FRERMIP
Flood and Riverbank Erosion Risk Management Investment Program

Bangladesh Water Development Board
Asian Development Bank

Flood and Riverbank Erosion Risk Management Investment Program – Project 1

ADB Loan No. 3138-BAN (SF)

Institutional Strengthening and Project Management Consultants (ISPMC)

QUARTERLY PROGRESS REPORT NO. 06

FOR

OCTOBER-DECEMBER 2016

Prepared by:

ISPMC
Institutional strengthening and project management consultant

Joint Venture
nhc northwest hydraulic consultants
Mott MacDonald

Project Office:
House 47 (8th Floor)
Road 27, Banani
Dhaka 1213, Bangladesh
Phone: 0088 (0) 2 986 1294
Email: ahmad.sajid@mottmac.com

FRERMIP
Flood and Riverbank Erosion Risk Management Investment Program

Reference:
ISPMC – FRERMIP
311
20 February 2017

ISPMC JV NHC-EMM
soniafrermip@gmail.com

To
Mr. A M Aminul Haque,
Project Director,
Flood and Riverbank Erosion Risk Management Investment Program
152/3/B Bir Uttam, Kazi Nuruzzaman Road, Panthopath,
Firoz Tower, (12th Floor) Dhaka-1205, Bangladesh

Subject : **Submission of Quarterly Progress Report No. 06 October-December 2016**

Reference: **As per Institutional Strengthening and Project Management Consulting Services Contract, Clause 9 (i), Page 35**

Dear Sir,

Please find enclosed Quarterly Progress Report No. 06 for the period October to December 2016 for the Flood and Riverbank Erosion Risk Management Investment Program (FRERMIP) – Project 1. This report has been prepared in close discussion with your office, using information available in the Development Project Performa and considering the Facility Administration Memorandum.

The quarterly progress report documents the status of project and progress made during the reporting quarter. When required, it identifies changes to the key assumptions and possible risks to project implementation. This report was prepared by ISPMC with contributions, assistance and cooperation of the Bangladesh Water Development Board (BWDB).

We look forward to further comments from BWDB, ADB and others on this report.

Yours sincerely,
JV Northwest Hydraulic Consultants – Euroconsult Mott MacDonald

Knut Oberhagemann
Team Leader

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    (Attn.: Mr. Zahir Uddin Ahmad, PIO; 2 copies)

15. Embassy of the Kingdom of the Netherlands, Gulshan, Dhaka
    (Attn.: Mr. Pieter de Vries)

ABBREVIATIONS AND ACRONYMS

ADB (BRM)	-	Asian Development Bank (Bangladesh Resident Mission)
BDT	-	Bangladesh Taka
BWDB	-	Bangladesh Water Development Board
CbFRM	-	Community-based Flood Risk Management
CEGIS	-	Center for Environmental and Geographic Information Services
DG	-	Director General
DDM	-	Department of Disaster Management
DPP	-	Development Project Performa
EKN	-	Embassy of the Kingdom of the Netherlands
GOB	-	Government of Bangladesh
GON	-	Government of the Netherlands
ha	-	hectare
km	-	Kilometer
Mil	-	Million (1,000,000)
IWM	-	Institute of Water Modeling
INGO	-	Implementation Non-Government Organization
ISPMC	-	Institutional Strengthening and Project Management Consultants
MIS	-	Management Information Systems
MoDM	-	Ministry of Disaster Management
MoWR	-	Ministry of Water Resources
O&M	-	Operation and Maintenance
PD	-	Project Director (BWDB and DDM)
PMO	-	Project Management Office (BWDB)
PMU	-	Project Management Unit (DDM)
PPTA	-	Project Preparatory Technical Assistance
QPR	-	Quarterly Progress Report
SMO	-	Sub-Project Management Office
ToR	-	Terms of Reference
USD	-	United States Dollars

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Table 1 Project Progress at a Glance

1. Basic Data

ADB Loan Agreement Number	3138-BAN(SF)
ADB Grant Agreement Number	0396-BAN(EF)
Project Name	Flood and Riverbank Erosion Risk Management Investment Program - Project 1
Country	Bangladesh
Borrower	People's Republic of Bangladesh
Executing Agency	Bangladesh Water Development Board
Implementing Agency	Department of Disaster Management

2. Financing

Modality and Sources	Projects ($ million)			Amount ($ million)
	I	II	III	
Asian Development Bank (ADB)	65	100	90	255
Government of The Netherlands (GON)	15.3	0	0	15.3
Government of Bangladesh (GOB)	23.3	45.3	34.8	103.4
Total	103.6	145.3	124.8	373.7

3. Milestones

Milestone	Date of		
	Approval	Signing	Effectiveness
ADB Loan Agreement	2014 June 27	2014 August 14	2014 August 15

Milestone	Project		
	I	II	III
Estimated Completion Date	2019 June 30	2021 December 31	2023 June 30

Milestone	Date
Last ADB Review Mission	9-11 November & 4-8 December 2016

4. Assets

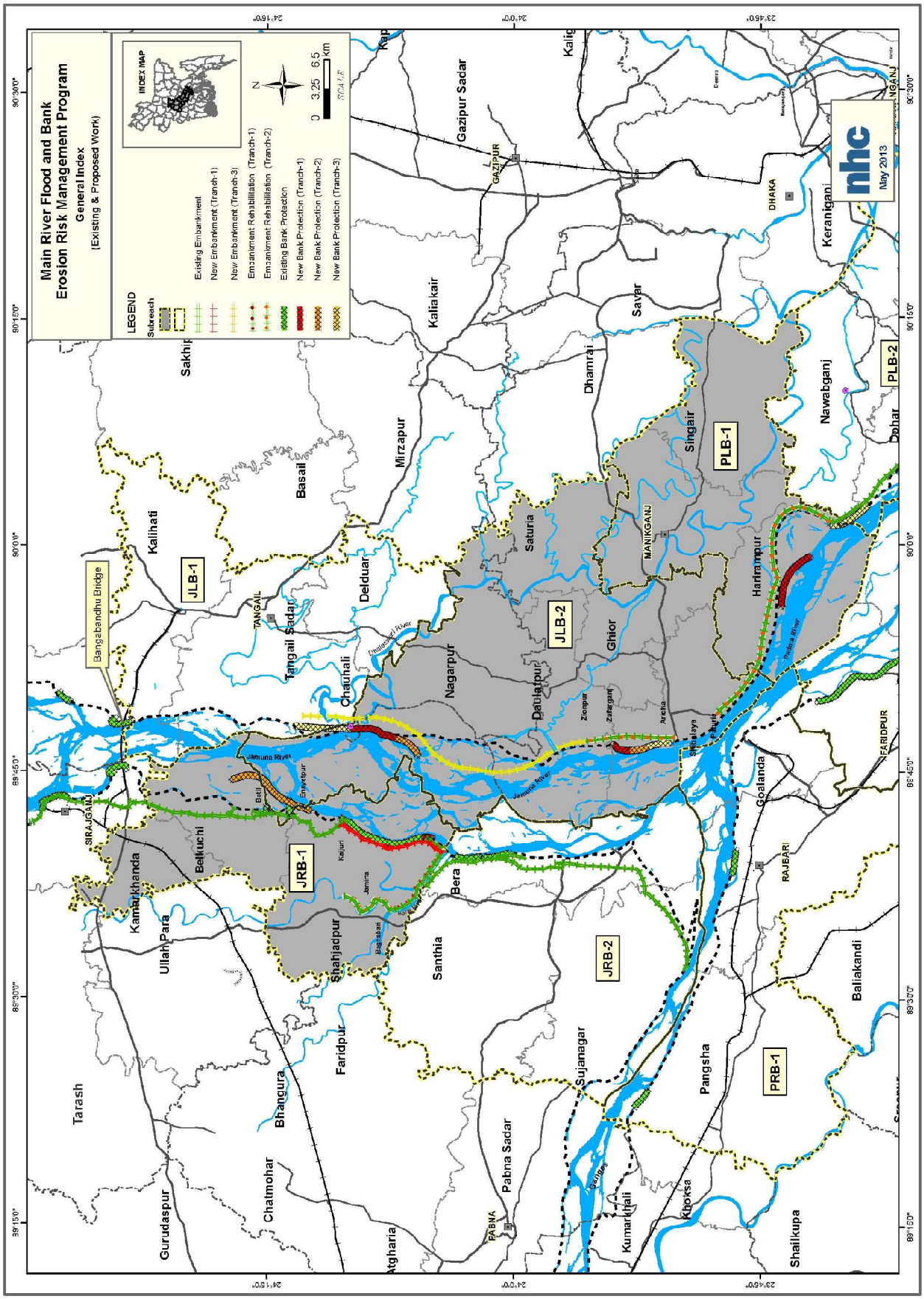
Proposed Project Assets	Goods	Services	Works	eXtra	Total	Available
Project Program Best Estimate (BDT Mil)	1473	1380	3538	1401	7792	8286

Primary Component	Secondary Component		Assigned Weight (%)	Progress	
				Actual (%)	Weighted (%)
1. Establishment & Recruitment	1.1	PMO Establishment and Staffing	2	100	2
	1.2	ISPMC Consultants Recruitment	2	100	2
	1.3	NGO Recruitment	2	50	1
2. Implementation; Tranche-1	2.1	Detailed Design	2	100	2
	2.2	Tender Documents Preparation	6	65	4
	2.3	Tendering and Contract Award	6	60	4
	2.4	Land Acquisition and Resettlement	8	30	2
	2.5	Project Management	6	45	3
	2.6	Physical Completion of Works	32	45	14
	2.7	Financial Disbursements	4	20	1
3. Knowledge Base & Capacity	3.1	Knowledge Base & Tech. Studies	4	40	2
	3.2	CBFRM Activities	6	10	1
	3.3	MIS Project Mgmt Module	4	5	0
4. River Study, Piloting & Master Plan	4.1	Long-term stabilization study	4	60	2
	4.2	Land recovery piloting	2	15	0
5. Preparation; Project-2	5.1	Feasibility Study; Project-2	6	20	1
	5.2	Detailed Design; Project-2	4	0	0
Totals			**100**		**41**

5. Physical and Financial Progress

Financial Indicator	BDT Million	US$ Million	% of Total
Estimate Project Cost (Source: DPP Page 1)	8,286	103.57	100
Physical Progress	3,541	44.26	43
PMO Expenditures	3,004	37.55	36
ADB Disbursement	2,729	34.84	33
Total Reimbursement	1,459	18.65	18

Figure 1 Project Location Map



1. INTRODUCTION

1.1 *Background*

The people in Bangladesh are often detrimentally affected by flooding and riverbank erosion along its four main rivers: Jamuna, Ganges, Padma and Meghna. Over 5,000 hectares (ha) of floodplain land is lost annually due to riverbank erosion, affecting over 55,000 people[1]. The risk associated with flooding and riverbank erosion increases with the growth of the population, and the high population density of Bangladesh restricts the scope for moving people away from disaster prone areas. Riverbank erosion increasingly threatens embankments required for flood protection. The threat of flooding and riverbank erosion discourages investment and leads to lower economic growth in riverine areas. Effective riverbank erosion and flood protection management is essential for the economic growth and poverty reduction in affected areas.

Starting in 2004, geotextile bag revetments were used systematically to protect long reaches of the Pabna Project and Meghna-Dhonagoda Irrigation Project (MDIP) against riverbank erosion. Between 2004 and 2011, this protection method was used along 17 km of the lower Jamuna River and some 11 km around the MDIP. Geobag revetments were incorporated into the Guideline for Riverbank Protection approved by BWDB in 2010. Following a feasibility study completed in December 2013, the Government of Bangladesh (GOB) and Asian Development Bank (ADB) agreed to continue riverbank protection for more systematic river stabilization along the lower Jamuna and upper Padma rivers from Bangabandhu (Jamuna) Bridge to Chandpur including reclaiming floodplain land lost during the widening process since the 1960s.

The Project Preparatory Technical Assistance (PPTA) implemented from 2012 to 2013 provides the key concept for FRERMIP and is documented in the Final Report, Feasibility Study, 2013 (**Ref.** 5). The ADB Facility Administration Memorandum, June 2014 (**Ref.** 1) is the key document prescribing the loan objectives and procedural details.

The loan for Project-1 of the Flood and Riverbank Erosion Risk Management Investment Program (FRERMIP) was signed on 14 August 2014, and the contract with the main consultant (ISPMC) was signed on 8 September 2015. This first project lays the foundation for systematic river stabilization supported by FRERMIP over three successive projects to be implemented over a period of around ten years. The first project, scheduled to be completed in June 2019, will provide structural and non-structural flood and riverbank erosion risk management measures in three high priority sub-project areas (**Figure 1**). Subsequent projects will extend the protected reaches with the goal to substantially stabilize the lower Jamuna and parts of the Padma River, based on an adaptive approach with designs adjusted to changing river conditions.

FRERMIP will provide a defined boundary between river and floodplain, and thus contribute to a more secure and improved livelihood for people living along the main rivers of Bangladesh, which will trigger faster economic growth and accelerate poverty reduction. The outcome of the program will be reduced flood and riverbank erosion risks in the sub-project reaches.

[1] Provided by Dr. M. Sarker based on his River Study Technical Note 2: Holistic River Morphology Analysis for the Brahmaputra River System

1.2 *The Project*

The project has three funding partners, two international donors, plus the local counterpart: Asian Development Bank (ADB), Government of Netherlands (GON) and Government of Bangladesh (GOB).

The project scope and implementation arrangements have not changed from those outlined in the ADB Report and Recommendation of the President (**Ref.** 2). The anticipated outputs of the project are still to provide:

1. flood and riverbank erosion risk mitigation functioning at priority river reaches
2. a strengthened institutional system for flood and riverbank erosion risk management
3. an operational program management system

Under Project-1, 17.8 km of riverbank protection[2] and 23 km of flood embankments (rehabilitation and new; refer to the Project Map, **Figure 1**) will be implemented. Project outputs will also include community capacity development for flood risk management activities, and a livelihood enhancement component for project-affected people.

The project will result in an improved knowledge base and enhanced institutional capacity in sustainable asset management, and better strategic management of the main rivers. The project will actively promote a sound and sustainable program management system which will facilitate the implementation process. **Table 1** placed at the beginning of the report, provides a summary of project information including salient reference data, estimates of project assets and physical progress, and a reimbursement summary in Bangladesh Taka (BDT) and US dollars (USD).

Delays in the bidding process for key work contracts, namely 23km of embankment construction, requires that Project-1 will be extended by a minimum of one construction season, until June 2019. The Project Management Office (PMO) has revised the current DPP to this end, and expects that the Project outputs can be fully achieved by the original scheduled closing date of 30 June 2019.

1.3 *Overall Progress*

The Project-1 has been very successful in building riverbank protection during the dry season 2015/16. In total, 17 km riverbank protection (underwater with temporary wave protection above low water level) was completed by July 2016. At two sites, concrete blocks for permanent wave protection will be required, with the Chauhali site having already cast around 56% of the total required quantities, and the Zaffarganj site having cast around 8%. The remainder is expected to be completed during the current dry season.

The overall weighted project progress is presented in **Table 1** and shows that the progress achieved to the end of the reporting period is around 41%. The progress was computed by identifying major project activities and assigning a weighting factor to each which quantifies the time/effort/resources required to complete the individual tasks. Compared to the total estimated projected cost, physical progress is 43%, PMO expenditure is 36%, ADB (plus GON) disbursement is 33%, and total reimbursement is 18%.

[2] The length of protection work has increased from 14 to 17 km due to changes in the river morphology at Chauhali and Harirampur between the feasibility study and work start.

1.4 *This Report*

Quarterly Progress Report No. 6 covers the period 01 October to 31 December 2016. The report describes activities carried out during the quarter, which included primarily project implementation, river study, and feasibility study activities.

2. PROJECT ACTIVITIES

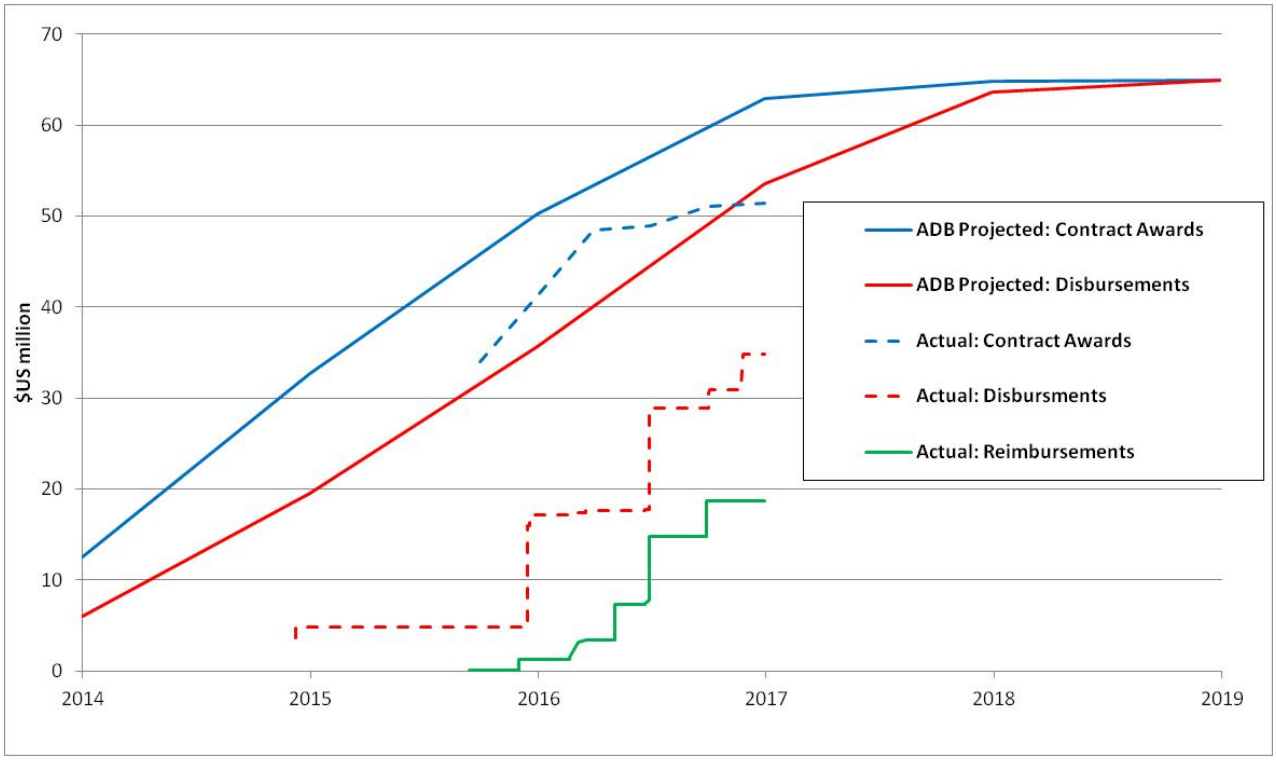
2.1 *INTRODUCTION*

The BWDB FRERMIP Project Management Office (PMO) started functioning in April 2014. That office was initially engaged in preconstruction and procurement activities, and since November 2015 with construction activities at three sites (through two Sub-project Management Offices (SMOs)). To date, a total of 17.8 km of riverbank protection has been constructed under the project: 7.0 km at Chauhali, 2.0 km at Zaffarganj and 8.8 km at Harirampur. During the reporting period, construction activities resumed at the two remaining sites: Chauhali and Zaffarganj. The need for adaptation work of the underwater protection and additional repair work to the temporary wave protection at Harirampur has been assessed based on four bathymetric surveys conducted in July, August, September, and October.

The Institutional Strengthening and Project Management Consultants (ISPMC) have been working since September 2015 and has completed the following activities: prepared the Project Inception Report, supported overall project management and capacity building activities, advised on design and construction issues, and prepared the terms of reference for a number of supporting studies. The River Stabilization Study and Initial River Management Master Plan have been presented at a National Workshop on 7 December 2016 and will be finalized during the first half of 2017 after additional team resources will become available through a variation order. The River Study group plan to complete a total of nearly 40 Technical Notes. ISPMC have recently completed the preliminary site selection for Project-2, identifying the specific subproject areas and physical works, conducting a preliminary cost-benefit analysis, and compiling necessary information required for the feasibility study.

The current status of implementation activities are discussed in the following sections, and summary and detailed tables are provided in **Appendix-A** and **Appendix-B**, respectively. The history of contractual awards and disbursements as projected by ADB and as actually achieved is shown in **Figure 2,** along with actual total reimbursements.

Figure 2 Contract, Disbursement and Reimbursement History



2.2 *PROJECT ASSET IMPLEMENTATION*

2.2.1 Introduction

Tables A-1 and A-2 show the type, number and total cost of assets currently included in the program. The cost of the proposed 23 Km of embankment (plus associated structures) has recently been revised to BDT 1210 Mil based on detailed cost estimates. The 16 km of riverbank revetment included in the current work program is expected to cost BDT 1886 Mil, plus BDT 1112 Mil for geo-bags. Similar details on an individual contract basis are provided in **Table B-4**. This detailed table also shows that the best estimate of final cost for all project assets currently identified is BDT 7789 Mil (Goods BDT 1473 Mil, Services BDT 1380 Mil and Works BDT 3535 Mil, plus BDT 1401 Mil of additional assets included in the DPP).

Using cross-link tables that connect these category items (and Asset Types) with other financial indicators, it is relatively easy to produce tables which show project progress based on ADB Financial Categories (**Table A-3**) or DPP Components (**Table A-4 and A-5**).

The PMO expect to spend around BDT 2032 million during the 2016/17 fiscal year, BDT 381 Mil under Revenue Categories, and BDT 1651 Mil under Capital Categories. The Capital Categories mostly related to the ongoing riverbank protection work at Chauhali and Zaffarganj, and land acquisition for the embankment in Koitola.

A number of changes to the implementation program have occurred during the reporting quarter. The proposed 1 km of riverbank protection at Koijuri has been deferred because there is currently no erosion at that site. The 5 km of road embankment in Koitola has been deferred due to a potential project cost over-run (**Section 5.5**).

2.2.2 Design Activities

The Design Circle-I has completed all designs and drawings required for the 2016/17 construction program including 12.5 km of new embankment, 10.5 km of embankment re-construction, and 4 appurtenant regulators. A summary of the design progress for the 2016/17 fiscal year is given in **Table 2** and details for each individual asset are available in **Table B-1**.

Table 2 2016/17 Design Progress Summary

Recipient Executing Agency	Total Packages	Design Data Collected/Submitted			Design under Process	
		Survey	Hydrology	Geotech	Design	Drawings
Koitola SMO	9	9	9	9	9	9
Manikganj SMO	1	1	1	1	1	1
Totals	**10**	**10**	**10**	**10**	**10**	**10**

2.2.3 Bidding Activities

No major contracts have been awarded during this quarter. One tender evaluation was completed on 19 December for supply of additional Geobags at Chauhali and Harirampur, and 5 tenders were received on 21 December for construction of the Koitola embankment. The evaluation of the 5 embankment tenders is still ongoing, but an anomaly has been identified which will likely delay the awards of contracts.

A summary of tendering progress, by primary component, is given in **Table 3** Bidding progress details, on an individual contract package basis, are given in **Table B-2.** These tables only include new contracts for the 2016/17 fiscal year.

Table 3 2016/17 Tendering Progress Summary

Component	Expression of Interest Received	Tender Notice	Tender Received	Notice of Award Issued
Goods; B: Materials	na	1	1	0
Goods; C: Vehicles & Equipment	na	0	0	0
Services; D: Consulting Services	1	0	0	0
Works; A: Civil Works	na	5	5	0
Totals	**1**	**6**	**6**	**0**

na – not applicable

2.2.4 Implementation Activities

During the reporting quarter, construction progress was good at Chauhali (39%), and satisfactory at Zaffarganj (10%). At Chauhali, the on-going work dominantly concentrates on the construction of permanent wave protection along the above-water slope, which started on 7 November 2016. At Zaffarganj, on-going work includes both geobag dumping, and construction of permanent protection along the above-water slope. Geobag dumping and casting of concrete blocks at Zaffarganj started in December, and the above-water slope is planned to start in January 2017. Charts showing construction progress over time for geobag dumping and concrete block casting are shown in **Appendix-D**, for both sites. Concrete block casting at Zaffarganj was deliberately deferred until the 2016/17 construction season in order to complete as much geobag revetment work as possible during the 2015/16 construction season. The progress of concrete block casting at Zaffarganj is expected to improve by the end of January when the contractor initiates a third casting area.

Due to an anomaly in the recently received tender documents for the Koitola embankment (**Section 2.2.3**), it is unlikely that there will be significant construction progress at these sites during the current 2016/17 construction season.
Table 4 shows the implementation progress summary, including all on-going (new for FY 2016/17 and carry-over contracts) and completed contracts. Details on an individual contract basis are available in **Table B-3**.

Table 4 Implementation (Physical) Progress Summary

Component	On-going & Complete Contracts	Best Estimate of Final Cost (BDT Mil)	Value of Cumulative Progress to Date (BDT Mil)	Projected Cumulative Progress to Next Qtr. (BDT Mil)
Goods; B: Materials	4	1,345	1,112	1,112
Goods; C: Vehicles & Equip.	10	57	46	46
Services; D: Consult. Service	7	1,253	368	486
Services; G: Program Mngt.	4	3	3	3
Works; A: Civil Works	11	3,104	1,132	1,507
Totals	**36**	**5,762**	**2,660**	**3,153**

2.2.5 Environmental Management

Since construction works had stopped or were substantially limited during the rainy season, no Environment Management Plan (EMP) compliance monitoring activities were planned or executed during the reporting period. Monitoring of the EMP will resume in January 2017 at ongoing construction works.

Three Environmental Management Plan (EMP) Compliance Monitoring Reports (28 February, 25 March and 7 June) have been prepared by the ISPMC and were transmitted after review from the PMO to ADB. In December, ADB informed that these reports did not fully satisfy the requirements for a semi-annual report. ADB has provided an example template for the semi-annual report and requested that the reports for Q1 and Q2/2016 be modified accordingly. The revised Semi-Annual EMP monitoring reports for Q1 and Q2/2016 will be finalized in early-January 2017 and sent through the PMO to ADB. Since very limited construction work was completed during Q3 and Q4, no semi-annual report will be prepared for this period.

The International Environmental Specialist conducted his 5th mission to the project, from 19-28 October 2016. He will conduct his 6th mission, from 16 to 27 January 2017. If required, a 7th mission will be conducted during March. At least one monitoring field trip will be conducted to each of the two on-going construction sites during January 2017.

2.2.6 Resettlement Services

After the flood season, work on the resettlement plans have restarted at the Chauhali and Zaffarganj riverbank protection sites. Activities at Harirampur have focused on determining land acquisition requirements. The Resettlement Plan (RP) prepared during the PPTA for the embankment works at Koijuri to Baghabari (23 km) will be updated by the INGO. The INGO mobilized a team in Shahjadpur and is conducting the necessary socio-economic and census surveys, as well as the land market price survey.

During the quarter, the ISPMC participated in two resettlement coordination meetings on 21 November and 12 December 2016. The meetings were held to review the INGO's progress, and plan future actions to facilitate preparation of RPs and necessary surveys prior to embankment construction work. These meetings were attended by the Chief Resettlement Officer PMO, INGO staff, ISPMC representatives, and SMO Executive Engineers.

The INGO has submitted their first monthly progress report in October and the second one in December. The format of these reports has improved to include the progress of ongoing activities, but the reports still suffer from some inconsistencies.

Resettlement activities performed during the reporting quarter and projected for the next quarter, at each site, are summarized in **Table 5**.

During the quarter, the regular supervision from ISPMC was limited due to the absence of a National Resettlement Specialist. The ISPMC proposed a replacement in January 2016 but that appointment has not yet been approved.

Table 5 Progress of Resettlement Activities

Sites	Resettlement Activities	Progress During Current Quarter	Projected Progress During Next Quarter
Chauhali	• Riverbank Protection Resettlement Impacts	• Surveys completed • Submission of LA plan to DC • Formation of Safeguard Committees (JVT, PVAT, GRC) • RP submitted to PMO & ADB, as per monthly report	• Completion & Approval of final RP • Information campaign • Issuance of ID cards to PAPs • Start Payment of Compensation
Zaffarganj	• Riverbank Protection Resettlement Impacts	• Survey completed • Submission of LA plan to DC • Formation of Safeguard Committees (JVT, PVAT, GRC) • RP submitted to PMO & ADB, as per monthly report	• Completion & Approval of final RP • Information campaign • Issuance of ID cards to PAPs • Start Payment of Compensation
Harirampur	• Riverbank Protection Resettlement Impacts	• Collection of maps and delineation of land to be acquired • Preparation of LA plan • Socio-economic Surveys started	• Completion of Surveys • Preparation & Approval of RP • Start Payment of Compensation
Koijuri to Baghabari , Shahjadpur, Sirajganj	• Embankment Construction Resettlement Impacts • Resettlement Site Preparation • Relocation of PAP	• Conducted socio-economic, census and land price surveys • Discussion on proposed resettlement sites • Agreement on ID cards for PAPs • Formation of Safeguard Committees (JVT, PVAT, GRC)	• Finalization of updated RP • Issuance of ID cards to PAPs • Information campaign • Start Payment of Compensation with DC • Finalize relocation sites • Assist resettlement of PAPs

Abbreviations:

DC	District Commissioner	JVT	Joint Verification Team
GRC	Grievance Redress Committee	LA	land acquisition
ID	identification	PAP	Project Affected People
		PVAT	Property Valuation Assessment Team

2.2.7 Livelihood Development

The main objective of the Income Livelihood Restoration Plan (ILRP) is to improve, or at least restore, the income and livelihood of all project affected people.

An INGO will be engaged to implement the ILRP under the Livelihood Development support study. The initial Livelihood Development ToR dated 22 February 2016 was revised and resubmitted to the PMO on 25 May 2016, and subsequently forwarded to ADB for their concurrence. According to the recent ADB Review Mission (**Section 3.2**), the ADB Resident Mission was to approve or send comments on the draft ToR to the PMO by 20 December 2016, but no response had been received by the end of the reporting quarter.

Gender issues were considered during preparation of the ILRP and the Livelihood Development ToR.

2.2.8 Flood Risk Management

Community-Based Flood Risk Management (CbFRM)
The previous Project Manager of the Project Management Unit (PMU), Department of Disaster Management (DDM) has recently been promoted and has left DDM for his new position. It is expected that a new Project Manager will be selected during the next quarter.

The contractual procedures for engaging the CbFRM NGO consultant is still stalled. An Expression of Interest (EoI) was received on 26 April 2016. The Evaluation Committee formed to shortlist the 42 respondents never met, and on 21 September 2016 the committee was cancelled by the Ministry of Disaster Management and Relief, without any stated reason. As stipulated in the latest Aide Memoire (08 December 2016), ADB's Bangladesh Resident Mission has issued a letter to the Director General (DG) DDM with copies to all concerned, including the Secretary Ministry of Disaster Management and Relief, urgently requesting that contractual procedures recommence as soon as possible. According to this letter, the Expression of Interest (EoI) evaluation committee is to be reconstituted with one member from both the BWDB PMO and ISPMC. It is hoped that the necessary contractual procedures will recommence during the next quarter once the new Project Manager PMU has been selected.

The procurement of PMU, DDM office equipment is currently under process. The original tender document prepared by the ISPMC is currently being revised by BWDB PMO following ADB's comments.

Regional Flood Forecast Response Plan
A preliminary draft of the Regional Flood Forecast Response Plan for Shahjadpur Upazila has been prepared. The ISPMC International and National Flood Risk Management Specialists met twice with the Project Manager PMU, DDM, and made one field trip to Shahjadpur Upazila and the Sirajganj BWDB office to meet with all stakeholders and get feedback on the proposed plan.

Upazila personnel have considerable experience in actual flood response and relief efforts, but their organization could still be improved by adding specific Action Plans with specific responsibilities for each key participant, that are automatically triggered by a specific water level along the Jamuna River at Sirajganj.

BWDB is currently not considered a key player by either DDM or Upazila officials, which indicates the need for improving its reputation within the local communities. In the Regional Flood Forecast Response Plan, it is proposed that BWDB has a key specific role to monitor both river water levels and embankment performance during a flood event, and to raise and strengthen the embankment when required.

During the next quarter, it is intended that the draft Regional Flood Forecast Response Plan for Shahjadpur Upazila will be finalized. It is also hoped that key results of the plan will be presented during the normal bi-monthly meeting of the Shahjadpur Upazila Disaster Management Committee.

2.2.9 Management Information Systems (MISs)

MIS Support Studies

Draft Terms of Reference (ToR) for both MIS Support Studies (**Section 2.3.1**) were prepared:

S-08 Annual Development Plan (ADP) MIS

S-09 Asset MIS

ADP MIS

After development of the ADP MIS ToR, it was discovered that a similar BWDB system is currently being developed by CEGIS using GOB funding: Smart Project Monitoring and Management Information System (SPMMIS). The main focus of SPMMIS seems to be the generation of GIS (spatial) tools to display administrative, infrastructure, and BWDB scheme and asset details, including technical design data. However, SPMMIS would also provide project implementation and monitoring details that would allow senior BWDB managers to monitor project progress at different levels of detail.

Rather than duplicate functionality currently being developed by SPMMIS, and due to a potential project cost over-run, it has been recommended that the FRERMIP ADP MIS be deferred until Project-2. At that time, the completed SPMMIS application could be reviewed, missing functionality could be added, and any limitations could be rectified.

Asset MIS

During development of the Asset MIS ToR, it was discovered that a very comprehensive and robust Asset Inventory System has already been developed under the Water Management Improvement Project (WMIP). The WMIP Scheme Database Inventory and Mapping System (SIMS) was developed over 7 years at a cost of BDT 10 Million, and was completed in April 2014. A 2nd phase of SIMS is currently under development by IWM, using GOB funding, to make the system fully web-based (i.e. users will not require any special software or hardware to use the system).

When the 2nd phase of SIMS is completed in late 2017, it will provide a very useful basis for an Asset MIS. While SIMS satisfies its objective as an inventory and mapping application, it was not designed as a "**Management**" Information System. Based on the existence of SIMS, the Asset MIS ToR has been completely revised so that it compliments SIMS rather than attempt to compete and replicate its existing functionality. Rather, the revised Asset MIS ToR now concentrates on the development of a Risk-Based O&M Module.

By adding a Risk-Based O&M module, the FRERMIP Asset MIS will provide a much needed focus to SIMS by providing true "**Management"** Information System functionality, which will assist senior BWDB managers. The Asset MIS will assist O&M program planning by automatically generating work programs for monitoring and routine O&M activities, and prioritizing O&M repair works, based on overall risk reduction.

In mid December, the FRERMIP PMO provided valuable comments on the draft Asset MIS ToR. The ToR will be revised accordingly to comply with these comments and subsequently submitted to ADB for their concurrence during the next quarter.

River Survey Database
Additional functionality has been developed in the River Survey database to allow users to:

- add known water levels to cross-section charts
- plot all cross-section charts at the same scale, with both distorted or undistorted scale, and reduced cross-section length
- print charts that fit correctly on the page
- filter surveys based on title names

Importing survey and element data has been improved, by performing a series of input data checks before processing. The import processes have also been documented to standardize and facilitate the procedures.

Additional surveys have been added to the database from Sirajganj, plus all FERMIP surveys performed to date at the 3 construction sites: Chauhali, Harirampur and Zaffarganj.

2.3 *OTHER PROJECT ACTIVITIES*

2.3.1 Supporting Studies

As specified in the DPP (Ref. 4), there are a total of 9 supporting studies (service contracts) funded under FRERMIP to help implement and expedite project outputs. Implementation Non-government Organizations (INGOs) or consulting firms would be engaged to complete these supporting studies.

Two supporting studies have already been awarded: for Resettlement Implementation, and Erosion Prediction Services. It is likely that 3 other Support Studies will be deferred until Project-2 (Participatory O&M, ADP MIS and Environmental Management Services) due to slower than anticipated implementation, lengthy contractual procedures, and a potential project cost over-run. The status of all support studies is summarized in **Table 6.**

The contractual procedures for these service contracts are necessarily laborious and time-consuming. The Terms of Reference (ToR) must be prepared, then the Expression of Interest (EoI) must be written, advertised, receive and evaluated, to obtain a short-list of technically competent INGOs. Then a formal tender document must be prepared, floated, received and evaluated. ADB concurrence is required 4 times during the contractual procedures. As a result, these service contracts can take a minimum of one year to complete.

Table 6 Status of Supporting Studies

Pkg.	Study Name	Present Status
S-02	Resettlement Plan Implementation	Resettlement INGO signed contract with BWDB on 16 March 2016, and work is ongoing.
S-03	Livelihood Development Services	ToR submitted to PMO on 25 May 2016. ADB concurrence under process (**Section 2.2.7**).
S-04	Community-based Flood Risk Management (CbFRM) Services	EOI received on 26 April 2016, and evaluation under process (**Section 2.2.8**).
S-05	Participatory O&M Support Services	Deferred until Project-2.
S-06	Multi-Beam Eco Sounding Survey	ToR under preparation. A demonstration survey was performed in October-November.
S-07	Erosion Prediction Services	CEGIS signed current contract with BWDB on 10 May 2016, and work is ongoing.
S-08	ADP MIS	Deferred until Project-2 (**Section 2.2.9**).
S-09	Asset MIS	Draft Asset MIS ToR rewritten to complement existing SIMS system by adding a risk-based O&M module. PMO comments were received in mid-December (**Section 2.2.9**).
S-10	Environmental Management Services: Fish Sanctuary Development Bio-diversity and Aquaculture Program	Deferred until Project-2 (**Section 2.2.5**).

2.3.2 Capacity Building

The current primary activity under the Capacity Building Program is the Training Program. A summary of Training Program progress is shown in **Table 7**. Details of the Capacity Building program are provided in **Appendix-E.**

During the reporting quarter, three workshops and 1 training session were organized and conducted under the ISPMC Capacity Building Component:

Date	Description	Trainees	Venue
28-Oct-2016	Workshops on Capacity Strengthening	30	Pan Pacific Sonargaon
07-Dec-2016	National Workshop on Draft River Stabilization and Preliminary River Management Master Plan	140	Pan Pacific Sonargaon
08-Dec-2016	Follow-up Workshop on Draft Master Plan	110	BWDB Board Hall
22-Dec-2016	Training for Task Force on Quality Control of Sand-filling of Geobags	30	BWDB Board Hall

On 28 October 2016, a workshop on Capacity Strengthening in BWDB was chaired by the DG BWDB Jahangir Kabir. During the workshop, two presentations were given on different aspects of capacity strengthening by ISPMC Capacity Development Specialists. After the presentations, a lively discussion ensued among participants, which included the following suggestions:

- A coherent training plan should be developed, rather than done by individual projects
- Training is an essential element to enhance the capacity of BWDB staff
- BWDB promotion, should be linked to training

- There should be some specialization of staff in the primary BWDB activities: irrigation, coastal protection and main river management
- Special effort should be made to train recently hired BWDB junior professional staff
- There is a clear need for better communication between BWDB and Bangladesh society

The National Workshop on Draft River Stabilization and Preliminary River Management Master Plan held on 07 December 2016 is well documented in **Section 3.2** and also in **Appendices-F, G, H and I**. Similarly, a summary of comments from the Follow-up Workshop on Draft Master Plan held on 08 December 2016 is documented in **Appendix-J**.

A training course for Task Force personnel on the Quality Control of Sand-filling of Geobags was held on 22 December 2016. Mr. Knut Oberhagemann, Team Leader, ISPMC gave a presentation during the training session. His presentation, entitled Geobag Revetments, included the principles of riverbank protection and explained how to construct stable revetments.

Table 7 Summary of Capacity Building Progress

Type of Training	Course Implementation Progress				
	Total	**Discussed**	**Prepared**	**Approved**	**Completed**
Capacity Building PMO					
A. Local Training	34	25	12	4	2
B. Overseas Training	3	2	1	1	1
C. Overseas Tours	3	3	1	1	1
PMO Totals	**40**	**30**	**14**	**6**	**4**
Capacity Building ISPMC					
Line 1:					
A. Workshops	7	7	4	4	4
B. Training	7	7	5	4	4
C. Seminars	1	0	0	0	0
Line- 2:					
A. Conferences	4	4	3	3	3
B. Study Tours	1	1	0	0	0
ISPMC Totals	**20**	**19**	**12**	**11**	**11**

2.3.3 River Study

The River Study has made considerable progress in the preparation of some key deliverables:

- **Strategic Framework** for preparing a long-term sector road map for the management of the main rivers, which is a key output of both Task 4 and 5 of the ToR
- **Long-term River Channel Stabilization Plan** for the Jamuna, Padma and Lower Meghna rivers, including technical notes on morphological trends, and including a strategic 25-year investment plan, which is a key output of Task 4 of the ToR

The Strategic Framework has been drafted and provided input for the National Workshop in early December 2016. Preliminary findings of the Long-term River Stabilization Study and Preliminary River Management Master Plan of Jamuna and Padma Rivers, including Dependent Areas, were presented at the Workshop held on 7 December 2016. The Workshop also presented river stabilization experiences from other major rivers world-wide, notably the Mississippi, Rhine and Yellow Rivers. It is intended to submit a first draft of the final River Study report during the first half

of 2017, depending on the approval of additional resources through a variation order. This uncertainty might impact on the schedule stipulated in the recent Aide Memoire (**Section 3.2**).

The River Study proceeded during the reporting quarter with focus on the above mentioned deliverables and other preparations for the Workshop. The preparations included:

- extraction of information from the Technical Notes that have been produced by the River Study Team (some in final form, others in draft or incomplete form)
- preparation of complementary information, in particular to quantify costs and benefits of the plans and compare these with previous works and plans in Bangladesh
- preparation of presentations of the three international rivers. External experts were engaged for the presentations of the river stabilization works for the Mississippi and Rhine Rivers, while the presentation for the Yellow River was prepared by the River Study Team based on information received from the Yellow River Conservancy Commission (YRCC) and from international literature
- continued preparation of various supporting studies, including river modeling, analyses of satellite images, land use for reclaimed land, socio-economics and fisheries. The work on the Technical Notes documenting these supporting studies also continued throughout the quarter

The main focus of FRERMIP is the river stabilization with the preliminary master plan derived from it, but with a wider focus on activities that become feasible as a direct result of the river stabilization. The master plan requires details about the main river after river stabilization in order to plan for water uses and other potential economic activities on the adjacent floodplain of the North-Central Zone.

A large number of Technical Notes (39) are being prepared, reviewed and finalized. Most notes are internal working documents and not formal deliverables under the contract. However, they will form the annexes to the River Stabilization Plan and Preliminary River Management Master Plan.

The main components being considered and studied are discussed below:

River Training

Issues to be studied include:

- the effect of narrowing the river on upstream water levels
- the river corridor and planform; answering the question whether the future river is capable of discharging large design floods
- the impact of river management on the sensitive char environment and char inhabitants
- how to maintain or improve the performance of important tributaries and distributaries

The continued work in the present reporting period has focused on the description of the morphology of the main river system:

- **General morphological characteristics and their changes over time.** This analysis will form a baseline for subsequent analyses of morphological impacts of interventions
- **Char age analyses.** Results of these analyses will be considered in recommendations for preferred future planforms
- **Dynamics of distributary offtakes.** Jamuna and Padma offtakes are unstable, and the study proves the benefit for offtake flow of more stable offtakes
- **Stability of large bifurcating main channels.** At least one stable bifurcation is an essential element in the future Jamuna planform. The study includes existing examples to understand how to keep such bifurcations stable

- **Potential reduction of low water levels after reducing the width of the active river corridor.** It is important to limit this negative impact, so this study will provide very important input to the decision on the preferred future active corridor width

Flood Embankments
Flood embankments are currently at risk of being eroded away by the shifting river channels. Once the main river is controlled, new improved embankments can be constructed, which in addition to providing flood protection can also serve as transportation routes especially over newly reclaimed land. However, it is important that gates and fish passes are strategically incorporated into the flood embankments, to prevent the separation of the floodplain environment from the river. Recent research suggests that wide embankments are necessary, especially on unconsolidated, uniform char soils, to guard against seepage failure. Roads may be accommodated on the embankment landside, and social forestry may be accommodated on its landside slope.

The study of flood management has made good progress through the finalization of a Technical Note on the subject. Specific flood protection solutions have been further analysed and specified for cost estimation. In the following period, protection options will be tested in mathematical models, before proposed alignments, crest levels and locations of hydraulic structures are finalized at the feasibility level for subsequent projects.

Land Reclamation
Reclaimed land is an important generator of economic benefits of the river stabilization. In particular, land with close connection to land infrastructure and navigation routes, where a river port can be established will be very attractive to industries. The Government of Bangladesh has a strong focus on industrialization and establishment of economic zones on newly reclaimed land. However, there are clear policies of providing khash land for the landless and obligations to provide a means of living for the char people. It also remains important to plan for the preservation of the unique riverine ecosystem, and this valuable source of fish and recreational areas.

In the current reporting period, the Technical Notes being prepared deal with spatial planning issues to be resolved, with the possibilities of providing faster amelioration of erosion protected char land for agricultural use. The Technical Notes also explore the impacts that river stabilization would have on fisheries, and possible mitigation in the form of stimulated aquaculture have been applied to extract concrete information for the draft plans.

Water Resource Management
The continued work of the water resources team has been planned during the reporting period, and major studies are going to be carried out during the next quarter. The national Water Supply and Water Quality specialist was replaced during the reporting period, with the aim of strengthening the work on ground water recharge.

Offtakes and Distributaries
Improved performance of offtakes and their distributaries is a major potential benefit of the river training. The Dhaleswari System with its multiple offtakes will be the focus of the study, but also the Old Brahmaputra and Arial Khan will be included to some extent. After main river stabilization, offtake performance can be improved to provide adequate dry season flow and sufficient flood flow capacity. With proper design, these offtakes may provide improved navigation, fisheries, and water quality in the rivers around Dhaka (in particular, augmentation of the Buriganga River flow) while restricting suspended sediment loads that can restrict conveyance capacity.

In the reporting period, no significant further work on this topic has been carried out, but the continued work has been discussed in detail and will be carried out during the next quarter.

Cross Border Navigation
The "Protocol on Inland Water Transit and Trade" between Bangladesh and India facilitates bilateral trade and commerce using cross border inland waterways. It has opened up an excellent opportunity for trade between the two countries. Each country shall ensure smooth navigation in the major river routes within its geographical jurisdiction and extend necessary navigational facilities. Narayanganj, Khulna, Mongla, and Sirajganj shall be used by Indian vessels as port of calls in Bangladesh; and Kolkata, Haldia, Karimgonj and Pandua by Bangladesh vessels in India. The main river management will ensure that these navigational facilities benefit both the countries.

Improved navigation has been included in the planning work as an important component, and the need for dredging and structural measures to develop and maintain navigable channels in the main rivers has been estimated in the preliminary findings presented at the Workshop on 7th December 2016.

Pilot Works
The discussion on the planning of pilot works (structural measures) worth around US$ 5 Mil has continued and is reaching a conclusion in terms of types and locations of the pilot works. Their purpose is to test approaches and technologies for potential future use along major rivers.

A memo was prepared and submitted to the PD PMO on 15 December which recommends three pilot work initiatives which can be implemented during the current 2016/17 low-flow season (January-May), and contribute to the river stabilization efforts planned for FRERMIP Projects-2 and -3. These recommended pilot works include: a flow control structure in Ghior Khal, grout filled jute mattresses at Harirampur, and reed plantations along the lower Jamuna.

Initially, permeable groyne pilot works along the Old Dhaleswari River were also considered, but they were subsequently rejected because they have limited relevance for the FRERMIP river stabilization vision, and could not be implemented during the 2016/17 fiscal year.

The purpose of the flow control structure in Ghior Khal would be to restrict the inflow into the khal and thus prevent the destabilization of the entire river course. The control structure would also be used to test whether inexpensive, non-permanent control structures could be used to temporarily stabilize downstream river reaches before permanent flood protection and offtake structures are built. The recommended control structure, made of geo-bags, would limit inflow into Ghior Khal during high flow, but would include a number of low-placed culverts to provide adequate dry season flow.

Grout filled jute mattresses could reduce the cost of permanent wave protection and promote the development of an innovative technology with potentially world-wide use of a product extensively growth in Bangladesh. The pilot work would optimize the mattress thickness, drainage characteristics, construction method and cost. Different designs would be tested for the permanent wave protection along the recently completed Harirampur riverbank protection.

Traditionally, the char population used reed plantations to encourage deposition of fertile soils. These reeds also exhibit a river training function by discouraging flow through flood spill channels. The proposed pilot work, at two location in the lower Jamuna, would determine the best type of reed, and measure both sedimentation rates and the effectiveness of closing flood spill channels.

Regional Planning and Social Development
Regional planning has been incorporated into a number of Technical Notes:

TN 1 Background Data, River Use, Studies and Plans
TN5 Upper Meghna - Present Conditions and Issues
TN 9 Use of Reclaimed Land

TN9 concentrates on the potential uses of land to be stabilised and reclaimed by FRERMIP and allied projects through a study of GoB policy, and an assessment of potential issues and land uses. TN9 then proposes a process for planned development. Further work on this is planned for early 2017.

Much of the land to be stabilized and reclaimed is char land, and therefore a programme of focus group discussions with the aim of assessing char dwellers' perceptions regarding developments on their land has been initiated. This social impact assessment (through focus group discussions) aims to ascertain current living conditions and what potentially affected people think about the proposed interventions in regards to their future aspirations.

Environmental Studies
Consolidated comments from ADB, Netherlands Embassy and other parties on the Strategic Environmental and Social Assessment (SESA) for the Long-term River Stabilization Plan, submitted in June 2016, are still awaited. Preparation of the Technical Note on Fisheries aspects in the Project-1 and Project-2 areas continued during the period, and will be finalized next quarter. The team also produced a summary of environmental and social issues for the Master Plan in October 2016.

2.3.4 Feasibility Study

Preliminary feasibility study work continued during the reporting quarter. The proposed riverbank revetment work made use of the current flood season survey to confirm the site selection.

Approval was received from the Department of Environment (DoE) for the Initial Environmental Examination (IEE) Scoping Report and the Terms of Reference (ToR) for the Environmental Impact Assessment (EIA) of the Project-2 works in early October. During the period, fieldwork started on collecting information on possible impacts and mitigation measures for the Project-2 works, and consultations with local communities on the works, as the first steps towards preparing the EIA report. Focus during these investigations has been on fisheries aspects (sanctuary establishment) and on the conjunctive use of lands for agriculture, industry and wildlife habitats, in particular for migratory birds. Various maps were prepared or updated depicting relevant environmental information.

In October, the environmental team contributed a section on environmental benefits and safeguards to a technical report on the economic feasibility of the proposed (Project-2) embankment from Paturia to Dohar. Conducting the biodiversity baseline and fish sanctuary study was considered but it was felt that most of the information needed for the Environmental Impact Assessment (EIA) for Project-2 works was already available, and it would take a lot of time (more than a year) before results became available. Therefore, the study has been deferred until Project-2. A first draft of the EIA for the proposed Project-2 works will be prepared during the second half of January and after internal review and amendments, this will be sent through the PMO to the ADB for review.

It is intended to conduct 2-Dimensional (2D) modeling of the area protected by the proposed Harirampur embankment to help determine economic benefits. Full economic benefits from the embankment will not be realized until Project-3 because the proposed embankment will not be extended along the Jamuna left bank. However, partial benefits are expected due to existing roads that will delay and reduce the effects of a flood event.

A bridge survey was conducted during November to determine the flow area through 88 bridges and culverts along major roads in the Harirampur project area. From the survey, it was possible to estimate both the PWD elevations for each bridge deck and high water levels at the bridge. Survey results were also used to estimate road crest elevations. Survey results will form an integral part of the 2D modeling inputs.

In late December, detailed cost estimates were prepared and submitted to the PMO for 3 critical surveys related to the proposed Harirampur (32 km) and Kaijuri embankments (6 km): resettlement survey, sub-soil investigation, and topographic survey. The resettlement survey will be used to quantify economic losses for all displaced persons. The sub-soil investigation will drill 15 boreholes to 40 m depth, and 10 boreholes to 15 m depth, and collect and analyze soil samples. For the topographic survey, a total of 20 benchmarks will be established, and a land topographic survey will be conducted using Total Station along a strip 50 m wide for the total length of both embankments (38 km).

Subject to the approval of additional ISPMC resources in the pending variation order, it is still anticipated that the feasibility study can be largely completed during the next reporting quarter, including all modeling and survey work.

3. ADMINISTRATIVE ARRANGEMENTS

3.1 *Establishment of Project Offices*

The PMO and two ISPMC offices are fully operational. The project management team of the ISPMC and the BWDB PMO Office are both located in the Firoz Tower, 152/3/B Bir Uttam, Kazi Nuruzzaman Road (Green Road), Dhaka-1205. The ISPMC River Study and Feasibility teams are located at the Banani Office: House 47 (8th Floor) Road 27, Banani, Dhaka.

Appendix-C Table C-1: Utilization of Consultant Person-Months details the time spent by all international and national specialists to the end of the reporting period. A total of 24 international specialists have expended 73 person-months (41% of total), and 35 national specialists have expended 188 person-months (38% of total), up to the end of the December 2016.

3.2 *Important Events*

ADB Review Mission

An ADB Review Mission was held on 9 – 11 November and 4 – 8 December 2016. The mission comprised N. Totsuka (Mission Leader/ Senior Water Resources Specialist), and Z. Ahmed (Team Leader, Water Resources Management, BRM). During the mission, the following project components and activities were reviewed:

A. Flood and Riverbank Erosion Risk Management Works
    1. Riverbank Protection Works
    2. Embankment Rehabilitation/ Construction Works
    3. Community-based Flood Risk Management
B. Other Project-1 Activities
C. Studies and Preparation for Project-2
D. Safeguard Requirements
E. Project Management

1. Financial Matters
2. Reporting Requirements

National Workshop
The National Workshop on Draft River Stabilization and Preliminary River Management Master Plan for the Jamuna-Pabma-Meghna River was held on 7th December 2016. The workshop was attended by several senior members from MoWR, BWDB, ADB, and EKN, as well as a distinguished list of technical specialists from BWDB, other government organizations, plus the consulting and academic communities.

The workshop agenda included the following:
- **Welcome Address:** Mr. A M Aminul Haque, Project Director, FRERMIP, BWDB
- **Presentation on the River Stabilization and Preliminary Master Plan:** Knut Oberhagemann, Team Leader, ISPMC, FRERMIP
- **Address by Special Guest:** Dr. Zafar Ahmed Khan, Senior Secretary, Ministry of Water Resources
- **Address by Chief Guest:** Barrister Anisul Islam Mahmud M.P., Honourable Minister, MoWR
- **Address by Chairperson:** Mr. Md. Jahangir Kabir, Director General, BWDB
- **Remarks from Development Partners:** Ms. Natsuko Totsuka, Senior Water Resource Specialist, ADB; and Mr. Pieter de Vries, First Secretary, EKN, Dhaka

Sessions on related International Experience included :
- **Training the Mississippi River:** Mr. Rob Davinroy, River Engineer , Mississippi, USA
- **Training the Rhine River:** Mr. Hendrik Havinga, River Engineering Expert, The Netherlands
- **Training the Yellow River:** Mr. Carsten Staub, River Study Team Leader, ISPMC, FRERMIP

There are five Appendices pertaining to the National Workshop:
- Appendix-F Summary of National Workshop, 7 December 2016
- Appendix-G Presentation: River Stabilization and Preliminary Master Plan
- Appendix-H Training the Rhine River (Hendrik Havinga)
- Appendix-I Training the Yellow River (Carsten Staub and Gerrit Klaassen)
- Appendix-J Comments Summary for Workshop 2nd Session at BWDB Office

4. FINANCIAL ARRANGEMENTS

4.1 *Statements of Expenditure*

Using the project implementation database, and with help from the FRERMIP PMO, the ISPMC tracks fiscal progress compared to Annual Development Plan (ADP) targets, BWDB PMO expenditures paid to contractors and suppliers, all reimbursement bill applications approved by ADB, and all ADB (and GON) disbursements (deposits) to the project.

Table A-5 shows the fiscal (ADP) target and progress, plus the cumulative totals to date for progress, expenses and reimbursements, for all DPP categories. The 2016/17 fiscal targets have recently been revised and are not expected to change again during the current fiscal year.

BWDB PMO expenditures by individual contract are provided in **Table B-5**. Only the total expenditure values are exactly correct. The individual donor values have been calculated using total expenditure values and the percent distribution by financial component.

Financial reimbursement on an individual contract basis is shown in **Table B-6.** The table shows the total bill claim amount, plus the reimbursed amount (BDT) by both ADB and GON. A summary of reimbursement applications for line of credit (L/C), direct payment and imprest amounts is shown in **Table B-7.** This table also shows the total bill amount claimed and the reimbursement amounts paid by ADB and GON in both BDT and US$.

Reimbursement values (BDT) are also summarized by ADB Financial Category **(Table A-3),** and by DPP Component **(Table A-4 and A-5)**.

Table B-8 shows the total ADB (plus GON) disbursement to the project. Total disbursement is the addition of all deposits to the ADB Loan Account and the Grant Imprest Account, plus the ADB and GON portions of all reimbursed Direct Payment and L/C applications.

A summary of the financial progress in available in **Table 1 Progress at a Glance** which shows that the progress of PMO expenditure is 36%, the ADB disbursement is 33% and the total reimbursement is 18%. The history of project disbursements and reimbursements (US$) is shown in **Figure 2 Contract, Disbursement and Reimbursement History**.

5. ISSUES FOR DISCUSSION AND AGREEMENT

5.1 *Compliance with Covenants*

The loan covenants are provided in the Loan Agreement, Program Agreement, and Grant Agreement (**Ref.** 3) and are in general being followed. With respect to Schedule 5, land acquisition and resettlement, the preparation of resettlement and land plans remains on the critical path as the completion of the above-water construction has commenced at Chauhali and will commence shortly at Zaffarganj. Both sites are intended to be completed during the dry season 2016/17, while the land acquisition and resettlement plans remain to be completed and compensation to be paid.

5.2 *Construction of Permanent Wave Protection*

The construction methodology of permanent wave protection above-water entails a high risk of experiencing localized failure. The slope, including the temporary geobag cover layer, is pushed downhill towards the low water line and into the river over the existing geobag protection. This weakens the protective works under water and at low water level:

- The downward movement of soil and geobags potentially disturbs the existing protective layer and might lead to uncovered patches after the erosion of the overlaying loose soil deposits.
- The concrete block berm is placed about 1m above low water level on a mix of loose deposits of sandy soil and geobags from the temporary wave protection layer; some of which may be destroyed. As per design, the berm is to be placed around 2m below low water level and to be covered by several layers of geobags placed in a defined manner and covered by concrete blocks. The current construction entails the following weaknesses:
    - The loose soil will escape through the gaps of the concrete blocks and, with some geobags remaining, lead to a very uneven surface inviting additional turbulence in the critical zone.
    - Sudden erosion along the riverside corner of the deposit will potentially lead to static flow slides locally destroying the mix of loose soil, geobags and concrete blocks.
    - The placement of additional soil onto the slope will further encourage geotechnical instability, which is already observed in a number of places. This is contrary to the concept of cutting back and unloading the above water slope to increase the geotechnical stability.

- Settlement of the loose deposit will lead to an undefined zone at the bottom of the placed concrete blocks. With parts of this zone uncovered, erosion and eventually geotechnical slope failure must be expected.

5.3 *Project-1 Construction Schedule*

The 23 km of embankment work in Koitola may be delayed due to an anomaly in all five contract bid documents received in mid December. It is not expected that the work will be able to start during the 2016/17 construction season. Construction completion is expected to take a minimum of two full dry seasons, which means the construction work will continue at least until June 2019. This delayed start should provide adequate time for associated land acquisition and resettlement activities to be completed prior to the start of construction.

5.4 *Revised Development Project Performa (DPP)*

The PMO is currently revising the DPP to balance the reduced loan amount (around US$ 7million) and allow for the increased cost of construction and associated land acquisition. The revised DPP will also reflect other necessary changes to the project that have occurred since the original DPP was issued in May 2014. Preparation of the revised DPP has been finalized by BWDB, and has been sent the Ministry of Water Resources for their approval.

5.5 *Project Cost*

There is a potential risk of cost overrun due to an exchange fluctuation between the SDR[3] and US$. According to the recent ADB Aide Memoire, the US$ loan amount may be reduced from the originally approved US$ 65 million to around US$ 58 million. Accordingly, the PMO has been actively seeking ways to reduce project costs while retaining the original core physical works program.

6. REFERENCES

1. ADB, 2014: Facility Administration Manual, Bangladesh: Multi-Project Financing Facility - Flood and Riverbank Erosion Risk Management Investment Program, 2014 June

2. ADB, 2014: Report and Recommendation of the President to the Board of Directors, Proposed Multi-Project Financing Facility People's Republic of Bangladesh: Flood and Riverbank Erosion Risk Management Investment Program, 2014 June

3. ADB, 2014: Loan Agreement, Program Agreement, and Grant Agreement; Flood and Riverbank Erosion Risk Management Investment Program – Project-1, between the People's Republic of Bangladesh and Asian Development Bank, 2014 August 14

4. BWDB, 2014: Development Project Proposal, Flood and Riverbank Erosion Risk Management Investment Program – Project 1, 2014 May

5. NHC, 2013: Project Preparatory Technical Assistance 8054 BAN, Main River Flood and Bank Erosion Risk Management Program, Main Report, 2013 December

[3] SDR is the unit of account for the ADB, and is not a currency per se. SDRs instead represent a claim to currency held by ADB member countries for which they may be exchanged.

TABLES

Appendix-A Work Program Summaries

Table A-1 Project Program Summary

Quantity (Units)

Component	Asset Type	Units	BWDB	DDM	MAN	KOI	TAN	Totals
A: Civil Works								
A1: Embankment Works	Cons/ReCon: Embank	km	0.0	0.0	0.0	10.5	0.0	**10.5**
	New: Embank	km	0.0	0.0	0.0	12.5	0.0	**12.5**
	New: Infrastr	BDTM	0.0	0.0	5.0	0.0	0.0	**5.0**
	New: Regulator	No	0.0	0.0	0.0	4.0	0.0	**4.0**
A2: Riverbank Prot Works	New: Revetment	km	0.0	0.0	9.0	0.0	7.0	**16.0**
A3: Emerg & Adaptation	Emerg: AdpRivProt	BDTM	54.0	0.0	0.0	0.0	0.0	**54.0**
A4: Pilot Land Recovery	New: RivTrnWrk	BDTM	380.0	0.0	0.0	0.0	0.0	**380.0**
B: Materials								
B1: Geotextile, Civil Works	Procure: GeoBag	Mil	0.0	0.0	2.7	0.0	1.9	**4.7**
B2: Geotextile, Emerg	Procure: AdpGeoBag	Mil	0.0	0.0	0.8	0.3	0.0	**1.0**
C: Vehicles & Equipment								
C1: Vehicles/Transport	Procure: Veh/Trans	No	16.0	0.0	0.0	0.0	0.0	**16.0**
C2: Office Equipment	Procure: Equip	BDTM	8.9	0.0	0.0	0.0	0.0	**8.9**
C3: Survey Equipment	Procure: Equip	BDTM	8.9	0.0	0.0	0.0	0.0	**8.9**
C4: DDM Office Eqpt	Procure: Equip	BDTM	0.0	0.6	0.0	0.0	0.0	**0.6**
D: Consulting Services								
D1: ISPM; Consultant Serv.	Service: Feasi.Stud	BDTM	173.0	0.0	0.0	0.0	0.0	**173.0**
	Service: Instit.Cap	BDTM	387.0	0.0	0.0	0.0	0.0	**387.0**
	Service: Riv.Stabil	BDTM	458.0	0.0	0.0	0.0	0.0	**458.0**
D2: INGO BWDB	Service: Liveli.Sup	BDTM	65.1	0.0	0.0	0.0	0.0	**65.1**
	Service: O&M	BDTM	24.0	0.0	0.0	0.0	0.0	**24.0**
	Service: Resettle.S	BDTM	17.5	0.0	0.0	0.0	0.0	**17.5**
D3: INGO DDM	Service: CBFRM	BDTM	0.0	66.9	0.0	0.0	0.0	**66.9**
D4: Survey & Investigation	Service: EvironMngt	BDTM	59.8	0.0	0.0	0.0	0.0	**59.8**
	Service: Eros.Pred	BDTM	143.5	0.0	0.0	0.0	0.0	**143.5**
E: Capacity Development								
E1: BWDB Training & Study	Service: Training	BDTM	68.4	0.0	0.0	0.0	0.0	**68.4**
E2: DDM Training	Service: Training	BDTM	0.0	1.6	0.0	0.0	0.0	**1.6**
E3: MIS Development	Service: Instit.Cap	BDTM	34.4	0.0	0.0	0.0	0.0	**34.4**
F: Land Acqn & Resettle								
F1: Land Compensation	Compensate: Land.Acqu	BDTM	884.8	0.0	0.0	0.0	0.0	**884.8**
F2: Resettle Benefits	Compensate: Resettle.B	BDTM	29.7	0.0	0.0	0.0	0.0	**29.7**
G: Program Management								
G1: Staff Salaries BWDB	Service: Prog.Mngt	BDTM	83.7	0.0	0.0	0.0	0.0	**83.7**
G2: Office Opns BWDB	Service: Prog.Mngt	BDTM	49.6	0.0	0.0	0.0	0.0	**49.6**
G3: Office Opns DDM	Service: Prog.Mngt	BDTM	0.0	12.1	0.0	0.0	0.0	**12.1**
G4: BWDB River Surveys	Service: Riv.Surv	BDTM	8.1	0.0	0.0	0.0	0.0	**8.1**
	Service: LandSurvey	BDTM	0.2	0.0	0.0	0.0	0.0	**0.2**
X: Misc. Costs								
X1: Misc. Costs	Compensate: CD&SD	BDTM	72.3	0.0	0.0	0.0	0.0	**72.3**
	Compensate: Interest	BDTM	199.2	0.0	0.0	0.0	0.0	**199.2**

Abreviations:
DDM - Department of Disaster Managment
MAN - Manikganj SMO
KOI - Koitola SMO
TAN - Tangail SMO

The unit BDTM refers to an estimated tost cost of Bangladesh Taka 1 Million.

Table A-2 Project Cost Summary

Cost (BDT Mil)

Component	Asset	BWDB	DDM	MAN	KOI	TAN	Totals
A: Civil Works							
A1: Embankment Works	Cons/ReCon: Embank	0	0	0	508	0	**508**
	New: Embank	0	0	0	472	0	**472**
	New: Infrastr	0	0	8	0	0	**8**
	New: Regulator	0	0	0	230	0	**230**
A2: Riverbank Prot Works	New: Revetment	0	0	1,054	0	832	**1,886**
A3: Emerg & Adaptation	Emerg: AdpRivProt	54	0	0	0	0	**54**
A4: Pilot Land Recovery	New: RivTrnWrk	380	0	0	0	0	**380**
							3,538
B: Materials							
B1: Geotextile, Civil Works	Procure: GeoBag	0	0	747	0	365	**1,112**
B2: Geotextile, Emerg	Procure: AdpGeoBag	0	0	234	71	0	**305**
							1,416
C: Vehicles & Equipment							
C1: Vehicles/Transport	Procure: Veh/Trans	45	0	0	0	0	**45**
C2: Office Equipment	Procure: Equip	4	0	0	0	0	**4**
C3: Survey Equipment	Procure: Equip	7	0	0	0	0	**7**
C4: DDM Office Eqpt	Procure: Equip	0	1	0	0	0	**1**
							57
D: Consulting Services							
D1: ISPM; Consultant Serv.	Service: Feasi.Stud	204	0	0	0	0	**204**
	Service: Instit.Cap	509	0	0	0	0	**509**
	Service: Riv.Stabil	305	0	0	0	0	**305**
D2: INGO BWDB	Service: Liveli.Sup	65	0	0	0	0	**65**
	Service: O&M	24	0	0	0	0	**24**
	Service: Resettle.S	16	0	0	0	0	**16**
D3: INGO DDM	Service: CBFRM	0	67	0	0	0	**67**
D4: Survey & Investigation	Service: EvironMngt	60	0	0	0	0	**60**
	Service: Eros.Pred	87	0	0	0	0	**87**
							1,337
E: Capacity Development							
E1: BWDB Training & Study	Service: Training	68	0	0	0	0	**68**
E2: DDM Training	Service: Training	0	2	0	0	0	**2**
E3: MIS Development	Service: Instit.Cap	34	0	0	0	0	**34**
							104
F: Land Acqn & Resettle							
F1: Land Compensation	Compensate: Land.Acqu	885	0	0	0	0	**885**
F2: Resettle Benefits	Compensate: Resettle.B	30	0	0	0	0	**30**
							914
G: Program Management							
G1: Staff Salaries BWDB	Service: Prog.Mngt	84	0	0	0	0	**84**
G2: Office Opns BWDB	Service: Prog.Mngt	50	0	0	0	0	**50**
G3: Office Opns DDM	Service: Prog.Mngt	0	12	0	0	0	**12**
G4: BWDB River Surveys	Service: Riv.Surv	8	0	0	0	0	**8**
	Service: LandSurvey	0	0	0	0	0	**0**
							154
X: Misc. Costs							
X1: Misc. Costs	Compensate: CD&SD	72	0	0	0	0	**72**
	Compensate: Interest	199	0	0	0	0	**199**
							272
Grand Totals		**3,190**	**81**	**2,042**	**1,281**	**1,197**	**7,792**

Abreviations:
DDM - Department of Disaster Managment
MAN - Manikganj SMO
KOI - Koitola SMO
TAN - Tangail SMO

Table A-3 ADB Categories: Reimbursed Amount, by Donor

all Values in BDT Mil

Code	Categories	Total Cost Est.	Value of Physical Progress	PMO Expenses	Reimbursed Amount		
					ADB	GON	Total
Component							
1	Works	3,538.0	1,131.9	962.1	593.5	0.0	**593.5**
2	Materials	1,416.2	1,111.6	984.3	693.0	0.0	**693.0**
3A	Vehicles - BWDB	44.9	34.5	34.9	1.5	0.0	**1.5**
3B	Equipment - BWDB	11.1	11.1	11.1	10.6	0.0	**10.6**
3C	Equipment -DDM	0.6	0.0				
4	Resettlement	29.7	0.0				
5	Training	104.5	15.1	14.7	13.8	0.0	**13.8**
6A	Consulting Services - Project Management - BWDB	1,018.2	346.2	186.1	19.1	108.5	**127.6**
6B	Consulting Services - NGO Services - BWDB	251.8	21.6	13.1	11.5	0.0	**11.5**
6C	Consulting Services - Project Management - DDM	66.8	0.0				
7A	Project Management - BWDB	57.9	26.3	8.6	7.3	0.0	**7.3**
7B	Project Management - DDM	12.1	0.0	0.0			
8	Interest	199.2	10.0	10.0			
9	Unallocated	1,040.8	832.3	779.1			
Grand Total		**7,791.7**	**3,540.6**	**3,004.1**	**1,350.2**	**108.5**	**1,458.8**

Table A-4 DPP Categories: Reimbursed Amount, by Donor

all Values in BDT Mil

Code	Categories	Total Cost Est.	Value of Physical Progress	PMO Expenses	Reimbursed Amount		
					ADB	GON	Total
Revenue Component							
4826	Interest & Service Charge for Netherland Grant	199.2	10.0	10.0			
4840	Capacity Development Program	104.5	15.1	14.7	13.8	0.0	**13.8**
4849	Resettlement Support Program	29.7	0.0				
4874	ISPMC; Implementation Consultant Services	509.1	152.7	93.1	9.5	54.3	**63.8**
4874	ISPMC; River Stabilization and Land Recovery Study	305.5	152.7	55.8	5.7	32.6	**38.3**
4874	ISPMC; Feasibility of Tranch-2/3 Project	203.6	40.7	37.2	3.8	21.7	**25.5**
4874	Resettlement Implementation Support	16.2	4.4	1.6	1.4	0.0	**1.4**
4874	Livelihood Support Program	65.1	0.0				
4874	Environmental Management Program	59.8	0.0				
4874	Community-based Flood Management Program (DDM)	66.8	0.0				
4874	Particiatory Regular O&M Training Support	24.0	0.0				
4886	Land/River Survey and Data Processing	8.3	2.5	2.5	0.4	0.0	**0.4**
4886	Survey and Investigation Data Processing	86.7	17.2	11.5	10.1	0.0	**10.1**
4700	PMO Salaries and Allowances	83.7	36.0				
4800	PMO Operational Expenses	49.6	23.8	6.2	6.9	0.0	**6.9**
4899	PMU DDM Oprational Expenses	12.1	0.0	0.0			
Revenue Totals		***1,823.8***	***455.1***	***232.6***	***51.7***	***108.5***	***160.2***
Capital Component							
6807	Transport Vehicles (Jeep 5, Motorcyle 10 and Speed Boat 1)	44.9	34.5	34.9	1.5	0.0	**1.5**
6819	Computer and Office Equipment BWDB	4.4	4.4	4.4	4.2	0.0	**4.2**
6819	Computer and Office Equipment DDM	0.6	0.0				
6851	Survey Equipment	6.7	6.7	6.7	6.4	0.0	**6.4**
6901	Land Acquisition (136 ha)	884.8	796.3	779.1			
7016	Construction of Inspection Bangalow at Manikganj	7.8	0.0				
7041	Regulator (new 4 and repair 3) in JRB1	229.9	0.0				
7081	Embankment (23 km) along RB Jamuna and LB Baria-Hurasagar, with Road (5 km)	980.4	0.0				
7081	Protective Works at RB Jamuna at Kaijuri, LB Jamuna at Chaulhali, Jafforganj & Harirampur (15 km)	2,997.7	2,243.6	1,946.4	1,286.4	0.0	**1,286.4**
7081	Land Recovery/River Training Works	379.8	0.0				
7081	Adaptive Protection and Emergency	358.6	0.0				
7091	CD and SD	72.3	0.0				
Capital Totals		***5,967.9***	***3,085.5***	***2,771.5***	***1,298.5***	***0.0***	***1,298.5***
Grand Total		**7,791.7**	**3,540.6**	**3,004.1**	**1,350.2**	**108.5**	**1,458.8**

Table A-5 DPP Categories: Key Physical and Financial Indicators

all Values in BDT Mil

Code	Categories	Total Cost		Fiscal		Total to Date		
		Budget	Revised Est.	Target	Progress	Progress	Expenses	Reimburs
Revenue								
4826	Interest & Service Charge for Netherland Grant	199.2	199.2	60.0	0.0	10.0	10.0	
4840	Capacity Development Program	104.4	104.5	25.0	0.4	15.1	14.7	13.8
4849	Resettlement Support Program	29.7	29.7	0.0	0.0	0.0		
4874	ISPMC; Implementation Consultant Services	406.4	509.1	100.0	75.3	152.7	93.1	63.8
4874	ISPMC; River Stabilization and Land Recovery Study	484.0	305.5	100.0	84.0	152.7	55.8	38.3
4874	ISPMC; Feasibility of Tranch-2/3 Project	178.1	203.6	60.0	14.8	40.7	37.2	25.5
4874	Resettlement Implementation Support	17.5	16.2	10.0	2.8	4.4	1.6	1.4
4874	Livelihood Support Program	65.1	65.1	0.0	0.0	0.0		
4874	Environmental Management Program	59.8	59.8	0.0	0.0	0.0		
4874	Community-based Flood Management Program (DDM)	66.9	66.8	0.0	0.0	0.0		
4874	Particiatory Regular O&M Training Support	24.0	24.0	0.0	0.0	0.0		
4886	Land/River Survey and Data Processing	8.0	8.3	2.0	0.0	2.5	2.5	0.4
4886	Survey and Investigation Data Processing	86.7	86.7	15.8	5.7	17.2	11.5	10.1
4700	PMO Salaries and Allowances	83.7	83.7	0.0	0.0	36.0		
4800	PMO Operational Expenses	49.6	49.6	8.0	2.5	23.8	6.2	6.9
4899	PMU DDM Oprational Expenses	12.1	12.1	0.0	0.0	0.0	0.0	
		1,875.1	***1,823.8***	***380.8***	***185.4***	***455.1***	***232.6***	***160.2***
Capital								
6807	Transport Vehicles (Jeep 5, Motorcyle 10 and Speed Boat 1)	64.1	44.9	0.0	0.0	34.5	34.9	1.5
6819	Computer and Office Equipment BWDB	8.9	4.4	0.0	0.0	4.4	4.4	4.2
6819	Computer and Office Equipment DDM	0.6	0.6	0.5	0.0	0.0		
6851	Survey Equipment	8.9	6.7	0.0	0.0	6.7	6.7	6.4
6901	Land Acquisition (136 ha)	884.8	884.8	248.3	159.3	796.3	779.1	
7016	Construction of Inspection Bangalow at Manikganj	5.0	7.8	4.1	0.0	0.0		
7041	Regulator (new 4 and repair 3) in JRB1	140.6	229.9	0.0	0.0	0.0		
7081	Embankment (23 km) along RB Jamuna and LB Baria-Hurasagar, with Road (5 km)	788.8	980.4	0.0	0.0	0.0		
7081	Protective Works at RB Jamuna at Kaijuri, LB Jamuna at Chaulhali, Jafforganj & Harirampur (15 km)	3,266.0	2,997.7	1,303.2	413.3	2,243.6	1,946.4	1,286.4
7081	Land Recovery/River Training Works	379.8	379.8	0.0	0.0	0.0		
7081	Adaptive Protection and Emergency	279.1	358.6	95.1	0.0	0.0		
7091	CD and SD	72.3	72.3	0.0	0.0	0.0		
		5,899.0	***5,967.9***	***1,651.2***	***572.6***	***3,085.5***	***2,771.5***	***1,298.5***
Totals		**7,774.0**	**7,791.7**	**2,032.0**	**758.0**	**3,540.6**	**3,004.1**	**1,458.8**

Appendix-B Work Program Details

Table B-1 Design Progress Details

Description	Total	Design Data Collection			Prog (%)		Remarks
		Surv	Hydraul	Geotech	Desn	Dwg	
Component A: Civil Works							
Koitola SMO							
Cons/ReCon: Embank: 4.8 km: Embankment Reconst. (4.8 km): Baghabari - Verakhola; km 12.5-17.3		c	c	na	100	100	Desn. & Dwg. Complete
Cons/ReCon: Embank: 5.7 km: Embankment Reconst. (5.7 km): Baghabari - Verakhola; km 17.3-23		c	c	na	100	100	Desn. & Dwg. Complete
New: Embank: 5 km: Embankment (5 km): Kaijuri - Bhatpara; km 0-5		c	c	na	100	100	Desn. & Dwg. Complete
New: Embank: 3.5 km: Embankment (3.5 km): Bhatpata - Gala; km 5-8.5		c	c	na	100	100	Desn. & Dwg. Complete
New: Embank: 4 km: Embankment (4 km): Gala - Verakhola; km 8.5-12.5		c	c	c	100	100	Desn. & Dwg. Complete
New: Regulator: 1 No: Kaijuri Reg 2V 1.5x1.8m		c	c	c	100	100	Desn. & Dwg. Complete
New: Regulator: 1 No: Rohindakandi Reg 2V 1.5x1.8m		c	c	c	100	100	Desn. & Dwg. Complete
New: Regulator: 1 No: Verakhola Reg 2V 1.5x1.8m		c	c	c	100	100	Desn. & Dwg. Complete
New: Regulator: 1 No: Andhar Manik Reg 4V 1.5x1.8m		c	c	c	100	100	Desn. & Dwg. Complete
Koitola SMO Totals	***9***	***9***	***9***	***9***	***9***	***9***	
Manikganj SMO							
New: Infrastr: 5 BDTM: Construction of Inspection Bungalow		c	na	na	100	100	Dwgs Complete
Manikganj SMO Totals	***1***	***1***	***1***	***1***	***1***	***1***	
Component Totals	***10***	**10**	**10**	**10**	**10**	**10**	

Legend:
n - not commenced c - completed
p - partially completed na - not applicable/required

Table B-2 Tender Progress Details

Package Code	Description	Dates												
		ISPMC ToR	ADB ToR	EoI Notice	EoI Received	BWDB EoI Eval	ADB EoI Eval.	ADB Bid Doc.	Tender Notice	Tender Received	Eval. Comp.	ADB Concur.	Appr.Compl. Authority	Notif. Award
Goods; B: Materials														
G-04.1	Supply of Geobags; Chauhali & Harirampur							13Sep16	27Sep16	14Nov16	19Dec16			
Component Totals		***0***	***0***	***0***	***0***	***0***	***0***	***1***	***1***	***1***	***1***	***0***	***0***	***0***
Goods; C: Vehicles & Equipment														
G-06.4	2017 Supply of Boat;													
G-06.5	2017 Supply of Motorcycles;													
G-09	2017 Supply of Office Equip; DDM;													
Component Totals		***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***
Services; D: Consulting Services														
S-03	Livelihood Development;	25May16												
S-04	Community Based Flood Risk Mngmt;	30Sep15	01Mar16	28Mar16	26Apr16									
S-07.3	2017 Data Processing;													
Component Totals		***2***	***1***	***1***	***1***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***
Works; A: Civil Works														
W-01	Embankment, & 2 Reg.; km 0-5							04Oct16	10Nov16	21Dec16				
W-02	Embankment; km 5-8.5							04Oct16	10Nov16	21Dec16				
W-03	Embankment; 8.5-12.5							04Oct16	10Nov16	21Dec16				
W-04	Embankment & 1 Regulator; km 12.5-17.3							04Oct16	10Jan17	21Dec16				
W-05	Embankment & 1 Regulator; km 17.3-23							04Oct16	10Nov16	21Dec16				
W-16	Construction of Inspection Bungalow;													
Component Totals		***0***	***0***	***0***	***0***	***0***	***0***	***5***	***5***	***5***	***0***	***0***	***0***	***0***
Project Totals		**2**	**1**	**1**	**1**	**0**	**0**	**6**	**6**	**6**	**1**	**0**	**0**	**0**

Abbreviations:

ADB - Asian Development Bank
BDT - Bangladesh Taka
Comp. - Completion
Concur. - Concurrence
Doc. - Document
Eval. - Evaluation
EoI - Expression of Interest
Notif. - Notification
ToR - Terms of Reference

Table B-3 Implementation Progress Details, by Contract

Contract Code	Description	Contractor	Best Estimate of Final Cost (BDT Mil)	Value of Cumulate Progress during Mth%	31-Jan-2017 Current Mth (%)	31-Jan-2017 Current Mth (BDT Mil)	28-Feb-2017 Next Mth (%)	28-Feb-2017 Next Mth (BDT Mil)	Remarks
Goods									
B: Materials									
G-01	Supply of Geobags: Chouhali, Sirajganj	BJ Geo-Textile	365.0	0	100	365.0	100	365.0	Implemenation Complete
G-02	Supply of Geobags: Zaforganj, Harirampur, Manikganj	BJ Geo-Textile	472.6	3	100	472.6	100	472.6	Implemenation Complete
G-03	Supply of Geobags: Harirampur, Manikganj	DFL-DCTL(JV)	274.0	0	100	274.0	100	274.0	Implemenation Complete
G-04.1	Supply of Geobags: Chauhali & Harirampur		233.8	0	0	0.0	0	0.0	Tend.Eval.Compl.BWDB
Component Totals			***1,345.4***			***1,111.6***		***1,111.6***	
C: Vehicles & Equipment									
G-05	2016 Supply of Jeep:	Pacific Motors Ltd.	5.5	0	100	5.5	100	5.5	Implemenation Complete
G-06.1	2015 Supply of Jeeps:	Progoti Industries	20.8	0	100	20.8	100	20.8	Implemenation Complete
G-06.2	2016 Supply of Jeep:	Progoti Industries	6.9	0	100	6.9	100	6.9	Implemenation Complete
G-06.3	2016 Supply of Motorcycles:	Atlas Bangladesh Ltd.	1.3	0	100	1.3	100	1.3	Implemenation Complete
G-06.4	2017 Supply of Boat:		6.9	0	0	0.0	0	0.0	Contract Not Yet Started
G-06.5	2017 Supply of Motorcycles:		3.5	0	0	0.0	0	0.0	Contract Not Yet Started
G-07.1	2015 Office Equipment: BWDB PMO	Logitech Computer Ltd.	2.2	0	100	2.2	100	2.2	Implemenation Complete
G-07.2	2016 Office Equipment: BWDB PMO	Source & Service	2.2	0	100	2.2	100	2.2	Implemenation Complete
G-08.1	2016 Supply of Survey Equipments:	Logitech Computers Ltd.	6.7	0	100	6.7	100	6.7	Implemenation Complete
G-09	2017 Supply of Office Equip; DDM:		0.6	0	0	0.0	0	0.0	Contract Not Yet Started
Component Totals			***56.6***			***45.6***		***45.6***	
Goods Totals			***1,402.0***			***1,157.2***		***1,157.2***	
Services									
D: Consulting Services									
S-01	ISPMC; Tranche 1:	NHC (JV) Mott MacDonald	1,018.2	15	34	346.2	45	458.2	Satisfactory Progress
S-02	Resettlement Implementation Support:	VRDS-HCL-JV	16.2	12	27	4.4	36	5.8	Satisfactory Progress
S-03	Livelihood Development:		65.1	0	0	0.0	0	0.0	Contract Not Yet Started
S-04	Community Based Flood Risk Mngmt:		66.8	0	0	0.0	0	0.0	EoI Received
S-07.1	2015 Erosion & Morphological Chg:	CEGIS	4.6	0	100	4.6	100	4.6	Implemenation Complete
S-07.2	2016 Erosion Prediction:	CEGIS	25.3	20	50	12.6	70	17.7	Satisfactory Progress
S-07.3	2017 Data Processing:		56.8	0	0	0.0	0	0.0	Contract Not Yet Started
Component Totals			***1,253.0***			***367.8***		***486.3***	
G: Program Management									
S-06.1	River Survey Work: left bank Padma & Jamuna	M/S Hasib Enterprise	0.1	0	100	0.1	100	0.1	Implemenation Complete
S-06.2	Survey Work for Land Acquisition: Hat-Pachi to Dombaria	Md. Salim Ektiar	0.2	0	100	0.2	100	0.2	Implemenation Complete
S-06.3	Land/River Survey Work: Jamuna at Chouhali 7km	M/S Biplob Enterprise	0.1	0	100	0.1	100	0.1	Implemenation Complete
S-06.4	2017 Bathymetric River Survey: Dhaka, Pabna and Mymenshingh	RAC Office	2.0	0	100	2.0	100	2.0	Implemenation Complete
Component Totals			***2.5***			***2.5***		***2.5***	
Services Totals			***1,255.5***			***370.3***		***488.8***	
Works									
A: Civil Works									
W-01	Embankment, & 2 Reg.: km 0-5		296.2	0	0	0.0	0	0.0	Tender Received
W-02	Embankment: km 5-8.5		133.3	0	0	0.0	0	0.0	Tender Received
W-03	Embankment: 8.5-12.5		130.3	0	0	0.0	0	0.0	Tender Received
W-04	Embankment & 1 Regulator: km 12.5-17.3		334.6	0	0	0.0	0	0.0	Tender Received
W-05	Embankment & 1 Regulator: km 17.3-23		315.9	0	0	0.0	0	0.0	Tender Received
W-06	Revetment: Jamuna at Chauhali, R1; km 0-2.5	I-J (JV)	386.9	39	63	243.8	90	348.2	Satisfactory Progress
W-07	Revetment: Jamuna at Chauhali, R2; km 2.5-7.0	I-J (JV)	445.2	39	63	280.4	90	400.6	Satisfactory Progress
W-08	Revetment: Jamuna at Zaffarganj, km 6.1-8.1	WEL-NZK-PTSL (JV)	557.8	10	20	111.6	47	262.2	Satisfactory Progress
W-09	Revetment: Padma at Harirampur, R1; km 0-3.5	M.M.Builders & Engineers Lt	271.3	0	100	271.3	100	271.3	Construction Complete
W-10	Revetment: Padma at Harirampur, R2; km 3.5-7	M.M.Builders & Engineers Lt	224.9	0	100	224.9	100	224.9	Construction Complete
W-16	Construction of Inspection Bungalow:		7.8	0	0	0.0	0	0.0	Dwgs Complete
Component Totals			***3,104.2***			***1,131.9***		***1,507.2***	
Works Totals			***3,104.2***			***1,131.9***		***1,507.2***	
ProjectTotals			**5,761.6**			**2,659.5**		**3,153.3**	

Table B-4 Project Program, by Contract

Code	Description	Cost (BDT Mil)
Goods		
Component B1: Materials Geotextile, Civil Works		
G-01	Geobags 1.25x1.00m; Chouhali, Sirajganj	364.97
G-02	Geobags 1.25x1.00m; Zaforganj & Harirampur, Manikganj	472.64
G-03	Geobags 1.25x1.00m; Harirampur, Manikganj	274.01
		1,111.62
Component B2: Materials Geotextile, Emerg		
G-04.1	Supply of Geobags; Chauhali & Harirampur	233.77
G-04.2	Supply of Geobags; Koitola;	70.85
		304.62
Component C1: Vehicles & Equipment Vehicles/Transport		
G-05	2016 Supply of Jeep;	5.49
G-06.1	2015 Supply of Jeeps;	20.78
G-06.2	2016 Supply of Jeep;	6.93
G-06.3	2016 Supply of Motorcycles;	1.31
G-06.4	2017 Supply of Boat;	6.92
G-06.5	2017 Supply of Motorcycles;	3.46
		44.89
Component C2: Vehicles & Equipment Office Equipment		
G-07.1	Supply of Office Equip.; BWDB PMO	2.20
G-07.2	2016 Office Equipment; BWDB PMO	2.18
		4.37
Component C3: Vehicles & Equipment Survey Equipment		
G-08.1	Supply of Survey Equipments;	6.75
Component C4: Vehicles & Equipment DDM Office Eqpt		
G-09	Supply of Computers & Photocopiers;	0.58
Goods Total		**1,472.83**
Services		
Component D1: Consulting Services ISPM; Consultant Serv.		
S-01	Implementation Consultant Services; Feasibility Study Tranche-2; River Stabilization & Land Recovery;	1,018.19
Component D2: Consulting Services INGO BWDB		
S-02	Resettlement Plan;	16.20
S-03	Livelihood Development;	65.13
S-05	Community Based O&M Training;	24.00
		105.33
Component D3: Consulting Services INGO DDM		
S-04	Cb Flood Risk Mngmt;	66.78
Component D4: Consulting Services Survey & Investigation		
S-07.1	2015 Erosion & Morphological Chg; Jamuna, Ganges, Padma R	4.60
S-07.2	2016 Erosion Prediction;	25.25
S-07.3	2017 Data Processing;	56.83
S-10	Environmental Management Services;	59.78
		146.46
Component E3: Capacity Development MIS Development		
S-08	MIS Development, Support 1;	12.88
S-09	MIS Development, Support 2;	21.52
		34.40
Component G4: Program Management BWDB River Surveys		
S-06.1	River Survey Work; Padma LB & Jamuna LB	0.15
S-06.2	Survey Work for Land Acquisition; Hat-Pachi to Dombaria	0.20
S-06.3	Land/River Survey Work; Jamuna at Chouhali 7km	0.15
S-06.4	Bathymetric River Survey; Dhaka, Pabna and Mymenshingh	1.99
S-06.5	2018 Bathymetric River Survey;	5.86
		8.35
Services Total		**1,379.51**

Table B-4 Project Program, by Contract

Code	Description	Cost (BDT Mil)
Works		
Component A1: Civil Works Embankment Works		
W-01	Embankment (5 km); Kaijuri - Bhatpara; km 0-5 Kaijuri Reg 2V 1.5x1.8m; Rohindakandi Reg 2V 1.5x1.8m;	296.21
W-02	Embankment (3.5 km); Bhatpata - Gala; km 5-8.5	133.31
W-03	Embankment (4 km); Gala - Verakhola; km 8.5-12.5	130.26
W-04	Embankment Reconst. (4.8 km); Baghabari - Verakhola; km 12.5-17.3 Verakhola Reg 2V 1.5x1.8m;	334.56
W-05	Embankment Reconst. (5.7 km); Baghabari - Verakhola; km 17.3-23 Andhar Manik Reg 4V 1.5x1.8m;	315.95
W-16	Construction of Inspection Bungalow;	7.80
		1,218.08
Component A2: Civil Works Riverbank Prot Works		
W-06	Revetment (2 km); Chauhali; km 0- 2.5	386.94
W-07	Revetment (4.5 km); Chauhali; km 2.5-7.0	445.15
W-08	Revetment (2 km); Zaffarganj; km 6.1-8.1	557.84
W-09	Revetment (3.5 km); Harirampur; km 0-3.5	271.28
W-10	Revetment (3.5 km); Harirampur; km 3.5-7	224.88
		1,886.09
Component A3: Civil Works Emerg & Adaptation		
W-12	Emergency/Adaptive 1; Riverbank Protection	17.82
W-13	Koijhuri-Benotia Revetment; Riverbank Protection	18.36
W-14	Emergency/Adaptive 3; Riverbank Protection	17.82
		54.00
Component A4: Civil Works Pilot Land Recovery		
W-15	River Training Pilot Work; & Land Recovery	379.80
Works Total		**3,537.97**
eXtra		
Component E1: Capacity Development BWDB Training & Study		
X-05	BWDB Training and Study Tours;	68.45
Component E2: Capacity Development DDM Training		
X-06	DDM Training;	1.60
Component F1: Land Acqn & Resettle Land Compensation		
X-07	Land Compensation;	884.79
Component F2: Land Acqn & Resettle Resettle Benefits		
X-08	Resettlement Benefits;	29.70
Component G1: Program Management Staff Salaries BWDB		
X-02	BWDB Staff Salaries;	83.67
Component G2: Program Management Office Opns BWDB		
X-03	BWDB Office Operations;	49.60
Component G3: Program Management Office Opns DDM		
X-04	DDM Office Operations;	12.07
Component X1: Misc. Costs Misc. Costs		
X-01	ADB Interest & Service Charge;	199.20
X-09	CD and SD;	72.33
		271.53
eXtra Total		**1,401.41**
Project Total		***7,791.71***

Table B-5 BWDB PMO Expenditure Summary, by Contract

all Values in BDT

Code	Description	ADB	GON	GOB	Total
Goods					
B1	***Geotextile, Civil Works***				
G-01	Supply of Geobags; Chouhali, Sirajganj	314,894,733	0	0	314,894,733
G-02	Supply of Geobags; Zaforganj, Harirampur, Manikganj	396,363,867	0	0	396,363,867
G-03	Supply of Geobags; Harirampur, Manikganj	273,041,387	0	0	273,041,387
Component Total		***984,299,987***	***0***	***0***	***984,299,987***
C1	***Vehicles/Transport***				
G-05	2016 Supply of Jeep;	1,940,400	0	4,989,600	6,930,000
G-06.1	2015 Supply of Jeeps;	5,940,900	0	15,276,600	21,217,500
G-06.2	2016 Supply of Jeep;	1,537,200	0	3,952,800	5,490,000
G-06.3	2016 Supply of Motorcycles;	366,940	0	943,560	1,310,500
Component Total		***9,785,440***	***0***	***25,162,560***	***34,948,000***
C2	***Office Equipment***				
G-07.1	2015 Office Equipment; BWDB PMO	2,087,749	0	109,882	2,197,630
G-07.2	2016 Office Equipment; BWDB PMO	2,066,333	0	108,754	2,175,087
Component Total		***4,154,081***	***0***	***218,636***	***4,372,717***
C3	***Survey Equipment***				
G-08.1	2016 Supply of Survey Equipments;	6,409,650	0	337,350	6,747,000
Component Total		***6,409,650***	***0***	***337,350***	***6,747,000***
Goods Total		***1,004,649,158***	***0***	***25,718,546***	***1,030,367,704***
Services					
D1	***ISPM; Consultant Serv.***				
S-01	ISPMC; Tranche 1;	24,195,078	137,725,829	24,195,078	186,115,985
Component Total		***24,195,078***	***137,725,829***	***24,195,078***	***186,115,985***
D2	***INGO BWDB***				
S-02	Resettlement Implementation Support;	1,409,400	0	210,600	1,620,000
Component Total		***1,409,400***	***0***	***210,600***	***1,620,000***
D4	***Survey & Investigation***				
S-07.1	2015 Erosion & Morphological Chg;	4,002,000	0	598,000	4,600,000
S-07.2	2016 Erosion Prediction;	6,016,050	0	898,950	6,915,000
Component Total		***10,018,050***	***0***	***1,496,950***	***11,515,000***
G4	***BWDB River Surveys***				
S-06.1	River Survey Work; left bank Padma & Jamuna	122,778	0	16,742	139,520
S-06.2	Survey Work for Land Acquisition; Hat-Pachi to Dombaria	170,702	0	23,278	193,980
S-06.3	Land/River Survey Work; Jamuna at Chouhali 7km	128,040	0	17,460	145,500
S-06.4	2017 Bathymetric River Survey; Dhaka, Pabna and Mymenshingh	1,753,294	0	239,086	1,992,380
Component Total		***2,174,814***	***0***	***296,566***	***2,471,380***
Services Total		***37,797,342***	***137,725,829***	***26,199,194***	***201,722,365***
Works					
A2	***Riverbank Prot Works***				
W-06	Revetment; Jamuna at Chauhali, R1; km 0-2.5	129,323,856	0	12,790,272	142,114,128
W-07	Revetment; Jamuna at Chauhali, R2; km 2.5-7.0	227,536,489	0	22,503,609	250,040,098
W-08	Revetment; Jamuna at Zaffarganj, km 6.1-8.1	50,763,313	0	5,020,547	55,783,860
W-09	Revetment; Padma at Harirampur, R1; km 0-3.5	244,469,460	0	24,178,298	268,647,758
W-10	Revetment; Padma at Harirampur, R2; km 3.5-7	223,389,944	0	22,093,511	245,483,455
Component Total		***875,483,062***	***0***	***86,586,237***	***962,069,299***
Works Total		***875,483,062***	***0***	***86,586,237***	***962,069,299***
eXtra					

Table B-5 BWDB PMO Expenditure Summary, by Contract

all Values in BDT

Code	Description	ADB	GON	GOB	Total
E1	***BWDB Training & Study***				
X-05	BWDB Training and Study Tours;	13,820,185	0	882,139	14,702,324
Component Total		***13,820,185***	***0***	***882,139***	***14,702,324***
F1	***Land Compensation***				
X-07	Land Compensation;	0	0	779,076,000	779,076,000
Component Total		***0***	***0***	***779,076,000***	***779,076,000***
G2	***Office Opns BWDB***				
X-03	BWDB Office Operations;	5,427,994	0	740,181	6,168,175
Component Total		***5,427,994***	***0***	***740,181***	***6,168,175***
G3	***Office Opns DDM***				
X-04	DDM Office Operations;	506	0	69	575
Component Total		***506***	***0***	***69***	***575***
X1	***Misc. Costs***				
X-01	ADB Interest & Service Charge;	10,000,000	0	0	10,000,000
Component Total		***10,000,000***	***0***	***0***	***10,000,000***
eXtra Total		***29,248,685***	***0***	***780,698,389***	***809,947,074***
Project Total		**1,947,178,247**	**137,725,829**	**919,202,366**	**3,004,106,442**

The donor values are calculated using Total Expenditure and percent distribution by Financial Component.

Table B-6 Reimbursement Summary, by Contract

Code	Description	Total Bill Amount (BDT	Reimbursed Amount (BDT		
			ADB	GON	Total
Goods					
B1	***Geotextile, Civil Works***				
G-01	Supply of Geobags; Chouhali, Sirajganj	275,363,302	275,363,302	0	275,363,302
G-02	Supply of Geobags; Zaforganj, Harirampur, Manikganj	239,635,750	239,635,750	0	239,635,750
G-03	Supply of Geobags; Harirampur, Manikganj	177,971,890	177,971,890	0	177,971,890
		692,970,942	***692,970,942***	***0***	***692,970,942***
C1	***Vehicles/Transport***				
G-05	2016 Supply of Jeep;	5,490,000	1,537,200	0	1,537,200
C2	***Office Equipment***				
G-07.1	2015 Office Equipment; BWDB PMO	2,197,630	2,087,749	0	2,087,749
G-07.2	2016 Office Equipment; BWDB PMO	2,175,087	2,066,333	0	2,066,333
		4,372,717	***4,154,081***	***0***	***4,154,081***
C3	***Survey Equipment***				
G-08.1	2016 Supply of Survey Equipments;	6,747,000	6,409,650	0	6,409,650
Goods Total		***709,580,659***	***705,071,873***	***0***	***705,071,873***
Services					
D1	***ISPM; Consultant Serv.***				
S-01	ISPMC; Tranche 1;	156,355,607	19,063,867	108,517,399	127,581,266
D2	***INGO BWDB***				
S-02	Resettlement Implementation Support;	1,620,000	1,409,400	0	1,409,400
D4	***Survey & Investigation***				
S-07.1	2015 Erosion & Morphological Chg;	4,600,000	4,002,000	0	4,002,000
S-07.2	2016 Erosion Prediction;	7,000,000	6,090,000	0	6,090,000
		11,600,000	***10,092,000***	***0***	***10,092,000***
G4	***BWDB River Surveys***				
S-06.1	River Survey Work; left bank Padma & Jamuna	141,500	124,520	0	124,520
S-06.2	Survey Work for Land Acquisition; Hat-Pachi to Dombaria	200,000	176,000	0	176,000
S-06.3	Land/River Survey Work; Jamuna at Chouhali 7km	149,860	131,877	0	131,877
		491,360	***432,397***	***0***	***432,397***
Services Total		***170,066,967***	***30,997,664***	***108,517,399***	***139,515,063***
Works					
A2	***Riverbank Prot Works***				
W-06	Revetment; Jamuna at Chauhali, R1; km 0-2.5	118,484,581	103,954,982	0	103,954,982
W-07	Revetment; Jamuna at Chauhali, R2; km 2.5-7.0	164,933,965	139,627,859	0	139,627,859
W-08	Revetment; Jamuna at Zaffarganj, km 6.1-8.1	55,783,860	50,763,313	0	50,763,313
W-09	Revetment; Padma at Harirampur, R1; km 0-3.5	145,585,898	132,483,167	0	132,483,167
W-10	Revetment; Padma at Harirampur, R2; km 3.5-7	197,499,011	166,627,945	0	166,627,945
		682,287,315	***593,457,265***	***0***	***593,457,265***
Works Total		***682,287,315***	***593,457,265***	***0***	***593,457,265***
eXtra					
E1	***BWDB Training & Study***				
X-05	BWDB Training and Study Tours;	14,688,401	13,807,097	0	13,807,097
G2	***Office Opns BWDB***				
X-03	BWDB Office Operations;	7,840,785	6,899,890	0	6,899,890
eXtra Total		***22,529,186***	***20,706,988***	***0***	***20,706,988***
Project Total		**1,584,464,127**	**1,350,233,790**	**108,517,399**	**1,458,751,189**

Table B-7 Reimbursement Summary, by Application

Acct. Type	Applic. No.	Date	Page	Cat	Rate of US Dollar	Total Bill Amount (BDT)	Total Bill Amount (US$)	Reimburs (%)	ADB Reimbursed Amount (BDT)	ADB Reimbursed Amount (US$)	Grant Applic. No.	Reimburs (%)	GoN Reimbursed Amount (BDT)	GoN Reimbursed Amount (US$)	Total Reimbursed Amount (BDT)	Total Reimbursed Amount (US$)
L/C	**BW001**	**30-Jun-2016**	**01**	**2**	77.80	514,111,953	6,608,123	100	514,111,953	6,608,123		0	0	0	514,111,953	6,608,123
Imprest	**BW006**	**14-Sep-2015**	**01**	**7A**	77.80	596,191	7,663	88	524,648	6,744		0	0	0	524,648	6,744
			02	**6B**	77.80	4,600,000	59,126	87	4,002,000	51,440		0	0	0	4,002,000	51,440
			03	**3B**	77.80	2,197,630	28,247	95	2,087,749	26,835		0	0	0	2,087,749	26,835
			04	**7A**	77.80	457,804	5,884	88	402,868	5,178		0	0	0	402,868	5,178
			05	**7A**	77.80	200,000	2,570	88	176,000	2,262		0	0	0	176,000	2,262
			06	**7A**	77.80	149,860	1,926	88	131,877	1,695		0	0	0	131,877	1,695
						8,201,485	***105,416***		***7,325,141***	***94,153***			***0***	***0***	***7,325,141***	***94,153***
Imprest	**BW008**	**03-Dec-2015**	**01**	**1**	78.74	77,441,455	983,509	91	70,471,724	894,993		0	0	0	70,471,724	894,993
			02	**2**	78.74	23,896,480	303,486	100	23,896,480	303,486		0	0	0	23,896,480	303,486
						101,337,935	***1,286,995***		***94,368,204***	***1,198,479***			***0***	***0***	***94,368,204***	***1,198,479***
Dir.Pay.	**BW009**	**23-Feb-2016**	**01**	**6A**	77.57	18,202,930	234,649	13	2,366,381	30,504	**BW010**	74	13,470,168	173,641	15,836,549	204,145
Imprest	**BW011**	**07-Mar-2016**	**01**	**1**	78.74	154,166,642	1,957,920	91	125,963,608	1,599,741		0	0	0	125,963,608	1,599,741
			02	**2**	78.74	887,099	11,266	100	887,099	11,266		0	0	0	887,099	11,266
			03	**6A**	78.40	4,597,309	58,639	13	597,650	7,623	**ED002**	74	3,402,009	43,393	3,999,659	51,016
			04	**7A**	78.74	800,964	10,172	88	704,848	8,952		0	0	0	704,848	8,952
						160,452,013	***2,037,997***		***128,153,205***	***1,627,582***			***3,402,009***	***43,393***	***131,555,214***	***1,670,975***
Dir.Pay.	**BW012**	**20-Mar-2016**	**01**	**6A**	77.57	30,049,770	387,364	13	3,512,027	45,273	**ED003**	74	19,991,540	257,706	23,503,567	302,979
Imprest	**BW013**	**05-May-2016**	**01**	**1**	78.60	242,232,508	3,083,883	91	207,335,427	2,639,716		0	0	0	207,335,427	2,639,716
			02	**2**	78.40	97,265,910	1,240,637	100	97,265,910	1,240,637		0	0	0	97,265,910	1,240,637
			03	**5**	78.60	624,855	7,950	94	587,364	7,473		0	0	0	587,364	7,473
			04	**7A**	78.74	173,409	2,202	88	152,600	1,938		0	0	0	152,600	1,938
						340,296,682	***4,334,672***		***305,341,300***	***3,889,763***			***0***	***0***	***305,341,300***	***3,889,763***
Dir.Pay.	**BW014**	**23-Jun-2016**	**01**	**5**	78.40	7,966,561	101,614	94	7,488,568	95,517		0	0	0	7,488,568	95,517
Dir.Pay.	**BW015**	**29-Jun-2016**	**01**	**6A**	77.57	37,052,991	477,641	13	4,336,393	55,899	**ED004**	74	24,684,081	318,196	29,020,474	374,096
Dir.Pay.	**BW016**	**29-Jun-2016**	**01**	**6A**	77.57	30,310,811	390,729	13	3,552,983	45,801	**ED005**	74	20,224,672	260,711	23,777,655	306,512
Imprest	**BW017**	**29-Sep-2016**	**01**	**1**	78.40	208,446,710	2,658,759	91	189,686,506	2,419,471		0	0	0	189,686,506	2,419,471
			02	**2**	78.40	56,809,500	724,611	100	56,809,500	724,611		0	0	0	56,809,500	724,611

Table B-7 Reimbursement Summary, by Application

Acct. Type	Applic. No.	Date	Page	Cat	Rate of US Dollar	Total Bill Amount (BDT)	Total Bill Amount (US$)	Reimburs (%)	ADB Reimbursed Amount (BDT)	ADB Reimbursed Amount (US$)	Grant Applic. No.	Reimburs (%)	GoN Reimbursed Amount (BDT)	GoN Reimbursed Amount (US$)	Total Reimbursed Amount (BDT)	Total Reimbursed Amount (US$)
Imprest	**BW017**	**29-Sep-2016**	**03**	**3A**	78.40	5,490,000	70,026	28	1,537,200	19,607		0	0	0	1,537,200	19,607
			04	**3B**	78.40	8,922,087	113,802	95	8,475,983	108,112		0	0	0	8,475,983	108,112
			05	**5**	78.40	6,096,985	77,768	94	5,731,166	73,102		0	0	0	5,731,166	73,102
			06	**6A**	78.40	36,141,795	460,992	13	4,698,433	59,929	**ED006**	74	26,744,928	341,134	31,443,362	401,063
			08	**6B**	78.40	8,620,000	109,949	87	7,499,400	95,656		0	0	0	7,499,400	95,656
			09	**7A**	78.40	1,584,307	20,208	88	1,394,190	17,783		0	0	0	1,394,190	17,783
			10	**7A**	78.40	1,585,375	20,222	88	1,395,130	17,795		0	0	0	1,395,130	17,795
			11	**7A**	78.40	1,595,731	20,354	88	1,404,243	17,911		0	0	0	1,404,243	17,911
			12	**7A**	78.40	304,456	3,883	88	267,922	3,417		0	0	0	267,922	3,417
			13	**7A**	78.40	884,047	11,276	88	777,961	9,923		0	0	0	777,961	9,923
						336,480,994	***4,291,849***		***279,677,635***	***3,567,317***			***26,744,928***	***341,134***	***306,422,563***	***3,908,451***
Project Totals						**1,584,464,127**	**20,257,050**		**1,350,233,790**	**17,258,411**			**108,517,399**	**1,394,781**	**1,458,751,189**	**18,653,192**

Table B-8 ADB and GON Disbursement Details

ADB Disbursements

ADB Loan Account

Appl. No	Date	US$	Rate	BDT
WL001	09-Dec-2014	3,682,433.00	77.85	286,677,409
Wl007	17-Dec-2015	11,069,711.00	78.70	871,186,256
BW008	20-Dec-2015	1,198,478.59	78.70	94,320,265
BW013	30-Jun-2016	3,889,762.94	78.40	304,957,414
BW011	02-Oct-2016	1,627,548.73	78.40	127,599,820
BW017	27-Nov-2016	3,567,316.77	78.65	280,569,464
		25,035,251.03		**1,965,310,629**

Grant Imprest Account

Appl. No	Date	US$	Rate	BDT
WG002	09-Dec-2014	1,189,354.00	77.85	92,591,209
WG007	17-Dec-2015	20,651.00	78.70	1,625,234
WG008	04-Oct-2016	319,995.00	78.40	25,087,608
ED002	24-Nov-2016	43,392.97	78.63	3,411,989
ED006	24-Nov-2016	341,134.29	78.63	26,823,389
		1,914,527.26		**149,539,429**

Reimbursement

Dir.Pay Applic	Date	Category	ADB and GoN	
			US$	(BDT)
BW009/BW010	23-Feb-2016	6A	204,145	15,836,549
BW012/ED003	20-Mar-2016	6A	302,979	23,503,567
BW014	23-Jun-2016	5	95,517	7,488,568
BW015/ED004	29-Jun-2016	6A	374,096	29,020,474
BW016/ED005	29-Jun-2016	6A	306,512	23,777,655
BW001 (LC)	30-Jun-2016	2	6,608,123	514,111,953
Totals			**7,891,372**	**613,738,766**

Total Disbursement

Currency	ADB & GON
BDT Mil	2,729
US$ Mil	34.84

Total Disbursement is the sum of the ADB Loan and Grant Imprest Account deposits, plus the total ADB & GoN Reimbursment amount.

Appendix-C Administrative Details

Table C-1 Utilization of Consultant Person-Months

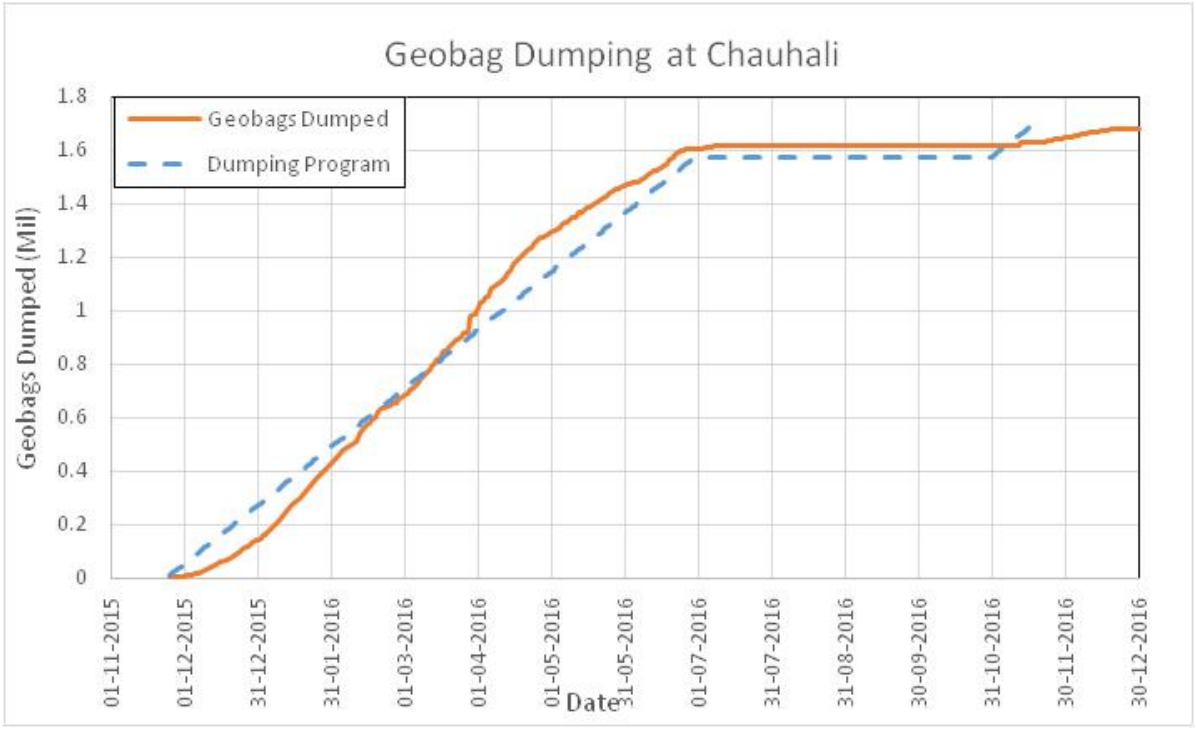
No.	Position	Firm	Name	Person-Months		
				Contract	Used	Balance
	MAIN TEAM - INTERNATIONAL					
I-1	Team Leader / River Mangement Specialist	NHC	Knut Oberhagemann	35.0	11.63	23.37
I-2	Institutional Development Specialist	EMM	Robert A. van de Putte	5.0	1.45	3.55
I-3	Morphologist	DELTARES	Eric Mosselman	5.0	1.67	3.33
I-4	River Engineer	NHC	Bruce Walsh	10.0	1.77	8.23
I-5	Construction / Quality Control Engineer	EMM	R. Mahendrarajah	24.0	0.00	24.00
I-6	Flood Disaster Risk Management Specialist	NHC	Dave Burkholder	12.0	4.70	7.30
I-7	Social Development / Resettlement Specialist	EMM	Jean Louis Leterme	8.0	6.09	1.91
I-8	Economist	NHC	John D. M. Roe	3.0	0.00	3.00
I-9	Financial Management Specialist	EMM	J. Spurr	1.5	0.00	1.50
I-10	Hydrologist	NHC	Derek Stuart	3.0	1.34	1.66
I-11	Environmental Specialist	EMM	Wandert Benthem	7.0	1.82	5.18
I-12	Information and Data Management Specialist	NHC	Dave Burkholder	4.0	3.92	0.08
I-13	Int'l Construction Advisor-Engineer	NHC	Graeme Vass	3.0	3.00	0.00
I-13	Junior Engineer	NHC	Jesper Mathiesen	2.0	3.29	**-1.29**
I-13	Numerical Modeller	NHC	Angela Thompson	3.0	5.27	**-2.27**
			Totals	**125.50**	**45.95**	**79.55**
	MAIN TEAM - NATIONAL					
N-1	DTL / Flood & Erosion Risk Management Spec.	EMM	Sharif Al Kamal	41.5	14.29	27.21
N-2	Institutional / Capacity Development Specialist	RPMC	Dr. M. A. Qassem	10.0	7.35	2.65
N-3	River Engineer (Morphologist)	CEGIS	Dr. Maminul Haque Sarker	8.0	6.62	1.38
N-4	Community-based Flood Risk Mngt. Spec.	RPMC	Quazi Towfique Islam	36.0	14.22	21.78
N-5	Resettlement Specialist	EMM	Shireen Akhter	15.0	1.86	13.14
N-6	Project Economist	RPMC	Amiul Islam	7.0	6.45	0.55
N-7	Procurement Specialist	RPMC	A. Abdullah Chowdhury	10.0	0.00	10.00
N-8	Construction Engineer	RPMC	Mirza Harunar Rashid	32.0	11.52	20.48
N-9	Financial Management Specialist	EMM	Md. Habibur Rahman/**Ektedar Rahman**	12.0	2.45	9.55
N-10-1	River Engineer Flood Management Infr.- 1	RPMC	Mukhles uz zaman	12.5	11.49	1.01
N-10-2	River Engineer Flood Management Infr. -2	RPMC	Md. Motiur Rahman	12.5	6.50	6.00
N-11	Social Development and Gender Specialist	EMM	Ruh Afza Ruhi/**Begum S. Nahar**	12.0	4.45	7.55
N-12	Environment Specialist	RPMC	Dr. Md. Nurul Islam/**Md. Amir Faisal**	16.0	5.83	10.17
N-13	Training Coordinator	EMM	Jahangir Kabir/ **Shameem Ahmed**	14.0	10.53	3.47
N-14	Information and Data Management Specialist	EMM	Asrafuzzamen	15.0	0.00	15.00
N-15	Hydraulic Structural Engineer	RPMC	Md. Dabir Uddin	10.0	0.00	10.00
N-16	Road Engineer	RPMC	Zakir Hossain	6.0	1.03	4.97
N-17	Geotechnical Engineer	EMM	Md. Korban Ali	7.0	0.00	7.00
N-18-1	Site Engineer 1 (PRB-1)	RPMC	Md. Nurul Amin	36.0	13.21	22.79
N-18-2	Site Engineer 2 (JLB-2 Chauhali)	RPMC	KM Nazmul Haque/ **Ekram Sarder**	36.0	8.20	27.80
N-18-3	Site Engineer 3 (JLB-2 Zaffarganj)	EMM	Md Faridul Alam	36.0	8.54	27.46
N-18-4	Site Engineers 4 (PLB-1 Harirampur)	EMM	Abdul Jalil/**Saiful Islam**	36.0	8.04	27.96
			Totals	**420.50**	**142.58**	**277.92**

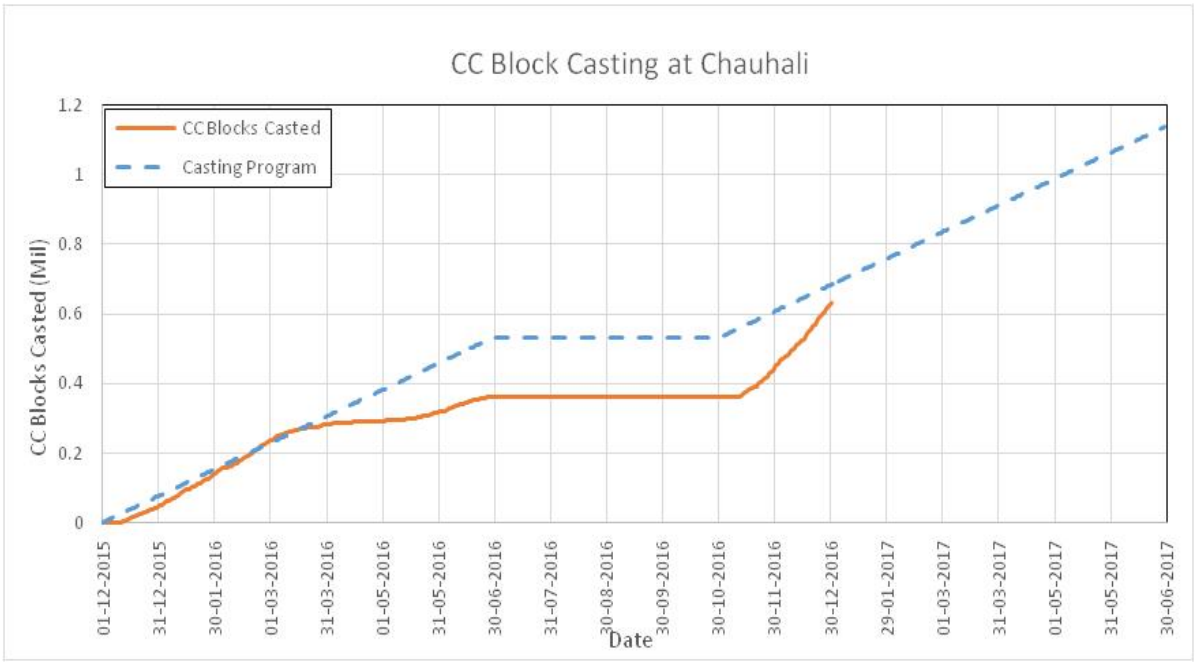
Table C-1 Utilization of Consultant Person-Months continued ...

	RIVER STUDY TEAM - INTERNATIONAL					
IR-1	Task Leader / Flood & River Management Spec.	NHC	Carsten Stuab	10.0	9.99	0.01
IR-2	Institutional Development Specialist	EMM	Robert A. van de Putte	3.0	0.33	2.67
IR-3	Morphologist	DELTARES	Sanjay Giri	7.0	1.79	5.21
IR-4	River Engineer (River Training)	NHC	Gerritt Klaassen	7.0	4.20	2.80
IR-5	Water Resources Management Specialist	DELTARES	W. J. Oliemans	5.0	0.79	4.21
IR-6	Economist	EMM	Alexander Mueller/**John D.M. Roe**	4.0	1.80	2.20
IR-7	Social / Regional Development Specialist	NHC	Mark Hopkins	5.0	5.01	-0.01
IR-8	Environmental Specialist	EMM	Wandert Benthem	4.0	1.87	2.13
IR-9	Hydrologist	NHC	Malcolm Leytham	5.0	0.93	4.07
			Totals	**50.00**	**26.71**	**23.29**
	RIVER STUDY TEAM - NATIONAL					
NR-1	Water Resources Management Specialist	RPMC	G M Akram Hossain	10.0	9.97	0.03
NR-2	Flood Management Specialist	RPMC	Md. Makbul Hossain	6.0	7.55	**-1.55**
NR-3	River Engineer (Morphologist)	CEGIS	Dr. Maminul Haque Sarker	9.0	2.66	6.34
NR-4	Economist	EMM	Dr. Shaker Ahmed	4.0	0.00	4.00
NR-5	Regional / Spatial Planner	RPMC	Dr. Shamim M Haque	4.0	3.37	0.63
NR-6	Institutional Development Specialist	RPMC	Dr. M. A. Qassem	4.0	4.00	0.00
NR-7	River Engineer	RPMC	Md. Motiur Rahman Jewel	8.0	7.84	0.16
NR-8	Hydrologist	EMM	Imdadul Haque Siddiqui	6.0	0.00	6.00
NR-9	Social Development and Gender Specialist	EMM	Ruh Afza Ruhi/**Begum S. Nahar**	5.0	4.27	0.73
NR-10	Environment / Climate Change Specialist	EMM	Md. Rakibul Haque	5.0	0.00	5.00
NR-11	Water Supply and Water Quality Specialist	EMM	Md. Mozammel Hossain	5.0	0.00	5.00
NR-12	Agriculture Specialist	RPMC	Dr Quazi Reasul Islam	4.0	3.12	0.88
NR-13	Fishery Specialist	RPMC	Dr. Md. S. Howlader	3.0	3.00	0.00
			Totals	**73.00**	**45.78**	**27.22**

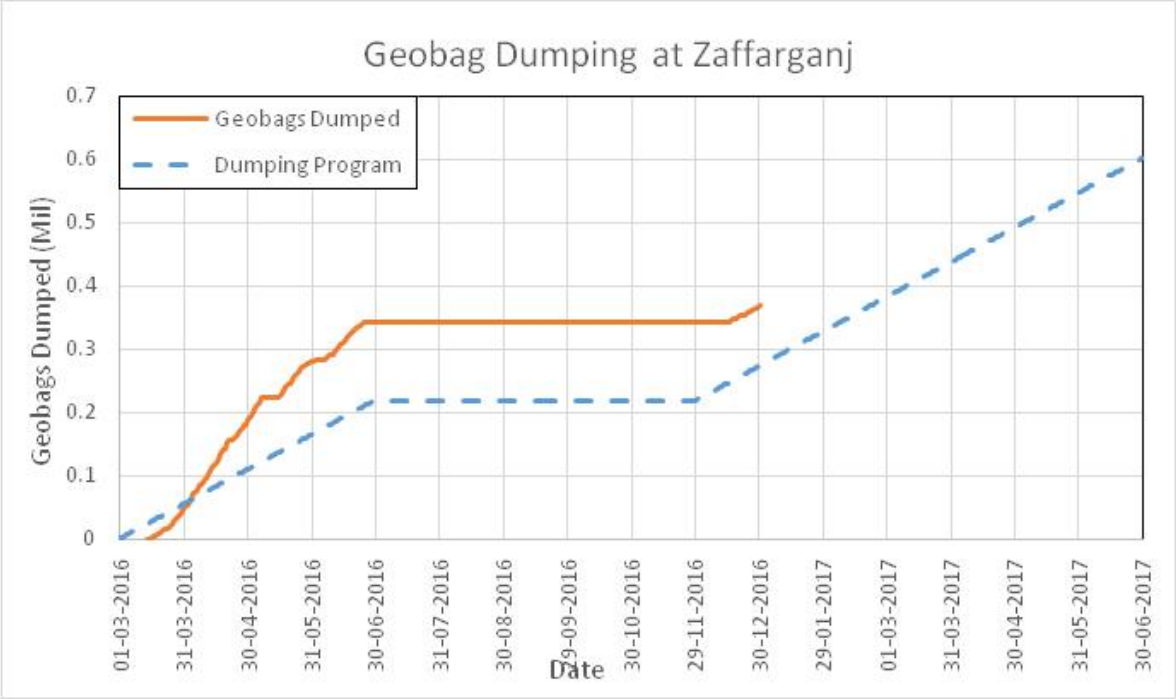
Appendix-D Construction Progress Charts

Chauhali





Zaffarganj


Geobag Dumping at Zaffarganj
Geobags Dumped
Dumping Program
Geobags Dumped (Mil)
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0.6
0.5
0.4
0.3
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0
01-03-2016
31-03-2016
30-04-2016
31-05-2016
30-06-2016
31-07-2016
30-08-2016
29-09-2016
30-10-2016
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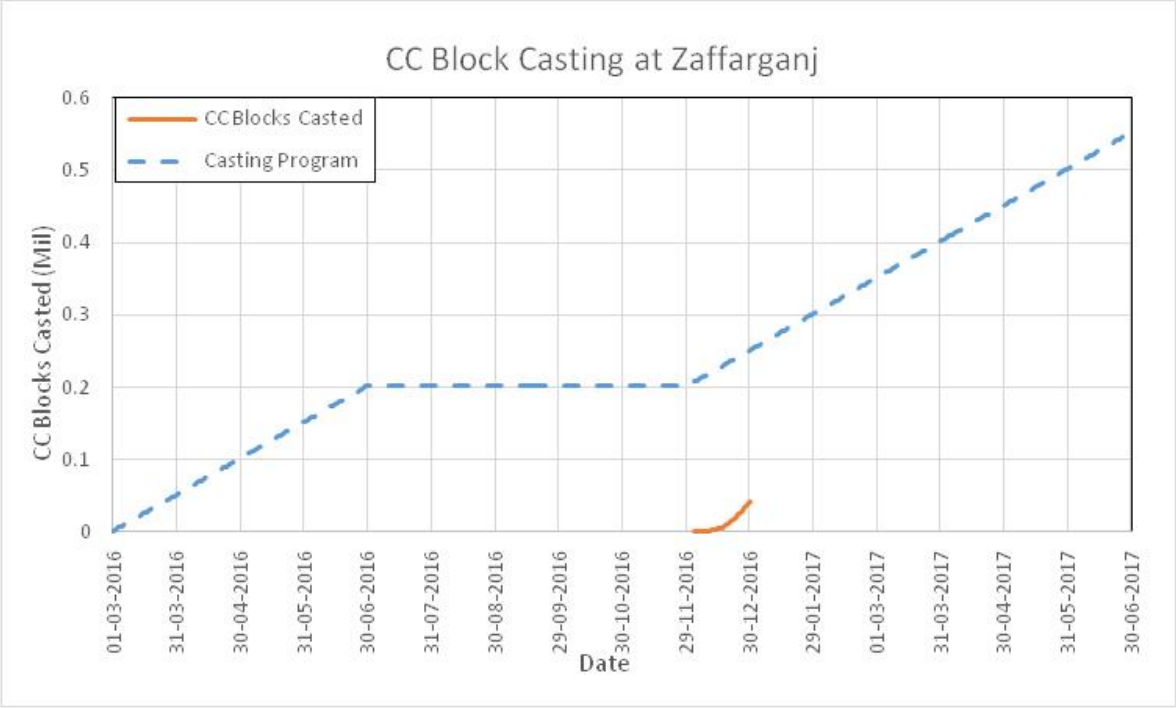
31-03-2017
30-04-2017
31-05-2017
30-06-2017
Date


CC Block Casting at Zaffarganj
CC Blocks Casted
Casting Program
CC Blocks Casted (Mil)
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01-03-2016
31-03-2016
30-04-2016
31-05-2016
30-06-2016
31-07-2016
30-08-2016
29-09-2016
30-10-2016
29-11-2016
30-12-2016
29-01-2017
01-03-2017
31-03-2017
30-04-2017
31-05-2017
30-06-2017
Date

Table D-1: Implementation Progress of Training Activities

Capacity Building, PMO

BWDB Capacity Development Program (As per DPP)		Total		Implementation Progress				Observations
Sl.	Description	Courses	Trainees	Discussed[2]	Prepared	Approved	Completed	
A. Local Training								
1	River Engineering	2	40	2	2	2	2	April 2016 by BUET
2	River Training Techniques	2	40	2	2	2		January- February 2017
3	Riverbank Geotechnical Stability	2	40	2	2			BUET with International Resource Persons
4	Riverbank Protection	2	40	2	2			BUET with International Resource Persons
5	Strategic Planning	2	40	2				BUET with International Resource Persons
6	Survey and Evaluation	2	40	2				Pursuing with leading survey organization
7	Underwater Investigations	1	20	1				Talked To Mr. Atique to organize
8	Resettlement	2	30	2				To be reconsidered during Mid-Term Review
9	Environment	2	30	2				One training done by ISPMC at 3 sites
10	Leadership	2	40	2	2			February 2017 to be organized by BIM
11	Project Management	2	40	2	2			March 2017, to be organized by BIM
12	Construction Management	2	40	2				Trying to organize the Training by FIDIC or equivalent
13	Technology Transfer (counterpart)	9	9					Scope yet to be finalized
14	Capacity Building for DDM	2	30	2				To be reconsidered during Mid-Term Review
Sub Total		**34**	**479**	**25**	**12**	**4**	**2**	
B. Overseas Training								
1	River Morphology	1	8	1	1	1	1	September 2016, IHE (Netherlands)
2	River Training Techniques	1	8	1				2017, IHE (Netherlands) Scope to be finalized
3	Financial Management	1	5					To be reconsidered during Mid-Term Review
Sub Total		**3**	**21**	**2**	**1**	**1**	**1**	
C. Overseas Study Tour								
1	North America[1]	1	10	1				Subjects to be determined
2	China[1]	1	10	1	1	1	1	16-24 August-2016,
	China (Not in DPP)	0	?	0				Additional Technical China Tour scheduled
3	India[1]	1	10	1				17- 27 April, 2017, Conference, Delhi & visit Assam
Sub Total		**3**	**30**	**3**	**1**	**1**	**1**	
PMO Totals		**40**	**530**	**30**	**14**	**6**	**4**	

[1] To include one official from MoWR, Planning Commision, ERD and IMED, and six from BWDB.

[2] Training course discussed with PD, other PMO officials, and the executing agency in charge of training.

Table D-1: Implementation Progress of Training Activities continued ...

Capacity Building, ISPMC, Under DPP provisional Sum

BWDB Capacity Development Program (As per DPP)		Total		Implementation Progress				Observations
Sl.	Description	Courses	Trainees	Discussed[2]	Prepared	Approved	Completed	
Line-1: Workshops, Traininig and Seminars (DPP provisional Sum)								
A.	**Workshops**							
1	Workshop on Draft Inception Report	1	123	1	1	1	1	09 Dec 2015, Pan Pacific Sonargaon
2	Workshops on Capacity Strengthening	1	30	1	1	1	1	28-Oct-2016, Pan Pacific Sonargaon
3	National Workshop on Draft River Stabilization and Preliminary River Management Master Plan for the Jamuna-Padma-Meghna Rivers	1	140	1	1	1	1	07-Dec-2016, Pan Pacific Sonargaon
4	Followup Workshop on Draft Master Plan	1	110	1	1	1	1	08-Dec-2016, BWDB Board Hall.
5	Workshop site selection project 2	1		1				Subjects to be determined as per need
6	Workshop feasibility study	1		1				
7	Workshop for BWDB design, planning & monitoring officials	1		1				
	Sub Total	**7**	**403**	**7**	**4**	**4**	**4**	
B.	**Training:**							
1	Environment at 3 sites	3	30	3	3	3	3	26 28 April 2016, Chauhali, Horirampur & Zaffarganj
2	Training for Task Force on Sand-fill of Geotextile bags at WAPDA Bhaban	1	30	1	1	1	1	22-Dec-2016, BWDB Board Hall.
3	**Special Training** on geotechnical training including software use	1	20	1	1			February 2017, BWDB Training Centre, Bagyakul
4	Special Training on barriers	1	20	1				February 2017, BWDB Training Centre, Bagyakul
5	Special Training on geotextile applications in hydraulic engineering	1	20	1				March 2017, BWDB Training Centre, Bagyakul
	Sub Total	**7**	**120**	**7**	**5**	**4**	**4**	
C.	**Seminars**							
1		1						Subjects to be determined
	Sub Total	**1**	**0**	**0**	**0**	**0**	**0**	

[2] Training course discussed with PD, other PMO officials, and the executing agency in charge of training.

Table D-1: Implementation Progress of Training Activities continued ...

Capacity Building, ISPMC, Under DPP provisional Sum

BWDB Capacity Development Program (As per DPP)		Total		Implementation Progress				Observations
Sl.	Description	Courses	Trainees	Discussed[2]	Prepared	Approved	Completed	
Line- 2: Conferences and Study Tours (DPP provisional Sum)								
A.	Conferences							
1	International Conference on Scour and Erosion	1	3	1	1	1	1	12-15 Sep-2016, Oxford,UK
2	International Conferences and Seminars	1	1	1				Subjects to be determined
3	Local conference: based on the capacity assessment of target participants (PMO, PIUs, contractors & other stakeholders	1	20	1	1	1	1	March-2016, Hotel Sonargaon
4	Local conference: DG Presentation	1	20	1	1	1	1	June-2016, Hotel Lake Castle
Sub Total		4	44	4	3	3	3	
B.	Study Tours							
1	Study Tour NW Europe	1	7	1				Subjects to be determined
Sub Total		1	7	1	0	0	0	
ISPMC Totals		20	574	19	12	11	11	

[2] Training course discussed with PD, other PMO officials, and the executing agency in charge of training.

Appendix-F Summary of National Workshop, 7 December 2016 Draft River Stabilization and Preliminary River Management Master Plan for Jamuna Padma and Meghna Rivers

Speeches:

The PD, FRERMIP, BWDB, A M Aminul Haque welcomed all participants to the National Workshop on the draft River Stabilization and preliminary River Management Master Plan for Jamuna Padma and Meghna Rivers. After explaining the background of the FRERMIP, the PD showed a short film summarizing the issue of river instability and BWDB's activities towards riverbank stabilization and land reclamation. The PD specifically highlighted the need to reduce the cost for riverbank protection further: while the important underwater part only requires 40% of the cost, 60% are spent on the hard cover layer above low water. Here FRERMIP intends to pilot new technologies to reduce the overall expenditure to the government.

The Team Leader focused in his presentation (attached) on three main issues:

(i) The delineation of the different study parts from more global (preliminary river management master plan), to river centric (river stabilization study), and direct implementation (Project-2);

(ii) The master plan will comprise seven key thrusts translating from a river centric approach to provide a corridor first, associated with land reclamation, stable flood protection, and distributary offtakes, as well as navigation, productive land use – particularly peri-urban development around Dhaka, and environmental enhancement;

(iii) The proposed approach compares well with international experience and is favourable in terms of cost. A 25-year investment plan will amount to some USD 4 billion.

After the presentation, special and chief guests held their speeches:

The Secretary, Ministry of Water Resources appreciated the two deliberations. He explained the government position on river stabilization and his role in providing an enabling environment for implementation. In this context he asked the Project Director to provide a summary of the world-wide experience to bring this to the attention of higher Government levels.

The Cabinet Minister, Ministry of Water Resources pointed to the difficulties when dealing with large forces of nature and their importance to the development of Bangladesh, with respect to food production through flood risk reduction and irrigation. The good progress Bangladesh has achieved with currently 7.1% annual GDP growth allows allocation of larger budgets to larger tasks. In this context, river stabilization has to be seen. The Minister agreed with the concept of the draft plan and observed that "what we have seen today is probably the beginning of the plan". Notwithstanding international experience, the rivers in Bangladesh are different in a number of ways, which needs to be accounted for.

There is no doubt that river stabilization with some 1,500km² of land reclamation in the heart of the country is very beneficial, much more than the around 1,000km² of land accreted in the Bay of Bengal, at the periphery of Bangladesh. Naturally, the land-use and land ownership need to be clarified beforehand to avoid that the land is turned back into a patchwork of less productive small plots. This reclamation would end the misery of the riverine population, large number of whom have been displaced and live as floating population in Dhaka. River stabilization will support the Vision 2041 to bring Bangladesh to developed country status. The FRERMIP has provided cost effective work with very good results, and is hoped to continue. In this context the Minister thanked the development partners.

The Director General, Bangladesh Water Development Board reminded the participants of the suffering of the population along the river and the large implication on Flood Control, Drainage, and Irrigation Schemes. A large number of embankment squatters not only lives in misery but also prevents effective embankment maintenance. The wider and wider rivers do not allow for navigation. The population does not want flooding and erosion, but to live their lives in peace. This

requires a Master Plan and investment plans, followed up with direct interventions, as planned under the Project-2, envisaged by BWDB. At the end of his speech the Director General thanked the development partners for financing this initiative, and the consultants for their untiring efforts. After the tea break three experts presented experience with river training from three continent. Mr. Rob Davinroy formerly US Army Corps of Engineers, provided experience from the Mississippi River, which was gradually narrowed and systematically trained. For the Mississippi different technologies were developed: while the upstream reaches make use of inexpensive rock, the downstream reaches depend on Articulate-Concrete-Mattresses produced and placed with very large mechanized equipment. In addition, different training structures are placed to improve navigability. He highlighted that embankments can be well built with sand, as the US experience of using only clay leads to very expensive works.

Question	**Answer**
Prof. Matin, BUET asked if the catchment is within the US	This is confirmed. The Missouri is dam controlled.
Harun-Ur-Rashid, SE Design Circle-2 wanted to know if only clay is recommended for flood embankments	The answer is no, sand is good, too provided it is well compacted.
Abu Saleh Khan, IWM suggested that Bangladesh can learn from the experience to avoid similar mistakes.	This is confirmed. An important additional point for Bangladesh is that a narrower, deeper river will reduce evaporation losses and provide more water overall.
Khaleduzzaman, RNE pointed to the problems with high riverbed levels in New Orleans and proposed tidal river basin management from Bangladesh and moving New Orleans to another place.	The river has aggraded in the New Orleans area, which is a problem with all rivers. The economy dictates dredging here, while in the upstream reaches dredging could be largely eliminated.

Mr. Hendrik Havinga provided background on the Rhine River. The upper part along the German-French border was braided in 1828 and turned into a meandering river by 1872. In 1963 a canal was operated on the French side for navigation to mitigate the incision resulting from the training works. In the downstream deltaic region, covered by the Netherlands, different stages of interventions can be distinguishes:

(i)	13th century	embankment construction
(ii)	18th century	Pannerdensch canal (defined bifurcation for flow distribution)
(iii)	19th century	groyne construction for navigation
(iv)	19th and 20th century	gradual narrowing of the channel for navigation
(v)	end 20th century	bend measures, fixed bed, and bendway weirs
(vi)	end 20th, early 21st century	nature restoration, room for the river, further narrowing, by-passes, longitudinal dikes (new development)

50% of all goods in The Netherlands are transported on rivers. Stable distributaries are the foundation for all work. It took 100-years to stabilize the flow distribution of the Pannerdensch canal, which was also the origin of the Rijkswaterstaat, the Dutch counterpart to the BWDB. Flood protection work follows a 1,250 year return period, which has an aggregate probability of exceedance of 1% in 100-years, and is therefore believed to be sufficiently unlikely. Since 1926 there has been no flooding or breaching of the embankments.

Question	**Answer**
Rob Davinroy pointed out that no flooding since 1926 is a tremendous economic success.	The flood risk was reviewed and improvement measures introduced, such as room for the river to lower flood levels

Harun-Ur-Rashid, SE Design Circle 2 asked why the embankments were strengthened over time.	Embankment construction developed gradually, with several phases of strengthening depending on changing design conditions. In this context it remains important to maintain good engineering skills in Bangladesh
Akram Hossain, Team Leader ECRRP pointed to the success of safe embankments since 1926.	The 1,250 year design flood was introduced in 1960 and the design discharge changed over time between 15,000 and 18,500m^3/s
Dr. Howlader, FRERMIP asked about measures to increase biodiversity	Side channels, summer dike openings, removed protection work are among the measures to enhance the natural habitats.
Dr. Taher Kondokar, DTL IMIP asked if there is private contribution to the maintenance financing.	Maintenance is purely government financed.

Mr. Carsten Staub concluded the specialist presentation with a summary of the stabilization of the Lower Yellow River, that has been successfully achieved over the last 60 years. The Lower Yellow River has important resemblances with the Jamuna-Padma Rivers, and – even more importantly – the stabilization approach applied for the Yellow River is very similar to the approach planned for the Jamuna-Padma. For the Yellow River, even a "learning by doing" approach was used. An important lesson learned is to start from the simpler meandering river reach to the more complex braided river planform.

Question	**Answer**
Harun-Ur-Rashi, SE Design Circle-2 asked to compare all three rivers with the Jamuna	This has been published and important differences, such as the storage of sediment in the upstream Yellow River have to be kept in mind
Abu Saleh Khan, IWM pointed to the India – Bangladesh agreement on basin level management, a potential Brahmaputra barrage influence, and the need for institutional capacity to implement river stabilization. Presently there are only Sirajganj and Chandpur to be maintained and BWDB finds that difficult. What would happen to a large number of works?	Naturally, river stabilization has to be seen in the basin context, but acknowledging that many developments cannot be precisely predicted. In order to limit maintenance cost, more robust construction than at Sirajganj and Chandpur are selected.

Ms. Natsuko Totsuka, ADB appreciated the PMO, BWDB, MoWR, and consultants for implementing the project very nicely, and the RNE as team member. She is very pleased to show good results of bank protection works and expects that the results of the studies will be the basis for future management of the country. She is very glad to be a member of this team. Important points for ADB are:

(i) It takes time and is not a one year job.
(ii) Quick and rushed interventions might hamper the river stability and we have to be patient.
(iii) We need to have a phased and gradual approach starting with a corridor with bank protection works at strategic locations.
(iv) The ongoing Tranche-1 project is a first step and part of a long-term plan with an initial contribution of only USD 0.4 billion out of financing requirements of USD 3.6billion.
(v) She expressed the strong belief that the small contribution is an important part of the country's stabilization.

(vi) The presentation is not the final result and more detailing will take place until April/May 2017

(vii) In parallel the feasibility study for Tranche-2 is expected between March to May.

(viii) The ADB target for Tranche-2 is Q3/Q4, which allows BWDB to do construction from the 2017/18 dry season.

(ix) Then in 2018, Tranche-3 can start and continue until 2023.

(x) ADB is happy to work with BWDB.

Mr. Khaleduzzaman from the Royal Netherlands Embassy congratulated the speakers for their very good presentations. The presented river stabilization plan, with the Minister behind, is now the time as there are no fund problems. We need to distinguish riverbank stabilization and river course stabilization. All three international presentations were on river training, until now we only use revetments. The master plan will focus more on the purpose of river use. Navigation can pay back the huge investment. Industrial and urban centers are necessary. His own calculations show that the benefit of the reclaimed land is in the order of USD 70 to 80 billion. The master plan should consider navigation, resettlement, environmental improvement, shifting industries out of Dhaka, and slum rehabilitation. In future we have an opportunity for pilot works. The banner does not carry the RNE logo, which should be added.

After the speeches of the development partners the open discussion took place. It was chaired by Mr. A.K.M. Momtaz Uddin Ahmed., ADG East.

Question	Answer
Habibur Rahman, PD ECRRP thanks for the presentations and points to the differences between the rivers in Bangladesh and the international ones presented. BWDB does not have expertise. BWDB now has a MoU with China also to study the rivers. Unfortunately, RBIP failed to convince the policy makers, but the China example might be able to do so. RBIP now is in hibernation, FRERMIP has done a good job.	It is agreed that Bangladesh needs to find its own solution to the specific river problems, unparalleled in the world. This notwithstanding, lessons learned from international rivers will be useful to avoid costly mistakes.
Prof. Matin, BUET asked about: (i) The tidal influence in the Mississippi. (ii) Can the braided reach in the Yellow River be compared before and after (iii) It will be appreciated to obtain lessons learned from work in Bangladesh as well (iv) The Rhine is a systematic river, maintained by each country. It needs communication to maintain.	 It is low Yes, data are available This is possible Basin cooperation always has the potential to optimize the benefits
PD Capital Dredging: There are different numbers on sediment load, ranging from 2 billion tons to 1 billion ton.	That is correct and there seem to be a reduction over time. However, reliable measurements end in the mid-1990s.
Dr. Abu Taher Kondokar, DTL IMIP: BWDB does not have river engineering experience	The skill set for training the Brahmaputra System has to be developed largely and nobody in the room has this skill set as of today
Rob Davinroy: River stabilization opens the door for development, for example Mr. Khaleduzzaman, RNE estimated 70 billion benefits. There is lots of sediment going into the Bay today and available for reclamation. Bangladesh is No.7 in natural gas and has resources for development. In the US navigation followed river training and now there is a powerful navigation sector.	Noted

The ADG East closed the workshop with a vote of thanks for the active participation at 2:45PM. He announced that a follow on seminar would be held the day after (Thursday) in the conference room of BWDB on Rhine and Yellow River training attended by BWDB Design, Monitoring, and Planning.

Appendix-G Presentation: River Stabilization and Preliminary Master Plan

FLOOD AND RIVERBANK EROSION RISK MANAGEMENT INVESTMENT PROGRAM PROJECT - I

Workshop on Interim Findings of the

Long-term River Stabilization Study

Preliminary River Management Master Plan

of Jamuna and Padma Rivers including Dependent Areas

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7 December 2016

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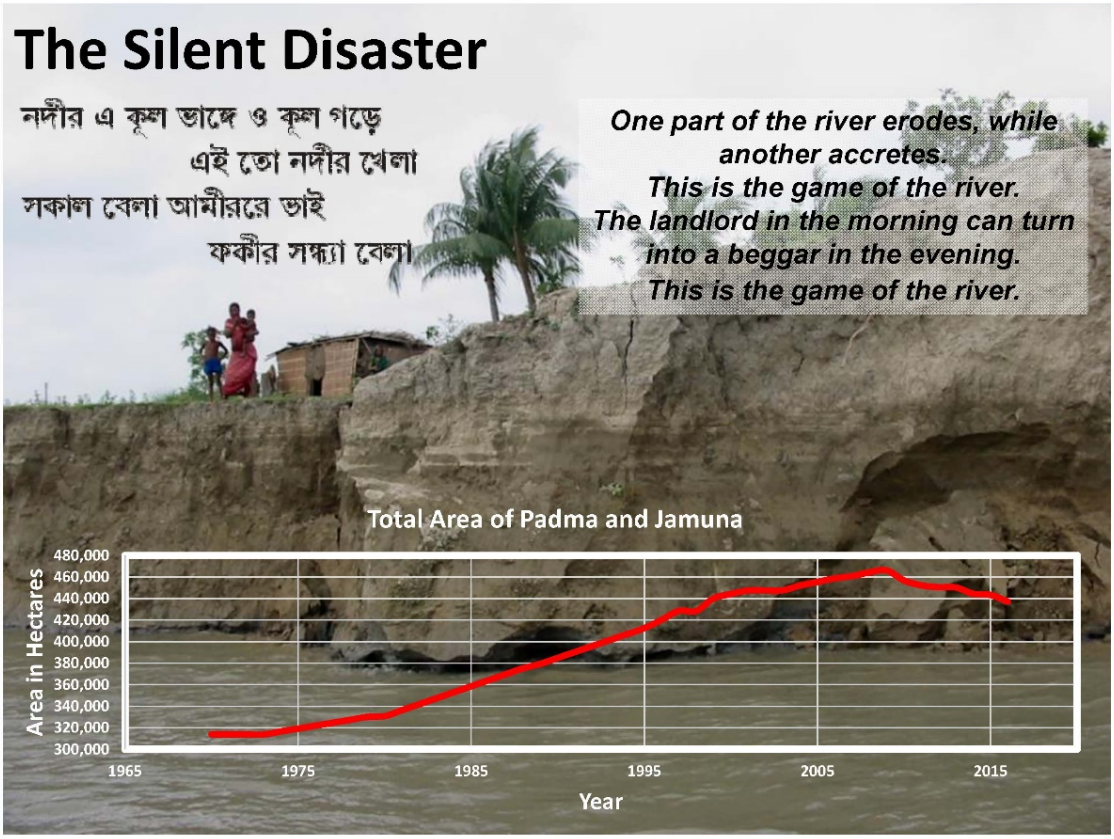

The Silent Revolution

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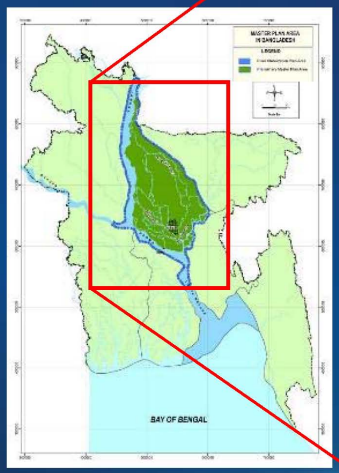
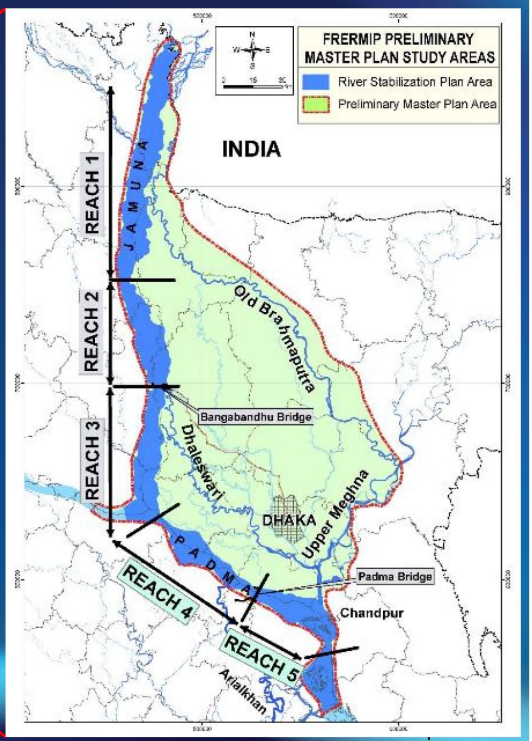
River Stabilization and Master Plan Area





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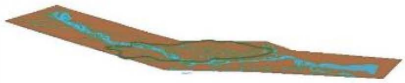
Multi-Dimensional Planning Framework

Projects (BWDB)
- FAP1, 21, 9B,1990s
- JMREMP, 2000s
- FRERMIP, 2014

FRERMIP, Project-2

Brahmaputra System: Main River StabilizationPlans
- FRERMIP, 2014 (MOWR/BWDB)

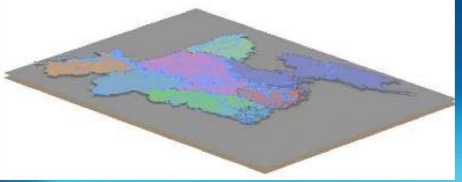


River Stabili-zation Study

River Management Plans (MOWR)
- NWMP, 2004
- Flood Action Plan, 1995
- Capital Dredging, 2015

Preliminary Master Plan

National Plans (Planning Commission)
- Five Year Plans 2015
- Delta Plan, 2016



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2 Classes of Rivers - 2 Types of Problems

Jamuna, Padma, and Lower Meghna (450 km)	Other Rivers (23,000 km)
Widening and too many channels	Siltation and no channels
Multiply dry season channels	Loss of dry season flow
Stable corridor	River restoration
River training	Capital dredging

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Strategic Thrusts

1. Stabilizing the River Corridor
2. Land Reclamation
3. Flood Risk Reduction
4. Navigation Restoration
5. Distributary Restoration
6. Increased Land-based Productivity
7. Environmental Enhancement

River Stabilization Plan

Preliminary Master Plan

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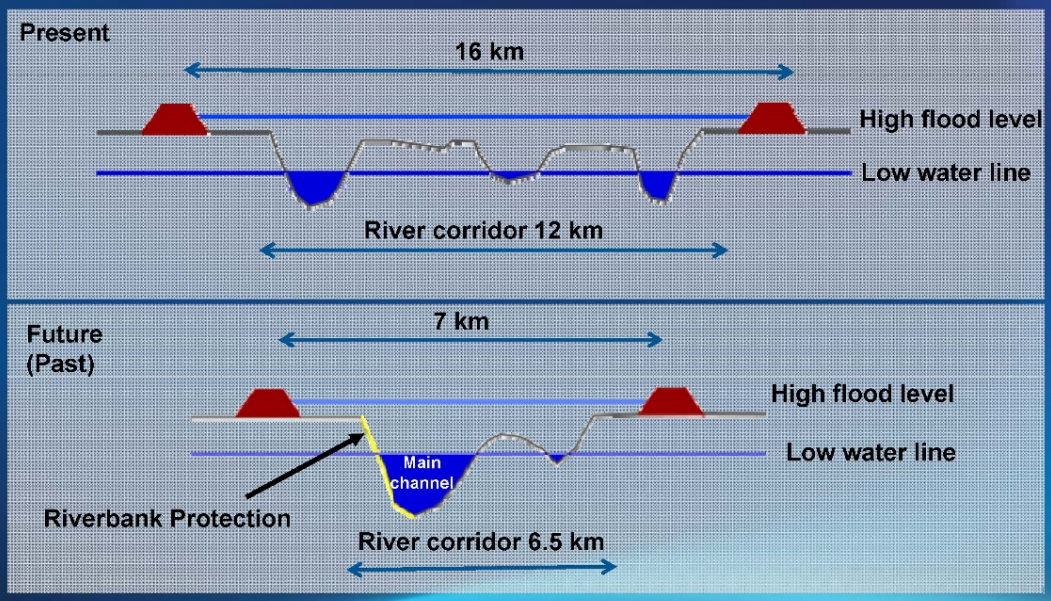
1. Stabilizing the River Corridor (MoWR)



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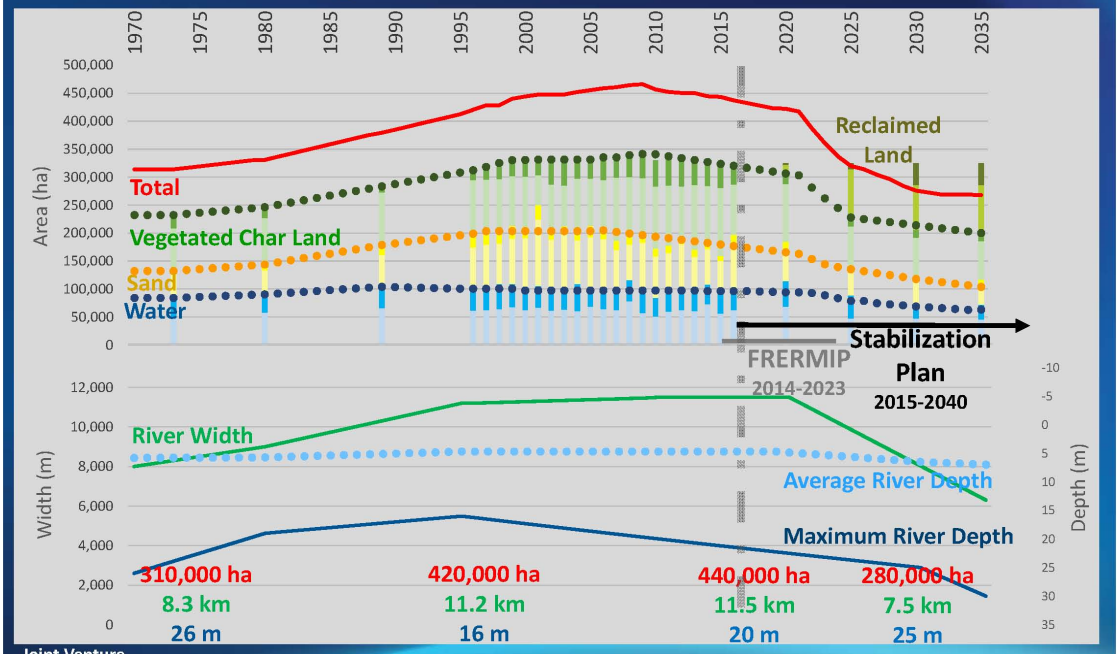
1. Stabilizing the River Corridor (MoWR)



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1. Stabilizing the River Corridor (MoWR)

Core Issues	Rhine	Mississippi	Yellow	BD
River training through bend control		√	√	√
"Learning by doing" over decades / centuries	√	√	√	√
Riverbank stabilization leads to defined channel	√	√	√	√
Mix of river training techniques	√	√	√	√
Strong institution	√	√	√	√

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Yellow River Experience

Bend control stabilizes a braided river

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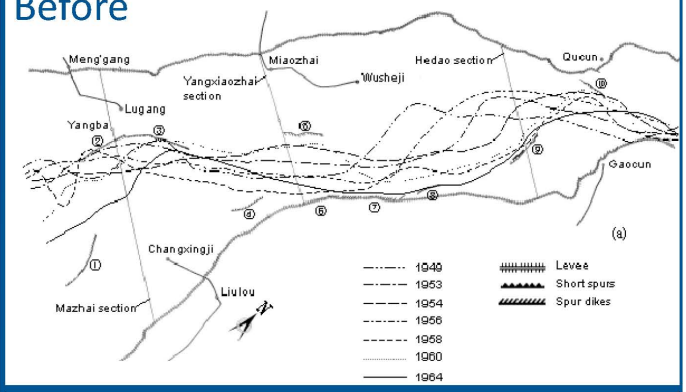
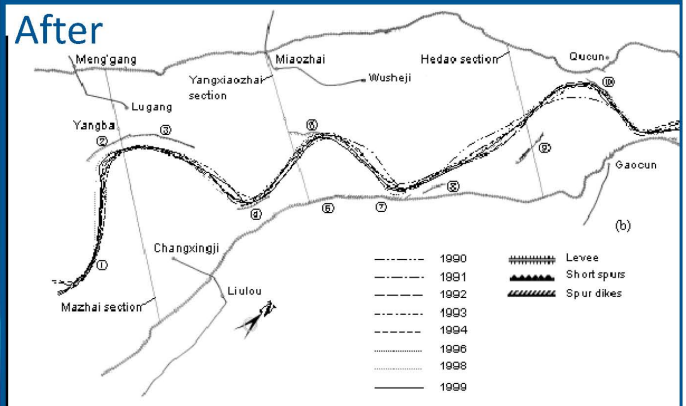
Before

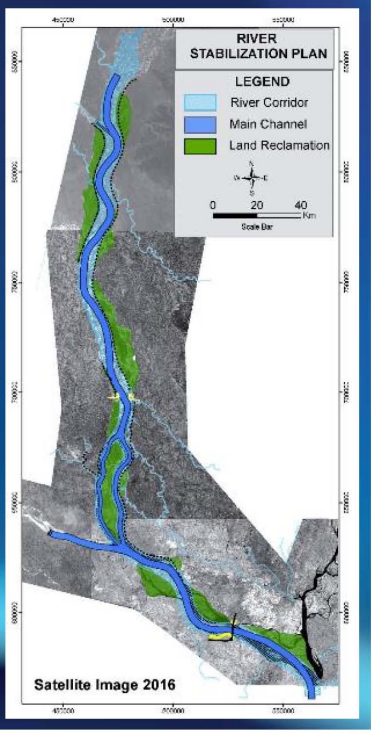


After



1. Stabilizing the River Corridor (MoWR)

- From uncontrolled braided to guided meandering.
- Following the natural river course
- Starting with 2016 morphology and existing works
- Phased investment over 25 years
- Sufficient for design events (floods and sediment wave)



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2. Land Reclamation (MoA, MoL)

Issues

- Land-use zoning
- Ownership policy for reclaimed land

Potential Reclamation (recovery of lost floodplain)

- Left bank 80,000ha
- Right bank 45,000ha
- Center 25,000ha

2,000ha reclaimed 2015/16, Harirampur, Manikganj District

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3. Flood Risk Reduction (MoWR, MoDM, MoL)

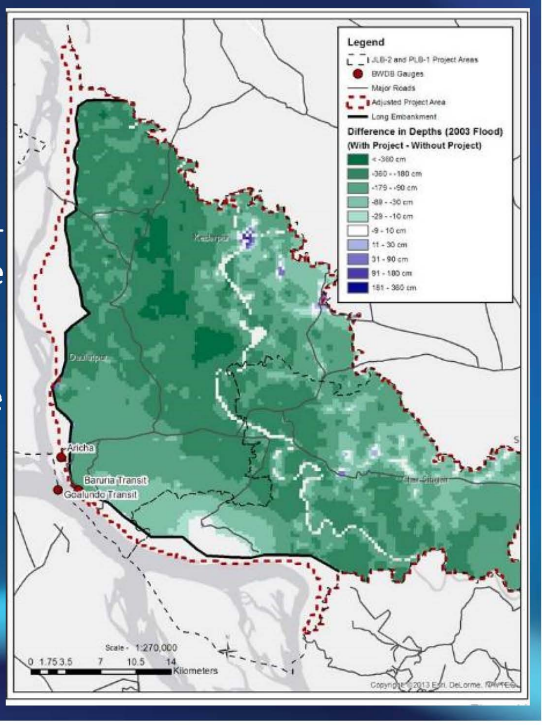
Approach:

- Structural work: 585km of new embankments, 307km (52%) over reclaimed land
- State-of-the-art design for 100-year flood with climate change allocation

Benefits in North-Central Zone

- 500,000ha of land
- 6 million people

protected from flood risk



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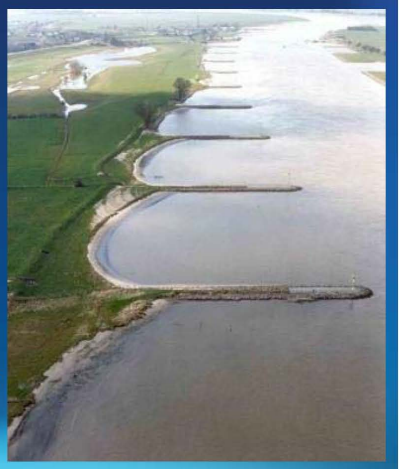
4. Navigation Restoration (MoWR, MoS)

Approach

- Jamuna + Padma and selected distributaries (e.g. Dhaleswari)
- Connecting the Dhaka-Chittagong route with Assam
- Low flow navigation corridor within the river corridor
- Navigation dredging initially and low spurs later



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5. Distributaries Restoration (MoWR)

- Benefits
  - Dry season flow (irrigation, navigation)
  - Water quality improvements
  - Ground water recharge (drinking water, irrigation)
  - Flood management
- Implementation sequence
  - Offtake stabilization
  - Embankment and offtake structure (flood barrier) works
  - River restoration dredging and riverbank protection

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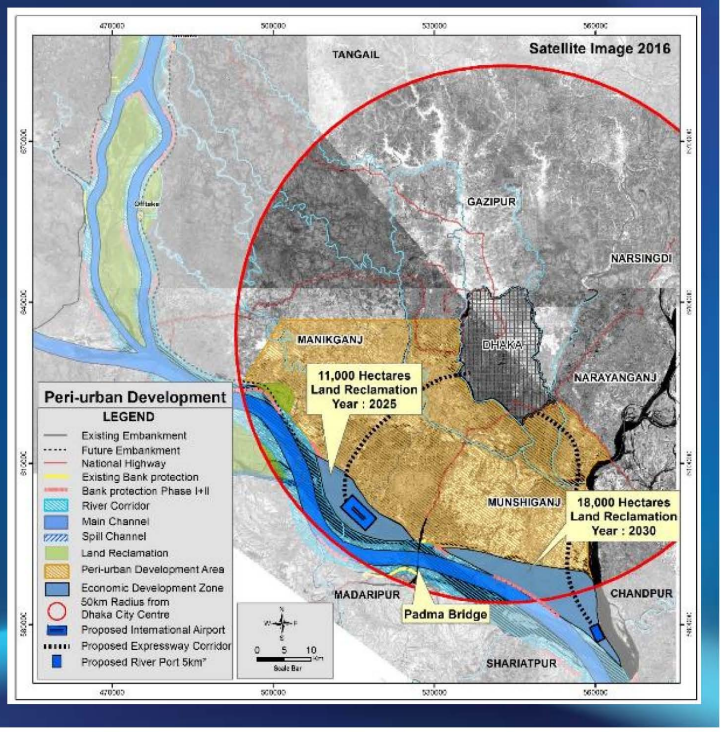
6. Increased Land-Based Productivity (MoA, MoL)

- Intensified agriculture
- Peri-urban development
  - Economic zones
  - Urban areas
  - Express ways
  - Inland ports
  - New airport



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7. Environmental Enhancement (MoE)

Positive Impacts

- Deep water fishery (Hilsha) and dolphin habitat will increase
- Capture fish production will reduce, aquaculture production will increase; overall fish production will increase by about 2.5 m MT
- Dry season distributary flow will increase
- Terrestrial habitat will increase

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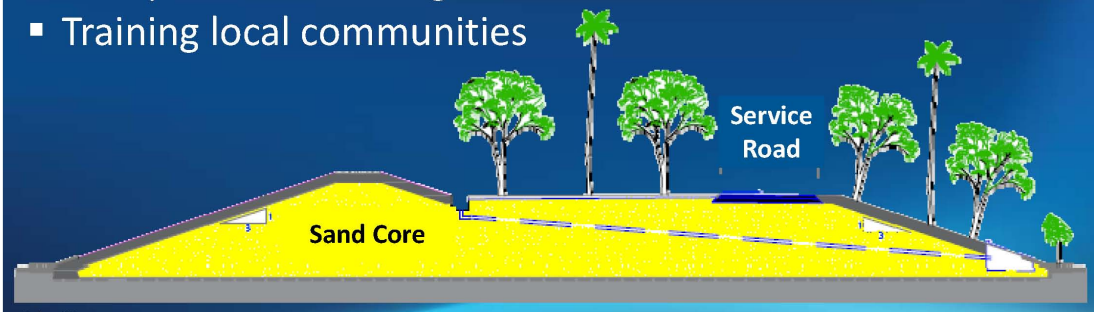
7. Environmental Enhancement (MoE)

Impact Mitigation/ Development Measures

- Regulators and fish passes to maintain river-floodplain connectivity
- Re-excavation of silted channels and beels
- Protected area to support biodiversity and fisheries
- Tree plantations along the embankments
- Training local communities



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Stabilization Investment Plan until 2040

	River	Riverbank Protection [km]	Embankment [km]	Navigation Spurs [km]	Navigation Dredging [million m³]	Other Works
Interventions	Jamuna	191	218	90	110	15%
	Padma	54	242	10	40	15%
	Total	245	460	100	150	15%
Cost (million USD)	Jamuna	955	436	270	328.5	515.9
	Padma	270	484	30	121.5	180.8
	Total	1225	920	300	450	696.7

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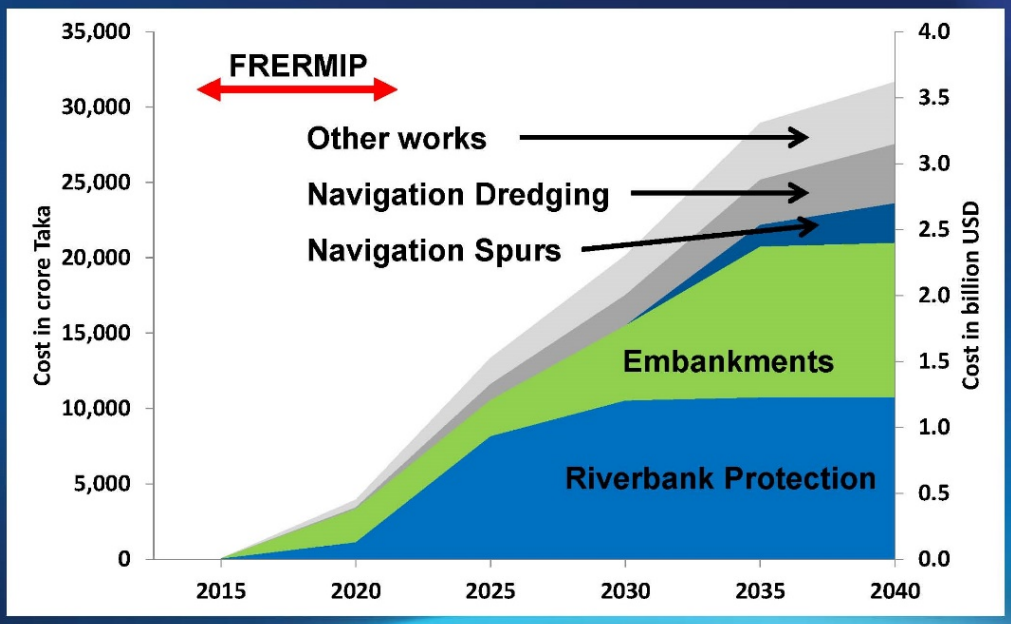
Stabilization Investment Plan until 2040



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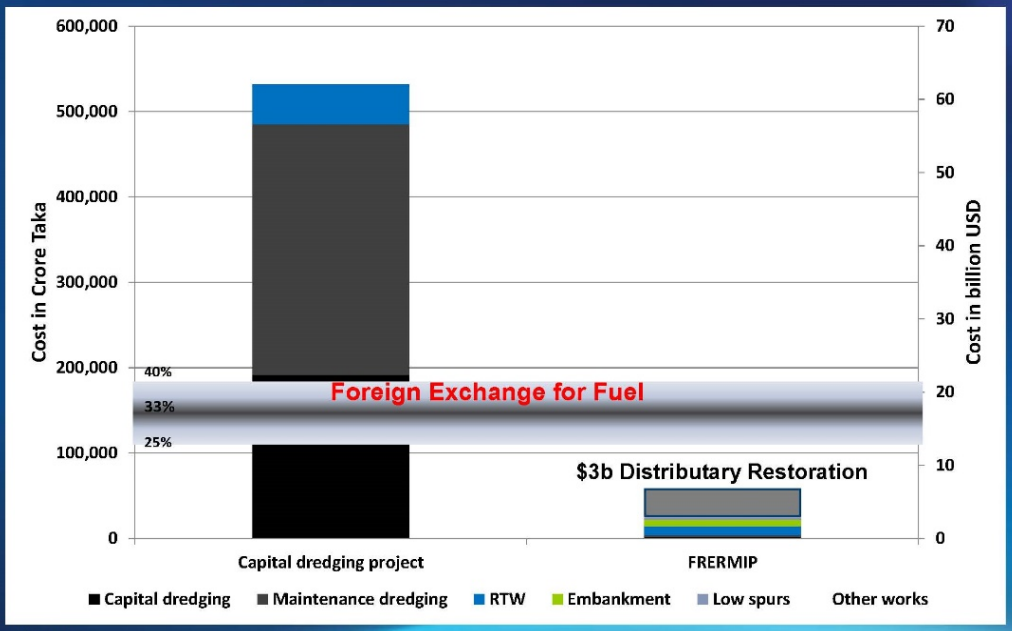
Comparison to Other Works



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Investment Packaging

Financing

- Upstream of Bangabandhu Bridge:
  - RMIP $1.8b (15,000 Crore)
- Downstream of Bangabandhu Bridge:
  - FRERMIP $0.4b (3,000 Crore)
  - Additional $1.4b (12,000 Crore)

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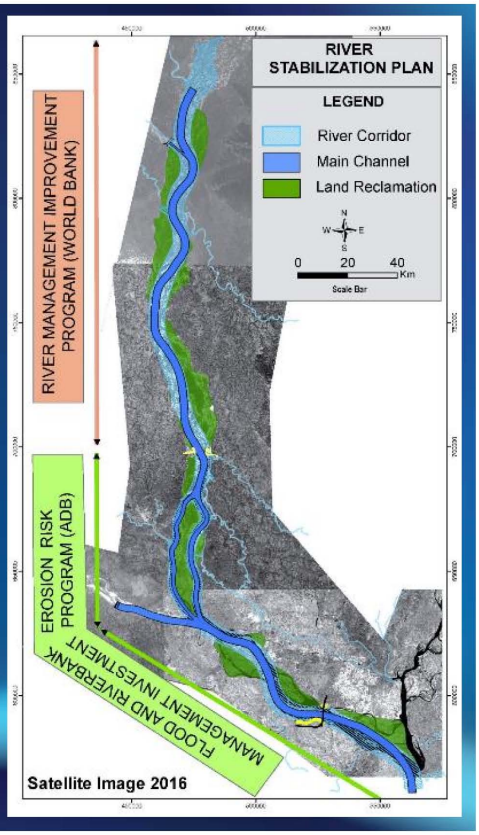

FRERMIP Project-2

- In line with the feasibility study 2013
- Focus
  - River Stabilization at critically eroding areas
  - Lower Jamuna, upper Padma, Chandpur

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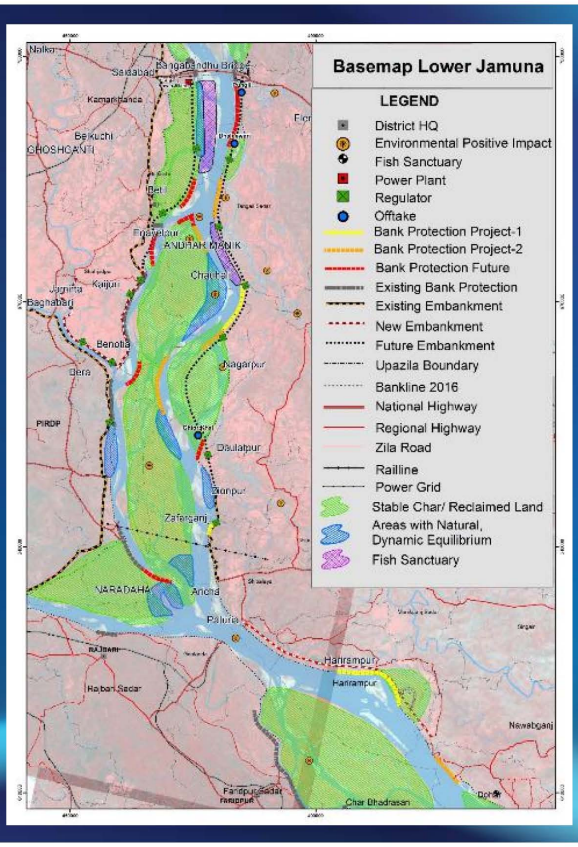
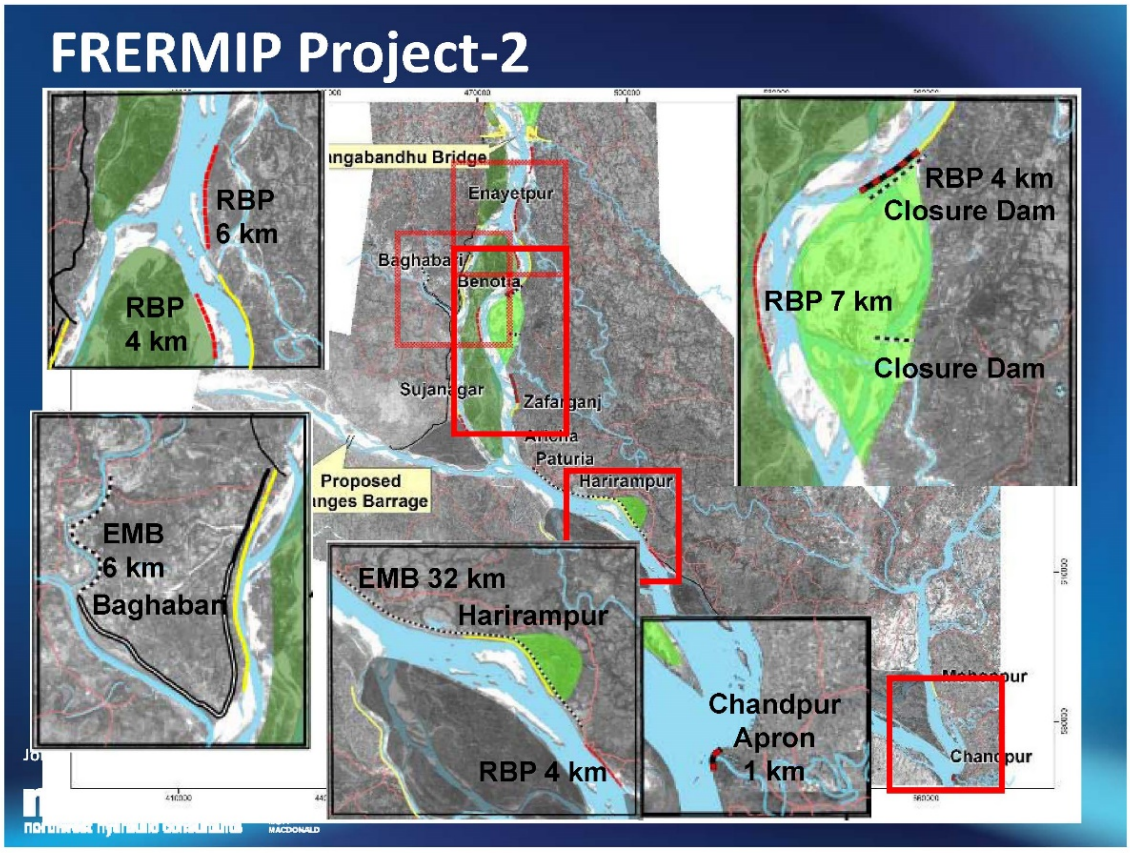


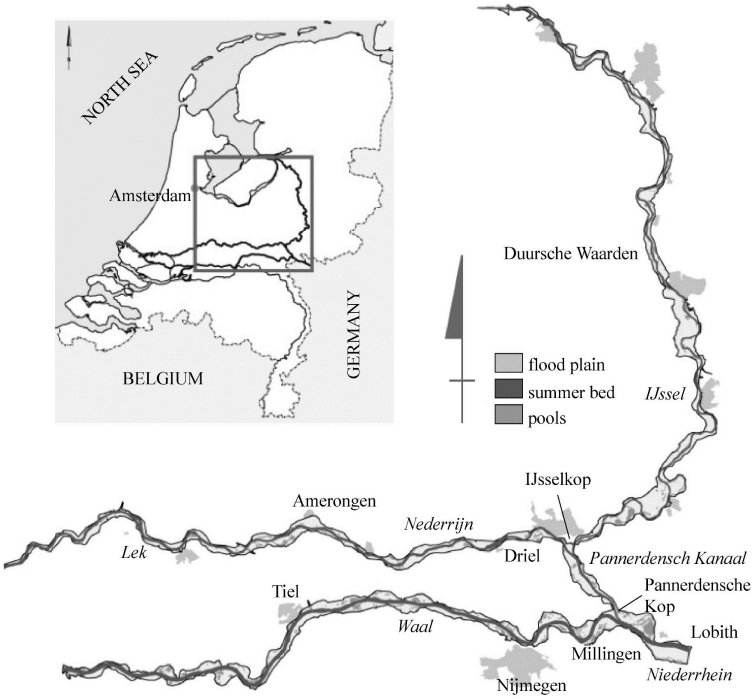

FRERMIP Project-2
RBP
6 km
RBP
4 km
ngabandhu Bridge
Enayetpur
Baghabari
Benotia
Sujanagar
Zafarganj
Paturia
Harirampur
Proposed
nges Barrage
RBP 4 km
Closure Dam
RBP 7 km
Closure Dam
EMB
6 km
Baghabari
EMB 32 km
Harirampur
RBP 4 km
Chandpur
Apron
1 km
Chandpur

Appendix-H Training the Rhine River (Hendrik Havinga)

The Rhine River rises in Switzerland, flows through Germany, partly is a boundary river with France and finally flows through the Netherlands where it forms a delta. Before regular river training works started, the river was of the braiding and meandering type upstream (in Germany) and of the meandering type downstream. The middle reach was determined by rocky sections so not many secondary channels were present there.
A variety of problems were present in the last centuries:

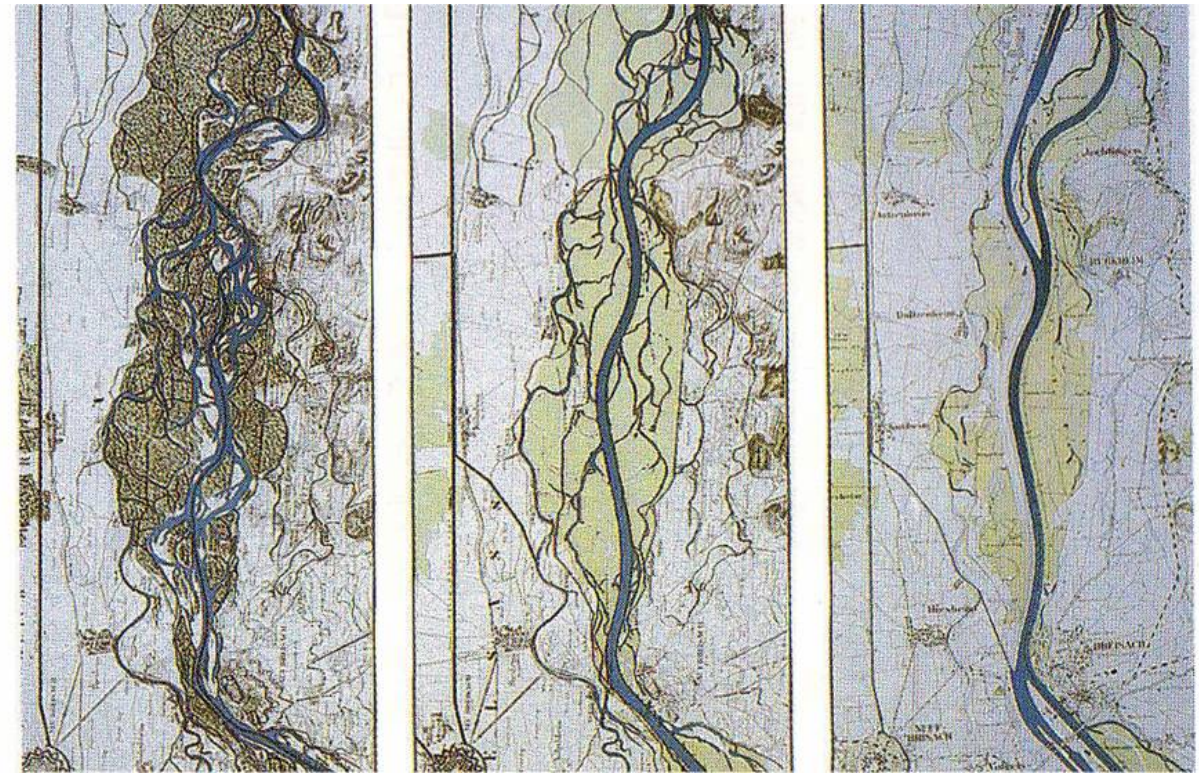
- Flooding caused by ice dams that jam the river.
- Many floods were caused by chars in the off-take of the clogged river distributaries.
- Flooding caused by breaching of weak dikes and (too) low dikes.
- Lack of fresh water in northern branches caused by bad off-take lay-out.
- Many shoals were present caused by secondary channels and the irregular planform of the low water bed, hampering navigation.

Much work has been done to stabilize the discharge and sediment distributions. The training that confined the low waterbed into one channel appeared very important to stop the breaching of embankments by ice dams. It also served a good development of inland navigation on the Rhine River.



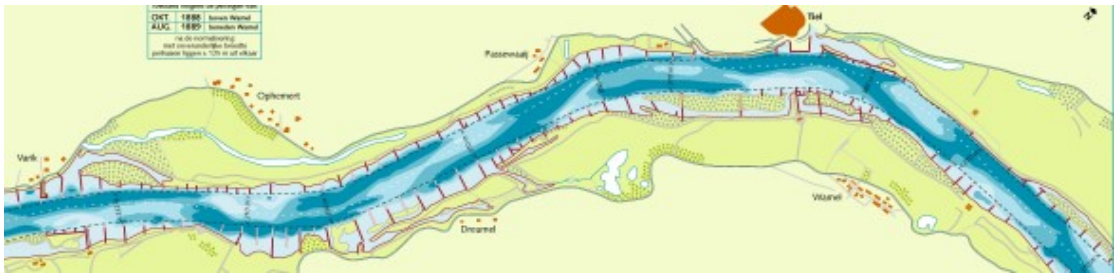
The upper Rhine River branches in the Netherlands

The reach of the Rhine River between Basel and Karlsruhe was the first reach that has been regulated ('trained'). The famous German engineer Tulla developed plans to build embankments, cut off bends and to confine the river in one low water bed. The background was twofold: a) get rid of malaria that was present in the secondary channels and many ponds and b) reduce the flooding.
The next figure shows three stages in this development:



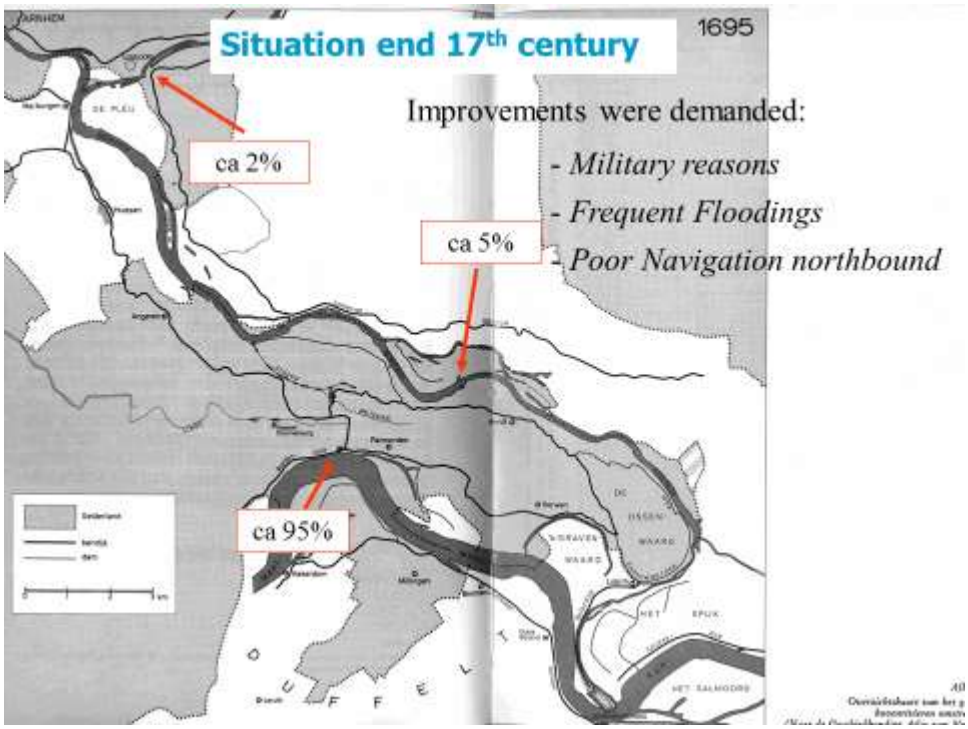
Planform changes of the German Upper Rhine: from braiding to one low water bed with floodplains

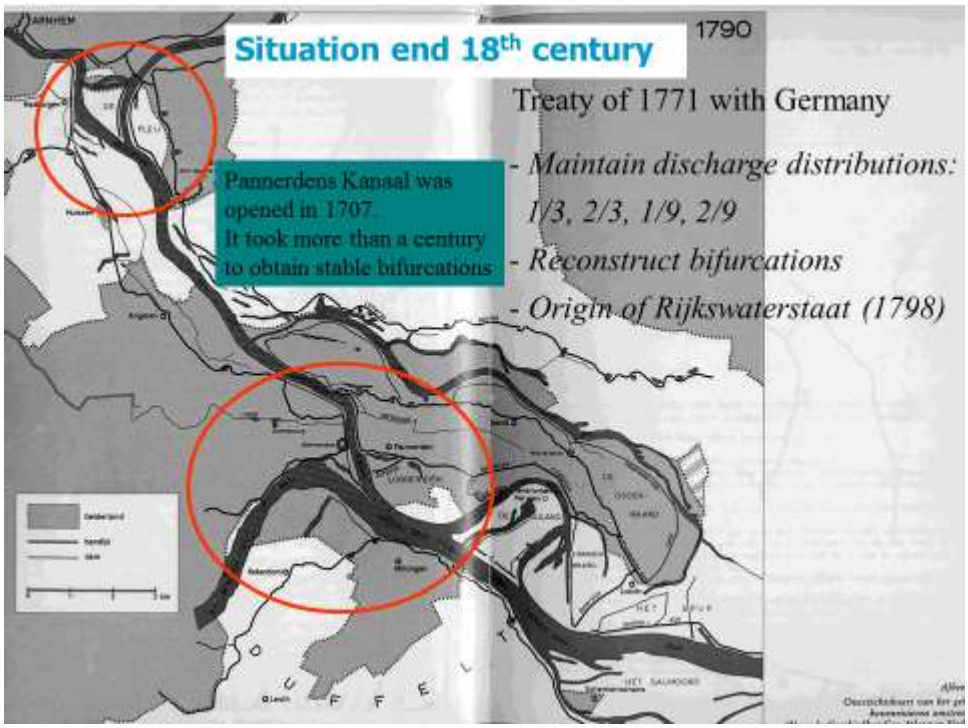
Since the 13th century levees were constructed by farmers living close to the river, that only protected their land. As a consequence neighboring farmers also had to build levees. This explains the often irregular form of the embankments along the Rhine River. Often also land was reclaimed by small structures, resembling spur dikes ('groynes'). Later on groynes have been built at regular distances and creating a low water bed with a constant standard ('normal') width. This method is called normalization of the low water bed. This has been repeated two times, until the available width for navigation in the Waal River (largest Rhine branch) has been reduced to 260 m. This resulted in available drafts (sailing depth's) of at least 2.5 m. 95% of the time the draft is larger.



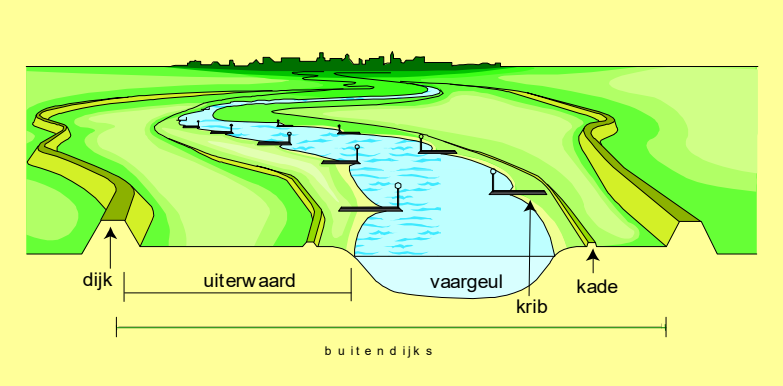
Waal River in 1889

In the 18th century much attention was given to the distributions in the upstream part of the Rhine delta. Because of a very bad lay-out of the off-take from the Niederrhein River to the northern branches, the IJssel River received little water. This hampered navigation, hurt agriculture and in dry periods enemy armies could easily cross the IJssel River. After long discussions between the Rhine bordering cities and negotiations with Germany (that owned some of the riverbanks at that time) it was decided to divide the Niederrhein water discharges in a strict way over the Rhine branches. To accomplish this a new mouth of the Nederrijn River was built, by digging the Pannerdensch Kanaal River and creating a new bifurcation dam. The latter had been made possible when after a big flood a large shoal appeared at the location where the division dam had been planned.





Situation at the offtake of the Niederrhein to the north in 1695 and 1790



Typical lay-out of the regulated Rhine River: embankments, floodplain, summer dike, groynes

The regulated Rhine River has been designed to serve the main interests: flood protection, agriculture and navigation. Positive effects of this river training are a high flood protection, no more flooding by ice dams, sufficient deep navigation channels with guaranteed depth (> 2.8 m in 95% of time) and width (> 150 m). Negative effects of the river training were the on-going bed erosion (caused by constriction of the width and canalization of Rhine branches upstream in Germany, holding back sediment), shoals near the newly created secondary channels (for nature restoration purposes and flood protection), deterioration of ecosystems caused by agriculture and the use of rock for groynes. The increased maintenance dredging of the navigation channel hampers navigation. Navigation is also hindered above the executed bend improvement measures (fixed layer and bendway weirs), as the water level partly lowers in accordance with the lowering of the bed level.
To minimize the above negative effects remedial measures are taken: sediment feeding, longitudinal dikes are tested (increased draft, lower flood levels, reduction of the bed erosion and more ecological potential), to reduce the bed erosion the dredged spoil is dumped again in deeper parts of the low water bed. Finally to restore nature special restoration projects have been executed.
The estimated **costs** in today's USD rates of the different river measures are:

- Division dam at bifurcation, 2 km long, 30-50 m wide: 10-20 Million.
- Groynes, to fixate the low water bed (for navigation): 3 Million/km length (5 groynes/km, at both riverbanks).
- Dredging the Waal River: 5 Million/y for some critical areas in a 100 km stretch.
- Longitudinal dike: 4 Million/km.

The following **benefits** have been accomplished:

- Since 1926 no more flooding have occurred.
- The stable discharge distributions supply reliable and sustainable conditions for navigation, flood protection and agriculture.
- Transport of goods over the Rhine River has grown much and today takes care of 50 % of the total transport in the Netherlands (165 Million ton/y by ship). This avoids a couple of highways to Germany and limits the carbon dioxide emissions.
- Increased bio diversity in the nature restoration projects.
- Little maintenance is required (e.g. 3% of the groynes are renovated yearly).

The experience with Rhine River training in the past leads to the conclusion that benefits of river measures can only be expected when they are executed according to a (master-)plan and managed by a strong governmental office. In the Netherlands this office (Rijkswaterstaat) exists already since 1798, and is an executive department of the Ministry of Public Works and Water management. Such a governmental water department should be responsible for the planning of measures, the

monitoring of effects of measures and autonomous developments in the river system. This department should also have the means to initiate innovative measures. For a sound river management much engineering knowledge is demanded within this department. Support from expert institutions like Deltares (formerly known as Delft Hydraulics) is also needed. Finally cooperation with technical universities (e.g. TU-Delft) contributes to the build-up of knowledge.

Appendix-I Training the Yellow River (Carsten Staub and Gerrit Klaassen)

Summary of Presentation at FRERMIP Workshop 7th December 2016

The Yellow River was chosen as an example of a river that has been successfully stabilized, partly because it has important resemblances with the Jamuna-Padma rivers, and – even more importantly – the stabilization approach applied for the Yellow River is very similar to the approach that we plan to use for the Jamuna-Padma. For the Yellow River, even a "learning by doing" approach was used. The Yellow River is believed to provide the best lessons for the training of the Jamuna-Padma. It is therefore the intention to get a Chinese engineer to come to Bangladesh and work with the FRERMIP team. The Yellow River is a very long river – even longer than the Brahmaputra. But its catchment is smaller. It is altogether a much smaller river – less than 5% of the Padma discharge. Table 1 below compares the characteristics of the two rivers. It is remarkable that in spite of its small size, it transports much more sediment than the Jamuna-Padma. And that is exactly what makes the Yellow River famous. The sediment transported by the Yellow River is much finer than the sediment transported by the Jamuna-Padma.

Table 1 Comparison of characteristics of Yellow River and Brahmaputra system

CHARACTERISTIC	YELLOW RIVER (LOWER)	BRAHMAPUTRA SYSTEM
Channel length	876 km	330 km
Channel slope	17 --> 7 cm/km	5 cm/km
Channel width	5 - 7 km	8 - 12 km
Flow discharge (average)	1,400 m^3/s	31,000 m^3/s
Bankful discharge	5,000 m^3/s	65,000 m^3/s
Sediment concentration	37 kg/m^3	1 kg/m^3
Sediment load	1.6 billion tons/year	1 billion tons/year
Sediment grain size	0.030 mm (silt)	0.2 mm (fine sand)
Channel pattern	Braided → Meandering	Braided (Jamuna) → Transition (Padma)
Stability	In the past frequent avulsions	Major avulsion within few hundred years
Note: typical figures		

As can be seen from Figure 1, the Lower Yellow River has hardly any catchment. The reason is that this part of the river is a so-called "suspended" or "perched" river. Deposition of large volumes of sediment over many centuries and continuous heightening of the embankments have caused the river to become elevated up to around 10 m above its surrounding flood plain, see Figure 2. This means the river is in effect disconnected from its floodplains. The raise of the river bed is a big problem, and needs to be minimized, as it raises flood levels as well and thereby continuously reduces flood safety, see Figure 3. Because of that, large reservoirs were planned and built with sediment retention as their main purpose. Sanmenxia with a total volume of 10 billion m^3 was built 1960 but already silted up during the following decade. Subsequently, the raise of river bed level continued, see Figure 3. In 1999 another large reservoir was completed, the Xiaolangdi reservoir with a total volume of 13 billion m^3. Figure 3 illustrates the raise in the 3000 m^3/s flood level at a number of stations along the Lower river. The more than 10 cm annual raise (indicating a corresponding rise in bed level), which took place after the Sanmenxia reservoir filled up and the Xiaolangdi reservoir was completed, is not a sustainable development and has to be stopped.

Figure 1 Yellow River catchment and Lower Yellow River

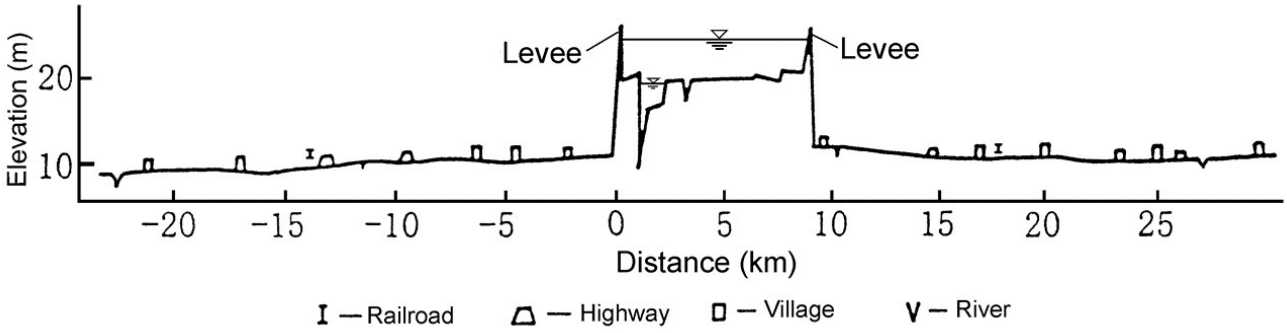


Figure 2 Lower Yellow River cross section illustrating the "suspended river".

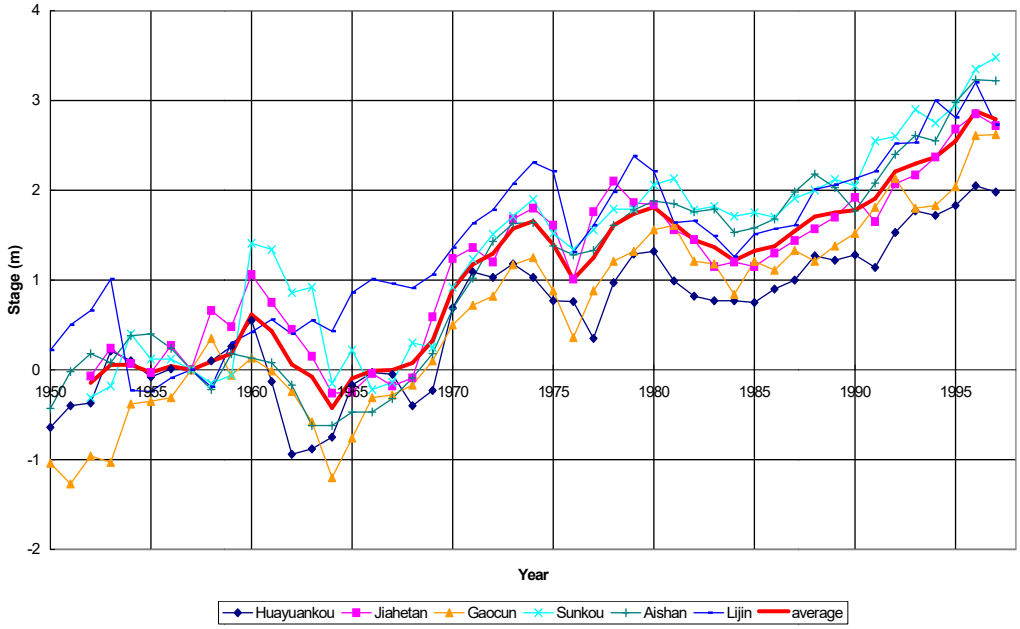


Figure 3 Changes in 3,000 m3/s water levels 1953-97 at a number of stations in the Lower Yellow River.

The extremely high sediment load of the Yellow River originates mainly from the middle reach of the Yellow River with large deposits of so-called loess deposits of highly erodible wind-blown loose deposits of silts. When this combines with high rainfall and steep terrain the result is an area of very high sediment yield, see Figure 4.

Figure 4 The origin of the high sediment load of the Yellow River; the loess plateau of the middle reach, with numerous eroding gullies through the loess plateau.

The lower Yellow River starts out as a braided reach upstream and ends in a meandering reach far downstream, with a transition reach in between, see Figure 5.
It is believed that the high sediment load is a main cause of the river instability, an also causes the braiding of the upstream part. Thus, reducing the sediment load of the Lower river will improve the situation.

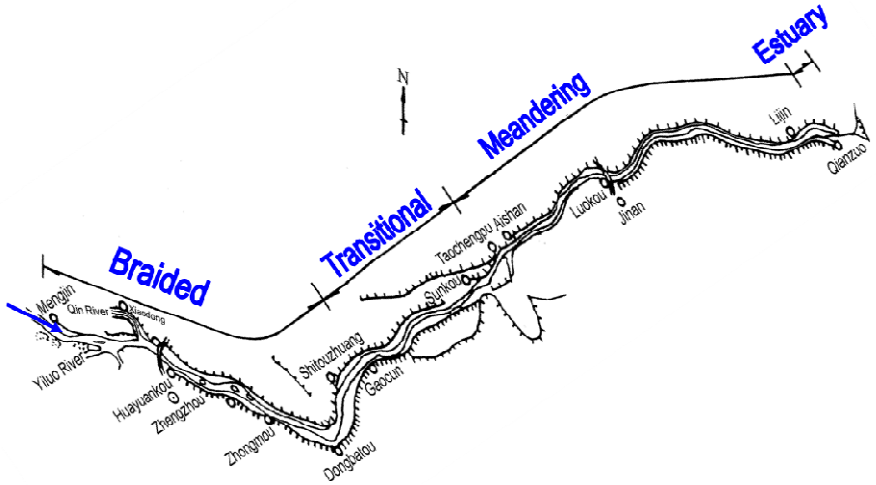


Figure 5 The three different reaches of the Lower Yellow River; from braided to meandering.

The approach adopted by the Yellow River Conservancy Committee (YRCC) was to manage floods by:

- Protecting the embankments against erosion
- Stabilizing the river by guiding the flow at bends

The strategy followed was to begin with the (easier) meandering reach, then stabilize the intermediate transitional reach, and finally do the (more difficult) braided reach. The work was carried out in three steps:

- first meandering reach (1950-1958),
- next transitional reach (1965-1974)
- finally braided reach (1973-ongoing)

At the same time extensive work was done to strengthen the embankments, reducing their vulnerability to piping. This was done partly by "warping" (pumping in sediments from the river corridor and filling it against the embankment), partly by implementing a thin impermeable wall from the crest of the embankment, by digging a narrow ditch and filling it with a cement/bentonite mix.

Figure 6 The very dynamic braided reach of the Lower Yellow River

Figure 7. illustrates the high variability of the river channels over the years. The braided reach is clearly more dynamic then the transitional reach.

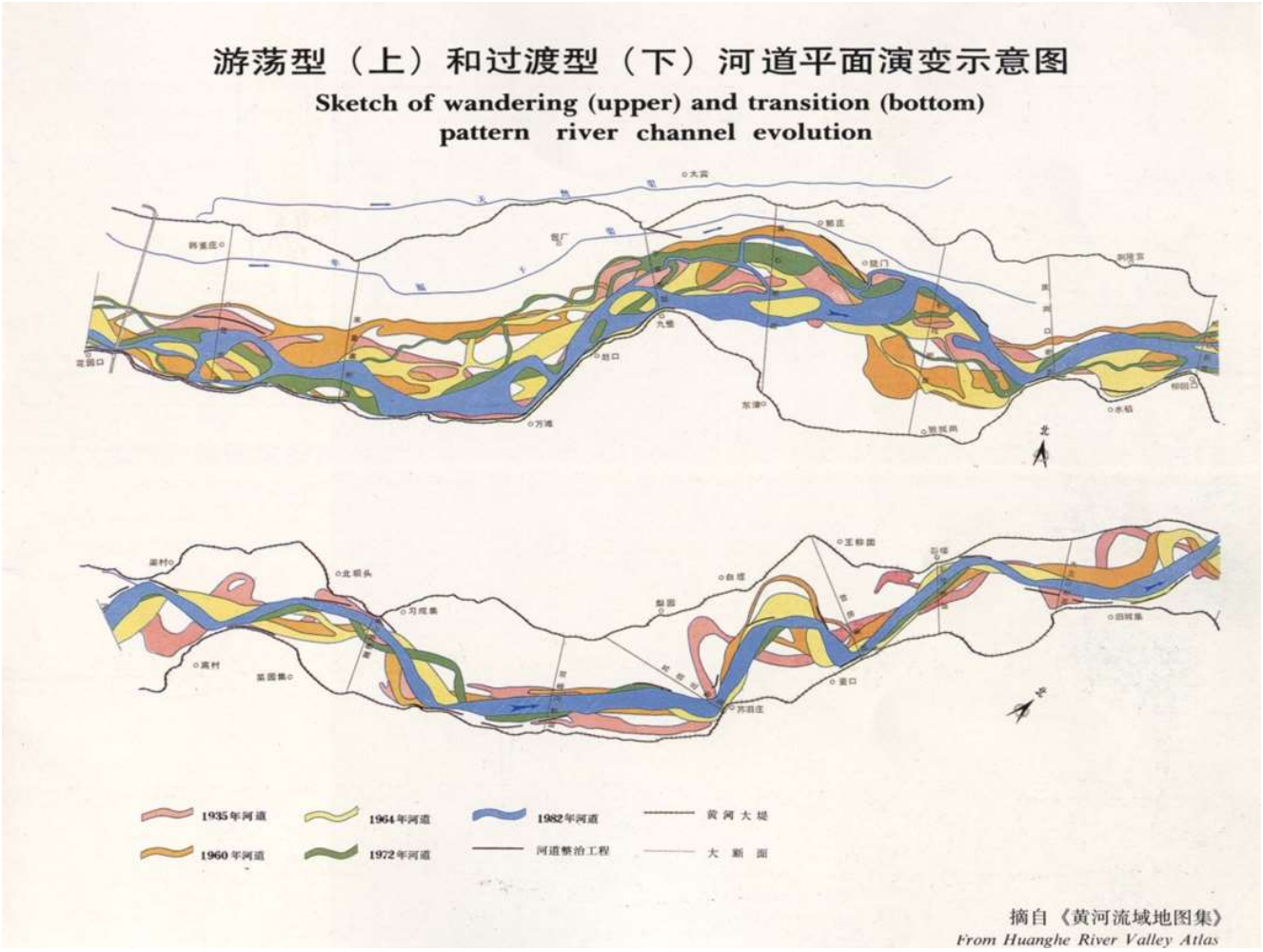


Figure 7 Illustrations of the variability of the braided (wandering) reach and the transitional reach.

The regulated river channel would be a meandering single channel, for which the design of the channel layout was initially guided by some design principles, and the implementation was based on the principle of "learning by doing". This means that the development of the river following the implementation of protecting/guiding works was closely monitored, and the approach adapted accordingly. Design principles, with reference to Figure 8, are:

Radius of curvature: r_c = (3-5)・B

Meander wavelength: λ = (9-15)・B

Meander amplitude: A = (2-4)・B

Bend distance: L = (5-8)・B

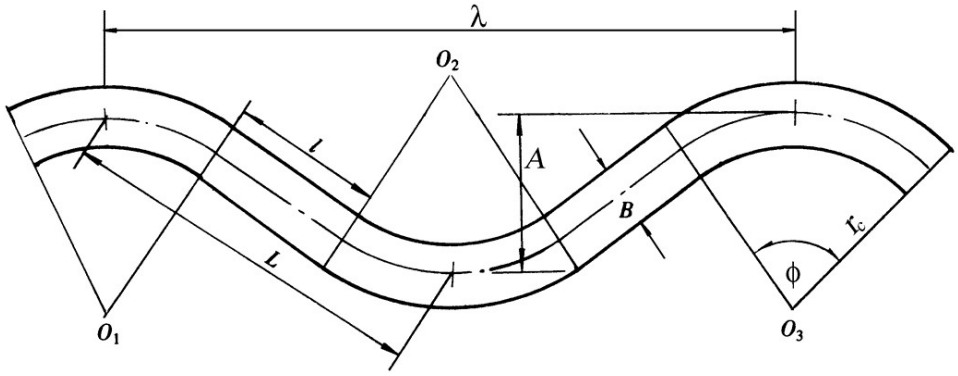


Figure 8 Definition sketch

The real channel patterns are more complex and applying simple rules does not always provide the optimal result. But by observing the river and adapting the structures it is possible to obtain a good result. Figure 9 shows an example of changing channel patterns and implemented protection and guiding structures.
Figure 10 shows an example of implemented structures that are not efficient, because the main channels appears to bypass them. It is important to continuously monitor the river and the performance of implemented structures to be able to adapt those structures and even to adapt completed (but not yet implemented) designs and plans. This is a basic principle of “learning by doing”.
Different types of structures are shown in Figure 11 and Figure 12. The short spurs/groynes are very closely spaced. As shown in the photos, spurs have a large stockpile of repair material on top for rapid repair in a flood situation.

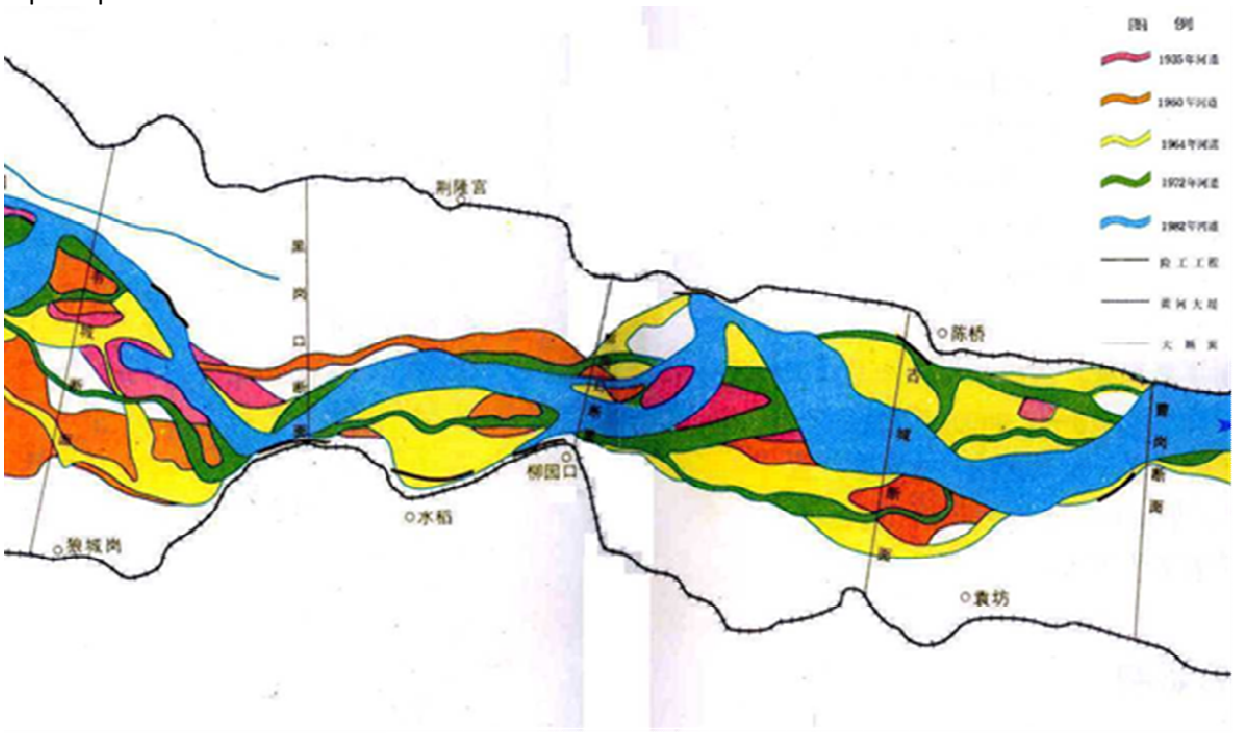


Figure 9 Illustration of how river training structures are used to protect embankments and to guide the flow (blue is the latest year).

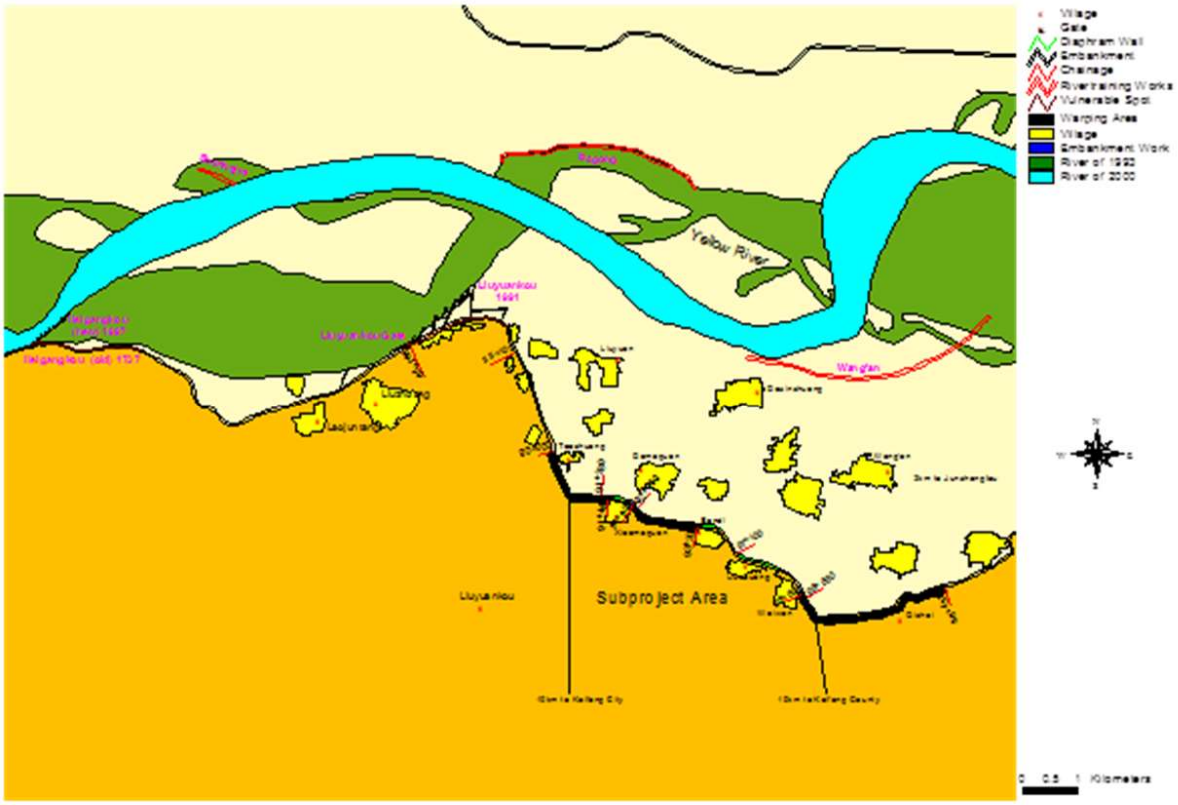


Figure 10 Illustration of situation where implemented structures are not efficient and adaptation is required (learning by doing)

Figure 11 Spur dikes at Caogang in Henan Province

Figure 12 Spur dikes at Liuyuankou in Henan Province

Figure 13 and Figure 14 show how the movements of the main channel have been successfully reduced from before implementation of river training work till after.

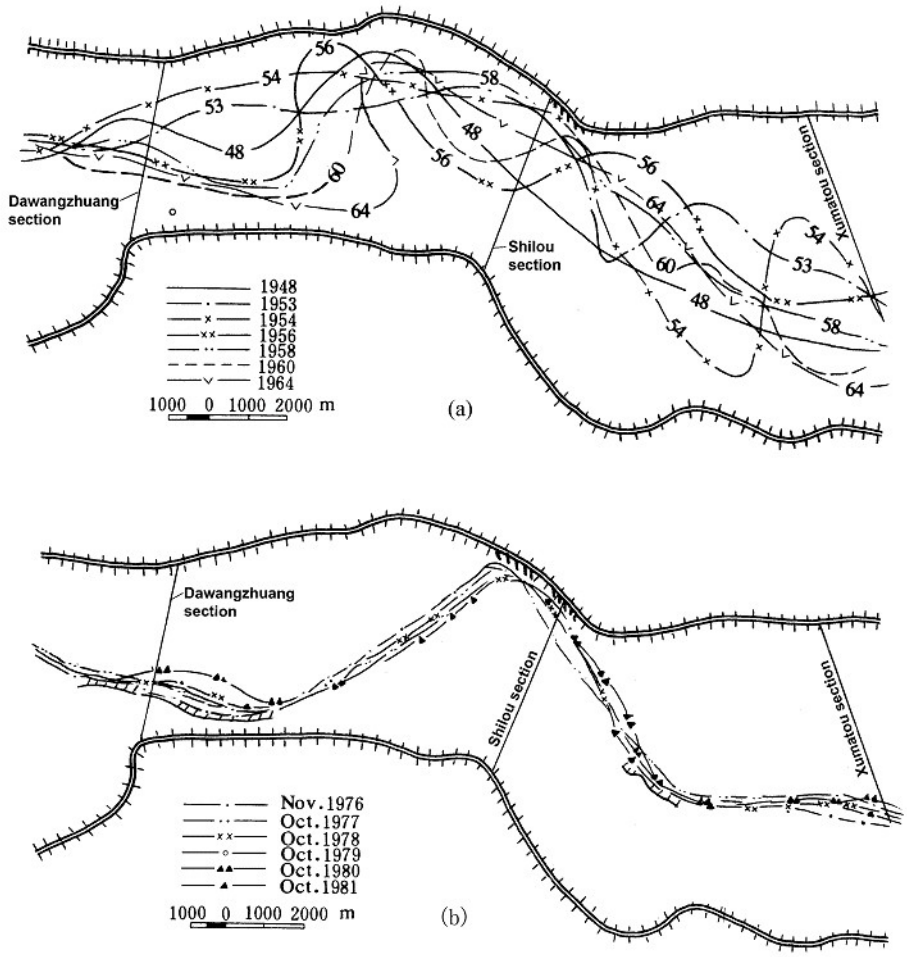


Figure 13 Before and after channel regulation (1948-1965 and 1975-1982). Laozhaizhuang to Xumatou reach (transitional)

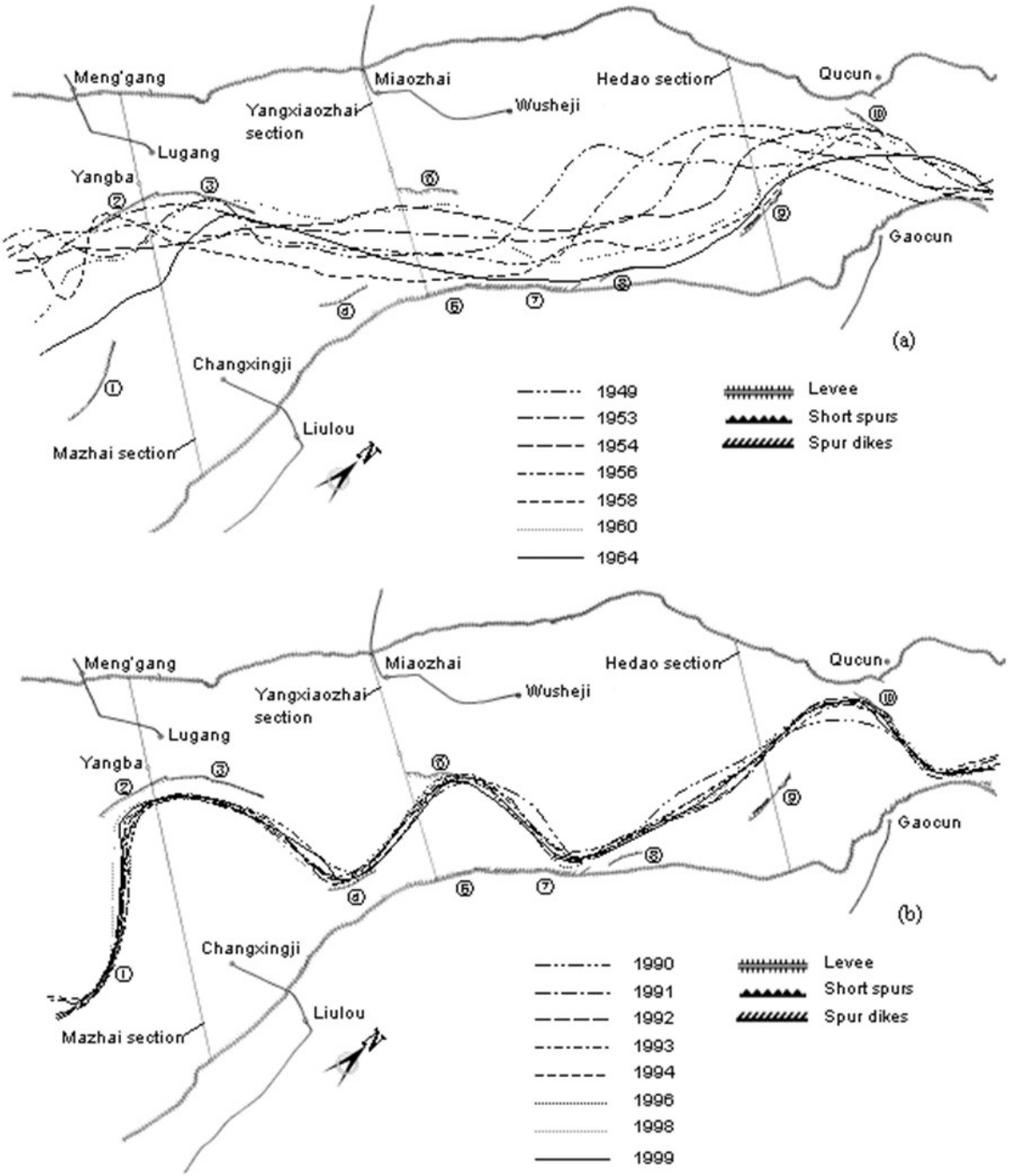


Figure 14 Before and after channel regulation (1949-1964 and 1990-1999). Liulou to Gaocun reach (braided).

The estimated total implementation cost has been 1-1.5 Billion USD (uncertainty at this moment whether this is converted to present day value).

The **positive impacts** of the efforts by YRCC to reduce flood risk by controlling the Yellow River are as follows:

- Intensity of shifting in channel position has reduced and the flow paths are stabilized
- Attack on levees has been controlled
- No breaches have occurred since 1950

- Floodplain use has intensified
- Aggradation increasingly controlled by upstream reservoirs (may also be reduced by increasing abstraction)
- Embankments made less vulnerable through improvement measures of the embankment ("warping" and central impermable cutoff wall)

The **conclusion** that can be drawn are:

- River training methods for Yellow River developed via:
    - learning by doing and
    - going from easy to difficult

- Combined embankment protection works and flow guide works are suitable method for training of braided rivers
- This method is the most promising approach for training the Jamuna-Padma rivers

Appendix-J Comments Summary for Workshop 2nd Session at BWDB Office

December 8th, 2016

The Director General of BWDB opened the workshop. He explained that the river training of Rhine and Yellow River provides important lessons learned for the preparation of a river management master plan.

Comment	Reply
Presentation on the Yellow River, Carsten Staub	
Harun-Ur-Rashid, SE, Design-2: We are interested in their designs. We want to know the type of material, size of material, the cost of the material for the Yellow River and the Mississippi River. We would like some ideas and parameters concerning the design, such as bed level, scour level, water levels. We would like to know how to calculate the size of the material taking into account wave action, the dumping volumes, the thickness. How do they determine the design discharge? Is it the maximum measured discharge? Which type of material do they use? Do they use geobags? What do they do at both ends of the protection works? Which formulas do they use? Does bed level vary in the wet season and the dry season? They have successfully trained their river and we should know how they are doing their design.	Carsten Staub: We plan to bring a Chinese expert to Bangladesh in January or February and we can have a more detailed discussion then. The material is dependent on local conditions. The Mississippi has rock available to use but this is not available in Bangladesh. But geobags work well here. Regarding the design formula, this is new in Bangladesh and much more can be learned about the performance of geobags revetments. Currently we are using formulas that are for other types of materials and we need to look into the applied formulas to be able to optimise the design. Now we have a good opportunity to learn. Right now, we are using multibeam at Padma bridge which can check damages, how the geobags have been placed and we can develop good design formulas based on monitoring already implemented structures. The design method for geobags structures is still in development.
Md. Mafuzur Rahman, ADG Planning: We hope we can collect data in the future, like design parameters. This is very important when comparing.	Carsten Staub: We are working on a note to collect parameters to compare. Hendrik Havinga: Comparing these rivers would be good work for a Masters student.
K M Humayun Kabir, PD. Capital (Pilot) Dredging There seem to be a lot of groynes/spurs in the Yellow river. I don't think they will work here because of the sandy conditions. It would be geotechnically challenging. We start with braided river so we do not have the stepped approach starting with the easy meandering river. We are starting with the more difficult case. Can we succeed?	Carsten Staub: Yes, it is true that for our main rivers we do not have the option to start with the easier meandering river. But we can learn from past experience and hopefully also from international experience, especially from the Yellow river. In Yellow River, the floodplain developed with finer sediment- silt and maybe some clay - all unconsolidated material. There is substantial ongoing work there to keep the embankments strong. They use what is called "warping", where they pump flood plain material up against existing embankments. They are digging narrow trenches for impermeable membranes from the crest of the embankments. In Bangladesh, the embankments have a core of sand, covered with

	a layer of finer material to make them water tight. This may not be sufficient to prevent piping as the outer layer may get damaged. When putting clay material on the outside, it could be penetrated due to activities of people.
Md. Aminul Islam, Exec. En. Design-2: We have our design practises, but experiences with extensive stabilisation of rivers like Jamuna-Padma are not many! We need to have people with knowledge of similar designs to teach BWDB professionals design methodology. The Jamuna river is a bigger challenge. The inflow of silt cannot be stopped/controlled because it comes from outside the border of Bangladesh. In terms of the Master Plan transportation and other aspects should be added to make the policy makers agree.	Carsten Staub: I agree with Mr Aminul, we have to learn from other rivers but we have to develop our own methods. No other river is like this, so we cannot simply copy methods. But we get ideas from other rivers. Regarding the economy and comparing costs for the Master Plan, we are much further than capital dredging. The purpose of the Master Plan is to organize all the benefits to come out of the project. It is already clear that the rate of return is very good. The question is how to use the benefits from reclaimed land and within distributary catchments. The plan has its focus on the main rivers, but includes the distributaries. In fact, it would be possible to separate the distributaries and consider these as separate projects with their own costs and benefits.
AFM Taubid Jaman, SDE Design 1: I am a mechanical engineer and my question is related to dredging and the size of grain. They are removing silt. The bigger the grain size the easier the dredging. How did they remove such fine silt with a regular dredger?	Carsten Staub: I wondered that too. We need clarification of this. But dredging was not a big part of the stabilization. They tried it and did not find it very useful.
Can you provide this plan without model studies?	Carsten Staub: The study must be well supported with morphological analysis based on satellite imagery and modelling to try to understand what the river will do. And afterwards we must see what is actually happening because the model is not accurate. You need to observe the river for the real answer. And a flexible approach is needed to be able to incorporate changes in the design and in the plan.
What is the mechanism to deal with the sediment?	Carsten Staub: Sediment knowledge is a key issue. The solution is still being worked out in China, but there the sediment issue is more serious. They have built big reservoirs with the primary purpose of retaining sediment, because the river bed sedimentation keeps increasing the flood risk. The first reservoir (Sanmenxia) is filled up and a second one (Xiaolangdi) has been built. The case in Bangladesh is less extreme, but here you cannot build upstream reservoirs because of the

	border. The sediment balance is indeed very important. Sediment will need to be dredged from the river. This sediment can be used to build embankments and fill up reclaimed land.
Presentation on the Rhine River, Hendrik Havinga	
Md. Aminul Islam, Exec. En. Design-2: You have confidence in the design discharge for the Rhine River. We need time to do this. But this is a good lesson that you have this. The fact that 50% of commodities is transported by navigation is the next focus of river planning. Harun-ur-Rashis, SE Design-2: How is the bifurcation ratio determined and how is it designed?	Hendrik Havinga: The bifurcation ratio was determined in discussion with Germany. And after many ideas and constructions we found you need to have a diversion dam that lies in an almost straight reach of the river. You take the cross sections of the branches and look at the backwater curve, which has to match at the bifurcation. You play with the hydraulic resistance and profile to create an ideal discharge distribution. The sediment distribution is important and is governed by the so-called Bulle effects. You should use a straight reach to minimize the Bulle effect. We do not have a control structure and a 1/3 : 2/3 ratio is stable. There is a water law, which demands from everybody that the water level should not be touched. For every river intervention, there must be compensation. By using models etc. it must be shown that water levels are not affected.
Md. Mafuzur Rahman, ADG Planning: Is the distribution the same in the flood season and the dry season?	Hendrik Havinga: The ratio holds for maximum floods and is also fixed for low flow conditions. Weirs downstream raise the water level at the bifurcating branches.
Dr Quassem/FRERMIP: Explain the lessons on bifurcations for us. We are also constructing a bifurcation structure. And how they are related.	Hendrik Havinga: The theory is the same. A main difference is that the sediment size is smaller, which can be an advantage because you don't have to worry about bed load transport as much so water distribution determines the sediment distribution. Carsten Staub: The sediment is finer so there is more suspended load but a large portion of the suspended load is close to the bed so helical flow still has an effect. Hendrik Havinga: So, the principles still hold. A small angle from a straight reach to take into consideration the helical flow. This can be compared in computer models.
Harun-Ur-Rashid, SE, Design-2: We have 3-4 offtakes. In the same way, as here, we could have a workshop to show how they are designed. And if they can be applied to here. In some cases, the offtakes even have flow that goes in the opposite direction.	

Bifurcation Presentation, Hendrik Havinga	
What is a bend way weir and what is its purpose?	Hendrik Havinga: It is below the water level so ships can sail over them. They sit at about 20^{o} and they catch the sediment. They are built to widen the navigation channel by disturbing the helical flow. They catch the sediment.
Dr. Md. Masood, Exec. En. Design-1: What is the main challenge to manage the river system? How much money does it take to stabilize the river?	Hendrik Havinga I cannot give you cost figures but I can give steps. You have to confine the low bed levels, which can be done by secondary channels. Embankments should be used but not too close to the river. You have to leave enough room for floods. You need low bed level and stable bifurcation.
Conclusion	

The Additional Director General, Planning, Mr. Md. Mafuzur Rahman closed the seminar at 1:30PM. He observed that systematic skill development would require a follow-up seminar with a deeper focus on design issues. In addition, the aspect of "learning by doing" is important. Given the early phase of activities, the Master Plan cannot be final and it is good that government and consultants work together. So BWDB would very much appreciate to discuss design issues during a future session.