Concept Note

Protecting livelihoods and assets at risk from climate change induced flooding in glacial river basins of Nepal

United Nations Development | Nepal

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GREEN CLIMATE FUND

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Concept Note

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Project/Programme Title:	Protecting livelihoods and assets at risk from climate change induced flooding in glacial river basins of Nepal
Country(ies):	Nepal
National Designated Authority(ies) (NDA):	Ministry of Finance, Government of Nepal
Accredited Entity(ies) (AE):	United Nations Development Programme
Date of first submission/ version number:	2018-02-13 [V1]
Date of current submission/ version number	2018-02-13 [V1]

Please submit the completed form to **fundingproposal@gcfund.org**
Please use the following naming convention in the subject line and the file name:
*"**CN-[Accredted Entity or Country]-yyyymmdd**"*

A. Project / Programme Information (max. 1 page)			
A.1. Project or programme	☒ Project ☐ Programme	**A.2. Public or private sector**	☒ Public sector ☐ Private sector
A.3. Is the CN submitted in response to an RFP?	Yes ☐ No ☒ If yes, specify the RFP: _____	**A.4. Confidentiality**[1]	☐ Confidential ☒ Not confidential
A.5. Indicate the result areas for the project/programme	Mitigation: Reduced emissions from: ☐ Energy access and power generation ☐ Low emission transport ☐ Buildings, cities and industries and appliances ☐ Forestry and land use Adaptation: Increased resilience of: ☒ Most vulnerable people and communities ☐ Health and well-being, and food and water security ☐ Infrastructure and built environment ☐ Ecosystem and ecosystem services		
A.6. Estimated mitigation impact (tCO2eq over lifespan)	N/A	**A.7. Estimated adaptation impact (number of direct beneficiaries and % of population)**	327,500 direct beneficiaries. This is approximately 2% of total population
A.8. Indicative total project cost (GCF + co-finance)	Amount: USD $63 Million	**A.9. Indicative GCF funding requested**	Amount: USD $23 Million
A.10. Mark the type of financial instrument requested for the GCF funding	☒ Grant ☐ Reimbursable grant ☐ Guarantees ☐ Equity ☐ Subordinated loan ☐ Senior Loan ☐ Other: specify_____		
A.11. Estimated duration of project/ programme:	5 years	**A.12. Estimated project/ Programme lifespan**	20 years
A.13. Is funding from the Project Preparation Facility requested?[2]	Yes ☐ No ☒ Other support received ☐ If so, by who:	**A.14. ESS category**[3]	☐ A or I-1 ☒ B or I-2 ☐ C or I-3
A.15. Is the CN aligned with your accreditation standard?	Yes ☒ No ☐	**A.16. Has the CN been shared with the NDA?**	Yes ☒ No ☐
A.17. AMA signed (if submitted by AE)	Yes ☒ No ☐ If no, specify the status of AMA negotiations and expected date of signing:	**A.18. Is the CN included in the Entity Work Programme?**	Yes ☒ No ☐
A.19. Project/Programme rationale, objectives and approach of programme/project (max 100 words)	The project objective is to safeguard the lives and livelihoods of 327,500 people and their physical and economic assets from the climate-induced threat of glacial lake outburst floods (GLOFs) and related hazards. This will be accomplished by adopting a comprehensive and integrated multi-hazard watershed-based approach resulting in strengthened institutional, technical, and financial capacity to develop and implement long-term GLOF and multi-hazard management strategies, including a combination of structural and non-structural measures which protect communities, employ eco-system-based approaches, and re-balance natural eco-system		

[1] Concept notes (or sections of) not marked as confidential may be published in accordance with the Information Disclosure Policy (Decision B.12/35) and the Review of the Initial Proposal Approval Process (Decision B.17/18).
[2] See here for access to project preparation support request template and guidelines
[3] Refer to the Fund's environmental and social safeguards (Decision B.07/02)

	functions. In addition, strengthened early warning and emergency response systems will provide forecasts and early warning to at-risk populations. The Executing Entity will be the Department of Hydrology and Meteorology (DHM). The Department of Soil Conservation and Watershed Management (DSCWM) / Ministry of Forest and Soil Conservation (MoFSC), Department of Water Induced Disaster Management (DWIDM) / Ministry of Irrigation (MoI) and other relevant ministries and departments are some of the key implementing partners.

B. Project / Programme details (max. 8 pages)

B.1. Context and Baseline (max. 2 pages)

Country Context and Climate Change

1. Nepal is home to 8 of the 10 highest mountain peaks in the world, including Mount Everest (8,848 m), whose snow pack and glaciers maintain the perennial flow of major domestic rivers and the Ganges in India. As glaciers retreat they leave behind weak moraine and ice dams, behind which glacial lakes are formed. A breach of these dams could lead to the discharge of large volumes of water and debris in a few hours, which can cause catastrophic flooding, mudflow and landslides downstream. There are 3,808 glaciers and 1,466 glacial lakes in the Nepal Himalaya draining to 4 major river basins. 21 of these lakes, draining to two river basins, are identified as a serious threat to 327,500 people in downstream communities. All the major rivers of Nepal are snow and glacier melt-fed and accommodate significant volumes of water flow throughout the year. However, 75% of the annual volume of water is discharged during the monsoon season (June–September) resulting in significant annual flooding. The observed maximum temperature increase in the high Himalayas in Nepal (0.86 ^{o}C per decade) is higher than in the lower parts of Nepal (0.2^{o}C per decade) and above the global average of 0.15-0.20°C per decade. Consequently, melt rate of Himalayan glaciers is intensifying, the number of glacial lakes is increasing, and existing glacial lakes are expanding. Glaciated area decreased by 24% and the volume of ice reserve decreased by 29 % from 1977 to 2010 in Nepal[4], forcing some mountain communities to migrate due to scarcity of water for their livelihood. While no projections have been provided, a similar decrease of glacier area and ice volume to that from 1977 to 2010, can be assumed for the future (Bajrachrya et al. 2014). The AR5 (IPCC, 2014) predicted increases in the warmest temperatures in Nepal of 2-3°C in the mid-term (2046–2065) and 3-5^{o}C in the long-term (2081-2100), while the warmest daily maximum temperature is projected to increase 4-5°C. The AR4 predicts that precipitation increases are very likely at higher latitudes by the mid-21st century under the RCP8.5 scenario, and over eastern and southern areas by the late-21st -century. Under the RCP2.6 scenario, increases are likely at high latitudes by the mid-21st century, while it is likely that changes at low latitudes will not substantially exceed natural variability. In addition, in Nepal more frequent and heavy rainfall days are projected and winters are expected to be drier and monsoon summers wetter which could result in more frequent and intense summer floods and winter droughts. Growing evidence from past events suggest climate change is affecting the monsoon's arrival and intensity, and will increase risk of deadly summer floods while decreased rains in water-stressed regions may force migration to already crowded cities and increase food insecurity.

Climate Change impacts

2. Due to climate change-induced accelerated melting of Himalayan glaciers, the instance of highly destructive GLOFs that decimate communities and assets downstream is increasing. Furthermore, these outburst floods are likely to trigger cumulative disaster events such as flash floods, mudflows and landslides downstream. As climate change continues to accelerate the rate of glacial melt, the livelihoods of millions of people, as well as growing hydropower and other critical assets, are increasingly at risk of devastation from GLOFs and other climate hazards in Nepal. Potentially dangerous lakes typically require a trigger mechanism to initiate a flood. These include: displacement waves from rock avalanches or ice avalanches collapsing into lakes from hanging or calving glaciers, moraine collapse due to seepage, and collapse of moraines due to the melting of their ice cores. In addition to accelerating glacial melt, climate change increases the likelihood of these trigger mechanisms. Nepal has experienced at least 24 GLOF events in the past. Of these, 14 are believed to have originated in Nepal itself, and 10 originated in lakes across the Tibet, China-Nepal border that drain to Nepal. Impacts from GLOFs include loss to lives, agriculture, hydropower, transportation and tourism, among other sectors. Impacts extend to 100 km and more downstream. The largest glacial lake of Nepal, Tsho Rolpa, was lowered in 2000 to reduce risk to downstream communities, and Imja lake was also lowered in 2016. However, the remaining 19 high-risk lakes pose an ever-increasing threat. Nepal is also highly susceptible to floods during the monsoon rains, patterns of which are impacted by climate change. Floods and landslides have caused approximately 8,400 deaths in Nepal from 1983 to 2013, with an average of 269 deaths per year

[4] International Centre for Integrated Mountain Development (ICIMOD) 2014 (Bajracharya et al., 2014)

(DWIDP 2013). Based on Desinventar records, the number of deaths between 1971 and 2010 was 4,327 for landslides and 3,899 for floods (DesInventar, 2011). Desinventar figures show an increasing trend in numbers of flooding events since 1971. In general, the mountainous and hilly regions are more prone to landslides while the Terai region is more susceptible to floods (Nepal IASC 2008), where deaths and building damage from landslides and floods peak in July and August (MoHA 2012). The most recent event occurred on August 10th, 2017, when torrential monsoon rain resulted in widespread flooding and landslides. In Nepal, 35 of 75 districts experienced severe flooding, affecting 1.7 million people. According to Ministry of Home affairs (MoHA) nearly 21,000 families were displaced, 191,717 homes partially damaged or destroyed, 159 dead, 29 missing and 45 injured.

Baseline Investment

3. The Climate Change Management Division and DHM of the Ministry of Population and Environment (MoPE) are among the government agencies actively working to monitor and mitigate the threat of GLOF and other floods in Nepal. At the national level the DHM provides real-time information 24-hours per day on hydrometric variables from a network of hydrometric monitoring stations throughout the country. The density of the hydrometric network is insufficient to meet the intensified monitoring requirements that climate variability demands. In only two river basins, GLOF specific flood forecasting and Early Warning Systems (EWSs) are available.

4. DHM is currently updating their existing climate risk monitoring and national early warning system capacities. With support from the World Bank they are implementing a project called *Building Resilience to Climate Related Hazards* that is investing in institutional strengthening, modernization of hydro-meteorological and environmental observation networks, and enhancement of service delivery systems. This project is part of the Pilot Program for Climate Resilience (PPCR), implemented over the period 2014-2019. However, the improved monitoring systems and internal capacity improvements accomplished via PPCR are not sufficient to quantify and track the GLOF risk in Nepal; installing monitoring systems at glacial lakes is not part of the project plan, and the project does not supply ongoing funds for additional personnel and operations and maintenance beyond 2019. Additional monitoring stations at glacial lakes as well as the long-term resources to maintain and manage these stations is necessary to adequately address GLOF risk in the face of climate change. Additional capacities for observation and early warning are critical to address the multi-hazard and cumulative impacts that the GLOFs are likely to trigger. Total PPCR investments approved in Nepal were around US$86 million in CIF financing, of which approximately $50 million was grants and $36 million was favourable concessional loans. Of this amount, around US$31 million was dedicated to the Building Resilience to Climate Hazards PPCR program (one of four PPCR projects in Nepal). Direct investment in GLOF risk reduction measures has been largely externally funded by projects such as *Tsho Rolpa glacial lake* lowering project (GoN funded, completed in 2000); *CBEWS program at Tsho Rolpa (UNDP 2011-2017); Community-based flood and glacial lake outburst risk reduction (CFGORRP) – Imja Lake Lowering Project (*2011-2018, UNDP GEF-LDCF total budget was US $ 7,249,430);

5. Watershed management in Nepal is the responsibility of the Department of Soil Conservation and Watershed Management (DSCWM) under the MoPE. The DSCWM coordinates government investment in flood and erosion mitigation measures – including physical infrastructure such as check dams and embankments, and ecosystem-based adaptation (EbA) measures such as riparian habitat restoration. Both the DSCWM and the National Planning Commission have initiated climate-resilient planning tools to screen developments and bolster natural and built infrastructure against flooding impacts from events including GLOF. In addition to these efforts, Nepal's significant community forestry programs, effective since 1978, actively help to secure slopes and mitigate the impacts of flash flooding (including GLOF) when conducted in riparian areas. Though these efforts are not currently coordinated by basin neither are the climate change scenarios impacting cumulative, multi-hazard risks across the catchments factored in, the DSCWM is in the process of developing Basin Management Plans for Nepal's three largest basins to help coordinate efforts at flood risk management from the high Himalaya to the alluvial Terai region. Watershed management and EbA approaches have been largely externally funded by projects such as: *USAID's Hariyo Ban Project (2012-2016),* which was extended for a second 5-year period in 2016 to run through 2021 with an additional $18 million*; The Nepal Climate Change Support Programme (NCCSP),* whose Phase I had a total financial commitment of £14.6 million to support local climate adaptation planning efforts, while in Phase II (2017-2022) DFID and EU are funding £7 million and £7.6 million respectively; *Ecosystem-based Adaptation (EbA) in Mountain Ecosystems Project (2011-2016),* which is enhancing the ability of decision makers in Nepal to plan and implement EbA measures at national and ecosystem levels; and the widespread *Community forestry programme*. However significant, these efforts remain limited in scale and requiring policy measures to institute them for a large-scale uptake.

Adaptation Solution

6. To enhance climate resilience and safeguard communities and their social and economic assets in the valleys downstream of high hazard GLOFs, the government of Nepal requires the knowledge, skills and capacity to understand, assess and manage the risk from GLOFs and related hazards under the conditions of changing climate. Nepal needs to adopt a comprehensive and integrated multi-hazard approach to strengthening institutional capacity, strengthening policy and legislative frameworks, implementing a combination of structural and non-structural protective measures (including ecosystem-based approaches), and strengthening and enhancing early warning and emergency response within GLOF catchments. More specifically, intensified climate variability requires the adaptation solution to include a greater density of observation systems to address the largest observation gaps in the higher Himalayan region and better inform snow hydrology and GLOF understanding. This multi-hazard observation network will trigger early warning systems during shock events and can provide ongoing timely and quality risk information tailored to population and productive sector needs. This expanded observation network and new technology will require a mechanism of service cost-recovery to ensure financial sustainability for operations and maintenance, including necessary technological upgrades in the future. It will also require development and institutionalization of technical capacities for GLOF risk reduction, including a range of methods for glacial lake lowering. In addition, this solution will also require risk reduction efforts downstream through land use and ecosystem-based solutions at catchment scale. Such a comprehensive solution will enable better risk reduction, prevention, and preparedness in the long-term. However, there are number of barriers that currently preclude this adaptation alternative from materializing.

Barriers

7. ***Lack of technical knowledge and modern technology:*** Relevant government institutions have limited technical capacity for developing the risk knowledge basis on which comprehensive climate risk and disaster management of GLOF and multi-hazards should be based– such as producing hazard, risk and vulnerability maps, or the systematic technical field surveys to assess the risks from GLOFs. Much of the research and development in this area was completed by regional and international donor organisations in an often *ad hoc* manner, without coordination with or embedding capacity within Nepali institutions mandated to perform these functions. Knowledge of current techniques, such as modelling, that should be applied in the management of these climate hazards are lacking. As a result, the country still lacks comprehensive climate risk information on hazards, risk and vulnerabilities. Information on the Himalayan region (such as snow hydrology or the changing status of glacial lakes and their potential hazard) is lacking, particularly in remote areas. Systematic field programs to undertake topographical and bathymetric mapping, hydro-meteorological observations, and geological, geophysical and glaciological surveys to evaluate the condition and composition of the moraine material, the geological setting of the lake, glacier, moraine and surrounding area are lacking. The International Centre for Integrated Mountain Development (ICIMOD) is the key organisation undertaking research on GLOF risk, based on their own mandate, but their GLOF risk studies have not been updated since 2012. As a result, there are uncertainties about current risks as well as dry period flows from glacial lakes and how they contribute to the water flows downstream. In addition, while some projects such as PPCR are helping to rehabilitate the hydrometric monitoring network in Nepal, there is no systematic observation and monitoring taking place on which to base the monitoring of GLOF and related hazards and key observation gaps remain, particularly in the high Himalayas. Setting up a system by which the government will be able to regularly track glacial conditions is fundamental to risk reduction strategies across all timescales. DRM practitioners at the national and sub-national levels are lacking detailed climate risk information to inform probabilistic assessments of risks posed by climate-induced disasters to communities and their assets, and to target limited financial resources to implement technically robust solutions. Without such risk assessments, tailored disaster and climate risk management measures cannot be developed. Specifically, there is a lack of capability at national and sub-national levels to conduct: i) climate risk assessments; ii) vulnerability assessments; iii) damage and loss assessments; iv) economic valuations to inform sectoral, national and subnational plans; v) risk financing; and vi) contingency planning.

8. Watershed-level approaches to GLOF risk reduction are limited. Few projects link upstream GLOF origins and flood hazard with catchment management and livelihood safeguarding downstream. Likewise, the linkages between upstream risk reduction approaches and downstream impacts (such as reduced risk or impacts to: environment, water resources, communities' cultural heritage, IP, gender, etc.) have not been adequately assessed. Detailed watershed characterization, dam breach modelling, and downstream hazard mapping has not been conducted to determine priority areas of response for GLOF intervention among all of Nepal's 21 high-risk glacial lakes. In addition, the studies that do exist do not account for climate change scenarios. There is limited knowledge of the range of risk reduction techniques that would be suitable to local conditions. Lake level lowering and EWS methods have been tried and tested but are not systematically applied. In addition, community awareness of GLOF risk is low and efforts to raise awareness have been minimal to date. Many of the people who live in the inundation zones of glacial lakes are indigenous populations and have not been

involved fully in risk assessment or CBEWS development. These gaps preclude systematic efforts of risk reduction at watershed level that would recognize hazard evolution processes and their interactions between upstream and downstream.

9. ***Policy and institutional barriers:*** The mandates of key institutions are still not finalised, making it difficult to fulfil essential GLOF and flood risk reduction functions. For example, both DHM's cost-recovery and income-generating capacity and their mandate for provision of data services and early warning to commercial interests are not articulated. This is a major sustainability issue; because this impacts the capacity to finance long-term operation and maintenance of improved hydrometric networks, such mandates should be developed. Beyond the mandate challenge, additional institutional barriers exist. Most climate change adaptation and resilient livelihoods efforts are sporadic, geographically dispersed, and project-based. Furthermore, climate-induced hazards are addressed mainly *ex-post,* focusing on rescue and relief. Despite hundreds of annual deaths and billions of Rupees in annual property loss due to flash floods, landslides, and other disasters, there is a lack of planning for, or sustained government-funding for, adaptation and resilient livelihoods programs for the *ex-ante* management of climate-induced disasters. Within GON departments and ministries there is overlap and fragmentation of institutional capacities. For example, both DHM and DWIDM have responsibility for hazard, risk and vulnerability assessment and both are involved in the mitigation and strategic management of hydrometeorological hazards (such as flood, droughts, soil erosion and landslides). And, both are implementing watershed management measures to address these hazards. Despite highly complementary competencies there is little coordination between the two agencies and there is little consideration of climate change in risk evaluation or programming.

10. ***Financial barriers:*** One financial barrier is the lack of investment in, and investment planning for, long-term climate risk reduction to address GLOF and flood risk, largely due to a lack of comprehensive climate risk and vulnerability data (including damages and losses) and cost-benefit analyses of undertaking such intervention measures. In addition, there are no financial mechanisms to sustain risk reduction approaches. Tried and tested GLOF risk reduction (e.g. Imja and Tsho Rolpa lake lowering) approaches have not been assessed for cost-effectiveness due to lack of capacity to complete such assessments, or for CBA-based appraisal-led design of risk management strategies. This limits the GoN's ability to systematically identify and program financial requirements for implementing risk reduction measures. The GoN contribution to total annual budget for climate change risk reduction, resilience and adaptation activities ranged from $87.1 Million USD (25%) to $83.5 Million USD (45%) from 2014/15 to 2016/17 with a combination of foreign grants and loans making up the remaining 55-75% of total investments. The national annual budget allocation for climate risk reduction, resilience and adaptation activities averages $85 Million USD while the average annual damages from climate related hazards is 1.5-2% GDP or $270-360 Million USD, predicted to rise to 2-3% GDP or $360-540 Million USD by mid-century (INDC). Structural measures such as lake lowering can cost around $3 million per lake. To date they have only been undertaken by donor funded projects because the GoN lacks the financial resources for such projects as well as the capacity to identify and plan for such investments. The combined challenges of a public deficit in climate change adaptation and resilience investment, existing lack of climate risk information, and increasing investment needs due to climate change hinder sustainable and well-planned investment in GLOF risk-reduction measures. Public investment and future appropriations for physical flood risk management efforts downstream are also lacking, including systems that address multiple hazards and small engineering efforts such as check dams, culverts, and or other water diversion methods. Investment in systemic catchment management to address impacts of flooding and reduce flood risk are limited and uncoordinated. High value EbA efforts like community forestry can be utilized to secure downstream areas in glacial catchments, but have to date not been a coordinated part of GLOF risk management since the watershed approach to GLOF and multi-hazard management is limited.

B.2. Project / Programme description (max. 3 pages)

11. The proposed project aims to address the above barriers and shift the baseline scenario towards climate resilience through two outputs, namely institutional strengthening and investment in GLOF and flood risk reduction strategies:

<u>Output 1</u> - Institutions strengthened to deliver climate risk information, monitoring and early warning services to local populations and productive sectors of economy

Activity 1.1 - Knowledge base and technical capacities strengthened for climate research and risk reduction strategies

Sub-activity 1.1.1 - Methods and SOPs for inventory and development of spatial digital database (GIS) of glaciers and glacial lakes (geophysical investigation, topographic and bathymetric surveys) developed.

12. The project will implement long-term measures to enable the continuous and systematic monitoring and evaluation of risks and the implementation of a GLOF early warning system. This will be accomplished via development of methods and Standard Operating Procedures (SOPs) through embedding the capacity to undertake risk assessment of GLOFs within DHM as well as within research and academia. The project will implement the step-by-step approach based on that developed by ICIMOD for GLOF risk assessment and management in Nepal (ICIMOD, 2011), which includes physical, field-based risk assessment methods for identifying risk of GLOF at the glacial lakes sites, and hazard and risk assessment of downstream communities using dam breach modelling, risk and vulnerability assessment methods to be introduced in Activity 1.1.3. A programme of monitoring of the 21 highest risk GLOFs identified by ICIMOD will be implemented using a multi-disciplinary, multi-stage approach, using multiple GIS and technical analyses supported by field surveys (see Activity 2.1.1). The SOPs to be developed and embedded with DHM and research and academia will enable systematic and long-term GLOF risk assessment in the future. In relation to this, DHM and Kathmandu University (and possibly other research institutions) may set up a national consortium to undertake such regular field investigations and studies. The feasibility study must identify institutionally and financially sustainable arrangements for this work.

Sub-activity 1.1.2 – Methods & tools introduced for glacial lake hazard prioritization using a combination of remote-sensing, satellite data and ground-truthing and socio-economic vulnerability assessment.

13. GLOF risk and hence prioritisation of GLOFs for intervention can be derived based on likelihood of the breaching of the moraine or ice dam and on the socio-economic impact of GLOFs on downstream receptors. Methods for systematically assessing the likelihood of breaching will be developed: The project will use high-resolution remote sensing of glacial lakes for a range of temporal periods, from which a methodology for hazard assessment will be developed that accounts for likely failure modes (self-destructive failure or dynamic failure), based on parameters including lake volume and area, GIS-based hazard assessment of ice avalanche trajectories, landslides/rockfalls, upstream GLOFs (i.e. cascade failure), and moraine stability using the same criteria as Rounce *et al.* (2016)[5] with adjustments as detailed in (Rounce *et. al.,* 2017)[6]. The project, with GCF funds will also undertake and develop long-term capacity for site-specific investigations to confirm parameters of the most critical dams. The impact of the hazard on downstream receptors will be assessed by the introduction of systematic dam breach modelling which will model and map the inundation and debris mass movement that would result from a dam breach (Activity 1.1.3). In Nepal, GLOFs result in losses to infrastructure, particularly roads, water supply, and hydropower plants, agriculture and damage to property. GLOFs are also likely to result in the loss of life. Hazard mapping will be used in combination with infrastructure (bridges, roads and buildings), land use (settlements, agriculture, grazing lands, and conservation areas, critical infrastructure), property, people and socio-economic data, to assess the risks and socio-economic impacts of GLOFs. These data layers will, in turn, inform the development of vulnerability maps for each glacial watershed. Following this analysis, a method of prioritisation will be developed based on the combined likelihood of failure and severity of downstream impact.

Sub-Activity 1.1.3 – Methods & technology introduced for modelling and mapping GLOF and other extreme flood, landslide, mudflow and soil erosion hazard and risk.

14. The GCF funds will be used to develop and deliver climate services such as climate hazard, risk and vulnerability assessments, cost-benefit assessments for adaptation of solutions and related training to embed capacity for such assessments within mandated institutions. The project will introduce dam breach modelling for GLOFs and introduce/strengthen capacity for flash flood, cloud burst hazard and risk modelling in glacial watersheds. In addition, the project will introduce flood hazard and risk modelling for, landslide, mudflow and soil erosion modelling and mapping taking a multi-hazard approach. This will enable a comprehensive risk assessment linking upstream GLOF breach risk with downstream GLOF risk with downstream hazards such as landslide, mudflow and erosion hazards that can be caused by flooding and that can also exacerbate the impacts of GLOFs, thus enabling development of comprehensive watershed-based solutions that address the root causes and effects of flooding and related hazards. This watershed based, multi-hazard approach will be embedded with DHM, DSCWM, DWIDM and other relevant institutions through the development of methods and guidelines and will include extensive capacity building.

[5] Rounce, D.R.; McKinney, D.C.; Lala, J.M.; Byers, A.C.;Watson, C.S. A new remote hazard and risk assessment framework for glacial lakes in the Nepal Himalaya. Hydrol. Earth Syst. Sci. 2016, 20, 3455–3475

[6] Rounce,Watson and C. McKinney (2017) "Identification of Hazard and Risk for Glacial Lakes in the Nepal Himalaya Using Satellite Imagery from 2000–2015"

Sub-activity 1.1.4 - Development of climate-induced hazard event recording and management database systems.

15. GCF resources will be used to improve hazard event recording and management database systems at DHM and other agencies which will provide evidence for budgeting and implementation of climate risk reduction measures and enable prioritisation of risk reduction and investment interventions. Such an accounting system will complement the hazard and risk modelling under sub-Activity 1.1.3. Nepal currently uses the Desinventar database for recoding of all hazard events. The mechanisms for collecting hazard information including the parameters will be examined, and further developed to ensure that the information that is being collected is managed in a manner which permits use in future risk reduction planning and implementation.

Activity 1.2 - Technological capacities strengthened for monitoring and early warning
Sub-Activity 1.2.1 – Improve observation network density in GLOF watersheds.

16. Matching GoN hardware investments to strengthen the hydrometric monitoring network and early warning systems, the GCF project will fill the gaps to enhance DHM's ability to monitor and warn populations downstream of GLOFs. The current monitoring gaps are mainly in the High Himalayas, where it is estimated that 40-50 hydrometeorological stations are needed across 21 glacial watersheds. This activity is important as it provides the missing monitoring needed for GLOF risk management and to improve lead times for downstream early warning systems. This capacity is urgently required due to the climate change accelerated risks posed by glacial lakes in the High Himalayas. Beyond the glacial lakes in Nepal, there are 12 glacial lakes in Tibet that threaten Nepal. More than 1000 people and many hydropower installations are at risk from these Tibetan lakes. Monitoring equipment will be installed on the border to provide improved lead times for EW in the Nepali downstream. There is a need for regional cooperation at the technical level to ensure that the necessary measures can be taken to protect populations within Nepal. Given ICIMOD's regional remit and mandate the project will seek to enhance and enable ICIMOD's work on transboundary glacial lake monitoring and assessment to improve understanding of the risk to Nepal. The project will examine approaches to strengthen technical cooperation on assessing and managing the risk from Tibetan glacial lakes using ICIMOD as the vehicle for such cooperation. Within Nepal, sustainability of the hydrometric system will be addressed in a comprehensive manner by establishing the enabling environment for DHM to engage in cost-recovery. This will also enable the establishment of agreements between DHM and key cost-recovery partners such as the Hydropower sector and National Parks (see Activity 1.3). DHM will be able to shift their hydrometric monitoring capacity and provision of EWS services from reliance on the current donor/IFI project basis, to a more comprehensive self-sustaining basis. These activities are in line with DHM's concept design and draft strategy for EWS.

Sub-Activity 1.2.2 - **Multi-hazard early warning combining centralized and community-based mechanisms**.

17. DHM has already established flood early warning systems (EWSs) in 33 rivers across Nepal, both self-funded and with the help of donors/IFIs. The various EWSs and increased capacity of DHM are significant advances, but these project-based systems need to be integrated into a single national system comprised of integrated centralised and community-based EWS. Based on existing systems, the project will build DHM's capacity to develop a fully integrated multi-hazard forecasting system, to be implemented within DHM. This system will cover the priority glacial watersheds, but will be expandable to integrate other EWS that are already in place in other basins. The project with GCF funds will address several improvements to the meteorological and hydrological forecasting capabilities of DHM to enable the production of high-quality, high-resolution weather forecasts in Nepal, particularly related to GLOF risk. More specifically it will develop community-based GLOF EWS where appropriate, to be implemented in at least 100 communities across the 21 glacial watersheds and based on full community engagement and participation. It is critical that centralized EWS is linked to and benefits from local community based early warning mechanisms, both for the purpose of cost-effectiveness as well as accuracy and timeliness of alert transmission. This project will aim to use gender-responsive participatory methods. The choice of communities (villages) will be made based on the risk assessment and mapping completed under the Activity 1.1. Communities' willingness to participate and actively engage in the EWS and DRM activities will also be one of the key criteria for the final selection of beneficiaries under this activity. The centralised and community-based EWSs will be fully integrated to provide a comprehensive solution.

Activity 1.3 – Policy and financial mechanisms for sustainable GLOF and flood risk information services developed

Sub-Activity 1.3.1 – Climate risk information products developed and tailored for use by productive sectors (tourism, hydro and irrigation)

18. This activity will use GCF funds to focus on developing climate risk information products that are tailored to enhancing the understanding of implications of climate related changes for each of the major sectors impacted

by GLOF and related risk. These sectors include hydropower, tourism and agriculture. In all cases, this will not simply be risks to physical assets, but also to a wider range of factors, including supply chains, market demand, environmental and social effects, and other characteristics relevant for sector operation. This perspective is especially relevant for water-intensive businesses. The climate hazard and risk information to be developed in Activity 1.2 will be used to fully characterise the risks to each sector and the likely impacts of climate variability and will serve as the foundation for l sector-specific climate risk management plans for long-term management of these risks. In addition, the project will develop sector-specific climate risk information products including targeted early warning services to each sector. Market demand for these products will be further explored during the feasibility study.

Sub-Activity 1.3.2 – Regulatory framework and procedures established for private sector co-finance for O&M of monitoring and EWS as well as climate information products.

19. In order to support development of the regulatory framework and procedures for enabling public-private partnerships to co-finance O&M for monitoring and EWS equipment, the project will provide methods and tools for quantification of the long-term operation and maintenance requirements under climate change, to safeguard investments and will assist government in identifying and prioritising financing, and identifying appropriate risk financing mechanisms such as public, private partnerships with key sectors, in the delivery and maintenance of climate risk knowledge and EWSs. Financing models for O&M costs (e.g. of community-based schemes that may involve the use of tariffs or in-kind contributions to establish community-based O&M programmes) and schemes to engage the private sector at local, national and sectoral levels in O&M financing will be developed, to ensure that the long-term costs will be met by the most appropriate and sustainable combination of financing sources. In addition, the project will support development of O&M investment plans based on cost-benefit analysis to be introduced in Activity 1.1.3 as well as the use of investment plans for technical justification for central budget allocation to cover investment in O&M cost of equipment. Furthermore, the CBA tools to be developed by the project will be embedded as a standardised requirement for developing investment plans for GLOF and multi-hazard risk management.

Sub-Activity 1.3.3 – Improve institutional mechanisms to enforce climate risk informed watershed management principles across all sectors.

20. The GCF project will address key institutional barriers to enforcing risk informed watershed management practices across all sectors. With GCF funds the project will develop long-term watershed management strategy for managing GLOF risks in Nepal for each glacial watershed, based on the risk assessment and prioritisation completed in Activity 1.1. The strategies will include risk reduction options (comprising lake lowering, controlled dam breaching and other structural interventions at the lakes and in the downstream catchments) as well as non-structural interventions, (including long-term monitoring and EWS, EbA watershed management options as well as sector-specific resilience measures for the main impacted sectors (hydropower, agriculture, critical infrastructure and tourism). The glacial watershed management strategies will include costed action plans (that include cost-effectiveness assessments). The project through Activity 1.2 is developing the risk knowledge and capacity of relevant institutions to perform necessary risk assessment on a long-term basis for GLOF and rain-induced flood related hazards. The project will further develop the systematic dissemination mechanisms for the use of relevant climate risk information to enable climate risks to be considered in delivering mandates across all sectors. This will be done through the Nepal Climate Change Knowledge Management Centre (NCCKMC) which is comprised of several governmental, non-governmental and community-based organizations, academic and research institutions involved in generating and disseminating data and information on climate change and its impacts. The project will develop the necessary mechanisms and technologies to embed climate risk information into the planning, response and management of these risks in the future, particularly as it relates to GLOF and multi-hazard risk at the watershed scale. During feasibility study, a review of the institutional arrangements and capacity for GLOF and flooding risk management will be undertaken. Importantly, mandates will be reviewed, and opportunities will be sought to support the rationalising of mandates to ensure an effective climate risk management framework for GLOF and rain-induced flood risk. The project will also develop an investment strategy for ensuring research or knowledge generation in Nepal by developing partnerships between relevant government institutions and relevant international agencies or international organizations to embed knowledge and training in Nepal. This will include development of appropriate programmes at government training institutions as well as at Nepalese universities to promote to promote advanced knowledge in all aspects of GLOF science and management including glaciology, geotechnics, geophysics, lake bathymetric survey methods, lake hydrology, lake mapping methods, dam breach modelling and risk assessment. . Importantly, the project will embed these watershed-based appraisal-led strategic risk management methodologies and knowledge sharing/management mechanisms in the DHM and DSCWM. This will enable Nepal to better plan, prioritise and identify funding requirements for future GLOF intervention measures. As discussed under Activity 1.3.2,

risk financing mechanisms to be identified will enhance institutional capacity to deliver GLOF and multi-hazard risk management strategies in the long-term.

Output 2 - Investment in GLOF and Flood risk reduction strategies at the watershed level scaled-up

Activity 2.1 – Developing and embedding institutional capacity for watershed characterization and field studies to verify the areas of priority interventions

Sub-activity 2.1.1 – Detailed, field-based investigations of particularly dangerous glacial lakes completed

21. The project will embed the capacity to systematically undertake field-based GLOF investigations within the relevant ministries and departments (including DHM). These field studies will include topographical and bathymetric mapping, hydro-meteorological observations, and geological, geophysical and glaciological surveys to evaluate the condition and composition of the moraine material, the geological setting of the lake, glacier, moraine and surrounding area. The project will fund these investigations for the highest risk of the 21 lakes. Geophysical investigation with ground-penetrating radar will be used to locate buried ice. Geomorphological processes and landforms will be evaluated. A bathymetric survey using either direct depth measurement or echo-sounding will be used to calculate the lake storage volume. Potential external GLOF triggers will be evaluated by observation of the associated glacier for hanging glaciers, glacial retreat and other phenomena. The possibility of ice avalanche, ice calving, rock fall or rock slope failure will be assessed. The hydro-meteorological investigation will include the installation of automatic hydrological stations to systematically measure discharge, flow and automatic meteorological stations will be installed to systematically record meteorological data such as air temperature, relative humidity, radiation, and wind speed and direction (new stations to be installed under sub-activity 1.2.1). Systematic survey methods will be introduced for recording hydraulic characteristics such as river cross-sections and changes in channel geometry, river longitudinal sections to record the steepness of the river and seepage. The data and information from the field investigations will be used as inputs to GLOF modelling to be implemented in Activity 1.1.3, in the development of GLOF risk management strategies (Sub-activity 1.1.3) and the design of GLOF risk reduction measures and described in Activity 2.2 below. This process of field investigation will be accompanied by the targeted skill building and capacity development that will result in SOPs for undertaking such regular updates in risk information and understanding, essential for any viable risk reduction strategies.

Sub-activity 2.1.2 – Priority degraded sub-watersheds upstream and downstream within glacial lake catchments.

22. The project will embed multi-criteria analysis methods into DHM and other responsible institutions to identify critical watersheds and to identify and prioritise the watershed management strategies. Criteria will include the following: 1) ***Impact of glacial dam breach*** (likely economic losses, likely loss of life, population at risk, property at risk, and impact on: national protected areas, agriculture, hydropower installations, forestry, the environment and heritage etc.). This will be based on output from Activity 1.1.3; 2) ***Likelihood of other hazards in the upper watersheds that can increase glacial dam failure risk*** (rockfall, avalanches etc.). Leeds University's[7] 'traffic light' matrix of contributing risk factors may be used to determine likelihood of dam failure; 3) ***Multi-parameter vulnerability assessment of the middle and lower watersheds***. This will be completed using appropriate watershed vulnerability assessment methods (based on DSCWM's existing watershed prioritisation tool) and will incorporate multi-criteria evaluation of sensitivity, exposure, and adaptive capacity indicators. Desk-based prioritisation will be enhanced to incorporate hazard mapping produced by modelling under Activity 1.1.3. Field-based verification methods will be undertaken in the 21 priority glacial lake watersheds. Such a multi-criteria watershed vulnerability tool will be important for systematic assessment of watershed-scale degradation and vulnerability to other hazards that contribute to, or are impacted by, flooding and other hazards. Subsequently, by overlaying the hazard and risk maps onto the watershed vulnerability mapping, watershed prioritisation based on highest combined risks from GLOF, monsoon flooding, landslide, soil erosion and other combined hazards that exacerbate flooding will be possible for the 21 priority glacial lake watersheds. In the long-term the project will be used to enable the routine integration of climate hazard and risk information with watershed degradation for protracted management of hazards at the watershed scale. The output of this activity will be the basis for identification of such long-term intervention measures and will inform GLOF watershed management strategies to be developed under Activity 1.3.3.

Activity 2.2 – Investment in GLOF and flash flood risk reduction for priority glacial lake watersheds

[7] David R. Rounce 1,* , C. Scott Watson 2 and Daene C. McKinney, 2017 "Identification of Hazard and Risk for Glacial Lakes in the Nepal Himalaya Using Satellite Imagery from 2000–2015", Remote Sens. 2017, 9, 654; doi:10.3390/rs9070654

23. **Sub-Activity 2.2.1 –** The project will **directly invest in lowering of the levels of 4 of the highest risk glacial lakes** which have been prioritised by DHM for urgent risk reduction interventions. The 4 identified lakes are comparable to the successfully lowered Tsho Rolpa and Imja lakes in terms of risk level. During feasibility, design methods for the lowering, processes and the engagement model for communities and particularly indigenous people will be developed. During project implementation, based on the field investigations to be carried out under Activity 2.1 and based on the experience of successfully lowering Imja and Tsho Rolpa lakes, more localised site-specific engineering works will be designed and implemented for the 4 lakes.

24. **Sub-activity 2.2.2** - The project will **directly invest in the construction of check dams for diversion of GLOF flow** to protect assets downstream of glacial lakes. This will also protect water sources, control drainage and infiltration, protect embankments, etc. This effort would include storage reservoirs with multi-use functionality, providing both a water source and flood alleviation. Sizing of reservoirs will include storage capacity for GLOF release. Protective measures for communities' economic assets (community managed micro hydro, water harvesting, and irrigation structures) will be included. Priority lake watersheds (within three main river basis), manly located in the central and eastern Nepal (catchments 5, 6 and 7 in Map 1 – Annex 1) will have these structural measures implemented under the project. This activity will be delivered with a combined resources from the GoN and GCF.

Activity 2.3 - Investment in EBA methods of watershed management to reduce flood risk

Sub-activity 2.3.1 – Scaling upcommunity-forestry management systems to reduce climate vulnerability.

25. The project will support existing forestry user groups who will be engaged to implement forest management plans to enhance forest resilience to climate change and to safeguard the functions of forest ecosystems against GLOFs, rain-induced flooding and other hazards. This will help stabilize soils, reduce runoff, and minimise soil and debris entrainment and transportation during high intensity floods. Based on multi-hazard developed under the activities above, the most appropriate areas for implementation of community-based forestry will be identified in intervention watersheds and a strategy and implementation plan elaborated. A watershed level approach will be taken to ensure linkages between upstream and downstream to maximise climate change adaptation in glacial lake watersheds. The project will directly invest in community forestry and NTFP livelihood development in priority watersheds. The GCF funds will be matched by GEF/LDCF project on *"climate resilient livelihoods in vulnerable watersheds of Nepal"* in the same and / or adjacent catchment areas thus amplifying the impacts at a greater scale of a larger landscape.

Sub-activity 2.3.2 – Community-based EWS and response capacity developed.

26. Based on the hazard and risk mapping and assessment, up to 100 communities will be identified for development of Community-based EWS, based on considerations of relative risk and lead time of the GLOF and rain-induced events. For upstream communities affected by short lead time events the project will provide at least one telemetered rain gauge in the headwaters to provide backup and additional information at national and district level and with communication equipment. The sensors will be deployed as high in the watershed as possible to provide the longest lead-time possible. These rain gauges will communicate real-time precipitation information. Some schemes may also include river gauges on telemetry. As a minimum, downstream communities will be equipped with the warning communication tools. The choice of schemes will directly influence the specification of rain gauge and river gauge types and locations and the deployment of some of the communications equipment. As part of the community-based EWS there will be extensive district and community-level awareness raising and capacity building to address community knowledge gaps about GLOF risks and determine necessary risk reduction strategies and actions that can be taken. This will include education and capacity development activities on GLOF and multi-hazard risk reduction, including preparedness, response, and EWSs. A comprehensive community-based awareness raising programme will be developed for each community, based on an understanding of GLOF, rain-induced risks and other hazards. Such programmes will be tailored depending on lead time, vulnerability groups, and receptors at risk. The project will develop a number of different community-based risk information disseminating methods e.g. by information packs provided to individuals, or by posting location-specific flood hazard and inundation maps and information in community centres. The project will also develop ways of translating the flood hazard mapping outlines into visible markers on the ground to indicate different zones of given flood return period, and of given historical flood events. Community intervention plans will also be developed to identify community-based intervention measures to enhance community resilience to GLOF and related hazards. Public awareness and education campaigns will include special disaster preparedness planning training for specific target groups, such as local schools, local district offices, community groups, and assistance to communities in high-risk areas with developing such local capacities. To fully embed awareness raising at the local level the project will develop and implement Training of Trainers (ToT) programmes and circular for the district and community level officials to enable long-term capacity building beyond the life of the project.

Accredited Entity

27. United Nations Development Programme (UNDP), as an accredited GCF agency, is preparing this proposal in cooperation with the Government of Nepal. The Government of Nepal will implement this project via UNDP's National Implementation Model (NIM), with project support from UNDP at the request of the Government in areas where appropriate. UNDP has been supporting sustainable development in Nepal since 1963. UNDP's current mandate in Nepal is to help the Government and its people build peace and achieve the Sustainable Development Goals (SDGs) by strengthening institutions, improving incomes and employment opportunities, improving policy and planning capabilities, empowering women and disadvantaged communities, and protecting Nepal from the impacts of natural disasters and climate change. The Government of Nepal and UNDP entered into an agreement through the Standard Basic Assistance Agreement (SBAA), signed by both parties on 23 February 1984, to govern UNDP's projects and programmes providing assistance to the country. UNDP's actions and programmes are defined in its Country Programme Action Plan (CPAP) which is prepared jointly by UNDP and the Government of Nepal. The CPAP is based on the broader United Nations Development Assistance Framework (UNDAF). UNDP's current CPAP (2013-2017) is based upon UNDAF 2012-2017. Under the CPAP, all cash transfers to an implementing partner are based on Annual Work Plans agreed to by the Implementing Partner and UNDP.

Implementation Arrangements

28. The project will be implemented following UNDP's National Implementation Modality (NIM), according to the Standard Basic Assistance Agreement between UNDP and the Government of **Nepal**, the Country Programme Action Plan (CPAP), and as policies and procedures outlined in the UNDP POPP (see https://popp.undp.org/SitePages/POPPSubject.aspx?SBJID=245&Menu=BusinessUnit).

29. The **Implementing Partner** for this project is the Department of Hydrology and Meteorology (DHM) within Ministry of Population and Environment (MoPE). DHM is headquartered in Kathmandu with six regional offices throughout the country, one assigned to each of the three major river basins (all located in the southern plains, or Terai), and three additional meteorological offices for the eastern, central, and western parts of the country. The critical regions for this project are covered both under the national office and under the regional basin offices. DHM has sole mandate from Government of Nepal to monitor all hydrological and meteorological activities. The organization is divided into two divisions: hydrology and meteorology. Together they manage several hundred monitoring stations throughout the country (including over 50 hydrological stations) and monitor and provide information on river hydrology, climate, air quality, water quality, snowfall, glaciers, and wind and solar energy. The DHM's principal activities are to collect and disseminate hydrological and meteorological information, issue forecasts for the public, aviation, mountaineering, and disaster management communities (including early warning), conduct special studies for policy makers, and manage relationships with related international and national organizations (like the IPCC and the World Meteorological Organization). DHM has been the implementing agency for several prior flood risk reduction programs, as detailed in the Baseline section above. In collaboration with other ministries, DHM will be a part of an internal government advisory committee to oversee the design of this GCF project. This coordinating body is already meeting and includes members from the Ministry of Finance (MoF), the NDA, as well as other departments within the MoPE. DHM is accountable to UNDP for managing the project, including the monitoring and evaluation of project interventions, achieving project outcomes, and for the effective use of UNDP resources. The following parties have entered into agreements with ***DHM*** to assist in successfully delivering project outcomes and are directly accountable to ***DHM*** as outlined in the terms of their agreement*: Ministry of Forestry, Ministry of Home Affairs, ICIMOD (research partner), and National Federation of Indigenous Nationalities.*

Risks and risk mitigation measures

30. A number of risks have been identified with the assumption that currently applied climate change scenarios are highly confident. A more extensive risk analysis will be conducted during proposal development, including a thorough environmental and social screening.

Identified Risks	Risk Probability	Mitigation Measures
Long-term sustainability of investments (e.g. check dams, weather stations)	Medium	Implementation will actively engage local groups to ensure greater ownership and this long-term sustainability. Cost recovery (e.g. from private sector) for O&M will be included as part of intervention

Cultural significance of glacial lakes	Medium-High	Early involvement of civil society/community and Department of National Parks and Wildlife Conservation (DNPWC) to identify significance of heritage value and develop plan of acceptable actions; Design of interventions to take account of cultural sensitivities and to be done in consultation with local communities (in particular, indigenous people); Ongoing engagement with local communities.
Staff turnover or lack of technical capacity within executing entities	Low-medium	Capacity needs assessments will be undertaken to identify any specific needs and gaps; As necessary, training programs will use train-the-trainer approach for continuity; Training materials will be packaged and made available online/as a computer package for continued learning or as refresher courses;; Government departments and institutions will be encouraged to consider succession planning as part of operation and maintenance.
Extreme event/s disrupts implementation or damages investments, resulting in delays and additional costs.	Low-medium	Timing of activities during implementation will be scheduled to minimize risk, to the extent possible; Where possible, design will incorporate flexibility to further reduce risk.
Inadequate or poor level of collaboration and commitment of participating communities.	Low	Early engagement – initiated during concept phase, will be continued throughout project; Project will seek to demonstrate "model" engagement of civil society; Project design to be done in collaboration with communities and other beneficiaries.
Politicking could derail the project	Low	The project will build-in transparent, fair and equitable management structures to dilute political interference by politicians that could result in favouritism, thereby depriving the needy. Project management systems will be simple and streamlined to avoid unnecessary bureaucracy.
Failure to disburse funds on time. This will create delays in implementation and prolong vulnerabilities to climate impacts which are already pronounced	Low	Nepal has strong track record of implementation of donor projects. The PMU will have a Finance Officer dedicated to the project and will be supported by the UNDP Country Office finance team. The project's financial management system and the project selection process will be designed to maximise transparency and accountability. Financial management competencies will be built into the project management team either through recruitment or capacity development throughout the project. An external audit will also be carried out each year.
Inadequate data on which to base catchment selection	Low-medium	Project will draw on combined experience and knowledge of both national and international specialists; ICIMOD has been engaged to support project and will enable consideration of glacial lakes in Tibet (which pose a significant GLOF risk to Nepal) as they are working with countries across the Himalayan region, including China; Modelling is to be carried out to determine potential extent of impacts i.e. dam break modelling, which will reduce the need for site specific survey data and aid selection of catchments.
Remoteness of communities (transport networks limited) and isolation during winter months prevents consultation	Low-medium	Civil society institutions have already been engaged to assist with consultation; Through use of government and civil society institution's existing networks, consultation can be rapidly initiated prior to onset of winter; Ongoing engagement and use of multiple communication channels will enable continued interactions with local communities

31. A detailed Social and Environmental Screening as well as an Environmental and Social Management Plan will be developed during proposal development stage.

B.3. Expected project results aligned with the GCF investment criteria (max. 3 pages)

Climate Impact Potential

32. This project has the potential to prevent loss of life and community infrastructure assets for the 1.78 million residents of the high mountain regions of Nepal. More specifically, the primary beneficiaries of this project are the approximately 327,500 residents of the 7 catchment areas of the 21 priority risk glacial lakes, many of whom belong to minority indigenous communities. The project is targeting those most vulnerable to GLOF and flood risk, in terms of poverty indices and risk to life and livelihoods. The impact potential of the enhanced GLOF and flood risk management and intervention measures is high and will safeguard vulnerable communities and their economic assets from these climate induced disasters. In addition, community resilience and livelihoods will be increased through the EBA strategies which will additionally enhance the environmental and ecological protective functions of the watersheds.

Paradigm Shift

33. The paradigm shift lies in the proposed strategy to address the increasing risks posed by GLOFs by improving institutional capacity to assess and manage GLOF and related risk in the long-term, and the investment in watershed-scale direct intervention measures. The baseline pathway will lead to progressively increasing risk of catastrophic failure of glacial dams and consequent loss of life, property and economic assets and livelihoods in the downstream catchments. The alternative pathway reduces the risk to 327,500 occupants of GLOF catchments through introduction of an integrated approach, which will embed new skills, methods and technologies to assess the hazard, risk and vulnerability to GLOF thus strengthening the knowledge systems and institutional capacity to monitor GLOF risk evolution processes, better understand the risk, and develop a range of risk reduction and management strategies. The project will enhance the capacity to early warning for GLOFs and other hazards and improve warning times within GLOF watersheds. This will create self-sustaining EWS systems as well as capacity for multi-hazard early warning and risk reduction. In addition, the project is introducing innovations by empowering local communities to undertake local monitoring and risk reduction efforts that complement the centralized system of EWS. The project will enhance the capacity to identify, plan and implement long-term GLOF and multi-hazard risk management strategies at the watershed scale by introducing combined structural and non-structural methods that link upstream and downstream. Long-term GLOF and multi-hazard risk investment planning will also be enhanced and policy and legislation strengthened to enable long-term sustainability of interventions, by engaging the private sector to shoulder some of the increasing costs of required observation networks and risk information and early warning services. It is developing the capacity and systems whereby the current gap between the demand and supply on vital climate risk information is closed. The project will result in improvements in watershed ecosystems and restoration of ecological function through the use of EbA strategies (such as community forestry and agro-forestry) which will reverse the deleterious effects of catchment degradation and enhance livelihoods of rural communities. The diagram in Annex 2 presents the Theory of Change of this project and demonstrates how the current barriers can be removed through the project activities to achieve transformational change.

Sustainable Development Potential

34. The project will have sustainable development co-benefits including ecosystem services protection, rural income generation, livelihood enhancement and job creation, improved access to education and training opportunities, and improved resilience of physical assets of communities. The main ***economic co-benefits*** from the project investment are derived from the avoided socio-economic losses for GLOF and related disasters. Under climate change, economic losses from single extreme hazard events are expected to double by mid-century, which could significantly impact and reverse socio-economic development gains of Nepal. Avoided losses to sectors such as hydropower could be significant. The project interventions that provide sector-specific risk information and risk management strategies will be important for the long-term development of the hydropower sector; such information as water flow forecasts and long term run-off projections will be critical for planning, risk information will assist with optimising operations (hydropower is affected both on supply and demand sides by climate change), and tailored risk information will be further used to inform siting and climate-proofing of hydropower installations. Climate risk informed planning of the hydropower sector is important nationally - secure hydropower development will help continue a shift to clean energy and reduce the current reliance on fuelwood. Climate risk information will also safeguard assets such as transportation (roads and bridges) which are critical to the economic development and functioning of rural communities. Economic co-benefits will also be realised in the agriculture sector, on which 65% of rural communities rely and which is at high risk from GLOFs and related hazards. Prevention of agricultural losses, coupled with enhanced agricultural livelihoods through agro-forestry and non-timber forest product livelihood opportunities, will result in overall enhanced productivity of the agricultural sector. In addition, wherever new hydrometric monitoring stations will be installed there will be prolonged job creation for operations and maintenance personnel. There is also opportunity for livelihood enhancement and income generation through the new early warning systems at the community level as well as any community forestry programmes. The areas around glacial lakes in the high Himalaya are predominately populated by indigenous minority tribes, and mountain groups as a whole are disadvantaged in Nepal with less access to education, resources, and

national decision-making processes. This project will directly benefit those vulnerable populations. In addition, the project will have significant benefits to gender co-benefits and will be conducted with close collaboration with a local gender expert dedicated to ensuring that gender considerations are a key part of any consultation or activity planning process. Villages cut off from basic transport services (i.e. roads and bridges) to access local markets, health centres or schools impact women disproportionately, as they need to reach hospitals during their pregnancy or health needs of their children. The project will therefore safeguard local communities and their assets from climate disasters with particular attention to women, indigenous communities and other vulnerable groups. ***Environmental co-benefits*** mainly relate to EbA strategies such as riparian plantings and community forestry which will provide water retention functions; regulation of hydrological flows (buffer runoff, soil infiltration, groundwater recharge, maintenance of base flows); natural hazard mitigation (e.g. flood prevention, peak flow reduction, soil erosion and landslide control); increased streambed stabilization resulting in decreased erosion, habitat preservation, and reforestation.

Needs of the Recipient

35. Nepal is a least developed country of 28.98 Million people, over 80% of which live in rural areas, mainly in the Terai (51%) and the Middle Hills (47%). Only 7% of the population lives in the High Mountains, and comprise a high percentage of indigenous people. Approximately 66.5% of Nepal's population is engaged in mainly subsistence agriculture, 12% in industry and 20% in tourism – an industry mainly based on trekking and eco-tourism and heavily reliat on natural mountain eco-systems. These sectors account for 32%, 14% and 54% of GDP respectively. Despite major poverty reduction in recent decades, Nepal still ranks below most neighbouring countries on the Human Development Index (HDI) with intensity of deprivation of 43.7%, 15.5% of the population living below the international income poverty line of $1.90 USD/day and 30.9% of the population living below the national poverty line. There are several factors that contribute to the vulnerability to climate change induced GLOF and related risks in Nepal. These include degradation of watershed eco-systems through deforestation. Forest occupies a total of 40.36% of the total land area, two-thirds of which is affected by grazing, tree cutting, bush cutting, sapling cutting, lopping and forest fire, bark removal from the tree base, snaring, foot trails, forest roads, etc., (DFRS, 2015). Firewood alone makes up two-thirds (2/3) of total energy consumption of Nepal. Out of the total area of forest, only 17.32% (1.03 million ha) lies inside Protected Areas. According to the World Bank, Nepal's forest cover has decreased by 25% since 1990. The loss of forests is resulting in imbalances in the watershed eco-systems and the loss of natural flood and landslide protective properties of watersheds, thus increasing exposure to GLOF, monsoonal flooding, mudflow, soil erosion, landslides and drought and negatively impacting the lives and livelihoods of local communities. Early warning systems specific to GLOF and its attendant hazards (i.e. landslides, mudflow, erosion etc.), exist in only two GLOF catchments. The short lead times of GLOFs (14 minutes to a couple of hours), gives communities very little time to respond to GLOFs and is not considered in conventional flood EWSs that may exist within watersheds. Women have less access to early warning and climate information, and generally, lack the skills to survive extreme events. Cultural and social restrictions curtail mobility of women and their ability to avoid disasters. Women and marginalized people are poorly represented in formulating disaster related policies and programme. Due to socially constructed roles, more women than men die or are injured from climate-induced hazards (NAPA, 2010). The communities at risk from GLOFs are therefore exposed and vulnerable due to lack of gender-responsive hazard, risk, and early warning information available with sufficient lead time prior to a shock event.

36. In Nepal, several sectors are highly vulnerable to GLOFs and related hazards including infrastructure, particularly roads, water supply, and hydropower plants, agriculture and damage to property. ***Road*** **density** of Nepal is increasing at an average annual rate of 2.96 % according to the World Bank development indicators. 60% of Nepal's roads, is concentrated in the lowland (Terai) areas of the country and at high risk of flooding. Road networks in Himalaya region is very low compared to Hills and Terai, but trekking trails through the 10 National Parks in Nepal, which are important for tourism in these areas and for connecting mountain communities, are at risk from being washed away by GLOFs and landslides. Roads, both paved, and unpaved and their associated bridges, are at risk from destruction from GLOFs and landslides and can result in communities being cut off. This has significant impact on daily life, economic activity and on tourism, particularly in mountainous areas. ***Tourism*** is a major sector in Nepal which is also likely to be significantly impacted by climate change induced GLOF and related. Official figures show that visitors to protected areas national parks averaged half a million prior to the 2015 earthquake. Almost 603,000 international tourists visited Nepal in 2010, an 18% increase from 2009. Many tourists visit for trekking and other outdoor pursuits in the mountains along well-known trekking routes. Official statistics show that the number of mountain rescues averages around 3,000 per year. With risk from GLOF, flooding, mudflows and landslides increasing due to climate change, the need for better climate risk information is very important to the tourist industry in Nepal. Many of the GLOFs of the past (particularly from Tibet) have destroyed ***Hydropower*** plants in Nepal. Hydropower, and other sectors that are water intensive are particularly sensitive to the impacts of climate change because both the supply and the demand side are affected by shifts in climate. Increased warming

leading to melting of the glaciers is reducing river baseflows in Nepal which could significantly impact available water resources for hydropower. At the same time, increasing temperatures are increasing the risk of GLOFs and other hazards which damage and destroy hydropower plants. Intensified monsoon rains also pose a risk to the operational safety of HPPs. The exact effects of these changes need to be assessed in the HP project design, construction, and long-term operation phases. Nepal has large hydropower potential due to the perennial nature of Nepali rivers and the steep gradient of the country's topography. However, total energy consumption is still very low (4.1 percent) (MOF, 2017). The development of the hydropower infrastructure, due to the requirement to place such installations high up within watersheds to maximise their energy generating potential, is resulting in installations close to glacial lakes, exposing these key infrastructures to GLOF risk. 177 hydropower plants (HPPs) are in the path of a GLOF as of 2016 (one in five HPPs in the Himalaya).

37. The ***agriculture*** *sector*, which is key to food security and self-sufficiency, is at significant risk from flooding from GLOF, monsoon flooding, soil erosion, landslides and mudflows, as well as reduced water resources due to loss of glacial reserves. Annually large areas of crops are damaged or lost to flooding making it difficult for the agriculture-dependent rural communities to sustain their livelihoods. Of the total arable land only 66.87% can be made irrigable due to geographical remoteness and land conditions. Irrigation infrastructure has been created for 52.71% of irrigable land and is at risk from GLOFs and related hazards. Rain-fed agriculture, is at risk due to increased monsoon flooding, declining river low flows resulting from the loss of glacial reserves as well as land degradation, soil erosion, mudflow and landslides. The watershed processes that are important to sustaining agriculture on already challenging topography and scarce land, needs to be brought back into equilibrium to enable agricultural productivity that sustains the population. A 2013 study on Economic Impact Assessment of Climate Change in key sectors (agriculture, hydropower and water-induced disasters) has estimated direct cost of current climate variability and extreme events equivalent to 1.5 to 2% of current GDP/year (approximately USD 270-360 million/year in 2013 prices) and much higher in extreme years. Overall, the economic costs of climate change in Nepal for these three sectors could be equivalent to 2-3% of current GDP/year by mid-century (INDC). This a huge additional financial burden which the government and people of Nepal will not be able to cope with. The project is therefore addressing the coping capacities of the government through technical, financial and institutional interventions which will enable GoN to systematically monitor, assess and manage GLOF risk in the future, while also developing the coping and adaptive capacity of communities in GLOF watersheds through implementation of eco-system based approaches that address the root causes of land degradation, restore the protective functions of the watershed, and safeguard the lives and livelihoods of communities.

Country Ownership

38. The project is fully ***aligned with key national policies, programmes and priorities*** of the Nepal government. Nepal's ***Climate Change Policy of 2011*** outlines climate change adaptation and risk reduction as a national priority agenda, but highlights the lack of detailed risk analyses, studies, and climate data to track progress and enable future change. This project as proposed will give Nepal the tools to be able to better understand and monitor not only GLOF risk, but also threat of cloudburst flooding. This will support national disaster risk management priorities and multi-hazard early warning systems. The latest ***Three-Year Development Plan* (2014-2017**)[8] priorities include hydro and other energy development; agriculture productivity and tourism. The project is addressing risk to these key sectors (hydropower, agriculture, and tourism) and will develop tailored climate risk information on which risks to other sectors can be systematically assessed and addressed.

39. Nepal's ***National Adaptation Programme of Action*** to Climate Change (2010) identified nine integrated projects as urgent and immediate national adaptation priority. They include: *Promoting community-based adaptation through integrated management of agriculture, water, forest and biodiversity sector; Community-based disaster management for facilitating climate adaptation; GLOF Monitoring and disaster risk reduction* and *Forest and Ecosystem management for supporting climate-led adaptation innovations; Ecosystem management for climate adaptation; Empowering vulnerable communities through sustainable management of water resource and clean energy support.*

40. ***Forest Policy 2015*** and **Forestry Sector Strategy 2016** include forest management, watershed management, national park and wildlife management, and climate change in the forestry sector, and have set a goal to maintain balance between livelihood improvement and ecosystems by conservation, promotion and best utilization of forest, vegetation, medicinal plants, wildlife, protected areas, biodiversity and watershed for employment creation and income generation of disadvantaged groups. Key policies include: increase forest production and productivity by sustainable forest management; integrated conservation and management of

[8] Three or Five-Year Development Plans are prepared by The National Planning Commission (NPC), in consultation with the concerned Ministry, Periodic Plans i.e. Five Year or Three Year Periodic Plan which encompasses the priorities, plans and budget allocations of all the sectors of the country

water and land to increase the land productivity; adopt climate change adaptation and reduction measures to reduce negative impacts.

41. This project is a priority for the Government of Nepal and represents the initiative and input of several different Ministries as well as numerous academic and research organizations and NGOs. The Ministry of Finance and the Ministry of Population and Environment (including both the Department of Hydrology and Meteorology and the Department of Soil Conservation and Watershed Management) have formed an internal working group that will guide the design of this project, which represents a strong commitment from these ministries to carry out the project as proposed. The Ministry of Home Affairs, the entity responsible for disaster response in Nepal, will participate as well. This project is being planned in coordination with Nepal's GCF Readiness program as well as the two direct access entities – the National Trust for Nature Conservation (NTNC) and AEPC, both of which will engage with the proposal development and project implementation teams. In addition, NDA personnel who are active in this proposal process are also managing the GCF Readiness program and will help ensure alignment of priorities as appropriate. There are many research institutions ready to help guide this project and provide the grounding scientific analysis necessary. These include representatives from Kathmandu University and the International Centre for Integrated Mountain Development (ICIMOD) in Nepal as well as researchers specializing in glaciology at Leeds University in the United Kingdom. These scientists will assist specialists from DHM with analysis of current and future GLOF and downstream flooding risk. Nepali NGOs have also pledged support to this project to provide data, consultation, and assistance in stakeholder engagement and training work. These include NEFIN, an organization dedicated to representing indigenous populations in the Himalaya, as well as the Himalayan Rescue Association, an organization that manages clinics and high mountain rescues in the event of floods and other events. Other NGOs that have participated in project design workshops to date include The Mountain Institute, WWF, and Practical Action. Additional stakeholder consultation at the field level in the areas of concern will be conducted in close collaboration with NEFIN and other relevant NGOs.

42. In addition, gender considerations will be specifically addressed during these processes with the assistance of a gender specialist in the Nepal UNDP Country Office. Support for this project also comes from Nepal's private sector. The hydropower and tourism industries are particularly interested in partnering with the Government of Nepal and UNDP on project implementation and in the possibility of increased access to GLOF risk information. To date, representatives from several independent power companies and the Department of Tourism and related organizations have been involved in stakeholder consultations and will continue to provide data and input.

Effectiveness and Efficiency

43. The project addresses the fundamental barriers to achieving resilience via the provision of technical capacities, policies and legislative enhancements, and by investing in watershed restoration for climate risk reduction for long term resilience of vulnerable communities and their physical assets. The combination of interventions related to natural capital and structural interventions, as proposed by this project, has been shown to lead to significantly larger improvements in resilience to communities, compared to only a single intervention approach. Investing in natural capital is more effective in the long term as it reduces levels of exposure to climate hazards. By addressing the capacity to undertake risk assessment and monitoring and to generate missing climate risk information, the project will lay the foundation for all GLOF and other hazards risk management in the future. In addition, by addressing the legislative and policy gaps, the project is ensuring long-term sustainability of project interventions. Furthermore, the adoption of this holistic and integrated approach that addresses all the root causes including land use management, will have long-term efficiency and effectiveness benefits, compared to the *ad hoc*, project based interventions that are currently undertaken. The INDC estimates that climate induced extreme events will result in $360-540 Million USD in damages annually in Nepal by mid-century. Records show that damages from the breaching of single GLOFs can be in the order to $3 Million USD. The pre-feasibility study also quantified the physical and socio-economic impacts of the 21 highest risk GLOFs in Nepal which found that economics damages of more than $20 million USD would be incurred from failure of the GLOFs in Nepal and 6,000 people, 8.3 km^2 of agricultural land, 21km of roads and 8.5 km of trekking trails are at risk from failure of the 21 highest risk GLOFs in Nepal GLOFs when only considering impacts for 50km downstream of GLOFs. The value of damages would be at least double further downstream as population density increases further down the valley. Annually, torrential monsoon rains result in widespread flooding and landslides in Nepal impacting hundreds of thousands of people. Without GCF funding, the damages and losses from the 21 highest risk GLOFs and other hazards in the downstream catchment would be more than $100 Million USD per annum. The project therefore has a potential project **IRR** of 2.7%. GCF investment will catalyse US$63million of co-financing for the rehabilitation of existing observation equipment, check-dam and reservoir structures for flood water control downstream and will secure O&M costs against all project supported infrastructure. The public good nature of this project's outputs doesn't entail significant revenue generation or cost recovery from the project although the project will support engagement

of the public sector for limited cost-recovery to cover the operation and maintenance of monitoring and early systems. Where income generation opportunities might occur indirectly because of project outcomes, these would apply directly to the beneficiaries (for instance, improved agricultural productivity), primarily as household income. A financial analysis for the project is therefore not deemed pertinent given that there is limited profit/income generation from the project. Overall, the proposed solutions are designed to be in line with best practices, community ownership, and synergies across the two outputs and inter-related activities and builds on ongoing efforts to ensure their efficiency and cost-effectiveness. The proposed activities and interventions will reach 100% of the 327,500 population of the 21 priority glacial watersheds, as improved watershed management will have attendant benefits beyond GLOF and flood risk management.

C. indicative financing / Cost information (max. 3 pages)

C.1. Financing by components (max ½ page)

Component	Indicative cost (USD)	GCF financing		Co-financing		
		Amount (USD)	Financial Instrument	Amount (USD)	Financial Instrument	Name of Institutions
Output 1	10 Million	3 Million	Grant	7 Million	Grant	GEF-LDCF
Output 2	53 Million	20 Million	Grant	33 Million	Grant	GoN
Indicative total cost (USD)	63 Million	23 Million		40 Million		

C.2. Justification of GCF funding request (max 1 page)

44. The total annual budget for climate adaptation and resilience activities nationally averages $85 Million (actual expenditure averages 60% of budget) comprising mainly donor grants (35%) and loans (16-17%) while the current annual damages due to climate extremes is $360 Million, increasing to $540 Million by mid-century due to climate change. The shortfall in expenditure in climate change adaptation is due to the lack of financial capacity of the GoN to fund such activities, and its inability to absorb any additional loans to do so. Nepal maintains a high degree of public debt, hovering around US$6.2 billion, US$3.8 billion of which is foreign debt. The country has a large foreign aid and investment portfolio and the vast majority of development projects have international support. The increased financial burden that climate change is placing on the government of Nepal and the affected communities is such that neither government nor communities will be able to cope in the future, certainly not by increasing indebtedness. To meet the financial burden that climate change requires to address the increasing risk of GLOF and related hazards, Nepal needs timely intervention to shift the current paradigm from piecemeal, project based efforts to the adaptation alternative which will bring long-term transformative change. In so doing the large expected financial burden of damages and losses due to climate change impact of extreme hazardous events can be avoided. GCF investment will secure the lives, livelihoods and assets of the most vulnerable people in Nepal and reduce their susceptibility to climate change-induced GLOF and related hazards that they have limited coping mechanisms to withstand.

45. The socio-economic conditions of Nepal and the public-good nature of the project interventions mean that GoN has few options to engage the private sector in the co-financing of climate risk management activities. The funding sought for the project is ***grant*** only, based on consideration of the following: 1)The project is seeking to safeguard the lives and livelihoods of the poorest, most vulnerable people in GLOF catchments - mostly poor farmers and indigenous communities with no capacity to pay for such climate risk and disaster management in the short or long term; 2) The project is addressing the additional risk and burden which climate change is placing on the GoN and the poorest communities in terms of increased risk of loss of life, agriculture, and property. In addition, it seeks to improve the climate risk information available to important sectors such as hydropower, tourism and agriculture on which national and local economic development relies. In this regard, the GCF funds will be used for DHM to produce and disseminate timely and quality climate risk information to the key productive sectors that can be payable and hence enable a certain level of future cost-recovery for O&M costs of an observation network that will have to increase in its density because of climate change risks. As part of the proposal development process a market assessment will be performed, including willingness to pay surveys to examine future cost recovery potential for O&M costs in the long term. In particular, the hydropower and tourism sectors have already expressed interest in expanded flood EWS information and will be the subject of further market investigation during the feasibility analysis and during project implementation. However, it is not anticipated that the cost-recovery that these sectors will provide will be significant to trigger overall income generation potential of the project, rather they are more likely to enhance sustainability along with other risk financing mechanisms that the project will develop; 3) the project beneficiaries would not be able or willing to pay and therefore cannot create the revenue stream required to repay a loan; 4) A loan would increase the government's debt which is currently 18% of GDP; 5) Previous

projects such as PPCR, have largely employed grants for Nepal.. The proposed GCF project is seeking to fund only the additional monitoring in the High Himalayas (HH) where the GLOF risk is increasing, and which is currently missing from the monitoring network. This speaks to the climate change additionality that GCF grants are designed to fund. The additional monitoring will complement the existing and already enhanced hydrometric network in addressing the existing flood risk as well as the increased risk posed by GLOFs; 6) Although the project will contribute to climate risk and early warning information availability, the main additionality will be provided to address the GLOF and associated risks and to enhance warning times to downstream communities; 7) The capacity building, long-term CRM strategy development, and eco-system based approaches which safeguard lives and livelihood, have no income generating capability. Grant funding at the amount requested for this project will close critical gaps in GLOF risk management, and go a long way towards ensuring that the Government of Nepal is able to completely monitor, manage and respond to GLOF and flood risk at a national scale. , Co-financing support for the project is available from the Government of Nepal ($33 Million USD) as well as a newly approved (2017) Least Developed Countries Fund project focused on integrated watershed management in the middle and downstream watersheds within a single GLOF watershed and is therefore highly complementary to this GCF project. This demonstrates GoN commitment and ownership of this project.

C.3. Sustainability and replicability of the project (exit strategy) (max. 1 page)

46. Investment in **human resources and institutions**: the project is focused on developing the institutions that have skilled human resources, information, tools and technologies to effectively pursue their mandate in climate risk management. The project investments will improve availability of risk information and create effective response mechanisms. This project will incorporate lessons learned and benefit from the existing collaborative relationship between UNDP, the DHM, and ICIMOD and other partners and will foster strong partnerships with and among relevant institutions to ensure shared goals and shared vision beyond the project. The project will help ensure sustainability by supporting all relevant government ministries in line with government policy, programme and strategic priorities. The establishment of methods and tools for developing glaciated watershed management strategies and plans, the introduction of risk assessment methods, standards and tools within relevant institutions, backed by the definition of these in guidance, legal and policy documents, makes this project highly replicable within Nepal (e.g. the introduction of a national approach to integrated watershed management will ensure replicability in all watersheds). The embedding of risk assessment, risk management and risk reduction methods for GLOFs and related hazards will be particularly important as GLOF risk develops in currently lower risk watersheds, which may develop into high-risk watersheds in the future. Furthermore, regional cooperation, and the fact that this project has been developed with full awareness of other GLOF related projects in the region, makes this project highly complementary, and potentially replicable to other projects regionally. As detailed above, this project plans to attract private sector investment – particularly in cost sharing regimes for long-term O&M for hydrometric equipment. This will include efforts to ensure that DHM is legally allowed to set up cost sharing and fee for service for providing hydrometeorological data (legislation currently drafted but not the mandate). Hence, by the end of the project, the activities and monitoring set up as part of the project are designed to be self-sustaining into the future. In addition, all activities will be conducted in ways that empower local stakeholders in EWS and other flood risk mitigation efforts. Capacity building programs set up will ensure the ongoing transfer of skills to create knowledge sharing and better climate services for the future. The project is developing fully-articulated long-term GLOF and multi-hazard risk management plans for each glacial lake watershed which will set the direction for systematic risk management in the future. In addition, the project will develop long-term risk financing mechanisms and investment plans. **Investment in natural capital**: To achieve long-term resilience and safeguard investments and communities against climate induced disasters and slow onset changes in weather patterns, functional and protected watersheds are an essential condition, particularly in complex and unfavourable terrain. Creating stable and well-managed natural capital is an investment in long term sustainability of social and economic assets that the GCF project will create in the face of climate change.

C.4 Engagement among the NDA, AE, and/or other relevant stakeholders in the country (max ½ page)

47. Numerous stakeholder consultations have taken place regarding this project and there is a high degree of government, private, and social sector interest. In 2017 two separate stakeholder workshops were held in May and August, as well as numerous individual consultations. In August 2017, the proposal development team met with over 150 stakeholders in Kathmandu to gather information on priorities for project formulation. Stakeholders consulted include relevant government ministries and departments, civil society organizations, and private sector entities. In addition to these consultations, UNDP is working with two national organizations specializing in indigenous persons and rural stakeholder engagement to ensure that proper consultation takes place at the local level throughout the proposed project area. Key stakeholders include:

- Ministry of Population and Environment (MoPE): The MoPE is facilitating the internal government project advisory council and providing support for the project. The MoPE also houses the DHM, the implementing agency.
- Ministry of Finance (MoF): As NDA for this project, the MoF is taking part in project oversight and internal government coordination.
- International Centre for Integrated Mountain Development (ICIMOD): this pan-Himalayan research NGO has provided scientific background information and lent their expertise on glacial and high-mountain regions to the proposal development team. ICIMOD plans to work closely with UNDP and the implementing agency to help perform risk analysis, provide mapping support, and enable capacity development for DHM and other government stakeholders.
- Nepal Federation of Indigenous Nationalities (NEFIN): this organization, together with their partners, will be involved in stakeholder consultations in the field with beneficiaries and IP communities.
- Department of National Parks and Wildlife Conservation (DNPWC): The DNPWC will be closely consulted for all GLOF risk areas lying within protected lands.
- Department of Soil Conservation and Watershed Management (DSCWM): the DSCWM, also under the MoPE, will be a partner in implementation along with DHM and has been consulted about how this project will connect with ongoing basin planning in Nepal.
- Hydropower companies and various coordinating professional organizations have participated in stakeholder workshops readily and will be consulted separately as part of market analysis and other efforts.
- The National Trust for Nature Conservation (NTNC) and Alternative Energy Promotion Center (AEPC): These are the two GCF direct access entities in Nepal and will be involved in the proposal and project implementation processes to enable capacity development.

48. Going forward, the project will continue to work closely with these institutions to develop the detailed project proposal.

D. Supporting documents submitted (OPTIONAL)

☒ Map indicating the location of the project/programme

☒ Diagram of the theory of change

☐ Financial Model

☒ Pre-feasibility Study

☐ Evaluation Report of previous project

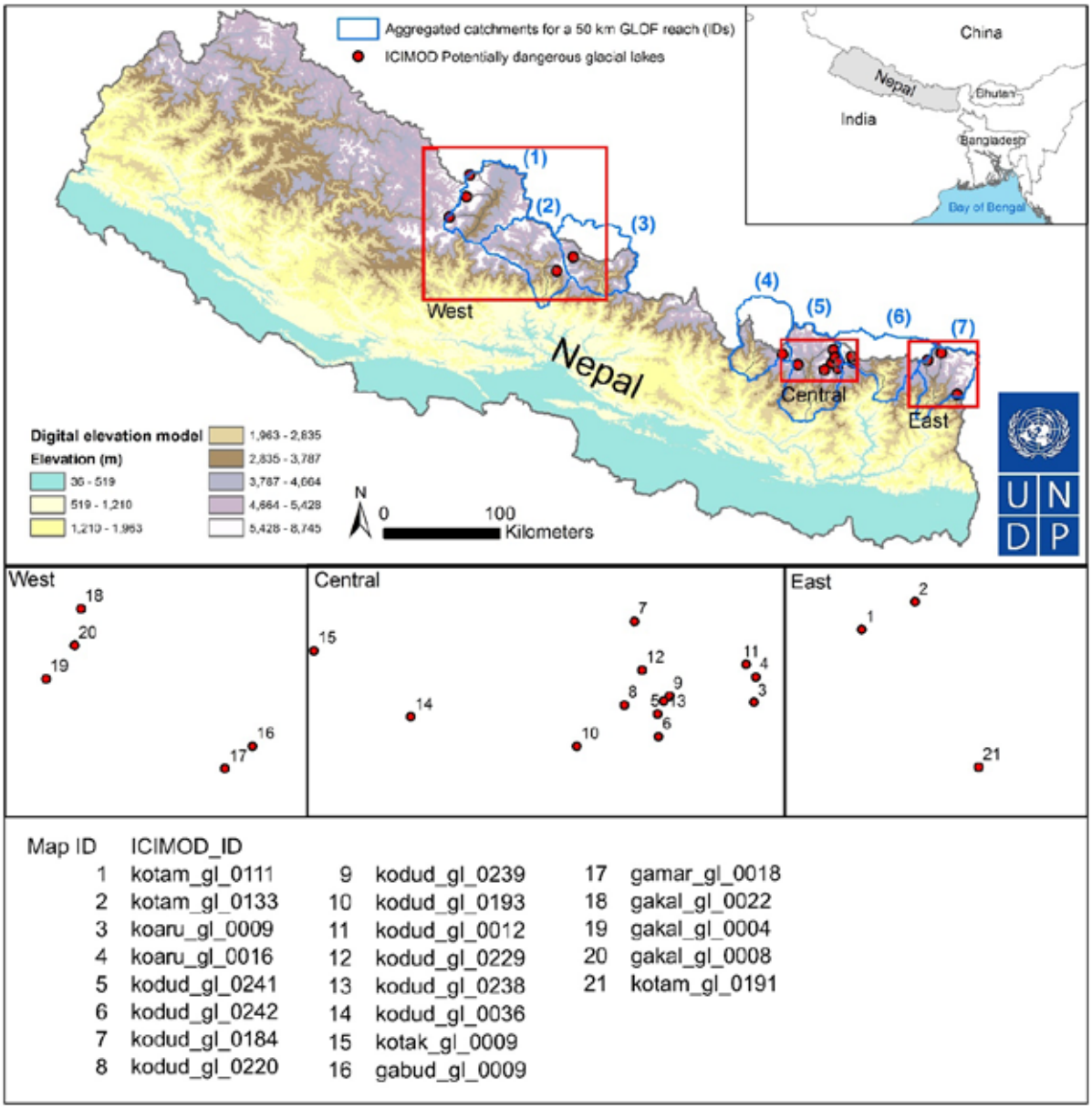
Self-awareness check boxes

Are you aware that the full Funding Proposal and Annexes will require these documents? Yes ☒ No ☐

- Feasibility Study
- Environmental and social impact assessment or environmental and social management framework
- Stakeholder consultations at national and project level implementation including with indigenous people if relevant
- Gender assessment and action plan
- Operations and maintenance plan if relevant
- Loan or grant operation manual as appropriate
- Co-financing commitment letters

Are you aware that a funding proposal from an accredited entity without a signed AMA will be reviewed but not sent to the Board for consideration? Yes ☒ No ☐

Annex 1: Map indicating the location of the project/programme



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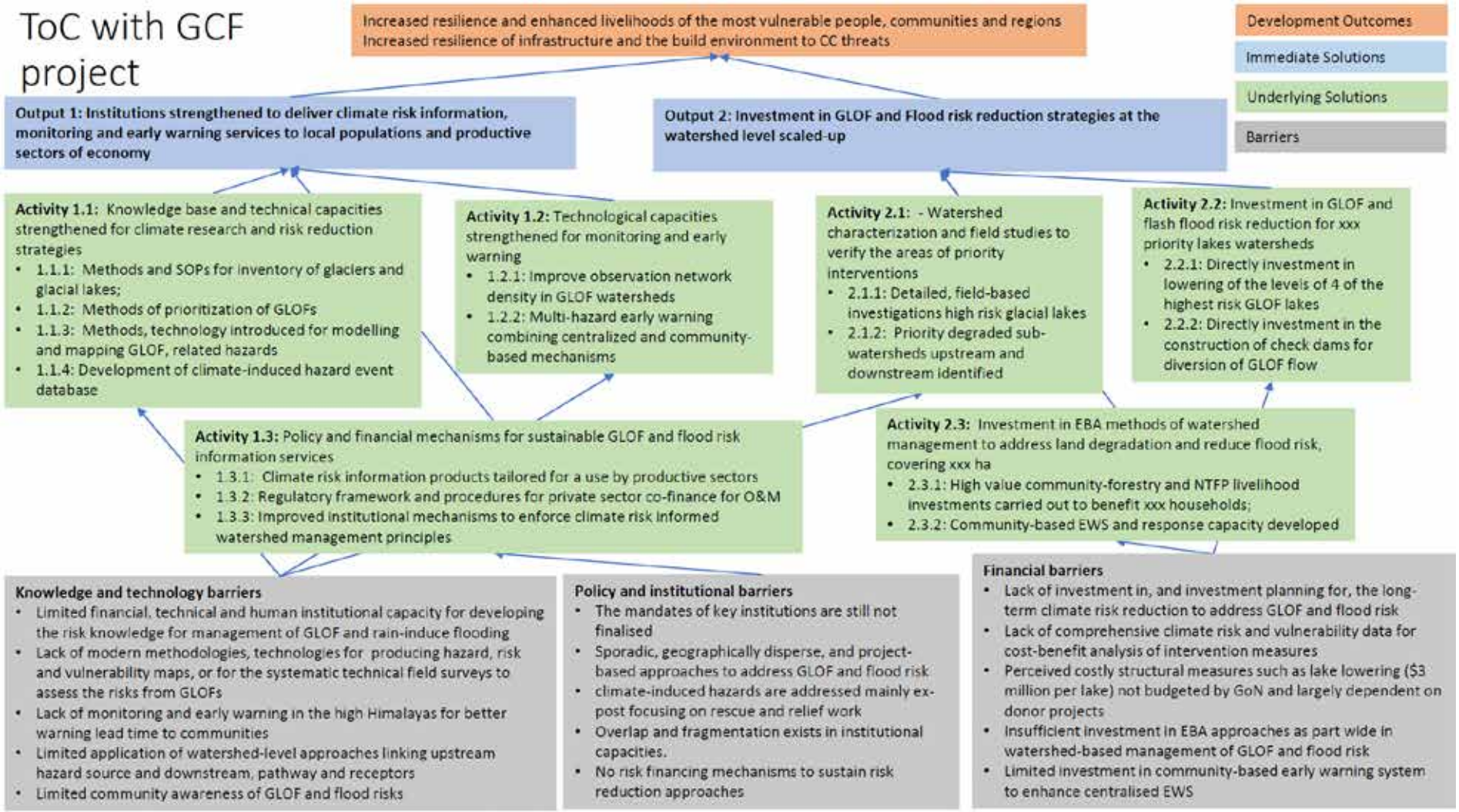
4	koaru_gl_0016	12	kodud_gl_0229	20	gakal_gl_0008
5	kodud_gl_0241	13	kodud_gl_0238	21	kotam_gl_0191
6	kodud_gl_0242	14	kodud_gl_0036		
7	kodud_gl_0184	15	kotak_gl_0009		
8	kodud_gl_0220	16	gabud_gl_0009		

Annex 2 – Diagram of Theory of Change



Annex 3 – Pre-Feasibility Study

Please see the attached document.