

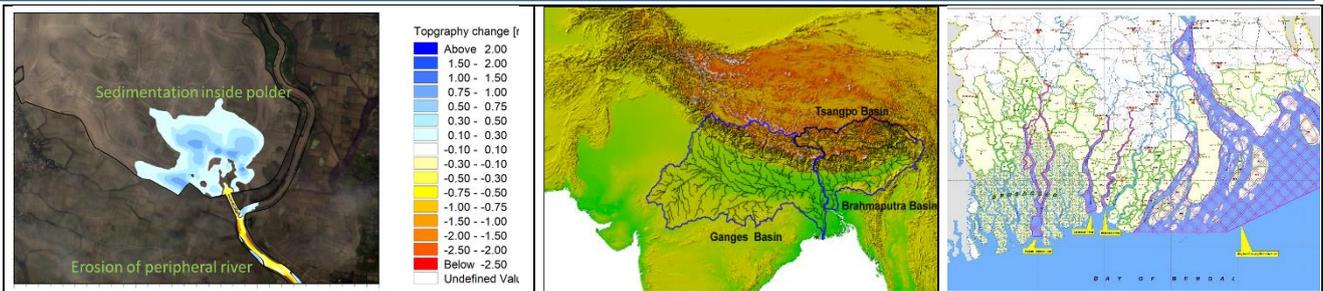
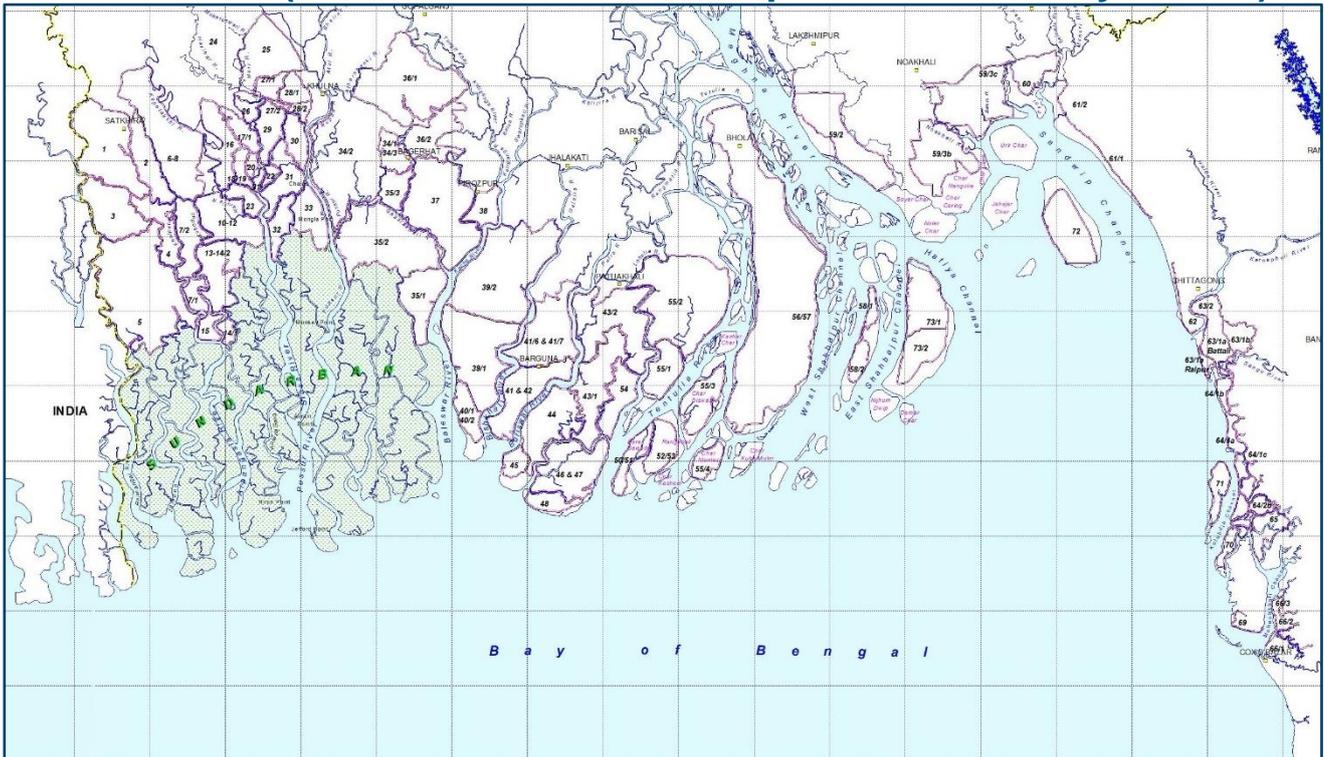
Ministry of Water Resources



Bangladesh Water Development Board

Coastal Embankment Improvement Project, Phase-I (CEIP-I)

Long Term Monitoring, Research and Analysis of Bangladesh Coastal Zone (Sustainable Polders Adapted to Coastal Dynamics)



QUARTERLY PROGRESS REPORT-9

March 2021



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March 2021



Long Term Monitoring, Research and Analysis of Bangladesh Coastal Zone

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Memo No: CEIP/LTMRA/0321/103

21 March 2021

Project Management Unit
Coastal Embankment Improvement Project, Phase-I (CEIP-I)
House No.15, 4th Floor, Road
No.24(CNW) Gulshan, Dhaka-1212

Attn: Mr. Syed Hasan Imam, Project Director

Dear Mr Imam,

Subject: Submission of Quarterly Progress Report-9

It is our pleasure to submit herewith three copies of the Quarterly Progress Report-9. This is the 9th Quarterly Progress Report describing the progress made between 1st October 2020 and 31st December 2020. We regret that the submission of the report has been severely delayed due to interruption of travel and our intra-project communications by the COVID-19 crisis.

The amount of progress made during this quarter has been less than optimal because of the inability of the International Staff to travel to Bangladesh for field work and further restrictions of their ability to work remotely because we had not been able to reach agreement about going outside the time limits set by our contract regarding the amount of home time charged by respective international staff positions. On the other hand, we must commend the efforts made by the national staff in giving their maximum possible support to compensate.

This report comprises 8 chapters describing progress in development of input datasets for modelling including coastal database, modelling long term processes, subsidence and climate change studies, capacity building. We have listed the number of reports delivered to you during the project and the other related documents that can be found in the Project Sharepoint Folder.

We are unfortunately unable to report progress in the Polder Development Plan, and the Investment Plan because the travel restrictions arising from the COVID-19 crisis made it impossible to deploy the international staff for this purpose and for developing new design parameters.

The extension of the project duration until January 2022 will make it possible to address these delays and complete our work programme.

Thanking you,

Yours sincerely,



Dr Ranjit Galappatti
Team Leader

Copies: Engineer Mohammad Ali, Director General, BWDB
Dr. Md Mizanur Rahman, ADG (Planning), BWDB
Dr Kim Wium Olesen, Project Manager, DHI
Dr Alessio Giardino, Deltares Project Manager
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Mr AKM Bodruddoza, Procurement Specialist
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ACRONYMS AND ABBREVIATIONS

ADCP- Acoustic Doppler Current Profiler

BDP2100- Bangladesh Delta Plan 2100

BIWTA- Bangladesh Inland Water Transport Authority

BMD- Bangladesh Meteorological Department

BoB - Bay of Bengal

BWDB- Bangladesh Water Development Board

CBA- Coast Benefit Analysis

CCP- Chittagong Coastal Plain

CDMP-Comprehensive Disaster Management Program

CDSP- Char Development Settlement Project

CEA- Cost Effectiveness Analysis

CEGIS- Centre for Environmental and Geographic Information Services

CEIP- Coastal Embankment Improvement Project

CEP- Coastal Embankment Project

CERP-Coastal Embankment Rehabilitation Project

CPA- Chittagong Port Authority

CPP-Cyclone Protection Project

CSPS-Cyclone Shelter Preparatory Study

DDM- Department of Disaster Management

DEM- Digital Elevation Model

DOE- Department of Environment

EDP- Estuary Development Program

FAP- Flood Action Plan

FM- Flexible Mesh

GBM- Ganges Brahmaputra Meghna

GCM- General Circulation Model

GIS- Geographical Information System

GNSS- Global Navigation Satellite System

GPS- Global Positioning System

GTPE- Ganges Tidal Plain East

GTPW- Ganges Tidal Plain West
HD- Hydrodynamic
InSAR- Interferometric Synthetic Aperture Radar
IPCC- Intergovernmental Panel for Climate Change
IPSWAM- Integrated Planning for Sustainable Water Management
IWM- Institute of Water Modelling
LCC- Life Cycle Costs
LGED- Local Government Engineering Department
LGI- local Government Institute
LRP- Land Reclamation Project
MCA- Multi Criteria Analysis
MES- Meghna Estuary Study
MoWR- Ministry of Water Resources
MPA- Mongla Port Authority
NAM - Nedbor Afstromnings Model
PPMM- Participatory Polder Management Model
RCP- Representative Concentration Pathways
RSET-MH- Rod surface elevation table – marker horizon
RTK- Real-Time Kinematic
SET-MH- Surface Elevation Tables – Marker Horizons
SLR- Sea Level Rise
SOB- Survey of Bangladesh
SSC- Suspended Sediment Concentration
SWRM- South West Region Model
TBM- Temporary Bench Mark
ToR- Terms of Reference
WARPO- Water Resources Planning Organization L - Water Level

1 INTRODUCTION

The coastal zone of Bangladesh spans over 710 km of coastline and is subject to multiple threats. Sixty- two percent of the coastal land has an elevation less than 3 meters above mean sea level. The coastal lands, being subject to regular flooding by saline water during high tides, could not be used for normal agricultural production in a country with a very high demand for land.

The damage caused by Cyclones Sidr and Aila in 2007 and 2009 led to a major new investment of World Bank funds called the Coastal Embankment Improvement Project through which the coastal embankment system was to be improved and made much more climate resilient, over several phases of construction. After the feasibility study of the first phase CEIP-1, it was recommended that certain gaps in our knowledge of the delta should be addressed by the research study which was to be known as the **Long-Term Monitoring, Research and Analysis of Bangladesh Coastal Zone**.

After a very long gestation period, the study was initiated on 15 October 2018 and the Inception Phase was completed in January 2019. The Inception Report was treated as the first Quarterly Progress Report (QPR-1). The Second Quarterly Progress Report which was submitted in April 2019 covered the period 1 January 2019 to 31 March 2019. The Third Quarterly Progress Report (QPR-3) covers the period 1 April 2019 to 30 June 2019. QPR-4 covered the period from 1 July 2019 to 30 September 2019. QPR-5 covering the period 1 October 2019 to 31 December 2019 was submitted in February 2020.

The advent of the COVID-19 crisis in early 2020 signalled the beginnings of a global pandemic. QPR-6 covered period 1 January to 31 March 2020. The work of the project during the 6th Quarter was not seriously affected because the international experts working in Dhaka were not recalled by their home offices until the 15th of March 2020. The Eighth Quarterly Progress Report (QPR-8) describing the progress made between 1st July 2020 to 30th September 2020 covered the second period where the original work schedule was badly affected by the travel bans imposed by Denmark, The Netherlands and the United States. The 8th and 9th Quarters had to be completed without a single International Consultant being permitted to travel to Bangladesh.

This report (QPR-9) covers the progress of work in the period 1st October to 31st December 2020. The constraints imposed by the travel bans which prevented the field inputs (in Bangladesh) by International Staff was the subject of several rounds of protracted negotiations between the Consultant and the Client – has made some progress in the face of growing global uncertainty. The preparation of this report has been delayed due to by these difficulties.

1.1 Work Plan

The Inception Report (DHI, 2019) gave a detailed description of the work to be carried out by this project. Table 1.1 shows the full schedule of activities originally scheduled to be carried out during the 30 months of the project. This work plan is based on the plan shown in the Inception Report published in December 2018. This work plan is a more detailed version with some adjustments that have had to be made due to contingencies and developments in the field.

The advent of the COVID pandemic early in the year has disrupted the work especially because of the travel restrictions placed on international staff by their respective governments from March 2020 onwards. The work plan and the staff deployment plan has been under continuous negotiation throughout the last quarter. These negotiations proceeded throughout this quarter and have reached a conclusion at the meeting with the BWDB and the World Bank on 17 August 2020.

The project duration has now been extended till the end of year 2021. The work programme has been modified to accommodate the travel restrictions imposed by the COVID-19 crisis. This

programme involves some staffing and budget changes currently under discussion. Section 1.2 describes the current adjusted work schedules and the corresponding lists of deliverables.

Table 1.1 (contd) Original Activity Schedule Page 2

No	TOR Reference/ Deliverables Code	TOR Deliverables	15-Oct-18	15-Nov-18	15-Dec-18	15-Jan-19	15-Feb-19	15-Mar-19	15-Apr-19	15-May-19	15-Jun-19	15-Jul-19	15-Aug-19	15-Sep-19	15-Oct-19	15-Nov-19	15-Dec-19	15-Jan-20	15-Feb-20	15-Mar-20	15-Apr-20	15-May-20	15-Jun-20	15-Jul-20	15-Aug-20	15-Sep-20	15-Oct-20	15-Nov-20	15-Dec-20	15-Jan-21	15-Feb-21	15-Mar-21	15-Apr-21				
			0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30				
D-4A-2		Morphology on a meso scale																																			
	D-4A-2:1	Report on upgrade and update of present meso scale model including detailed explanation of the methodology and assumptions. Geospatial datasets of erosion and sedimentation in the coastal zone at present for various seasons and circumstances in relevant. These geospatial datasets should include full meta-data and be stored and archived in Database of BWDB																																			
	D-4A-2:2,3	Geospatial datasets of erosion and sedimentation in the coastal zone at present for various seasons and circumstances in relevant. These geospatial datasets should include full meta-data and be stored and archived in Database of BWDB; Geospatial datasets of erosion and sedimentation in the coastal zone for possible scenarios 25, 50 and 100 years from now, for various reasons and circumstances if relevant. These geospatial datasets should include full meta-data and be stored and archived in Database of BWDB																																			
	D-4A-2:4	Technical report (one report for 4A-2 - FINAL REPORT ON ESTUARINE MORPHOLOGY)																																			
D-4A-2		Bank Erosion on Meso scale																																			
	D-4A-2:1,2	Report on upgrade and update of present meso scale model including detailed explanation of the methodology and assumptions. Geospatial datasets of erosion and sedimentation in the coastal zone at present for various seasons and circumstances in relevant. These geospatial datasets should include full meta-data and be stored and archived in Database of BWDB																																			
	D-4A-2:3	Geospatial datasets of erosion and sedimentation in the coastal zone for possible scenarios 25, 50 and 100 years from now, for various reasons and circumstances if relevant. These geospatial datasets should include full meta-data and be stored and archived in Database of BWDB																																			
	D-4A-2:4	Technical report (one report for 4A-1 and 4A-2)																																			
D-4D-3		Other special purpose models																																			
	D-4D-3:1,2,3,4	Geospatial datasets of High Water, Low Water and maximum salt intrusion in all river branches for average tide in the wet and dry season at present and at 25, 50 and 100 years from now, including full meta-data stored and archived in database of BWDB. Geospatial datasets of groundwater salinity at 3 relevant levels (in the upper shallow, lower shallow and deeper aquifers, to be designated by BWDB) at present and at 25, 50 and 100 years from now, including full metadata and stored and archived in Database of BWDB. Tidal and salinity curves for key locations in the coastal zone (about 20, to be designated by BWDB) in the wet and dry season at present, and at 25, 50 and 100 years from now. Exceedance frequency curves for water levels in the same 20 stations at present, and at 25, 50 and 100 years from now. Define extreme water levels in the polder of coastal zone at 25, 50 and 100 years from now, due to cyclonic storm surges																																			

Table 1.1 (contd) Original Activity Schedule Page 3

No	TOR Reference/ Deliverables Code	TOR Deliverables	15-Oct-18	15-Nov-18	15-Dec-18	15-Jan-19	15-Feb-19	15-Mar-19	15-Apr-19	15-May-19	15-Jun-19	15-Jul-19	15-Aug-19	15-Sep-19	15-Oct-19	15-Nov-19	15-Dec-19	15-Jan-20	15-Feb-20	15-Mar-20	15-Apr-20	15-May-20	15-Jun-20	15-Jul-20	15-Aug-20	15-Sep-20	15-Oct-20	15-Nov-20	15-Dec-20	15-Jan-21	15-Feb-21	15-Mar-21	15-Apr-21		
			0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30		
D-4A-3	D-4A-3:1,2,3	The model setup developed will be updated under this project with all accompanying technical document with detailed explanation of the methodology and assumptions.																																	
		A report that describes the pros and cons of the different methodologies to prevent water-logging within the polder and sedimentation of tidal river system including polder-subsidence. The report will include meta-data on the models used and measurements, recommendations for polder design including drainage and long term management plan, and recommendations for pilot area/ polder to implement the ideas, such as but not limited to location, methods and measurements. Recommended plan to manage sediment at the downstream stretch of the tidal river and in the polder.																																	
D-4B	D-4B:1,2,3	Subsidence Geospatial datasets of total subsidence at present and for 25, 50 and 100 years from now, including full metadata and stored in Database of BWDB and Estimate the annual rate of subsidence. Detailed Technical Report with description and explanation of geospatial analysis of the total subsidence in the four regions of the polder area of the coastal zone at present and for 25, 50 and 100 years from present, including description of the causes of subsidence, full metadata and stored in Database of BWDB. Report on the total subsidence in specific polders (designated by BWDB) in 25, 50 and 100 years from now when no sediment is supplied to the polder, including the amount of sediment needed to counteract this subsidence.																																	
D-4C	D-4C:1,2	Meteorology Technical Report describing current trends and future scenarios in rainfall in the polder area of coastal zone for four coastal regions (including estimation of rainfall distribution over the year) and cyclone frequency and intensity for the next 25, 50 and 100 years from now, including meta-data of the datasets used for the trend analyses and store and archived in Database of BWDB. The Research Team shall include a description of the statistical and downscaling methods used for reproducibility reasons. Geospatial Dataset and archived in Database of BWDB.																																	
D-4D	D-4D:1,2,3	Climate Change Effects Geospatial datasets of High Water, Low Water and maximum salt intrusion in all river branches for average tide in the wet and dry season at present and at 25, 50 and 100 years from now, including full meta-data stored and archived in database of BWDB.																																	
		Geospatial datasets of groundwater salinity at 3 relevant levels (in the upper shallow, lower shallow and deeper aquifers, to be designated by BWDB) at present and at 25, 50 and 100 years from now, including full metadata and stored and archived in Database of BWDB.																																	
	D-4D:4,5 Tidal and salinity curves for key locations in the coastal zone (about 20, to be designated by BWDB) in the wet and dry season at present, and at 25, 50 and 100 years from now. D-4D:4,5 Exceedance frequency curves for water levels in the same 20 stations at present, and at 25, 50 and 100 years from now. Define extreme water levels in the polder of coastal zone at 25, 50 and 100 years from now, due to cyclonic storm surges.																																		
	D-4D:6 Technical Report with description and explanation of the geospatial datasets of surface and ground water salinity, and the tidal salinity and water level curves, including description of relevant seasonal variations, used models, indication of more and less likely scenarios and full metadata. The Research Team shall also discuss the effect of at least two relevant options of redistribution of river water in the South West delta on salt intrusion.																																		

Table 1.1 (contd) Original Activity Schedule Page 4

No	TOR Reference/ Deliverables Code	TOR Deliverables	15-Oct-18	15-Nov-18	15-Dec-18	15-Jan-19	15-Feb-19	15-Mar-19	15-Apr-19	15-May-19	15-Jun-19	15-Jul-19	15-Aug-19	15-Sep-19	15-Oct-19	15-Nov-19	15-Dec-19	15-Jan-20	15-Feb-20	15-Mar-20	15-Apr-20	15-May-20	15-Jun-20	15-Jul-20	15-Aug-20	15-Sep-20	15-Oct-20	15-Nov-20	15-Dec-20	15-Jan-21	15-Feb-21	15-Mar-21	15-Apr-21					
D-5																																						
D-5A																																						
	D-5A:1	Technical Report on Long Term Polder Improvement measures and Polder Development Plan																																				
	D-5A:1																																					
	D-5A:1																																					
	D-5A:2	Design of polder improvement measures of 17 polders under CEIP-I with consideration of existing improvements. Draft report focusing on initial 4 Polders to be optimised. Final report, 17 polders																																				
	D-5A:3	Report for each of the 3-5 polders with a description of ; Present situation, boundary conditions (scenarios), Matching with polder options, Including management plan, Costs and benefits. Draft report focusing on initial 4 Polders to be optimised. Final Report, 17 Polders.																																				
D-5B		Report describing the Interdependencies and relations between the processes and parameters, consequences for the boundary conditions and recommendations for future action plan/ research																																				
D-6		Updating of design paramerters and specificaitons for construction works and management paractices																																				
	D-6.1	Report with updated set of design parameters and specifications for construction/ reconstruction of the polders as well as associated appurtenant structures. Detailed delivery plan to be developed druing the inception phase.																																				
D-6.2 & D-6.3	D-6.2 & D-6.3	Report on Management plans for the polders including review approaches of polder management and performance monitoing mechanism Detailed delivery plan to be developed during the inception phase																																				
D-7		Investment Plan for Entire CEIP																																				
	D-7:1	An investment plan describing a phaased polder improvement roadmap and required budget																																				
	D-7:2	An investment plan for long term management of the polders, including the expansion of monitoring																																				
	D-7:3	An execution plan including financing and fundraising strategies and plan and technical collaboration plan																																				
D-8		Action Plan for Capacity Building On the job technical training in country Report on: results of the on the job training, list of participants International Workshop Teach the teacher, Teaching at the universities																																				
D-9.1		Outreach Program																																				
	D-9.1:1	Workshops																																				
	D-9.1:2	Workshop Report (Stakeholder's workshop at Barisal and Khulna & Mid-term workshop at Dhaka)																																				
D-9.2		Communication Strategy Storage of all datasets of BWDB and Communication materials																																				
QPR																																						

▲ Draft submission of report ▲ Revised submission of report

1.2 Revised List of Non-Modelling Milestones and Deliverables)

Table 1.2 a: List of non-modelling milestones and deliverables (Part 1)

Overview of Deliverables		As per Consultant				
No	ToR Deliverables	Program Item	Status	Deadline as per Signed Contract	Date of Submission to PIU	Proposed Revised Deadline
D-1	Inception					
	Inception Workshop	Inception Workshop	Accepted	4-Jan-19	9-Jan-19	
	Inception Report (Workplan etc)	Inception Report (Workplan etc)	Accepted	4-Jan-19	30-Jan-19	
D-2	Detailed Literature Review and its Summary and Lessons Learnt					
	Literature Inventory & Interim Review 1	Literature Inventory & Interim Review 1	Submitted	4-Feb-19	24-Jun-19	January 2021
	Literature Inventory & Interim Review 2	Literature Inventory & Interim Review 2	Submitted	4-Oct-20	15-Jan-20	March 2021
	Literature Review & Lessons Learnt	Literature Review & Lessons Learnt	Pending	4-Oct-20		March 2021
D-3	Development of Input Datasets for Modelling the physical processes					
	Soft and hard copies of map of the location of all the current field measurement stations, by tape, stored in Database of BWDB, Map showing the location of primary BM with values	Data Report, Inventory & Quality Checks (Includes field Data collection and monitoring programmes)	Submitted	4-Jul-19	29-Sep-19	
	Raw datasets of all type of data. Including meta-data. Stored in Database of BWDB					
	Completed and validated dataset including meta-data, stored in Database of BWDB	Database Design Report	Submitted	4-Jul-19	11-Sep-19	
		GIS Based Maps	Submitted	4-Jul-19	25-Sep-19	
	GIS based National Coastal Polder Database/ Management Information System/ Database	GIS Based Database/ MIS system/ Sharepoint	Pending	4-Jul-19		Sep/21
	Boundary conditions and data for calibration and validation of models	Supply of Model Boundary Data	Submitted	4-Jul-19	25-Sep-19	
	Monitoring results on sedimentation rate in rivers and floodplain	Monitoring Results on Sedimentation rate in rivers	Submitted	4-Jul-19	12-Dec-20	Nov/20
	Annual and seasonal sediment load of major rivers and to Bay of Bengal	Annual & Seasonal Sediment load of Major rivers & to Bay of Bengal	Pending	4-Aug-19		March 2021
	Technical memorandum describing the validation and completion procedures that have been used by the consultant for all type of data; for reproducibility purposes and to be stored in Database of BWDB	Technical Report of Data analysis & Validation	Submitted	4-Aug-19	16-Feb-21	Dec-20
	Memorandum with recommendations to improve the data collection, processing, validation and dissemination within the GoB	Technical Report on improving Data collection	Pending	4-Aug-19		Dec-20
D-5A	Finalization of approach for reconstruction of the Polder at different coastal zones including their phasing and construction program					
	Technical Report on Long Term Polder Improvement measures and Polder Development Plan	Draft	Submitted	4-Apr-21	6-Aug-19	Sep-21
		Final	Pending			Oct-2021
	Design of polder improvement measures of 17 polders under CEIP-1 with consideration of existing improvements with a description of ; opportunities for livelihood, spatial planning, water management and operation, subsidence, raising of low lying area and future climate change scenarios.	Draft	Submitted	4-Apr-21	17-Jan-21	February 2021
		Final	Pending			Apr-21
	Report for each of the 3-5 polders with a description of; - Present situation - Boundary conditions (scenarios) - Establish design, including management plan - Costs and benefits - Matching with polder options	Draft	Pending	4-Jul-20		Jul-21
		Final	Pending			Aug-21
D-5B	Coherence and Overall picture of Delta					
	Report describing the Interdependencies and relations between the processes and parameters, consequences for the boundary conditions and recommendations for future action plan/ research	Coherence with respect to Overall Delta	Pending	4-Apr-21		Jul-21
		Environmental Assessment of Proposed Interventions	Pending			
D-6.1	Updating of design parameters and specifications for construction work					
	Report with updated set of design parameters and specifications for construction/ reconstruction of the polders as well as associated appurtenant structures	Updated Design Parameters & Specifications		4-Apr-21		July 2021
	Detailed delivery plan to be developed during the inception phase for D-6.1	Detailed Delivery Plan	Submitted	4-Feb-19	11-Apr-20	
D-6.2	Review of approaches for management of polders with emphasis on acti					
	Report on Management plans for the polders	Polder Management Plan	Pending	4-Apr-21		Nov-21
	Detailed delivery plan to be developed during the inception phase for D-6.2	Detailed Delivery Plan	Submitted	4-Feb-19	11-Apr-20	
D-6.3	Setting up a performance monitoring Mechanism					
	Report on participatory monitoring mechanism with goals and targets	Performance Monitoring Mechanisms		4-Apr-21		Nov-21
	Detailed delivery plan to be developed during the inception phase for D-6.3	Detailed Delivery Plan	Submitted	4-Feb-19	11-Apr-20	

Table 1. 2 b: List of non-modelling milestones and deliverables (Part 2)

No	ToR Deliverables	Program Item	Status	Deadline as per Signed Contract	Date of Submission to PIU	Proposed Revised Deadline
D-7	Investment plan for the Entire CEIP					
	An investment plan describing a phased polder improvement roadmap and required budget	An investment plan describing a phased polder improvement roadmap and required budget		4-Apr-21		Nov-21
	An investment plan for long term management of the polders, including the expansion of monitoring	An investment plan for long term management of the polders, including the expansion of monitoring		4-Apr-21		Nov-21
	An execution plan including financing and fundraising strategies and plan and technical collaboration plan	An execution plan including financing and fundraising strategies and plan and technical collaboration plan		4-Apr-21		Nov-21
D-8	Action Plan for Capacity Building					
	On the job technical training in country	In-country on-the- job Training	Pending	Continuous		december 2021
	Report on: results of the on the job training, list of participants	Training Report with list of trainees	Pending	Bi Annually		december 2021
	International Workshop	International Workshop	Pending	4-Jul-20		december 2021
	Teach the teacher, Teaching at the universities	Curriculum Development	Pending	4-Apr-21		december 2021
D-9.1	Outreach Program					
	Workshops	Workshop 1 - Barishal	Accepted		30-Mar-19	
	Workshops	Workshop 2 - Khulna	Accepted		27-Apr-19	
	Workshops	Workshop 3 - Mid Term Progress Workshop	Accepted		6-Feb-20	
	Workshops	Workshop 4	Pending			
	Workshops	Workshop 5	Pending			
	Workshops	Workshop 6	Pending			
	Workshops	Workshop 7	Pending			
	Workshop Report	Workshop 1 Report - Barishal	Submitted		20-Feb-20	
	Workshop Report	Workshop 2 Report - Khulna	Submitted		20-Feb-20	
	Workshop Report	Workshop 3 Report - Mid Term Progress Workshop	Submitted		8-Jun-20	
	Workshop Report	Workshop 4 Report	Pending			
	Workshop Report	Workshop 5 Report	Pending			
	Workshop Report	Workshop 6 Report	Pending			
	Workshop Report	Workshop 7 Report	Pending			
D-9.2	Communication Strategy					
	Storage of all datasets BWDB	Storage of all datasets BWDB		4-Apr-21		December 2021
	Communication materials such as brochures, animations etc.	Communication materials such as brochures, animations etc.		4-Oct-20		December 2021
Q	QPR					
	QPR-1	QPR-1			30-Jan-19	
	QPR-2	QPR-2	Submitted		20-Aug-19	
	QPR-3	QPR-3	Submitted		20-Aug-19	
	QPR-4	QPR-4	Submitted		7-Nov-19	
	QPR-5	QPR-5	Submitted		2-Mar-20	
	QPR-6	QPR-6	Submitted		10-Jun-20	
	QPR-7	QPR-7	Submitted		6-Sep-20	
	QPR-8	QPR-8	Submitted		20-Jan-21	
	QPR-9	QPR-9	Pending			
	QPR-10	QPR-10				

1.3 Revised List of Modelling Milestones and Deliverables

Table 1. 3 a: List of Modelling Deliverables & Milestones (Part 1)

DELIVERABLES RELATED TO MODELLING ACTIVITIES							
TOR Reference	TOR Deliverables	Scale	Model	Status	Delivery Dates as per signed Contract	Delivery Dates (by Consultant)	Proposed Revised Deadline
D-4A-1: 1	The software newly developed under this project with all source code and accompanying technical document with detailed explanation of the methodology and assumptions			Pending	4-Apr-21	At the end of each model	
D-4A-1: 2, 3	Geospatial datasets of main sources and deposits of sediment at present, including full meta-data a restored and archived in Database of BWDB Geospatial datasets of main sources and deposits of sediment for 100 years from present, including full meta-data are published and archived in Database of BWDB.	Macro	GBM Basin Model	Submitted	D-4A-1: 2 (Jan 20) D-4A-1: 3 (Oct 20)	Mar-20	Feb-21
		Macro	Macro scale River Model	Submitted		Mar-20	
		Macro	Macro scale River Model	Submitted		Mar-20	
		Macro	GBM Basin Model Applications	Pending		7th Quarter	
		Macro	Macro scale River Model Applications	Pending		7th Quarter	
		Macro	Macro scale River Model Applications Sediment Budget Analyses	Pending		7th Quarter Apr-20	
D-4A-1: 4	Technical report (one report for 4A-1 & 4A-2)			Pending	Draft (Jul 20) Final (Jan 21)	Oct-20	Feb-21
Long Term Morphology Modelling							
D-4A-2: 1	Report on upgrade and update of present meso scale model including detailed explanation of the methodology and assumptions.	Meso	Pussur Sibs	Submitted	4-Oct-19	Mar-20	oct-20
		Meso	Baleswar-Bishkhal Model	Submitted		Mar-20	
		Meso	Lower Meghna	Submitted		Mar-20	
		Meso	Sangu	Submitted		Mar-20	
D-4A-2: 2, 3	Geospatial datasets of erosion and sedimentation in the coastal zone at present for various seasons and circumstances in relevant. These geospatial datasets should include full meta-data and be stored and archived in Database of BWDB. Geospatial datasets of erosion and sedimentation in the coastal zone for possible scenarios 25, 50 and 100 years from now, for various reasons and circumstances if relevant. These geospatial datasets should include full meta-data and be stored and archived in Database of BWDB	Meso	Pussur Sibs	Pending	D-4A-2: 2 (Apr 20) D-4A-2: 3 (Jul 20)	7th Quarter	Apr-21
		Meso	Baleswar-Bishkhal Model	Pending		7th Quarter	Apr-21
		Meso	Lower Meghna	Pending		7th Quarter	Apr-21
		Meso	Sangu	Pending		7th Quarter	Apr-21
D-4A-2: 4	Technical report (one report for 4A-1 & 4A-2)			Pending	Draft (Jul 20) Final (Oct 20)	Nov-20	Apr-21
Bank Erosion on Meso Scale							
D-4A-2: 1, 2	Report on upgrade and update of present meso scale model including detailed explanation of the methodology and assumptions. Geospatial datasets of erosion and sedimentation in the coastal zone at present for various seasons and circumstances in relevant. These geospatial datasets should include full meta-data and be stored and archived in Database of BWDB	Meso	Pussur	Submitted	4-Oct-19	Apr-20	Interim Reports: October 2020 Final Report May 2021
		Meso	Sibs	Submitted		Apr-20	
		Meso	Baleswar	Pending		Apr-20	
		Meso	Bishkhal	Submitted		Apr-20	
		Meso	Lower Meghna	Pending		Apr-20	
		Meso	Sangu	Pending		Apr-20	
D-4A-2: 3	Geospatial datasets of erosion and sedimentation in the coastal zone for possible scenarios 25, 50 and 100 years from now, for various reasons and circumstances if relevant. These geospatial datasets should include full meta-data and be stored and archived in Database of BWDB	Meso	Pussur	Pending	D-4A-2: 2 (Apr 20) D-4A-2: 3 (Jul 20)	Dec-20	April 2021
		Meso	Sibs	Pending		Dec-20	
		Meso	Baleswar	Pending		Dec-20	
		Meso	Bishkhal	Pending		Dec-20	
		Meso	Lower Meghna	Pending		Dec-20	
		Meso	Sangu	Pending		Dec-20	
		Meso	Pussur-Sibs fine sediment model- ext	Submitted		Jan-20	
		Meso	FINAL REPORT ON BANK	Pending		Jan-21	
D-4A-2: 4	Technical report (one report for 4A-1 and 4A-2) The model setup developed will be updated under this project with all accompanying technical document with detailed explanation of the methodology and assumptions.	Meso	FINAL REPORT ON BANK	Pending	Draft (Jul 20) Final (Oct 20)	Jan-21	April 2021
D-4A-3: 1, 2, 3	A report that describes the pros and cons of the different methodologies to prevent water-logging within the polder and sedimentation of tidal river system including polder-subsidence. The report will include meta-data on the models used and measurements, recommendations for polder design including drainage and long term management plan, and recommendations for pilot area/ polder to implement the ideas, such as but not limited to location, methods and measurements.	Micro	Pilot TRM Model for Polders 24 etc	Pending	4-Oct-20	Mar-20	Interim Report: November 2020 Final Report: May 2021
		Micro	5 or more polder models	Pending		20-Sep	Mar-21
D-4A-3: 4	Recommended plan to manage sediment at the downstream stretch of the tidal river and in the polder						

Table 1.3 b: List of Modelling Milestones and Deliverables (Part 2)

TOR Reference	TOR Deliverables	Scale	Model	Status	Delivery Dates as per signed Contract	Delivery Dates (by Consultant)	Proposed Revised Deadline
SUBSIDENCE							
D-4B: 1, 2,3	Geospatial datasets of total subsidence at present and for 25, 50 and 100 years from now, including full metadata and stored in Database of BWDB and Estimate the annual rate of subsidence.		Field Campaigns (several)	Pending	D-4B: 1, 2 (Oct 20) D-4B: 3 (Report: Draft - July 20, Final - Oct 20)	Dec-20	July 2021
	Detailed Technical Report with description and explanation of geospatial analysis of the total subsidence in the four regions of the polder area of the coastal zone at present and for 25, 50 and 100 years from present, including description of the causes of subsidence, full metadata and stored in Database of BWDB.		Subsidence Geospatial Datasets	Submitted		Oct-20	
				Pending		Oct-20	
METEOROLOGY (these are covered under other modelling and data topics)							
D-4C: 1, 2	Technical Report describing current trends and future scenarios in rainfall in the polder area of coastal zone for four coastal regions (including estimation of rainfall distribution over the year) and cyclone frequency and intensity for the next 25, 50 and 100 years from now, including meta-data of the datasets used for the trend analyses and store and archived in Database of BWDB. The Research Team shall include a description of the statistical and downscaling methods used for reproducibility reasons. Geospatial Dataset and archived in Database of BWDB.		Technical reports & Database	Pending	D-4C: 1 (Apr 20) D-4C: 2 (Jul 20)		Jan 2021
CLIMATE CHANGE EFFECTS							
D-4D: 1, 2, 3	Geospatial datasets of High Water, Low Water and maximum salt intrusion in all river branches for average tide in the wet and dry season at present and at 25, 50 and 100 years from now, including full meta-data stored and archived in database of BWDB.		Salinity intrusion & Groundwater Salinity	Pending		Oct-20	February 2021
	Geospatial datasets of groundwater salinity at 3 relevant levels (in the upper shallow, lower shallow and deeper aquifers, to be designated by BWDB) at present and at 25, 50 and 100 years from now, including full metadata and stored and archived in Database of BWDB. Tidal and salinity curves for key locations in the coastal zone (about 20, to be designated by BWDB) in the wet and dry season at present, and at 25, 50 and 100 years from now.						
D-4D: 4, 5	Exceedance frequency curves for water levels in the same 20 stations at present, and at 25, 50 and 100 years from now. Define extreme water levels in the polder of coastal zone at 25, 50 and 100 years from now, due to cyclonic storm surges.		Extreme Storm Surges	Pending		Oct-20	February 2021
D-4D: 6	Technical Report with description and explanation of the geospatial datasets of surface and ground water salinity, and the tidal salinity and water level curves, including description of relevant seasonal variations, used models, indication of more and less likely scenarios and full metadata. The Research Team shall also discuss the effect of at least two relevant options of redistribution of river water in the South West delta on salt intrusion.			Pending		Nov-20	February 2021
Other special purpose models							
D-4D: 1, 2, 3, 4, 5	Geospatial datasets of High Water, Low Water and maximum salt intrusion in all river branches for average tide in the wet and dry season at present and at 25, 50 and 100 years from now, including full meta-data stored and archived in database of BWDB.	Bay of Bengal	Storm Surge Model	Pending		Dec-19	February 2021
	Geospatial datasets of groundwater salinity at 3 relevant levels (in the upper shallow, lower shallow and deeper aquifers, to be designated by BWDB) at present and at 25, 50 and 100 years from now, including full metadata and stored and archived in Database of BWDB. Tidal and salinity curves for key locations in the coastal zone (about 20, to be designated by BWDB) in the wet and dry season at present, and at 25, 50 and 100 years from now.	Bay of Bengal	Storm Surge Model	Pending		Dec-20	Interim Report: February 2021 Final Report June 2021
		Bay of Bengal	Wave Propagation Model	Pending		Dec-20	
		Bay of Bengal	Salinity Model	Pending		2020 end	

1.4 List of Deliverables Submitted

Table 1. 4: Total List of Deliverables including revised report submitted to PD

SL No.	Name of the Report	Date of Submission (m/d/y)	Reference as per Tracker	Program Item/Description as per Tracker	Reports under component
1	Final Inception Report	1/30/2019	D-1: 2	Inception Report (Workplan etc)	Component-1
2	QPR-2	04/07/2019	Q 2	QPR-2	QPR
3	1st interim Literature Review Report	6/24/2019	D-2: 1	Literature Inventory & Interim Review 1	Component-2
4	Report on Selection of Polders for Conceptual Design as Pilot Program	8/6/2019	D-5A:1	Polder Development Plan	Component-5
5	QPR-3	08/06/2019	Q 3	QPR-3	QPR
6	Database Design Report (1 st submission)	9/11/2019	D-3: 3	Database Design Report	Component-3
7	Report on Regional Stakeholder's Consultation Workshop, Barisal (Both English and Bengali versions),	9/24/2019	D-9.1: 2	Workshop 1 Report - Barishal	Component-9
8	Report on Regional Stakeholder's Consultation Workshop, Khulna (Both English and Bengali versions),	9/24/2019	D-9.1: 2	Workshop 2 Report - Khulna	Component-9
9	Supply of GIS Based Maps	9/25/2019	D-3: 4	GIS Based Maps	Component-3
10	Supply of Boundary Data for Models at Various Scales	9/25/2019	D-3: 5	Supply of Model Boundary Data	Component-3
11	Data Reports, Inventory, Quality Checks	9/29/2019	D-3: 1, 2	Data Report, Inventory & Quality Checks (Includes field Data collection and monitoring programmes)	Component-3
12	QPR-4	11/7/2019	Q 4	QPR-4	QPR
13	Interim Literature Review Report 2	1/15/2020	D-2: 2	Literature Inventory & Interim Review 2	Component-2

SL No.	Name of the Report	Date of Submission (m/d/y)	Reference as per Tracker	Program Item/Description as per Tracker	Reports under component
14	QPR-5	3/2/2020	Q 5	QPR-5	QPR
15	Database Design Report (Revised)	5/21/2020	D-3: 3	Database Design Report	Component-3
16	Revised Interim Literature Review Report 1	5/31/2020	D-2: 1	Literature Inventory & Interim Review 1	Component-2
17	Mid-term Progress Workshop Report	6/8/2020	D-9.1: 2	Workshop 3 Report - Mid Term Progress Workshop	Component-9
18	QPR-6	6/10/2020	Q 6	QPR-6	QPR
19	Boundary conditions and data for calibration and validation of models (Revised Submission)	6/11/2020	D-3: 5	Supply of Model Boundary Data	Component-3
20	GBM Basin Model and Macro Scale river and coastal model -current scenario (1 st submission)	8/12/2020; 8/16/2020;	D-4A-1: 2, 3	Model Set up Calibration & Validation	Component-4
21	Meso-scale Interim Report: Effect of human interventions on tidal and sediment dynamics in the Pussur-Sibsa basin (1 st submission)	Sep 2020	D-4A-2: 3	Pussur Sibsa Fine Sediment Model	Component-4
22	QPR-7	9/6/2020	Q 7	QPR-7	QPR
23	MIKE 21C Bishkhali Meso-scale Bank Erosion Morphological Modelling Study: Model Development Report	10/08/2020	D-4A-2: 1, 2	Bishkhali: Model Set up Calibration & Validation	Component-4
24	Interim Subsidence Report	10/30/2020	D-4B: 1, 2,3	Report	Component-4
25	MIKE 21C Pussur meso-scale bank erosion morphological modelling study: Model development report	10/30/2020	D-4A-2: 1, 2	Pussur: Model Set up Calibration & Validation	Component-4
26	MIKE 21C Sibsa meso-scale bank erosion morphological modelling	10/30/2020	D-4A-2: 1, 2	Sibsa: Model Set up Calibration & Validation	Component-4

SL No.	Name of the Report	Date of Submission (m/d/y)	Reference as per Tracker	Program Item/Description as per Tracker	Reports under component
	study: Model development report				
27	GBM Basin Model and Macro Scale river and coastal model -current scenario (Revised)	11/19/2020	D-4A-1: 2, 3	Model Set up Calibration & Validation	Component-4
28	Lower Meghna-Tetulia river system morphological modelling study-Current situation	12/02/2020	D-4A-2: 1	Lower Meghna: Model Set up Calibration & Validation	Component-4
29	Meso-scale Interim Report: Effect of human interventions on tidal and sediment dynamics in the Pussur-Sibsa basin (revised)	12/04/2020	D-4A-2: 3	Pussur Sibsa Fine Sediment Model	Component-4
30	Monitoring Results on Sedimentation rate in Rivers and Floodplain	12/12/2020	D-3:6	Monitoring Results on Sedimentation rate in rivers	Component-3
31	Baleswar-Bishkhali morphological modelling study-Current situation- Interim Report	01/06/2021	D-4A-2: 1	Baleswar-Bishkhali: Model Set up Calibration & Validation	Component-4
32	Pussur-Sibsa morphological modelling study-Current situation - Interim Report	01/06/2021	D-4A-2: 1	Pussur Sibsa: Model Set up Calibration & Validation	Component-4
33	Sangu River morphological modelling study- Interim Report	01/06/2021	D-4A-2: 1	Sangu: Model Set up Calibration & Validation	Component-4
34	Review/Improvements on-going work (CEIP-I)	01/17/2021	D-5A:2	Improvement to 17 Polders	Component-5
35	QPR-8	01/20/2021	Q 8	QPR-8	QPR
36	Data Validation and Compilation Report	02/16/2021	D-3:8	Technical Report of Data Analysis and validation	Component-3

Deliverable 23 to 30 have been submitted during Q9.

2 DATA ACQUISITION

2.1 2.1 Collecting Existing Data

IWM already has a very comprehensive database comprising hydrometric, meteorological and morphological and environmental data collected over many decades all over the territory of Bangladesh and the adjacent ocean. These data have the advantage of having been used many times over in a large model studies which have also established the quality of the data through repeated verification.

The present study requires the addition of socio-economic data and its subdivision in to a polder-wise demarcated body of data. The availability of data is described in the Inception Report and is too large to be included in this progress report. The reader is directed to the Inception report for an outline of availability. Appendix A of the Second Quarter Progress Review Report gives a list of available data.

2.2 2.2 Field Surveys carried out by IWM

2.2.1 Mobilization

The survey team was mobilized on 05 February 2019. A team of 12 personnel comprising the IWM survey Expert, experienced hydrographic surveyor and land surveyors has been deployed for conducting the planned data collection campaign as per specification.

2.2.2 Summary of Field Survey Activities in the 8th Quarter (ending September 2020)

In this quarter from October 2020 to December 2020, field survey for the 5 selected polders is being carried out for modelling TRM, cyclone storm surge/ flood hazard and finally conceptual polder design.

In addition, routine discharge and sediment measurements at Bahadurabad of Brahmaputra river and at Hardinge Bridge of Ganges river are also being continued for the better understanding of the sediment rating curve. As the discharge observations at Bahadurabad and Harding Bridge could not be achieved according to the planned schedule during March 2020 to September 2020 due to the lockdown of COVID-19 and also due to breakdown of two number ADCP, it is planned to continue the measurements over those two locations up to September 2021 during the extended period of the project. In this period, measurements will be done with a more frequency to achieve the target number of measurements which would also helpful for more understanding in the sediment rating curve analysis.

The survey methodology for the 5 polders survey employed by IWM survey teams is described in the Seventh Quarterly Report and the methodology for the others survey is described in details in the Second Quarterly Progress Report.

In this quarter from October 2020 to December 2020, the progress of discharge and sediment monitoring has been shown in Table 2-2 to Table 2-3.

Survey methodology/progress for the 5 polders:

The survey was started in Feb-2020. However, due to the lockdown under COVID-19, the field work was suspended in 20/03/2020 which has been restarted again in June-2020.

The main feature of the 5 polders survey included cross-section of surrounding embankment and internal drainage canals, detail structure inventory, cross-section of the surrounding rivers/canals, and land level survey. Out of these, the cross sections survey of the surrounding embankment, internal drainage canal and structure inventory have been already completed. The land level survey is being continued during this present quarter starting from November 2020. The progress of the survey for 5 polders has been shown in Table 2.1.

Establishment of Bench Marks:

1. Bench Mark Fly:

The survey work for the all polders has been conducted with reference to available existing Survey of Bangladesh (SOB) bench mark (BM) situated around the polders area. TBMs have been kept by engraving on the permanent structures like regulator and sluices during the survey. Closing error will be checked to maintain the survey accuracy.

Table: Total List of reference Bench Mark

1	BM-1039	The pillar is situated on the Upazilla Research center compound, PS: Dumuria, Dist: Khulna.	2.135	748347	2524502	Polder 29
2	BM-148	The pillar situated on the N/E corner of pond behind the house of Mr. Rumi commissioner east side of Patharghata Hospital road, Vill: Patharghata Hospital road, UP: Patharghata, Dist: Barguna.	2.137	806423	2439568	In Polder 40/1
3	BM-4103	Situated in the Turabgonj High School Compound, PS: Kamalnagar, Dist: Laxmipur	4.314	280961	2524625	In Polder 59/2
4	GPS-214	Situated in the Motirhat High School compound, PS: Komolnagar, Dist: Laxmipur	3.624	272674	2524873	
5	GPS-274	The pillar is situated at west side of Sandwip Para cyclone shelter and east bank of pond, Vill: Sandwip Para, UP: Bashkhali	3.599	383788	2446678	In Polder 64/1A and Polder 64/1B
6	BM-5117	SOB BM pillar no-5117 situated in SE corner of 73no Sora Primary School. Vill: Sora, Up: Gabura, PS: Shyamnagar, Dist: Satkhira	2.044	732187	2459629	In Polder 15

2. Embankment cross section:

Cross sections of the existing embankment are taken at 500 meter intervals. Apart from the Polder 15, a total of 296Km embankment cross section survey has been carried out for the other 5 polders. The embankment cross sections of Polder 15 were conducted during 2016 under CEIP-I. However, some

part of the embankment in Polder 15 has been damaged significantly due to the recent cyclone Amphan during May 20, 2020. This changed part of the embankment has been revisited through conducting 44 nos cross sections to cover the damaged part of the embankment. All cross sections are taken with perpendicular to the alignment of the embankment and has been extended at least 15 m beyond the toe in the country side (C/S) and 50 meter in the river side (R/S). At locations of breaches, damages, cross-sections have been taken at the closer intervals to represent the correct configuration of the cross-section. Cross section has been carried out by using optical level and handheld GPS.



Figure: Embankment Cross section Survey

3. Drainage Channel Survey:

The cross section of the Khal has been carried out at an interval of 500 meter or closer where ever necessary, to represent the correct configuration of the khal. A total of 326 Km drainage channel cross section survey will be carried out in the five polders excluding Polder 15. The cross section survey has been conducted during March 2017 at Polder 15 can be utilized here in this study. Cross section has been extended at 15 m beyond the bankline and spot level to be taken maximum 5 m apart or less as necessary to represent the correct configuration of the cross section. Cross sections of the drainage channel have been conducted by using optical level and hand GPS. The tentative locations of the cross section are made by delineating the alignment of the existing drainage channel.

4. Structure Inventory: The structural dimensions/level, information like operational practice, physical condition of structure, launching apron and drainage channels condition has been recorded during the survey A log-sheet was prepared and followed in the field for recording the necessary information regarding the structure.



Figure. Sluce-10 of P-64/1A



Figure: Asanghar Sluice of P-29

5. Cross section of the surrounding river:

A total of 340 cross-sections of the peripheral river of all 6 polders is being conducted. River section survey is being carried out at 500m-1000m interval considering the existence of the drainage regulator and also along the river bend. The cross sections extended up to high bank or up to embankment. The survey has been done by using DGPS & Echo sounder for the channel part while the shallower part and the dry land have been surveyed by using Optical Level.



Figure: Bathymetry Survey at the surrounding river of Polder 29.

6. Topographic Survey:

Spot levels together x, y co-ordinate have been carried out around 50mx50m interval by using optical level and GPS or total station for the drainage model. Spot level are undertaken in the open area mainly and some representative spot level will be also recorded inside the homestead. Initially, it was planned to conduct topography survey along the limited area (30% of the available open area). However, a total of 450 Km² covering the whole area of 5 polders excluding the polder-15 for interest of this research project. Land level survey conducted during 2017 at Polder-15 under the detail design of CEIP-1 will be utilized for this study. Level data has been processed in Arc View GIS software to produce spot level with reference to MSL vertical datum. The spot levels have been taken along with physical features ID like khals, road, embankment, paddy land etc.

Table 2. 1: Progress/future plan of survey for 5 polders

SI No	Polder	Item of work	Quantity	Progress up to Sep-2020	Progress in between Oct-Dec-2020	Cumulative Progress	Remarks
1	(P-40/1) Patharghata, Barguna	Embankment (Km)	22	22	0	22	
		structure (Nos.)	27	27	0	27	
		Drainage Canal (Km)	27	27	0	27	
		Perepheral River Section (nos.)	43	43	0	43	
		Land Level (Km ²)	20	0	20	20	
2	(P-29) Dumuria/Batiaghata, Khulina	Embankment (Km)	49	49	0	49	
		structure (Nos.)	41	41	0	41	
		Drainage Canal (Km)	121	121	0	121	
		Perepheral River Section (nos.)	120	60	60	120	
		Land Level (Km ²)	79	0	79	79	
3	(P-59/2) Char Alexander/Kamalnagar, Noakhali	Embankment (Km)	88	88	0	88	Land level survey will be done during January-2021
		structure (Nos.)	8	8	0	8	
		Drainage Canal (Km)	73	73	0	73	
		Perepheral River Section (nos.)	61	0	61	61	
		Land Level (Km ²)	209	0	0	0	
4	(P-64/1A) Bashkhali, Chittagong	Embankment (Km)	54	54	0	54	
		structure (Nos.)	5	5	0	5	
		Drainage Canal (Km)	42	42	0	42	
		Perepheral River Section (nos.)	56	0	56	56	
		Land Level (Km ²)	52	0	52	52	
5	(P-64/1B) Bashkhali, Chittagong	Embankment (Km)	83	83	0	83	Land level survey is in progress.
		structure (Nos.)	50	50	0	50	
		Drainage Canal (Km)	63	63	0	63	
		Perepheral River Section (nos.)	24	0	24	24	
		Land Level (Km ²)	90	0	50	50	
6	(P-15) Syamnagar, Satkhira	Embankment (Km)	27	27	0	27	Survey has been conducted during 2017 in connection with CEIP-1 for detail design. For this study revisit has been done through conducting 44 nos. embankment and 49 nos. perepheral river cross section. In addition, some structure inventory has been revisited.
		structure (Nos.)	7	7	0	7	
		Drainage Canal (Km)	20	20	0	20	
		Perepheral River Section (nos.)	36	36	0	36	
		Land Level (Km ²)	31	31	0	31	
Total		Embankment (Km)	323	323	0	323	
		structure (Nos.)	138	138	0	138	
		Drainage Canal (Km)	346	346	0	346	
		Perepheral River Section (nos.)	340	139	201	340	
		Land Level (Km ²)	481	31	201	232	

Table 2. 2: Progress of the discharge observation

SL no.	Location/ River Name	Target (Number)		Progress upto Sep-2020	Progress in between Sep - Dec 2020	Cumulative progress upto Dec-2020	Remarks
		TOR	Modified				
A	3 main rivers						
1	Bahadurabad, Brahmaputra	18	48	22	8	30	Data collection will be done upto September-2021 as a part of the extended study.
2	Hardinge Bridge, Ganges	18	48	21	9	30	
3	Bhairab Bazar, Upper Meghna	18	48	26	0	26	
Total of A		54	144	69	17	86	
B	Lower Meghna						
4	Chandpur, Lower Meghna	3	5	5	0	5	2 spring+ 1 neap during monsoon and 2 nos. 1 Spring +1 Neap for dry season
C	5 nos. Tidal rivers surrounding the Polders.						
5	U/S of Mongla port, Pusur	44	8	8		8	For each location 8 measurement: 1 spring in every two months and -1 neap in every six months for the periods of one year.
6	Nalian, Shibsha		8	8		8	
7	Charduani, Baleswar		8	8		8	
8	Bhandaria, Baleswar		8	8		8	
9	Polder-17/2, Gangril		8	8		8	
Total of C		44	40	40	0	40	
D	Additional 3 tidal River						
10	Dasmina, Tetulia	0	2	4		4	2 nos. measurement during June-Oct-19, 1 Spring+ 1 Neap
11	Kakchira, Bishkhali	0	3	3		3	Total 3 nos. -1 spring in dry season and 1-Neap+1-Spring for monsoon
12	Taliar dwip, Shangu	0	2	2		2	2 nos. measurement during June-Oct-19, 1 Spring+ 1 Neap
Total of D		0	7	9	0	9	

Table 2. 3: Progress of suspended sediment sampling for total concentration

SL no.	Location/ River Name	Discharge observation		Suspended Sediment Sampling for Total concentration			
		As per TOR	Modified	As per TOR	Progress upto Sep-2020	Progress from Sep-Dec 2020	Cumulative Progress upto Dec 2020
A	3 main rivers						
1	Bahadurabad, Brahmaputra	18	48	1056	1791	436	2227
2	Hardinge Bridge, Ganges	18	48				
3	Bhairab Bazar, Upper Meghna	18	48				
B	Lower Meghna						
4	Chandpur, Lower Meghna	3	5	234	149	0	149
C	5 nos. Tidal rivers surrounding the Polders.						
5	U/S of Mongla port, Pusur	44	40	3432	2736	0	2736
6	Nalian, Shibsha						
7	Charduani, Baleswar						
8	Bhandaria, Baleswar						
9	Polder-17/2, Gangril						
D	Additional 3 tidal River (as per modified plan)						
10	Dasmina, Tetulia	0	2	0	633	0	633
11	Kakchira, Bishkhali	0	3				
12	Taliar dwip, Shangu	0	2				

3 DEVELOPMENT OF INTERACTIVE GEODATABASE OF COASTAL ZONE

3.1 Introduction

This section presents the progress of tasks and activities for developing an Interactive Geodatabase for Coastal Zone (IGDCZ) during the 9th quarter (October 2020 to December 2020) of the project.

According to the Terms and Reference (ToR) of the project in Component-3 the objectives are:

- To collect all input datasets, undertake Quality Assurance/Quality Checking (QA/QC) and update/modify datasets as necessary for use in the modelling of the physical processes in the coastal zone of Bangladesh
- To improve the process of data collection, QA/QC and data dissemination and sharing among the government agencies

In order to achieve the above objectives, a web GIS based Interactive Geodatabase for Coastal Zone (IGDCZ) has been developing under this project. In doing the database application several tasks and activities are being conducted by IWM team. This section describes the progress of these tasks and activities which have been performed in this quarter of project tenure. The summary of work progress against different tasks are presented in Table 3.1

Table 3. 1: Summary of Interactive Geodatabase for Coastal Zone (IGDCZ) Progress work

SI No	Task & Activities	Progress (%) Upto 8 th Quarter	Progress (%) 9 th Quarter	Overall Progress (%)
1	Inception Phase			
1.1	Review Existing Systems	100	-	100
1.2	Consultation with Project Team	continue		continue
1.3	Consultation with Project Client	continue		continue
1.4	Requirement Analysis	100	-	100
1.5	Data Requirements and Data sources	100	-	100
1.6	Conceptual System Architecture	100	-	100
1.7	Inception Report	100	-	100
2	Data Collection and Processing			
2.1	Coastal Bank Erosion (Satellite Image)	100	-	100
2.2	Land use Classification (Satellite Image)	75	10	85
2.3	Other Data Collection (shapefile & tabular)	90	-	90
2.4	Other Data Processing (shapefile & tabular)	80	5	85

SI No	Task & Activities	Progress (%) Upto 8 th Quarter	Progress (%) 9th Quarter	Overall Progress (%)
3	GIS Mapping			
3.1	Polder Maps for Data Collection	75	10	85
4	Database Design & Development			
4.1	Database Design Development	100	-	100
4.2	Database Design Report	100	-	100
4.3	Database Implement	85	10	90
5	Web GIS Application Development			
5.1	IGDCZ Prototype Development	100	-	100
5.2	Full Version Development	85	5	90
5.3	GIS Core Module	90	-	90
5.4	Dashboard Development	70	10	80
5.5	Metadata Preparation	10	30	40
5.6	Metadata Interface Development	10	30	40
5.7	User Administrative Module	70	-	70
5.8	Document Archiving	100	-	100
5.9	Tutorial (help tutorial)	100	-	100
5.10	Testing & Debugging	80	5	85
5.11	Data Validation and Check	80	10	90
5.12	Software & Hardware Procurement	-	-	-
5.13	Installation of SW and HW at BDWB Data Center	-	-	-
5.14	Migration of Database and Application to BWDB Servers	-	-	-
5.15	Fully operational commissioning	-	-	-
5.16	Preparation of User Instruction Manual	-	-	-
6	Training & Technology Transfer			
7	Feedback and update (ongoing)	50	10	60

3.2 Data Collection and Data Processing

Hydrometeorological Data

Data collection and data processing are ongoing tasks. The meteorological data for the period from 2013 to 2019 have been collected from BMD and subsequently processed them for IGDCZ database.

Land Use change in the coastal area

Land used maps are being generated for the years 1990, 2000 and 2020 using available satellite images. The task is ongoing about 85% of this work is completed.

3.3 Web Application Development

User Feedback

Since the web GIS based IGDCZ is under developing stage. It is hosted in development server at IWM. A significant progress has been made during the reported quarter by IWM team, concurrently, online feedback and suggestions received from the potential users of BWDB, World Bank and Project team members. Accordingly, the received feedback and suggestions were reviewed and necessary changes were made in the application, this one way of conducting user acceptance test in developing IGDCZ application.

Dashboard

A new look of Dashboard is under development stage in the application. The old one was built with access point for accessing different modules. The new dashboard consists of interfaces of the summary information of polder database and the gateway to access different modules of the application.

Polder Data Modification

A web Interface of Polder Data modification tool has been developed with the core GIS module. User can search a particular polder by selecting a Zone, Circle, Division and Sub-division from Zone, Circle, Division and Sub-division list. A subsequently polder data can be modified on the selected polder attribute table in the database.

Metadata Interface

A standard metadata template has been developed based on the Dublin Core (<https://dublincore.org/>) and Geospatial Data Standard (<https://www.fgdc.gov/standards>), both standards are certified by ISO standards. According to these standards, a template consists of sixteen elements of the meta information of the data has been prepared which include Name or title, Data type, Subject, Description (Abstract, history, process description, purpose), coverage (spatial, temporal), date of published, creator, contributor, publisher, source, relation, language, rights, identifier, and format). In relation to the IDGCZ database, respective metadata interfaces have been developed with each type of layers and dataset. The metadata input entry, edit facilities were also developed.

3.4 Workplan

The development work has been conducted according a prepared workplan. Figure 3.1 shows the workplan with current status of different tasks and activities.

Workplan of IGDCZ Development

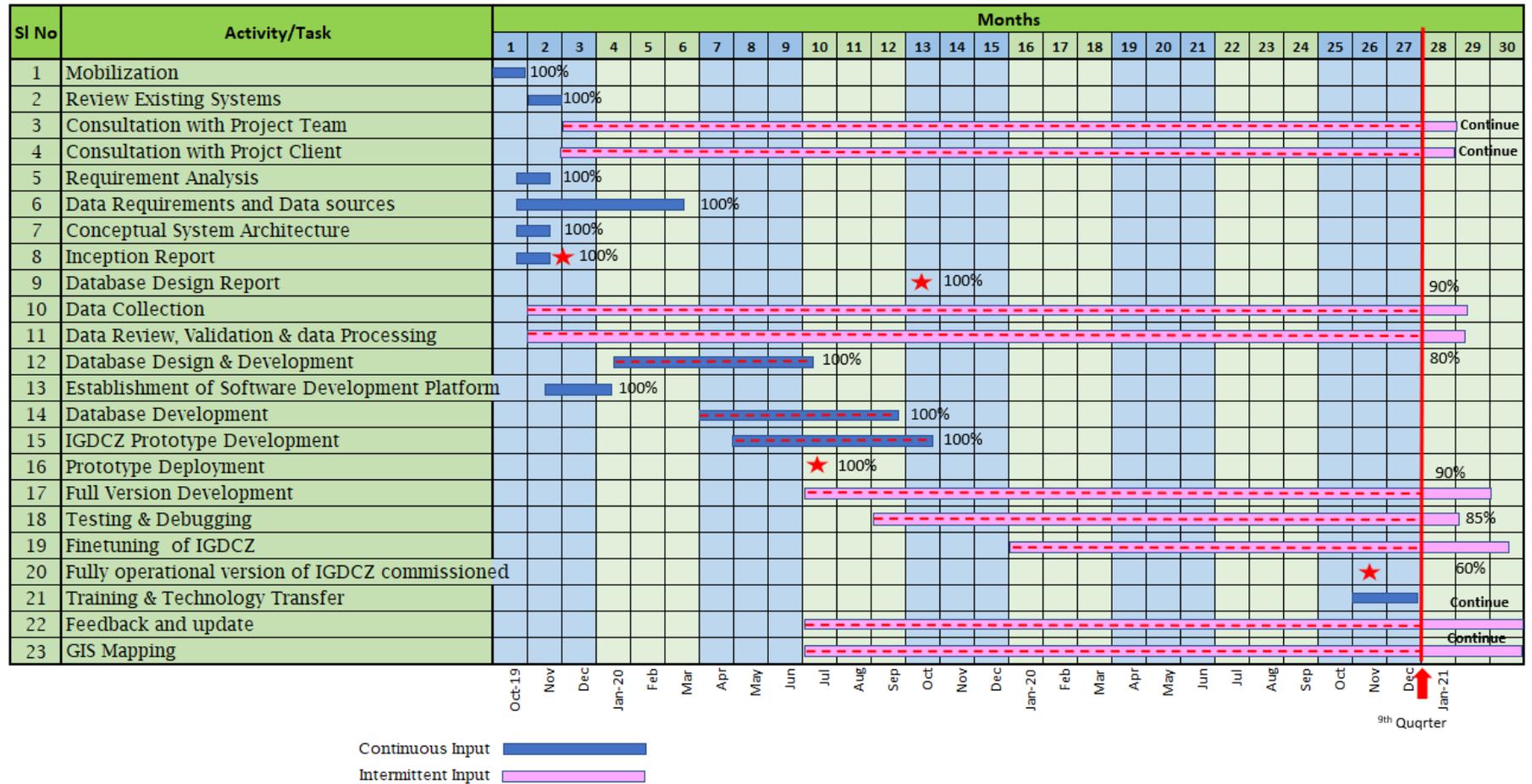


Figure 3. 1: Workplan of IGDCZ Development

3.5 Plan for the Next Quarter

Plan for the next quarter is summarized in Table 3.2

Table 3. 2: Plan for the Next Quarter

SI No	Task & Activities	Progress (%) Upto 9 th Quarter	Plan Progress (%) for Next Quarter	Overall Progress (%)
1	Inception Phase			
1.1	Review Existing Systems	100	-	100
1.2	Consultation with Project Team	continue		continue
1.3	Consultation with Project Client	continue		continue
1.4	Requirement Analysis	100	-	100
1.5	Data Requirements and Data sources	100	-	100
1.6	Conceptual System Architecture	100	-	100
1.7	Inception Report	100	-	100
2	Data Collection and Processing			
2.1	Coastal Bank Erosion (Satellite Image)	100	-	100
2.2	Land use Classification (Satellite Image)	85	15	100
2.3	Other Data Collection (shapefile & tabular)	90	-	
2.4	Other Data Processing (shapefile & tabular)	85	5	90
3	GIS Mapping			
3.1	Polder Maps for Data Collection & Processing	85	5	90
4	Database Design & Development			
4.1	Database Design Development	100	-	100
4.2	Database Design Report	100	-	100
4.3	Database Implement	90	5	95
5	Web GIS Application Development			
5.1	IGDCZ Prototype Development	100	-	100
5.2	Full Version Development	90	5	95
5.3	GIS Core Module	90	5	95

SI No	Task & Activities	Progress (%) Upto 9 th Quarter	Plan Progress (%) for Next Quarter	Overall Progress (%)
5.4	Dashboard Development	80	10	90
5.5	Metadata Preparation	40	20	60
5.6	Metadata Interface Development	40	20	60
5.7	User Administrative Module	70	-	70
5.8	Document Archiving	100	-	100
5.9	Tutorial (help tutorial)	100	-	100
5.10	Testing & Debugging	85	5	90
5.11	Data Validation and Check	90	5	95
5.12	Software & Hardware Procurement	-	-	-
5.13	Installation of SW and HW at BDWB Data Center	-	-	-
5.14	Migration of Database and Application to BWDB Servers	-	-	-
5.15	Fully operational commissioning	-	-	-
5.16	Preparation of User Instruction Manual	-	20	20
6	Training & Technology Transfer			
7	Feedback and update (ongoing)	60	20	80

4 MODELLING LONG TERM PROCESSES

4.1 Introduction

A very large proportion of the work carried out by the consultant on this project comprises the development and application of many types of mathematical models for predicting the long-term processes (evolution) of the conditions in the Bengal Delta. The evolution of the Bengal Delta under the disturbances imposed upon it by natural processes and by human interventions occur at many different length and time scales. Model development is now almost complete, and applications are underway.

There are many different types of models, using a variety of formulations and many versions of standard software being used in this study. Table 4.1 Lists the Models that are under development by the project team.

Table 4.1: Models currently under development

LIST OF MODELLING ACTIVITIES			
	Modelling Activity	Sub description	Scale
A	GBM Basin Model	Hydrotrend	Macro
B	Macro scale River Model	Delft3D Main River system (2D)	Macro
C	Macro scale River Model	Delft3D Main River system (1D)	Macro
D	Pussur Sibsa	Delft3D: Modelling of long term Morphology	Meso
E	Baleswar-Bishkhali Model	Delft3D: Modelling of long term Morphology	Meso
F	Lower Meghna	Delft3D: Modelling of long term Morphology	Meso
G	Sangu	Delft3D: Modelling of long term Morphology	Meso
H	Pussur Sibsa	MIKE21C: Modelling of bank erosion process	Meso
I	Baleswar-Bishkhali Model	MIKE21C: Modelling of bank erosion process	Meso
J	Lower Meghna	MIKE21C: Modelling of bank erosion process	Meso
K	Sangu	MIKE21C: Modelling of bank erosion process	Meso
M	Pussur-Sibsa fine sediment model- ext	Delft3D Fine Sediment (2D/3D)	Meso
N	Pilot TRM Model for Polder 24	MIKE11, MIKE21 AND MIKE FLOOD	Micro
O	Storm Surge Model	Generating Synthetic Storm Events	Bay of Bengal
P	Storm Surge Model	MIKE21FM & CYLONE MODEL	Bay of Bengal
Q	Salinity Model	Delft3D Salinity (2D/3D)	Total Coast

The 16 models listed in Table 4.1 have been under continuous development in the two years (8 Quarters) the project has been active. The work has been carried out by teams of modellers comprising numbers of modellers from the International Staff working in close collaboration with counterpart groups of modellers at IWM.

The close collaboration which is reflected in these reports was carried out in the last three quarters under severe constraints imposed by the travel bans imposed by several governments on account of the COVID-19 crisis that prevented the International Modellers from travel to Bangladesh. This collaboration was facilitated by the relationships initiated and continuously developed during the first 6 Quarters with International staff making frequent brief visit to Bangladesh. This work continued with the International Staff contributing remotely – although constrained by contractual limits placed on the length of “home office” inputs. These limits have been under negotiation and the conditions for collaboration are being relaxed in the 8th Quarter onwards.

The 16 modelling tasks listed in Table 4.1 reports are described in sections 4.2 onwards below. They were described in greater detail the previous Quarterly Progress Reports. The actual work carried out are discussed in detail in the reports listed in Table 4.2 below.

Table 4. 2: Total List of Modelling Deliverables (Component 4A) including revised report submitted to PD:

SL No.	Name of the Report	Date of Submission (m/d/y)	Reference as per Tracker	Program Item/Description as per Tracker	Reports under component
1	GBM Basin Model and Macro Scale river and coastal model -current scenario (1 st submission)	8/12/2020; 8/16/2020;	D-4A-1: 2, 3	Model Set up Calibration & Validation	Component-4
2	Meso-scale Interim Report: Effect of human interventions on tidal and sediment dynamics in the Pussur-Sibsa basin (1 st submission)	Sep 2020	D-4A-2: 3	Pussur Sibsa Fine Sediment Model	Component-4
3	MIKE 21C Bishkhali Meso-scale Bank Erosion Morphological Modelling Study: Model Development Report	10/08/2020	D-4A-2: 1, 2	Bishkhali: Model Set up Calibration & Validation	Component-4
4	MIKE 21C Pussur meso-scale bank erosion morphological modelling study: Model development report	10/30/2020	D-4A-2: 1, 2	Pussur: Model Set up Calibration & Validation	Component-4
5	MIKE 21C Sibsa meso-scale bank erosion morphological modelling study: Model development report	10/30/2020	D-4A-2: 1, 2	Sibsa: Model Set up Calibration & Validation	Component-4
6	GBM Basin Model and Macro Scale river and coastal model -current scenario (Revised)	11/19/2020	D-4A-1: 2, 3	Model Set up Calibration & Validation	Component-4
7	Lower Meghna-Tetulia river system morphological modelling study-Current situation	12/02/2020	D-4A-2: 1	Lower Meghna: Model Set up Calibration & Validation	Component-4
8	Meso-scale Interim Report: Effect of human interventions on tidal and sediment dynamics in the	12/04/2020	D-4A-2: 3	Pussur Sibsa Fine Sediment Model	Component-4

SL No.	Name of the Report	Date of Submission (m/d/y)	Reference as per Tracker	Program Item/Description as per Tracker	Reports under component
	Pussur-Sibsa basin (revised)				
9	Baleswar-Bishkhali morphological modelling study-Current situation-Interim Report	01/06/2021	D-4A-2: 1	Baleswar-Bishkhali: Model Set up Calibration & Validation	Component-4
10	Pussur-Sibsa morphological modelling study-Current situation - Interim Report	01/06/2021	D-4A-2: 1	Pussur Sibsa: Model Set up Calibration & Validation	Component-4
11	Sangu River morphological modelling study- Interim Report	01/06/2021	D-4A-2: 1	Sangu: Model Set up Calibration & Validation	Component-4

4.2 Macro Scale Modelling (A, B & C)

Macro Scale Models are designed to investigate the processes that take place in the Bengal Delta and on larger parts of the major river system and flood plains within Bangladesh. The processes modelled are described along large space and time scales with the following objectives (see TOR):

- *Understand sediment dynamics of the GBM delta*
- *Selection and prioritization of drivers of change and development of future scenarios (example: change in transboundary flow through dams, river linking, land use change, infrastructure development)*
- *Estimate future changes, using possible scenarios for future (natural and anthropogenic) developments*

These objectives required that three types of models had to be deployed to achieve them.

Hydrotrend Basin Model: The Hydrotrend model covers the flows of water and sediments within entire Ganges-Brahmaputra-Meghna (GBM) Basin over the medium and long-time scales. The overall water and sediment balances within the basin are modelled both for the current scenario and the long term taking into account climate change and upper catchment developments such as on-going dam construction.

2-D and 1-D Macro-scale models: These models based on Delft3D software studies the detailed sediment balances and morphological development in the major estuaries and the transport and redistribution of sediments along the Bay of Bengal coast line and tidal pumping of some sediments load northwards into western estuaries in the coastal zone. The first stage models (Current Scenario) present the details of these models.

4.3 Meso Scale Modelling of Long-Term Morphology (D, E, F & G)

The objectives of the meso scale modelling work have been described in the TOR as

- *Understanding the dynamics of the river branches and estuaries in the coastal zone of the GBM delta, channel switching and bank erosion both in the fluvial—dominated parts of the delta as well as in the tidally—influenced river delta.*
- *Estimate future changes, predicting erosion and sedimentation in the coastal area*

The long term morphological development of four estuarine rivers systems (Pussur-Sibsa, Baleshwar-Bishkhali, Lower Meghna-Tentulia and Sangu) are being modelled using Delft3D modelling software. The Current situation has been modelled and the long-term development is under development.

4.4 Meso Scale Modelling of Bank Erosion (H, I, J & K)

Although not specifically mentioned as an objective in the TOR, river-bank erosion has been included in the work as the experience of CEIP-1 has revealed this to be a subject crucial to the sustainability of the polder system. MIKE21C software has been used to investigate this problem on the (Pussur-Sibsa, Baleshwar- Bishkhali and Lower Meghna-Tentulia) river systems. The work on the Sangu river has not yet progressed sufficiently to justify submission.

4.5 Morphology on a micro scale (water-logging/polder management M & N)

A study of the impact of human intervention on the distribution of fine sediments in the Pussur Sibsa basin and the morphological impact of poldering is presented in a separate study (M). A separate study of the mechanisms of how Tidal River Management (TRM) can be used to simultaneously control sediment deposition in peripheral channels and reclaim water-logged lands in low lying beels within polders is presented in report N.

4.6 Storm Surge Modelling (O & P) and Saline Intrusion Modelling (Q)

The generation of a variety of cyclonic storms in the southern Bay of Bengal and their propagation along tracks approaching the GBM Delta, as well as the impacts of climate change on their intensities have been studied (O). The propagation of storm surges into the delta and the consequent increases in estuarine water levels and the impact of wave action on the embankment have been studied in the context of designing polder drainage systems and embankment protection systems in the face of climate change and sea level rise (P). The extent of sea level rise on saline intrusion far into the Southwest and South Central Regions have also been studied (Q)

4.7 Conclusions

The large numbers of modelling studies described above has enables us to acquire a better, quantitative understanding of the hydraulic and morphological processes that determine the sustainability of the habitations in the coastal zone of Bangladesh, taking into account its geological under-pinning, climate change and human development activities in the entire basin. The tools developed above can be used to predict the short, medium and long-term impacts of these changes on the well-being of coastal communities. We need to keep in mind that the longer-term future depends on too many variables beyond our control. It is therefore necessary that planners keep at their disposal these modelling tools, *appropriately updated*, to be used for managing the coastal zone in the future. It is the objective of this project to ensure (through capacity building programmes) that the skills necessary for continuously updating and running these models continue to be available for the future.

5 OTHER STUDIES

This Chapter covers progress of Work under Components 4B, 4C and 4D in the Terms of Reference

5.1 Subsidence and Delta Building

Field work on subsidence and delta building have continued during this quarter.

In order to provide planning support to the improved and sustainable embankment design instrument to capture surface erosion-sedimentation and subsidence were installed across coastal areas of Patuakhali, Bagerhat, Khulna, Satkhira and Sundarban. RSET-MH instrument were installed to measure erosion-sedimentation. GPS instrument installed to measure subsidence.

Erosion-Sedimentation Measurement by RSET-MH

A major campaign for installing RSET-MH were held in July 2019. In this initiative a number of instrument were installed in Kalapara in Patuakhali district (2 sets, one inside the embankment, another outside), Dumki in Patuakhali district (2 sets, one inside the embankment, another outside), Sharonkhola in Bagerhat district (2 sets, one inside the embankment, another outside), Assasuni in Satkhira district (2 sets, one inside the embankment, another outside), Hiron Point in Sundarban (2 sets, one near the bank, another relatively inner). For these sets of instruments a baseline measurement campaign was carried out in December 2019.

Two RSET instrument were installed in Katka Sundarban earlier than 2019. The first measurements were done for these in July 2019, then done in October 2019.

As known another sets of RSET instrument were installed in Sundarban. In this lot there were 3 locations in Sundarban (2 sets in Sarbatkhali Forest Camp, 1 set further east of Sarbatkhali, 1 set quite deep inside the Sundarban – all installed around 2014/2015). Another sets of REST was installed inside Polder 32 in Dacope upazila in Khulna district (4 locations, installed around 2017/2018). By planning for all sites two sets of measurements are to be carried out in a year – one before monsoon, and another one during a suitable time after monsoon. However, due to Covid-19 pandemic no premonsoon measurement was carried out in 2020.

Subsidence Measurement by GPS

An interim report titled Interim Subsidence Report dated October 2020 (Ref: Memo No. CEIP/LTMRA/0320/ dated 30 October 2020 received by PD office on 01 November 2020) was submitted in November 2020. This report covered all forms of subsidence measurement (GPS instrument installed for longer time, GPS campaign measurements on SOB GPS pillar etc). This report can be referred to for further details about progress on the subsidence study..

5.2 Climate Change Effects (analysis of historical data)

This section does not include any progress specific to this Quarter as the relevant experts have exhausted their home time allocation.

The progress made in previous quarters are described in Chapters 5.2 and 5.3 in QPR-7

6 APPROACH TO POLDER RECONSTRUCTION

This Chapter covers progress of Work under Components 5.A and 5.B in the Terms of Reference

In December 2020 the report “Reconstruction of the Polder at different coastal zones including their phasing and construction program. Review/Improvements on-going work (CEIP-1)” (deliverable 5A-2) was submitted to the client. The main objective of the Long-term monitoring, research and analysis of the Bangladesh coastal zone project is to create a framework for polder design, based on understanding of the long-term and large-scale dynamics of the Bangladesh delta and experience with different sustainable polder implementation concepts. As part of this work a review of the implementation of the CEIP-1 project was presented in the report, in order to learn from its experiences up until now that can be used for future (sustainable) polder development. Because the construction of improvements under CEIP-1 are still on-going it is difficult to evaluate their performance and impact. Based on a brief history of polder reconstruction and a literature review of water management issues in the polders of Bangladesh, the on-going and proposed CEIP-1 interventions were assessed on future impact. As there is a strong focus on embankment construction, this included a risk assessment as part of the review to provide initial insights in the costs and benefits of the project. Although no final conclusions could be drawn (as the CEIP-1 project has not finished yet and more in-depth analysis is needed), the review does provide not only an overview of the challenges in polder development but also suggested directions for improvement. As such it helps improving the design of future polder projects and in drafting a polder development plan for the coastal zone of Bangladesh.

7 DESIGN PARAMETERS, CONSTRUCTION MANAGEMENT & MONITORING

This Chapter covers progress of Work under Components 6.1, 6.2 and 6.3

The work on revisiting design parameters, construction management and monitoring not progressed during this quarter.

8 CAPACITY BUILDING

8.1 Introduction

Action plan for Capacity Building of professionals and stakeholders in planning, design, construction supervision and management of the polders, has been specified as an important component (No 8) in the Terms of Reference.

8.2 The Capacity Building Plan

The action plan formulated in early 2020 was to comprise the following:

On the job training: This programme is currently on-going wherever the national staff is working closely with the international staff. There has been close collaboration between national consultants and their international mentors and much progress has been made and some reports are being prepared on setting up, calibration and validation of several models on several model scales. The only drawback is the we do not have any BWDB staff who have sufficient availability to participate in any meaningful way. Any proposals for involving BWDB staff more will be welcome. So far, we have even managed to continue having meaningful interaction between national staff and their overseas counterpart even after they have returned to their home countries.

We intend to make proposals for the intensive involvement of a small number of (younger) BWDB engineers who will participate (if possible full time and embedded for periods up to three months) within the modelling teams comprising both international and national experts going through some formal training and learning to run models developed by the project, and run several model applications and then learn all the steps of developing a new models setup.

Local training courses conducted by project resource persons in Bangladesh: We were also planning to conduct formal training courses of several days duration at the IWM training room but with formal course materials being distributed. No additional budget would be needed. A list off short courses was to be circulated. Facilities at the IWM training room could be utilized.

Overseas training on short courses: We have funds for one 2 week course for 5 BWDB personnel in NL and DK (possibly mid-level technical content. We also have half the budget allocated for MSc students still left in the kitty. It is suggested that this is utilized for short courses abroad for mid-level BWDB staff. The available budget is to be divided up among the following:

The following short courses were planned:

- 3.1 Study tour for senior to mid-level staff to Netherlands and to Denmark (one week each)
- 3.2 Short Courses for 5 persons each for two weeks duration in IHE
- 3.3 Short Courses for 5 persons each for two weeks duration at DHI

The course description are under discussion and are available.

The provision was also made for 5 persons to visit Lamont in the US will be discussed with Mike Steckler on his next visit.

The training activities up to the end of the 7th Quarter are described in QPR-2 to QPR-7.

The Capacity Building Plan had to be modified to take into account the travel restrictions imposed on the international staff by the COVID-19 outbreak.

8.3 Special Training Course in Riverbank Erosion Modelling

A training programmed on “Mike21C: Riverbank Erosion Modelling” was conducted intermittently (duration five days) by the Consultant’s Team. The training program commenced from 5 October and closed on 12 October 2020 at the office of the Consultant: Flat#3/B, House#4, Road#23/A, Banani, Dhaka-1213.

The training program was inaugurated virtually by Mr. A.M. Aminul Haque, Director General, BWDB on 5 October 2020. Md. Harun Ur Rashid, Chief Engineer, Design, BWDB, Dhaka evaluated the training course on the last day of training. Following evaluation process, Mr. Motaher Hossain, Addl. Director General (Planning), BWDB distributed training certificates amongst the participants and closed the program. The whole training program was coordinated by Mr. Zahir-ul Haque Khan, Deputy Team Leader.

Trainers: DHI: Dr Kim Wium Olesen & Dr Soren Tjerry

IWM: DR Upal Mahmud, Mr Mohalmmmed Ziaur Rahman

The training course was focused on Riverbank erosion prediction which is highly valuable for using planning and design of protective measures, establishment of polder alignment. The followings are the usefulness of Riverbank erosion prediction tools:

- **Planning new embankments:** Take bank erosion into account to avoid building an embankment too close to an eroding bank. Both the identification of the eroding bank and the estimated bank erosion magnitude are of value.
- **Time-scale for temporary embankments:** Use bank erosion forecasting to plan temporary embankments that will eventually fail, but bank erosion forecasting can be used for optimizing the financial investment, i.e. giving the temporary embankment enough time before it fails.
- **Planning mitigation:** Some bank erosion can be mitigated by e.g. dredging shoals. A typical example would be the small flood channels opposite of eroding banks (e.g. east of the island in Baleswar), which can be dredged to reduce erosion pressure on the bank to the west of the island.
- **Planning tiered land:** Land close to an eroding bank should not be protected; the land further away should. The land close to an eroding bank can still be used, but e.g. for fish farming or other activities more suited.

The MIKE 21 Curvilinear Flow Model (MIKE 21C) was selected as the software suitable for these studies as it supports both standalone hydrodynamics or combined hydrodynamic and sediment transport simulations. In this training program, the tidal river (Bishkhali river) was selected which covers the existing hydrological and morphological behaviour of the tidal river including present bank erosion and future bank erosion prediction for different scenarios. This training helped to understand the development of river erosion model and its application for erosion management.

The following participants participated from BWDB in the above-mentioned Training Program:

S.L No	Name	Designation & place of posting	E-mail ID & Mobile No
01.	Dr. Md. Sarfaraz Banda	Executive Engineer, PMU, Cluster Project, BWDB, Dhaka.	sarfarazbanda48@gmail.com Mobile-01318-236260
02.	Dr. Muhammad Masood	Executive Engineer, Design Circle-1 BWDB, Dhaka.	masood35bd@yahoo.com Mobile No-01318-235010
03.	Dr. Md. Khairul Islam	Executive Engineer, CSO to DG BWDB, Dhaka.	dg.bwdb.bd@gmail.com Mobile No-01719-859366
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Photograph 1: Distribution of Certificate by Mr. Motaher Hossain, ADG Planning, BWDB



Photograph 2: Speech by Mr. Motaher Hossain, ADG Planning and Md. Harun Ur Rashid, Chief Engineer, Design, BWDB

8.4 Special Training Course in Management of the Integrated Coastal Zone Database

The Capacity Building in terms of IGDCZ is mainly meaning to increase the skills of BWDB relevant officials to operationalize the system. The awareness about the development and potential use has begun from the consultation meetings and presentation workshops with live demonstrations of the IGDCZ.

A formal and live demonstration of IGDCZ was given in BWDB conference room on 6 February 2020 in presence of Joint Chief, Planning Wing of MoWR, DG, BWDB and higher officials of BWDB and experts.

The participants, especially the potential users and maintenance authority of the IGDCZ were made aware of the functionalities and uses of the developed IGDCZ.

Another day-long live demonstration and feedback meeting was done in Pani Bhaban on 30 Nov, 2020 before a team of BWDB officials including field level officers. In that meeting a number of feedback and suggestions were obtained to enrich the database and make it more useful for BWDB. The access to the IGDCZ was shared to the officials for their read-only use and submission of the feedback. A snapshot is presented in Figure below.



Figure: In-depth demonstration on IGDCZ

More formal training on use, updating, installation and GIS is planned for BWDB officials which is presented in the Table below. The trainings for Mid-Feb and Mid-March could not be held as BWDB did not provide participants. However, they are interested in the training and assured that they would provide participants in the future. Accordingly, the consultants will reschedule the training period for the Capacity building plan.

Figure 8-1: Capacity building plan

SI .No.	Training	Tentative period	Duration	Participants
1	Awareness on use of IGDCZ	Mid-Feb, 2021	3 days	15 officials from BWDB
2	Training on installation of IGDCZ Database and Applications	Mid-March, 2021	3 days	5 ICT and GIS officials from BWDB
3	Training on GIS	Early-April, 2021	3 days	10 ICT/GIS and Field officials