CTCN
CLIMATE TECHNOLOGY CENTRE & NETWORK

Technical Assistance Response Plan – Terms of Reference

Country	**Bangladesh**
Request ID#	**2016000088**
Title	Monitoring & Assessment of Climate Change Impact on Geomorphology in the Coastal Areas of Bangladesh
NDE	Dr. A.K.M. Rafique Ahammed, Director General, Department of Environment, Ministry of Environment, Forest and Climate Change, Government of Bangladesh. dg@doe.gov.bd Poribesh Bhaban, E-16, Agargaon, Sher-e Bangla Nagar, Dhaka 1207, Bangladesh
Proponent	Md Saiful Hossain, Superintending Engineer, Processing Flood Forecasting Circle, Bangladesh Water Development Board. se.pffc@bwdb.gov.bd; pd.bwdb.shews@gmail.com 72, Green Road, Dhaka-1205, Bangladesh

Summary of the CTCN technical assistance

The coastline of Bangladesh is on the frontline of climate change, and the coastal communities are becoming increasingly more vulnerable to a number of threats, including: cyclones and storm surges; erosion of river banks, islands and chars; sea level rise; salinity intrusion; floods; droughts; drainage congestions; and coastal erosion.

The CTCN technical assistance will underpin and strengthen existing efforts such as the World Bank funded project Coastal Embankment Improvement Project (CEIP-1) to increase the resilience of the coastal population by enhancing the capacity of stakeholders in Bangladesh to apply Earth Observation (EO) based approaches for synoptic monitoring of changes and dynamics within the coastal zone.

The technical assistance will provide technical support and training for key stakeholders in Bangladesh to 1) Apply state-of-art GIS and remote sensing software for advanced image analysis; 2) Acquire, process and analyze satellite derived data for periodic monitoring of morphological processes in the coastal zone and impact assessments; and 3) Apply EO derived data products for assessing climate related impacts and risks to develop early warning mechanisms.

It is anticipated that the Government of Bangladesh will pursue a GCF project to build further on the capacities developed as part of the CEIP-1 and this technical assistance.

Agreement:

(If possible, please use electronic signatures in Microsoft Word file format)

National Designated Entity to the UNFCCC Technology Mechanism	**Proponent**
Name: Dr. A.K.M. Rafique Ahammed	Name: Md Saiful Hossain
Title: Director General	Title: Superintending Engineer
Date:	Date:
Signature:	Signature:

UNFCCC Climate Technology Centre and Network (CTCN)

Name: Rose Mwebaza
Title: CTCN Director
Date:
Signature:

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1. Background and context

The coastal zone of Bangladesh is prone to multiple threats. Sixty two percent of the coastal land has an elevation less than 3 meters and eighty-three percent is within 5 meters above mean sea level. The flow of the rivers entering the Ganges, Brahmaputra Meghna (GBM) delta is the third largest in the world and river floods occur regularly, often leading to flooding of one third of the country. With a sediment supply of 1 billion tons per year, The GBM delta has the largest sediment supply in the world. This leads to accretion of the land area in the coastal zone, mainly in the Meghna Estuary (approx. 5-10 km^2/year in net accretion), and to highly unstable river branches and estuaries.

The large amounts of sediments deposited form loose land masses that subside under natural conditions of over burden pressure. It has been noticed that the subsidence rate may be higher in places due to anthropogenic factors like drainage and ground water extraction. On top of that there are tectonic movements in the deep subsoil, caused by horizontal plate movements. This subsidence rate strongly exacerbates the effect of climate change induced sea level rise.

The coastal zone hosts nearly 42 million people which is projected to grow to 61 million by 2050. The high pace of population growth continues to push millions of people to live in the most low-lying and vulnerable coastal areas.

The Government of Bangladesh's commitment to develop a safe and inhabitable coastal zone can be dated back to the mid-1960s. Compelled by the call for intensive rice cultivation during the green revolution, the government constructed a series of embankments and polders in order to provide tidal flood protection for coastal population; thereby enabling intensification of crop production and agricultural growth. The system was originally designed to protect the low-lying land against inundation from the high spring tides in monsoon-months. When the polders were initially constructed attention was not given to storm surges that could over-top the polder and thus result in submergence of the protected area and destruction of crops as well as homesteads often killing hundreds of people. The risk has increased due to subsidence of land and embankments, sea level rise and potentially due to a more erratic climate.

A thorough understanding of the impacts of sea level rise and its interaction with the natural morphological processes (e.g. erosion, accretion, subsidence) as well as the anthropogenic changes is required to build resilience and maintain sustainable livelihood for the population in the coastal zone of Bangladesh in order to support the rehabilitation and strengthening of polders and other coastal protection technologies.

2. Problem statement

The vulnerability of the coastal population in Bangladesh is on the rise due to climate change. Climate variability and change will accentuate the intrinsic risks: (i) cyclones and storm surges (ii) erosion of river banks, islands and chars, (iii) sea level rise, (iv) salinity intrusion, (v) floods, (vi) droughts, (vii) drainage congestions and (viii) coastal erosion.

These risks lead to the formulation of a Technology Needs Assessment in 2012 and the development of the CTCN TA Request. In parallel the Government of Bangladesh obtained a World Bank Credit for the project Coastal Embankment Improvement Project (CEIP-1) where the overall project development objective is to increase the resilience of coastal population to natural

disasters and climate change. During the early course of CEIP-1 pertinent knowledge gaps were identified and in response to this the ongoing project "Long Term Monitoring, Research and Analysis of Bangladesh Coastal Zone (Sustainable Polders Adapted to Coastal Dynamics) " (see Section 8 of this Response Plan for further details) was conceived. There are considerable overlaps between this project and the original CTCN TA Request, hence this Response Plan will focus on elements that will support and strengthen the work of CEIP-1.

Assistance is requested to provide technical support and training to apply state-of-the-art Earth Observation (EO) techniques to address the risk facing the Coastal Zone of Bangladesh. It will support the local technical staff to undertake assessment and provide early warning of bank erosion and better understand the morphological processes under climate change impacts.

The assistance required includes:

1. Assessment of endogenous capacity in geospatial processing applications and satellite image analysis
2. Demonstration, methodological guidelines and technical training in using Earth Observation technologies for impact analysis and early warning of inland bank erosion.
3. Demonstration, methodological guidelines and technical training in using Earth Observation technologies for monitoring the dynamics of coastlines and assessing the impact of climate change and storm surges on the coastal zone
4. A framework (outline) for a Bank Erosion Contingency Planning

3. Logical Framework for the CTCN Technical Assistance:

(Guidance: Please note that multiple activities lead to one Output, and multiple Outputs lead to one Outcome. There can be several Outputs, but only one Outcome description capturing the CTCN technical assistance. Deliverables are the products or services to be delivered to the NDE/Proponent/CTCN based on the Activities and the Outputs.)

***Objective**:*
The objective of the technical assistance is to enable Bangladesh to make periodic assessment of the changes that are taking place in the coastal areas and enhance the knowledge base for climate change related phenomenon in order to assess the impacts of climate change so that appropriate strategies and actions can be proposed for implementation.

Outcome:
The technical assistance will build sustainable capacity among technical staff as well as decision makers to utilize modern EO techniques to monitor climate change challenges and to provide early warning in the coastal zone of Bangladesh. In order to fully operationalize EO techniques and make best use of the EO derived products, capacity building activities will be organized and planned from both a technical perspective (technical training) and from a management/user perspective (oriented to decision makers and other stakeholders who will make use of the information products). The technical training workshop will develop the skills and capacities of technicians and system/services operators to utilize EO techniques and software components to analyze satellite imagery, while the user workshop focusing on the management/user perspective will contribute to ensure that the derived information and data products are embedded within management/decision making processes. The training activities and methodological guidelines will be compiled into a clear and concise compendium to facilitate sustainable and long-term knowledge transfer. The compendium will include introductions to relevant tools and open source software components; step-by-step guidelines for data acquisition, pre-processing and analysis; and guidelines for data interpretation and integration of derived information and data products.

	Month											
	1	2	3	4	5	6	7	8	9	10	11	12
Output 1: Development of implementation planning and communication documents												
Activity 1.1: Preparation of an agreed work plan and required annexes i) A detailed work plan of all activities, deliverables, outputs, deadlines and responsible persons/organisations and a detailed budget to implement the Response Plan. The detailed work plan and budget must be based directly on this Response Plan; ii) Based on the work plan, a monitoring and evaluation plan with specific, measurable, achievable, relevant, and time-bound indicators used to monitor and evaluate the timeliness and appropriateness of the implementation. The monitoring and evaluation plan should apply selected indicators from the Closure and Data Collection report template and enable the lead implementer to complete the CTCN Closure and Data collection report at the end of the assignment (please refer to item iv below and section 14 in the Response Plan);											

iii) A two-page CTCN Impact Description formulated in the beginning of the technical assistance and update/revised once the technical assistance is fully delivered (a template will be provided); iv) A Closure and Data Collection report completed at the end of the technical assistance (a template will be provided).												
Deliverable 1: i) Detailed work plan ii) Monitoring and evaluation plan iii) CTCN Impact Description iv) Closure and Data Collection report												
Output 2: Assessment of endogenous capacity in geospatial processing applications and satellite image analysis												
Activity 2.1: Establish a GIS and earth observation data handling capacity baseline Under this activity the desired capacities will be evaluated against existing capacities in order to generate an understanding of existing assets and capacity to process geospatial data and satellite imagery. This will help determine what additional capacities are required to reach the project objectives. To determine key priority training areas, an initial needs assessment will be administered using a questionnaire survey analysis, followed up with an on-site focus group discussion with key technical specialists within the Bangladesh Water Development Board (BWDB). This activity will inform and refine the capacity building activities in support of output 3+4.												
Deliverable 2: Deliverable 2.1: Minutes of the focus group discussion meeting Deliverable 2.2: A capacity assessment summary report incl. analysis of survey responses and lessons learned from focus group discussions												
Output 3: Development of methodology for use of earth observation tools to provide early warning of bank erosion in the coastal zone												

Activity 3.1: Establish a science-based methodology to detect bank erosion based on satellite data EO data obtained through satellite imagery can provide a synoptic view of the coastal zone and provide time critical river insight into river bank erosion processes and morphological changes. This activity will apply a user centric approach to define and adopt a best practice methodology for an EO based approach, primarily relying on data from the Sentinel-1 and Sentinel-2 satellites, to assess river morphology, erosion and sedimentation processes, and waterline reach. Initially, a thorough literature review will be conducted in parallel with user consultation to determine best practice guidelines that satisfy and comply with the needs and requirements of the core users. The methodology will build upon established methods and tools based on time-series analysis of satellite imagery to facilitate assessment of river morphology and bank erosion/accretion. The adopted method be used to help stakeholders effectively and routinely monitor the capacity of existing flood control measures and determine vulnerable reaches of the river to inform the planning of river bank protection measures and drainage improvement works.												
Activity 3.2: Test the established method on a specific case/ground truthing In this activity the methodology determined in activity 3.1 will be applied and tested using a local demonstration case study in a Bangladeshi delta. In-situ data will be used for model calibration and validation. This approach will allow for robust validation of the applied model and illustrate the spatial detail and accuracy. The demonstration case will be derived through user consultation in order to identify relevant case studies where existing ground truth data is available. Any gaps in in-situ data requirements will be addressed using Very High Resolution (VHR) satellite imagery to collect "pseudo truth" data. The demand driven approach aims to build confidence about the added value and potential of EO services to contribute to early warning systems among the user community.												
Deliverable 3: Deliverable 3.1: Step-by-step guide with methodological guidelines for applying EO based approaches to derive early warning systems for bank erosion in the coastal zone.: This will include methodological guidelines and introductions to prerequisite software components, as well as step by step guides on how to apply the technology, using selected demonstration/testing case studies in Bangladesh.												
Output 4: Development of methodology for use of earth observation tools to assess climate change impacts in the coastal zone												
Activity 4.1: Establish a science-based methodology to detect coastal accretion and erosion based on satellite data												

This activity will apply a user centric approach to define and adopt a methodology for an EO based method to model coastal geomorphology, erosion and accretion in order to analyze shoreline variability and trends. Both optical and Synthetic Aperture Radar (SAR) data will be exploited, and high-frequency Sentinel satellites will be combined with historic satellite archives in order to assess both long term coastal variation, attributed to sea level rise and climate change as well as acute variation, e.g. due to storms. For change detection analysis in general and for coastline change monitoring in particular, image acquisition times needs to be considered in order to mitigate potential flaws from changes not related to actual movements of the coastline. For this purpose, it is important to try to mitigate the potential influence caused by variations in tide levels as well as the influence from tropical cyclones and associated storm surges. Therefore, tide measurements and cyclone historical tracks will be intercoupled within the data acquisition process, and stored as metadata, in order to apply tidal correction in the various accretion and erosion analysis. SAR derived altimetry methods will be included in the methodological outline in order to detect sea surface heights in order to monitor the long-term sea level change due to climate change, tides and coastal erosion and accretion processes. Anomaly detection of satellite derived normalized difference vegetation index (NDVI) measurements will be used to serve as a proxy indicator of salinity intrusion and chemical changes inside the polders. Initially a thorough literature review and existing best practice guidelines will be conducted in parallel with user consultation to determine the optimal methodology satisfying the needs and requirements of the core users. The adopted method will allow stakeholders to effectively monitor the geomorphological processes contributing to accretion and erosion in the coastal zone.												
Activity 4.2: Test the established method on a specific case/ground truthing In this activity the methodology determined in activity 4.1, will be applied and tested using a local demonstration case study in a Bangladeshi coastline zone. In-situ data will be used for model calibration and validation. This approach will allow for robust validation of the applied model and illustrate the spatial detail and accuracy. The demonstration case will be derived through user consultation in order to identify relevant case studies where existing ground truth data is available. Any gaps in in-situ data requirements will be addressed using VHR satellite imagery to collect “pseudo truth” data. The demand driven approach aims to build confidence about the added value and potential of EO services to contribute to assessing coastal accretion and erosion, among the user community.												
Deliverable 4: Deliverable 4.1: Step-by-step guide with methodological guidelines for applying EO based approaches to detect coastal accretion and erosion. This will include methodological guidelines and introductions to prerequisite												

software components, as well as step by step guides on how to apply the technology, using selected demonstration/testing case studies in Bangladesh.												
Output 5: Capacity built on earth observation tools and geospatial data handling												
Activity 5.1: Technical capacity building workshop This activity will consist from a combined 5-day technical training and field work session for 12-15 technical specialists, to be held in Khulna, Bangladesh. The participants for the technical workshop will be discussed in advance with the national counterparts, and ultimately selected by the BWDB. The final selection of participants for the workshop will aim to ensure a gender representation of at least a 70/30 split. During this activity the technical expertise of the select specialists within BWDB and other relevant agencies will receive focused technical training with a view to increase the capacity of stakeholders to apply the technical methodology derived from Output 3+4. The training will include introductions to all necessary software components, in addition to a focused training activity on data acquisition, pre-processing, analysis and mapping. The training will also focus on how to use the data and results to assess risks related to climate change impacts. While the technical sessions will be held in facilities in Khulna, in-situ sampling and data collection in the field will be conducted during a one-day side trip. While the focus of the technical training workshop will be to develop the capacity of key technical specialists to develop their skillsets within EO data handling, processing and analysis a further aim is to contribute to the ability of the specialists to act as trainers of trainers and to further anchor EO services at institutional level. In order to accomplish this objective, a compendium of the training material, data packages and guidelines will be disseminated subsequently.												
Deliverable 5: Deliverable 5.1: Training compendium consisting of Introductions to key software components and analytical tools; Data packages; Step-by-step guidelines to processing workflows and analysis; Guidelines for data interpretation and integration Deliverable 5.2: Report on the technical capacity building workshop with a plan for follow up activities Deliverable 5.3: Images, presentations and communication material from the workshops												
Output 6: A framework for a Bank Erosion Contingency Planning												

Activity 6.1: Development of the framework in collaboration with CEIP-1 An output of the CEIP-1 World Bank project is management practices for the polders in the coastal zone. This management plan will include necessary steps in case of possible threats to the embankments due to bank erosion. An important element in this will be the capacity to use EO to provide early warning of bank erosion in the coastal zone (Output 3). Possible subsequent steps could be river surveys and detailed mathematical modelling to clarify feasibility of possible mitigation measures (e.g. bank protection and/or retirement of the embankment). In this activity a framework for bank erosion contingency planning will be established in collaboration with the CEIP-1.												
Activity 6.2: A project evaluation meeting and study trip to Bangkok for 6 selected stakeholders at managerial level within the BWDB and other relevant agencies This meeting and field trip will aim to solidify the capacity building activities by raising awareness about the application potential and integration of derived information products into existing monitoring mechanisms, within the high-level segment. In Bangkok a visit to Hydro and Agro Informatics Institute (HAII) will be organized. HAII is a public organization under Ministry of Science and Technology, Thailand and is a key institution in water management in Thailand.												
Deliverables 6: Deliverable 6.1: The framework for the Bank Erosion Contingency Planning Deliverable 6.2: Minutes of the project evaluation meeting Deliverable 6.3: Report on the study trip to Bangkok												

4. Resources required and itemized budget:

Please provide an indicative overview of the resources required and itemized budget required to implement the CTCN technical assistance, including for M&E-related activities, using the table below. Important to note that minimum 1% of the budget should explicitly target gender specific activities related to the technical assistance (please see section 10 for further information on gender). Once the Response Plan is completed, a Response Implementation partner(s) will be selected by the Climate Technology Centre (CTC). A detailed activity-based budget for the CTCN assistance will be finalized by the CTCN and selected Implementer.

Activities and Outputs	**Input: Human Resources** *(Title, role, estimated number of days)*	**Input: Travel** *(Purpose, national vs. international, number of days)*	**Inputs: Meetings/events** *(Meeting title, number of participants, number of days)*	**Input: Equipment/Material** *(Item, purpose, buy/rent, quantity)*	**Estimated cost** *Please accumulate the costing at Activity and Output level and provide an estimated costing range for each activity and the total Response Plan*	
					Minimum (USD)	**Maximum (USD)**
Output 1: **Development of implementation planning and communication documents**	*Geomorphologist / project management, 12 man days*		*2 teleconferences*		14.400,00	14.400,00
Output 2: Assessment of endogenous capacity in geospatial processing applications and satellite image analysis	*Capacity building expert, 10 man days*	*International mission for 4 days*	*Focus group meeting, 10 participants, 1 day*	*Meeting room*	13.400,00	13.400,00
Output 3: Development of methodology for use	*Senior remote sensing specialist and remote sensing*				26.400,00	26.400,00

of earth observation tools to provide early warning of bank erosion in the coastal zone	*specialist, 22 man days*					
Output 4: Development of methodology for use of earth observation tools to assess climate change impacts in the coastal zone	*Senior remote sensing specialist and remote sensing specialist, 22 man days*				26.400,00	26.400,00
Output 5: Capacity built on earth observation tools and geospatial data handling	*Senior remote sensing specialist and capacity building expert, 14 man days*	*International mission for 7 days*	*12-15 participants, 5 days (Khulna)*	*Meeting room + catering*	33.920,00	33.920,00
Output 6: A framework for a Bank Erosion Contingency Planning	*Geomorphologist, 21 man days*	*International mission for 10 days*			31.500,00	31.500,00
Cross-cutting:	*Gender specialist*		*5-10 days to review capacity assessment reports and training material and make recommendations for strengthened gender focus*		(budget included under Output 1 through 6)	(budget included under Output 1 through 6)
Estimated range of costing for the entire Response Plan					146.020,00	146.020,00

5. Profile and experience of experts

Based on the required Human Resources identified in section 4 (Resources required and itemized budget) please provide a description of the required profile of all involved experts for the implementation of the CTCN Response Plan.

Experts required	Brief description of required profile
Geomorphologist / project management	A M.Sc. or Ph.D. in fluvial or coastal morphology, min. 20 years of experience in morphology of large rivers/deltas, comprehensive experience from Bangladesh required, fluency in English
Capacity building expert	The capacity building expert will have a relevant university degree (M.Sc. or Ph.D.) level with proven experience (min 5-10 years) conducting capacity building and stakeholder engagement processes in the global south, including proven experience in conducting capacity needs assessments. Furthermore, the capacity building expert has a detailed understanding of satellite derived data products and geospatial data analysis and processing.
Senior remote sensing specialist	A M.Sc. or Ph.D. in geography and/or remote sensing with a min. 15 years' experience in advanced satellite image and geospatial analysis, including advanced time series analysis within coastal and water related environments using SAR and optical data.
Remote sensing specialist	The remote sensing specialist has at least an M.Sc. in remote sensing or geography, with a specialization in remote sensing or geoinformatics. The remote sensing specialist will have at least 5-10 years of experience and expert knowledge in the use of remote sensing and geospatial analysis in a wide range of applications, including for erosion risk assessments and coastal monitoring.
Gender specialist	The national Gender Specialist has at least a Bachelor's Degree in social sciences, international development, economics, political science, or a related field. Minimum 5 years of experience from working similar projects to strengthen the gender focus.

6. Intended contribution to impact over time

The project is intended to establish methodological guidelines and step-by-step workflows for EO assessments of coastal zone dynamics in Bangladesh, and train staff for the development of an early warning capacity for bank erosion attacks, which is one of the most significant risks from climate change. Furthermore, the EO based workflows will allow stakeholders to increase the general understanding of the geomorphological processes in the coastal zone of Bangladesh and the impacts of climate change on these processes. The project will contribute significantly to develop the technical ability of key stakeholders within relevant government agencies in Bangladesh, including the BWDB, to conduct time critical analysis of erosion/accretion processes and assessments of climate change impacts using advanced remote sensing methods. The project is expected to contribute to the avoidance of economic losses and loss of livelihood and lives as a result of climate change enhanced risks. The beneficiaries are the population of the delta which today is 42 million and expected to increase to 61 million by 2050. According to "Nationwide climate vulnerability assessment in Bangladesh (2018)" Climate Vulnerability Indices are generally high in the coastal zone of Bangladesh. For instance, Mangrove Forest Vulnerability in the Khulna division (western part of coastal zone) is in excess of 0.7 at most locations (0 means no vulnerability, 1 means highly vulnerable). Saline water intrusion reduces freshwater availability and impacts crop yield in particular for vegetable cultivation which has an adverse effect on human health in the coastal zone.

7. Relevance to NDCs and other national priorities

The Government and the people of Bangladesh are committed to achieve the Sustainable Development Goals (SDGs). It is the policy of the nation to ensure equitable distribution of growth and development in every part of the country. The coastal belt in the past had not received much of attention. But now that attention would need to be enhanced. This project will provide a major impetus to the development efforts of the Government.

- A sustainable development pathway that is resilient to disaster and climate change; entails sustainable use of natural resources; and successfully manages the inevitable urbanization transition. (7th Five Year Plan (http://www.lged.gov.bd/UploadedDocument/UnitPublication/1/361/7th_FYP_18_02_2016.pdf), page 36)
- Infrastructure to ensure that existing assets (e.g., coastal and river embankments) are well maintained and fit-for-purpose and that urgently needed infrastructure (e.g., cyclone shelters and urban drainage) is put in place to deal with the likely impacts of climate change. (BCCSAP 2009 (https://www.iucn.org/downloads/bangladesh_climate_change_strategy_and_action_plan_2009.pdf), Page XVIII)
  Research and knowledge management to predict the likely scale and timing of climate change impacts on different sectors of economy and socioeconomic groups; to underpin future investment strategies, and to ensure that Bangladesh is networked into the latest global thinking on science, and best practices of climate change management. (BCCSAP 2009, Page XVIII)

8. Linkages to relevant parallel on-going activities:

The vulnerability of the coastal population is on the rise due to climate change. Climate variability and change will accentuate the intrinsic risks facing coastal Bangladesh. These risks lead to the formulation of a Technology Needs Assessment and the development of the CTCN TA Request in 2016 with the title: "Technology for Monitoring & Assessment of Climate Change Impact on Geomorphology (Sea level rise/fall, Salinity, Sedimentation etc.) in the Coastal Areas of Bangladesh". In parallel the Government of Bangladesh obtained a World Bank Credit for the Coastal Embankment Improvement Project (CEIP-1) with the overall project development objective is to increase the resilience of coastal population to natural disasters and climate change. More specifically, the project aims at:

- Reducing the loss of assets, crops and livestock during natural disasters;
- Reducing the time of recovery after natural disaster such as cyclone;
- Improving agricultural production by reducing saline water intrusion which is expected to worsen due to climate change;
- Improving the Government of Bangladesh's capacity to respond promptly and effectively to an eligible crisis or emergency.

During the early course of CEIP-1 pertinent knowledge gaps were identified and in response to this the project "Long Term Monitoring, Research and Analysis of Bangladesh Coastal Zone (Sustainable Polders Adapted to Coastal Dynamics" was conceived and implementation of this project was commenced in October 2018. The project will run for 30 months and as part of the project BWDB staff will be trained in the methodologies used in this project. These are mainly mathematical modelling and various types of field surveys. The mathematical models will simulate the morphological development of the Coastal Zone on various scales (micro, meso and macro scales) in response to climate changes and anthropogenic development in the basin (such as e.g. reservoir construction and water diversion in India). It is the intent that this staff should continue their activities as a center of excellence under BWDB.
The activities under this CTCN TA will be closely coordinated with the CEIP-1 project. The BWDB staff also engaged in the CEIP-1 project will be invited to take part in all training activities under this TA. The methods developed under the TA will be verified using ground data collected as part of the CEIP-1 project.

9. Anticipated follow up activities after this technical assistance is completed:

Sustainable management of the coastal zone of Bangladesh will require continued focus from the Government of Bangladesh and financing that will be beyond this TA. It is therefore anticipated that the Government of Bangladesh will pursue a GCF project to build further on the capacities developed as part of the CEIP-1 and this TA.

10. Gender and co-benefits: [to be further revised based on CTCN inputs]

Imbedded in design of the activities:	Women are today well-represented amongst water professionals in the government sector and private consultancy organizations (e.g. IWM). This TA will encourage well-balanced (with respect to gender) nomination of professionals for the training activities. Furthermore, women are amongst the most vulnerable to climate change enhanced risks and will as such benefit significantly from the risk mitigation provide by this TA.
Gender and co-benefits intended as result of the activities:	It is expected that this TA will reduce the vulnerability of women in the Coastal Zone of Bangladesh to climate change related risks. It is furthermore anticipated that this TA will increase the technical capacity of the women participating in the training and capacity development activities.

11. Main in-country stakeholders in implementation of the technical assistance activities:

Using the table below, please list and describe the role of in-country stakeholders, participants and beneficiaries who will be involved in or directly consulted during implementation of the assistance.

In country stakeholder	**Role in implementation of the technical assistance**
Processing & Flood Forecasting Circle, Bangladesh Water Development Board (BWDB)	Main applicant and assisting the CTCN contractor in implementation of the CTCN supported technology.

Coastal Embankment Improvement Project – I, BWDB	Main responsible for ensuring sustainable polder development in the coastal zone of Bangladesh
Department of Environment, Bangladesh	Will provide technical support
Institute for Water Modelling (IWM)	Centre of excellence in Bangladesh within water modelling and part of the CEIP-1 team. Counterpart
The Center for Environmental and Geographic Information Services (CEGIS)	Centre of excellence in Bangladesh with comprehensive expertise within EO. Counterpart.
Bangladesh Unnayan Parishad (BUP)	Center of excellence with experience in socio-economic analysis and climate change impact response activities. Counterpart
Md Saiful Hossain, Superintending Engineer, Processing Flood Forecasting Circle, Bangladesh Water Development Board. se.pffc@bwdb.gov.bd 72, Green Road, Dhaka-1205, Bangladesh	Will act as the main counterpart of the CTCN contractor (Request Proponent)

12. SDG Contributions:

*Instructions: Please complete the grey section below for **a maximum of three SDGs** that will be advanced through this TA. A complete list of SDGs and their targets is available here: https://sustainabledevelopment.un.org/partnership/register/.*

Goal	Sustainable Development Goal	Direct contribution from CTCN TA (1 sentence for top 1-3 SDGs)
1	End poverty in all its forms everywhere	
2	End hunger, achieve food security and improved nutrition, and promote sustainable agriculture	Sustainable polders are essential for food security for the almost 42 million people living in the coastal zone of Bangladesh
3	Ensure healthy lives and promote well-being for all at all ages	
4	Ensure inclusive and equitable quality education and promote life-long learning opportunities for all	
5	Achieve gender equality and empower all women and girls	
6	Ensure availability and sustainable management of water and sanitation for all	Sea level rise (SLR) will aggravate problems related to salinity intrusion which threatens access to fresh water.
7	Ensure access to affordable, reliable, sustainable, and modern energy for all (consider adding targets for 7)	
	7.1 - By 2030, ensure universal access to affordable, reliable and modern energy services	
	7.2 - By 2030, increase substantially the share of renewable energy in the global energy mix	
	7.3 - By 2030, double the global rate of improvement in energy efficiency	
	7.a - By 2030, enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology	
	7.b - By 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, in particular least developed countries, small island developing States, and land-locked developing countries, in accordance with their respective programmes of support	
8	Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all	
9	Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation	
10	Reduce inequality within and among countries	

11	Make cities and human settlements inclusive, safe, resilient and sustainable	
12	Ensure sustainable consumption and production patterns	
13	Take urgent action to combat climate change and its impacts	
	13.1 - Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries	Recent cyclones (e.g. Sidr in 2007 and Aila in 2009) have brought substantial damage to the embankments and threaten the integrity of the coastal polders. SLR will further aggravate this threat and increased saline intrusion will affect negatively agriculture in the area. Early warning of bank erosion will add to the resilience of the entire coastal zone.
	13.2 - Integrate climate change measures into national policies, strategies and planning	
	13.3 - Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning	
	13.a - Implement the commitment undertaken by developed-country parties to the United Nations Framework Convention on Climate Change to a goal of mobilizing jointly $100 billion annually by 2020 from all sources to address the needs of developing countries in the context of meaningful mitigation actions and transparency on implementation and fully operationalize the Green Climate Fund through its capitalization as soon as possible	
	13.b - Promote mechanisms for raising capacity for effective climate change-related planning and management in least developed countries and small island developing States, including focusing on women, youth and local and marginalized communities	
14	Conserve and sustainably use the oceans, seas and marine resources for sustainable development	
15	Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss	
16	Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels	
17	Strengthen the means of implementation and revitalize the global partnership for sustainable development	

13. Classification of technical assistance:

Please indicate primary type of technical assistance. Optional: If desired, indicate secondary type of technical assistance.

Please tick off the relevant boxes below	*Primary*	*Secondary*
☒ 1. Decision-making tools and/or information provision	☒	☐
☐ 2. Sectoral roadmaps and strategies	☐	☐
☐ 3. Recommendations for law, policy and regulations	☐	☐
☐ 4. Financing facilitation	☐	☐
☐ 5. Private sector engagement and market creation	☐	☐
☒ 6. Research and development of technologies	☐	☒
☒ 7. Feasibility of technology options	☒	☐
☒ 8. Piloting and deployment of technologies in local conditions	☒	☐
☐ 9. Technology identification and prioritisation	☐	☐

Please note that all CTCN technical assistance contributes to strengthening the capacity of in country actors.

14. Monitoring and Evaluation process

Upon contracting of the implementing partners to implement this Response Plan, the lead implementer will produce a monitoring and evaluation plan for the technical assistance. The

monitoring and evaluation plan must include specific, measurable, achievable, relevant, and time-bound indicators that will be used to monitor and evaluate the timeliness and appropriateness of the implementation. The CTCN Technology Manager responsible for the technical assistance will monitor the timeliness and appropriateness of the Response Plan implementation. Upon completion of all activities and outputs, evaluation forms will be completed by the (i) NDE about overall satisfaction level with the technical assistance service provided; (ii) the Lead Implementer about the knowledge and learning gained through delivery of technical assistance; and (iii) the CTCN Director about timeliness and appropriateness of the delivery of the activities and outputs.