Funding Proposal

FP272: Protecting livelihoods and assets at risk from Glacial Lake Outburst Floods (GLOFs) and climate change-induced flooding in glacial river basins of Nepal

Nepal | United Nations Development Programme (UNDP)| Decision B.42/06

24 July 2025

GREEN CLIMATE FUND

Contents

Note to Accredited Entities on the use of the funding proposal template
• Accredited Entities should provide summary information in the proposal with cross-reference to annexes such as feasibility studies, gender action plan, term sheet, etc. • Accredited Entities should ensure that annexes provided are consistent with the details provided in the funding proposal. Updates to the funding proposal and/or annexes must be reflected in all relevant documents. • The total number of pages for the funding proposal (excluding annexes) **should not exceed 60**. Proposals exceeding the prescribed length will not be assessed within the usual service standard time. • The recommended font is Arial, size 11. • Under the GCF Information Disclosure Policy, project and programme funding proposals will be disclosed on the GCF website, simultaneous with the submission to the Board, subject to the redaction of any information that may not be disclosed pursuant to the IDP. Accredited Entities are asked to fill out information on disclosure in section G.4.

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"FP-[Accredited Entity Short Name]-[Country/Region]-[YYYY/MM/DD]"

PROJECT/PROGRAMME SUMMARY

A.1. Project or programme	Project	**A.2. Public or private sector**	Public
A.3. Request for Proposals (RFP)	Not applicable		

A.4. Result area(s)		**GCF contribution**	**Co-financers' contribution[1]**
	Mitigation total	Enter number %	Enter number %
	☐ Energy generation and access	Enter number %	Enter number %
	☐ Low-emission transport	Enter number %	Enter number %
	☐ Buildings, cities, industries and appliances	Enter number %	Enter number %
	☐ Forestry and land use	Enter number %	Enter number %
	Adaptation total	Enter number %	Enter number %
	☒ Most vulnerable people and communities	55 %	35 %
	☐ Health and well-being, and food and water security	Enter number %	Enter number %
	☒ Infrastructure and built environment	25 %	35 %
	☒ Ecosystems and ecosystem services	20 %	30 %

A.5. Expected mitigation outcome *(Core indicator 1: GHG emissions reduced, avoided or removed / sequestered)*	*N/A*	**A.6. Expected adaptation outcome** *(Core indicator 2: direct and indirect beneficiaries reached)*	Total Beneficiaries: **2,298,303** 55% of which are women and 45% men.
			Direct: 385,956 / Indirect: 1,986,980
			1.3% / 6.6%
A.7. Total financing (GCF + co-finance[2])	49,944,050 USD	**A.9. Project size**	Small (Upto USD 50 million)
A.8. Total GCF funding requested	36,158,230 USD		

A.10. Financial instrument(s) requested for the GCF funding	☒ Grant	36,158,230USD	☐ Equity	Enter number
	☐ Loan	Enter number	☐ Results-based payment	Enter number
	☐ Guarantee	Enter number		

A.11. Implementation period	7 years (84 months)	**A.12. Total lifespan**	20 years
A.13. Expected date of AE internal approval	Click or tap to enter a date.	**A.14. ESS category**	B
A.15. Has this FP been submitted as a CN before?	Yes ☒ No ☐	**A.16. Has Readiness or PPF support been used to prepare this FP?**	Yes ☐ No ☒
A.17. Is this FP included in the entity work programme?	Yes ☒ No ☐	**A.18. Is this FP included in the country programme?**	Yes ☒ No ☐

A.19. Complementarity and coherence	Yes ☒ No ☐
A.20. Executing Entity information	The National Executing Entity for this project is the Government of Nepal, represented by the Department of Hydrology and Meteorology (DHM) under Ministry of Energy, Water Resources and Irrigation (MoEWRI) of Nepal - which will be responsible for implementation and serve as UNDP's Implementing Partner (IP). The Host Country will receive the funds through the Ministry of Finance, which will play an intermediary role in distributing the funds to the IP and Responsible Parties through the appropriate channels/systems The project activities will be implemented through the IP and other responsible parties, namely National Disaster Risk Reduction and Management Authority (NDRRMA), and Ministry of Forests and Environment and its departments — including the Department of Forest and Soil Conservation (DoFSC) and the Department of National Parks and Wildlife Conservation (DNPWC).

A.21. Executive summary (max. 750 words, approximately 1.5 pages)

1. Nepal is a Least Developed Country (LDC) situated in South Asia with a landscape defined by a variable topography and climate, ranging from subtropical conditions in the lowland plains to sub-zero climates in the steep Himalayan Mountains. While climate change is observed across the country, the rate of temperature increase is more pronounced at higher altitudes[3]. This temperature rise accelerates the rate of glacial retreat, increasing the size of glacial lakes located in these high-altitude areas and, in turn, their likelihood of breaching in the form of Glacial Lake Outburst Floods (GLOF). The risk of GLOFs is further exacerbated by increasing temperatures which increase the rate of snow and ice melt and the proportion of precipitation falling as rain, which increases the volume of the lakes, thereby reducing the amount of 'freeboard' (the vertical distance between the top of the dam wall and the maximum water level), which increases the likelihood of overflow and the intensity of resulting floods[4].

2. The Representative Concentration Pathway (RCP) 4.5 and 8.5 climate scenarios project that temperatures and monsoon rainfall will continue to rise in the future, both increasing lake water volumes and the probability of avalanches, rockfalls and dam wall collapse, which trigger GLOFs. In particular, Nepal's Thulagi, Lower Barun, Lumding Tsho and Hongu 2 Lakes are at exceptionally high risk of breaching. These four lakes have already exhibited considerable increases in volume, accelerated degradation of their ice-cored moraines, and a reduced amount of 'freeboard' as a result of climate change. Combined, these factors have destabilized the lakes, exposing the Gandaki Basin and the Dudhkoshi and Arun Sub-basins to the threat of a GLOF event. Given the steep topography of these basins, flooding from GLOFs and heavy monsoon cloudbursts often triggers landslides that threaten the lives and livelihoods of local indigenous communities. [5]

3. Since the 1970s, 26 GLOF events have been recorded across 47 potentially dangerous glacial lakes, resulting in catastrophic consequences that have ranked Nepal, alongside Bhutan, as the most economically impacted country by glacial flood impacts. GLOFs cause severe flooding, landslides and mudflows that damage infrastructure and private assets, and disrupt transportation networks, agricultural production, power supplies from hydropower plants and tourism activities. In addition, floods often have substantial health impacts, with water- and vector-borne diseases spreading widely after flood events. Damages from GLOFs are often irreparable for decades, with considerable economic costs, particularly to downstream populations. Flood models predict that a breach of any of the high-risk glacial lakes will result in an economic loss of up to US$109 million[6], although this conservative figure excludes additional losses to hydropower plants and the subsequent financial ramifications of disrupted power supply. Because of the Thulagi, Lower Barun, Lumding Tsho and Hongu 2 Lakes' increasingly high risk of breaching, these lakes have been prioritised for urgent adaptation actions under the proposed project. Without intervention, these glacial lakes could breach at any given moment, adversely impacting vulnerable Nepalese

[1] Co-financer's contribution means the financial resources required, whether Public Finance or Private Finance, in addition to the GCF contribution (i.e. GCF financial resources requested by the Accredited Entity) to implement the project or programme described in the funding proposal.
[2] Refer to the Policy of Co-financing of the GCF.
[3] DHM, 2017. Observed Climate Trend Analysis of Nepal (1971-2014). Department of Hydrology and Meteorology, Kathmandu
[4] ICIMOD and UNDP. 2020. Research Report. Available at: https://lib.icimod.org/record/34905
[5] ICIMOD and UNDP. 2020. Research Report:. Available at: https://lib.icimod.org/record/34905
[6] Annex 3: Financial and Economic Appraisal

communities. Marginalized groups — including indigenous peoples[7] and women[8] — residing downstream of glacial lakes are particularly vulnerable to climate change-induced disasters, largely because of a lack of gender sensitivity and social inclusivity in planning for disaster risk reduction and climate change adaptation actions, development and post-disaster relief. Moreover, gender norms, imbalanced division of labour, unequal wages, and less access to and control over land and other productive assets for women result in fewer livelihood options available to women, making them more vulnerable to the impacts of GLOF events.

4. While the Government of Nepal (GoN) acknowledges the need to prioritise investment into proactive GLOF risk reduction strategies, the country has limited technical, financial and institutional capacity to design and implement interventions with sustainable GLOF risk reduction and adaptation benefits. These limitations are further constrained by the country's increasing public debt burden, which climbed from 26% of GDP in 2016–2017 to 30% in 2018–2019, with projections to increase in the future[9]. By 2022, central government debt has reached 41% of GDP[10]. Based on these factors, Nepal's efforts to address the impacts of GLOFs have been reactive and project-based, which are ineffective and insufficient to build the long-term climate resilience of Nepal's population. This constraint has left many downstream indigenous communities highly vulnerable to GLOFs and monsoon flooding. Without external support, the GoN will remain unable to invest in the necessary GLOF risk-reduction strategies required to protect the most vulnerable communities in the country or support major economic sectors following GLOFs and other extreme events.

5. Approximately USD36 million of GCF funds are being requested alongside USD14 million in cofinance to reduce the risk and impacts of GLOFs at the four priority glacial lakes by shifting towards a proactive approach to GLOF risk reduction in Nepal. The priority glacial lakes were identified based on extensive consultations and modelling by ICIMOD and UNDP, in collaboration with GoN, that identified potentially-dangerous glacial lakes (PGDLs) in the Hindu Kush Himalayan region using remote sensing[11]. The proposed project presents an integrated approach to GLOF risk management in Nepal by addressing institutional and technical capacities, physical protection (both grey[12] and green[13] infrastructure approaches), hazard monitoring and early warning. This integrated approach will utilise GCF funds to: i) lower the water levels of the Hongu 2 Lake by 1 m and the Thulagi, Lower Barun and Lumding Tsho Lakes by 3 m to reduce their risk of breaching; ii) implement Eco-Disaster Risk Reduction (Eco-DRR[14]) interventions in mountain ecosystems comprising a hybrid of nature-based and grey-engineering solutions to mitigate the residual flood impacts from a GLOF; iii) establish and implement early warning systems (EWS) to alleviate damages and prevent the loss of lives from GLOFs; and iv) strengthen the technical and institutional capacity of Nepal's Department of Hydrology and Meteorology (DHM) to plan for and respond to GLOFs and floods. These interventions will catalyse a shift from a need- and project-based approach towards proactive and pre-emptive approaches, engendered through strengthened capacity among institutions and communities. This paradigm shift in GLOF management will reduce the risk and impact of GLOFs and climate change-induced extreme flooding on vulnerable communities in Nepal, ensuring that livelihoods, agriculture and infrastructure are safeguarded. Moreover, the long-term sustainability of GCF's investment has been accounted for in the development of a robust operations and maintenance (O&M) plan, which carried across all physical interventions of the project. While ownership of project O&M will be held by DHM and the Department of Forest and Soil Conservation (DoFSC) – having formally committed financial and human resources to this end – several other stakeholders, including local authorities, community leaders and private-sector partners have indicated commitment to the success of interventions and form an integral part of long-term sustainability.

6. The combination of interventions described above will reduce flood risks associated with glacial lakes across over 11,000 km^2, delivering considerable adaptation benefits to the communities located in the Gandaki Basin and

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[7] for example, the Dalits people of the Hill and Terai areas
[8] in particular, women from marginalised indigenous groups
[9] International Monetary Fund. (2020). *2020 Article IV Consultation — Press Release; Staff Report; And Statement by The Executive Director for Nepal* (Issue 20)
[10] Public Debt Management Office (pdmo.gov.np) https://pdmo.gov.np/downloadfiles/Final-compiled-Annual-debt-Report-2078-1680509833.pdf
[11] Further details on the selection of the priority glacial lakes can be found in Section 4 of Annex 2: Feasibility Study.
[12] Grey infrastructure has been defined, in the context of this project, as conventional structural measures such as gabions, concrete revetments and flood walls.
[13] Green infrastructure has been defined, in the context of this project, as biological measures which make use of Nature-based Solutions and live plant species to mitigate and reduce the risk and impact of floods.
[14] Eco-DRR combines natural resource management and ecological engineering with other DRR methods to have more effective disaster prevention, reduce the impact of disasters on people and communities, and support disaster recovery: UNDRR (2020), Ecosystem-Based Disaster Risk Reduction: Implementing Nature-based Solutions for Resilience, United Nations Office for Disaster Risk Reduction – Regional Office for Asia and the Pacific, Bangkok, Thailand

Dudhkoshi and Arun Sub-basins. The reduced flood risk from lake lowering interventions is expected to reduce economic losses in Nepal by US$86.9 million. While the economic benefits are substantial relative to the investment, these reduced damages are of a public good nature — hPPPighlighting the needs for GCF grant support, as the interventions will not generate direct financial returns to support the use of alternative finance instruments. Overall, the project will confer direct adaptation benefits and indirect benefits to 385,956 and 1,912,347 vulnerable people in Nepal respectively, by reducing the adverse impacts of GLOFs on human life and enabling the population to prepare for and respond to these extreme events accordingly. This will include specific focus on the unequal vulnerabilities of different groups of society, including women and indigenous groups. Further benefits, including health benefits from the reduced impact of flooding as a result of adopting the downstream Eco-DRR interventions in the mountain ecosystems, are expected with Nepal continuing to set an example for innovative approaches to GLOF risk reduction that can be readily scaled up and replicated across the region.

7. The project's activities have been designed to sustain the paradigm shift and impact of project interventions discussed above, with a strong focus on country ownership. These activities will be embedded into existing national entities, including: i) the Department of Hydrology and Meteorology (DHM) housed within the Ministry of Energy Water Resources and Irrigation (MoEWRI); ii) the Ministry of Finance (MoF), which is the National Designated Authority (NDA) for Nepal; and iii) other government institutions proposed as responsible parties of this project. The project's development involved stakeholders from relevant Nepalese government ministries and departments, civil society organisations (CSOs), women's groups and private sector entities to ensure that the expectations and concerns of local stakeholders were incorporated into the project's design and that these individuals, particularly women, will be effectively involved and equally represented throughout the implementation process. Public-private partnerships will be developed to support the scaling, operation and maintenance of project interventions beyond the lifespan of the project. The project is aligned with several national priorities, including Nepal's Climate Change Policy (2019), National Adaptation Plan (NAP) (2021-2050) and Nepal's Third National Communication (TNC) to the UNFCCC (2021).`

PROJECT/PROGRAMME INFORMATION

B.1. Climate context (max. 1000 words, approximately 2 pages)

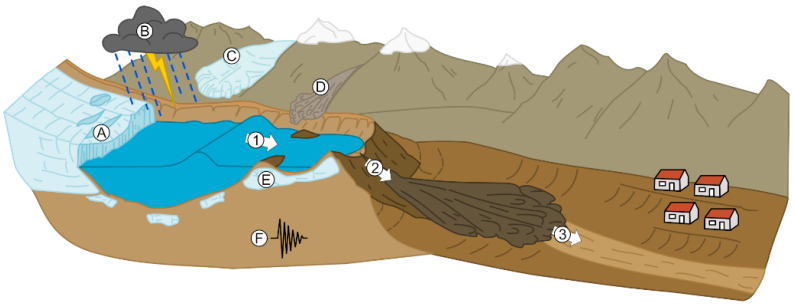
Context

8. Nepal is located in Southern Asia, with a land area of 147,000 km^2 and a population of 29 million people. The country's topography varies dramatically, with an elevation range of 8,849 m in a span of only 80 km — with flat, lowland Terai Plains (less than 70 masl) along the southwest border with India to the high, steep Himalayan Mountains in the northeast (reaching 8,848.6 masl). This variable terrain influences the local climate, with polar conditions at higher altitudes, intermediate cold climates south of the higher peaks, transitioning into tropical regions along the southern border. In addition to this geographic variation in climate, Nepal experiences temporal climate variation, with hot, wet summers and mild, dry winters. Summer rainfall is strongly influenced by the monsoon, which brings heavy rainfall. The impact of the monsoon, combined with the steep topography, exposes Nepal to numerous climate-induced natural hazards, including severe thunderstorms, landslides, extreme rain-induced flooding and Glacial Lake Outburst Floods (GLOFs) in high mountain areas. The geophysical setting combined with the socio-economic status and exposure of local/indigenous populations and infrastructure, lead to high impacts and associated risks from climate-induced hazards, particularly GLOFs and flooding.

9. Nepal is a Least Developed Country (LDC), ranked as the 26th-poorest nation globally and the second poorest in South Asia, with approximately a quarter of the population living below the poverty line. Socio-economic development is constrained by several factors, including the limited provision of basic services and resources. Although 87% of the population has basic access to water, available water is often not safe for consumption and the incidence of water-borne diseases is high. Limited access to electricity and transportation for many communities in remote areas further reduces access to goods and services. These challenges to economic development are exacerbated by the impacts of natural hazards, which lead to the loss of lives and resources, damage to infrastructure, and considerable declines in economic productivity during recovery efforts; the destruction of roads by natural disasters often cuts communities off from relief efforts, delaying critical aid and recovery.

Baseline scenario – Glacial Lake Outburst Floods

10. Glacial lakes are formed when a glacier erodes the underlying terrain and subsequently melts, filling the depression with fresh water. The resulting lakes are either dammed downstream by moraines[15] or ice. Many of these lakes are considered extremely dangerous as their dam walls are unstable and have the potential to burst, resulting in devastating Glacial Lake Outburst Floods (GLOFs) as shown in Figure 1 below. In Nepal, there are 3,800 glaciers and 2,000 glacial lakes. Of these, 47 are considered potentially dangerous based on: i) characteristics of the lakes and their dams; ii) the activity of the source glacier; and iii) the morphology of the surroundings[16]. An example of one of these potentially dangerous glacial lakes is presented in Figure 1.



Glacial Lake Outburst Floods (GLOFs) can have many triggers, including: (A) glacier calving; (B) intense precipitation; (C) avalances; (D) rockfalls and landslides; (E) degradation of the moraine, particularly ice cores; and (F) seismic activity. The key stages of a GLOF include: (1) the formation of a seiche wave that can overtop the moraine; (2) breach and degradation of the moraine; and (3) reesultant flooding downstream.

Figure 1. Basic glacial lake structure and the sequences of triggers that cause Glacial Lake Outburst Floods (GLOFs) .

[15] A moraine is any glacially formed accumulation of unconsolidated glacial debris that occurs in both currently and formerly glaciated regions on Earth, through geomorphological processes.
[16] Bajracharya et al (2020). Research Report. ICIMOD and UNDP.

11. A GLOF occurs when there is a breach of a glacial lake [17]. In the Himalayas, the primary GLOF trigger is an avalanche entering a lake, causing a tsunami-like wave that can overtop and erode the terminal moraine, and generate the ensuing flood. Other triggers include: i) displacement waves from rockfalls; ii) moraine failure due to dam settlement and/or piping; iii) degradation of ice-cored moraines; iv) seismic activity; or v) rapid input of water from extreme rainfall events or from a GLOF upstream. The unpredictable nature of GLOFs and the interdependence of their trigger mechanisms make it difficult to quantify the threats they pose. Historically, GLOFs have had catastrophic consequences in Nepal through the direct impacts of flooding and secondary impacts such as landslides, erosion, and sedimentation in river valleys. Damages caused by GLOFs in Nepal are immense, with each outburst resulting in the potential loss of human lives, destruction of houses and whole villages and loss of critical infrastructure such as roads, bridges and hydropower plants. Often, damages are irreparable for years or even decades, with considerable costs to the economy and impacts on downstream populations. A total of 26 GLOF events have been recorded in Nepal since 1977 and the country has been ranked alongside Bhutan as having the overall greatest national-level economic consequences of glacier flood impacts, excluding deaths. Figure 4 below is a screengrab from a video showing the severe damage to infrastructure from a GLOF experienced among downstream communities.

***Figure 2**: Thulagi Glacial Lake in Nepal. This lake is considered one of 47 potentially dangerous glacial lakes in Nepal[1].*

Figure 3. Damage to infrastructure from a GLOF experienced by downstream communities in Yangle Kharka, Sankhushabha District, Nepal in 2017[18].

[17] Further details on what triggers a GLOF are presented in Section 3 of Annex 2: Feasibility Study.
[18] Scientific American. Full video available at: https://www.youtube.com/watch?v=BDPbtP-0AW8.

12. In addition to GLOFs, Nepal is susceptible to floods resulting from extreme rainfall events, which have similar but less intense impacts on the population in comparison to GLOFs. During heavy monsoon cloudbursts, flash floods occur in the mountains, while in the southern plains, water breaches riverbanks and inundates large areas of land. Furthermore, given the steepness of slopes and the swift flow of water bodies, heavy rains and flash floods often trigger landslides that cause extensive loss of life and damage to infrastructure and the environment. The vulnerability to floods in Nepal was demonstrated by the tragic floods experienced across several districts aroundin September 2024. Extreme rainfall led to flash flooding and landslides that killed at least 224 people and injured a further 158[19], with the Nepal Red Cross reporting damages to at least 5,300 households (impacting approximately 26,500 people) across the affected districts. The floods also affected access to basic services such as water, transportation, communication and electricity services, particularly in rural areas where such services take time to restore[20].

Climate rationale

Climate change impacts on glaciers and GLOFs[21]

13. Records show an increase in the frequency of GLOFs in recent decades in response to rising temperatures associated with climate change, which increase the rate of glacial retreat, thereby elevating the volume of glacial lakes. In addition to an general warming trend of 0.6°C–1°C per decade in the high mountainous and Himalaya areas, Nepal has experienced significant extreme temperature trends, including increases in extreme temperatures as well as shortening of cold spells in most of the country[22]. As a result of this warming, most glaciers have lost mass more rapidly since the 1960s, with unprecedented losses over the last decade.

14. As glaciers retreat, the surface area and volume of a glacial lake at their base increases, creating a heightened risk of a GLOF. Future climate projections under RCP4.5 show increases of 1.3°C and 1.72°C projected by 2065 and 2100, respectively, with more extreme increases under the RCP8.5 scenario, reaching 1.07°C by 2045, 1.82°C by 2065, and 3.58°C by 2100[23]. Glacier mass loss is projected to accelerate throughout the 21st century, with a loss of between 40 ± 25% and 69 ± 21 % of 2015 glacier volume expected by 2100 in RCP 2.6 and RCP 8.5, respectively. This accelerated loss of glacial mass contributes to increasing glacial runoff, which subsequently increases the probability of a GLOF event being triggered by other hazards, such as avalanches, rockfalls, heavy rainfall and earthquakes.

15. In addition to accelerating glacial retreat, other climate change related factors contribute to the increased risk of GLOFs, including: i) more intense and frequent rainfall and rainfall-induced floods, which increase the risk of rainfall-triggered GLOFs; and ii) the degradation of ice-cored moraines as a result of rising temperatures, which destabilizes dam walls and increases the risk of breaching. The climate drivers of increased GLOF risk due to climate change are listed below (see Annex 2, section 3 for further details):
    - Increasing temperatures which accelerate glacial and snow melt, increase the volume of water in glacial lakes, as well as destabilising ice core dam walls and surrounding frozen slopes;
    - Increasing rainfall intensity which increases likelihood of flood and landslides triggering a GLOF event;
    - Increasing water volume of glacial lakes increases the likelihood of a breach as a result of the elevated pressure on moraine and ice dams;
    - Reduced amount of 'freeboard'[24] between the maximum water level and the top of the dam with the increased lake volume, thereby increasing the likelihood of overflow;
    - Increased volume of water in the glacial lake, resulting in more intense floods and posing a greater risk to the populations downstream.

16. In Nepal, glacier areas have decreased by 24% in the 33 years between 1977 and 2010. Much of the resulting meltwater has settled in glacial lakes. Indeed, evidence from several glacial lakes in Nepal indicates that they have been expanding as temperatures increase. In particular, Thulagi Glacial Lake in Manang district has increased in area from 0.72 to 0.94 km^2 since 1990, while Lower Barun Glacial Lake in Sankhuwasabha district has increased in area from 0.64 to 2 km^2 for the same period. Similarly, Lumding Tsho Glacial Lake in Solukhumbu district has increased in area from 0.2 to 0.77 km^2 from 1962 to 2000 (See Section 4.4. of Annex 2 for more details on the impacts on these four high priority glacial lakes). These increases, combined with other characteristics of the lakes,

[19] 2024 September Floods and Landslides: Situation Report
[20] Nepal Flood and Landslide Response 2024 - DREF Operational Update
[21] See Section 4.4. of Annex 2- Feasibility Study for more details on the CC impacts
[22] Government of Nepal. Department of Hydrology and Meteorology. 2017. Observed Climate Trend Analysis of Nepal (1971-2014).
[23] MoFE, 2019. Climate change scenarios for Nepal for National Adaptation Plan (NAP). Ministry of Forests and Environment, Kathmandu
[24] the vertical distance between the top of the dam wall and the maximum reservoir water level

have resulted in these lakes being categorised as Rank I on the ICIMOD list of Potentially Dangerous Glacial Lakes (PDGLs). The categorisation of these lakes was confirmed through a joint study between UNDP and ICIMOD in 2020, which identified 47 potentially dangerous glacial lakes (21 of which were in Nepal), based on the following criteria : i) characteristics of the lakes and their dams, such as the area of the lake and the condition of the dam; ii) the characteristics of the source glacier (such as the condition of hanging glaciers, the distance to lakes, the steepness of glacier tongues etc.); and iii) the physical condition of the surroundings (such as the presence of large snow avalanche sites immediately above the lake and potential rockfall or rock slide sites around the lake). This study informed the selection of target lakes for this project based on whether: i) the lake is large with the possibility of expansion due to calving of glaciers; ii) the lake is retained by the loose moraine end dam; iii) there is an outlet that allows overflow to pass over/through the moraine or if all water is collected within the lake; iv) there is a steep outlet slope; v) there is a hanging source glacier; and vi) there are chances of snow and/or ice avalanches and landslides impacting the lake and dam. The proposed lakes are all located in the northern Himalayan region of Nepal and are the only Rank I PDGLs identified in both the 2011 and 2020 studies for Nepal, which are yet to be mitigated. Three of these lakes are located in the Koshi Basin, with the Lumding Tsho and Hongu-II in the Solukhumbu district and draining into the Dudhkoshi sub-basin, and Lower Barun in the Sankhuwasabha district draining into the Arun sub-basin. Thulagi is located in the Manang district, and forms part of the Marsyangdi sub-basin in the Gandaki Basin and . As temperatures increase with climate change, these lakes will likely expand further, increasing the risk of GLOFs.

Table 1: Summary of Climate Trends and projections[25]

Climate Variable	Baseline	Trend	Projection
Average Temperature	• National: 12.1°C • The High Mountains: ○ Summer 5–15°C ○ winter <0°C	• National: ↑ 0.055 ˚C yr^{-1} • High mountainous areas: ○ ↑ 0.06°C–0.12°C yr^{-1}	• RCP 4.5: ↑ 0.92˚C by 2045, 1.3˚C by 2065 and 1.72˚C by 2100 • RCP 8.5: ↑ 1.07˚C by 2045, 1.82˚C by 2065 and 3.58˚C by 2100 • High Mountain areas ○ RCP 4.5: ↑ 0.95˚C by 2045, 1.36˚C by 2065 and 1.79˚C by 2100 ○ RCP 8.5: ↑ 1.09˚C by 2045, 1.86˚C by 2065 and 3.69˚C by 2100
Average Maximum Temperature	• National: 23.6°C	• National: ↑ 0.04°C yr^{-1} • High mountainous areas: ○ ↑ 0.07°C–0.3°C yr^{-1}	• RCP 4.5: ↑ 1.8˚C by 2059 and 2.5˚C by 2099 • RCP 8.5: ↑ 2.4˚C by 2059 and 5˚C by 2099
Average Minimum Temperature	• National: 11.6˚C • High mountainous areas: <4˚C	• National: ↑ 0.002 °C/yr^{-1}	• RCP 4.5: ↑ 1.7˚C by 2059 and 2.5˚C by 2099 • RCP 8.5: ↑ 2.4˚C by 2059 and 5˚C by 2099
Temperature Extremes	• Warm Days: 36.5 days • Warm Nights: 36.5 days • Cold Days: 36.5 days • Cold Nights: 36.5 days • Cold Spell Duration: 20.3 days	• ↑ Number of warm days and nights • ↓ Number of cool days and nights • ↓ Cold spell duration	• ↑ Number of warm days by 87.33% (RCP4.5) and 124.7% (RCP8.5) by 2065 • ↑ Number of warm nights by 115.7% (RCP4.5) and 159.2% (RCP8.5) by 2065 • ↓ Number of cool days and nights • ↓ Cold spell duration by 63.9% (RCP4.5) and 73.3% (RCP8.5)
Average Rainfall	• Annual: 1,830 mm • Monsoon: 250–450 mm per month	• National: ↓ 1.3 mm yr^{-1} • High mountainous areas: ↓ 2-4 mm yr^{-1} • Monsoon Season: -7.5 to +9 mm yr^{-1}	• RCP 4.5: ↑ 2.1% by 2045, 7.9% by 2065 and 10.7% by 2100 • RCP 8.5: ↑ 6.4% by 2045, 12.1% by 2065 and 23% by 2100
Extreme Rainfall	• Rainy days: 166.4 days • Very wet days: 18.1 days • Extremely wet days: 3.5 days	• Number of rainy days increasing significantly in the northwestern districts	• Rainy days: -3 days (RCP4.5) and -1.6 days (RCP8.5) • Very wet days: +0.3 days (RCP4.5) and +2.2 days (RCP8.5)

25 See Annex 2 for further details and sources.

		• Extremely wet days decreasing in the northern and mountain districts	• Extremely wet days: +0.9 days (RCP4.5) and +1 day (RCP8.5)

Impacts of GLOFs and potential for risk reduction

17. Given the magnitude of GLOF events, their impacts on settlements, roads, bridges, hydropower projects and other infrastructure can be severe, as well as causing significant losses of lives and livelihoods. Flood models[26] for the beaching of the four highest priority glacial lakes (Thulagi, Lower Barun, Lumding Tsho and Hongu 2) predict economic losses[27] totalling US$ 67.4–109.2 million[28]. The specific losses for each lake are summarised in Table 3 though these estimates do not include potential losses to hydropower plants and the subsequent economic ramifications of disrupted power supply. Without intervention, these glacial lakes risk breaching and the risk increases with climate change. However, these risks can be reduced significantly through the implementation of appropriate risk mitigation and adaptation measures such as: i) manually lowering each of the glacial lakes, thereby reducing their total volume and subsequently reducing the GLOF risk/magnitude; ii) constructing check dams and other downstream mitigation measures, such as flood walls, gabions and revetments, as well as Nature-based Solutions (NbS) such as brush layering and reforestation, to reduce residual flood impacts; and iii) establishing and implementing early warning systems (EWS) to reduce damages and prevent loss of life. (See Section 5.1.3 of Annex 2 for more details on option assessed).

18. It is estimated that, by manually lowering the Thulagi, Lower Barun and Lumding Tsho Lakes by 3 m, and the Hongu 2 Lake by 1 m and installing the proposed downstream GLOF risk reduction measures, the total potential damages associated with a GLOF can be reduced by US$ 45.1–86.9 million[29] based on two different probability models of a GLOF occurring at any of the four target glacial lakes. Specifically, the project considered an Annual Probability Scenario (Scenario I) — which used historical records from 1980 to 2017 to calculate the percentage chance of a GLOF per year assuming a similar rate of occurrence in the future — and a Return Period based Probability Scenario (Scenario II) — which accounted for the probable magnitude of a GLOF as well as the return-period for an event of a given size. Damages were calculated based on modelled flood depth and velocities mapped over at-risk infrastructure and livelihood activities in the potential flood areas, as well as the potential for loss of life. The details of these models and their results are available in Annex 3: Financial and Economic Appraisal. Comparing expected losses and intervention costs with projected benefits (including discount factors), the Net Present Value (NPV) of the proposed project was calculated to be US$86,919,219 for the Annual Probability Scenario, and US$45,126,562 for the Return Period based Probability Scenario[30]. Under both scenarios, the interventions save 1,932 lives, 420 houses, 1,201 hectares of cultivated land and 8,180 GWh of electrical production, resulting in high benefit to cost ratios of 4.9 and 8.02 for Scenarios I and II respectively. Thus, the implementation of these measures will clearly safeguard the lives and livelihoods of vulnerable communities in Nepal in an economically sensible way.[31]

Complementarity with existing projects, programmes and initiatives[32]

19. In recent years, numerous projects, programmes and baseline investments have been implemented in and around Nepal to address GLOF risk and alleviate the impact of glacial flooding. Lessons learned and best practices from these initiatives have been incorporated into the proposed project's design to replicate successful adaptation techniques and ensure complementarity between the proposed project and existing actions, with the most relevant initiatives identified during project development. An analysis of identified projects was later conducted to prevent the duplication of or adverse impact on ongoing initiatives, with GCF resources intended to complement and build on existing initiatives, specifically filling in gaps and areas not yet covered by baseline investments. Achieving complementarity between various initiatives will depend on the implementation of proposed activities, such as the expansion of recently-upgraded climate monitoring and early warning systems to include glacial lakes, as well as ensuring that means for monitoring glacial lakes will be funded beyond the project's lifespan. The most relevant

[26] Hydraulic modelling used a 6-step approach: i) Breach Parameter Analysis; ii) Breach Hydraulic Modelling; iii) Froehlich Breach Peak Flow; iv) Breach Hydrograph Adjustment; v) Flood Routing of the Hydrograph; and vi) Flood Hazard Mapping. See Annex 24 for more details.

[27] Damages were assessed based on GLOF downstream flood modelling, with flood velocity and depth as the primary parameters. Damage risks were considered for the projected flood areas, focusing on population performing livelihood activities such as agriculture, housing and settlements and the developed infrastructures (e. g. roads, trail bridges, bridges, etc.). Damage estimates were based on the calculation of the mean impacts of multiple dam breach scenarios. See Annex 23a for more details.

[28] These potential economic benefits are cumulative across all four lakes and are estimated over a 25-year time horizon.

[29] The high value of losses can be attributed to the exposure of hydropower installations to the GLOF impacts and the associated loss of revenue of these installations. The remaining losses are predominantly contributed to by public infrastructure and real estate.

[30] The NPVs are cumulative across all four lakes and are estimated over a 25-year time horizon.

[31] See Section 5.3. of Annex 2- Feasibility Study for more details on the economic impacts of GLOFs in Nepal.

[32] A comprehensive list of baseline projects, programmes, initiatives and other past and ongoing projects related to the proposed project are presented in Section 7 of Annex 2: Feasibility Study.

initiatives (determined by the parameters discussed above) are presented below and include a description of how the proposed project will complement existing investments.

20. The Nepal Climate Change Support Programme II (NCCSP II) (2019-2024, UK Aid, US$3.1 million) NCCSP II is the third instalment of a programme that has been implemented by the Ministry of Forest and Environment (MoFE) and 26 local governments in 14 districts in Nepal, with support from UNDP. In the first phase (NCCSP I), UNDP provided technical assistance to the MOPE and GoN to implement the NAPA. The focus was 80% on local level actions to implement local adaptation programmes of action (LAPA) and 20% on strengthening institutional capacity and national-level coordination of Nepal's efforts to alleviate the impacts of climate change. These efforts will be expanded in the forthcoming second phase (NCCSP II) of the project. Phase I and Phase II of the project are bridged by the NCCSP I-Transition Extension (TE), which provides support and technical assistance to 26 local governments across 14 districts to implement multiple Climate Resilient Development Projects (CRDPs). The NCCSP I-TE supported 78 CRDPs between 2018–2019 and is currently engaging with the abovementioned local governments to expand on this number. The proposed project will complement this initiative by addressing community resilience through the co-development of community response mechanisms (Activity 2.2) and expanding on protecting wetlands and settlements (Output 3). Expanding these initiatives from districts located in neighbouring provinces to those targeted by the NCCSP II will enable the proposed project to fill gaps in community coverage and complement the activities implemented under NCCSP II.

21. *Improving Climate Resilience of Vulnerable Communities and Ecosystems in the Gandaki River Basin, Nepal (2020—2026, IUCN, US$27.4 million)*
This IUCN project aims to improve the resilience of vulnerable communities and ecosystems in the Gandaki River Basin by working across traditional political and administrative boundaries to plan and implement climate change adaptation measures[33]. There is strong complementarity with the proposed project in that the project area overlaps with the Thulagi Lake area, thereby providing a foundational entry point for implementation in the region. The high risk of the area necessitates further adaptation action to complement the adaptation measures supported by the ongoing IUCN-supported project. The proposed project will build on this existing initiative's knowledge management, technical capacity and ecosystem restoration efforts by expanding similar approaches into the other target areas. Additionally, the proposed project will work in synergy with the IUCN-supported project implementation unit to incorporate ecosystem-based climate change adaptation approaches into government policies and plans. The GLOF and flash flood risk and impact reduction measures under Output 3 of the proposed project will complement the capacity building- and knowledge management-based interventions of this IUCN project to elevate the impact of GCF resources.

22. *Developing Climate Resilient Livelihoods in the Vulnerable Watershed in Nepal (2020—2024, GEF LDCF, US$42.9 million)*
23. The objective of this project is to develop climate-resilient community livelihoods through integrated watershed management practices by establishing the necessary policies and institutional frameworks. The project will introduce and scale-up integrated watershed management practices and climate-smart agriculture in four major watersheds: Dudhkoshi, Molung, Llkhu and Sunkoshi Canyon within the lower Sunkoshi basin. An additional focus of this project is to strengthen hydrometeorological monitoring, which will be complemented by the hydrometeorological monitoring systems developed and strengthened by the proposed project in neighbouring areas, creating a more comprehensive network. The design of the proposed additions to the hydrometeorological monitoring equipment under this project and the associated EWS will consider the work done under the GEF project, ensuring that there is no overlap and that stations are optimally positioned to maximise coverage over the target areas.

Saptakoshi High Dam Project (ongoing, Government of Nepal, US$ 23.8 million)

24. The Saptakoshi High Dam is a multipurpose project on the Saptakoshi River of Nepal. The project's primary focus is to generate hydropower and control floods in southeast Nepal and neighbouring India. Catastrophic flooding resulting from the erosion of the river's embankments in 2008 catalysed this project's efforts, including the development of a 296 m-high multipurpose dam that will help control downstream flooding and provide 3300 MW of electricity and irrigation potential. The improved control of downstream flooding under this project will complement the residual flood risk and impact reduction measures under Output 3 of the proposed project.

Building a Resilient Churia Region in Nepal (BRCRN) (2020-2027, GCF, US$47.3 million)

[33] GCF FP131: Improving Climate Resilience of Vulnerable Communities and Ecosystems in the Gandaki River Basin, Nepal. 2021. Available at: https://www.greenclimate.fund/sites/default/files/document/fp131-iucn-nepal_0.pdf

25. The BRCRN project aims to confront climate change challenges in Nepal by enhancing the resilience of ecosystems and vulnerable communities in the Churia region. This GCF-funded project will promote widespread adoption of climate-resilient land use practices, confront the challenges of deforestation and forest degradation and build resilience to climate-induced hazards in the region, contributing to Nepal's nationally determined contribution (NDC). The BRCRN project will support CBOs in adopting and investing in climate-resilient, sustainable natural resource management approaches, complementing CBO capacity-building activities under Output 3 of the proposed project. In addition, the BRCRN project will support integrated river system-level planning on various government, CBO and other partner levels, which will further complement the climate risk and hazard information planning interventions under Output 1 of the proposed project.

B.2 (a). Theory of change narrative and diagram (max. 1500 words, approximately 3 pages plus diagram)

Problem statement

26. To date, 26 GLOF events have been recorded in Nepal since the 1970s. The accelerated melting of glaciers caused by climate change is increasing the frequency and intensity of GLOFs in Nepal. This trend is expected to continue to worsen under future climate scenarios. The impacts of GLOFs for the largely Indigenous communities living downstream of glacial lakes are considerable. In addition to flooding, GLOFs cause landslides and mudflows that threaten lives and livelihoods, as well as causing significant damage to infrastructure and private assets, while also disrupting transportation networks, agricultural production, power supply from hydropower plants, and tourism activities in the country. These GLOF events also have considerable economic impacts, where a single GLOF has the potential to cause more than US$100 million in damages. There are 47 Lakes in Nepal currently considered potentially dangerous, of which four have been prioritised for urgent adaptation action: the Thulagi, Lower Barun, Lumding Tsho and Hongu 2 Glacial Lakes. Technical and fiscal limitations have reduced the capacity of the Government of Nepal (GoN) to secure adequate, sustainable adaptation interventions, infrastructure and EWS to alleviate the impacts of GLOFs, leaving many of Nepal's downstream populations at increased risk. Moreover, the GoN's capacity to fund and implement adaptation measures has been severely limited by other extreme events that require significant investment for recovery efforts.

27. Where implemented, efforts to address the impacts of GLOFs has been reactive and project-based, limiting the capacity to build resilience. In addition, the density of the current hydrometric network is insufficient to meet the intensified monitoring requirements that climate variability and the increasing risk of GLOF events require. While DHM has recently updated climate risk monitoring and national early warning system capacity under the World Bank project *'Building Resilience to Climate Resilient Hazards'*, these improvements are unable to quantify and track GLOF risk in Nepal effectively. These limitations have persisted as the project did not include monitoring systems at glacial lakes or supply ongoing funds for operations, maintenance and additional personnel beyond completion in 2019. In addition, watershed management and EbA approaches to GLOF risk reduction have largely depended on external funds, leading to further limitations of GoN's risk reduction capacity. Without intervention, the increased volume of glacial lakes, the consequent trigger risk and subsequent magnitude of GLOFs are expected to continue to rise, posing a major risk to downstream communities.

Preferred adaptation solution

28. There is an urgent need in Nepal to shift away from a reactive, project-based response to GLOFs towards building sustainable national capacity to respond to an impending GLOF event and implement tangible and cost-effective GLOF risk reduction measures both up- and downstream. This integrated approach to the reduction of GLOF risk and the associated impacts on downstream communities — including direct economic loss reduction — should comprise: i) physical risk reduction measures at the four glacial lakes in Nepal most at risk of breaching, namely the Thulagi, Lower Barun, Lumding Tsho and Hongu 2 Lakes, through the field-tested method of lake lowering; ii) downstream, watershed-level interventions such as reforestation and forest cover maintenance as well as flood defence infrastructure reinforced by bioengineering technologies to complement the physical risk reduction interventions (lake lowering) and reduce the residual impacts of a GLOF event on vulnerable downstream communities; iii) interventions to strengthen technical and institutional capacity at the national level to integrate climate risk and hazard information into planning, policy and response strategies; iv) a GLOF early warning system (GLOF EWS) to generate and disseminate improved GLOF- and climate change-related information to national and local decision-makers; and v) community-level GLOF awareness and early warnings to promote appropriate response strategies and develop long-term adaptive capacity. To ensure the sustainability and scalability of interventions, the project should facilitate strong public-private partnerships, particularly with the energy and tourism sectors which stand to benefit directly from GLOF risk reduction and have the potential to contribute to the operations, maintenance, and scaling of interventions. This integrated approach was co-designed with national

stakeholders — including government institutions, local authorities, civil society[34] and technical experts — through a combination of extensive consultations and technical studies. Details on the stakeholder engagements process are outlined in Section D.5 below, with described in full under Annex 7a – Stakeholder Engagement Report, while further details of the technical studies are included in Annex 2 – Feasibility Study.

Barriers to the preferred solution

Several technical, institutional and financial barriers to the preferred adaptation solution have been identified for Nepal. In order for the preferred solution above to be successfully implemented, these barriers need to be overcome. The barriers are summarised below.

29. Barrier 1 — *Limited technical knowledge and institutional capacity, including watershed-level approaches to GLOF risk reduction:* The GoN has: i) insufficient data and expertise related to GLOF risk reduction and management; ii) limited internal institutional guidelines and standards for GLOF risk reduction planning and response; iii) unclear institutional arrangements for GLOF risk reduction; and iii) inadequate mechanisms to ensure the coordination of efforts between national and sub-national governments, including the local level governments and key stakeholders. These insufficient institutional arrangements for GLOF risk reduction can be attributed to Nepal's reliance on external support for GLOF monitoring and risk reduction measures, with the highlighted capacity constraints hindering the establishment of a sufficient knowledge base for GLOF risk reduction in the country.

30. Adequate GLOF risk reduction in Nepal is further inhibited by the combination of knowledge gaps and limited capacity to develop and effectively implement watershed-level management plans for GLOF risk reduction. At present, the legal and policy frameworks on climate change adaptation in Nepal focus on across-the-board approaches to GLOF risk reduction. This gap for watershed-level approaches to GLOF management has been further exacerbated by limited collaboration and coordination between different GoN agencies. Moreover, there is limited GLOF monitoring, glacial lake mapping, risk reduction and EWS in Nepal, and to date, most studies on high mountain regions and GLOF risk in Nepal have been project-based, resulting in insufficient data to effectively support watershed-level approaches for climate risk reduction.

31. Barrier 2 — *Limited access to current, reliable and timely climate risk information and early warnings technology*: There are gaps in Nepal's hydrometeorological monitoring network, which constrain the implementation of integrated watershed-level approaches for catchment management, risk reduction and the dissemination of early warnings to communities. This is particularly evident in the lack of vulnerability maps, technical field surveys, hazard and risk information and comprehensive climate information in Nepal. Additionally, research and monitoring in remote areas of the Himalayan region are constrained, resulting in gaps in coverage of the existing hydrometeorological system. This also affect private sector actors in the area, who are vulnerable to the impacts of GLOF and monsoon rainfall, but do not have adequate access to reliable climate risk information and early warnings. Consequently, the potential contributions from these sectors to the development and maintenance of such systems are being leveraged to their full potential.

32. *Barrier 3 — Limited investment in, and investment planning for, long-term climate risk reduction to address GLOF and flood risk*: There is a general lack of investment in long-term climate risk reduction in Nepal. Given the high cost of GLOF risk reduction interventions, the country has limited financial mechanisms to sustain risk reduction approaches or to support the mainstreaming of public investment initiatives or public-private partnerships (PPPs) for downstream flood management. Moreover, investment in risk reduction measures is hindered by limited opportunities to generate income or recoup the high costs associated with implementing these measures, which constrains the GoN's ability to attract and secure the necessary investments for GLOF risk reduction, particularly from the private sector. This challenge is compounded by the GoN's limited capacity to systematically identify, plan for and programme financial requirements for risk reduction measures.

33. Barrier 4 — *Limited community awareness and skills for GLOF disaster reduction actions*: Knowledge of climate change and its impacts — including GLOFs and rain-induced flooding — is limited among the different groups living in areas exposed to GLOFs and other extreme climate events throughout Nepal. Linked to this is the limited adaptive capacity of these groups to manage the impacts of extreme flooding events. This limited adaptive capacity is further exacerbated by inadequate investment in DRR interventions in the exposed areas, which increases the risk of damage to infrastructure, disruption of livelihoods — including agriculture and tourism — as well as potential injury and loss of life in these areas. The youth, women and marginalised Indigenous groups are the most vulnerable to these impacts.

[34] Including indigenous people, women's organisations and other marginalised groups.

Project Approach

Goal Statement

34. **IF** the levels of the Thulagi, Lower Barun, Lumding Tsho and Hongu 2 glacial lakes are reduced and nature-based flood mitigation measures and early warning systems are introduced in downstream catchments, **THEN** the resilience, disaster preparedness and adaptive capacity of downstream communities will be enhanced, **BECAUSE** the likelihood of catastrophic breaches and intensity of Glacial Lake Outburst Floods (GLOFs) will be reduced and communities will be better prepared to avoid and recover from residual flood risks.

Theory of Change

35. The proposed project seeks to enhance Nepal's resilience to climate-induced hazards, specifically glacial lake outburst floods (GLOFs) and flash floods. This will be achieved by strengthening institutional capacity to integrate climate risk into planning and development, implementing disaster risk reduction measures, and improving early warning systems and community preparedness. By addressing the root causes of vulnerability and reducing exposure to these extreme events, the project aims to safeguard lives, livelihoods, and critical infrastructure while promoting sustainable, climate-resilient development.

36. A key outcome of the project is ensuring that local and national-level institutions adopt an integrated approach to planning and development that incorporates climate risk and hazard information. Strengthening institutional and technical capacity will enable decision-makers to incorporate climate risk considerations into policies, strategies, and investment plans, ensuring proactive and informed decision-making (Output 1). The project will facilitate collaboration among key government agencies, the private sector, and local communities to institutionalize climate risk management, creating a foundation for long-term resilience.
37.
38. At the community level, the second project outcome will be the reduced exposure of vulnerable communities to GLOFs and flash floods while increasing preparedness to respond to residual flood risks. This will be achieved through improved hazard monitoring, the generation and dissemination of early warnings (Output 1), and the implementation of targeted risk reduction measures (Output 3). Communities will benefit from a strengthened early warning system that provides timely and actionable information, allowing for effective preparedness and response. Furthermore, physical interventions, such as lake-lowering activities at high-risk glacial lakes and hybrid Eco-disaster Risk Reduction (EcoDRR) strategies, will mitigate the probability and intensity of GLOFs, reducing downstream flood impacts.

39. To achieve these outcomes, the project will undertake a range of activities. Institutional capacity will be strengthened through training programs, policy development, and the integration of climate risk considerations into planning processes. Hazard monitoring systems will be enhanced by expanding hydrometeorological observation networks, improving data collection and analysis, and developing user-friendly climate information products. Early warning systems will be upgraded to ensure that communities receive timely and comprehensible alerts, supported by community-based preparedness initiatives, such as drills, awareness campaigns, and response planning. Risk reduction measures will include engineering interventions to lower water levels in high-risk lakes and nature-based solutions to manage residual flood risks, ensuring a comprehensive approach to disaster risk management.
40.
41. The project also addresses critical barriers that have hindered Nepal's ability to implement effective adaptation measures. Weak early warning systems will be strengthened through an expanded observational network and enhanced coordination among relevant institutions. The lack of tangible risk reduction measures will be addressed by implementing lake-lowering activities and downstream interventions that mitigate flood risks. The project will also catalyse the development of policy and financial mechanisms for GLOF risk reduction, engaging private sector actors such as the hydropower and tourism industries to support long-term sustainability. Additionally, community ownership will be fostered through participatory approaches, ensuring that local populations are actively involved in planning, monitoring, and responding to climate hazards.

42. The success of the project is contingent on several assumptions. It assumes that government agencies and stakeholders will remain engaged throughout the implementation period, ensuring effective coordination and collaboration. The project is also based on the assumption that lowering glacial lakes will reduce the likelihood and intensity of outburst floods and that early warnings will provide sufficient lead time for communities to take protective action. Additionally, it assumes that communities will understand and adhere to the warnings and response measures designed for their specific locations. Potential risks include financial or institutional constraints that could

delay implementation, technological challenges in monitoring systems, and socio-economic barriers that may affect community participation. Downstream flood mitigation measures must also be designed to withstand potential extreme flood events following lake-lowering interventions.

43. By overcoming these barriers and reinforcing key assumptions, the project will contribute to a transformative shift in how Nepal manages climate risks. The integration of climate risk considerations into institutional decision-making, the enhancement of early warning systems, and the implementation of proactive risk reduction measures will reduce disaster impacts and build long-term resilience. Through these interventions, Nepal will move from a reactive disaster response approach to a proactive, climate-resilient development pathway, safeguarding communities and key economic sectors from the growing risks posed by GLOFs and extreme flooding events.

44. These interventions are described in Section *B.3. Project/programme description* below, with their transformative impact expanded on in Section *D.2. Paradigm shift potential*. The Theory of Change for the project is presented in Figure 7 below.

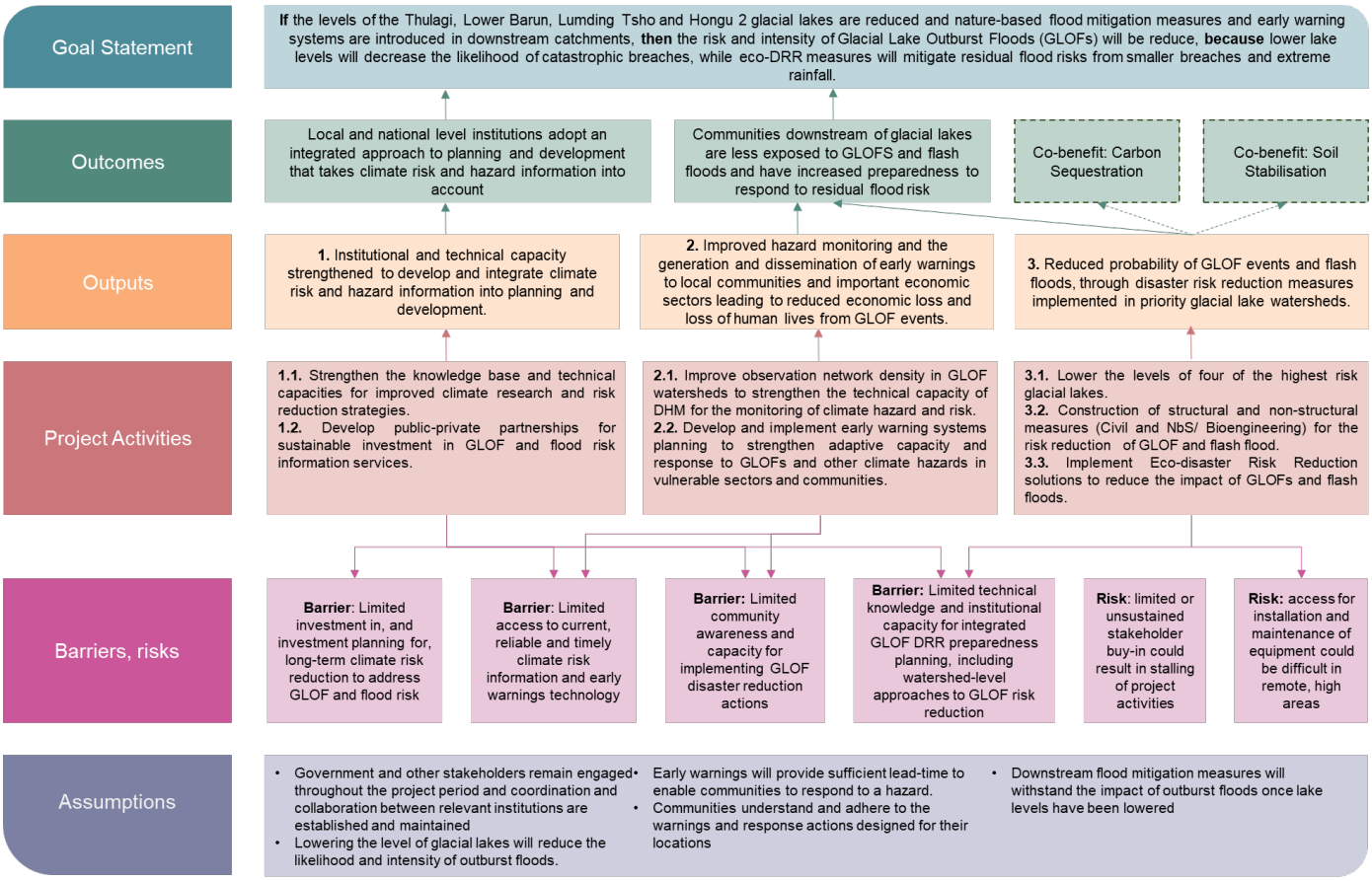


Figure 4. Theory of Change diagram.

B.2 (b). Outcome mapping to GCF results areas and co-benefit categorization

Output number	GCF Mitigation Results Area (MRA 1-4)				GCF Adaptation Results Area (ARA 1-4)			
	MRA 1 Energy generation and access	**MRA 2** Low-emission transport	**MRA 3** Building, cities, industries, appliances	**MRA 4** Forestry and land use	**ARA 1** Most vulnerable people and communities	**ARA 2** Health, well-being, food and water security	**ARA 3** Infrastructure and built environment	**ARA 4** Ecosystems and ecosystem services
Output 1	☐	☐	☐	☐	☒	☐	☐	☐
Output 2	☐	☐	☐	☐	☒	☐	☐	☐

Output 3	☐	☐	☐	☐	☒	☐	☒	☒

Co-benefit number	Co-benefit					
	Environmental	Social	Economic	Gender	Adaptation	Mitigation
Co-benefit 1: Carbon Sequestration	☐	☐	☐	☐	☐	☒
Co-benefit 2: Soil Stabilisation	☒	☐	☐	☐	☐	☐

B.3. Project/programme description (max. 2500 words, approximately 5 pages)

Project objective

45. The objective of the proposed project is to safeguard the lives and livelihoods of people and their assets by reducing the risk of Glacial Lake Outburst Floods (GLOFs) and related hazards in Nepal. This shift will be achieved by implementing a transformative approach to the way in which the Government of Nepal (GoN) addresses GLOFs and flooding. Specifically, direct investments from the GCF combined with co-financing from DHM, DoFSC, MoEWRI, MOFE, NDRRMA , DNPWC, NTB and IPPAN will be used to: i) reduce the impacts of a GLOF and its residual impacts on vulnerable communities; ii) promote the adoption of GLOF early warning system (EWS) measures among national- and local-level decision-makers to enhance rapid response to an impending GLOF; and iii) strengthen the technical and institutional capacity of the GoN and local communities to implement GLOF risk reduction measures through targeted training and awareness raising. The combined effect of project interventions will result in the adoption and implementation of a climate-resilient, integrated approach to GLOF risk reduction and flood management that can be readily scaled up and replicated nationally and across South Asia. The proposed project will contribute to the GCF's paradigm shift objective of increased climate-resilient sustainable development. Proposed project outputs and activities are described in detail below.

46. The project will directly benefit 385,956 people of Nepal (55% women and 45% men, 1.3% of the total population of Nepal) by reducing their exposure to GLOFs through glacial lake lowering and EcoDRR. These direct beneficiaries have been selected based on the dam breach modelling results that identify the direct impact area of a potential GLOF event, mapped against the population resident in those areas. The delineation of the direct impact area involved dividing the basins into two categories: i) the main river basin area where flood mitigation and degraded physical environment restoration measures will be implemented; and ii) the downstream area of the main river channel where Early Warning System (EWS) are proposed. Based on these delineations, the estimated direct impact area of Arun and Dudhkosi basin is 5,115km^2, and 4,063km^2, respectively, with an additional 856km^2 and 1,917km^2, respectively, accounted for in the downstream direct impact area. The direct impact area of Thualagi is estimated to be 1,917km^2. There are 29 rural/urban municipalities in the direct impact area of Arun Basin while this is 16 and 19 in Dudhkosi and Marshyangdi basins, respectively. In addition to these direct beneficiaries, 1,912,347 people living in the municipality wards surrounding the direct impact area will indirectly benefit by enabling the population to prepare for and respond to these extreme events accordingly.

Output 1. Institutional and technical capacity strengthened to develop and integrate climate risk and hazard information into planning and development.

47. Output 1 will improve DHM's technical and institutional capacity to develop and disseminate tailored climate risk information and establishing public-private sector partnerships to encourage investment into GLOF risk reduction in Nepal. The strengthened regulatory frameworks, combined with capacity building and skills development in the disaster risk reduction sector, will create an enabling environment for the upscaling and replication of project interventions across the country. This upscaling potential will be achieved by: i) improving DHM's capacity for hazard mapping and prioritizing GLOF risk reduction strategies; ii) leveraging investment from the private sector into GLOF risk reduction beyond the conventional project-based approach; and iii) training the relevant staff from DHM on monitoring GLOFs, operating and maintaining existing risk databases and disseminating tailored, user-friendly climate risk information to major productive sectors in Nepal, including the hydropower and tourism sectors. The combined impact of these interventions will create a foundation for ongoing, sustainable glacial monitoring in Nepal, enabling adaptive management of GLOF risk reduction measures — not only at the target lakes, but across all PDGLs in the country. These systems will not only assess the condition of the lakes themselves, but will include broader consideration of glacial health and future risk; enabling preventative measures to be adopted as potential risks are identified.

48. The project activities that will be implemented under Output 1 are described below, with further details on these activities (including on the associated sub-activities and deliverables) presented in Section E.6 of this Funding

Proposal. DHM will support the implementation of this Output through the DHM Field Office, which will assist in the implementation of project activities (Sub-activities 1.1.1, 1.1.2 and 1.2.2).

49. The budget for Output 1 is USD 4,323,878, including a combination of USD 3,206,993 GCF finance and USD 1,116,885 co-finance from DHM and UNDP. GCF finance will be used to cover the additional costs of strengthening DHM's capacity for hazard mapping and prioritizing/designing GLOF risk reduction strategies. This funding will complement DHM's in-kind co-finance, which will cover the equipment and staff costs, ensuring that project interventions are mainstreamed into the day-to-day processes of DHM. Moreover, GCF funds will be used to engage the private sector and foster public-private partnerships (PPPs) with DHM that will catalyze sustainable finance for the maintenance of GLOF and flood risk information services.

Activity 1.1. Strengthen the knowledge base and technical capacities for improved climate research and risk reduction strategies.

50. There is an urgent need within DHM for the development of an in-house monitoring database for glaciers and glacial lakes. While DHM has the hardware and software capabilities, formal Standard Operating Procedures (SOPs) and training are required to catalyse the development and management of this database. To address this need, Activity 1.1 will strengthen DHM's institutional and technical capacity for implementing sustainable GLOF risk reduction strategies in Nepal. This capacity development will enable DHM to regularly monitor and update risk status for each glacier beyond the project period.

51. First, methods and SOPs for the inventory and development of a spatial digital database (GIS) of glaciers and glacial lakes will be developed and institutionalised in DHM. The development of this GIS database is the first and most important step in the identification and quantification of risks through desk studies and remote sensing analysis. The SOPs for the GIS database should focus on:
    - data acquisition and frequency of data collection;
    - database management;
    - methodologies/standard procedures for analysis and quality control, incorporating hydrodynamic models that account for the cascading hazards (including no only climate hazards, but other natural hazards such as landslides and earthquakes) that impact GLOF risk;
    - reporting and publication formats; and
    - online geoportal management for the dissemination of reports.

52. The establishment of the GIS database will be supported by geophysical investigation, as well as topographic and bathymetric surveys. SOPs for the investigation and surveys should focus on:
    - pre-field planning of logistics, including equipment checks and survey layouts;
    - human resources management;
    - stepwise procedures for conducting field work;
    - Monitoring and Evaluation protocols; and
    - report generation and publication formats for bathymetric, DGPS, GPR, ERT and other surveys.

53. The risk status of the identified glaciers and glacial lakes using the GIS database, geophysical investigation and surveys will be updated by DHM every five years to account for changes in climate and geophysical conditions. The selection of this time period was informed by international best practice; in India, the usual practice is to update the status annually, while a recent study through ICIMOD reported that updating the status every five years is sufficient. Second, methods and tools will be introduced into DHM's operating procedures for GLOF hazard prioritisation and mapping other extreme events – particularly heavy rainfall and flooding. This hazard prioritisation will use the established GIS database, remote-sensing and satellite data, as well as ground-truthing and socio-economic vulnerability assessments. Methodologies and SOPs for implementing integrated GLOF risk reduction in vulnerable watersheds will be developed, informed by the GIS database and hazard mapping that will also be undertaken under this activity. Moreover, the methodologies and SOPs will include clear processes to integrating an investment strategy into the prioritisation process. This strategy will outline the steps needed to replicate risk reduction activities in priority lakes, including the sequencing, roles and responsibilities of lead agencies, resource requirements and finance strategy for prioritised lakes. The relevant staff[35] in DHM's Remote Sensing and GIS and Snow Survey and Glacier Lake Departments will be trained on regular/operational monitoring for risk prioritisation, as well as how to use the risk information generated to plan for and design GLOF risk reduction strategies in Nepal's high-risk areas. Established methods and tools will be robust and replicable on a national scale for operational monitoring and DHM is committed to continuing to provide training to its staff in the Remote Sensing and GIS and Snow Survey and

[35] 9 technical staff from DHM

Glacier Lake Departments on the methods and tools established under this project activity beyond the project lifetime, as well as include training as priority work in its annual programme. Overall, this project activity will contribute to DHM's efficient and effective implementation of Nepal's Disaster Risk Reduction National Strategic Plan of Action 2018–2030[36], and the Disaster Risk Reduction and Management Act, 2074 and Disaster Risk Reduction and Management Rules, 2076 (2019)[37]. These are the main guiding policy documents for disaster response in the country.

Sub-activities:

1.1.1. Develop methods and SOPs for inventory and development of spatial digital database (GIS) of glaciers and glacial lakes (including geophysical investigation, as well as topographic and bathymetric surveys).

1.1.2. Introduce methods and tools for ongoing GLOF hazard prioritization within DHM, and mapping other extreme flood, landslide, mudflow and soil erosion hazards and risks, using a combination of remote-sensing and satellite data, as well as ground-truthing and socio-economic vulnerability assessments.

1.1.3. Introduce methodology and standard operating procedures (SOPs) for integrated GLOF risk reduction implementation planning in vulnerable watersheds.

1.1.4. Train technical staff in DHM's Remote Sensing and GIS and Snow Survey and Glacier Lake Departments on regular/operational monitoring for risk prioritisation, as well as how to use the risk information generated.

Activity 1.2. Develop public-private partnerships for sustainable investment in GLOF and flood risk information services.

54. This project activity will contribute to improving GLOF and flood risk reduction in Nepal by: i) improving DHM's capacity to develop and disseminate climate risk information to major economic sectors, such as tourism and hydropower; and ii) enhancing public-private sector partnerships to encourage future investment into GLOF risk reduction strategies in Nepal. At present, weather- and climate change-related risk information is accessible by the public through the DHM website, phone messaging, radio, television and tailored bulletins. Such platforms are also viable means to disseminate sector-specific information. However, this tailored information is currently limited to specific focus areas and disseminated only when a potential extreme climate event has been identified. While DHM produces sector-specific, user-friendly climate risk information to the aviation, agriculture and tourism sectors, there is a need to expand the provision of tailored climate risk information to the hydropower and tourism sectors which will be done under Activity 1.2. The process of tailoring this information will be supported by training DHM staff on the generation, recording, and maintenance of hydrometeorological databases to disseminate the most updated climate hazard exposure and vulnerability information to key economic sectors, including agriculture, hydropower and tourism which are particularly vulnerable to GLOFs. The use of this information by the targeted sectors will be recorded by registering user statistics on DHM's website and evaluating mobile applications and online databases. Other opportunities to ensure use of the information have been identified, including sharing sector-specific data to appropriate responsible agencies[38] and developing customised telephone applications.

55. The sustainability of GLOF risk reduction strategies in Nepal will be supported by the establishment of public-private sector partnerships (PPPs) to formalize and institutionalise long-term agreements focused on the sustainable uptake of GLOF risk reduction strategies, particularly with regard to the scaling and maintenance of down-stream EcoDRR measures, as well as the maintenance of EWS systems. Private sector actors in the hydropower, tourism and insurance sectors recognize the potential impact of climate-related hazard on their industries and indicated during consultations their commitment as partners, including Independent Power Producers' Association, Nepal (IPPAN), Trekking Agencies' Association of Nepal (TAAN) and other tourism-sector entities — confirmed by co-finance contributions outlined in Section C. The initial co-finance investments from IPPAN and NTB will include the provision of land for hydrometeorological stations, as well as the provision of security services and training support on EWS and climate hazard safety events for trekkers, travel agencies, porters, hoteliers and local businesses. Ongoing engagements with private sector partners have also indicated that the reduced risk resulting from project interventions — including the physical lake lowering and Eco-DRR measures, as well as the improved climate information services — will further incentivize continued private investment in the target landscapes. This will likely include direct investment in EcoDRR measures upstream of hydropower dams, which serve to not only reduce flood risk, but also provide co-benefits in terms of regulating hydrological flow, creating a win-win situation when the more severe risk from an catastrophic GLOF is reduced through lake lowering.

[36] GoN. 2018. Disaster Risk Reduction Strategic Plan of Action. Available at: https://app.adpc.net/sites/default/files/public/publications/attachments/DRR%20National%20Plan%20of%20Action%20%28Nepal%29.pdf.
[37] GoN. 2019. Disaster Risk Reduction and Management Act, 2074 and Disaster Risk Reduction and Management Rules, 2076. Available at: https://bipad.gov.np/uploads/publication_pdf/DRRM_Act_and_Regulation_english.pdf.
38 NDRRMA and NEOC at the centre and at province level, Provincial EOCs and at local level, LDMCs have been established in the municipality level — chaired by the mayor/chairperson

56. The development of PPPs during the project's implementation will build on these initial engagements in a longer, broader process to establish long-lasting agreements, including, *inter alia*, annual engagement workshops for the review and expansion of PPPs. This engagement during implementation will be used to identify entry-points for long-term PPPs, which will then be followed by direct engagements to agree on appropriate partnerships. In addition to supporting the uptake of GLOF risk reduction interventions, the project will identify opportunities for PPPs to leverage future investment into similar impactful lake-lowering and downstream interventions. This process will include sensitising private partners to the financial and economic benefits of GLOF risk reduction, as well as linking in engagements with various regional entities working in the GLOF risk reduction space to manage potential geopolitical risks linked to private investment. It is anticipated that these partnerships will have the potential catalyse significant additional investments in DRR strategies downstream of the project, particularly as the understanding of the risks faced and the benefits of adaptation interventions are demonstrated (see Output 3). Through the proposed engagement process, the proposed project will identify suitable modalities for engaging in PPPs for similar risk reduction projects in the future. It should be noted that no land acquisition or displacement of local communities will be considered in the establishment of PPPs and their associated interventions under this activity.

57. The production of customized and targeted risk information for pre-project adaptation planning and early warnings will identify potential risks and provide strong incentives for private sector investment in future disaster risk reduction initiatives where necessary, with the PPPs mobilising resources[39] to address climate change threats, including heavy rainfall and flood risks, as well as GLOF risk. Risk analysis and requirements relating to climate change — as stipulated in national policies and plans — will be integrated into the established PPPs. In particular, arrangements for cost recovery from the private sector through fee-based climate risk information services tailored for the hydropower sector will be made as part of PPP, as well as engaging the private sector in the operation and maintenance of the observational network for EWSs[40]. Several private and government agencies have been identified as potential target for these partnerships, including: i) the Ministry of Energy, Water, Resources and Irrigation: The Department of Electricity Development; ii) Nepal Electricity Authority; iii) the Department of Water Resources and Irrigation; and iv) Private Hydropower Developers. Under this project activity, policy provisions will be made and extensive stakeholder consultations will be held with representatives from the target sectors — in particular the independent power producers and tourism industries that are highly vulnerable to flooding impacts including GLOFS — to formalise and institutionalise long-term agreements to support the sustainable uptake of GLOF risk reduction in Nepal. Risk information for adaptation planning and early warnings is considered critical for investors in downstream areas. While this information is broadly accessible to the public, customised information targeted at investment partners could serve as an incentive for cost sharing on monitoring systems. Moreover, the use of data generated by the system to develop marketable, targeted information products could incentivise additional investment/contributions to the long-term operation and maintenance of the investments. Consultations during the establishment of PPPs will identify the specific information products required by different members of the private sector. For example, specific long-term forecasts that include avalanche, landslide and flood risks will be developed for members of the tourism and/or trekking industries. Other incentives include providing evacuation plans, adaptation planning and knowledge dissemination workshops for decision-makers.

Sub-activities:

1.2.1 Develop climate-induced hazard event recording and management database systems.

1.2.2 Develop climate risk information products and tailor them for use by productive sectors (tourism and hydropower).

1.2.3 Establish public-private sector partnerships to generate long-term buy-in and economic benefits for investment in GLOF risk reduction.

Output 2. Improved hazard monitoring and the generation of early warnings, including the dissemination of early warnings to local communities and important economic sectors leading to reduced economic loss and loss of human lives from GLOF events.

58. Project interventions under Output 2 strengthen Nepal's GLOF early warning system (EWS) as well as the capacity of Nepal's Department of Hydrology and Meteorology (DHM) to facilitate rapid information sharing and early action preceding a GLOF. At present, DHM has limited technical and institutional capacity to detect, monitor and respond to GLOFs and other extreme climate events. Current EWS coverage in the Gandaki Basin, and Dudhkoshi and Arun Sub-basins does not extend far enough to reach all downstream communities that will be affected should the Thulagi, Lower Barun, Lumding Tsho and Hongu 2 Lakes breach. This places these — mostly Indigenous —

[39] Economic analyses have demonstrated the cost-effectiveness of EcoDRR measures in relation to the potential losses resulting from the risk, indicating a strong financial case for such investment.

[40] Co-finance investments from IPPAN and NTB demonstrate the buy-in from private sector to this concept.

communities at increased risk of being impacted by a GLOF and the residual flooding. To address these constraints, a study was recently commissioned by UNDP for the *"Identification of required optimum number of Hydrological and Meteorological Stations for the proposed GCF-funded project"*. This study identified gaps in the existing EWS network — in terms of number of stations required — to detect and monitor hydrological and meteorological changes that contribute to GLOFs. In addition, the study identified limitations in the generation and dissemination of early warnings to downstream communities to enable them to respond timeously to impending GLOFs.

59. Output 2 of the project will fill these gaps in two ways. First, hydrological and meteorological stations will be installed across the prioritised GLOF watersheds to improve monitoring capacity and coverage in higher altitude areas. This will be complemented by training workshops targeting DHM staff to strengthen their capacity to: i) collect, process and manage climate data from the new and existing stations; and ii) use the generated data to develop early warning information products, including easily interpretable infographics for local communities. This will enable DHM to reliably and timeously forecast GLOFs and other extreme climate events using data from the country's new and existing hydrological and meteorological stations. The data from these stations will be housed on DHM's existing servers. Second, the adaptive capacity and response among vulnerable communities in the target districts of Manang, Sankhuwasabha and Solukhumbu to GLOFs will be enhanced through a combination of capacity-building and awareness-raising interventions. Specific details on the project activities that will be implemented under Output 2 are presented below. Further details on these activities, including the associated sub-activities and deliverables, are presented in Section E.6 of this Funding Proposal. The sustainability of interventions under Output 1 will be ensured through their alignment with key government priorities laid out in the GoN's 'Fifteenth Plan' (2019/2020 – 2023/24)[41], which includes specific focus on improved hydrometeorological services.

60. Support for the implementation of this Output will be provided by: i) DHM, through the PIU and DHM Field Office, assisting in the implementation of the project activities (Sub-activity 2.1.1) and supporting Operation and Maintenance (O&M); ii) IPPAN by providing land for the installation of weather stations (Sub-activity 2.2.1); iii) UNDP through the provision of communication, data processing and EWS software to strengthen the technical capacity of early warning systems (Sub-activity 2.2.1); iv) Nepal Tourism Board (NTB) by assisting capacity development (Sub-activity 2.2.1); and v) NDRRMA by assisting with disaster preparedness and response training (Sub-activity 2.24) and supporting O&M.

61. The budget for Output 2 is USD 10,386,991 including a combination of USD 8,532,609 GCF finance and USD 1,854,382 co-finance from NDRRMA, DHM, NTB, IPPAN and UNDP. GCF finance will be used to cover the additional costs of extending the hydro-met observation network to increase the reliability of early warnings, and to strengthen the technical capacity of DHM staff to produce and disseminate early warnings, as well as institutionalizing GLOF EWS into local DRR processes, including through the development of local response plans. DHM co-finance will cover staff costs and provide the necessary processing equipment for the EWS. The NDRRMA will provide logistical support for disaster preparedness and response as well as staff costs for processing household data for effective disaster preparedness. Finally, private sector co-finance from IPPAN and NTB will cover the cost of land as well as O&M for hydro-met equipment, with further O&M support from NDRRMA.

<u>Activity 2.1. Improve observation network density in GLOF watersheds to strengthen the technical capacity of DHM for the monitoring of climate hazard and risk.</u>

62. Under this activity, hydrological and meteorological stations will be installed across high-risk GLOF watersheds to fill gaps in the current observational network. These gaps include inoperative monitoring stations, poor coverage in higher altitude areas and low-resolution temporal and spatial coverage. In response to the existing gaps in Nepal's observational network, the following interventions will be implemented under Activity 2.1[42]:

- 6 base stations at Pangboche, Jayaram Ghat – Middle Hill, Tumlingtar (Turkighat), Chatara, Dharapani and Muglin (2 in the Marsyangdi Basin, 2 in the Dudhkoshi Sub-basin and 2 in the Arun Sub-basin) to perform intensive monitoring that will produce high quality hydrology, sediment and water quality data.
- 24 automatic weather stations (AWS) at key locations in GLOF watersheds (7 AWS in the Marsyangdi Basin, 5 in the Dudhkoshi Sub-basin and 12 in the Arun Sub-basin) to collect temperature, atmospheric pressure, humidity, horizontal wind and snow depth data.

[41] https://npc.gov.np/images/category/15th_plan_English_Version.pdf
[42] Proposed locations for each of the types of monitoring stations in the following list can be accessed here: https://www.google.com/maps/d/viewer?mid=1O9atidsKvf5EqmaMJ05pidNW8Q2Arth3&ll=27.765268424180118%2C84.81280566406248&z=7

- 9 precipitation gauges (PCP) at key locations in GLOF watersheds (2 in the Marsyangdi Basin and 7 in the Dudhkoshi Sub-basin) to measure precipitation in the form of snow and rain.
- 27 radar-based water level sensors (RLS) at key locations in GLOF watersheds (11 in the Marsyangdi Basin, 8 in the Dudhkoshi Sub-basin and 8 in the Arun Sub-basin).

63. The real-time data acquired from this critical infrastructure will be used by DHM to: i) observe and monitor GLOF risk; ii) support EWS; and iii) assist with glacier modelling. Additionally, the real-time data acquisition system will integrate data from new and existing hydrology stations. Increasing the density of the observation network is critical to enable effective EWS in the target areas under increasing GLOF threat because of climate change driven accelerated warming and glacier retreat. EWS coverage, and the dissemination of warnings, will be expanded throughout Nepal to support real-time contact with communities vulnerable to GLOFs, through the use of mobile phones, as well as to supplement insufficient coverage of vulnerable communities (although coverage will be nationwide, warmings will only be distributed to targeted groups who are located in likely affected areas).. To achieve this, all new meteorological and hydrological equipment installed under the project will be integrated into the existing EWS network and will use GPRS/GSM technologies provided by service providers under Nepal Telecom Authority[43]. Furthermore, the observation of basic meteorological variables by the AWS will enable these stations to be included in the Global Basic Observing Network (GBON). The EWS system will be made more robust with the installation of a central low-cost tower using a 'free to air' satellite mode system, accompanied by the installation of 9 siren towers across the target GLOF watersheds (4 towers in the Marsyangdi Basin, 2 in the Dudhkoshi Sub-basin and 3 in the Arun Sub-basin). The cost, operation and maintenance of the EWS equipment will be the responsibility of DHM as part of their co-finance contribution to ensuring the sustainability of the system (see Annex 21 for further details). This Activity contributes to Strategy 2 (to transform the hydrological and meteorological stations into modern automated stations with the latest technology and expand them as needed) of the Hydrology and Meteorology Sectoral priorities of the Fifteenth Plan. The technical design and location of the hydrometeorological monitoring equipment under this project will consider the work done under the 'Developing Climate Resilient Livelihoods in the Vulnerable Watershed in Nepal' GEF project, ensuring that there is no overlap and that stations are optimally positioned to maximise coverage over the target areas.

Sub-activities:

2.1.1. Install 6 Base Stations at Pangboche, Jayaram Ghat – Middle Hill, Tumlingtar (Turkighat), Chatara, Dharapani and Muglin (2 in the Marsyangdi Basin, 2 in the Dudhkoshi Sub-basin and 2 in the Arun Sub-basin).
2.1.2. Install 24 automatic weather stations (AWS) at key locations in GLOF watersheds (7 AWS in the Marsyangdi Basin, 5 in the Dudhkoshi Sub-basin and 12 in the Arun Sub-basin).
2.1.3. Install 9 Precipitation gauges (PCP) at key locations in GLOF watersheds (2 in the Marsyangdi Basin and 7 in the Dudhkoshi Sub-basin).
2.1.4. Integrate new and existing hydrology stations into a real-time data acquisition system.
2.1.5. Install 27 radar-based water level sensors (RLS) at key locations in GLOF watersheds (11 in the Marsyangdi Basin, 8 in the Dudhkoshi Sub-basin and 8 in the Arun Sub-basin).
2.1.6. Install a low-cost tower with a free air satellite mode system and 9 accompanying siren towers at Rabuwa, Jayaram and other locations in GLOF watersheds to be determined through site validations (4 towers in the Marsyangdi Basin, 2 in the Dudhkoshi Sub-basin and 3 in the Arun Sub-basin).

Activity 2.2. Develop and implement early warning systems planning to strengthen adaptive capacity and response to GLOFs and other climate hazards in vulnerable sectors and communities.

64. Activity 2.2 will improve Nepal's EWS to strengthen adaptive capacity and response among vulnerable communities in the target districts of Manang, Sankhuwasabha and Solukhumbu to GLOFs, rain-induced floods and other climate hazards. First, the technical and institutional capacity of DHM will be strengthened to enhance the rapid dissemination of early warnings to: i) critical national and local entities involved in disaster response (including the National Emergency Operation Centre (NEOC), District Emergency Operation Centre (DEOC), Municipal Emergency Operation Centre (MEOC), national stakeholders, district and local stakeholders, Local Emergency Operation Centre (LEOC), Community Disaster Management Committee (CDMC)/Task Force, and local communities); ii) key actors in productive sector networks; and iii) vulnerable communities in the target districts and throughout Nepal. This will be achieved by training relevant technical staff at DHM in efficient and effective ways to generate and disseminate early warnings to improve community response to GLOFs. To ensure that the observation network remains operational, training will also be provided to the relevant staff on operating and maintaining the existing and newly installed hydrological and meteorological stations in the target basins. In so doing, DHM will have the required capacity to generate and disseminate accurate forecasts and early warnings of impending GLOFs.

[43] A list of appropriate service providers that use GCM technologies is available at: https://www.nta.gov.np/en/.

65. To ensure sufficient understanding among target communities of how to access and respond to early warnings, community-based disaster response plans will be developed for selected municipalities of 11 districts in the target watersheds, namely Bhojpur, Dhankuta, Khotang, Okhaldhunga, Sankhuwasabha, Manang, Lamjung, Sindhuli, Solukhumbu, Sunsari and Udayapur. These plans will be developed in a participatory way with communities and ward leaders[44] in the target districts and provide step-by-step guidance on how to access early warning and what actions to take once an early warning is received, in line with CDMC protocols. The co-development of these plans will be conducted in a gender responsive manner, in line with actions identified in the Gender Action Plan (Annex 8b). Training will then be delivered by representatives from NEOC, LEOC and CDMC on how to implement the actions contained in the response plans and response drills will be organised by these entities to practice what actions to take in the event of a GLOF, flood or another climate hazard. NDRRMA will support the delivery of the training under this activity, assist with logistics arrangements and the mobilisation of youth networks and volunteer corps, and ensuring that the capacity building interventions reach Indigenous Peoples groups and are gender responsive.

66. GLOF EWS will be fully institutionalised by developing multi-hazard-based risk assessments — which integrate community knowledge and science-based assessments — and holding annual training workshop for communities on disaster risk management (DRM), first aid and search and rescue. This process will start with a comprehensive stocktaking exercise to include existing methods and tools for understanding climate risks and prepare corresponding specific measures at the local level. NDRRMA will lead this institutionalisation process, supported by local government actors. Engagement workshops with *inter alia* the mayor, chairperson, technical officers on GLOF EWS, updates to the observational network, safety, operation and maintenance will also be conducted to ensure the establishment and uptake of knowledge and early warning processes at the national, local and community levels.

67. Effective collaboration between Local Emergency Operation Centres and DHM will be ensured through engagement workshops and meetings that will strengthen vertical and horizontal linkages between these entities, strengthening existing ICT systems to facilitate effective sharing and dissemination of information. This collaboration will facilitate integration of DHM's dissemination mechanism into the LEOC, with specialist(s) contracted to import household data to the BIPAD Portal for the application of DSS and CAP — cleaning; processing; importing; and verifying. This will also allow for localising and rolling out of the digital DIMS/BIPAD Portal, supported by awareness raising that targets local government and communities, for effective disaster preparedness.

68. To ensure that target districts are able to access and respond to early warnings effectively, knowledge and awareness will be improved with training workshops and materials for vulnerable communities in the four target glacial basins. This process will be supported by the establishment and mobilising of youth groups as well as volunteer's corps, increasing community involvement in the early warning processes — including through the capture, validation and application of traditional knowledge in local monitoring and response plans.

69. Climate-responsive Municipal Disaster Preparedness and Response Plans will be developed with effective collaboration at the municipal level through engagement workshops for the preparation and completion of these plans. Local-level Climate-resilient Action Plans will also be developed through this method, with validation workshops held and action plans developed for the implementation of these plans, ensuring local-level stakeholder participation, as well as ownership and uptake by the target communities and local government. The proposed project will establish the appropriate structures to ensure the Plans are implemented and followed beyond project completion by acknowledging linkages between Local Emergency Operation Centres and DHM, developing these Plans in close collaboration with local municipalities and raising awareness on early warning response and access.

Sub-activities:

2.2.1. Strengthen the technical and institutional capacity of DHM to produce early warnings and disseminate them to government agencies and productive sectors.
2.2.2. Co-develop community-based response plans for 10 districts, namely Bhojpur, Dhankuta, Khotang, Okhaldhunga, Sankhuwasabha, Saptari, Sindhuli, Solukhumbu, Sunsari and Udayapur.
2.2.3. Institutionalise GLOF EWS by developing multi-hazard-based risk assessments (integrating community knowledge and science-based assessments), and train communities on disaster risk management, first aid and search and rescue.

[44] A ward is the smallest unit of local government in Nepal.

2.2.4. Strengthen vertical and horizontal linkages between Local Emergency Operation Centres and DHM to integrate DHM's dissemination mechanism, import household data[45] to the BIPAD Portal for the application of DSS and CAP (cleaning; processing; import; verification), and localise and roll out the DIMS/BIPAD Portal for effective disaster preparedness.
2.2.5. Improve the knowledge and awareness of target districts of how to access and respond to early warnings, including by establishing and mobilising youth groups and volunteer's corps.
2.2.6. Develop climate-responsive Municipal Disaster Preparedness and Response Plans, as well as Local-level Climate-resilient Action Plans.

Output 3. Reduced probability of GLOF events and flash floods, through disaster risk reduction measures implemented in priority glacial lake watersheds.

70. Output 3 will reduce the risk of GLOFs in the Gandaki Basin, and Dudhkoshi and Arun Sub-basins. A joint assessment was undertaken by UNDP and ICIMOD in 2020[46] of the glacial lakes in the Himalayas to identify Potentially Dangerous Glacial Lakes (PDGLs)[47]. From this, the glacial lakes were ranked based on their respective hazard levels, determined by the characteristics of the lakes and their dams, the activity of the source glacier and morphology of the surroundings. The critical lakes were classed under Rank 1, and these warrant the immediate implementation of potential measures for GLOF mitigation. Lakes classed under Ranks 2 and 3 require regular monitoring. Several Rank 1 glacial lakes were identified within Nepal, and while all pose a serious risk, 4 of the lakes at the highest risk of breaching have been selected for interventions under the proposed project to reduce the risk they pose to the population of Nepal. These are the Thulagi, Lower Barun, Lumding Tsho and Hongu 2 Lakes (Figure 8). Further details on the selection of these lakes for urgent intervention are provided in Section 4 of Annex 2: Feasibility Study.

[45] Data on demography – family details – age group, whether need special support with their contact numbers for quick rescue and relief- and will be linked with https://bipadportal.gov.np/
[46] Bajracharya, SR., Maharjan, SB., Shrestha, F., Sherpa, TC., Wagle, N. and Shrestha, AB. 2020. *International Centre for Integrated Mountain Development (ICIMOD); United Nations Development Programme (UNDP).* Available at: https://lib.icimod.org/record/34905.
[47] ICIMOD. 2020. Research Report. Available at: Available at: https://www.np.undp.org/content/nepal/en/home/library/crisis_prevention_and_recovery/glacial_lake_inventory_2020.html

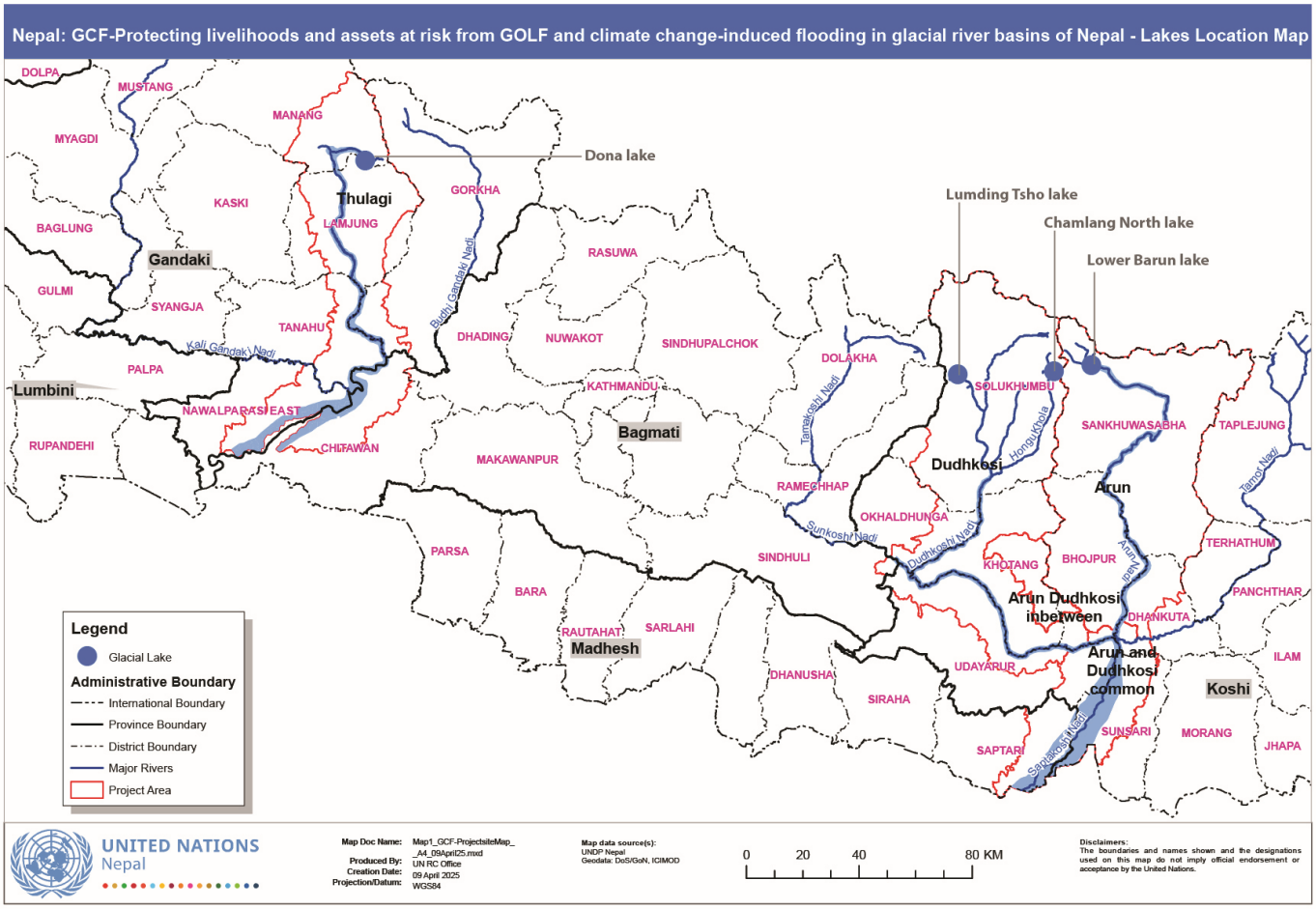


Figure 5. Locations of each of the target glacial lakes, relative to one another and their respective districts.

71. Following the selection of the target lakes, an options analysis based on primary modelling, as well as international literature and proven successful lake lowering interventions (as described in Section B.1), was undertaken to determine the specific interventions required to sufficiently reduce the risk of GLOFs impacting nearby vulnerable communities. As a result of this analysis, an approach combining physical lake lowering and downstream adaptation interventions was selected for the proposed project. To reduce the primary risk of a GLOF, the water levels will be lowered at the four priority lakes (Thulagi, Lower Barun, Lumding Tsho and Hongu 2). Lowering the water level of the lakes will reduce the potential of triggering a GLOF, as well as reducing the magnitude of a GLOF when one is triggered. In so doing, lake lowering will avoid US$67.4–109.2 million in potential damages and losses to vulnerable communities that are located within the potential flood-affected area. Furthermore, Eco-Disaster Risk Reduction (Eco-DRR) measures that adopt a hybrid approach of nature-based and grey infrastructure will be implemented downstream of the lakes to reduce the residual impacts of a GLOF after lake lowering. These downstream interventions will include a combination of conservation ponds and flood walls to divert GLOF and flash flood flow and nature-based eco-engineering solutions for riverbank stabilization and flood mitigation. Implementing these downstream interventions will reduce the damages to agricultural land and other infrastructure, which was shown by the UNDP commissioned Residual Risk and Vulnerability assessment (Annex 23), which included modelling for four different scenarios of GLOF impacts at the Lower Barun, Hongu 2 and Lumding Tsho Glacial Lakes. The models accounted for the GLOF impacts on the entire river basin downstream of each Glacial Lake, with the Lower Barun Glacial Lake affecting the Arun River Sub-basin and impacts in the Dudhkoshi River Sub-basin being divided into subsets with the Hongu 2 Glacial Lake affecting the Hongu-Dudhkoshi River Basin subset and the Lumding Tsho Glacial Lake affecting the Lumding-Dudhkoshi subset. The four modelled scenarios were: i) Scenario 1 (S1) — GLOF at the Glacial Lake without any interventions with a complete breach; ii) Scenario 2 (S2) — GLOF at the Glacial Lake after lowering the recommended depth with complete breach of moraine dam; ii) Scenario 3 (S3) GLOF

at the Glacial Lake with a partial breach[48] after lowering by the prescribed amount of 3 m for Lower Barun and Lumding Tsho and by 1 m for Hongu 2; and iii) Scenario 4 (S4) — GLOF at the Glacial Lake with a partial breach[49] after lowering by the prescribed amount and with downstream adaptation interventions. The GLOF impacts on agricultural land and infrastructure were calculated for all four scenarios and are summarised in Table 5. While there is a reduction in impacts between S1 and S2 — which shows the effectiveness of lowering the Glacial Lakes by the prescribed amount to reduce damages and losses — it should be noted that the primary benefit of lake lowering is the reduced risk of a total breach, with partial breach becoming the more likely scenario after lake lowering. The benefit of this is demonstrated by the significant decrease observed for S3 and S4. Moreover, further reductions in the impacts are shown between S3 and S4 which indicates the importance of downstream adaptation measures to further offset the impacts of a partial GLOF at any of the three Glacial Lakes. These results show that Eco-DRR is the most effective solution with the greatest reduction of losses by supplementing lake lowering benefits with hybrid grey and green infrastructure interventions downstream. The project activities that will be implemented under Output 3 are described below, with further details on these activities (including on the associated sub-activities and deliverables) presented in Section E.6 of this Funding Proposal. Support for the implementation of this output will be provided by: DHM through the DHM PIU and Field Office, assisting in the implementation of project activities, the provision of programme M&E costs and the construction of access trails to project sites (Sub-activities 3.1.1 and 3.1.2); ii) DoFSC through the provision staff time, the use of machinery and the implementation of construction works — relating to the planting of trees (Sub-activity 3.3.1); and iii) DNPWC through the DNPWC PIU and Field Office to assist in the implementation of project activities (Sub-activity 3.3.10).

Table 2. Modelled impacts of GLOF events at the Hongu 2, Lower Barun and Lumding Tsho Glacial Lakes under different intervention scenarios.

River Basin	**Expected direct damage**											
	Agricultural land (ha)				Household (No.)				Road (km)			
	S1	S2	S3	S4	S1	S2	S3	S4	S1	S2	S3	S4
Arun	1, 271	674	236	20	272	267	173	10	7	7	7	1.9
Hongu-Dudhkoshi	256	256	115	5	124	123	83	4	6	6	6	1.6
Lumding-Dudhkoshi	104	104	71	7	99	97	65	2	6	6	6	1.6
River Basin	**Expected direct damage**											
	Trail bridge (No.)				Motorable bridge (No.)				Trail (km)			
	S1	S2	S3	S4	S1	S2	S3	S4	S1	S2	S3	S4
Arun	32	32	26	4	2	2	1	1	9	9	9	2.8
Hongu-Dudhkoshi	17	17	13	1	3	3	2	1	2	2	2	1.5
Lumding-Dudhkoshi	21	21	13	0	2	2	2	2	2	2	2	1.5

72. The budget for Output 3 is USD 31,736,872 including a combination of USD 22,697,118 GCF finance and USD 9,039,754 co-finance from DHM, DoFSC, DNPWC and UNDP. For lake lowering interventions, GCF finance will be used to cover the technical design and construction costs, while DHM will provide co-finance towards staff costs for lake lowering designs, as well as for the construction of an access trail to all project sites. For downstream interventions, GCF finance will be used to fund the construction of flood walls, revetments and conservation ponds, as well as the implementation of EcoDRR measures to reduce the potential impact of residual GLOF flood waters, with DoFSC providing co-finance for supporting equipment and staff costs. DNPWC will co-finance staff costs for the development and implementation of integrated, climate- and gender-responsive watershed and national park management plans. Finally, UNDP co-finance will be used to cover the costs of necessary support staff for the implementation of downstream measures, including technical advisors, as well as GESI, M&E and safeguards experts.

Activity 3.1. Lower the levels of four of the highest risk glacial lakes.

[48]Partial breach depth - 5 m for Hongu 2 and Lower Barun, and 3 m for Lumding Tsho.
Note: there is no valid research on the likely GL breaching depth, so local knowledge was considered. Local people reported that the most likely depth as they have noticed in the past.
[49]Partial breach depth - 5 m for Hongu 2 and Lower Barun, and 3 m for Lumding Tsho.

73. Under this activity, the levels of the four highest-priority lakes will be physically lowered to reduce the volume of the lakes. This will involve several steps. First, detailed site-specific engineering designs will be undertaken for the lowering of the Thulagi, Lower Barun, Lumding Tsho and Hongu 2 Lakes. These designs will be informed by several on-the-ground assessments and validated by engineers and the AE before construction starts. The required assessments include:
    - topographical surveys of the site and the moraine dam to inform detailed analysis and precise design;
    - a bathymetric investigation to determine the most recent lake volume, depth and topography, extension, and end moraines change;
    - hydrometeorology assessments to determine the current discharge of the glacier outlet; and
    - geophysical investigations using a GPR survey, and electric resistivity tomography assessments of the sites to determine the stability of the moraine dam and the intensity of the geophysical environment.

74. Once the designs have been validated, construction will commence in Year 2 of project implementation to lower the Thulagi, Lower Barun and Lumding Tsho by 3 m and the Hongu 2 Lake by 1 m. The optimal level of lake lowering for each site was determined during the initial lake assessments and options analysis, considering the physical aspects of the lakes and the cost-benefit ratio of the risk reduction potential (Annex 26: Technical Lake Lowering Design report). The conceptual design for lowering the water levels of the four target lakes are summarised below. Technical concept designs of the lake lowering interventions and further details on the engineering required to lower the four lakes are presented in Annex 26: Technical Lake Lowering Design report. DHM will be responsible for the implementation of this activity and will determine whether to mobilise its own expert resources or outsource consultancy services. This activity will support institutional capacity for systematic lake lowering in the future as it is embedded within and will develop the capacity of DHM. DHM will also address the ongoing, in-house Operation and Maintenance (O&M) of the structures built under this activity (detailed below). For further details regarding O&M, see Annex 21: Operations and Maintenence Manual.

75. The lowering of the Thulagi, Lumding Tsho, and Lower Barun Lakes will be undertaken through a 4-step process. First, the outlet channel will be blocked by a cofferdam. Second, a diversion channel will be constructed to divert flow while the construction for the permanent lake lowering is undertaken. The effluent from this diversion channel will be discharged at 165 m, 70 m, and 55 m for Thulagi, Lumding Tsho, and Lower Barun Lakes, respectively, downstream of the proposed structure. Third, once the flow is diverted, a sluice gate will be constructed at an optimal location to be determined based on the studies above, with a trapezoidal shaped channel downstream of the original outlet channel where the temporary cofferdam is in place. Fourth, once the channel and sluice gate are in place, the cofferdam will be removed and the discharge channel reopened, reinforced with boulder impact gabion walls to protect it against bank erosion when the water is released after removing the cofferdam. After the completion of the main channel, the cofferdam (which is blocking the flow of water to the main channel) will be removed. The diversion channel (which is at higher elevation from the main channel) will be left as it is and water will flow from the main channel. It will act as the alternative channel only at the time of high discharge maintaining the smooth flow in the main channel. An example of this process is presented below in the extracts of concept drawing for lowering the Thulagi Lake (Figure 9, Figure 10, Figure 11, and Figure 12). Full, detailed concept drawings for the lowering of all four lakes are presented in Section 12 of Annex 2: Feasibility Study and Annex 26: Technical Lake Lowering Design report.

76. For Hongu 2, only the main channel is proposed. Since there is no outlet discharge of the lake, the end moraine itself will act as a sluice gate and no diversion canals are required. Once the main channels are built, the end moraine will be excavated to lower the glacial lake.

77. Considering lessons learn from previous lake lowering exercises, all interventions targeting the the glacial lakes will take special consideration of cultural connections between local people and the lakes. This will include respecting local customs and worship practices, as well as organizing forgiveness worship with local groups prior to commencing structural work. All waste generated during the lake lowering activities will also be carried back to Kathmandu. In addition, considering remoteness of the locations and access restrictions, detail planning will be done on workers' health and safety. During implementation/construction phase, the project will follow strict OHS standards, including ensuring use of safety gears, provision for first aid facilities, emergency response protocols – including evacuation procedures in case of serious injury – and overnight stay facilities in temporary housing made on onsite for this purpose.

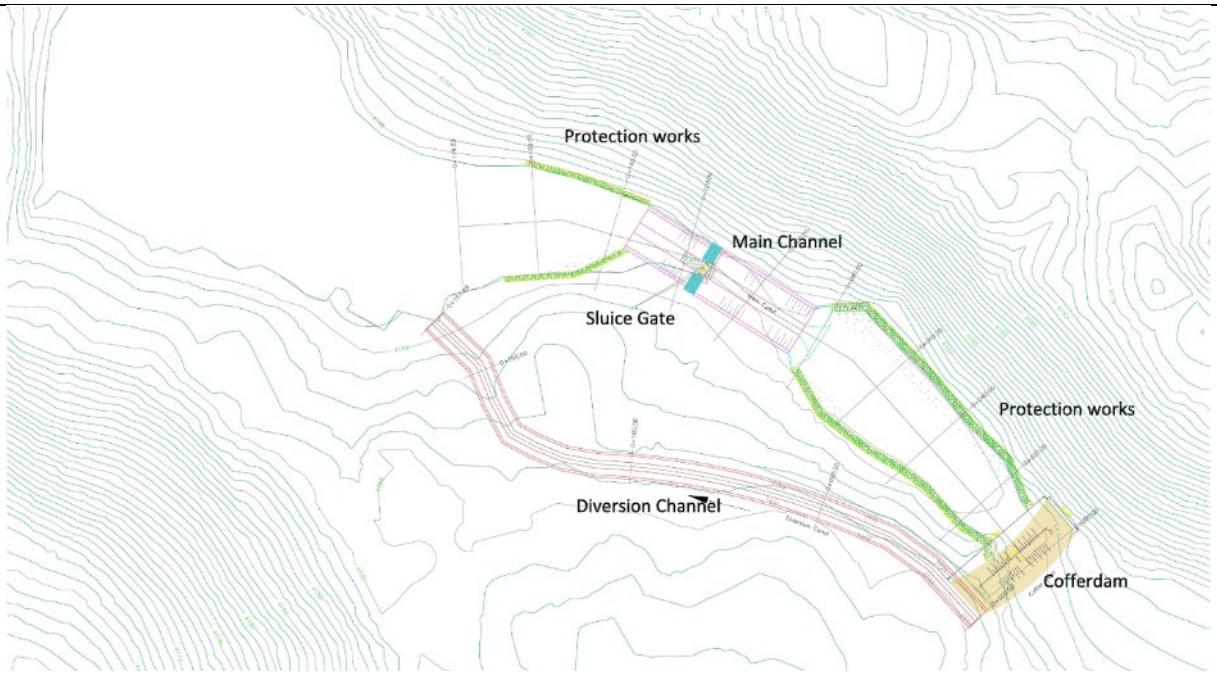


Figure 6. Schematic design of Thulagi Glacial Lake, adapted after full illustration in Annex 26: Technical Lake Lowering Design report.

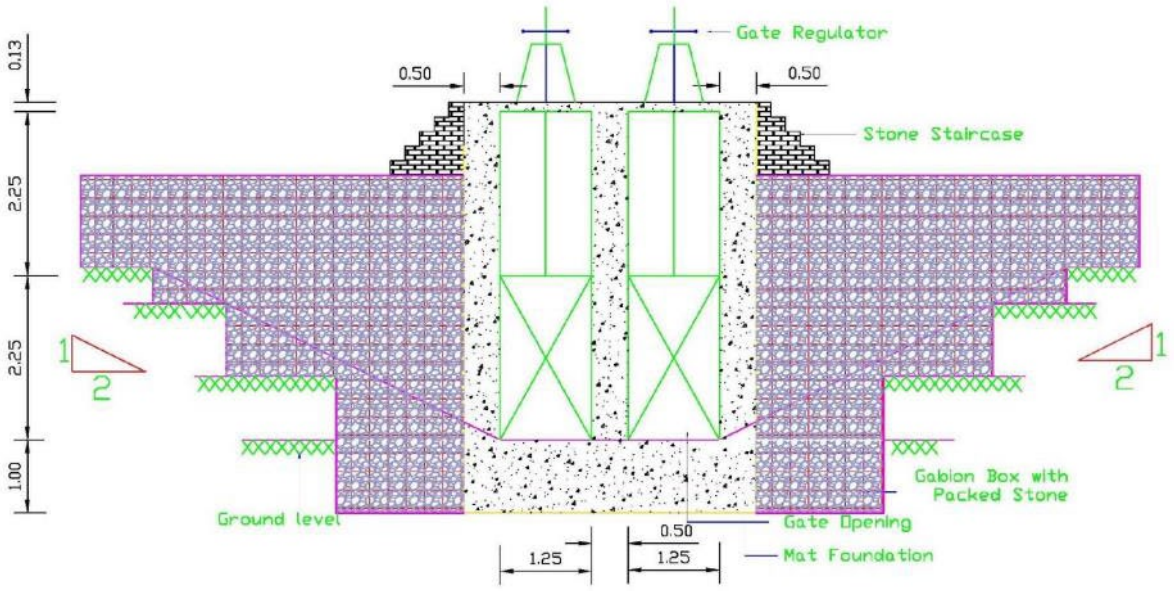


Figure 7. Schematic design of Thulagi vertical sluice gate, adapted after full illustration available in Annex 26: Technical Lake Lowering Design report. Measurements to scale have been provided in metres (m).

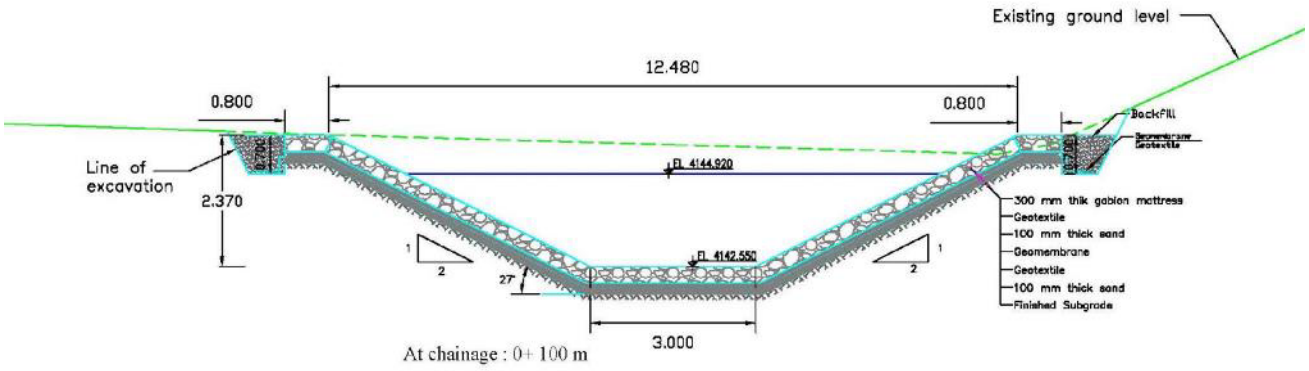


Figure 8. Schematic design of Thulagi main channel cross section, adapted after full illustration available in Annex 26: Technical Lake Lowering Design report. Measurements to scale have been provided in metres (m).

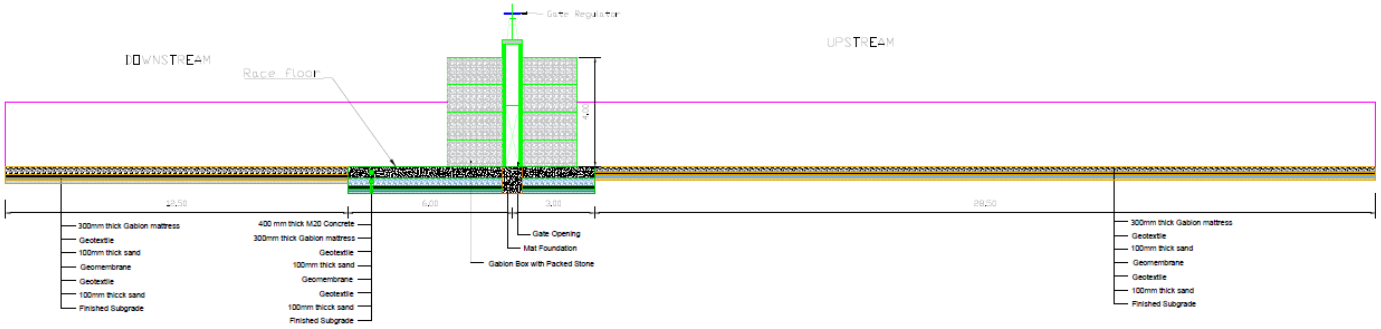


Figure 9. Schematic design of Thulagi main channel profile with gated structure, adapted after full illustration available in Annex 26: Technical Lake Lowering Design report.

Sub-activities:
3.1.1. Undertake detailed site-specific engineering designs for lake lowering.
3.1.2. Lower the levels of the four lakes (Thulagi, Lower Barun, Lumding Tsho and Hongu 2).

<u>Activity 3.2. Construction of structural and non-structural measures (Civil and NbS/ Bioengineering) for the risk reduction of GLOF and flash flood.</u>

78. After lake lowering, while the risk of GLOFs triggering will be significantly reduced, there will still be potential for GLOFs to occur, but with a lower magnitude. Under this activity, check dams and other protective infrastructure will be established at strategic locations in the Dudhkoshi and Arun Sub-basins to address the residual flood risk after lake lowering. The purpose of this infrastructure will be to attenuate and divert the intense flow of water caused by GLOFs and flash floods from the Lower Barun, Lumding Tsho and Hongu 2 glacial lakes[50]. The specific infrastructure that will be constructed under Activity 3.2 is described below. For each sub-activity, detailed site-specific engineering designs will be developed and validated prior to construction.

- 3,102 m^3 of flood walls and RCC revetments will be built along stretches of riverbank where a high possibility of bank undercutting and inundation was identified. Suitable locations were identified using flood models, accounting for the velocity of river flow along with the embankment material, topographical, morphological, and geological conditions of the riverbank and river flow direction. The height of revetments was set considering the 'Design Flood Level' (see Annex 23a for more detail on the site selection and design considerations).
- 67 conservation ponds will be established (38 in the Arun Sub-basin and 29 in the Dudhkoshi Sub-basin) to reduce concentrated surface flow following a GLOF or during a monsoon or other extreme rainfall event and consequently prevent the formation of gullies and the triggering of shallow landslides.

79. The infrastructure installed under this activity will provide immediate benefits to complement the long-term Eco-disaster Risk Reduction and nature-based solutions implemented under Activity 3.3. Initial concept drawings and

[50] Downstream interventions at Thulagi are being implemented under an IUCN project and are therefore not included in the design of this project.

costing information for the downstream interventions are presented in Annex 23b: Concept drawings and bill of quantities for downstream interventions.

80. Department of Forests and Soil Conservation (DoFSC) is responsible for the operation and maintenance of check dams and other infrastructure for the diversion of residual GLOF and flash floods. DoFSC will provide the required budget and human resources for the O&M and deploy the workforce as required. The institutional and financial sustainability of this and future investments will be ensured by embedding activities within the existing structure of DoFSC, For further details see Annex 21: Operations Manual.

Sub-activities:
3.2.1. Install 3,101.61 m3 of flood walls and RCC revetments.
3.2.2. Construct 67 conservation ponds (38 in the Arun Sub-basin and 29 in the Dudhkoshi Sub-basin).

Activity 3.3. Implement Eco-disaster Risk Reduction solutions to reduce the impact of GLOFs and flash floods.

81. Under Activity 3.3., Eco-disaster Risk Reduction (Eco-DRR) solutions will be implemented at strategic locations in the mountain ecosystems of Dudhkoshi and Arun Sub-basins to reduce the impacts of residual flooding from GLOFs on vulnerable communities in the basins, while simultaneously contributing to the restoration and rehabilitation of degraded ecosystems in floodplain areas. The interventions that will be implemented under this project activity were identified using a modelling approach that assessed residual flood risk after lake lowering (Annex 23a). Potential flood risk areas were identified over a stretch of 100 km along downstream of the target lakes in the target river basins to identify the most vulnerable locations. The flood model (depth and velocity) was overlaid with data on physical assets such as settlements, households, agricultural land, and transport infrastructure to assess potential impact and damages. A flood depth-damage model was then used to identify priority areas for intervention under various flood scenarios. These areas were given a priority ranking on a three-point scale, and interventions were considered for all Priority One (P1) areas. Interventions were considered along three categories, namely green, grey and hybrid solutions, and the potential benefits of each was considered. The results of the study showed that hybrid interventions that fit under the Eco-DRR umbrella would be most effective in reducing the impacts of residual flood. Specific interventions were then identified for each site (Arun River Basin: 108 sites; Dudhkois River Basin: 124 Sites; shown in detail in Annex 23b), which include: i) planting trees along 460 ha of vulnerable riverbanks[51], sub-watershed areas and floodplains of four river systems; ii) constructing 17,744 m^3 of vegetative gabion walls; iii) building 978,436 m of live check dams; iv) constructing 15,298.94 m^3 of vegetative gabion revetments; v) installing 7,246 m^3 of vegetative gabion spurs; vi) installing 29,685 m^3 of vegetative gabion check dams and 15,010 m^3 of vegetative dry stone check dams; vii) establishing 3,194 m^2 of vegetative stone rip-rap; viii) undertaking 45,188 m of brush layering; and ix) planting 29.8 ha of grass seedlings. This activity will be implemented by DoFSC which will also oversee the operations and maintenance and associated costs in partnership with local governments and community forest user groups (FUGs). To this end, the project will engage organisations such as the Federation of Community Forestry Users Nepal (FECOFUN)[52], which work with communities on natural resource management and use rights. This engagement will promote community ownership of ecological infrastructure and support the long-term sustainability of interventions. Such approaches where communities are adequately engaged and given control over the maintenance of natural resources that benefit them have yielded positive results in Nepal.

82. The specific species chosen for tree planting and vegetative hybrid infrastructure will follow local guidelines developed by Ministry of Forests and Environment, and will be conducted on government owned land. Such protocols are based on best practices through past projects and are currently being used on extensive government planting programmes across the country. The project will complement these initiatives, building on existing operational mechanisms under DoFSC while specifically targeting flood vulnerable areas. The lessons learned from the project, specifically around the theme of Eco-DRR, will be captured through the watershed management plans and the climate-resilient agricultural management and information system. The involvement of DoFSC in the implementation of the project will ensure that the capacity developed through this activity translate across the country to facilitate the scaling of Eco-DRR interventions. Design examples for these interventions are shown in Figure 13, Figure 14, Figure 15 and Figure 16 below. These Eco-DRR and nature-based solutions will reduce soil erosion and increase the infiltration capacity of the soil in floodplain areas. This, in turn, will decrease surface runoff and reduce the sedimentation of tributaries caused by flooding in the project areas. Concept drawings and cost information for the interventions proposed under this activity are presented in Annex 23b: Concept drawings and bill of quantities for downstream interventions.

[51] 1x1m planting density creating a green belt of 20m along the riverbank.
[52] FECOFUN represents 8.5 million forest users across Nepal

83. It is anticipated that the direct involvement of local governments will leverage additional investment in local adaptation measures downstream of the project, extending their contribution beyond the initial commitments made through co-finance to the proposed project. This potential to leverage additional finance, bolstered by the capacity development of local institutions, contributes to the upscaling potential and sustainability of project interventions. Furthermore, the engagement of key private stakeholders who stand to benefit from risk reduction measures, including the Nepal Tourism Board (NTB) and the Independent Power Producers' Association of Nepal (IPPAN), provides additional potential for leveraging finance for the scaling of interventions downstream of the project. Both organisations have already indicated their support for the project through co-finance commitments. While the values of these commitments are modest, they demonstrate the willingness of the organisations to engage in risk-reduction and a recognition of the potential value/benefits of the project. The potential for leveraging additional finance is particularly strong for IPPAN, which has recognised the important role of watershed management for sustainable power production and risk reduction – bolstered by the information services provided through Output 1.

84. Physical adaptation interventions under this activity will be supported by developing Integrated Watershed Management and National Park Management plans to create the regulatory framework for sustainable land management and climate change adaptation. Training and capacity building interventions targeting community members, community-based organisations (CBOs), non-governmental organisations (NGOs) and local government officials will ensure the effective implementation of these plans. The capacity development of these groups will be delivered under thematic training modules, including: i) capacity development of community members and local government on climate change induced hazards and disasters, and adaptation measures; ii) curriculum for climate change related education and trainings for secondary level school teachers and students; and iii) capacity development of trainings for CBOs, including mothers groups, women-lead cooperatives, Indigenous Peoples organisations and local eco- and youth-clubs. Training participants will be identified according to the Gender Equality and Social Inclusion (GESI) Action Plan (Annex 8), including Indigenous Peoples, Dalits, and women representatives.

85. The training modules will be designed to engage government officials in the implementation of Multi-Hazard Risk Reduction Measures (MHRRM). The training will enhance their capacity with tools and techniques used in the MHRA and implementation techniques in Climate Change Adaptation (CCA), Ecosystem-based Disaster Risks Reduction (Eco-DRR), and the use of Agriculture Management Information Systems (AMIS). Capacity development of the relevant stakeholders and local and regional levels will support the development of multi-hazard assessment, and integrated, climate- and gender-responsive watershed and national park management plans in the Arun and Dudhkoshi Sub-basins, as well as on the effective integration of these measures into federal and municipal level budgets.

Sub-activities:

3.3.1. Plant 153.3 ha of trees along vulnerable riverbanks, sub-watershed areas and flood plains of 4 river systems (81.6 ha in the Arun Sub-basin and 71.6 ha in the Dudhkoshi Sub-basin).
3.3.2. Establish 17,744 m3 of vegetative gabion walls (10,796 m3 in the Arun Sub-basin and 6,948 m3 in the Dudhkoshi Sub-basin).
3.3.3. Install 978,436 m of live check dams (955,396 m in the Arun Sub-basin and 23,040 m in the Dudhkoshi Sub-basin).
3.3.4. Install 15,298.94 m3 of vegetative gabion revetments (3,447.5 m3 in the Arun Sub-basin and 11,851.44 m3 in the Dudhkoshi Sub-basin).
3.3.5. Install 7,246 m3 of vegetative gabion spurs (4,608 m3 in the Arun Sub-basin and 2,638 m3 in the Dudhkoshi Sub-basin).
3.3.6. Install a total of 29,685 m3 of vegetative gabion check dams (21,960 m3 in the Arun Sub-basin and 7,725 m3 in the Dudhkoshi Sub-basin) and a total of 15,009.8 m3 of vegetative dry stone check dams (9,371.25 m3 in the Arun Sub-basin and 5,638.5 m3 in the Dudhkoshi Sub-basin).
3.3.7. Install a total of 3,194 m2 of vegetative stone rip-rap (1,582.5 m2 in the Arun Sub-basin and 1,611.5 m2 in the Dudhkoshi Sub-basin).
3.3.8. Implement a total of 45,188 m of brush layering (36,750 m in the Arun Sub-basin and 8,438 m in the Dudhkoshi Sub-basin).
3.3.9. Plant a total of 298,162 m2 of grass seedlings (155,419 m2 in the Arun Sub-basin and 142,743 m2 in the Dudhkoshi Sub-basin).
3.3.10. Develop and implement integrated, climate- and gender-responsive watershed and national park management plans, including the integration of these plans into local and national level budgets.
3.3.11. Develop and implement a climate-resilient agricultural management and information system.

3.3.12. Strengthen the technical and institutional capacity of community members, government officials and CBOs to understand and implement multi-hazard risk assessments, use climate-resilient agricultural management and information system, implement climate-resilient GLOF and flood risk reduction strategies, and integrate Eco-DRR into government budgets.

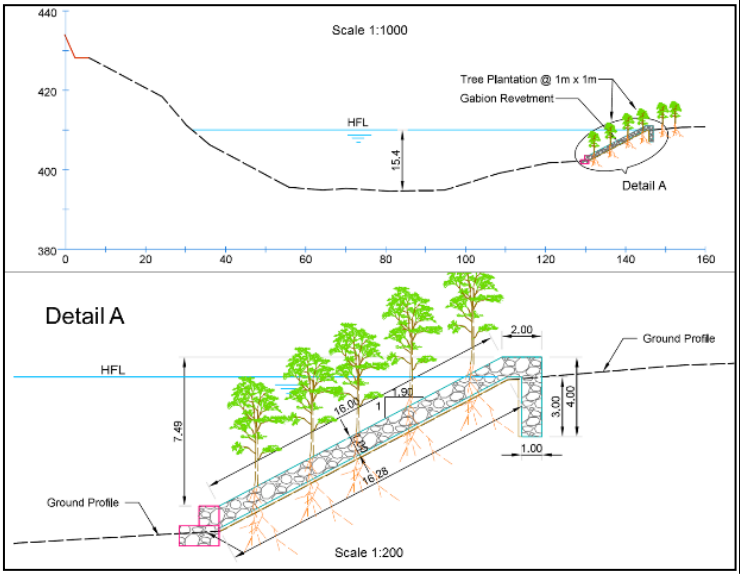


Figure 10. Design example for the vegetative gabions that will be constructed.

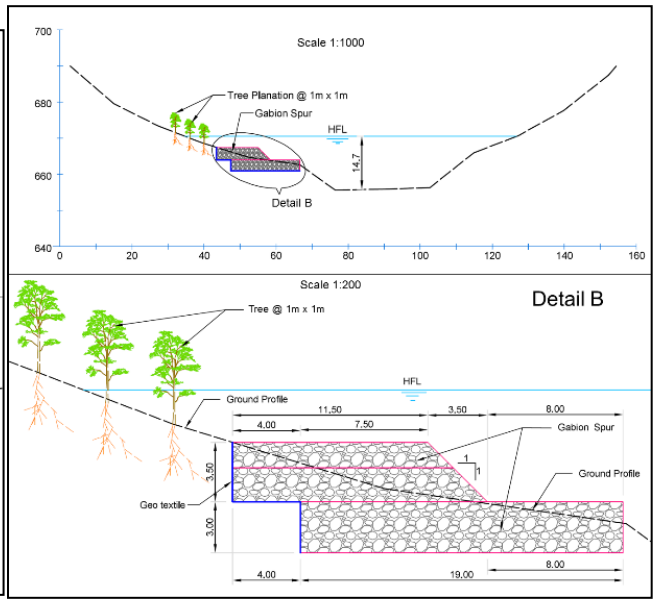


Figure 11. Design example for the gabion spurs that will be constructed.

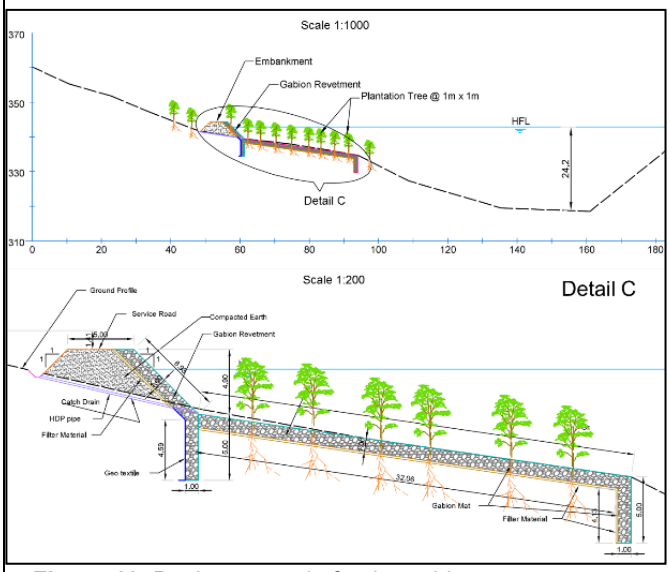


Figure 12. Design example for the gabion revetments that will be constructed.

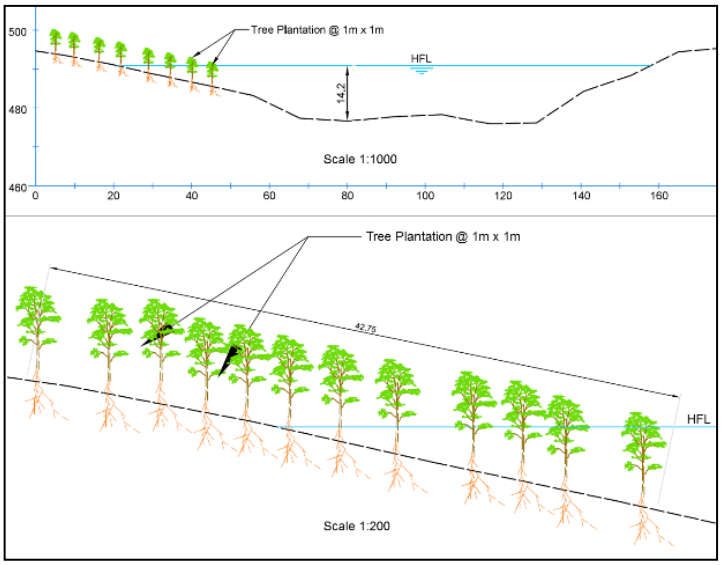


Figure 13. Design example for the tree plantations along the riverbanks

B.4. Implementation arrangements (max. 1500 words, approximately 3 pages plus diagrams)

86. The project will be implemented following UNDP's support to National Implementation Modality (NIM), according to the Standard Basic Framework Agreement (SBFA) between UNDP and the Government of Nepal (GoN) signed on 23 Feb 1984, the Country Programme Document 2023-2027 (CPD), and as per policies and procedures outlined in the UNDP - POPP - Chapter.

87. The national executing entity - also referred to as the national 'Implementing Partner' in UNDP terminology is required to implement the project in compliance with UNDP rules and regulations, policies, and procedures (POPP), including the NIM Guidelines (POPP NIM). These include relevant requirements on fiduciary, procurement, environmental and social safeguards, and other performance standards. The (national) Implementing Partner for

this project is the Department of Hydrology and Meteorology (DHM) under Ministry of Energy, Water Resources and Irrigation (MoEWRI) of Nepal.

88. Executing entity (Implementing partner (IP) per UNDP terminology) 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. A subsidiary agreement (project document) will be established between UNDP and MoEWRI/DHM as per Article 3 of the SBAA. All references in the SBAA to "Executing Agency" shall be deemed to refer to "Implementing Partner".

Executing Entity (IP per UNDP terminology)

89. The National Executing Entity for this project is the Government of Nepal, represented by two entities:
    - The Department of Hydrology and Meteorology (DHM) under Ministry of Energy, Water Resources and Irrigation (MoEWRI) of Nepal - which will be responsible for implementation and serve as UNDP's Implementing Partner (IP)
    - The Ministry of Finance - which will play an intermediary role in distributing the funds to the IP and Responsible Partiess through the appropriate channels/systems.

    As the IP, MoEWRI/DHM will be accountable to UNDP for managing the project, including the monitoring and evaluation of project interventions achieving project outcomes and for the effective use of GCF resources. The MoEWRI/DHM will designate a National Project Coordinator, responsible for the overall direction, strategic guidance and timely delivery of the Project. UNDP will also provide oversight through UNDP Country Office in Nepal, the Bangkok Regional Hub and Headquarters in New York.

90. In addition, the Government of Nepal has requested UNDP to provide direct project services for this project. UNDP, in agreement with GoN, will provide implementation support (support to NIM) as agreed in the letter of agreement (LOA) signed between MoEWRI/DHM (on behalf of GoN) and UNDP. Such support will be predominantly administrative, particularly related to the recruitment of specialists and other complex procurement actions. UNDP and GoN acknowledge and agree that those services are not mandatory, and will be provided only upon Government request and specified in the Letter of Agreement (LoA). When requested, as is the case for this project, the direct project services follow UNDP policies on the recovery of direct project costs relating to GCF funded projects.

91. Notwithstanding the provision of these administrative support services by UNDP and as stated above, it is noted that the full accountability for the execution of the project remains solely with the EE, under the strategic guidance of the project board. UNDP will not exercise any discretion or decision-making with respect to day-to-day management and execution of the project.

Accredited Entity

92. UNDP provides a three-tier oversight and quality assurance role involving UNDP staff in Country Offices and at regional and headquarters levels. The quality assurance role supports the Project Steering Committee by carrying out objective and independent project oversight and monitoring functions. This role ensures appropriate project management milestones are managed and completed. Project assurance must be independent of the Project Management function; the Project Steering Committee cannot delegate any of its quality assurance responsibilities to the Project Manager. The project assurance role is covered by the Accredited Entity fee provided by the GCF. As an Accredited Entity to the GCF, UNDP is required to deliver GCF-specific oversight and quality assurance services including; (i) day-to-day oversight supervision, (ii) oversight of the project completion, (iii) oversight of project reporting.

93. The justification to engage UNDP support services responds to the capacity constraints identified based on partner capacity assessments and the results of HACT micro-assessment of the MoEWRI/DHM and the Responsible Parties (RPs). UNDP will be the best entity to engage various partners from both public and private sector, either following competitive procurement process or other partnership arrangement. Such support services and the cost involved, shall be detailed in a Letter of Agreement (LoA) for UNDP support services. As the support services will be provided by UNDP, usual UNDP regulations, rules and procedures apply.

Responsible Parties

94. Responsible parties will be overseen by and report to the MoEWRI/DHM in its role as Executing Entity. As such they will enter upon written agreements with the MoEWRI/DHM specifying their role in project implementation including deliverables, budgets and workplan. These legal agreements will reflect the requirements for the flow of GCF funds in accordance with the provisions made in the Accreditation Master Agreement (AMA) and the project's

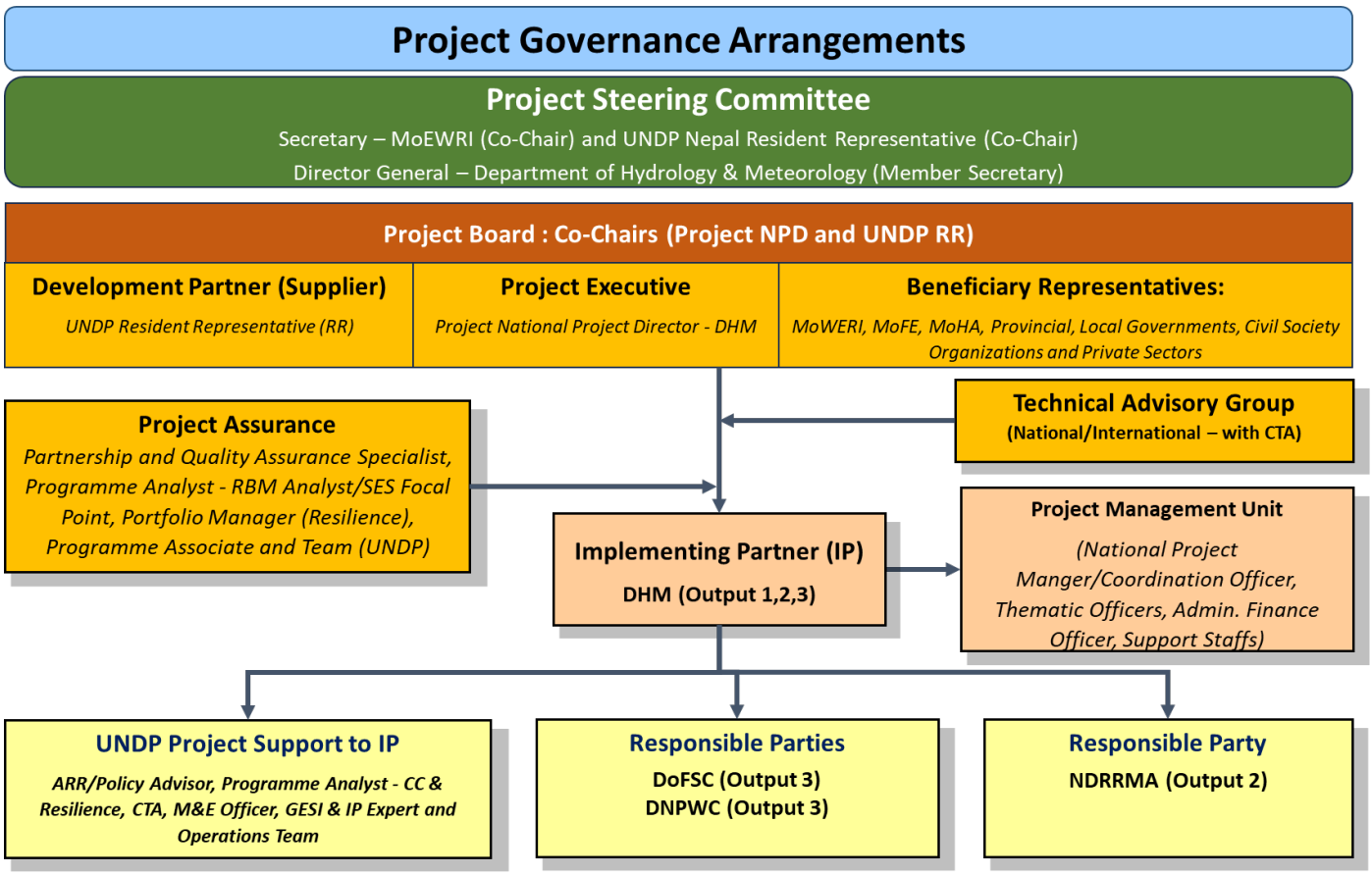
Funded Activity Agreement (FAA). Responsible parties will report on the usage of project funds and delivery of the workplan to the MoEWRI/DHM.

95. The following parties will enter into agreements with MoEWRI/DHM to assist in successfully delivering project outcomes and are directly accountable to MoEWRI/DHM and will serve as the 'Responsible Parties (RP)' for the execution of the outputs and activities in the targeted project areas as outlined in the terms of their agreement:
    - The Department of Forests and Soil Conservation (DoFSC) of Ministry of Forests and Environment (MoFE),
    - The Department of National Parks and Wildlife Conservation (DNPWC) of Ministry of Forests and Environment (MoFE),
    - The National Disaster Risk Reduction and Management Authority of Nepal (NDRRMA), Ministry of Home Affairs.
    - UNDP Nepal Country Office.

96. The specific roles that the Executing Entity and RPs will be responsible for during implementation of the Activities are as set out in Table 6 below. In addition to these lead organisation, opportunities will be sought during project inception for engaging with the International Centre for Integrated Mountain Development (ICIMOD) to support the knowledge generation and management components of the project. Overall, the role of ICIMOD is primarily advisory and will be implemented through ongoing relationships with the government of Nepal, as well as existing MoU between ICIMOD and UNDP in region which seeks to explore opportunities for future partnerships. UNDP has an existing MoU for such collaboration with ICIMOD which will be used as the foundation for such engagement. Beyond their technical advisories, ICIMOD may be engaged as service providers for specific activities in line with their expertise. In such instances, standard procurement processes would be followed. UNDP also has the foundation in place to work directly with ICIMOD through the signing of Letter of Agreement should this be required.

Table 3. Activity-level distribution of implementation responsibilities

Output	Activity	Executing Entity	Implementing Partner/Responsible Parties
Output 1: Institutional and technical capacity strengthened to develop and integrate climate risk and hazard information into planning and development.	1.1. Strengthen the knowledge base and technical capacities for improved climate research and risk reduction strategies.	MoEWRI/DHM	DHM, DOFSC UNDP
	1.2. Develop policy and financial mechanisms for sustainable GLOF and flood risk information services.		
Output 2: Improved hazard monitoring and the generation and dissemination of early warnings to local communities and important economic sectors.	2.1. Improve observation network density in GLOF watersheds to strengthen the technical capacity of DHM for the monitoring of climate hazard and risk.		DHM, NDRRMA UNDP
	2.2. Improve early warning systems to strengthen adaptive capacity and response to GLOFs and other climate hazards.		
Output 3: GLOF and flash flood risk and impact reduction measures implemented in priority glacial lake watersheds.	3.1. Lower the levels of four of the highest risk glacial lakes.		DHM, DoFSC NDRRMA, DNPWC UNDP
	3.2. Construction of structural and non-structural measures (Civil and Nbs/ Bioengineering) for the risk reduction of GLOF and flash flood.		
	3.3. Implement eco-disaster risk reduction solutions to reduce the impact of GLOFs and flash floods.		



Project Steering Committee

97. The project will be governed by the Project Board (PB) which will be set up by the MoEWRI/DHM, the project Executing Entity, and chaired by the Secretary of MoEWRI responsible for Water Resources and Irrigation. The PB will also be co-chaired by UNDP Resident Representative. Other members of the PB will include Joint-Secretary level representatives from relevant federal and provincial ministries including National Planning Commission, UNDP, representatives of community organizations, indigenous people organization, academia, development partners and private sector as necessary. The PB will be the senior, dedicated body for coordination and strategic guidance. The PB will meet at least twice a year.

98. The PB will ensure that activities of the project comply with the strategies, principles and overall approach outlined in this proposal. The PB will be responsible for making decisions by consensus. Its responsibilities including recommendation for UNDP and Executing Entity approval of project plans, substantive revisions and acceptance of the project progress reports. In order to ensure UNDP's ultimate accountability, PB decisions should be made in accordance with standards that shall ensure management for development results, the best value for money, fairness, integrity, transparency and effective international competition. In the case where a consensus cannot be reached, the final decision shall rest with UNDP. Project reviews by the PB will take place at least twice a year, or as necessary when raised by the Project Coordination Officer (PCO) or one of the committee members. The PB must be consulted by the PCO for decisions where there are substantial changes required to the Annual Workplan as per deviation tolerances set by a donor or UNDP, whichever is lower.

99. The PB members will have the following functions:
    - An Executive (role represented by the executing entity/implementing partner) that holds the project ownership and chairs the PB. The Executive will be National Project Director, DHM, which will play the overall coordination functions and collaboration with the responsible parties and UNDP.
    - The Development Partner represents the interests of the parties concerned that provide funding and/or technical expertise to the project. This role will be fulfilled by UNDP.
    - Beneficiary Representatives from the MoEWRI, MoFE, MoHA, as well as provincial, local governments, CSOs and private sector partners who ensure the realization of project benefits from the perspective of project beneficiaries..

- Project Assurance: UNDP performs the quality assurance role and supports the PB and Project Management Unit by carrying out objective and independent project oversight and monitoring functions. This role ensures appropriate project management milestones are managed and completed. The PB cannot delegate any of its quality assurance responsibilities to the CO. UNDP provides a three – tier oversight services involving the UNDP Country Offices and UNDP at regional and headquarters levels. Project assurance is totally independent of the Project Management function.

Implementation and Operational Arrangements

100. UNDP in consultation with the Chair of the PB will set up a Technical Advisory Group (TAG) chaired by a senior government official, who is not involved in project management and oversight. The CTA of the project selected by UNDP and senior technical specialists and experts of MoEWRI, DNPWC, DSCWM and NDRRMA will be the members of the TAG. Other members of TAG will include technical experts working in other government agencies, research institutions, development partner organizations and national and international organizations, with relevant experience in various thematic areas of the project, as decided by UNDP in consultation with the Chair of the PB. The main function of the TAG will be to provide technical advice and inputs to the Executing Entity and RPs based on international best practice, regards to thematic assessments and technical studies conducted by the project. Including the Chair, the number of TAG members will be limited to a maximum of eleven. Meetings of the TAG will be organized up to twice a year, though it can meet on ad hoc basis as and when required.

101. The Executing Entity will establish and manage a Project Management Unit (PMU) that will operate under the overall guidance of the National Project Director and recruit its staff. Additional administrative and logistical support staff for processing of human resources, procurement and logistic aspects of the implementation of the project may be assigned by UNDP.

102. The PMU is responsible for overall planning and budgeting, collaborating with other ministries, sectors and government entities to implement the project performance management system; bidding for the provision of project consultancy services; coordination with the responsible parties in terms of bidding of goods and services; disbursement and implementation of project audits, operation of accounts, monitoring and preparation of overall project reports (annual), and safeguards policy monitoring reports.

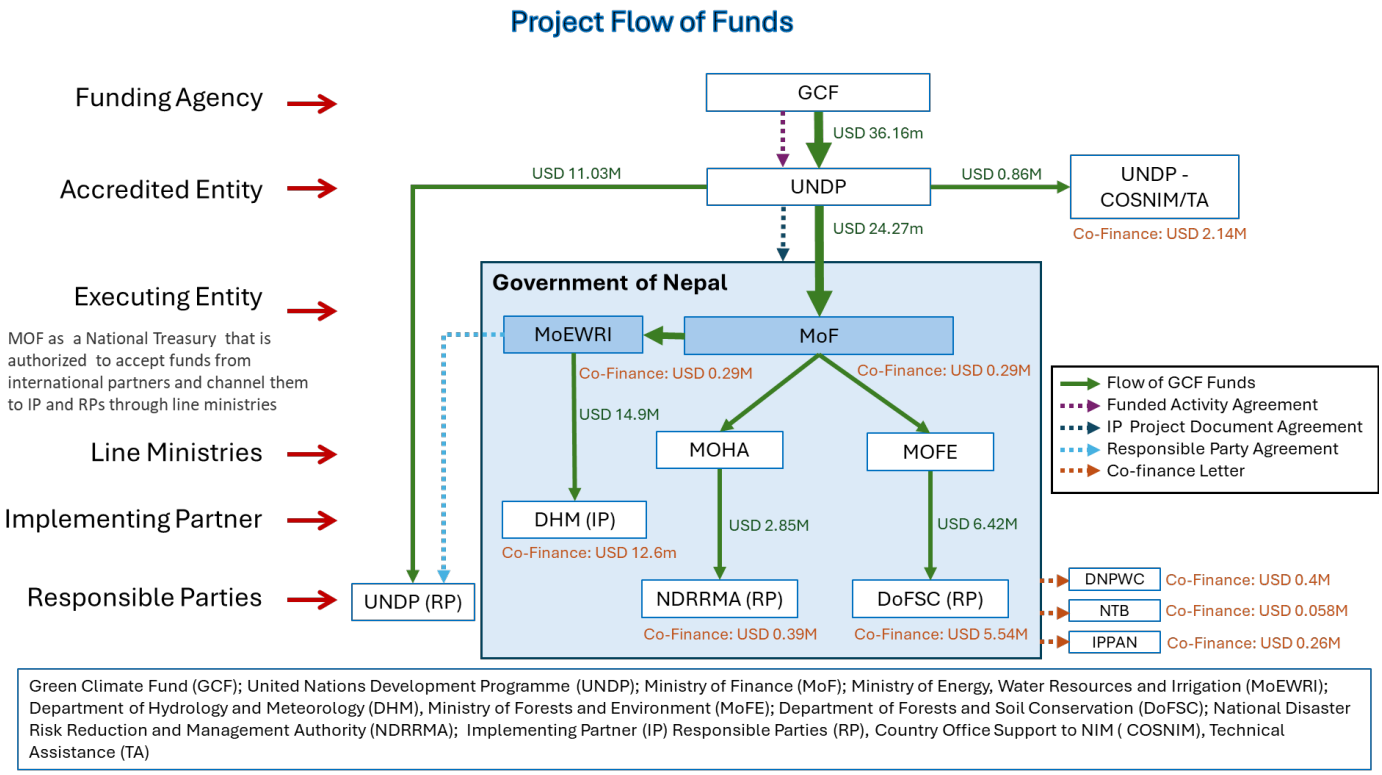
103. The PMU will be headed by the Project Coordination Officer (PCO), who will have day-to-day management and supervisory responsibilities of the project team and will be supported by thematic specialists as well as operational assistants. The PCO is responsible for the delivery of results specified in the project document, to the required standard of quality and within the specified constraints of time and cost. The multi-year work plan and annual work plan are prepared and updated by the PCO, with support from other PMU members, and reviewed and approved by the PB. The PCO is also responsible for maintaining and updating the procurement plan, project risk log, and stakeholder engagement plan. With technical support from the Monitoring and Evaluation (M&E) Expert, the Environment and Social Safeguard (ESS) Officer, and the Gender Equality and Social Inclusion (GESI) Expert. The PCO also take the overall responsibility of adhering the project activities to the ESMF, IPPF, and GAAP and make periodic reports to the PB. Gender equity will be mainstreamed in each output and activity and oversight for gender mainstreaming will be provided by a project-financed gender specialist.

104. The “project assurance” function of UNDP is to support the PB by carrying out objective and independent project oversight and monitoring functions. This role ensures appropriate project management milestones are managed and completed. Project assurance has to be independent of the PCO; therefore, the PB cannot delegate any of its assurance responsibilities to the PCO. The project assurance role will be assumed by UNDP Deputy Resident Representative, who will represent UNDP in the Board, together with UNDP’s Portfolio Manager for Environment and Resilience, Programme Analyst – RBM and Programme Associate on behalf of UNDP.

Fund Flow

105. Upon approval of the project by the GCF Board, a Funded Activity Agreement (FAA) will be signed between the GCF and UNDP. Following FAA signing, UNDP and Government of Nepal will sign project document, which is a legal document that outlines fund flow from Accredited Agency to the IP and RPs through the Ministry of Finance and upon meeting the conditions precedents to first disbursement therein, the GCF proceed (grant) will be disbursed to UNDP. UNDP will transfer the GCF funds to the Ministry of Finance (MoF) of Nepal, from where the funds will be disbursed to the MoEWRI and Responsible Parties (RPs) through appropriate mechanism against approved annual work plan and budget. UNDP will retain necessary funds in line with the approved budget in the funding proposal to provide technical and operational support services to the IPs and RPs for implementation of project. Following the decision of the PB the funds will be transferred on quarterly basis from MoF to the Executing Entity (DHM) and the RPs (DoFSC, DNPWC and NDRRMA) through respective line ministries.

106. For the flow co-finance, formal commitment letters have been provided (Annex 13), creating the basis for managing co-finance commitments between UNDP and co-financiers. Co-finance will not flow into the project accounts, but will rather be managed directly by the co-financing entities as per the details of their individual commitments, with inputs being regularly monitored and reported through the APR process. Additionally, UNDP Prodoc, which is officially signed between EE and UNDP, provides the legal basis to realize co-financing for government entities, which will flow through the government finance systems (LMBIS, PLMBIS and SUTRA) which will be recorded, monitored and audited.



B.5. Justification for GCF funding request (max. 1000 words, approximately 2 pages)

107. Nepal is one of the 20 most disaster-prone countries in the world, with multiple climate change- and non-climate change-related hazards affecting the country. Examples of climate change-related hazards include: i) floods; ii) droughts; iii) landslides; iv) windstorms; v) hailstorms; vi) forest fires; vii) Glacial Lake Outburst Floods (GLOFs); and viii) avalanches. Nepal is one of the most vulnerable countries in the world to climate change-induced disasters, ranking within the top 10 countries most affected by climate change on the long-term global Climate Risk Index from 2009 to 2019[53]. For example, recurrent extreme rainfall events have caused extensive flooding across Nepal. Floods in 2001 and 2008 collectively killed 1,673 people, while extreme rainfall in August 2017 caused widespread floods across 35 of the country's 77 districts, inundating 80% of the land in the Terai region. More than 190,000 houses were destroyed or partially damaged, displacing tens of thousands of people and rendering many homeless. These impacts also resulted in shortages of food and water, as well as other essential items in the affected areas.[54]

108. The capacity of the Government of Nepal (GoN) to respond to climate hazards is additionally constrained by the urgent recovery needs from recent disasters. For example, following the series of devastations and especially after the two earthquakes in April and May 2015[55] that caused extensive damage to property and physical infrastructure and resulted in the loss of 8,790 lives, the Government of Nepal (GoN) established and prioritised a five-year Reconstruction Strategy to expedite the reconstruction of damaged infrastructure and to shape the course of the country's long-term development through the promotion of sustainable livelihoods[56]. The 2017 extreme rainfall event

[53] Ministry of Home Affairs. (2018). Nepal Disaster Report, 2017: The Road to Sendai, Kathmandu: Government of Nepal.
[54] National Planning Commission 2017. Nepal Flood 2017: Post Flood Recovery Needs Assessment
[55] The magnitudes of these earthquakes were 7.9 and 7.3 respectively
[56] NRA. (2016). Nepal Earthquake 2015: Post-Disaster Recovery Framework, 2016-2020. Kathmandu: National Reconstruction Authority

resulted in severe flooding, which affected 1.7 million people and damaged 126,000 ha of rice paddies[57]. The combined impact of these major events on Nepal resulted in US$ 6 billion in economic losses and required the establishment of a period of rebuilding[58,59,60]. Following the 2015 earthquakes, the rebuilding activities in Nepal are now 93% complete, which translates to the reconstruction of 753,00 private houses out of 811,000. Moreover, the reconstruction of government and school buildings, health facilities, historical monuments and security forces buildings are all still ongoing[61]. The current state of the reconstruction efforts emphasises: i) the extended amount of time currently required to rebuild after extreme events; ii) that the Nepalese infrastructure are inadequate to deal with these extreme events; and iii) how vulnerable Nepalese communities are to extreme events. The recovery efforts for such events have also placed considerable strain on Nepal's economy, impacting the country's fiscal capacity to fund adaptation.

109. In the 2021/2022 UNDP Human Development Report, Nepal is ranked 144 out of 191 countries on the Human Development Index (HDI), with a value of 0.602 — indicating low levels of development[62]. The country's Gross National Income (GNI) per capita is US$ 970, while its Gross Domestic Product (GDP) amounts to US$ 29.17 billion. In 2018, the country's annual GDP growth rate was 6.7%. Despite this growth, the country's public debt increased from 26% of GDP in 2016–2017 to 30% in 2018–2019 — and is projected to further increase into the future[63]. This debt burden is likely to be exacerbated by increased extreme climate events and their related impacts, with public funding required to support recovery efforts and thereby reducing economic growth and the ability of the GoN to repay public debt.

110. Imports of goods and services accounted for 46% of Nepal's total GDP of US$ 29 billion in 2018. These imports were significantly disrupted in September 2015, for a period of four months, during a period where Nepal was engaged in relief and rebuilding efforts in the wake of the earthquakes earlier in the year[64]. This impact on trade exacerbated already-existing unequal social and economic opportunities, which are prevalent in the hierarchical social structure of the country, and which have resulted in Nepal's rating of 32.8 in the 2013 Gini coefficient[65]. The combination of the 2015 earthquakes and their impacts on trade resulted in a decrease in Nepal's GDP growth rate to 3% for 2014–2015 and subsequently to 0% for 2015–2016. While this rate had recovered to 6.7% by 2018, the recurrence of these extreme events will have significant impacts on Nepal's population — 80% of whom lived in rural areas and 25% lived below the national poverty line as of 2011[66,67]. Furthermore, the impacts of these events on Nepal's economy have resulted in the GoN having to prioritise national rebuilding efforts, with little funding available for the implementation of climate change adaptation efforts or projects.

111. Nepal's economic growth model is aimed at achieving middle-income country status by 2030, by shifting from consumption to investments — with a focus on the development of physical and social infrastructure. The country's current growth model is, however, strongly reliant on employment abroad — particularly in the Gulf Cooperation Council countries, India and Malaysia — which accounted for 25% of the GDP in 2018–19[68]. This overseas employment, combined with the country's reliance on imports and the recent Covid-19 pandemic, is likely to have a substantive impact on the GoN's ability to invest in climate-resilience building activities and projects. The Nepali economy is in liquidity crisis despite the measures undertaken by the Nepal's Rastra / Central Bank. There is significant cash deficit for various financial and economic activities as the liquidity crunch persist. GCF support, in the form of grant financing, is therefore necessary to overcome the financial barriers to addressing the impacts of extreme climate events by improving the resilience and preparedness of Nepal and lay the foundation for the private sector engagement and investment in climate risk reduction in the future.

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[57] National Planning Commission. (2017). Nepal Flood 2017: Post Flood Recovery Needs Assessment. Government of Nepal.
[58] NRA. (2016). Nepal Earthquake 2015: Post-Disaster Recovery Framework, 2016-2020. Kathmandu: National Reconstruction Authority
[59] NRA. (2017b). Rebuilding Nepal. NRA Newsletter. Kathmandu: Nepal Reconstruction Authority, Government of Nepal.
[60] Ministry of Home Affairs. (2018). Nepal Disaster Report, 2017: The Road to Sendai, Kathmandu: Government of Nepal
[61] National Reconstruction Authority (2021). NRA Press Release on Sixth Anniversry of Earthquake.
[62] UNDP. (2021/2022 Human Development Report, Uncertain Times, Unsettled Lives: Shaping our Future in a Transforming World. Available online at https://hdr.undp.org/system/files/documents/global-report-document/hdr2021-22pdf_1.pdf
[63] International Monetary Fund. (2020). *2020 Article IV Consultation — Press Release; Staff Report; And Statement by The Executive Director for Nepal* (Issue 20)
[64] https://databank.worldbank.org/views/reports/reportwidget.aspx?Report_Name=CountryProfile&Id=b450fd57&tbar=y&dd=y&inf=n&zm=n&country=NPL
[65] The Gini coefficient is a measure of the deviation of the distribution of income among individuals or households within a country from a perfectly equal distribution. A value of 0 represents absolute equality, a value of 100 absolute inequality.
[66] The national poverty line in 2011 was NRs 19,621 per capita per year. This was US$ 274.7 in 2011 and US$ 167.75 in 2021.
[67] Asian Development Bank. (2017). Country Poverty Analysis (Detailed): Nepal, 2013–2017.
[68] International Monetary Fund. (2020). *2020 Article IV Consultation — Press Release; Staff Report; And Statement by The Executive Director for Nepal* (Issue 20)

112. To address the risks of floods, particularly GLOFs, Nepal should adopt a comprehensive and integrated climate risk management approach centred around the reduction and prevention of, as well as the preparedness for these hazards. The project proposes to address the primary risk of GLOFs through the process of lowering the level of the target glacial lakes, a practise that has been effectively implemented in the country previously. For example, Imja Lake in the Solukhumbu District was identified as being at risk from GLOFs and, accordingly, the *Community Based Flood and Glacial Lake Outburst Risk Reduction Project* was established in 2015 to lower its water level by 3 m through the construction of an open channel, to help mitigate the GLOF hazard potential. The cost estimate for the lowering of the four target lakes is US$2.6 million each, with further investment required to bring about the paradigm shift in the management approach of GLOF related risks and impacts — detailed calculations for the lake lowering cost estimates can be found in Annex 26: Technical Lake Lowering Design report. At present, the country has limited capacity to finance these climate change adaptation interventions through domestic sources of funding — including both private and public sector finance — as it prioritises funds for the abovementioned rebuilding efforts. The GoN is therefore seeking US$36.1 million in GCF grant financing to build the climate resilience of communities in Nepal, to adapt to the impacts of GLOFs and other climate-driven extreme events. Co-finance of US$13.785 million for this project will be provided by DHM, DoFSC, MoEWRI, NDRRMA, DNPWC, MoFE, UNDP, NTB and IPPAN (please see Section C.1 for a breakdown of co-finance contributions).

113. Without GCF support and with the financial impact of the recent Covid-19 pandemic, the public and private sectors in Nepal will continue to operate under the existing reactive approach to extreme climate events and natural disasters, limiting national and local-level decision-makers' capacity to plan for and respond to the increasing impacts of climate change. Moreover, as climate change increases the frequency of extreme climate events such as GLOFs, the vulnerability of communities in Nepal will continue to rise — with ongoing rebuilding events being interrupted by these future extreme events. GCF support is therefore required to implement interventions that reduce the vulnerability of these communities, to ensure that government-led reconstruction and development activities can proceed without interruption.

B.6. Exit strategy (max. 500 words, approximately 1 page)

Sustainable disaster risk reduction in Nepal

114. The principles of sustainability underpin all three project outputs, with the highest direct adaptation impact potential being realised through Outputs 2 and 3. Interventions under Output 2 will ensure that vulnerable communities are timeously informed of GLOFs and other extreme events, while the interventions under Output 3 will simultaneously ensure that these communities are protected from the physical risks posed by these events. The introduction of long-term monitoring systems coupled with improved dissemination systems and methods under Output 2 will enable vulnerable communities to prepare for GLOFs and other extreme events appropriately and adequately in the future.

115. The integration of physical risk reduction measures, introduced under Output 3, with improved early warning systems (EWS), introduced under Output 2, will enable vulnerable communities to respond to extreme events — such as GLOFs — more effectively. Furthermore, the physical risk reduction measures introduced under Output 3 are designed to deliver long-term adaptation benefits to the target communities, through a combined grey and green infrastructure approach. The combination of grey and green infrastructure will ensure the long-term sustainability of Output 3 as the green infrastructure interventions will contribute to the restoration and rehabilitation of degraded ecosystems in the target areas — these ecosystems will provide additional protective services once restored — while the grey infrastructure will provide immediate protection to both vulnerable communities and the green infrastructure, which will take longer to provide the expected benefits. Involvement and training of community members in the construction of the lake lowering systems will ensure that technical skills and knowledge are retained within the communities, allowing them to take responsibility for the implementation and management of similar interventions in the future. The integration of Outputs 2 and 3 will also lead to strengthened adaptive capacity in these communities, by enabling long term climate-resilient planning that is not contingent on extensive periods of recovery from extreme events.

Public-private partnerships to promote GLOF risk reduction

116. Investment in long-term capacity building under Output 1 will be complemented by the establishment of public-private partnerships to formalise and institutionalise long-term agreements focused on the sustainable uptake of GLOF risk reduction in Nepal to complement the investment in long-term capacity building under Output 1. In particular, partnerships will be developed between entities such as NTB, IPPAN, TAAN and the Ministry of Energy, Water, Resources and Irrigation: The Department of Electricity Development, Nepal Electricity Authority, Department of Water Resources and Irrigation, and Private Hydropower Developers. The production of customised and targeted risk information for pre-project adaptation planning and early warnings will provide strong incentives

for private-sector investment in future disaster risk reduction initiatives. Country-wide uptake of GLOF risk reduction interventions will be promoted by the establishment of public-private partnerships, and introducing the model to leverage future investment in similar impactful lake lowering and downstream interventions. Initial co-finance investments from IPPAN and NTB demonstrate the willingness of the private sector to engage with the project and a general buy in to the benefits of the proposed approach. It is anticipated that the improved understanding of GLOF risk and agreements facilitated by the project, combined by on-the-ground interventions, will have potential to leverage significant additional finance downstream of the project, particularly for eco-DRR interventions that align with watershed management investments of the hydropower producers.

117. The mechanisms for establishing and expanding these public-private partnerships will be developed under Activity 1.2 and supported by strengthening DHM's institutional and regulatory systems for climate-responsive planning and development. The public-private partnerships will support the sustainability of GLOF risk reduction strategies by engaging private sector actors in the hydropower, tourism and insurance sectors to produce customised and targeted risk information for pre-project adaptation planning and early warnings. Opportunities to engage with the health sector will also be explored, linked to the expected reduction in the spread of water- and vector-borne diseases after flood events. The production of customised and targeted risk information will incentivise disaster risk reduction initiatives and adaptation planning in private sectors, with the PPPs enabling long-term mobilisation of resources to directly address climate change issues. By engaging these partners throughout the process — from project design and throughout the implementation — the project is instilling a sense of ownership in the approach, creating a platform for continued, sustainable investment in the long term.

Capacity development and knowledge sharing for climate-responsive planning

118. Outputs 2 and 3 will be supported by strengthening the institutional and technical capacity of DHM under Output 1 to effectively manage the hazard monitoring and the generation and dissemination of early warnings introduced under Output 2. Furthermore, the focus on knowledge management, under Output 1, will enable DHM to monitor the effectiveness of project interventions and develop an evidence base that can be used to further develop capacity, as well as inform future disaster risk reduction in Nepal. As a result, DHM will be fully equipped to undertake the required hazard mapping and design and implement GLOF risk reduction interventions in-house, as opposed to being dependent on external entities and other nationally-driven initiatives for their disaster preparedness. In addition to the establishment of public-private partnerships with IPPAN, TAAN and other tourism-sector entities, the sharing of institutional and technical knowledge generated under the project and stored within existing ministries will support the long-term sustainability of project interventions by providing a knowledge base for GLOF risk reduction in Nepal. The provision of this knowledge base will be achieved by developing methods and SOPs for the inventory and development of a spatial digital database (GIS) of glaciers and glacial lakes along with methods, tools and operating procedures for GLOF hazard prioritisation, and methodologies and SOPs for implementing integrated GLOF risk reduction in vulnerable watersheds.

119. The project will promote knowledge sharing (discussed above) by facilitating collaboration between GoN agencies, thereby catalysing integrated approaches to GLOF monitoring and knowledge management. The dissemination of sector-specific weather- and climate change-related risk information by DHM will be expanded to include the hydropower and tourism sectors via several platforms, including the DHM website, phone messaging, radio, television and tailored bulletins. In addition, evacuation plans, adaptation planning and knowledge dissemination workshops for decision-makers will be initiated under Output 1. In particular, mechanisms for collaboration will be fostered under Activity 1.1, which will involve the strengthening of knowledge bases, and Activity 1.2, which will involve knowledge dissemination workshops, with decision-makers to facilitate knowledge sharing, networking and risk informed planning. Moreover, the design of the proposed project accounts for mutual learning and knowledge-sharing opportunities for all involved stakeholders. Establishing public-private partnerships and facilitating knowledge sharing among stakeholders will ensure that there is a strong sense of country ownership around project interventions. This sense of ownership will be important in ensuring the long-term sustainability, as well as the scalability and replicability, of project interventions.

120. The project's sustainability is further enhanced by its alignment with the priorities laid out in the GoN's 'Fifteenth Plan' 5-year development plan (2019/2020 – 2023/24)[69], which prioritises sustainable use of natural resources alongside climate adaptation, green economies and improved hydro-meteorological services. Details on the alignment are presented under Section D.5. This alignment will ensure that the strategies introduced in this project are effectively mainstreamed into development planning at all levels — from national through to community — with the resulting knowledge and decision-making procedures fully embedded within national systems. Moreover, this

[69] https://npc.gov.np/images/category/15th_plan_English_Version.pdf

country-driven approach will promote a sense of ownership, ensuring that risk reduction measures continue to be prioritized beyond the scope of the project.

Operation and maintenance beyond the project lifetime

121. Regular Operations and Maintenance (O&M) of the lake lowering interventions, EWS installations and downstream Eco-DRR measures will be undertaken during and after the project to guarantee the sustainability and optimal functioning of these interventions. Specific roles and responsibilities for O&M will consider the technical aspects of the interventions and be held by various stakeholders, including DHM, NDRRMA and DoFSC.

122. DHM will be responsible for the operations and maintenance of lake lowering interventions under Activity 3.1. The O&M for interventions introduced as part of the lake lowering process will commence in Year 7 — after the target lakes are lowered in Year 6 — and continue for 15 years. DHM will decide whether to mobilise its own expert resources or contract any consultancy services. O&M will be enforced by a local enumerator. This local enumerator will be recruited and trained for a period of time by the DHM or a professional consultant, after which they will perform their responsibilities to ensure the safety and operation of the structures. These responsibilities will include regular gate operation, timely inspection of hydromechanical and civil structures and reporting of any faults to DHM. Maintenance work necessitates minor civil projects, which will be coordinated with the local authorities. DHM will recruit contractors to perform O&M depending on the scope of work necessary. Minor civil works and maintenance will be carried out on a regular basis according to specific structures, while major maintenance will be expected every 8-10 years.

123. In addition to the lake lowering interventions, DHM will also be responsible for O&M of the new hydrological and meteorology stations installed as part of the EWS interventions. Operations and maintenance of the meteorological and hydrological stations installed under Output 2 of the project will commence in Year 5 — after the new stations are installed in Year 4 — and continue for 15 years. The prior experience that DHM has with monitoring stations will provide guidance on maintaining the hydrological and meteorological stations for efficient operation. The different types of maintenance required will include, *inter alia*: i) emptying precipitation gauge buckets regularly, with the frequency depending on the monsoon precipitations; ii) ensuring the replacement of batteries and solar panels to prevent missed data; and iii) regular maintenance to remove any encroaching vegetation and upkeep of fences and cable connections. Over and above the O&M required for the project, DHM has proposed to upgrade existing stations during the project period as co-financing which will enhance overall monitoring and early warning capabilities. Moreover, by co-developing climate-responsive Municipal Disaster Preparedness and Response Plans, and Local-level Climate-resilient Action Plans with vulnerable communities, the project will fully integrate these systems into local governance structures, ensuring local ownership sustain these systems beyond the scope of the project. This will be further enhanced by the strengthening of vertical and horizontal linkages between Local Emergency Operation Centres and DHM, enabling the long-term flow of information for effective disaster preparedness at local levels.

124. DoFSC will be responsible for the operation and maintenance of all downstream flood risk reduction (EcoDRR) and watershed and sub-watershed restoration initiatives implemented under Output 3. O&M measures for the downstream flood reduction interventions will begin after Year 2 of the project, and continue for 15 years. The different types of maintenance required for these interventions will include: i) routine annual maintenance; ii) maintenance during high flood season or after monsoons; and iii) special maintenance during extreme weather events. Proper and regular maintenance will be especially important until the planted species have established proposely. Maintenance is also required in the case of early damage to structures for which resources are to be allocated regularly.

125. The long-term sustainability of the downstream measures is set on the foundation of robust government priorities for reforestation. The Government of Nepal has given high priority to plantation programmes, which are reflected in several strategic plans and policies. This includes targets of planting at least 5,000 ha of trees per year to counter deforestation and restore degraded forests; linked to government ambitions toward the achievement of the Sustainable Development Goals, particularly SDG 15 – Life of Land: protect, restore, and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss. Similarly, the fifteenth-development plan of Nepal (2019-2024) aimed to increase annual plantation area targets from 4,000 ha to 30,000 by end of the plan period, as well as to produce at least 22-30 million seedlings annually. Moreover, the plan aims to expand private/family forests by 30,000 ha, agroforestry practices by 100,000 ha, and public-land plantations by 20,000 ha. National priorities for forest restoration are also reflected in the Nationally Determined Contribution (NDC), which emphasizes the enhancement of carbon sequestration and forest carbon storage for combating climate change impacts by planting trees, while maintaining 45% of the total area of the country under forest cover by 2030. Given this strong prioritization, the project will work with government

to leverage the allocation of public funds to the ongoing implementation of Eco-DRR measures beyond the scope of the project.

126. A detailed framework for operations and maintenance of the project interventions, including details on the annual costs, is presented in Annex 21: Operations and Maintenance Manual.

FINANCING INFORMATION

C.1. Total financing

(a) Requested GCF funding (i + ii + iii + iv + v + vi + vii)	Total amount		Currency	
	36,158,230		million USD ($)	
GCF financial instrument	**Amount**	**Tenor**	**Grace period**	**Pricing**
(i) Senior loans				
(ii) Subordinated loans				
(iii) Equity				
(iv) Guarantees				
(v) Reimbursable grants				
(vi) Grants	36,158,230			
(vii) Results-based payments				

(b) Co-financing information[70]	Total amount	Currency
	13,785,820	USD ($)

Name of institution	Financial instrument	Amount	Currency	Tenor & grace	Pricing	Seniority
Department of Meteorology and Hydrology (DHM)	Grant	4,542,721	USD ($)			
	In kind	1,555,234				
	In-Project O&M	1,033,897				
Department of Forest and Soil Conservation (DoFSC)	In kind	2,196,839	USD ($)			
	In-Project O&M	607,448				
National Disaster Risk Reduction and Management Authority (NDRRMA)	Grant	174,904	USD ($)			
	In-Project O&M	216,833				
Department of National Park and Wildlife Conservation (DNPWC)	In kind	407,952	USD ($)			
Ministry of Forest and Environment (MoFE)	In kind	293,245	USD ($)			
Ministry of Energy, Water Resources and Irrigation (MoEWRI)	In kind	293,245	USD ($)			
UNDP	Grant	2,143,869	USD ($)			
Nepal Tourism Board (NTB)	In kind	58,334	USD ($)			
Independent Power Producers' Association, Nepal (IPPAN)	In kind	261,299	USD ($)			

Total financing (c) = (a)+(b)	Amount	Currency
	49,944,050	USD ($)

[70] In addition to having signed co-finance letters, first-level due diligence has been conducted on co-financers, considering several parameters: annual budget of the entity, co-finance commitments to the project, local presence to manage commitments, level of priority for the project indicated by the entity, relevance to ongoing workstreams and results of capacity assessments. For all public entities, results suggest high confidence in the co-finance materializing and being directed towards, with the commitments already integrated into entity work plans. In all cases, the annual contributions account for manageable percentages of available annual budgets in light of the contribution towards their priority programmes.

(d) Other financing arrangements and contributions (max. 250 words, approximately 0.5 page)	The following parallel financing will be provided for the proposed project: • US$ 3,066,440 from DHM. • US$ 1,525,424 from DoFSC. • US$ 816,301 from DNPWC. • US$ 962,477 from IPPAN • US$ 24.33 Million from 15 Municipalities in Dudhkoshi Watershed • US$ 24.8 Million from 15 Municipalities in Arun Watershed • US$ 1.05 Million from Nasong Rural Municipality in Thulagi Watershed An additional US$4,056,019 in long-term finance for O&M will be provided by DHM, DNPWC and DoFSC, which flow after the project implementation period and is addition to the O&M finance provided during the seven-year implementation period.

C.2. Financing by component

Output	Activity	Indicative cost million USD ($)	GCF financing		Co-financing		
			Amount Options	Financial Instrument	Amount Options	Financial Instrument	Name of Institutions
1. Institutional and technical capacity strengthened to develop and integrate climate risk and hazard information into planning and development.	1.1 Strengthen the knowledge base and technical capacities for improved climate research and risk reduction strategies.	4.323878	1.046855	Grants	1.116885	In-kind Grants	DHM UNDP
	1.2. Develop public-private partnerships for sustainable investment in GLOF and flood risk information services		2.160138	Grants			
2. Improved hazard monitoring and the generation and dissemination of early warnings to local communities and important economic sectors	2.1 Improve observation network density in GLOF watersheds to strengthen the technical capacity of DHM for the monitoring of climate hazard and risk	10.386991	3.823603	Grants	1.854382	In-kind Grants	DHM IPPAN NTB UNDP
	2.2. Develop and implement early warning systems planning to strengthen adaptive capacity and response to GLOFs and other climate hazards in vulnerable sectors and communities		4.709006	Grants			
3. GLOF and flash flood risk and impact reduction	3.1. Lower the levels of four of the highest risk glacial lakes.	31.736871	11.976515	Grants	9.039754	In-kind Grants	DHM UNDP DoFSC DNPWC
	3.2. Construction of structural and non-		1.102913	Grants			

measures implemented in priority glacial lake watersheds	structural measures (Civil and NbS/ Bioengineering) for the risk reduction of GLOF and flash flood						
	3.3. Implement Eco-disaster Risk Reduction solutions to reduce the impact of GLOFs and flash floods		9.617690	Grants			
PMC		3.496310	1.721511	Grants	1.774799	In-Kind Grants	MoFE MoEWRI UNDP
Indicative total cost (USD)		49.944050	36.158230		13.785820		

C.3 Capacity building and technology development/transfer (max. 250 words, approximately 0.5 page)

C.3.1 Does GCF funding finance capacity building activities?	Yes ☒ No ☐
C.3.2. Does GCF funding finance technology development/transfer?	Yes ☒ No ☐

Technology transfer

127. Outputs 2 and 3 of the proposed project will facilitate technology transfer by implementing innovative climate change adaptation interventions to reduce the risk and impacts of GLOFs in Nepal. These interventions include: i) lowering the levels of four of the highest risk glacial lakes in Nepal; ii) installing check dams and other infrastructure for the diversion of GLOF and flash flood flow; iii) implementing Eco-Disaster Risk Reduction solutions to reduce the impact of GLOFs and flash floods; and iv) improving the observation network density in GLOF watersheds to strengthen the technical capacity of DHM for the monitoring of climate risk and hazard. The technologies that are to be implemented under the project have been concept proofed in Nepal through donor-funded and nationally-driven initiatives (described in Section B.1). However, creating conditions and capacities for technology transfer is novel to this project and will be accomplished by: i) instilling the functions and protocols across the relevant national institutions; and ii) building the required capacities to enable the use of lake lowering methods and technologies in addressing GLOF risks. In addition, an integrated approach will be implemented to reduce the risks and impacts from a GLOF event at one of the four target glacial lakes. Historically, the GoN has taken a single-hazard approach in addressing GLOFs by lowering lakes that overlook the broader catchment level and upstream and downstream interlinkages. While the proposed project still aims to reduce the risks and impacts of a GLOF by lowering the levels of targeted lakes upstream, this single risk reduction measure will be bolstered by the implementation of complementary measures, such as Eco-DRR solutions downstream of the same catchment area and strengthening national and local capacity to identify, plan for and respond to these extreme events. The vertical integration of upstream- and downstream-hazard risk management and adoption of a multi-hazard risk management approach will ensure the effective monitoring and management of hazards that trigger GLOFs while retaining GLOF risk reduction as the core focus of the project. This approach will be supported by complementary systems of GLOF risk monitoring and EWS that are centrally- and/or locally/community-led.

Capacity-building interventions

128. The technical and institutional capacity of decision-makers at the national and local levels will be strengthened under Outputs 1 and 2 of the projects by:

- developing methods and SOPs for inventory and development of spatial digital database (GIS) of glaciers and glacial lakes (including geophysical investigation, as well as topographic and bathymetric surveys);
- introducing methods and tools for GLOF hazard prioritization, and mapping other extreme flood, landslide, mudflow and soil erosion hazards and risks, using a combination of remote-sensing and satellite data, as well as ground-truthing and socio-economic vulnerability assessments;
- introducing methodology and standard operating procedures (SOPs) for implementing integrated GLOF risk reduction in vulnerable watersheds;
- developing climate-induced hazard event recording and management database systems;

- developing climate risk information products and tailor them for use by productive sectors (tourism and hydropower); and
- establishing public-private sector partnerships to generate long-term buy-in and incentives for investment in GLOF risk reduction.

129. Under Output 2 of the project, capacity-building activities will focus on increasing the capacity of DHM to detect and monitor GLOFs and other extreme events, as well as generate and disseminate early warning information products to the most vulnerable communities in the Gandaki Basin, and Dudhkoshi and Arun Sub-basins. To complement the installation of hydrological and meteorological stations, training workshops targeting DHM staff will be delivered to strengthen their capacity to: i) collect, process and manage climate data from the new and existing stations; and ii) use the generated data to develop early warning information products, including easily interpretable infographics for local communities. The adaptive capacity and response among vulnerable communities in the target districts of Manang, Sankhuwasabha and Solukhumbu to GLOFs will be enhanced through a combination of training and awareness-raising interventions.

EXPECTED PERFORMANCE AGAINST INVESTMENT CRITERIA

This section refers to the performance of the project/programme against the investment criteria as set out in the GCF's Initial Investment Framework.

D.1. Impact potential (max. 500 words, approximately 1 page)

130. The proposed project will contribute to the GCF's fund-level adaptation objective of increased climate-resilient sustainable development by protecting highly exposed areas of the Himalayan valleys from GLOFs, shifting the GLOF and flood risk management paradigm towards an integrated, evidence-based and climate-responsive approach, and enabling community-level GLOF awareness for the promotion of appropriate response strategies and development of long-term adaptive capacity. In so doing, the project has been designed to achieve one GCF fund-level impact and three fund-level outcomes as presented in the GCF Integrated Results Management Framework.

Fund-level Impacts

131. The proposed project will enhance climate resilience in Nepal's Gandaki Basin, and Dudhkoshi and Arun Sub-basins, contributing to GCF's first Adaptation Result Area (ARA1) — Increased resilience and enhanced livelihoods of the most vulnerable people, communities and regions, and ARA4 — Ecosystems and ecosystem services.

132. To reduce the primary risk of a GLOF, the water levels will be lowered at the four priority lakes (Thulagi, Lower Barun, Lumding Tsho and Hongu 2). Lowering the water level of the lakes will reduce the potential of triggering a GLOF, as well as reducing the magnitude of a GLOF when one is triggered. Furthermore, Eco-Disaster Risk Reduction (Eco-DRR) measures that adopt a hybrid approach of nature-based and grey infrastructure will be implemented downstream of the lakes to reduce the residual impacts of a GLOF after lake lowering, supported by gender-responsive watershed and national park management plans. These downstream interventions will include a combination of conservation ponds and flood walls to divert GLOF and flash flood flow and nature-based eco-engineering solutions for riverbank stabilization and flood mitigation. The implementation of lake lowering, hard infrastructure interventions and Eco-DRR will significantly reduce the exposure of vulnerable communities to climate risks, while increasing the adaptive capacity of those communities. This is expected to directly reduce the potential economic losses from GLOF events by US$ 45,126,562 – 86,919,219 (see Section D.6 for more detail on avoided losses).

133. This impact will directly benefit 385,956 people in Nepal (55% women and 45% men, 13% of the total population of Nepal) through glacial lake lowering, flood risk reduction and ecosystem restoration. Indirect beneficiaries will include 1,986,980 people in communities adjacent to the direct impact areas (Figure 17). Overall, the project interventions will increase the climate resilience of 10 districts in the target basins. This increased resilience will lead to US$ 45,126,562 – 86,919,219 in avoided losses in the event of a GLOF at the four most vulnerable glacial lakes, as well as an estimated 1,932 fewer lives lost. Further co-benefits will be achieved in terms of climate mitigation potential, with an estimated -339,480 tCO2-e of carbon sequestration anticipated through the project.

134. Project beneficiaries were assessed based on the areas of the Arun, Dudhkosi and Marsyangdi River Basins, where communities will benefit from glacial lake lowering and GLOF risk reduction, along with the restoration of degraded ecosystems in the Arun and Dudkhosi Basins that will trigger benefits for the populations living in the basins by improving ecosystem health. The estimated direct impact areas of Arun and Dudhkosi Basins are 5,115 km^2 and 4,063 km^2, respectively. The downstream impact areas of these basins are 856 km^2 and 1917 km^2, respectively. The impact area of the Marshyandgi Basin is 1917 km^2. There are 29 municipalities in the direct impact area of the Arun Basin, and 16 and 19 in the Dudkhosi and Thulagi Basins, respectively. The number of beneficiaries was taken as the population of these impact areas.[71]

[71] See Annex 27a for more detail on the methodology for assessing the beneficiary estimates.

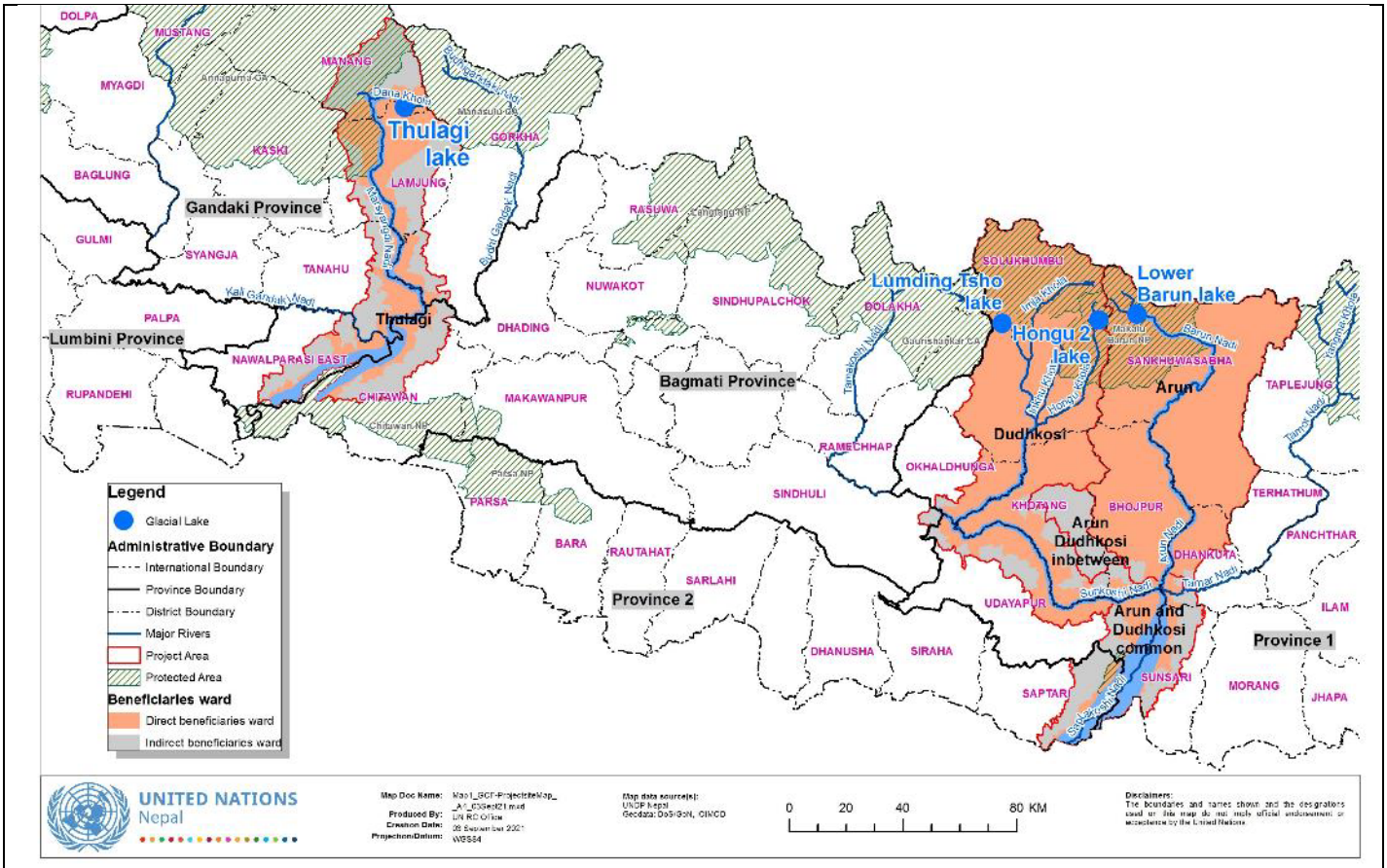

Figure 14. Map of the overall project sites and where direct and indirect beneficiary areas are delineated.

Core Indicator 5: Degree to which GCF investments contribute to strengthening institutional and regulatory frameworks for low emission climate-resilient development pathways in a country-driven manner.

135. Output 1 will strengthen the GoN's institutional and technical capacity to develop and integrate climate risk and hazard information into planning and development. Strengthening institutional and regulatory systems in Nepal will be achieved through the implementation of two project activities under Output 1. Under Activity 1.1, the existing knowledge base and technical capacities for improved climate research and risk reduction strategies will be strengthened. This will be achieved by developing methods and SOPs for the inventory and development of a spatial digital database (GIS) of glaciers and glacial lakes. This GIS database will be supported through geophysical investigations, as well as topographic and bathymetric surveys. In conjunction with the GIS database and surveys, methods and tools will be introduced into DHM's operating procedures for GLOF hazard prioritisation, as well as mapping other extreme events. Furthermore, the GIS database and surveys will inform the development of methodologies and SOPs for implementing integrated GLOF risk reduction in vulnerable watersheds, under this activity. The development and implementation of these methods and SOPs will ensure that DHM's institutional capacity for climate-responsive planning and development is strengthened. Under Activity 1.2, policy and financial mechanisms will be developed to promote the uptake of sustainable GLOF and flood risk information services and intervention strategies across the country. This will improve the capacity of DHM to develop and disseminate climate risk information to major economic sectors. By expanding DHM's ability to provide tailored climate risk information to the hydropower and tourism sectors, Output 1 will ensure that public-private sector partnerships that encourage future investment into GLOF risk reduction strategies are enhanced. Furthermore, long-term agreements to support the sustainable uptake of GLOF risk reduction in Nepal will be formalised and institutionalised through the development of policy provisions and extensive stakeholder consultations with relevant representatives from target sectors.

Core Indicator 6: Degree to which GCF investments contribute to technology deployment, dissemination, development or transfer and innovation

136. The effective use of climate information will be a central component of early action in response to an anticipated extreme climate event. Output 2 will the use of climate information by facilitating technology transfers to strengthen Nepal's GLOF early warning systems (EWS) as well as the capacity of DHM to facilitate rapid information sharing and early action preceding a GLOF. Under Output 2, Activity 2.1 will contribute to the generation of climate information through the installation of hydrological and meteorological stations across the prioritised GLOF

watersheds. The new stations will improve monitoring capacity and coverage in higher altitude areas, resulting in an increase in the reach of warning, adaptive capacity of communities and the number of lives safeguarded. The adaptation benefits of the hydrological and meteorological stations built under Output 2 will be enhanced by the capacity development initiatives under Outputs 1 and 2 of the project. By training DHM and NDRRMA staff through training workshops, the project will strengthen their capacity to use climate information for EWS decision making and developing early warning information products — specifically climate-responsive Municipal Disaster Preparedness and Response Plans and Local-level Climate-resilient Action Plans.

Core indicator 8: Degree to which GCF investments contribute to effective knowledge generation and learning processes, and use of good practices, methodologies and standards

137. The project will produce customised and targeted risk information for adaptation planning and early warnings that will provide strong incentives for private sector investment in future disaster risk reduction initiatives. This will include improving DHM's capacity for hazard mapping and prioritising GLOF risk reduction strategies; and establishing a GIS database, supported by geophysical investigation, as well as topographic and bathymetric surveys. Relevant staff from DHM will also be trained on monitoring GLOFs, operating and maintaining existing risk databases and disseminating tailored, user-friendly climate risk information to major productive sectors in Nepal, including hydropower and tourism sectors. These initiatives will provide the knowledge base required to mobilise resources to address climate change issues through PPPs. These PPPs will integrate project-generated risk analyses and requirements relating to climate change — as stipulated in national policies and plans.

138. In addition to contributing to the CGF's impact indicators, the project aligns with and contributes to several targeted results under the GCF-2 Strategic Plan for 2024-2027. This includes:

- Target 1 – NDCs, NAPs and LTS: Through the proposed project, GCF contributions will contribute directly to the implementation of Nepal's NAP, specifically in terms of establishing a GLOF risk reduction and early warning systems in glaciated river basins, which is identified as a key priority for the country.
- Target 3 – CIEWS: Output 2 of the proposed project will enhance CIEWs in Nepal through improved hazard monitoring and the generation and dissemination of early warnings to local communities and important economic sectors. This is linked with national targets of Sendai Framework for DRR (National DRR/ M Strategic Action Plan 2018-2030), Paris Agreement(NAP, NDC) and also EW4ALL Initiatives.
- Target 6 – Infrastructure: The risk reduction actions under Output 3 will build resilience of infrastructure in Nepal by reducing GLOF risk through both physical measures and EcoDRR measures.
- Target 9 – locally-led adaptation action: The project's approach will promote local ownership to adaptation action, as outlined in section D.5 below.

D.2. Paradigm shift potential (max. 500 words, approximately 1 page)

139. With the increasing intensity and risk of GLOF events, the Government of Nepal (GoN) has identified the existing model of reactive response to these extreme events as no longer appropriate and initiated a shift to proactive risk management measures that reduce GLOF risk before an event occurs. A shift towards this preventative and prepared model will better equip Nemal to manage and respond to GLOFs and associated flooding and other extreme events, such as landslides. Initial steps towards GLOF risk reduction involved lowering two priority lakes: Tsho Rolpa and Imja Glacial Lake. While these initial efforts were effective and had important demonstrative value, their implementation elucidated the need for further action to catalyse sustainable investment at scale and instituting GLOF risk reduction practice. The proposed project will propel the paradigm shift by establishing an enabling environment to catalyse investment into lowering other at-risk glacial lakes across Nepal. While this approach will facilitate public-private partnerships to promote investment, it will also enable the advancement in GLOF risk reduction in Nepal through the introduced capacities (tools, methods, technologies and institutional processes). Specifically, the proposed project will introduce an integrated approach that combines upstream risk reduction measures with downstream interventions and upgraded early warning systems (EWS) to address residual flood risks that remain after lake lowering. These proposed actions will be complemented by establishing an improved policy environment, demonstrating the complementarity between GLOF risk reduction and private-sector interests and leveraging further private investment. Importantly, this paradigm shift in GLOF risk reduction will go beyond the *status quo* of meeting immediate needs through project-based, externally funded disaster recovery towards comprehensive management that will break the current cycle of reactive, precarious and often expensive measures.

Potential for scaling up and replication

140. Twenty-one of the 47 potentially dangerous glacial lakes (PDGLs) identified in a 2020 report prepared by ICIMOD and UNDP, in collaboration with the government of Nepal (GoN), are located in Nepal. Of these 21 PDGLs,

the proposed project focuses on reducing the risk of a GLOF at the 4 most at-risk glacial lakes in Nepal, namely the Thulagi, Lower Barun, Lumding Tsho and Hongu 2 Lakes. Under the project, the water levels of these four lakes will be lowered (Activity 3.1), supported by the implementation of Eco-DRR interventions involving a combination of engineering (Activity 3.2) and nature-based solutions (Activity 3.3) to reduce the residual impacts of a GLOF event on vulnerable downstream communities. Such interventions have already proven to be successful in Nepal (as evidenced under the GEF-funded project, entitled *Community Based Flood and Glacial Lake Outburst Risk Reduction (2013—2017)* and by further demonstrating the tangible benefits from these interventions, the project will promote their use at the remaining 17 PDGLs in Nepal and across the Himalayan region. While not all of these lakes have been deemed to need specific, urgent intervention and others are currently not considered technically or economically feasible, climate change is continually altering the risk level of each lake. The risk monitoring systems under Output 1 will enable DHM to continually monitor the risk at each lake, and prioritise interventions as needed, ensuring that risks are identified and mitigated as they develop around each lake. Potential risk reduction measures identified for each PDGL are categorized as structural measures and non-structural measures, with varying levels of input required. This will create a national framework for ongoing action, ensuring that government funds available for GLOF are optimized, and external sources – including private sector partnerships – are sought to bridge finance gaps as the needs arise. While lake lowering is considered one of the more extreme measures for those most dangerous lakes, earlier interventions will begin with the scaling of non-structural measures such as EcoDRR and the expansion of GLOF EWS. The National Planning Commission's Mid-term Expenditure Framework (MTEF) already includes direct consideration of hydromet observation networks and EWS, providing the platform for DHM to expand these networks (for example through the establishment of new stations or upgrading of manual stations in other basins) as well as to carry out studies in high altitudes using regular government funding sources. Moreover, through DHM's close engagements and close relationships with various regional entities working in the GLOF risk reduction space, the lessons learned from the project implementation in the four target lakes will be shared broadly, ensuring that regional mechanisms currently under development consider and learn from the experiences in Nepal. The strong focus on knowledge and learning, as detailed in "Potential for knowledge management and learning" sub-section below will create the foundation for attracting and sensitizing potential donors and financial partners to support in scaling of project interventions to remaining PDGLs.

141. In addition to the interventions implemented under Output 3, the project will improve Nepal's EWS to strengthen adaptive capacity and response among vulnerable communities in the target districts of Manang, Sankhuwasabha and Solukhumbu. Training included under this activity will strengthen the capacity of DHM and NDRRMA and will support the upscaling of improved EWS beyond the target districts. In addition, this training will support the upscaling of multi-hazard assessments and integrated, climate- and gender-responsive watershed and national park management plans beyond the target districts and communities. The contribution of the project to the growing evidence base demonstrating best practices related to GLOF risk reduction, both within Nepal and internationally, will further support and enable project interventions to be upscaled and replicated. For example, the production of customised and targeted risk information will provide strong incentives for private-sector investment in future disaster risk reduction initiatives – including through public-private partnerships (PPPs) which will facilitate cost-recovery for climate information services as well as direct support for the expansion and maintenance of observational networks. This work in developing the foundation for ongoing PPPs will include a strong focus on demonstrating these benefits, alongside sensitising the private sector to the broader financial and economic benefits from the avoided loss and damage from GLOF risk reduction – for example the potential ~USD10–23M in prevented losses in the hydropower sector from the proposed risk reduction measures. The successful implementation of PPPs will provide a proof of concept to leverage future investment in similar impactful lake lowering and downstream interventions, while the partnerships created on the international stage through the close engagements with various regional entities working in the GLOF risk reduction space will help navigate the geopolitics of private investment in GLOF risk reduction in the region. Although the initial co-finance investments from IPPAN and NTB are limited, they demonstrate the willingness of the private sector to engage in partnerships that de-risk their businesses, including early warnings and flood risk mitigation. Both sectors have already indicated general buy in to the benefits of the proposed approach and interest in continued engagement beyond the project. It is anticipated that the improved understanding of GLOF risk and agreements facilitated by the project, combined with on-the-ground interventions, will have potential to leverage significant additional finance downstream of the project, particularly for eco-DRR interventions that align with watershed management investments of the hydropower producers.

142. The potential for scaling project interventions is boosted by the strong alignment with Nepal's 15th Five-year Development Plan. In particular, the project falls within the ambitions of Nepal's National Strategy 7 which prioritises the protection of land, forest and water resources, including a focus on strategies for climate change adaptability and disaster risk reduction.

Contribution to the creation of an enabling environment

143. To support the uptake of the new adaptation interventions in Nepal, an enabling environment will be created for enhanced planning for and response to GLOF events. Specifically, regulatory structures for improving watershed management and incorporating climate risk information into planning and decision-making will be developed under Activity 1.1. This will be supported by the establishment of mechanisms for private sector involvement in flood risk information services (Activity 1.2) to enable ongoing partnerships between the private sector and the DHM, which is mandated to generate and disseminate climate risk information to facilitate rapid response. DHM's capacity to fulfil its mandate will be strengthened by expanding the existing hydrometeorological monitoring network and improving its in-house capacity to undertake hazard mapping, climate research and risk reduction strategy development (Activity 2.1). These improvements will be complemented by establishing an enabling environment for early action and community-based disaster risk reduction for end-users of climate risk information through the development of EWS and community-based GLOF risk reduction activities (Activity 2.2). The implementation of downstream measures under Activity 3.3 will be supported by capacity development and training for government stakeholders (such as DHM and NDRRMA), community members, CBOs and NGOs. This training and capacity building will enable the development and implementation of multi-hazard assessment, and integrated, climate- and gender-responsive watershed and national park management plans. A key aspect of the a sustainable enabling environment is ensuring local ownership of project interventions. Please see Section B.6 for detailed discussion on how the project will promote the transfer of ownership to local entities – a concept that has been embedded throughout the project design.

Potential for knowledge management and learning

144. The project includes numerous activities that will contribute to knowledge management and learning. First, the project will contribute substantially to the body of knowledge on how to approach and undertake the highly technical task of lake lowering to reduce the risk of GLOF events occurring. Lake lowering is technically difficult and has only been done a handful of times in the Himalayas. The involvement of government institutions and the Nepalese army in implementing the lake lowering interventions for the proposed project will help to ensure that learning is held in institutional memory to benefit future GLOF risk reduction efforts. Second, Activity 1.1 will strengthen technical capacity for hazard mapping and creating systems for databasing climate-induced hazard, which will contribute to the longevity of technical flood risk reduction knowledge by making that information more widely accessible. Third, the design of the proposed project accounts for mutual learning and knowledge sharing by working with communities in the implementation, operation and maintenance of lake-lowering, downstream residual risk reduction interventions and EWS. Additionally, capacity development and training workshops will strengthen knowledge management and learning among government stakeholders, CBOs, NGOs and vulnerable communities. During implementation, opportunities for local and indigenous knowledge to be continually incorporated into DRR strategies will be sought.

145. The knowledge and lessons generated under the project will be properly archived within DHM, GoN, the Nepalese Army, UNDP as well as the communities in the project areas. Additionally, relevant knowledge products and lessons will be widely disseminated through national and internal media and communications events. Cross-institutional ties established under the project will support effective dissemination and utilisation of information for future GLOF risk reduction interventions beyond the project timeframe. Accordingly, the knowledge and learning gained from the project, along with the strengthened regulatory and institutional mechanisms, will help maintain an enabling environment for proactive approaches to GLOF risk management, thereby increasing the sustainability of the paradigm shift catalysed under the project.

D.3. Sustainable development (max. 500 words, approximately 1 page)

146. The proposed project will contribute towards achieving 4 of the 17 UN Sustainable Development Goals (SDGs). These are: SDG 3 — Good health and well-being; SDG 5 — Gender equality; SDG 11 — Sustainable cities and communities; SDG 13 — Climate action; and SDG 15 — Life on Land. The contribution of the proposed project to these SDGs aligns with Nepal's 15th Five-Year Development Plan (2019/20–2023/24) [72] by providing the Necessary Conditions (NCs) to achieve the country's goals and objectives. First, by contributing to SDGs 11 and 13, the project will assist in the achievement of the goals for multiple sectors outlined in the Development Plan, including: i) Disaster Risk Reduction and Management — To reduce human, material, economic, social, cultural, and environmental loss caused by all kinds of natural calamities and non-natural disasters; ii) Climate Change — To contribute to building a sustainable society by augmenting the capacity to adapt to climate change and minimizing its adverse effects; and iii) Hydrology and Meteorology — To help in protecting the lives and properties of citizens and support the development of sustainable infrastructure through reliable hydrological and meteorological services. Secondly, by supporting SDGs 3 and 5, the project will contribute to the country's goals in

[72] National Planning Commission, Government of Nepal. The Fifteenth Plan (Fiscal Year 2019/20 – 2023/24). Kathmandu. Available at: https://npc.gov.np/images/category/15th_plan_English_Version.pdf

the following sectors: i) Gender Equality and Women Empowerment — To achieve substantial gender equality by ensuring equal and meaningful participation of women; and ii) Inclusion — Inclusive development with the presence and meaningful participation of all citizens of the state. In addition, numerous environmental, social and economic co-benefits will be achieved through project interventions as described below.

Environmental co-benefits

147. Reducing the likelihood and impacts of a Glacial Lake Outburst Flood (GLOF) in Nepal, upgrading and expanding the country's existing hydrological and meteorological Early Warning Systems (EWS) and implementing downstream Eco-DRR solutions will yield several environmental co-benefits. These benefits are outlined below.

- The reforestation of mountain slopes, planting of grass seedlings and revegetation of riparian areas will contribute to improved soil stability and consequently reduce erosion. This will improve the quality of soils and promote infiltration of rainwater, which will reduce the impacts of intense rainfall on riverine areas.
- The reforestation interventions will also have a mitigation co-benefit, as the 4.6 million trees and other vegetation planted will sequester atmospheric carbon (490 ha of tree and vegetation coverage[73]).
- Preventing soil erosion, sequestering atmospheric carbon and creating environmental buffers, all of which will be restored and/or maintained through the project will contribute to regulatory environmental services in the target areas.
- Securing and improving freshwater supply and nutrient supply through reforestation and erosion reduction interventions will also contribute to environmental provisioning services in Nepal.
- Climate-related information collected by the upgraded EWS will be utilized by the agricultural sector to improve crop selection and harvest planning.

Social and Economic co-benefits

148. Reducing the risk of a GLOF and rainfall-induced floods occurring and severely impacting vulnerable communities in Nepal will increase the resilience of these communities and provide several social and economic co-benefits. These benefits are described below.

- Decreasing the amounts of stagnant water post-flood will reduce the prevalence of water- and vector-borne diseases. This outcome will alleviate the burden on post-disaster emergency response services and local healthcare systems.
- Involving community members living near and the target lakes in the construction process of lowering the target lakes will promote the uptake and ownership of this GLOF risk reduction measure beyond the project period which, in turn, will contribute to securing their lives and livelihoods under future climate change conditions.
- Improving preparedness of local communities for flood events through upgraded and expanded EWS and climate information services will reduce personal financial losses of community members. This is because communities will be better prepared to secure their personal assets in anticipation of a GLOF or rainfall-induced flood.
- Close engagements with Indigenous Peoples throughout the development of local early warning and response mechanisms will ensure the preservation of indigenous knowledge and promote inclusion of IPs in the decision making processes.
- The reduction in GLOF risk can be leveraged by the tourism industry to promote ecotourism activities in targeted watersheds. The anticipated increase in tourism will create employment opportunities for local workers and entrepreneurs, as well as yielding economic benefits to the communities.
- The interventions will reduce the severity of GLOF impacts on hydropower installations in the target area, benefitting the energy sector and supporting stable energy supply in the region. Decreasing the risk of severe damage to hydropower installations posed by flood impacts will not only decrease costs of physical damage (primary project benefit) but will also prevent long-term power supply loss after an extreme event. This, in turn, will enable relief efforts, communication networks and local businesses to continue operating as normal during and immediately after and extreme event.
- Multiple sectors will benefit from avoided and reduced damages, in particular the agriculture and tourism sectors, where agricultural productivity and infrastructure as well as tourism facilities will be safeguarded from the impacts of GLOFs. Local businesses and industry in the target areas will benefit as their infrastructure and operations will be less severely impacted, and these will all be supported by the benefits to the energy sector with reduced energy supply interruptions. This will also provide social co-benefits of food and income security. The agriculture and tourism sectors will also be supported through the environmental co-benefits listed above, as agricultural land and fertile soils will have reduced impacts and natural environments that attract tourists will also be less severely affected.

[73] This value is calculated by adding together the area covered by the grass seedlings (298,162 m^2) and the 4.6 millions trees (4,600,000 m^2). Figure 16 was used to calculate the area covered by the 4.6 million trees.

- Reducing damages caused by a GLOF will decrease the time required for economic sectors to become operational and for communities to recover immediately following GLOF or rainfall-induced flood events.
- Training community members living near and the target lakes on the engineering and civil works required to lower the target lakes will embed the skills and knowledge of this process within the communities. This will not only contribute towards securing the sustainability of this adaptation measure, but also substantially improve the employability — and subsequently livelihoods — of participating community members to undertake similar construction, engineering and civil works in the future as the demand for such expertise increases under climate change conditions.

Gender-sensitive development impact

149. The reduction in the likelihood and potential impacts of GLOFs will help to limit the disruptions to critical health, education and care services following these events. Given the gendered demographics of the employees and users of these institutions, as well as gendered vulnerability to climate change, the project will facilitate gender-sensitive development, as described below.

- Reducing disruptions to the functioning of public buildings and the delivery of primary services will enable both women and men's economic and household activities to resume without unnecessary delay, following GLOF or rainfall-induced flood event.
- The project gender action plan (GAP) has outlined actions to promote gender equality in project implementation that include: i) development of a practical Gender Equality and Social Inclusion (GESI) working strategy guideline for rural municipalities and wards; ii) measures to support and increase women's and socially excluded groups' effective and meaningful decision-making on climate change induced disaster iii) integration of GESI into Climate Change Adaptation (CCA) or Disaster Risk Reduction (DRR) or GLOF-related training manuals and organisation of participatory GESI awareness workshops. There will also be integration of GESI into CCA, DRR and GLOF risk management training and coaching; iv) Updating EWS knowledge products, training manuals, methods and approaches to make them responsive to the experiences of women and highly marginalized groups; v) Integration of GESI in the development of long-term integrated watershed management strategy for managing GLOF risks for each glacial watershed.
- Women's groups already play a critical role in Community-Based Flood Early Warning Systems (CBFEWS) in Nepal. The GAP prioritises collaboration with these groups to improve GESI throughout all stages of the project, seeking to support and expand these groups through the project activities, including to increase decision making and leadership opportunities and engagement.
- Through these measures, the project addresses the underlying factors contributing to gender inequality in the country, thereby contributing to gender-sensitive sustainability beyond the project's lifetime.

D.4. Needs of recipient (max. 500 words, approximately 1 page)

Vulnerability of the country

150. Nepal is one of the most vulnerable countries in the world to climate change-induced disasters, ranking within the top 10 countries most affected by climate change on the long-term global Climate Risk Index from 2009 to 2019[74]. The country's Second Nationally Determined Contribution (NDC) identifies several primary reasons for the country's vulnerability, including: i) the country's fragile topography; ii) climate sensitive livelihoods of the people; and iii) limited adaptive capacity[75].

151. Reports from Nepal's Ministry of Home Affairs (MoHA)[76] indicate that over the past 10 years, more than 4,000 people have died from climate change-induced disasters. Moreover, these disasters have resulted in accumulated economic losses of US$5.34 billion as of 2015[77]. In particular, the frequency of GLOFs has already increased, with this trend expected to continue under future climate change conditions[78]. Such events have severe impacts on Nepal — including loss of lives and livelihoods, and damages to infrastructure and transportation routes — and are exacerbated by the country's economic composition. For example, tourism makes up a large portion of the country's GDP, accounting for 6.7% in 2019[79]. The aftermath of extreme events significantly reduces tourist activity and damages vital infrastructure for these industries. This not only affects revenue generation but also leads to

[74] Global Climate Risk Index 2021. More information available at: https://reliefweb.int/sites/reliefweb.int/files/resources/Global%20Climate%20Risk%20Index%202021_1_0.pdf
[75] Adaptive capacity relates to the capacity of systems, institutions, humans and other organisms to adjust to potential damage, to take advantage of opportunities, or to respond to consequences.
[76] Nepal Ministry of Home Affairs (MoHA) Nepal Disaster Report, 2019.
[77] Nepal Ministry of Home Affairs (MoHA). Disaster Preparedness Network, 2018.
[78] Further details on observed and projected GLOF events are presented in Section 3.2 of Annex 2: Feasibility Study.
[79] Travel & Tourism Economic Impact 2020. Nepal. 2020. World Travel and Tourism Council (WTTC)

increased unemployment in the tourism sector. The impacts of GLOFs and other extreme climate events — such as landslides and extreme flooding — also hinder the development of Nepal's hydropower potential. While developing this sector would be crucial for the country — which currently ranks 137th out of 147 countries on a scale of quality of electricity supply[80] — current run-of-the-river hydropower plants[81] are dependent on rainfall patterns for continued power supply from water flow. These hydropower plants are therefore extremely vulnerable to climate change, evidenced by power shortages that are experienced during the dry season when energy demand rises as water flow decreases. This problem will become increasingly severe under future climate change conditions, where more variable rainfall patterns and longer dry seasons are expected.

Vulnerability of beneficiary groups

152. While poverty has decreased in Nepal in recent years from 68% of the population in 1996 to 25% in 2011[82], this progress is not equally spread across the country. Some social groups and geographical areas remain far below the national income poverty line of US$1.90/day[83]. In particular, economic and human development has been constrained in the country's mountainous Himalayan region where the proposed project's target basins — the Arun and Dudhkoshi Sub-basins — are located. This is largely because these areas are inaccessible to the majority of the population and extremely vulnerable to GLOFs, flooding and other extreme events such as landslides. These events cause significant damage to important infrastructure, including roads, which provide access to food supplies, goods and disaster relief services. This results in critical services becoming non-operational, leading to further reductions in economic productivity and increases the vulnerability of target communities. Moreover, vulnerable communities in the project areas are impacted by climate change because their livelihoods (e.g. agriculture and tourism) are concentrated in downstream areas which are exposed to the flooding and landslides caused by GLOFs. A low capacity to manage or respond to risks to mitigate the negative effects of climate change impacts further compounds the pressure on these communities.

Socioeconomic status

153. Nepal's Human Development Index (HDI) value for 2019 was 0.602, which ranks at 142 out of 189 countries and territories, placing the country in the "medium development" category. While Nepal's HDI has increased from 0.380 in 1990 and major poverty reduction has been achieved in recent years, Nepal still ranks below most neighbouring countries' HDI values. In addition to an increased HDI, the country has also seen an increase in its Gross National Income (GNI) per capita by 151% from 1990 to 2019[84]. Despite this, recent surveys of national living standards indicate that 30% of the population live below the national poverty line of US$1.90/day[85]. Current costs associated with the impacts of climate change and extreme events are estimated at US$270-360 million per year, approximately 1.5 to 2% of the country's 2014 GDP[86].

Institutional capacity needs

154. The Government of Nepal (GoN) currently has limited technical capacity and institutional capacity to implement efficient and effective GLOF and disaster risk reduction measures. This results in national- and local-level decision-makers becoming locked into a cycle of reacting to GLOFs and other extreme events, as opposed to developing pre-emptive measures to mitigate the impacts and risks of GLOFs in Nepal. There is therefore an urgent need to: i) improve the country's GLOF EWS; and ii) develop comprehensive preparedness plans to facilitate proactive action and rapid response to impending GLOFs, flooding and other extreme events.

D.5. Country ownership (max. 500 words, approximately 1 page)

155. Managing the impacts of GLOFs, climate change-induced flooding and other impacts of extreme climate events (such as landslides and heatwaves) are high priorities for the GoN. This is evident in the government's preparation of several national policies and strategic plans focused on climate change adaptation, with which the project is strongly aligned. The project's alignment with these priorities and plans is described below.

156. **The GoN's Climate Change Policy (2019)** is being implemented by numerous sectoral ministries and subnational entities to address the impacts of climate change in the country[87]. Its objectives are to: i) enhance climate change adaptation capacity of communities vulnerable to climate change; ii) increase resilience of

[80] ADB. 2015. Asian Development Outlook 2015: Financing Asia's Future Growth. Manila.
[81] Run-of-the-river hydroelectricity is a type of hydroelectric generation plant with no water storage at all or a limited amount of storage.
[82] Country Poverty Analysis – Nepal, Asian Development Bank 2017. More information available at: https://www.adb.org/sites/default/files/linked-documents/cps-nep-2013-2017-pa-detailed.pdf
[83] World Bank, 2019. More information available at: https://data.worldbank.org/country/NP
[84] Human Development Report 202, UNDP. More information available at: http://hdr.undp.org/sites/all/themes/hdr_theme/country-notes/NPL.pdf
[85] World Bank, 2019. More information available at: https://data.worldbank.org/country/NP
[86] IDS-Nepal, PAC and GCAP. 2014. Economic Impact Assessment of Climate Change in Key Sectors in Nepal. Kathmandu, Nepal: Integrated Development Society (IDS).
[87] GoN. 2020. Climate Change Policy, 2076.

vulnerable ecosystems; iii) promote a transition to a green economy; iv) mobilise national and international financial resources for climate change adaptation and mitigation; v) mainstream climate change issues into national and subnational policies, strategies and plans; vi) mainstream gender equality and social inclusion into climate change programs; and vii) increase the use of reliable forecasting in planning for disaster risk reduction[88]. In alignment with these objectives, the proposed project will facilitate adaptation to climate change by reducing the exposure and impacts of GLOFs and flooding on vulnerable communities. In particular, under Output 2 early warning systems (EWS) will be developed for improved disaster risk reduction (DRR) monitoring, response and information dissemination to communities vulnerable to GLOFs.

157. **The Country Programme Document for Nepal (2023-2027)** outlines UNDP's contributions to Nepal's development in three main areas of work, namely inclusive economic growth, strengthened governance systems and increased climate adaption and environmental resilience. Specifically, the document provides an overview of the country's five-year development ambitions led by UNDP based on nation-wide consultations, the SDGs and Nepal's Fourteenth Development Plan. Key priority areas for the country programme include to: i) promote inclusive and resilient economic growth founded on decent jobs, an integrated social security and protection system and sound policies that enhance productivity and investments and reduce multidimensional poverty; ii) improve the coherence and quality of governance across the three tiers of government to ensure constitutional rights, access to justice and empower people, especially women and marginalized communities, to exercise agency over their lives; and iii) advance resilient and sustainable systems for use of natural resources through public policies, strong institutions and active community participation[89]. The proposed project is well aligned with the country programme as vulnerability to climate change-induced GLOFs and flooding will be addressed through a variety of activities, including lake lowering and diversion infrastructure, eco-DRR, and EWS monitoring improvements. Furthermore, the project will develop local and national technical capacity for understanding and utilising climate risk and hazard information (Output 1). This will include strengthening the institutional knowledge-base and developing policy and fiscal mechanisms for information services focusing specifically on GLOF and flood risk.

158. **Nepal's National Adaptation Programme of Action (NAPA)** (2010) identifies the GoN's priority activities towards climate change adaptation[90]. These priority profiles, as related to flood risk reduction, include: i) promoting community-based adaption through integrated management of the agricultural, water, forest and biodiversity sectors; ii) community-based disaster management for facilitating climate change adaptation; iii) GLOF monitoring and disaster risk reduction; iv) ecosystem management for climate change adaptation; and v) empowering vulnerable communities through sustainable management of water resources and clean energy supply[91]. The proposed project will contribute towards the NAPA's goals of addressing GLOF and flooding risk, as well as adaptation and community upliftment by i) directly lowering GLOF and flooding risk through lake lowering and check dam installation (Output 3); ii) improving observation networks for increased monitoring and response capacity (Output 2); iii) supporting institutional knowledge and technical capacity for improved planning and response (Output 1); and iv) developing mechanisms for strengthened policy and fiscal access for GLOF and flood risk information services (Output 1).

159. **The National Adaptation Plan (NAP)** (2021–2050) comprises 64 priority programmes and sets a framework to reduce vulnerability and build Nepal's resilience to climate change by integrating adaptation across various sectors and levels of government[92]. The process of developing Nepal's NAP included engagement with a wide range of stakeholders to establish a sustainable enabling environment through strategic institutional arrangements across governance levels[93]. In addition, the NAP aligns with critical international frameworks, including the Nationally Determined Contributions (NDC), Sustainable Development Goals (SDGs), United Nations Convention of Biodiversity (CBD), United Nations Convention to Combat Desertification (UNCCD), and the Sendai Framework for Disaster Risk Reduction[94]. Priority sectors relating to flood risk include: i) forest, biodiversity and watershed conservation; ii) water resources and energy; iii) rural and urban settlements; and iv) disaster risk reduction and management[95]. The NAP will be reviewed and updated in 2031 to account for social, economic, political, legal and climate risk changes. The priorities of Nepal's NAP comprise programmes in eight thematic and four cross-cutting sectors, spanning short, medium and long-term time frames. The proposed project is aligned with Nepal's NAP

[88] GoN. 2020. Climate Change Policy, 2076.
[89] UNDP. 2022. Nepal Country Programme 2023-2027.
[90] GoN. 2010. National Adaptation Programme of Action (NAPA) to Climate Change. Available at: https://www.adaptation-undp.org/sites/default/files/downloads/nepal_napa.pdf
[91] GoN. 2010. National Adaptation Programme of Action (NAPA) to Climate Change. Available at: https://www.adaptation-undp.org/sites/default/files/downloads/nepal_napa.pdf
[92] GoN. 2021. National Adaptation Plan 2021-2050.
[93] MoFE, 2019. Climate change scenarios for Nepal for National Adaptation Plan (NAP). Ministry of Forests and Environment, Kathmandu.
[94] GoN. 2021. National Adaptation Plan 2021-2050.
[95] GoN. 2021. National Adaptation Plan 2021-2050.

priority to establish GLOF risk reduction and early warning systems in glaciated river basins as this will: i) control climate-induced disasters through lake lowering, GLOF diversion and downstream activities (Output 3); and ii) strengthen monitoring systems by improving the observation network density and implementing early warning systems (Output 2).

160. **Nepal's Third National Communication (TNC)** to the UNFCCC (2021)[96] presents an overview on the projected climate change impacts for Nepal and identifies the national climate change adaptation and mitigation priorities which includes an indication of the country's current greenhouse gas (GHG) inventory. The adaptation priorities in the TNC focus on the need to adapt to the impacts of increasing annual mean temperature and increasingly frequent extreme climate events such as GLOFs and monsoon flooding. The project will contribute to the objectives of the TNC by reducing risk associated with climate change impacts, particularly vulnerability of downstream communities to glacier retreat and Glacial Lake Outburst Floods (GLOFs), including eco-DRR reducing measures and lake lowering (Output 3). The TNC includes a GLOF vulnerability ranking of different districts in Nepal — six as very highly vulnerable, six more as highly vulnerable and seven as moderately vulnerable — of which the proposed project's intervention sites are aligned with.

161. In its **Second Nationally Determined Contributions (NDC)** (2020)[97], Nepal identifies mitigating GHG emissions and undertaking studies and actions for adaptation as critical actions to reduce the impacts of climate change in the country. Nepal's contributions are conditional on bilateral and multilateral grant support to strengthen limited national resources and technical capacities for scaling up climate action. While this project will not directly contribute towards mitigation objectives, it recognises the need for climate change mitigation as global warming is causing the accelerated rate of glacial melt, increasing GLOF risk. The proposed project is aligned with the NDC, which acknowledges DRR and management as an adaptation priority to increase climate resilience in the country.

162. **Nepal Disaster Risk Reduction National Strategic Plan of Action (2018–2030)**. This action plan was prepared by the GoN with the endorsement of Nepal's National Disaster Risk Reduction and Management Council. The plan's objectives are in line with the Disaster Risk Reduction and Management Act (2017) as well as the National Strategy on Disaster Risk Management (2009). Accordingly, the plan serves as the policy framework for DRR planning, guidance and management in Nepal. In particular, the action plan focusses on: i) improving understanding of disaster risk through multiple assessment types; ii) strengthening multi-level disaster risk governance; iii) promoting investment in DRR based on comprehensive risk information; and iv) improving disaster preparedness and integrating "build back better" approaches during recovery from extreme events[98]. Moreover, the plan highlights the following as some of the most pronounced types of disasters experienced by the country: i) road accidents; ii) epidemics; iii) earthquakes; iv) landslides; v) floods; vi) snowstorms and avalanches; and vii) droughts[99].

163. **The Sendai Framework for Disaster Risk Reduction (2015–2030)**[100] — of which the GoN is committed to implementing — aims to substantially reduce disaster risk and losses in lives, livelihoods and health, as well as in the economic, physical, social, cultural and environmental assets of people, businesses, communities and countries. The framework identifies four priority actions to achieve this goal, namely: i) Priority 1 — Understanding disaster risk vulnerability, capacity, exposure of people and assets, hazard characteristics and the environment; ii) Priority 2 — Strengthening disaster risk governance at national, regional and global levels to ensure effective and efficient management of disaster risk; iii) Priority 3 — Investing in disaster risk prevention and reduction through structural and non-structural measures to enable appropriate resilience; and iv) Priority 4 — Enhancing disaster preparedness for effective response and to "Build Back Better" in recovery, rehabilitation and reconstruction.

164. **The Environmental Protection Act (2019).** The Environmental Protection Act aims to amend and consolidate legislation relating to the natural environment. The act includes, *inter alia*: i) the required information for approving the preparation of environmental studies — including strategic environmental analyses and EIAs — while granting powers to relevant agencies to conduct these studies; ii) necessary legislation to control pollution and hazardous material disposal and their inspection; iii) provisioning for climate change adaptation and mitigation plans; iv) the

[96] Ministry of Forests and Environment. 2021. Third National Communications to the UNFCCC. Available at: https://www.mofe.gov.np/downloadfile/Nepal_TNC%20Rep_1627452942.pdf
[97] GoN. 2020. Second Nationally Determined Contribution (NDC). Available at: https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Nepal%20Second/Second%20Nationally%20Determined%20Contribution%20(NDC)%20-%202020.pdf
[98] GoN. 2018. Disaster Risk Reduction Strategic Plan of Action. Available at: https://app.adpc.net/sites/default/files/public/publications/attachments/DRR%20National%20Plan%20of%20Action%20%28Nepal%29.pdf
[99] GoN. 2018. Disaster Risk Reduction Strategic Plan of Action. Available at: https://app.adpc.net/sites/default/files/public/publications/attachments/DRR%20National%20Plan%20of%20Action%20%28Nepal%29.pdf
[100] UN. Sendai Framework on Disaster Risk Reduction (2015–2030). Available at: https://www.preventionweb.net/files/43291_sendaiframeworkfordrren.pdf

safeguarding of national heritage sites and environmentally protected areas; and v) penalties for environmental transgressions[101]. In addition, the act legislates climate change risk management and the production of technical standards to determine priority areas. Carbon trading for mitigation purposes is also legalised under the act, which subsequently makes provision for the prescribed legislature to regulate the trade[102].

165. **The Fifteenth Plan (2019/2020 – 2023/24).** The project aligns with the priorities laid out in the GoN's 'Fifteenth Plan' 5-year development plan. Specifically, the long-term national strategies identified in the Fifteenth Plan include the conservation and sustainable utilization of natural resources and improve resilience. The 5-year plan for the sustainable use of natural resources targets increasing national forest density by 5% — a target that the project will directly contribute toward reaching. The project also contributes to several of the Plan's identified drivers of transformation, including through its benefits to hydroelectric power and promotion of a green economy and the development of tourism services. The Fifteenth Plan also directly prioritized climate action, with the goal to "contribute to building a sustainable society by augmenting the capacity to adapt to climate change and minimizing its adverse effects". To this end, the Plan highlights several key strategies that the project will contribute to, including: i) improving policy and institutional structures at federal, provincial, and local levels for climate change management; ii) implementing national, provincial, and local adaptation plans to reduce the vulnerability of communities; and iii) carrying out research and capacity-building activities in the field of climate change. Closely linked with the climate action ambitions, the Fifteenth Plan prioritizes the development of the hydrometeorological services, with the goal of "protecting the lives and properties of citizens and support the development of sustainable infrastructure through reliable hydrological and meteorological services".

Stakeholder engagement

166. The project was developed in a participatory way in collaboration with stakeholders from relevant Nepalese government ministries and departments, civil society organisations (CSOs) and private sector entities. The Nepalese Ministry of Finance (MoF) — the Nationally Designated Authority (NDA) for the project — is responsible for the overall management of GCF engagement in Nepal and has been engaged throughout the project development phase. All entities engaged during project development are listed below; further information can be found in Annex 2.

- The Ministry of Energy Water Resources and Irrigation (MoEWRI): The MoEWRI is the Executive Entity of the proposed project and is facilitating the internal GoN project advisory council- Project Steering Committee and providing support for the project. This ministry also houses the DHM, one of the project implementing units (PIU) for the proposed project.
- The Ministry of Finance (MoF): As NDA for the proposed project, the MoF is involved in project oversight and internal government coordination.
- The International Centre for Integrated Mountain Development (ICIMOD): This pan-Himalayan research intergovernmental organisation (NGO) has provided scientific background information and shared their expertise on glacial and high-mountain regions to the proposal development team. ICIMOD plans to work closely with UNDP and the Executing Entity/Implementing Partner (EE/IP) to help perform risk analyses, provide mapping support, and enable capacity development for DHM and other GoN stakeholders.
- Nepal Federation of Indigenous Nationalities (NEFIN): This organisation, in collaboration 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 Forests and Soil Conservations (DoFSC): The DoFSC, also under the MoFE, will be an implementation partner along with DHM and has been consulted about linkages with this project and ongoing basin planning in Nepal.
- Hydropower companies and numerous coordinating organisations have readily participated in stakeholder workshops and will be consulted separately as part of a market analysis and other market-related efforts.
- The National Trust for Nature Conservation (NTNC) and Alternative Energy Promotion Centre (AEPC): These are the two GCF Direct Access Entities (DAEs) in Nepal and will be involved in the proposal and project implementation processes to enable capacity development in the country.
- National Disaster Risk Reduction and Management Authority (NDRRMA) will be a responsible party and coordinate with the Local Disaster Management Committees (LDMCs).
- Nepal Federation of Indigenous Nationalities (NEFIN) undertook consultations with indigenous peoples from specific villages of the Koshi and Gandaki river basins. These consultations were conducted with indigenous peoples who are impacted by flooding (both glacial lake outbursts and rainfall-induced) and other climate-

[101] GoN. 2019. Environmental Protection Act (2076). Available at: www.lawcommission.gov.np
[102] GoN. 2019. Environmental Protection Act (2076). Available at: www.lawcommission.gov.np

induced disasters. Consultation details can be found in Annex 7: Project Governance and Institutional Arrangement.

- Regular consultation to engage the Federation of Community Forestry Users Nepal (FECOFUN), their member networks and Community Forestry User Groups (CFUGs) were carried out during project development. During the project implementation, FECOFUN or their members will engage at different scales from central level Project Steering Committee (PSC) to local level project implementation. They may also represent the Local-level Disaster Management Committee (LDMC).
- Ministry of Federal Affairs and General Administration (MoFAGA).
- The Ministry of Home Affairs (MoHA).
- Department of Water Resources and Irrigation (DoWRI).
- The Water and Energy Commission Secretariat (WECS).
- The National Planning Commission (NPC).
- Kathmandu University (KU).

167. The project was developed following an extensive stakeholder engagement process, beginning with initial institutional and community consultations held during the first phase of project design. These engagements included two separate workshops as well as numerous individual consultations that were held in May 2017. The focus of these engagements was on identifying the broad needs and vulnerabilities within the project's target areas, which were incorporated into early project design. In August 2017 in Kathmandu, further stakeholder engagements were conducted focusing on defining priorities for project formulation. Similar to the initial phase, stakeholders consulted in these engagements included relevant government ministries and departments, CSOs, and private sector entities to validate the design of the project and ensure alignment with national priorities. More than 450 representatives were consulted to ensure local ownership of the project and to adequately capture the needs of communities. In this context, stakeholder engagement was primarily intended to:

- ensure that expectations and concerns of local stakeholders were incorporated into project design and implementation;
- establish rapport with beneficiary communities to encourage local buy-in for the project;
- identify a range of desired gender-related development impacts of climate change projects in the target sites and to ensure that such impacts are incorporated into the design framework;
- support responsible parties in preparing gender assessments and action plans; and
- ensure that all stakeholders, especially women, are effectively involved and equally represented throughout the project design and implementation process.

168. In addition to these consultations, UNDP is working with two national organisations specialising in Indigenous Peoples (IPs) and rural stakeholder engagement to ensure appropriate consultation occurs at the local level throughout the project area. This includes a three-day Consultation Workshop with indigenous peoples from January 16-18, 2018 organized in Pokhara, followed by community visits to conduct key informant interviews and collect additional information. Detailed consultations were also held as part of the gender assessment process. These included key informant interviews (KIIs), Focus Group Discussions (FGDs), and observations with key GLOF/CC/DRR-related personnel/members, partners and community people (government, NGOs, federations/networks/groups, diverse community people) at federal, district and local community levels. Field level consultation were carried out with women and men from diverse groups, with efforts to target individuals who were not included in community groups represented at other community meetings. Further details on these consultations are provided in the relevant IP and Gender annexes. More recently, several further engagements were held in August 2023 and again in January 2024 in partnership with the Nepal Federation of Indigenous Nationalities (NEFIN). During these consultations, support was shown for the general project design, while stressing the need for urgent action. In addition to validating the design, indigenous communities highlighted some of the specific actions that should be followed during implementation – including continued engagement and FPIC processes, as well as guaranteeing the long-term preservation of cultural, religious and tourism sites in project areas. Several recommendations were made to ensure inclusive involvement of indigenous communities in the project, including creating employment opportunities for indigenous households.

D.6. Efficiency and effectiveness (max`. 500 words, approximately 1 page)

169. The economic viability of the proposed programme was assessed by making a cost benefit analysis model that attempted to analyse the quantified value of the benefits flowing to the affected communities and compared them to the costs of mounting the interventions under the proposed programme. The economic analysis mainly considered the following benefits of the programme:

- loss of lives averted;
- damage to buildings / houses averted;
- loss of agricultural produce averted;
- damage to hydropower projects averted; and

- loss of tourism income averted.

170. This decrease in damages was calculated by comparing the expected amount of damage or losses in the no-intervention scenario, to the expected amount of damage in the post-intervention scenario. The damage numbers were taken from experts' report titled: 'Residual Risk Modelling & Watershed/Sub-watershed Vulnerability Assessment'.[103] To design optimal interventions downstream of the four glacial lakes, experts modelled the expected peak flood flow from GLOFs on the four lakes, in a number of scenarios. They utilized Hydrologic Engineering Center's River Analysis System (HEC-RAS) for the modelling, and reported on the expected damages sustained in the case of no-intervention on the lakes and a complete breach of the moraine dam; only lake-lowering done on the lakes to the recommended depth of 1-3 meters and a complete breach of the moraine dam; a partial breach of the moraine dam after lake lowering has been done; and a partial breach after lake lowering but with suggested downstream measures in place, to assess the effectiveness of the suggested risk reduction measures.

171. This data on damages in different scenarios was used to work out the expected benefit, in terms of loss avoided, due to the implementation of the programme. Values also had to be assigned to lives, buildings, agricultural land and hydropower projects. The value of lives was taken as the Value of a statistical life in the US proportional to the GDP per capita ratio between the two countries.

172. It isn't known when a GLOF event would occur with any certainty, therefore the benefit was normalised by factoring in the probability of a GLOF event occurring at any point in time during the appraisal time horizon of 25 years. Two different methods were used to assign probability to the risk of a GLOF. One of the ways was by reviewing published papers, and ICIMOD documents for recorded GLOFs that had the potential of causing damages in 37 years from 1980 to 2017. Assuming that such events could only have occurred from lakes which at that time would have been classified as 'Potentially Dangerous Glacial Lakes (PDGLs)' if an inventory had been taken at that time, a simple proportion of the number of events that occurred versus the number of lakes in existence in the number of years was worked out. Considering there are 21 identified PDGLs, and nine recorded GLOFs that were significant enough to cause some damage occurred in the past 37 years, the annual probability of a GLOF on any one lake worked out to 1.16%.

173. The probability was also calculated from return period data from a paper published in the journal: 'Proceedings of the National Academy of Sciences of the United States of America' (PNAS). The researchers have used statistical methods to infer lake volumes from lake areas known through satellite data and used that in simulated scenarios to predict the sizes and frequency of future GLOF events in the entire Himalayas. Since the four intervention lakes are all located in Eastern Himalayas, the return period on flood volumes was matched with the expected flood volume from the four intervention lakes. The return period was then made into the annual probability[104]. This method calculated a separate annual probability for each glacial lake which is listed in Table 7 below.

Table 4. Annual probability of GLOF occurrence at each of the four target glacial lakes.

Glacial Lake	Annual Probability
GL21-Lower Barun	0.50%
GL24-Hongu 2	1.33%
GL45-Thulagi	0.91%
GL30-Lumding Tsho	0.56%

174. By multiplying the annual probability with the value of expected losses in case a GLOF event occurs in the absence of an intervention and comparing that with the expected losses after the intervention, a value was assigned to the benefits of pursing the interventions under this proposed programme. This was compared with costs and the

[103] The GLOF intensity and potential damages were based on HEC-RAS modelling, underpinned by assumptions that a breach would reach all the way to the bottom of the lake, resulting in a large flood flow simulation. This assumption leads to high damage estimates, even in the post-lake lowering scenario, and consequently, suggests only marginal improvements in reducing damage. While the model's use of a full breach scenario was based on available data, it is important to note that a breach all the way to the bottom of the lake is highly unlikely. As such, the actual risk and potential benefits of lake lowering may be more significant if a partial breach scenario were considered, as experts have indicated that a breach in the range of 5 to 8 meters is much more plausible. However, due to the unavailability of specific data for partial breach scenarios, the model has had to rely on the extreme breach assumption, which limits our ability to fully assess the real-world effectiveness of lake lowering.

[104] Note: These probabilities are based off of historical data, and not specific future climate scenarios. There is currently no established literature directly assessing how different climate change scenarios will impact GLOF probabilities. However, given that climate change is expected to increase GLOF risk, these probabilities are considered conservative under future climate scenarios.

time value of money factored in using a discount factor to work out the Net Present Value of the Programme. The summary of base case results is given below in Table 8.

Table 5. Calculated Net Present Values (NPV) for each of the four target glacial lakes for Scenario I and Scenario II.

Scenario	BCR	NPV (USD)	NPV Lake Lowering (USD)	NPV Downstream (USD)
Scenario I (1.16% Annual Probability)	4.90	86,919,219	13,678,594	77,474,084
GL21		47,832,223	18,591,035	30,299,553
GL24		10,786,354	-2,423,237	14,267,956
GL45		16,814,961	-3,077,784	20,951,110
GL30		11,485,681	588,581	11,955,465
Scenario II (Return period based Probability)	3.75	45,126,562	-236,142	49,596,163
GL21		16,666,744	6,344,492	11,380,616
GL24		13,255,431	-2,392,207	16,706,003
GL45		12,090,478	-3,099,537	16,248,380
GL30		3,113,910	-1,088,890	5,261,165

175. Lake lowering alone appears, from the data we have, not to be beneficial because the HEC RAS modelling showed only a minor improvement in damages between the do-nothing scenario and the post lake lowering scenario. This could be because the HEC RAS modelling was done for a breach all the way to the bottom of the lake for the no intervention and post lake lowering scenarios. Both cases modelled a large peak flood flow, and therefore damages are high. The authors of the report note that 'these scenarios are not expected to occur'. In the absence of damages data for a scenario where a GLOF occurs with a breach at this likely depth, a conclusion cannot be drawn from the negative NPV result about the lack of economic viability of lake lowering as an intervention.

176. Overall, both the base-case scenarios show a positive overall NPV and high benefit cost ratio. In these two scenarios, the investment pays off well. The planned programme interventions have the potential in case a GLOF event happens to save 1932 lives, 420 houses, 1201 hectares of cultivated land and 8180 GWh of electrical production.

Application of best practices for the proposed project

177. Best practices from several other past and ongoing initiatives were used to inform the design of GLOF risk reduction interventions to be implemented under the proposed project. Lessons learned from numerous baseline investments into climate change adaptation in Nepal were also used to guide the design of all project interventions. Such lessons include appropriate mechanisms for ensuring that project activities are implemented in a participatory, gender-inclusive and sustainable way. The specific international best practices and lessons learned that were applied to the design of the proposed project — and that will contribute to the efficiency and effectiveness of project interventions — are summarised below. Specific details on all best practices and lessons learned relevant to the project are presented in Section 9 of Annex 2: Feasibility Study.

International best practices and lessons learned identified for the project include:

- drawing on the technical capacity of the Nepalese Army and DHM to undertake the planning and implementation of lake lowering activities;
- constructing check and detention dams to manage high volumes of water in high flood risk areas by detaining the increased volume of water in the dams and gradually releasing it at a controlled rate;
- installing protective transverse and longitudinal structures (including gabion spurs, flood walls, RCC revetments, conservation ponds and live check dams) to stabilise riverbanks, and direct water away from high-risk communities, infrastructure and land;
- implementing relevant nature-based solutions such as tree planting along vulnerable riverbanks, vegetative gabion walls, vegetative gabion revetments, vegetative gabion check dams, vegetative stone rip-rap, bush layering and planting grass seedlings;
- ensuring effective operations and maintenance (O&M) by establishing SOPs for GLOF risk reducing systems and equipment, including lakes lowered under the project, observation networks for hazard monitoring, community-based early warning systems, nature-based solutions and the database for climate-induced hazards;
- using remote sensing via satellite tracking to trace interannual changes in glacial lakes;

- installing climatological stations and high-altitude meteorological stations and integrating existing hydrology stations into a real-time data acquisition system to expand the reach and usability of monitoring systems;
- developing SOPs and methods for relevant assessments to inform effective project implementation, including for hazard prioritization and mapping, and geophysical, topographic and bathymetric surveys;
- ensuring Indigenous and local knowledge is included, and community-based response mechanisms are co-developed to increase the adaptive capacity of vulnerable communities;
- enhancing cross-level coordination, operation and maintenance of dissemination mechanisms to deliver EWS to key stakeholders by establishing multi-hazard early warning systems that include centralised and community-based mechanisms;
- supporting the development of institutional memory by establishing systems for recording and managing climate-induced hazards; and
- developing climate risk knowledge products from public and private sector staff to support disaster management and capacity development.

LOGICAL FRAMEWORK

E.1. Project/Programme Focus

☐ Reduced emissions (mitigation)

☒ Increased resilience (adaptation)

E.2. GCF Impact level: Paradigm shift potential (max 600 words, approximately 1-2 pages)

Assessment Dimension	Current state (baseline)		Potential target scenario (Description)	How the project/programme will contribute (Description)
	Description	Rating		
Scale	The Government of Nepal has identified that the existing model of reactive response to GLOFS is no longer appropriate and initiated a shift to proactive risk management measures that reduce GLOF risk before an event occurs. Some DRR interventions are being implemented in Nepal, but not at the scale required to adequately protect vulnerable communities. While these initial efforts were effective, their implementation elucidated the need for further action to catalyse sustainable investment at scale.	Low	The number of people with reduced GLOF risk is substantially increased in the targeted watersheds. An enabling environment exists for private sector investment in further risk reduction measures, including the availability of customised and targeted risk information and the establishment of public-private partnerships.	• Regulatory structures for improving watershed management and incorporating climate risk information into planning and decision-making will be developed, supported by the establishment of mechanisms for private sector involvement in flood risk information services to enable ongoing partnerships between the private sector and the DHM. • DHM's capacity to fulfil its mandate will be strengthened by expanding the existing hydrometeorological monitoring network and improving its in-house capacity to undertake hazard mapping, climate research and risk reduction strategy development. • The implementation of downstream measures will be supported by capacity development and training for stakeholders to enable the development and implementation of multi-hazard assessments, and integrated, climate- and gender-responsive watershed and national park management plans.
Replicability	Initial steps towards GLOF risk reduction involved lowering two priority lakes: Tsho Rolpa and Imja Glacial Lake. While interventions under this initiative were considered successful, they did not catalyse the replication of interventions needed to fully address the scope of risk in Nepal. A 2020 report by UNDP and ICIMOD identified 21 potentially dangerous glacial lakes (PDGLs) in Nepal which are suitable for intervention, plus an additional 26 PDGLs in the across the Himalayas. Initial co-finance investments from IPPAN and NTB demonstrate the willingness of	Low	By reducing the risk of a GLOF at the 4 most at-risk glacial lakes in Nepal – namely the Thulagi, Lower Barun, Lumding Tsho and Hongu 2 Lakes – and addressing downstream residual flood impacts and response strategies, the project will further demonstrate the tangible benefits from these interventions, thereby promoting their use at the remaining 17 PDGLs in Nepal and across the Himalayan region. This will be supported by the upscaling of multi-hazard assessments and integrated, climate-	• Strengthening the capacity of DHM and NDRRMA and will support the upscaling of improved EWS beyond the target districts • Contributing to the growing evidence base demonstrating best practices related to GLOF risk reduction, both within Nepal and internationally • Production of customised and targeted risk information will provide strong incentives for private-sector investment in future disaster risk reduction initiatives, further promoted by the establishment of public-private partnerships, using the project as proof of concept to leverage future investment in similar impactful lake lowering and downstream interventions.

	the private sector to engage with the project and a general buy in to the benefits of the proposed approach.		and gender-responsive watershed and national park management plans beyond the target districts and communities.	
Sustainability	Some investments have been made into GLOF risk reduction measures in Nepal, but have generally lacked the long-term engagement strategies and incentives needed to catalyse broader investment for sustainable risk reduction at scale. For example, there has been a lack of engagement with the private sector to mobilize further investment in risk reduction measures needed to achieve sustainability of existing and future interventions – not only for lake lowering, but also for risk monitoring, early warning and downstream flood mitigation. .	Low	Regularly updated knowledge on lake-lowering and other GLOF risk reduction measures are integrated into the decision-making processes of national and sub-national institutions. Public-private partnerships are established to formalize and institutionalize long-term agreements and mobilize investment focused on the sustainable uptake of GLOF risk reduction in Nepal to complement the investment in long-term capacity building. Communities are actively engaged in down-stream risk reduction measures and take ownership of long-term operation and maintenance of interventions.	The involvement of government institutions and Nepalese army in implementing the lake lowering interventions will help to ensure that learning is held in institutional memory to benefit future GLOF risk reduction efforts. Beyond the retention of knowledge and experience, the project will actively invest in improved risk knowledge systems related to GLOFS, enabling the prioritisation of risk reduction interventions in Nepal. This will include institutionalising spatial digital database of glaciers and glacial lakes within DHM, with processes for regularly updating risk status of glacial lakes to ensure decisions are based on the latest data. Creating systems for databasing climate-induced hazard will contribute to the longevity of technical flood risk reduction knowledge by making that information more widely accessible. Broadening private sector engagement will be facilitated by improving DHM's capacity to develop and disseminate climate risk information to major economic sectors while enhancing public-private sector partnerships. This will include making policy provisions underpinned by an extensive stakeholder consultations with the relevant representatives from key economic sectors to formalise and institutionalise long-term agreements to support the sustainable uptake of GLOF risk reduction in Nepal. Mutual learning and knowledge sharing with communities in the implementation, operation and maintenance of lake-lowering, downstream residual risk reduction interventions and EWS will further enhance the role of knowledge in long-term sustainability.

E.3. GCF Outcome level: Reduced emissions and increased resilience (IRMF core indicators 1-4, quantitative indicators)						
GCF Result Area	**IRMF Indicator**	**Means of Verification (MoV)**	**Baseline**	**Target**		**Assumptions / Note**
				Mid-term	**Final[105]**	
Total Adaptation Beneficiaries	Core 2: Direct and indirect beneficiaries reached	**1. DHM/MoEWRI** a. Annual Progress Report (Reports - MOEWRI) 2. M**OFE/DOFSC/DNPWC** a. Annual Progress Report (https://www.mofe.gov.np/resources/progress-reports-6128b. Annual Progress Report (Report | Department of National Park and Wildlife Conservation) **3. NDRRMA/MoHA** (https://bipad.gov.np/np/report) a.Annual Progress Report b. Nepal Disaster Report c. 5 W Dashboard (https://bipad.gov.np/np/5w-dashboard-flood-and-landslide-september-2024) **4. Project Specific** a. Quarterly Monitoring Report b. Third party Monitoring Report	No beneficiaries prior to project implementation Direct: 0 (Male: 0, Female: 0) Indirect: 0 (Male: 0, Female: 0)	Direct[106]: 192,978 total Women: 100,614 Men: 92,364	Direct: 385,956 total Women: 201,228 Men: 184,728 Indirect: 1,986,980 Women: 1,036,658 Men: 950,322	Local communities and major productive sectors commit to adopting climate-resilient interventions. Benefits incur for people reached by early warnings and who are protected from GLOFs and flooding by implementing infrastructural and Eco-DRR solutions in the four most vulnerable glacial basins in Nepal. Indirect benefits incur through increased preparedness for extreme events.

[105] The final target means the target at the end of project/programme implementation period. However, for core indicator 1 (GHG emission reduction), please also provide the target value at the end of the total lifespan period which is defined as the maximum number of years over which the impacts of the investment are expected to be effective.
[106] Detailed explanation on beneficiary numbers are provided in Annex 2, Section 13, and summarised in Section D.1 above.

		c. Annual Progress Report d. Interim Evaluation Report e. Project Completion Report f. Terminal Evaluation Report				
ARA1 Most vulnerable people and communities	Core 2: Direct and indirect beneficiaries reached	**1. DHM/MoEWRI** a. Annual Progress Report (Reports - MOEWRI) 2. M**OFE/DOFSC/DNPWC** a. Annual Progress Report (https://www.mofe.gov.np/resources/progress-reports-6128 c. Annual Progress Report (Report | Department of National Park and Wildlife Conservation) **3. NDRRMA/MoHA** (https://bipad.gov.np/np/report) a. Annual Progress Report b. Nepal Disaster Report c. 5 W Dashboard (https://bipad.gov.np/np/5w-dashboard-flood-and-landslide-september-2024) **4. Project Specific** a. Quarterly Monitoring Report	No beneficiaries prior to project implementation Direct: 0 (Male: 0, Female: 0) Indirect: 0 (Male: 0, Female: 0)	Direct[107]: 192,978 total Women: 100,614 Men: 92,364	Direct: 385,956 total Women: 201,228 Men: 184,728 Indirect: 1,986,980 Women: 1,036,658 Men: 950,322	Local communities and major productive sectors commit to adopting climate-resilient interventions. Benefits incur for people reached by early warnings and who are protected from GLOFs and flooding by implementing infrastructural and Eco-DRR solutions in the four most vulnerable glacial basins in Nepal. Indirect benefits incur through increased preparedness for extreme events.

[107] Detailed explanation on beneficiary numbers are provided in Annex 2, Section 13, and summarised in Section D.1 above.

		b. Third party Monitoring Report c. Annual Progress Report d. Interim Evaluation Report e. Project Completion Report f. Terminal Evaluation Report				
	Supplementary 2.4: Beneficiaries (female/male) covered by new or improved early warning systems	**1. DHM/MoEWRI** a. Annual Progress Report (Reports - MOEWRI) **2. NDRRMA/MoHA** (https://bipad.gov.np/np/report) a. Annual Progress Report b. Nepal Disaster Report c. 5 W Dashboard (https://bipad.gov.np/np/5w-dashboard-flood-and-landslide-september-2024) **3. Project Specific** a. Quarterly Monitoring Report b. Third party Monitoring Report c. Annual Progress Report d. Interim Evaluation Report e. Project Completion Report	Populations living downstream of glacial lakes are highly exposed to GLOF hazards, with limited adaptive capacity or access to early warnings to reduce to the impacts of extreme climate events. Direct: 0 (Male: 0, Female: 0) Indirect: 0 (Male: 0, Female: 0)	Direct[108]: 192,978 total Women: 100,614 Men: 92,364	Direct: 385,956 total Women: 201,228 Men: 184,728	Early warnings are effectively disseminated through the entities responsible for the coordination of disaster response, including the NEOC, LEOC, Community Disaster Management Committee (CDMC)/Task Force. Communities the ownership of and adopt Climate-responsive Municipal Disaster Preparedness and Response Plans as well as Local-level Climate-resilient Action Plans All people living in targeted GLOF risk areas are reached by the EWS

[108] Detailed explanation on beneficiary numbers are provided in Annex 2, Section 13, and summarised in Section D.1 above.

		f. Terminal Evaluation Report				
	Supplementary 2.7: Change in expected losses of lives due to the impact of extreme climate-related disasters in the geographic area of the GCF intervention	**Ministry of Home Affairs/NDRRMA** a. BIPAD Portal- Real time loss and damage report (https://bipadportal.gov.np/damage-and-loss/) b. Post Disaster Assessment Report if disaster happens c. Nepal Disaster Report (NDRRMA)	2,282 potential lives lost	The expected reduction in losses of lives can only be determined at the end of Year 6 once all four lakes have been lowered.	A decrease of 2,208 in lives lost because of a GLOF.	Expected loss of life was calculated using the number of households affected by a GLOF under different modelled scenarios. Average household size was considered as 4.6 people. Potential loss of lives in the baseline considers a full breach without any intervention. Target scenarios consider lower lake levels, leading to only a partial breach, with down-stream mitigation measures addressing residual flood risk.
ARA3 Intrastructure and built environment	Supplementary 3.1: Change in expected losses of economic assets due to the impact of extreme climate-related disasters in te geographic area of the GCF intervention	**Ministry of Home Affairs/NDRRMA** a. BIPAD Portal- Real time loss and damage report (https://bipadportal.gov.np/damage-and-loss/) b. Post Disaster Assessment Report if disaster happens	The baseline estimated physical asset damages[109] that could result from GLOFs at the four most vulnerable glacial lakes to a GLOF are:	The change in expected losses (in US$) can only be determined at the end of Year 6 once all four lakes have been lowered.	Expected losses reduced by US$ 45,126,562 – 86,919,219 through avoided damages.	Two different methods were used for the cost-benefit analysis conducted for the project, namely a scenario assessing annual probability of a GLOF and another scenario assessing the return period based probability.

[109] The baseline values of losses at the four target glacial lakes are presented as a range of values based on the two different Probability Scenarios of GLOF occurrence ate the glacial lakes, based on Annual Probability and Return Period based Probability. The lower probability has a lower associated baseline loss amount and thus becomes the minimum value of the range presented, while the higher probability scenario has higher associated baseline loss and so this value is the upper limit of the range presented. As GLOF occurrence is difficult to predict, these two probabilities are given equal consideration in estimating losses and benefits. The details of the derivation of these probabilities as well as the models used to calculate losses and benefits are presented in Annex 3: Financial and Economic Appraisal.

		c. Nepal Disaster Report (NDRRMA)	Thulagi: US$ 12,090,478 – 16,814,961 Lower Barun: US$ 16,666,744 – 47,832,223 Lumding Tsho: US$ 3,113,910 – 11,485,681 Hongu 2: US$ 10,786,354 – 13,255,431 Total estimated damages from a GLOF at all four lakes: US$ 45,126,562 – 86,919,219			Scenario I: Annual Probability determined the annual probability of a GLOF at any one lake to be 1.16%. Scenario II: Return Period based Probability calculated GLOF probability using return period data from a published paper titled 'Hazard from Himalayan glacier lake outburst floods'. This method used statistical models to infer lake volumes from lake areas known through satellite data and subsequently simulated scenarios to predict the sizes and frequency of future GLOF events. The probability from this study that was applicable to the four target lakes was used to derive return periods as an annual probability. The full details of the probability models and calculations are presented in Annex 3: Financial and Economic Appraisal.
ARA4 Ecosystems and ecosystem services	Supplementary 4.1: Hectares of terrestrial forest, terrestrial non-forest, freshwater and coastal marine areas brought under	1. M**OFE/DOFSC/DNPWC** a. Annual Progress Report (https://www.mofe.gov.np/resources/progress-reports-6128)	0	98 ha of improved terrestrial ecosystems *51 ha in Arun* *47 ha in Dudkoshi*	200 ha of improved terrestrial ecosystems *109 ha in Arun* *91 ha in Dudkoshi*	Communities maintain the downstream adaptation interventions implemented in the Dudhkoshi and Arun Sub-basins.

	resoration and/or improved ecosystems	c. Annual Progress Report (Report | Department of National Park and Wildlife Conservation) **2. Project Specific** a. Quarterly Monitoring Report b. Third party Monitoring Report c. Annual Progress Report d. Interim Evaluation Report e. Project Completion Report f. Terminal Evaluation Report				Interventions listed by volume or length converted to area according to average values as follows: • Vegetative gabion walls with average height of ~2.25m • Living check dams with average width of ~2m • Vegetative gabion revetments with average height of ~3.15m • Vegetative gabion spurs with average height of ~3.5m • Vegetative gabion or dry-stone check dams with average height of ~2.25m • Brush layering with average width of ~2m

E.4. GCF Outcome level: Enabling environment (IRMF core indicators 5-8 as applicable)

Core Indicator	Baseline context (description)	Rating for current state (baseline)	Target scenario (description)	How the project will contribute	Coverage
Core Indicator 5: Degree to which GCF investments contribute to strengthening institutional and regulatory frameworks for low emission climate-resilient development pathways in a country-driven manner	DHM has a division and a section as an institutional mechanism and regulatory system for determining GLOF risk and hazard prioritisation. However, DHM is not equipped to produce tailored warnings and strong public-private sector partnerships that incentivise/encourage investment into GLOF risk reduction do not currently exist.	medium	The strengthened regulatory frameworks, combined with capacity building and skills development in the disaster risk reduction sector, will create an enabling environment for the upscaling and replication of project interventions across the country. The project will will contribute to the efficient and effective implementation of Nepal's	Climate risk information products produced and tailored for use by productive sectors (hydropower, tourism and agriculture). Public-private sector partnerships established with productive sectors (hydropower, tourism and agriculture) for long-term buy-in/incentives for investment in GLOF risk reduction and climate risk information products produced and used by the entities in these partnerships	Multiple sub-national areas within a country

			Disaster Risk Reduction National Strategic Plan of Action 2018–2030 , and the Disaster Risk Reduction and Management Act, 2074 and Disaster Risk Reduction and Management Rules, 2076 (2019).		
Core Indicator 6: Degree to which GCF investments contribute to technology deployment, dissemination, development or transfer and innovation	At present, DHM has limited technical capacity to detect, monitor and respond to GLOFs and other extreme climate events. Current EWS coverage in the Gandaki Basin, and Dudhkoshi and Arun Sub-basins does not extend far enough to reach all downstream communities that will be affected should the Thulagi, Lower Barun, Lumding Tsho and Hongu 2 Lakes breach. Gaps exist in the EWS network in terms of number of stations required to detect and monitor hydrological and meteorological changes that contribute to GLOFs.	low	DHM is equipped to reliably and timeously forecast GLOFs and other extreme climate events using data from the country's new and existing hydrological and meteorological stations.	Hydrological and meteorological stations will be installed across the prioritised GLOF watersheds to improve monitoring capacity and coverage in higher altitude areas. This will be complemented by training workshops targeting DHM staff to strengthen their capacity to: i) collect, process and manage climate data from the new and existing stations; and ii) use the generated data to develop early warning information products, including easily interpretable infographics for local communities. The data from these stations will be housed on DHM's existing servers.	National level (one country)
Core indicator 8: Degree to which GCF investments contribute to effective knowledge generation and learning processes, and use of good practices, methodologies and standards	There is an urgent need within DHM for the development of an in-house monitoring database for glaciers and glacial lakes. While DHM has the hardware and software capabilities, formal Standard Operating Procedures (SOPs) and training are required to catalyse the development and management of this database.	medium	The production of customised and targeted risk information for pre-project adaptation planning and early warnings will provide strong incentives for private sector investment in future disaster risk reduction initiatives, with the PPPs mobilising resources to address climate change issues. Risk analysis and requirements relating to climate change — as	The project will contribute to effective knowledge generation by: • improving DHM's capacity for hazard mapping and prioritising GLOF risk reduction strategies; • establishment of the GIS database will be supported by geophysical investigation, as well as topographic and bathymetric surveys; • training the relevant staff from DHM on monitoring GLOFs, operating and maintaining existing risk databases and disseminating tailored, user-friendly climate risk information to major productive	National level (one country)

			stipulated in national policies and plans — will be integrated into the established PPPs.	sectors in Nepal, including the tourism, hydropower and tourism sectors.	

E.5. Project/programme specific indicators (project outcomes and outputs)

Project/programme results (outcomes/ outputs)	Project/programme specific Indicator	Means of Verification (MoV)	Baseline	Target		Assumptions / Note
				Mid-term	Final	
Output 1: Institutional and technical capacity strengthened to develop and integrate climate risk and hazard information into planning and development.	1.1. Capacity of DHM to assess risk, prioritise GLOF risk reduction strategies and direct investments towards GLOF risk reduction in Nepal	1. Capacity Assessment Scorecard[110] **2. DHM/ MoEWRI** a. Annual Progress Report (Reports - MOEWRI) **4. Project Specific** a. Quarterly Monitoring Report b. Third party Monitoring Report c. Annual Progress Report d. Interim Evaluation Report	Level 1	Level 2	Level 4	Creating SOPs and building capacity within DHM enables them to prioritise glacial lakes for risk reduction interventions without external support.

[110] Capacity Development Scorecard
Level 1: No formal processes, methodologies or SOPs in place for regularly assessing GLOF risk or prioritizing risk reduction measures in Nepal. Prioritisation and investment is undertaken by external entities (e.g. UNDP/ICIMOD) and not by the government
Level 2: Methodologies and SOPs are in place for regularly assessing GLOF risk and producing updated priority list of glacial lakes for GLOF risk reduction interventions, but DHM staff lack the capacity to adequately implement the processes. Risk reduction prioritisation and investment still reliant on external entities.
Level 3: Methodologies and SOPs are in place for regularly assessing GLOF risk and DHM staff are trained on the processes and have updated the priority list of glacial lakes for GLOF risk reduction interventions.
Level 4: Risk knowledge systems related to GLOFS are fully operational and updated priority lists of glacial lakes are being regularly updated using geophysical and geospatial data enabling the prioritisation of risk reduction interventions in Nepal. Project M&E systems are fully integrated into national entities, under DHM leadership.

		e. Project Completion Report f. Terminal Evaluation Report				
Output 2: Improved hazard monitoring and the generation and dissemination of early warnings to local communities and important economic sectors leading to reduced economic loss and loss of human lives from GLOF events.	2.1. Number of stations for Nepal's EWS to account for the four most vulnerable glacial basins to GLOFs and rain-induced flooding in Nepal.	**1. DHM/MoEWRI** a. Annual Progress Report (Reports - MOEWRI) **2. Project Specific** a. Quarterly Monitoring Report b. Third party Monitoring Report c. Annual Progress Report d. Interim Evaluation Report e. Project Completion Report f. Terminal Evaluation Report	46 meteorological stations[111] servicing the areas downstream of the Thulagi, Lower Barun, Lumding Tsho and Hongu 2 Glacial Lakes	A total of 32 pieces of new monitoring equipment installed, comprising: At least 3 Base Stations installed At least 12 automatic weather stations installed At least 3 precipitation gauges installed At least 13 radar-based water level sensors (RLS) installed 1 low-cost tower with a free air satellite mode system and 4 accompanying siren towers installed	A total of 67 pieces of new monitoring equipment installed, comprising: 6 Base Stations installed (2 in the Marsyangdi Basin, 2 in the Dudhkoshi Sub-basin and 2 in the Arun Sub-basin) 24 automatic weather stations installed (7 AWS in the Marsyangdi Basin, 5 in the Dudhkoshi Sub-basin and 12 in the Arun Sub-basin) 9 precipitation gauges (2 in the Marsyangdi Basin and 7 in the Dudhkoshi Sub-basin) 27 radar-based water level sensors (RLS) installed (11 in the Marsyangdi Basin, 8 in the Dudhkoshi Sub-basin and 8 in the Arun Sub-basin) 1 low-cost tower with a free air satellite mode system and 9 accompanying siren towers (4 towers in the Marsyangdi Basin, 2 in the Dudhkoshi Sub-basin and 3 in the Arun Sub-basin)	First responders and national- and local-level decision-makers will be the main users of the data. The private sector will also be allowed access to climate data.

[111] specifically climatic and precipitation stations.

	2.2. Change in lead times for communities from when an early warnings received till a GLOF hits	**1. DHM/MoEWRI** a. Annual Progress Report (Reports - MOEWRI) **2. Project Specific** a. Quarterly Monitoring Report b. Third party Monitoring Report c. Annual Progress Report d. Interim Evaluation Report e. Project Completion Report f. Terminal Evaluation Report	0	At least 30 minute lead time for four communities in target watersheds	At least 30 minute lead time for all target communities	Lead times were considered to be zero in the absence of an EWS. The targets consider the flood arrival time at the first downstream community from the point of triggering a GLOF based off of flood modelling. The approach assumes that there is sufficient demand for community level uptake and the use of early warning information products among national-level decision-makers, the private sector and the entities responsible for the coordination of disaster response, including the NEOC, LEOC, Community Disaster Management Committee (CDMC)/Task Force, and local communities.
Output 3: Reduced probability of GLOF events and flash floods, through disaster risk reduction measures implemented in priority glacial lake watersheds.	3.1. Change in the water level of the four most high-risk glacial lakes in Nepal.	**1. DHM/MoEWRI** a. Annual Progress Report (Reports - MOEWRI) **2. NDRRMA/MoHA** (https://bipad.gov.np/np/report) a. Annual Progress Report b. Nepal Disaster Report	The baseline water levels for the target glacial lakes are as follows: Lower Barun: 205 m Lumding Tsho: 114 m Hongu 2: 53.4 m Thulagi: 76 m[112]	All pre-construction actions required in the four locations have been completed, including topographical surveys, bathymetric investigation, discharge analysis of the Thulagi Glacier Lake outlet, and geographical investigation through a GPR survey[113].	3 m reduction in water level in the Thulagi, Lower Barun and Lumding Tsho Lakes and 1 m reduction in water level in the Hongu 2 Lake. The water levels of the target lakes after lowering will be as follows: Lower Barun: 202 m Lumding Tsho: 111 m Hongu 2: 52.4 m Thulagi: 73 m	No external factors inhibit the lowering of the four target lakes during the implementation period. Communities maintain the downstream adaptation interventions implemented in the Dudhkoshi and Arun Sub-basins.

[112] Residual Risk Modelling & Watershed/sub-watershed Environmental Vulnerability Assessment. 2021. UNDP.
[113] This is because the pre-construction period is 2 years and the construction period 3 years, meaning that the full construction works required to lower the water level in the four lakes will be completed by end Year 5/Year 6.

		c. 5 W Dashboard (https://bipad.gov.np/np/5w-dashboard-flood-and-landslide-september-2024) **3. Project Specific** a. Quarterly Monitoring Report b. Third party Monitoring Report c. Annual Progress Report d. Interim Evaluation Report e. Project Completion Report f. Terminal Evaluation Report		Site-specific engineering designs have been developed and validated for lowering the levels of all four lakes.		
	3.2. Number or volume of infrastructural risk reduction measures installed to reduce the impacts of GLOFs and flooding.	1. M**OFE/ DOFSC/DNPWC** a. Annual Progress Report (https://www.mofe.gov.np/resources/progress-reports-6128 b. Annual Progress Report (Report | Department of National Park and Wildlife Conservation) **2. Project Specific** a. Quarterly Monitoring Report b. Third party Monitoring Report	0	At least 1,500 m^3 of flood walls and RCC revetments in the Arun Sub-basin At least 30 conservation ponds of at least 60m^3 each (15 in each of the Arun and Dudhkoshi Sub-basins)	3,101.61 m^3 of flood walls and RCC revetments in the Arun Sub-basin 67 conservation ponds of at least 60m^3 each (38 in the Arun Sub-basin and 29 in the Dudhkoshi Sub-basin)	

		c. Annual Progress Report d. Interim Evaluation Report e. Project Completion Report f. Terminal Evaluation Report				
	3.3. Area or volume of Eco-DRR measures implemented in downstream catchments of Arun and Dudhkoshi Sub-basins	1. M**OFE/ DOFSC/DNPWC** a. Annual Progress Report (https://www.mofe.gov.np/resources/progress-reports-6128) b. Annual Progress Report (Report | Department of National Park and Wildlife Conservation) **2. Project Specific** a. Quarterly Monitoring Report b. Third party Monitoring Report c. Annual Progress Report d. Interim Evaluation Report e. Project Completion Report f. Terminal Evaluation Report	0	At least 75 ha of trees planted (37.5 ha each in the Arun and Dudhkoshi Sub-basins) At least 8,800 m3 of vegetative gabion walls constructed (5,400 m3 in the Arun Sub-basin and 3,400 m3 in the Dudhkoshi Sub-basin) At least 475,000 m of live check dams constructed (465,000 m in the Arun Sub-basin and 10,000 m in the Dudhkoshi Sub-basin). At least 7,600 m3 of vegetative gabion revetments constructed (1,800 m3 in the Arun Sub-basin and 5,800 m3 in the Dudhkoshi Sub-basin). At least 3,600 m3 of vegetative gabion spurs constructed (2,300 m3 in the Arun Sub-basin and 1,300 m3 in the Dudhkoshi Sub-basin). At least 14,800 m3 of vegetative gabion check	153.3ha of trees planted (81.6 ha in the Arun Sub-basin and 71.6 ha in the Dudhkoshi Sub-basin) 17,744 m3 of vegetative gabion walls constructed (10,796 m3 in the Arun Sub-basin and 6,948 m3 in the Dudhkoshi Sub-basin). 978,436 m of live check dams constructed (955,396 m in the Arun Sub-basin and 23,040 m in the Dudhkoshi Sub-basin). 15,298.94 m3 of vegetative gabion revetments constructed (3,447.5 m3 in the Arun Sub-basin and 11,851.44 m3 in the Dudhkoshi Sub-basin). 7,246 m3 of vegetative gabion spurs constructed (4,608 m3 in the Arun Sub-basin and 2,638 m3 in the Dudhkoshi Sub-basin). 29,685 m3 of vegetative gabion check dams	Contractors for restoration activities will source labour and inputs – including seeds/seedlings – from local suppliers. Seedlings are available at numerous private and public nurseries throughout Nepal. Where local supply of specific species is not readily available, contractors conducting restoration efforts will establish new temporary nurseries and seed replication units to meet supply. Drones are provided by the project for seed sowing. Contractors for construction works (Embankments, gabions, check dams, revetments etc) will supply necessary inputs. Restoration efforts and hybrid infrastructure will follow local guidelines developed by Ministry of Forests and Environment

				dams constructed (11,200 m3 in the Arun Sub-basin and 3,600 m3 in the Dudhkoshi Sub-basin). At least 7,500 m3 of vegetative dry stone check dams constructed (4,700 m3 in the Arun Sub-basin and 2,800 m3 in the Dudhkoshi Sub-basin). At least 1,500 m2 of vegetative stone rip-rap constructed (750 m2 in the Arun Sub-basin and 750 m2 in the Dudhkoshi Sub-basin). At least 22,500 m of brush layering constructed (18,300 m in the Arun Sub-basin and 4,200 m in the Dudhkoshi Sub-basin). At least 149,000 m2 of grass seedlings planted (77,708 m2 in the Arun Sub-basin and 71,371 m2 in the Dudhkoshi Sub-basin).	constructed (21,960 m3 in the Arun Sub-basin and 7,725 m3 in the Dudhkoshi Sub-basin). 15,009.8 m3 of vegetative dry stone check dams (9,371.25 m3 in the Arun Sub-basin and 5,638.5 m3 in the Dudhkoshi Sub-basin). 3,194 m2 of vegetative stone rip-rap planted (1,582.5 m2 in the Arun Sub-basin and 1,611.5 m2 in the Dudhkoshi Sub-basin). 45,188 m of brush layering planted (36,750 m in the Arun Sub-basin and 8,438 m in the Dudhkoshi Sub-basin). 298,162 m2 of grass seedlings planted (155,419 m2 in the Arun Sub-basin and 142,743 m2 in the Dudhkoshi Sub-basin).	
Project/programme co-benefit indicators						
Co-benefit 1: Carbon Sequestration	*tCO_2-e sequestered*	Estimating sequestration potential using FAO ExACT tool	0	-5,320 *tCO_2-e*	-15,000 *tCO_2-e* *Project Lifespan:* -100,104 *tCO_2-e*	Targets for Carbon sequestration were estimated using the FAO ExACT tool. The estimates considered a 7-year implementation phase and 20-year capitalisation phase.

						Sequestration benefits were derived from restoration efforts assumed that trees are planted 2 m apart at a density of 2800 trees per hectare fpr 153ha or restoration, and assumed the area of vegetated EcoDRR infrastructure to function as restored grasslands.
Co-benefit 2: Soil stabilisation	Changes in rate of soil erosion in watershed areas	M**OFE/DOFSC** a. Annual Progress Report (https://www.mofe.gov.np/resources/progress-reports-6128)	An estimated 1.7 mm of topsoil is lost each year due to soil erosion in Nepal. In the targeted Koshi Basin, soil loss of up to 22 t ha^{-1} $year^{-1}$ in the barren lands were reported.	Erosion rates per hectare reduced by 10% in restored areas	Erosion rates per hectare reduced by 20% in restored areas	Downstream EcoDRR interventions that reduce the impact of residual flooding after lake lowering will stabilize mountain slopes, reducing soil erosion and landslides. Soil erosion baseline was determined from a scientific analysis by the Tribhuvan University in Nepal, which estimated soil loss of Nepal through the application of the Revised Universal Soil Loss Equation (RUSLE) model.[114] Targets were set based on expert opinion by Nepalese scientists involved in developing and modelling the impacts of EcoDRR measures.

E.6. Project/programme activities and deliverables

Activities	Description	Sub-activities	Deliverables
1.1. Strengthen the knowledge	There is an urgent need within DHM for the development of an in-house monitoring database for glaciers and glacial lakes. While	Develop methods and SOPs for inventory and development of spatial digital database (GIS) of glaciers and glacial lakes	Approved methods and SOPs used by the Government of Nepal for inventory and

[114] Koirala *et al.* 2019. Estimation of Soil Erosion in Nepal Using a RUSLE Modeling and Geospatial Tool. Geosciences 2019, 9, 147; doi:10.3390/geosciences9040147 and Chalise, D., Kumar, L. and Kristiansen, P., 2019. Land degradation by soil erosion in Nepal: A review. Soil systems, 3(1): 12.

base and technical capacities for improved climate research and risk reduction strategies.	DHM has the hardware and software capabilities, formal Standard Operating Procedures (SOPs) and training are required to catalyse the development and management of this database. To address this need, Activity 1.1 will strengthen DHM's institutional and technical capacity for implementing sustainable GLOF risk reduction strategies in Nepal. First, methods and SOPs for the inventory and development of a spatial digital database (GIS) of glaciers and glacial lakes will be developed and institutionalised in DHM. The development of this GIS database is the first and most important step in the identification and quantification of risks through desk studies and remote sensing analysis. The SOPs for the GIS database should focus on: • data acquisition and frequency of data collection; • database management; • methodologies/standard procedures for analysis and quality control; • reporting and publication formats; and • online geoportal management for the dissemination of reports. The establishment of the GIS database will be supported by geophysical investigation, as well as topographic and bathymetric surveys. SOPs for the investigation and surveys should focus on: • pre-field planning of logistics, including equipment checks and survey layouts; • human resources management; • stepwise procedures for conducting field work; • Monitoring and Evaluation protocols; and • report generation and publication formats for bathymetric, DGPS, GPR, ERT and other surveys. The risk status of the identified glaciers and glacial lakes using the GIS database, geophysical investigation and surveys will be updated by DHM every five years to account for changes in climate and geophysical conditions. The selection of this time period was informed by international best practice; in India, the usual practice is to update the status annually, while a recent through the ICIMOD reported that updating the status every five years is sufficient.	(including geophysical investigation, as well as topographic and bathymetric surveys).	development of spatial digital database (GIS) of glaciers and glacial lakes.
		Introduce methods and tools for GLOF hazard prioritization, and mapping other extreme flood, landslide, mudflow and soil erosion hazards and risks, using a combination of remote-sensing and satellite data, as well as ground-truthing and socio-economic vulnerability assessments.	Approved methods and tools used by the Government of Nepal for GLOF hazard prioritization and mapping other extreme flood, landslide, mudflow and soil erosion hazards and risks.
		Introduce methodology and standard operating procedures (SOPs) for implementing integrated GLOF risk reduction in vulnerable watersheds.	Approved methodology and standard operation procedures (SOPs) used by the Government of Nepal for implementing integrated GLOF risk reduction in vulnerable watershed.
		Train technical staff in DHM's Remote Sensing and GIS and Snow Survey and Glacier Lake Departments on regular/operational monitoring for risk prioritisation, as well as how to use the risk information generated.	Training workshops for technical DHM staff.

	Second, methods and tools will be introduced into DHM's operating procedures for GLOF hazard prioritization and mapping other extreme events. This hazard prioritisation will use the established GIS database, remote-sensing and satellite data, as well as ground-truthing and socio-economic vulnerability assessments. Finally, methodologies and SOPs for implementing integrated GLOF risk reduction in vulnerable watersheds will be developed, informed by the GIS database and hazard mapping that will also be undertaken under this activity. The relevant staff in DHM's Remote Sensing and GIS and Snow Survey and Glacier Lake Departments will be trained on regular/operational monitoring for risk prioritisation, as well as how to use the risk information generated to implement GLOF risk reduction strategies in Nepal's high-risk areas. Given the methods and tools established will be robust and replicable on a national scale for operational monitoring, DHM is committed to continuing to provide training to its staff in the Remote Sensing and GIS and Snow Survey and Glacier Lake Departments on the methods and tools established under this project activity beyond the project lifetime, as well as include training as priority work in its annual programme. Overall, this project activity will contribute to the efficient and effective implementation of Nepal's Disaster Risk Reduction National Strategic Plan of Action 2018–2030, and the Disaster Risk Reduction and Management Act, 2074 and Disaster Risk Reduction and Management Rules, 2076 (2019). These are the main guiding policy documents for disaster response in the country.		
1.2. Develop public-private partnerships for sustainable investment in GLOF and flood risk information services.	This project activity will contribute to improving GLOF and flood risk reduction in Nepal by improving DHM's capacity to develop and disseminate climate risk information to major economic sectors (such as tourism and hydropower) and enhancing public-private sector partnerships to encourage future investment into GLOF risk reduction strategies in Nepal. At present, weather- and climate change-related risk information is accessible by the public through the DHM website, phone messaging, radio, television and special tailored bulletins. Such platforms are also viable means to disseminate sector-specific information. The tailoring of such information, however, is currently limited to certain focused areas and is only disseminated when a potential extreme climate event	Develop climate-induced hazard event recording and management database systems.	Operational climate-induced hazard event recording and management database systems.
		Develop climate risk information products and tailor them for use by productive sectors (tourism and hydropower).	Climate risk information products used by productive sectors (tourism, and hydropower).
		Establish public-private sector partnerships to generate long-term buy-in and incentives for investment in GLOF risk reduction.	Approved strategy by the Government of Nepal for public-private sector partnerships to generate long-term buy-in and incentives for investment in GLOF risk reduction.

	has been identified. While DHM produces sector-specific, user-friendly climate risk information to the aviation, agriculture and tourism sectors, there is a need to expand the provision of tailored climate risk information to the hydropower and tourism sectors which will be done under Activity 1.2. This tailoring will be supported by training DHM staff on the generation, recording and maintenance of hydrometeorological databases to ensure the most updated climate risk information disseminated to all productive sectors. To record the use of this information by the targeted productive sectors, user statistics will be registered on DHM's website, as well as through mobile applications and online databases. Other opportunities to ensure use of the information have been identified, including through sharing sector-specific data to appropriate responsible agencies and developing customized telephone applications. To support the sustainability of GLOF risk reduction strategies in Nepal, the establishment of public-private sector partnerships should be established. Private sector actors in the hydropower, tourism and insurance sectors have been identified as appropriate partners, and most of the private and government agencies targeted for these partnerships work directly with inter alia the Ministry of Energy, Water, Resources and Irrigation: The Department of Electricity Development, Nepal Electricity Authority, Department of Water Resources and Irrigation and Private Hydropower Developers. Under this project activity, policy provisions will be made, and extensive stakeholder consultations will be held with the relevant representatives in from the target sectors to formalise and institutionalise long-term agreements to support the sustainable uptake of GLOF risk reduction in Nepal. Risk information for pre-project adaptation planning and early warnings are the primary and the most important incentives for investors in downstream areas. While access to such information on a broader scale is a right of the public, customised targeted information for such investment partners can be incentives for cost-sharing. Other incentives include providing evacuation plans, adaptation planning and knowledge dissemination workshops for decision-makers.		
2.1. Improve observation network	Under this activity, hydrological and meteorological stations will be installed across GLOF watersheds to fill gaps in the current	Install 6 Base Stations at Pangboche, Jayaram–Ghat - Middle Hill, Tumlingtar (Turkighat), Chatara, Dharapani and	6 Base stations installed.

density in GLOF watersheds to strengthen the technical capacity of DHM for the monitoring of climate hazard and risk.	observational network. These gaps include inoperative monitoring stations, poor coverage in higher altitude areas and low-resolution temporal and spatial coverage. In response, the following will take place under the project activity: 6 base stations will be installed at Pangboche, Jayaram–Ghat - Middle Hill, Tumlingtar (Turkighat), Chatara, Dharapani and Muglin (2 in the Marsyangdi Basin, 2 in the Dudhkoshi Sub-basin and 2 in the Arun Sub-basin). 24 automatic weather stations (AWS) will be installed at key locations in GLOF watersheds (7 AWS in the Marsyangdi Basin, 5 in the Dudhkoshi Sub-basin and 12 in the Arun Sub-basin) to measure temperature, atmospheric pressure, precipitation, humidity, horizontal wind and snow depth. 9 Precipitation gauges (PCP) will be installed at key locations in GLOF watersheds (2 in the Marsyangdi Basin and 7 in the Dudhkoshi Sub-basin) to measure precipitation factors. The real-time data acquired from this critical infrastructure will be used by DHM to: i) observe and monitor GLOF risk; ii) support EWS; and iii) inform glacier modelling. Additionally, the real-time data acquisition system will integrate data from new and existing hydrology stations. To support real-time, mobile contact with vulnerable communities vulnerable to GLOFs, as well as supplement insufficient coverage of vulnerable communities, EWS coverage will be expanded throughout Nepal. This will be achieved by installing 27 radar-based water level sensors (RLS) at key locations in GLOF watersheds (11 in the Marsyangdi Basin, 8 in the Dudhkoshi Sub-basin and 8 in the Arun Sub-basin), using GCM technologies provided by service providers under Nepal Telecom Authority[115]. A low-cost tower with a free air satellite mode system will be installed, accompanied by the installation of 9 accompanying siren towers across the target GLOF watersheds (4 towers in the	Muglin (2 in the Marsyangdi Basin, 2 in the Dudhkoshi Sub-basin and 2 in the Arun Sub-basin).	
		Install 24 automatic weather stations (AWS) at key locations in GLOF watersheds (7 AWS in the Marsyangdi Basin, 5 in the Dudhkoshi Sub-basin and 12 in the Arun Sub-basin).	24 automatic weather stations (AWS) installed.
		Install 9 Precipitation gauges (PCP) at key locations in GLOF watersheds (2 in the Marsyangdi Basin and 7 in the Dudhkoshi Sub-basin).	9 Precipitation gauges (PCP) installed.
		Integrate new and existing hydrology stations into a real-time data acquisition system.	New and existing hydrology stations integrated into a real-time data acquisition system
		Install 27 radar-based water level sensors (RLS) at key locations in GLOF watersheds (11 in the Marsyangdi Basin, 8 in the Dudhkoshi Sub-basin and 8 in the Arun Sub-basin).	27 radar-based water level sensors (RLS) installed.
		Install a low-cost tower with a free air satellite mode system and 9 accompanying siren towers at Rabuwa, Jayaram and other locations in GLOF watersheds to be determined through site validations (4 towers in the Marsyangdi Basin, 2 in the Dudhkoshi Sub-basin and 3 in the Arun Sub-basin).	Low-cost tower and 9 accompanying siren towers installed.

[115] A list of appropriate service providers that use GCM technologies is available at: https://www.nta.gov.np/en/.

	Marsyangdi Basin, 2 in the Dudhkoshi Sub-basin and 3 in the Arun Sub-basin).		
2.2. Develop and implement early warning systems planning to strengthen adaptive capacity and response to GLOFs and other climate hazards in vulnerable sectors and communities	Activity 2.2 will improve Nepal's EWS to strengthen adaptive capacity and response among vulnerable communities in the target districts of Manang, Sankhuwasabha and Solukhumbu to GLOFs, rain-induced floods and other climate hazards. First, the coordination between DHM and NDDRMA will be strengthened to enhance response to GLOFs and other extreme events in Nepal. This will be achieved by: i) establishing an information dissemination and communication system; ii) establishing working groups for coordination between DHM, NDRRMA and relevant stakeholders; iii) conducting engagement workshops between local emergency operation centres to strengthen localisation and roll out of DIMS/BIPAD Portal for effective disaster preparedness and information management; and iv) developing and disseminating a household database of two target glaciated basins through the BIPAD Portal. Second, the technical and institutional capacity of DHM will be strengthened to enhance the rapid dissemination of early warnings to: i) critical national and local entities involved in disaster response (including NEOC, DEOC, national stakeholders, district and local stakeholders, LEOC, Community Disaster Management Committee (CDMC)/Task Force, and local communities); ii) key actors in productive sector networks; and iii) vulnerable communities in the target districts and throughout Nepal. This will be achieved by training the relevant technical staff at DHM staff on efficient and effective ways to generate and disseminate early warnings to improve community response to GLOFs. To ensure that the observation network remains operational, training will also be provided to the relevant staff on operating and maintaining the existing and newly installed hydrological and meteorological stations in the target basins. In so doing, DHM will have the required capacity to generate and disseminate accurate forecasts and early warnings of impending GLOFs. To ensure sufficient understanding among target communities of how to access and respond to early warnings, community-based disaster response plans will be developed. These plans will be developed in a participatory way with communities and ward	Strengthen the technical and institutional capacity of DHM to produce early warnings and disseminate them to government agencies and productive sectors.	Training workshops and material for DHM on improving their generation and dissemination of early warnings.
		Co-develop community-based response plans for 10 districts, namely Bhojpur, Dhankuta, Khotang, Okhaldhunga, Sankhuwasabha, Saptari, Sindhuli, Solukhumbu, Sunsari and Udayapur.	• 10 community-based response plans. • 10 community engagement workshops.
		Institutionalise GLOF EWS by developing multi-hazard-based risk assessments (integrating community knowledge and science-based assessments), and train communities on disaster risk management, first aid and search and rescue.	3 multi-hazard-based risk assessments developed (1 in the Arun Sub-basin; 1 in the Dudhkoshi Sub-basin and 1 in the Marsyangdi Basin). Training workshops for community-based DRM first aid and search and rescue. Local government engagement workshops (with the mayor, chairperson, technical officers etc.) on GLOF EWS, updates to the observational network, safety, operation and maintenance.
		Strengthen vertical and horizontal linkages between Local Emergency Operation Centres and DHM to integrate DHM's dissemination mechanism, import household data to the BIPAD Portal for the application of DSS and CAP (cleaning; processing; import; verification), and localise and roll out the DIMS/BIPAD Portal for effective disaster preparedness.	Engagement workshops and meetings to strengthen vertical and horizontal linkages between Local Emergency Operation Centres and DHM. Specialist(s) contracted to integrate DHM's dissemination mechanism into the LEOC, and import household data to the BIPAD Portal for the application of DSS and CAP (cleaning; processing; import; verification) DIMS/BIPAD Portal localised and rolled out, supported by awareness raising targeting local government and communities.
		Improve the knowledge and awareness of target districts of how to access and respond to early warnings, including by establishing and mobilising youth groups and volunteer's corps.	Training workshops and material for vulnerable communities in the Arun and Dudhkoshi Sub-basins and Marsynagdi Basin on how to access and respond to early warnings.

	leaders [116] in the target districts and provide step-by-step guidance on how to access early warning and what actions to take once an early warning is received, in line with CDMC protocols. Training will then be delivered by representatives from NEOC, LEOC and CDMC on how to implement the actions contained in the response plans and response drills will be organised by these entities to practice what actions to take in the event of a GLOF, flood or another climate hazard. GLOF EWS will be fully institutionalised by developing multi-hazard-based risk assessments — which integrate community knowledge and science-based assessments — and holding annual training workshop for communities on disaster risk management (DRM), first aid and search and rescue. NDRRMA will lead this institutionalisation process, supported by local government actors. Engagement workshops with *inter alia* the mayor, chairperson, technical officers on GLOF EWS, updates to the observational network, safety, operation and maintenance will also be conducted to ensure the establishment and uptake of knowledge and early warning processes at the national, local and community levels. Effective collaboration between Local Emergency Operation Centres and DHM will be ensured through engagement workshops and meetings that will strengthen vertical and horizontal linkages between these entities. This collaboration will facilitate integration of DHM's dissemination mechanism into the LEOC, with specialist(s) contracted to import household data to the BIPAD Portal for the application of DSS and CAP — cleaning; processing; importing; and verifying. This will also allow for localising and rolling out of the DIMS/BIPAD Portal, supported by awareness raising that targets local government and communities, for effective disaster preparedness. To ensure that target districts within the are able to access and respond to early warnings effectively, knowledge and awareness will be improved with training workshops and materials for vulnerable communities in the Arun and Dudhkoshi Sub-basins and Marsyangdi Basin. This process will be supported by the establishment and mobilising of youth groups as well as		Youth groups and volunteer's corps established and mobilised.
		Develop climate-responsive Municipal Disaster Preparedness and Response Plans, as well as Local-level Climate-resilient Action Plans.	Engagement workshops for the preparation and completion of the plans. Climate-responsive Municipal Disaster Preparedness and Response Plans Local-level Climate-resilient Action Plans. Validation workshops and action plans for the implementation of the plans.

[116] A ward is the smallest unit of local government in Nepal.

	volunteer's corps, increasing community involvement in the early warning processes. Climate-responsive Municipal Disaster Preparedness and Response Plans will be developed with effective collaboration at the municipal level through engagement workshops for the preparation and completion of these plans. Local-level Climate-resilient Action Plans will also be developed through this method, with validation workshops held and action plans developed for the implementation of these plans, ensuring local-level stakeholder participation, as well as ownership and uptake by the target communities and local government.		
3.1. Lower the levels of four of the highest risk glacial lakes.	Under this activity, detailed site-specific engineering designs will be undertaken for the lowering of the Thulagi, Lower Barun, Lumding Tsho and Hongu 2 glacial lakes. These designs will be informed by the following assessments and validated by engineers and the AE before construction starts: A topographical survey of the site and the moraine dam is needed for detailed analysis and precise design. Bathymetric investigation to determine the most recent volume of the lake, depth and topography, lake extension, and end moraines change. Hydrometeorology: We only measured discharge using the most basic method, the floating method. In the Thulagi Glacier Lake, the tracer approach was not used. Therefore, to design the more detailed structural intervention needed, we must have the current discharge of the glacier outlet. A geophysical investigation using a GPR survey, and an electric resistivity tomography of the sites are required to determine the stability of the moraine dam and the intensity of the geophysical environment. Once the designs have been validated, construction will commence in Year 2 of project implementation to lower the Thulagi, Lower Barun, Lumding Tsho and Hongu 2 lakes by 3 m. These lakes and the level by which they will all be lowered were determined through a preliminary options analysis and vulnerability assessment commissioned by UNDP for the proposed project. The findings from these assessments indicated that the four target glacial lakes are the most at risk of breaching.	Undertake detailed site-specific engineering designs for lake lowering.	Site-specific engineering designs completed for lowering water levels of the four target lakes.
		Lower the levels of the four lakes (Thulagi, Lower Barun, Lumding Tsho and Hongu 2).	All pre-construction actions and construction completed for the four lakes. Water levels of the Thulagi, Lower Barun, Lumding Tsho and Hongu 2 lakes lowered by 3 m.

	Given that climate change is expected to increase this risk, these lakes were prioritised for lowering to reduce the impacts of a GLOF on surrounding and downstream communities. The conceptual design for lowering the water levels of the four target lakes are as follows: For Thulagi, Lumding Tsho, and Lower Barun, the outlet channel at the end moraine will be blocked by cofferdam, and a diversion channel will be built to divert the flow of the lake. For Thulagi, Lumding Tsho, and Lower Barun, the effluent from this diversion channel will be discharged at 165 m, 70 m, and 55 m, respectively, downstream of the proposed structure. During this period, a sluice gate will be built at the identified site. The main channel will be trapezoidal in shape, 70 m downstream from the cofferdam for Thulagi and 25 m and 40 m for Lower Barun and Lumding Tsho, respectively. This channel will carry the lake discharge after the cofferdam is removed. The banks adjacent to the main channel will be strengthened with boulder impact gabion walls to protect it against bank erosion when the water is released after removing the cofferdam. For Hongu 2, only the main channel is proposed. Since there is no outlet discharge of the lake, the end moraine itself will act as a sluice gate and no diversion canals are required. Once the main channels are built, the end moraine will be excavated to lower the glacial lake.		
3.2. Construction of structural and non-structural measures (Civil and NbS/ Bioengineering) for the risk reduction of GLOF and flash flood..	Under this activity, check dams and other protective infrastructure will be established at strategic locations in the Dudhkoshi and Arun Sub-basins. The purpose of this infrastructure will be to attenuate and divert the intense flow of water caused by GLOFs and flash floods from the Lower Barun, Lumding Tsho and Hongu 2 glacial lakes. The specific infrastructure that will be constructed under Activity 3.2 is described below. • 3,101.61 m^3 of flood walls and RCC revetments will be built along stretches of riverbank where a high possibility of bank undercutting and inundation was identified. • 67 conservation ponds will be established (38 in the Arun Sub-basin and 29 in the Dudhkoshi Sub-basin) to reduce concentrated surface flow following a GLOF or during a monsoon or other extreme rainfall event and consequently prevent the formation of gullies and the triggering of shallow landslides.	Install 3,101.61 m^3 of flood walls and RCC revetments. Construct 67 conservation ponds (38 in the Arun Sub-basin and 29 in the Dudhkoshi Sub-basin).	3,101.61 m^3 of flood walls and RCC revetments. 67 conservation ponds constructed (38 in the Arun Sub-basin and 29 in the Dudhkoshi Sub-basin).

	Combined, these interventions will reduce the damages and losses from GLOFs and flooding in the target basins. Furthermore, the infrastructure installed under this activity will complement the Eco-disaster Risk Reduction solutions implemented under Activity 3.3 by reducing the impacts of GLOFs and flash floods while these long-term interventions are being established. Concept drawings and bill of quantities for the interventions proposed under this activity are presented in Annex 23: Concept drawings and bill of quantities for downstream interventions.		
3.3. Implement eco-disaster risk reduction and nature-based solutions to reduce the impact of GLOFs and flash floods.	Under Activity 3.3, Eco-disaster Risk Reduction (Eco-DRR) solutions will be implemented at strategic locations in the Dudhkoshi and Arun Sub-basins to reduce the impacts of residual flooding from GLOFs on vulnerable communities in the basins, while simultaneously contributing to the restoration and rehabilitation of degraded ecosystems in floodplain areas. The interventions that will be implemented under this project activity include: i) planting 4.6 million trees along vulnerable riverbanks, sub-watershed areas and floodplains of 4 river systems; ii) constructing 17,744 m^3 of vegetative gabion walls; iii) building 978,436 m of live check dams; iv) constructing 15,298.94 m^3 of vegetative gabion revetments; v) installing 7,246 m^3 of vegetative gabion spurs; vi) installing 29,685 m^3 of vegetative gabion check dams and 15,009.8 m^3 of vegetative dry stone check dams; vii) establishing 3,194 m^2 of vegetative stone rip-rap; viii) undertaking 45,188 m of brush layering; and ix) planting 298,162 m^2 of grass seedlings. These Eco-DRR solutions will reduce soil erosion and increase the infiltration capacity of the soil in floodplain areas. This in turn will decrease surface runoff and reduce the sedimentation of tributaries caused by flooding in the project areas. Combined, these interventions will reduce the damages and losses to from GLOFs and flooding in the target basins. Concept drawings and bill of quantities for the interventions proposed under this activity are presented in Annex 23: Concept drawings and bill of quantities for downstream interventions.	Plant 153.3 ha of trees along vulnerable riverbanks, sub-watershed areas and flood plains of 4 river systems (81.6 ha trees in the Arun Sub-basin and 71.6 ha in the Dudhkoshi Sub-basin). Establish 17,744 m^3 of vegetative gabion walls (10,796 m^3 in the Arun Sub-basin and 6,948 m^3 in the Dudhkoshi Sub-basin). Install 978,436 m of live check dams (955,396 m in the Arun Sub-basin and 23,040 m in the Dudhkoshi Sub-basin). Install 15,298.94 m^3 of vegetative gabion revetments (3,447.5 m^3 in the Arun Sub-basin and 11,851.44 m^3 in the Dudhkoshi Sub-basin). Install 7,246 m^3 of vegetative gabion spurs (4,608 m^3 in the Arun Sub-basin and 2,638 m^3 in the Dudhkoshi Sub-basin). Install a total of 29,685 m^3 of vegetative gabion check dams (21,960 m^3 in the Arun Sub-basin and 7,725 m^3 in the Dudhkoshi Sub-basin) and a total of 15,009.8 m^3 of vegetative dry stone check dams (9,371.25 m^3 in the Arun Sub-basin and 5,638.5 m^3 in the Dudhkoshi Sub-basin). Install a total of 3,194 m^2 of vegetative stone rip-rap (1,582.5 m^2 in the Arun Sub-basin and 1,611.5 m^2 in the Dudhkoshi Sub-basin). Implement a total of 45,188 m of brush layering (36,750 m in the Arun Sub-basin and 8,438 m in the Dudhkoshi Sub-basin). Plant a total of 298,162 m^2 of grass seedlings (155,419 m^2 in the Arun Sub-basin and 142,743 m^2 in the Dudhkoshi Sub-basin).	153.3 ha trees planted (81.6 ha trees in the Arun Sub-basin and 71.6 ha in the Dudhkoshi Sub-basin). 17,744 m^3 of vegetative gabion walls established (10,796 m^3 in the Arun Sub-basin and 6,948 m^3 in the Dudhkoshi Sub-basin). 978,436 m of live check dams built (955,396 m in the Arun Sub-basin and 23,040 km in the Dudhkoshi Sub-basin). 15,298.94 m^3 of vegetative gabion revetments installed (3,447.5 m^3 in the Arun Sub-basin and 11,851.44 m^3 in the Dudhkoshi Sub-basin). 7,246 m^3 of vegetative gabion spurs (4,608 m^3 in the Arun Sub-basin and 2,638 m^3 in the Dudhkoshi Sub-basin). 29,685 m^3 of vegetative gabion check dams installed (21,960 m^3 in the Arun Sub-basin and 7,725 m^3 in the Dudhkoshi Sub-basin) and 15,009.8 m^3 of vegetative dry stone check dams installed (9,371.25 m^3 in the Arun Sub-basin and 5,638.5 m^3 in the Dudhkoshi Sub-basin). 3,194 m^2 of vegetative stone rip-rap installed (1,582.5 m^2 in the Arun Sub-basin and 1,611.5 m^2 in the Dudhkoshi Sub-basin).

	Physical adaptation interventions under this activity will be supported by developing Integrated Watershed Management and National Park Management plans to create the regulatory framework for sustainable land management and climate change adaptation. Training and capacity building interventions targeting the relevant groups will ensure the effective implementation of these plans. The capacity development of community members, CBOs, NGOs and relevant government officials will be delivered under thematic training modules, including: i) capacity development of community members and local government on climate change induced hazards and disasters, and adaptation measures; ii) curriculum for climate change related education and trainings for secondary level school teachers and students; and iii) capacity development of trainings for CBOs of various kinds, including mothers groups, women-lead cooperatives, Indigenous peoples organisations and local eco- and youth- clubs. Training participants will be identified according to the Gender Equality and Social Inclusion (GESI) Action Plan, including Indigenous peoples, Dalits, and women representatives. The training modules will be designed to engage government officials in the implementation of Multi-Hazard Risk Reduction Measures (MHRRM). The training will enhance their capacity with tools and techniques used in the MHRA and implementation techniques in Climate Change Adaptation (CCA), Ecosystem-based Disaster Risks Reduction (Eco-DRR), and the use of Agriculture Management Information Systems (AMIS). Capacity development of the relevant stakeholders and local and regional levels will support the development of multi-hazard assessment, and integrated, climate- and gender-responsive watershed and national park management plans in the Arun and Dudhkoshi Sub-basins.		45,188 m of brush layering (36,750 m in the Arun Sub-basin and 8,438 m in the Dudhkoshi Sub-basin). 298,162 m^2 of grass seedlings planted (155,419 m^2 in the Arun Sub-basin and 142,743 m^2 in the Dudhkoshi Sub-basin).
		Develop and implement integrated, climate- and gender-responsive watershed and national park management plans.	Integrated, climate- and gender-responsive watershed and national park management plans.
		Develop and implement a climate-resilient agricultural management and information system.	Climate-resilient agricultural management and information system developed and implemented.
		Strengthen the technical and institutional capacity of community members, government officials and CBOs to understand and implement multi-hazard risk assessments, use climate-resilient agricultural management and information system, and implement climate-resilient GLOF and flood risk reduction strategies.	• 3-day capacity development training on CCA, MHRA tools and models and risk reduction measures for relevant government officials and community members (12 trainings in Arun basin and 7 trainings in Dudhkoshi basin). • Workshops held for curriculum development and training on climate-change related education for 10 Secondary school level teachers and 8 students from Arun and Dudhkoshi basins. • Training prepared and delivered to community-based organisations on the implementation of Indigenous and Traditional Knowledge based activities (15 CBOs from Arun basin and 12 CBOs from Dudhkoshi basin).

E.7. Monitoring, reporting and evaluation arrangements (max. 500 words, approximately 1 page)

178. Project-level monitoring and evaluation will be undertaken in compliance with the UNDP POPP and the UNDP Evaluation Policy. The Project Manager, Monitoring, Evaluation and Training Specialist, and Gender and Social Inclusion Specialist, under the oversight of UNDP as the AE, will be responsible for monitoring the progress of all project activities against the outcome-based indicators presented in the Logical Framework (Section E of this Funding Proposal). Any delays or challenges experienced during the implementation phase will be communicated timeously to the Project Board and the UNDP Country Office by the Project Manager, so that any appropriate support and corrective measures required can be actioned efficiently. The Project Manager will also ensure that all project staff maintain transparency, responsibility and accountability in monitoring and reporting on project results.

179. Monitoring and evaluation of project activities will be undertaken on an annual basis. The type of monitoring activities to be conducted during the implementation phase, as well as the responsible parties for undertaking these activities, are detailed in Annex 11: Monitoring and Evaluation (M&E) Plan. Such activities include field observations, key informant interviews and focus group sessions. The costs associated with undertaking the necessary monitoring, assessments and engagements required to inform the project evaluations are presented in Annex 4: Detailed budget.

180. A project inception workshop will be held after project approval and the Funded Activity Agreement (FAA) becomes effective and UNDP project document has been signed by all relevant parties to: i) re-orient project stakeholders to the project strategy and discuss any changes in the overall context that may influence project implementation; ii) discuss the roles and responsibilities of the project team, including reporting and communication lines and conflict resolution mechanisms; iii) review the project Logical Framework; iv) discuss reporting, monitoring and evaluation roles and responsibilities and finalise the M&E plan (Annex 11); v) review the financial reporting procedures and mandatory requirements, and agree on the arrangements for the annual audit; and vi) plan and schedule Project Board meetings and finalise the first year annual work plan for the project. The final inception report will be shared with the UNDP Country Office, UNDP Regional Technical Advisor and Project Board for clearance. Once the report has been cleared by the relevant parties, it will be submitted to the GCF for approval. This will happen within six months after the Funded Activity Agreement (FAA) becomes effective.

181. An Annual Performance Report (APR) will be prepared by the Project Manager, UNDP Country Office, and UNDP Regional Technical Advisor for submission to the GCF, Project Board and relevant project stakeholders. The Project Manager, supported by the Monitoring, Evaluation and Training Specialist, will ensure that the indicators included in the project Logical Framework are monitored annually and that the results from regular M&E activities are presented in the GCF APR. Any challenges and delays experienced during the implementation phase will be monitored by the Project Manager and reported in the GCF APR.

182. During the implementation phase, specific means of verification will be used to assess the: i) progress of project interventions towards achieving GCF Fund-level impacts and Fund-level outcomes; and ii) performance of interventions against the project performance indicators presented in Section E.5 of this Funding Proposal. A Monitoring, Evaluation and Training Specialist, and Gender and Social Inclusion Specialist will be employed to conduct and coordinate on-the-ground monitoring and evaluation (M&E) of the project and ensure that gender targets are met. The Monitoring, Evaluation and Training Specialist, and Gender and Social Inclusion Specialist will design and operationalise a performance monitoring framework to track the project's progress towards achieving its targets. This will be achieved by: i) measuring the performance against the project indicators (Sections E.3–5) to evaluate the progress of the project; ii) reporting the project's performance to the Project Steering Committee (PSC) and Project Implementing Unit (PIU); and iii) providing technical support to the Project Manager. Additionally, Monitoring, Evaluation and Training Specialist, and Gender and Social Inclusion Specialist will be responsible for overseeing and monitoring the application of gender-disaggregated indicators[117]. At particular milestones (e.g. baseline, mid-term and project closure), the Monitoring, Evaluation and Training Specialist, and Gender and Social Inclusion Specialist will undertake evidence-gathering exercises to verify the project's performance against the outcomes-based indicators presented in the Logical Framework, M&E Plan and Gender Action Plan. The results from this process will be presented in periodic reports developed by the Monitoring, Evaluation and Training Specialist, and Gender and Social Inclusion Specialist, supported by the Project Manager. These reports will be submitted to the PSC and validated during the Independent Interim and Final Evaluations for the project, as described below.

183. UNDP will be responsible for managing the Independent Interim (mid-term) and Final Evaluations of the project, including the process for contracting these positions. For the Interim Evaluation, an independent consultant will be contracted to provide an assessment of project performance against its targets at the project's mid-term. This will be an outcomes-based assessment and will include analysing whether the project is on track, what problems and challenges the project is encountering, and what corrective

[117] The project's gender targets as well as the associated gender-disaggregated indicators are presented in Annex 8: Gender Assessment and Action Plan.

actions are required, so that the project can achieve its intended outcomes by project completion in the most efficient and sustainable way. Following this evaluation, the PSC will develop a management response to the evaluation recommendations along with an implementation plan for undertaking the required actions. It is the responsibility of UNDP to assess whether the agreed recommendations are being implemented during the remainder of the project period. The completed Interim Evaluation report will be cleared by the UNDP Country Office as well as the UNDP Regional Technical Advisor.

184. Independent national and international consultants will be contracted by UNDP to conduct the Final Evaluation Report at the end of project implementation. UNDP will be responsible for overseeing the Final Evaluation Report, which is a summative evaluation. This evaluation will include an independent assessment of the project's overall performance against standard evaluation criteria (e.g. strategic relevance, effectiveness, efficiency, likelihood of impact and sustainability), as well as against the project indicators presented in the Logical Framework. This evaluation will be based on *inter alia* documentaries of evidence, field observation visits and key informant interviews. Following completion of the evaluation, the Final Evaluation report will be developed and shared with the UNDP Country Office as well as the UNDP Regional Technical Advisor for clearance.

185. The UNDP Country Office will include the planned project evaluations in the UNDP Country Office evaluation plan. All evaluation reports, including responses to feedback received from the public, will be uploaded in English to the UNDP Evaluation Resource Centre (ERC)118. The UNDP CO will retain all M&E records for this project for up to eight years after financial closure to support ex-post evaluations.

118 available at: www.erc.undp.org

RISK ASSESSMENT AND MANAGEMENT

F.1. Risk factors and mitigations measures (max. 3 pages)

Selected Risk Factor 1

Category	Probability	Impact
Technical and operational	Low	Medium

Description

Turnover of key project personnel, as well as relevant staff from provincial and local governments, could delay project implementation and negatively impact the retention and transfer of institutional knowledge gained under the project. Staff in key government institutions may lack the capacity to implement effectively and on time. Staffing challenges may be further compounded by remote locations and short windows of opportunity for work in high altitudes.

Mitigation Measure(s)

Regular stakeholder consultations will be held with all project partners involved in project implementation to ensure that institutional capacity is retained in the event of turnover of key project personnel. In addition, the PSC will be responsible for ensuring coordination between relevant project stakeholders during the implementation phase. The PSC will identify personnel whose primary responsibilities will be to act as a focal point for facilitating stakeholder engagements undertaken during the implementation of the project. Moreover, project operational handbooks will be developed to provide project staff with standardised training on project interventions. UNDP, as AE, will provide close oversight on project implementation, supporting government staff where needed to avoid delays related to capacity shortfalls.

For remote location access: drawing on past experience, the project will engage in advanced planning to ensure timely mobilization of human resources not to miss the working season in harsh remote locations (in such locations, working season is only a few month-window during the year for hard work). The project will also use the local work force who are accustomed to the conditions and are capable of doing hard work in such locations. UNDP Nepal and Govt. of Nepal has prior experience implemented a GLOF project in Imja lake and a similar approach will be employed in this project, including capturing lessons and best practices. In addition, lessons from similar projects implemented in Bhutan and Nepal can also be employed for this project.

Selected Risk Factor 2

Category	Probability	Impact
Technical and operational	Medium	Medium

Description

The occurrence of a GLOF, other flooding event, earthquake or other natural disaster or climate change-related event during project implementation could delay the implementation of project interventions and negatively impact project areas and target communities.

Mitigation Measure(s)

Project interventions will be continuously monitored to identify potential extreme events for appropriate measures to be enacted should such an event occur. Operational manuals will also be developed to identify the necessary measures to be enacted for different extreme events and hazards (Activity 1.1). To ensure as minimal disruption as possible to project interventions, disaster mitigation and response activities will be prioritised at the target communities while the project interventions are being established. In addition, project implementation schedules will consider historical trends regarding the frequency of extreme climate events and will plan around these periods accordingly. All available information from DHM will be used to assess the GLOF risk prior to and during implementation. Where possible, downstream risk reduction interventions will be conducted after lake lowering and EWS interventions, when the risk is already reduced. Workers will be briefed on the potential risks, signs to be aware of, and actions to take in the event of an emergency.

Selected Risk Factor 3

Category	Probability	Impact

Technical and operational	Low	Medium
Description		
Delays during the procurement process could disrupt the efficient implementation of project interventions.		
Mitigation Measure(s)		
UNDP will assist DHM with the procurement process to ensure that the process proceeds according to international standards and to ensure that any delays or problems that arise are resolved quickly and efficiently. Moreover, UNDP's experience in the adaptation field will enable them to directly approach potential partners should the initial rounds of the procurement process prove unsuccessful. Additional mitigation actions identified to avoid procurement delay include: i) advance procurement planning and approval of procurement plan at the time of approval of annual work plan of the project; and ii) directly working with the entities who have gone through competitive process and the government or UNDP has long-term agreements signed. Fair pricing and transparency is mandatory for both the government and UNDP to ensure a competitive process has been adopted in procurement as set by standard procurement rules of the government and UNDP. All procurement notices are made public and given sufficient time to seek quotations or bids, which are evaluated based on pre-set criteria, which is part of procurement notice. All project transactions are mandatory audited by the government and UNDP as per set audit rules every year which also includes financial management Given the relevance of EWS, weather stations and measuring equipment and civil works among the projected procurement needs for this project, a dedicated meeting will be scheduled between UNDP Nepal and Bureau of Management/Office of Procurement/Crises, Climate and Infrastructure Team soon after securing GCF Board approval. UNDP also has the option to channel high-value procurement actions through existing corporate LTAs. In addition, UNDP can also provide specialized support for infrastructure/civil works and lessons learnt through other GCF projects of a similar nature.		
Selected Risk Factor 4		
Category	**Probability**	**Impact**
Governance	Low	Medium
Description		
The Government of Nepal's transition from a unitary governance system to a federal democratic republic over the past decade could alter political priorities. This shift could lead to project stakeholders diverting their efforts away from project implementation. Similar risks may emerge following elections, when key government stakeholders might change.		
Mitigation Measure(s)		
The Government of Nepal's transition from a unitary governance system to a federal democratic republic means that the mandates, capacities and interagency relationships of governmental institutions and mechanisms are still being established. While Nepal's Constitution and its Local Government Operation Act (2017) both provide detailed information on the roles, responsibilities and coordination mechanisms of government operations, the project will be developed with the lessons learned from previous and existing projects in Nepal to ensure that project activities incorporate, but are not solely reliant on, government agencies. This approach aims to minimise the impact of any potential shifts in the political landscape. The PSC will engage directly with the NDA to ensure close communication with government officials and to identify and address potential delays or changes to project management or interventions.		
Selected Risk Factor 5		
Category	**Probability**	**Impact**
Technical and operational	Medium	Medium
Description		
Potential risks related to the implementation of project interventions in the remote project target areas include: i) difficulty accessing project areas for installation and maintenance of equipment; ii) ESS risks related to altering river		

channels/check dams; and iii) the risk of project staff and community members suffering from acute mountain sickness or being affected by adverse weather conditions. In addition, community members have limited capacity for the maintenance of equipment related to project interventions.
Mitigation Measure(s)
An assessment of project areas prior to implementation and installation of equipment and/or infrastructure will ensure that the correct measures are established to enable the effective installation, and later maintenance, of that equipment/infrastructure (Activities 2.1, 2.2, 3.1 and 3.2). Continuous monitoring from local government officials and community-based organisations (CBOs) in the project areas, to inform the PSC, will ensure the safety of contractors and workers during project implementation, and will serve as the institutional mechanism to ensure effective maintenance of project interventions. In addition, this monitoring will serve to identify potential ESS risks to ensure they are addressed quickly and efficiently.

Selected Risk Factor 6		
Category	**Probability**	**Impact**
Technical and operational	Medium	Medium
Description		
Check dams constructed as part of project interventions may not sufficiently mitigate extreme flood events, resulting in continued impacts on target communities.		
Mitigation Measure(s)		
Prior to construction, all infrastructure will be designed based on site evaluations, with specifications relevant to each target site (Activities 3.1 and 3.2). The construction of these infrastructure will occur during periods when extreme climate events are less likely — according to historical trends — to minimise the potential risks during construction. All infrastructure will be designed and built to be consistent with international engineering standards, to ensure that they are resilient to extreme climate events and natural disasters.		

Selected Risk Factor 7		
Category	**Probability**	**Impact**
Governance	Low	Medium
Description		
A lack of buy-in or commitment from communities where project interventions are intended to be implemented will undermine the effectiveness of these activities.		
Mitigation Measure(s)		
The project will actively seek to create community ownership of the project through community consultations and trainings and will accordingly encourage community participation in project activities. These community consultations and trainings will ensure that community members understand the importance of the project interventions, in addition to enabling them to effectively maintain, monitor and report on these interventions.		

Selected Risk Factor 8		
Category	**Probability**	**Impact**
Governance	Low	Medium
Description		
Limited collaboration and coordination between project stakeholders, including relevant government departments, ministries and the private sector will reduce the timely delivery and effectiveness of the project.		
Mitigation Measure(s)		
Extensive stakeholder consultations will ensure that the roles and responsibilities of project stakeholders are well defined, while also developing and strengthening existing interagency collaboration and coordination. The PSC will be responsible for ensuring coordination between all relevant project stakeholders during project implementation. This responsibility also includes facilitating stakeholder engagements during the project implementation to ensure continued collaboration and to mediate potential disputes.		

Selected Risk Factor 9		
Category	**Probability**	**Impact**
Technical and operational	Low	High
Description		
Risks may arise related to procurement and management of construction/civil works related to lake lowering and EWS equipment. These include: i) potential for unfair procurement process and price manipulation; ii) contractors lack capacity/experience to deliver on time and in budget; and iii) contractors not following the procedures laid out in the ESMP.		
Mitigation Measure(s)		
UNDP, as the accredited entity, will ensure that fair and transparent procurement processes are followed, and that a detailed vendor selection process is carried out to assess the experience and credentials of potential vendors. The quality assurance process for the procurement of technical suppliers will include inputs from a suitably qualitied chief technical advisor, who will sit on the PMU, with support from members of the TAG. This includes screening proposals against the project's ESMP to ensure that all provisions for environmental and social safeguards are strictly adhered to. Should suitably experienced firms not be identified for the glacial lake lowering, the Nepal Army, who has experience implementing similar activities from previous GLOF risk reduction projects, may be brought in to support.		
Selected Risk Factor 10		
Category	**Probability**	**Impact**
Governance	Low	Medium
Description		
The project may face challenges in maintaining financial sustainability and ensuring compliance with evolving environmental regulations, and protect infrastructure against natural hazards given Nepal's economic situation and the challenges faces related to adapting to changing political priorities during federal transition.		
Mitigation Measure(s)		
a) Nepal's priorities to build resilience against risks including from GLOFs prevails all other priorities, including economic development, which will continue despite changes in political landscape, as risk reduction remains at the top of political parties agenda, b) as the transition towards federal system of governance will be expedited in the near future, empowering sub-national governments who will be expected to play more stronger role in risk mitigation as per constitutional mandates c) project sites mainly include protected areas of Nepal, governed under strict environment conservation regulations supported by protected area laws, which has remained stable in comparison to other environment conservation related regulations d) at national level monitoring of GLOF risks and sharing risk information with concerned authorities has been embedded in the regular work stream of DHM funded from the government budget.		
Selected Risk Factor 11		
Category	**Probability**	**Impact**
ML/FT	Low	Medium
Description		
Risks related to money laundering (ML), terrorist financing (TF), and prohibited practices (PP) could undermine the integrity of project financing, leading to misallocation of funds, reputational damage, and potential legal repercussions. Weak financial oversight in remote or high-risk areas may also expose the project to illicit financial flows, impacting effective implementation and stakeholder trust.		
Mitigation Measure(s)		

UNDP has robust processes in place to safeguard against money laundering, terrorist financing, and prohibited practices, clearly articulated in the stand-alone AML-CFT policy. The project will strictly follow the processes and procedures defined in this policy, including related to due diligence and partnership assessment criteria for all partners it engages. Each entity will be screened against the criteria set out in this policy and other policies referenced herein. Core project partners have already been screened, with the overall PCAT risk rating for all partners to be engaged in the project assessed as “Low risk” or “Very Low Risk”.

Selected Risk Factor 12

Category	Probability	Impact
	Low	Medium

Description

Given the complex nature of the engineering activities under the project, there is a potential reputation risk for UNDP should the project experience significant delays related to procurement issues or logistical challenges for works in remote and high-altitude glacial lakes, or more seriously should the works not meet international technical standards.

Mitigation Measure(s)

The project has been designed in close consultation with technical experts both locally and globally. This includes detailed assessments during the design of the project’s lake lowering interventions, with technical experts to ensure that designs are fully in line with international standards. The implementation plan, including disbursement schedule, logistical support and procurement actions are also prepared based on the narrow working season under difficult/remote conditions. During implementation, the project will continue to engage technical experts to bolster Project’s internal capacity for meeting engineering standards. This will include ensuring that the full-time project manager has considerable experience in managing complex engineering projects (including experience related to GLOF risk reduction), as well as the establishment of a Technical Advisory Group (TAG) that will bring together local and international expertise to provide technical oversight and guidance for the implementation of all technical engineering works.

Furthermore, approaches to avoid reputational damage include the mitigation measures linked to procurement detailed in Risks 3 and 9 above, as well as mitigation measures related to works happening in remote locations and high altitudes described under Risk 5.

GCF POLICIES AND STANDARDS

G.1. Environmental and social risk assessment (max. 750 words, approximately 1.5 pages)

186. The environmental and social risks associated with this project have been evaluated in accordance with GCF's Environmental and Social Safeguards (ESS) as well as UNDP's Social and Environmental Standards (SES). The project is classified as Substantial according to UNDP's Social and Environmental Screening Procedure (SESP). An Environmental and Social Management Framework (ESMF) has been developed for the project to guide the management of environmental and social issues, including.

187. An Environmental and Social Management Framework (ESMF) has been prepared to summarise the potential environmental and social risks that may be associated with the project, as well as provide a framework under which these risks will be addressed during and after the implementation period. Further environmental and social impact assessments (ESIA) and the development of environmental and social management plans ESMPs, along with the other safeguard plans (e.g., gender action plan, stakeholder management plan, indigenous peoples plans, labour management etc) are specified in the ESMF. A summary of the findings of this ESMF is presented below, with the full ESMF included as Annex 6 to this Funding Proposal.

Environmental impacts

188. Environmental impacts are primarily associated with the project are linked to potential impacts associated with the installation of equipment, flood mitigation structures and construction surrounding lake lowering measures. Further targeted impact assessments (ESIAs) will be undertaken for each of the three catchments. ESMPs for each catchment will also be prepared prior to commencement of construction.

189. To limit the potential damage caused by monsoon rains, all construction activities will take place during the dry season. This will also limit soil erosion and sedimentation caused by construction activities and limit the environmental impacts. To reduce the potential for a negative visual impact on the landscape, local materials will be used where possible. Construction designs will also consider the inclusion of culturally appropriate measures. The potential environmental impact of sourcing construction materials — such as tree, shrubs and rocks — will be managed through the establishment of small-scale community-based nurseries and sourcing through existing legal quarries only. Planting of trees will only be done according to site-specific guidance developed to match key tree species which are adapted to the local context. Site-specific matching will avoid any risks to local biodiversity and ensure compliance with Nepal's Forestry Policy. Appropriate monitoring of the environmental impacts will be further developed as part of the project's ESMPs.

190. Several of the project sites are within National Parks, in the high alpine areas of Nepal. These areas are particularly sensitive. ESIAs will be undertaken to further assess potential impacts to the parks. The existing National Park Management Plans will be updated to permit and control the proposed activities within the parks. No activities will be undertaken within the parks before assessment and without approval from the National Parks authority.

191. The design of the physical interventions has taken into account potential climate change variations and have been validated through modelling. Dam break modelling to determine areas of impact if catastrophic failure and assist in identifying mitigation measure designs and identifying 'safe zones'/escape pathways as part of EWS. Operation and maintenance plans will assist in the sustainability of the interventions.

Social impacts

192. The main potential adverse social impacts associated with the project include the potential discrimination or limited engagement of Indigenous Peoples, Dalits or other marginalized groups — including women. Indigenous Peoples of the mountain communities in the proposed project sites and the broader Himalayan region have deep cultural and spiritual connections to conserving water sources, nature, and soil. Their traditional knowledge plays a crucial role in shaping sustainable climate resilience strategies through local actions. Practices such as community-led watershed management, traditional weather forecasting, sacred landscape preservation, and sustainable resource use offer valuable insights into Glacier Lake Outburst Flood (GLOF) risk reduction, nature-based solutions, and ecological conservation. Indigenous monitoring techniques, oral histories, and traditional communication practices also enhance Early Warning Systems by complementing scientific methods with localized expertise, while social / cultural groups offer social safety nets for disaster preparedness and actions. This will be managed through implementation of the Indigenous Peoples Engagement Framework that has been prepared. In addition to ensuring engagement, the Framework will also ensure inclusion of Indigenous Peoples in project planning and implementation, to ensure they are not adversely impacted by proposed measures, such as lake lowering. Early in the project implementation phase, Indigenous Peoples Plans will be prepared for each of the three catchments. Activities that could trigger the need for FPIC have been identified in the IPPF. Organizations like the Nepal Federation of Indigenous Nationalities (NEFIN) and the National Indigenous Women's Federation

(NIWF) are actively involved in engaging Indigenous communities, ensuring their knowledge is systematically integrated into policies and interventions. This approach strengthens efforts of the project, fostering culturally appropriate, community-driven, and ecologically sustainable solutions for long-term climate resilience. It should be noted that for no activities will indigenous people be relocated from their land or have traditional access to land removed.

193. There are activities within the project that could represent gender risks e.g., unequal representation of women, GBV/SEAH due to worker influx etc. The project Gender Action Plan includes measures to promote women's empowerment and gender equality within the framework of the project. The Plan includes detailed measures that target the empowerment of women within the project, while also taking into account gender-specific contexts and vulnerabilities. Further to this, participation from women, Indigenous groups, Dalit communities and other marginalized groups will be ensured by their representation of 50% of the project beneficiaries. Finally the ESMF includes a GBV/SEAH Action plan to address SEAH-related risks and the grievance redress mechanism includes specific pathways for the management of complaints relating to GBV/SEAH.

194. As mentioned above, country ownership is prioritised as critical to the sustainability of the project. Similarly, the importance of Indigenous traditional practices, knowledge and skills on resilience to natural disasters — including extreme climate events — has been emphasised. Careful consideration of the physical impacts of construction on water conditions downstream is also necessary, as water is traditionally considered sacred in Dolakha, Manang and other Buddhist and animist Indigenous communities.

195. The project will involve a wide range of stakeholders over large areas, therefore multi-level, systematic engagement will be required if all stakeholders are to be effectively communicated with and mis-information avoided. The project includes development of EWS warnings and GLOF reduction measures, communicating these to all stakeholders in terms that are readily understood is critical to the success of the project. Further, the various safeguard documents produced for the project need to be disclosed. A Stakeholder Engagement Plan has been developed for the project to help guide the engagement process.

196. A Grievance Redress Mechanism (GRM) has been developed for this project and is described in in the ESMF. These GRM is compatible with Nepalese legislation and compliant with UNDP and GCF standards, allowing any project stakeholder with complaints or grievances towards the project to communicate their concerns through an appropriate process. The GRM will be used at all stages of the project and will provide an accessible, rapid, fair and effective response to concerned stakeholders, in particular any vulnerable groups that may lack access to formal legal systems or support. As previously noted, the GRM contains specific pathways for the treatment of SEAH and GBV complaints.

G.2. Gender assessment and action plan (max. 500 words, approximately 1 page)

197. A Gender Equality and Social Inclusion Assessment — in line with the objectives of the GCF's Gender Policy and gender guidelines — has been developed by UNDP to inform the design of the proposed project (Annex 8). The document was based on field consultations — including 30 key informant interviews, nine focus group discussions (FGDs) and two multi-stakeholder national level workshops — as well as available data from studies conducted by the GoN, UN agencies, civil society organisations (CSOs), donor agencies and multilateral development banks.

198. The gender assessment indicates the extent to which gender inequality exists in Nepal. The country has a medium Gender Development Index (GDI), ranking 147 out of 189 countries in 2018. Gender inequalities, vulnerability and risk is exacerbated by climate change in multiple, nuanced and overlapping ways in Nepal. Gender norms, imbalanced division of labour, unequal wages, and less access to and control over land and other productive assets for women result in fewer livelihood options available to women, making them more vulnerable to climate change. Women are particularly vulnerable because of a lack of gender sensitivity in planning, development and post-disaster relief.

199. Other key vulnerable groups identified in the GESI assessment include Dalits and Indigenous groups. Dalits – – members of the lowest caste according to the Hindu social structure — residing in the Terai and Pahad[119] region are considered to be the most excluded and vulnerable group in the target areas. Indigenous groups, particularly those living in the disaster prone and remote areas of Majhi, Kumal, and Botes were also found to be extremely vulnerable. Within these different marginalised groups, women, women-headed households, the elderly, people with disabilities (PWD), pregnant and lactating mothers and children are considered to be even more vulnerable to climate change and extreme climate events. Other groups vulnerable to climate change and natural disasters are

[119] The Terai region of Nepal encompasses the lowland plains along the country's border with India. The Pahad region is the geophysical region that includes the lower hills. More information can be found in Annex 2: Feasibility Study.

poor women, elderly people, people living with disabilities across all caste and ethnic groups living in geographically remote and disaster-prone areas. These groups are particularly vulnerable because of, *inter alia,* both historical and recent inadequate consideration and integration of Indigenous groups in resilience efforts.

200. In line with the GCF's gender priorities, and the recommendations put forward by the GESI experts following consultations, the proposed project will integrate the following key areas in the Gender Action Plan (GAP):
intersectional mapping and defining of primary stakeholders and their different and overlapping exclusions, vulnerabilities, roles and contributions in terms of climate change and disaster risks;
partnerships with specialised government and non-governmental institutions to support climate-smart technology — at household and commercial level — that is accessible to women;
systematic and formal linkages of new or existing entities for improved networking and participation, through: i) women and marginalised people's groups ii) local wards and municipalities; and iii) Disaster Risk Reduction and climate change-related committees' planning structures;
improved accessibility to established institutions with experience of value chains (VCs) and micro-enterprises in the Koshi Basin areas for women and men from poor and marginalised groups;
timely, accurate and accessible communication with poor women and marginalised groups about the project and local government resources;
gender outcomes captured in the Monitoring Information System (MIS) of the project for feedback and improved upscaling purposes;
climate change and DRR management strategies with systematic integration of GESI for the project cycle; and
capacity building packages for project staff and key partners with a GESI focus.

201. These measures will ensure equal participation and maximise benefits from investment in this project. The key results regarding gender expected from this project include enabling poor and marginalised women and men to lead and manage at least 35% of the GLOF/DRR, Integrated Watershed Management and Eco-system based related committees in the project areas, providing opportunities for women to hold 50% of key decision-making positions, training 60% of women technical staffs in DHM in regular/operational monitoring for risk prioritization, providing employment and training to 60% marginalised people and ensuring that 35% women's groups in five watershed/sub-watershed areas are leading and implementing project activities (see Annex 8 for further details). The AE, EE and project PMU will ensure the implementation of activities and expected outcomes will be achieved, monitored and evaluated.

G.3. Financial management and procurement (max. 500 words, approximately 1 page)

202. The financial management and procurement of this project will follow UNDP financial rules and regulations. Further guidance is outlined in the financial resources management section of the UNDP Programme and Operations Policies and Procedures available here. UNDP has comprehensive procurement policies in place as outlined in the 'Contracts and Procurement' section of UNDP's Programme and Operations Policies and Procedures (POPP). The policies outline formal procurement standards and guidelines across each phase of the procurement process, and they apply to all procurements in UNDP[120].

203. Any materials or intangible assets procured under the project is governed by UNDP's Programme and Operations Policies and Procedures – under chapters (i) Asset Management - Property, plant and equipment and ii) Asset Management - Intangible assets (https://popp.undp.org/administrative-services). For technology solutions, clauses under the UNDP contract General Terms and Conditions, regulate Intellectual Property (IP) rights depending on the type of software or license being procured. As per the terms of the AMA, in relation to a Funded Activity that is a grant financed in whole or in part with GCF Proceeds, if any part of such grant is used to purchase any durable assets or equipment used to implement the relevant Funded Activity (such as vehicles or office equipment), upon completion of the Funded Activity or termination of the relevant FAA in accordance with its terms, the Accredited Entity shall take such steps in relation to such assets or equipment which it reasonably deems in the best interest of the continued operation of the Funded Activity taking into consideration the objectives of the Fund and the terms of the applicable SBAA. For the transfer of asset from UNDP to the Government a UNDP Template has to be completed to transfer Title of Assets from UNDP to the Government (https://popp.undp.org/document/transfer-title-assets-undp-government-country-office), where it is stated that "The transfer of title is limited to the use of such assets solely for the stated purposes of the Project in the manner and place as set out in the Project Document.

The project will be implemented following UNDP CO Support to National Implementation Modality (NIM) in line with UNDP's POPP guidelines available here. This choice is justified given the GoN's request for UNDP to execute the project and the findings of the capacity assessment of government agencies (Harmonized Approach to Cash Transfers — HACT assessments) that indicate low risk in national implementation. UNDP will ascertain the national

[120] Further details on the POPP are available at: https://popp.undp.org/SitePages/POPPSubject.aspx?SBJID=211&Menu=BusinessUnit.

capacities of the Implementing Partner by undertaking an evaluation of capacity following the Framework for Cash Transfers to Implementing Partners (part of the Harmonized Approach to Cash Transfers — HACT).

204. The UNDP Enterprise Risk Management (ERM) Policy identifies 'Capacities of the Partners' as a key Strategic Risk to be managed for the success of UNDP's work. The Partner Capacity Assessment Tool (PCAT) was designed to assess the level of risk that is present when UNDP works with partners to implement programmes and projects. The level of risk is identified by analysing partner capacity and matching project management and oversight with the level of risk assessed. By identifying areas for capacity improvement, the PCAT should also help to reduce future partner risk levels if the capacity building actions are implemented and sustained. The Partner Capacity Assessment is conducted for all projects and covers executing entities, responsible partners, grant recipients and other partners to ensure that the proposed project partners are not a prohibited organisation and do not engage in practices that are inconsistent with UNDP's social and environmental standards and code of ethics.

205. The project will be audited in accordance with UNDP policies and procedures on audits, informed by and together with any specific requirements agreed in the Accredited Master Agreement (AMA). According to the current audit policies, UNDP will be appointing the auditors. In UNDP, scheduled audits are performed during the project cycle as per UNDP assurance/audit plans, based on the Implementing Partner's risk rating and UNDP's guidelines. A scheduled audit is used to determine whether the funds transferred to the Implementing Partner were used for the appropriate purpose and in accordance with the work plan. A scheduled audit can consist of a financial audit and/or an internal control audit.

Avoidance of money laundering, terrorist financing, sanctions violations, or prohibited practices.

206. UNDP has a stand-alone AML-CFT policy which defines due diligence and partnership assessment criteria for all partners it engages. Each entity is screened against the criteria set out in this policy and other policies referenced herein.

207. UNDP also applies a zero-tolerance policy in relation to fraud and corruption. The guiding principles of UNDP's commitment to prevent, identify and address all acts of fraud and corruption have been laid out in the UNDP Policy against Fraud and Corrupt Practices (the "FCP Policy"), which applies to all activities and operations of UNDP, including projects and programmes. The fundamental principles of UNDP's FCP Policy serve as the basis for and are integrated in UNDP's policy frameworks in relation to procurement, financial management, internal control and accountability and staff rules and regulations.

208. Under the terms of the FCP Policy, AML-CFT Policy and related policies, UNDP has a commitment, when developing a new programme or project, to ensure that risks related to fraud and corrupt practices are fully identified and considered in the programme/project design and processes and that adequate and effective measures to mitigate such risks are put in place. In this light, the processes and requirements for UNDP's partnership capacity assessment (PCAT) require UNDP to carry out a thorough due diligence of the risks in relation to the programme/project it intends to engage in, as well as in relation to the potential partners who will be involved in the implementation of such programmes/projects. Such capacity assessments include, among other things, a screening of all entities being considered to be contracted by or partner with UNDP against the Consolidated UN Security Council Sanctions List (to which UNDP, by virtue of being an organ of the United Nations and therefore being part of the same entity, is also beholden), an assessment of any history of fraud, corruption or other fraudulent practices and/or potential conflicts of interest. Based on this capacity assessment, UNDP then builds an internal control component into the design of the project and ensures that the financial management of the programme/project contains adequate safeguards to prevent, monitor and address any risks and acts of fraud, corruption or AML/CFT that may be identified.

209. Reference is also made to the Harmonized Approach to Cash Transfers (HACT) applied by UNDP, which represents a common operational (harmonized) framework for transferring cash to government and non-governmental Partners (both Implementing Partners and Responsible Parties). The common objective of the HACT framework is to support a closer alignment of development aid with national priorities and to strengthen national capacities for management and accountability. It serves as a set of procedures on requesting, disbursing, providing assurance, and reporting on funds to effectively manage risks, reduce transaction costs and promote sustainable development in a coordinated manner. Cash transfers (above the threshold of $300,000 in a programme cycle, or otherwise in all circumstances where UNDP considers the operating environment high risk or has no prior experience with the partner) are presumed to present a material risk to UNDP and will require a HACT micro assessment and risk rating by qualified third party service providers. Spot checks, programmatic Output verification and auditing requirements are then determined and carried out at a frequency determined in line with the risk rating.

G.4. Disclosure of funding proposal

☒ No confidential information: The accredited entity confirms that the funding proposal, including its annexes, may be disclosed in full by the GCF, as no information is being provided in confidence.

☐ With confidential information: The accredited entity declares that the funding proposal, including its annexes, may not be disclosed in full by the GCF, as certain information is being provided in confidence. Accordingly, the accredited entity is providing to the Secretariat the following two copies of the funding proposal, including all annexes:

- full copy for internal use of the GCF in which the confidential portions are marked accordingly, together with an explanatory note regarding the said portions and the corresponding reason for confidentiality under the accredited entity's disclosure policy, and
- redacted copy for disclosure on the GCF website.

The funding proposal can only be processed upon receipt of the two copies above, if containing confidential information.

ANNEXES

H.1. Mandatory annexes

☐	Annex 1	NDA no-objection letter(s) **(template provided)**
☐	Annex 2	Feasibility study - and a market study, if applicable
☐	Annex 3	Economic and/or financial analyses in spreadsheet format
☐	Annex 4	Detailed budget plan **(template provided)**
☐	Annex 5	Implementation timetable including key project/programme milestones **(template provided)**
☐	Annex 6	E&S document corresponding to the E&S category (A, B or C; or I1, I2 or I3): - Environmental and Social Management Framework (ESMF)
☐	Annex 7	Summary of consultations and stakeholder engagement plan
☐	Annex 8	Gender assessment and project/programme-level action plan **(template provided)**
☐	Annex 9	Legal due diligence (regulation, taxation and insurance)
☐	Annex 10	Procurement plan **(template provided)**
☐	Annex 11	Monitoring and evaluation plan **(template provided)**
☐	Annex 12	AE fee request **(template provided)**
☐	Annex 13	Co-financing commitment letter, if applicable **(template provided)**
☐	Annex 14	Term sheet including a detailed disbursement schedule and, if applicable, repayment schedule

H.2. Other annexes as applicable

☐	Annex 15	Evidence of internal approval **(template provided)**
☒	Annex 16	Map(s) indicating the location of proposed interventions
☐	Annex 17	Multi-country project/programme information **(template provided)**
☐	Annex 18	Appraisal, due diligence or evaluation report for proposals based on up-scaling or replicating a pilot project
☐	Annex 19	Procedures for controlling procurement by third parties or executing entities undertaking projects financed by the entity
☐	Annex 20	First level AML/CFT (KYC) assessment [HACT Micro Assessment Reports]
☐	Annex 21	Operations and Maintenance Manual (Operations and maintenance)
☐	Annex 22	Assessment of GHG emission reductions and their monitoring and reporting (for mitigation and cross cutting-projects)
☐	Annex 23a	Residual Risk Modeling & Watershed Vulnerability Assessment Risk Reduction Measures
☐	Annex 23b	Residual Risk Modeling & Watershed Vulnerability Assessment Risk Reduction Measures - Cost Estimates, Models & Drawings
☐	Annex 24	Dam Breach Assessment Report
☐	Annex 25	Hydrological and Meteorological Stations for proposed GCF funded project
☐	Annex 26	Technical Lake Lowering Design report
☐	Annex 27	a) Adaptation Beneficiaries b) Adaptation Beneficiaries (Excel)

** Please note that a funding proposal will be considered complete only upon receipt of all the applicable supporting documents.*