GOVERNMENT OF THE PEOPLE'S REPUBLIC OF BANGLADESH

MINISTRY OF WATER RESOURCES

BANGLADESH WATER DEVELOPMENT BOARD

COASTAL EMBANKMENT IMPROVEMENT PROJECT, PHASE-1 (CEIP-1)

TERMS OF REFERRENCE (ToR)

FOR

CONSULTING SERVICES FOR

INDEPENDENT PANEL OF EXPERT (IPOE) FOR

HYDRODYNAMIC AND COASTAL MODELLING EXPERT

PACKAGE NO.CEIP-1/D1/S18

DECEMBER 2017

1. Background:

Bangladesh is a low lying deltaic country. The coastal zone in southern Bangladesh adjoining the Bay of Bengal is characterized by a delicately balanced natural morphology of an evolving flat delta, subject to very high tides and frequent cyclones coming in from the Bay of Bengal encountering very large sediment inflows from upstream. The strength of the tides and the flatness of the delta causes the tides to influence river processes a long way upstream in the southern estuaries. This entire area is called the coastal zone. Most of the land in the coastal zone is within 1 to 1.5 meter PWD. The coastal zone, in its natural state, used to be subject to inundation by high tides, salinity intrusion, cyclonic storms and associated tidal surges. In 1960s, polderization had been started to make these land a permanent agricultural land. A polder is a designated area that is enclosed on all sides by dykes or embankments, separating them from the main river system and offering protection against tidal floods, salinity intrusion and sedimentation. Polders are equipped by inletsand outlets to control the water inside the embanked area. The polders lands are slightly higher than sea level. Without embankments the coastal communities would be exposed to diurnal tidal fluctuations. The polders were designed to keep the land safe from the daily tide to allow for agriculture activities. But the coastal embankment system of Bangladesh was originally designed to protect against the tides and the associated salinity intrusion, without much attention to storm surges. Recent cyclones brought substantial damage to the embankments and further threatened the integrity of the coastal polders. In addition to breaching of the embankment due to cyclones, siltation of peripheral rivers surrounding the embankment caused the coastal polders to suffer from water logging, which lead to large scale environmental, social and economic degradation. Poor maintenance and inadequate management of the polders have also contributed to internal drainage congestion and heavy external siltation. As a result, in some areas soil fertility and good agriculture production are declining because of water logging and salinity increase inside polders.

The above reasons have led the Government to re-focus its strategy on the coastal area from one that only protects against high tides to one that provide protection against frequent storm surges. The long term objective of the Government is to increase the resilience of the entire coastal population to tidal flooding and natural disasters by upgrading the whole embankment system. With an existing network of embankment of nearly 5,700 km long with 139 polders, the magnitude of such a project is daunting and requires prudent planning. Hence a multi-phased approach of embankment improvement and rehabilitation has been adopted over a period of 15 to 20 years. The Coastal Embankment Improvement Project – Phase 1 (CEIP-1) is the first phase of this long term program CEIP

2. The Coastal Embankment Improvement Project- Phase I (CEIP-I)

After cyclones SIDR and AILA struck the coastal zone causing severe damage to the infrastructure, life and property, the Government of Bangladesh (GOB) obtained an IDA/credit for Emergency Cyclone Recovery and Restoration Project (ECRRP), 2007 and some proceeds from this credit were used to meet the expenses for carrying out the Feasibility Study of The Coastal Embankment Improvement programme. As an outcome of the study, a project in the name of Coastal Embankment Improvement Project Phase-I (CEIP–I) is conceived. The overall project development objective is to increase the resilience of coastal population to natural disasters and climate change. More specifically, the project aims to (a) increase the area protected in selected polders from tidal flooding and frequent storm surges, which are expected to worsen due to climate change; (b) improve agricultural production by reducing saline water intrusion in selected polders; and (c) improve the Government of Bangladesh's capacity to respond promptly and effectively to an eligible crisis or emergency. These objectives will be achieved by strengthening and upgrading embankments as part of an integrated approach to improve the polder system in the coastal area.

Level of Protection: Existing embankments were designed to protect only against high tides. In the course of the project preparation, protection against a 25 year return period surge height with additional buffer due to climate change has been adopted. A higher return period for the technical design of embankment structures would be prohibitively expensive. In addition, the new parameters and standards for embankment rehabilitation and improvement will make it more resistant to breaches due to overtopping. The increased endurance to overtopping can be attained by better slope protection and efficient drainage schemes. Foreshore afforestation is carried out systematically as part of the project when technically, environmentally and socially feasible to provide biological protection buffer to embankments. The design of the embankment and realignment needs will be done so as to minimize land acquisition.

Wide array of activities are considered as integral elements of this project. Therefore, the project is divided into five components:

A. Rehabilitation and Improvement of Polders;
B. Implementation of Social and Environmental Management Plans;
C. Construction Supervision, Monitoring & Evaluation of Project Impact, Supervision of Social and Environmental Plans, and Coastal Zone Monitoring;
D. Project Management, Technical Assistance, Training and Strategic Studies; and
E. Contingent Emergency Response.

3. Setting up of an Independent Panel of Expert (IPoE):

The CEIP-I is being implemented by the Bangladesh Water Development Board (BWDB), which acts as the Project Implementing Agency. BWDB has set up a Project Management Unit (PMU) to monitor the implementation of the project. The PMU is led by a Project Director (PD) and located in BWDB's Headquarters in Dhaka. The PMU will engage a Team of Experts designated as **Independent Panel of Expert (IPoE)** who will provide technical and professional support to ensure safety, economy, state of the art construction/ improvement of the embankment system and water management practices inside the protected areas while ensuring social and environmental safeguards. The role of the IPOE will be to:

a) Act as an independent "peer reviewer" to undertake quality control functions of the various technical outputs (studies, designs, drawings, monitoring reports etc.) that will be generated by the CEIP-I. Provide suggestions and guidance for improvement on analysis and techniques for deriving the outputs;
b) Meet as a panel to discuss the quality of different outputs completed at various stages of the project and to pinpoint quality issues to be addressed and explored further;
c) Provide advisory input on social, environmental, technical, geo-morphological, resettlement, community initiatives and long term plans for operation and maintenance during the implementation of CEIP-I; and
d) Provide guidance and advisory inputs when needed and as asked by the PMU or the Project Steering Committee.

The IPOE will undertake the following activities:

(i) Review all technical reports in their respective area of expertise. The Chair of IPoE will collate all comments and submit to the PD. When a report will be reviewed by two or more members of the Group or, by the IPOE as a group, the Chair will provide a consolidated feedback to the PD;
(ii) Detailed review of various Reports including Long Term Monitoring, Research and Analysis of Bangladesh Coastal Zone undertaken under the CEIP-I;
(iii) Detailed review of the coastal polder improvement works (polder strategy) considering possible impacts of sea-level rise due to climate change, storm

surges, land subsidence, changes in tidal and sediment dynamics, and anticipated variations in salinity boundaries due to different flow regimes under external drivers of change;

(iv) Expert opinion on the water resources management for improvement of the coastal polders and morphological studies of river and estuaries in the changing climate and different future scenarios;

(v) Review the detailed engineering design of the coastal embankments, drainage regulators, flushing inlets, drainage canals, river training works, and all other related works and construction of foundations in soft river deposits, including knowledge of the effects of scour and the prediction of flexibility of foundations, suitability of earth for construction of embankments;

(vi) Expert opinion on various modeling studies;

(vii) Expert opinion on the dynamic behavior and environment of the coastal ecosystem, water management & Sundarbans;

(viii) Expert opinion on social and resettlement studies and management plans;

(ix) Guide and suggest in exploring and investigation on the Tidal River and Sediment Management in coastal polders;

(x) Undertake field visits as may be considered necessary;

(xi) Provide any other expert advice as may be requesteded by BWDB.

4. Members of the IPOE and their Modalities of work

The IPoE shall consist of nationally /internationally renowned professionals/ engineers who are widely acknowledged to be experts in their respective field. The members of the IPoE should possess among them acknowledged expertise and requisite experience in the field for which they would be engaged. Besides their specific expertise areas, every expert should have a clear notion of the project as a whole. Questions about the sustainability of the polder concept are being raised frequently, reason why new concepts will be looked for in the long term study. Panel members therefore must be able to think multi-disciplinary and should have a holistic and pragmatic view. Experience in large-scale complex delta projects is a prerequisite. It is proposed that the Panel comprises of 5 renowned experts in the following fields:

i. Coastal, Estuarine and River Morphology & Sediment /Tidal River Management Expert
ii. Hydrodynamic and Coastal Modelling Expert
iii. Design Expert in Embankment and Hydraulic Structures
iv. Social Expert
v. Environment, Water Management and Polder Expert

The PMU will engage members of the IPOE who will report to the Project Director. The members of the IPOE is expected to work as a group but may also be invited to provide input as an individual, as may be deemed necessary by the PD. Each expert will be engaged separately, but the Panel will work as a team. The appointment of each member is expected to last for the entire duration of the project unless unforeseen circumstances occur. It is important to minimize the turnaround of panel members in order to ensure consistent view and guidance through the project implementation period.

Each member of the IPoE will be contracted to provide input for a total of 175 days over 3 years. However, the distribution of input may not be uniform across the Panel. Depending on their expertise, some members may be asked for more (or less) input in different years.

One of the members will be appointed as chair of the IPOE. The chair will coordinate IPOE's activity and chair its meetings. Panel meeting may take place virtually or face to face. IPOE meetings are required to be held based on milestones in the progress of the project during the

implementation. Extraordinary meetings of the IPOE may also be called in critical situations. Similarly, the services of individual members may be called upon, if considered necessary by the PMU. Site inspections and investigation may be conducted by the IPOE depending upon the issue.

The IPoE should consist of five individuals including the chair. It is expected that the IPoE will include some experts from the resident in Bangladesh (if required) and familiar with the procedures and systems for design and construction in Bangladesh, as well as other experts drawn from around the world. Ideally the numbers of Bangladeshi and International experts should be appropriately balanced.

5. Key Functions of the Hydrodynamic and Coastal Modelling Expert:

The tasks of the Expert shall include but not necessarily be limited to the followings:

- Suggest and guide in establishing pertinent parameters for all hydrodynamic and coastal modelling excercises in terms of areas, boundary conditions, accuracy, grid size and model set-up;
- Assess the verification of the data set carried out by the Modelling team;
- Provide guidance in the calibration process and thereafter validation of the modelling;
- Advise on developing storm surge model and updating and improving of available storm surge model for the Bay of Bengal;
- Provide expert opinion on methodology of studying the long-term changes in boundary conditions in the perspective of climate change and drivers of change including the future change in the GBM river system;
- Analyze the storm surge level /height for establishing return period of storm surge level at different location of the coastal area;
- Assess the risk of storm surge considering sea level rise and wave analysis and wave modeling for computing wave run-up for the interventions;
- Review the results of the modeling activities and advise on how these should be translated into design parameters for the proposed interventions;
- Review the various reports including Long Term Monitoring, Research and Analysis of Bangladesh Coastal Zone undertaken under the CEIP-I & provide comments for their improvement;
- Assess how the recommendations of the Long Term Monitoring, Research and Analysis of Bangladesh Coastal Zone undertaken under the CEIP-I can be translated into requirements and concepts for next phases of CEIP;
- Any other tasks as suggested by the PD.

6. Qualifications:

He/she should have Ph.D in his/her field of specialization. In case of exceptionally experienced candidates the academic qualification may be relaxed to a Masters degree from an international renownned University in Civil Engineering/Coastal and/or River Engineering/Hydraulic Engineering/Water Resources Engineering/Hydraulic Modelling. He/she should have 20 years of professional experience with at least 10 years experience on relevant field like; tide, wave and storm surge modeling and strategic coastal zone management planning. He/she should have experience in risk assessment and devising

mitigation measures for risk reduction in the coastal area and rivers It is preferred to have experience in similar working conditions like Ganges-Megna-Brahmapupra (GMB) Deltas.

7. Duration of the Assignment:

Duration of the consultancy services would be approximately 175 days over the 3 years of the starting from FY 2017-2018 to FY 2019-2020. However, the contract may be extended depending on performance of the consultant and project needs.

8. Selection Procedures:

The consultants will be selected in accordance with World Bank Guidelines: Selection and Employment of Consultants by the World Bank Borrowers, (January 2011, Revised July 2014).

9. Remuneration : Negotiable

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