Country	**Bangladesh**
Request ID#	**2023000003**
Title	Development of Medium- to Long-Range Hydrologic Forecasting System for Ganges-Brahmaputra-Meghna River Basins
NDE	Name : Dr. Abdul Hamid Position : Director General Organization : Department of Environment, Ministry of Environment, Forest and Climate Change Email : dg@doe.gov.bd Address : Poribesh Bhaban, E-16, Agargaon, Sher-e Bangla Nagar, Dhaka 1207, Bangladesh
Proponent	Name : Dr. Md. Sazzad Hossain Position : Superintending Engineer Organization : Bangladesh Water Development Board Email : se.pffc@bwdb.gov.bd,sazzad176@gmail.com Address : Hydrology Building 1, 72, Green Road, Dhaka-1205

Summary of the CTCN technical assistance

The main goal is to use the VIC-River Routing Model for forecasting river discharge over a 10-day period in the Ganges-Brahmaputra-Meghna river basins of Bangladesh. It relies on Digital Elevation Model (DEM) data and GIS tools to calculate slope, flow direction, and river order, which then helps estimate river discharge, water movement, and other properties at grid points each day. This technology aids in understanding hydrological responses based on weather forecasts and supports applications like mid to long-term flood prediction, early warning systems, adaptation planning, and decision-making in Bangladesh. Ultimately, the project's medium to long-term objectives are to mitigate flood and drought risks, thus improving food security and livelihoods. Specific aims of this technology support include:

- Establishing historical meteorological and hydrological forecast data and assessing their accuracy.
- Enhancing the capabilities of the Flood Forecasting and Warning Center (FFWC) under the Bangladesh Water Development Board (BWDB) by transferring knowledge and technology for mid to long-term flood predictions.
- Developing a comprehensive plan for an information dissemination system.

Agreement:

National Designated Entity to the UNFCCC Technology Mechanism
Name: Dr. Abdul Hamid
Title: Director General
Department of Environment, Ministry of Environment, Forest and Climate Change

Date: 04.08.24

Signature:

Proponent

Name: Dr. Md. Sazzad Hossain
Title: Superintending Engineer
Bangladesh Water Development Board

Date: 29 July 2024

Signature:

UNFCCC Climate Technology Centre and Network (CTCN)

Name: Jonathan DUWYN
Title: CTCN Director
Date:
Signature:

Jonathan Duwyn
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Technical Assistance Response Plan – Terms of Reference

1. Background and context

Bangladesh is highly susceptible to disasters, ranking as the fifth most disaster-prone country globally, with a particularly high risk of flooding in South Asia. Each year, approximately 20-30% of the country experiences flooding, which can escalate to 70% during catastrophic floods. This recurrent flooding leads to loss of life, disruption of livelihoods, and significant damage to crops, livestock, and infrastructure. Over recent decades, factors such as climate change, population growth, and human activity on floodplains have made floods more frequent and severe. With its flat topography and location at the confluence of the Ganges-Brahmaputra-Meghna river basin, Bangladesh faces challenges in controlling floods through structural measures. The flood management approach has shifted since the early 2000s, emphasizing a combination of structural and non-structural measures, with a focus on non-structural solutions like flood forecasting and early warning systems. The Flood Forecasting and Warning Center (FFWC), part of the Processing Flood Forecasting Circle (PFFC) within the Bangladesh Water Development Board (BWDB), is responsible for generating flood forecasts and issuing early warnings. However, the current 3 to 5-day deterministic flood forecasts are often insufficient for effective planning and flood management. There is a strong demand, particularly among farmers and agricultural extension workers, for medium and long-range flood forecasts, as even a 10-day lead time may not be adequate for long-term planning. Furthermore, the existing flood forecast products by FFWC are underutilized due to weak dissemination linkages to remote flood-prone communities. Forecast and warning messages primarily reach national and district-level stakeholders, but there is a lack of capacity and resources for disseminating this information down to the village and household levels. Even when the forecast reaches the community level, there is often a shortage of expertise to interpret and apply the forecast effectively.

2. Problem statement

The FFWC collaborates with the Regional Integrated Multi-Hazard Early Warning System (RIMES) to generate 1-10 day probabilistic forecasts for 38 Bangladesh locations. The 'Climate Forecast Application for Bangladesh (CFAB)' model, developed with RIMES and National Center for Atmospheric Research, Georgia Tech in the 2000s, needs technical enhancements for more accurate 10-day forecasts. The FFWC has previously conducted research, in collaboration with RIMES on generating 1-3 months flow outlook for Brahmaputra and Ganges rivers which showed promising results using the ensemble mean of the European Center for Medium range Weather Forecast (ECMWF's) 6 month precipitation forecast which is made available to FFWC through RIMES with further technical assistance this system can be operationalized and applied for flood flow and hydrological drought monitoring across the major rivers of Bangladesh. The FFWC's website (ffwc.gov.bd) and Interactive Voice Response system (10941) were developed in 2013-2014 under the Comprehensive Disaster Management Program II but need improvements, including making it toll-free and providing localized forecasts.

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 overall objective of this technology support is to develop a mid to long-term hydrological forecasting system for the Ganges-Brahmaputra-Meghna river basins in Bangladesh. This technology will leverage the VIC-River Routing Model and weather forecast data provided by ECMWF to enhance the understanding of hydrological responses in the region and provide opportunities for flood forecasting in Bangladesh. Ultimately, the project's medium to long-term objectives are to mitigate flood and drought risks, thus improving food security and livelihoods.

Outcome:

- Establishing historical meteorological and hydrological forecast data and assessing their accuracy.
- Enhancing the capabilities of the Flood Forecasting and Warning Center (FFWC) under the Bangladesh Water Development Board (BWDB) by transferring knowledge and technology for mid to long-term flood predictions.
- Developing a comprehensive plan for an information dissemination system

	Month											
	1	2	3	4	5	6	7	8	9	10	11	12
Output 1: Development of implementation planning and communication documents												
Activity 1: All implementers must undertake the following activities at the beginning and at the end of the CTCN technical assistance. i) A detailed work plan of all activities, deliveries, outputs, deadlines and responsible persons/organisations and 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 (initial and final versions) iv) Closure and Data Collection report												
Output 2: Creation of a steering committee, mapping of stakeholders and kick-off meeting												
Activity 2.1: Kick-off meeting A virtual meeting will be organized to conduct consultations with NDE and stakeholders. This meeting will also be an opportunity to discuss the detailed activities, scope, final deliverables, performance indicators, task progress schedule, and Bangladesh-specific collaboration aspects of this Technical Assistance (TA). This meeting with the stakeholder working group will be organized to present the team of experts, the goals, milestones, anticipated deliverables, and the responsibility and role of the stakeholder working group												
Deliverable 2: i) Material used during the meeting ii) Stakeholder mapping report containing a complete stakeholder list including name, position, institution, gender, and role of each member iii) A meeting report with materials, list of participants, and online meeting snapshot.												
Output 3: Construction of 25-km resolution ECMWF S2S hydro-meteorological forecast data using VIC-River Routing model												
Activity 3.1: Construction of past hydrological reanalysis data and S2S weather/hydrological forecast data We will obtain Subseasonal to Seasonal (S2S) weather forecast data from ECMWF, covering the period from 2015 to 2022. Currently, ECMWF provides S2S weather forecast data with a 25-km resolution, including daily temperature, relative humidity, atmospheric pressure, wind speed, and precipitation. Additionally, we will acquire hydrological forecast data through the VIC-River Routing model, which is based on the 25-km resolution surface hydrology model, utilizing meteorological data provided by ERA5 reanalysis												
Activity 3.2: Quantitative evaluation of simulated river discharge data by the VIC-River Routing model We quantitatively validate the long-term hydrological forecast data based on the VIC-River Routing model using observed monthly river discharge data, assessed through the Nash-Sutcliffe Efficiency (NSE) and Kling-Gupta Efficiency (KGE) indices. This verification will be conducted with limited observed data from the Ganges-Brahmaputra-Meghna river basin in Bangladesh. The data is sourced from the Global Runoff Data Centre (https://www.bafg.de/GRDC), covering different observation periods for two Ganges river basin observation points (Paksey: 1969-1975 and Hardinge Bridge: 1985-1992), as well as one Brahmaputra river basin												

observation point (Bahadurabad: 1969-1992).												
Activity 3.3: Verification of historical intra-seasonal and seasonal hydro-meteorological forecast data We will evaluate the predictability of medium-term (within 15 days) and long-term (within 30 days) weather forecast data provided by ECMWF S2S forecasts by comparing them with ERA5 reanalysis data. This assessment will be based on the ROC (Receiver Operating Characteristic) and CRPSS (Continuous Ranked Probability Skill Score) indices.												
Deliverables 3: i) Past river discharge data (2015-2022) and forecasted river discharge data ii) A verification report for the intra-seasonal and seasonal hydro-meteorological forecast data based on ROC and CRPSS verification indices												
Output 4: Workshops for technology transfer and strengthening disaster management stakeholder capacities												
Activity 4.1: Workshop for understanding the mid- and long-term flood forecast data (Workshops for technology transfer) We plan to hold a workshop related to understanding of the VIC-River Routing model and education on the process of creating forecast data using it, either online or offline meeting. This workshop on programming, coding sequences, and methods for analyzing forecast data, based on an understanding of the model, as part of the technology transfer process. It will be conducted as a face-to-face workshop or an online workshop. If it is an online workshop, we can record a video related to it and provide a recorded video after the seminar.												
Activity 4.2: Capacity building workshop conducted for central and local government disaster management personnel We have planned a workshop related to the establishment of policy foundations for the analysis and utilization of disaster information system configuration and provision, in addition to expertise in the field of hydrology for natural disaster prediction models and observation technologies, as well as capacity building of responsible agencies and the overall utilization of technology. To fully utilize and disseminate the disaster information system throughout the country, policy makers would also participate in the capacity building programs. The workshop will enhance participants' understanding and improve the dissemination of the workshop through ToT(Training of Trainers) program. It will be conducted as a face-to-face workshop or an online workshop. The workshop would also contain the performance sharing sessions to improve the participation. - Analysis on management process and coping mechanism about previous drought and flood events in Bangladesh - Flood and drought coping strategies in other countries with similar environmental social status - Assistance in developing disaster-coping training programs for both community and related												

organizations												
Activity 4.3: Establish a plan for developing an integrated dissemination system We plan to meet with stakeholders to a plan for developing an integrated dissemination system to deliver information to flood-prone areas. We aim to identify limitations in the dissemination methods employed by FFWC and discuss alternative communication strategies for effective disaster management measures. To enable communities in disaster-prone areas to effectively utilize communication strategies during emergencies, community-level capacity building will be provided, providing them with sufficient knowledge and skills to understand climate change impacts and take appropriate actions in case of emergency - Analysis on pros and cons of current dissemination system for developing improvement strategy - Assistance in cooperation enhancement strategy among disaster-coping related organizations in various levels												
Deliverables 4: i) Materials used during the workshop ii) Recorded videos (if it is an online workshop) iii) Program code to create river discharge forecast data iv) A meeting report with materials, a list of participants, and workshop photos. v) A report for developing an integrated dissemination system												
Output 5: Deriving proposal for subsequent project implementation and resource integration												
Activity 5.1: Establishing follow-up project plans for maximizing the effectiveness of TA and ensuring long-term sustainability To achieve the ultimate goal of this project, which is 'Performing detailed activities in the initial stage of overseas technology transfer for climate technologies held domestically for Bangladesh and establishing subsequent plans,' it is imperative to identify and develop proposals for follow-up projects as part of the process of implementing this TA project. Based on discussions with the Bangladesh government and funding agencies, it is deemed the most crucial step towards achieving the final goal. While the requests of the TA are currently focused on technical aspects, such as transferring state-of-the-art modeling techniques and establishing strategies for disseminating information to local communities, identifying follow-up projects that can ensure the actual implementation of strategies and policies developed through the TA is necessary to maximize its effectiveness and ensure long-term sustainability. In order to increase the potential for local entry of domestic climate technologies and equipment, we will prioritize examining the feasibility of KOICA project implementation when pursuing follow-up projects. Our goal is to generate one proposal, such as a GCF Concept Note, for the implementation of a follow-up project.												

Deliverables 5: i) GCF concept note for a follow-up business proposal : The GCF concept note, which is the task related to this project, stands as the first submission step, and include usually a) A project/programme information section, including - Context and baseline of the country/region, the current issues, - Project/programme description - Expected project results in line with GCF investment criteria, - Current engagement situation with the relevant stakeholders b) An indicative cost section, that includes and estimation of the cost per components, the justification of the GCF funding request, and the sustainability/replicability of the project. c) Additionally, a theory of change diagram, map indicating the project location can be included, but they are optional at the time of Concept Note submission. The concept note cannot exceed 12 pages, thus it can be seen as a summary, introducing the overall project. Meanwhile, the funding proposal will include all the project's details in a much longer form (60 pages), which include implementation plan, budget breakdown and pre-feasibility studies. ii) Minutes of relevant meetings												

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	**Maximum**

Output 1: Development of implementation planning and communication documents						
Activity 1: Formulation of i) Detailed work plan, ii) Monitoring and evaluation plan, iii) CTCN Impact Description, iv) Closure and Data Collection report.	PO1 (2 months) PO2~PO10 (1 month) WE1~WE5 (2 months)				$ 15,385	$ 15,620
Output 2: Creation of a steering committee, mapping of stakeholders and kick-off meeting						
Activity 2.1: Kick-off meeting	PO1 & PO2 (1 day) WE1~WE5 (1 day)		Online kick-off meeting with stakeholders		-	-
Output 3: Construction of 25-km resolution ECMWF S2S hydro-meteorological forecast data using VIC-River Routing model						
Activity 3.1: Construction of past hydrological reanalysis data and S2S weather/hydrological forecast data	PO1~10 (6 months)				$ 59,720	$ 60,635
Activity 3.2: Quantitative evaluation of simulated river discharge data by the VIC-River Routing model	PO1~10 (3 months)				$ 14,930	$ 15,160
Activity 3.3: Verification of	PO1~10 (3 months)				$ 14,930	$ 15,160

historical intra-seasonal and seasonal hydro-meteorological forecast data						
Output 4: Workshops for technology transfer and strengthening disaster management stakeholder capacities						
Activity 4.1: Workshop for understanding the mid- and long-term flood forecast data (Workshops for technology transfer)	PO1~10 (2 month)	International : 3~4 day	Workshop for understanding the mid- and long-term flood forecast data with PO1, PO2 and stakeholders		$ 11,280	$ 11,460
Activity 4.2: Capacity building workshop conducted for central and local government disaster management personnel	WE1~5 (2 months)	International : 3~4 days	Workshop to strengthen disaster management personnel capacity with WEs and stakeholders		$ 13,220	$ 13,420
Activity 4.3: Establish a plan for developing an integrated dissemination system	WE1~5 (2 months)	International : 3~4 day	Identify limitations of dissemination methods and discuss alternative communication strategies for effective disaster management measures with stakeholders		$ 9,460	$ 9,600
Output 5: Deriving proposal for subsequent project implementation and resource integration						
Activity 5.1: Establishing follow-up project plans for maximizing the	WE1~5 (9 months)		Online meetings to establish follow-up project plans for maximizing the		$ 9,460	$ 9,600

effectiveness of TA and ensuring long-term sustainability			effectiveness of TA and ensuring long-term sustainability			
Estimated range of costing for the entire Response Plan					$ 148,385	$ 150,655

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
PO1 Name : Jonghun Kam Title : Associate Professor of POSTECH Role : Principal Investigator (PI)	Degree : Ph.D Sectors of expertise : Environmental Engineering Years of experience : 2015-Present Language requirements : English, Korean
PO2 Name : Byeong-Hee Kim Title : Researcher of POSTECH Role : Data analysis / Hydrological modeling	Degree : Ph.D Sectors of expertise : Atmospheric science Years of experience : 2020-Present Language requirements : English, Korean
PO3 Name : Suenghee Choi Title : Student of POSTECH Role : Data analysis / Platform development	Degree : Bachelor degree Sectors of expertise : Mathematics Years of experience : 2022-Present Language requirements : English, Korean
PO4 Name : Eunmi Lee	Degree : Bachelor degree Sectors of expertise : Environmental Engineering

Title : Student of POSTECH Role : Data analysis / Visualization	Years of experience : 2021-Present Language requirements : English, Korean
PO5 Name : Kwang-Hun Lee Title : Doctoral candidate of POSTECH Role : Data analysis / Visualization	Degree : Master degree Sectors of expertise : Environmental Engineering Years of experience : 2020-Present Language requirements : English, Korean
PO6 Name : Jiam Song Title : Student of POSTECH Role : Data analysis / Visualization	Degree : Bachelor degree Sectors of expertise : Chemical engineering Years of experience : 2021-Present Language requirements : English, Korean
PO7 Name : Raza Hassan Title : Doctoral candidate of POSTECH Role : Data analysis / Visualization	Degree : Master degree Sectors of expertise : Environmental Engineering Years of experience : 2016-Present Language requirements : English
PO8 Name : Ali Shahid Title : Researcher of POSTECH Role : Data analysis / Visualization	Degree : Master degree Sectors of expertise : Hydrology Years of experience : 2022-Present Language requirements : English
PO9 Name : Dar Murtaza Ahmad Title : Doctoral candidate of POSTECH Role : Data analysis / Visualization	Degree : Master degree Sectors of expertise : Hydrology Years of experience : 2020-Present Language requirements : English
PO10 Name : Yukyeong Lee Title : Researcher of POSTECH Role : Reference search	Degree : Bachelor degree Sectors of expertise : Mathematics Years of experience : 2015-Present Language requirements : English, Korean
WE1 Name : Sangwook Im Title : CEO of Weatherpia	Degree : Bachelor degree Sectors of expertise : Business

company Role : Co-Investigator (CI)	Years of experience : 2008-Present Language requirements : English, Korean
WE2 Name : Jiup Park Title : Researcher of Weatherpia Role : Capacity building/Advice on follow-up project	Degree : Ph.D Sectors of expertise : Atmospheric science Years of experience : 2000-Present Language requirements : English, Korean
WE3 Name : Seoyoung Kang Title : Researcher of Weatherpia Role : Establishing financial resources strategy/ Capacity building	Degree : Master degree Sectors of expertise : Oceanography Years of experience : 2002-Present Language requirements : English, Korean
WE4 Name : Woosol Kang Title : Researcher of Weatherpia Role : Establishing information delivery strategy/ Capacity building	Degree : Master degree Sectors of expertise : Environmental Management Years of experience : 2023-Present Language requirements : English, Korean
WE5 Name : Dayun Jung Title : Researcher of Weatherpia Role : Establishing information delivery strategy/ Capacity building	Degree : Bachelor degree Sectors of expertise : Business Years of experience : 2021-Present Language requirements : English, Korean

6. Intended contribution to impact over time

This technological support will provide medium to long-term hydrological forecasts for the Ganges-Brahmaputra-Meghna river basin in Bangladesh, utilizing climate model-based forecast data that can predict previously unexperienced weather conditions in the changing climate system, surpassing the limitations of probabilistic hydrological forecasts. The VIC-River Routing model will not only offer long-term historical hydrological reconstruction data for all rivers across Bangladesh but also enable the provision of medium to long-term hydrological forecast data. These data can be utilized not only for upper and lower basin water resource management within the watershed but also play a crucial role in inter-basin water resource management.

7. Relevance to NDCs and other national priorities

Bangladesh proposed a 24 million tons of greenhouse gases emission by 2030, which is 10% of the total emissions in 2011. Disaster management, such as flood, is a key priority included in the adaptation plan released by Bangladesh. Among these projects, the Coastal Embankment Improvement Project (CEIP) increased the resilience of the population living in coastal regions of Bangladesh, by mitigating the cyclones and flood impacts through emergency responses. According to Bangladesh's NDC published in 2021, this project increased the safeguarding of approximately 183,900 people in the targeted area. Water resource management is also essential for food security, and thus the Ministry of Water Resources is establishing several projects for climate change adaptation. Over the past ten years (2011-2021), riverbank protection, river excavation, irrigation and drainage canals maintenance were carried out, enabling the plantation of more than one million trees, and the establishment of fisheries culture in the rehabilitated areas. As stated by the Minitry of Environment, Forest and Climate Change (2021), the achievement of the NDC is achieved through capacity building and strengthening, where data collection is a key factor. In the present situation, up to 20 to 30% of Bangladesh's lands are subject to flood every year, which can be extended to 70% of the country's territory in case of extreme flood and overflow scenario. Although the Government of Bangladesh is currently allocating 6 to 7 (USD 1 billion) percent of its annual budget to climate change adaptation, the World Bank estimated that the required financial allocation by 2050 should be around USD 5.7 billion a year, which is 5 times higher than the current one.
The presented forecast technology will contribute, in terms of flood prediction, to the different adaptation plan established by the government of Bangladesh, and will help allocating fund to other projects.

8. Linkages to relevant parallel on-going activities:

The VIC-River Routing Model (VIC-RRM) calculates river discharge based on data from a Digital Elevation Model (DEM), which includes slope, flow direction, and river order information. It computes properties for each grid point, such as area, flow velocity, and distance between grid points. Using the calculated runoff, it estimates the amount and direction of water movement at each grid point over a day, thereby estimating river discharge. Simulations with the VIC-River Routing Model provide insights into hydrological responses to weather conditions as it utilizes meteorological data to generate runoff, supplementing limited river flow observations, often constrained by short periods and discontinuous data. In a project focused on the southwestern region of Chungcheongnam-do, South Korea, utilizing high-resolution domestic DEM data, the VIC-RRM was used to reproduce historical long-term river discharge. The recreated historical river discharge data helped identify regional characteristics related to past droughts, such as severity, duration, and frequency. This information was used to make practical policy recommendations regarding drought

management and water supply adjustments based on local conditions.

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

This technology is part of the establishment of a long-term climate crisis management and disaster risk reduction process. Once the CTCN implementation is completed, the long-term hydrological forecast data can be used for other prediction models related to climate change adaptation. The outputs of this technology can be followed by a sponsored project from the Green Climate Fund (GCF). Indeed, if mid and long-term flood and floodgate predictions become possible, the forecasting, risk assessment capacity of local community can be increased, and thus the adaptation and preparation to flood disaster would be possible, based on the knowledge acquired by the technology. As specified by the United Nations and the World Meteorological Organization (WMO), half of the countries are not sufficiently equipped with early warning systems. Through this project, early warning systems based on the data acquired by the presented technology could be implemented and structured in network with other collected data, to ensure a strong alert system within the covered area. This would prevent both human and structure. In this scenario, personal training to enable a better recognition of the early sign of flooding would be essential, as the early warning systems need to be well understood by the exposed regions. These actions could be possible through a future project funded by the Green Climate Fund.

10. Gender and co-benefits:

Imbedded in design of the activities:	All the activities will have a gender angle by ensuring the participation of women in the trainings, workshops, capacity building, knowledge transfer, stakeholder´s consultation process but also in including gender as a man criterion while developing and testing the technology.
Gender and co-benefits intended as result of the activities:	All the activities of this project are vowed to benefit to all population, women included. According to the World Bank, women are more exposed to natural disaster, because they often have the role of family's primary caregiver. The accurate forecasts will improve the response time of population and rescue means, by creating a risk knowledge of the region. Risk knowledge is especially important in rural areas where the known risk is usually lower than other regions. The public awareness developed through this technology also enable women to take decisions and the necessary actions. The effectiveness of the rescue intervention induced by the presented technology would benefit more to women, who are usually in charge of protecting elderly people, and thus their endurance can be limited in case of flood.

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
National Designated Entity (NDE)	Align proposed technical assistance to the maximum extent possible with national implementation plans for climate change adaptation and, where applicable,

	facilitate relationships with the Department of Environment (DoE) to avoid duplication of efforts.
Department of Environment (DoE)	The DoE will review proposed technical assistance with the NDE and provide relevant support to the NDE.
Flood Forecasting and Warning Center (FFWC) under the Processing Flood Forecasting Circle (PFFC) of the Bangladesh Water Development Board (BWDB)	The FFWC will act as the main counterpart of CTCN and facilitate relationships with key personnel who will be imported mid- to long-term flood forecasting skills.
Regional Integrated Multi-hazard Early Warning System (RIMES)	The RIMES will provide technical support to PFFC, FFWC and NDE for implementation.
Local Government Institutions (LGIs)	The LGIs will provide relevant support to implement the activities at the field level.
Disaster Management Committees	The DMC will provide relevant support to implement the activities at the field level
Civil Society Action Group (NGO representatives and local elites)	The Civil Society Action Group will provide relevant support to implement the activities at the field level and help to identify the beneficiaries and to ensure transparency, accountability and monitoring.

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	Yes, the TA will have the ancillary benefit of promoting sustainable agriculture by collecting necessary meteorological data and forecasting river discharge, which, when disseminated to the people of Bangladesh, including farmers, can help mitigate the impact of hydrological disasters
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	Yes, with the acquired data, agricultural management can provide advice to emergency response teams before the flood season. This can be achieved as an ancillary benefit stemming from the data-driven system.
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	Yes, utilizing the forecasted medium to long-term river discharge data for disaster preparedness measures, we can minimize the damage to densely populated cities, enabling them to become more resilient and sustainable
12	Ensure sustainable consumption and production patterns	
13	Take urgent action to combat climate change and its impacts	*All TAs should indicate relevance to Goal 13 and at least one target below (13.1 to 13.b).*
	13.1 - Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries	The TA will seek to ensure the flow of information from the urban centers to the rural communities where the information is quite thin. It will supply scientific based information on drought and other climate related disasters over a distributed network that is owned and managed by local communities.
	13.2 - Integrate climate change measures into national policies, strategies and planning	The VIC-River Routing model, utilizing forecast data openly provided by ECMWF, enables the prediction of river discharge. This can be utilized in national policies, strategies, and plans related to measures and prevention of damages from droughts and floods caused by climate change. It holds the potential to minimize the impact of natural disasters on the people of Bangladesh.
	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.

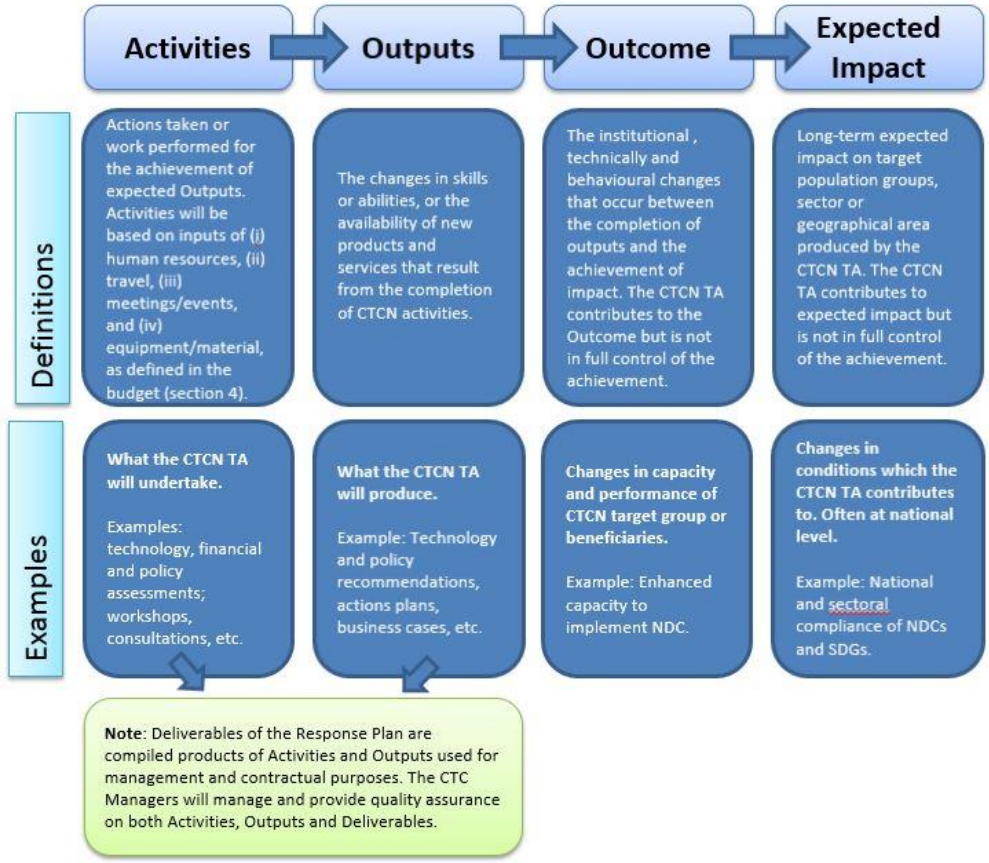
Annex 1: Guidance note for designing a Response Plan (to be deleted when submitting the Response Plan)

1. Objective of the Response Plan

The Response Plan is developed by CTCN specialists in response to a country request for technical assistance. It constitutes the Terms of Reference of the CTCN technical assistance that will be provided to the country and it provides the formulation of and subsequent basis for the monitoring and evaluation of the Response Plan implementation, as well as its expected outcomes and anticipated impacts.

2. Results chain and Logical Framework Approach to be defined in the CTCN Response Plan

The result chain is the causal sequence that stipulates the necessary flow of actions and processes to achieve desired objectives and results – beginning with inputs, moving through activities and outputs, and culminating in individual outcomes. The outcome will contribute to the desired impact in the society. The Logical Framework Approach is an analytical process used to support objectives-oriented project planning and management. It provides a set of pre-defined concepts which are used as part of an iterative process to aid structured and systematic analysis and management of the CTCN technical assistance.



3. Role of the Response Planning Design Team

The Response Planning Design Team is selected by the Climate Technology Centre (CTC). The composition of the team depends on each particular request but may include the National Designated Entity (NDE), the request Proponent, Climate Technology Manager of the CTCN, experts from the CTCN Consortium, UNIDO and UNEP experts from regional offices and other experts as needed.

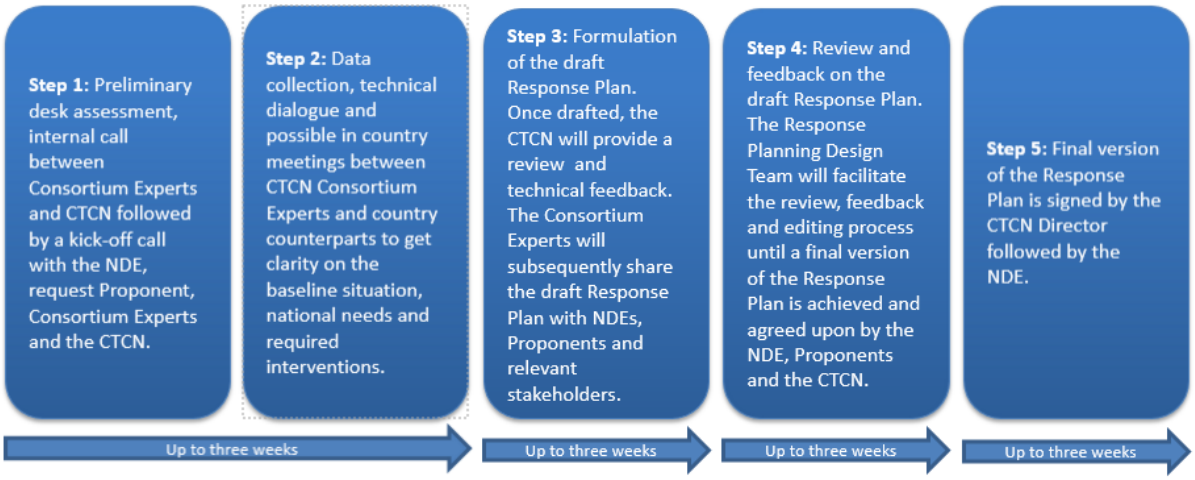
The role of CTCN Consortium experts is to lead the design of the Response Plan. The NDE will provide overall guidance on national context and priorities whereas the request Proponent will provide more detailed information on the sector, barriers and requested assistance. The Climate Technology Manager of the CTCN will provide quality assurance of timeliness and appropriateness of the Response Plan.

The Response Planning Design Team will draft all sections of the Response Plan template building on the information contained in the CTCN Request, based on expertise on the given topic and potentially further data collection, as required. This will be done by the CTCN Consortium Experts in consultation with the NDE, request Proponent and relevant stakeholders. The Response Plan has to be agreed to and approved by the NDE and the CTCN Director. This Response Plan will serve as the basis to identify, select and engage an expert institution from the Climate Technology Network or Consortium to lead the implementation of the CTCN Response Plan in the requesting country.

To the extent possible, staff from UNEP and UNIDO Regional, Sub-Regional and/or National Offices should be involve in all stages of formulation of the Response Plan to maximize synergies and avoid overlap with ongoing initiatives, as well as ensure relevance to regional and national context.

4. Process for designing the Response Plan

The Response Planning process should be completed over a period of up to 60 working days (12 weeks). Indicative steps and related timelines are laid out below:



5. Design Considerations

Annex 1. Guidance Note for the Response Plan template

In order to maximize the impact of the technical assistance provided by the CTCN and provide an effective M&E process, the Response Plan should integrate as much as possible the considerations below:

Climate Technology focus: The Response Plan should have a clear focus on climate technologies, and identify activities that enable the identification, development, deployment or diffusion of one or several specific technologies (including equipment, techniques, knowledge and skills).

Barrier removal / Problem solving: The activities should contribute to address the specific problem statement identified in the Request. The barriers identified should be those hampering the identification, development, deployment or diffusion of one or several climate technologies or climate actions. Therefore, it may be necessary to limit the CTCN Response Plan to a set of activities for technical assistance commonly agreed with the NDE (and Proponent when needed) compared to the original request submitted. The CTCN will liaise with NDEs and Proponent in case the scope of the technical assistance deviates from the original request.

Use of the CTCN assistance by stakeholders: The Response Plan should identify clearly how the products of the CTCN assistance will be used in the short term once support is delivered, by who and when, to ensure it will lead to specific impacts in the country. The activities should engage the stakeholders that will use the concrete results of the assistance to deploy the technologies, including from the private sector, the public sector, research institutions, etc.

Within the scope of CTCN resources: The cost of the technical assistance provided by the CTCN cannot exceed USD 250,000 per Response Plan. Therefore, it may be necessary to prioritize activities and limit the CTCN Response Plan to a set of priority activities commonly agreed with the Proponent and the NDE to remain under this value. Under section 4 of the Response Plan template, an indicative activity based budget should be presented. The proposed budget is indicative and should present an estimated costing range per activity, output as well as a total costing range for the delivery of the Response Plan. Once the Response Plan is finalised and published for tendering, interested parties will provide competitive offer against the indicative budget.

CTCN activities and outputs should be linkable to monitoring and evaluation indicators: All proposed activities and outputs must be linkable to monitoring and evaluation indicators that are specific, measurable, achievable, relevant, and time-bound. The monitoring and evaluation process and corresponding indicators will be developed by the Lead Implementer as part of the work plan and will allow the CTCN technology Manager to monitor the timeliness and appropriateness of the implementation.

Synergies with existing efforts: The Response Plan should focus on activities that are not already being fully supported or that are in the process of being fully supported by another national, regional or international organization. Synergies and complementarity also require that the CTCN assistance is not duplicating past activities. It is possible in the Response Plan to indicate co-financing from the government, the Proponent or another stakeholder, that will maximize the effectiveness of the CTCN assistance.

Gender mainstreaming: The CTCN mission is to build or strengthen developing countries' capacities to identify technology needs, to facilitate the preparation and implementation of technology projects and strategies taking into account gender considerations. The Response Plan must therefore describe how gender considerations will be included and monitored within the proposed activities, and any gender co-benefits that will be gained as a result of implementing the CTCN technical assistance.