Version: 1

CONCEPT NOTE FOR A REGIONAL PROJECT/PROGRAMME

Title of Project/Programme: Hydrological Status and Outlook system for integrated water resources management and climate resilience in Bangladesh and Nepal (HydroSOS-BaNe)

Countries: Bangladesh, Nepal

Thematic Focal Area[1]: Disaster risk reduction and early warning systems

Type of Implementing Entity: Multilateral Implementing Entity

Implementing Entity: World Meteorological Organization

Executing Entities: World Meteorological Organization[2], Bangladesh Meteorological Department (BMD), Bangladesh Water Development Board (BWDB), Department of Hydrology and Meteorology of Nepal

Amount of Financing Requested: 12,090,000 (in U.S Dollars Equivalent)

Project Formulation Grant Request: Yes ☒ No ☐

Amount of Requested financing for PFG: 80,000 (in U.S Dollars Equivalent)

Letters of Endorsement (LOE) signed for all countries: Yes ☒ No ☐

NOTE: LOEs should be signed by the Designated Authority (DA). The signatory DA must be on file with the Adaptation Fund. To find the DA currently on file check this page: https://www.adaptation-fund.org/apply-funding/designated-authorities

Stage of Submission:

☐This concept note has been submitted before

☒This is the first submission ever of the concept note

In case of a resubmission, please indicate the last submission date: N/A

[1] Thematic areas are: Food security; Disaster risk reduction and early warning systems; Transboundary water management; Innovation in adaptation finance.

[2] Justification to include WMO as an executing entity has been provided by the NDA and shared with the submitted proposal

Executive Summary

Bangladesh and Nepal cover a major portion of the Ganga Brahmaputra Meghna (GBM) River Basin that spreads over 1.7 million sq. km. This targeted region with a population of more than 500 million is one of the most populated river basins across the world. Both Bangladesh and Nepal[3] face increasing climate change related events impacting its socio-economic and ecological context including water resources management. The worst affected are those dependent on the agricultural sector, estimated to be 60-70% of the total population. The socio-economic baseline vulnerability conditions are being exacerbated by a climate that has undergone considerable change in recent decades and is expected to continue further. Based on the national consultations carried out by the World Meteorological Organization during 2019-2020 with the stakeholders of the GBM targeted countries, immediate need for alternating flood and water shortages monitoring and forecasting systems and associated water resources information are highlighted of a growing economy and population.

The proposed project seeks to increase the climate adaptive capacities and resilience of beneficiary communities to hydro-climatic risks. Furthermore, it will enhance local, national, and regional adaptation strategies and implementation mechanisms based on an approach of integrated monitoring and management of water resources. Floods and drought being common feature in the two countries, the project envisages strengthening capacities of the National Meteorological and Hydrological Services (NMHSs) through an innovative, robust and tailored Regional Hydro-Meteorological Early Warning System (providing short term and seasonal status) embedded into a Long-term Integrated Water Resource Information System with concrete adaptation actions developed through participatory process and executed in an integrated manner.

The HydroSOS BaNe project is aligned with the Adaptation Fund objective to "reduce vulnerability and increase adaptive capacity of communities to respond to the impacts of climate change at local, national and regional level" and also it will support the United Nation Early Warning System for All initiative which is led by the World Meteorological Organization with other international partners to cover everyone on the planet (Bangladesh and Nepal are part of first 30 priority countries) with the Early Warning system in the next five years. Implementing climate adaptation strategies and improving the management of water resources is recognized by the two GBM riparian countries as one of the major challenges. The project will tackle climate adaptation issues, ensuring transversal solutions from governance to technical and decision making. It will develop the underlying capacity of national and regional institutions to maintain long-term sustainability and to scale up the results. It will support stakeholders at all levels by providing policy and management guidance and by sharing scientific information, knowledge and best practices for an integrated disaster risk reduction and climate change adaptation.

Risk maps, Community-based flood and drought management, Hydrological Status and Outlook system will be implemented to strengthen integrated water resources management and early warning systems, leading to increased preparedness and resilience to floods and droughts events. Furthermore, at local scale, agricultural practices will be improved based on new knowledge and early warnings that will enable farmers to adapt their production methods. The HydroSOS BaNe project will assist the two countries in the implementation of coordinated and joint measures to improve their existing flood and drought management strategies and plans at regional, national and local level and to build on the lessons learned from the past and current projects related to disaster risk reduction and climate change adaptation. The two riparian countries will therefore benefit not only from a basin-wide transboundary management framework to ensure long-term social, economic and environmental development, as well as concrete solutions to alleviate a potential increase of vulnerability and to build an effective network of actors.

The World Meteorological Organization (WMO), as Implementing and Executing Entity, will be involved for supervision and execution at several levels during the implementation of the project activities, allowing to benefit from its international as well regional presence. At the national level, NMHSs as the Executing Entities, will fulfil the execution, coordination and relationships with the institutions and stakeholders at the local and national levels. One of the inter-governmental regional entities will be the focal point for hosting the HydroSOS EWS including data sharing coordination and links with the national structures.

The long-term sustainability of the project achievements is supported by the NMHSs of the two targeted countries sharing the meteorological, hydrological and climatological data and related products for the HydroSOS EWS. NMHSs and other agencies in charge of disaster management and environmental protection have already provided their support to ensure the long-term transfer of information from the national database to continue operations of the proposed HydroSOS EWS coordination unit at the inter-governmental regional entity.

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[3] During the project development phase, WMO continuously consulted India, Bhutan and People's Republic of China (PRC) for their participation as the executing entities for the proposed HydroSOS project. However, India, Bhutan and PRC have not submitted endorsement and commitment letters. So, the proposed project is again submitted only for the two countries: Bangladesh, and Nepal. Once the project is approved and moves into implementation, National agencies of India, Bhutan and PRC will be invited as observers or technical partners to develop HydroSOS system and after the completion of the project, it is expected that the HydroSOS EWS will be scaled up to cover the entire GBM region possibly through national investments or international funding mechanism

PART I: PROJECT/PROGRAMME INFORMATION

Title of Project/Programme:	Hydrological Status and Outlook system for integrated water resources management and climate resilience in Bangladesh and Nepal (HydroSOS-BaNe)
Countries:	Bangladesh, Nepal
Thematic Focal Area[4]:	Disaster risk reduction and early warning systems
Type of Implementing Entity:	Multilateral Implementing Entity
Implementing Entity:	World Meteorological Organisation (WMO)
Executing Entities:	World Meteorological Organisation (WMO) and National Meteorological and Hydrological Services of the targeted two countries (Bangladesh Meteorological Department, Bangladesh Water Development Board (BWDB), Department of Hydrology and Meteorology of Nepal)
Amount of Financing Requested:	12,090,000 USD ($)

Project / Programme Background and Context:

Project Overview

Approx. 1.9 billion people, or a quarter of the world's total population live in South Asia. It includes 216 million extremely poor constituting 29% of the world's total poor population[5]. The South Asian region is amongst the most vulnerable from a climate change point of view, making it further challenging for sustenance of growth and development. There is a heavy dependence on climate sensitive livelihoods such as agriculture, fishing, forestry etc. and the region is experiencing impacts of climate change including flooding, Glacial Lake outburst flood (GLOF), forest fires, soil erosion, saline water intrusion. A key focus which has received significant prominence in recent times is the effective use of available water resources and its efficient management to withstand impacts of future climatic change and sustain hard earned developmental gains. Due to climatic changes, water resources face a variety of stresses such as variation in rainfall, rising surface temperatures, population growth, rapid urbanization, industrialization. At the same time, an effective water resource management mechanism carries enormous potential for poverty alleviation, reducing impact of floods and droughts, and realization of various water resources projects such as hydropower, irrigation, navigation etc.

Bangladesh and Nepal cover a major portion of the Ganga Brahmaputra Meghna (GBM) River Basin. The GBM basin spread over an area of over 1.7 million sq. km and has a population of more than 500 million, making it one of the most populated river basins in the world. Both Bangladesh and Nepal face challenges stemming from its socio-economic and ecological context leading to inadequate water resources management. Climate extremes specifically, floods and droughts are common phenomenon with enormous environmental, social, and economic consequences. In spite of abundant natural resources, the number of people living under the poverty line and highly vulnerable to climate change events in these two countries are estimated to be around 10 million (ADB, 2019). The monsoon flooding during 2017 in the GBM basin, resulted in ~1200 deaths[6]. Around 80% of Bangladesh is floodplain, with major floods affecting millions of people every six years or so. Nepal relies on the monsoon system for its agriculture; and significant rainfall variation leads to drought, flood, landslides etc. putting much stress on the country's food distribution system. More than 10 glacial lakes of Nepal are identified as Potentially Dangerous Glacial Lake (PDGL) which may outburst causing floods and endangering human lives with major impact on agriculture, infrastructure, ecosystem and environmental services. Nepal faces a range of water induced hazards including glacier lake outburst flood (GLOF), landslides, debris flow, riverine flooding, flash floods and urban floods. It experiences increased water availability during the monsoon but a scarcity during the winter and pre-monsoon season impacting agriculture that is mostly monsoon dependent. Studies conducted for the GBM region suggest that there will be significant variation in flow and quality of water over a medium to long term with a strong impact on population, water for public use, demand for irrigation, hydropower, industry etc. The overall trend in the GBM region points towards a growing anthropogenic development combined with climatic changes resulting in additional demands on water resources and triggering challenges such as

[4] Thematic areas are: Food security; Disaster risk reduction and early warning systems; Transboundary water management; Innovation in adaptation finance.
[5] https://worldbank.github.io/SARMD_guidelines/poverty-measures.html
[6] https://iopscience.iop.org/article/10.1088/1748-9326/ab10ee/meta

ecosystem degradation, erosion, salinization, water logging, displacements and migration. When water shortages or drought events occurs, impacts to agricultural yields, threatening food security and widespread migration across the sub-region can be witnessed.

The prevailing conditions make it imperative that there should be adequate capacity at a regional, national and local level in terms of technical knowledge and decision making for shared water resources and risk management mechanism for climate extremes. Based on a recent assessment and participative consultations carried out by the World Meteorological Organization (WMO) with the National stakeholders of the two targeted GBM basin countries, immediate need for alternating flood and water shortages monitoring and forecasting systems during the monsoon and dry seasons and associated water resources information are highlighted of a growing economy and population. Other main conclusions highlighted were to build upon the current context and on-going work to prepare the region for future socio-economic development and environmental changes, such as integration of disaster risk reduction in the national adaptation and management plans (National Adaptation Plans (NAPs) and National Adaptation Programme of Action (NAPA) identified under the National Determined Contribution's (NDC) for the GBM countries. It thus calls for innovative frameworks and policies, enhancement of synergy, complementarities and coordination at regional level to foster integrated flood and drought management including ecosystem based adaptations, availability of standardized interoperable Hydro-meteorological data, especially on real time basis, coordination of information channels and procedures for end-to-end early warning systems, and increase in knowledge availability with community members on social-economic and environmental risks and their participation in decision making.

There is a need for improving and complementing the adaptation plans, guidelines and policies on the climate-based threats especially for floods and drought events in GBM countries such as Bangladesh and Nepal. At the national level, Bangladesh and Nepal have existing climate change adaptation action plans and strategies or are in the process of implementing National Adaptation Plans (NAPs) and National Adaptation Programme of Action (NAPA) enhancing the climate change adaptation efforts of the national agencies and their communities. Furthermore, both countries have listed activities on integrated water resources management, early warning and climate adaptation in their intended nationally determined contributions (INDCs). The main areas for INDCs listed by the two GBM riparian countries are summarized in Table 1 for the topics closely related to the major fields of the HydroSOS BaNe project. The countries are dedicated to find support for achieving the targets.

Table 1: INDC areas of the GBM countries

GBM project countries / INDC contribution to	Bangladesh	Nepal
Surface Water Use and Rainwater Harvesting	☒	☒
Water Resources Management	☒	☒
Flood management	☒	☒
Agriculture and Food Security	☒	☒
Disaster Management	☒	☒
Capacity Building and Strengthening of relevant stakeholders	☒	☒

Source : https://unfccc.int/NDCREG

Geographical Context

The GBM river basin is located between latitude 21°25′N to 31°50′N and longitude 73°25′E to 98°75′E. (Figure 1). It is a transboundary river basin covering an area of 1.7 million sq. km., distributed between five countries: Bangladesh (7%), Bhutan (3%), China (18%), India (64%) and Nepal (9%)[7]. The GBM basin is the third largest freshwater outlet to the ocean and each of its three main rivers have important tributaries, some of them being transboundary themselves. The three main rivers converge a few hundred km. upstream in Bangladesh before flowing into the Bay of Bengal.

Both Ganga and Brahmaputra rivers originate in the Himalayan Mountain Range. The Ganga River emerges from the Gangotri Glacier and joins the Bay of Bengal after traversing a distance of 2758 km. The Brahmaputra River which is known as Yalung Zangbo in China originates in the northern slope of Himalaya and after flowing through India enters into Bangladesh where it is called Jamuna. It traverses a total length of 2260 km[8] and both Ganga and Brahmaputra join together in the Sundarbans of Bangladesh. The

[7] FAO. 2011. AQUASTAT Transboundary River Basins – Ganges-Brahmaputra Meghna River Basin. Food and Agriculture Organization of the United Nations (FAO). Myanmar not included in the list of countries here has approx.100 sq. km. of the upper Meghna River with around 300 residents (World Bank 2015).

[8] Sharma et al. 2021. Climate Change detection and attribution in the GBM River Basin. Geoscience Frontiers. https://doi.org/10.1016/j.gsf.2021.101186

tributaries of Meghna River originate in the mountains of eastern India. A prominent tributary for example is Barak River and these tributaries flow southwest into Bangladesh to join Ganga and Brahmaputra. As a result of this confluence, a large delta is formed comprising 80% of Bangladesh and part of Bengal (India) before they flow together into the Bay of Bengal.

The GBM basin shows distinct climatic features due to Monsoon variability and unique topographic features. For example, it includes elevation up to 8848.86 m in the upper Himalayan region and the plains of Ganges, Terai, Northeast India and Bangladesh. Mount Everest, the highest peak in the world and Cherrapunji the second wettest place anywhere, are part of the GBM region. Most of the river system in the basin is located in the monsoon belt and rainfall varies from 250 to more than 4000 mm a year. The unique topographic features of the GBM basin alters monsoonal flow shaping spatial distribution of precipitation. For example, it results in higher rainfall in the mid mountains-southern foothills of Nepal, Northeast part of India close to Bangladesh and much lower on the leeward side. The Ganga basin is known for high snowfall in the upper Himalayan region, high precipitation in the middle mountain range and plains of Ganges with very precipitation in the northwest of the upper region and very high precipitation downstream closer to the deltaic areas in Bangladesh. The Brahmaputra basin has both high precipitation zones and dry rain shadow areas while the Meghna River basin has the world's highest precipitation area. The delta region experiences strong cyclonic weather both before and after the monsoon season. The winter precipitation is mainly through the Western disturbances and Indian Monsoon alone accounts for 60-90% of the annual total rainfall in the GBM basin. The temperature as a function of altitude varies from 40 degree C in the plains of Bangladesh during summer to minus 30s degree C in the upper Himalayas.

Figure 1 https://www.researchgate.net/figure/Ganges-Brahmaputra-Meghna-GBM-Basin_fig2_326831987

Table 2: GBM Basin Area within Countries[9]

Country	Ganges basin		Brahmaputra basin		Meghna basin	
	Basin area (1000 km²)	Percentage of total area	Basin area (1000 km²)	Percentage of total area	Basin area (1000 km²)	Percentage of total area
China	33	3	293	50		
Nepal	140	13				
Bhutan			45	8		
India	861	80	195	34	49	58
Bangladesh	46	4	47	8	36	42
Total	1,080	100	580	100	85	100

Flood and Drought situations in the two GBM Basin Countries

Bangladesh

The landmass of Bangladesh is formed due to the process of sedimentation of the GBM river system, and it is mostly flat terrain except the north-east and its south-east region. Bangladesh receives 72% of its rainfall during the southwest monsoon, with average rainfall being approx. 2300 mm. It experiences four types of floods: flash flood, rain-fed, riverine flood and flood due to cyclonic storm surge. Around 25-30% of the entire country reports flooding every year. There have been eight major floods during 1954-2020 with one of them in 1996 being the most impactful flooding nearly 68% of the country. The country receives large quantities of runoff sediments which makes riverbank erosion a major challenge. Apart from these, drought is a major concern. In the last five decades, Bangladesh has suffered 20 severe droughts with significant impact on its water and food security[10]. The northern region which is the food basket of the country also happens to be the most impacted from drought occurrences. In recent times, major droughts have occurred in 1995, 2000, 2006 and 2009.

Figure 2: river basins covering Bangladesh region.

[9] Salehin, Mashfiqus & Khan, M Shah Alam & Prakash, Anjal & Goodrich, Chanda. (2011). Opportunities for Transboundary Water Sharing in The Ganges, The Brahmaputra and The Meghna Basin.

[10] Islam, S.M.S; Islam, K.M.A; and Mullick, M.R.A. 2022. Drought hot spot analysis using local indicators of spatial autocorrelation: An experience from Bangladesh. *Environmental Challenges*, 6. https://doi.org/10.1016/j.envc.2021.100410

Nepal

Nepal covers most of the Himalayan Mountains or peaks and being a water abundant country experiences frequent flooding. Lately it is suffering from increasing instances of localized drought as well under the effect of climatic change. Nepal carries other hazard risks such as landslides, GLOF, urban floods etc. The country receives about 80% of its total rainfall during the monsoon (June-September) period. During monsoon, flash floods are often a major hazard with 70% of the settlements being located within the drainage basin. The country faces several glacial lake outbursts flood (GLOF) in past. There are 2070 glacial lakes with size >0.03km2 in Nepal, out of which 21 are identified as potentially dangerous for GLOF. Apart from this, there are 26 potentially dangerous glacial lakes located in China (25) and India (1), which could have a flooding impact in Nepal and downstream, if GLOF occurs. Major GLOF incidents in recent times include Bhotekoshi (2016) which damaged the headwork of Bhokekoshi Hydropower Project (45 MW) and Barun River(2017) which caused flooding and debris flow in Makalu Barun National Park area. In addition to GLOF, the river blockage due to landslides and debris flows causes formation of artificial dams and subsequent Landslide Dam Outburst Flood (LDOF) causing significant impact on downstream settlements and infrastructure. The Melamchi flood (2021) is one example of the cascading effect of GLOF, LDOF and heavy rainfall. The flooding in 2019 affected most of the districts of Terai and caused 90 deaths, and USD 584.6 Million damage to infrastructures and services[11]. There are increasing incidents of prolonged droughts with consequent risk for forest fires, agricultural losses, biodiversity losses etc.

Figure 3: Major River basins of Nepal

GBM Region

The GBM basin is identified as the most flood prone basin. Bangladesh and Nepal, receives an average annual precipitation of 2200 mm and 1600 mm respectively; with floods, drought and landslides being its major concerns. Flood during and after monsoon often disrupt lives and livelihoods. In 2021 at least three major floods were reported in Nepal. Two of them occurred in June 2021, the first was a flash flood which occurred in the rain shadow northern region (Manang District) and the second, known as Melamchi disaster, was a result of intense rainfall combined with glacier deposition dislocation and landslide dam outbursts resulting in flash flood and debris flow affecting the Melamchi water supply project. The third flood incident occurred during Post Monsoon period in October 2021 and it resulted widespread damage to farm sector and caused agricultural losses to the tune of 10 million USD.

Risk hotspot

The GBM is one of the risk hotspots in South and Southwest Asia where disaster risk areas converge with poverty, population density and a low human development index. More than one third or 34.55 % of the total population in the GBM basin are at the risk of flood exposure (UN ESCAP 2020). As a matter of fact, it has a flood-drought syndrome as the rivers flood during the monsoon while they are drier during the remaining periods, causing water scarcity. A relationship is found between floods in the GBM basin and El Nino Southern Oscillation, for example six out of the seven most devastating floods have occurred during La Nina years.

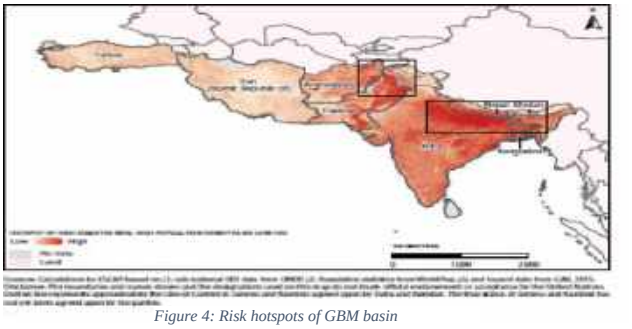


Figure 4: Risk hotspots of GBM basin

Socio-Economic Context

The estimated population living in the GBM region is more than 500 million, 70% of which are rural and together they constitute one of the world's largest pocket of poverty[12]. The population density is high for example, when compared with Africa, the latter is 18 times bigger in size with a population less than twice that of the GBM region. The intra-basin population density however varies; for example, the lowest is reported from China 6 per sq. km. followed by Bhutan 18, Nepal 195, India 432 and Bangladesh for which the highest 1013 number of people are living per sq. km. The two targeted countries falling within the basin; Bangladesh and Nepal are ranked between 129 and 143 in the global Human Development Index (HDI): a composite measure of average achievement on key parameters of a long and healthy life, education, and standard of living (UNDP 2020). The intra-basin comparison shows that only 0.79% of the population has a high HDI whereas 32.5 % fall within low and medium HDI. The vast majority of people depend on agriculture for their livelihood.

Administratively Nepal is divided into 7 Provinces, 77 Districts, 753 Local Levels (293 Municipalities and 460 Rural Municipalities). Administratively Bangladesh is divided into eight Divisions (namely: Dhaka, Mymensingh, Sylhet, Rajshahi, Chittagong, Khulna, Rangpur and Barisal), 64 districts, 492 Upazila (Sub-districts) and 4554 Unions (group of villages).

Table 3: Socio-Economic Conditions of GBM Countries[13]

Socio Economic Indicators	Bangladesh	Nepal

[11] https://un.org.np/sites/default/files/doc_publication/2018-11/PFRNA_Report_Final.pdf
[12] UN ESCAP (2020). The Disaster Riskscape across South and South-West Asia The Disaster Riskscape across South and South-West Asia: Key Takeaways for Stakeholders (unescap.org)
[13] Rasul, G. 2015. Water for growth and development in the Ganges, Brahmaputra, and Meghna basins: an economic perspective, International Journal of River Basin Management, 13:3, 390. DOI: 10.1080/15715124.2015.1012518

Estimated Population	169,828,911	29,164,578 (2021)
Population Annual Growth Rate between 2022-2023	1.11%	0.92% (2011-2021)
Population below National Poverty Line (In Percentages)	~24.3%	15.1%
GDP Per Capita (US Dollar) - 2021	$1,910	$1,399
Literacy rate - 2019	74.68%	76.2% (2021)
Life expectancy	72 years	70 years
Human Development Index	0.661	0.602
Global Gender Gap[14]	0.714 (71st)	0.692 (96th)
Annual Freshwater Withdrawal for Agriculture (Billion Cubic meters) [15]	9.5	35.9
Per Capita Energy Use (including all types of energy)	468 gigajoules (GJ) per year	21.45 GJ per year or 5.96 MWh /yr

Environment and Ecosystem Context:

Ecosystem services such as food production, water quality for biotic organisms, purification of water etc. are increasingly under stress in major basin areas across the world including the GBM. Processes supporting ecosystem services have developed over thousands of years and the interconnected nature of its various components is such that effects in one region or area influence services across the basin.[16] In addition to biophysical factors operating at different scales, a variety of social processes attenuate or reinforce impacts and together these have bearing on sustenance of ecosystem services.

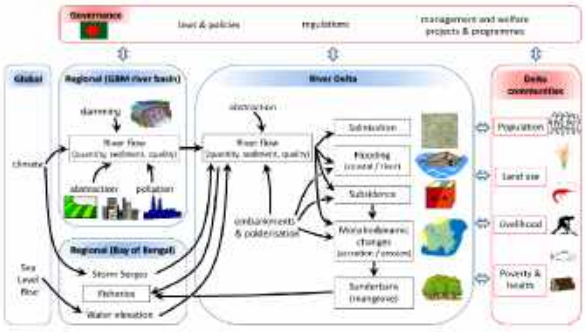


Figure 5 Interconnectedness of global scale effects on climate change

Figure 5 illustrates the interconnectedness of global scale effects such as sea level rise and climatic change with regional and local scale effects alongside social factors. The GBM basin's river flow, water elevation, damming, embankment, flooding, salinization, subsidence, loss of mangroves, fisheries etc. are thus closely intertwined with population increase, land use, poverty, migration, livelihood etc. Bio-physical factors and social factors influencing ecosystem services in the Delta region (Source: Nicholls et al., 2016[17])

Water related Development in Bangladesh and Nepal

The GBM region carries immense potential for development through water resources for example, irrigation, dams, hydro-power etc. The practice of irrigation through flood water, canals dates back to historical times and these have found mention in ancient mythological books and scriptures. It was developed further from the twelfth century onwards and subsequently by the British during the colonial period or mid-19th to mid-20th century. The estimated irrigated area in the GBM basin is around 35 million ha that includes groundwater and surface area irrigation. The distribution among the two targeted nations are as follows; Bangladesh (14%), and Nepal (3.3%)[18]. The potential for gravity irrigation system in Bangladesh is quite limited mainly due to its flat topography and instability of rivers. In 2008, the total irrigation coverage in Bangladesh was 5.05 million ha out of which 4.93 million ha was in the GBM region. 75% of it is groundwater while the remaining is surface irrigation. Nepal fully located within the

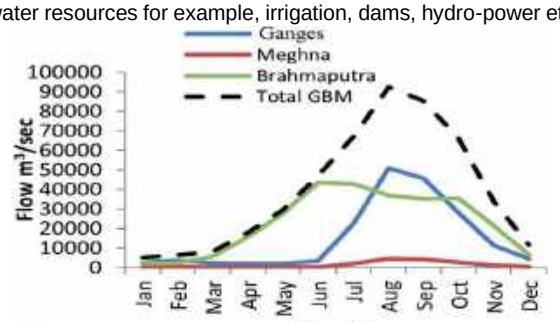


Figure 6: flow measurements in GBM river basin

[14] https://www3.weforum.org/docs/WEF_GGGR_2022.pdf
[15] https://data.worldbank.org/indicator/ER.H2O.FWTL.K3?end=2020&locations=NP&start=2020&view=bar
16 Adger et al. 2018. Ecosystem services, Well-being and Deltas: Current Knowledge and Understanding, In Nocholis et al. (Eds) Eco-system Services for Well-Being in Deltas. https://doi.org/10.1007/978-3-319-71093-8

17 Nicholls, et al. 2016. Integrated assessment of social and environmental sustainability dynamics in the Ganges-Brahmaputra-Meghna delta, Bangladesh. __soton.ac.uk_ude_PersonalFiles_Users_sf1f15_mydocuments_FEE_CMEES_ePrints_estuarine%20and%20coastal%20shelf%20science%2009%20August%202016_R%20Nicholls.pdf

Ganga basin had an estimated 1.5 million ha irrigated area out of which 75% was surface water and the remaining ground water. The GBM basin has a number of dams, constructed for irrigation and hydro-power purposes. Nepal has only one storage hydropower project with storage capacity of 85 million m^3. Nepal hydro-electricity accounts for more than 96% of the total country's electricity generation. A number of large and small dams have been constructed in bordering countries of Nepal and Bangladesh. Bangladesh does not have any large dams and has constructed three barrages over Teesta, Tangon and Manu Rivers for irrigation purposes. Table provides details of dams and barrages in the GBM Basin[19].

Large dams in the Ganges-Brahmaputra-Meghna river basin

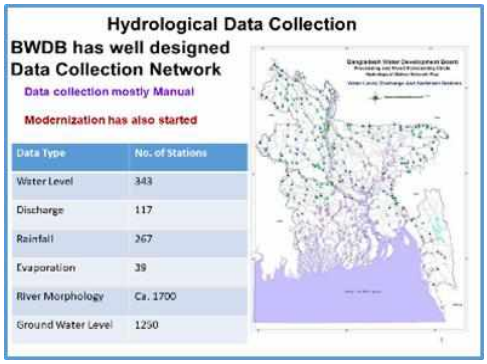
Country	Name	Nearest city	River	Year	Height (m)	Capacity (million m^3)	Main use *
Bhutan	Chhukha	Chhukha	Ti Chu	1988	40	‡	H
	Tala-Wankha	Phuntsholing	Wang (Raidak)	2006	91	‡	H
	Kurichhu	Gyelposhing	Kuri	2002	33	‡	H
	Basochu	Wangduephodrang	Base stream	2001	‡	‡	H
	Punatsangchu	‡	Puna Tsang	(under constr.)	141	‡	H
India	Rihand	Sonbhadra	Rihand	1962	91	10 600	H
	Farakka barrage	‡	‡	1974	‡	‡	‡
	Bhimgoda	‡	‡	1854	‡	‡	I
Nepal	Gandaki	‡	‡	‡	‡	‡	‡
	Kosi	‡	‡	‡	‡	‡	‡
Bangladesh	Manu barrage		Manu				I
	Tangon barrage		Tangon				I
	Teesta barrage		Teesta				I

* I = irrigation; H = Hydropower

Figure 7 Large dams in GBM basin countries: not updated.

Status of Hydro-meteorological Observation Network

Bangladesh: A total of 46 synoptic stations are in operation under the Bangladesh Meteorological Department (BMD). In addition, BMD operates 10 Pilot Balloon stations and 4 Rawinsonde stations.



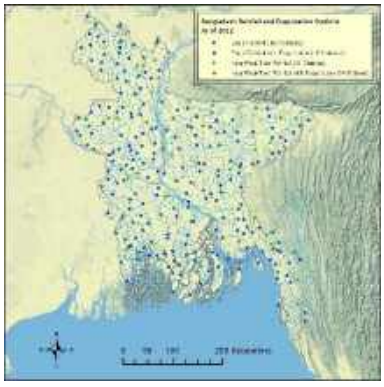


Figure 8: Available Hydrological and Meteorological stations or associated existing products in the GBM countries to be used for developing the HydroSOS system.

Nepal:

The Department of Hydrology and Meteorology (DHM), Nepal is maintaining a network of 194 hydrological stations (48 manual only, 6 telemetric only and 140 manual and telemetric). Additionally, 11 cryosphere monitoring stations (2 fully automatic) and 22 sediment monitoring stations are being operated by the DHM. There are around 500 rainfall stations (182 manual only, 34 telemetric only and 284 manual and telemetric). The stations are continuously being upgraded to telemetric systems. Additionally, the department is operating 3 weather RADARs and one radiosonde station.

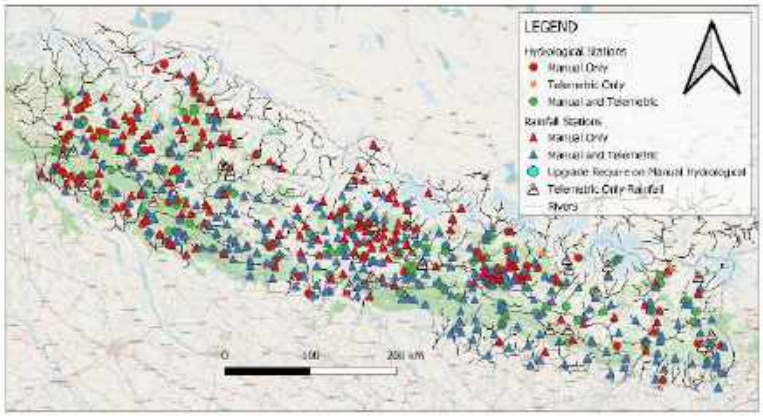


Figure 8: Location of hydro-meteorological station of Nepal and its coverage

[19] FAO 2011 https://www.fao.org/3/CA2138EN/ca2138en.pdf

Status of Flood Forecasting and Early Warning Solutions:

Bangladesh

The Flood Forecasting and Warning Center (FFWC), under the Bangladesh Water Development Board (BWDB), collects hydrological data from 109 water level stations and 74 rainfall stations to provide flood warnings. FFWC is involved in preparation of flood status reports at national level, weekly bulletin during dry season, monthly and annual flood reports and issues a range of warning/advisories which include daily statistical bulletin of floods, river situation, descriptive flood bulletin, and forecasts for 24, 48, 72, 96 and 120 hours at 54 monitoring points on the major rivers. In addition, it provides a 10 day probabilistic flood forecast at 37 monitoring points on the major rivers, and a special flood report during the monsoon season. For the pre-monsoon season, three-day flash flood forecasts are given at 25 monitoring points on the major rivers in the Northeastern region.

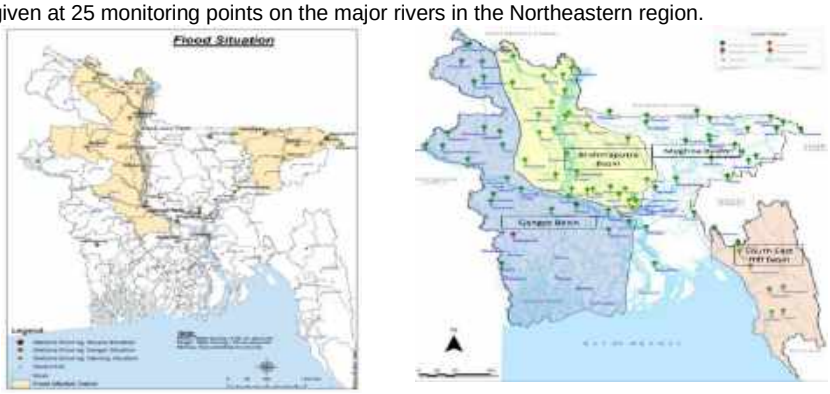


Figure 9: Flood monitoring situation in Bangladesh

Nepal

Based on Global, Regional and National level model output, Flash Flood Guidance System (FFGS), freely available products and technical capacity of DHM, the Flood Forecasting Division (FFD) of DHM issues the Flood Forecasting Bulletin daily in Monsoon for subsequent 3 days. District wise flash flood warning for 24 hours lead period is also issued. Further, Special Bulletins are issued throughout the year as and when there is a forecast of severe flooding in any specific regions. The rainfall and water level data from telemetric stations along with the products of RADAR and satellites are regularly monitored. The warning information for flood risk is communicated to the public in potential flood affected areas through SMS. For this purpose, 273 high flood risk zones have been identified and are being extended throughout the country. New projects have been planned such as flood forecasts and rainstorm flow EWS. Some of the key challenges include greater coverage for the northern mountainous region, modeling capacity, impact-based forecasts and last mile connectivity.

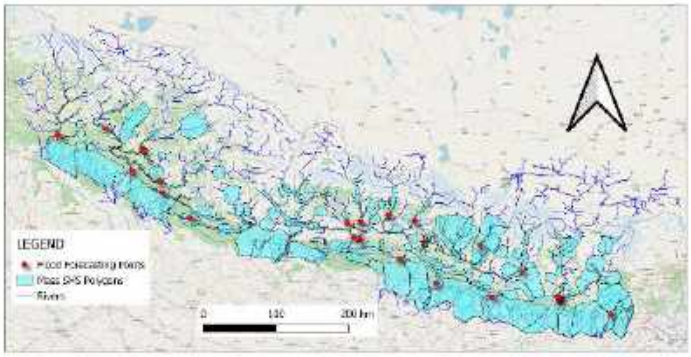


Figure 10: Existing Flood SMS Polygons and Major Flood Forecasting Points

Climate Change Context

Past and present climate change

The nature of change in climate over the GBM region points towards a widespread warming across the basin during the period 1980-2013[20]. Warming is found to be more intense over the northern part of the basin with a maximum decadal increase in temperature being 0.6 °C. During the same period, there is a significant decline in the rainfall over the basin. The monsoon rainfall which occurs mostly during the period June-August is estimated to have declined by as much as 39 mm per decade during 1998-2013 in the high precipitation regions such as the northeast of India, southwest of Bhutan, Nepal and Bangladesh. The rainfall appears to be increasing though insignificantly over the Ganga basin at the rate of 12 mm per decade. This change in the monsoon precipitation is not natural and is linked to anthropogenic causes. A strong correlation is found between declining monsoon rainfall and the increase in GHG emission. For example in some of the region, confidence over attribution to GHG emission is more than 90%[21].

[20] Khandu et al. 2017. Change and variability of precipitation and temperature in the GBM basin based on global high-resolution reanalysis. Int. Journal of Climatology. 37:2741-59.

[21] Sharma, C., Shukla, A.K. and Zhang, Y. 2021. Climate change detection and attribution in the Ganga-Brahmaputra-Meghna river basin. Geoscience Frontiers. https://doi.org/10.1016/j.gsf.2021.101186

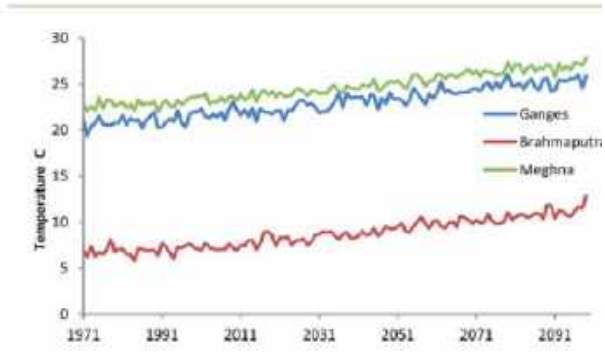


Figure: 11 Annual Mean Temp. Change over 1971-2099 in the GBM Catchment for Q0 realization (Source: Whitehead et al. 2015)

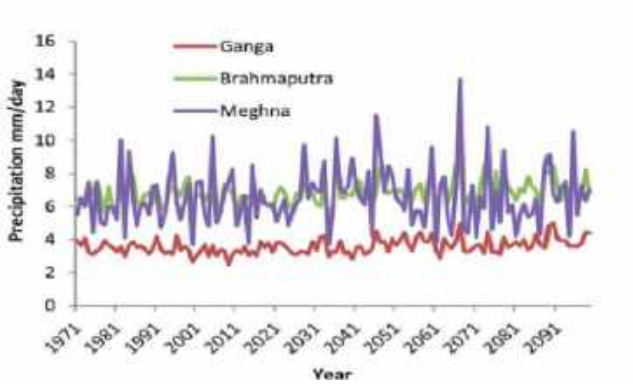


Figure: 12 Annual Mean Precipitation Change over 1971-2099 in GBM Catchment for Q0 Realization (Source: Whitehead et al., 2015)

Bangladesh is witnessing an average rise in temperature of 0.5 °C, over the period 1976 to 2019. The rise in maximum temp. is not uniform for example, as compared to 0.5°C for the central part, the rise is higher up to 0.9 °C for the eastern part. The rainfall analysis for the same period shows that during the peak monsoon season (June to August), the average monthly mean rainfall has declined by 60 mm while in the period-Sep-Oct. it has increased by 43 mm. As a result of these, the summers have become longer, winter warmer and the monsoon not only erratic but also is extended from March to October[22].

The annual maximum temperature trend in Nepal is significantly positive (0.056oC/yr) and annual minimum temperature trend is also positive (0.002oC/yr) but it is insignificant. There is no significant trend observed in precipitation in any season. Number of rainy days is increasing significantly mainly in the northwestern districts of Nepal. Trends of warm days and warm nights are significantly increasing in the majority of the districts[23].

Further during the period 1977-2010, the Himalayan ice reserve of Nepal has declined by 29% or equivalent to 129 sq. km. The glaciers have receded on an average 38 km per year and the number of glacial lakes have increased by 11%[24]. Other studies point out that the average temperature rose between 1-1.3 °C and the warming is neither uniform nor defined by the altitude.[25]. There are positive and negative movements in so far as change in precipitation is concerned although overall there is minor change during 1971-2010. The areas receiving higher rainfall are becoming wetter while those receiving less rainfall are getting drier.[26]

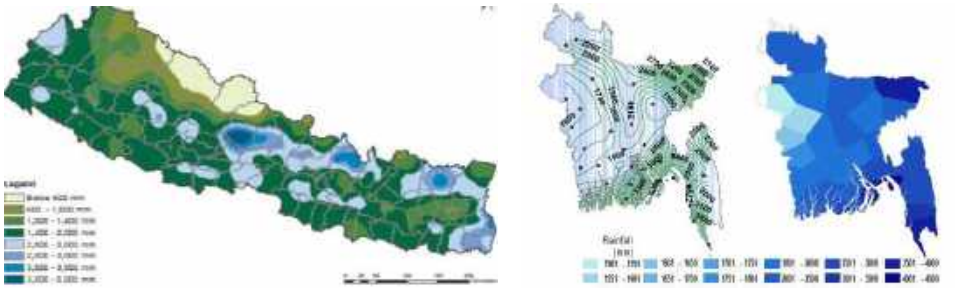


Figure 13 Mean annual precipitation in Bangladesh and Nepal

Climate variations in two other GBM countries (non-targeted at this stage but linked with Bangladesh and Nepal)
Bhutan has experienced a temperature increase of just under 1°C during the twentieth century with a faster increase being reported in the last fifty years. Overall, the minimum temperature is increasing at a faster rate than the maximum. In terms of rainfall, there is a decline in the country's wettest region and a weakening of the summer monsoon over the subcontinent region[27]. Other studies also report marginal decrease in country's rainfall for the period 1996-2017.[28] The glacial area loss in Bhutan over the period 1980-2010 is 23.3% with a varying rate of reduction in different elevation zones. As a result of this loss, the number of glacial lakes have increased by 14.8%[29].

[22] World Bank. 2021. Climate Change in Bangladesh. Climate Change in Bangladesh: Impact on Infectious Diseases and Mental Health (worldbank.org)
[23] DHM, 2017. Observed Climate Trend Analysis in the Districts and Physiographic Regions of Nepal (1971-2014). Department of Hydrology and Meteorology, Kathmandu
[24] Government of Nepal. 2016. Ministry of Population and Environment Report. Nepal First NDC.pdf (unfccc.int)
[25] World Bank 2021. Climate Risk Country Profile Nepal. Climate Risk Country Profile: Nepal (adb.org)
[26] Bohlinger and Sorteberg. 2018. A comprehensive view on trends in extreme precipitation in Nepal. Int. Journal of Climatology, 38. DOI: 10.1002/joc.5299
[27] World Bank. 2021. Climate Risk Country Profile Bhutan. Climate Risk Country Profile: Bhutan (reliefweb.int)
[28] NCHM. 2019. Report on the Historical Analysis on Climate and Climate Projection for Bhutan. Royal Government of Bhutan. Analysis of Historical Climate and Climate Change Projection.pdf (nchm.gov.bt)
[29] Bajracharya et al. 2014. The status and decadal glacial change in Bhutan from 1980s to 2010s based on satellite data. Annals of Glaciology. 55(66). doi: 10.3189/2014AoG66A125

Since 1950's India has experienced a rise in average temperature, extreme temperature, rainfall events, droughts, sea level and a decline in monsoon precipitation with changes in the monsoon system. The average temperature of India over the period 1901-2018 has increased by 0.7 °C. Similarly, the summer monsoon rainfall has decreased by 6% over 1951-2015. This decline is more prominent for specific regions including the Indo Gangetic Plain. Importantly in the same period 1951-2015, the frequency and spatial coverage of droughts have increased. The frequency in certain regions including the north-east has increased to two per decade while area impacted has risen by 1.3% per decade. In addition, the country faces sea level rise which was earlier at the rate of 1.06-1.75 mm per year during 1874-2004 but has increased to 3.3 mm per year during the period 1993-2017.[30]

Past and Current Effects of Climate Change

The water level change in the GBM delta over a 45-year period, 1968-2012 is found to be faster ~ 3mm/y as compared to the global mean sea level ~2 mm/y. It is found to be accelerating since 2005 in the west of the delta and the maximum rate of delta subsidence during 1993-2012 was 1-7 mm/y.[31]

Bangladesh, under the combined impact of erratic monsoon, increased average temperature and other climatic stresses; is witnessing several kinds of effects. For example, the wetlands have dried up, incidence of extreme events have increased and so has the frequency of tropical cyclones and intensity of floods. The tropical cyclone 'Mora' in May 2017 affected 3.3 million including Rohingya refugees who were hosted in the particular region. Due to heavy rain events, the number of landslides have also increased which earlier was limited. There are regions which are increasingly becoming prone to droughts and an increase in dry months is found for the northwest region of the GBM basin area. Significant sea level rise is measured at different places; 4 mm per year at Hiron Point in the west, 6 mm per year at Char Changa and 8 mm per year at Cox's Bazar in the southeast. Bangladesh being a country which mostly lies within, less than 10 m above sea level (10% area is less than 1 m above sea level) an increasing sea level holds considerable threat for the future. The sea level rise has already led to doubling of the soil salinity and the affected region in the country has increased from 1.5 million ha in 1973 to 3 million ha in 2007.[32] One estimate is that the economic cost of climatic impact on key sectors such as agriculture, hydropower and water induced disasters is as much as 1.5 to 2 percentage of the country's GDP[33]

Nepal is experiencing several kinds of climatic change effects including drought, heat and cold waves, floods, landslide, GLOF, snow, avalanches, and forest fires. A trend analysis for drought over 32 years, 1981-2012 shows that there is an increase in severity and frequency particularly in the central region. In the absence of a distinct trend for regional average precipitation, inter annual variation however is large. The summer seasons of 2004, 2005, 2006 and 2009 and winter seasons of 2006, 2008 and 2009 witnessed widespread severe drought conditions impacting agriculture and livestock production.[34] Based on AQUEDUCT analysis, the population estimated to be annually impacted by flood (as of 2010) is 157,000 and the corresponding GDP impact is about US$ 218 million. Monsoon floods such as the one in 2009 (Koshi Embankment Breach) impacted 3.5 million in Nepal and India. Further there are over 1000 glacier lakes in Nepal and accelerated glacier melting is resulting in formation of new lakes, increasing significantly the risk of GLOFs. Overall during 1971 to 2004, more than 3.5 lakh people are found to be exposed to extreme flood[35]. Migration in the form of seasonal or long term often is the principal adaptation measures which in turn have detrimental effects on communities[36].

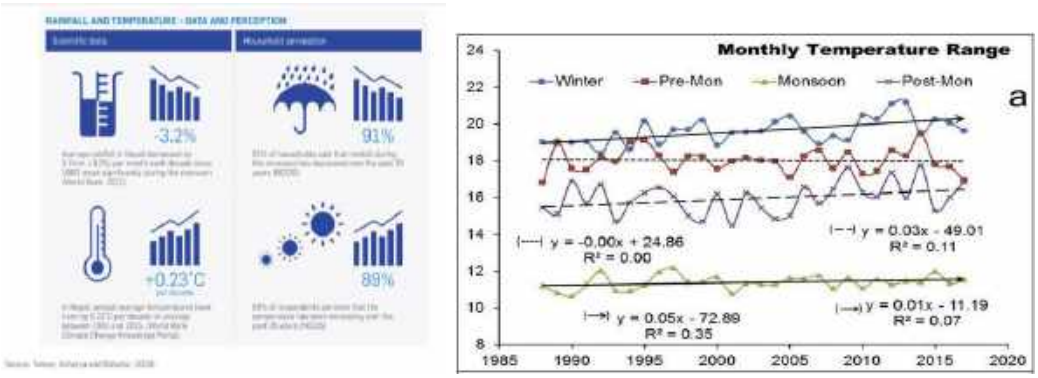


Figure 14: Bangladesh and Nepal climate change information

Climate Change Effects in other GBM Countries:

[30] MOES. 2020. Assessment of Climate Change over the Indian Region. Government of India. 489178_1_En_Print.indd (reliefweb.int)

[31] Becker et al. 2020. Water level changes, Subsidence and Sea Level Rise in the Ganga-Brahmaputra-Meghna Delta. PNAS. 117(4):1867-76. www.pnsas.org/cgi/doi/10.1073/pnas.1912921117

[32] Ministry of Foriegn Affairs. 2018. Climate Change Profile Bangladesh. Govt. of Bangladesh. Bangladesh (1).pdf

[33] Government of Nepal. 2016. Ministry of Population and Environment Report. Nepal First NDC.pdf (unfccc.int)

[34] Dahal et al. 2016. Drought risk assessment in central Nepal: temporal and spatial analysis. Drought risk assessment in central Nepal: temporal and spatial analysis (springer.com)

[35] World Bank. 2021. Nepal Country Profile. Climate Risk Country Profile: Nepal (adb.org)

[36] Dixit, A. n.d. Impacts and Adaptive Strategies. Climate Change in Nepal: Impacts and Adaptive Strategies | World Resources Institute (wri.org)

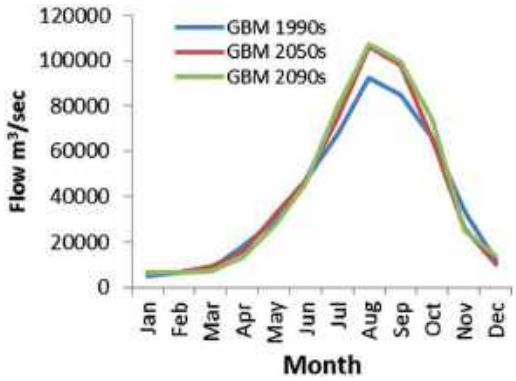
Because of rising mean temperature and resulting acceleration in glacial melting; Bhutan faces effects of climatic change in several forms including formation of supra-glacial lake and lake outbursts, monsoon floods, drought, forest fire etc. The country's entire northern region has glacial or snow fed lakes. Water levels in several of these lakes have reached a critical geostatic threshold. Following the Lemthang Tsho GLOF incident 2015, a comprehensive assessment was undertaken to identify potentially dangerous glacial lakes in the country[37]. The country is experiencing more frequent and intensified flash floods in the last decade due to an increase in intensity of rainfall and also because of deviation in the monsoon's cycle. Closely related to such floods are landslides, impact of tropical cyclones, soil erosion etc. For example, cyclone Aila 2009 caused rainfall of 76 mm over 24 hours and triggered much devastation in Bhutan. An estimated 8.6 MT soil per hectare is lost annually especially in the rainy season. Similarly, in 2010, landslides and floods damaged more than 2000 acres of farmland and impacted over 4000 households. Given that the large majority of the Bhutanese population are dependent on subsistence farming; erratic rainfall holds considerable risk leading to increasing drought incidence[38].

Climatic changes are already being seen in a variety of forms in India. It includes increased occurrences of flood and droughts, decline in ground water availability, increased risk of coastal flooding, increased stress and undermining of water, health and energy security. The Hindu Kush Himalayas (HKH) due to increased temperature is experiencing a decline in snowfall and retreat of glaciers in recent decades. Sea level rise in the North Indian Ocean (NIO) that was 1.06-1.75 mm per year during 1874-2004 has increased to 3.3. mm per year during 1993-2017. A decline in total monsoon rainfall during the last seven decades has increased the frequency and spatial extent of drought over the period 1951-2016. For example, areas such as northeast, southwest etc. of the country are experiencing 2 droughts per decade and further there is an increase in total area by 1.3% per decade. There is a significant reduction in the number of tropical cyclones in the North Indian Ocean (NIO) over the period 1951-2018. However, a frequency increase (+1 per decade) is observed in occurences of Very Severe Cyclonic Storm (VSCS) in the post monsoon cyclone season during the period 2000-2018[39].

Future Climate Change in Bangladesh and Nepal (or GBM Basin in general)

Future Effects of Climate Change

A study of climatic impact using alternate scenarios (business as usual, more sustainable and less sustainable future) shows that for 2050 and 2090 there will be significant enhancement of monsoon flow with a significant rise in flood potential (Fig: 11). Low flows are forecasted to result in an extended drought period with consequences for water and sediment supply, agricultural irrigation and saline water intrusion. One of the models which assessed likely effects of climate change on hydrology of GBM basin shows that by the end of 21st century the GBM basin will be warmer by ~3.4°C, and changes of mean precipitation as runoff will increase by 16.3 % in the Brahmaputra, 19.8% in the Ganga and 29.6% in the Meghna basin.[40] Simulation study based on a scenario of an increase of 1.5 to 2 °C temperature over the GBM basin shows a considerable increase in flood risk, in terms of area and water depth for two types; one in five and one in hundred year flood category.[41]



The variation in temperature and rainfall will have significant consequences for water availability and its quality in the GBM basin. It is estimated that by 2100 even under representative concentration pathway 4.5, the subsidence could double the projected sea level rise reaching 85-140 cm across the delta[42]. In spite of the uncertainties involved, the projections highlight the extent of the flood risk and coastal inundation which the delta population is exposed to in near future. The extent of saline intrusion in the GBM basin due to climatic change is being studied[43]. It shows an increasing salinity magnitude due to reduced upstream discharge and sea level rise (Akter et al. 2019). The sixth IPCC assessment report highlights the loss of snow cover in the Tibetan Plateau since the early 21st century and retreat of glaciers since 1970's. It is projected that the whole Tibetan Plateau and the Himalayan region will experience heavy precipitation in the 21st century. The South Asian region similarly will experience more intense and frequent heat waves and annual and summer monsoon will increase in the 21st century with enhanced inter-annual variation[44].

Figures show projected changes in average daily temperature, maximum and minimum for Bhutan under different pathways[45]. This study further shows an increase in annual median rainfall over all emission pathways by 2090. For example, precipitation is projected

[37] NCHM. 2019. Reassessment of potentially dangerous glacial lakes in Bhutan. Govt. of Bhutan. Re-assessment of Potentailly Dangerous Glacial Lakes.pdf (nchm.gov.bt)
[38] ICIMOD. 2016. Climate+Change Handbook. BMCI, Bhutan. icimodBhutanClimate016.pdf
[39] Krishnan et al. 2020. Assessment of Climate Change over the Indian region. 489178_1_En_Print.indd (iitd.ac.in)

[40] Masood et al. 2015. Model study of the impacts of future climate change on hydrology of GBM Basin. Hydrol. Earth System Science. 19. doi:10.5194/hess-19-747-2015

[41] Uhe, P.F. et al. 2019. Enhanced Flood Risk with 1.5 °C Global Warming in the Ganges, Brahmaputra, Meghna Basin. Environ.Res.Lett.14: 074031. https://doi.org/10.1088/1748-9326/ab10ee

42 Becker et al. 2020. Water level changes, Subsidence and Sea Level Rise in the Ganga-Brahmaputra-Meghna Delta. PNAS. 117(4):1867-76. www.pnsas.org/cgi/doi/10.1073/pnas.1912921117

43 Akter, R., Asik, T.Z., Sakib, M. et al. 2019. The dominant climate change event for salinity intrusion in the GBM delta. Climate. 7, 69. http://dx.doi.org/10.3390/cli7050069

44 IPCC Sixth Assessment Report, Working Group Physical Science Basis PowerPoint Presentation (ipcc.ch)

45 World Bank and Asian Development Bank. 2021. Climate Risk Country Profile Bhutan. 15874-WB_Bhutan Country Profile-WEB.pdf (worldbank.org)

to increase by 10% under pathway RCP 6.0 and 11% under RCP 8.5 from a baseline median. The impacts of climatic changes will aggravate flood, drought and heat wave conditions and in addition will be felt in sectors such as water, forest and biodiversity, agriculture, energy. The climatic impact on flood alone is expected to increase over $41 million on GDP by 2030 in RCP 8.5 emission pathways and this will raise annual impact due to river flooding on Bhutan's GDP to 4% [46]. Precipitation increase in the southern border with India during monsoon together with average number of days with heavy precipitation will have repercussions for flood risk, impact runoffs and rates of river discharge. The projected number of days for dry spells by the end of the century and impact of rising temperature on water resources, rate of snowmelt etc. are further challenges which require to be negotiated.

Targeted Project Areas and Beneficiaries

In the GBM region, extreme weather hazards and climate change affect people on various spatial, temporal and social scale. By alleviating the impact of flood and drought hazard, the project will benefit the overall population of the basin. In particular, the Early Warning System (EWS) will be designed to reach the civil protection services and other private and public stakeholders as well as the general public. The population segment in Bangladesh and Nepal will benefit directly from the project's outputs through the following types of activities: 1) new tools and products developed for risk reduction, such as flood and drought risk maps and climate scenarios. It will augment EWS, and climate change adaptation measures at the community level, 2) testing of the HydroSOS EWS on pilot areas to understand the applicability and effectiveness, 3) capacity building measures with an aim to updating or formulation of policies, plans and guidelines synergized with three components of the HydroSOS BaNe project.

Phase 1: Under the GBM basin especially in Bangladesh and Nepal, flood hazards are mostly reported either as pluvial flood linked to high rainfall precipitation or as riverine flood. The flood risk maps for current and future predicted climates should therefore be developed for the overall surface of Bangladesh and Nepal to account for possible pluvial floods and risk indicators on population, built-up areas, agriculture, water resources, wetlands and protected areas etc. Drought on the other hand can affect any part of the basin. Through risk maps, climate scenarios and HydroSOS EWS, the program will provide important support for a much larger population vulnerable to drought and its impact. The direct beneficiaries of the new tools within the two countries will include:

1. National Meteorological and Hydrological Services (some 500 persons from the two countries), who will be contributing to the development of the tools, providing improved or new services but also gaining in capacities and means of actions.
2. Emergency, Civil protection authorities and Disaster Management Services (estimated 500 to 1000 persons from two countries), who will be integrating new risk maps/warning into their operating procedures and crisis management.
3. Other National authorities of the countries and related departments (estimated total 200 persons) such as Health, Water, Irrigation and Agriculture.
4. Social Institutions such as schools, hospitals, fire stations etc. (estimated to several thousands of people), who will be able to prepare or improve their emergency plans;
5. Non-governmental organizations (NGO's), International Non-governmental organizations (INGO's) (estimated to be several hundreds), who will either directly use the new information to improve their resilience capacity and adaptation or transfer to their partners.
6. Community-based organizations (CBO), farmer and fishermen associations, in particular women groups etc. (estimated to be thousands of persons over the basin) who will be using the new tools and methodologies to decrease their vulnerability to extreme events;
7. Managers of industrial sites (estimated to several thousands of people over the basin), and private companies (dam's operators) who will be able to draw emergency plans and build more resilient infrastructures;
8. Individual Community members of urban and rural areas especially youths who are more familiar with Information Technologies (potentially the whole population of Bangladesh and Nepal, but in the first stage, estimated 5-10 %, or approximately up to 1 million persons) who will, get timely warning messages and possibly contribute to disseminating and crowdsourcing of information for early actions.

Phase 2: A series of pilot testing on the dissemination, use and feedback of the HydroSOS flood and drought Early Warning System will be conducted during the monsoon and dry season for selected target areas as shown below in Table 4, which involve representatives of the major groups of beneficiaries. Eight pilot-test areas, expected to be studied during year 2 and 3 of the project have already been identified on the basis of following criteria (final selection will be performed during the course of the programme):

- agricultural or urban areas on which collaborations are already established with communities and groups of citizens for example in the field of water resources management, land planning, risk reduction, exercises with civil security, any project related to the participation of citizens and communities.
- agricultural or urban areas that have been affected by extreme events (drought or flood).
- areas where Early Warning Systems have been set up (by previous projects) and are being used.
- areas preferably with mobile network coverage or with a good telecommunication system.
- areas where the effect of extreme events is known, or areas to be affected by dam operations.

Table 4: Pilot tests location for the flooding and dry season

Location of pilot sites (hazard type)	**Estimation of the number of people participating to**	**Criteria for selection**

46 World Bank and Asian Development Bank. 2021. Climate Risk Country Profile Bhutan. 15874-WB_Bhutan Country Profile-WEB.pdf (worldbank.org)

	the pilot testing exercise	
Kurigram, Bangladesh (Floods-Transboundary)	100,000	Kurigram district is one of the riverine flood prone areas. Over the last 25 years, a number of major flooding events have occurred impacting over a million citizens. In 2020, Kurigram experienced the worst flooding event in the last 50 years. An estimated 50'000 people were affected. Significant damage was incurred on infrastructure, agriculture, livestock and housing. The population of the region is expected to reach 3 million by 2025 with women and elderly in particular exposed to hydro-meteorological hazards, and having less access to education, employment and services. The extension of flood prone areas in this region is very large due to its flat topography. In the flood prone area of Kurigram, the development decision is conditioned by individual economic capacities and not by their level on risk knowledge.
Lalmonirhat, Bangladesh (Floods and Drought)	85,000	This district is fully dependent on the water from Teesta River for meeting its agricultural needs. Presence of Gazoldoba barrage at the upstream and continuous extraction of water from the river leaves the downstream scarce in irrigation water. Lalmonirhat is mainly affected by the flood from Teesta basin. Being a funnel shaped flashy basin, Teesta plays a very critical role in both flash and seasonal flood. Most of the basin resides outside the country and presence of a number of water control structures are available and make it extremely difficult to forecast/manage the flood events.
Faridpur, Bangladesh (Floods)	90,000	Faridpur is on the Padma basin, right after the confluence of Brahmaputra and Ganges. Flood in any one of the basins make the location vulnerable to flood.
Sunamganj, Bangladesh (Flash Floods)	85,000	Sunamganj is located in the North-Eastern region of the country, right below the Meghalaya in India. This critical position makes it vulnerable to flash flood along with monsoon flood. The pre-monsoon flash flood is a big threat to rice crop. Infrastructure & livelihood are also severely affected. In 2017, a devastating pre-monsoon flash flood nearly destroyed all the crops. In 2022, Sunamganj experienced the worst flooding in recorded history.
Naogaon, Bangladesh (Floods and Drought)	85,000	Both floods and droughts are frequent in this region. This area receives huge flow from transboundary Himalayan tributaries during monsoon which recedes also comparatively quickly. During the dry periods (Nov-May) due to high temperature and low rainfall the area becomes susceptible to drought. Both floods and droughts impact agriculture, drinking water and livelihood of the rural community.
West Rapti, Nepal (floods)	1,13,000	The selected location, West Rapti has faced major flooding in the previous years' impacting several thousands of people. Geographically it has a plain topography. There are several active community-based organizations which could provide support in the testing of the HydroSOS EWS. Also, this region has availability of quality historical hydrological data which is important for calibrating the models.
Kankai (Jhapa) Flood and Drought Nepal	1,00,000	The region of Kankai (Jhapa) has vulnerable populations which experienced both flash and riverine flooding. It has dense real-time observation networks which will be useful in the development of the HydroSOS EWS and later for the verification of forecasts. Also, it is a pilot site for testing drought events.
Bagmati River Nepal (Sarlahi, Rautahat) Flood and Drought	45,000	The Bagmati river in Nepal is selected for urban and riverine floods. Existing operational flood forecasting model are available and will be useful for comparison of the forecasts and warning of flooding events. Also, this is a water deficit basin during low flow period.
Tinau River (Palpa, Rupendehi) Flood and Drought	50,000	Water deficit basin with smaller size to test the accuracy of the HydroSOS forecasts and warnings. Annual Flood events observed in the downstream area with impacts to urban population and infrastructures
Tamakoshi River (Dolakha) Transboundary and GLOF	17,000	This river in Dolakha region is a transboundary river with China. This site is useful for testing of potential GLOF events. Also in this area, hydro- power projects are present which could provide results in useful of HydroSOS products in the power generation and water management.

The pilot testing will provide the opportunity to train communities and agencies during real flooding or drought situations which will help to assess the effectiveness and applicability of the HydroSOS Ba-Ne EWS. The results of the exercises will provide lessons to be learnt and will allow to identify gaps and challenges to improve the system and services. The knowledge gained by the communities and agencies will be helpful to implement similar activities with other stakeholders. The pilot testing communities (100-150 at each site including women and youths) and agencies (10-20 at each site working in disaster management, civil protection, irrigation department, CBO's, NGO's) are expected to disseminate this knowledge and skills in other areas, inside or outside the basin, where floods and drought management are also of growing concerns.

Figure 15: The targeted project region of Bangladesh and Nepal (area covered under the red boundary) with the potential pilot testing sites of the HydroSOS system and community-based initiatives are presented above. The test sites will be finalized during the inception phase of the project implementation.

Phase 3: Capacity development activities will be carried out for agencies at local/national and regional level and communities which are affected by floods and drought events during the different phase of the project on following areas:

- Extreme events, risks maps and climate change adaptations
  - Flood and Drought Risk assessment and information on risk profile through a national/regional database;
  - Floods and drought risk maps development at national and transboundary level;
  - Information on future social and environmental risk scenarios and risk management strategies.
- Early Warning System for floods and drought and measures to reduce risk
  - End-to-End Early Warning System;
  - Dissemination of early warnings to agencies, IOs, NGOs, communities and citizens;
  - Natural and nature-based solutions for floods considering ecosystem sustainability.
- Governance
  - Mainstreaming Gender in Flood Management.
  - Identification of gaps and needs for the long-term strategies for floods and drought management and climate change adaptation by local and national stakeholders of GBM countries.
  - Revision, or development, of plans, policies and guidelines for risk reduction in the view of future climate change by national and regional policymakers.

Project / Programme Objectives

The proposed project objective is to increase the climate adaptive capacities and resilience of beneficiary communities to hydro-climatic risks. Furthermore, the project will develop local, national and regional adaptation strategies and implementation mechanisms based on integrated monitoring and management of water resources. Floods and drought being common feature in the two countries, the project envisages strengthening the capacities of National Meteorological and Hydrological Services (NMHSs) with an innovative, robust and tailored regional Hydro-Meteorological early warning system (providing short term and seasonal status) embedded into a long-term integrated water resource information system and concrete adaptation actions developed through a participatory design and executed in an integrated manner.

The HydroSOS BaNe project is aligned with the Adaptation Fund objective to "reduce vulnerability and increase adaptive capacity of communities to respond to the impacts of climate change at local, national and regional level" and also it will support the United Nation Early Warning System for All initiative which is led by the WMO with other international partners to cover everyone on the planet (Bangladesh and Nepal are part of first 30 priority countries) with the Early Warning system in the next five years. Also, the HydroSOS BaNe project targeted countries are supported through Systematic Observation financing facility (SOFF) initiative (UN Fund co-created by UNDP, UNEP and WMO) The Adaptation Fund is member of the SOFF Advisory Board. SOFF goal is to support countries to improve their meteorological observations in compliance with the internationally agreed WMO Global Basic Observation Network (GBON), and which in turn will support Global Research Centres for Long-Range Forecasts (such as European Centre for Medium-Range Weather Forecasts) in developing high quality meteorological and hydrological monitoring and forecasting products.

Existing or under development national hydrological, meteorological and climatological modeling systems, early warning and decision-making platforms will be incorporated into the proposed system with scope to include lessons learned in each geographical

context and incorporate important inputs from other projects and initiatives. This HydroSOS BaNe project aims to enable different actors and stakeholders at regional, national and local level to manage climate, weather and water-related risks more effectively. This strategy recognizes that the current water crisis in the GBM basin is inextricably linked to climate change and requires systemic changes.

This project plans to drive that change using an integrated climate and water approach to deal with increasing exposure to water related risks. A change of systems and mindset will be carried out by bringing together different disciplines in the water, climate and disaster management sectors and fostering collaboration amongst global, national, and local partners which traditionally have been working separately. This will be done by breaking institutional barriers among sectors and organizations and establishing a model of cooperation that will enable different actors to achieve common goals. The broader aim is to forge new relationships that will deliver strategic results in future, and beyond this project. A more detailed theory of change (ToC) framework is provided in the figure. National partners, including National Governments, Research Organizations, Private Sectors, etc. in each country will set their own roles and responsibilities around these focus areas, with decisions delegated as close to communities as possible. This will allow for maximum flexibility and impact depending on the available capacities in the country. The ToC will be refined further by the country teams during the next phase.

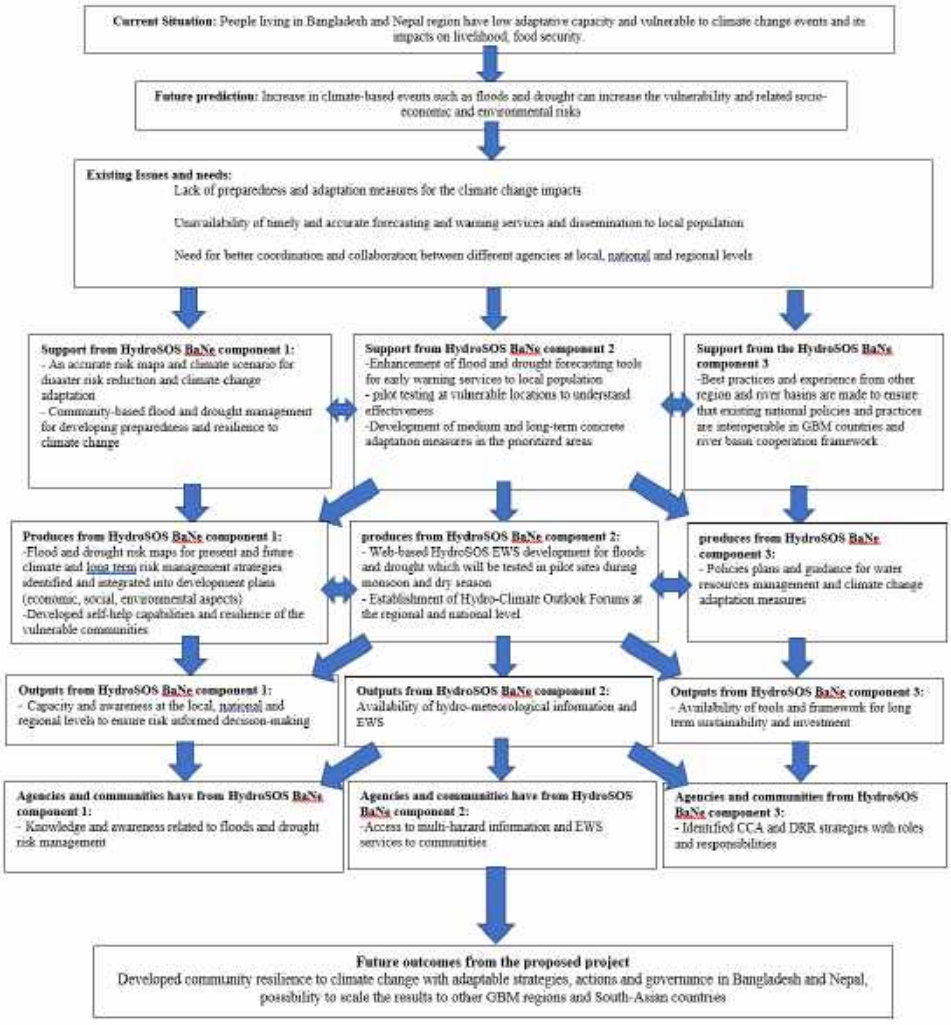


Figure 16: Theory of Change based on the HydroSOS BaNe project

Project / Programme Components and Financing:

Currently, the institutional arrangements for managing the water resources of the transboundary rivers of the Ganga Brahmaputra Meghna (GBM) basin are lacking or not enforced. This will change with effective synergy and coordination between the regional and national and other institutions linked to the basin. A separate approach by different countries leads to non-integrated management of water resources increasing the risk of water scarcity, land and natural ecosystem degradation. Over the region of Bangladesh and Nepal, flood forecasting and early warning systems until now have been developed only for the sub-basins through the WMO, GEF, World Bank supported projects. Further it is not updated with the state-of-the-art technologies.

A large part of the whole basin therefore requires warning procedures to organize actions between the technical institutions in charge of assessing extreme hazards, the National Meteorological and Hydrological Services (NMHS), the institutions in charge of disaster civil security and the communities and citizens at risk. This means that the technical capacities to develop and run the models especially for hydrological sub-seasonal to seasonal must also be developed, on the basis of the experience and existing capabilities in the two countries (learning from each other). Depending on the responsibilities and capacities of the Meteorological Service/Agency and the Hydrological Service in the two countries, the development and maintenance of the forecasting tools could be assigned at the regional level mainly to the regional entities such as ICIMOD and RIMES ensuring long term investments and sustainability. Coordination and communication within the agencies and communities on issues of floods and drought must be improved by developing the appropriate information services, radio programmes, websites and mobile platforms. Furthermore, communities should trust and follow the official messages from their national or regional centres. As the most effective way of communication occurs through mobile platforms, national institutions should explore the use of multiple technological and non-technological channels of communication.

Several aspects must be defined and implemented in order to foster appreciable level of participation from communities and citizens into flood, drought and environmental management. Besides legal Instruments and operational procedures to support integrated

water resources management in the GBM Basin, additional non-structural measures, such as development of risk culture, education, capacity building, natural and nature-based solutions should be implemented with the involvement of the stakeholders to increase climate resilience of the population. The following concrete outcomes are to be further refined or developed during the proposal phase through additional national dialogues and based on already on-going, existing or planned activities.

Project Components	Expected Outcomes	Expected Concrete Outputs	Amount (US$)
Component 1: Risk-based preparedness and adaptation to the climate variabilities and water and environmental uncertainties	Outcome 1.1 Floods and drought risks informed decision-making at the regional, national and local levels	Output 1.1.1 Vulnerability and exposure assessment (including gender and sector-wise analyses) and risk maps are developed for the targeted countries	1,000,000
		Output 1.1.2 Develop capacity and awareness at the local, national and regional levels to ensure risk informed decision-making	
		Output 1.1.3 Long term risk management strategies identified and integrated into development plans (economic, social, environmental aspects)	
	Outcome 1.2 Preparedness and resilience to climate change promoted through innovative and community-based initiatives.	Output 1.2.1 Implementation of community-based floods and drought management strategies in the vulnerable sites and different ecosystems	2,000,000
		Output 1.2.2 Strengthened awareness of vulnerable communities and agencies on hydro-meteorological risks through education programs including nature-based solutions and mainstreaming gender	
Component 2: Strengthening water resources management through access to hydro-meteorological information and augment regional /national capacity to monitor and assess Hydro-Meteorological hazards	Outcome 2.1 A web-based Hydrological Status and Outlook System for EWS is designed and developed together with the National services	Output 2.1.1 Improved hydrological status and outlook instruments through data standardization for EWS is designed and developed	4,000,000
		Output 2.1.2 Existing products and tools are integrated and visualized in the regional HydroSOS for EWS	
		Output 2.1.3 Establishment of Hydro-Climate Outlook Forums at the regional level	
	Outcome 2.2 Development of medium and long-term concrete adaptation measures in the prioritized areas and updates based on lessons learned and monitoring instruments	Output 2.2.1 EWS and concrete adaptation measures tested in selected vulnerable communities.	2,000,000
		Output 2.2.2 Coordination and collaboration developed at the regional, national and local level	
		Output 2.2.3 Decision-makers are informed with key water resources management parameters for current status and sub-seasonal and seasonal outlooks	
Component 3: Water and climate resilient regional cooperation arrangements together with National and regional stakeholders, and community involvement	Outcome 3.1 Improve information base and practices related to water resource management and climate change adaptation	Output 3.1.1 Best practices and experience from other region and river basins are made to ensure that existing national policies and practices are interoperable in GBM river basin cooperation framework	600,000
		Output 3.1.2 Analysis and optimisation of benefits of regional water and climate adaptation action.	
	Outcome 3.2 National adaptation strategies (i.e. NAPs) are fully inclusive of water management issues,	Output 3.2.1 An inclusive process is developed to ensure that National adaptation strategies explicitly address water relevant instruments and strategies. Inclusive approaches are operational to include local communities.	600,000

	address community concerns. Methodology and mechanism for leveraging and sharing benefits of optimizing adaptation at regional level are in place.	Output 3.2.2 Regional mechanism for adaptation cooperation on HydroSOS established and operational. Periodic review and update of the mechanism is agreed on by riparian states.	
8. Project/Programme Execution cost			950,000
9. Total Project/Programme Cost			11,150,000
10. Project/Programme Cycle Management Fee charged by the Implementing Entity (if applicable)			940,000
Amount of Financing Requested			12,090,000

Project Duration: 4 years (48 months) (proposed start from May 2024, mid-term evaluation- May 2026, project closing and final evaluation around June 2028)

PART II: PROJECT / PROGRAMME JUSTIFICATION

A. Describe the project components, particularly focusing on the concrete adaptation activities, how these activities would contribute to climate resilience, and how they would build added value through the regional approach, compared to implementing similar activities in each country individually.

There is a need for better, more effective and coherent regional, national and local strategies and decision-making frameworks to address water related climate resilience challenges in the GBM riparian countries. These challenges are being exacerbated by a changing climate, deterioration in socio-economic and environmental conditions and unplanned development. It is thus vital that the GBM basin is better understood through a regional project which provides opportunities to share experiences, and address knowledge gaps. Such a project will be useful to manage water resources, extreme events linked to climatic impact in a transboundary management framework and in an environment of mutual trust and confidence. The project partners propose to design and implement a large-scale, concrete and cooperative system allowing integration of relevant knowledge on quantitative and qualitative aspects of water resources and offer services and decision-making support to the end-users. This system (technical development, services delivery, support activities) will be worked out in close cooperation with the national and local partner as well as with the community beneficiaries through stakeholder engagement practices. This will improve livelihood support and contribute to increased adaptive capacity and resilience to climate change related events.

Until now, very little focus is found on determining the cost-effectiveness of climate change adaptation interventions across the GBM Basin as a whole. As a result, there is limited baseline information to be used for comparative analyses of approaches which are sustainable and replicable across the entire GBM region. In the HydroSOS BaNe project in Bangladesh and Nepal, new solutions will be implemented to improve risk reduction and climate change adaptation. Special attention will be given to promote community of users, guidance material, decision-support tools, online training, use of social networks and crowdsourcing. These solutions will be tailored according to the local needs and capacities, to account for social and cultural appropriateness. The HydroSOS End-to-End Early Warning Systems will be tested with additional climate projections to study the impact of future scenarios on spatial and urban planning and their consequences on socio-economic development.

The basin scale approach involving two countries is a suitable way to identify and implement cost-effective measures as countries in GBM region have similar challenges related to climate change events (floods and drought) that will be addressed through this project. Unfortunately, India being an upstream country has presently not provided their agreement and endorsement to join the HydroSOS project in the GBM countries. However, they will technically observe the implementation of the project activities and in future will design a HydroSOS standalone national project implementing from methodology and tools tested under this proposed HydroSOS BaNe project. The proposed project's activities under each component will promote improved coordination between regional, national and local institutions responsible for transboundary water management, disaster risk reduction and climate change adaptation. Through integration of previous knowledge and ongoing projects of the two participating countries, the planned project will ensure a) minimum overlap and b) transfer of methodologies and skills from one area to the other. A regional approach results in greater co-benefits as compared to the national one because one set of resources generates productive outcomes for two countries, which individual national projects would have achieved using more resources (human, time as well as material resources). Working at a regional level will allow the proposed project to reach several type of communities (rural, urban, semi-urban, transboundary, etc.) of the two countries with new methodologies and tools. The development and maintenance of End-to-End Early Warning System at the regional level and all related functionalities can be mutualized and shared depending on the individual needs and uses. The transboundary EWS dissemination strategies will determine the most efficient and effective ways to reach the remotest areas or the last-mile and will have broader coverage, so as to facilitate early warnings to the most vulnerable populations. The developed methodologies can be tested later at a larger scale within the basin, or easily adapted to similar types of environments at local or national level. It will thus create a community of users and will also foster integration of socio-economic and environmental risks and climate change approaches at national, regional and local levels.

A regional approach involving Bangladesh and Nepal will bring the countries to work in a more coordinated way and additionally, transboundary support and actions will allow them to share data and information on weather, climate and water resources and avoid disaster impacts on environment, social and economic services. Such regional approach will enhance cost effectiveness of capacity development (at one time participants from two countries will be involved) as well as ensuring a certain level of generic scope of tools and methodologies developed for future application beyond the pilot testing sites. Centralizing the capacity building of the Hydro-Meteorological Agencies together with the regional body will enhance cost effectiveness.

Component 1: Risk-based preparedness and adaptation to the climate variabilities and water and environmental uncertainties

The GBM region is one of the poorest around the world and carries large dependence on water resources as most are engaged in occupations such as farming, forestry, livestock, fishing. Freshwater sources which were once found to be abundant are increasingly under stress due to the twin impact of climate change and population increase. In view of the necessity to safeguard livelihoods from an increasing effect of climate change, it is essential to have an effective water resource management mechanism that protects from floods and droughts. The first component seeks to build resilience through carrying out flood and drought risk analysis integrating basin scale to the local level. It will combine transboundary water resource management strategies with innovative climate adaptive measures, disaster preparedness and capacity building programs for the target communities. Some of the key activities include comprehensive vulnerability/risk analysis to ensure representation of differential risk posed on account of gender, age, ethnicity, ecosystem, livelihood choices etc. Risk maps developed will be integrated into the decision-making process through systematic training and awareness programs from the local to national and regional level. Insights from the analysis will be used to build climate resilience by mainstreaming DRR into the development process such as effecting necessary changes in policies and programs. A key focus of the component will be incorporation of the role of gender and nature-based solutions in alleviating risk and ensuring smooth adaptation.

Component 2: Strengthening water resources management through access to hydro-meteorological information and augment regional /national capacity to monitor and assess hydro-meteorological hazards

The primary focus of the second component will be development of a) web based EWS in association with national hydro-meteorological agencies from a regional scale hydrological status/outlook platform and b) formulation and testing of concrete adaptation measures for the medium and long term. A range of activities such as data standardization, data sharing mechanism, integration of existing tools and available methods will be undertaken to develop an EWS to operate at a regional level. Based on lessons learned, concrete adaptation measures will be formulated and tested in selected vulnerable communities. The measures such as risk baked maps and their effective use to be accomplished through institutionalization of the regional cooperation framework and continual monitoring of the system to enable remedial measures to be taken.

Component 3: Water and climate resilient regional cooperation arrangements together with National and regional stakeholders, and community involvement

Presently, the GBM countries as well as at the region lacks transboundary level decision framework and strategies to overcome the challenges of the basin-wide water resources management. To increase adaptive capacity and empower people to cope with their changing environment, the development of decision-support framework can help national and local agencies to mutually understand and respond to challenges and opportunities in the GBM countries.

The project builds on a number of risk reduction master policies and plans, and adaptation measures listed in the section E and F. a large coordination effort, joint methodologies and shared tools are still needed to ensure that the results and outputs of the national projects are integrated at the regional levels as the river basins are shared between the GBM countries.

Activities of component 3 explore how coordination efforts at the regional level will be beneficial to the concerned institutions, such as the NMHSs, Disaster Management, Environmental Agencies to plan, test and improve strategies based on experience sharing.

Adaptation measures and strategies aligning with AF ESP and gender principles will be discussed at local level in agreement with local organizations and communities to increase the resilience to floods and drought. The participation and engagement of local stakeholders will facilitate the adoption of the strategies and subsequently result in long-term sustainability.

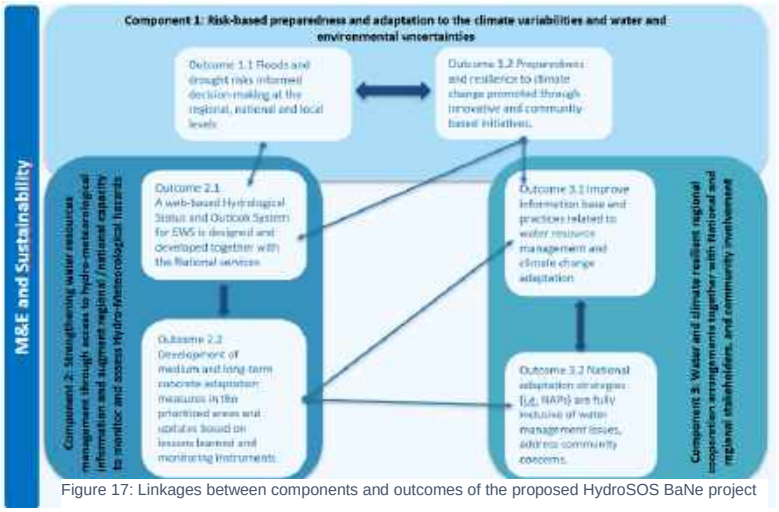


Figure 17: Linkages between components and outcomes of the proposed HydroSOS BaNe project

Project Components	Expected Outcomes	Expected Concrete Outputs	Activities planned
Component 1: Risk-based preparedness and adaptation to the climate variabilities and water and environmental uncertainties	Outcome 1.1 Floods and drought risks informed decision-making at the regional, national and local levels	Output 1.1.1 Vulnerability and exposure assessment (including gender and sector-wise analyses) and risk maps are developed for the GBM basin	Activity 1.1.1.1 Conduct a desk study (compilation of existing evidence-based past data (topographic maps, satellite images, studies of extreme events, reports of disasters, etc.) and field visits to gather available information on vulnerability and exposure for current and future climate and identify gaps or additional needs. Activity 1.1.1.2 Develop an action plan to complement gathered information on the exposure and vulnerabilities Activity 1.1.1.3 Organize stakeholder's meetings and workshops, working on risk management to select priority areas for community consultations Activity 1.1.1.4 Conduct pilot field studies (focus group discussion and semi-structured interviews) with communities to identify the multi-dimensional drivers of vulnerability and risk (social, economic, ecological, cultural, political, and infrastructural determinants of vulnerability) in Bangladesh and Nepal region highly exposed to different hydrometeorological hazards Activity 1.1.1.5 Draft the field studies reports and the GBM-atlas with the existing static information available
		Output 1.1.2 Develop capacity and awareness at the local, national and regional levels to ensure risk informed decision-making	Activity 1.1.2.1 Assess the available IT equipment (computers, servers, databases, etc.) and IT/GIS expertise at the NMHSs services and other relevant services (e.g. Geographical Institute, Disaster Management, etc.). Purchase additional equipment if necessary Activity 1.1.2.2 Create the HydroSOS information exchange IT network by connecting the existing information and data available at the national and regional services Activity 1.1.2.3 Develop the meteorological, climatological and hydrological database and create the links with the existing databases for the collected information on hazards, vulnerabilities and exposure including the main driving hydro-meteorological parameters for floods and drought events (e.g. precipitation, evaporation, water levels, temperature, soil moisture, soil type, etc.) Activity 1.1.2.4 Develop web-based flood and drought risk maps using the dynamic hydro-meteorological, environmental and static social and structural database and existing maps developed in the GBM targeted countries through the past projects (see part G for more information) Activity 1.1.2.5 Scenarios for socio-economic and environment development along with the climate change projections are collected and projected impacts on population, water resources, urban development, environment and agricultural areas are analyzed Activity 1.1.2.6 Organize training workshop for professionals related to hydrology and meteorology, disaster management, and GIS etc. to convey knowledge and improve skills needed for using risk maps Activity 1.1.2.7 Identify roles and responsibilities to the agencies and organizations forming a task team to regularly complement and improve the database and risk maps and also to monitor and report on the new updates
		Output 1.1.3 Long term risk management strategies identified and integrated into development	Activity 1.1.3.1 Design and develop the guideline presenting the whole process of risk maps development and future impacts on various sectors with examples of implementation on highly vulnerable urbans and agricultural areas

		plans (economic, social, environmental aspects)	Activity 1.1.3.2 Develop supplementary means of communication to reach a wider population (infographics, posters, videos, leaflets for schools, etc.) Activity 1.1.3.3 Organize trainings and workshops with stakeholders (representatives of communities, local policymakers, and decision makers) to disseminate the information on future climate and risk changes and to obtain additional qualitative input on potential impacts for socio-economic and environmental aspects Activity 1.1.3.4 Develop safeguard action plan for risk management at medium and long term with the output from workshops and consultations with the relevant stakeholders
	Outcome 1.2 Preparedness and resilience to climate change promoted through innovative and community-based initiatives.	Output 1.2.1 Implementation of community-based floods and drought management strategies in the vulnerable sites and in different ecosystems	Activity 1.2.1.1 Conduct participative community consultations to identify and select the appropriate local measures or equipment (non-structural preparedness tools such as early warning dissemination through loudspeakers and local radio, locally installed rain-gauge and river-gauge for hydrological data collection, marking of vulnerable houses for rapid response support, flood level marking plates to mark the previous year's floods useful for future construction of resilient houses, simulation exercises, knowledge and awareness session on disaster risk reduction, ecosystem services, climate change adaptation and drought indicators). Activity 1.2.1.2 Develop and install the local measures as identified with the communities under activity 1.2.1.1 Activity 1.2.1.3 Identification of existing or development of new local flood and drought management committees or groups Activity 1.2.1.4. Capacity building of local management committees or groups identified under activity 1.2.1.3 Activity 1.2.1.5 Development of community-based flood and drought management manual including safety and safeguard measures for preservation of natural habitats, land and soil conservation, biological diversity. Activity 1.2.1.6 Organize meetings to share knowledge and experience of added value of local measures or equipment under 1.2.1.2
		Output 1.2.2 Strengthened awareness of vulnerable communities and agencies on hydro-meteorological risks through education programs including nature-based solutions and mainstreaming gender	Activity 1.2.2.1 Organize dedicated short courses on the IUCN standards for nature-based solutions approaches and concepts for targeted beneficiaries to disseminate knowledge on natural and nature-based solutions (NbS) for flood and drought management Activity 1.2.2.2 Collect feedbacks from the workshop participants on their views and perception of NbS tools Activity 1.2.2.3 Recommend actions to increase the use of natural and nature-based solutions and environmentally friendly methodologies with the involvement of local population and aligning with the Adaptation Fund ESP principles Activity 1.2.2.4 Conduct workshops to provide support for developing project proposals (submission to the internal and external agencies in future) on implementing natural and nature-based solutions for the flood and drought events. Activity 1.2.2.5 Organize and conduct workshops on the Training Manual for mainstreaming gender in the End-End Early Warning System for Flood Forecasting (E2E-EWS-FF) and flood management with potential participants from NMHSs, local policymakers, civil authorities, women and community-based organizations etc. Activity 1.2.2.6 Collect feedbacks from the workshop participants on their views and knowledge sharing on mainstreaming gender in E2E-EWS-FF and IFM with other stakeholders Activity 1.2.2.7 Recommend actions that would improve the participation of women and other vulnerable groups into flood management and early warning

Component 2: Strengthening water resources management through access to hydro-meteorological information and augment regional /national capacity to monitor and assess Hydro-Meteorological hazards	Outcome 2.1 A web-based Hydrological Status and Outlook System for EWS is designed and developed together with the National services	2.1.1 Improved hydrological status and outlook instruments through data standardization for EWS is designed and developed	Activity 2.1.1.1 Make an inventory of the gauging stations with real-time data transfer (or pseudo real-time) in the GBM Basin and prepare descriptive sheets for each station (location, equipment, data series, etc.) Activity 2.1.1.2 Perform a field/desk study to check the availability and quality of the data and information related to runoff, rainfall and other relevant hydrometeorological and agrometeorological data and also through the flood forecasting and drought monitoring products available at each NMHSs and other relevant institutions Activity 2.1.1.3 Update the database of hydro-meteorological parameters with new information, or interconnect with existing platforms mainly through WMO Hydrohub (enhancing hydrological monitoring and data exchange) and World Hydrological Observing System (WHOS) mandate of standardization of data and information management systems. Activity 2.1.1.4 Organize training for the NMHSs staff related to data collection, calibration and maintenance of equipment following WMO standards Activity 2.1.1.5 Describe the thresholds for flood events and for drought period based on hydro-meteorological events and risk maps for various risk levels (for example, low- medium-high) through consultations with technical services and local representatives supported by evidence-based experiences. Activity 2.1.1.6 Define the values of the thresholds for floods and for drought events, at and around each gauging station, in relationship with past events Activity 2.1.1.7 Conduct the water resources assessment in the GBM region to understand the changing value of water level, water quality, in relationship with present status and past events Activity 2.1.1.8 Develop the HydroSOS products for the GBM basin based on above defined thresholds and real time and historical information available at the National level and from Satellite based products. Activity 2.1.1.9 Link the thresholds of flood and drought with the socio-economic and environmental impact
		2.1.2 Existing products and tools are integrated and visualized in the regional HydroSOS for EWS	Activity 2.1.2.1 For the areas with available forecast models in the sub-basins (e.g., Ganga, Brahmaputra and Meghna basin), create the procedure to use the outputs of the existing products and models within the network of centers producing HydroSOS jointly with the NMHSs Activity 2.1.2.2 Develop software to collect the meteorological and hydrological forecasts and to calculate the daily warning status or outlooks levels for each of the sub-basin and vulnerable areas Activity 2.1.2.3 Design and develop the interface to gather all individual warning levels on the main HydroSOS transboundary system Activity 2.1.2.4 Prepare user guide to convey all available knowledge on the interface to the various groups of users (forecasters, IT staff, decision-makers, etc.) Activity 2.1.2.5 Carry out trainings and capacity development workshops with the NMHS professionals, local/national agencies and users of the web based EWS and water resources management for using Hydro SOS. Activity 2.1.2.6 Gather feedbacks, suggestions and scope for improvements from the workshop participants Activity 2.1.2.7. In Bangladesh, upgrade integrated water resource management strategies Activity 2.1.2.8. Organize a workshop to share experiences on risk maps and hydro-SOS EWS with other GBM countries
		2.1.3 Establishment of Hydro-Climate Outlook Forums at the regional level	Activity 2.1.3.1 Identify the linkages with the existing regional Climate Outlook forum disseminating the information available with the HydroSOS Ba-Ne system Activity 2.1.3.2 Nominate members for Hydrological outlook group which could be merged with the

			climate outlook forum at the regional level Activity 2.1.3.3 Organize annual regional Hydro-climate outlook meetings with the existing and nominated members Activity 2.1.3.4 Develop guidance documents for regular coordination and meetings with the Hydro-climate outlook members
	Outcome 2.2 Development of medium and long-term concrete adaptation measures in the prioritized areas and updates based on lessons learned and monitoring instruments	2.2.1 EWS and testing of identified adaptation measures in selected vulnerable communities.	Activity 2.2.1.1 Finalize the selection of the pilot tests areas with the concerned agencies and communities on the basis of the draft list presented in Table 4 Activity 2.2.1.2 Organize meetings on each of the pilot areas to identify the roles and responsibilities of the different groups of stakeholders during the tests and present the coordination and collaboration mechanism enabling first responders to receive and use efficiently the HydroSOS early warning information Activity 2.2.1.3 Identify the good practices, challenges and limitations of products and services during the Flood and Drought events at each of the pilot testing locations Activity 2.2.1.4 Raise awareness about the pilot testing using multi-media channels Activity 2.2.1.5 Develop an action plan to further improve products and services after the pilot testing
		2.2.2 Coordination and collaboration developed at the regional, national and local level	Activity 2.2.2.1 Organize national consultative workshops (participants from local/national agencies involved in Floods and Drought management) to share the knowledge (new methodologies, concepts and tools for effective forecasting and dissemination of early warnings) from the pilot tests Activity 2.2.2.2 Based on pilot testing, update/develop coordination and collaboration standard operating procedures (SOP) for jointly preparing and responding to future flood and drought events
		2.2.3 Decision-makers are informed with key water resources management parameters for current status and sub-seasonal and seasonal outlooks	Activity 2.2.3.1 Describe the network of the relevant policy-makers responsible for floods and drought management as well as other related fields (water resources, health, agriculture, ecosystem, forestry, soil and land management.) Activity 2.2.3.2 Organize and conduct national workshops to identify the gaps and needs in existing policies and plans with special attention on safeguard actions for minimizing direct and indirect risks arising from the project activities, and to highlight the key long-term strategies for water resources management especially for flood current status and sub-seasonal to seasonal drought outlook Activity 2.2.3.3 Present the recommendations to the concerned decision-makers at the national level
Component 3: Water and climate resilient regional cooperation arrangements together with National and regional stakeholders, and community involvement	Outcome 3.1 Improve information base and practices related to water resource management and climate change adaptation	3.1.1 Best practices and experience from other region and river basins are made to ensure that existing national policies and practices are interoperable in GBM river basin cooperation framework	Activity 3.1.1.1 Conduct a desk study, and hold meetings with stakeholders, to identify the status of climate and future socio-economic changes in the transboundary governance plans, policies and guidelines for flood and drought management in Bangladesh and Nepal Activity 3.1.1.2 Develop a short report underlining the strengths together with the identified gaps and additional needs related to climate and development impacts in the GBM regional Activity 3.1.1.3 Organize and conduct national and regional workshops to review, propose update and implementation arrangements on existing plans, policies and guidelines on water resources management and climate change adaptation in the GBM Basin. Activity 3.1.1.5 Propose long-term actions for strengthening resilience and capacities at transboundary, national and local levels to be implemented by NMHSs and the other regional agencies

			Activity 3.1.1.6 Collect feedbacks, suggestions and recommendations from the workshop participants on the links between activities of National Programmes Activity 3.1.1.7 Identify roles and responsibilities of the individual organizations and define the coordination mechanism to improve the implementation of the water resources management and climate change adaptation measures
		3.1.2 Analysis and optimization of benefits of regional water and climate adaptation action.	Activity 3.1.2.1 Conduct consultation with national stakeholders to gather examples of best practices and approaches for water resources management, flood and drought risks reduction and climate adaptation related measures Activity 3.1.2.2 Draft report on recommendations for improving regional water and climate adaptation action. Activity 3.1.2.3 Organize the dissemination of the report to policy-makers and decision-makers
	Outcome 3.2 National adaptation strategies (i.e. NAPs) are fully inclusive of water management issues, address community concerns. Methodology and mechanism for leveraging and sharing benefits of optimising adaptation at regional level are in place.	3.2.1 An inclusive process is developed to ensure that National adaptation strategies explicitly address water relevant instruments and strategies. Inclusive approaches are operational to include local communities.	Activity 3.2.1.1 Prepare/suggest updating of framework for adapting the National adaptation strategies with safeguard actions on long term water resources management, climate change adaptation and disaster risk reduction with local stakeholders Activity 3.2.1.2 Conduct community-based workshops with agencies, local communities/ organizations and other relevant stakeholders to identify and prioritize adaptation measures Activity 3.2.1.3 Collect feedbacks, suggestions and recommendations Activity 3.2.1.4 Propose action plans at local and national levels to review and improve the National Adaptation strategies together with the local communities
		3.2.2 Regional mechanism for adaptation cooperation on HydroSOS established and operational. Periodic review and update of the mechanism is agreed on by riparian states.	Activity 3.2.2.1 Organize and conduct workshops to disseminate the results of Hydro-SOS EWS and associated products on climate adaptation for the GBM Activity 3.2.2.2 Collect feedbacks, suggestions and recommendations from the workshop participants on the links between activities of National Programmes and the HydroSOS BaNe project Activity 3.2.2.3 Identify roles and responsibilities of the individual agencies or organizations and define the coordination mechanism to review and update the implementation of the climate change adaptation measures based on good practices identified in the GBM riparian countries.

B. Describe how the project /programme would promote new and innovative solutions to climate change adaptation, such as new approaches, technologies and mechanisms.

The development and implementation of a free, open-source, and sustainable Hydrological Status and Outlook System (HydroSOS) BaNe will aim at augmenting operational capabilities of National Meteorological and Hydrological Services and the institutions in charge of water planning and management and disaster risk reduction. The aim will be to develop an innovative system operating on a daily, weekly and monthly timescales capable of providing: 1) An indication of the current basin-wide hydrological status (including: groundwater, river flow, soil moisture, cryosphere); 2) An appraisal of where this status is significantly different from 'normal' (for example, indicating drought and flood situations); 3) An assessment of where this is likely to get worse over coming months and season. HydroSOS BaNe will bring together existing tools and approaches to develop composite products of hydrological and meteorological status and outlook through the implementation of the WMO HydroHub (enhancing hydrological monitoring (through the uptake of innovative technologies and approaches) and building capabilities) and World Hydrological Observing System (WHOS)[47] mandate of standardization of hydrological metadata, data and information management system access and exchange. A detailed inventory of existing methodologies, equipment (hard and software), skills and operational procedures in the GBM targeted countries will be conducted to build on available tools and products.

The applicability and effectiveness of the proposed HydroSOS Ba-Ne system will be tested in various pilot sites selected by the participating countries to incorporate feedback and suggestions of end-users. Other project outcomes will include development of floods and drought risk maps using the local, national and global data and impact-based forecasting and warning services. There have been studies in the past to understand characteristics of floods and drought in the GBM basin countries. Floods can be predicted successfully with lead-time ranging from several days to even up to a few weeks by some of the countries. However, a regional approach will ensure information is shared between the respective agencies of the countries and is further developed for end-user to support timely decisions. Understanding of a slow-setting drought is in particular constrained due to lack of regional datasets and standardization in analytical methods and interconnectedness between different types of droughts namely meteorological, hydrological and agricultural. The HydroSOS BaNe project will focus on integration of various types of droughts and provide support in drought monitoring and prediction from monthly to sub-seasonal to seasonal outlooks. It will aim to standardize processes followed across countries in the basin for production of hydrological status and outlooks and ensure region wide collection, dissemination of the information for climate change adaptation measures. The most vulnerable elements of the basin; human and environmental resources such as water, fish, minerals and agriculture etc. need long lasting, innovative, and coordinated measures to ensure sustainable development of the area.

Innovations under component 1: The floods and drought risk maps, integrating environmental indicators to the impact on human and properties approaches, will be open-source and thus facilitate mainstreaming of results into other initiatives relating to floods and drought management or generally development processes in the target countries. Risk maps will be developed for both current and future projected climate changes and will be crucial for generating impact-based forecasts for example for extreme floods and drought events. Coordinating with the countries will help promote adoption of risk assessment/mapping methodologies by other countries in the GBM (South Asia in general) which are also prone to floods and drought events. Community based flood management including nature-based solutions and gender mainstreaming in the selected communities will be useful to identify and design innovative solutions relating to risks identification, adaptation measures and dissemination of warnings within communities and at local levels.
Examples of locally led adaptation actions through various HydroSOS BaNe project will include:
· Communities and individuals raising the level of houses to protect their lives and properties from flood hazards maps and awareness programme
· Building of temporary structural measures such as dikes and levees, diversion of flood water etc.
· Changing the agriculture patterns e.g., use of crops withstanding the excess water or reduced water
· Enhanced water security with a focus on innovative water distribution and storage in water scarce rural areas, including through rainwater harvesting systems, solarized water systems, enhanced household water treatment and storage.
· Promoting integrated water resource management in both drought and flood-prone landscapes through nature-based solutions such as watershed restoration, water and soil conservation measures.

Nature-based or green solutions will also be designed such as multipurpose green infrastructures, keeping in mind that they should be beneficial not only from the environmental, but also from the perspective of economic and social as well. Take for example, earmarking areas that gets flooded during heavy rains toll be used for livelihood purpose such as for temporary fishing during a monsoon period and recreational areas during dry season.

Innovation under component 2: An integrated and state-of-the-art approach to flood and drought early warning systems is an immediate priority for the GBM countries (especially Bangladesh and Nepal) where timely and relevant information are lacking for impending hydro-meteorological hazards. In these countries during a flooding situation in one part, there can be a drought in another part of the country. An integrated approach to floods and drought monitoring and early warning systems will support national forecasters to observe and generate useful early warning services to the stakeholders.

It must be underlined that the methods for producing warnings will differ depending on the characteristics of the hazard (flood or drought), as both hydrological extremes differ in their spatial and temporal distribution. Floods are relatively rapid events, caused by intense precipitation, limited in time and affecting localized areas as compared to drought. Whereas drought in contrast is a slowly developing phenomenon and might have a much-distributed impact both in area and time. On the one hand, the data needed to describe both phenomena can be partially shared, such as meteorological, hydrological and agronomical parameters. On the other

[47] https://public.wmo.int/en/our-mandate/water/whos

hand, the methodology to forecast the two phenomena varies considerably and depends on the availability of different types of meteorological forecasts (from nowcasting for short pluvial events to seasonal and sub-seasonal forecasts for drought onset). The HydroSOS end-to-end hydrological and meteorological monitoring, forecasting and disseminating system will be innovatively designed to bring together existing knowledge, tools and approaches to develop composite products of hydrological and meteorological status and outlook through the implementation of the WMO Hydrohub (enhancing hydrological monitoring and data exchange) and World Hydrological Observing System (WHOS) mandate of standardization of data and information management systems. A detailed inventory of existing methodologies, equipment (hard and software), skills and operational procedures in the GBM countries will be conducted to build on available tools and products. The proposed system will provide possibilities to receive information from the users (crowdsourcing) about their observations during the floods and drought events. The web-based early warning system will be made compatible and scalable to integrate other hazards in future, such as fire, diseases etc.

Innovative approach under component 3: The project will bring together policymakers and decision makers to review, develop and refine existing policies on water management and disaster risk management following experiences and lesson learned from the outcome of component 1 and 2. This will allow developing regional/transboundary water management and climate adaptation plans and guidelines instead of country specific ones. Flood management solutions will be designed with communities, benefiting from existing capacities and traditional knowledge, together with recent innovations and lessons learnt from similar situations. Besides, the project will provide support to land-use planning, alongside national and local authorities, taking into account national and local policies (environmental regulations, building codes, etc.), to areas at risk and help minimizing risks of disasters in coherence with local requirements.

C. Describe how the project would provide economic, social and environmental benefits, with particular reference to the most vulnerable communities, and vulnerable groups within communities, including gender considerations. Describe how the project would avoid or mitigate negative impacts, in compliance with the Environmental and Social Policy of the Adaptation Fund

The Project will be beneficial in general, providing vital support to the most marginalized section including those dependent on subsistence farming. Being one of the most poverty regions of the world, people's livelihoods in GBM basin region are critically linked to climatic variation and extremes such as flood and drought. The major economic, social, and environmental benefits are highlighted here.

Economic Benefits	Social Benefits	Environmental Benefits
● Water security/management and economic growth are closely linked, and the project envisages considerable benefits from this approach ● Availability and access to surface/groundwater will result in higher farm productivity, increase in income, creation of new assets and growth of local and regional economy. ● An effective flood and drought EWS will help in taking adaptive measures such as farm practices, crop selection/adoption, harvest timing etc. It will build resilience into livelihoods and contribute to local economy ● The GBM river plains is the food basket of the region and effective management holds the key to ensuring food security. Rice and Wheat; the main staple foods together account for over half the dietary energy; and these crops require a considerable amount of water. ● Water is an important input for other economic activities including household and commercial water use, hydropower generation and ecosystem services. The project will drive development and industrial growth in the GBM region.	● More than 10 million people will benefit in terms of access to EWS service in order to adapt to climatic variation and climatic extremes such as flood and drought ● Development of an inclusive EWS for climatic hazards will ensure participation and access of the most vulnerable groups including those with disability, women, senior citizens and children. ● Emphasis on community participation in project conception/design and project monitoring will contribute to building local network, voluntary groups, ownership/accountability and sustenance ● Inclusion and training of indigenous groups, Community based and Non-Government Organizations to carry forward the initiatives beyond project phases ● It will help deal with ongoing large scale out-migration and strengthen social institutions	● The project with its nature-based solution approach will promote appropriate adaptation measures and help maintain ecological balance for the entire basin ● Efficient water management mechanisms and corresponding practices will foster sustainability for example, through appropriate irrigation methods, crop choices etc. ● Increased understanding of climatic changes and its relationship with natural resources including water and environment ● Increased hydropower generation will contribute to reduction in non-renewable energy sources ● There will be more systematic measures to mitigate land degradation and soil desertification

● Hydropower is both economical and renewable and the GBM basin carries immense potential for hydropower development. ● Improved water management ensures access to sanitation, health and environmental sustainability. The GBM basin already under climatic stress ● The project will supplement cooperation among riparian countries leading to increased trade and navigation		

A final Environmental and Social Risk Management Plan (ESRMP) will be developed in consultation with primary stakeholders and to be submitted as part of the programme proposal. ESRMP will delve into impact analysis of the proposed project and identify potential undesirable effects so that they can be addressed with suitable measures. There will be formal mechanism available within ESRMP to report any grievances arising out of project activities directly to the project implementing authorities and funding agencies

D. Describe or provide an analysis of the cost-effectiveness of the proposed project and explain how the regional approach would support cost-effectiveness.

The proposed project is an innovative solution to deal with challenges emanating from better water resource management, disaster risk reduction and in building community resilience through increased farm income, inclusive growth, participative resource sharing and gender sensitization. The cost effectiveness analysis includes various short-term benefits such as prevention and minimization of losses from hydro-meteorological hazards, availability and access to impact based EWS. It further includes strengthening of observational networks, modeling capabilities and communication infrastructure. In the medium-term climate adaptation and disaster risk mitigation planning will be augmented through development of risk maps, irrigation facilities, climate resilient cropping, renewable energy generation, development of local economy and creation of new social institutions etc. In the long-term perspective, there will be optimal use of water resources leading to prevention and mitigation of flood and droughts, ecological restoration, formulation and implementation of policies for making communities adapt to climate changes. A regional approach is essential to bring into alignment a common and integrated approach that rests on mutual interest, common concerns, and considerable benefits for the participating countries. Transboundary river systems such as GBM Basin requires a regional approach without which effective management will be extremely difficult. On the other hand, a regional approach provides scope for data sharing on a real time basis and facilitating disaster response and execution of risk reduction measures.

HydroSOS BaNe project component	**Component Cost (US$)**	**Beneficiaries (Approximately) through the proposed project**	**Proposed project beneficiaries and benefits**	**Alternatives to proposed approach and cost**
Risk-based preparedness and adaptation to the climate variabilities and water and environmental uncertainties	3,000,000	Directly 10,000 Indirectly 1,000,000	Development of preparedness and adaptation measures based on dynamic risk assessment and risk-based plans. Differential risk identification and prioritization for vulnerable sections including gender, elderly, disabled. Capacity building at the local community level for making use of risk maps and available information Incorporation of emerging risk from climate change perspective into development planning	Disaster risk reduction measures such as dams and reservoirs for flood control and irrigation involve much higher cost, but with limited benefits and detrimental environmental consequences Conventional risk maps fail to incorporate climate change induced risks and thus will be ineffective
Strengthening water resources management through access to hydro-	6,000,000	Directly 100,000 Indirectly more than 1,000,000	Regional level data sharing will help better utilization of water resources and climate change events Regional approach is critical to	National level EWS for flood and droughts are developed separately and operate independently without being integrated at the basin scale

meteorological information and augment regional /national capacity to monitor and assess Hydro-Meteorological hazards			mitigate hydro-meteorological hazards through integrated approach to floods and drought monitoring and EWS Participation of communities in designing EWS for floods and droughts. Increasing productivity and better health and utility through access to water resources. Systematic documentation of climatic change effects and filling of gaps in existing observational network	Water resource management framework is country specific and without real time data or meta-data sharing Techno-centric EWS installed without community consultation and participation leading to lack of effectiveness and ownership
Water and climate resilient regional cooperation arrangements together with National and regional stakeholders, and community involvement	1,200,000	Directly 1 Million	Operationalization of an integrated Climate adaptation with disaster risk reduction approach at a regional and national levels Community empowerment through involvement in refining national and local policies for effective and efficient implementation of adaptation plan and development practices Sharing of knowledge and practices with other communities of the region	Disaster Risk Reduction and Climate Adaptation programs and policies executed separately without synergy and joint strategy Limited Community involvement and programs without integrating science based risk mapping and thus failing to be useful Community knowledge sharing is not provided with other neighboring countries/communities

E. Describe how the project is consistent with national or sub-national sustainable development strategies, including, where appropriate, national or sub-national development plans, poverty reduction strategies, national communications, or national adaptation programs of action, or other relevant instruments, where they exist. If applicable, please refer to relevant regional plans and strategies where they exist.

The proposed project will contribute to UN Sustainable Development Goal (SDG) target 6.5 to implement integrated water resources management at all levels, including through transboundary cooperation. It also contributes to target 1.5 in building resilience through reduction in exposure and vulnerability for climate related extreme events; target 2.4 to ensure sustainable food production through climate adaptation to drought, flooding, other disasters; and target 11.5 making human settlements inclusive, safe, resilient and sustainable. At the national level, Water Resources Strategy (WRS) and Intended Nationally Determined Contributions (INDCs) and action plan (National Adaptation Plans or NAP and National Adaptation Plans for Action or NAPA) of each country will be taken into account to ensure that project outcomes are consistent and improves water resources management and in turn, reduce flood and drought disaster risks. Regional, national and local water management policies and action plans will be reviewed to ensure that knowledge and experience gained through the project feeds back to the national development policies and plans in the area of livelihood, natural resources management, ecosystem protection, disaster risk management, climate change adaptation and human rights in relation to migration and adaptation. A specific guideline for regional entities or centers will be prepared together with the involvement of the national stakeholders with an aim to build better coordination and collaboration with different agencies of each participating country.

Bangladesh

National Adaptation Plan (2023-2050)	The project will directly support the Bangladesh NAP vision which is conceptualized based on underlying aim i.e., to reduce risk and vulnerability due to the adverse impacts of climate change, and to help fulfil Bangladesh's aspiration to become a climate-resilient nation. Ecosystem resilience in the face of climate change is core to achieving this aspiration, recognizing that ecosystems may be adversely impacted both by anthropogenic impacts and by climate change. Promoting sustainable nature-based solutions that balance economic growth and environmental sustainability has been sought as a means of ecosystem-based adaptation (EbA).
National Adaptation Programme of Action (NAPA)	The project is closely aligned with and will address several National Adaptation Programme of Action (NAPA 2005 & 2009-revised) adaptation strategies, namely Strategy 2 – Providing drinking water to communities to combat the effects of climate change (Output 1.3); Strategy 3 – Capacity building for

	integrating climate change into land-use planning, infrastructure design and conflict management (Outputs 4.1. and 4.2); Strategy 4 – Disseminating climate change and adaptation information to vulnerable communities (Outputs 2.4 and 4.2); Strategy 5 – Constructing flood shelters to cope with enhanced recurrent floods (Output 2.1); Strategy 6 – Mainstreaming adaptation into policies and programmes in different sectors (Output 4.1); Strategy 10 – Promoting research on drought, flood and climate-resilient crops to facilitate adaptation (Output 3.1 and 4.2); 11 – Promotion of adaptation to coastal crop agriculture (Output 3.1); and Strategy 15 –Exploring options for emergency preparedness measures to cope with enhanced climatic disasters (Outputs 1.1; 2.1; 2.2; 2.3; and 2.4). NAPA 2009 emphasized on four basic national security issues of Bangladesh i. e. a) food security, b) energy security, c) water security, and d) livelihood security (including right to health) and respect for local community on resource management and
Bangladesh Environment and Climate-Resilient Sustainable Development (Vision 2021)	Under the Bangladesh Environment and Climate-Resilient Sustainable Development (Vision 2021), the goal is that, by 2021, the livelihoods of Bangladesh's population will be self-sustaining through development that ensures a healthy environment and the welfare of future generations. Climate change is a specific focus of this vision, i.e.: i) climate change adaptation in the agriculture sector; and ii) mitigating the natural hazards and threats imposed by climate change. Several elements of the project are consistent with Vision 2021, including improving resilience against the increased intensity of climate-induced disasters (Outputs 1.1; 2.1; 2.2; 2.3 and 2.4) and the dissemination of climate-resilient agricultural practices (Output 3.1).
The 8th Five Year Plan (7th FYP) (2021-2025) of Bangladesh	The 8th FYP outlines new strategies, institutions and policies, while strengthening the existing ones, to complete Bangladesh's agenda of achieving the social and economic outcomes of the country's Vision 2025. Several initiatives under the 8th FYP are consistent with the project and are specifically targeted to people living in Bangladesh.
Bangladesh Climate Change Strategy and Action Plan (BCCSAP)	The BCCSAP is built upon Bangladesh's NAPA and outlines nearly 50 programmes and projects to be implemented by the country over the short-, medium- and long-term. The proposed project is closely aligned with the seven strategic areas of the BCCSAP. These strategic areas, as well as the alignment between them and the project are described below. i) Disaster management. The project will contribute to disaster management at a local and regional level. This will be achieved by developing hazard maps for Bangladesh regions that are vulnerable to climate induced natural disasters (Output 2.1) and increasing the coverage of the other disaster preparedness Programme (Output 2.2). The project will also contribute to greatly improved disaster resilience at a local level by strengthening preparedness and response actions (Output 1.2) and improving stakeholders' knowledge and skills against cyclones and floods (Output 2.2). ii) Research and knowledge management. The project will contribute to improved research and knowledge generation regarding adaptation options in communities (Output 4.2) and locally appropriate climate resilient agricultural practices (Outputs 3.1 and 4.1). iii) Capacity building and institutional strengthening. The project will improve the capacity of communities to prepare for and respond to the impacts of increasingly severe climate induced disasters (Outputs under component 1, 2 and 3) and improve agricultural productivity under climate change conditions (Outputs under component 1 and 2). In addition to this, the project will capacitate local government institutions and policy makers to promote climate-resilient approaches in the project areas and at a district level (component 3).
Bangladesh Climate Change Resilience Fund (BCCRF) Guidelines, 2010	The BCCRF provides grants for climate resilience projects in Bangladesh. The guidelines outline the criteria and procedures for accessing and utilizing funds to implement adaptation measures.
National Plan for Disaster Management (NPDM)	National Plan for Disaster Management (NPDM) 2021-2025 Action for disaster risk reduction: was prepared and is aligned with national, regional and international frameworks including Delta Plan 2100, 8th 5 Year Plan of Government of Bangladesh, SFDRR, Asia Regional Plan for Implementation of the Sendai Framework for Disaster Risk Reduction, Dhaka Declaration 2015 Plus for Disability Inclusive Disaster Risk Management. The plan places importance for disaster risk management linking with rapid urbanization and climate change, and the necessity of DRR for sustainable development, and is flexible and adaptive in cognizance of the changing nature of risks in Bangladesh.
The Bangladesh Delta Plan 2100 Formulation Project (BDP 2100)	The Government has recently adopted the Bangladesh Delta Plan 2100, aimed at gradual, sustainable development through adaptive delta management approach. The plan identifies climate change as a significant future challenge and reaffirms Bangladesh's commitment to both reducing GHG emissions as well as lays the foundation for climate adaptation initiatives for the following decades. It specifically identified 52 climate change adaptation projects for enhancing climate resilience of the delta. The project will specifically support the climate change adaptation practices and approaches

Mujib Climate Prosperity Plan, climate inclusive updated National Environment Policy (2018),	"Mujib Climate Prosperity Plan" for Bangladesh for mobilizing financing, primarily through international cooperation, for implementing renewable energy and climate resilience initiatives, thus contributing to both climate change adaptation and mitigation. The draft plan identifies several key initiatives, which focus on renewable energy, energy storage infrastructure, power grid modernization, establishing carbon market regime etc. for future-proofing locally-led adaptation outcomes, and enhancing MSMEs.
updated Standing Order on Disaster (2019)	The objective of the formulation of the Standing Orders on Disaster (SOD) is to inform all concerned about their roles and responsibilities at every stage of disaster risk management. As per the SOD, each ministry, division, department and agency will prepare its own detailed work plan to perform its responsibilities and functions efficiently as mentioned in the Standing Orders; and will take necessary measures to implement it as per their own duty and capacity. To respond to a disaster, the National Disaster Management Council (NDMC)
Sustainable Development Goals	Bangladesh has made significant progress towards achieving the SDGs, particularly in areas such as poverty reduction, education, healthcare, and gender equality. One of the prioritized goal is on Climate Change and Disaster Management: Bangladesh is highly vulnerable to climate change and natural disasters. The country has prioritized climate change adaptation and disaster risk reduction initiatives. Bangladesh has implemented various projects to enhance climate resilience, promote sustainable agriculture, and protect the environment.

Nepal

National Adaptation Plan of Nepal- water resources and irrigation	NAP Nepal has 9 priority adaptation programs. Agriculture and Food security is the top priority and accounting of water availability for irrigation is required for suitable adaptation measures. Water Resources and Energy as well as disaster risk reduction and management are also the priority programs for NAP. The irrigation systems in Nepal are largely managed by Water User Associations (WUA) which play a significant role in the management and operation of irrigation facilities at the local level.
Irrigation Policy 2013	The objective of the Irrigation Policy is to provide year-round irrigation to suitable agricultural land, develop institutional capability for sustainable irrigation management, and to enhance knowledge and skills in the irrigation sector. The policy emphasizes the importance of year-round irrigation services, service-oriented management, and cost-sharing with water users for efficiency and sustainability. The irrigation policy focuses on strategies like floodwater storage and inter-basin water transfer to address climate change impacts.
National Action Plan on Climate Change (NAPCC) June 2008.	Given the vulnerability of Nepal's water resources to climate change, efforts are being made to integrate climate change adaptation into irrigation and water resources management. This includes improving the resilience of irrigation infrastructure, incorporating climate change considerations into water allocation and planning, and promoting climate-smart water management practices.
Water Use Efficiency	Enhancing water use efficiency in agriculture is crucial for sustainable water resources management. Nepal has been focusing on promoting efficient irrigation technologies, water-saving practices, and improved water management techniques to optimize water use and minimize wastage.
National Five-year development plan (NDP) 2019-2023 - Planning Commission	Vision and Goals: The NDP sets out a vision for Nepal's development and establishes goals and targets to be achieved over the five-year period. It aligns with the broader national development agenda and priorities. Sectoral Plans: The NDP covers various sectors of the economy and society, including agriculture, energy, infrastructure, education, health, tourism, environment, and social development. It outlines strategies, policies, and programs specific to each sector to address challenges and achieve desired outcomes. Socio-economic Development: The plan focuses on promoting inclusive and sustainable economic growth, poverty reduction, job creation, and improving livelihoods. It aims to strengthen infrastructure, enhance productivity, and enhance social services to uplift the standard of living for all Nepali citizens. Regional and Local Development: The NDP recognizes the importance of regional and local development and aims to bridge regional disparities in terms of economic opportunities, access to services, and infrastructure development. It emphasizes decentralized planning and the participation of local communities and governments in the development process. Cross-cutting Themes: The NDP incorporates cross-cutting themes such as gender equality, social inclusion, environmental sustainability, and climate change adaptation. It highlights the need to mainstream these issues across sectors and ensure equitable development for all segments of society.
Agriculture Development Programs	Nepal's agricultural sector is critical for rural livelihoods. The government, along with non-governmental organizations (NGOs) and development partners, implements various programs to promote agricultural productivity, enhance market access, and provide training and technical support to farmers. These initiatives aim to improve rural incomes and food security.

Sustainable Development Goals (SDG)	Gender equality and women empowerment: Nepal is committed to promoting gender equality, women's empowerment, and the elimination of all forms of discrimination and violence against women and girls. Efforts are being made to enhance women's participation in decision-making processes and ensure equal opportunities in education, employment, and leadership roles. Sustainable agriculture and food security: Nepal is working towards promoting sustainable agriculture practices, enhancing food security, and improving the livelihoods of rural communities. This includes increasing agricultural productivity, promoting climate-resilient farming techniques, and ensuring access to markets and resources for small-scale farmers. Clean energy and climate action: Nepal aims to promote clean and renewable energy sources, increase energy efficiency, and enhance resilience to climate change. The country has set ambitious targets for expanding renewable energy capacity, promoting sustainable transport, and conserving natural resources. Sustainable cities and communities: Nepal is focusing on building sustainable and resilient cities and communities through improved urban planning, efficient infrastructure, affordable housing, and access to basic services such as water, sanitation, and transportation. Conservation of ecosystems and biodiversity: Nepal is committed to preserving its rich biodiversity, protecting ecosystems, and promoting sustainable natural resource management. Efforts are being made to conserve forests, protect wildlife, manage water resources, and promote sustainable tourism.
National Adaptation Programme of Action (NAPA) 2010, and National Framework on Local Adaptation Plans for Action 2011	The Nepal NAPA identified nine priority areas for adaptation action based on a thorough assessment of climate change impacts and vulnerability: Agriculture and food security: Addressing the impacts of climate change on agriculture, including changes in rainfall patterns, temperature, and increased frequency of extreme weather events. Water resources: Focusing on adaptation measures related to water availability, water supply, and water management in the context of changing hydrological conditions. Forests and biodiversity: Protecting and managing forests and biodiversity to enhance their resilience to climate change and to support the livelihoods of local communities. Health: Addressing the health risks associated with climate change, such as the spread of vector-borne diseases and the impact on public health infrastructure. Rural development and infrastructure: Building the resilience of rural infrastructure, including roads, bridges, irrigation systems, and other critical infrastructure. Urban areas and infrastructure: Addressing the vulnerability of urban areas to climate change impacts, including urban planning, infrastructure development, and management. Mountain ecosystems: Focusing on adaptation measures for the fragile mountain ecosystems, including glacial lakes, high-altitude biodiversity, and livelihoods of mountain communities. Disaster risk reduction and early warning systems: Strengthening the capacity for disaster risk reduction and early warning systems to respond effectively to climate-related hazards. Livelihood diversification: Promoting alternative livelihood options and income-generating activities to reduce the vulnerability of communities dependent on climate-sensitive sectors.
National Climate Change Policy, 2019	This policy outlines Nepal's strategic approach to addressing climate change. It emphasizes the need for adaptation, mitigation, capacity building, and international cooperation to reduce vulnerability and enhance resilience to climate change impacts. The policy envisions “a country spared from the adverse impacts of climate change” (p. 5) with a focus on climate justice and the linkages between environmental conservation, human development and sustainability. It addresses both mitigation and adaptation, with the adaptation component focusing on adaptation and resilience for local communities, in line with the priorities identified in the National Adaptation Programme of Action (NAPA)
National Framework on Local Adaptation Plans for Action (LAPAs), 2011	LAPA was developed, following an approach “delivery of adaptation services to the most climate-vulnerable areas and people” (p. 2). The LAPA framework aims to ensure that approaches to integrating climate change adaptation and resilience building in development efforts are bottom-up, inclusive, responsive and flexible. It outlines a process for local adaptation planning that involves sensitization, vulnerability and adaptation assessment and prioritization of adaptation options, leading to the formulation of a LAPA, which is then integrated into local planning, implemented and monitored (Government of Nepal, 2011c).
Water resources policy, 2019	The policy entails three different levels of government to ensure clarity in the role and responsibilities for use, allocation and development of water resources through legal instruments, policy measures and institutional development. It focuses on water auditing & water accounting and guidance to be followed by the IWRM river basin offices

Water Resource Strategy 2002	The Water Resources Strategy was formulated based on policy principles that prioritize the adoption of Integrated Water Resources Management (IWRM) principles, emphasizing resource conservation and environmental protection by holistic management of river basins. The water resource strategy aims to achieve multiple objectives, including reducing poverty, providing access to safe water and sanitation, ensuring food security, generating hydropower, meeting industrial needs, facilitating water transport, protecting the environment, and preventing water-induced disasters.
National Water Plan 2005	The National Water Plan 2005 operationalizes Water Resources Strategy, 2002 aiming to achieve goals of economic development, poverty alleviation, food security, and environmental protection. It is a framework that guides stakeholders for development and management of water resources and services. The short, medium and long-term action plans for the water sector has been developed through this plan.
Disaster Risk Reduction National Strategic Plan of Action (2018-2030)	This is the planning framework that covers the entire cycle and stages of disaster risk management. The plan is prepared in line with the Sendai Framework on Disaster Risk Reduction declaration for 2015-2030 and Sustainable Development Goals for 2015-2030.
National Disaster Risk Reduction Policy,2017 (2075)	The long-term vision of this policy is to contribute to sustainable development by making the nation safer, climate adaptive and resilient from disaster risk. The policy includes the increase in awareness, monitoring of natural and non- natural disasters, climate change adaptation, development of a multi-hazard early warning system for forecast based preparedness and response plan and also encouraging the regional /international agencies for rehabilitation after disaster.
Water Induced Disaster Management Policy, 2015 (2072)	It emphasizes water-induced disaster management programs to be aligned with IWRM principle and the river basin development concept; a master plan at national level and at local level to be formulated; and to be prioritized according to short term, medium term and long-term perspective and implemented with active community participation. Provision for classification of land based on effects of flood, landslide and mechanism to identify its use for settlement, economic activities and agricultural purpose.

F. Describe how the project meets relevant national technical standards, where applicable, such as standards for environmental assessment, building codes, etc., and complies with the Environmental and Social Policy of the Adaptation Fund.

Relevant social and environmental concerns, laws/regulations, enforcing agencies, and enforced/regulated items in Bangladesh and Nepal will be reviewed and considered during the design and implementation of the project activities. Some of the laws or acts are provided below:

Environmental Act or Law • Environmental Conservation Act, 1995 • Environment Conservation Rules,1997 • Environmental Court Act, 2000 • The Local Government Ordinance, 1983 and Bangladesh Environmental Conservation Act, 2010	This act focuses on the conservation and protection of the environment in Bangladesh. It addresses various environmental issues, including pollution control, hazardous substances, environmental clearance for development projects, and environmental offenses. Also, Bangladesh Environmental Conservation Act, 2010 which focuses on the conservation and protection of the environment in Bangladesh. It addresses various environmental issues, including pollution control, hazardous substances, environmental clearance for development projects, and environmental offenses.
Bangladesh Meteorological Act, 2018	An act to make provisions for the purpose of issuing accurate meteorological and climate forecasts on timely basis, combating and reducing meteorological disaster, protecting public life and property, proper use of climate resources and making meteorological services strong, consolidated, target-oriented and updated
Bangladesh Climate Change Trust Fund (BCCTF) Act, 2010	This act established the BCCTF, which provides financial resources for implementing climate change projects and programs. The fund supports adaptation and mitigation initiatives at the national and local levels.
Labour Act or Laws, 2006	This act governs various aspects of employment and labor relations in Bangladesh. It covers matters such as working hours, wages, occupational safety and health, labor welfare, trade unions, and dispute resolution mechanisms.
Disaster Management Act	Disaster Management Act 2012 and National Disaster Management Policy 2015
Wildlife (Conservation and Security) Act, 2012	This act provides legal provisions for the conservation and protection of wildlife in Bangladesh. It regulates hunting, trading, and possession of wildlife, and establishes penalties for offenses related to wildlife conservation.

Forest Act, 1927	This act governs the conservation, management, and utilization of forests in Bangladesh. It covers aspects such as forest management, timber harvesting, wildlife protection, and community forestry.
Bangladesh water act 2013 and Bangladesh national water policy 1999	The Bangladesh Water Act of 2013 addresses various aspects of water management in the country. It provides a comprehensive framework for the regulation, conservation, and equitable distribution of water resources. The act aims to ensure sustainable use of water, promote integrated water resource management, and establish a system for resolving water-related disputes. Bangladesh National Water Policy of 1999 serves as a guiding document for water governance and development strategies. It emphasizes the need for efficient water allocation, pollution control, and conservation measures, while considering the social, economic, and environmental aspects of water management. Both the Water Act and National Water Policy play significant roles in shaping Bangladesh's approach to water resource management.

Nepal

Environment Protection Rules, 2020 (2077)	This act provides the legal framework to protect the fundamental right of each citizen to live in a clean and healthy environment, provide the victims with compensation by the polluter for any damage resulting from environmental pollution or degradation, maintain a proper balance between environment and development, mitigate adverse environmental impacts on environment and biodiversity and face the challenges posed by climate change in Nepal. It addresses issues such as pollution control, environmental impact assessment, waste management and natural resource conservation. It focuses on sustainable management of the environment with suitable mitigation measures and effective environmental management plans. The regulation has defined a list of projects/activities whether Brief Environmental Examination, Initial Environmental Examination (IEE) or Environment Impact Assessment (EIA) is required. Detailed methodologies for scoping, Terms of Reference, public hearing and reporting mechanism of environmental studies.
Forest Act, 2019 (2076)	This act governs the protection, conservation, and utilization of forests in Nepal. It regulates activities such as forest management, timber harvesting, community and other forests, conservation of wildlife, environment, watershed and biodiversity.
National Women Commission Act, 2017 (2074)	It formulates and implements necessary programs for protection and promotion of the rights and interests of women and to ensure gender justice through the empowerment of women & end all forms of violence and discrimination against women
National Natural Resources and Fiscal Commission Act, 2017 (2074)	Legal mechanism for mobilization of natural resources, revenue distribution and grant to three tiers of government in Nepal.
National Dalit Commission Act, 2017 (2074)	It seeks to conduct study and research on the prevailing legal provisions relating to the Dalit for the protection and promotion of the rights, interests and the empowerment of the Dalit Community,
The Social Security Act, 2075 (2018)	It makes necessary provisions on the protection of the right to social security of the indigenous citizens, incapacitated and helpless citizens, helpless single women, citizens with disabilities, children, citizens who are unable to take care themselves and citizens belonging to the tribes on the verge of extinction
National Parks and Wildlife Conservation Act, 1973	This act establishes national parks, wildlife reserves, and conservation areas in Nepal. It provides legal provisions for the protection and conservation of wildlife, their habitats, and biodiversity.
Water Resources Act, 1992 (2049) Water Resources Regulations, 1993 (2050)	This act regulates the development, utilization, and management of water resources in Nepal. It covers aspects such as water rights, priority order for utilization of water resources, licensing, water quality control, irrigation, hydropower generation, and flood control. This regulation has a mechanism of District Water Resource Committee for licensing of water resources and provision of Water Resources Utilization Inquiry Committee for dispute management.
National Disaster Risk Reduction and Management Act-2017	To protect human lives and properties of the public, private and individual from natural and non-natural disasters by effective disaster risk and management. National Disaster Risk Reduction and Management Authority is established, and disaster management is a

	shared responsibility of three tier of Government. Rights, Functions and Duties of Province Disaster Management Committee, District Disaster Management Committee, Local Level Disaster Management Committee are clearly defined.
Irrigation Regulation-2000 (2056)	Provision for registration of irrigation water user's association for construction, management and operation of irrigation systems. Rights, duties and function of irrigation water user's association defined and provision on collection of irrigation service fee. Provision of water allocation to farmers based on water availability on source.

G. Describe if there is duplication of project with other funding sources, if any.

The project will ensure that its products and tools build on existing resources, infrastructures and services available at the national and local level and thus avoid duplication. Some of the existing National level activities (Hydro-Meteo monitoring, forecasting and warning services by the National Meteorological and Hydrological services of the targeted countries) will be considered and data and outputs will be integrated into the proposed HydroSOS system. Synergies and complementarities will be established with completed and on-going regional and national projects such as WMO HYCOS-HKH, Regional flood outlook for the Ganges and Brahmaputra river basins developed by ICIMOD, South Asia Flash Flood Guidance System (SAFFGS), IUCN BRIDGE GBM etc. A preliminary list of national activities and projects are mentioned under Annex 2.

Table 1: Other ongoing or planned projects and programmes in the region

Projects/Objectives	Objectives/Description	Possible Synergies/Complementarities
- GEFID 10207 Building climate resilient livelihoods in vulnerable landscapes in Bangladesh (BCRL) ☐ EWS; institutional capacity building etc. https://www.thegef.org/projects-operations/projects/10207	The overarching objective of this project is to improve the resilience of people, communities, and ecosystems to climate change, and improve livelihoods through increased value addition in the agricultural food systems of Bangladesh. Outcome 1.1: Technologies and innovative solutions piloted or deployed to reduce climate-related risks and/ or enhance resilience Outcome 1.2: Innovative financial instruments and investment models enabled or introduced to enhance climate resilience	Both projects will be able to learn from each other in terms of experiences and challenges, especially as stakeholders and partners will be invited to participate to the advisory committee of the HydroSOS BaNe project. A part of the results and methodologies of GEF BCRL project will be complementary to the HydroSOS BaNe project as both projects aim at improving early warning: the type of information provided by the early warning system (EWS) could be integrated into HydroSOS EWS. The methodology for climate resilient crops warnings proposed in GEF BCRL project could be linked to HydroSOS similarly to an experiment on one of the pilot sites. Adaptation solutions of GEF BCRL to improve the resilience of communities and their livelihoods could be integrated while developing Components 1 and 2 and some of them could be further transferred in the different regions of the GBM Basin. Additionally, FAO could be one of the stakeholders to receive sub-seasonal to seasonal warnings and can take an active role into the dissemination of information with a wide range of local stakeholders (farmers groups, insurance company, private companies, etc.), including decision-makers from national/local agencies responsible for Flood and Drought Management.
- GEFID 10727 Managing Watersheds for Enhanced Resilience of Communities to Climate Change in Nepal (MaWRiN) ☐ WRM (floods, droughts etc.), NBS etc. https://www.worldwildlife.org/projects/managing-watersheds-for-enhanced-resilience-of-communities-to-climate-change-in-nepal-mawrin	The objective of this project is to enhance climate resilience of Indigenous people and local communities in the Marin watershed through nature-based solutions and livelihood diversification. The proposed requested GEF funding will help increase the resilience of the local communities of the Marin watershed in the face of long-term climate change and associated hazards such as landslides, floods, droughts and forest fires by reducing vulnerability, increasing adaptability, and improving the transfer and expansion of locally appropriate nature-based solutions.	This National project in Marin watershed of Nepal will be screened and synergies will be developed on the work proposed on improving vulnerabilities, increasing adaptability and NbS solutions in Nepal by developing implementation partnerships and using the methodologies and approaches proposed by the MaWRiN project partners possibly to other regions of Nepal and Bangladesh. WWF being technical partner of WMO will be invited to join as the technical partners or part of the advisory committee of the proposed HydroSOS BaNe
- GEFID 6989 Developing Climate Resilient Livelihoods in the Vulnerable Watershed in Nepal	To develop climate resilient community livelihoods through integrated watershed management practices	Improved planning and management of water resources will help the communities in increasing their livelihood and (agricultural) production. The

☐ WRM (floods and droughts) https://www.thegef.org/projects-operations/projects/6989	Outcome 1.1: Technologies and innovative solutions piloted or deployed to reduce climate-related risks and/ or enhance resilience Outcome 1.2: Innovative financial instruments and investment models enabled or introduced to enhance climate resilience	HydroSOS BaNe project will provide necessary information on floods and drought EWS and indicators, making the beneficiaries have timely knowledge and awareness on the impending events. The resilience approaches and methodologies of GEF project could be shared and integrated in the pilot testing locations of other countries of the HydroSOS BaNe.
- GEFID 4551 Community Based Flood and Glacial Lake Outburst Risk Reduction ☐ Climate disaster (glacial Lake outburst flood) https://www.undp.org/nepal/projects/closed-community-based-flood-and-glacial-lake-outburst-risk-reduction-project	The objective of CFGORRP is to reduce human and material losses from Glacier Lake Outburst Flooding (GLOF) in Solukhumbu district and catastrophic flooding events in the Terai and Churia Range. For achieving this objective, the Project has been streamlined into two main components. Component I (GLOF) is specifically aligned towards reducing GLOF risks arising from Imja Lake, and Component II (Flood) aims to reduce human and material losses from recurrent flooding events in the four flood prone districts of Terai. Approximately 96,562 vulnerable people will directly benefit from this project.	The HydroSOS BaNe project will fully benefit from the efforts of CFGORRP project in Nepal which is strengthening the Glacier Lake Outburst Flooding (GLOF)observation and warning services in pilot districts of Nepal. The output of CFGORRP will be integrated into the HydroSOS EWS and will be utilized by the national agencies together with other global and locally development products for riverine and urban floods. If Glacier Lake Outburst Flooding (GLOF) observation and warning products and services is found effective, it will be expanded to cover also other vulnerable regions of Nepal and Bangladesh.
Integrated River Basin Management (IRBM) in the Hindu Kush Himalayas (HKH) Region/ICIMOD https://www.icimod.org/event/integrated-river-basin-management-in-the-hindu-kush-himalaya/	The overall goal of the Hindu Kush Himalaya-HYCOS project was to contribute to protect lives, livelihoods, property of vulnerable communities, and infrastructure by enhancing flood risk management capacity in the region. For that purpose, the project aimed at establishing a framework for regional cooperation that ensured efficient collection and real-time transmission of hydrometeorological data and the sharing of information for integrated hydrological information systems and aspects of transboundary flood management within the Indus River basins. The data is available on a real time basis from This initiative is preparing focused basin reports on three river basins – Indus, Ganges, and Brahmaputra – to provide recommendations for elevating river basin governance in the HKH. Also, Training mid-level and senior practitioners across HKH region in IRBM	The HydroSOS BaNe project will benefit from the IRBM-HKH methodologies and tools used for providing recommendations for elevating river basin governance in the HKH and the capacity building activities. Most of the results obtained during IRBM-HKH will be integrated into various activities of HydroSOS BaNe. Indeed, the trained groups of people of IRBM-HKH project will be contacted and involved in the development of the Transboundary HydroSOS EWS and also in the governance related activities leading to tailored and sustainable strategies for managing climate change extremes and integrated river basin management for water, energy, food, and ecosystem security. The HydroSOS BaNe project will collaborate with ICIMOD to gain technical expertise in identify the needs and proposing adequate early warning solutions for GLOF, Snow Melt related floods to be possibly included in the future into the HydroSOS EWS system.
Regional Mainstreaming Water Resilience in Asia and Pacific/ADB https://www.adb.org/projects/55064-001/main	Capacity building to enhance water security and resilience in Asia and the Pacific. It seeks to support a) increased climate resilience in water projects, programs, and policies by facilitating a shift toward climate-resilient and low-carbon development; (b) use information and communications technology (ICT), digital and remote sensing technologies, and innovations.	Component 2 of the HydroSOS BaNe project will build on the existing water resources monitoring and flood forecasting capacities and integrate the output of the early warning into HydroSOS EWS. This ADB project provides experiences on the challenges, and lessons learnt during the implementation phase of a climate resilience development and address also the issues of the sustainability of the water security. The proposed project team will have consultation to identify synergies and complementarities between activities. Standard Operating Procedure (SOP) will be developed by the proposed project for the sustainability where it could be helpful for the increased climate resilience in water projects, programs, and policies by facilitating a shift toward climate-resilient.

Coastal Resilience through Nature-Based and Integrated Solutions in Asia Pacific (Bangladesh) https://www.adb.org/projects/54212-001/main	Building coastal resilience in Asia-Pacific requires adopting long-term and integrated planning approaches. Given their potential benefits, nature-based solutions are to be considered as part of integrated plans combining grey and green solutions and soft measures such as awareness raising, policy making, land use planning and early warning.	The integrated planning approaches developed through the project favor adaptive management, a risk-based approach, inclusive processes, and consider the full spectrum of coastal resilience in Bangladesh. HydroSOS EWS will ensure the tools and products developed water risk and adaptive management designed and implemented will be assessed and will be integrated in the HydroSOS EWS.
Regional Flood Information System/HKH Hydrological Cycle Observation System (HKH-HYCOS), ICIMOD https://www.icimod.org/initiative/hycos/ https://hydrohub.wmo.int/en/projects/Himalayan-HYCOS	It aims at flood management through data sharing from 28 hydro-meteorological stations including the GBM region	Component 2 of the HydroSOS Ba-Ne project will build on the existing flood forecasting capacities at ICIMOD and integrate the output of the RFIS into the HydroSOS EWS so that the national forecasters from the meteorological and hydrological services could use it for analyses with other global and HydroSOS products output.
South Asia Water Initiative/World Bank https://www.worldbank.org/en/programs/sawi	SAWI supported climate resilience and sustainable, fair, and inclusive development by: - strengthening awareness and knowledge about regional water issues; - enhancing technical and policy capacity, - supporting dialogue and participatory decision processes to build trust; and - scoping and informing World Bank investments. SAWI worked in the Indus, Ganges and Brahmaputra River basins and in the Sundarbans wetlands, shared by Bangladesh and India. Together, SAWI activities spanned seven countries: Afghanistan, Bangladesh, Bhutan, China, India, Nepal and Pakistan.	The output of the completed SAWI project in Nepal and Bangladesh such as Strategic Basin Planning, Nepal Water Platform, River Management Improvement Bangladesh, Basin modeling and Strengthening Hydro-met Services and DRM in Bangladesh will be reviewed and utilized in the implementation of component 1, 2 and 3. The lesson learned and implementation challenges from the SAWI will not be replicable during the HydroSOS BaNe project. The World Bank will be invited during the inception phase of the project to follow the implementation as well as to ensure the methodologies, tools and products are scaled to cover other region of GBM Basin or in South Asia and South–East Countries.
ADB funded Water resources project preparatory Facility/ Expansion of coverage areas for flood control infrastructure, irrigation and drainage areas https://www.adb.org/projects/45206-001/main	A detailed study for high priority water resources projects undertaken; (ii) environmental, social, and technical capacity of the Department of Water Resources and Irrigation (DWRI) improved; (iii) Irrigation Master Plan updated; and (iv) efficient project management.	The ADB funded project is also planning to setup various water resources infrastructures for floods and droughts in the Nepal region. As the HydroSOS BaNe project is not going to implement any structural flood control measures, Component 1 of the HydroSOS BaNe project will develop risk maps and ensure to have details of these water resources infrastructures for improving resilience and capacities of the communities to the climate change events.
Strengthening Integrated Flood Risk Management: Nepal Flood Risk Sector Assessment/ADB Funded https://www.adb.org/projects/52014-001/main	To strengthen Integrated Flood Risk Management (IFRM) solutions, enhancing knowledge and application of IFRM strategies in DMCs. It will provide and promote holistic IFRM solutions, including basin-scale and nature-based solutions.	The proposed project will build on the work carried out by the ADB funded on IFRM solutions designing as both the project is proposing the IFRM strategies for to maximize net benefits from the use of flood plains and minimizing loss of lives, property damage and impact to environment that may include nature-based and other soft approaches. The HydroSOS BaNe project will assess the technical assistance provided to the participating countries and build on the results to ensure baseline information and solutions designed/proposed are considered during the initial implementation phase especially for component 1 and 2.

Irrigation and Water Resources Management Project Telemetry System	Establishment of hydrometric stations equipped with telemetric systems on major rivers, tributaries and key precipitation recording locations for management of water distribution systems on the basis of real time data.	The HydroSOS BaNe EWS project will integrate the real-time data and information from the hydrometric system installed on major rivers, tributaries and other areas for visualization and as well as for hydrological model inputs for developing forecasting and early warning services in the targeted project countries.
Regional flood outlook for the Ganges and Brahmaputra River basins developed by ICIMOD https://library.wmo.int/doc_num.php?explnum_id=4701	The project aimed at improving regional cooperation on flood risk management including the installation and operation of 30 upgraded hydrometeorological stations in four countries (Bangladesh, Bhutan, Nepal and Pakistan) and the facilitation of real-time data transmission using state of-the-art technology. Establishment of regional and national flood information systems to share real time data and information and increase lead time of flood forecasting.	The HydroSOS-BaNe will build collaboration with ICIMOD for sharing of the data and information from the operational stations and database for the development of the HydroSOS products and EWS. Also, the ICIMOD regional flood information system could be linked or integrated within HydroSOS EWS to receive the real time flood forecasting information (jointly with hydrological processes) to support in the decision-making processes for early warning and early action at the local levels.
South Asia Flash Flood Guidance System (SAFFGS) https://community.wmo.int/en/south-asia-flash-flood-guidance-system-sasiaffgs	It is part of a global FFGS which currently provides flash flood early warnings to three billion people. Participating countries of SAFFGS are Bhutan, Bangladesh, India, Nepal and Sri Lanka.	FFGS is developed by US-based Hydrologic Research Centre with financial support from USAID and the World Meteorological Organization (WMO). SSAFFGS is presently operational in South Asia and HydroSOS BaNe project will use the flash flood related data and products for development HydroSOS EWS for stakeholders at the local levels.
IUCN BRIDGE GBM project https://www.iucn.org/our-work/region/asia/our-work/water-and-wetlands/bridge-ganges-brahmaputra-meghna-river-basins-bridge-gbm#:~:text=The%20BRIDGE%20GBM%20project%2C%20facilitated,and%20Governance%20(BRIDGE)%20programme	It aims to build the capacity of a network of Civil Service Organizations (CSOs) in the GBM region to enhance their engagement in transboundary water management issues. The BRIDGE GBM project falls under the umbrella of the global Building River Dialogue and Governance (BRIDGE) programme.	The HydroSOS BaNe project will check and involve the relevant CSOs from Bangladesh and Nepal to participate in the design and implementation of various proposed activities such as risk maps, community-based flood and drought management, pilot testing of the HydroSOS EWS, local collaboration for developing policies and plan etc. This will ensure existing capacities, lesson learned, and good practices are utilized and enhanced with updated or new tools, products etc. for the management of floods and drought.
Building Resilience to Climate Hazard - Pilot Program for Climate Resilience (PPCR-BRCH)	The objective is to provide the accuracy and timely weather and flood forecasts and warnings for climate- vulnerable communities through capacity building, establishment of advanced data collection technologies and enhanced modeling techniques.	The real time data collected from the stations can be used to develop models in data scarce basins, its testing and performance analysis.
Bagmati River Basin Improvement Project https://www.adb.org/projects/43448-013/main	Flood forecasting & early warning systems MIKE model was developed. Additional support being provided under TA to enhance the model performance and a NGO recruitment in process under BRBIP-AF to strengthen the earlier trained communities.	BRBIP project supports the HydroSOS project for evaluation of the baseline study of the flood EWS in Bagmati River, compare the performance of MIKE model Flood Forecasting and Early Warning to HydroSOS EWS. The flood affected communities can be trained for flood and drought adaptation measures.
Priority Based River Basin Flood Risk Management Program (PRBFRMP) https://prbfrmp.dwri.gov.np/about-us/introduction	Output 1. Improved flood protection infrastructure. Output 2. Enhanced flood forecasting and response systems. Support the government and communities in flood-prone areas to improve early flood warning systems through (i) installing about 40 rain gauges and 30 hydro meteorological stations, (ii) developing about 5 flood forecasting and early warning systems (FFEWS), and (iii) improving maintenance of	The PRBFRMP has focused to improve flood forecasting and early warning system in 5 Small River Basins: (i) Bakraha.; (ii) Mawa Ratuwa; (iii) Lakhandei; (iv) Mohana Khutiya and (v) East Rapti. These basins are prone to flooding during monsoon and facing drought during the winter. The HydroSOS thus developed can be tested for flood EWS and drought in data scarce small basins.

	FFEWS. Output 3. Improved flood prevention and preparedness capacity.	

If applicable, describe the learning and knowledge management component to capture and disseminate lessons learned.

A repository of project's technical reports, voices from the fields, training manuals and guidelines will be developed and made accessible to all. Innovative knowledge products and skills developed through the project will be communicated to respective stakeholders of the targeted countries, across the South-Asian countries and beyond. The medium of communicating these outputs will be the project website, social media channels, national and international workshops/seminars etc. Several experience sharing field visits with the neighboring countries will be organized for the national and local level stakeholders.
Knowledge management tools and platforms including community of practices (CoP) will be developed for sharing experience and storing project documents, reports etc. It will also be ensured that the methodologies adopted, and human resources trained (from both the agencies and communities) remain a support for other actors and stakeholders in developing floods and drought risks maps, climate change scenarios, community-based initiatives and HydroSOS of their respective countries (and also in regions outside of the GBM basin) through national investments or international funding mechanism.

H. Describe the consultative process, including the list of stakeholders consulted, undertaken during project preparation, with particular reference to vulnerable groups, including gender considerations, in compliance with the Environmental and Social Policy of the Adaptation Fund.

A preliminary joint national assessment and consultation studies were conducted in the targeted countries with the NMHSs and other concerned authorities during the year 2020 with an aim to better understand their current capabilities, needs and priorities for effective management of water resources and climate extremes in the GBM countries. Even though there were travel restrictions in these countries due to the covid-19 pandemic, the project team organized vulnerable community visits (with local level associations, women, youths, minor and vulnerable groups, at various sites of the basin to understand current needs and examine benefits of the project outputs and services), regional virtual consultation meeting, two day hybrid regional workshop and national consultation workshops with the National stakeholders to present and finalize the project activities and collect missing and additional information such as user requirements to investigate and discuss benefits and functionalities (types of information, forms of warning etc.), selection and finalization of the sites for the pilot testing of the HydroSOS-GBM products, inputs on social and environmental risks, role and responsibilities of the national agencies, etc. In the next phase of the project development, several face-to-face consultations are planned with the national and regional entities including conducting of social and environmental impact assessments.
The community-related consultation also provided the opportunity to get feedback from more than 100 individuals consisting of marginalized, vulnerable and women groups (check the minutes of meeting of the vulnerable community visits) about the issues and needs related to the existing early warning system and the future proposed HydroSOS early warning system envisaged by WMO and national partners (Annex 2 add- the demo HydroSOS screenshots available here https://eip.ceh.ac.uk/hydrology/HydroSOS/portal/ . The proposed functionalities (type of information, forms of warning, dissemination channels, etc.) and benefits of the HydroSOS products and service were discussed with the participants so that their views, suggestions will be acknowledged and incorporated in the final design and development of the web-based early warning system.

Total consulted citizens (Individuals of vulnerable, marginalized and minority communities including women) through focus-group discussions and semi-structure interviews: 100; Number of female participants: approximately 40% are from Government or community associations and NGO's (including women groups): 10
Additionally, the consulted members suggested further requirements for enhanced floods and drought management at the local level including better sourcing; access and delivery of the early warning information to every section of the communities (potentially have last-mile connectivity), timely support to vulnerable individuals, rain-gauge and river-gauge instruments for local forecasting, loudspeaker (megaphone) and radio for early warning information dissemination.

Some of the main outcomes of the citizen consultations are summarized as below:

- Riverine floods in the downstream agriculture areas are generating negative impacts. There is a need to develop local capacities to manage the agricultural production between the floods to ensure food security and adequate income. The requirement is timely information on the climate change events its variabilities and information on adaptation measures.
- Flood events are occurring faster than before and the conventional is no longer effective, endangering lives of people and their livelihoods.
- A new mode of early warning communication system is required for increasing self-help capabilities, preparedness and response measures. Internet connectivity is available with mobile phones and similarly local radio network can be useful for communication.
- Access routes to the schools, offices, jobs centers are inundated during the flood events, reducing the capacities of people to have regular and economical activities.
- Gender sensitive approach of the proposed project will provide capacity development and sustainable functioning of women groups and associations in the countries
- Any activity related to water and soil conservation will be welcome in order to improve agricultural productivity
- The communities are ready to test any new technologies or tools for better adaptation to the climate change and variability.

Their suggestions are incorporated for a community-based flood and drought management approach and involvement is given due importance during the pilot testing and further included as part of activities under the components 1 and 2.

The project will indirectly benefit hundreds of thousands of people living in the GBM countries through the proposed strategy of community-based flood and drought management and by enabling local level climate change adaptation measures. In addition, private sectors such as those in agriculture, aquaculture, hydropower will be one of the important stakeholders to benefit from the project outcomes. The studies for hazard and vulnerability mapping proposed under Component 1 of this project will help screen potential risks from a local community perspective (as per the Adaptation Fund's Environmental and Social Policy (ESP) and Gender Policy (GP)) that may arise during implementation. From an environmental viewpoint, the IUCN Red List of Ecosystems Categories and Criteria will be studied to better understand the status of ecosystems, applicable at local, national and global levels.

In the concept note development phase, a regional face to face workshop with the WMO, representative of NMHSs and environmental agency of Bangladesh and Nepal was organized during early June 2023 mainly to review and finalize the HydroSOS concept note – agree on the list of activities, updated institutional arrangements, selection of potential pilot sites for the testing of the HydroSOS EWS, agreed on the way forward including review of Terms of Reference for the Environmental Impact Assessment (EIA) and Social Impact Assessment (SIA) study.

In the next phase of the project development (through EIA and SIA) and inception phase, several face-to-face consultations are planned with the national and regional entities as well as to carry out community consultations including local level associations, women, youths, minor and vulnerable groups, at various sites of the basin to examine benefits of the project outputs and services.

I.Provide justification for funding requested, focusing on the full cost of adaptation reasoning.

Climate changes have been severely affecting the GBM countries with regular and large-scale floods and drought events especially impacting lives, properties, livelihoods and ecosystems. The government of the two riparian countries are developing and implementing various strategies and action plans to be better prepared to these extreme events, with technical and financial support from ministries, international development partners and agencies. The Adaptation Fund will support the HydroSOS BaNe project to expand on, and complement existing projects, in accordance with the development priorities of the countries in the urban and rural areas. The yearly flood and drought events have reduced community capabilities and their investments in socio-economic growth, such as houses, assets, livestock, food security etc. The proposed project will provide benefits to both communities and agencies and opportunities to work in a coordinated and collaborated way achieving long-term adaptation measures for Flood and Drought management. The need for concrete adaptation measures to extreme events is an important requirement for the GBM riparian countries according to the initial consultation by WMO with the stakeholders of the GBM Basin. The HydroSOS BaNe project includes the following components for developing adaptation measures and capacities:

Component 1: Risk-based preparedness and adaptation to the climate variabilities and water and environmental uncertainties

Baseline situation (without any support from the Adaptation Fund)

In general, 80 percent of the land and natural resources in the GBM region and countries are prone to floods and drought events. The hydrological and meteorological characteristics of the GBM Basin and the projected climate change impacts on socio-economic vulnerabilities have not been adequately addressed and incorporated into development planning and other land use practices over the years. The government agencies of the countries also lack adequate information about the increasing risks related to climate extreme events, resulting in improper planning and decision-making for flood and drought management. Therefore, private and community infrastructures and natural resources are continuously exposed to climate variability, resulting in damage and degradation of adaptive capacities.

Impact due to the proposed project (with the support of Adaptation Fund)

The HydroSOS BaNe project plans detailed assessments of vulnerabilities, capacities and exposure to floods and drought events in the targeted GBM countries and the development of the related risk maps for present and future predicted climate scenarios. Moreover, the project will help in the development of risk management framework and capacities of the stakeholders (especially policy-makers, disaster managers etc.) to take risk informed decision-making for floods and drought events. In addition, the project will bridge the gap in adaptation measures to integrate future scenarios (economic, urban, climate, environment, etc.) into current knowledge (risks mapping, hydrometeorological features) and practices to improve the future planning and design of concrete adaptation measures or interventions. For this purpose, synergies will be created between country level projects or programmes on climate change adaptation to develop integrated flood and drought management strategies and approaches at local, national and regional levels.

Component 2: Strengthening water resources management through access to hydro-meteorological information and augment regional /national capacity to monitor and assess Hydro-Meteorological hazards

Baseline situation (without any support from the Adaptation Fund)

Presently there is no systematic measurement practices appropriate for water resources and floods and drought monitoring and forecasting over a large part in the GBM Basin. The available instruments such as radars, sensors and gauges provide information but there is no timely availability of flood and drought forecasting and warning information to the communities prone to these hazards. The existing flood and drought preparedness and response measures at local, national and regional level are ineffective, due to the lack of technical capabilities of various national agencies working on floods and drought management including coordination at local, national and regional levels. Without AF support, the situation will not change, or even deteriorate, and the population in the GBM riparian countries will continue to remain highly exposed to extreme weather, water and climate events and face consequent damages. Additionally, local actors and flood prone communities lack knowledge and tools for mainstreaming gender and developing natural and nature-based solutions for flood management, however they have useful traditional solutions and adhoc experiences which need to be captured and integrated in new flood and drought management strategies.

Impact due to the proposed project (with the support of Adaptation Fund)
The HydroSOS BaNe project will support the development and implementation of HydroSOS, an End-to-End Early Warning System for both floods and drought resulting in tailored hydrometeorological information services for the agencies, communities and the general public. The AF support will be used to strengthen data collection, transfer and management from the existing instruments available on the GBM and from external sources (national systems for monitoring hazards, global platforms (NOAA, NASA, JAXA, Joint Research Commission), satellite-based data etc.): this is a mandatory step towards a robust and appropriate network for forecasting and early warning information. The GIS-based early warning information system will be developed for the beneficiaries at all levels made of simple colour coded graphs and risks zoning, as proposed in the HydroSOS EWS prototype. The EWS will improve the stakeholder's capacities to take decisions and prepare for reducing impacts and if required, implement alternative practices. These systems will be more efficient with improved coordination between the hydrometeorological services, the other concerned departments at local and national levels and the communities prone to floods and drought. The capacity development activities, such as Gender mainstreaming for End-to-End Early Warning Systems for Floods and Integrated Flood and Drought Management through natural and nature-based solutions will help in developing pro-active approaches to account for climate change variability and its associated impacts.

Component 3: Water and climate resilient regional cooperation arrangements together with national and regional stakeholders, and community involvement
Baseline situation (without any support from the Adaptation Fund)
Although the GBM countries have recognized the need to adapt to climate change variability, the existing governance structure at the transboundary and national levels does not provide coordination and collaboration in water and natural resources management. The policies, guidelines or plans for collecting and sharing data and information related to hydro-meteorological conditions are not yet enforced to improve preparedness to extreme events. The shortage of policies plans and strategies at local, national and transboundary level for the management of short- to medium-term disaster risks exposes the GBM countries population to non-sustainable socio-economic conditions.
Impact due to the proposed project (with the support of Adaptation Fund)
The AF support will allow to develop an enabling environment between local, national and international actors and stakeholders. Systematic coordination between the riparian countries will facilitate the achievement of the common objective to develop concrete risk reduction and climate adaptation measures. Additionally, the project will develop capacities of beneficiaries to review or develop new policy frameworks to integrate climate risks to land, water, environment, livelihood with development plans and practices at local, national and transboundary level of the GBM Basin.

K. Describe how the sustainability of the project outcomes has been taken into account when designing the project.

Project sustainability will be achieved through close collaboration and capacity building of stakeholders at all levels i.e. local, national and transboundary ensuring their long term commitments for climate change adaptation activities and services developed through the project. The provision of sufficient human and financial resources will be ensured for the production, operation and maintenance of the new knowledge products and tools developed such as HydroSOS EWS which will be free, tailored and open source for use by the stakeholders
Sustainability strategies for outcomes of the three HydroSOS BaNe components:

Outcomes under Component 1	**Outcomes under Component 2**	**Outcomes under Component 3**
Long term sustainability will be developed through participatory stakeholder engagement and knowledge exchange between local communities and government agencies. By showing, how and when, the risks for floods and drought events will change over short and longer periods in the GBM basin, the stakeholders will be more aware of the value of the vulnerability, capacity, exposure and risks assessment activities, the alteration of the risks factors and their impact on their daily life. The Bangladesh and Nepal NMHSs will provide support (staff and resources) to complete activities proposed under the HydroSOS BaNe project, such as development of flood and drought risks maps. The periodical assessment of the risk related information will need to be developed by the national agencies to update the	Long term maintenance of the operation tools and methodologies for the activities under component 2 will be secured through commitment from the countries to provide adequate resources for the sustainability of the new system. The NMHSs of the two countries (executing agencies of the project) will be highly involved in the development and operation of the HydroSOS Early Warning System for Flood and Drought during the course of the project and subsequent to its completion. NMHSs commitment is already taken to ensure that the HydroSOS Early Warning System (HydroSOS EWS) will be integrated into the day-to-day operations of the observatory centre. Doing so will ensure the long-term sustainability and operation of the software platform and related databases. Following the project's completion, the NMHSs will ensure the on-going maintenance and updating of the system regardless of the availability of other sources of funding (**The NMHSs have already provided support letters to ensure the long-term transfer of information from the national databases to continue operations of the HydroSOS EWS coordination unit.** It is anticipated that NMHSs will work with the regional entity (ICIMOD or RIMES) who could be	The involvement of regional entities such as Joint River Commission (JRC), RIMES, ICIMOD together with NMHSs is extremely valuable to ensure the implementation of component 3, and specifically the sustainability and long-term effects of data sharing policies, sustainable development plans and practices and code of conducts at the local, national and transboundary scales. JRC will extend its operational role and maintain the project results on the longer term, therefore contributing to the design and implementation of the GBM basin Strategic Action Programme (SAP). Major institutions in charge of coordination and civil defence activities from national to local level will be integrated while detailing, and later implementing, the project components:

associated flood and drought risk maps of their communities in order to be prepared for climate related extreme events. Local communities will, be encouraged and incentivized to continue implementing and maintaining the various activities and deliver concrete adaptation outputs under component 1.	hosting the HydroSOS EWS operational center and will cover maintenance costs through other on-going and future projects or initiatives that will be linked to the early warning system developed under the HydroSOS BaNe project. The long-term sustainability of this achievement is also dependent on the continuous availability of the meteorological, hydrological and climatological data and related products from the National Meteorological and Hydrological Services (NMHSs) of Bangladesh, Nepal and other GBM countries. WMO will build on lasting collaborations with the NMHSs, as the pilot project HKH-HYCOS were endorsed 10 years ago. The hydroSOS and Early Warning Systems (EWS) for Floods and Drought, as envisaged in the demo prototype, will be developed and used by the actors of national agencies, especially the representatives of NMHSs, water resources agencies, the Country Water Partnerships and national disaster management authorities. The long-term shares of duties and responsibilities for the Flood forecasting and EWS will be taken up by a regional entity such as RIMES or ICIMOD in collaboration with the NMHSs, with support at governmental level in the Ministries. Additional institutions involvement will be discussed during the capacity development activities of component 2.1.	

Image source:
https://www.tbsnews.net/sites/default/files/styles/infograph/public/images/2020/08/08/map.jpg?itok=S64kLcWp&timestamp=1596861723

National Ministries, Financial institutions such as Asian Development Bank, World Bank and International organizations will be invited to follow the project implementation and success stories, as an example, ADB and WB for scaling the project to other countries of the South Asia and South-East Asia and the National Ministry of environment and forest in Bangladesh and Nepal, as financing instrument of national environment and climate adaptation projects to implement nature-based solutions identified through the project. National Meteorological and Hydrological agencies will be able to contribute to the expansion of the HydroSOS EWS to the entire national portion and beyond as shown in above figure.

L. Provide an overview of the environmental and social impacts and risks identified as being relevant to the project.

The entire project activities will be screened for any environmental and social risks according to the 15 principles outlined in the AF's Environmental, Social and Gender Policies. As noted in the following table, all principles are applicable in the countries and for all sites of the targeted countries, GBM region in general. Specific principles will be analyzed on a case-by-case basis during various field visits and in view of the exposure to one or both floods and drought hazards. It is also noted that when a specific risk is applicable and triggered, this could lead to other risks as well. Based on initial consultations and assessment with the Country stakeholders, highly impacting risks are not part of the proposed project on the GBM region as all the measures follow the principles of integrated water resources management and contribute to increased preparedness measures for climate change events such as floods and drought.

However, some of the proposed project activities such as the development of risk maps can alert the national agencies and communities about the locations possibly at-risk for flood or drought events. The national agencies might then consider moving or

relocating people, or people on their own could decide to move to safer places in urban or rural areas. This can be considered as primary indirect risks. Moreover, secondary or dependent risks such as economic marginalization, fight for water, land and food resources and social and cultural conflicts with the existing people at the new location might become a challenge to the relocating families. The national agencies or people should be made aware of this kind of risks and their impacts. The proposed project will raise awareness or knowledge for such risks and potential safeguard measures with prior and informed consent of the stakeholder. With the information available at this stage, the project is expected to fall into medium risk category B because interventions such as information through risk maps and EWS will strengthen national agencies and communities' capacities to prepare and adapt to the climate change. This will be further reassessed during the EIA and SIA studies planned in the final phase of the project development

Table 11: Based on information available and initial screening on the Environmental and social policy principles of the Adaptation Fund

Checklist of environmental and social principles	No further assessment required for compliance	Potential impacts and risks – further assessment and management required for compliance
Compliance with the Law	Further assessment during the EIA and SIA studies. However, the project will ensure that the existing national and transboundary laws, policies and guidelines of GBM countries will be followed during the implementation of adaptation measures or in capacity development activities. The project will not require any prior environmental and construction legal and regulatory permission as there are no physical or structural construction planned in the project activities. If required international laws on data sharing protocol among different countries will be consulted and agreed upon with the stakeholders.	In case of any potential impacts and risks identified during the EIA and SIA studies, risks prevention or management strategies will be developed
Access and Equity	Further assessment during the EIA and SIA studies. The project activities will provide impartial and equitable access to project stakeholders. The project design is developed to allow representative of all groups in every capacity development training/workshop at local levels. however, the project has capacity development activities to which only small percentage of the communities will be able to participate. The project will ensure that these representatives of communities will further disseminate the information to wider groups. The selected participants will be expected to disseminate the training knowledge to other members of communities or organizations so that everyone will have fair and equitable access to all project benefits. The selection of participants/beneficiaries will also be made in consultation with local practices, traditions and access to social facilities.	In case of any potential impacts and risks identified during the EIA and SIA studies, risks prevention or management strategies will be developed
Marginalized and Vulnerable Groups	Further assessment during the EIA and SIA studies. The project will contribute to the reduction of existing inequalities for EWS for floods and drought, particularly those affecting marginalized or vulnerable groups dependent on agriculture or living in urban areas. The EWS system for floods and drought will be available through technological sources. During the pilot testing, the members of communities (including marginalized and vulnerable groups) and local agencies will be provided with adequate knowledge and explanations about the systems to use it for their own benefits. Community-based flood and drought management activities including gender mainstreaming will support the participation of marginalized and vulnerable groups and their appropriation of projects benefits.	There is a risk that vulnerable and marginalized groups will have insufficient knowledge and access to technological devices such as mobile phones or lack of good cellular connectivity specially required for outcome 2.1 of the proposed activities. To avoid the exclusion of marginalized and vulnerable communities, local radio channels and traditional practices will be implemented to reach these groups especially women, girls, elderly, physically challenged individuals.
Human Rights	No further assessment is required. The proposed activities are or will not be against any of the established international and national human rights. Moreover, the proposed project will promote the basic human rights of access to information, water, and food	In case of any potential risks and impact identified during the EIA and SIA studies, risks prevention or management strategies will be developed

	The project will provide opportunity for every individual to give their views, perceptions and needs in developing better climate change adaptation measures.	
Gender Equity and Women's Empowerment	No further assessment is required. The proposed project will improve the gender equity and women empowerment through the WMO developed tool: Training Manual for mainstreaming gender in End-to-End Early Warning system for Flood forecasting and integrated Flood Management through a participatory design approach. This will help in increasing the participation of women, girls and other vulnerable groups in Flood and Drought management activities as well as decision making processes.	The proposed project is targeting region where men occupy the majority of the leadership positions. Women participation to disaster preparedness and decision making is often limited due to cultural and social norms. There is therefore a risk that women will not benefit equitably from the proposed adaptation measures and capacity-development interventions. Planning of the participative activities will ensure that women and representative of women associations will be sufficiently well represented
Core Labor Rights	No further assessment is required. The project will be implemented and managed in compliance with the countries designated labour laws. No individual will be hired without pay and payment will be based on national labour pay scales. Children's labour will be forbidden, and it will not be accepted from the project partners and national agencies.	In case of any potential risks and impact identified during the EIA and SIA studies, risks prevention or management strategies will be developed
Indigenous People	No further assessment is required. The indigenous population in the region will be consulted and involved during the design and implementation of the project activities. The traditional knowledge of indigenous people on Flood and Drought will be useful when preparing the risk maps, the early warnings and information dissemination.	In case of any potential risks and impact identified during the EIA and SIA studies, risks prevention or management strategies will be developed
Involuntary Resettlement	There are no activities proposed in the project which will create direct involuntary resettlement of communities. However, the risks of displacement of the population after the mapping of floods and drought risk areas could be possible as some areas could be classified as high risk for the loss of lives. On the basis of evidence-based and scientific information, the agencies will propose new prevention plan to prohibit future settlement in the high-risk areas.	In case of any potential risks and impact identified during the EIA and SIA studies, a built-in safeguard approach for risks prevention or management strategies will be developed
Protection of Natural Habitats	There are no potential direct risks to the protection of ecosystems and its natural habitats and biological diversity through the project activities. Ecosystem services related assessment will be carried out to understand the issues related to the protection of natural habitats. Capacity development related to Natural and Nature-based solutions will be provided for protection of natural habitats	In case of any potential risks and impact identified during the EIA and SIA studies, a built-in safeguard approach for risks prevention or management strategies will be developed
Conservation of Biological Diversity	There will be no direct risks associated with the conservation of biological diversity as the project activities will not involve any physical action on natural resources and introduce any known invasive species. The proposed project activities will provide opportunities to improve the understanding of natural processes in relationship with the water cycle.	In case of any potential risks and impact identified during the EIA and SIA studies, a built-in safeguard approach for risks prevention or management strategies will be developed
Climate Change	No further assessment is required. The proposed project activities will not result in any greenhouse gas emission to the atmosphere and deforestation, so there will not be any impact to climate change. Furthermore, the project does not only increase the flood and drought adaptation capacity and resilience of the local population but also contributes to develop better governance structure,	In case of any potential risks and impact identified during the EIA and SIA studies, a built-in safeguard approach for risks prevention or management strategies will be developed

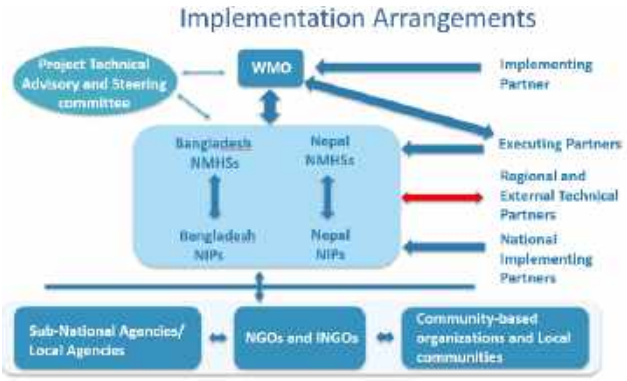
	policies and plan at both national and regional level for climate change adaptation.	
Pollution Prevention and Resource Efficiency	No further assessment is required. The project activities are not expected to result in water, air and soil pollution.	
Public Health	No further assessment is required. The project activities should not have negative effect on public health. The project will identify the communities at risks which are prone to inundation and provide awareness of best practices for health-related safety during various capacity building activities.	
Physical and Cultural Heritage	No further assessment is required. The project does not have any activity related to affecting physical and cultural heritages. The purpose of the project is to develop better management of water resources and have traditional and cultural integration among the individuals.	
Land and Soil Conservation	No further assessment is required. The project will promote the conservation of soil and land resources, especially through the risk mapping and selection of natural and nature-based solution with environmental-friendly solutions. Through the HydroSOS EWS, Communities will improve their agricultural practice and help to build the capacity of farmers and technicians.	

PART III: IMPLEMENTATION ARRANGEMENTS

A. Describe the arrangements for project management at the regional and national level, including coordination arrangements within countries and among them. Describe how the potential to partner with national institutions, and when possible, national implementing entities (NIEs), has been considered, and included in the management arrangements.

WMO will be the implementing and executing entity for the project providing overall management, procurement services and specific technical support in the execution of the activities. Its international experience and presence through their WMO Regional Office for Asia, situates it ideally for coordinating with national authorities, especially NMHSs (other executing entities of the project). The Technical Support Unit (TSU) of the WMO Associated Programme on Flood Management (APFM) and the Integrated Drought Management Programme (IDMP) supported by a network of Support Base Partners comprising of NMHSs, academia or research centers, private engineering companies and internationals organizations will design and develop technical solutions with the executing partners and they will have close links with the beneficiaries in the field. Considering the existing capacities of the NMHSs and mandate of working and supported by the WMO, it is important that WMO provide technical execution support to the NMHSs so as to develop affordable, tailored and sustainable solutions following WMO standards, guidelines and practices in the project countries. Other WMO teams (members of Standing Committee on Hydrology, Disaster Risk reduction and Agriculture) will provide support in reviewing the project results and programmes. The HydroSOS team comprising of WMO hydrological coordination staff, UK Centre for Ecology & Hydrology(UK-CEH) and other contributing partners will be instrumental in providing technical guidance and implementation support to the national agencies. Other on-going initiatives of WMO Climate Risk and Early warning system (CREWS), Flash Flood Guidance System, HydroHub programme, Dynamic Water Assessment Tool (DWAT) will contribute to the development of tools, products and services delivery to the decision makers and also expand the results of the project to the neighboring regions.

At the National level, WMO will collaborate with NMHSs of two riparian countries of GBM to lead the technical implementation and coordination of the project activities. For executing the project activities, the National Hydrological Services (NHSs) of each country (through a project technical manager) will be the National focal point and will implement the technical activities at the National and local levels through local agencies, NGOs and private partners forming a network of technical support group. NHSs will be in-charge of engaging and disseminating the project results towards the related Ministries in charge of Water Resources, Environment, Hydropower, Irrigation, Agriculture and Civil Defense, and to the regional organizations such as International Centre for Integrated Mountain Development (ICIMOD), Regional Integrated Multi-Hazard Early Warning System for Africa and Asia (RIMES) etc. working at the basin level. The National agencies of the GBM countries will come up with regional intergovernmental associations or authorities such as recently formed Joint River Commission (panel of meteorologists, hydrologists, and disaster risk management professionals from the operational organizations or services) to define the regional implementation plan and strategies for the long-term sustainability of the project outputs and outcomes. A project steering/advisory committee will be established with membership of National designated authority, agencies specialized in hydrology, meteorology, water resources, disaster management and of regional entities which will provide review and strategic guidance to the implementation of the project activities as well as support in promoting the project results in the region or outside the GBM countries. The proposed project will take into consideration the existing information, resources and infrastructures available in the country and try to support the needs of the GBM countries to develop HydroSOS system as well as support in developing concrete adaptation measures for climate change resilience at local and national levels. For each of the two countries, the contributing national and local partners related support (knowledge and skills) will be gathered and used for developing tools and products. They will play an important role in the implementation of the activities and working with the local stakeholders and beneficiaries. The list of the national agencies responsible for each activity will be refined before the inception meeting. A detailed project implementation arrangement is described in the figure above showing how implementing, executing and other national entities coordinate and report to each other. During the next phase of the project development, a clear description of the roles and responsibilities of the implementing entity and of executing entity or organizations/stakeholders involved in the project will be provided.



B. Describe the measures for financial and project / programme risk management.

Financial and project risks measures will be assessed as an on-going process throughout the design and implementation of the project. The initial potential risks identified are:

Type of risk and how it affects the project	**Risk impact on the project goal** (Low, medium, high)	**Probability of occurrence** (low, medium, high)	**Mitigation measure(s)**
Acceptance of the project Even though detailed needs assessments and consultations with stakeholders have been conducted since 2019, the support of the stakeholders can differ in the targeted countries. This will result in differential levels of acceptance or support and eventually could slow down the inception phase of the project.	Medium	Low	- During the preparation phase of the project, all relevant stakeholders (government, agencies, departments and communities) will be/are clearly identified, so that they fully share the vision and goal of the project and are aware of their contribution to the project, hence fostering ownership and sustainability over the process. - MoU or agreements will be signed with the participating stakeholders. - Roles and responsibilities of the implementing/executing agencies and other technical agencies/organizations will be defined in the initial stages of the project so that all the activities are completed in a coordinated way.
Physical risks Administrative barriers hinder sharing of hydro-meteorological, social and topographic data. This result in difficulties to implement components 1 and 2.	Medium	Medium	The implementing (WMO) and executing (NMHSs) entities will ensure the required data and information are made available and national level tools and products are shared. Furthermore, WMO is mandated for regional exchange of data and information on hydrology, meteorology and climatology and can request the enforcement of the agreements.

Technical/quality risks Component 2 of the project is too technical and not adapted to specific area or countries. This might result in low commitment and interest from stakeholders	Medium	Low	The project activities will be first reviewed by experts of WMO and NMHSs and eventually with the support of NIPs, local decision-makers and participants from community, the available resources, expectations and suggestions will be collected. The feedbacks and suggestions from the participants will be integrated into the planning and implementation of the activities.
Restructuring of government officials Restructuring in the government work structure may cause possible shifts of responsible persons at local and national levels to a different location. This can result in delays and loss of support.	Low	Medium	Alternative persons from the departments will be involved in most of the activities so that implementation of project activities will not be hampered at any time.
Financial/resources risks ▪ Inadequacy of the financial management system: procurement system, financial availability, monitoring, reporting and auditing system, etc. ▪ Availability of project resources ▪ This will result in slowing down the project activities	Low	Low	During implementation, project and financial monitoring/reviews will be conducted to ensure efficient management of project resources.
Human resources/capacity risks ▪ Lack of skills or human resources availability ▪ Adequacy between existing and required experience and skills ▪ This results in slowing down the project activities	Medium	Low	-The project benefits from the deployment of professionals/staffs by the implementing and executing agencies (WMO/NMHSs) who are selected by a panel of experts. Their ToRs are developed based on the project needs and in collaboration with the hosting institutions. - National support is obtained at the level of the governmental agencies to ensure sufficient human resources
Documentation/Reporting risks ▪ Lack of available tools and templates for developing reports and progress report ▪ Delays of reporting by the partners ▪ This results in delays in the reporting process and access to funding	Low	Medium	Appropriate tools/templates and reporting structures and procedures will be put in place by WMO to ensure proper documentation and reporting so that donor agencies and steering committee receive timely reports.
Political risks Interference from the local/national political parties This will result in delaying the project activities	Low	Low	The project will adhere to the goals, laws, and policies of the respective GBM countries. Whenever and wherever required, permission of national consensus of the countries will be taken or shown.
Gender neutral approach Techniques and technological tools developed are not accepted by all groups of the communities. This decreases the gender inclusive or equality compliances	Low	Medium	The project includes gender sensitive approach in all activities. Wherever required non-technological or traditional methods will be adopted to reach and get participation from every group of the communities.

WMO Monitoring Evaluation and Risk Prevention (MERP) team and its technical advisory group (Standing Committee of Hydrology and working groups) will provide support to the project team and executing agency for conducting regular risk monitoring and evaluation of the project activities, and the results will be tracked and reported in WMO's internal monitoring system. In addition to this, a dedicated Monitoring and Evaluation (M&E) team will be formed, to ensure essential budget and resources are allocated to execute the M&E framework including mid-term and terminal evaluation.

C. Describe the measures for environmental and social risk management, in line with the Environmental and Social Policy of the Adaptation Fund.

In the final preparation (proposal development) phase, an Environmental Impact Assessment (EIA) and Social Impact Assessment (SIA) study (in line with the Environmental, Social and Gender Policies of the Adaptation Fund) will be conducted for screening the proposed project activities against the15 principles of the Environmental and Social Policy of the Adaptation Fund. The EIA and SIA

will be undertaken taking to account for the existing laws, legislation or practices in place of Bangladesh and Nepal countries, along with the transboundary laws on Environment and Social including Gender.

A regional or local consultants with more than 10 years of experience in conducting Environment and Social Impact assessment will be hired to carry out EIA and SIA in the targeted region. The methodology of the study includes field visits to the vulnerable locations of Bangladesh and Nepal, semi-structured interviews or focus-group discussions with the agencies (national meteorological and hydrological services (NMHSs), environment, water resources and irrigation, civil authorities etc.) and citizens (representatives of communities impacted by floods and droughts, marginalized and vulnerable communities, associations or self-help groups etc.). Based on EIA and SIA study, an Environmental and Social Risk Management plan will be developed and submitted during the final preparation phase.
A dedicated Grievance mechanism will be developed for the beneficiaries of the project to address or report any complaints or discrimination directly to the National, Designated Authorities, Implementing entity (WMO) and funding agency (Adaptation fund). The stakeholders will be made aware of this Grievance Mechanism during several consultations carried out in the project preparation and implementation phase. Several means (using emails, social media or through posts) will be made available through which one can report the concerns they may have or find during activity design and implementation phase.

D. Describe the monitoring and evaluation arrangements and provide a budgeted M&E plan.

Monitoring and Evaluation (M&E) measure the overall progress and impact of the project activities through the Baseline, Key Performance Indicators (KPI) and Targets to be achieved. They will be monitored regularly to identify the achievements or insufficiencies, therefore supporting the development of additional strategies to achieve the targets.

Monitoring and evaluation arrangements for the project activities
A monitoring and evaluation system will be developed to support the implementation and decision-makers team in designing, implementing and adjusting the program activities. The overall (short, medium and long term) impact of the planned activities will also be assessed using the resources, methodologies or tools etc. The monitoring and evaluation arrangements will have a gender disaggregated system of data collection (baseline and target to be achieved as established in the context of the results framework of the project) and reporting for each of the project outcomes and component.
The M&E arrangements will be structured and organized at various level of institutional set-up such as:

Institutional level	Responsible actors	Support to the M&E framework
Local or Community level M&E activities	National Project Manager, Local Staff of Agencies (NMHS, Water Resources, Disaster Management), NGOs National External M&E expert	Collect Baseline, KPI, target to be achieved, means of verification for the activities implemented at the local level Updated checklists with the local project progress reports (LPPR) through semi-structure interviews or focus-group discussions, field visits consultation, Technical activity report
National level Monitoring and evaluation activities	Regional and National Project Manager, NMHSs staff, International M&E expert	Collect Baseline, KPI, target to be achieved, means of verification for the activities implemented at the National level Updated checklists with the National project progress reports (NPPR) through semi-structure interviews or focus-group discussions, field visits consultation, Technical activity report
Regional/Transboundary level Monitoring and evaluation activities	Regional and National Project Manager, NMHSs staff, International M&E expert	Collect Baseline, KPI, target to be achieved, means of verification for the activities implemented at the National level Updated checklists with the regional project progress reports (RPPR) through semi-structure interviews or focus-group discussions, field visits consultation, Technical activity report

Monitoring and evaluation arrangement for Project Management
The Project Management Unit (PMU) will be provided with monitoring and evaluation tools of project activities and resources. The PMU under the implementing and executing agencies will ensure that the executing agencies have adequate resources and capacity to measure and monitor results at the local, national and transboundary level. The quarterly monitoring and annual evaluation reports of the executing agencies along with the financial statements and resource management will be submitted to the implementing agency (WMO) and further to the Adaptation Fund Secretariat for the review.

The monitoring and evaluation assessment of the activities will be conducted regularly with the local, national and regional agencies and communities after which a report will be prepared to track progress made since the start of the project's and in particular from the previous reporting period. The reporting includes, but is not limited to, on the following:

Report content	Additional Description

Progress on the project's objective and outcomes – each with indicators, baseline data and end-of-project targets;	aggregated, gender disaggregated, percentage of change
Project outputs delivered per outcome (quarterly, half-yearly and yearly);	Activities completed for each output in the reporting period as compared to planned
Lessons learned/good practice and challenges;	Check or assess the real benefits to the stakeholders or challenges encountered
Progress on work plan and expenditure reports; and	Update on the work plan and use of funds
Project risk and adaptive management.	Any grievance or risk encountered during the period, any measures taken
Any other information as required	

The M&E activities with their implementation plan are shown in the table below:

Monitoring & Evaluation Activity List	Accountable Parties (short name)	Timeline															Budget allocation
		2024				2025				2026				2027			
		Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4
Design, development and review of the Monitoring and Evaluation tools	WMO/NMHSs	X															The budget allocation will be provided in the final preparation phase of the project
Monitoring the project activities and outputs (quarterly)	NMHSs and NIPs	X	X	X		X	X	X		X	X	X		X	X	X	
Improvement or additional changes in the Monitoring tool	WMO/NMHSs																
Monitoring the activities and reporting the project outputs (Annually)	WMO/NMHSs				X								X				
Mid-term Evaluation of the project activities and assessing the progress	WMO/NMHSs								X								
Final or Termination evaluation and reporting (before the completion of project)	WMO/NMHSs															X	

A detailed M&E tool will be made available for project activities, as well as for the project management team (including budget allocation) during the final preparation phase.

E. Include a results framework for the project / programme proposal, including milestones, targets and indicators.

The detailed project results framework, which defines the key performance indicators and means of verification for each component, outcomes and its activities, will be developed in the final proposal.

F. Demonstrate how the project / programme aligns with the Results Framework of the Adaptation Fund

This part will be further developed in the full proposal, but the development of the HydroSOS BaNe project will be in line with the strategic results framework of the Adaptation Fund.

Project Objective(s)[1]	**Project Objective Indicator(s)**	**Fund Outcome**	**Fund Outcome Indicator**	**Grant Amount (USD)**

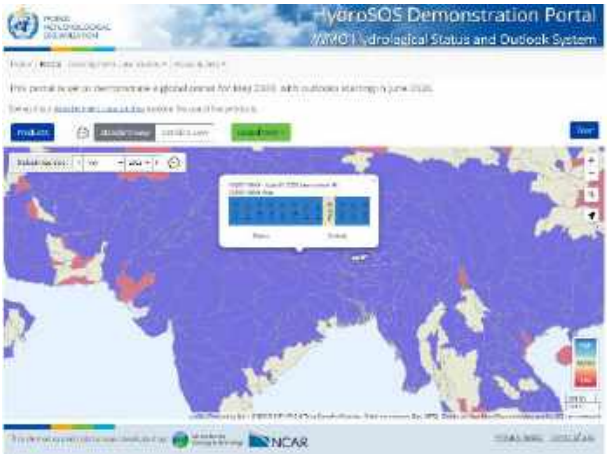
The HydroSOS BaNe project will reduce vulnerabilities and strengthen community resilience through integrated approach for flood and drought management in the GBM countries, namely Bangladesh and Nepal; while providing support for decision-making in socio-economic and environmental development against the climate change and variability	• Degree of improvement in populations' resilience to floods and drought events and increased capacities of national agencies on climate change • Staffs of the local /national Hydrological and meteorological services and community representatives are trained on climate change adaptation measures for floods and drought events • Reviewed Policies and guidelines at national and transboundary level for flood and drought management is better integrated and action plans are developed.	Assist developing country Parties to the Kyoto Protocol that are particularly vulnerable to the adverse effects of climate change in meeting the costs of concrete adaptation projects and programmes in order to implement climate-resilient measures. Outcome 1: Reduced exposure at national level to climate-related hazards and threats	1. Relevant threat and hazard information generated and disseminated to stakeholders on a timely basis	12,090,000
Project Outcome(s)	**Project Outcome Indicator(s)**	**Fund Output**	**Fund Output Indicator**	**Grant Amount (USD)**
Outcome 1.1 Floods and drought risks informed decision-making at the regional, national and local levels	Flood and Drought risks maps for the targeted two GBM countries/ region are developed which provide support for disaster risk preparedness and management	Output 1: Risk and vulnerability assessments conducted and updated at a regional level	1.1. No. and type of projects that conduct and update risk and vulnerability assessments	1,000,000
Outcome 1.2 Preparedness and resilience to climate change promoted through innovative and community-based initiatives.	Building awareness of future risks and impacts on economic, urban, climate, environment etc. due to climate change and variability	Output 6: Targeted individual lives and community livelihood strategies strengthened in relation to climate change impacts, including variability Output 7: Improved integration of climate-resilience strategies into country development plans	6.1.1. No. and type of adaptation assets (physical as well as knowledge) created in support of individual or community livelihood strategies	2,000,000
Outcome 2.1 A web-based Hydrological Status and Outlook System for EWS is designed and developed together with the National services	At least 70 % of the population in Bangladesh and Nepal region has HydroSOS Forecasting and EWS and it has been utilized.	Output 2.2: Targeted population groups covered by adequate risk reduction systems	2.2.1. Percentage of population covered by adequate riskreduction systems	4,000,000
Outcome 2.2 Development of medium and long-term concrete adaptation measures in the prioritized areas and updates based on lessons learned and monitoring instruments	Atleast two pilot locations of each GBM countries have been tested with developed HydroSOS EWS tool and models	Output 2.2: Targeted population groups covered by adequate risk reduction systems	2.1.2. Capacity of staff to respond to, and mitigate impacts of, climate-related events from targeted institutions increased	2,000,000

			2.2.1. Percentage of population covered by adequate riskreduction systems	
Outcome 3.1 Improve information base and practices related to water resource management and climate change adaptation	Strengthened plans, policies and guidelines on water resources management and climate change adaptation documents with necessary amendments.	Output 3: Targeted population groups participating in adaptation and risk reduction awareness activities	3.1.1 No. and type of risk reduction actions or strategies introduced at local level	600,000
Outcome 3.2 National adaptation strategies (i.e. NAPs) are fully inclusive of water management issues, address community concerns. Methodology and mechanism for leveraging and sharing benefits of optimising adaptation at regional level are in place.	Locals/national/regional stakeholders integrate risk management policies, plans into national and transboundary development plans.	Output 7: Improved integration of climate-resilience strategies into country development plans	7.1. No., type, and sector of policies introduced or adjusted to address climate change risks	600,000
			7.2. No. or targeted development strategies with incorporated climate change priorities enforced	

G. Include a detailed budget with budget notes, broken down by country as applicable, a budget on the Implementing Entity management fee use, and an explanation and a breakdown of the execution costs.

The total budget of the HydroSOS-BaNe project is estimated at USD 12,090,000 for the development of activities in the two participating countries, including an amount of USD 940,000 for project executing entities and an amount of USD 950,000 to cover the expenses of the implementing entity. A detailed budget will be presented in the full project proposal. The disbursement schedule will be developed and presented in the full project proposal along with funds dis-aggregated for each activities, at country and regional levels.

Annex 1: HydroSOS Global demonstrator products as a demonstration of end products: https://eip.ceh.ac.uk/hydrology/HydroSOS/portal/



PART IV: ENDORSEMENT BY GOVERNMENTS AND CERTIFICATION BY THE IMPLEMENTING ENTITY

A. Record of endorsement on behalf of the government[48] *Provide the name and position of the government official and indicate date of endorsement for each country participating in the proposed project/programme. Add more lines as necessary. The endorsement letters should be attached as annexes to the project/programme proposal.*

Ms. Farhina Ahmed Secretary Ministry of Environment, Forest and Climate Change	Date*: July 20 2023*
Mr. Yam Nath Pokharel Under Secretary (Technical) Climate Change Management Division Ministry of Forests and Environment	Date*: August 03 2023*

B. Implementing Entity certification *Provide the name and signature of the Implementing Entity Coordinator and the date of signature. Provide also the project/programme contact person's name, telephone number and email address*

I certify that this proposal has been prepared in accordance with guidelines provided by the Adaptation Fund Board, and prevailing National Development and Adaptation Plans and subject to the approval by the Adaptation Fund Board, commit to implementing the project/programme in compliance with the Environmental and Social Policy of the Adaptation Fund and on the understanding that the Implementing Entity will be fully (legally and financially) responsible for the implementation of this project/programme.	
 Moyenda Chaponda Implementing Entity Coordinator Project Management and Implementation Unit	
Date: 10 August 2023	Tel. and email: +41 22 730 8646 and mchaponda@wmo.int
Project Contact Person: Hwirin Kim	
Tel. And Email: +41 22 730 8358 and hkim@wmo.int	

[48] Each Party shall designate and communicate to the secretariat the authority that will endorse on behalf of the national government the projects and programmes proposed by the implementing entities.

সচিব
পরিবেশ, বন ও জলবায়ু পরিবর্তন মন্ত্রণালয়
গণপ্রজাতন্ত্রী বাংলাদেশ সরকার
বাংলাদেশ সচিবালয়, ঢাকা-১০০০

Secretary
Ministry of Environment, Forest and Climate Change
Govt. of the People's Republic of Bangladesh
Bangladesh Secretariat, Dhaka-1000

Letter of Endorsement on behalf of the Government of Bangladesh

Record No. 00.0000.067.019.17.part(1).155 Date: 20 July 2023

To: The Adaptation Fund Board
c/o Adaptation Fund Board Secretariat
Email: Secretariat@Adaptation-Fund.org
Fax: 202 522 3240/5

Subject: Endorsement for Hydrological Status and Outlook system for integrated water resources management and climate resilience in Bangladesh and Nepal (HydroSOS-BaNe) project

In my capacity as designated authority for the Adaptation Fund in Bangladesh, I confirm that the above regional grant proposal is in accordance with the government's national priorities in implementing adaptation activities to reduce adverse impacts of, and risks, posed by climate change in Bangladesh and Nepal region.

Accordingly, I am pleased to endorse the above grant proposal with support from the Adaptation Fund. If approved, the project will be implemented by the World Meteorological Organization (WMO) and executed by the World Meteorological Organization (WMO), Bangladesh Meteorological Department (BMD), Bangladesh Water Development Board (BWDB), and Department of Hydrology and Meteorology of Nepal in close coordination with the climate change focal ministry in these two countries.

Justification to include WMO as an executing partner is provided below in the Annex 1.

Sincerely,

20.07.2023

Dr. Farhina Ahmed
Secretary
Ministry of Environment, Forest and Climate Change
and
Designated authority for the Adaptation Fund in Bangladesh

সচিব
পরিবেশ, বন ও জলবায়ু পরিবর্তন মন্ত্রণালয়
গণপ্রজাতন্ত্রী বাংলাদেশ সরকার
বাংলাদেশ সচিবালয়, ঢাকা-১০০০

Secretary
Ministry of Environment, Forest and Climate Change
Govt. of the People's Republic of Bangladesh
Bangladesh Secretariat, Dhaka-1000

Annex 1: Request for Change in Project Execution Arrangements: HydroSOS Bane Project (Bangladesh and Nepal)

To: The Adaptation Fund Board
c/o Adaptation Fund Board Secretariat
Email: Secretariat@Adaptation-Fund.org
Fax: 202 522 3240/5

Record No.00.0000.067.019.17.part(1).155 Date: 20 July 2023

Subject: Agreement on the implementation of HydroSOS BaNE project by the WMO together with the Bangladesh Meteorological Department (BMD), Bangladesh Water Development Board (BWDB), and Department of Hydrology and Meteorology of Nepal

Dear Adaptation Fund Secretariat,

As the Designated Authority for Bangladesh. I would like to present my compliments to the Secretariat.

I am writing this letter to endorse the change requested by the Implementing and Executive Partners regarding the Executing Entities responsible for the implementation of the regional project " Hydrological Status and Outlook system for integrated water resources management and climate resilience in Bangladesh and Nepal (HydroSOS-BaNe) " that WMO is also executing the project in Bangladesh and Nepal.

The Designated Authority was informed about the need to officially submit an endorsement letter in order to formalize the change and to obtain the approval by the Project and Programme Review Committee (PPRC) and the Adaptation Fund Board, and would like to state that such change does not represent any inconvenience but represents, in fact, the best solution to ensure continuity and quality implementation of the project activities at the regional, national and local levels, considering the limited capacity (technical and human) of the Bangladesh Meteorological Department (BMD), Bangladesh Water Development Board (BWDB), and Department of Hydrology and Meteorology of Nepal to execute the activities at the national and regional level. Also, WMO being an United Nations specialized agency has several advantages such as VAT exemption during the procurement of goods and services, expertise and availability of technical tools and products etc. which will be instrumental in the execution of the project activities.

Sincerely,

20.07.2023

Dr. Farhina Ahmed
Secretary
Ministry of Environment, Forest and Climate Change
and
Designated authority for the Adaptation Fund in Bangladesh

Government of Nepal

Ministry of Forests and Environment

Ref.No. 14

P.O. Box No.3987
Singha Durbar, Kathmandu

Date:- 3rd August, 2023

Letter of Endorsement

To: The Adaptation Fund Board
c/o Adaptation Fund Board Secretariat
Email: Secretariat@Adaptation-Fund.org
Fax: 202 522 3240/5

Subject: **Endorsement for Hydrological Status and Outlook system for integrated water resources management and climate resilience in Bangladesh and Nepal (HydroSOS-BaNe) project**

In my capacity as designated authority for the Adaptation Fund in Nepal, I confirm that the above regional grant proposal is in accordance with the government's national priorities in implementing adaptation activities to reduce adverse impacts of, and risks, posed by climate change in Bangladesh and Nepal region.

Accordingly, I am pleased to endorse the above grant proposal with support from the Adaptation Fund. If approved, the project will be implemented by the World Meteorological Organization (WMO) and executed by the World Meteorological Organization (WMO), Bangladesh Meteorological Department (BMD), Bangladesh Water Development Board (BWDB), and Department of Hydrology and Meteorology of Nepal in close coordination with the climate change focal ministry in these two countries.

Justification to include WMO as an executing partner is provided in separate letter.

Sincerely,

3rd August, 2023

Mr. Yam Nath Pokharel
Designated Authority, Adaptation Fund
Position: Under Secretary (Technical)
Head, Adaptation Section
Climate Change Management Division
Ministry of Forests and Environment, Government of Nepal
Singhadurbar, Kathmandu, Nepal
Tel: +977 14211996, Mobile: +977-9851112634
Email: ynpokharel@gmail.com
Web: https://mofe.gov.np/

Government of Nepal

Ministry of Forests and Environment

Ref.No. 15

P.O. Box No.3987
Singha Durbar, Kathmandu

Date:- 3rd August, 2023

To: The Adaptation Fund Board
c/o Adaptation Fund Board Secretariat
Email: Secretariat@Adaptation-Fund.org
Fax: 202 522 3240/5

Subject: **Agreement on the implementation of HydroSOS BaNE project by the WMO together with the Bangladesh Meteorological Department (BMD), Bangladesh Water Development Board (BWDB), and Department of Hydrology and Meteorology of Nepal**

Dear Adaptation Fund Secretariat,

As the Designated Authority for Nepal. I would like to present my compliments to the Secretariat.

I am writing this letter to endorse the change requested by the Implementing and Executive Partners regarding the Executing Entities responsible for the implementation of the regional project " **Hydrological Status and Outlook system for integrated water resources management and climate resilience in Bangladesh and Nepal (HydroSOS-BaNe)** " that WMO is also executing the project in Bangladesh and Nepal.
The Designated Authority was informed about the need to officially submit an endorsement letter in order to formalize the change and to obtain the approval by the Project and Programme Review Committee (PPRC) and the Adaptation Fund Board, and would like to state that such change does not represent any inconvenience but represents, in fact, the best solution to ensure continuity and quality implementation of the project activities at the regional, national and local levels, considering the limited capacity of the Bangladesh Meteorological Department (BMD), Bangladesh Water Development Board (BWDB), and Department of Hydrology and Meteorology of Nepal to execute the activities at the national and regional level. Also, WMO being a United Nations specialized agency has several advantages such as VAT exemption during the procurement of goods and services, expertise and availability of technical tools and products etc. which will be instrumental in the execution of the project activities.
I trust that you will look on this endorsement favorably.

Sincerely,

30 August, 2023

Mr. Yam Nath Pokharel
Designated Authority, Adaptation Fund
Position: Under Secretary (Technical)
Head, Adaptation Section
Climate Change Management Division
Ministry of Forests and Environment, Government of Nepal
Singhadurbar, Kathmandu, Nepal
Tel: +977 14211996, Mobile: +977-9851112634
Email: ynpokharel@gmail.com
Web: https://mofe.gov.np/

Project Formulation Grant (PFG)

Submission Date: 10 August 2023

Adaptation Fund Project ID:
Country/ies: Bangladesh and Nepal
Title of Project/Programme: Hydrological Status and Outlook system for integrated water resources management and climate resilience in Bangladesh and Nepal (HydroSOS-BaNe)
Type of IE (NIE/MIE): MIE
Implementing Entity: World Meteorological Organization
Executing Entity/ies: World Meteorological Organization, National Meteorological and Hydrological Services of the targeted two countries (Bangladesh Meteorological Department (BMD), Bangladesh Water Development Board (BWDB), and Department of Hydrology and Meteorology (DHM) of Nepal)

A. Project Preparation Timeframe

Start date of PFG	**15 October 2023**
Completion date of PFG	**15 January 2024**

B. Proposed Project Preparation Activities ($)

Describe the PFG activities and justifications:

List of Proposed Project Preparation Activities	Output of the PFG Activities	USD Amount
Hire consultants to draft project proposal and organize and conduct consultations with agencies and partners of the past and on-going projects in the GBM region to understand their expertise, experience, and to identify connections with the local stakeholders and beneficiaries, available resources and services, communication channels etc.	Meetings are successfully conducted, and past or on-going project knowledge, experience and contacts are noted and shared with WMO and other executing partners, which will be integrated into the full project proposal.	15,000
Performing a consultation workshop involving implementing and executing entities along with national partners of the six countries, finalizing roles and responsibilities, project result framework, M&E plan, budget, and time estimation for implementing each activity of the HydroSOS BaNe project	Roles and responsibilities of each stakeholder are assigned, M&E, project result framework, budget and time period for every activity are finalized along with the list of potential partners is identified with their budget estimation.	45,000

Hire consultant(s) to contribute to the development of the environmental and social risk management plan of the HydroSOS BaNe project through the environmental and social impact assessment (ESIA) aligning with the Environmental and Social (ES) and Gender policies of the Adaptation Fund	Environmental and social risk management plan is available and included in the project proposal	20,000
Total Project Formulation Grant		80,000*

*- the amount is inclusive of 13% project support or admin fee for the implementing entity

C. Implementing Entity

This request has been prepared in accordance with the Adaptation Fund Board's procedures and meets the Adaptation Fund's criteria for project identification and formulation

Implementing Entity Coordinator, IE Name	Signature	Date (Month, day, year)	Project Contact Person	Telephone	Email Address
Moyenda Chaponda, World Meteorological Organization		August 08 2023	Dr Hwirin Kim	+41 22 730 8358	hkim@wmo.int mchaponda@wmo.int