GOVERNMENT OF THE PEOPLE'S REPUBLIC OF BANGLADESH

MINISTRY OF WATER RESOURCES

BANGLADESH WATER DEVELOPMENT BOARD

Terms of Reference

for

Feasibility Study for Integrated Water Resources Management in the Sandhya-Baleshwar River basin (Package no: SB/BRB-02)

(সন্ধ্যা-বলেশ্বর নদীর অববাহিকায় পানি সম্পদ ব্যবস্থাপনার নিমিত্ত সম্ভাব্যতা সমীক্ষা)

March 2025

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1. Background

A study project named as *"Feasibility Study for Basin-wise Water Resources Management Project of Rivers in Barisal Zone"* has been approved by Bangladesh Planning Commission on 16 May, 2024. Later, The Ministry of Water Resources approved the project on 28 May, 2024. This study has been included in the above-mentioned project.

Bangladesh lies in the deltaic deposits of the Ganges-Brahmaputra-Meghna river system, more commonly known as the Bengal Delta, that forms the largest delta in the world. A dense river network has crisscrossed this low-lying delta plain before ultimately fall into the Bay of Bengal in the south. Every year these rivers carry about one trillion cubic meters of water and one billion tons of sediments. The huge amount of sediment is the main driving factor behind the dynamic morphological nature of the rivers. Bankline shifting, erosion and flooding are some of the frequent phenomena that the rivers go through. The alluvial floodplains of the rivers are prone to erosion as they are composed of highly unconsolidated and erodible sediments. Monsoon floods associated with severe riverbank erosion hit the country every year grasping thousands of hectares floodplains.

The Meghna estuary is currently an active delta building estuary of the Ganges-Brahmaputra delta system. The building process in the delta is continuing, which is causing the active delta to shift at different locations. The assessment of delta shifting is mainly based on indicators such as shifting of the delta building estuary, tidal forces, sediment dispersal process, erosion-accretion process, and also shifting of the direction of the distributaries, which is now, however, a quantitative assessment.

The Sandhya River branches off the Arial Khan. Later, it joins the Kocha River. Baleshwar River originates from Kaligonga River which outfalls into the Bay of Bengal. Sandhya-Baleshwar River basin (*Figure1*) management is vital for agriculture, navigation, fisheries, livestock and port facilities. These two rivers are ecologically important. Being situated in the active delta system, riverbank erosion is also very common in Barisal. In addition to this, climate change-induced natural events, like-cyclones, storm surges, floods, etc put additional stresses on the hydro-morphological systems. Considering the existing problems in the Barisal region there is a need of holistic study considering all sectoral issues in an integrated manner for management of the river systems in the study area.

Based on the above scenario, a comprehensive study has been undertaken to enhance fresh water availability of Sandhya-Baleshwar river and protect the both banks through a combination of protective measures and dredging as well as mitigation of flood and navigation problems in an integrated manner.

2. Study Area

The study area consists of Sandhya-Baleshwar river system including its all the tributaries such as Kocha, Ghariakhali, Bhola (Bagerhat),Bisharkandi, Harta, Orta e.t.c. and distributaries such as Panguji, Pana, Halta, Pona, Bogi etc. The study area also includes all upazillas falling under the Sandhya-Baleshwar river catchment that encompass mainly under Barishal, Bagerhat, Pirojpur & Borguna district. Besides, it also focuses on Polder 35/1, 39/1A, 39/1B, 39/1C, 39/1D, 40/1, 40/2. Brief descriptions of the river systems but not limited to following are given below:

Sandhya River- Baleshwar River Systems

The Sandhya River branches off the Arial Khan in the Rohmotpur union of the Babuganj Thana under Barishal district. Later, it joins the Kocha River at the Shoriktola Dhumritola union of the Sadarupazila, Pirojpur. The river is tidal and it overflows its banks during the monsoon. It is a perennial flowing river and categorized as Class-III Route of the BIWTA. It will be covered under this study.

This extremely tapering river issues from the Kaligonga (Pirojpur) in the Deergho union of the Nazirpurupazila under Pirojpur district and outfalls into the Bay of Bengal through the Pathorghata upazila under the Borguna district. It is a perennial flow river. It is more than 60 times wide at downstream compared with its starting width. The length and width of the river are 146 km and 1.6 km respectively. During the monsoon, the flow increases, and rising waters overflow its banks into the floodplains. This is a tidal river and boats ply through the year-round.

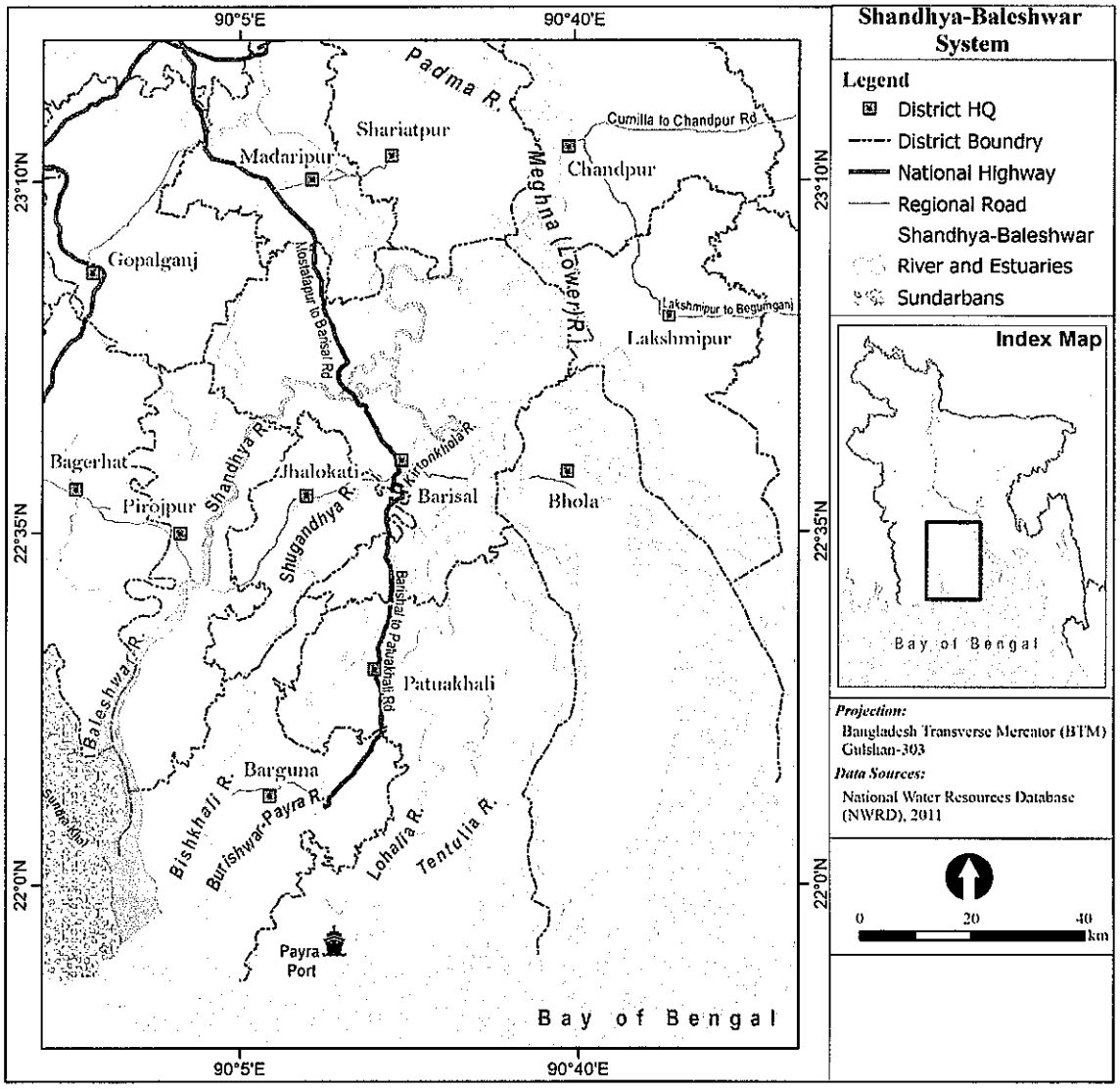

Figure 1: Study Area

3. Objectives

The overall objective of the study focuses on comprehensive short and long-term plan for Integrated Water Resources Management (IWRM) of Sandhya-Baleshwar River basin considering River, flood, erosion, sedimentation, polders, in-polders water and estuary management along with other relevant issues. The study also includes comprehensive assessment of the technical feasibility, environmental sustainability, socially acceptability and economic viability for the formulation of proposed development projects relevant to the study area. The specific objectives of the study but not limited to the following are:

Hydrological and Morphological Model Study

- To analyze the prevailing problems (i.e. erosion, flooding, sedimentation, bed level rise, salt water intrusion, drainage congestion and tidal action including cyclonic storm surge etc. from water resources management perspectives) and underlying causes within the basin of the study area including rivers and its tributaries/ distributaries/ khals considering existing projects ;
- To prepare a holistic and integrated plan combining nature-based solution for improved water resource, river, erosion, sedimentation, polders, in-polder water and estuary management of the study area including rivers and their tributaries/distributaries/khals/small rivers etc. considering future land use pattern, climate change and sea level rise;
- Understand the dynamics of estuary in the project area, and developing options for sustainable management of river and estuary and land reclamation ;
- To identify the required short and long term interventions in a holistic approach including tributaries/distributaries;
- To prepare detail design of proposed interventions such as embankment, river/khal dredging with dredged material management plan, protective works, water and drainage management structures, etc.;
- To estimate the detail cost of the project including economic and financial analysis to acquire the extended project outcomes.

Environmental and Social Impact Study

- To conduct a detailed Environmental and Social Impact Assessment (ESIA) for outcomes of technical study's interventions and prepare an Environmental Management Plan & Social Action Plan;
- To prepare a plan for protection of accreted land by nature-based interventions;
- To prepare required Resettlement Action Plan (RAP) and Land Acquisition Plan (LAP)
- To prepare biodiversity conservation; ecological restoration and afforestation plan of the study area;
- To assess the project with respect to Environmental Sustainability, Climate Resilience and Disaster Risk and find the ways for reducing/mitigating negative impacts.

4. Scope of Work

The Scope of Work of the study but not limited to the following are:

Hydrological and Morphological Model Study

Data collection, survey and analysis:

- Collect and review of relevant available study reports, data, satellite images, maps, information etc;
- Synchronize all the relevant past and present projects and also collect the information of on-going development activities;
- Collection of secondary data on tide, current, sediment, discharge, wave and satellite imageries and finding data gaps;
- Necessary soil boring and data analysis (SPT, c, Φ, liquidity limit, plasticity limit, d50 and other data related to study) for the design of proposed interventions;
- Reviewing the existing flooding and drainage conditions of the River basin;
- Revisiting the ongoing re-excavation/dredging activities in the internal khals and optimizing all these activities considering overall drainage improvement of the area;
- Field bathymetric survey, survey to collect data including river/ tributaries/distributaries/khals/small rivers cross section, embankment section, polder topography, water level, discharge and sediment concentration;
- Preparation of an inventory of embankments, polders, regulators, bridges, culverts, and other water control structures with the present condition of the river systems;
- Historical tidal data analysis in order to know the tidal range for different period, seasonal variation, maximum and minimum water level etc.;
- Field visit, reconnaissance survey and consultation with local people about the sedimentation problem, storm surge height, inundation area, erosion-deposition pattern etc.;
- Establishment of climate change projection including sea level rise, changes in precipitation and cyclonic wind speed;
- Frequency analysis of time series rainfall for selecting design rainfall event.

Assessment of hydro-morphologic characteristics and model development:

- Identify the prevailing problems of river sedimentation, erosion, conveyance capacity, flooding, inundation, storm surge etc.;
- Assessment of existing hydraulic structures in the study area to present overall scenario whether they should be rehabilitated or not;
- Development of Hydrological and polder drainage model to assess the drainage condition and its improvement;
- Development of hydrodynamic and Morphological model to assess and characterization of present hydro-morphological conditions such as sedimentation, erosion, re-siltation etc of the river/ tributaries/distributaries/khals/small rivers of the study area;
- Development of hydrodynamic model for the study area to establish the baseline hydrological condition;

- Development of storm surge and wave model due to cyclonic wind for ascertain the storm surge level and wave height in establishing the crest level of the embankment;
- Assess the vulnerability of storm surge, wave, flooding, erosion etc. considering climate change and sea level rise;
- Simulation of cyclonic storm surge events, preparation of storm surge risk map in the study area as well planning of erosion protection and land development measures from storm surge;
- Salinity modelling to understand the salinity dynamics and salinity intrusion in the changing climate and sea level rise, preparation of isohaline map for different salinity level;
- Assessment of e-flow requirement of Sandhya-Baleshwar river system including tributaries and distributaries and ecosystem obtained from these rivers;
- Identification of reasons behind erosions and sedimentation based on the analysis of data and model results;
- Assessment of erosion vulnerability of the existing embankment;
- Assessment of climate change, soil subsidence and sea level rise (SLR) impacts on the selected option.

Option development, Planning and designing:

- Devise potential options for improved water resource management plan considering technical aspects and in consultation with BWDB and local stakeholders;
- Assess the effectiveness of different interventions through simulation of scenario using mathematical model;
- Planning and design of river erosion, sedimentation and flood management measures in an integrated way;
- Preparation of flood inundation map (1 Day, 2 Day & 5 Day), contour map for both bathymetry and topography and flow map;
- Prepare a plan for strengthening of existing embankment/ polders within the project area along with in-polder water management plan;
- Determine the dredging requirement of rivers in consideration with diversion of water flow, backfilling rate, decrease of current speed and erosion vulnerability applying mathematical model and Dredged material management plan with location, area and volume of deposition;
- Assessment of the impact of dredging/ excavation volume of rivers and khals;
- Selection of alternative alignments for dredging for erosion and flood management and navigation based on bathymetric data, field measurements, model results on current speed and direction;
- Assessment of re-siltation rate in the rivers;
- Devise a plan for drainage improvement of the study area including excavation of khal, dredging in peripheral rivers, remodelling of water control structures etc. considering sea level rise and changed rainfall pattern due to climate change;

- Planning and detail design and drawing of the proposed interventions such as rehabilitation of embankment, riverbank protection works, water management structures dredging/re-excavation etc.
- Devise plan and design for Polders rehabilitation with in-polder water management in each polders mentioned in the study area and propose alternative designs instead of conventional design for embankment, structures etc;
- Incorporating the Delta Appraisal Framework (DAF) to align with the goals of BDP 2100 and principles of Adaptive Delta Management (ADM)

Economic and Financial Analysis

- Preparation of cost estimate of the project works as per DPP format on the basis of recent actual schedule of rates;
- Estimation of Benefits to be derived after implementation of the proposed project;
- Estimation of BCR, EIRR, NPV of each planning option based on the with and without project situation
- Detailed financial and economic analysis.

Environmental and Social Impact Assessment

- Establishment of physical, environmental and social baseline condition;
- Selection of valued environmental and social components impacted by the existing and proposed interventions in the project area;
- Assessment of environmental flow of the Sandhya-Baleshwar River ;
- Identification of important ecosystem (land/aquatic) and measures for conservation/restoring of the ecosystem of the study area;
- Social Impact Assessment (SIA) study due to implementation of the project interventions;
- Assessment of future development of agriculture, fisheries, navigation, urbanization etc.
- Assessment of land acquisition for establishing/restoration of rivers and preparing LAP & RAP if necessary;
- Formulation of options for the development of fisheries production capacity;
- Environmental Impact Assessment (EIA) study of the proposed interventions;
- Environmental Management & Monitoring Plan;
- Preparation of environmental enhancement and conservation plan;
- Preparation of bio-diversity conservation plan;
- Preparation of approval of ESIA ToR from DoE and make reports to take Environmental Clearance Certificate from DoE;
- Using the DAF tool to assess potential environmental and socio- economic impacts under present and future climate change and socio-economic uncertainties including demographic changes.

- Dissemination of the study results to all stakeholders by arranging workshops;
- Preparation of ESIA study reports.

Project Assessment with respect to Environmental Sustainability, Climate Resilience, and Disaster Risk Analysis

- Assessment of environmental, disasters and climate change impacts or risk from the projects;
- Disaster Impact Assessment (DIA);
- Planning the counter measures to reduce/mitigate these negative impacts;
- Determination of costs for reducing/mitigating the negative impacts;
- Finding alternative ways of the project deliverables without incurring these environmental costs;
- Selecting contingency plan for emergency disaster management;
- Determination of the rehabilitation period after, remaining risks and adequate risk reduction measures.

5. Expected Outputs and Outcome

Outputs

The Specific details of expected outputs are indicated below:

- Baseline hydrodynamic and morphological conditions;
- Contour map for both topography and bathymetry, flow map and inundation map;
- Comprehensive short and long-term plan for Integrated Water Resources Management (IWRM) of *Sandhya-Baleshwar River basin* considering River, flood, erosion, sedimentation, polders, in-polders water and estuary management along with other relevant issues;
- Lists of interventions on short and long term for integrated water resource management, river, erosion, sedimentation, polders, in-polders water and estuary management
- Type, Location, length, volume and alignment of river reaches for embankment, river/khal dredging with dredged material management plan and dredging volume , protective works, water and drainage management structures, etc.;
- River, water, erosion and flood management plan with proposed maintenance program;
- E-flow requirement assessment of Sandhya-Baleshwar river system including tributaries and distributaries and ecosystem obtained from these rivers;
- Polders rehabilitation with in-polder water management plan in each polders
- Suggestive measures for drainage improvement of structures considering the restoration of interconnecting links with rivers/khals etc;

- Detailed design of proposed interventions.
- Socio-economic baseline condition of the Project and detail ESIA of proposed interventions;
- Environmental Management Plan (EMP) which should include:
  - Mitigation Measures
  - Enhancement Plan
  - Compensation Plan and
  - Monitoring.
- Approval of ESIA ToR from DoE and Prepare reports based on ToR of DoE and take necessary measures to collect Environmental Clearance Certificate from DoE;
- Resettlement action plan (RAP) and Land Acquisition Plan (LAP);
- Biodiversity conservation; ecological restoration and afforestation plan of the study area
- Assessment report with respect to Environmental Sustainability, Climate Resilience and Disaster Risk and ways for reducing/mitigating negative impacts;
- Investment cost with year-wise break-up as per DPP requirement;
- Costing with phasing and economic analysis considering agriculture, industry, fisheries, shipping, and city development/urbanization sector for the forecasting year 2041 and to achieve Sustainable Development Goals (SDGs) and implement Bangladesh Delta Plan (BDP)-2100.
- Project implementation plan.
- Workshop
- Reports (Prescribed Feasibility study report format of Planning Commission by following the indicators of DAF)

Outcome

Comprehensive Short and long-term plan for Integrated Water Resources Management (IWRM) of Sandhya-Baleshwar River basin along with feasibility study for DPP preparation.

6. Duration of the Services and Reporting

The study would be carried out within **15 (Fifteen) months** from the date of signing the contract. The schedule of submission of deliverables is as follows:

Sl.	Report	Deadline
1	Inception Report, 20 copies	At the last week of 2nd month

Sl. No	Report	Deadline
2	Progress Report-10 copies	At the last week of 4th month
3	Interim Report, 20 copies	At the last week of 6th month
4	Progress Report-10 copies	At the last week of 8th month
5	Progress Report-10 copies	At the last week of 10th month
6	Draft Final Report, 20 copies (Along with detailed design vetted from concerned BWDB Design Circle and ESIA report in separate volume)	At the last week of 12th month
	Detailed guideline of climate-resilient infrastructures design and other deliverables would be submitted after prior approval from the concerned Design offices of BWDB	
7	Final Report 30 copies	At the last week of the 14th month

N.B. Hard and Soft copies (along with CD/DVD and portable hard drive) of all the reports, presentations, data, cross-sections, long profile, documents, kml file, shape file, model setup etc. have to be submitted and must be handed over to BWDB. Data and reports will be copyright property of BWDB. No part of this report may be reproduced, distributed, or transmitted in any form or by any means, including photocopying, recording, or other electronic or mechanical methods without the prior written permission of BWDB.

The Project Director, BWDB, Dhaka would be representing BWDB and receiving all the deliverables mentioned above. Review meetings with participation of concerned Planning, Design and Field level officials of BWDB would be held on Inception, Interim and Draft Final Reports. The office of the Project Director would communicate with other line departments and all concerned for consultation, sharing of ideas and to discuss the findings as well as disputes also.

7. Dissemination of Study Results

- Workshop and consultation meetings for disseminating the study results to relevant stakeholders;
- Preparation of Inception Report, Interim, Draft Final and Final feasibility study report according planning commission format compiling the technical, social, environmental and economic aspects;

8. Seminar/Conference/Workshop

The consultant will arrange 1 (one) extended consultation workshop in the study area after the submission of Draft Final Report. Goal of arranging these workshops is to disseminate the study results among stakeholders, different government and non-government officials working in water and social sector, local administration, intellectuals, thinkers, representatives from development partners etc. The PD office shall provide necessary support to arrange the workshops.

9. Key Personnel and Qualification

9.1 Key personnel

It is estimated that to carry out Package-2 of the study requires **59 man-months**. The composition of the team and their man-months is given below.

Sl. No	Professionals	Nos of Professionals	Month	Man-month
1	*2*	*3*	*4*	*5*
1	Team leader (Senior Water Resources Engineer)	1	5	5
2	Water and Flood Management Specialist	1	3	3
3	River Engineer	1	3	3
4	Coastal Morphologist/Morphological Modeler	1	3	3
5	Hydrological and Hydro-Dynamic Modeler	1	3	3
6	Senior Design Engineer	1	4	4
7	Design Engineer	1	4	4
8	Economist	1	3	3
9	Environmentalist	1	3	3
10	Disaster Management and Climate change Specialist	1	2	2
11	Sociologist	1	3	3
12	Fisheries Specialist	1	3	3
13	Agriculturist	1	2	2
14	GIS and Remote Sensing Analyst	2	2	4
15	Survey Specialist	1	2	2
16	Field Researcher/Junior Engineer	4	3	12
Total		**20**		**59**

9.2 Qualifications, Experience and Task of the key personnel

Disciplines	Qualification and tasks
1. Team leader (Senior Water Resources Engineer)	He/She should have Bachelor degree in Civil/Water Resources Engineering with 20 years or more professional experiences including 15 years' experience in projects involving erosion management, water resources management and Planning, tidal hydraulics, polder rehabilitation with in-polder water management, coastal morphology, dredging projects and field execution and leading of such projects. Higher degree in relevant field is preferred. His/her major responsibilities shall include but not necessarily be limited to the following: ***Tasks:*** Major responsibilities shall include but not necessarily be limited to the following: • Guide and supervise the study team in carrying out the study programme; • Responsible for making a comprehensive water management plan of the study area • Review the available reports on erosion problem and potential solution to improve erosion vulnerability of the river basin of the study area; • Responsible for formulation of specifications and strategy for data collection and processing and planning of improvement measures; • Analyse the tidal dynamics and morphological conditions; • Carry out overall co-ordination and top supervision of the different study activities and maintain close liaison with the client; • Development of different dredging plan and assessment of effectiveness for identification of area to be dredged for erosion management and navigability; • Development of monitoring plan for quality control of the dredging and its performance; • Supervise dredged material management plan and resettlement action plan if required; • Organise interaction meetings with local stakeholders and BWDB officials and workshop to disseminate study results.

Disciplines	Qualification and tasks
	• Responsible to prepare the Inception, Interim, Progress, Draft Final and Final reports along with other documentation. • Disseminate monitoring results to all stakeholders. Also, responsible for preparing erosion management, dredging and drainage improvement plan;
2. Water and Flood Management Specialist	He/She should have Bachelor degree in Civil/Water Resources Engineering with 15 years or more professional experiences including 12 years' experience in projects involving flood & erosion management, water resources management and Planning, tidal hydraulics, polder rehabilitation with in-polder water management, coastal morphology, dredging projects and field execution of such project. Higher degree in relevant field is preferred. His/her major responsibilities shall include but not necessarily be limited to the following: ***Tasks:*** Major responsibilities shall include but not necessarily be limited to the following: • Responsible for making a comprehensive water and flood management plan • Responsible for formulation of specifications and strategy for data collection and processing and planning of improvement measures; • Organise interaction meetings with local stakeholders and BWDB officials and workshop to disseminate study results. • Responsible to prepare the Inception, Interim, Draft Final and Final reports. • Disseminate monitoring results to all stakeholders. Also, responsible for preparing erosion management, dredging and drainage improvement plan;
3. River Engineer	He/She should have Bachelor degree in Civil/Water Resources Engineering/ River Engineering with 15 years or more professional experiences including 12 years' experience in projects involving erosion management, river morphology, dredging projects and field execution of such project. Higher degree in relevant field is preferred. His/her major responsibilities shall include but not necessarily be limited to the following:

Disciplines	Qualification and tasks
	Tasks: Major responsibilities shall include but not necessarily be limited to the following: • Responsible for making a comprehensive river management plan • Responsible for formulation of specifications and strategy for data collection and processing and planning of improvement measures; • Devising of the dredging requirements on the basis of the recent bathymetry of the channel and the design criteria of the navigation channel; • Development of different dredging plan and assessment of effectiveness for identification of area to be dredged for erosion management and navigability; • Selection of the dredged material disposal methodology and location so that the dredging activities does not affect the environment and ensure beneficial use of the dredge materials; • Development of monitoring plan for quality control of the dredging and its performance; • Organise interaction meetings with local stakeholders and BWDB officials and workshop to disseminate study results. • Responsible to prepare and contribute in the Inception, Interim, Draft Final and Final reports. the Inception, Interim, Draft Final and Final reports. • Disseminate monitoring results to all stakeholders. Also, responsible for preparing erosion management, dredging and drainage improvement plan;
4. Coastal Morphologist/ Morphological Modeller	He/She should have Bachelor degree in Civil Engineering/Water Resources Engineering having 15 years or more professional experiences including 12 years' experience in the field of river, estuarine and coastal morphology & hydraulics, numerical modeling and erosion projects. Higher degree in relevant field is preferred. His/her major responsibilities shall include but not necessarily be limited to the following: ***Tasks:*** Major responsibilities shall include but not necessarily be

Disciplines	Qualification and tasks
	limited to the following: • Identify the present morphological process in tidal environment and erosion-deposition pattern of the project area; • Develop morphological/sediment transport/mud transport model • Establish baseline morphological behaviour based on model result and available data; • Assess the capital dredging • Assess the backfilling rate and maintenance dredging in the channel • Analyse and optimise the dredging channel • Contribute in preparing the report of the study and workshop materials • Attend meeting as when required
5. Hydrological and Hydro-Dynamic Modeler	He/She should have Bachelor Degree in Civil/Water Resources Engineering with 15 years professional experiences or more including 12 years' experience in the field of hydrological and hydrodynamic model development; tidal action, cyclone and storm surge modeling. Previous experience in a similar work and environment (erosion-accretion of char-lands, estuary development, coastal polders and land reclamation etc) is preferred. His/her major responsibilities shall include but not necessarily be limited to the following: **Tasks:** His/her major responsibilities shall include but not necessarily be limited to the following: • Recognizing and assessing hydrological and hydraulic data need with their specifications, and making arrangement for their collection • Advising survey team regarding survey activities, measurements, installation of hydrometric stations in accordance with the need of this particular study • Planning and advising concerned professional on database development, data correction and data analysis for the model • Developing, updating, calibrating, validating and simulating tidal scenarios in a model

Disciplines	Qualification and tasks
	• Ascertaining design parameters for bank erosion, embankment, flood management structures etc • Making overall interpretation of flow pattern and their implications on the development of proposed project • Guiding the junior modellers and engineers • Attend meeting as and when required • Contribute in preparing the report of the study and workshop materials
6. Senior Design Engineer	He/She should have Bachelor degree in Civil Engineering/ Water Resources Engineering with 15 years professional experiences or more including 12 years' experience in designing of different types of hydraulic structures in coastal area, river management infrastructures and polder and in-polder water resources management structures design in water sector related projects along with expertise on software related to hydraulic structure design. Higher degree in relevant field is preferred. ***Tasks:*** His/her major responsibilities shall include but not necessarily be limited to the following: • Collaborate with team leader for making a comprehensive water management plan • Prepare detail design of protective works, embankment, polders, slope protection, water resources management structures (drainage cum flushing structures, drainage structures, flushing structures, culvert/bridge etc), river dredging, other water control structures etc; • Identify the locations of sub soil investigation for proposed infrastructures; • Establish design parameters for relevant infrastructures considering the impacts of climate change and sea level rise; • Design of various types of hydraulic Structures; • Design of river bank protection work, embankment and other ancillary structures (if required) • Estimation of cost for the proposed structures • Responsible for preparation of design related parts of

Disciplines	Qualification and tasks
	different reports as required for the proposed study . • Attending meeting as and when required; • Any and all other works necessary for proper study .
7. Design Engineer	He/She should have Bachelor degree in Civil Engineering/ Water Resources Engineering, having 12 years professional experiences or more including 08 years' experience in designing of different types of hydraulic structures in coastal area, river management infrastructures and polder and in-polder water management structures design in water sector related projects along with expertise on software related to hydraulic structure design. Higher degree in relevant field is preferred. ***Tasks:*** His/her major responsibilities shall include but not necessarily be limited to the following: • Establish design criteria using different design guidelines; • Identify the locations of sub soil investigation for proposed infrastructures; • Designing of alternative protective measures; • Develop design specifications and drawing; • Cost estimate of different protective measures; • Prepare detail design of protective works, embankment, polders, drainage structures, regulators, river dredging, other water control structures etc; • Analysis of soil-boring & other geological survey results; • Collaborate with Team Leader and Senior Design Engineer; • Contribute in report writing; and • Assist the team leader in coordinating the study
8. Environmentalist	He/She should have Master's degree in Environmental Engineering/ Environmental Science/ Geography/ Civil Engineering/ Water Resources Engineering or relevant field having 15 years professional experiences or more including 12 years' experience in the field of environmental studies including in the field of EIA and water resources management projects. Higher degree in relevant field is preferred. His/her major responsibilities shall include but not necessarily be limited to the following:

Disciplines	Qualification and tasks
	• Prepare an inventory of present environmental situation and carry out Environmental Impact Assessment (EIA); • Review the existing environmental policies and guidelines; • Preparation of Environmental data collection plan; • Describe breeding/ spawning behaviors and migratory patterns of aquatic and terrestrial fauna. • Identification of aquatic and terrestrial habitat types. • Inventory of aquatic and terrestrial wildlife. • Carryout environmental survey; • Preparation of approval of ESIA ToR from DoE and prepare reports based on ToR of DoE and take necessary measures to collect Environmental Clearance Certificate from DoE; • Establishment of environmental baseline condition of the study area; • Assessment the impact of project interventions on the environment; • Co-ordinate activities & assist the technical Team; • Any other assignment given by the Team Leader; • Attend meeting when required; • Preparation of Environmental Management and Monitoring Plan.
9. **Disaster Management and Climate change Specialist**	He/She should have Bachelor degree in Civil /Water Resources Engineering/Hydrology with 12 years professional experiences or more including 8 years' experience in assessment of climate change and disaster risks management in water sector. Higher degree in relevant field is preferred. His/her major responsibilities shall include but not necessarily be limited to the following: ***Tasks:*** • Review and analyze relevant policies and related documents regarding climate change, disaster risk reduction and other related developments dynamics especially which will impact on delivery of the projects; • Assessing water related climate risks in the water resources management systems;

Disciplines	Qualification and tasks
	• Disaster Impact Assessment (DIA); • Creating enabling environment for climate risk-informed integrated water resources management and development; • Contribute to risk managements of the project by close monitoring and provide technical advice to mitigate the risks and/or inform corrective actions; • Assessment of salinity at present, project and climate change conditions ; • Contribute in preparing the report of the study and presentation materials. • Attend meetings with the client, contractor and other stakeholders as and when required; • Assist Team Leader and keep updating regarding progress on dredging activities and related issues.
10. Sociologist	He/She should have Masters degree in Sociology/Statistics from a recognised University with 12 years professional experiences or more including 8 years' experience in sociological activities & field survey, i.e., interaction with the stakeholders, holding Focus Group Discussion (FGD), Target Group Discussion (TGD) and work-shops/seminars at field level to find out the desired goal of the study and to disseminate the results of the study. Higher degree in relevant field is preferred. His/her major responsibilities shall include but not necessarily be limited to the following: ***Tasks:*** • Holding interaction meeting with the stakeholders at field level holding Focus Group Discussion (FGD), Target Group Discussion (TGD) and work-shops/seminars at field level to find out the desired goal of the study and to disseminate the results. • To find-out the conflicting issues, conduct motivational works among the stakeholders against any negative issue and to suggest mitigation measures. • Collecting, Analysing and interpreting the data on CS/RS map; • Demarcation of the required land acquisition area on CS/RS map • Formulate a Land Acquisition Plan (LAP)for project components;

Disciplines	Qualification and tasks
	• To prepare Resettlement Action Plan (RAP) considering social safeguard, livelihood, peoples' participation etc; • Assess social impacts, suggest mitigation measures due to the proposed project; • Responsible for preparing the SIA report of the study; • To assist the study team in holding seminars, workshops
11. Fisheries Specialist	He/She should have Masters degree in Fisheries Science/ Zoology and a post-graduate degree in relevant field with 12 years professional experiences or more including 8 years' experience in field survey, evaluation of agricultural & fisheries benefits of a project between pre & post project condition by introducing improved fisheries Activities. Higher degree in relevant field is preferred. His/her major responsibilities shall include but not necessarily be limited to the following: • Analysis of the existing conditions of the fisheries practices and production; • Suggest for improved fish culture method with respect to time and land • Evaluate the fisheries benefits after post project condition. • Identify impacts on ecology and ecosystem and suggest appropriate mitigation measures. • Describe breeding/ spawning behaviours and migratory patterns of aquatic fauna; • Identification of aquatic habitat types; • Prepare inventory of aquatic lives; • Carry impact study and suggest mitigation measures due to proposed project; • Assess the Fishery benefit derived from the project interventions; • To assist the study team in holding seminars, workshops; • To assist the study team in preparation of maps for workshops and reports etc and development of database software.
12. Agriculturist	He/She should have Masters degree in Agriculture / Crop Science with 12 years professional experiences or more including 8 years' experience in field survey, evaluation of

Disciplines	Qualification and tasks
	agricultural benefits of a project between pre-& post project condition by introducing improved agricultural practices. Higher degree in relevant field is preferred. His/her major responsibilities shall include but not necessarily be limited to the following: • Analysis of the existing conditions of the agricultural practices and production; • Analyse the potential for new and improved cultivation practises in the study area; • Suggest for improved agricultural method with respect to time, land, cropping pattern, cropping inputs & agricultural practices; • Design crop calendar, cropping pattern and crop efficiency; • Evaluate the agricultural benefits after post project condition. • To assist the study team in holding seminars, workshops; • To assist the study team in Preparation of maps for workshops and reports etc and development of database software. • Contribute in the ESIA and other relevant report preparation;
13. Economist	He/She should have Master's degree in economics with 12 years professional experiences or more including 8 years' experience in collection, computation & analysis, evaluation of flood management, drainage & irrigation project. Higher degree in relevant field is preferred.His/her major responsibilities shall include but not necessarily be limited to the following: • Collect, compute analyze and evaluate the agro-socio-economic data of the project. • Identify all costs and benefit based on engineering, agronomic, social analysis including with and without project scenario. • Calculate BCR,NPV, FIRR,EIRR of the project. • Perform the economic and financial analysis of the proposed intervention in order to assess the economic and financial feasibility. • Conclusion of socio-economic viability of each planning option and the project as a whole;

Disciplines	Qualification and tasks
	• Prepare annual expenditure schedule; • Any and all other works necessary for proper study.
14. GIS and Remote Sensing Analyst	He/She should have Bachelor degree in Civil Engineering/Water Resources Engineering/Urban and Rural Planning/Masters' degree in Geography with 12 years professional experiences or more including 8 years' experience in preparing GIS coverage; Contour Maps, Digital Elevation Models. Higher degree in relevant field is preferred. His/her major responsibilities shall include but not necessarily be limited to the following: • Collect previous GIS maps in the study area and analyse the previous conditions; • Preparation of all types of GIS based maps including data collection, required maps for modelling, analysis results of project area and difference maps of bed topography; • Preparation of study/basin area maps with all the relevant features; • Preparation of project map showing existing and proposed infrastructures; • Preparation of maps for workshops and Reports as suggested; • Assist the Study Team.
15. Survey Specialist	He/She should have Bachelor Degree in Civil Engineering/Water Resources Engineering with 12 years professional experiences or more including 8 years' experience in hydrographic, topographic and hydrometric survey and knowledge on using DGPS, ADCP, hydr-pro, Arcview, and other technology like Tearra model for processing surveyed data. Higher degree in relevant field is preferred. His/her major responsibilities shall include but not necessarily be limited to the following: **Tasks:** • Prepare survey plans; • Field survey for topography, bathymetry, tide, current, sediment, salinity and wave data; • Preparing detailed specification for all field survey activities;

Disciplines	Qualification and tasks
	• Supervise the survey activities; • Ensure the quality of the survey; • Guide in processing and analyzing the data; • Preparation of Survey Report
16. Field researcher/ Junior Engineer	He/She should have Bachelor degree in Civil Engineering/ Water Resources Engineering with 4 years professional experiences or more including 3 years' experience in analysis of different types of data including sediment, discharge, water level, flow velocity, environmental data etc. Higher degree in relevant field is preferred. His/her major responsibilities shall include but not necessarily be limited to the following: • Responsible for the collection of relevant field data and data from different organizations; • Ensure data quality and prepare data needed for hydrological and morphological modelling and analysis; • Provided necessary support with data for other task required for performance by the Study Team; • Analyse of all the surveyed data; • Assist the feasibility study team; • Responsible for compiling and preparing the Inception, Interim, Progress, Draft Final and Final reports along with other documentation.

10. Study Organization, Duties and Responsibilities

10.1 BWDB's Responsibilities

The Consultant shall work under the direct supervision of the Project Director, BWDB, Dhaka. The Hydrology Wing of BWDB shall assist the project team as required, particularly with regard to the hydrological and morphological aspects of the study. It shall also ensure the involvement of concerned officials of BWDB in survey works, field data collection activities as and when required by the consultant. Field survey and field data collection will be done by the consultant in close consultation with the concerned field Executive Engineers and design office of BWDB under the guidance of the concerned Superintending Engineers.

The Project Director, BWDB, Dhaka will ensure that the objective of the study as detailed in the ToR would be achieved within all agreed time schedule and that the contents of the report are acceptable to GoB and will direct the planning process and work program and supervise the Study and monitor progress according to the objectives set in ToR. BWDB will only bear

the cost of the items that were mentioned in the reimbursable cost. Other unspecified costs won't be borne by BWDB.

The Project Director, BWDB, Dhaka will arrange regular meetings between the consultant, BWDB professionals, and concerned officials from other agencies to discuss technical and project management issues. Any unresolved issue either technical or otherwise shall be taken up with BWDB's senior engineers (Chief Engineer (Civil) Planning; concerned Chief Engineers, Chief Engineer, Monitoring, Chief Engineer Design & Chief Engineer, Hydrology; or other GoB agencies as required).

BWDB shall provide or make available the following data, services and facilities to the consultants, as per existing rules of BWDB:

- Available hydrological, morphological, meteorological data and records on rivers and khals of the Study Area following existing BWDB data acquisition rules;
- Available contour maps, aerial photographs, mosaics, maps and previous study reports of the Study Area, if required;
- Any other services, available with BWDB, to help the consultants to carry out the data collection and project evaluation program as per ToR;
- Necessary guidance on study activities when required;
- Any clarification required about this document for clear understanding of the process of conducting project evaluation.

10.2 Consultant's Responsibilities

The consultant should carry out the services as detailed in "Objectives, Scope of Works and Expected outputs" in the best interest of the Government with reasonable care, skill and diligence with sound engineering, administrative and financial practices. The Consultants should be responsible to the client (BWDB) for discharge of responsibilities. It will be the responsibility of the consultant to collect all related information and data required for conducting the study. The consultant shall maintain full and continuous liaison with the BWDB concerned project and field offices. Throughout the consultancy period, the consultant's activities will be reviewed time to time by BWDB conforming to the schedule of time. The consultant at every stage starting from planning of the study, developing methodology, conceptual solutions, river management plan, flood and drainage improvement measures, revision of plan, developing mathematical model etc. will meet with the expertise of BWDB to explain the issue and based on the discussion they will improve the measures. The consultant team will also take the opinions from the officials of relevant sectors (e.g. RRI, WARPO, LGED, BADC, DAE, BMDA, DPHE, RHD, DoE, DoF, etc.) through Technical Committee meeting. The study must be complied with Bangladesh Delta Plan 2100, Sustainable Development Goals (SDG), Bangladesh Water Act-2013, Bangladesh Water Rules-2018 and relevant acts, Rules, regulation, policies. Reports prepared and submitted by the consultants shall be reviewed and approved in tripartite meeting. The consultant will strictly follow the objectives, scope of works, and outputs of the study. All the

collected raw and processed data and reports are to be handed over to BWDB in GIS and any other format what so ever used in the study in soft copies. After completion of the study Printer and Computer accessories should be handed over to BWDB. The publication of the data and used in the study of third party require prior written permission of BWDB.In response to that, the consultant should-

- Make available all the primary and secondary data (entire set of information involving audio-visual recordings) to BWDB or other agencies concerned as and when required. Data and information would be submitted to the client both in hard and soft copies.
- Make necessary arrangements for site investigation, environmental and social survey & data collection as needed for performance of the assigned task and evaluation thereby.
- Provide all support for the effective delivery of the services as stipulated in the objectives, scope of works and expected outputs written in the ToR.
- Actively join the workshops with regard to the purpose of the study in presence of the BWDB officials and other stakeholders both at the project area.
- All types of technical support (like preparation of maps on necessity of the client and any other information related to the task the consultant is assigned with) would be provided to the client.

All the stakeholder consultation sessions would be recorded for future documentation. Video recording would be done and the clips should be handed over to the client. Discussants would be introduced with necessary introductory information and mobile phone number duly incorporated in the reports. Discussion points should be focused properly and addressed accordingly.

11. Payment Schedule

Payments shall be made in line with agreed-on outputs according to the following schedule:

- **Inception Report:** Twenty (20) percent of the lump-sum Contract Price shall be paid upon submission of the Inception Report duly accepted by the Client.
- **Interim Report:** Twenty (20) percent of the lump-sum Contract Price shall be paid upon submission of the Interim Report duly accepted by the Client.
- **Draft Final Report:** Thirty (30) percent of the lump-sum Contract Price shall be paid upon submission of the Draft Final Report duly accepted by the Client.
- **Final Report:** Thirty (30) percent of the lump-sum Contract Price shall be paid upon submission of the Final Report duly accepted by the Client.

The ToR Committee which has been formulated as per memo no. 42.01.0000.005.22.002.18-42 dated 25/03/24 has reviewed the ToR and recommended for kind approval of the competent authority. Thus, the ToR is hereby forwarded for kind approval.

3.3.25
(M. Abdur Rakib)
Executive Engineer (Civil)
Directorate of Planning-1, BWDB, Dhaka
& Member-Secretary, ToR/RFP Review Committee

03/03/25
(Oli Afaz Chowdhury)
Executive Engineer (Civil)
Negotiation Cell, Office of the Chief Engineer(Civil) Planning, BWDB, Dhaka
& Member, ToR/RFP Review Committee

03/03/2025
(Sourav Kumar Das)
Executive Engineer (Civil)
Contract & Procurement Cell, BWDB, Dhaka
& Member, ToR/RFP Review Committee

03.03.25
(Dr. Robin Kumar Biswas)
Superintending Engineer (Civil)
Directorate of Planning-1, BWDB, Dhaka
& Member, ToR/RFP Review Committee

03/03/25
(Md. Aminul Islam)
Superintending Engineer (Civil)
Design Circle-2, BWDB, Dhaka
& Co-opt Member, ToR/RFP Review Committee

03.03.2025
(Dr. Shamal Chandra Das)
Chief Engineer (Civil)
Planning, BWDB, Dhaka
& Convener, ToR/RFP Review Committee

APPROVED
27.03.25
(A.K.M. Tahmidul Islam)
ID No. 660715001
Director General
BWDB, Dhaka.