a height of 3.8 m at Barisal was considered.
Solar radiation	Despite the unavailability of reliable projections of future UV light incidence, its changes relative to recent observations are deemed insufficiently large to significantly modify the geotextile material resistance to sunlight exposure.

Based on these parameters, the risks for the project were identified to:

Risk	Potential Climate Change Impact
Main river flood	Increase in peak flows and resultant levels in main rivers, hence increase in flood risk.
Main river erosion	Increase in flood flows in main rivers with resultant increase in scour depth and erosion risk (above and below water) due to increase in stage and velocity.
Interior flooding	Increase in interior flooding or water logging from increased local precipitation, sea level rise (which could extend the duration of flooding), difficulty draining due to high flows in main rivers, and flooding from main rivers.
Wind speed increase	Increase in wave impacts on embankment and riverbank protection works.
Storm surge	Increase in strength and frequency of cyclones will increase storm surge in the Bay of Bengal with potential impacts on water levels and flooding along the main rivers.
Sea level rise	Increase in sea level may impact interior flooding and flooding along the main rivers.

The adaptation measures to address the ensuing risks from climate change are summarized in the next table. These measures are included under this project, however, some of the measures will require to be continued following this project as the required adaptation needs ensue. This is especially relevant to the additional scour depth, which can only be addressed when the scour emerges. To address this need and to ensure the sustainability of the works, BWDB has been committed to maintain the works and carry out necessary maintenance and adaptation works.

Risk	Suggested Adaptation Measure
Main river flood	Raising of the flood embankment crest by about 0.4 meters.
Main river erosion	Supply of additional geobags through adaptation works (dumping of geobags over launched slope). The size of the geobags used under Project 1 is expected to be sufficient for future conditions.
Interior flooding	The planned drainage regulators are sufficient in capacity for the drainage of the interior. However, if drainage is required during flood events in the main rivers, gravity drainage is not possible. In this case, pumping facilities will have to be introduced and/or cropping patterns have to be adapted when appropriate in the future.
Morphological uncertainty	Provision of an additional about 20% of length of riverbank protection to counter uncertainties in river morphology which are aggravated due to increases in rainfall and sediment, leading to a higher flood discharge and sediment freight, which is compounded by a higher risk for earthquakes occurring during floods. As the increase in flood and sediment discharges is not linear, the river instability increases.
Storm surge	Raising of embankments where the embankments are exposed to the main river with considerable fetch and little setback to mitigate wave overtopping. The required heightening depends on the local fetch and wind climate and are location specific.
Sea level rise	Raising of embankments by 0.4 meters to adapt to new flood water level and pumping of interior floodwater, when it becomes necessary.

D. Climate Risk Screening Tool and/or Procedure Used

The tools used for Climate Risk Screening were the “AWARE for Projects” rapid climate risk screening tool as well as an extensive modeling using HEC-RAS 2D software, covering the main rivers and the area impacted by the rivers.

IV. CLIMATE ADAPTATION PLANS WITHIN THE PROJECT

Climate change adaptation measures within the project consist of structural and non-structural interventions. The structural interventions comprise (i) embankment height, (ii) wave protection, and (iii) provision of additional underwater protection elements. Non-structural interventions are mostly associated with raising awareness and training the population as part of community-based flood risk management activities. Details of cost and measures are in the following table. All costs stated include direct and indirect taxes, and price and physical contingencies.

Adaptation Activity	**Target Climate Risk**	**Estimated Adaptation Costs** ($ million)	**Adaptation Finance Justification**
Riverbank protection - Design scour safety margin - Provision of additional bags in initial construction to launch to design scour plus safety margin.	Larger floods with higher flow velocities are expected to scour the river near riverbank protection to greater depths, requiring additional launching material.	22.2	The project will construct 30 km of riverbank protection and additional geobags will cost about $740,000 more per km than without climate change.
Riverbank protection - Length of works - About 20% of the length is to be extended due to climate change.	Larger floods with higher flow velocities require extension of the length of protection works to (i) protect additional reaches and (ii) provide safety against outflanking due to higher morphological dynamic.	14.8	The estimated adaptation costs include the costs of the 6 km riverbank protection (above and below water) constructed under the project to address impacts of climate change (at an average cost of about $1.9 million per km) and the cost of the additional land acquisition and resettlement.
Riverbank protection - Length of adaptation works	Larger floods cause higher and more frequent floods with high flow velocities, resulting in increased scouring	15.2	The launching of the riverbank protection works is expected to be along 50% of the works. (adaptation works are around 10 km).
Flood embankment - Increase of design flood - Design increased from 50-year to 100-year flood return period (minor rivers)	Large floods are expected to result in higher water levels, requiring an increase in embankment crest level.	1.7	The estimated adaptation costs include the costs of the increase in height and earthworks (about $95,000 per km of the 7.9 km of flood embankment to be constructed under the project), and acquisition of the additional land.
Community-based flood risk management – Awareness to the population on climate change impacts combined with flood risk management	Higher and more frequent floods will impact the local population.	0.9	Additional resources for trainings cost are about $5,600 for each of the 160 community-based flood risk management units.
	Total	54.8	ADB will finance 86.5% of this total cost.

Source: Asian Development Bank.

Climate Risk and Vulnerability Assessment

July 2021

People's Republic of Bangladesh: Flood and Riverbank Erosion Risk Management Investment Program (Tranche 2)

FLOOD AND RIVERBANK EROSION RISK MANAGEMENT INVESTMENT PROGRAM (FRERMIP) TRANCHE 2

CLIMATE RISK AND VULNERABILITY ASSESSMENT AND GEOLOGICAL HAZARD RISK ASSESSMENT

FINAL REPORT

Prepared for:

Asian Development Bank

Prepared by:

Institutional Strengthening and Project Management Consultant (ISPMC)

Joint Venture
NORTHWEST HYDRAULIC CONSULTANTS LTD/EUROCONSULT MOTT MACDONALD

July 2021

NHC Ref No. 004000020

Prepared by:

K.M. Leytham, PhD
Principal, Northwest Hydraulic Consultants

Mariza Costa Cabral, PhD
Senior Scientist,
Northwest Hydraulic Consultants

With contributions from:

Jesper Mathiesen
Northwest Hydraulic Consultants

Derek Stuart
Principal, Northwest Hydraulic Consultants

Andrew Nelson
Northwest Hydraulic Consultants

John Roe
Independent Consultant

DISCLAIMER

ACRONYMS

ADB	Asian Development Bank
ASLR	Absolute sea level rise. See also RSLR.
BNBC	Bangladesh National Building Code
CRVA	Climate Risk and Vulnerability Assessment
EIRR	Economic Internal Rate of Return
ENSO	El Niño Southern Oscillation
FRERMIP	Flood and Riverbank Erosion Management Investment Program
GBM	Ganges-Brahmaputra-Meghna
GCM	Global climate model
MFF	Multi-tranche financing facility
NPV	Net present value
Q_f	Mean annual peak flow
Q_s	Mean annual bed material transport
SLR	Sea level rise. See also ASLR and RSLR
RBIP	River Bank Improvement Program
RCM	Regional climate model
RCP8.5	Representative concentration pathway (for greenhouse gases) resulting in a net heat imbalance of 8.5 Watt/m^2 by the year 2100.
RSLR	Relative sea level rise. (Sea level rise relative to land.) See also ASLR.

EXECUTIVE SUMMARY

The Asian Development Bank (ADB) is supporting the Flood and Riverbank Erosion Risk Management Investment Program (FRERMIP), whose principal goal is to reduce flood and riverbank erosion risk along the Jamuna and Padma rivers in Bangladesh. FRERMIP is an investment program. Work under Project 1 is nearing completion and comprises about 18 km of riverbank protection and 21 km of flood embankment. Project 2 will include (i) 34 km of riverbank protection works with innovative technologies, combined with "building with nature" approaches for channel closure; (ii) 7.9 km of climate-resilient flood embankments; (iii) building a stable distributary offtake; and (iv) 2 regulators to improve drainage and flows between river and floodplain.

A key component of the work is revetments using geotextile bags ("geobags") for underwater protection against scour and for temporary above-water protection against erosion, which is later replaced by permanent above water protection using CC blocks. Another main works is the construction of flood embankments at key locations, which are designed for 100-year flood levels and 1.0 m freeboard along minor rivers (all rivers excluding Jamuna, Padma, Ganges and Meghna rivers).

The Climate Risk and Vulnerability Assessment (CRVA) and Geological Hazard Risk Assessment presented in this report deal with Project-2 to inform project design and identify adaptation measures to protect Project 2 investments against climate risk and geological risks to the extent possible. Current risk and future risk for a timeframe centered around the year 2050 is evaluated, for consistency with the expected economic life of the infrastructure. This CRVA builds on technical studies conducted under FRERMIP Tranche 1 project as background for the River Stabilization Plan (RSP) which were published as Annexes:

- D – River engineering (in particular Volumes 1, 3 and 4)
- E – Flood risk management (Volumes 1 and 2)
- F – River stabilization impacts (in particular Volumes 1, 3, 5 and 6)
- H – Safeguards, land use & economic assessment (in particular Volumes 2 and 6)

Project 2 subprojects are described and mapped in Section I, and the CRVA scope and methodology are laid out in Section II. The projected changes in future climate and hydrology are summarized in Section III (drawing from Annex D, Volume 3 of the RSP), indicating a trend towards higher peak flows and higher flow velocities in the Jamuna/Padma River (with sea level rise contributing further to higher still water levels in the Padma river), and larger waves induced by stronger winds. Higher flow velocities create a greater risk of scour, higher-energy waves increase erosive power on riverbanks and flood embankments, and higher peak flows with larger waves increase the risk of riverbank and embankment overtopping and the risk of flooding.

The recommended climate change adaptation measures in Section IV include: raising the embankment height at Shahjadpur (JRB-1)by 0.4 m in anticipation of increased peak flows and sea level rise; provision of an additional 1,675,000 geobags for protection against increased underwater scour;. The design of one intervention, namely the Ghior Khal offtake structure,

depends on the implementation of other interventions, mostly the Salimabad river closure and detailed design is ongoing.

The recommended timing for implementation of the climate change adaptation measures varies and depends on monitoring of main river flows and water levels as well as continuous monitoring of the performance of riverbank protection works. Recommendations are that flood embankment raises to adapt to climate change be implemented in the early 2020's (say between 2021 and 2024), with the design floods having been adjusted accordingly. Hardening of embankment crests to counter potential wave overtopping would be implemented at the same time as embankment raises and provisions for this were incorporated in the design of Project 2 works. Placement of additional geobags to maintain under water protection will be dependent on findings of the monitoring program.

The potential impact of climate change on wind regime and resulting impacts on wave height and wave runup is particularly uncertain. The uncertainty of climate impacts is compounded by lack of short interval wind speed and wave climate observations. It is recommended that a long-term program of wind and wave monitoring be initiated and conducted by the office of the Chief Engineer River Management, BWDB to provide an improved basis for the analysis and design of wave protection works on the main rivers and to refine the related climate adaptation measures as appropriate.

The economic viability of tranches 1 and 2, presented in Section VI, translates into an overall economic internal rate of return (EIRR) of 13.4% and net present value (NPV) benefits of 5,812 BDT million (US$68.6 million). With regard to the economic benefits of tranches 1 and 2, flood mitigation makes a significant contribution accounting for 82% of economic benefits in JRB-1. Riverbank protection also provides substantial economic benefits in PLB-1 (100%), JLB-2 (91%) and JRB-1 (18%). For JLB-2, char land development accounts for 9% of the economic benefits. For the overall program, riverbank protection contributes 60% of the economic benefits, followed by flood mitigation (37%) and char land development (3%).

The region is at significant risk of earthquakes, which would produce direct seismic loads on flood embankments and riverbank protection structures, which in turn could generate large amounts of sediment into the Brahmaputra/Jamuna/Padma river system. This would result in morphological changes which could induce additional risk to the investment structures (Section V).

Seismic loads are considered in riverbank protection and embankment designs following the 2015 Bangladesh National Building Code (BNBC) and international standards. While the BNBC do not specifically target earthen or sloped structures such as embankment and riverbank protection works proposed under Project 2, for design purposes, the structures were assigned a high occupancy category of III to IV, which requires designing for higher seismic forces (Section V-A).

With respect to channel morphological changes induced by earthquakes (Section V-B), landslides in the Eastern Himalaya triggered by the magnitude 8.6 Assam earthquake of 1950 generated an enormous volume of sediments into the Brahmaputra river system with pronounced effects on river morphology over the following decades. Bed aggradation and decreased lateral channel stability accompanied by increased channel width and braiding intensity changes are believed to have been induced in the Jamuna and Padma rivers by the sediment inflows from the earthquake.

The 1950 earthquake is estimated to have a 450-year recurrence interval (Annex F Volume 5 of the RSP). The sediment volume generated by an earthquake increases exponentially with magnitude, so that an earthquake with a return period of 50 years is expected to produce only 1% of the sediment produced by a 500-year earthquake. Therefore, a sediment release comparable to that of the 1950 earthquake is unlikely to occur within the economic life of Project 2. Furthermore, a decade or more may lapse before the main sediment pulse reaches the Jamuna River, enabling time for preparation and adaptive management of geomorphic change. Recommendations were made for embankment and riverbank protection design (Annex D, Volumes 1, 3 and 5 of the RSP) to enable adaptive management without excessive cost, i.e., without loss of the Project 2 river stabilization investment. These recommendations include (i) selecting work sites based on models and accounting for impacts of climate change; (ii) following the adaptive approach for riverbank protection to enable adaptation of the works to a deeper river; (iii) using a crest section on the embankment that can be raised independently of a road being built on it, thus saving costs; and (iv) using wave protections to prevent damages due to overtopping.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

I. INTRODUCTION

I-A. Project Description

1. The Asian Development Bank (ADB) is supporting the Flood and Riverbank Erosion Risk Management Investment Program (FRERMIP), the principal goal of which is to reduce flood and riverbank erosion risk along the Jamuna and Padma rivers in Bangladesh.

2. FRERMIP is financed through a multi-tranche facility. Works under Project 1 (Tranche 1) were completed and comprised approximately 18 km of riverbank protection and 21 km of flood embankment. The Climate Risk and Vulnerability Assessment (CRVA) and Geological Hazard Risk Assessment presented in this report deal with Project-2, which will implement work in the same three subprojects as Project 1. The subprojects and main interventions are listed in **Table I-1. Figure 1** shows Project 1 works.

3. Works is expected to lead to the development of a river stabilization for the Jamuna/Padma River which, in the long-term, will result in stabilizing the river and narrowing the width of the active river corridor. A key component of the proposed works is the systematic and large-scale application of geotextile bag ("geobag") revetments for riverbank protection.

Table I-1. Project-2 subprojects principal interventions.

Subproject	Location	Length (km)	Work details	Type
JRB-1	Enayetpur	7	Riverbank protection on char with geobags	2
	Benotia	3.5	Riverbank protection at bank with geobags	2
	Shahjadpur	7.9	Embankment with drainage regulators	4
JLB-2	Upstream Chauhali	15.5	Riverbank protection at bank with geobags	2 (1 km type 1)
	Offtake structure	1 (+ 4 km RBP)	Structure to regulate flow into the Old Dhaleswari. Design to be based on study, including some 4 km of riverbank protection to connect to existing Chauhali protection works	3 and 2
	Solimabad closure	1	Building with nature approach to close the Solimabad channel	5
PLB-1	Harirampur extension	4	Riverbank protection at bank with geobags	2

The type of intervention in the column "Type" is specified in Table I-2.

Table I-2. Description of the different types of interventions.

Type	Description
1	Geobag revetment with 250 kg geobags on dredged slope and temporary geobag wave protection above low water level followed by permanent wave protection with CC blocks
2	Geobag revetment with 250 kg geobags on existing slope and temporary geobag wave protection above low water level followed by permanent wave protection with CC blocks
3	Offtake structure to provide stable inflow conditions into the Ghior Khal. Design to be finalized following study at the beginning of Project 2)
4	Embankment at minor river (all rivers except Jamuna, Padma, Ganges and Meghna rivers), 100-year flood level + 1 m freeboard
5	Dredged sand plug

4. Works potentially affected by climate change impacts are riverbank protection and flood embankments, i.e., all project locations in **Table I-1** except the Solimabad closure. The Solimabad closure under subproject JLB-2 is a short-term intervention intended to assist sediment deposition and the conversion of char land to agricultural use by closing the Solimabad channel on the left (eastern) bank of the Jamuna river. Because this is a short-term intervention, there would be no climate change impacts, hence the Solimabad closure is not discussed further in this report.

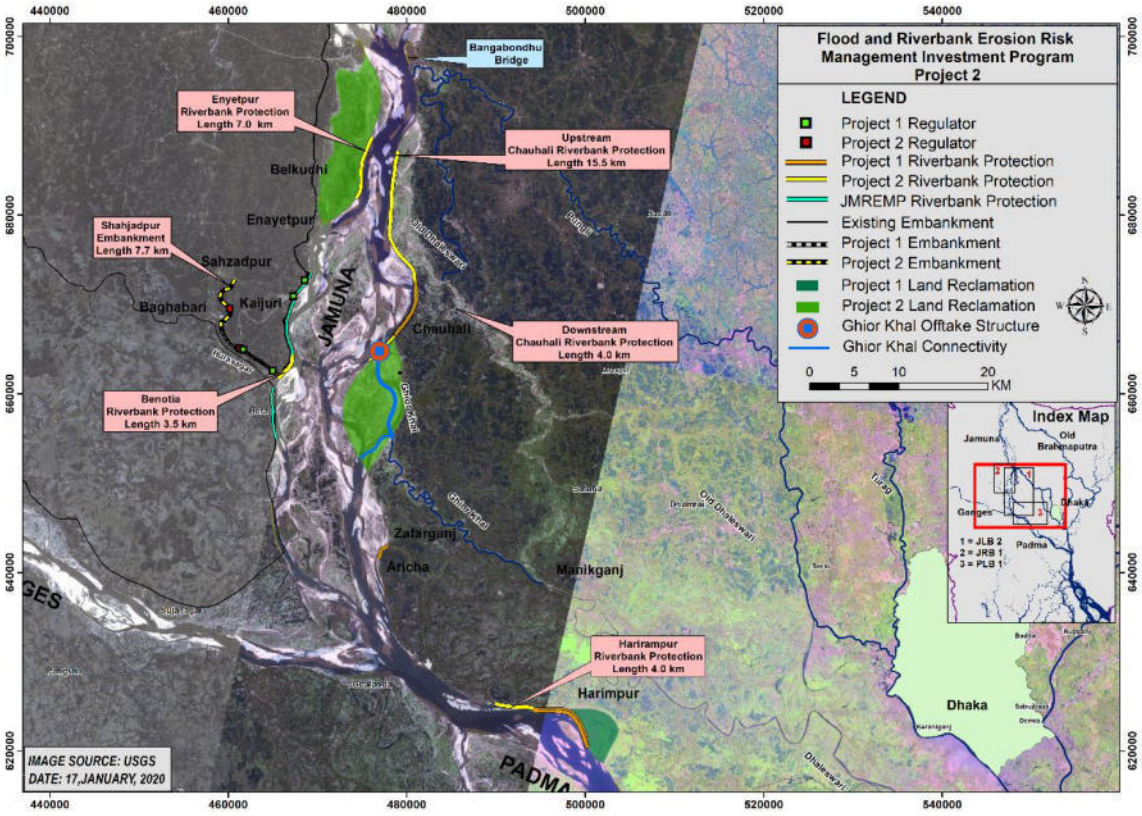


Figure 1. Project 1 and Project 2 interventions

I-B. CRVA and Geological Risk Assessment

5. ADB, on behalf of the ISPMC, applied the "AWARE for Projects" rapid climate risk screening tool[1], referred to as AWARE hereafter, to the project area to identify the potential climate risks. The AWARE tool evaluates risks for 16 individual hydroclimatic factors and provides a first screening of risk potentially induced by those factors to the project area. AWARE also provides a first screening of geological hazard risk. Thereafter, a detailed assessment was conducted building on previous FRERMIP climate change studies[2] but specifically evaluating climate risks and vulnerabilities associated with Project-2 subprojects. The impacts of projected changes in peak flows and mean sea level on water levels in the Jamuna and Padma Rivers were assessed through a study conducted by the ISPMC using the two-dimensional HEC-RAS hydraulic model.[3]

6. **AWARE rated the overall climate risk as "high" and the overall geological hazard risk as "medium"** for the Project 2 (named "subproject Jamuna" in AWARE). Although the overall AWARE risk rating was "medium" for geological hazard, the earthquake risk was rated as "high". The AWARE report is in Annex A.

7. The hydroclimatic factors receiving a "high" risk rating were:

(i) Flooding
(ii) Onshore Category 1 storms
(iii) Sea level rise

8. The AWARE screening also assessed the flowing hydroclimatic factors as posing a "medium" risk:

(i) Temperature rise
(ii) Precipitation increase
(iii) Precipitation decrease
(iv) Windspeed increase
(v) Windspeed decrease
(vi) Solar radiation change

9. However, temperature rise, precipitation decrease and wind speed decrease are not expected to have significant negative impacts on the Project 2 subprojects (and are not discussed any further in this CRVA) because:

(i) Building materials and construction are resilient to temperature increases,
(ii) A decrease in precipitation would result in lower floods and flow velocities, resulting in a higher factor of safety for both riverbank protection and flood embankments. Adverse impacts, such as droughts, do not apply to this area, and

[1] "AWARE for Projects" is a web-based, rapid climate risk screening tool developed for ADB by Acclimatise (a consulting firm based in the United Kingdom). "AWARE for Projects" is described in www.acclimatise.uk.com/index.php?id=4&tool=1.
[2] The CRVA relies on scenarios of future change in key climatological and hydrological parameters from Project 1 climate change study (Northwest Hydraulic Consultants & Mott MacDonald Joint Venture, 2018a – referred to as Annex F, Volume 6 of the RSP in this CRVA), and potential future changes in river morphology adapted from CEGIS (2010).
[3] Annex E, Volume 2 of the RSP (Northwest Hydraulic Consultants & Mott MacDonald Joint Venture, 2018b)

(iii) Wind speed decrease would result in lower wave heights, resulting in a higher factor of safety for wave protection .

10. Projected increases in temperature (by 1.3°C for the monsoon season and 1.6°C for the dry season, according to estimates by Masood et al., 2015) could have a broad range of adverse impacts, not related to the Project 2 subprojects, on human health, crop productivity, and agricultural water demand.

11. AWARE is a useful tool for rapid identification of potential climate-related risks and geological-related risks affecting a proposed project area. When a project receives a "high risk" AWARE rating, ADB requires that a more comprehensive risk assessment be conducted.

12. The key climate-related risks are listed in **Table I-3** and are addressed in this CRVA.

Table I-3. Climate-related risks addressed by this CRVA

Risk	Potential Climate Change Impact
Main river flooding	Increase in peak flows and resultant stage on main rivers with consequent increase in flood risk.
Main river erosion	Increase in flood flows on main rivers with resulting increase in scour depth and erosion risk (above and below water) due to increase in stage and velocity.
Interior flooding	Increase in interior flooding or water logging from increased local precipitation, sea level rise (which could extend the duration of flooding), difficulty draining due to high flows in main rivers, and flooding from main rivers.
Wind speed increase	Increase in wave impacts on embankment and riverbank protection works.
Storm surge	Increase in strength and frequency of cyclones will increase storm surge in the Bay of Bengal with potential impact on water levels and flooding along the main rivers.
Sea Level Rise	Increase in sea level may affect both interior flooding and flooding along the main rivers.

13. The CRVA summarizes the climate risk assessment and its results, especially pertaining to adaptation measures, and was used to inform project design, ensuring that the investment is protected against climate risk to the extent possible. This document also assesses geological risk from earthquakes.

II. CRVA SCOPE AND METHODOLOGICAL FRAMEWORK

II-A. Scope

14. The CRVA evaluates current and future risks for a timeframe centered around the year 2040 for consistency with the expected implementation of the River Stabilization Plan. The implementation of this plan is expected to alter the morphology and flooding impacts in the area, requiring a review of the risks to the project assets around year 2040. The CRVA also identifies and assesses possible adaptation or mitigation options to reduce the identified risks and vulnerabilities under future climate change impacts.

II-B. Methodology

15. The CRVA consists of the following main tasks:

16. **Task 1: Summarize historic and future climate and hydrological data of interest.** Observed and projected data sets of climate and hydrology are obtained (from BWDB and Bangladesh Meteorological Department) and summarized (Section III). Uncertainties in these data sets are discussed. The projected changes in the following variables important to the design and performance of Project 2 subprojects are:

a) Main river peak flows at key locations (Section III-A)
b) Sea level rise (Section 0)
c) Project area precipitation (Section III-C)
d) Windspeed (Section III-D)
e) Storm surge (Section III-E)
f) Solar radiation (Section III-F)

17. **Task 2: Assess climate change impacts and risks to Project 2 subprojects.** Current riverbank protection and embankment design parameters are assessed for climate change and the projected changes are analyzed against today's design standards (Section IV). Based on the analysis, potentially required design adjustments or adaptation strategies are recommended.

18. **Task 3: Evaluate geologic risk associated with earthquakes.** The risks associated with earthquakes are assessed (Section V). Two issues have been identified and addressed: the direct impact of seismic loads on Project 2 infrastructure (embankments and riverbank protection works), and the impact of earthquakes on the sediment loads in the main rivers and the subsequent impact on river morphology.

19. **Task 4: Economic analysis.** Economic analysis is performed of climate change impacts and potential adaptation measures (Section VI).

II-C. Uncertainty and adaptation measures

20. The Brahmaputra/Jamuna/Padma River is one of the most dynamic rivers in the world and considerable uncertainty surrounds any attempt to predict the morphological behavior of the river to any degree of detail. Although there is some level of skill in short-term (roughly one year ahead) predictions of the locations and severity of scour attack, much remains to be learned about the intermediate and long-term behaviors of the river.

21. A number of factors will affect the future behavior of the river. Chief among these are: the future flow regime, which in turn will be affected by upstream activities in the basin (e.g. dam building and land use change) and climate change; future sediment inputs, also affected by the flow regime, land use change, and landslide activity; and river training works and other riverbank stabilization measures, such as proposed under this project for the Jamuna and Padma rivers, and similar projects under consideration for the Brahmaputra River in Assam state in India, upstream of the Jamuna river.

22. Uncertainties associated with climate change are thus only one of several significant sources of uncertainty, with morphological uncertainties absent climate change probably being the dominant source of uncertainty with respect to the design and performance of riverbank protection.

23. While there is a considerable body of work addressing the effects of climate change on basic forcings (precipitation for example), there is much less information on the effects of climate change on river morphology. In the Brahmaputra river, increased streamflows lead to higher sediment loads, which tend to counteract scouring. Sea level rise also introduces a tendency for sediment accretion and

increased elevation of the river channel and banks. The net geomorphological effect of these different factors, combined with the riverbank stabilization works, is subject to great uncertainty. The study by CEGIS (2010) used physically-based equations to predict the response of the Jamuna River (and other rivers) to hypothetical changes in these influencing factors, but not considering riverbank stabilization. The geomorphological effects of the specific changes in mean sea level and peak flows adopted for the 2040 horizon, combined with the Project 1 and Project-2 riverbank stabilization works, have not been studied, and also represent a source of uncertainty.

24. **Adaptation to uncertainty in the geomorphologic behavior of the river.** Because of the unpredictable behavior of the main rivers and uncertainty surrounding their response to the proposed river stabilization works, Project 1 has established an adaptive management "meam" (monitoring-evaluation-adaptation-maintenance) program. Key components of this program to be adopted by the Chief Engineer River Management, BWDB include:

(i) Systematic monitoring and evaluation. Systematic flood season monitoring of riverbank protection works is proposed to identify needs for remedial actions in the event of severe scour attack and to improve understanding of the river's behavior and interaction between riverbank protection works and the river (started under Project 1 and to be continued under Project 2 and beyond).

(ii) Emergency measures. To provide a flexible, immediate response mechanism to scour attack, strategic stockpiling of geotextile bags is proposed to provide immediate support for timely emergency remediation and adaptation to changing morphological conditions. (undertaken under Project 1 and provisions for continuation (if required) under Project 2).

(iii) Supporting studies. Several studies are proposed to support adaptation measures. These include study of grout-filled jute mattresses for above-water bank protection, study of wind waves, also in support of the design of above-water bank protection, and further research into the sizing of geobags (a few studies were completed for the River Stabilization Plan; these are to be extended under Project 2 and thereafter expanded and updated periodically).

25. These adaptation measures (mainly surveys and studies), while initially designed to address morphological uncertainty, are equally applicable to the uncertain impacts of climate change.

26. **Uncertainty of climate change and hydrologic projections.** While global and regional climate models represent the state of scientific knowledge concerning the climate system, this knowledge remains incomplete. In particular, our understanding of the multiple and complex processes involved in the Indian summer monsoon contains important gaps (refer toAnnex F, Volume 6 of the RSP). A major source of uncertainty pertains to the unknown future pathway of global greenhouse gas emissions, which will be determined by political decisions, individual decisions, the evolution of regional economies, and technological advances, among other factors. Another source of uncertainty stems from the large differences between future climate simulated by different global climate models.

27. Additional uncertainty is introduced by the hydrological models used to translate projected climate variables into hydrological variables; by hydraulic models used to translate flows into still water height; and by models of wave height, erosion, or scour. The estimation, using extreme value analysis, of design flows (e.g. for determining flood embankment crest elevations) is also subject to some uncertainty.

28. Current design standards set flood embankment crest elevations for the main rivers at the historic 1 in 200-year flood level plus 1.5 m of freeboard. For minor rivers, embankment crest elevations are set at the historic 1 in 100-year flood level plus 1.0 m of freeboard. The freeboard is intended to

accommodate wave runup, uncertainty in hydrological and hydraulic conditions, embankment settlement and other factors. However, no explicit allowance is made under current river embankment design standards of BWDB for the impacts of climate change.

III. SUMMARY OF HISTORIC AND FUTURE CLIMATE AND HYDROLOGICAL DATA OF INTEREST

29. The scenarios of future change proposed in the Project 1 climate change study (Annex F, Volume 6 of the RSP) are adopted in this CRVA and are summarized below for the time horizon of interest, 2040.

III-A. Peak Flows

30. The climate change study (Annex F, Volume 6 of the RSP) considered several major studies that used hydrological models runs under general circulation model (GCM)-projected climatic inputs to obtain hydrological projections for the three river basins, Ganges, Brahmaputra and Meghna. The climate change study selected the study by Masood et al. (2015) as base data for further analysis. The Masood et al. study used an ensemble of 5 GCM projections for a scenario of high future greenhouse gas emissions (RCP8.5). Because one of the major uncertainties associated with GCM projections stems from uncertain model parameters, the study used 10 alternative parameter sets for each of the GCMs. The H08 hydrological model was used to derive hydrological projections from the climate projections.

31. The results from Masood et al. (2015) were chosen because: a) they use the most recent GCM runs; b) they use a future emissions pathway (RCP8.5) which is high but plausible given the accelerated recent growth of actual global emissions and lack of clear global commitment to emissions reduction; c) they reduce the uncertainty associated with GCM parameter sets; d) the precipitation increases obtained for the far future (2075-2099) approximately agree with the projections by the GCMs selected by Sharmila et al. (2015) as best reproducing observed monsoon characteristics; and e) their manuscript published a comprehensive summary of results in the form of the table reproduced in **Table III-1**.

32. **Table III-1** summarizes the ensemble-mean results from Masood et al. (2015) for changes in monsoon season mean flows. The projected mean flow increases are larger than the precipitation increase in all three river basins, in the order of 10% for the Brahmaputra and Ganges, and 20% in the Meghna, in the near future time frame (2015-2039). In the far future, these flow increases reach 20%, 36%, and 42% for the Brahmaputra, Ganges, and Meghna, respectively. The increase in wet season runoff (an indicator of flood risk) is projected to be especially large for the Meghna river basin. For the time horizon 2040, linear interpolation from **Table III-1** was used to estimate the values listed in **Table III-2.**

33. Of interested to this CRVA are projected changes in peak flows. In the absence of reliable quantitative projections of future peak flows in the three rivers, the observations-based peak flows of a given return period are used, and increased by the percent changes projected for the mean seasonal flows (**Table III-2**). This approach is justified given that all three rivers often maintain stages close to their annual peak during 2 or 3 months in the monsoon season. The results are presented in **Table III-3,** and were calculated as follows:

(i) To estimate projected values for 2040 and 2100 for Jamuna river at Bahadurabad, **Table III-2** percent changes for the Brahmaputra river flows were used.

(ii) For the Ganges river at Hardinge Bridge, **Table III-2** percent changes for the Ganges river flows were used.

(iii) For the Padma river at Mawa and at Baruria Transit, a weighted average of **Table III-2** percent changes for the Brahmaputra and Ganges rivers was used, where the weights were the historical peak flows (labelled "Hist." in **Table III-3)** of the two rivers, Jamuna and Ganges. Given uncertainty in the records at Mawa, peak flow quantiles at that location are based on quantiles from the Baruria Transit records less estimated flows leaving the Padma via the left bank Arial Khan offtake (discussed further in Annex F, Volume 6 of the RSP).

(iv) Peak flows at Chandpur are estimated based on quantiles from Baruria Transit and flows on the Meghna river at Bhairab Bazar.

Table III-1. Projected climate and hydrological changes proposed for the FRERMIP study, for the Brahmaputra, Ganges, and Meghna river basins (redrawn from Masood et al. (2015)).

Variable	Period	Brahmaputra % change (T_{air}: °C)				Ganges % change (T_{air}: °C)				Meghna % change (T_{air}: °C)			
		annual mean	dry season (November-April)	Wet season (May-October)	annual	annual mean	dry season (November-April)	Wet season (May-October)	annual	annual mean	dry season (November-April)	Wet season (May-October)	annual
(a) Meteorological variables													
Precipitation (mm year^{-1})	present-day (1979-2003)	1632	–	–	–	1154	–	–	–	3192	–	–	–
	near-future (2015-2039)	1720	4.2	5.6	5.4	1218	–0.1	6.2	5.6	3598	11.4	12.9	12.7
	far-future (2075-2099)	1897	23.0	15.1	16.3	1383	3.6	21.5	19.8	4139	33.6	29.0	29.6
T_{air} (°C)	present-day (1979-2003)	5.5	–	–	–	21.7	–	–	–	23.0	–	–	–
	near-future (2015-2039)	6.7	1.4	1.0	1.2	22.8	1.1	0.9	1.0	23.7	0.8	0.6	0.7
	far-future (2075-2099)	10.3	5.5	4.1	4.8	25.9	4.6	3.7	4.1	26.8	4.3	3.4	3.8
Net radiation (W m^{-2})	present-day (1979-2003)	63	–	–	–	97	–	–	–	114	–	–	–
	near-future (2015-2039)	62	2.0	–1.6	–0.4	97	–0.2	–0.9	–0.7	112	–0.4	–2.2	–1.5
	far-future (2075-2099)	66	10.3	3.1	5.6	101	5.3	3.4	4.1	119	6.5	3.0	4.4
(b) Hydrological variables													
Total runoff (mm year^{-1})	present-day (1979-2003)	1166	–	–	–	372	–	–	–	1999	–	–	–
	near-future (2015-2039)	1244	0.5	8.6	6.7	414	2.5	12.1	11.3	2380	10.5	20.2	19.1
	far-future (2075-2099)	1355	2.9	20.3	16.2	495	–2.3	36.3	33.1	2793	24.2	41.8	39.7
ET (mm year^{-1})	present-day (1979-2003)	467	–	–	–	785	–	–	–	1193	–	–	–
	near-future (2015-2039)	477	5.5	0.9	2.1	808	4.9	2.1	3.0	1216	5.2	0.4	1.9
	far-future (2075-2099)	543	25.6	12.9	16.4	892	19.3	10.9	13.6	1347	18.2	10.5	12.9
Soil moisture (mm)	present-day (1979-2003)	335	–	–	–	186	–	–	–	336	–	–	–
	near-future (2015-2039)	338	0.4	1.2	0.9	192	2.7	3.4	3.1	354	6.6	5.1	5.5
	far-future (2075-2099)	340	0.2	2.3	1.5	197	0.4	8.3	5.8	359	6.7	6.9	6.9

Table III-2. Projected changes in monsoon season mean flow volume for time horizons 2040 and 2100 (relative to the reference period 1979-2003) for each of the three main rivers as they enter Bangladesh, based on Masood et al. (2015). These values are obtained from Table III-1 by interpolation.

	Brahmaputra		Ganges		Meghna	
	2040	2100	2040	2100	2040	2100
Monsoon season (May-Oct) mean flow volume change	+ 11%	+ 23%	+ 17%	+ 42%	+ 25%	+ 46%
Dry season (Nov-Apr) mean flow volume change	+ 1%	+ 3%	+ 3%	- 3%	+ 11%	+ 27%

Table III-3. Projected peak flow frequency at different main river locations, for time horizons 2040 and 2100, based on historical peak flow frequency (Annex F, Volume 6 of the RSP) and projected percent changes in seasonal flows (Table III-2).

		2-year	10-year	20-year	50-year	100-year	200-year	500-year
Jamuna River Bahadurabad (m^3/s)	**Hist.**	66,000	85,100	91,400	101,400	108,600	115,900	125,500
	2040	73,300	94,500	101,500	112,600	120,500	128,600	139,300
	2100	81,200	104,700	112,400	124,700	133,600	142,600	154,400
Ganges River Hardinge Bridge (m^3/s)	**Hist.**	49,700	64,600	69,600	75,700	77,500	80,200	83,300
	2040	58,100	75,600	81,400	88,600	90,700	93,800	97,500
	2100	70,600	91,700	98,800	107,500	110,100	113,900	118,300
Padma River Baruria Transit (m^3/s)	**Hist.**	94,000	122,000	132,000	143,000	152,000	160,000	176,000
	2040	106,700	138,500	149,800	162,300	172,500	181,600	199,800
	2100	123,100	159,800	172,900	187,300	199,100	209,600	230,600
Padma River Mawa (m^3/s)	**Hist.**	92,200	118,500	127,500	137,000	145,000	153,000	168,500
	2040	104,600	134,500	144,700	155,500	164,600	173,700	191,200
	2100	120,800	155,200	167,000	179,500	190,000	200,400	220,700
Lower Meghna Chandpur (m^3/s)	**(Est.)**	103,000	132,700	142,800	153,400	162,400	171,400	188,700
	2040	119,000	153,300	165,000	177,300	187,600	198,000	218,000
	2100	137,400	177,000	190,400	204,600	216,500	228,500	251,600

III-B. Sea Level Rise

34. Sea level, relative to land, is an important boundary condition for river discharge and water level. Rises in mean sea level relative to land enable ocean tides to penetrate farther into stream channels,

slowing down flood drainage due to backwater effects even at locations some distances away from the coast (Ikeuchi et al., 2015), aggravating the severity and duration of floods (Karim and Mimura, 2008), and leading to salinization.

35. This effect is expected to impact the Lower Meghna, Padma, and even the Jamuna rivers. Peak levels may further increase or decrease in response to future morphological adjustments of the river channel, and hydrodynamic effects due to future embankments upstream. Quantitative evaluation of future rating curves requires detailed hydrodynamic studies, to be carried out through a continuous monitoring program covering the impact of interventions as well as external factors such as climate change, upstream interventions in the river and land use.

36. The rise in sea level relative to land (relative sea level rise) may be greater or lesser than absolute sea level rise, depending on vertical movement of the land. This, in turn, depends on sediment accretion, which is provided by sediment carried to the land surface by flood waters. Other potential factors are land subsidence (e.g., due to excess groundwater extraction, or urbanization), and tectonic movements.

37. The absolute mean sea level in the Bay of Bengal has been rising at a fast pace (5.5 mm/year; Kusche et al., 2016), twice as rapid as the global average (2.7 mm/year). This is explained by the very large heat uptake by the Indian Ocean's surface. (Lumpkin & al, 2020) estimates that the Indian Ocean's top 700 meters took up more than 89% of the global ocean's heat uptake in the between 1960 and 2018.

38. For year 2040, Kusche et al. (2016) estimates of *absolute* sea level rise are approximately 30 cm. This value is just below the 32 cm adopted by the Bangladesh Ministry of Environment and Forest's National Adaptation Programme of Action (MOEF, 2005) for 2050. Assuming a rate of land subsidence of 2.9 mm/year, equal to the median of observed values published for different coastal locations of Bangladesh (Brown and Nicholls, 2015), the estimated sea level rise *relative* to land for year 2040 is approximately 40 cm.

III-C. Project Area Precipitation

39. The projected climatic changes over Bangladesh for time horizon 2040 are summarized in **Table III-4**. Values are the median of the 26 GCMs included in the USGS global climate viewer[4], for RCP8.5. All global climate models project higher temperatures for Bangladesh, although the rate of warming depends on the model and on the future pathway of greenhouse gas emissions. Mean seasonal precipitation projections are for a 7% increase during the monsoon season, and a 9% decline in the dry season, compared to the reference period 1980-2004. Future increases in monsoon season precipitation within Bangladesh, could exacerbate interior flooding (i.e. flooding on the country-side of embankments) for which drainage regulators are planned to be incorporated in flood embankments.

Table III-4. Projected change in mean seasonal rainfall in Bangladesh for time horizon 2040 and 2100, relative to 1980-2004.

	2040	2100
Monsoon season (May-Oct) mean rainfall change	+ 7 %	+ 23 %
Dry season (Nov-Apr) mean rainfall change	- 9 %	+ 3 %

[4] http://regclim.coas.oregonstate.edu/visualization/gccv/cmip5-global-climate-change-viewer/

III-D. Project Area Wind Speed

40. High winds generate waves in the Jamuna/Padma River, which may lead to erosion of the upper slope of riverbank protection works or possibly even breaches of embankments (Section IV-C) if these are insufficiently protected. Projections of future peak wind speeds were obtained from regional climate model simulations, given that the space and time resolution of global climate models is too coarse to represent this variable. The Coordinated Regional Climate Downscaling Experiment (CORDEX) provides high-resolution projections available online[5] which are used in this CRVA. The CORDEX projections are obtained using a regional climate model (REMO) to downscale the results of a global climate model (MPI-ESM-LR), developed at the Max Planck Institute for Meteorology (MPI) in Germany.

41. The time series of two wind variables – the maximum daily wind speed and the maximum daily windgust speed – were downloaded from CORDEX, for the grid cell covering the Jamuna River, and the distributions of these simulated variables were compared for two 30-year simulation periods: (a) 1975-2005; and (b) 2025-2055, which is centered in the year of interest, 2040. It was found that the stronger winds (>10 m/s) are projected to intensify by approximately 10% in both wind variables.

42. Thus, observed maximum wind speeds were increased by 10% for estimating 2040 projected wave heights in the Jamuna/Padma River in Section IV. Given the uncertainty associated with climate model projections at the desired high spatial and temporal resolution, the possibility of a 20% increase in maximum wind speed was also considered for wave height calculations in Section IV.

III-E. Storm Surge

43. AWARE screening identified a high risk from “Onshore Category 1 Storms” (i.e. cyclones), which have severe impacts on coastal areas around the Bay of Bengal. The nearest Project 2 subproject to the coast is PLB-1 at Harirampur, approximately 200 km upriver from the coast. This section provides information on the potential impact of climate change on storm surge at coastal locations in the Bay of Bengal. The potential upriver impact of storm surge at subproject areas was estimated by hydraulic modelling (discussed in Section IV-B).

44. High intensity cyclones often give rise to high storm surges, and in the Bay of Bengal storm surges several meters high have been reported (e.g., IWM, 2005; Ali, 2000), showing great spatial variability across the Bay. Surges can propagate upstream through the Lower Meghna and Padma River channels but become attenuated with distance from the coast and are much smaller in the Padma River compared to the coast.

45. With climate change, warmer sea surface temperatures are expected to intensify cyclones (e.g., Emanuel, 1987, 2005; Saunders and Harris, 1997), which could increase storm surge heights. Rising sea levels, on the other hand, have a counteracting effect towards reducing storm surge heights. The sea surface temperature of the Bay of Bengal has risen on average by an estimated 0.47°C during the past half century and, while no significant increase in frequency has been detected, there appears to be a trend towards cyclone intensification (Quadir and Iqbal, 2008).

46. Karim and Mimura (2008) summarized the foreseeable impacts of climate change and sea level rise on cyclone and storm surge frequency and magnitude in Bangladesh. According to the modelling approach used by Karim and Mimura (2008) (based on Emanuel, 2005, and Ali, 2000), the surge height

[5] https://esg-dn1.nsc.liu.se/search/cordex/

of 7.6 meters observed[6] during the 1991 cyclone would have reached 9 meters if the sea surface temperature (SST) was 2°C higher, and over 11 meters if SST was 4°C higher, assuming a 40 cm rise in mean sea level (the projected relative sea level rise for 2040 considered in Project 2).

47. Regarding upriver flooding of the Padma River, it is most important to note that cyclones have not been known to strike Bangladesh in the summer monsoon season, with the sole exception of cyclone Komen which was formed near the southern coast of Bangladesh in late July 2015, reached wind speeds of 75 km/h and moved ashore in southeastern Bangladesh on 30 July 2015. The first strong cyclone to ever strike in the monsoon season since systematic records began, raises the possibility that further ocean warming may give rise to summer cyclones in Bangladesh. This is concerning because monsoon streamflow peaks could back up if they encounter high storm surge, which could lead to exceptional floods.

48. Cyclones also often produce negative surges to the left of their storm track, as the wind direction points away from the coast, and can draw water levels down near the coast. Negative surges, if they were to occur during the monsoon season, may be capable of causing short-term rapid drawdown of water levels, with potential implications for embankment stability. To our knowledge, the magnitude and rate of such a drawdown, and whether it could extend to the Padma River, has not been studied. However, a brief review of water level data from Mawa shows evidence of negative surge during the April 1991 cyclone with lowest water levels about 0.5 m lower than would otherwise be expected.

49. To evaluate the potential impact of future cyclones and associated storm surges occurring during the summer monsoon season, when streamflows are high, hydraulic simulations of the 200-year flow in the Padma River, presented in Section IV-B, considered a storm surge of 3.8 meters at Barisal – a value close to that observed at Barisal during the cyclone of November 1970 (Smith and Ward, 1998) lasting for 36 hours (thus overlapping with high tide).

III-F. Solar Radiation

50. The longevity of the geotextile materials used for geobags is affected by UV exposure. Most geobags are to be placed under water, below the low water level, and will therefore have little UV light exposure. However, some bags are to be used temporarily as wave protection above low water and above mean high water, being thus exposed to direct solar radiation for several months of the year. This exposure is reduced by sediment that deposits on the bags surface (Oberhagemann and Hossain, 2010).

51. Projections of future change in UV light exposure depend on cloudiness simulated by climate models (especially for the dry season), and natural changes in solar intensity which varies in 11-year cycles of variable maximum intensity, with the next two cycles peaking around 2023 and 2034. Predictions of solar activity strength in future cycles is highly uncertain (Hathaway, 2009), and forecasting solar irradiance is even more difficult (Wang et al., 2005). Projections of cloudiness are also highly uncertain, as they differ greatly between global climate models. The net result is that neither the magnitude nor direction of change in solar radiation at different future times is currently known.

52. The life expectancy of the geotextile material for the type of riverbank protection application under Project 2 is estimated to be between 50 and 100 years, on the basis of different studies compiled

[6] Different literature sources often quote very different storm surge height values for the same storm, and do not describe how surge height is defined or how it was measured. Chiu and Small (2016) have found that surge heights reported as observed may be overstated.

by Zellweger (2007).

53. The geotextile material specifications are in accordance with industry standards for performance under UV exposure. Previous experience in Bangladesh indicates durability for at least two years for the geobags exposed above water for wave protection. In the past, bags that were used as temporary wave protection were typically removed after about two years, and were then used for permanent protection under water. Diving investigations have determined that the previous two-year UV exposure did not affect the bags effectiveness for underwater protection (Oberhagemann and Hossain, 2010).

54. Despite the unavailability of reliable projections of future UV light incidence, its changes relative to recent observations are deemed insufficiently large to significantly modify the geotextile material resistance to sunlight exposure.

IV. ASSESSMENT OF CLIMATE CHANGE IMPACTS AND RISKS TO PROJECT 2 SUBPROJECTS

IV-A. Introduction

55. The key structural interventions of Project 2 subprojects (**Table I-1**) are:

(i) Flood embankments
(ii) Drainage regulators (built into the flood embankments to provide for land drainage on the country-side of flood embankments back to the river system)
(iii) Underwater riverbank protection works (i.e. scour protection)
(iv) Above-water riverbank and embankment protection works

56. This section presents an analysis of the impacts on climate change on the design and/or performance of each type of intervention.

IV-B. Embankments and Drainage Regulators

57. This section discusses the impacts of climate change on flood embankment crest elevations and on flooding, as affected by both embankments and drainage regulators. The impacts of climate change on wave protection for embankments are discussed in Section IV-C.

1. Flood Embankment Crest Elevations

58. No allowance is made by BWDB under current river embankment design standards for the effects of climate change, however the planned embankment is designed to enable raising the crest independently of the road section, once required.

59. Climate change will affect embankment design crest elevations through the combined effect of sea level rise and increased peak flows. Embankment design crest elevations could also be affected by higher wave runup. Other factors which could affect future water levels and hence embankment crest elevations include future morphological changes associated, for example, with future changes in sediment loading and sediment accretion. These changes are considered too speculative to quantify and account for at the present time and are addressed through the freeboard.

60. Adaptation to climate change impacts would consist of raising the embankment crest elevations when the freeboard for the design flood falls below a predetermined value, potentially in the order of one fourth to one third of the originally available freeboard.

61. The impacts of projected changes in peak flows and mean sea level on water levels in the Jamuna and Padma Rivers were evaluated using the two-dimensional HEC-RAS hydraulic model of the Jamuna/Padma River and its floodplain (described in Annex E, Volume 2 of the RSP). The results of this model were used to assess (i) changes in flood peak water levels, (ii) changes in flow velocities, (iii) extents of flooding, and (iv) changes in duration of flood peaks. Few of the results were also used for further analysis in combination with other factors such as wind speed changes to assess future wave impacts.

62. To evaluate the impact of climate change on project design parameters, the hydraulic model was run for the following scenarios:

(i) Scenario 1: Historic peak flows with historic sea level and current channel/floodplain geometry without Project 1[7] and Project-2 subprojects.
(ii) Scenario 2: Same as Scenario 1 but with Projects 1 and 2 subprojects infrastructure in place.
(iii) Scenario 3: Projected 2040 peak flows with 2040 sea level and current channel/floodplain geometry without Projects 1 and 2 infrastructure.
(iv) Scenario 4: Same as Scenario 3, but with Projects 1 and 2 subprojects infrastructure in place.
(v) Scenario 5. Same as scenario 4, but adding a hypothetical storm surge.

63. The historic peak flows for flood return periods from 2 to 500 years (obtained from flood frequency analysis of observed annual peak flow records) and 2040 peak flows are in **Table III-3**. The projected 2040 mean sea level relative to land is 0.4 m higher than historical (Section 0**)**. The model boundary conditions are the flows at Bahadurabad (at the upper end of the Jamuna River) and at Hardinge Bridge on the Ganges River; and the sea level at the Bay of Bengal, which influences the still water height upstream approximately to the Ganges River confluence.

64. The HEC-RAS model was used to estimate the still water height along the length of the Jamuna/Padma River channel, the extent of flooded areas on the floodplain, and the depth of water (which defines "flood class") throughout the flooded areas. Simulations were performed for main river flows with return periods from 2- to 200-years, with the 200-year historic peak flow representing the project design flow for the main rivers.

65. **Figure 2** shows the profile of still water height along the length of the Jamuna/Padma River, from Bahadurabad (on the left) to Chandpur (on the right), for the historical (blue) and projected 2040 (orange) 200-year peak flow event (scenarios 2 and 4, respectively); and **Figure 3** shows the difference between the two curves in **Figure 2**, which ranges between 0.26 m and 0.55 m. **Figure 3** thus shows the impact of climate change by 2040 on the 200-year water surface profile with the Project 2 subprojects in place. Considering the degree of uncertainty in the analysis, it was derived that adaptation to climate change would require embankment raises of 0.4 m at all subproject areas upstream from Chandpur to maintain freeboard allowances comparable with the current standard (taking into account reduction of freeboard over time due to settlement).

66. The amount of embankment raise required to adapt to climate change may increase with construction of additional flood embankments in line with the RSP but outside of this investment program but increases may also be partially offset by morphological change in the river channel, which is expected to become deeper and possibly wider in response to narrowing of the overall river corridor

[7] Project 1 subprojects include the Chauhali and Zafarganj embankments on the left bank of the Jamuna and the Kaijuri embankment on the right bank (**Figure 1**) and were physically completed by June 2020.

under the River Stabilization Plan prepared under Project 1 and approved by BWDB in 2020. The timing and amount of future morphological changes is however highly uncertain.

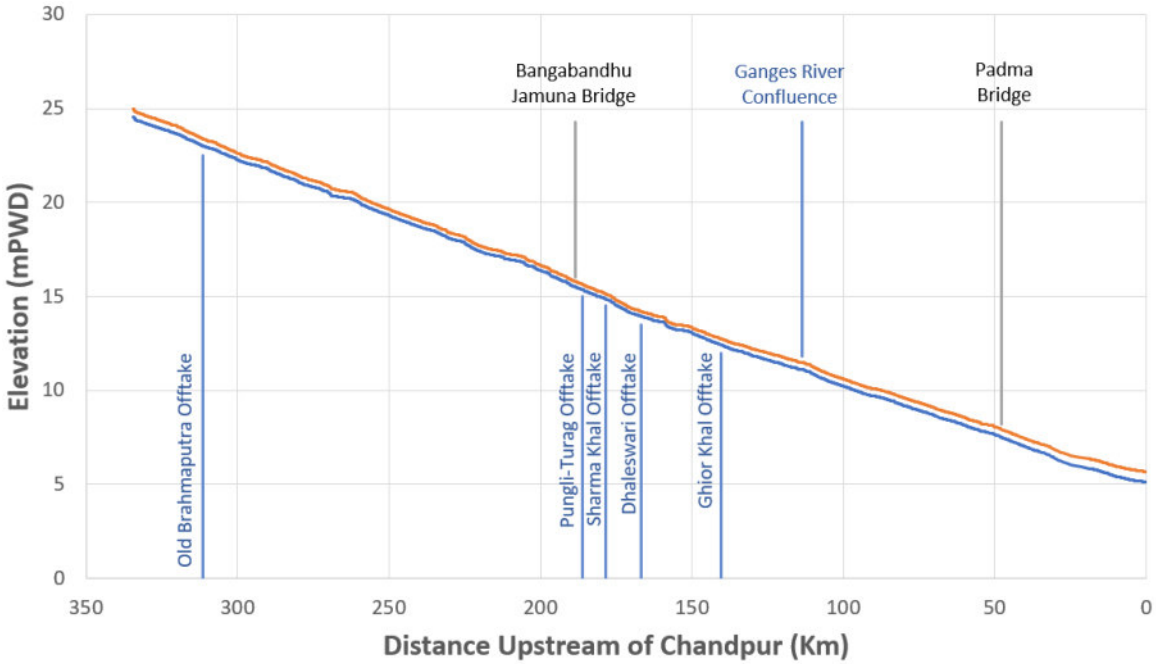


Figure 2. Water levels with 200-year return period with the Projects 1 and 2 subprojects in place, for the historical flow and sea level (scenario 2, in blue) and the 2040 projected flow and sea level (scenario 4, in orange)

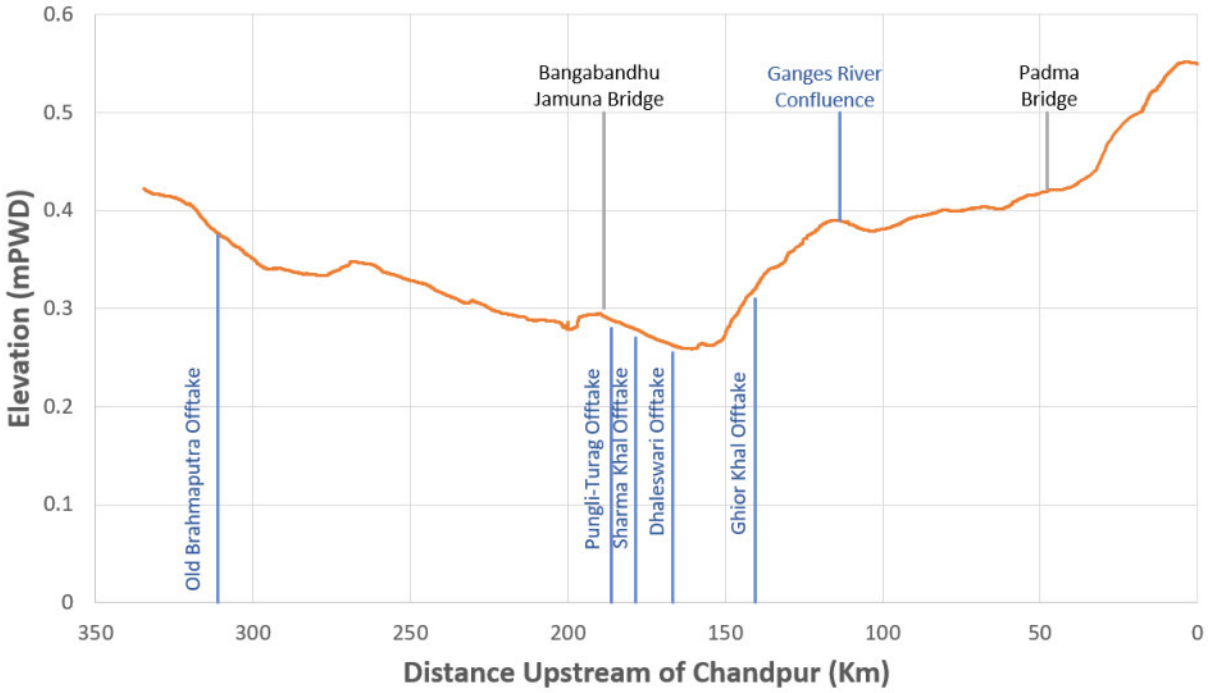


Figure 3. Difference in water levels with 200-year return period between the 2040 projected conditions and the historical conditions from Figure 2

2. Storm Surge

67. As per Section III-E, with the occurrence of cyclone Komen in July 2015, the potential appears to exist for ocean warming under climate change to give rise to summer monsoon season cyclones in Bangladesh with associated storm surge possibly exacerbating monsoon flooding on the Padma and Lower Meghna Rivers.

68. Project 2 subproject most vulnerable to monsoon season storm surge would be that nearest to the Bay of Bengal, i.e. the Harirampur revetment, located some 200 km upriver from the coast. To evaluate vulnerability to storm surge, simulations were conducted with the HEC-RAS model for scenario 5, which assumes a storm surge of 3.8 meters at Barisal – a value close to that observed at Barisal during the record cyclone of November 1970 (Smith and Ward, 1998) – lasting 24 hours (thus overlapping with high tide), and coincident with the 2040 climate 200-year return period monsoon season peak flow with the 2040 projected sea level. Such an extreme combination of conditions is unlikely to occur, but this worst case scenario was selected as a test of the vulnerability of the system to such an event.

69. Detailed model results (Annex E, Volume 2 of the RSP) show a rapid attenuation of storm surge upstream from Chandpur, such that at Harirampur (approximately 90 km upstream from Chandpur) the water level increase due to storm surge was reduced to about 0.2 m.

70. The potential also exists for negative storm surge (i.e. a drop in water level at the Bay of Bengal propagating upstream). Negative surges have been known to destroy coastal aquaculture installations (As-Salek, 1997) and evidence of negative surges are apparent in water level records on the Padma River at Mawa, about 50 km upstream from Chandpur. A rapid drop in water level could adversely impact both embankment and riverbank stability, however based on information from hydraulic

modeling of hypothetical positive surges, the magnitude of potential negative storm surge at Harirampur is judged to be too small to be of concern.

71. **Conclusion: Project-2 subprojects are not vulnerable to the effects of storm surge from cyclones in the Bay of Bengal and are not expected to be in the near future.**

3. Flooding from the Main Rivers

72. The Project 2 embankment at Shahjadpur, in combination with the embankment built under Project 1 (**Figure 1** to Figure 7) provide local reductions in country-side flood levels but have reduced impact on larger-scale flooding from the main rivers with water intrusion through other paths, bypassing the embankments. Significant reductions in such larger-scale flooding from the main rivers will only be achieved on implementation with a more complete system of flood embankments under various follow-up projects in line with the River Stabilization Plan.

73. **Figure 4** and **Figure 5** display inundation depth[8] with the Projects 1 and 2 subprojects in place, for the historical and projected 2040 200-year peak flow event (with 2040 mean sea level), respectively. The local impacts of Project-2 subprojects are illustrated in Error! Reference source not found. which displays the difference in flood depth for the historical 200-year peak flow event with the Projects 1 and 2 subprojects in place versus without those subprojects. Error! Reference source not found. is similar to Error! Reference source not found., but for the 2040 projected 200-year event.

74. Error! Reference source not found. and Error! Reference source not found. show local reductions in flood elevations behind the Project 2 Shahjadpur and Aricha-Chauhali embankments (green and yellow shading in subproject JRB-1 and JLB-2 respectively) and some small areas with increased flood depth (pink shading) in JLB-2, and JRB-1 upstream from the flood embankments. The small areas of increased flood depths are due to minor increases in main river water level caused by embankment construction which in turn results in an increase in flow escaping the river upstream from the (relatively short) embanked reaches.

75. Difference in inundation depths with the Projects 1 and 2 subprojects in place, with and without climate change, are in **Figure 6** for the 20-year event and in **Figure 7** for the 200-year event. Since Projects 1 and 2 embankments are of limited extent (**Figure 1**) they have relatively limited impacts on large-scale flooding from the main rivers under either the historic climate or under future climate.

76. Simulation results are summarised in **Figure 8** and **Figure 9** which show changes in flood conditions over the model domain in terms of total area which becomes wetter or drier under the various scenarios. **Figure 8** summarizes results for historic and 2040 climate scenarios with and without the Project 1 and 2 interventions in place, showing a modest net reduction in flooding. Note that Project 2 subprojects benefits in terms of net reduction in flooded area are greater under the 2040 climate than under historic climate. **Figure 9** shows the rather substantial increase in flooded area under the future (2040) climate relative to the historic climate conditions with Projects 1 and 2 interventions in place.

[8] Prepared using a HEC-RAS 2D model, covering the area of the River Stabilization plan (BWDB, 2020)

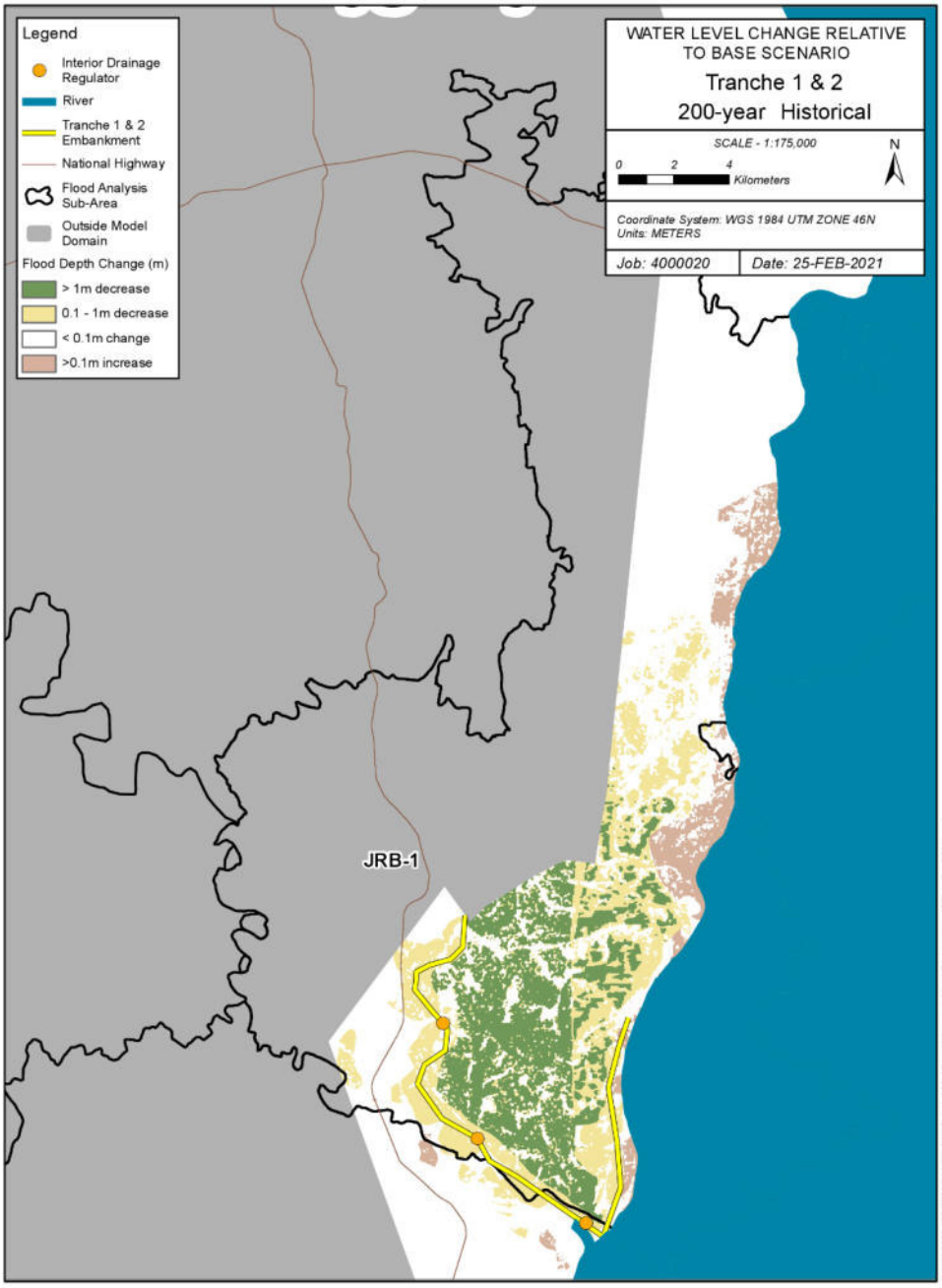


Figure 4. Inundation depth for the historical 200-year peak flow event.

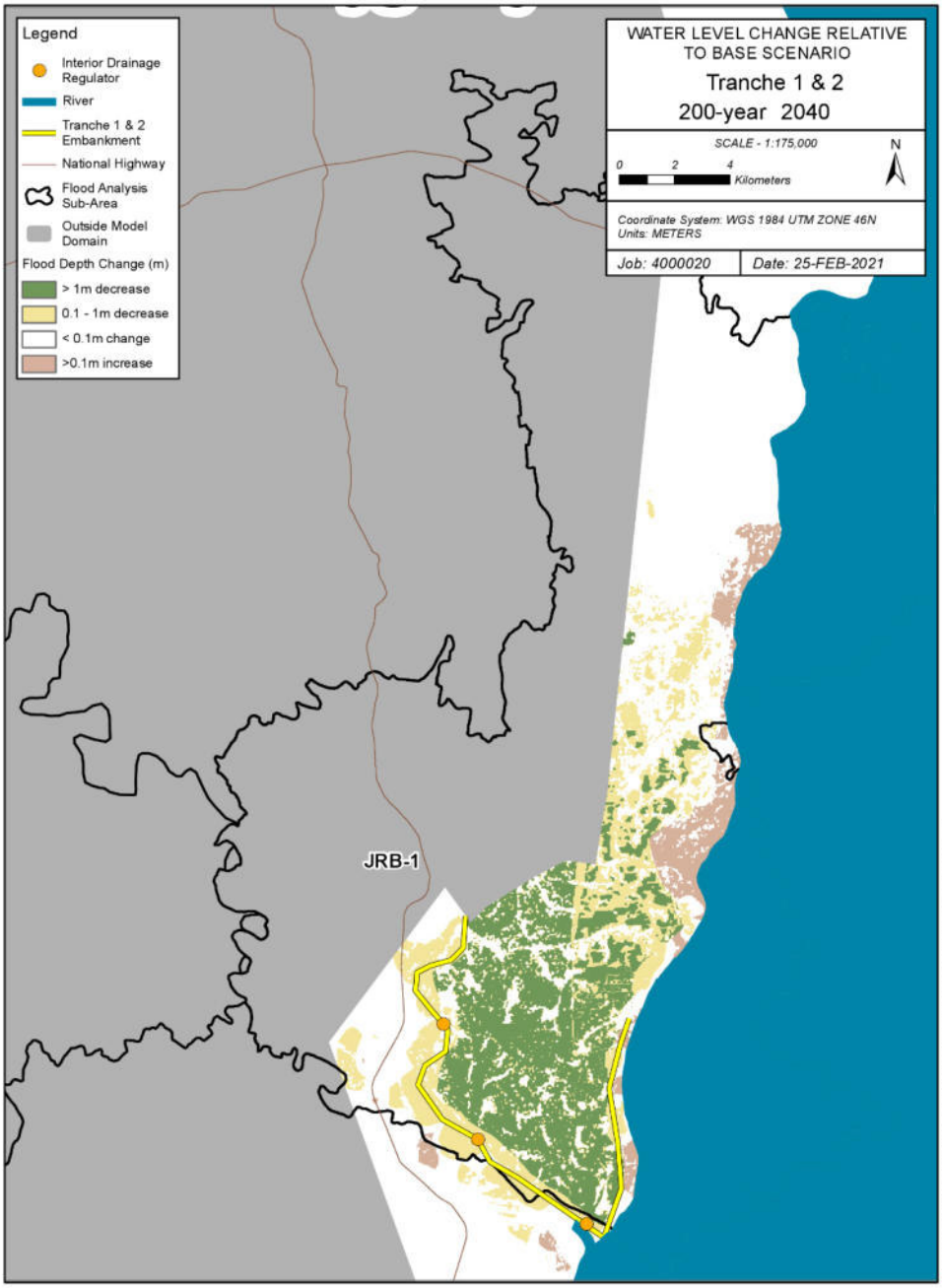


Figure 5. Inundation depth for the 2040 projected 200-year peak flow event and 2040 projected mean sea level.

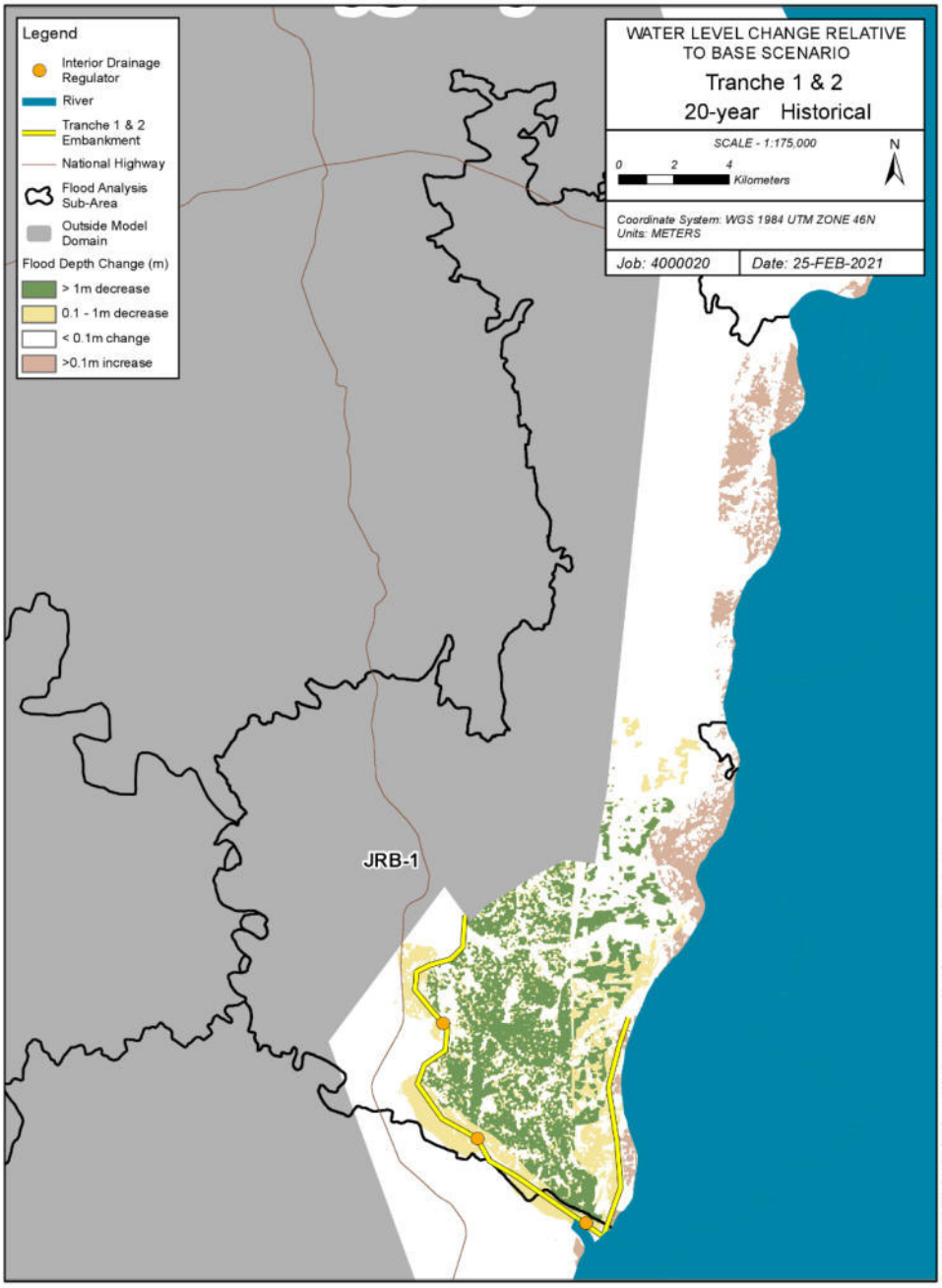


Figure 6. Difference in simulated inundation depth for the 2040 projected 20-year return period peak flow event and 2040 mean sea level with the Projects 1 and 2 interventions versus historic climate with Projects 1 and 2 interventions.

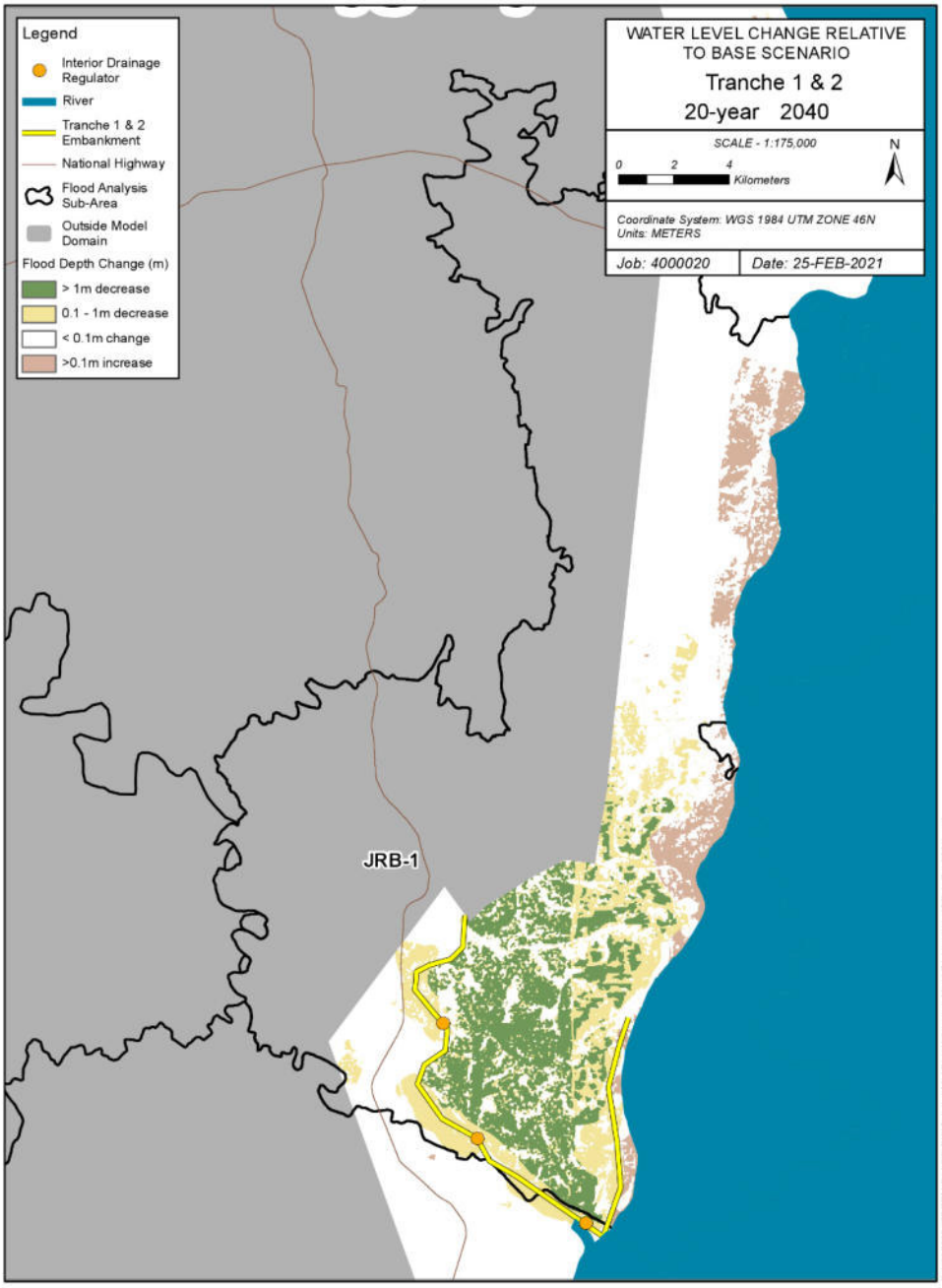


Figure 7. Difference in simulated inundation depth for the 2040 projected 200-year return period peak flow event and 2040 mean sea level with the Projects 1 and 2 interventions versus historic climate with Projects 1 and 2 interventions.

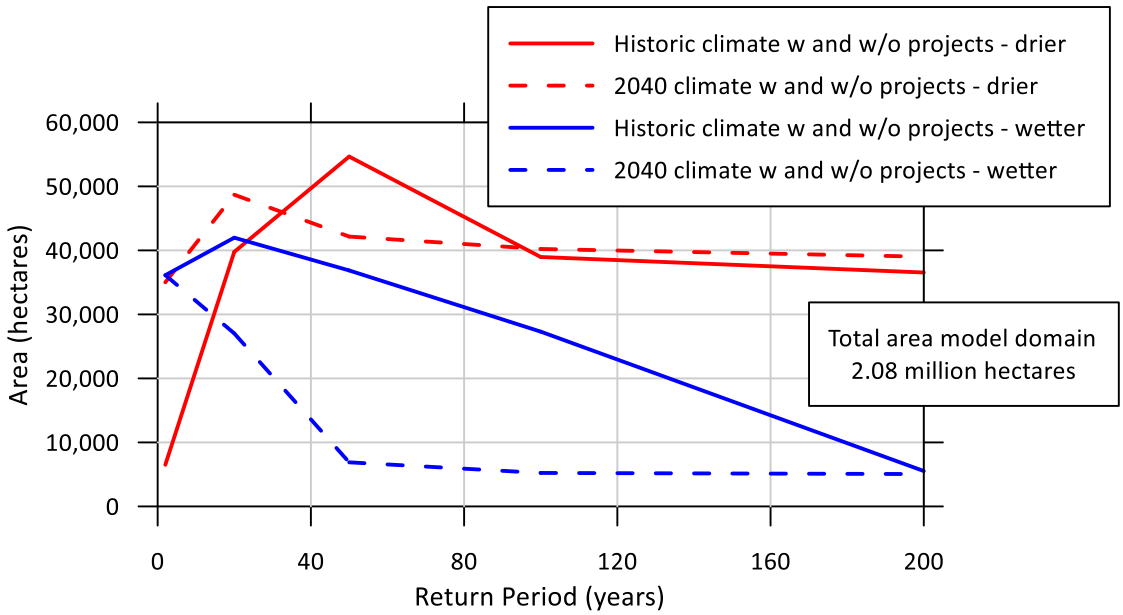


Figure 8. Summary of changes in flooded area under historic and 2040 climate with and without projects in place

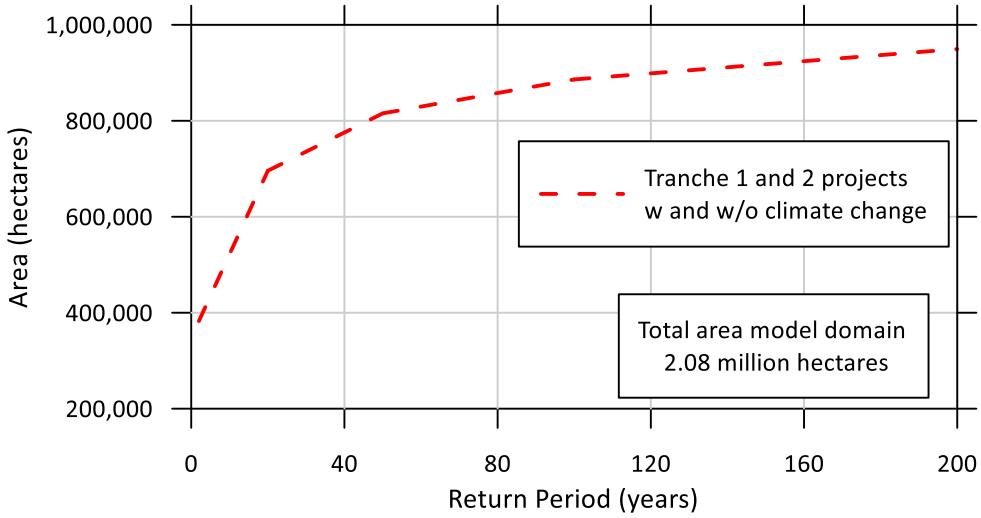


Figure 9. Summary of changes in flooded area with projects in place with and without climate change

4. Interior Flooding

77. Interior flooding (i.e. flooding on the country-side of flood embankments) may increase under future climate impacts because of increased monsoon season rainfall over the subproject areas combined with increased main river levels which will restrict and possibly delay drainage of country-side flood waters.

78. Drainage of country-side flood water into the main rivers is provided by a series of drainage regulators (several of which are also designed to provide fish passage) to be built into the embankments. Current designs call two regulators with 2 m x 2 m vents in the Shahjadpur embankment.

79. Simulations were performed of selected flood events to investigate the impacts of climate change on the interior flood regime with Project 2 subprojects in place. Increases in river levels under climate change cause a corresponding increase in interior flood levels which cannot be mitigated by modifications to regulator sizing or operation. Adaptation to climate change would require pumping of interior flood waters into the main rivers (not under consideration at the present time), or adaptation of crops and cropping patterns to changing (post-project) interior flood levels. No specific crop adaptation measures are recommended under Project 2– future changes in crops and cropping patterns will most likely be driven by other climate changes (notably air temperature), changes in market conditions, and development of new crop varieties.

80. The situation is similar at the Shahjadpur embankment but more complicated by lack of data, particularly on interior runoff amounts.

IV-C. Riverbank Protection

81. Climate change impacts on riverbank protection works are mainly through projected increases in discharge and associated flow velocities, and increased wave height resulting from an increase in wind speeds. These potential impacts are described and assessed in this section based on the part of riverbank protection (underwater or above water) that is affected by the impact change.

1. Underwater Protection – Increased water levels and flow velocities

82. Climate change impacts the underwater protection mainly through higher waver levels and increased flow velocities, which may result in greater scour depths and which may require larger protection element sizes and increased maintenance of protection works.

83. The riverbank protection work for Project 2 consists of the three elements:

(i) Permanent wave protection built above low water level and consisting of durable concrete blocks, grout-filled mattresses, or other similar hard protection.
(ii) Underwater slope protection consisting of three layers of sand-filled geotextile bags (geobags) stable to the design flow velocities.
(iii) An underwater apron consisting of five layers of geobags for self-launching in case of scour attack.

84. An integral aspect of design is monitoring and evaluation of revetment performance, and adaptive management in the event of scour attack and deployment (launching) of the geobags making up the apron. After the geobags in an apron have launched, additional geobags must be placed to maintain the necessary protection. The basis for design of geobag revetments is described in more detail in Annex D, Volume 3 of the RSP. Monitoring and adaptive management were originally proposed to address issues related to geomorphic uncertainty independent of climate change. However, as discussed in Section II-C and below, uncertainty in the river response to climate change can be addressed under the same monitoring and adaptive management approach. An extensive monitoring package targeting said parameters is included in Project 2 to measure the performance of the works and provide information for improvement of the design.

85. The current approach to sizing of geobags relies on the USACE/Maynord formula (USACE,1994) for sizing of rock rip-rap, with application of a shape factor to account for the differences in behavior between rip-rap and geobags. Sizing of protective elements (whether geobags or rip-rap) is quite sensitive to the assumed design velocity, with a relatively small increase in assumed velocity leading to a relatively large increase in the size (weight) of element needed to ensure stability, as discussed further below.

86. The designs for Project 2 use standard 250 kg bags. These are considered to provide a good compromise between relative ease and speed of placement, and the resulting robust protection that is provided for the potential range of flow and scour conditions that are expected to develop at the Project 2 subproject sites.

87. The current sizing of geobags is considered to be conservative. As discussed in Annex D, Volume 3 of the RSP, physical model tests have shown that, except at deep scour depths, the USACE formula tends to oversize geobags. It should also be noted that geobag sizing for the Project 2 sites is based on full implementation of a River Stabilization Plan with a narrowed channel resulting in a higher design velocity (3.5 m/s) than would be expected under current conditions (3.0 m/s).

88. Changes in hydraulic conditions under climate change are expected to be relatively modest. Hydraulic modeling of the 200-year flood event at the PLB-1 subproject, for example, shows an approximately 0.4 m increase in water level and a 3.5% increase in near-bank flow velocity by 2040 relative to current climate conditions. It is assumed that design velocities for 2040 under climate change would increase by the same percentage.

89. **Table IV-1** summarizes the results of representative geobag sizing calculations following the USACE formula for present and future (2040) climate. The formula used is:

$$\frac{D_n}{y} = C_s S_f C_v C_T \left[\frac{V}{\sqrt{K_1 g y}} \left(\frac{\rho_w}{\rho_s - \rho_w} \right)^{0.5} \right]^{2.5}$$

90. The formula calculates an equivalent geobag diameter D_n under consideration of the flow velocity v, water depth y, density of water and sand, various coefficients, and a safety factor. Readers are referred to Annex D, Volume 3 of the RSP for further information on the USACE formula and details of the various design parameters.

91. The examples in **Table IV-1** show minimum geobags sizes for the post-launching condition on a 1V:2H slope for present conditions (2018) and for 2040 with a 3.5% and 5% increase in design velocity. A 3.5% increase in design velocity (and 0.4 m increase in water level) results in an increase in the required minimum geobag weight of 28% (from 165 kg to 211 kg). A 5% increase in design velocity would increase the required weight by 43% (from 165 kg to 235 kg). The current designs using 250 kg bags are sufficiently conservative to accommodate 2040 projected climate change but the sensitivity of geobag sizing to velocity is quite evident.

Table IV-1. Current and future potential geobag designs.

Parameter	Unit	2018	2040	2040
Density water ρ_w	kg/m^3	1000	1000	1000
Density sand ρ_s	kg/m^3	1700	1700	1700
Gravity g	m/s^2	9.81	9.81	9.81

Stability Coefficient C_S	-	0.31	0.31	0.31
Safety Factor S_f	-	1.2	1.2	1.2
Velocity Distribution Coefficient C_V	-	1.25	1.25	1.25
Thickness Coefficient C_T	-	1	1	1
Side Slope Factor K_1 for slope 1V:2H	-	0.88	0.88	0.88
Water depth y	m	36	36.4	36.4
Velocity increase relative to 2018	%		3.5%	5.0%
Flow velocity V	m/s	3.50	3.62	3.68
Diameter D_n	m	0.46	0.50	0.52
Volume	m^3	0.10	0.12	0.14
Weight	kg	165	211	235

92. More severe changes than the 3.5% or 5% increase in velocity assumed above may reduce the safety factor for geobag sizing below the value of 1.2 assumed in **Table IV-1**, and, in extreme situations, may result in mobilization of some geobags and potential loss of some protective cover. Such situations are expected to be identified and rectified during monitoring and adaptation planned as an integral part of the Project 2 design.

93. A monitoring plan for Project 2 will include for monthly or twice monthly monitoring of underwater works during the flood season using modern bathymetric survey equipment such as single- and multi-beam echo sounder. These can be complemented with diving surveys during the dry season to confirm locally findings of the bathymetric survey. No additional monitoring of revetment performance is necessary under climate change.

94. It is assumed that under climate change, larger floods will lead to greater annual erosion. Currently, for Project 1 subprojects, about 10 m of scour depth on average has been observed in the first few flood seasons after project implementation, although there are sections that scoured much more and others that did not scour at all. Under climate change, annual scour depth is assumed to increase by roughly 20%, from 10 m to 12 m. The increased scour depth would increase the slope length (after launching of geobags) to be protected by placement of additional geobags under adaptive management.

2. Above-water slope protection – Wave impacts

95. The above-water upper slope of the riverbanks and embankments are subject to impact from waves that can potentially destroy the slope and cause local erosion, or breaches of an embankment. The impact energy of a wave depends on the wave height (H) and the wave period (T), both of which are dependent on wind speed, wind direction, fetch, and water depth.

96. To allow time for the riverbank to consolidate and to gather further experience with grout-filled jute mattress as piloted under project 1, all permanent wave protection works have been deferred to the follow-up project. Instead, temporary wave protection with geobags will be constructed. These however will not be subject to impacts of climate change as they are set to be replaced in a few years time.

V. EVALUATION OF GEOLOGIC RISK ASSOCIATED WITH EARTHQUAKES

97. As per Section I-B, the AWARE screening produced an overall risk rating of "medium" for geological hazards, but with earthquake risk rated as "high". Accordingly, this section provides an evaluation of the risk induced by earthquakes to the Project 2 subprojects. Two issues have been identified and addressed: the direct impact of seismic loads on the infrastructure (flood embankments and riverbank protection works) to be built under Project 2 (Section V-A), and the impact of earthquakes on the sediment loads in the main rivers and subsequent impacts on the river morphology (Section V-B).

V-A. Earthquake Risks to Infrastructure Design and Performance

98. Seismic loads are considered in the project riverbank protection and flood embankment designs following Bangladesh national building guidelines (the Bangladesh National Building Code) and international standards reflected in load cases developed for River Bank Improvement Program.[9] Under Project 2, riverbank protection and flood embankments will be increasingly built on recovered char land to maximize the land area protected and guide the river towards a meandering planform. Therefore, the design for earthquake resistance becomes increasingly important as the newly recovered land consists of loosely packed, non-cohesive soils susceptible to liquefaction.

99. The load cases considered under Project 2 combine different loads based on probability of occurrence and probability of superposition of the load events. According to the expected overall probability of a load case, different minimum factors of safety were defined. In total, four loading cases were defined for the geotechnical design of flood embankments and riverbank protection for slope stability and internal erosion (**Table V-1**).

Table V-1. Load cases for geotechnical stability and internal erosion

Load Case	Loads considered	Probability	Factor of safety (slope stability and internal erosion)
LC 1	Dead loads, permanent load, lateral earth pressure, permanent hydraulic pressure as well as regularly variable hydraulic water pressure	Permanent	1.4 and 1.5
LC 2	LC 1 and rare combination of loads such as standard high flood and rapid drawdown	Rare	1.3 and 1.4
LC 3	LC 1 and one exceptional load such as earthquakes and maximum flood	1:50 years and 1:100 years	1.2 and 1.2
LC 4	LC 1 and two simultaneous exceptional loads such as earthquakes, rapid drawdown and maximum flood	1:2500 years	1.1 and 1.0

100. The Bangladesh National Building Code (BNBC) from 2015 divides the country into four seismic zones (**Figure 10**) with different levels of ground motion. Each zone has a seismic zone coefficient (Z)

[9] Fichtner and Northwest Hydraulic Consultants (2015) River Bank Improvement Program Feasibility Report Final Report

which represents the design peak ground acceleration (PGA). The PGA zone coefficient is applied to a design earthquake having a 2% probability of exceedance within a period of 50 years (corresponding approximately to an earthquake with a return period of 1 in 2,500 years). The earthquake ground motion used in design is represented by the Design Response Spectrum, which takes into account the seismic zone, importance of the structure (considering "the consequences of collapse for human life, on their importance for public safety and civil protection in the immediate post-earthquake period, and the social and economic consequences of collapse", BNBC (2015)), type of structure, and local soil conditions in the formula:

$$S_a = \frac{2}{3}\frac{ZI}{R}C_S$$

where:

S_a = design spectral acceleration,

Z = seismic zone coefficient,

I = structure importance factor,

R = a response reduction factor, and,

Cs = normalized acceleration response spectrum, which is a function of structure characteristics and soil type.

101. All Project 2 subproject sites are in seismic Zone 2 with the exception of the riverbank protection works upstream of Chauhali, which extend into Zone 3. Sites in Zone 2 have a PGA zone coefficient Z of 0.2, while the one in Zone 3 has a PGA zone coefficient of 0.28.

102. Under the BNBC, buildings are classified into one of four occupancy categories depending on the consequences of collapse for human life, and on the social and economic consequences of collapse. The occupancy categories are in turn associated with a structure importance factor. The BNBC does not specifically mention earthen or sloped structures, such as flood embankments and riverbank protection works such as these proposed under Project 2. For Project 2, these structures have been assigned an occupancy category of III to IV as failure of embankments or riverbank protection can have extreme consequences, especially when located near densely populated areas. This gives a structure importance factor of 1.25 to 1.5, which, as can be seen in the above formula, leads to higher seismic forces in design. Soil characteristics are covered by the C_S factor, varying from dense sand with a clay top layer along consolidated riverbanks to loose sand on newly recovered char land.

103. **Therefore, under Project 2 the flood embankments have been and will be designed to withstand these forces with measures including (i) flat slopes of maximum 1V:3H, further flattened with berms for high sections; (ii) ground improvement with permeable vertical drains to improve the base and minimize settlement; and (iii) provision of a wide base, in particular on loose, permeable soils (char lands) to minimize seepage and piping under the embankment.**

Figure 10. Seismic zones in Bangladesh (Bangladesh National Building Code 2015)

V-B. Earthquake Impacts on River Morphology

104. The magnitude 8.6 Great Assam Earthquake of 1950 had a pronounced impact on morphological processes in the Brahmaputra River Basin. The earthquake generated a tremendous volume of landslide activity through the eastern Himalaya (Mathur, 1953; Verghese, 1990) and is believed to have been an important factor driving morphologic changes along the Jamuna River through the second half of the 20th century (Goswami, 1985; Bhuyia and Rahman, 1988; Delft Hydraulics and DHI, 1996; Sarker and Thorne, 2006; Sarker, 2008; Sarker et al., 2014). Bed aggradation and

decreased lateral channel stability accompanied by increased channel width and braiding intensity changes are believed to have occurred on the Jamuna and Padma rivers due to a sediment pulse from the earthquake. The mechanisms connecting earthquake induced changes in sediment supply to morphological changes in the Jamuna, however, have not been clearly described but there are likely important interactions between sediment supply variability and decadal periodicity in flood flows (Fichtner and NHC, 2015).

105. The 1950 earthquake was a relatively low-recurrence interval but highly impactful event, particularly from the perspective of sediment supply to the Brahmaputra and its tributaries in the Himalayas. Technical Note F8 evaluates the magnitude-frequency relationship for large earthquakes in the Brahmaputra River Basin. It finds an event somewhere in the Brahmaputra Basin with equivalent magnitude of the 1950 earthquake to have about a 450-year recurrence interval. **Table V-2** lists the estimated magnitudes of several other recurrence interval events and an indication of associated landslide volumes. Earthquake-triggered landslide volume scales exponentially with magnitude (Keefer, 1994), and so the expected volume of sediment mobilized in landslides by a 500-year recurrence interval event is about 25 times larger than that mobilized by a 100-year event (**Table V-2**). Based on the Jamuna believed sensitivity to perturbations in sediment supply and these probabilities of occurrence, it is important to stabilize the river in such a way that it will be able to accommodate a perturbation similar to that caused by the 1950 earthquake without either the river stabilization works or surrounding infrastructure sustaining catastrophic damage (Technical Note F8).

Table V-2: Estimated earthquake recurrence intervals and associated landslide volumes for the Brahmaputra/Jamuna river basin (adapted from Technical Note F8).

Recurrence Interval (T in year)	Magnitude (M)	Landslide Volume (m^3)	Landslide volume relative to average annual yield*
25	6.9	1.4×10^8	0.5 X
50	7.3	5.5×10^8	2 X
100	7.7	2.2×10^9	8 X
200	8.1	8.7×10^9	30 X
500	8.7	5.4×10^{10}	200 X
1000	9.1	2.1×10^{11}	1000 X

*Calculations assume 500 mt/year sediment yield (Bora, 2004; Pahuja and Goswami, 2006; Stewart et al., 2008) and density of 1.73 t/m^3.

106. Even though the mechanistic connection of the 1950 event to morphodynamic changes in the Jamuna river is not fully resolved, the history of channel response is the best way to understand potential future impacts. This experience is described in detail by Sarker and colleagues (Sarker and Thorne, 2006; Sarker, 2008; Sarker et al., 2014), further considered by Fichtner and NHC (2015). It is summarized in Technical Note F8 and below. Sediment from the 1950 earthquake is believed to have driven bed aggradation, decreased lateral channel stability, and increased channel width and braiding intensity. The bed level at Bahadurabad increased by about 1 to 1.5 m during the aggradation wave and elevated bed levels lasted for a period of several decades. Following the introduction of the sediment pulse to the headwaters, the channel initially narrowed and then widened rapidly from about 8 to 12 km as the aggradation wave reached its peak and a period of relatively large floods occurred. The minimum active channel width (bankline to bankline excluding chars) along the river during its widest extent was about 7 km.

107. Confining flood flows and the alluvial corridor with embankments and river training structures, respectively, as proposed under Project 2, will have major impacts on morphologic processes in the river including how it will respond to future large sediment supply pulses. This is because: 1) the river will no longer be able to freely adjust its width and its planform may be more static with scour holding dominant channels against river training structures, and 2) channel-forming discharge will be greater (and more variable) due to less conveyance of flood flows across the floodplain.

108. Differences between the response to the 1950 earthquake and a future event of similar magnitude following implementation of the River Stabilization Plan are evaluated in Technical Note F8. Key changes include:

(i) Bed levels in the channel will increase more than they did during passage of the past sediment wave, but due to acceleration of the pulse celerity, the effect will be less than proportional. For instance, an 80% reduction in alluvial corridor width may result in about a 25% increase in the maximum bed wave height. This may necessitate raising embankments above their design level by somewhere in the order of 2 m, however the required embankment raise could be partially offset by future morphological changes in the channel, which will become deeper and possibly wider in response to narrowing of the overall river corridor.

(ii) Rapid sedimentation resulting from an aggradation wave will have the primary impact of raising water levels relative to bar, char, and floodplain elevations around the channel. This may substantially increase the volume of flow conveyed outside of the antecedent active channel area and lead to chute cut-offs dissecting these surfaces and increasing the braiding intensity. The active channel may be expected to extend from river training works on one bank to river training works on the other. Individual anabranches are not expected to follow the preferred main channel path—as during periods of lower sediment supply— and will erode into unprotected portions of the bankline. Proactive and reactive investments in further riverbank protection will be required to maintain long-term function of the river training strategy.

(iii) Accelerated sedimentation in areas of the floodplain that are protected from lateral migration will be permanent, which, in the long-term, will reduce the proportion of flow conveyed through the flood corridor (i.e. the area between embankments excluding the alluvial erodible corridor) and increase flow concentration across the erodible corridor, potentially amplifying the effects described above. This will also have a long-term effect on flood corridor flow conveyance and increase flood water levels.

109. A decade or more may elapse between an earthquake affecting sedimentation in the Brahmaputra Himalayan tributaries and response on the Jamuna River, leaving time for adaptive management when a large future earthquake triggers a sediment pulse. Attention to several design considerations, however, would be necessary to enable adaptive management without loss of the previous river stabilization investments. The most important design considerations to enable resilience in the face of an expected large future sediment pulse impacting the Jamuna River include:

(i) Design embankments so that they may be raised in the future without major work to maintain their stability.

(ii) Enable an appropriate erodible corridor within the bounds of river training structures. A first approximation of the necessary alluvial corridor width of 7 km is determined from the history of active channel widths during the second half of the 20th century.

(iii) Design river training structures to withstand scour conditions associated with an aggressively migrating braided planform.

110. These considerations all have the advantage of additionally increasing the system resilience to hydrological variability and impacts of climate change.

VI. ECONOMIC ANALYSIS OF CLIMATE CHANGE ADAPTATION MEASURES

VI-A. Introduction

111. Due to climate change impacts, peak flows in the Jamuna/Padma River are projected to increase. Consequently, during the wettest monsoon seasons, a higher occurrence of larger flow velocities and an increased risk of scour are expected. Increased wind speeds will also contribute to larger waves. To mitigate the risks of scouring and deterioration of the riverbank protection works as well as overtopping of the flood embankments, climate change adaptation measures are to be included in the design.

112. The main objectives of the economic assessment are to: (i) estimate the economic benefits and costs of mitigating riverbank erosion and alleviating flooding in the three subprojects both with and without climate change adaptation measures; and (ii) assess the impact of introducing the proposed climate change adaptation measures on the economic viability of investments in riverbank protection works and flood embankments proposed under tranche 2.

VI-B. Economic Investment Costs

1. Main Interventions

113. **Table VI-1** summarises the main interventions proposed for each subproject area under Project-2.

Table VI-1: Main interventions at the three subprojects under Projects 1 and 2

Subproject	Riverbank Protection		Flood Embankment	
	Constructed (Project 1)	Proposed (Project-2)	Constructed (Project 1)	Proposed (Project-2)
JRB-1		10.5 km	21.0 km	7.9 km
JLB-2	9.0 km	15.5 km		
PLB-1	8.8 km	4 km		
Total	**17.8 km**	**30.0 km**	**21.0 km**	**7.9 km**

114. It can be seen from **Table VI-1** that 17.8 km of riverbank protection works have been constructed under tranche 1 to protect existing settlements and agricultural land from riverbank erosion at Chauhali, Zafarganj and Harirampur. In addition, 21.0 km of flood embankment has been constructed at JRB-1.

115. Under Tranche 2, a further 7.9 km of flood embankment will be constructed at JRB-1. In addition, 3.5 and 7 km of riverbank protection works will be built to mitigate erosion of the mainland on the right bank of the Jamuna River at Benotia and Enayetpur respectively . At JLB-2, 15.5 km of revetment works will be built upstream of Chauhali, and further 4 km will be constructed in combination with an offtake structure to connect to the existing Chauhali protection following the building with nature based

approach to close the Solimabad channel. In PLB-1, an extension of the existing Harirampur protection by 4 km is proposed.. Subproject locations are in **Figure 1**.

116. The financial investments primarily comprise riverbank protection works (including geotextiles), flood embankments and dredging works as well as land acquisition and resettlement costs.. Other project costs include vehicles/equipment, social/environmental management, unallocated protection works, disaster risk management and subproject/project management. The financial investment costs for tranches 1 and 2 were then converted to economic values using economic conversion factors for foreign costs, local materials, skilled/unskilled labour and machinery. The methodology to derive economic prices is in FRERMIP: Economic Analysis of Tranches 1 and 2 - Supplementary Report.[10]

117. Total economic costs amounted to Tk7,675 million ($90.6 million) for JRB-1, Tk10,420 million ($123.0 million) for JLB-2 and Tk3,365 million ($39.7 million) for PLB-1 Annual operation and maintenance (O&M) costs were also included in the economic analysis to adequately sustain the infrastructure throughout its economic life. Annual O&M costs as a percentage of capital costs were estimated at the rates of 2% for riverbank protection works and 5% for flood embankments and other structures.

2. Climate Change Adaptation Measures

118. Project 2 works will be monitored during the monsoon season to ensure that the riverbanks are effectively protected by the geobags against scour. Increased flow velocity due to climate change is expected to increase scour risk and result in a need for placement of an **additional 1,675,000 geobags for underwater protection**.

119. Expected higher floods with higher flow velocities increase the morphologic dynamic of the rivers, resulting in increased threat of outflanking of riverbank protection structures and increased threat for additional parts of the riverbank. To mitigate these threats, the length of riverbank protection works planned is **about 15% higher**.

120. The increased morphological dynamic is also expected to cause faster and more extensive scouring, leading to increased adaptation works requirements in the short term. It is expected that adaptation works will be required at **additional 30%** of riverbank protection length.

To adapt to higher water levels associated with climate change, **raising the embankment height** by an estimated 0.4 m is also required (Section IV-B).. For the purposes of the analysis, it has been assumed that under Project 2 only a service road is built on the 7m wide berm of the embankment and that only the embankment crest will be raised. Further road development is expected to be done by other government agencies and are not included under FRERMIP.

121. With higher and more frequent high floods, the threat to the population increases, which is addressed through the Community-based Flood Risk Management (CbFRM) activities, under which 160 community groups will be trained under Project 2. To increase risk awareness, **training modules on climate change are included in the activities**.

122. The costs for the measures described above are summarized in Table VI-2 and amount to $ 54.8 million. The bulk of measures are for riverbank protection works, highlighting the magnitude of the expected impact of climate change on the river morphology.

[10] FRERMIP: Economic Analysis of Tranches 1 and 2 - Supplementary Report, May 2021.

Table VI-2 Financial cost of adaptation measures (in $ million)

Adaptation Activity	Estimated Adaptation Costs ($ million)
Riverbank protection - Design scour safety margin - Provision of additional bags in initial construction to launch to design scour plus safety margin.	22.2
Riverbank protection - Length of works - About 20% of the length is to be extended due to climate change.	14.8
Riverbank protection - Length of adaptation works	15.2
Flood embankment - Increase of design flood - Design increased from 50-year to 100-year flood return period (minor rivers)	1.7
Community-based flood risk management – Awareness to the population on climate change impacts combined with flood risk management	0.9
Total	54.8

VI-C. Economic Benefits

123. The expected economic benefits of the investment program are: (i) reduced land loss due to protection from riverbank erosion, (ii) mitigation of flood damage resulting from embankment construction, (iii) increased agricultural production, and (iv) development of reclaimed char lands.

124. The economic benefits of Project 2 interventions are: (i) reduced land and property loss due to protection from riverbank erosion, (ii) mitigation of damage and losses due to floods, and (iii) increased agricultural production due to improved security from the threat of flooding, and (iv) char land development. Flood mitigation makes a significant contribution accounting for 82% of economic benefits in JRB-1.. Riverbank protection also provides substantial economic benefits in PLB-1 (100%), JLB-2 (91%) and JRB-1 (18%). For JLB-2, char land development is also important and accounts for 9% of the economic benefits. For the overall program, riverbank protection contributes 60% of the economic benefits, followed by flood mitigation (37%) and char land development (3%).

VI-D. Economic Viability With and Without Adaptation Measures

125. Based on the incremental annual benefit and cost streams over a 30-year period, the economic internal rates of return (EIRR) and net present values (NPV) were estimated in order to determine the economic viability of the program interventions both with and without climate change adaptation measures.

126. Without climate change adaptation measures, the results of the economic analysis indicate that the EIRRs for tranches 1 and 2 are 14.1% for JRB-1, 14.0% for JLB-2, and 14.1% for PBL-1 and 14.0% overall (Table VI-3). When climate change adaptation measures are included, the EIRRs decline to 13.6% for JRB-1, 13.2% for JLB-2, 13.2% for PBL-1 and 13.4% overall. These results clearly show that, the proposed investments still remain economically viable with climate change adaptation measures for JRB-1, JLB-2, PLB-1 and the overall investment program.

127. Comparing the economic viability of tranches 1 and 2 investments (including adaptation measures) with tranche 1 investments, it is evident from Table V1-3 that the EIRR for JRB-2 will increase from 12.8% to 13.6%. Similarly, it is envisaged that the EIRR for JLB-1 will rise from 12.3% to 13.2%. However, the EIRR of PLB-1 falls from 14.0% to 13.2%.. Overall, the EIRR is expected to rise from 12.9% under Project 1 to 13.4% under tranches 1 and 2.

Table VI-3: Economic viability of investments under Projects 1 and 2

Investment with and without adaptation measures	JRB-1		JLB-2		PLB-1		Overall	
	EIRR	NPV (BDT M)	EIRR	NPV (BDT M)	EIRR	NPV (BDT M)	EIRR	NPV (BDT M)
Tranche 1	12.8%	1,232	12.3%	852	14.0%	842	12.9%	2,927
Tranche 1 and 2 - without adaptation measures	14.1%	2,640	14.0%	2,847	14.1%	1,081	14.0%	6,568
Tranche 1 and 2 - with adaptation measures	13.6%	2,435	13.2%	2,482	13.2%	896	13.4%	5,812

EIRR = economic internal rate of return; NPV = net present value, JLB = Jamuna Left Bank; JRB = Jamuna Right Bank, PLB-1 = Padma Left Bank

VII. CONCLUSIONS AND RECOMMENDATIONS

128. The analyses of climate and hydrological projections for time horizon 2040 presented in this CRVA enabled to evaluate the risks of each Project-2 subproject to climatic changes, and recommend specific climate change adaptation measures for, to the extent possible, preserving each subproject integrity. The economic analysis showed that the investments under Project 1 and Project 2, including the climate change adaptation measures, are economically viable, with encouraging economic benefits and good overall rate of return on investment.

129. The projected changes in climate and hydrology (Section III) indicate a trend towards higher peak flows and higher flow velocities in the Jamuna/Padma River (with sea level rise contributing further to higher still water levels in the Padma river), and larger waves promoted by stronger winds. Higher flow velocities pose greater risk of stream bed scour, higher-energy waves increase erosive power on river banks and embankments, and higher peak flows with larger waves increase the risk of riverbank and embankment overtopping and flooding.

130. The recommended climate change adaptation measures (Section IV) include: raising the embankment heights at Aricha-Chauhali (JLB-2) and Shahjadpur (JRB-1) by 0.4 m in anticipation of increased peak flows and sea level rise; provision of an additional geobags for protection against increased underwater scour; use of thicker protective elements (concrete blocks or grout-filled mattresses) for above-water riverbank protection against wave action; protecting the crest of the Aricha-Chauhali embankment from the effects of potential wave overtopping using grout-filled mattresses and training of the local population about the risks of climate change.

131. The economic viability of the program presented in section VI, translates into an overall economic internal rate of return (EIRR) of 13.4% (including adaptation measures). the financial costs of the adaptation measures are summarized in Table VI-2.

132. The region is at significant risk of earthquakes, which would produce direct seismic loads on embankments and riverbank protection structures, and which could mobilize great amounts of sediment into the Brahmaputra/Jamuna/Padma river channels. The latter would result in morphological changes which could pose additional risk to the investment structures (Section V).

133. Seismic loads are considered in Project 2 riverbank protection and embankment designs follow the 2015 Bangladesh National Building Code (BNBC) and international standards. While the BNBC does not specifically include earthen or sloped structures such as the embankment and riverbank

protection works proposed under Project 2, for design purposes, the Project 2 structures were assigned a high occupancy category of III to IV, which requires incorporating in the design higher seismic forces (Section V-A).

134. With respect to channel morphological changes induced by earthquakes (Section V-B), landslides in the eastern Himalaya triggered by the magnitude 8.6 Assam earthquake of 1950 introduced an enormous volume of sediment into the Brahmaputra River system with pronounced effects over the subsequent decades on river morphology. Bed aggradation and decreased lateral channel stability accompanied by increased channel width and braiding intensity changes are believed to have been induced on the Jamuna and Padma rivers by the sediment pulse from the earthquake.

135. The 1950 earthquake is estimated to have a 450-year recurrence interval (Annex F, Volume 5 of the RSP). The sediment volume generated by an earthquake increases exponentially with magnitude, so that an earthquake with a return period of 50 years is expected to produce only 1% of the sediment produced by a 500-year earthquake. Therefore, a sediment release comparable to that of the 1950 earthquake is unlikely to occur within the economic life of the Project-2 subprojects – i.e. within the next three decades. Furthermore, a decade or more may elapse before the main sediment pulse reaches the Jamuna River, allowing time for preparation and adaptive management of geomorphic change. The River Stabilization Plan includes recommendations for embankment design, which were applied to the design of Project 2 works (Annex F, Volume 5 of the RSP) to enable adaptive management without excessive cost, i.e., without loss of the river stabilization investment.

136. The recommended timing for implementation of the climate change adaptation measures varies and will depend on monitoring of main rivers flows and water levels as well as continued monitoring of the performance of riverbank protection works. Placement of additional geobags to maintain under water protection would be dependent on findings of the proposed monitoring program.

137. The potential impact of climate change on wind regime and resulting impacts on wave height and wave runup is particularly uncertain. The uncertainty of climate change impacts is compounded by lack of short interval wind speed and wave climate observations. It is recommended that a program of wind and wave monitoring be initiated and conducted by the office of the Chief Engineer River Management, BWDB to provide an improved basis for the analysis and design of wave protection works on the main rivers and to refine the related climate change adaptation measures as appropriate.

VIII. REFERENCES

ADB (2017) Aware report, Asian Development Bank. Date created: 29.11.2017. Aware Build Version: 3.5.011117. This report is included as Annex 1.

Ali, A. (2000) Climate change impacts and adaptation assessment in Bangladesh. *Climate Research* 12 (2): 109-116.

As-Salek, J. A. (1997) Negative surges in the Meghna estuary in Bangladesh. *Monthly Weather Review* 125: 1638-1648.

Bangladesh Bridge Authority (2011) Slope Protection Cover Layers for Padma Bridge RTW: Annex E to the Padma River Training Works Final Design Report for the Padma Multipurpose Bridge Design Project. Document No. 60097044-REP-1C-02-RT-202 of the Bangladesh Bridge Authority, 5 July 2011.

BWDB. (2020). River Stabilization Plan Supplementary Annex E Volume 2 Flooding: numerical modeling. Dhaka: BWDB.

Bhuyia, A. H., and Rahman, M. (1988) Changing width of the Jamuna during 1972-1986. *Journal Bangladesh National Geographic Association*, 15, 16(1,2), 123–137.

Bora, A. K. (2004). Fluvial Geomorphology. In V.P. Singh, N. Sharma, and C.S.P. Ojha (Eds.), *The Brahmaputra Basin Water Resources* (pp. 88–112). Springer Netherlands [online]. Available from: http://link.springer.com.ezproxy.library.ubc.ca/chapter/10.1007/978-94-017-0540-0_6 (Accessed 30 June 2014).

Brown, S. and R. J. Nicholls (2015) Subsidence and development in mega deltas: The case of the Ganges-Brahmaputra-Meghna, *Science of the Total Environment* 528: 362-374.

BUET (Bangladesh University of Engineering and Technology) (2010) Guidelines for River Bank Protection. Bangladesh University of Engineering and Technology for Bangladesh Water Development Board.

CEGIS (Center for Environmental and Geographic Information Services) (2010) Impacts of climate change on the morphological processes of the main rivers and Meghna Estuary of Bangladesh, Prepared for Asian Development Bank, under Pilot and Demonstration Activities Programme (PDA Programme), p. 113.

Chiu, S., and C. Small (2016) Observations of Cyclone-Induced Storm Surge in Coastal Bangladesh, *Journal of Coastal Research* 32 (5): 1149-1161. https://doi.org/10.2112/JCOASTRES-D-15-00030.1

Ciria, USACE, MTES (2013) International Levee Handbook. Ciria, London. https://www.ciria.org/Resources/Free_publications/ILH.aspx

Delft Hydraulics, and DHI (1996) *FAP 24 River Survey Project Final Report Main Volume*. Report prepared by Delft Hydraulics and the Danish Hydraulic Institute for the Water Resources Planning Organization, Government of Bangladesh.

Emanuel, K. A. (2005) Increasing destructiveness of tropical cyclones over the past 30 years. *Nature* 436: 686-688.

Emanuel, K. A. (1987) The dependence of hurricane intensity. *Nature* 329: 483-485.

EurOtop (2016) Manual on wave overtopping of sea defences and related structures. http://www.overtopping-manual.com

Fichtner and Northwest Hydraulic Consultants (2015) Annex A, Volume 1: Morphology. *River Bank Improvement Program Feasibility Report and Detailed Design Priority Reach Final Report*.

Flather, R. A. (1994) A storm surge prediction model for the Northern Bay of Bengal with application to the cyclone disaster in April 1991. *Journal of Physical Oceanography* 24: 172-190.

Goswami, D. C. (1985) Brahmaputra River, Assam, India: Physiography, Basin Denudation, and Channel Aggradation. *Water Resources Research*, 21(7), 959–978. doi:10.1029/WR021i007p00959.

Hathaway, D. (2009) Solar cycle forecasting. *Space Science Review* 144: 401-412, doi:10.1007/s11214-008-9430-4.

Ikeuchi, H., Y. Hirabayashi, D. Yamazaki, M. Kiguchi, S. Koirala, T. Nagano, A. Kotera, and S. Kanae (2015) Modeling complex flow dynamics of fluvial floods exacerbated by sea level rise in the Ganges-Brahmaputra-Meghna delta. *Environmental Research Letters* 10, doi:10.1088/1748-9326/10/12/124011.

IWM (2005) Impact assessment of climate change on the coastal zone of Bangladesh. Final Report, Institute of Water Modelling, Dhaka, Bangladesh, 37 pp.

Karim, M. F., and N. Mimura (2008) Impacts of climate change and sea-level rise on cyclonic storm surge floods in Bangladesh. *Global Environmental Change* 18: 490-500, doi:10.1016/j.gloenvcha.2008.05.002. Also the poster by these authors: http://wcrp.ipsl.jussieu.fr/Workshops/SeaLevel/Posters/2_12_FazlulKarim.pdf

Keefer, D. K. (1994) The importance of earthquake-induced landslides to long-term slope erosion and slope-failure hazards in seismically active regions. *Geomorphology*, 10(1–4), 265–284. doi:10.1016/0169-555X(94)90021-3.

Kusche, J., B. Uebbing, R. Rietbroek, C. K. Schum, and Z. H. Khan (2016) Sea level budget in the Bay of Bengal (2002-2014) from GRACE and altimetry. *Journal of Geophysical Research: Oceans* 121: 1194-1217, doi:1002/2015JC011471.
Lee, S.-L., W. Park, M. Baringer, A. Gordon, B. Huber, and Y. Liu (2015) Pacific origin of the abrupt increase in Indian Ocean heat content during the warming hiatus, *Nature Geoscience*, doi:10.1038/ngeo2438.
Masood, M., P. J.-F. Yeh, N. Hanasaki, and K. Takeuchi (2015) Model study of the impacts of future climate change on the hydrology of Ganges-Brahmaputra-Meghna basin. *Hydrology and Earth System Sciences* 19: 747-770, doi:10.5194/hess-19-747-2015.
Mathur, L. P. (1953) Assam earthquake of 15th Aug. 1950 - A short note on factual observations. In M.B. Ramchandra Rao (Ed.), *A Compilation of Papers on the Assam Earthquake of August 15th, 1950* (pp. 56–60). National Geophysical Research Institute, the Central Board of Geophysics, Hyderabad, India.
MOEF (2005) National adaption programme of action, final report, Ministry of Environment and Forestry, Government of Bangladesh, Dhaka.
Northwest Hydraulic Consultants & Mott MacDonald Joint Venture (2018a) Future conditions affecting flows: Climate change and flow regulation. Annex F, Volume 6, Flood and Riverbank Erosion Risk Management Investment Program – Project 1. Prepared for Bangladesh Water Development Board.
Northwest Hydraulic Consultants & Mott MacDonald Joint Venture (2018b) Hydrology and Flood Modelling. Annex E, Volume 2 of the RSP, Flood and Riverbank Erosion Risk Management Investment Program – Project 1. Prepared for Bangladesh Water Development Board.
Northwest Hydraulic Consultants & Mott MacDonald Joint Venture (2018c) Overview of the Design of Geotextile Bag (Geobag) Revetments for use in Bangladesh and Recommendations for Further Studies. Appendix to Annex D, Volume 3 of the RSP, Flood and Riverbank Erosion Risk Management Investment Program – Project 1. Prepared for Bangladesh Water Development Board.
Northwest Hydraulic Consultants & Mott MacDonald Joint Venture (2018d) Impact of Earthquake Induced Sediment Supply. Annex F, Volume 5 of the RSP, Flood and Riverbank Erosion Risk Management Investment Program – Project 1. Prepared for Bangladesh Water Development Board.
Northwest Hydraulic Consultants & Mott MacDonald Joint Venture (2018e) Economic Assessment. Annex H, Volume 6 of the RSP, Flood and Riverbank Erosion Risk Management Investment Program – Project 1. Prepared for Bangladesh Water Development Board.
Oberhagemann, K. and M. M. Hussain (2010) Geotextile bag revetments for large rivers in Bangladesh. *Geotextiles and Geomembranes,* doi:10.1016/j.geotexmem.2010.12.003.
Pahuja, S., and Goswami, D. (2006) A fluvial geomorphology perspective on the knowledge base of the Brahmaputra. *Background Paper*, 3.
Quadir, D. A., and M. A. Iqbal (2008). Tropical cyclones: Impacts on coastal livelihoods. International Union for Conservation of Nature and Natural Resources. Bangladesh Country Office, Dhaka, Bangladesh.
Sarker, M. H. (2008) *Morphological Response of the Brahmaputra-Padma-Lower Meghna River System to the Assam Earthquake of 1950.* (Ph.D. thesis). University of Nottingham.
Sarker, M. H., and Thorne, C. R. (2006) Morphological response of the Brahmaputra–Padma–Lower Meghna river system to the Assam earthquake of 1950. *Braided Rivers: Process, Deposits, Ecology and Management (Special Publication 36 of the IAS)*, 21, 289–310.

Sarker, M. H., Thorne, C. R., Aktar, M. N., and Ferdous, M. R. (2014) Morpho-dynamics of the Brahmaputra–Jamuna River, Bangladesh. *Geomorphology*, 215, 45–59. doi:10.1016/j.geomorph.2013.07.025.

Saunders, M. A., and A. R. Harris (1997) Statistical evidence links exceptional 1995 Atlantic hurricane season to record sea warming. Geophysical Research Letters 24 (10): 1255-1258.

Sharmila, S., S. Joseph, A. K. Sahai, S. Abhilash, and R. Chattopadhyay (2015) Future projection of Indian summer monsoon variability under climate change scenario: An assessment from CMIP5 climate models. *Global Planetary Change* 124: 62–78.

Smith, K., and R. Ward (1998) Floods: Physical Processes and Human Impacts. John Wiley & Sons, Chichester, U.K., 382 pp.

Stewart, R. J., Hallet, B., Zeitler, P. K., Malloy, M. A., Allen, C. M., and Trippett, D. (2008) Brahmaputra sediment flux dominated by highly localized rapid erosion from the easternmost Himalaya. *Geology*, 36(9), 711–714.

USACE (U.S. Army Corps of Engineers) (1984) Shore Protection Manual. USACE, Vicksburg, Mississippi.

Verghese, B. G. (1990) *Waters of Hope: Himalaya-Ganga Development and Cooperation for Billion People*. 1st ed. Academic Publishers, Dhaka, Bangladesh.

Wang, Y.-M., J. L. Lean, N. R. Sheeley Jr. (2005) Modeling the Sun's magnetic field and irradiance since 1713. *Astrophysics Journal* 625: 522-538.

World Bank (2000), Bangladesh, climate change and sustainable development, Rep. 21104-BD.

Zellweger, H. (2007) Geotextile bags for river erosion control in Bangladesh, under water behavior and environmental aspects. Diploma thesis, ETH Zürich.

ANNEX 1: AWARE REPORT

01 Introduction

This report summarises results from a climate and geological risk screening exercise. The project information and location(s) are detailed immediately below.

The screening is based on the Aware™ geographic data set, compiled from the latest scientific information on current geological, climate and related hazards together with projected changes for the future where available. These data are combined with the project's sensitivities to hazard variables, returning information on the current and potential future risks that could influence its design and planning.

Project Information

PROJECT NAME: [trial] BAN L44167-015 Flood and Riverbank Erosion Risk Management Investme

SUB PROJECT: Jamuna

PROJECT NUMBER / REFERENCE: L44167-015

SECTOR: Agriculture, Natural Resources, and Rural Development

SUB SECTOR: Rural flood protection - river bank strengthening, channels & drainage

DESCRIPTION:

02 Chosen Locations

1) JLB1
2) JLB2
3) JRB1

03

Project Climate Risk Ratings

Below you will find the overall climate risk level for the project together with a radar chart presenting the level of risk associated with each individual climate risk topic analysed in Aware^{TM}. Projects with a final “High risk” rating are always recommended for further more detailed climate risk analyses.

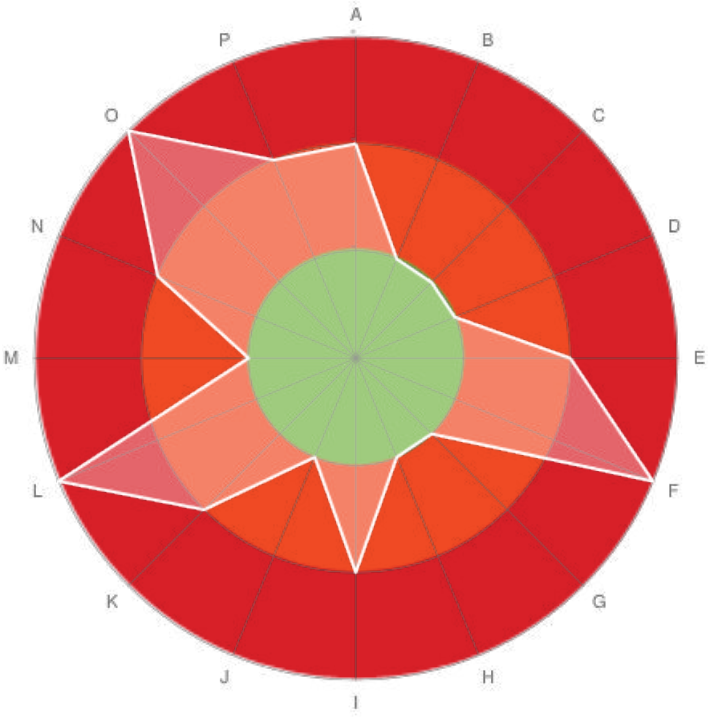
The radar chart provides an overview of which individual risks are most significant. This should be used in conjunction with the final rating to determine whether the project as a whole, or its individual components, should be assessed in further detail. The red band (outer circle) suggests a higher level of risk in relation to a risk topic. The green band (inner circle) suggests a lower level of risk in relation to a risk topic.

In the remaining sections of this report more detailed commentary is provided. Information is given on existing and possible future climate conditions and associated hazards. A number of questions are provided to help stimulate a conversation with project designers in order to determine how they would manage current and future climate change risks at the design stage. Links are provided to recent case studies, relevant data portals and other technical resources for further research.

Final project climate risk ratings

High Risk

Breakdown of climate risk topic ratings

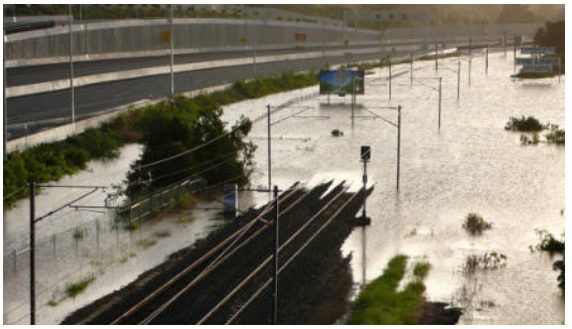


A) Temperature increase
B) Wild fire
C) Permafrost
D) Sea ice
E) Precipitation increase
F) Flood
G) Snow loading
H) Landslide
I) Precipitation decrease
J) Water availability
K) Wind speed increase
L) Onshore Category 1 storms
M) Offshore Category 1 storms
N) Wind speed decrease
O) Sea level rise
P) Solar radiation change

04
HIGH RISK

FLOOD

ACCLIMATISE COMMENTARY



• Our data suggest that the project is located in a region which has experienced recurring major flood events in the recent past. A high exposure in Aware means that between 1985 and 2016 there have been at least one significant, large-scale flood event in the region. This is based on post-processed data from the Dartmouth Flood Observatory at the University of Colorado.

• The risk and type of flooding is dependent on local geographical factors including:
- Proximity to the coast and inland water courses
- Local topography
- Land use characteristics, including land use in upstream catchment area
- Design and maintenance level of drainage infrastructure
- Vulnerability of exposed assets
• Up to date information on flood risk worldwide is available online, for example UNEP / UNISDR's Global Risk Data Platform and Dartmouth Flood Observatory's Global Active Archive of Large Flood Events.

1. What does this mean for the design and construction of my project?

• If floods are identified as a potential problem for the project, it is recommended that:
- More localized information is collected on past floods and their consequences in the exact project location, especially since flood hazard can change significantly over short distances; depending on the findings, a site-specific flood risk assessment (including flood modelling) might be required that provides a good understanding of the current and future flood risk level
- Information is collected on land use and building regulations, such as flood zonation ordinances
- The project siting, design and construction features ensure that site-specific flood risk management measures are undertaken. Such measures could include a combination of grey infrastructure (such as flood defence infrastructure) and green infrastructure (such as restoration of wetlands) to reduce flood risk, as well as measures to manage the residual flood risk (such as through flood early warning, flood preparedness planning, flood insurance etc.)

2. What does the science say could happen in the future and what does this mean for the design of my project?

• Climate change is projected to influence the frequency and intensity of flood events.
• Existing engineering designs may not take into consideration the impact of climate change on the risks from flooding. See "Critical thresholds" in the "Help & glossary" section for further details on how a changing climate can impact on critical thresholds and design standards.

3. As a starting point you may wish to consider the following questions:

Q1 Would the expected performance and maintenance of the project be impaired by flooding?
Q2 Is there a plan to integrate climate change into a flood risk assessment for the project?
Q3 Does the project siting consider flood risk to ensure the proposed project will not be impacted by flooding and will not increase risk of flooding?
Q4 Does the project design and construction features incorporate measures to manage flood risk, both in the immediate term and as risk of flooding changes as a consequence of climate change?
Q5 Will the project include emergency management plans which make provision for continued successful operation in the event of floods?

4. What next?

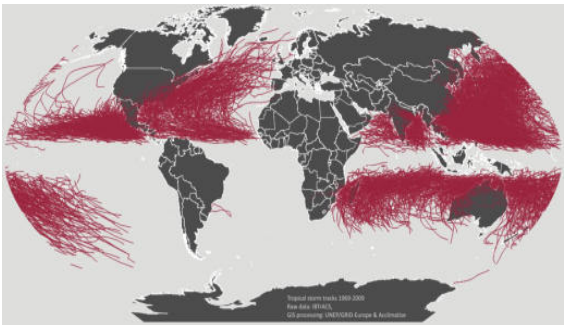
• See the section "Further reading" in "Help and glossary" at the end of this report which lists a selection of resources that provide further information on a changing climate.
• Click here or here for the latest news and information relating to floods and climate change.

I have acknowledged the risks highlighted in this section.

05
HIGH RISK

ONSHORE CATEGORY 1 STORMS

ACCLIMATISE COMMENTARY



• Our data suggest that the project is located in a region which has experienced Category 1 storms in the recent past. A high exposure in Aware means that between 1968 and 2009 there have been at least one Category 1 storm in the region. This is based on post-processed data from UNEP/ GRID-Europe.
• On the Saffir-Simpson Hurricane Scale a Category 1 storm is characterised by sustained winds in excess of 119 km/hr (33 m/s).
• Even this least intense storm can still produce plenty of damage and be life threatening.
• These regions may also be susceptible to lower intensity but more frequent tropical or extra tropical storms as well as less frequent higher-intensity storms. The damages caused by storms may not be only due to strong winds, but also from cyclone-induced heavy rainfall and subsequent flooding and storm surges. The cyclone risk is dependent on factors including:
- Proximity to the coast
- Shape of the coast
- Local topography
- Land use characteristics
- Vulnerability of exposed assets
• Up to date information on storm risk worldwide is widely available online, for example UNEP / UNISDR's Global Risk Data Platform and the joint SOPAC/SPC, World Bank and ADB Pacific Catastrophe Risk Assessment and Financing Initiative (PCRAFI).

1. What does this mean for the design and construction of my project?

If storms are identified as a potential problem for the project, it is recommended that:
- More localised information is collected on past storms and their consequences
- Information is collected on the characteristics of the coast, local topography, natural barriers, land use and building regulations
- The project siting, design and construction features ensure that cyclone risk management measures are undertaken. Such measures could include a combination of grey infrastructure (such as levees) and green infrastructure (such as restoration of mangroves) to reduce cyclone risk, as well as measures to manage the residual flood risk (such as through early warning, cyclone shelters etc.)
- Where the proposed infrastructure will act as a critical facility, a more detailed storm risk assessment is undertaken

2. What the science says could happen in the future and what does this mean for the design of my project?

• Climate change is projected to influence the frequency and intensity of tropical or extra tropical storms.
• Existing engineering designs may not take into consideration the impact of climate change on the risks from tropical or extra tropical storms. See "Critical thresholds" in the "Help & glossary" section for further details on how a changing climate can impact on critical thresholds and design standards.

3. As a starting point you may wish to consider the following questions:

Q1 Would the expected performance and maintenance of the project be impaired by hazards associated with storms e.g. storm surges and strong winds?
Q2 Are there any plans to integrate climate change factors into a storm risk assessment for the project?
Q3 Do the project design standards incorporate features to resist storm risk (high wind and storm

surges), both in the immediate term and as storm risk changes as a consequence of climate change?
Q3 If the proposed infrastructure is likely to be used by as an evacuation center and/or is a critical facility, will the project include emergency management plans which make provision for continued successful operation in the event of storms?

4. What next?

• See the section "Further reading" in "Help and glossary" at the end of this report which lists a selection of resources that provide further information on a changing climate.
• Click here or here for the latest news and information relating to storms and climate change.

I have acknowledged the risks highlighted in this section.

06
HIGH RISK

SEA LEVEL RISE

ACCLIMATISE COMMENTARY

You have indicated that the project is located in a Low Elevation Coastal Zone (LECZ), which could be affected by sea level rise.

1. What does this mean for the design of my project?

• There is a potential for an increase in incidences where current design standards will not be sufficient. See "Critical thresholds" in the "Help and glossary" section for further details on how a changing climate can impact on critical thresholds and design standards.

• The design, operational and maintenance standards should be reviewed - take into consideration current impacts of inundation from the sea as well as potential future changes.

2. How could sea level rise affect the project even without future climate change?

• Low Elevation Coastal Zones (LECZs) are particularly prone to local tropical cyclones, mid-latitude storms and associated storm surges.
• Erosion of the coastline can exacerbate 'coastal squeeze', putting pressure on natural sea defences, such as salt marshes and mangroves as well as man-made structures.
• Up to date information on coastal storm and flood risk worldwide is available online, for example UNEP / UNISDR's Global Risk Data Platform.

3. What does the science say could happen by 2100?

• Some recent research suggests that global sea levels could be 0.75 to 1.9m higher by the end of the century.
• Local changes in ocean density/dynamics and land movements can also add to, or lessen, the effects of sea level rise at a given location.
• Sea level rise has the potential to accelerate the rate of coastal erosion. Changes in erosion regimes also impact the rate of sedimentation in other areas, particularly in estuarine and other tidal settings. This could provide problems with access to existing ports and jetties.
• In tropical regions, increasing ocean acidification and temperatures can lead to coral reef bleaching and destruction. Such reefs can provide a natural barrier to coastal inundation and erosion.
• In addition, sea level rise could cause saline intrusion into aquifers, further depleting useable water resources.
• Local sea level rise in combination with storm surge and wave height poses a hazard to offshore fixed assets, such as oil and gas platforms.

If you want to know more about trends in sea level rise around the world, please refer to: NOAA's Sea Level Trends map.

4. What next?

1. See the section "Further reading" in "Help and glossary" at the end of this report which lists a selection of resources that provide further information on a changing climate.
2. Click here or here for the latest news and information relating to sea level and climate change.

I have acknowledged the risks highlighted in this section.

07
MEDIUM RISK

TEMPERATURE INCREASE

Would an increase in temperature require modifications to the design of the project in order to successfully provide the expected services over its lifetime?

Chosen Answer

Cannot answer.

Not enough information is known about the sensitivity of the project design to increases in temperature.

ACCLIMATISE COMMENTARY

1. What does this mean for the design of my project?

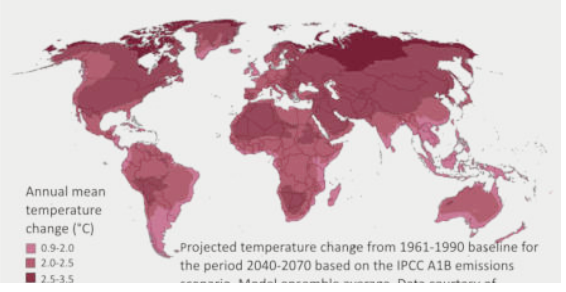
• Although you have stated that you could not answer whether the project is sensitive to increases in temperature it is recommended that you consider that an increase in mean seasonal and annual temperature could have implications for a number of hazards.
• There is a potential for an increase in incidences where current design standards will not be sufficient. See "Critical thresholds" in the "Help and glossary" section for further details on how a changing climate can impact on critical thresholds and design standards.

• The design, operational and maintenance standards should be reviewed - take into consideration current impacts of high temperatures as well as potential future changes.

2. How could current high temperatures affect the project even without future climate change?

• Heatwaves put stress on buildings and other infrastructure, including roads and other transport links. In cities, the 'urban heat island' can increase the risk of heat related deaths.
• Warm weather can raise surface water temperatures of reservoirs used for industrial cooling. In addition, this could impact local eco-systems, improving the growing conditions for algae and potentially harmful micro-organisms in water courses.
• Heatwaves can have an impact on agricultural productivity and growing seasons.
• High temperatures can have implications for energy security. Peak energy demand due to demand for cooling can exceed incremental increases on base load in addition to the risk of line outages and blackouts.
• Human health can be affected by warmer periods. For example, urban air quality and disease transmission (e.g. malaria and dengue fever) can be impacted by higher air temperatures.
• Wildfire risk is elevated during prolonged warm periods that dry fuels, promoting easier ignition and faster spread.
• Permafrost and glacial melt regimes as impacted by warm periods.
• If our data suggests that there are existing hazards associated with high temperatures in the region, they will be highlighted elsewhere in the report. This may include existing wildfire risks as well as areas potentially impacted by permafrost and glacial melt.

3. What does the science say could happen by the 2050s?



• If you want to know more about projected changes in the project location across a range of GCMs and RCPs please refer to USGS's CMIP5 Global Climate Change Viewer for detailed maps.

4. What next?

1. See the section "Further reading" in "Help

and glossary" at the end of this report which lists a selection of resources that provide further information on a changing climate.

2. Click here or here for the latest news and information relating to temperature and climate change.

I have acknowledged the risks highlighted in this section.

08
MEDIUM RISK

PRECIPITATION INCREASE

Would an increase in precipitation require modifications to the design of the project in order to successfully provide the expected services over its lifetime?

Chosen Answer

Cannot answer.

Not enough information is known about the sensitivity of the project design to increases in precipitation.

ACCLIMATISE COMMENTARY

1. What does this mean for the design of my project?

• There is a potential for an increase in incidences where current design standards will not be sufficient. See "Critical thresholds" in the "Help and glossary" section for further details on how a changing climate can impact on critical thresholds and design standards.

• The design, operational and maintenance standards should be reviewed - take into consideration current impacts of heavy precipitation events as well as potential future changes.

2. How could current heavy precipitation affect the project even without future climate change?

• Seasonal runoff may lead to erosion and siltation of water courses, lakes and reservoirs.
• Flooding and precipitation induced landslide events.
• In colder regions, seasonal snow falls could lead to overloading structures and avalanche risk.
• If our data suggests that there are existing hazards associated with heavy precipitation in the region, they will be highlighted elsewhere in the report. This may include existing flood and landslide risks.

3. What does the science say could happen by the 2050s?

• If you want to know more about projected changes in the project location across a range of GCMs and RCPs please refer to USGS's CMIP5 Global Climate Change Viewer for detailed maps.

4. What next?

1. See the section "Further reading" in "Help and glossary" at the end of this report which lists a selection of resources that provide further information on a changing climate.
2. Click here or here for the latest news and information relating to water and climate change.

I have acknowledged the risks highlighted in this section.

09
MEDIUM RISK

PRECIPITATION DECREASE

Would a decrease in precipitation require modifications to the design of the project in order to successfully provide the expected services over its lifetime?

Chosen Answer

Cannot answer.

Not enough information is known about the sensitivity of the project design to decreases in precipitation.

ACCLIMATISE COMMENTARY

1. What does this mean for the design of my project?

• There is a potential for an increase in incidences where current design standards will not be sufficient. See "Critical thresholds" in the "Help and glossary" section for further details on how a changing climate can impact on critical thresholds and design standards.

• The design, operational and maintenance standards should be reviewed - take into consideration current impacts of decreased precipitation events as well as potential future changes.

2. How could reduced precipitation affect the project even without future climate change?

• Decreased seasonal runoff may exacerbate pressures on water availability, accessibility and quality.
• Variability of river runoff may be affected such that extremely low runoff events (i.e. drought) may occur much more frequently.
• Pollutants from industry that would be adequately diluted could now could become more concentrated.
• Increased risk of drought conditions could lead to accelerated land degradation, expanding desertification and more dust storms.
• If our data suggests that there are existing hazards associated with decreased precipitation in the region, they will be highlighted elsewhere in the report. This may include water availability and wildfire.

3. What does the science say could happen by the 2050s?

• If you want to know more about projected changes in the project location across a range of GCMs and RCPs please refer to USGS's CMIP5 Global Climate Change Viewer for detailed maps.

4. What next?

1. See the section "Further reading" in "Help and glossary" at the end of this report which lists a selection of resources that provide further information on a changing climate.
2. Click here or here for the latest news and information relating to water and climate change.

I have acknowledged the risks highlighted in this section.

10
MEDIUM RISK

WIND SPEED INCREASE

Would an increase in average and maximum wind speed require modifications to the design of the project in order to successfully provide the expected services over its lifetime?

Chosen Answer

Cannot answer.

Not enough information is known about the sensitivity of the project design to increases in wind speed.

ACCLIMATISE COMMENTARY

1. What does this mean for the design of my project?

• Although you have stated that you could not answer whether the project is sensitive to increases in wind speed, there is a potential for an increase in incidences where current design standards will not be sufficient. See "Critical thresholds" in the "Help and glossary" section for further details on how a changing climate can impact on critical thresholds and design standards.

• The design, operational and maintenance standards should be reviewed - take into consideration current impacts of increasing wind speed as well as potential future changes.

2. How could stronger winds affect the project even without future climate change?

• The design and operation of certain infrastructure (e.g. wind turbines) is determined by the prevailing climatic wind conditions.
• Given the energy in the wind is the cube of wind speed, a small change in the wind climate can have substantial consequences for the wind energy available.
• Similarly, small changes could have dramatic consequences for wind related hazards e.g. wind storm damage.
• If our data suggests that there is an existing risk of tropical storms in the region, it will be highlighted elsewhere in the report.

3. What does the science say could happen in the future?

• Climate change could alter the geographic distribution and/or the seasonal variability of wind resource.
• Climate model projections remain uncertain and it appears unlikely that mean wind speeds will change by more than the current inter-annual variability.
• Changes in extreme wind speeds associated with extra-tropical and tropical storm are similarly uncertain. However, there have been studies that suggest fewer but more intense events. Stronger storms bring with them an increases risk of coastal storm surge, coastal erosion, wind damage and flooding.
• Given future uncertainty it is advisable to carefully assess past wind speed in the region, bearing in mind that it could change in the future. The UNEP Solar and Wind Energy Resource Assessment SWERA provides a useful global overview of wind information.

4. What next?

1. See the section "Further reading" in "Help and glossary" at the end of this report which lists a selection of resources that provide further information on a changing climate.

2. Click here or here for the latest news and information relating to wind and climate change.

I have acknowledged the risks highlighted in this section.

11
MEDIUM RISK

WIND SPEED DECREASE

Would a decrease in average and maximum wind speed require modifications to the design of the project in order to successfully provide the expected services over its lifetime?

Chosen Answer

Cannot answer.

Not enough information is known about the sensitivity of the project design to decreases in wind speed.

ACCLIMATISE COMMENTARY

1. What does this mean for the design of my project?

Although you have stated that you could not answer whether the project is sensitive to decreases in wind speed, there is a potential for incidences where current design standards will not be met and also for 'over designing' for risks that might diminish. See "Critical thresholds" in the "Help and glossary" section for further details on how a changing climate can impact on critical thresholds and design standards.

• The design, operational and maintenance standards should be reviewed - take into consideration current impacts of reduced wind speed as well as potential future changes.

2. How could wind variability affect the project even without future climate change?

• The design and expected operation of certain infrastructure (e.g. wind turbines) is determined by the prevailing climatic wind conditions.
• Given the energy in the wind is the cube of wind speed, a small change in the wind climate can have substantial consequences for the wind energy available.

3. What does the science say could happen in the future?

• Climate change could alter the geographic distribution and/or the seasonal variability of wind resource.
• Climate model projections remain uncertain and it appears unlikely that mean wind speeds will change by more than the current inter-annual variability.
• Given future uncertainty it is advisable to carefully assess past wind speed in the region, bearing in mind that it could change in the future. The UNEP Solar and Wind Energy Resource Assessment SWERA provides a useful global overview of wind information.

4. What next?

1. See the section "Further reading" in "Help and glossary" at the end of this report which lists a selection of resources that provide further information on a changing climate.
2. Click here or here for the latest news and information relating to wind and climate change.

I have acknowledged the risks highlighted in this section.

12
MEDIUM RISK

SOLAR RADIATION CHANGE

Would a change in solar radiation require modifications to the design of the project in order to successfully provide the expected services over its lifetime?

Chosen Answer

Cannot answer.

Not enough information is known about the sensitivity of the project design to solar radiation.

ACCLIMATISE COMMENTARY

1. What does this mean for the design of my project?

• Although you have stated that you could not answer whether the project is sensitive to changes in solar radiation, there is a potential for incidences where current design standards will not be sufficient or met. See "Critical thresholds" in the "Help and glossary" section for further details on how a changing climate can impact on critical thresholds and design standards.

• The design, operational and maintenance standards should be reviewed - take into consideration current impacts of fluctuating solar radiation as well as potential future changes.

2. How could changes in solar radiation affect the project even without future climate change?

Medium (yearly, seasonal) or longer term variations in solar radiation at the Earth's surface can affect for example:
• Agricultural yields. Rates of photosynthesis (and therefore growing season) are proportional to the surface solar radiation.
• Solar power potential.
• The rate of degeneration of building materials.

3. What does the science say could happen in the future?

• Future projections of regional 'dimming' or 'brightening' are difficult to predict. This is due largely to the large uncertainty surrounding cloud formation under climate change conditions.
• Given future uncertainty it is advisable to carefully assess past levels of solar radiation in the region, bearing in mind that it could change in the future. The UNEP Solar and Wind Energy Resource Assessment SWERA provides a useful global overview of solar radiation information.

4. What next?

1. See the section "Further reading" in "Help and glossary" at the end of this report which lists a selection of resources that provide further information on a changing climate.
2. Click here or here for the latest news and information relating to water and climate change.

I have acknowledged the risks highlighted in this section.

13

The sections above will provide details on all high and medium climate hazard risks from Aware™ where these are suggested by the climate sensitivities of the project and / or the underlying data. Selected Low risks may also be detailed. Local conditions, however, can be highly variable, so if you have any concerns related to risks not detailed in this report, it is recommended that you investigate these further using more site-specific information or through discussions with the project designers.

14 Project Geological Hazard Risk Ratings

Below you will find the overall geological hazard risk level for the project together with a radar chart presenting the level of risk associated with each individual geological risk topic analysed in Aware™. Projects with a final "High risk" rating are always recommended for further more detailed geological risk analyses.

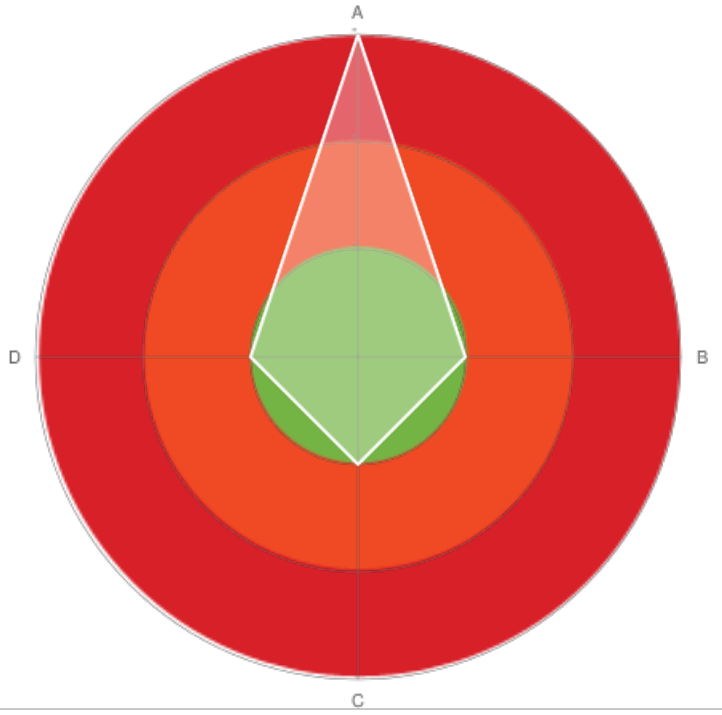
The radar chart provides an overview of which individual risks are most significant. This should be used in conjunction with the final rating to determine whether the project as a whole, or its individual components, should be assessed in further detail. The red band (outer circle) suggests a higher level of risk in relation to a risk topic. The green band (inner circle) suggests a lower level of risk in relation to a risk topic.

In the remaining sections of this report more detailed commentary is provided. Information is given on existing geological conditions and associated hazards. A number of questions are provided to help stimulate a conversation with project designers in order to determine how they would manage geological risks at the design stage. Links are provided to recent case studies, relevant data portals and other technical resources for further research.

Final project geological hazard risk ratings

Medium Risk

Breakdown of geological hazard risk topic ratings



- A) Earthquake
- B) Seismic landslide
- C) Tsunami
- D) Volcano

15
HIGH RISK

EARTHQUAKE

ACCLIMATISE COMMENTARY

• Our data suggest that the project is located in a region where Peak Ground Acceleration (PGA) of >31 cm/s may be expected from a 250yr return period event, potentially leading to moderate to heavy damage. This is based on post-processed data from International Centre for Numerical Methods in Engineering (CIMNE) and INGENIAR Ltda (GAR15).

• Earthquake risk is dependent on several factors including the characteristics of the hazard, exposure of assets and population to the hazard, and vulnerabilities:
- Distance away from the epicentre
- Depth of the earthquake
- Local geology
- Duration of the shaking
- Population density
- Land use characteristics
- Design standards, construction quality and materials, and maintenance standards of infrastructure and assets.
• Up to date information on seismic risk worldwide is available online, for example UNEP / UNISDR's Global Risk Data Platform, GEM Foundation's OpenQuake Platform and OpenQuake tools.

1. What does this mean for the design and construction of my project?

• If earthquakes are identified as a potential problem for the project, it is recommended that:
- More localised information is collected earthquake history and any associated secondary hazards (liquefaction, landslide, tsunami, fire)
- Information is collected on local building regulations and how they factor earthquake risk considerations
- Soil investigations are conducted, including assessment of physical characteristics, such as liquefaction potential, stability of slope etc
- The project design and construction features ensures that the structures can adequately resist seismic forces during earthquakes
- Where the proposed infrastructure will act as a critical facility, such as, major dams, power plants etc., a more detailed earthquake risk assessment is undertaken to inform the project siting, design and construction process if necessary.

2. As a starting point you may wish to consider the following questions:

Q1 Would the expected performance of the project be impaired by earthquakes?
Q2 Does the project team have a good understanding of the earthquake risk in the area, including past earthquakes, soil characteristics, local building regulations?
Q3 Is there a plan to assess seismic risk to project design, construction and operation?
Q4 Do the project design standards incorporate features to resist seismic forces?
Q5 If the proposed infrastructure is likely to be used by as an evacuation center and/or is a critical facility, will the project include emergency management plans which make provision for continued successful operation in the event of earthquakes

3. What next?

• See the section "Further reading" in "Help and glossary" at the end of this report which lists a

selection of resources that provide further information on disaster risk reduction.

I have acknowledged the risks highlighted in this section.

16

The sections above will provide details on all high geological hazard risks from Aware™ where these are suggested by the underlying data. Local conditions, however, can be highly variable, so if you have any concerns related to risks not detailed in this report, it is recommended that you investigate these further using more site-specific information or through discussions with the project.

ADDITIONAL SECTORAL GUIDANCE:

Agriculture sector further reading and resources:

	UN FAO's programme for observations, modelling, and analysis of terrestrial ecosystems to support sustainable development: GTOS.
	UN FAO's software tool-box for crop yield forecasting: AgroMetShell.

HELP AND GLOSSARY:

Model agreement and uncertainty:

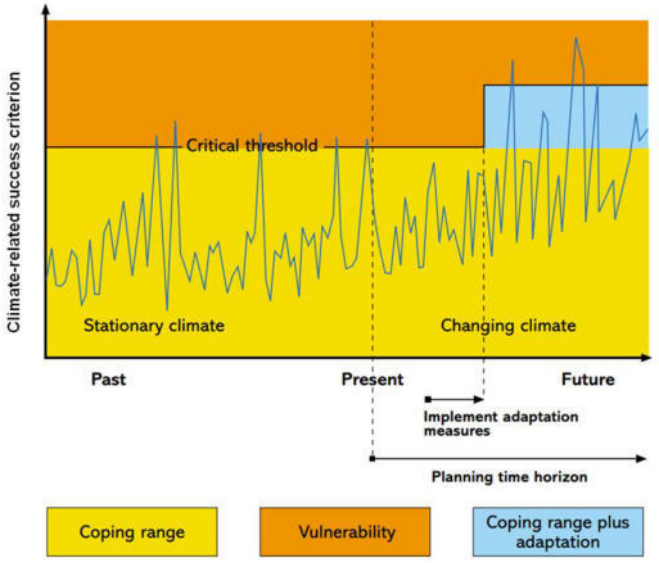
Although climate models are constantly being improved, they are not good enough to predict future climate conditions with a degree of confidence which would allow precise adaptation decisions to be made. Outputs from different climate models often differ, presenting a range of possible climate futures to consider, and ultimately a wide range of possible actions to take. In Aware, climate projections make use of GCM ensemble percentiles to determine: for temperature increase, whether 75% of CMIP5 GCM ensemble agree on a magnitude of change; for precipitation increase and decrease, whether 75% of CMIP5 GCM ensemble agree on the direction of change.

Even with improvements in climate modelling, uncertainties will remain. It is likely that not all the climate statistics of relevance to the design, planning and operations of a project's assets and infrastructure will be available from climate model outputs. The outputs are typically provided as long-term averages, e.g. changes in average monthly mean temperature or precipitation. However, decisions on asset integrity and safety may be based on short-term statistics or extreme values, such as the maximum expected 10 minute wind speed, or the 1-in-10 year rainfall event. In such cases, project designers or engineers should be working to identify climate-related thresholds for the project (see "Critical thresholds" section below) and evaluate whether existing climate trends are threatening to exceed them on an unacceptably frequent basis. Climate models can then be used to make sensible assumptions on potential changes to climate variables of relevance to the project or to obtain estimates of upper and lower bounds for the future which can be used to test the robustness of adaptation options.

The key objective in the face of uncertainty is therefore to define and implement design changes (adaptation options) which both provide a benefit in the current climate as well as resilience to the range of potential changes in future climate.

Critical thresholds:

A key issue to consider when assessing and prioritising climate change risks is the critical thresholds or sensitivities for the operational, environmental and social performance of a project. Critical thresholds are the boundaries between 'tolerable' and 'intolerable' levels of risk. In the diagram below, it can be seen how acceptable breaches in a critical threshold in today's climate may become more frequent and unacceptable in a future climate.

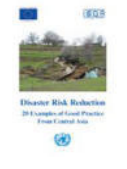


The relationship between a critical threshold and a climate change related success criterion for a project. [Source: Willows, R.I. and Connell, R.K. (Eds.) (2003). *Climate adaptation: Risk, uncertainty and decision-making*. UKCIP Technical Report, UKCIP, Oxford].

Climate change scenarios can be used to see if these thresholds are more likely to be exceeded in the future. The simplest example is the height of a flood defence. When water heights are above this threshold, the site will flood. The flood defence height is the horizontal line labelled 'critical threshold'. Looking at the climate trend (in this case it would be sea level or the height of a river) – shown by the blue jagged line – it can be seen that the blue line has a gradual upward trend because of climate change. This means that the critical threshold is crossed more often in the future – because sea levels are rising and winter river flows may be getting larger. So, to cope with

this change, adaptation is needed – in this case, one adaptation measure is to increase the height of the flood defence.

Further reading and resources:

	Report detailing changes in global climate: The Global Climate 2001 - 2010
	IPCC report on climate-related disasters and opportunities for managing risks: Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation (SREX)
	IPCC report on impacts, adaptation and vulnerability: Climate Change 2014: Impacts, Adaptation, and Vulnerability
	IFC report on climate-related risks material to financial institutions: Climate Risk and Financial Institutions. Challenges and Opportunities.
	Nationally Determined Contributions (NDCs) submitted under the COP21 Paris Agreement: NDC Registry.
	ADB report on investment in disaster resilience: Investing in Resilience: Ensuring a Disaster-Resistant Future.
	UNISDR's report on disaster risk success stories: Disaster risk reduction: 20 examples of good practices from Central Asia.
	UNISDR's review and analysis of data and information on disaster risk patterns and trends: Global Assessment Report on Disaster Risk Reduction.
	CRED's International Disasters Database: EM-DAT.
	DesInventar Project's historical disaster impact catalogues: DesInventar.

PreventionWeb	National progress reports to UNISDR on DRM commitments: HFA National Progress Reports.
PreventionWeb	National documents DRM policy and strategy documents and studies: Disaster risk reduction in the world.
GAR	National-level factsheets based on the Global Assessment Report: Country Profiles.
	GEM NEXUS Building and population inventory : GED4GEM database.
GAR	GAR analysis tool of exposure including population, capital stock and economic indicators: Risk Data Platform CAPRAViewer.

Aware data resolution:

The proprietary Aware data set operates at a resolution of 0.5 x 0.5 decimal degrees (approximately 50 km x 50 km at the equator). These proprietary data represent millions of global data points, compiled from environmental data and the latest scientific information on current climate / weather related hazards together with potential changes in the future. Future risk outcomes are based on projections data from the near- to mid-term time horizons (2020s or 2050s, depending on the hazard and its data availability).

Global climate model output, from the World Climate Research Programme's (WCRP's) Coupled Model Intercomparison Project phase 3 (Meehl et al., 2007) and 5 (CMIP5) multi-model dataset (Taylor et al., 2012), were resampled to a 0.5 degree grid.

[Taylor, K.E., R.J. Stouffer, G.A. Meehl (2012) "An Overview of CMIP5 and the experiment design." Bulletin of the American Meteorological Society, 93, 485-498.

[Meehl, G. A., C. Covey, T. Delworth, M. Latif, B. McAvaney, J. F. B. Mitchell, R. J. Stouffer, and K. E. Taylor: The WCRP CMIP3 multi-model dataset: A new era in climate change research, Bulletin of the American Meteorological Society, 88, 1383-1394, 2007]

Aware data application:

In some instances Risk Topic ratings are only based on Aware data, including:
• Flood
• Permafrost
• Landslides – precipitation induced
• Earthquake
• Landslides – seismic induced
• Volcano
• Tsunami

Country level risk ratings:

These are generated from the data points within a country's borders. For single locations, site-specific data are used, and for multiple locations or countries, composite data across the portfolio of locations are used.

Glossary of terms used in report

"Climate model projections agree": for temperature, defined as 75% of CMIP5 GCM ensemble members agreeing that annual average temperature increase will reach 2°C; for precipitation increase or decrease, defined as 75% of CMIP5 GCM ensemble members agreeing on the direction of annual average precipitation change.

"Climate model projections do not agree": for temperature, defined as only 25% of CMIP5 GCM ensemble members agreeing that annual average temperature increase will reach 2°C; for precipitation increase or decrease, defined as only 25% of CMIP5 GCM ensemble members agreeing on the direction of annual average precipitation change.

The overall climate risk score for the project (high, medium or low) is based on a count of high risk topic scores. A project scores overall high climate risk if greater than or equal to 3 individual risk topics score high. A project scores overall medium climate risk if between 1 and 2 individual risk

topics score high. A project scores overall low climate risk if none of the individual risk topics score high.

The overall geological risk score for the project (high, medium or low) is based on a count of high risk topic scores. A project scores overall high geological risk if greater than or equal to 2 individual risk topics score high. A project scores overall medium geological risk if 1 individual risk topic scores high. A project scores overall low geological risk if none of the individual risk topics score high.

DISCLAIMER:

The Content in Aware and its output report is provided on an “as is” and an “as available” basis and without warranties of any kind either expressed or implied. To the fullest extent permissible pursuant to applicable law, Acclimatise disclaims all warranties, express or implied, including, but not limited to, implied warranties of merchantability and fitness for a particular purpose. Acclimatise does not warrant that the functions contained in the Content will be uninterrupted or error-free and does not accept any responsibility for any mistakes, errors or other deficiencies in the Content and disclaims all liability in respect of your use of the Content to the fullest extent possible in each and every applicable jurisdiction.

Neither Acclimatise nor any third party content providers shall be liable for any errors, inaccuracies or delays in content, or for any actions taken in reliance thereon. The Content is for general information purposes only. The Content is provided by Acclimatise and from sources which Acclimatise believes to be reliable and whilst every endeavour is made to keep the information up-to-date, complete and correct, no representations or warranties are made of any kind, express or implied, about the completeness, accuracy, reliability, suitability or availability with respect to the Content. Any reliance you place on such information is therefore strictly at your own risk.

The Content does not provide any form of advice (investment, tax, legal) amounting to investment advice, or make any recommendations regarding particular financial instruments, investments or products. Acclimatise will not be liable for any loss or damage caused by a reader's reliance on information obtained in our Content. Users are solely responsible for their own investment decisions. Acclimatise’s opinions and analyses are based on sources believed to be reliable and are written in good faith, but no representation or warranty, expressed or implied, is made as to their accuracy or completeness. Acclimatise is not authorised for the conduct of investment business (as defined in the UK's Financial Services and Markets Act 2000) and the Content provided in our services and products are not intended as, and shall not constitute, investment advice.

Consultant's Report

Bangladesh: Flood and Riverbank Erosion Risk Management Investment Program (FRERMIP)

ECONOMIC ANALYSIS OF TRANCHES 1 AND 2

SUPPLEMENTARY REPORT

May 2021

ACRONYMS

ADB	-	Asian Development Bank
BBS	-	Bangladesh Bureau of Statistics
BDT	-	Bangladesh Taka
BDT M	-	Bangladesh Taka Million
CEGIS	-	Centre for Environmental and Geographical Information Services
DW	-	Deepwater
EFA	-	Economic and Financial Analysis
EIRR	-	Economic Internal Rate of Return
ENPV	-	Economic Net Present Value
FRERMIP	-	Flood and Riverbank Erosion Management Investment Program
GoB	-	Government of Bangladesh
ha	-	hectare
HYV	-	High Yielding Variety
ISPMC	-	Institutional Strengthening and Project Management Consultants
Km	-	kilometer
LGED	-	Local Government Engineering Department
MFF	-	Multitranche Financing Facility
MoDMR	-	Ministry of Disaster Management and Relief
NPV	-	Net Present Value
PPTA	-	Project Preparation Technical Assistance
O&M	-	Operation and Maintenance
PPTA	-	Project Preparation Technical Assistance
SCF	-	Standard Conversion Factor
SWRF	-	Shadow Wage Rate Factor

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

APPENDIXES

1 INTRODUCTION

1. The economic and financial analysis examines the viability of investments in riverbank protection works, flood embankments and supporting components being implemented under the Flood and Riverbank Erosion Risk Management Investment Program (FRERMIP) at three priority subprojects. The program was planned to be implemented in three tranches using ADB's multitranche financing facility (MFF). The MFF modality permits: (i) flexible, phased interventions which are adaptable to the dynamic river morphology in Bangladesh, (ii) long term riverbank erosion and flood protection management planning aimed at future stabilization of the river courses, and (iii) more effective support for enhancing institutional capacity in the sector. However, due to significant delays, the originally planned second and third tranches were combined into a final and single tranche to accelerate processing and mitigate further postponements to program implementation.

2. The main objectives of the economic analysis are to:

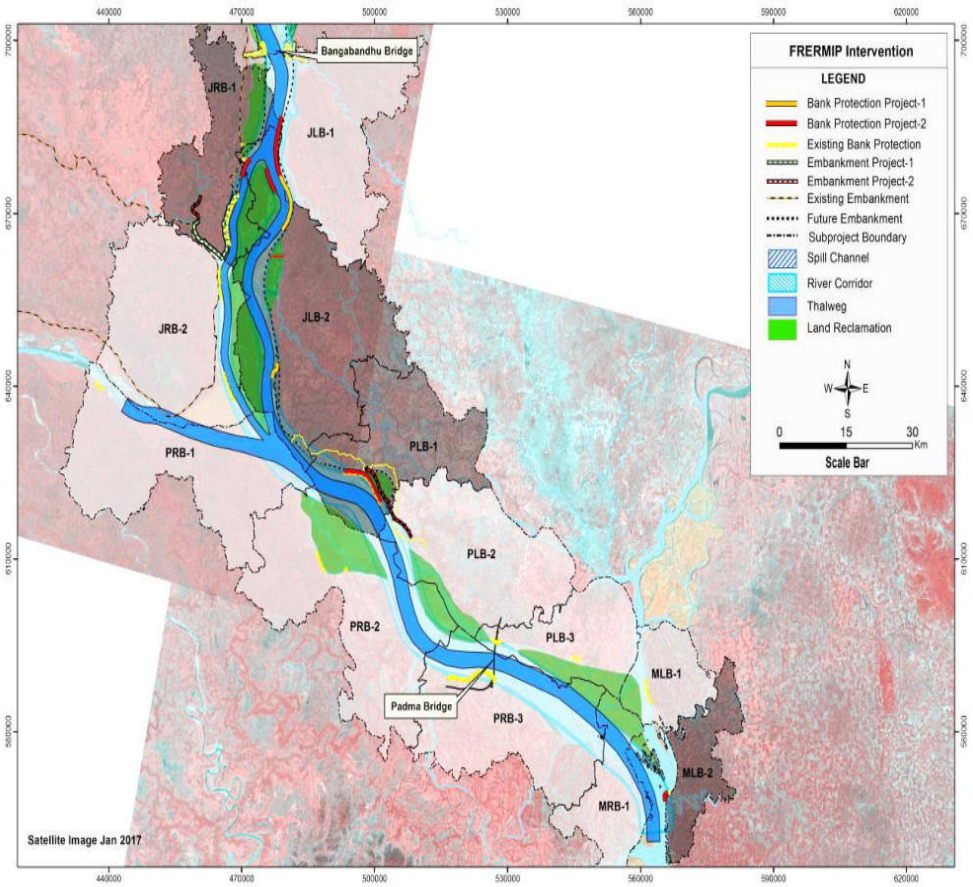
   (i) estimate the economic benefits and costs of mitigating riverbank erosion and alleviating flooding at three priority subprojects: Jamuna Right Bank 1 (JRB 1), Jamuna Left Bank 2 (JLB 2), and Padma Left Bank 1 (PLB 1) located along the banks of the Jamuna and Padma rivers;

   (ii) identify additional benefit streams (such as char land[1] reclamation) relevant to the shifting focus from passive riverbank protection works to more active and holistic river stabilization;

   (iii) assess the economic viability of the proposed interventions for each priority subproject and the program as a whole.

3. The location of the three priority subprojects is in Figure 1-1.

Figure 1-1 Location of Priority Subprojects



[1] An accretion in a river, the chars are valuable to the economy of Bangladesh as additional cultivable areas.

2 MAIN INTERVENTIONS OF TRANCHES 1 AND 2

4. The following table summarises the main interventions proposed for each priority subproject area under Tranche 2 of the investment program. The riverbank protection works constructed along the river reaches at JLB 1 (Chauhali) and PLB 1 (Harirampur) under Tranche 1 are also presented. Similarly, the flood embankment constructed at JRB-1 under Tranche 1 is also included.

Table 2.1 Main Interventions at Priority Subprojects under Tranche 1 and 2

Subproject	River Bank Protection		Flood Embankment		Channel Closure (Tranche 2)	Char land Development (Tranche 2)
	Constructed (Tranche 1)	Proposed (Tranche 2)	Constructed (Tranche 1)	Proposed (Tranche 2)		
JRB-1		10.5 km	21.0 km	7.9 km		
JLB-2	9.0 km	15.5 km			1 km	6,000 ha
PLB-1	8.8 km	4.0 km				
Total	17.8 km	30.0 km	21.0 km	7.9 km		6,000 ha

N.B. CC blocks for permanent wave protection will be built on the Tranche 2 bank protection works during a follow-on project.

5. It can be seen from Table 2.1 that a total of 17.8 km of riverbank protection works (i.e. 9 km at JLB-2 and 8.8 km at PLB-1) have been constructed under Tranche 1 to protect existing settlements and agricultural land from riverbank erosion at Chauhali and Harirampur. In addition, a 21.0 km flood embankment has been reconstructed at JRB-1 under Tranche 1 to mitigate flooding due to breaches and overtopping of the existing embankment.

6. Under Tranche 2, a further 7.9 km of flood embankment will be reconstructed at JRB-1 with the potential to mitigate flooding over a total area of 32,200 hectares. In addition, bank protection works will be built to mitigate erosion of the mainland on the right bank of the Jamuna River at Enayetpur (7 km) and Benotia (3.5 km). At JLB-2, 15.5 km of revetment works will be built on the left bank of the Jamuna river upstream of Chauhali. These works will mitigate erosion of both banks of the Jamuna river. Furthermore, a channel closure will be built to close off the channel south of Chauhali and this will facilitate the reclamation of about 6,000 ha of char land at Solimabad following the attachment of the char to the mainland. In addition, the existing bank protection works at PLB 1 will be extended by 4 km.

7. Under Tranche 2, it is anticipated that the proposed riverbank stabilisation and flood mitigation works at JRB-1 as well as the revetment works and channel closure at JLB-2 would be constructed over a period of 3 years, while the proposed flood embankment at JRB-1 would be undertaken over 2 years (excluding the time required for land acquisition and resettlement).

3 METHODOLOGY AND KEY PARAMETERS

8. In the economic analysis, an incremental approach was adopted which contrasted the future-with and future-without project scenarios under Tranches 1 and 2 of the program. The analysis evaluated the benefits and costs, as well as the economic viability of proposed riverbank protection and flood mitigation measures, for each subproject and the program as a whole. The analysis was carried out in accordance with the Asian Development Bank (ADB) Guidelines for the Economic Analysis of Projects.[2]

9. For each subproject, economic viability was assessed by determining the following economic criteria: (i) economic internal rate of return (EIRR) and (ii) economic net present value (ENPV). These economic criteria were then subjected to sensitivity analysis to evaluate the

[2] ADB. 2017. *Guidelines for the Economic Analysis of Projects*. Manila.

impact of changes in benefits and costs. Switching values were also calculated to estimate the percentage by which project benefits and costs would need to change to reach an EIRR of 9% and an ENPV of zero.

10. The economic analysis used the world price numeraire approach and the Bangladesh Taka (BDT) was the unit of account with an exchange rate of BDT 84.7 per US dollar (February 2021). Other key features of the methodology were:

(i) Economic life of the program is 30 years (including the construction period), so EIRRs and ENPVs were estimated on the basis of a 30-year incremental net benefit stream;

(ii) Constant 2020 prices were used for both costs and benefits over the 30 year period and price contingencies were omitted;

(iii) No residual value of capital investment was assumed at the end of the project life;

(iv) Taxes and duties were omitted from the analysis as these are transfer payments with no economic cost;

(v) Standard conversion factor (SCF) of 0.9 was used to convert the financial prices of domestic goods to economic values;

(vi) Economic prices for foreign costs remained unchanged from their financial values;

(vii) Financial prices of unskilled labor (engaged in project construction and agricultural activities) were converted to economic values by applying of a shadow wage rate factor (SWRF) of 0.75, while the SCF was applied to the price of skilled labor;

(viii) Market prices for different of types of land (i.e. agriculture, homestead and market/commercial land) were used as proxy for their economic value;

(ix) Discount rate of 9% was used to estimate ENPVs; and

(x) Minimum EIRR required for economic viability is 9% in accordance with ADB guidelines.

Based on the SCF and SWRF, economic conversion factors were also estimated for specific cost item and the derivation of these specific economic conversion factors is in Appendix A.

11. For the purposes of the current analysis, the estimation of economic benefits has been primarily based on secondary data sources which included:

(i) original economic analysis prepared by the PPTA in 2013[3];

(ii) data from relevant line departments and district administration offices; and

(iii) field survey to collect data on land values in areas vulnerable to erosion. These 2018 values were then updated to 2020 prices by applying a price escalation rate of 5.5% per annum[4].

4 ECONOMIC BENEFITS

12. The main economic benefits considered in the analysis are: (i) reduced land loss due to protection from riverbank erosion; (ii) mitigation of flood damage resulting from embankment breaches and overtopping; and (iii) development of reclaimed char land. It has been assumed that the mitigation of land losses and flood damage will be fully attained in the year following construction of the riverbank protection in all subprojects as well as the embankment works in JRB 1. Char development in JLB 2 is expected to start after the closure of the channel at Solimabad.

[3] Main River Flood and Bank Erosion Risk Management Program, Final Report, Annex G: Economic Assessment, December 2013 (Project Preparatory Technical Assistance 8054 BAN)

[4] Based on domestic cost escalation factors for Bangladesh (from ADB website).

4.1 Riverbank Protection

13. The economic benefits resulting from the mitigation of riverbank erosion are based on the estimated areas of agricultural, homestead and market/commercial land which would be lost if bank protection measures were not implemented. The areas of land expected to be eroded at the three subproject sites were estimated from the historical rates of riverbank erosion. These erosion rates were based on an analysis of satellite imagery of the banklines[5] along both banks of the Jamuna and Padma rivers. Changes in the banklines were analysed to determine the rates of erosion along each reach of the Jamuna and Padma rivers between 2010 and 2017. This analysis was an update of a more detailed study undertaken by the Centre for Environmental and Geographical Information Services (CEGIS) in 2015[6].

14. The areas of land vulnerable to erosion vary considerably from year to year, as well as between locations, so it is problematic to quantify the reduction in riverbank erosion associated with bank protection works. However, based on the information provided by the CEGIS studies, the Consultant estimated that, following the construction of the revetment works under Tranches 1 and 2, the proposed works in JRB 1 are expected to protect an average of 25 ha of mainland per year at Benotia and 60 ha of char land per year at Enayetpur. With respect to the revetment works in JLB 1, i.e. upstream of Chauhali and the channel closure at Solimabad, it is anticipated that an average of 140 ha per year of mainland and 100 ha of char land will be protected from riverbank erosion while, in PLB 1, the protection works are expected to save 70 ha of mainland per year from riverbank erosion (see Table 4.1).

Table 4.1 Erosion Rate and Estimated Area Lost to Riverbank Erosion

Subproject	Erosion Rate per Annum (ha) [1/]		Area Lost to Riverbank Erosion (ha) [2/]	
	Mainland	Char land	Mainland	Char land
JRB 1	25	60	525	1,260
JLB 2	140	100	3,270	2,100
PLB 1	70	-	1,770	-
Total	235	160	5,565	3,360

[1/] Consultant's estimates of annual rate of land loss in vulnerable areas to be protected from river bank erosion based on data of historical rates of riverbank erosion along the banklines of the Jamuna and Padma rivers.

[2/] Total area lost to riverbank erosion over 30 year life of the program (including construction period) if riverbank protection works are not constructed.

15. During the 30 year life of the program, the revetment works and channel closure at JLB 2 are therefore expected to protect a total of 3,270 hectares of mainland, as well as 2,100 hectares of char land on the Jamuna left bank, from riverbank erosion. While, at PLB 1, a total of 1,770 hectares of mainland will be saved following construction bank of protection works. In addition, the proposed revetment works at JRB-1 are expected to protect about 550 ha of mainland at Benotia and 1,260 ha of char land at Enayetpur (see Table 4.1).

16. Land price data were collected from the subproject areas during a field survey in 2018. The average land values per hectare for agricultural, homestead and market land were estimated for each subproject and then updated to 2020 prices by applying a price escalation rate of 5.5% per annum (Table 4.2). With regard to land use in the areas to be protected from riverbank erosion, Table 4.2 also shows the proportions of agricultural, homestead and market land within each subproject area.

17. The overall average land values per hectare were then calculated for the areas benefitting from protection works in each subproject. Based on 2020 prices for agricultural, homestead and market land, the overall value of land which will be saved from bank erosion was estimated at

[5] Banklines are the lines that delineate the floodplain from the river. They can be clearly seen on satellite imagery as they are typically vegetated, as opposed to river channels or low-lying sand bars.

[6] Prediction of River Bank Erosion along the Jamuna, Ganges and Padma Rivers in 2015, Centre for Environmental and Geographical Information Services (CEGIS), Dhaka, Bangladesh (March 2015).

an average of Tk5.10 million per hectare in PLB 1 (Harirampur), BDT 6.89 million per hectare in JLB 2 (Chauhali) and Tk8.68 million per hectare in JRB-1 (Benotia). For char land areas to be protected from bank erosion at JRB 1 (Enatyanpur) and JLB 2 (Solimabad), a land value of BDT 1.38 million per hectare was used based on estimates made by local farmers as char land is very rarely traded.

Table 4.2 Land Use and Land Values in Areas Benefiting from Protection Works

Subproject	Agricultural Land		Homestead Land		Market Land		Overall	
	% of Total Area	Land Value (BDT M per ha)	% of Total Area	Land Value (BDT M per ha)	% of Total Area	Land Value (BDT M per ha)	% of Total Area	Overall Land Value (BDT M per ha)
JRB 1	60%	6.89	36%	10.33	4%	20.66	100%	8.68
JLB 2	66%	5.51	30%	8.27	4%	19.29	100%	6.89
PLB 1	73%	4.30	25%	6.48	2%	17.10	100%	5.10

Source: Consultant's estimates based on land price data collected from subproject areas and land use data from an analysis of satellite imagery.

18. In addition, to reflect the increasing demand for protected land within each subproject area, it has also been assumed that there would be an overall increase in the value of land at the rate of 3% per annum for mainland areas. This annual increase in land values is based on the expected expansion in settlements and commercial/industrial developments within the subproject areas. It has also been assumed that the economic benefits of the bank protection works begin when the revetment works are completed and there is no risk of further erosion. For the channel closure at Solimabad, the economic benefits of erosion mitigation and char land development start when the channel is closed.

4.2 Flood Mitigation

19. The economic benefits of constructing a 28.9 km flood embankment at JRB-1 (under Tranches 1 and 2) were estimated on the basis of the number and value of the main assets located within the vulnerable area to be protected from future flooding, and the probability of damage under various flood scenarios. It is estimated that an area of over 32,000 hectares could benefit from the construction of the flood embankment. Agricultural crops, buildings and roads are the major types of assets vulnerable to flooding within the subproject area. Flood damage data were obtained from the Ministry of Disaster Management and Relief (MoDMR) district estimates for the 1988, 2003 and 2007 flood events. The probabilities of occurrence (return periods) for these flood events were estimated at 0.01 (100 years), 0.5 (2 years), and 0.05 (20 years) respectively.

20. The estimates of crop damage were derived from crop areas which were lost due to floods in the subproject area multiplied by the average economic value of production per hectare for the Aman rice crop (Tk67,375). The estimated value of crop damages in the 1988, 2003 and 2007 flood events are in Table 4.3.

21. With regard to buildings, the number of buildings within JRB 1 was based on information reported in the Bangladesh Bureau of Statistics (BBS) census data from which estimates for 2020 were derived by applying the average annual growth rate for three categories of building (i.e. pucca, semi-pucca and kutcha) over a 10 year period. The proportions of each building category either partially or totally damaged by each flood event were then applied to the projected number of buildings in 2020. In economic prices, the replacement costs were estimated at BDT 705, BDT 564 and BDT 212 per ft^2 for pucca, semi-pucca and kutcha respectively, and the value of damage for partially damaged buildings was assumed to be 50% of replacement cost.

22. For roads, the lengths of roads in JRB 1 were derived from BBS data and the damage to roads in each flood year was derived from MoDMR district data. Paved and earthen roads were

analysed and construction costs (in economic prices) have been based on unit rates of the Local Government Engineering Department (LGED), i.e. Tk11,144,323 per km for paved roads and Tk3,179,550 per km for earthen roads These unit values for buildings and roads were then multiplied by the number of buildings and the length of roads damaged by each flood event. The estimated economic value of the damage to buildings and roads for the three flood events are in Table 4.3.

23. Based on the damage values for the three flood events, flood damage probability functions were then derived to estimate the value of expected annual damage. The damage probability function assigns higher damage values to floods of large magnitude but with low probability of occurrence. Conversely, floods with smaller magnitudes and lower damages are more frequent and so have a higher probability of occurrence. The expected value of annual damage was determined by integrating the function using the Riemann sums method[7]. Expected annual values were estimated both with and without program interventions, and the annual economic benefits from flood mitigation were then determined by calculating the difference between the expected annual values (Table 4.3). The damage probability functions for total damage values can be depicted graphically in the flood damage exceedance probability curves. The flood damage curves (for both with and without program scenarios) are presented in Figure 4-1 and the area between the curves is the expected annual damage that would be mitigated by the flood embankments up to their 'as built' return period.

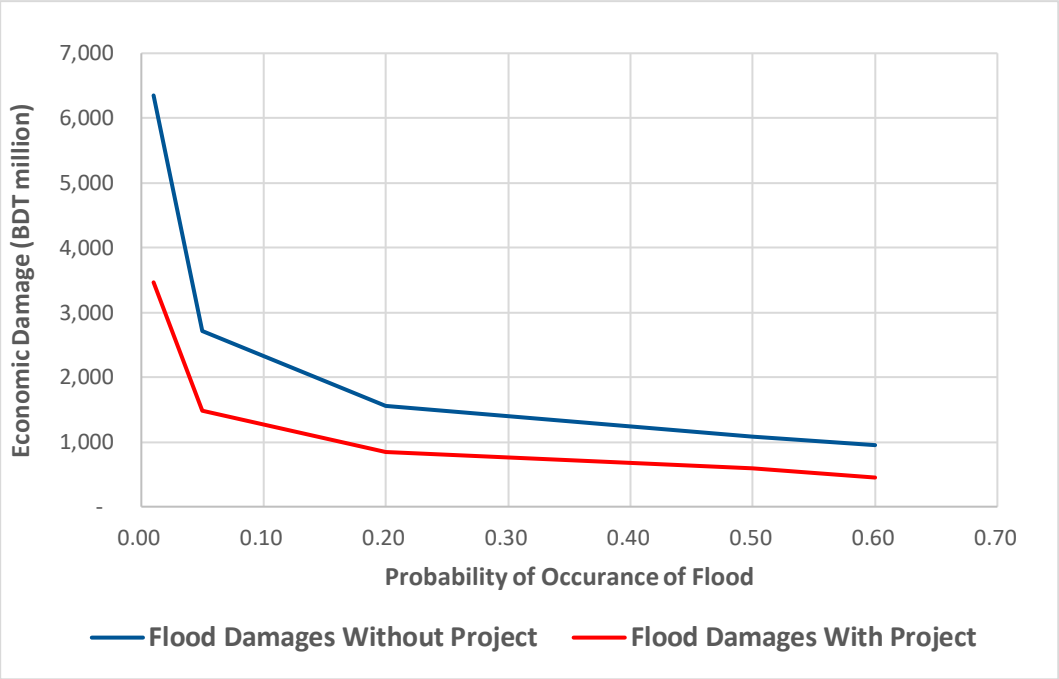
Table 4.3 Economic Values of Damages for Various Flood Events in JRB 1

Return Period	Probability of Occurrence	Economic Value of Flood Damages (BDT million)			
		Crops	Buildings	Roads	Total
2 years	0.5	78.9	718.5	282.2	1,079.6
20 years	0.05	368.8	1,961.6	375.4	2,075.8
100 years	0.01	829.8	3,498.3	2,021.5	6,349.6
Expected Annual Damage Value (BDT million)					
Without Program		144.4	891.9	266.5	1,302.8
With Program		65.6	405.4	121.1	592.1
Annual Economic Benefits from Flood Mitigation		78.8	486.5	145.4	710.7

24. It would be preferable to include further flood events in the damage assessment, e.g. flood events with return periods of 1 in 10 years, 1 in 30 years and 1 in 50 years. This analysis would be more accurate, but this may not significantly change the results. Through interpolation, three plots were added to the graph to obtain more clearly defined damage curve and this analysis indicated that the annual economic benefits would be lower but the margin of error is about 5% to 10%. Consequently, having only three flood events but with a wide spread of return periods (i.e. 2 years, 20 years and 100 years) does provide a reasonably accurate estimate of expected annual flood damages.

[7] https://mathinsight.org/calculating_area_under_curve_riemann_sums

Figure 4-1 Flood Damage Exceedance Probability Curves



Source: Flood damage-probability function given in Table 4.3.

25. The method used to calculate average annual expected damage followed the same approach taken in the original economic analysis prepared for the EFA of the RRP of the MFF for FRERMIP (RRP BAN 44167) in 2014 and is therefore considered valid.[8] There is, however, a risk of overestimating the benefits of flood protection using this method as it implicitly assumes that all flood damages will be mitigated by the flood embankments. This has been recognized by the institutional strengthening and project management consultants (ISPMC) team under Tranche 1 and, in 2020, a flood modelling study was undertaken to identify the areas which will be free of flooding following embankment construction. Based on this flood modelling, the average annual flooded area in JRB-1 was estimated at 32,204 ha without the embankment and 14,636 ha with the embankment, so 17,568 ha (or 55% of the JRB-1 area) are expected to remain free of flooding following embankment construction.

26. In addition, there are other damages/losses due to flooding which have not been included in the economic analysis due to lack of data. These include damages/losses of house and building contents as well as vehicles. These damages/losses could account for around 15% to 30% of overall economic losses due to flooding (based results of similar flood studies in Asia). Furthermore, other economic losses, such as disruption and dislocation to economic activities during floods, are difficult to quantify. Given the adjustments to limit the benefits of mitigating flood damages to the flood free areas directly benefiting from embankments, as well as the omission of significant damages/losses, the approach adopted is therefore unlikely to significantly overestimate the economic benefits of the flood mitigation measures. It should also be noted that, in JRB 1, land benefitting from riverbank protection does not overlap with area benefiting from flood mitigation.

27. In addition, an overall increase in the value of assets at the rate of 3% per annum in real terms was also applied in the analysis. This annual increase is based on the expected rate of development, e.g. house construction and infrastructural improvements, within the JRB 1 area.

[8] ADB. 2014. *Report and Recommendation of the President to the Board of Directors: Proposed Multitranche Financing Facility to the People's Republic of Bangladesh: Flood and Riverbank Erosion Risk Management Investment Program.* Manila.

4.3 Increased Agricultural Production

28. In addition to mitigating flood damage, increases in crop production are likely to be gained from reduced flooding in JRB-1. Based on land types by flood depths (i.e. F0, F1, F2, F3 and F4)[9], cropping patterns were determined for both with and without flood embankment scenarios. Changes in cropping pattern would mainly derive from the switch to high yielding rice crops in the monsoon season (i.e. from DW Aman to HYV Aman) as a result of reduced flooding. Furthermore, there would be a decrease in flooding duration which would facilitate earlier dry season cropping. The cropping intensity is also expected to rise from 217% to 233%.

29. To derive the economic benefits of increased agricultural production, economic crop budgets were prepared to estimate the net economic benefits per hectare for each crop in both the with and without project situations. The economic net benefits per ha were then applied to the increased in the areas of F0, F1 and F2 land (resulting from the construction of flood embankments) and the total net economic benefits were determined. The increases in F0, F1 and F2 land (obtained from the results of the ISPMC flood modelling) and were estimated at 7,659 hectares for the JRB-1 subproject area.

30. In addition to increasing crop production, it is also anticipated that a reduction in flooding would facilitate an increase in culture fish production through both an expansion of fish ponds and an improvement in fish productivity. To estimate the economic benefits of reduced flooding, the net economic benefits from culture fish farming (in both with and without project situations) were estimated. The economic net benefits per hectare from fish ponds[10] were then applied to the with and without project fish pond areas. By deducting without project net benefits from with project net benefits, incremental net economic benefits from culture fish production were derived.

4.4 Char land Development

31. At present, char lands are partially used by local people to grow a range of crops to meet their subsistence requirements, but there is a high proportion of unutilised land. Soil fertility and water retention are poor, and farmers use traditional practices to improve soil structure and fertility over a long period of time. As char land is also subject to extensive flooding during the monsoon season, cropping intensity and crop productivity are therefore very low.

32. However, following the channel closure in JLB 2, the bankline channel south of Chauhali will result in the Solimabad char joining the mainland. This would facilitate agricultural development on about 6,000 ha of char land with a gradual increase in crop area and production over a 20 year period. To achieve sustainable crop production, improved methods of soil amelioration would also need to be adopted to ensure that productive, mixed cropping systems are established. It is also anticipated that a future cropping intensity of 200% would be achieved (i.e. similar to the existing mainland areas which remain unprotected from flooding).

33. On the basis of the expected crop yields, crop inputs, labour and machinery requirements as well as produce/input prices and wage rates, economic crop budgets were prepared to determine the economic net returns per hectare for each crop. The economic net returns per ha were then applied to the crop areas to derive the total net economic benefits from crop production.

34. As a result of an increase in the supply of cereals and fodder (mainly from crop by-products), it is anticipated that the number of cattle, buffalo, sheep, goats and poultry would gradually increase. Livestock are a source of a wide range of products including milk, meat, and manure, as well as cash income, but productivity is very low. However, an improvement in livestock productivity is expected to arise due to the adoption of better livestock husbandry practices, particularly with respect to nutrition and animal health care. Based on future increases in livestock numbers and economic net returns per head (from improved productivity), the

[9] Including F0: 0 to 30 cm (high land); F1: 30 to 90 cm (medium high land); F2: 90 to 180 cm (medium low land); F3: 180 to 360 cm (low land); and F4: above 360 cm (very low land).

[10] A substantial increase in culture fish production is expected. This production increase was estimated by the Fisheries Specialist based on data from similar areas which have benefited from flood protection.

economic benefits from livestock production were estimated and included in the economic analysis.

35. With the availability of reclaimed char land, there would also be considerable demand, particular from households recently displaced by riverbank erosion as well as landless households in the local areas, for the development of rural settlements on the reclaimed char land. However, without the construction of an embankment to mitigate flood damages, the establishment of houses, shops, public buildings and infrastructure will be very limited. The establishment of settlements on the reclaimed char land has therefore not be included in the economic benefits of char land development.

4.5 Overall Economic Benefits

36. For each subproject, the economic benefits of bank protection works, flood embankments and char land development (as previously described) were then estimated over a 30 year period to derive the net present value (NPV) for each type of economic benefit. The NPVs of the economic benefits are combined together in Table 4.4 and it can be seen that total economic benefits are estimated at BDT 10.02 billion for JRB-1, BDT 9.16 billion for JLB-2 and BDT 3.32 billion for PLB-1 with an overall program total of BDT 22.39 billion.

37. The economic benefits of riverbank protection are estimated at BDT 13.46 billion (60% of the overall program) and accounts for 91% and 100% of the economic benefits in JLB 2 and PLB-1 respectively. While, the economic benefits of flood mitigation are estimated at BDT 8.25 billion (37% of the overall program) and accounts for 82% of the economic benefits in JRB 1. For JRB 1, riverbank protection also contributes 18% of the economic benefits while, in JLB 2, char land development contributes 9% to the economic benefits (Table 4.4).

Table 4.4 Economic Benefits of Program Interventions by Subproject

Project Intervention	JRB -1		JLB-2		PLB-1		Overall Program	
	Econ. Benefit (BDT M)	% of total	Econ. Benefit (BDT M)	% of total	Econ. Benefit (BDT M)	% of total	Econ. Benefit (BDT M)	% of total
Riverbank protection	**1,778**	**18%**	**8,365**	**91%**	**3,317**	**100%**	**13,460**	**60%**
Flood mitigation	**8,246**	**82%**	**-**	-	**-**	**-**	**8,246**	**37%**
Reduced damage	7,301	73%	-	-	-	-	7,301	33%
Incremental agriculture	945	9%	-	-	-	-	945	4%
Char land development	**-**	**-**	**799**	**9%**	**-**	**-**	**799**	**3%**
Total	**10,024**	**100%**	**9,164**	**100%**	**3,317**	**100%**	**22,505**	**100%**

N.B. Economic benefits based on net present value (NPV) over 30 years discounted at 9% per annum.

4.6 Non-Quantified Benefits

38. The interventions would also have a number of other economic benefits. However, mainly due to the lack of available data to provide reliable estimates, these other benefits have not been included in the economic analysis. The non-quantified benefits include:

(i) Mitigation of injuries and the loss of life (both human and animal) caused by flooding;

(ii) Damage to the contents of buildings (i.e. houses and commercial/industrial/public buildings) as well as vehicles;

(iii) Mitigation of the disruption to economic activities resulting from river bank erosion and flooding;

(iv) Reduction in relocation costs and distress to local people caused by river bank erosion and flooding;

(v) Reduction in the costs of disaster relief and rehabilitation; and

(vi) Environment benefits from the conservation of ecological assets on char lands.

39. In addition, indirect economic benefits are also expected to result from an increase in economic activities which are primarily related to agricultural development. These indirect benefits include an increase in the transport, storage and marketing of agricultural produce, as well as an increased in the supply of inputs to farmers, through both forward and backward linkages to the external value chains.

5 ECONOMIC COSTS

40. The financial investment costs of riverbank protection works (including geotextile materials) and flood embankment works have been estimated on the basis of physical quantities of the civil works and materials valued in 2020 prices. Land acquisition and resettlement costs have been based on official government rates currently prevailing in the subproject areas. In addition to the specific costs related to each subproject, other program costs including vehicles/equipment, community-based flood risk management, capacity development, consultancy services, environmental mitigation/management, pilot land recovery and PMO operation will also be incurred to ensure the effective implementation and sustainability of program investments.

41. The financial investment costs for Tranche 2 were combined with expenditure incurred for each subproject under Tranche 1 to derive the total costs of Tranches 1 and 2. The financial costs for Tranches 1 and 2 were then converted to economic values by first omitting taxes and duties and then applying economic conversion factors to local costs. The total economic costs of the project interventions amounted to BDT 7.68 billion (US$ 90.6 million) for JRB-1, BDT 10.42 billion (US$ 123.0 million) for JLB-2 and BDT 3.37 billion (US$ 39.7 million) for PLB 1, and BDT 21.46 billion (US$ 253.4 million) for the overall program as indicated in Table 5.1.

42. The costs of riverbank protection works (including adaptation works[11]) accounted for the largest proportion of base costs at JLB 2 (71%) and PLB 1 (76%), while bank protection works comprise 31% of total costs for JRB 1. The costs of flood embankments and land acquisition/resettlement accounted for the highest proportion of total costs at JRB-1 with 51%. Supporting components also represent a significant proportion of base costs with 18% of overall program costs.

43. It should, however, be noted that the economic costs of Tranche 2 also included the costs of wave protection for the revetment works with concrete blocks. These revetment works have been deferred to a follow-on project, but have been included in the present economic analysis as the works ensure that the economic benefits of riverbank protection will be sustained throughout the 30-year life of the program. It has also been assumed that these additional revetment works would be constructed between 2025 and 2028.

44. Annual operation and maintenance (O&M) costs as a percentage of capital costs have been estimated at the rates of 2% for riverbank protection works and 5% for flood embankments and other structures (e.g. regulators). Annual O&M costs are assumed to commence in the year following the completion of the construction works.

[11] Adaptation works are not allocated to specific subprojects in the financial costs but, for the purposes of the economic analysis, these adaptation costs have been allocated between subprojects in the same proportions as the costs of the main protection works have been distributed.

Table 5.1 Economic Investment Costs for Tranches 1 and 2 Interventions

Project Intervention	JRB-1		JLB-2		PLB-1		Overall Program	
	Econ. Cost (BDT M)	% of total	Econ. Cost (BDT M)	% of total	Econ. Cost (BDT M)	% of total	Econ. Cost (BDT M)	% of total
Riverbank Protection Works	**1,894**	24.7%	**6,166**	59.2%	**2,289**	68.0%	**10,349**	48.1%
Flood Mitigation Works	**1,391**	18.1%	**810**	7.8%	**-**	-	**2,201**	10.2%
Land Acquisition & Resettlement	**2,495**	32.5%	**559**	5.4%	**183**	5.4%	**3,237**	15.1%
Adaptation Works	**480**	6.3%	**1,180**	11.3%	**260**	7.7%	**1,920**	8.9%
Other Components [1/]	**1,461**	18.4%	**1,704**	16.4%	**634**	18.8%	**3,753**	17.7%
Total Cost [2/]	**7,675**	100%	**10,420**	100%	**3,365**	100%	**21,460**	100%
Total Cost *(US$ million)*	***90.6***		***123.0***		***39.7***		***253.4***	

[1/] Institutional Strengthening and Project Management Consultants services.

[2/] Including physical contingencies computed at 8.5% of investment costs for civil works, 6.5% for supporting components and 0% for land acquisition and resettlement.

6 ECONOMIC VIABILITY AND SENSITIVITY ANALYSIS

6.1 Economic Viability

45. The results of the economic analysis undertaken for the investments under Tranches 1 and 2 are in Table 6.1 and indicated that the EIRRs are 13.6% for JRB-1, 13.2% for JLB-2 and 13.2% for PBL-1 with an overall EIRR of 13.4%. This analysis shows that, at a 9% EIRR threshold, the investments under Tranches 1 and 2 are economically viable for all subprojects as well as the overall program.

46. Comparing the economic viability of Tranche 1 with the overall program investments, it is evident that the EIRR for JRB 1 increases from 12.8% to 13.6%. Similarly, it is envisaged that the EIRR for JLB 1 will rise from 12.3% to 13.2%, while the EIRR for PLB-1 would fall from at 14.0% to 12.2%. Furthermore, the EIRR for the overall program is expected to increase from 12.9% to 13.4%.

Table 6.1 Economic Viability of Investments under Tranches 1 and 2

Investment Tranche	JRB -1		JLB -2		PLB-1		Overall Program	
	EIRR (%)	ENPV (BDT M)	EIRR (%)	ENPV (BDT M)	EIRR (%)	ENPV (BDT M)	EIRR (%)	ENPV (BDT M)
Tranche 1	12.8%	1,232	12.3%	852	14.0%	842	12.9%	2,927
Tranches 1 and 2	13.6%	2,435	13.2%	2,482	13.2%	896	13.4%	5,812

6.2 Sensitivity Analysis

47. To take account for future risks and uncertainties, sensitivity analysis was undertaken to assess the impact of changes in costs and benefits on economic viability of each subproject and the overall program. The results of the sensitivity analysis are in Table 6.2 and it can be seen that if investment costs increased by 15%, the EIRR of the overall program would fall to 11.5%. Similarly, a 25% rise in investment costs would result in an EIRR of 10.4% but the program would still remain economically viable. The sensitivity analysis also considered the possibility of not achieving the economic benefits envisaged and it evident in Table 6.2 that, if the area and/or value of the land protected from riverbank erosion decreased by 15%, the EIRR

for the program would fall to 11.8% Furthermore, a decrease in the value of protected land by 25% would reduce the EIRR to 10.9%. With regard to not achieving the expected average annual flood damage, a 15% decrease in damage values would reduce the EIRR of JRB-1 to 12.2%, while a 25% fall in damage values would result in an EIRR to 11.3%.

48. The sensitivity analysis also assessed the prospect of annual land and property prices in the subproject areas not increasing (in real terms) by 3% per annum, and the analysis showed that the EIRR of the overall program would fall to 9.9% but still remain economically viable. Furthermore, if the reclaimed char land was not developed by the local population in the JLB-2 subproject area, the EIRR would fall to 13.0%. Finally, if the costs of wave protection for the revetment works are omitted, the EIRR of the overall project increases to 14.0%.

Table 6.2 Sensitivity Analysis of Tranches 1 and 2

Sensitivity Test	JRB-1		JLB -2		PLB-1		Overall Program	
	EIRR (%)	ENPV (BDT M)	EIRR (%)	ENPV (BDT M)	EIRR (%)	ENPV (BDT M)	EIRR (%)	ENPV (BDT M)
Base Case	13.6%	2,435	13.2%	2,482	13.2%	896	13.4%	5,812
Increase in Investment Costs by 15%	11.8%	1,616	11.3%	1,479	11.2%	533	11.5%	3,628
Increase in Investment Costs by 25%	10.7%	1,070	10.2%	811	10.2%	291	10.4%	2,172
Decrease in Value of Protected Land by 15%	13.3%	2,221	11.3%	1,315	10.9%	398	11.8%	3,924
Decrease in Value of Protected Land by 25%	13.1%	2,079	10.0%	583	9.3%	67	10.9%	2,729
Decrease in Average Annual Flood Damage Values by 15%	12.2%	1,659	13.2%	2,482	13.2%	826	12.8%	4,967
Decrease in Average Annual Flood Damage Values by 25%	11.3%	1,142	13.2%	2,482	13.2%	896	12.6%	4,520
No annual increase of 3% in land and property values	11.5%	1,113	9.3%	144	8.9%	(10)	9.9%	1,247
No char land development	13.6%	2,435	12.3%	1,798	13.2%	896	13.0%	5,129
Excluding wave protection for revetment works	14.1%	2,648	14.0%	2,847	14.1%	1,081	14.0%	6,576

49. Switching values were also calculated to estimate the percentage by which the economic benefits and costs would need to change to reach an EIRR of 9% and an ENPV of zero. The results, presented in Table 6.3, show that the overall program investments would require a reduction in annual benefits of 28% or an increase in costs of 40% to become economically unviable. JRB-1 investments would need a reduction in benefits of 31% or an increase in costs of 45%, while PLB-1 investments would require a reduction in benefits of 27% or an increase in costs of 37%. JLB-2 would become economically unviable with a decrease in benefits of 28% or an increase in costs of 38%. This clearly shows that the subprojects and the overall program are robust to adverse changes in benefit and cost streams.

Table 6.3: Switching Values of Tranches 1 and 2

JRB -1		JLB -2		PLB-1		Overall	
% Fall in Benefits	% Rise in Costs	% Fall in Benefits	% Rise in Costs	% Fall in Benefits	% Rise in Costs	% Fall in Benefits	% Rise in Costs
(31%)	+45%	(28%)	+38%	(27%)	+37%	(28%)	+40%

N.B. Switching value is the percentage change in benefits or costs required to achieve an EIRR of 9%.

APPENDIX A: ECONOMIC CONVERSION FACTORS

In the economic analysis, the following economic conversion factors were applied to the economic costs. Table A1 also shows the derivation of the each conversion factor.

The economic conversion factors used to convert financial costs to economic values were derived from the foreign cost at CF=1.0, unskilled labor at SWRF=0.75 and other local costs (e.g. materials, skilled labor) at SCF of 0.9. For example, a conversion factor of 0.86 was used for riverbank protection works, i.e. 15% of foreign cost at 1.0, 50% of local cost at 0.9 and 35% of unskilled labor at 0.75. The SCF of 0.9 and SWRF of 0.75 have been consistently used in the economic analysis of rural development projects in Bangladesh for many years.

Table A1: Economic Conversion Factors

Cost Item	Economic Conversion Factor	Derivation of Economic Conversion Factor
Riverbank protection works	0.86	F: 15% x 1 + L: 35% x 0.9 + USL: 35% x 0.75 = 0.86
Channel Closure	0.87	F: 10% x 1 + L: 65% x 0.9 + USL: 25% x 0.75 = 0.87
Embankment	0.84	F: 10% x 1 + L: 40% x 0.9 + USL: 50% x 0.75 = 0.84
Offtake Structure	0.84	F: 10% x 1 + L: 40% x 0.9 + USL: 50% x 0.75 = 0.84
Maintenance of civil works	0.85	F: 10% x 1 + L: 50% x 0.9 + USL: 40% x 0.75 = 0.85
Land Acquisition/Resettlement	0.90	L: 100% x 0.9 = 0.9
Consultancy Services	0.95	F: 50% x 1 + L: 50% x 0.9
Equipment and vehicles	0.95	F: 50% x 1 + L: 50% x 0.9
PMO operation	0.90	L: 100% x 0.9 = 0.9
Other supporting components	0.90	L: 100% x 0.9 = 0.9

N.B. F = foreign, L = local materials and labour, and USL= Unskilled labor.

With regard to the main project benefits, i.e. erosion mitigation and flood protection, the financial values related to mitigating land losses have been used as a proxy for the economic value of land. The economic value of damages to crops, property and infrastructure due to flooding have been estimated by applying the SCF of 0.9 to their financial values. Furthermore, in the calculation of incremental crop benefits from flood mitigation, the changes to cropping patterns were not expected to increase labor requirements so unskilled labor was not valued.

APPENDIX B:

ECONOMIC BENEFITS AND COSTS OF TRANCHES 1 and 2

Table B1: Economic Benefits and Costs of Tranches 1 and 2 (BDT Million in Constant 2020 Prices) : JRB 1

							1							1	(Million BDT)
Year	Costs							Incremental Benefits							
	Investment					O & M	Total Cost	Embankment			Bank Protection			Total Benefits	Incremental Net Benefits
	Riverbank Protection Works	Embankment Works	Land Acquisition & Resettlement	Unallocated Works	Other Project Costs			Agriculture	Fisheries	Reduction in Flood Damage	Agric. Devt Charland	Eroded Land Value	Livestock Devt		
2015/16			514		213		728	0	0			0	0	0	-728
2016/17			505	25	221		751	0	0			0	0	0	-751
2017/18		488	415	24	286		1,214	0	0			0	0	0	-1,214
2018/19		488		15	250		753	0	0			0	0	0	-753
2019/20						50	50	71	32	474		0	0	577	527
2020/21						50	50	71	32	488		0	0	591	541
2021/22	307		424	83	89	50	954	71	32	503		0	0	606	-348
2022/23	614	207	424	166	178	50	1,640	71	32	518	0	0	0	621	-1,019
2023/24	614	207	212	166	178	50	1,428	71	32	533	0	0	0	636	-792
2024/25						110	110	107	47	711	0	349	0	1,215	1,105
2025/26	179					110	289	107	47	732	0	358	0	1,244	955
2026/27	179					110	289	107	47	754	0	366	0	1,274	986
2027/28						117	117	107	47	777	0	374	0	1,305	1,188
2028/29						117	117	107	47	800	0	383	0	1,337	1,220
2029/30						117	117	107	47	824	0	392	0	1,370	1,253
2031/32						117	117	107	47	849	0	401	0	1,404	1,287
2032/33						117	117	107	47	874	0	411	0	1,439	1,322
2033/34						117	117	107	47	900	0	421	0	1,476	1,359
2034/35						117	117	107	47	927	0	431	0	1,513	1,396
2035/36						117	117	107	47	955	0	441	0	1,551	1,434
2036/37						117	117	107	47	984	0	452	0	1,590	1,473
2038/38						117	117	107	47	1,013	0	463	0	1,631	1,514
2038/39						117	117	107	47	1,044	0	475	0	1,673	1,556
2039/40						117	117	107	47	1,075	0	486	0	1,716	1,599
2040/41						117	117	107	47	1,107	0	498	0	1,760	1,643
2041/42						117	117	107	47	1,140	0	511	0	1,806	1,689
2042/43						117	117	107	47	1,175	0	524	0	1,853	1,736
2043/44						117	117	107	47	1,210	0	537	0	1,901	1,784
2044/45						117	117	107	47	1,246	0	551	0	1,951	1,834
2045/46						117	117	107	47	1,284	0	565	0	2,003	1,886
Total	1,894	1,391	2,495	480	1,416		7,675	655	290	7,301	0	1,778	0	10,024	2,435
% total	24.7%	18.1%	32.5%	6.3%	18.4%		100.0%	6.5%	2.9%	72.8%	0.0%	17.7%	0.0%	100.0%	
EIRR %							13.61%								
Benefit Cost Ratio							1.45								
NPV @ 9%(Million BDT)							2,435								

Table B2: Economic Benefits and Costs of Tranches 1 and 2 (BDT Million in Constant 2020 Prices) : JLB 2

							1								1 (Million BDT)
Year	Cost							Incremental Benefits							
	Investment					O & M	Total Cost	Embankment			Bank Protection			Total Benefits	Incremental Net Benefits
	Riverbank Protection Works	Offtake Structure & Fish Sanctuary	Land Acquisition & Resettlement	Unallocated Works	Other Project Costs			Agriculture	Fisheries	Reduction in Flood Damage	Agric. Devt Charland	Eroded Land Value	Livestock Dev't		
2015/16	530		31		92	0	652	0	0	0	0	0	0	0	-652
2016/17	822		23		94	0	939	0	0	0	0	0	0	0	-939
2017/18	288		22		123	0	433	0	0	0	0	0	0	0	-433
2018/19	469		22		130	0	620	0	0	0	0	390	0	390	-230
2019/20						42	42	0	0	0	0	402	0	402	360
2020/21						42	42	0	0	0	0	414	0	414	372
2021/22	693		185	118	316	42	1,355	0	0	0	0	426	0	426	-928
2022/23	1,214		185	354	316	42	2,111	0	0	0	0	439	0	439	-1,672
2023/24	1,214	405	92	354	316	42	2,424	0	0	0	0	452	0	452	-1,971
2024/25	347	405		354	316	42	1,464				37	1,324	4	1,365	-100
2025/26	295					176	471	0	0	0	55	1,359	8	1,422	951
2026/27	295					176	471	0	0	0	72	1,396	12	1,480	1,010
2027/28						187	187			0	90	1,434	16	1,540	1,353
2028/29						187	187			0	107	1,473	21	1,601	1,413
2029/30						187	187	0	0	0	125	1,513	25	1,662	1,475
2031/32						187	187	0	0	0	142	1,554	29	1,726	1,538
2032/33						187	187	0	0	0	160	1,596	33	1,790	1,602
2033/34						187	187	0	0	0	178	1,640	38	1,856	1,668
2034/35						187	187	0	0	0	195	1,685	43	1,924	1,736
2035/36						187	187	0	0	0	213	1,732	43	1,988	1,800
2036/37						187	187	0	0	0	230	1,779	43	2,053	1,865
2038/38						187	187	0	0	0	248	1,829	43	2,120	1,932
2038/39						187	187	0	0	0	265	1,879	43	2,188	2,001
2039/40						187	187	0	0	0	283	1,932	43	2,258	2,070
2040/41						187	187	0	0	0	301	1,985	43	2,329	2,142
2041/42						187	187	0	0	0	318	2,041	43	2,402	2,215
2042/43						187	187	0	0	0	336	2,098	43	2,477	2,289
2043/44						187	187	0	0	0	353	2,157	43	2,553	2,366
2044/45						187	187	0	0	0	371	2,217	43	2,631	2,444
2045/46						187	187	0	0	0	371	2,280	43	2,694	2,506
Total	6,166	810	559	1,180	1,704		10,420	0	0	0	683	8,365	116	9,165	2,482
% total	59.2%	7.8%	5.4%	11.3%	16.4%		100.0%	0.0%	0.0%	0.0%	7.5%	91.3%	1.3%	100.0%	
EIRR %							13.23%								
Benefit Cost Ratio							1.37								
NPV @ 9%(Million BDT)							2,482								

Table B3: Economic Benefits and Costs of Tranches 1 and 2 (BDT Million in Constant 2020 Prices) : PLB 1

							1								1	(Million BDT)
Year	Costs							Incremental Benefits								
	Investment					O & M	Total Cost	Embankment			Bank Protection				Total Benefits	Incremental Net Benefits PLB-1
	Riverbank Protection Works	Embankment Works	Land Acquisition & Resettlement	Unallocated Works	Other Project Costs			Agriculture	Fisheries	Reduction in Flood Damage	Agric. Devt Charland	Eroded Land Value	Road Transport	Livestock Devt		
2015/16	583		29		70	0	682	0	0	0		0	0		0	-682
2016/17	269		23	1	102	0	394	0	0	0		0	0		0	-394
2017/18	128		44	25	98	0	295	0	0	0		0	0		0	-295
2018/19	77			25	141	0	242	0	0	0		263	0		263	20
2019/20						22	22	0	0	0	0	271	0		271	248
2020/21						22	22	0	0	0	0	279	0		279	256
2021/22	151		35	42	45	22	295	0	0	0	0	287	0		287	-8
2022/23	303		35	83	90	22	533	0	0	0	0	296	0		296	-237
2023/24	303		17	83	90	22	515	0	0	0	0	304	0		304	-211
2024/25						41	41	0	0	0	0	439	0		439	398
2025/26	95					41	137	0	0	0	0	452	0		452	316
2026/27	190					41	232	0	0	0	0	466	0		466	234
2027/28	190					41	232				0	480	0		480	248
2028/29						51	51			0	0	494	0		494	443
2029/30						51	51	0	0	0	0	509	0		509	458
2031/32						51	51	0	0	0	0	524			524	473
2032/33						51	51	0	0	0	0	540	0		540	489
2033/34						51	51	0	0	0	0	556	0		556	505
2034/35						51	51	0	0	0	0	573	0		573	522
2035/36						51	51	0	0	0	0	590	0		590	539
2036/37						51	51	0	0	0	0	608	0		608	557
2038/38						51	51	0	0	0	0	626	0		626	575
2038/39						51	51	0	0	0	0	645	0		645	594
2039/40						51	51	0	0	0	0	664	0		664	613
2040/41						51	51	0	0	0	0	684	0		684	633
2041/42						51	51	0	0	0	0	705	0		705	654
2042/43						51	51	0	0	0	0	726	0		726	675
2043/44						51	51	0	0	0	0	747	0		747	697
2044/45						51	51	0	0	0	0	770	0		770	719
2045/46						51	51	0	0	0	0	793	0		793	742
Total	2,289	0	183	260	634		3,365	0	0	0	0	3,317	0	0	3,317	896
% total	68.0%	0.0%	5.4%	7.7%	18.8%		100.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	100.0%	
EIRR %							13.18%									13.18%
Benefit Cost Ratio							1.37									
NPV @9%(Million BDT)							895.94									

Table B4: Economic Benefits and Costs of Tranches 1 and 2 (BDT Million in Constant 2020 Prices) : Overall Program

(Million BDT)

Year	Costs							Incremental Benefits							Incremental Net Benefits
	Investment					O & M	Total Cost	Embankment			Bank Protection			Total Benefits	
	Riverbank Protection Works	Embankment Works	Land Acquisition & Resettlement	Unallocated Works	Other Project Costs			Agriculture	Fisheries	Reduction in Flood Damage	Agric. Devt Charland	Eroded Land Value	Livestock Dev't		
2015/16	1,113		574		375		2,062	0	0	0	0	0	0	0	-2,062
2016/17	1,091		551	26	417		2,085	0	0	0	0	0	0	0	-2,085
2017/18	416	488	481	50	507		1,941	0	0	0	0	0	0	0	-1,941
2018/19	546	488	22	40	520		1,616	0	0	0	0	653	0	653	-963
2019/20						114	114	71	32	474	0	672	0	1,249	1,135
2020/21						114	114	71	32	488	0	693	0	1,284	1,169
2021/22	1,152	0	644	243	450	114	2,603	71	32	503	0	713	0	1,319	-1,284
2022/23	2,131	207	644	604	584	114	4,284	71	32	518	0	735	0	1,356	-2,928
2023/24	2,131	612	322	604	584	114	4,367	71	32	533	0	757	0	1,393	-2,974
2024/25	347	405	0	354	316	193	1,616	107	47	711	37	2,112	4	3,019	1,403
2025/26	569					327	896	107	47	732	55	2,169	8	3,118	2,222
2026/27	664					327	991	107	47	754	72	2,228	12	3,221	2,229
2027/28						346	536	107	47	777	90	2,288	16	3,325	2,789
2028/29						355	355	107	47	800	107	2,350	21	3,432	3,077
2029/30						355	355	107	47	824	125	2,414	25	3,542	3,186
2031/32						355	355	107	47	849	142	2,479	29	3,654	3,299
2032/33						355	355	107	47	874	160	2,547	33	3,769	3,414
2033/34						355	355	107	47	900	178	2,617	38	3,887	3,532
2034/35						355	355	107	47	927	195	2,689	43	4,009	3,654
2035/36						355	355	107	47	955	213	2,763	43	4,129	3,773
2036/37						355	355	107	47	984	230	2,839	43	4,251	3,896
2038/38						355	355	107	47	1,013	248	2,918	43	4,377	4,021
2038/39						355	355	107	47	1,044	265	2,999	43	4,506	4,150
2039/40						355	355	107	47	1,075	283	3,082	43	4,638	4,282
2040/41						355	355	107	47	1,107	301	3,168	43	4,773	4,418
2041/42						355	355	107	47	1,140	318	3,256	43	4,913	4,557
2042/43						355	355	107	47	1,175	336	3,347	43	5,055	4,700
2043/44						355	355	107	47	1,210	353	3,441	43	5,202	4,847
2044/45						355	355	107	47	1,246	371	3,538	43	5,353	4,997
2045/46						355	355	107	47	1,284	371	3,637	43	5,489	5,134
Total	10,349	2,201	3,237	1,920	3,753		21,460	655	290	7,301	683	13,460	116	22,505	5,812
% total	48.2%	10.3%	15.1%	8.9%	17.5%		100%	2.9%	1.3%	32.4%	3.0%	59.8%	0.5%	100.0%	
EIRR %							13.37%								
Benefit Cost Ratio							1.40								
NPV @ 9%(Million BDT)							5,812								