Government of Nepal

Empowered lives. Resilient nations.

United Nations Development Programme

Country: NEPAL

PROJECT DOCUMENT[1]

Project Title:	**Community Based Flood and Glacial Lake Outburst Risk Reduction Project**
UNDAF Outcome(s):	People living in areas vulnerable to climate change and disasters benefit from improved risk management and are more resilient to hazard-related shocks (Outcome 7).
Expected CP Outcome(s):	Same as UNDAF Outcome

Expected Nepal Country Programme Action Plan (CPAP) Output (s)

Output 7.3. Vulnerable populations have increased knowledge about disaster risk management and capacity for climate change adaptation and mitigation of risks.

Output 7.3.2. Water level in Imja Glacier Lake reduced by 3 meters and risk mitigation measures adopted in 4 most vulnerable Tarai districts.

Executing Entity/Implementing Partner: Department of Hydrology & Meteorology (DHM), Ministry of Science, Technology and Environment (MoSTE)

Implementing Entity/Responsible Partners: UNDP

Programme Period:	2013 – 2017
Atlas Award ID:	00069781
Project ID:	00084148
PIMS #	4657
Start date:	2013
End Date	2017
Management Arrangements	NIM
PAC Meeting Date	10 April 2013

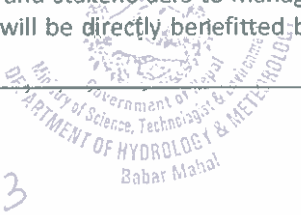
Total allocated resources:	**7,249,430**
• GEF-LDCF	6,300,000
• UNDP (in-cash)	949,430
Co-finance (kind – parallel co-financing)	
• *UNDP (CDRMP)*	*7,682,900*
• *NRRC*	*2,857,811*
• *Govt Nepal/DWIDP*	*7,000,000*
• *USAID-ADAPT ASIA*	*157,369*
• *ICIMOD*	*1,705,000*
Total Co-finance	*19,403,080*

[1] For UNDP supported GEF funded projects as this includes GEF-specific requirements

Brief Description

Nepal is one of the most disaster-affected countries in the world and among the top ten countries that are most affected by climate-related hazards. Nepal's economic and human development have been greatly constrained by the country's mountainous terrain, lack of access to the sea and its high susceptibility to natural disasters, particularly floods, landslides, windstorms, hailstorms, earthquakes, forest fires, glacial lake outburst floods (GLOFs) and avalanches. Climate change is projected to increase the severity and unpredictability of flooding and will also increase the risk of potentially catastrophic Glacial Lake Outburst Floods (GLOFs) in the High Mountains as glaciers retreat and glacial lakes expand. A recent report on Disaster Risk Reduction concluded that as climate change impacts increase, more than 1 million people in Nepal would become vulnerable to climate-induced disasters every year. The Government of Nepal is acutely aware of the growing problems the country faces due to existing and future climate-related hazards. However, there are a number of key barriers that must be overcome.

LDCF support will help the GON to overcome some of the key barriers to managing the growing risks of GLOFs in the High Mountains and flooding in the Tarai and Churia Range of southern Nepal through with a strong emphasis on community engagement, empowerment and social inclusion. At present, there is insufficient institutional knowledge and capacity to understand and manage GLOF risks, as they are highly complex, site-specific and too costly; and at the same time there lacks cohesion among different agencies to manage the risks associated with recurrent flooding in the Tarai in current on-going programmes. The support will assess the gaps and help increase the institutional knowledge and capacity of the various stakeholders and also build the limited capacity and understanding among local communities regarding ways to reduce their vulnerability to GLOFs in the mountains and flooding in Tarai. It will improve information sharing and coordination at the central and local levels and among the various Ministries, Departments and non-governmental actors. Under the first component, the project strategy for reducing GLOF risks arising from Imja Lake posing threat to local populations, material assets and tourists visiting Sagarmatha (Mount Everest) National Park will have significantly reduced by reducing the lake volume through an artificial controlled drainage system combined with a community-based early warning system (CBEWS). Under the second component, the project strategy for reducing human and material losses from recurrent flooding events in 4 flood prone districts (Mahottari, Siraha, Saptari and Udayapur) will have increased the adaptive capacity of local communities in eight VDCs of 3 river basins (Ratu, Khando, Gagan) and two tributaries Hadiya and Kong through locally-appropriate structural and non-structural measures, including flood-proofed water and sanitation systems, a sediment control programme, river bank and slope stabilization and the implementation of CBEWS. The sediment control programme in Ratu river, the first of its kind in Nepal, will demonstrate the critical importance of managing upstream-downstream linkages in any riverine flood risk management programme. Through this support, in addition to strengthening/building capacity of key local and national institutions and stakeholders to manage GLOF and lowland flood risks in Nepal; approximately 96,562 vulnerable people will be directly benefitted by these interventions.



Agreed by (Executing Entity/Implementing Partner): 15 July 2013

Date/Month/Year

Agreed by (UNDP): 15 July 2013

Date/Month/Year

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ADAPT-Asia	Adaptation Project Preparation Facility for Asia
ADB	Asian Development Bank
AEPC	Alternative Energy Promotion Center
AIT	Asian Institute of Technology
BCPR	Bureau for Crisis Prevention and Recovery
BPC	Nepal Butwal Power Company
BZMC	Buffer Zone Management Committee
CBDM	Community Based Disaster Management
CBDRR/M	Community Based Disaster Risk Reduction/Management
CBEWS	Community Based Early Warning System
CBO	Community Based Organizations
CCMD	Climate Change Management Division
CCP	Climate Change Policy
CDMA	Code Division Multiple Access
CDO	Chief District Officer
CDRC	Central Disaster Relief Committee
CDRMP	Comprehensive Disaster Risk Management Programme
CEPTE	Centre for Excellence in Production and Transportation of Electrical Energy
CPAP	Country Programme Action Plan
CRM-TASP	Climate Risk Management Technical Assistance Support Project
DDC	District Development Committee
DDRC	District Disaster Relief Committee
DEEU/S	District Energy and Environment Unit/Sections

DIPECHO	Disaster Preparedness European Commission's Humanitarian Aid
DFID	Department for International Development
DFO	District Forest Office
DHM	Department of Hydrology and Meteorology
DNPSC	Department of National Parks and Soil Conservation
DoG	Department of Geology
DRM	Disaster Risk Management
DRR	Disaster Risk Reduction
DRRAP	Disaster Risk Reduction Action Plan
DSCO	District Soil Conservation Office
DSCWM	Department of Soil Conservation and Watershed Management
DWIDP	Department of Water Induced Disaster Prevention
ECHO	European Commission's Humanitarian Aid office
EIA	Environmental Impact Assessment
ELA	Equilibrium Line Altitude
EOC	Emergency Operations Center
EPP	Emergency Preparedness Plan
EWS	Early Warning System
FAO	Food and Agriculture Organization
FS4	Flagship 4 Programme
GDP	Gross Domestic Product
GEF	Global Environment Facility
GLOF	Glacial Lake Outburst Floods
GoN	Government of Nepal
GRMC	GLOF Risk Management Committee

HDI	Human Development Index
HFA	Hyogo Framework for Action
HiCCDRC	Himalayan Cryosphere, Climate and Disaster Research Center
HMGWP	High Mountain Glacial Watershed Programme
ICIMOD	International Center for Integrated Mountain Development
IDNDR	International Decade for Natural Disaster Reduction
IDS	Integrated Development Society
IEE	Initial Environmental Examination
INC	Initial National Communications
I/NGO	International/ Non-governmental Organization
IPCC	Intergovernmental Panel on Climate Change
ISDR	International Strategy for Disaster Reduction
ISS	Implementation Support Services
KACC	Khumbu Alpine Conservation Council
km	kilometre
KU	Kathmandu University
LAPA	Local Adaptation Plan for Action
LDC	Least Developed Country
LDCF	Least Developed Country Fund
LDO	Local Development Officer
LIA	Little Ice Age
LIGG	Lanzhou Institute of Glaciology and Geocryology
m	meters
masl	meters above sea level
MCTC	Ministry of Culture, Tourism and Civil Aviation

MoA	Ministry of Agriculture
MoSTE	Ministry of Science, Technology and Environment
MoF	Ministry of Finance
MoFSC	Ministry of Forests and Soil Conservation
MoHA	Ministry of Home Affairs
MoI	Ministry of Irrigation
MoPE	Ministry of Population and Environment
NAPA	National Adaptation Programme of Action to Climate Change
NASA	National Aeronautics and Space Administration
NAST	National Academy of Science and Technology
NCRA	Natural Calamity (Relief) Act
NRRC	Nepal Risk Reduction Consortium
NRs	Nepali Rupees
NSDRM	National Strategy for Disaster Risk Management
NSET	National Society for Earthquake Technology
NWP	National Water Plan
NWRS	National Water Resources Strategy
OECD	Organization for Economic Co-operation and Development
PEB	Project Executive Board
PEP	People's Embankment Programme
PIF	Project Identification Form
PPG	Project Preparation Grant
PRECIS	Providing Regional Climate for Impact Studies
PSC	Project Steering Committee
RBMF	Results-based Management Framework

RCCRP	Regional Climate Risk Reduction Project in the Himalayas
RCCP	Rastrapati (President's) Churia Conservation Program
RDRC	Regional Disaster Relief Committee
RGLOFRRP	Regional GLOF Risk Reduction Project
RGSL	Reynold Geoscience
SCCF	Special Climate Change Fund
SNC	Second National Communication
SNPO	Sagarmatha National Park Office
SPCR	Strategic Programme for Climate Resilience
TMI	The Mountain Institute
TNA	Technology Needs Assessment
TRGRRP	Tsho Rolpa GLOF Risk Reduction Project
TYP	Three Year Plan
UK	United Kingdom
UNDAF	United Nations Development Assistance Framework
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNICEF	United Nations Children Fund
UNISDR	United Nations International Strategy for Disaster Reduction
UNOCHA	United Nations Office for the Coordination of Humanitarian Affairs
USAID	U.S. Agency for International Development
USD	United States Dollars
VDC	Village Development Committee
VDMC	Village Disaster Management Committees
WDO	Women Development Office

WECS	Water and Energy Commission Secretariat
WIDMP	Water-Induced Disaster Management Policy
WMO	World Meteorological Organisation
WWF	World Wide Fund for Nature

I. SITUATION ANALYSIS

1.1 Brief Country Overview

1. Located in the Hindu Kush-Himalayas, Nepal is a land-locked country bounded by China to the north, and India to the east, south and west. The country has a total geographic area of 147,181 km^2 and is typically divided into five physiographic zones that run broadly in an east-west direction. These are, from north to south: the Tibetan Plateau to the far north; the Higher Himalaya, with over 240 peaks above 6,096 meters above sea level (masl); the Lesser Himalaya; the Shiwalik Hills or Churia Range as they are known in Nepal; and the fertile alluvial plains of the Tarai, which comprise the northern extension of the Indo-Gangetic Plain, to the far south. Major fault lines separate the zones from each other and the entire region is highly seismic. Altitudes range from 60 to c. 200 masl in the Tarai to 8,848 masl at the peak of Sagarmatha (Mount Everest).
2. For development planning purposes, these zones are generally treated as three geographic units or ecological zones, namely the High Mountains (including the Tibetan Plateau), the Middle Hills (including the Churias), and the low-lying Tarai. The Middle Hills make up two thirds of the country's geographic area, while the Tarai, which consists of a narrow belt between 20-70 km wide, covers some 13% of the country's geographic area. For administrative purposes and planning purposes, the country is divided into five Development Regions (Eastern, Central, Western, Mid Western and Far Western) and 75 districts. Districts are further subdivided into smaller administrative units such as municipalities, Village Development Committees (VDCs) and Wards. The country's capital, Kathmandu, occupies the largest valley in the Middle Hills (Figure 1).

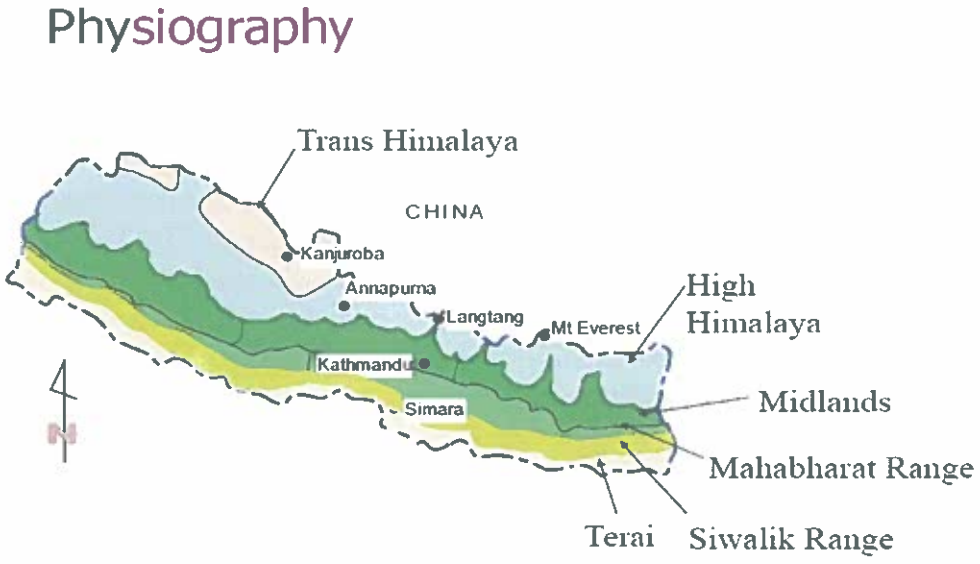


Figure 1: Physiography of Nepal, ICIMOD

3. Over 80% of Nepal's population of 26 million (CBS 2006 in UNDP, 2009) lives in rural areas, mainly in the Tarai (51%) and the Middle Hills (47%); only 7% of the population lives in the High Mountains (UNDP, 2009). Population density is highest in the Tarai (330/km^2) and lowest in the High Mountains (33/km^2) and intermediate in the Middle Hills (167/ km^2 ; Khanal et. al, 2007). The average annual population growth rate between 1991 and 2001 was 2.25%, with the highest rate of growth (2.62%) in the Tarai region (Khanal et. al, 2007). Although Nepal has undergone major poverty reduction in recent decades, the country still had the lowest national per capita GDP in South Asia in 2009 (UNDP 2009) and also ranked below most neighbouring countries on the Human Development Index (HDI). According to the latest national survey of living standards, 30.9% of the population lives below the poverty line. The poverty rate varies significantly across the country's five development regions and the three major ecological zones, with highest rates of poverty in the Mid and Far Western Development Regions. However, in terms of distribution of the poor, 47% and 45% live in the Middle Hills and Tarai, respectively, and only 7.5% in the High Mountains (UNDP, 2009).

4. Nepal's economic and human development have been greatly constrained by the country's mountainous terrain and its associated problems of inaccessibility, marginality and fragility and lack of access to the sea and its high susceptibility to natural disasters: Nepal is one of the most disaster-affected countries in the world. The country is exposed to multiple hazards, particularly floods, droughts, landslides, windstorms, hailstorms, earthquakes, forest fires, glacial lake outburst floods (GLOFs) and avalanches. Reports from Nepal's Ministry of Home Affairs (MoHA) show that over the course of the past 10 years, more than 4,000 people have died from climate-induced disasters, which have resulted in accumulated economic losses of US$5.34 billion (Ministry of Home Affairs, Disaster Preparedness Network, Documentation Centre, 2010). Low levels of human and physical capital, weak government institutions, and political instability have also contributed to the slow pace of development (UNDP, 2009).

5. Agriculture is the main source of livelihood for the majority of the population. The fertile floodplains of the Tarai are Nepal's agriculturally most productive region, and also the location of the majority of the country's small-scale industries, which rely heavily on processing agricultural produce (UNDP, 2009). However, although approximately 66% of the national population engages in agriculture, the agricultural sector accounts for only 36% national GDP (UNDP, 2009). The contribution of industry to GDP has stagnated generally, partly due to the unfavourable business climate that prevailed during time of the Maoist insurgency between 1995 and 2006. Nepal's export-oriented industries were particularly hard hit by the unfavourable political and business climate of the past decade. The share of exports in national GDP fell from 23 per cent in 1996 to 14 per cent in 2006 (UNDP, 2009). Furthermore, fuel shortages, rising fuel prices, slow progress in post-conflict reconstruction and political uncertainties have continued to adversely affect the industrial sector in recent years. Tourism is one of the Nepal's most important sources of foreign currency. Mount Everest alone in the Solukhumbu district has been able to generate USD 2.3 million in

royalties in 2010. Nepal's total earning from the tourism sector in 2010 was USD 329,982 million.[2] The total share of travel and tourism in national economy was 53.5 billion (4% of total GDP) in 2011 and the estimated forecast for 2012 is 4.7% (TTEI Nepal, 2012)

6. The country's ecosystem services and fragile natural resource base, including its land, water, and forest resources, are under increasing pressure from a rapidly growing population and poorly planned and regulated development. The deterioration of the environmental and natural resource base has contributed to chronic rural poverty and migration to urban areas, as well as heavy out-migration to India, Arab states and other countries. Uncontrolled urbanization and spreading infrastructure, especially housing has reduced the availability of agricultural land and increased congestion and environmental degradation associated with the poorly managed disposal of solid and industrial wastes and other forms of pollution. According to the latest Ecological Footprint measurements, Nepal's use of resources and waste production currently exceed it's biocapacity by 20%.[3]

1.2 Climate change - induced problem

7. Nepal falls within a subtropical climate zone. However, due to its unique physiographic and topographic distribution it possesses enormous climatic and ecological diversity within a north-south span of about 140 km (see Figure 1 and 2). The climate types ranges from subtropical in the south to arctic in the north. The climate of Nepal is essentially dominated by the south-easterly monsoon which provides most of the precipitation during the rainy summer months (June to September). Nepal climate is characterized by four distinct seasons: the pre-monsoon (March-May); the monsoon (June-August/September); post-monsoon (September/October-November) and winter (December-February). Monsoonal precipitation is the most important climatic element for agriculture as well as development of water resources. Average annual precipitation in the country is 1,768 mm (Shrestha et al. 2000). Depending on the location about 70 to 85% of annual precipitation in the country occurs during this period (Singh 1985; Ives and Messerli 1989).

8. In general, the onset and retreat of the south-westerly monsoon is associated with the change in the direction of seasonal winds and the northward and southward shift of the Intertropical Convergence Zone (ITCZ). Nepal receives heaviest precipitation when the position of ITCZ is close to the foothills of Himalaya. Precipitation is also heavy when the monsoon depressions forming over Bay of Bengal pass through the country. The south-eastern part of Nepal receives the first monsoon rainfall, which slowly moves towards west. There is a marked variation of monsoon precipitation amount from east to west, as well as from south to north. The contribution of the monsoon precipitation is substantially greater in the south-eastern part of the country compared to the north-west. Even so, due to the extreme topographical variation, precipitation varies significantly from place to place both in local scale as well as in macro-scale. Most parts of the country receive an average annual rainfall of between 1,500-2,500mm, up to a maximum of 4,500mm in some places. Monsoon rainfall, which is also characterized by high inter-annual variation, is highest in the east and declines westwards, while winter rains are higher in the northwest and decline to the southeast. Temperature varies with altitude and season, generally increasing from north to south and decreasing with altitude. The winter season is the coldest, while

[2] See Nepal Tourism Statistics 2010: http://www.tourism.gov.np/uploaded/statistics2010.pdf

[3] The Ecological Footprint method provides a useful measure of population, per capita consumption and the intensity of resource use and waste production relative to 'biocapacity', i.e. the area of productive land and water available to produce resources or absorb CO_2 waste under current management practices. See Ewing et al. 2010 and Global Footprint Network 2011.

the highest temperatures occur during the pre-monsoon months (MoE 2010). Temperature records show high inter-annual variability. The approaching monsoon winds are first intercepted by the foothills of Churia range, where heavier rainfall occurs, and rainfall increases with altitude on the windward side and sharply decreases in the leeward side. Lumle (1,642 masl) lying south (windward side) of the Annapurna range in Nepal Himalayas receives about 5,000 mm of annual rainfall, whereas Jomsom (2,750 masl) lying north (leeward side) of it receives only about 250 mm of rain per annum. Summer monsoon precipitation occurs as snow and ice at higher altitudes, which plays a vital role in nourishing large numbers of glaciers, especially those situated in eastern and central Nepal, the majority of which are summer accumulation type glaciers.

9. Winter precipitation is caused by westerly weather systems and associated systems are commonly known as westerly disturbances which have their origin further west. The low pressure systems are steered and swept eastwards by the westerly winds aloft. These disturbances bring snow and rain during winter and spring, most significantly to the north-western part of the country. Winter precipitation contributes significantly to the annual total precipitation in Nepal's northwest. It plays a major role in the mass balance of glaciers in western Nepal, while playing a secondary role in the glaciers of eastern and central Nepal (Seko and Takahashi 1991). Although the winter precipitation is not as impressive in volume or intensity as the summer monsoon precipitation, it is of vital importance in generating water flows for agriculture. Most of the winter precipitation falls as snow and nourishes snowfields and glaciers which generate melt water during the dry season between February and April.

10. The maximum temperature of the year occurs in May or early June. Temperature starts decreasing from October and reaches the minimum in December or January. As temperature decreases with height, the sharp altitudinal gradients in the topography of the country have resulted in significant spatial variation in temperature. The Tarai belt is the hottest part of the country where maximum temperatures cross 45°C. The highest temperature ever recorded is 46.4°C in Dhangadhi, a town in far western Tarai, in June 1995.

11. Temperature data collected from the mid-1970s from 49 hydro-meteorological stations of Nepal indicate that the average temperature between 1977 and 1994 increased at a rate of 0.06 °C per year (Shrestha et al. 1999 and Shrestha and Aryal 2011; Xu et al, 2007). The warming trends varied from 0.068 to 0.128 °C/yr in most of the Middle Hills and Himalayan regions, while the Siwalik and Tarai regions show warming trends of less than 0.038 °C/yr (Shrestha et al., 1999). A study based on data from 1975 to 2005 shows that the mean temperature of the country is increasing steadily at the linear rate of 0.04°C/year (Baidya et. al., 2007). This rate is much higher than the mean global rate of warming (0.0177 °C/year for last 25 years). Warming was more pronounced in high altitude regions such as the Middle Hills and the Himalayas i.e., the rise in temperature was greater at the higher altitudes. In fact, the adjacent plains and foothill areas experienced only negligible warming and increases in temperature were more pronounced during the cooler months (0.06–0.08 oC per year from October–February, for all of Nepal) than for the warmer months (0.02–0.05 oC per year for March–September for all of Nepal. In high-altitude areas, using the relationship between glacial retreats and climate warming, scientists have found greater temperature rises in some glaciated areas in Nepal. For example, Kadota et al. (1997) estimated a 1.4 oC temperature rise from 1989 to 1991 at the terminus of glacier AX010 in the Shorong Himal (at 4,958 masl) while studying the rapid retreat of the glacier after 1989. Relatively smaller, but nevertheless considerable, temperature increases (average of 7 stations, 0.025 oC per year) were recorded at stations around glaciers in the Dhaulagiri region during the last decades of the twenty-first century (Shrestha and Aryal 2011). Also, the increase is little higher in maximum than in minimum temperature series. The temperature data for Kathmandu, when compared with the global data in the latitude belt 24-40°N, a general similarity between the two series is seen i.e. an overall decreasing trend from 1940-1970 and a monotonous increase thereafter.

12. Nepal being a mountainous country, the temperature variation with altitude also plays very important role in vegetation and other aspects of social life. The lapse rate of the maximum temperature is always higher than that of the minimum temperature. Differences between the highest and the lowest lapse rates for maximum and minimum temperatures are observed during the monsoon and pre-monsoon seasons, respectively due to perhaps altitudes, topography and wind patterns. The highest lapse rate is during pre-monsoon season with the temperature being the maximum. Whereas, the lowest lapse rates is seen during winter season with the minimum temperature. Strong spatial and temporal variations exist in the rainfall distributions of Nepal

(Shrestha et al., 1999; Shrestha, 2000). The seasonal mean rainfall is highest during summer monsoon season and lowest during winter. Pre- and post-monsoon thunder activities and occasional passage of the western disturbances make rainfall during these periods a little higher than winter. However, variability is highest during post-monsoon and lowest during monsoon seasons (Shrestha et al., 1999; Shrestha, 2000). Although variability of monsoon rainfall is relatively small, this variability may have severe impacts on the socio-economy. All-Nepal summer monsoon rainfall time series shows both interannual variability and a slight increasing trend (about 20 % of the average per decade). Extreme monsoon rainfall events have also been analyzed and the results show that, over a period of 47 years, 7 droughts and 8 flood conditions associated with intraseasonal variation of monsoon rainfall occurred, which have direct impact on both agriculture and water resources (Shingvi et al., 2010). Figure 2 below shows the cross section of Nepal's topography (Shrestha et.al., 1999):"

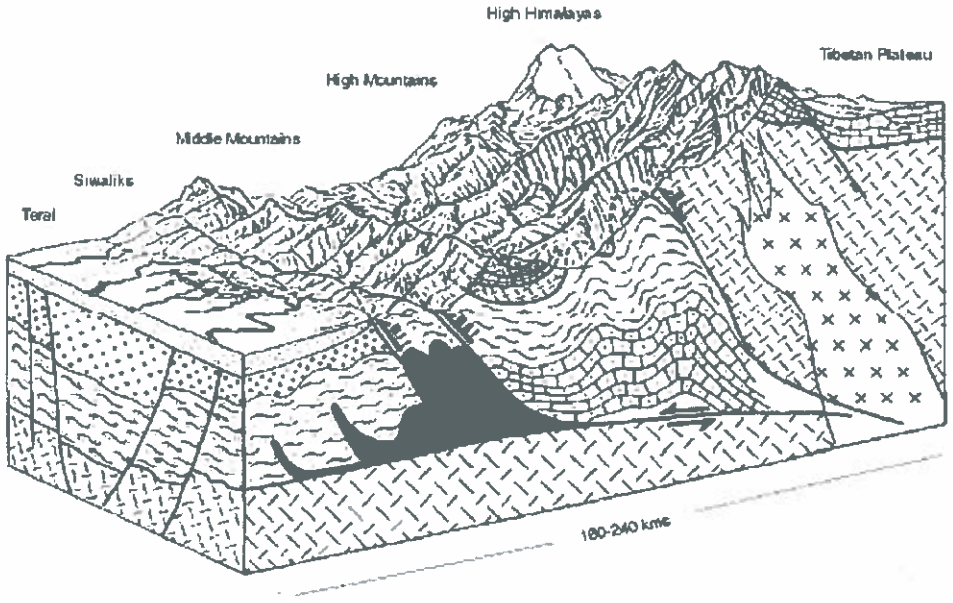


Figure 2: Cross section of Nepal's topography (Shrestha et.al., 1999)

13. Nepal's economic and human development is closely tied to a number of climate-sensitive resources and sectors, such as agriculture, water and hydropower. Its population is already exposed to a large range of natural hazards, including climate-related hazards. Although, the country's overriding development priority is to achieve *'a remarkable and sustained reduction'* in the country's poverty level and promote socially inclusive development (Section 1.2), climate variability and increasing extreme weather conditions threatens to further constrain development and potentially undermine recent development gains by negatively impacting critical natural resources and economic sectors and exacerbating existing climate-related disaster risks.

14. The current impacts of climate change in Nepal include water shortages in the dry season due to glacial retreat; accumulation of large bodies of water on glaciers or behind thinning

moraine[4] dams which increases the risk of glacial lake outburst floods (GLOFs); and increasingly erratic rainfall during the monsoon season (shorter, more intense bursts of rain that alternate with longer dry periods) which increase the risk of flash floods, landslides, erosion and reduced groundwater reserves due to excessive surface runoff. These impacts often have immediate adverse consequences for the country's population, particularly its rural poor, especially the most vulnerable among them, as well as negatively impacting the hydropower, water resources and agricultural sectors.

15. According to a climate change vulnerability index prepared in 2010 by Maplecroft, a British Risk Analysis firm, Nepal is the fourth most vulnerable country in the world to the impacts of global warming. A recent case study of "*Economic and Financial Decision-Making in Disaster Risk Reduction*" in Nepal supported by UNDP (MoHA, 2010) concluded that as climate change impacts increase more than 1 million people in Nepal will be vulnerable to climate-induced disasters such as floods, landslides and drought every year.

16. Observed trends in climate-related flooding and other hazards and related losses and damages are discussed below, followed by a summary of the key findings of climate change projections for Nepal. Further details are provided in the climate risk analysis in Annex 1.

1.2.1 Observed Trends in Climate-related Flooding Hazards, Losses and Damages

17. Nepal faces a variety of natural hazards of geologic and climatic origin. The entire country is extremely earthquake-prone as mountain-building processes are still underway in the geologically young Himalayas. Intense monsoon rainfall and/or earthquakes also serve as triggers for floods, landslides, debris flow and other secondary hazards. Fire and drought are problems in the dry season. Landslides are the most common and frequent natural hazard, especially in the Middle Hills and High Mountains, while floods are especially common and problematic in the densely-populated and cultivated low-lying Tarai region. More recently, there has been growing concern about the increasing risk of glacier lake outburst floods (GLOFs) originating in the High Mountains due to glacial retreat and expansion of glacial lakes in some areas.

18. Nepal has more than 6,000 rivers and streams, which fall into three broad categories based on source and discharge (Fig. 3). The major perennial rivers, such as the Koshi, Gandaki, Karnali and Mahakali river systems, originate in the High Mountains and carry snow-fed flows with significant discharge even in the dry season. Others originate in Middle Hills or the Mahabharat Range and are fed by precipitation percolation and ground water recharge, including natural springs. Although perennial, these rivers are characterized by large seasonal fluctuations in discharge. They include the Mechi, Kankai, Kamala, Bagmati, West Rapti and Babai rivers. The third category of river systems, which originate in the Churia

[4] A mass of till (boulders, pebbles, sand, and mud) deposited by a glacier, often in the form of a long ridge. Moraines typically form because of the plowing effect of a moving glacier, which causes it to pick up rock fragments and sediments as it moves, and because of the periodic melting of the ice, which causes the glacier to deposit these materials during warmer intervals.

Range and flow through the Tarai, are seasonal, with little or no discharge during dry season, and characterized by a high rate of sedimentation and bank scouring.

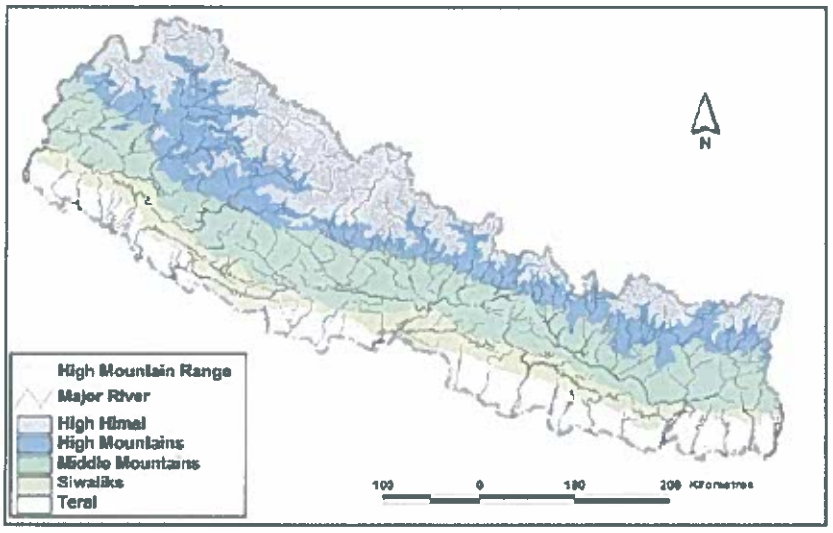


Figure 3: River Drainage systems and networks of Nepal (Himalayan River Fun, Kathmandu)

19. Not surprisingly, given the country's topography, monsoon climate and its numerous rivers and streams covering, most of Nepal, excluding the glacier-free districts of the High Mountains to the north, is extremely flood-prone, particularly during the monsoon season. During the monsoon (June-September), perennial rivers often swell, flow faster and overflow causing widespread flooding in downstream areas as far as the Tarai. Melting snow in the High Himalaya, especially in early summer, also contributes to downstream flooding. Seasonal rivers, which drain the areas between the basins of the larger and medium-sized rivers, are also responsible for flash floods and inundation of settlements and agricultural lands in the Tarai during the monsoon. Devastating floods are generally triggered by one or more of the following events: i) continuous rainfall and cloudburst, ii) GLOFs, iii) landslide dam outburst floods (LDOFs), iv) floods triggered by the failure of infrastructure, and v) sheet flooding or inundation[5] in lowland areas due to an obstruction imposed against the flow.

20. Apart from injuries and loss of lives and damage to infrastructure and property, floods also cause human miseries, contaminate drinking water and destroy agricultural crops and fields. Thus, flooding causes considerable collateral damage in terms of epidemics, diseases and famines. The full potential impacts of flooding are clearly demonstrated by the last major devastating flooding event that occurred in the Central Region of Nepal in July 1993. Over 1,300 people lost their lives, while thousands became homeless, and thousands of hectares of crops were destroyed. Forty-four districts and half a million people from 73,000

[5] To cover with water, especially flood-water

households are reported to have been adversely affected by this particular event. Several important bridges on the Prithvi and Tribhuvan highways, including seven on the Prithvi Highway alone, were washed away, isolating Kathmandu Valley from the rest of the country, while the Kulekhani 1 and 2 power stations had to be shut down due to damage to the penstock pipe. Several major and minor irrigation projects were also either damaged or completely washed away. The total loss in terms of physical destruction was estimated to be approximately USD 67 million (NRs 5 billion) (Pradhan, 2007).

21. The disaster dataset for Nepal (Nepal DesInventar data) is an important source of information on historical natural disasters since 1971. INVENTAR, maintained by NSET with financial and technical support from UNDP, provides information on disaster-related human deaths and injuries, as well as the impact and losses from all types of hazards, including both large-scale disasters and smaller events that may not involve loss of human lives. Between 1971-2007, flood, fire and epidemics were the most common major disasters in terms of number of recorded incidents, while epidemics, landslides and floods caused the largest number of deaths (NSET, 2007). Among the different hazards, floods affected the largest number of people. Thus, of all those affected by disasters between 1971-2007, 68% were affected by floods (Figure 3), with the highest number of deaths and injuries occurring in some of the Tarai and Middle Hill Districts.

22. Floods and landslides are the most devastating overall in terms of number of deaths and damage caused. Of all deaths due to natural disasters in 2010, 29% and 25% were due to floods and landslides, respectively, while 71% of all families affected by disasters in 2010 were affected by floods (DWIDP, 2011). Between 2001-08, floods and landslides: killed nearly 1,700 people; affected over 220,000 families; killed over 33,000 livestock; destroyed over 52,000 houses and washed away or destroyed over 22,000 ha of land. The monetary value of damages due to floods and landslides for 2001-2008 (Figure 3) was estimated as US$130 million (about 0.1% of GDP) (MoHA, 2010).

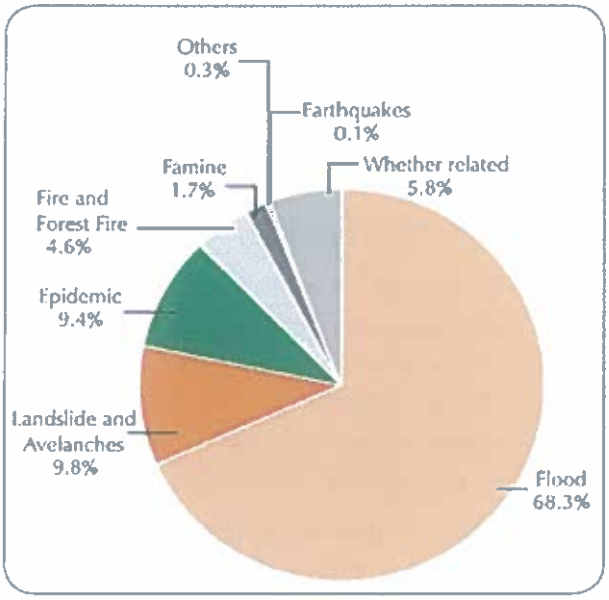


Figure 4: Disaster-affected people by different types of natural disasters between1971-2007 (NSET, 2007)

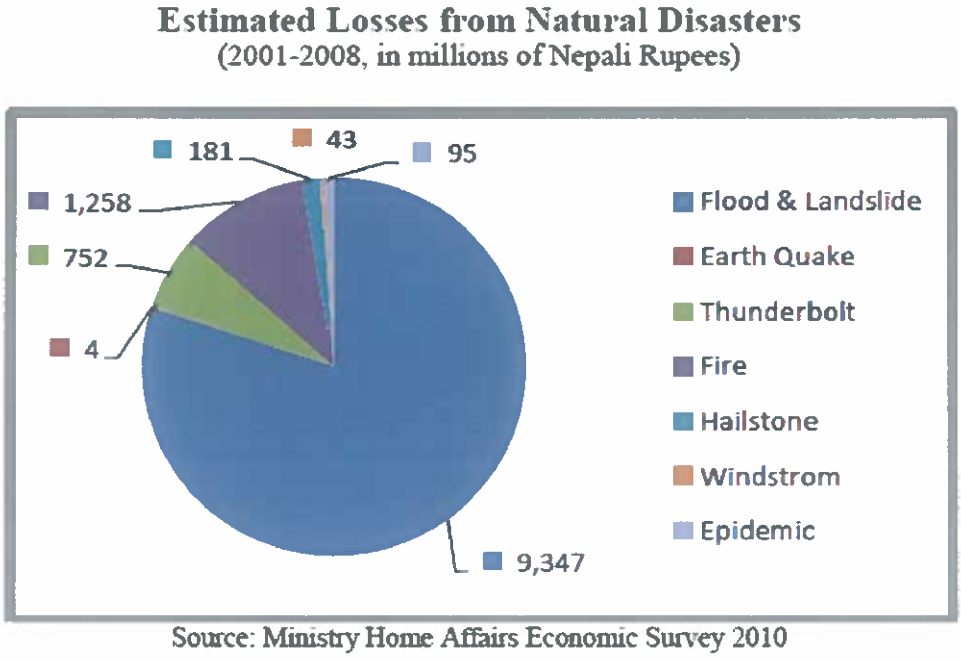


Figure 5: Losses from different natural disasters from the year 2001-2008 (MoHA, 2010). Note: In 2008, .014 USD was equal 1 Nepalese Rupee

Flooding has become an increasingly serious concern as there has been a marked increase in the severity and uncertainty of flooding events and growing risks of potentially catastrophic GLOFs in certain parts of the High Mountains. Between 1971 and 2007 (i.e. a 37-year period),

more than 2,500 floods were reported. These affected more than 3,000,000 people, caused at least 3,000 deaths and destroyed or damaged some 150,000 buildings (UNDP, 2009). These two types of major flooding risks, which are the primary focus of this project, are described further below.

1.2.2 GLOF Risks in the High Mountains of Nepal

23. GLOFs occur relatively infrequently, but are the most hazardous flood risk in the High Mountains. ICIMOD has identified over 2323 glacial lakes in Nepal (ICIMOD 2011). Most of these have been formed in response to warming temperatures during the second half of the 20th century (Yamada and Sharma 1993; Yamada 1998; ICIMOD, 2011), as a result of rapid glacier melting. Various studies indicate that the warming trend in the Himalaya region has been greater than the global average (ICIMOD, 2007).

24. Studies have shown that the majority of present day large moraine dammed lakes did not exist before the 1950s. These lakes started forming in the mid to late 1950s, and in the 1970s they grew in a rather rapid manner. Most of the glacial lake outburst flood (GLOF) events recorded in this region happened in the last three decades or so. There are strong indications that the GLOF frequency has increased in recent decades. There are over 200 potentially dangerous glacial lakes in the HKH region out of which 10 have been classified as hazardous, which could burst out and cause flash floods (ICIMOD 2007). Under the observed and projected climate scenarios, it is very likely that the risk of GLOF events will increase in future.

25. As the glaciers retreat, lakes start to form and fill up behind natural moraine or ice dams at the bottom or on top of these glaciers. When the water volume reaches a certain critical level, either due to glacial melt and/or potentially extreme precipitation events, the ice or sediment bodies that contain the lakes can breach suddenly, leading to a discharge of huge volumes of water and debris. These discharges, known as Glacial Lake Outburst Floods (GLOFs), have the potential to release millions of cubic meters of water and debris, with peak flows as high as 15,000 cubic meters per second. During a GLOF, the V-shaped canyons of a normally small mountain stream can suddenly develop into an extremely turbulent and fast-moving torrent, some 50 meters deep. Additionally, GLOF events in the Higher and Lesser Himalayas often have a cumulative effect on the downstream plains and Tarai region, which experiences a higher rate of sedimentation and larger area of flood inundation as a result. A recent study by ICIMOD on the formation of glacial lakes in the Hindu-Kush Himalayas and GLOF risks has identified 20 potentially dangerous glacial lakes in Nepal (ICIMOD 2010).

26. GLOFs have been recorded 14 times in the Nepalese Himalayas, most recently in 2004 (Table 1). These have sometimes had devastating consequences as in the case of Dig Tsho in 1985 and Tam Pokhari in 1998 as a result of the large volume of discharged water and debris resulting in the destruction of downstream farmland, infrastructure, and villages.

Table 1: Past GLOF events in Nepal and Tibet having effects in Nepal.

Date	Lake Name	Major River basin	Cause	Impacts and Damages
15th century	Machhapuchchhre	Seti Khola	Moraine collapse	Pokhara Valley covered by 50–60m deep debris including boulders greater than 10m in diameter
1935	Taraco lake	Poiqu (Bhote-Sun Koshi) basin	unknown	Wheat field destroyed, several Yaks lost
1964	Longda Glacier lake	Trishuli River Basin	unknown	unknown
1964	Zhangzangbo	Poiqu (Sun Koshi) basin	unknown	unknown
1964	Gelhaipu Co	Pum Qu (Arun) Basin	unknown	unknown
1968, 1969, 1970	Ayico	Pum Qu (Arun) Basin	unknown	4.59 million m^3 Sediment deposited
1977	Nare	Dudh Koshi (Imja River)	Moraine collapse	Mini-hydro, bridges, farm land destroyed
1980	Nagma Pokhari	Tamor Basin	Moraine collapse	Villages destroyed 71 km from source
1981	Zhangzangbo 2nd time	Poiqu (Sun Koshi) basin	unknown	Destroyed highway, intake of Sun Koshi Hydropower station
1982	Jinco	Pum Qu (Arun)	unknown	8 villages affected and 1600 livestock lost
1985	Dig-Tsho	Dudh Koshi	Ice avalanche	Destroyed Namche Hydropower station, 14 bridges, trails, agricultural land
1991	Chubung	Tama Koshi	Moraine collapse	Houses and farm land destroyed
1998	Tam Pokhari	Dudh Koshi	Moraine overtopping	Destroyed 5 bridges, agriculture, 2 human casualties
2003	Kabache lake	Madi River	Moraine collapse	5 human casualties, 24 houses, hundreds of hectares of agricultural land, 1 suspension bridge and 7 km Agriculture road destroyed

Sources: Bajracharya et al., 2008; Damen, 1992; Dwivedi, 2000 & 2005; Dwivedi et al.al, 1999; Galay, 1985; Ives et al., 2010 ; Lanzhou Institute of Glaciology and Geocryology (LIGG), Water and Energy Commission Secretariat (WECS), Nepal Electricity Authority (NEA), 1988; Mool et al., 1995, 2001; Yamada, 1998.

1.2.3 Flooding in the Tarai and the Churia Range

27. The Tarai is an almost flat land covered with thick deposits of alternating sand, gravel and silt, while the Churia hills, which are comprised of very fragile soils and sedimentary rock, are Nepal's first monsoon barriers, and serve as a water recharge area for the Tarai. The hills of the Churia Range are inherently fragile, being comprised of sedimentary rocks and boulders that are highly susceptible to weathering and erosion, which has resulted in slopes

failures and perennial erosion at several locations. The Churia is also overlying the most active fault of the Himalayan region, known as the Himalayan Frontal Thrust and is thus earthquake prone. Earthquakes, even of small magnitude, produce cracks in the rocks that enlarge further during each subsequent seismic event. This makes rocks more susceptible to landslides and debris flow during the rainy seasons. Additionally, the Churia Range has experienced high rates of deforestation and forest degradation in recent years as a result of growing demand for fuelwood, timber and agricultural land by local and distant communities in the plains. Declining forest cover has further accelerating natural erosion rates and increased rates of sedimentation of rivers and streams that originate or pass through the Churias. Sediments from debris flows, landslides and soil erosion are all ultimately deposited on the cultivated lands of the Tarai as well as also raising the level of the river bed, and further increasing the risks of flooding. It is estimated that river beds of major rivers in Tarai rise by about 10-15 cm every year. Vulnerability to flooding impacts is also especially high in the Tarai region due to proximity of people and their assets to the river, including a long-standing tradition of settlement and cultivation in the floodplains.

28. During the monsoon, rivers originating from the Mahabharat range cause great damage in the Tarai, with inundation caused by river flooding spreading as far as 10 kilometres and resulting in extensive damage to people, assets and infrastructure. Riverine floods from the major perennial rivers generally rise slowly in the southern Tarai plains. Flash floods, on the other hand, which occur with little or no warning, are characterized by a minimal time lapse between the start of the flood and peak discharge and are extremely dangerous because of the suddenness and speed with which they occur. They may be triggered by extreme rainfall, glacial lake outbursts, and/or the failure of dams due to structural reasons or caused by landslides, debris, ice, or snow. Damming of a river by a landslide is another potentially dangerous situation. Such a blockage of the river flow is more common in narrow valleys where the slopes are steep on both sides of the river. Landslide dams will eventually collapse, causing heavy downstream flooding, which generally results in loss of life and damage to property. The eastern Tarai is generally more flood-prone than the west (Figures 5 & 6) and was the location of Nepal's most recent major flood event in 2008, when the Koshi River caused flooding in Sunsari and Saptari districts. The Ministry of Home Affairs (MoHA), estimated that at least 65,000 people lost their homes as a result of flooding during this event. The magnitude and frequency of flash floods has increased in recent years, particularly in the Tarai and the Churia range, as a result of an increasing trend in extreme rainfall events, i.e. short bouts of very intense rainfall.

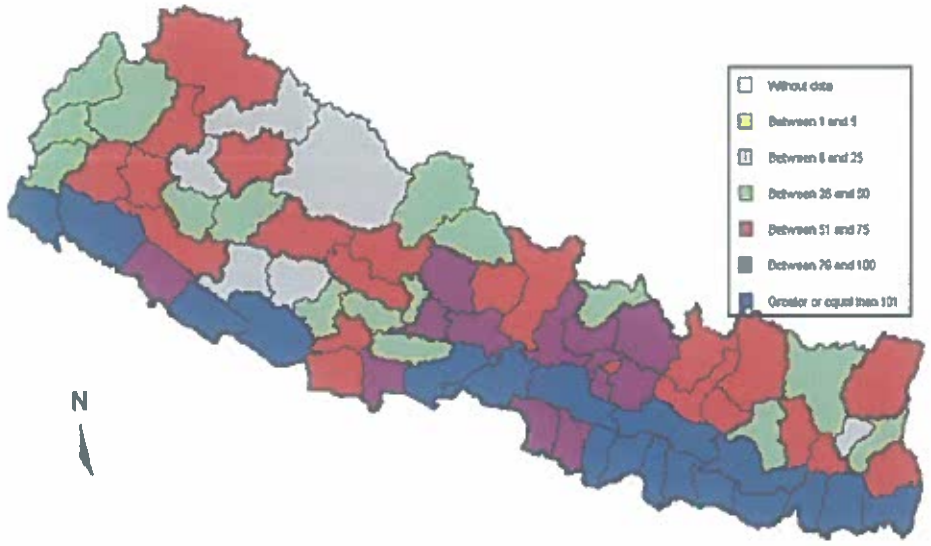


Figure 6: District wise distribution of flood events during the years 1971-2007 (UNDP, 2009).

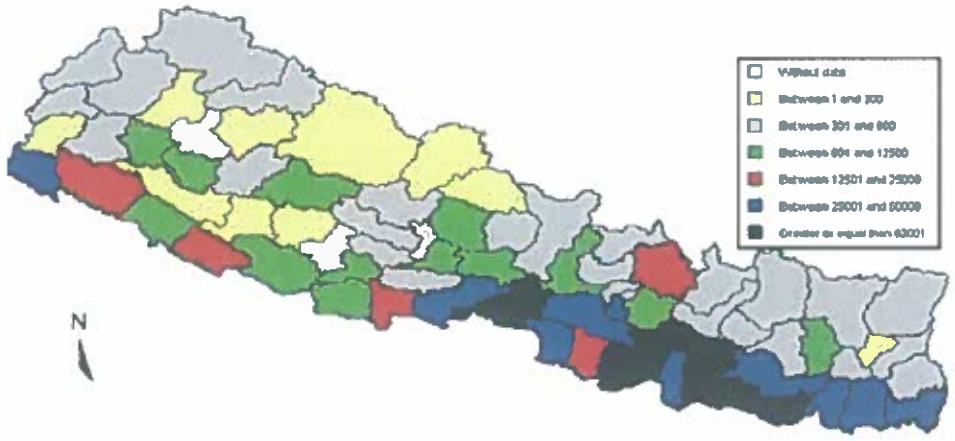


Figure 7: District wise distribution of numbers of affected people due to flooding during the years 1971-2007 (UNDP, 2009).

1.2.4 Summary of Projections from Climate Change Models and Scenarios

29. The Intergovernmental Panel on Climate change (IPCC) assessment reports provide a comprehensive review of climate models in terms of temperature and precipitation projections (IPCC 2007; Christensen et al. 2007). Climate models show greater than average warming in the South Asian Region in summer. There is a general consistency among the models in their output for winter while the agreement is less for summer or both temperature and precipitation. In contrast, the consistency among models in precipitation predictions, as well as the significance of projected changes are low both for the winter as well as summer seasons (Christensen et al. 2007). General circulation models tend to not perform well over the high altitude regions of concern here, and regional climate models such as PRECIS model have been found to perform better (Christensen et al. 2007).

30. Climate change projections from the IPCC's Fourth Assessment Report (2007) based on the ensemble average of the General Circulation Model indicates that temperatures for the period 2080 to 2099 could be warmer in Nepal by 4°C in winter and 2.5 to 3°C in summer relative to 1980 to 1999 temperatures. The IPCC AR4 found that warming is South Asia is projected to be at least 2-4°C by the end of the century (Christensen et al. 2007). There is a clear elevational gradient in warming rates in the Nepal's Himalayan range similar to that seen in the observed historical temperature data. In general, the trend is higher increases at higher altitude regions. Another analysis by the OECD (2003) showed significant and consistent increase in temperature projections above the baseline average for Nepal for the years 2030 (+1.2°C), 2050 (+1.7°C) and 2100 (3°C), with somewhat larger warming in the winter months than the summer months. Very recently climate change projections for Nepal were examined using Hadley Centre's high resolution regional climate model, called PRECIS (Providing Regional Climate for Impact studies). Temperature projections derived from the PRECIS model also show a rising trend in both maximum and minimum mean temperatures during the 21st century across the whole country, with a higher rate of increase in the high altitude regions. The PRECIS simulations corresponding to the SRES A1B (IPCC) emission scenario were carried out for a continuous period of 1961–2098. The climate projections were examined over three time slices, viz. short (2020s, i.e. 2011–2040), medium (2050s, i.e. 2041–2070) and long (2080s, i.e. 2071–2098) changes.

31. The HadRM2 simulation of the Eastern Himalayan region projected an increase of winter, pre-monsoon, monsoon, post-monsoon, and annual precipitations respectively by 57, 46, 7, 15, and 18% of the current simulations by the 2050s (Annex 1). In general, PRECIS regional model is considered to give more consistent projections for the Himalayan region. However based on the distributions of the PRECIS projected annual precipitation for baseline period (1981-2010) and percent increment form baseline during short (2011-2040), medium (2041-2070) and long (2071-2098) term future durations, the overall annual precipitation in the country is found to be decreasing by 2%of the baseline amount by 2020s and it increases by 6% and 12% for the baseline by 2050s and 2080s respectively.

32. Projections of mean annual rainfall averaged over the country from different models are broadly consistent in indicating increases in rainfall over Nepal. This is largely due to increases in Jun-Aug and Sep-Nov (wet season) rainfall.

    - Jun-Aug rainfall is projected to change by -36mm (-22%) to +224mm (+104%) per month by the 2090s. Sep-Nov rainfall is projected to change by -17mm (-38%) to +44mm (+71%) per month by the 2090s. These increases are offset a little by projected decreases in Dec-Feb rainfall, such that annually, projected changes range from -14mm (-31%) to +59mm (58%) per month.
    - The increases in Jun-Aug rainfall are largest in the South-East of Nepal.

33. The proportion of total rainfall that falls in heavy[6] events is projected to increase in projections from most models. Annually, changes in projections range between -7 to +17% by the 2090s. Increases in Jun-Aug and Sep-Nov are offset partly by decreases in Dec-Feb.

    - Projections indicate that maximum 1- and 5-day rainfalls are expected to increase in the future, and that these increases may be dramatic. Annually, 1-day maxima change by -7mm to +53 mm by the 2090s, and 5-day maxima change by -16 to +129mm. These increases are most evident in Jun-Aug and Sep-Nov (wet season) rainfall, when changes of -4 to +125mm in Jun-Aug and -10 to +57 mm are projected in 5-day maxima for the 2090s; the maximum increases projected by the model

[6] A 'Heavy" event is defined as a daily rainfall total which exceeds the threshold that is exceeded on 5% of rainy days in the current climate of that region and season

ensemble are twice the magnitude of current average 5-day maximum rainfalls (C. McSweeney et. al, 2012).

Flooding hazards

34. Model projections on the effect of climate change on stream flow in the Himalayan Rivers vary regionally and between climate scenarios, largely following projected changes in precipitation. Climate scenarios can be useful in furthering the understanding of the changes that can be expected in the regional hydrology and water availability. Furthermore, the scenarios can be used to predict changes in the glacial mass in the Himalayas; an important source of water in the river basins during non-monsoon seasons. Model projections on the effect of climate change on stream flow vary regionally and between climate scenarios, largely following projected changes in precipitation. In south Asia, HadCM3 shows an increase in the annual runoff ranging from 0-150 mm/yr by the year 2050, relative to the average runoff for the period 1961-1990. These climate models are unable to highlight the details in seasonal runoff variations, although it is generally suggested that due to the higher evaporation and decrease in glacier mass, low flows are likely to decrease (IPCC 2007).

35. There are still only few analyses of runoff variations due to climate change on smaller geographical scales. In 2001, a project called SAGARMATHA (Snow and Glacier Aspects of Water Resources Management in the Himalaya) investigated the impacts of climate change on the hydrology of the Indus, Ganges, and Brahmaputra basins. The results have shown the impacts of deglaciation to vary considerably within the region and within catchments. Highly glaciated catchments and those catchments where meltwater contributes significantly to runoff have been shown to be most vulnerable to deglaciation (Rees and Collins 2004; Sullivan et al. 2004). While the relative changes are less in winter, any variation in water availability in this traditionally dry period could have serious impacts for water users. In the monsoon dominated basins such as the Ganges, the impacts are likely to be less severe.

36. Several recent studies (e.g., Immerzeel 2008; Immerzeel et al. 2010; Bolch et al. 2011; Miller et al. 2011) indicate that, although glacial retreat in the HKH region is occurring, the rates of retreat are less than those originally suggested by the AR4 (Cogley et al. 2010; Miller et al. 2011). Clearly more objective and transparent discussions of the evidence are needed (Miller and Rees 2011). Many of the Himalayan glaciers, which have been investigated in the eastern and central HKH region are receding, but it is still not clear how these attenuations in glacial mass will affect river discharges both upstream and downstream. Miller and Rees (2011) have summarised likely changes in the contributions of glaciers to river discharge as follows. The glacial melt that occurs in the monsoon-dominated eastern and central parts of the Himalayas does not contribute significantly to annual river discharge downstream. It is estimated that glacial melt accounts for, on average, only 10% of the river flow of the Ganges; estimates vary between 2–20% among basins. In the rivers of the eastern region, glacial melt coincides with monsoon precipitation, and by comparison, the large volume of rainwater dwarfs the contribution of meltwater.

37. Recently Immerzeel et al. (2012) developed a high-resolution combined cryospheric hydrological model that explicitly simulates glacier evolution and all major hydrological processes. The analysis shows that both temperature and precipitation are projected to increase which results in a steady decline of the glacier area. The river flow is projected to increase significantly due to the increased precipitation and ice melt and the transition towards a rain river. Rain runoff and base flow will increase at the expense of glacier runoff. However, as the melt water peak coincides with the monsoon peak, no shifts in the hydrograph are expected. The model was used to assess the future development of glaciers and runoff using an ensemble of downscaled climate model data in the Langtang catchment in Nepal. In the catchment the glaciers are retreating steadily under climate change and it is estimated that in 2035 the glacier area will be reduced by 32% (Immerzel et.al 2012). This catchment is representative for the southern slopes of central and eastern Himalayas where glacier systems are dynamic, moderate in size and often characterized by debris covered tongues. The positive temperature and precipitation trends will increase evapotranspiration[7] and snow and ice melt while more precipitation will fall as rain instead of snow. The net result is an increase in stream flow by 4 mm y-1 that can be attributed to the increase in precipitation and the change from melt-fed river to rain-fed river. The partitioning of stream flow is indeed showing strong changes. Rain runoff and base flow are increasing, snow runoff remains more or less constant and glacier runoff is eventually decreasing. There is almost no research on impact of climate change and glacier melting in the western part of Nepal, which is relatively more impacted by the westerly disturbances compared to the central and eastern parts of Nepal.

38. One phenomenon that occurs parallel to deglaciation is the growth and ultimate outburst of moraine dammed lakes. Studies have shown that the majority of present day large moraine dammed lakes did not exist before the 1950s. These lakes started forming in the mid to late 1950s, and in the 1970s they grew in a rapid manner. Most of the glacial lake outburst flood (GLOF) events recorded in this region happened in the last three decades or so. There are strong indications that the GLOF frequency has increased in recent decades. There are over 200 potentially dangerous glacial lakes in the HKH region, which could burst out at any time (ICIMOD 2007). Under the observed and projected climate scenarios, it is very likely that the frequency of GLOF events and their magnitudes will increase.

39. Climate change involves, perhaps most seriously, changes in the frequency and magnitude of extreme weather events. There is widespread agreement that global warming is associated with these extreme fluctuations, particularly in combination with intensified monsoon circulations. Although many other factors are involved, the growing incidence and toll of related natural disasters, such as floods and drought, is of particular concern. In parts of central Asia, regional increases in temperature will lead to an increased probability of events such as mudflows and avalanches that could adversely affect human settlements (Lafiazova 1997). In 2007, seven of the top 10 natural disasters, by number of deaths,

[7] The combined processes of evaporation, sublimation, and transpiration of the water from the earth's surface into the atmosphere.

occurred in Hindu-Kush Himalayan countries, altogether accounting for 82% of the total deaths (UN/ISDR 2007). This indicates both the prevalence of disasters in the region, and the susceptibility to such events. The lack of high frequency observational data in the region hinders a comprehensive assessment of changes in extreme climatic events. An increase in the frequency of high intensity rainfall has been observed in Nepal (Chalise and Khanal 2001). High intensity events can lead to flash floods and landslides. A recently developed database by ICIMOD suggests a steady increase in flash flood events in the region (Figure 7 bottom), which could be due to an increase in high intensity precipitation events.

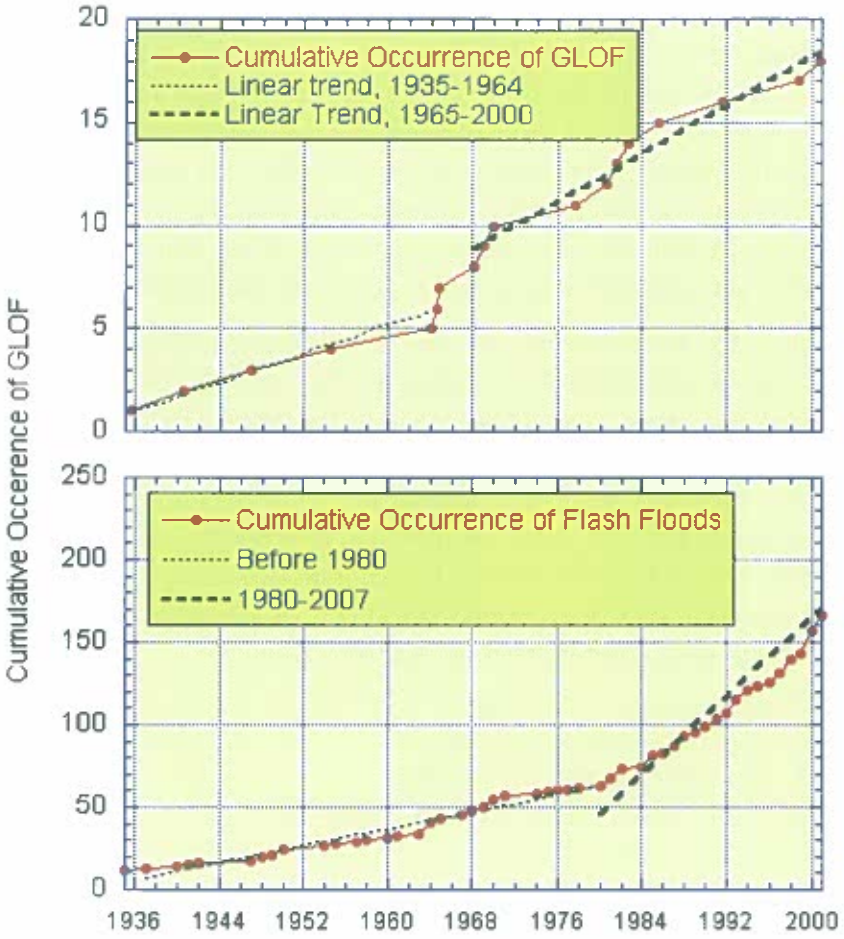


Figure 8: Cumulative occurrence of GLOFs (top, NEA 2004) and flash floods (bottom, Xu Jianchu et al. 2007)

1.3 Long-term solution and barriers to achieving the solution

40. The long-term solution to managing the risks associated with climate change-induced flooding in Nepal is to shift from a primarily reactive post-disaster response to a situation of increased adaptive capacity as a result of greater proactive disaster preparedness combined with concrete mitigation measures that reduce the risks of flood-related damage to

people's lives, assets and infrastructure. Specific options for increasing adaptive capacity and disaster preparedness, and the barriers that need to be overcome to achieve this situation, vary in the two very distinct geographic areas targeted by this project, i.e. the High Mountains and the low-lying Tarai and foothills and slopes of the Churia hills. These are therefore discussed separately for each geographic area below.

1.3.1 Options and Barriers to Managing GLOF Risks in Nepal

41. There are a number of structural and non-structural measures that can be used, ideally in a coordinated fashion, to reduce and manage GLOF risks to human life and property in the potential GLOF impact zone. These include: implementing a real-time GLOF hazard monitoring system to provide advance information on potentially dangerous situations; increasing public understanding of GLOF risks and options for managing these; developing Early Warning Systems (EWS) to give downstream residents, tourists and owners of infrastructure sufficient time to take action to protect their lives and material assets; and undertaking structural mitigation measures to reduce the likelihood of a GLOF hazard.

42. The most critical factor that determines the stability of a supra-glacial (or end-moraine dammed) lake such as Imja and Tsho Rolpa is the strength and cohesion of the end moraine.[8] The volume of water in the lake is vital as it determines the hydrostatic pressure on the end moraine and will increase as the volume of water in the lake increase. Thus, the most common and effective structural mitigation measures for GLOFs is such lakes are aimed at reducing the volume of water in the lake, which not only reduces the hydrostatic pressure exerted on the end moraine dam, but should also reduce the potential peak surge discharge in the event of a GLOF (ICIMOD 2011). There are different ways to achieve this that can be used alone or in combination, as follows:

    - Controlled breaching of the moraine dam
    - Construction of an outlet control structure
    - Pumping or siphoning the water from the lake
    - Tunnelling through the moraine barrier or under an ice dam

43. Such mitigation measures must be implemented with great care, however. Since moraine dam stability is a major part of the problem, any anthropogenic disturbance to the dam that arises as a result of implementing the mitigation measures, for example during construction, could actually increase the level of risk at that time. Thus, it is critical to select the most appropriate mitigation measure for an individual lake on a case-by-case basis. Additionally, stringent Safety & Evacuation Plans must be developed and implemented during the construction phase and systems put in place to monitor the physical condition of the end moraine and lateral dams, lake, glacier, and surrounding areas as part of a

[8] In the case of a lake associated with a clean-ice glacier, GLOFs are more likely to be triggered by surge waves caused by ice, snow and/or rock avalanches into the lake that cause water to overtop the end moraine (see ICIMOD 2011 for further details.)

comprehensive GLOF Risk Monitoring System of a given high-risk lake (Annex 3 and 6).

44. To date, Tsho Rolpa is the only glacial lake in Nepal where GLOF mitigation measures have been implemented (Annex 3). A siphon system to remove water from the lake was installed in 1995 but met with limited success. Subsequently, an open channel was cut through the end moraine dam and a 4 metres-deep artificial spillway created. This intervention, which was completed in 2000, succeeded in lowering the lake by 3 metres (ICIMOD 2011). Early Warning Systems were also put in place, but proved to be unsustainable in the long run, partly due to their high-tech nature and thus the high maintenance involved (see Section 2.4, Outcome 1 & Output 1.3). Through the support of ADAPT ASIA, a pre feasibility study was conducted during the PPG phase to explore possibilities for Community Based Early Warning Systems, aligning with UNDP's ongoing programme – CDRMP (Annex 6). However, to implement the possible options, the project plans to mobilise resources during the implementation period.

45. In addition to reduce the volume of lake water, there are several other preventative structural measures that can be implemented to help reduce the likelihood, or impact of, a GLOF. These include removing masses of unstable rocks to guard against avalanches or rockfalls hitting the lake surface and causing a surge wave, as well as implementing measures to protect infrastructure in the downstream area. Other measures include check-dams, mini dams, spillways, slope stabilization and reinforcement. Check dams are helpful in reducing the flow of water coming down by gravity flow and conserving soil and thus provide downstream protective measures. Removing or restraining trigger mechanisms include stabilization of adjacent slopes. Slope stabilization may be through vegetation or engineering structures. Additionally, a last resort measure might be to relocate people and critical infrastructure from high-risk areas. However, the local communities rarely favour the former option for a host of social, cultural and sometimes economic reasons, while the latter is generally extremely costly.

46. Based on the experience of Tsho Rolpa, ICIMOD's extensive work on glacial lakes and GLOFs in Nepal as well as work undertaken by Kathmandu University and ADAPT-Asia as part of the preparation for this project (see Section 2.3.3, No. 7 and Annex 6), reducing the volume of Imja Lake through an artificial controlled drainage system was identified as the most suitable GLOF mitigation measure, combined with a system to monitor the risks of a GLOF at Imja Lake and a low-tech community-based EWS (CBEWS). There are, however, several major barriers to implementing this proposed integrated solution.

Institutional Knowledge, Capacity and Coordination Barriers

47. Government and disaster management authorities have been used to managing recurrent risks, based on seasonality and historic hazard occurrences and have limited understanding and experience of managing growing climate risks, including current variability and the projected impacts of climate change, that are increasing the range and magnitude of disasters that Nepal is having to cope with. The Department of Hydrology & Meteorology (DHM) of the Ministry of Environment, Science & Technology (MoSTE) is mandated to

monitor all flood risks in the country including GLOFs, but DHM currently has little capacity for regular monitoring of GLOF risks, which are exceptionally challenging to monitor for technical, logistical and financial reasons, the latter in part due to the logistics involved. DHM undertakes bathymetric surveys and monitoring of the highest risk glacial lakes once every two years but there is limited management or application of these data for DRM and planning purposes. DHM and other national and local counterparts, including private sector partners, gained considerable technical knowledge and experience as a result of leading the successful lowering of Tsho Rolpa Lake between 1995-2000. However, DHM has limited human resource with specialist capacity within its Glacial Lake Monitoring Section of DHM, i.e. glaciologists, alpine geologists and hydrologists, particularly those with experience of structural measures for mitigating GLOF risks. Additionally, there are numerous complex physical and climatic factors involved in understanding and managing GLOF risks some of which are site-specific and Nepal has 2323 glacial lakes, including 20 high-risk lakes that require far greater research and systematic monitoring than DHM or its partners are currently able to provide.

48. The Ministry of Home Affairs (MoHA) is designated as the lead agency responsible for responding to disasters through implementation of the disaster-related acts and regulations of the government (see Section 2.3.2). The role of other ministries and departments is to support MoHA collectively in its mandates of responding to disasters, and implementing mitigation measures and risk reduction planning. MoHA manages the Central Disaster Relief Committee (CDRC) headed by the Home Minister of Nepal, the mechanism which becomes active during major disaster events in order to provide co-ordinated support for immediate relief to disaster victims. The machinery under the MoHA is equipped for doing search and rescue operations, and co-ordinating post disaster humanitarian assistance. The human resources within MoHA and its line agencies have training and experience mainly in post-disaster rescue, relief and rehabilitation activities, rather than in planning and implementing disaster preparedness and prevention. At the local level, the District Disaster Relief Committee (DDRC), which includes representation from all the main line agencies as well as local NGOs/INGOS and is headed by the Chief District Officer, directly operates under the CDRC and reports to MoHA about post disaster damage and response. Very recently the DDRCs with the support of district line agencies and development partners has remained engaged in making annual disaster response plans and their implementation at the district level. The DDRC members generally have very little knowledge about climate change or GLOF risk management and lack perspectives of long term periodic risk management planning. There is also insufficient coordination between different agencies at present for systematic information sharing on GLOF risk management and also no efficient mechanism for communicating GLOF warnings effectively. Despite the Local Self Government Act 2059(?) (LSGA) has given mandates to the local bodies such as District Development Committees (DDC) and Village Development Committees (VDC) for planning and implementation of disaster management and risk reduction activities, in lack of incentives and capacities, led by disconnect between risk reduction and development planning, and rush for hitting the annual target of development budget allocated for the district, reduction of disaster risks in delivery of development results have never been the priority at

the local level.

Individual Knowledge and Capacity at the Local Community Level

49. Local communities in the High Mountains of Nepal vary in their level of awareness and understanding of climate change and the risks posed by a potential GLOF event. In areas such as Tsho Rolpa and Imja where many outsiders have conducted research and engaged with local communities on these issues, there is naturally relatively greater awareness and knowledge about GLOFs, but understanding of the options available to increase their adaptive capacity through community actions is more limited. In many cases, communities expect the government to undertake structural mitigation measures, but do not realize that there are actions they themselves can take to reduce their vulnerability to GLOFs. For example, there are no functional community-based EWS systems in place in areas at potential risk from GLOFs in Nepal. A community-based EWS was implemented at Tsho Rolpa for a few years, but local communities did not continue to maintain the EWS after a few years. Communities are also not aware that they could potentially undertake some relatively simple monitoring of GLOF risks locally, for example, visual inspections of different physical parameters associated with GLOF risks such as the condition of the end moraine, the lake level at marked points, or the risks of avalanches into a lake from ice, snow and rock falls.

50. This lack of knowledge and low capacity is especially worrying as DDRCs are generally located in district headquarters, far from the locations and populations that are most vulnerable to GLOF risks. Thus, in the event of a GLOF, DDRCs have limited ability to manage or mitigate GLOF impacts, especially in the short-term. For example, Imja Lake is 7-9 days walk from the Solokhumbu District Headquarters in Saleri, where the DDRC is based.

Financial Barriers

51. One of the biggest challenges of managing and mitigating GLOF risks in Nepal is the lack of adequate financial resources available to the concerned government departments and authorities, both nationally and locally. Apart from technical and human resource capacity constraints, DHM also has very limited financial resources to implement its full mandate. Disaster preparedness and mitigation activities at the local level are the responsibility of district and local level authorities, who also generally have very limited funds for this purpose. Researching, monitoring or and reducing the risks associated with glacial lakes is also extremely expensive, in part due to the terrain and climatic conditions involved as well as the technical complexity of the methods of risk assessment and management. Even non-structural measures of GLOF risk management, such as the development of simple community-based EWSs is relatively costly to develop and implement in such remote locations.

1.3.2 Options and Barriers to Managing Lowland Flooding Risks

52. Several complementary and integrated strategies are required to effectively address climate-related flood risks in the Tarai and Churia Range, including low-cost structural (bio-dykes, bioengineering, earthen embankments and bamboo spurs) and non-structural mechanisms (community awareness and training programmes, the development of a community-based EWS, drills, etc) that can easily be scaled up and replicated by communities, local authorities and other important local and national actors.

53. To date, government's response to flooding in the Tarai and Churai Range has mainly targeted the Tarai, with a heavy focus on protecting major infrastructure such as highways, bridges, major irrigation facilities and power stations. In relation to people, the emphasis to date has been more on post-disaster relief and recovery rather than pre-disaster planning and preparedness. These relatively high-cost structural methods of flood control have thus had limited coverage and varying success in actually controlling the impacts of floods on local populations and their material assets. The Department of Water-Induced Disaster Prevention (DWIDP) of the Ministry of Irrigation, which was created in 2000, is mandated to minimize human casualties and damage to infrastructure from water-induced disasters. DWIDP's main work in the Tarai in recent years has been through the People's Embankment Programme (PEP), which has been running for the last 3 years and is implemented in the middle and southern Tarai (south of the East-West Highway). Since 2009, the PEP has constructed 75 km of embankment and 533 spurs along 12 rivers in the Tarai.

54. There are few CBEWSs in place in the Tarai and Churia so far in 5 river basins and 7 districts (Rukum, Sunsari, Kaski, Chitwan, Dolakha, Sindhupalchok and Mahottari), but to date there has been relatively little investment by government in non-structural measures of reducing people's vulnerability to flooding (Annex 7). However, the government is placing growing emphasis on integrating disaster risk reduction planning into district-level development plans, which could potentially allow a more comprehensive and integrated approach to flood control in the Tarai and Churia Range.

55. Given the widespread nature of flooding in the Tarai and Churia Range and the large numbers of people affected, the ideal approach to reducing people's vulnerability to flooding in this region is to use a combination of low-cost small-scale structural interventions and non-structural measures based on a site-specific assessment of vulnerability and the best options for minimizing human and material losses from flooding. The project proposes to do this in 4 districts in the Tarai and Churia. However, there are a number of barriers to further replication and upscaling of this approach across the wider region, which are discussed below.

Institutional, Technical and Financial Capacity Barriers

56. DWIDP's mandate to reduce the human deaths and damage caused by water-induced disasters includes implementing programmes on river basin conservation, developing appropriate technology, research, information systems, human resources and institutional capacity, and raising awareness of communities in flood-prone areas to increase their ability

to mitigate the impacts of water-induced disasters. However, DWIDP currently has very few technical staff and annual budget to fulfil its mandate in a systematic and comprehensive manner. Out of its annual budget of about USD 31.76 million (NRs. 2.7 billion), the Department currently spends around USD 11.76 (NRs. 1 billion) on disaster risk management in the Tarai. However, there are over 200 rivers that pass through the Tarai many of which are the source of seasonal flooding. The total length of most of these rivers is in a range of 30-50 km. Structural measures like embankment, dykes and spurs, which have to be constructed along both sides of a river, require considerable financial and technical resources and DWIDP is currently able to target only 12 flood-prone rivers in the Tarai, that too, not in their entirety.

57. Another key gap in interventions by DWIDP to date is sediment management in the upper catchments of rivers that flow into the Tarai. There has been considerable discussion about sedimentation control within DWIDP and while some members of DWIDP consider such an integrated approach essential for effective flood control, others remain to be convinced of the benefits of sediment management. There is a pressing need to demonstrate the value of implementing a more comprehensive approach to flood control that also includes improved management of upstream areas. However, currently DWIDP does not have the budget to implement a sediment control programme.

58. Department of Watershed Management and Soil Conservation (DWMSC) under Ministry of Forest and Soil Conservation (MFSC) are mandated for working on upstream soil conservation and erosion control of a watershed. Appropriate soil conservation measures if carefully applied can potentially control runoff and reduce sediment load in the downstream rivers, thereby minimizing the causes of flooding during monsoon rains. However, DWIDP with the mandates of flood management in the downstream has hardly developed a culture of working in collaboration with the DWMSC in the upstream, and thus the flood mitigation activities implemented by DWIDP mainly through embankments in the downstream area has only limited impacts in the long run because of increased sediment load in the rivers. Based on the statistics of CBS (1998), in Churia (as known as Siwalik) range Eastern Nepal, foothills of South aspect sandstone has landuse ranging from forest to grazing where erosion rate is 780-3680 ton/sq.km/yr. Very recently with the support of UNDP the two departments have collaborated to work in two sub-watersheds on a pilot basis with DWMSC making efforts to control runoff and soil erosion at the upstream and DWIDP constructing flood mitigation structures at the downstream. Building upon the success of this pilot integrated flood management activities, future flood management programmes need to be upscaled.

59. As noted earlier, DHM has the mandate to monitor all flood risks in Nepal, but the agency also has insufficient human and technical capacity for monitoring and forecasting recurrent flood risks, such as the annual monsoon-related flooding in the Tarai and Churia Range. A recent technical capacity assessment of DHM by UNDP found that although DHM has the equipment to monitor and forecast real-time rainfall, the Department lacks the technology and expertise to analyse the real-time rainfall data and basin level discharge data to assess the level of flood risks and other potential impacts in a given geographical area. There are also no systems in place for DHM to communicate flood risk warnings to MoHA (who in turn would relay the information to its agencies such as the Emergency Operation Centres and DDRCs), as well to DWIDP and other relevant departments.

60. At the local level, until very recently, there was little integration of flood risk reduction measures into district development plans. However, in recent years under the leadership of

DRRC, greater attention is being given towards pre-disaster planning and preparedness, including the preparation of annual District Disaster Management Plans (DDMP) and Emergency Preparedness Plans (EPP), which are prepared specifically to prepare for the monsoons in the Tarai. DDMPs are still in a pilot phase and have been prepared for four districts. The DDMP proposes to integrate risk reduction activities into the district development plan, while the EPP is focused on responding to an actual disaster. However, line agency representatives at the district level also have limited technical capacity for planning and evaluating flood control options, particularly in the context of a changing climate.

61. At present, the Government of Nepal has too many competing priorities on its limited financial resources to be able to invest any significant resources in the capacity development of either DHM or DWIDP or to increase the budgets of District Authorities for DRM planning. Furthermore, while there are many institutions and actors working on flood risk management at the central and local levels, there is little systematic coordination between the different Ministries and Departments and non-governmental actors to manage flood risks in a more integrated manner.

Upstream landuse patterns

62. The recent long-running political conflicts in Nepal resulted in displacement of people from the lower Tarai into the upstream Churia range. This has resulted in increased rates of forest logging and clearance in the Churia as people cleared land for settlements and agriculture as well as a source of income as many displaced people rely on illegal logging for their livelihood. This in turn has increased the problem of downstream sedimentation and flooding as the Churia is comprised of weak and fragile rocks that are easily eroded. Sedimentation is increasing the Upper Tarai (towards north) down to the Middle Tarai where the major depositions of coarse sediment occur, with finer sediment deposited further downstream. As a result of sedimentation, river levels are increasing, rivers are changing course, as channels narrow in some places as sediments are deposited and widen in others due to erosion. Higher sediment load in rivers means less natural scouring and deepening of the riverbed by water. Instead, riverbeds are rising in some areas due to combined impact of sedimentation and less natural scouring, such that villages and embankments are at or even below the height of the river basin in some areas. Such villages are especially vulnerable to flooding.

63. The Churia has severe environmental and economic impacts not only in the periphery of this zone, but has severe threat to the downstream Tarai communities as many rivers originate from the Churia, passes through Tarai and drain out to India. Deforestation, encroachment and grazing added by high rate of extreme precipitation in this zone, has enhanced the degradation of Churia range, as a result, heavy floods and sedimentation happens in the Lower Tarai causing heavy loss of lives and properties. The main governmental body responsible for Churia conservation is the Ministry of Forest and Soil Conservation (MFSC). Activities related to Churia conservation are implemented by Department of Forest (DoF) and Department of Soil Conservation and Watershed

Management (DSCWM) that fall under MoFSC. The DSCWM normally addresses the problem of topsoil protection with non-structural and limited bio-engineering measures. Beside the regular programs of afforestation, controlling deforestation, grazing and soil conservation implemented by DoF and DSCWM through their respective district level f offices, they are also implementing complementary activities supported by Rastrapati (President's) Churia Conservation Program (RCCP) since 2010. According to the RCCP guidelines, the major goal of the program is maintaining balance between sustainable development and environment for poverty alleviation by increasing the productivity of land through conservation and proper use of natural resources. Specific objectives of the program are: (a) integrated management and conservation of soil, water, forest and biodiversity of Churia area; (b) maintaining balance between environment protection and sustainable development through sustainable and environment friendly land use, physical development, infrastructure development, agriculture and economic activities. However, delivery and effectiveness of this programme has been very slow and poor as the programme is unable to address the root causes of deforestation, and forest degradation in the Churias. Despite RCCP is a priority programme of the Government of Nepal, it lacks geographic focus and clarity about what to achieve with the limited government funds thinly spread over the entire Churia range from East to West. Since all four targeted programme districts of the proposed project are also the programme districts of RCCP, there is an ample opportunity to synergize approaches undertaken by the two programmes and implement activities complementing to each other in both upstream-downstream areas.

Individual Knowledge and Capacity at the Local Community Level

64. Local communities in the Tarai and Churia Range have a long history of coping with annual seasonal flooding, although these coping mechanisms are fairly rudimentary. People voluntarily live in high-risk areas due to the fertile floodplain soils that they cultivate. Some live in raised platform houses. During the monsoon, people watch the water levels to decide when to leave their homes and field for a raised area such as embankments and roads where they will camp for few days until the water level goes back down. However, local communities are facing increasingly unpredictable extreme precipitation events followed by severe flooding of their homes and land. Furthermore, in some areas embankments are at the same level as the river within 2-3 years of construction due to sedimentation.

65. Most people are unaware of the linkages between the increasing frequency and intensity of extreme weather event and climate change. Nor are they aware of the linkages between upstream land use and the rates of sedimentation and downstream flooding. Many people do understand the importance of stabilizing riverbanks and steep slopes for erosion control, but there is relatively little local buy-in for bioembankments (or biodykes) as opportunities for cash-for-work for communities are more limited in this type of soft construction. Additionally, bioembankments must be protected against grazing and any major use until grasses and other vegetation are well established. Thus, short-term needs and benefits often prevail over longer-term less tangible benefits. Organized community engagement in

managing and mitigating flood risks is very limited. For example, community engagement in the DWIDP's PEP has been largely on a cash-for-work basis, but even this has been on a small-scale thus far as most of the work is undertaken through contractors who may not necessarily use local labour.

II. STRATEGY

2.1 Project rationale and policy conformity

66. The project will contribute to reducing human and material losses from GLOFs in Solokhumbu District and catastrophic flooding events in the Tarai districts and the Churia hills of Nepal. This will be achieved by overcoming a range of national and local-level barriers to the effective management of flood risks relating to knowledge, capacity, finance and technical know-how. Specifically, the project will reducing GLOF risks arising from a demonstration high-risk glacial lake in Solokhumbu District and river-flooding risks in the Tarai and Churia Range through a number of structural and non-structural mechanisms with a strong emphasis on community engagement, engagement of women and empowerment and social inclusion. Key elements of the project strategy for reducing GLOF risk include developing an artificial controlled drainage system combined with a community-based early warning system and strengthening of individual and institutional capacities for disaster risk management.

67. The project has been developed in line with LDCF guidelines and is aligned with the updated Results-Based Management Framework for the LDCF and SCCF (GEF/LDCF.SCCF.9/Inf.4 of October 20, 2010). The project also satisfies criteria outlined in UNFCCC Decision 7/CP.7 and GEF/C.28/18. Consistent with the guidance of the Conference of Parties (COP-9), the project will implement priority interventions identified in Nepal's National Adaptation Programme of Action (NAPA), which was endorsed by the Government of Nepal in September 2010. The NAPA represents the most recent effort to assess and prioritize the most immediate climate change risks faced by Nepal.

68. The project addresses the objectives outlined in NAPA Profile 3 'Community-based Disaster Management for Facilitating Climate Adaptation' and NAPA Profile 4 'GLOF Monitoring and Disaster Risk Reduction'), in which UNDP was found to have comparative advantage as a result of its range of existing baseline projects and investments in Disaster Risk Management (see Section 2.3.3). UNDP was therefore requested by the Government of Nepal to develop a proposal for LDCF funding that addressed both these priority actions in a single project. Thus, the project is divided into two separate components in two distinct geographic areas that correspond to NAPA Profiles 3 and 4, respectively. Project Outcome 1 focuses on actions required to reduce risks from imminent Glacial Lake Outburst Flooding (GLOF) in high risk areas (NAPA Profile 4), while Outcome 2 addresses the actions needed to address community-based disaster risk reduction and the climate-proofing of communal

water sources for disaster-prone communities' priorities (NAPA Profile 3).

69. The project was developed through close consultation with key government partners engaged in climate risk management, particularly flood risk management, as well as consultations with local government authorities, communities, CBOs and NGOs in the target project areas (see Section 2.2 and 2.3.5 below and Annex 4). Imja Lake, the proposed project target area in the High Mountains, is among the 6 glacial lakes identified during the NAPA process as being the most 'critical', i.e. at most immediate risk of bursting (MoE, 2010). Selection of the four flood-prone districts for project interventions was similarly based on vulnerability assessments conducted during the NAPA and additional further analysis (see Section 2.3.5 and Annex 3).

2.2 Country ownership

2.2.1 Country eligibility and country drive

70. Nepal is one of the world's 48 Least Developed Countries (LDCs) and one of 14 LDCs in Asia. Nepal became a signatory to the United Nations Framework Convention on Climate Change (UNFCCC) in June 1992. It was ratified on 2 May 1994 and entered into force in July 1994. The country is eligible for technical assistance from UNDP and the project is aligned with the United Nations Development Assistance Framework (UNDAF) for Nepal, specifically with UNDAF Outcome 7, "**People living in areas vulnerable to climate change and disasters benefit from improved risk management and are more resilient to hazard-related shocks**". The project is also aligned with UNDP Nepal's Country Programme Action Plan (CPAP) Document. Specifically, the project is aligned with CPAP Output 7.1 "**Government officials at all levels have the capacity to lead and implement systems and policies to effectively manage risks and adapt to climate change**" and CPAP Output 7.3.2 **"Water level in Imja Glacier Lake reduced by 3 meters and risk mitigation measures adopted in 4 most vulnerable Tarai districts"**. The proposed project was endorsed by the national GEF operational focal point on 27th June 2011 (Annex 12).

2.2.2 Stakeholder Baseline Analysis

71. Inputs obtained from a range of national and local primary and secondary stakeholders (Table 2 & Annex 3) were used to guide the development and design of the project. Consultations with the Department of Hydrology and Meteorology (DHM) of the Ministry of Science, Technology and Environment (MoSTE) and the Department of Water-Induced Disaster Prevention (DWIDP) of the Ministry of Irrigation were especially significant, as DHM is the Project Executing Agency and will play a lead role in the implementation of Component 1, while DWIDP, will have a particularly significant role in the implementation of Component 2. Specific project target areas were identified on the basis of stakeholder consultations, studies and analyses conducted during the project preparation phase, as well as detailed discussions with DHM and DWIDP as described further in Section 2.3.

72. Major stakeholders with a day-to-day role and/or those who are critical to the project's

ultimate success are detailed in Table 2 below. Other important stakeholders, such as the numerous volunteer networks, CBOs and NGOs operating in the target districts are listed in the Stakeholder Involvement Plan in Annex 5, which also includes details of stakeholders who may only engage more intermittently with the project on a needs basis.

Table 2: Key Project Stakeholders

Category	Institution	Involvement in the project
National Government Institution	Ministry of Science, Technology and Environment (MoSTE) Focal Point: Mr. Keshab Bhattarai Secretary	During the project preparation phase (PPG phase), the MoEST was the focal Ministry to initiate the programme formulation task and was involved in the development of the initial concept (PIF) and conduct of design activities. It played a key role in bringing the partners and stakeholders together in disseminating information and helping to shape the project outcomes and outputs at every level. During the implementation phase of the full sized project (FSP), MoSTE play the role of cooperating agency and will be responsible for ensuring coordination of the LDCF initiative with other on-going initiatives including promoting the various sub-initiatives undertaken in this project. It will promote ownership of the project by the GoN and ensure the interventions meet national priorities. The MoSTE may approach other relevant line ministries and departments to provide input when needed. MoSTE will chair the Project Steering Committee (PSC) meeting.
	Climate Change Management Division (CCMD), MoSTE Focal Point: Mr. Prakash Mathema, Joint Secretary	During the PPG phase, on behalf of the GoN/MoSTE, the CCMD played the role of coordinator to support the project formulation phase. CCMD was involved in the design of the concept (PIF) as well as during the PPG phase. It played a key role in securing approval for the project from the GoN. During the FSP implementation phase, CCDM within MoSTE will undertake a coordinating role to support the effective role out of project activities. The CCMD of MoSTE will also ensure alignment of the proposed project with Nepal's NAPA follow-up programme. The CCMD will be the member of PSC.
	Department of Hydrology and Meteorology (DHM), MoSTE Focal Point: Mr. Rishi Ram Sharma,	During the PPG phase, under the guidance of the MoSTE, the DHM was involved in the project formulation exercise by providing substantial inputs from their experiences and expertise to the overall design of this initiative. During the FSP implementation phase, DHM will be the implementing partner as per the GoN and UNDP's agreed National Implementation Modality. DHM shall be the overall responsible

Category	Institution	Involvement in the project
	Director General	and accountable agency to deliver the objective and outcomes of the project. DHM will be Executive member of the PEB meeting and will be coordinating and supporting MOSTE in organising the PSC. DHM will be responsible for reconciling all substantive and financial reporting by various responsible parties and reporting to UNDP as per agreed work plan.
	Department of Water Induced Disaster Prevention (DWIDP), Ministry of Irrigation (MoI) Focal Point: Mr. Prakash Poudel, Director General	During the PPG phase, the DWIDP was involved in providing substantial inputs on flood related information especially for component 2 from their experiences and expertise. During the FSP implementation phase, under the overall guidance of the MoSTE and in close collaboration with the DHM, the DWIDP (as responsible party) shall be responsible for providing technical inputs, monitoring of the project activities that are planned to be implemented under Component 2 of the Project. The DWIDP will be a member of the Project Executive Board (PEB) and PSC as one of the Senior Beneficiaries,
	Department of Soil Conservation and Watershed Management (DSCWM), Ministry of Forests and Soil Conservation (MoFSC) Focal Point: Mr. Bharat P. Pudasaini, Director General	During the FSP implementation phase,the DSCWM under the guidance of the MoFSC and MOSTE, will provide technical inputs and support on issues related to upstream watershed management and soil conservation activities to reduce flood risk in the Tarai region (under Component 2). The DSCWM will be involved in the conduct of the EIA/IEE (as appropriate) in the upstream area where structural measures will be undertaken. The Department will also play active role as a member of the PEB as one of the Senior Beneficiaries and will be a member of the PSC
	Department of National Parks and Wildlife Conservation (DNPWC), MoFSC Focal Point: Mr. Megh B. Pandey, Director General	During the FSP implementation phase, the DNPWC shall help to coordinate with the Sagarmatha National Park and Buffer Zone Management Committee to complement with the ongoing initiatives while implementing project activities for the GLOF risk reduction component (Component 1) on Imja Glacial Lake. The DNPWC will play an active role at the PEB as one of the Senior Beneficiaries and will also be a member of the PCS.
	Ministry of Home Affairs (MoHA) Focal Point: Mr. Sushil J.B. Rana, Secretary	During the PPG phase, MoHA participated in project stakeholder meetings and contributed to establish linkages with district level disaster relief committees to the design of the project. During the FSP implementation phase, MoHA will be a responsible party to the IP and implement Community-based Disaster Management actions under both Components 1 and 2 through the central and district relief committees. Since MoHA has the

Category	Institution	Involvement in the project
		mandate to work on disaster risk and preparedness activities under GON, the work will be closely linked under their jurisdiction. MoHA will also be a member of the PSC.
	Ministry of Federal Affairs and Local Development (MoFALD) Focal Point: Mr. Shital Babu Regmi, Secretary	During the PPG phase, MoFALD participated in project stakeholder meetings and contributed to draw linkages with district line agencies and the capacity related issues that would be important during the design of the project. During the FSP implementation phase, MoFALD will be a responsible party to the IP and shall support in delivering activities under Components 1 and 2. The MoFALD will play a vital role in facilitating community mobilization, institutional empowerment and capacity building, integrating project purpose, objectives and activities into the local development planning. The MoFALD will be a part of PEB as one of the Senior Beneficiaries and will also be a member of the PSC.
	Ministry of Finance (MoF) Focal Point: Mr. Krishna Hari Banskota, Secretary	During the PPG phase, MoF participated in project stakeholder meetings. They supported the design of the project by providing feedback to the design team and to ensure that the GEF resources are allocated appropriately. During the FSP implementation phase, the project will work closely with the MoF. MoF's senior official is assigned as GEF and they are the key recipient of LDCF, and responsible for the transfer of LDCF resources to the Implementing Partner, DHM and associated responsible parties according to a work plan agreed by all key stakeholders including UNDP, and perform fiscal monitoring of project spending within the Government system. The MoF will play the role at the PEB as one of the Senior Beneficiaries and will also be a member of the PSC.
	Alternative Energy Promotion Centre/Ministry of Science, Technology and Environment (AEPC/MoSTE) Focal Point: Dr. Govinda Pokharel, Executive Director	During the FSP implementation phase, AEPC/MoSTE will be indirectly involved in the project to provide advice on development of the utilization of drained glacial lake water out flow for energy production (under Component 1) as required.
	Ministry of Culture, Tourism and Civil Aviation (MCTC)	During the FSP implementation phase, the project will work closely with the MCTC in order to benefit from and contribute to tourism infrastructure in and around the Imja lake area and to connect

Category	Institution	Involvement in the project
	Focal Point: Mr. Ganesh Raj Joshi, Secretary	with the tourism industry by addressing GLOF risk reduction activities. MCTC will be a member of the PSC.
Development Partners and INGOs	United Nations Development Programme (UNDP) Focal Point: Ms. Shoko Noda, Country Director	UNDP was requested by the MoSTE to serve as the GEF Implementing Agency to support the Government with the formulation of the concept and preparation of the project document for CEO approval. During the FSP implementation phase, as per discussions with the MoSTE/GON the project will be implemented under the National Implementation Modality where UNDP will play an active role as the Senior Supplier in the Project Board. In this role, UNDP will provide oversight support to the project as per its role as a GEF IA. UNDP provides project cycle management services (also referred to as General Management Services-GMS) via the UNDP Country Office, with specialized technical and oversight support by the UNDP-GEF unit at the regional and global level. Expected direct project services by UNDP to the Implementing Partner have been identified (if required) and are documented. The Direct Project Costs that are implementation-driven and are incurred for, and can be traced to, the delivery of project inputs have been estimated. These costs are incurred as part of Country Office support to NIM projects.
	International Center for Integrated Mountain Development (ICIMOD) Focal Point: Dr. Arun Bhakta Shrestha	During the PPG design phase, ICIMOD was involved in the project formulation exercise by providing substantial inputs from their experiences and expertise. The proposed project builds on ICIMOD's long-standing experience in monitoring and analysing GLOF risks in the Hindu-Kush Himalayan region. ICIMOD's technical input will inform all GLOF-related aspects of the proposed project (Component 1) and shall bring their knowledge gained through their previous experiences working on GLOF drainage and EWS issues. During the FSP implementation phase, ICIMOD will work collaboratively with the project team by providing substantial inputs from their experiences and expertise. ICIMOD will have provide guidance on the technical matters while implementing the

Category	Institution	Involvement in the project
		project as part of the Technical Advisory Group.
	High Mountain Glacial Watershed Programme (HMGWP) Focal Point: Dr. Alton Byers, Director	During the PPG design phase, TMI and the HMGWP worked in one of the key Project Target Areas around Imja Lake and provided community focused information for the design of Component 1. During the FSP implementation phase, HMGWP will be implementing a number of complementary activities in support of achieving Project Outcome 1 related to establishing a CBEWS in the Imja GLOF Impact Zone and strengthening local individual and institutional capacity for GLOF risk management.
	Practical Action (PA) Focal Point: Mr. Anup G. Phaiju	During the PPG design phase, PA with its long experience on CBEWS was an important partner to consult during the project preparation and to design appropriate/innovative field based EWS for the project. During the FSP implementation phase, the project shall collaborate with PA to implement Component 2 activities in the Tarai/Churia region.
	ADAPT Asian /United States Agency for International Development (USAID) Focal Point: Mr. Lee Baker, Chief of Party	During the PPG phase, UNDP leveraged the support of the USAID ADAPT Asia team to support pre-feasibility studies on lowering the Imja Glacial Lake and explore opportunities to establish CBEWS in Tsho Rolpa Lake as well as Micro-Hydro Plant downstream of Imja Lake from the drained water. The studies, financed by the ADAPT-Asia Programme, were undertaken by collaborating with Kathmandu University and Practical Action. During the FSP implementation phase, the project will also collaborate with USAID's High Mountain Glacial Watershed Programme which is formulated to address the perceived gaps in knowledge and collaboration on GLOFs and to develop follow up pilot and capacity building activities. HMGWP has the goal of increasing awareness of the critical importance of high mountain watersheds in the context of climate change, highland-lowland interactions, and ecosystem services and has a project targeted in Solukhumbu starting from mid-2012.
Academia	Academic and Research Institutions such as Kathmandu University (KU)	During the PPG phase, KU with the support of ADAPT Asia was involved in conducting the pre-feasibility of the design the outflow mechanism for Imja Lake to reduce water levels by 3m. They also conducted a design to establish CBEWS in Tsho Rolpa and also did an in-depth study on the possibilities of setting up and micro-hydro plant from the drained glacial lake water. During the FSP implementation phase, KU shall be providing their

Category	Institution	Involvement in the project
		guidance and technical expertise as part of the Technical Advisory Group of the project. The Himalayan Cryosphere, Climate and Disaster Research Center (HiCCDRC) at KU along with similar research bodies from other academic institutions will be consulted during the implementation of this project for their technical knowledge regarding the condition and status of Nepal's Glacial Lakes.

2.3 Design principles and strategic considerations

73. The project is well-aligned with national policies and goals on climate change, disaster risk management and socially inclusive poverty reduction and human development (Section 2.3.2). Through alignment with the key national disaster management policies as well as with major projects and programs currently under definition and/or implementation in Nepal that are described further in the subsections that follow, the project will improve the adaptive value of ongoing government, bilateral and multilateral investments in a high-risk GLOF area and in four flood-prone river basins of the Tarai and Churia Range. The project will use LDCF resources to finance the additional costs of achieving sustainable development imposed by the impacts of climate change. It is exclusively country-driven and will integrate climate change risk considerations into disaster preparedness and risk management systems. In line with paragraph 12 d) of LDCF guidelines, the project puts emphasis on

    - Development of early warning systems (EWSs) against climate-related extreme events;
    - Monitoring of conditions for, and development of, programs to respond to flooding and glacial lake outburst flooding (GLOF); and
    - Raised awareness and understanding among local communities about the necessity and benefits of preparedness for climate hazards.

74. These priorities are aligned with the expected interventions articulated in the LDCF programming paper and decision 5/CP.9.

75. Gender mainstreaming has been given particular consideration in the design of the project considering the role of men and the important role that women often play in disaster relief and recovery, as discussed separately under Section 2.3.4 The proposed project builds especially closely on the knowledge, experience and partnerships developed by UNDP through its integrated Disaster Risk Reduction programme, particularly the following four UNDP-led initiatives, which are also contributing co-financing to this project. These aspects of project design and strategic considerations are discussed further below.

2.3.1 *Alignment with LDCF Results-based Management Framework and Linkages with the LDCF Adaptation Portfolio*

76. With regards to the LDCF Results-based Management Framework (RBMF), the project is aligned with Objective CCA-1 (Reducing Vulnerability: Reduce vulnerability to the adverse impacts of climate change, including variability, at local, national, regional and global level) and compliant with Outcome 1.2 (Reduced vulnerability to climate change in development Sectors). Output 1.2.1 of the LDCF Results Framework (Vulnerable physical, natural and social assets strengthened in response to climate change impacts, including variability) corresponds to the main impact indicators of the proposed project.

77. Additionally, as discussed in Section 2.1, the project has been designed to address the most urgent and immediate adaptation priorities identified in Nepal's NAPA, which has analyzed the multiple climate risks and vulnerabilities of the country. The project is also fully aligned with major relevant national policies and existing programmes on disaster risk management in the country, particularly on flood risk management. The project builds on the knowledge generated by other relevant adaptation and DRM projects and programmes in Nepal and internationally, notably on two other LDCF projects on GLOF risk reduction in Asia. The project has been designed to avoid duplication and instead will work in partnership with several key institutions and on-going or proposed initiatives that will support the achievement of the project's planned outcomes. These different aspects of project design are discussed further below.

2.3.2 *Linkages with Key National Policy Processes and Initiatives*

78. Both Nepal's Initial National Communications (INC) to the UNFCCC of 2004 and the NAPA have highlighted how the confluence between low degrees of human and economic development, mountainous topography and a high dependence on climate-sensitive natural resources has resulted in substantive human and economic losses from climate-related events over the past 10 years. According to the NAPA, "Observations of the effects of increased climatic variability in some parts of Nepal show increasing erratic and intense rains. This climatic trend combined with fragile topography, deforestation and eroded soils are leading to landslides and flash flooding hazards. It is projected that rainfall intensity will increase across many areas of Nepal with climate change. Vulnerable communities will have to increase adaptive capacity to cope with climatic hazards. These hazards also affect the availability of water resources particularly for household use. Water supplies need to be managed so they are climate proofed."

79. Nepal's NAPA process is embedded within the country's development objectives, which are in turn guided by an overriding poverty reduction agenda. The country's Tenth Five-Year Plan/Poverty Reduction Strategy Paper (2002-2007) and its interim Three-Year Plans (2007-2010 and 2010-2012) are aimed at achieving 'a remarkable and sustained reduction in the poverty level in Nepal', which is only possible if development gains are not undermined by climate-related disasters.

80. Prior to 1982 before the formulation of the **Natural Calamity (Relief) Act** (NCRA)[9], however, there were no national plans or activities specifically for disaster mitigation and preparedness. The Ministry of Home Affairs (MoHA) is designated as the lead agency responsible for implementation of the NCRA, which focuses mostly on rescue and relief work and does not specify the duties and responsibilities of other stakeholders, including the non-governmental sector. The NCRA does, however, provide for the formation of a 25-member Central Disaster Relief Committee under the chairmanship of the Minister for Home Affairs. The Act describes the functions of this committee in relation to natural disasters and also empowers the government to constitute regional, district, and local level natural disaster relief committees by publishing a notification in the Nepal Gazette. The NCRA also includes provision for adequate legal backups to implement government policies and strategies addressing overall disaster management and risk reduction. Additionally, the **Soil and Water Conservation Act 1982** empowered the government to regulate land use in designated water shed areas to minimize soil erosion and landslide with a provision of controlling natural calamities such as flood, land-slide and conserving water shed areas. The Department of Soil Conservation and Watershed Management of the Ministry of Forests and Soil Conservation is mandated to implement this act.

81. It was only after 1991, following the declaration of the International Decade for Natural Disaster Reduction (IDNDR), that there was more concerted action on developing disaster management strategies and plans. After the global call for disaster reduction by the United Nations (UN) General Assembly, in Resolution 44/236 of December 22, 1989, the Government of Nepal (GoN) formed an IDNDR national committee. This committee felt the need for a National Action Plan on disaster preparedness, response, mitigation, rehabilitation and reconstruction as the NCRA focuses mainly on rescue and relief operations following disaster events. Accordingly GoN approved the **National Action Plan for Disaster Management in Nepal on February 18, 1996** (MoHA, 1996). The National Action Plan 1996 has four sections: (i) disaster preparedness, (ii) disaster response, (iii) disaster reconstruction and rehabilitation, and (iv) disaster mitigation.

82. As early as 2002, GoN developed a 25-year **National Water Resources Strategy 2002** (NWRS) in recognition of Nepal's increased vulnerability to water-induced disasters as a result of increased climate variability and projected future climate change impacts to mitigate the effects of both on water resources. The NWRS covers emergency response, rescue and relief in the event of a water-induced disaster, and also seeks to enhance institutional capabilities for managing water-induced disasters and to establish measures for water-induced disaster prevention, warning, preparedness and mitigation in at least 20 priority districts by 2010, and the whole country by 2027. The following activities have been identified to achieve these targets:

    - Prepare and implement a water induced disaster management policy and plan.

[9] This act is sometimes referred to as the National Disaster Relief Act as well in English due to differences in translation.

- Conduct risk/ vulnerability mapping and zoning.
- Strengthen the disaster networking and information system
- Establish disaster relief and rehabilitation systems.
- Carry out community awareness/ education on disaster management.
- Establish active Inundation Committee(s) with respect to neighboring countries.
- Prepare and implement flood plain action plans.
- Implement disaster reduction/ mitigation measures.
- Strengthen institutional set-up and capacity.

83. To implement this strategy, a **National Water Plan 2005** (NWP) was developed and ratified. The NWP aims further elaborates how to improve institutional capabilities for managing water-induced disasters and promote the development of effective measures for better management and mitigation of water induced-disasters. The long-term goal of the Plan is to make Nepal's water-disaster management system fully functional, effective, and responsive to people's needs (Pradhan, 2007). The NWP includes seven priority action programs:

    - Water Related Disaster Management Policy and Program
    - Risk/ Vulnerability Mapping an Zoning Program
    - Disaster Networking and Information System Improvement Program
    - Community-level Disaster Preparedness program
    - Program for Relief and Rehabilitation Measures
    - Activation of Inundation Committee
    - Flood, Drought, Landslides/Debris Flow, GLOF and Avalanches Mitigation Program

84. The NWP has set following specific targets for water-induced disaster management:

    - By 2007, identification of potential disaster zone by type and location on a district map
    - By 2007, availability of emergency relief materials in all the five development regions
    - By 2017, establishment of infrastructures for mitigating predictable disasters in 20 districts
    - By 2017, warning systems established and functional across the country
    - By 2027, reducing the level of economic losses due to water-induced disaster to the levels experienced in other developed countries.

85. Shortly after the NWP was developed, a **Water-Induced Disaster Management Policy, 2006**

(WIDMP) was introduced for the management of water-induced disasters as part of the general management of river basins. One of the important objectives of the policy was to define the role of local and central government institutions, non-government organizations, community organizations, and private institutions in the management of rivers. It also aims to preserve rivers, river basins, and water-related environments for the sustainable use of natural resources and facilities such as drinking water, irrigation, river navigation, and road transport; reclaiming riverbanks and flood-affected areas. The policy has the following objectives: a) mitigating the loss of life and property arising from water-induced disasters such as floods and landslides; b) preserving rivers, river basins, and water-related environments for the sustainable use of natural resources and facilities such as drinking water, irrigation, river navigation, and road transport; c) reclaiming river banks and flood-affected areas in order to rehabilitate landless people and carry out socioeconomic activities; d) developing and strengthening institutions for the control of water-induced disasters and management of flood-affected areas; e) defining the role of local and central government institutions, non-government organizations, community organizations, and private institutions in the management of rivers

86. The **Tenth Five Year Plan for Nepal (2002-07)** prioritized natural disaster management, including floods, landslides, debris flow and erosion. It included the first National Plan for Disaster Management with clear-cut objectives, strategies, and programmes. In relation to flood-related disasters, proposed actions under the Tenth Plan included: strengthening capabilities of institutions involved in water-induced disaster management by formulating policy and action plans on disaster management; strengthening the collection, storage, and dissemination of information about water-induced disasters by zoning of hazardous areas based on risk and vulnerability maps of areas prone to flood, debris flow, and GLOFs; preparation of a comprehensive flood and river control master plan and implementation based on prioritization; and integrated watershed management and river control programmes with community engagement.

87. The Tenth Plan paved the way for the development of a more comprehensive National Strategy for Disaster Risk Management in 2009A **National Strategy for Disaster Risk Management in Nepal** (NSDRM) was developed for the Government by the Nepal Society for Earthquake Technology (NSET) in 2008 and adopted by the Executive Government of Nepal in 2009. The NSDRM was developed through an extensive process of stakeholder consultations, with assistance from the European Commission and UNDP. It includes substantial data on the risk profile of Nepal and a detailed analysis of the existing and proposed institutional and legal system for DRM. The long-term vision of this strategy is to establish disaster resilient communities, who are able to bounce back from climate-related shocks and stresses. The strategy advocates strongly for integrating risk reduction measures with national goals for sustainable development and poverty reduction and protecting citizens from avoidable disaster by being sensitive to issues of social justice, social inclusion and equality, including gender, ethnicity, disabilities, acute poverty and marginalization of particular communities, such as the Dalits. The strategy aims to mainstream Disaster Risk Reduction (DRR) into development through sector-based planning, using the principles of the Hyogo Framework of Action (2005-15). The NSDRM outlines four key guiding principles

for a national approach to disaster management as follows: (1) incorporating the disaster risk management issues identified in the National Development plans; (2) the inclusion of cross-cutting issues in planning and implementation (human rights, gender and social inclusion, decentralization and local self-governance, staff safety and security); (3) acceptance of a cluster approach to create sectoral working groups in line with the policy of the UN Inter-Agency Standing Committee approach; (4) and using the five key priorities in the Hyogo Framework for Action as logical steps towards achieving disaster risk reduction.

88. Based on the Hyogo Framework principles and to meet the objectives of the NSDRM, GoN launched the comprehensive **Nepal Disaster Risk Reduction Consortium** (NRRC) in May 2009. The NRRC is a unique institutional arrangement, bringing together financial institutions, development partners, the Red Cross / Red Crescent Movement, and the UN, including UNDP, the UN Office for the Coordination of Humanitarian Affairs (OCHA) and the UN International Strategy for Disaster Reduction (ISDR), in partnership with the Government of Nepal. Other founding members include the Asian Development Bank (ADB), and the World Bank. The NRRC was formed to support the Government of Nepal in developing a long term **Disaster Risk Reduction Action Plan** (DRRAP) building on the NSDRM. It bridges the spectrum of development and humanitarian partners and unites them under a common action plan. Participating organizations remain autonomous in implementing program activities but agree to contribute to a prioritized common set of DRR actions. The NRRC aims to increase investment in risk reduction, to ensure more efficient and effective allocation of existing resources, and to mobilize additional funding for DRR. It also recognizes the value of empowered communities as a key driver to reduce vulnerability to disasters.

89. Based on Government priorities and discussions with multi stakeholder groups during 2009, the government and Consortium members identified the following five flagship areas for immediate action on disaster risk management in Nepal:

    - School and hospital safety - structural and non-structural aspects of making schools and hospitals earthquake-resilient
    - Emergency preparedness and response capacity
    - Flood management in the Koshi river basin
    - Integrated community-based disaster risk reduction/management
    - Policy/Institutional support for disaster risk management

90. This project is particularly well aligned to Flagship Programme 4 (FS4; see also Section 2.3.3) on integrated community based disaster risk reduction/management (CBDRR/M) and also with Flagship Programmes 5 on policy/institutional support for DRM in Nepal, which is led by UNDP (see Section 2.3.3, No.1). FS4, which is led by the International Federation of Red Cross and Red Crescent Societies (IFRC), acknowledges that the disaster risk management system within Nepal is currently undergoing changes driven by the recognition of the need to shift from reactive and relief-based approaches to proactive mitigation and adaptation architecture. This requires institutional, legislative and policy change to support the decentralization of responsibility such that stakeholders at national, district and village levels become more fully engaged in DRM. Through this shift, local government and civil society will be empowered to develop capacity and build sustainable approaches to

reducing disaster risk and avoid more costly, external response interventions. FS4 is therefore also addressing the connection between national and local authorities in relation to resource allocation, planning, hazard mitigation and vulnerability reduction in partnership with a strong civil society. Drawing on the NSDRM, a series of components are being promoted to address priority needs in support of scaling up of local level (DRM), including:

- enhancing local level risk assessment methodologies;
- improving the reliability and geographical coverage of community-based early warning systems;
- scaling up of community-based preparedness and mitigation actions;
- developing community capacity for engaging in local level risk reduction action; and
- undertaking vulnerability reduction measures

91. The **Three Year Plan (2007/8-2010/11)** for Nepal follows the logic of the Tenth Plan, and emphasizes the objectives of human security and protection of livelihood assets from natural disasters through sustainable, environment-friendly and results-oriented development. It demands strengthened 'no regrets' disaster management practices, which are efficient, effective and able to reduce vulnerability in a changing climate. The Government of Nepal (GoN) has recently issued the Three Year Plan (TYP) Approach Paper (2010/11-2013/14), which has the objectives of promoting green development, making development activities climate-friendly, mitigating the negative impacts of climate change and promoting adaptation. The key expected outcomes of the current TYP (2010/11-2013/14) are to prepare and implement a national framework on climate change adaptation and mitigation, disaster risk reduction, poverty reduction and poverty environment initiatives. Based on the outcome to address CC adaptation and mitigation and DRR, Climate Resilient tool was prepared but is yet to be adopted by the sector programmes. To mainstream poverty reduction and poverty environment initiative into the development planning currently the analysis has been completed and preparation of framework is in progress. With a view to implementing these strategies, the TYP identifies the different sector agencies that will take the lead on different aspects of NAPA follow-up implementation under the overall guidance and coordination of MoSTE. The project's execution and management arrangements, which are discussed in Section V are also in line with the TYP, which recommends that NAPA Profile 3 ('Community-based Disaster Management for Facilitating climate Adaptation') and NAPA Profile 4 ('GLOF Monitoring and Disaster Risk Reduction') are addressed through a cooperation between MoHA, MoSTE including DHM/MoSTE, DWIDP/MoI, MoA, MoFALD and UNDP (see Section 2.2.2.).

2.3.3 Linkages with Major Recent and On-going DRM and Climate Change Programmes and Projects

92. A number of recent and on-going programmes and projects have provided hazard, risk and vulnerability data that have contributed to the definition of target areas for project interventions (Section 2.3.5) as well as enabled identification of the specific areas where LDCF support is especially needed to fill key gaps in existing approaches to climate risk management in Nepal. Some of these are also providing financial resources for

complementary investments (see Section IV), especially in the field of community-based disaster preparedness and early warning systems, as well as facilitating the project's entry to local communities, NGOs, CBOs and the planning and decision-making processes of local government authorities. The rich accumulated experience and knowledge of several of these programmes and projects have been major assets to the development and design of this project.

1. **Comprehensive Disaster Risk Management Programme (CDRMP)**

   Project duration: 2011-2015; Financial scope: 20 million USD (Donors: UNDP, BCPR, DFID, EC-DIPECHO and WB)

93. The CRDMP was assigned to UNDP by the inter-agency Nepal Risk Reduction Consortium (NRRC) and addresses the NRRC's Flagship Programme 5 (see Section 2.3.2). The CDRMP aims to strengthen the institutional and legislative aspects of DRM in Nepal, by building the capacities of MoHA, other ministries, and local and emergency preparedness and response. The CDRMP focuses on national and local institutional and capacity development for disaster management, including training of district-level climate change and disaster risk management focal points, the delivery of community based risk reduction trainings, and the establishment of Emergency Operations Centers (EOCs) at both district and central level. CDRMP has established effective working relationships with technical focal persons in MoHA, including DHM, MoFALD, DWIDP/MoI and the Department of Soil Conservation and Watershed Management (DSCWM) of the Ministry of Forests and Soil Conservation. Apart from government partners, CDRMP's partnerships include research institutions and NGOs such as Kathmandu University, Tribhuvan University, the Government Staff College, the National Academy of Science and Technology (NAST), ICIMOD, and a number of local NGOs and CBOs, which have already been involved in hazard and risk assessments, small mitigation measures, and capacity building of communities and local government bodies in various districts.

94. A particular strength of the CDRMP lies in the broad array of institutional partnerships it can mobilize to support an effective and coordinated GLOF and flood risk management effort under the current LDCF project. Three of the planned project target areas are also directly covered by the CDRMP, namely Solukhumbu where Imja Lake is located, and two of the four districts targeted by the project in the Tarai and Churia Range, Mahottari and Saptari (see Section 2.3.5). CDRMP's engagement in these areas will provide complementary investment to support capacity development and institutionalization of GLOF and flood risk management skills, including support to the development of Community-based Early Warning Systems (CBEWs). Additionally, through the CDRMP-funded Emergency Operations Centres (EOCs), the proposed LDCF project will be able to ultimately connect local efforts in flood early warning and preparedness with a network of district and central-level institutions which can effectively process and relay flood risk and early warning information to hazard-prone sites. Additionally, as a flagship project for Disaster Management in Nepal, the CDRMP is well placed to mobilize additional resources from various funds to further complement the activities that will be financed by the LDCF and other cofinanciers in this

project.

2. Regional Climate Risk Reduction Project in the Himalayas (RCRRP) – Nepal Component
Project duration: 2010; Financial scope: USD 200,000

95. The RCRRP was supported by the European Commission's Humanitarian Aid office (ECHO) and was implemented by UNDP's Bureau for Crisis Prevention and Recovery (BCPR). The aim of the project was to develop and implement comprehensive risk management strategies to address climate-induced hydro-meteorological hazards in the Himalayan region. In the implementation process, feasible measures to reduce the risks faced by mountain communities and to mitigate impacts of hydro-meteorological/climatic hazards were identified and implemented at community and local administration level. The RCRRP supported capacity development for disaster risk reduction on a small-scale with a focus on Dolakha District through the following actions: delivering community-based disaster risk management training for communities and government agencies; conducting hazard vulnerability and risk assessments; preparing feasibility studies for low cost early warning systems; delivering school-based training in disaster risk reduction; developing school manuals for disaster risk reduction; and supporting the preparation of community disaster preparedness and response plans.

96. While its limited financial scope was restricting the outreach of the RCRRP, the project responded to the rising GLOF threat from Tsho Rolpa glacial lake through establishing a community-based, low-tech Early Warning system (EWS) in 3 downstream communities. The initiative was an important starting point for GLOF risk reduction, but of insufficient scale to incorporate other communities downstream of Tsho Rolpa (such as Beding, Syalu, Suri Dovan, Bhorle, Singati, Nagdhaha, Khimti, and others as far as 100 kilometers down the projected GLOF Impact Zone). The proposed LDCF project will build on the experiences from the RCRRP in designing a CBEWS for the projected Imja Lake GLOF Impact Zone and will explore opportunities for additional financing to expand the reach of the existing CBEWS in Tsho Rolpa to cover a wider range of communities in all downstream high-risk areas in line with the study conducted by ADAPT Asia (Annex6). The project will benefit in particular from a range of GLOF hazard maps and awareness materials that were developed with RCRRP financing, and utilize the community-based DRM training kits that the RCRRP has developed and adopted.

3. Regional GLOF Risk Reduction Project (RGLOFRRP) - Nepal Component
Project Duration: 2008/2009; Financial scope: USD 295,000; Funding agency: DIPECHO/ECHO

97. This project was designed to address the problem of GLOFs in the Himalayan region and enable comparative analysis of GLOF threats and risk mitigation efforts in Nepal, Bhutan, India and Pakistan. This comparative analysis found that a coordinated approach combining structural with sociological and community-based methods is necessary to prepare vulnerable communities against the threat of GLOFs and glacier melts in the targeted sub-region. The project has provided a community-based risk assessment of GLOF risk from Imja

Lake and Dig Tsho. The project assessment report highlights that while implementing disaster risk reduction programs in the Imja valley, it is important to combine structural programs with non-structural activities. The assessment to this project emphasises that being a spiritually-rich community, Khumbu residents have a high regard for their spiritual leaders. The LDCF project has built on the findings and recommendations of this project by ensuring that risk reduction programs are developed with the participation and approval of local spiritual leaders and vulnerable communities. Additionally, the report highlighted the need for greater coordination among different institutions working on glacier-related issues in the Khumbu region in order to effectively manage GLOF risks. These findings have been taken into consideration in the design of this project's Outcome 1.

4. Climate Risk Management Technical Assistance Support Project (CRM-TASP)

Project Duration: 2008-2012 Financial scope: USD 525,000

98. The CRM-TASP project, a UNDP BCPR-supported initiative, analyzes risks to development that are associated with climate variability and change, and prioritizes measures that will assist countries in better managing those risks in both the short and longer terms. It advocates managing risks at all time scales (weather, climate, extremes, changing climate) and integrates the analysis of climate-related risks with analysis of the institutional, decision and policy landscape; consensus-based identification and prioritization of risk management actions (in alignment with the NAPA); development of decision-support tools; and the mainstreaming of climate risk management into local and national development processes.

99. In the context of this project, the CRM-TASP project provides connectivity with a Regional Multi-Hazard Early Warning System (RIMES), which is coordinated by the Asian Disaster Preparedness Center in Bangkok. RIMES provides flood and storm early warning information to a number of Asian Countries, which can then be transmitted from Hydromet Departments (such as DHM) to regional and local partners. This connectivity is essential when establishing flood risk management systems and early warning protocols in the Himalayas and Tarai/Churia Range. Options for communicating timely and accurate early warning information to local inhabitants in project target districts were assessed during the project preparation and the most locally appropriate ones selected. In addition, the project will explore the potential for adapting the training modules on climate risk management developed by the CRM-TASP project for use in project target areas.

5. Strategic Programme for Climate Resilience (SPCR)

Project Duration: 5 years from 2012; Funding scope: Approximately $40 million as a combination of grant and loan from the Climate Investment Funds managed by ADB and WB

100. The Strategic Programme for Climate Resilience (SPCR) was developed by the GoN, in partnership with World Bank, IFC, ADB and was approved by the Pilot Programme for Climate Resilience (PPCR) sub-committee on June 28, 2011. The SPCR will be providing valuable complementary parallel financing (Section IV). Component 2 of the SPCR ('Building Resilience to Climate-Related Hazards'), focuses on strengthening hydro-

meteorological infrastructure, weather and flood forecast and information systems, and community hazard warning systems and will complement several outputs and activities planned under this project as described in greater detail in Section 2.4. This component is designed to build resilience in vulnerable communities by establishing multi-hazard early warning systems and improving access to financial instruments such as micro-insurance/finance that reduce the adverse impacts of climate induced shocks. The main objective of the SPCR Component 2 is to diminish the impacts of extreme climate related events, protect lives and assets, and support agricultural livelihoods by establishing multi-hazard information and early warning systems, upgrading the existing hydro-met and agricultural information management systems, and improving the accuracy and timeliness of weather and flood forecasts and warning. This includes strengthening the capacity of DHM. Activities funded through the project would help improve decision-making and planning in key climate vulnerable and water resources dependent sectors, particularly agriculture, and contribute to building resilience for communities and sectors at risk. Activities will focus on the installation of real-time hydro-meteorological infrastructure, and information nation-wide, the establishment of early warning systems for priority vulnerable communities, and the creation of climate risk insurance / finance programs for vulnerable communities, home owners and women. In particular, SPCR-supported activities under this component will complement project activities related to the establishment of the community-based Early Warning Systems in Imja GLOF Impact Zone and in the Tarai and Churia Range. The Project Information Document (PID) concept note is current with the GoN and awaiting final approval. Once approved the project will be implemented by MoSTE's Department of Hydrology and Meteorology.

6. 4th Flagship Programme (FS4) of the Nepal Risk Reduction Consortium (NRRC)

Project Duration: 2010-2015; Funding scope: 2.8 million

101. The project will also coordinate with the NRCC's Flagship 4 (FS4) Programme, which focuses on integrated community based disaster risk reduction/management (also see Section 2.3.2 for details about NRRC). The NRRC Flagship 4 (FS4), led by the International Federation of Red Cross and Red Crescent Societies (IFRC) and MoFALD, is taking the lead in reducing vulnerability to natural disasters through community-based DRR/DRM.

102. The objectives of the FS4 are to:

- Provide an overall strategic framework for community-based disaster risk reduction (CBDRR) activities
- Map and demonstrate the progress of CBDRR projects on a national level over a period of time
- Attract additional resources and partners
- Strengthen the linkages with government/administrative structures in Nepal to ensure sustainability

103. FS4 aims to have CBDRR projects covering 1,000 Village Development Committees (VDCs) over 5 years. More than 500 VDCs have CBDRR projects underway or in the planning that

are Flagship 4 compliant. Mapping of over 275 CBDRR projects across Nepal has been done. Nine minimum characteristics of what a disaster resilient community comprises in Nepal have been agreed on as follows:

1. Organisational base at Village Development Committee (VDC) / ward and community level
2. Access to Disaster Risk Reduction (DRR) information
3. Multi-hazard risk and capacity assessments
4. Community preparedness / response teams
5. Disaster Risk Reduction / Management plan at Village Development Committee / municipality level
6. Disaster Risk Reduction (DRR) Funds
7. Access to community-managed resources
8. Local level risk / vulnerability reduction measures
9. Community based early warning systems

104. An Information Platform has also been created for information sharing and project mapping (www.nrrc.org.np). Members include: Nepal Red Cross Society, Save the Children, Practical Action, Action Aid, Mission East, Handicap International, UNDP, Oxfam, Caritas, ADRA Nepal, Lutheran World Federation and more. IFRC's Flagship 4 programme parallel investments at Siraha, Saptari and Udayapur in the Tarai region will benefit the proposed LDCF project.

7. The High Mountain Glacial Watershed Programme, ADAPT-Asia and other USAID-funding initiatives & Programmes

HMGWP: Project Duration: 2012-2015; Funding scope: NA
Adapt-Asia: Project Duration: 2012; Funding scope: USD 152,000

105. The High Mountain Glacial Watershed Programme (HMGWP) is an initiative of The Mountain Institute (TMI) funded by the U.S. Agency for International Development (USAID) through its Climate Change Resilient Development (CCRD) Project. HMGWP also receives financial support from the U.S. Department of State. HMGWP's goal is to increase awareness of the critical importance of high mountain watersheds in the context of climate change, highland-lowland interactions and ecosystem services. It seeks to achieve this goal by combining international and national scientific experience with local knowledge and resources to develop innovative tools and practices for facilitating adaptation to climate change in high-altitude mountain ecosystems and increasing local resilience to the impacts of climate change. TMI and the HMGWP have already started working in one of the key Project Target Areas around Imja Lake and have provided useful inputs for the design of Component 1 (see Section 2.4). HMGWP will be implementing a number of complementary activities in support of achieving Project Outcome 1, particularly in relation to Outputs 1.3 and 1.4 on establishing a CBEWS in the Imja GLOF

Impact Zone and strengthening local individual and institutional capacity for GLOF risk management.

106. USAID's new Climate Change Adaptation Project Preparation Facility for Asia or ADAPT-Asia aims to bring together Asian governments and fund managers and other key partners to clarify the procedures for accessing different adaptation funds and to provide a marketplace for investment project proposals. In this context, ADAPT-Asia which is assisting countries in the Asia-Pacific region to gain access to Climate Change Adaption Funds established collaboration with UNDP to undertake preliminary engineering/feasibility tasks during the project preparation phase that would help the GoN during the implementation phase of this project. ADAPT-ASIA along with ICIMOD and The Centre for Excellence in Production and Transportation of Electrical Energy (CEPTE) of the School of Engineering, Kathmandu University carried out Topographic Survey and Engineering Design of the Outlet Channel & Pre-feasibility Study for a Mini-Hydropower Generation Facility from Imja Glacial Lake during June - July 2012. The objectives of the study were to: i) to present detail topographical survey data and all relevant field data including the current river flows and all other information needed to design the outlet channel in a controlled and systematic manner that will be needed to reduce any GLOF risk. ii) To present data analyses and design of outlet channel with a cost estimation of earthwork excavation for the lowering down of the lake water level by 3 m and iii) To present preliminary analysis of river flows and the added hydraulics due to the controlled drainage of the Imja Lake for developing a Pre-feasibility study complete with estimated costs for a mini of micro-hydropower facility that will serve the communities downstream of the Imja Lake.

8. **International Centre for Integrated Mountain Development (ICIMOD)**
Project Duration: 2011-2014; funding scope: USD 1,705,000

107. ICIMOD is currently implementing **Cryosphere Monitoring Project (CMP)** and **Establishment of a Regional Flood Information System (HKH-HYCOS)** to observe the Hindu-Kush Himalayas Hydrological Cycle. The project is being implemented in other Hindu-Kush Himalayan countries including Nepal. The CMP project aims to build the institutional and human capacities in snow and glacier monitoring in Nepal and similarly, HKH-HYCOS project aims to strengthen the efforts of GON to reduce emerging climate change risks in Nepal. The project will also coordinate with ICIMOD to collaboratively strengthen capacities of national institutions and professionals in snow and glacier monitoring through this project. Along with it will also coordinate to complement in strengthening the GON systems to reduce emerging climate change risks in Nepal by supporting DHM.

108. USAID is also implementing the **SERVIR** programme, which is a regional visualization and monitoring system that integrates earth observations such as satellite imagery and forecast models together with in situ data and other knowledge for timely decision-making. SERVIR evolved through a 'non-traditional' partnership between USAID and NASA (National Aeronautics and Space Administration) to make earth observation data, decision-support tools for interpreting the data, and online mapping capability, more generally available. Thus, SERVIR features web-based access to satellite imagery, decision-

support tools and interactive visualization capabilities, and puts previously inaccessible information into the hands of scientists, environmental managers, educators and decision-makers, enabling them to respond better to a range of issues including disaster management, agricultural development, biodiversity conservation, and climate change. SERVIR-Himalaya, which is particularly relevant to this project, is being implemented by ICIMOD with a focus on the Hindu Kush-Himalayan region. Baseline data generated by SERVIR/ICIMOD has been helpful in assessing the risks associated with the GLOF and flood components of this project.

9. **People's Embankment Programme (PEP), Department of Water Induced Disaster and Prevention (DWIDP)/Government of Nepal**
   Project Duration: 2009/2010 – 2017; funding scope: USD 7 million

109. The PEP-programme is a Government of Nepal/ Ministry of Irrigation led programme which is being implemented through DWIDP working in Ratu River of Mahottari district in the lowland Tarai region of Nepal. This programme is under implementation since 2009/2010 (2066/67 – Nepali fiscal year). The project combines both structural and non-structural activities like flood preparedness, helping to set up early warning for the communities and the engagement in embankment works (hardware construction) by involving local people from the region. Ministry of Irrigation/Government of Nepal has also established seven field offices for "People's embankment Program under the Department of water Induced Disaster Prevention. The primary objective of this program is to conduct phase-wise river training and management works in 10 selected rivers of from high land to Nepal-India boarder to minimize the loss of land and property. Secondary objectives are
    - To create opportunity of employment to the people of lower income by their involvement in the construction works of embankments
    - To reclaim the land and its proper use by the concerned authorities
    - To develop the embankment constructed for flood control as an alternative way of transportation
    - Environment protection

110. The goal of People's Embankment programme it to minimize the loss of life and property, fertile farmland and infrastructures as a consequence of flood, inundation, river bank cutting, to provide safety against disaster and to improve the standard of living of the vulnerable people. The target for PEP-programme is to build 66.61 km of embankment on both sides of the Ratu River with gravelling on the top of the embankment to serve as road, and construct bioengineering to protect slopes in 55 hectares along the river. Until 15th June 2012, the PEP-programme has constructed 28.3km embankment (biogabions, dykes etc). The proposed project can complement and build on the efforts established by the PEP-programme especially in the Ratu River of Mahottari district; as this project also plans to protect the flood prone areas of the Ratu River in the upstream and downstream areas of this region. While working on the downstream, the project plans to coordinate with President's Churia Conservation Programme in the upstream in the complementing districts.

2.3.4 *Social and Gender Aspects of Disaster Risk Management in Nepal*

111. Numerous studies indicate that women often suffer disproportionately more than men from the impacts of disasters, including higher rates of mortality, due to gender-based differences in access to information, training, mobility, decision-making, resources, cultural norms and barriers as well as high rates of male out-migration (Nellemann, C., Verma, R. and Hislop, L., 2011:37). These studies underscore the importance of understanding the gender implications of disasters, including climate-related disasters, and integrating this understanding into the design of DRM and climate change adaptation measures, with particular attention to the linkages between climate-related disasters, development and women's social marginalization, lack of choice and the skewed power relations between men and women (UNDP, 2011).

112. Other marginalized groups that need special consideration during DRM and climate change adaptation planning, include socio-economically disadvantaged and/or marginalized communities, such as dalits, endangered and highly marginalized ethnic groups. Members of these communities are often less well-educated than other communities and also frequently excluded from the dominant communities' user groups and other activities. Because of social exclusion and poor education, marginalized communities often have limited understanding of, and access to information about, potential disasters and options for mitigating the impacts of such disasters, which make them particularly vulnerable to the impacts of climate-related and other disasters. Other vulnerable group, include the very old, the very young and person with disabilities, especially when they are also from a marginalized community and women.

113. In the highly dynamic socio-ecological Tarai and Churia, water-induced hazards such as flooding, erosion, landslides, drought and water-borne diseases have been shown to collectively have a greater impact on marginalized, indigenous and poor people's livelihoods, food insecurity and health. Community interactions and consultations undertaken in Udayapur, Siraha, Saptari and Mahottari Districts during the PPG (see Annex 4 for details) confirmed the hardships faced by different groups during floods, particularly women and young children (see Annex 4). In most of the visited communities, young men had migrated to find work as paid labour, because of the impacts of floods and sedimentation on agricultural lands and crops. Consequently, many communities are mostly comprised of elderly people, young women and children. Women are the caretakers of their homes, fields and natural resources during and after the floods. However, women are still frequently subjected to domestic and sexual violence and often do not have access to female aid workers to whom they can express their gender specific needs and concerns. Domestic and sexual violence often becomes worse during and after floods, when people are forced to move to shelters or other dry areas, where they are no separate and secure sleeping or toilet facilities for women or adequate lighting and other security measures. Flooding is particularly problematic for pregnant women or those who are about to give birth or have just given birth and women who have just given birth face more difficulties. Some women reported on the trauma of having to walk several miles in

the flood-affected areas with labour pains and the complications they endured with new born-babies and young children during floods. For example, in one community two babies born during a flood immediately contracted pneumonia. These children are almost two years old now, but still suffer from frequent respiratory problems, which add to their families' difficulties and expenses. The risk of water-borne disease during floods is especially high for the very young and the very old. Additionally, floods frequently disrupt the education of children, especially small children, who may be unable to attend classes for days and weeks.

114. PPG consultations with local communities downstream of Imja Lake in Ghat, Namche and Dingobche revealed that women are very active as able adult men are all occupied with outside activities such as accompanying trekkers and mountaineers. Women were very aware of the risks they faced from a potential GLOF and felt they and their children were particularly vulnerable since they spend more time at home and in the area generally than the men, who may be away for long periods for work.

115. Despite the differential impacts of disasters on women, children and elderly, the special needs of these groups are rarely taken into account in DRM planning and implementation. They also continue to have minimal or no voice in reconstruction planning and remain marginalized in their access to relief resources. For example - ensuring of women participation in capacity building, exchange visits, flood preparedness training, establishing community level VDMC and task forces are important and not practiced frequently. The reasons for this include: lack of appreciation by decision-makers of the many benefits of mainstreaming gender and other social considerations into DRM planning and rescue and relief operations as well as lack of knowledge and experience in undertaking more socially sensitive DRM planning. There is also a lack of gender-disaggregated data in Nepal on loss of lives and properties due to disasters in order to conclusively demonstrate the benefits of mainstreaming gender into DRM planning to key decision-makers. Nonetheless, gender gender-sensitive DRM planning is slowly gaining ground in Nepal due to the efforts of DRM practitioners and other advocates of this approach. Initiatives like flood proofing to drinking water supply system through raised tubewells is also related to gender issue as destruction of tubewells during flooding compel women to reach far in search of drinking water.

116. This project has ensured that gender mainstreaming and other social considerations have been taken into account in the project's overall design. Feedback from especially vulnerable groups during community consultations undertaken during project preparation has been integrated into the design of specific project outputs as described further in Section 2.4. For example, the community-based early warning systems that will be developed with LDCF support will be simple enough to be managed and operated by children, women and the elderly, including illiterate people. Gender mainstreaming and other social considerations will be integrating into the more detailed planning of project activities during project implementation. These aspects will also be monitored specifically during project implementation and documented in relevant progress reports.

2.3.5 *Project Target Areas*

117. The Project's two main components will be implemented in two discrete geographic areas of Nepal. The activities associated with Outcome 1 (reduction of GLOF risks) will be implemented in and around Imja Lake in Solokhumbu District, while those under Outcome 2 (reduction of flood risks in the Tarai and Churia Range) will be implemented in four flood-prone districts in central and south-eastern Nepal: Mahottari, in Central East Nepal and Saptari, Siraha and Udaypur in Eastern Nepal. The main project target areas are described briefly below with further details in Annexes 2 and 3. These sites were selected based on additional analyses of risk and vulnerability and consultations undertaken during the project preparation phase.

Imja Lake

118. Imja Lake (or Imja Tsho in Tibetan) is located in the eastern Nepal Himalayas, in the eastern part of Sagarmatha National Park and the north-eastern part of the Dudh-Koshi river sub-basin (Fig. 9). Imja is a moraine-dammed glacial lake fed by the Lhotse Shar Glacier and the Imja Glacier and constitutes the headwater of the Imja River.

Figure 9: Location Map of Imja Glacial Lake in East Nepal (SOURCE: ICIMOD)

119. During the PPG phase of the project Imja Lake was selected, in preference to Tsho Rolpa and other potentially dangerous glacial lakes, as the main project area for GLOF risk reduction interventions for the reasons outlined below (see Annex 3 for details).

120. Imja Lake is among the 20 most potentially dangerous glacial lakes identified by ICIMOD in 2010, and one of the most high-risk glacial lakes in the entire Hindu Kush-Himalayan region based on the rate of growth of the lake (using 2007 data). The lake did not actually exist in the early 1960s. Satellite images at the time indicate only a few small supraglacial ponds in its present location. Between 1975 and 2002, the area of the lake grew rapidly from 0.3 km^2 to 0.86 km^2 (Bajracharya et al. 2007). The rate of retreat of the Imja Glacier is among the highest recorded in the Hindu Kush-Himalayan region at a staggering 42 meters per annum from 1962 to 2009 (ICIMOD Field Report, 2009). Tsho Rolpa, another

high-risk glacial lake in the eastern High Mountains, has already been the focus of several GLOF risk reduction interventions (Annex 3), but Imja has not.

121. There are a total of 35 Village Development Committees (administrative division of a District) or VDCs adjoining Imja/Dudhkoshi River along a distance of 120 km[10] from Imja Glacial Lake to the confluence of Imja/Dudhkoshi with Sunkoshi with a total population of 96,767. Among them 5 VDCs with a total population of 12,184 are located within 50 km distance from the lake site (see Table 3 for further details).

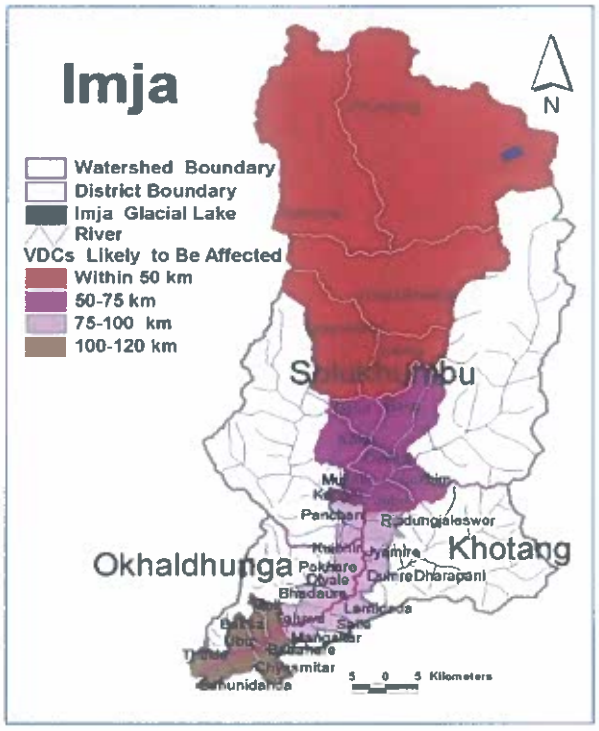


Figure 10: VDCs exposed to potential GLOF risk from Imja Glacial Lake (Source: ICIMOD)

Table 3: Number of adjoining VDCs and population exposed to potential Imja GLOF risk and by distance from the lake.

Distance from the lake	No of VDCs	Population
Within 50 km	5	12,184
50-75 km	9	31,862
75-100 km	14	34,585
100-120 km	7	18,136
Total	**35**	**96,767**

Source: Compiled from Population Census, 2001(CBS, 2003)

[10] It is estimated that a total area of 1009.9 hectares up to 120 km km downstream of Imja Glacial Lake is exposed to GLOF risk (ICIMOD, 2011)

122. People living in these adjoining VDCs are likely to be directly affected by a potential GLOF. Many of these communities are dependent on natural and environmental resources such as forests, pasture, fisheries, and eco-tourism and adventure tourism which may be destroyed, partially destroyed or have access blocked due to direct or indirect damage caused by a GLOF event.

123. The area exposed to GLOF risk is one of the most important tourist destinations of Nepal. It is estimated that 30,000 trekkers visit the area annually with average stays of more than two weeks. Huge investment has been made in the construction of lodges in the area (construction cost of about 9-10 million NRs per hotel). Trekking trails which follow the bank of Dudhkoshi are also vulnerable to Imja GLOF. In 1985 traffic flow was blocked for more than 20 days after the damage of trails and bridges between Jorsalle to Ghat by the Dig Tsho GLOF.

124. One estimate for 1997 shows that nearly 20,331 people were employed as porters and guides in the Everest region when the number of tourist visiting Khumbu region was 18,179. Similarly, tourism revenue for 1995 from Khumbu region was estimated to be US$ 0.869 million which is 22.1 per cent of the total revenue from tourism (mountaineering royalties, trekking peak fees, trek permit fees and park entrance fees) in the country when the number of tourist visiting this area was 14,997. The collection of park entrance fee for 1995 was about USD 0.235 million (Sharma, 2001). The number of visitors at present is more than double as compared to 1995, the employment generation as well as the revenue from tourism may also have doubled. If a GLOF occurs the number of visitors to this area is likely to decrease considerably, significantly affecting the national economy.

125. This region provides tourism based employment opportunity not only for its local people but also for people living in nearby districts. All the livelihood options such as tourism, trade and business, agriculture and livestock are directly or indirectly affected by a potential GLOF event. The flow of people, animal and goods is also likely to be blocked due to damage of trails and bridges.

126. There are a total of 25 bridges over Dudhkoshi River. The bridges in the upper reaches, in the vicinity of Dingboche area, are highly vulnerable to the potential Imja GLOF. In addition to these, 23 suspension bridges in the middle and lower reaches of Dudhkoshi River are likely to be susceptible to lateral erosion[11] during the GLOF. Irrigation canal of 500 meter length in Dingboche, five water mills and about 7 km of transmission line in different places are at GLOF risk. About 4 km of road under construction near Jayaramtar is also at GLOF risk.

127. Many hydropower projects with potential capacity of more than 1500 MW are going to be developed along the Dudhkoshi River as indicated by the applications submitted for survey license. These projects are also at risk from a GLOF event.

[11] The action of a stream in undermining a bank on one side of its channel so that material falls into the stream and disintegrates; simultaneously, the stream shifts toward the bank that is being undercut.

128. The total estimated amount real estate, agricultural assets and infrastructure and public infrastructure exposed to potential GLOF risk is equivalent to about USD 11.89 million under modeled flood scenario and USD 35.5 million under assumed maximum level of flood (35 m high from the river bed). Out of a total of exposed value under modeled flood scenario, nearly 9.36 million is highly susceptible to potential GLOF risk since the elements are located in highly vulnerable areas which are likely to be washed way or damaged from potential GLOF or secondary impacts such as bank erosion, landslides and siltation. The value of exposed elements which are located in relatively low hazard zones under the modeled flood scenario is equivalent to USD 2.54 million (Khanal, N. R., 2009).

Comparative analysis of the GLOF risk of Imja and Tsho Rolpa lakes

129. During the PPG, Imja Lake was selected as the main project area for GLOF risk reduction intervention based on the described data, information, and gathered knowledge gathered from various sources local locally held multi-stakeholder consultation and views of concerned government officials, especially from the ministry of Environment, Govt. of Nepal.

130. Although Imja Lake has fewer downstream inhabitants numbering 96,767 living up to a range of 120 km downstream of Imja Lake Outlet compared to 141,911 inhabitants to 100 km downstream of Tsho Rolpa Lake Outlet, the results of vulnerability assessments undertaken by ICIMOD in 2009 (Khanal, 2011) revealed a significantly higher potential for human and material losses from an Imja Lake GLOF compared to a Tsho Rolpa GLOF. The total economic value of potential risk and damage from an Imja GLOF event in the Dudhkoshi region to hydropower investments alone is estimated to be US$8.98 billion nearly four times higher than from a potential Tsho Rolpa GLOF, which is US$2.4 billion (ICIMOD, 2011) as indicated in Table 4 below.

Table 4: Population downstream that could be affected by potential GLOF events

Description	**Imja** (120 km)	**Tsho Rolpa** (100 km)
Population potentially directly affected due to loss of resources	**96,767**	**141,911**
Population potentially indirectly affected	**501,773**	**524,323**
Exposed Hydropower investment potential (billion US $)	**8.98**[12]	**2.4**

[12] See table 18 in Annex 3 for detail

Table 5: Monetary value of other exposed public properties and community assets to GLOF risk (USD 000).

Glacial Lakes	Dudhkoshi (Imja)		Tamakoshi (Tsho Rolpa)	
Flood Scenario	Model	Max	Model	Max
Real Estate	8,917	31,729	1,411	6,524
Agriculture Sector	932	1,680	117	330
Public Infrastructure	2,037	2,084	319	1,928
Revenue	7	7	0	0
Total	11,893	35,500[13]	1,847	8,781

131. The difference in the estimated economic value of damage from a GLOF at Imja and Tsho Rolpa is mainly due to the high volume of tourism and hydropower investment in the Imja area. As previously outlined a GLOF at Imja would not only potentially threaten the lives of tourists, but also potentially damage critical tourism infrastructure such as roads, trails, suspension bridges, guesthouses and teashops. It could also sever the route between Everest Base Camp and Lukla in the south, which is the main entry point for trekkers. Such damage could take several years to repair causing enormous direct and indirect economic losses to local communities, whose livelihoods are centered around tourism, the broader tourism industry and to the park.

132. It is estimated that a total land area of 1,010 hectares located in a distance up to 120 kilometers downstream of the potential inundation zone of Imja Lake is exposed to direct GLOF risk. A GLOF at Imja could thus potentially affect 96,767 number of people in 35 VDCs within flood-prone areas in three districts that are directly exposed to a GLOF risk and a further 501,773 people who may be affected indirectly, who are within the 120 km downstream GLOF impact zone, but not in flood-prone areas.

Table 6: Crops (M. Tons) and Land (hectares) potentially affected by a GLOF in Imja and Tsho Rolpa.

Properties	Imja GLOF Impact Zone (hectare)[14]	Tsho Rolpa GLOF Impact Zone hectare
Total Land	377.5	129.2
Khet (Irrigated land)	275.7	113.2
Bari (rain-fed land)	101.8	15.9
Crops (Metric ton)	1801.3	666.9
Paddy	696.3	247.5

[13] See Annex 3 - Figure 2.6 and Table 13 for detail

[14] Estimate for Imja is based on the modeled flood level (Annex 3)

Wheat	252.4	52.1
Maize	478.5	179
Millet	82.6	119.8
Potato	277.9	54.8
Other crops		0.6
Vegetables	13.6	13.2

133. Based on the afore presented data, information, knowledge and above all quantitative and qualitative analysis , it is clear that Imja warranted greater attention and priority for the GLOF risk reduction project intervention which the project document has adopted. Project interventions will target the entire area identified as being exposed to GLOF risk and the settlements, communities and infrastructure identified as being most at risk from a GLOF. This will not only recue the risk to the immediate population and properties including the various elements of national and global importance but also help build resilience in the vital sectors of agriculture, hydropower, forestry, and tourism and community infrastructure (Annex 2 and 3).

Target Flood-Prone Districts in the Tarai & Churia Range

134. The preliminary selection of districts for LDCF project interventions proposed at the PIF stage was further refined during the project preparation phase based on additional analyses of vulnerability to climate change-induced flooding in the most vulnerable regions of the Tarai and Churia Range. These included analyses of three weighted indices, including the flood risk index and the climate vulnerability index developed by the Ministry of Environment during the NAPA preparation and an additional simple index of existing external interventions aimed at disaster management developed during the PPG (see Annex 2). This provided greater emphasis on districts with relatively few external interventions and resulted in the following selection of target districts: Mahottari, in Central East Nepal and Saptari, Siraha and Udaypur in Eastern Nepal. Of these, only Mahottari was part of the preliminary identification of potential target sites at the PIF stage. All the selected districts are among the districts prioritized for the first phase of adaptation planning under the NAPA, except Udaypur, which falls within the second phase. However, Udaypur was also selected in order to ensure the project included one major site within the Churia Range, given the significance of upstream-downstream linkages to flooding risks in the Tarai.

135. These four districts encompass 3 river basins: the Ratu, Gagan and Khando and 2 tributaries of the Trijuga River, the Hadiya and Kong, which will be the focus of different outputs under Outcome 2 of this project. The 3 river basins and 2 tributaries targeted by the project are in order of largest to smallest rivers: the Ratu (also known as Rato) in Mahottari District in central-east Nepal, the Khando in Saptari District, the Gagan in Siraha

District and the Hadiya and Kong, tributaries of the Trijuga River, in Udaypur District (Figure 10). All are Class 3 rivers that originate in the Churia Range, which are particularly prone to flash floods and heavy sedimentation. The Hadiya and Kong basins are fully within the Churia. In terms of severity of flood impacts on the local population and material assets, the Ratu River, which also flows through the Jaleshor municipality, and the Khando River, has had the biggest adverse impacts. The Ratu Khola (river), which originates from the Mahabharat range, is a major source of annual flooding in Dhanusha and Mahottari districts. Flooding of the Ratu in 2004 resulted in severe inundation lasting up to a week in some areas including Jaleshor; the area inundated was 1,710 ha with an average depth of submergence of c. 1.5m. Over 9,200 people in 7 VDCs were affected to varying extents. The most severe case of flooding of the Khando was in 1997 during which over 10,000 people in 6 VDCs including over 5,200 people in Jaleshor were affected. While flooding lasted only for about 48 hours, some 4,600 ha were inundated with an average depth of submergence of between 1.00-1.75 m (DWIDP data).

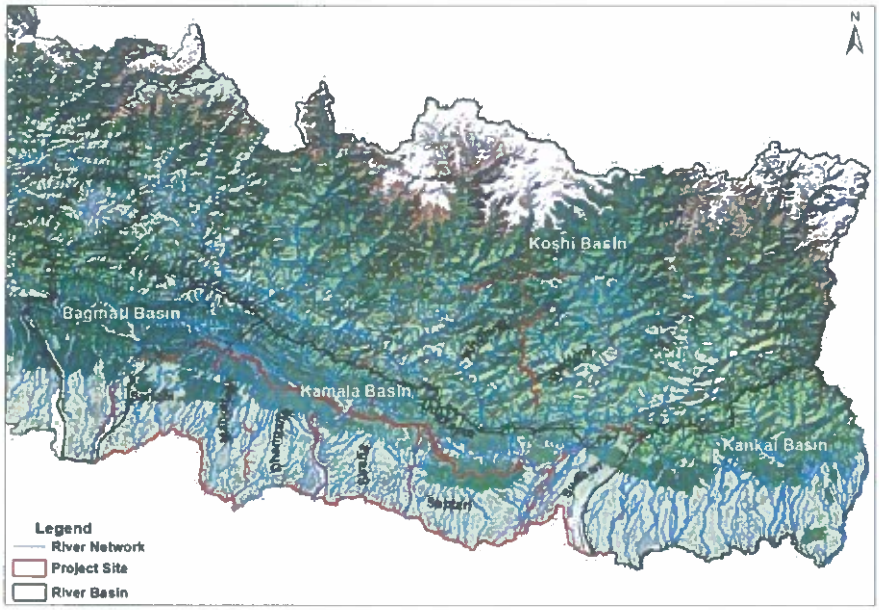


Figure 11: Map of Easter Nepal with river networks including district boundaries of Tarai region (Source: ICIMOD).

136. Data on the value of economic losses are not available just for floods. Combined data on flood and landslides over 9 years from 2001 to 2010, however, indicate the highest levels of losses in Udaypur district, (USD 9 million), followed by and Mahottari (USD 1 million), Saptari (USD 2.2 million) and Siraha (USD 2 million; 1 USD = NRs. 70). During the same period, human losses were as follows: Udaypur 535 (mainly because of landslide), Mahottari 126 (flood), Siraha 19 (flood and landslide) and Saptari 4 (flood) (DWIDP data).

2.3.6 UNDP's Comparative Advantage

137. UNDP's comparative advantage for the proposed project lies in its long-standing

experience of working with different government entities to advance disaster risk reduction in Nepal, including MoHA, DHM, and DWIDP. UNDP is one of the founding members of the Nepal Risk Reduction Consortium (NRRC) and has a long track record of investing its own core resources in disaster risk reduction and climate risk management projects, as documented in the assessment of 'who does what' in climate-related disaster risk reduction (UNDP, 2010) As indicated by the substantive cash and parallel co-financing it is contributing to the proposed project, all of which is funded by bilateral and core resources (outlined in Section B.1), UNDP is well positioned to support the targeted allocation of LDCF financing to urgent and immediate local climate risk management needs. UNDP support is provided to this project in both technical as well as financial terms (see Section C.1).

138. In addition to evident alignment in terms of UNDP's existing portfolio in Nepal and a verifiable track record in providing financial and technical support to climate risk management projects, the proposed project matches with UNDP's comparative advantage in capacity development (as articulated in the GEF Council Paper C.31.5 "Comparative Advantage of GEF agencies"). In this context, it is important to highlight that UNDP has garnered extensive experience in the implementation of GLOF and flood risk management projects, most notably in Bhutan (LDCF-funded) and Pakistan (AF-funded). These efforts provide immediate entry points for South-South technical cooperation and the sharing of lessons learned. Through its network of country offices and regional advisors who act as conduits for the exchange of technical and project management experience, UNDP is well positioned to assist Nepal in the design and implementation of the proposed project.

2.3.7 Expected National and Local Benefits

139. The project responds to two of the most urgent and immediate priorities identified in Nepal's NAPA (Section 2.1). By the end of the project, the following specific national and local benefits are expected.

140. At the national level, LDCF funding will enable the government of Nepal to address important investment gaps in community-based climate risk reduction. Many of these gaps have been highlighted in a number of previous assessments by development partners but never been followed up due to lack of adaptation financing and sufficient institutional know-how. Specifically the project will contribute to strengthening the institutional and technical capacity of two lead government agencies with a major role in flood risk monitoring and management in relation to GLOFs and riverine flooding in the Tarai and Churia Range, namely DHM and DWIDP. Additionally, it will contribute to improved coordination between DHM, DWIDP and other key partners working on DRM within and outside MoHA at the national level.

141. At a local level, LDCF funding will greatly reduce the risk of human and economic losses from catastrophic flooding events in four districts of the Tarai and Churia Range and in the GLOF Impact Zone of Imja Lake and neighbouring areas. In the Tarai and Churia

Range, at least 64,700 of the most poor and vulnerable households are expected to benefit from one or more of the following measures: flood-proofed water and sanitation systems, CBEWSs, sediment control and stabilization of riverbanks and slopes in the Ratu river basin. In Solokhumbu District and other areas within wider Imja Lake GLOF Impact Zone, at least 31,862 population (within the high risk settlements), somewhat USD 8.98 billion worth of material assets and infrastructure, and around 30,000 tourists annually, will benefit from the reduced risks of a GLOF event at Imja Lake through lowering of the lake and reducing its volume and through the development of a CBEWS. Additionally, in both the Tarai and Churia Range and in and around Imja, communities, including women and other disadvantaged groups, will be more empowered to plan and prepare for potential disasters themselves as a result of the capacity development and community mobilization interventions facilitated by the project, which will include the formation of village-level disaster management committees, plans and task forces. Local DDRCs in the project target areas will also have greater knowledge and technical skills for integrating DRM into district development plans and emergency preparedness plans as a result of the targeted training provided by the project as well as opportunities to engage proactively in different project interventions.

2.4 Project Objective, Outcomes, Outputs and Indicative Activities

142. The project's overall objective is to reduce human and material losses from Glacier Lake Outburst Flood (GLOF) events in Solukhumbu District and catastrophic flooding events in the Tarai and Churia Range of Nepal.

143. In order to achieve this objective, the project has two discrete outcomes targeting each of these distinct geographic areas. Outcome 1 deals specifically with reducing the risks of human and material losses from Glacier Lake Outburst Flooding events from Imja Lake in Solokhumbu District, while Outcome 2 seeks to reduce human and material losses from recurrent flooding events in four flood-prone districts of the Tarai and Churia Range, specifically, in Mahottari, Saptari, Siraha and Udaypur Districts, in the Ratu, Khando, Gagan, Hadiya and Kong river basins.

Outcome 1: Risks of human and material losses from Glacial Lake Outburst Flooding (GLOF) events from Imja Lake reduced

Without LDCF intervention (baseline)

144. A number of initiatives, including assessments by ICIMOD and the UNDP/DIPECHO-funded Regional GLOF Risk Reduction project, have analyzed the threats arising from Imja Lake to surrounding communities and economic assets and highlighted the urgent necessity to undertake structural measures to prevent a catastrophic outburst flood (see www.managingclimaterisk.org and Annex 4 Potential human and material losses from a

GLOF event have been estimated by ICIMOD at US$8.98 billion, with nearly a 100,000 people potentially affected directly and a further 500,000 affected indirectly (Khanal et al. 2011; Annex 3). However, there are currently no plans or financing for implementing a GLOF risk reduction programme for Imja Lake as has been undertaken at Tsho Rolpa in Dolakha District (Annex 3).

145. While reducing the level of a glacial lake is considered the most effective structural means of reducing GLOF risks, undertaking such work in a remote, high altitude area that is distant from various supply and transportation routes is technically challenging, labor-intensive, costly and potentially risky. Experience from the Tsho Rolpa Mitigation and Early Warning Progamme of 1995 and the subsequent Tsho Rolpa GLOF Risk Reduction has also demonstrated that low-tech community-based Early Warning Systems that require only minimal maintenance and long-term investment are likely to be more effective in remote areas than high-maintenance, high-tech EWSs (Annex 7). However, even community-based EWSs (CBEWS) require careful planning and involve start-up costs in terms of engaging local communities, identifying locally appropriate mechanisms for monitoring and communication, establishing upstream-downstream linkages, training, and other factors to ensure the EWS remains operational and effective over the long-term. Thus, although ICIMOD studies have advocated for a GLOF Early Warning System (EWS), these recommendations have not been implemented as yet due to insufficient financial resources and technical capacity to design and implement a locally-appropriate EWS for Imja Lake. There is currently also no local disaster preparedness or planning for an effective response to a potential GLOF event either locally or at the district level.

146. The Department of Hydrology & Meteorology (DHM) of MoSTE is mandated to monitor all flood risks in the country including GLOFs, but DHM currently has little capacity for regular monitoring of GLOF risks, which are exceptionally challenging to monitor for technical, logistical and financial reasons, the latter in part due to the logistics involved. In 2007, a team from the Asian Institute of Technology (AIT) extended WiFi (wireless LAN) from Namche village to Imja Lake over a distance of more than 27 km, and linked up a Field Server to capture images and meteorological data. These data were transferred in real-time to a server located in Japan. Since then, ICIMOD is monitoring snow cover in the Imja Lake area in coordination with DHM, both through direct observation, remote sensing and the SERVIR system (Section 2.3.3). DHM also undertakes bathymetric surveys and monitoring of the highest risk glacial lakes once every two years but there is limited management or application of these data at present. There is currently little specialist capacity within the Glacial Lake Monitoring Section of DHM, i.e. glaciologists and hydrologists, particularly those with experience of artificial controlled drainage of glacial lakes.

147. UNDP has recently completed an assessment of DHM's technical capacity for establishing an Early Warning System for flood forecasting under the climate risk management component of UNDP/CDRMP (Section 2.3.3). The assessment found that data management, analysis and application systems and human capacity need to be greatly strengthened and expanded. DHM has the equipment to monitor and forecast real-time

rainfall, but lacks the technology and expertise to analyse the real-time rainfall data and basin level discharge data to assess the level of flood risks and other potential impacts in a given geographical area. There are also no systems in place for DHM to communicate flood risk warnings to MoHA (who in turn would relay the information to its agencies such as the EOCs and DDRCs), as well to DWIDP and other relevant departments. There is, however, little allocated government budget for the capacity development of DHM. DHM will soon be implementing a major five-year programme under the World Bank's Strategic Program for Climate Resilience (SPCR) that will include strengthening DHM's capacity, as well as modernizing and upgrading the department's hydromet stations and networks as well as improving its weather and flood forecasting services (see Section 2.3.3). A network of institutions working on EWS in Nepal is also being formed under the leadership of DHM with support from UNDP.

148. There is also little local capacity to manage GLOF Risks in the Imja Lake area. Hazard and vulnerability assessments conducted by ICIMOD in settlements downstream of Imja Lake in 2010 revealed that local communities are generally aware of the risks posed by a potential GLOF event but most are extremely reluctant to relocate from these areas, not only for cultural reasons, but also because of the relatively high economic returns they receive from tourism, which is their main livelihood source (Annex 2, 3 and 4). This was reconfirmed during community consultations conducted by ICIMOD during the project preparation, which additionally found that many local residents feel helpless and unable to manage or address GLOF risks by themselves (Annex 4). Communities favour the lowering of the lake as a mechanism for reducing GLOF risks. However, this is clearly something that can only be undertaken with external financial and technical support. In addition, the local community also suggested other options that could strengthen their adaptive capacity. Local residents are particularly interested in the potential for generating power from the water drained from the lake through the installation of a microhydro station as was done at Tsho Rolpa (although power has not been distributed to local residents there and is limited to few months in the year). At present, communities meet some of their energy requirements for heating and cooking through liquid paraffin gas (LPG) and kerosene as they are residents of a national park and therefore have limited access to fuelwood. Sagarmatha National Park only allows communities to collect firewood once a year, which is not enough to meet demand.

149. More recently, the High Mountain Glacier Watershed Programme (HMGWP) has also been engaging local communities in the Imja Valley to increase awareness about GLOF risks (Section 2.3.3-5). The programme is primarily focussed on helping communities develop innovative tools and practices for adapting to climate change. The programme will identify and mentor champions within the local community who will be trained to undertake vulnerability needs assessments and build greater climate change awareness.

150. Thus, while there are a number of relevant and important baseline activities underway in the Imja GLOF Impact Zone, these are currently on a small scale or insufficiently integrated to provide a comprehensive and effective approach to GLOF risk management in the Imja Lake area. It is particularly important to understand the logistical context

within which these GLOF risks have to be managed, which applies to many remote high-altitude areas. For example, Solokhumbu District Headquarters, where the District Disaster Relief Committee (DDRC) is based, is located in Saleri in the Solo Region, which is 7-9 days walk from Imja Lake. There is no DDRC in the Khumbu Region (the northern part of Solokhumbu), where Imja Lake is located. The nearest District Emergency Operation Centres (DEOC) are in Sankuwashaba and Dolkaha (adjoining east and west to Solokhumbu district) while a Regional Emergency Operation Centre (REOC) is planned in Dhankuta (in the Middle Hills of the eastern region). The nearest major hospital from Imja, Khunde Hospital, is about 2 days walk from Imja. The Department of National Parks and Soil Conservation (DNPSC) has a visitor registration office in Jorsalle, at the entry of SNP, which is about 4 days walk from Imja, while the actual SNP headquarters is in Namche, which is 27 km away and about 3 days walk from Imja as well. In addition, there are other hospitals and health posts, mainly in Namche and in Lukla, which is about 5 days walk from Imja.

151. Under the business-as-usual scenario, GLOF risks will continue to rise with on-going glacier retreat and other climate-change related impacts. Without LDCF support, the residents of the Imja GLOF Impact Zone, tourists to SNP and vital infrastructure and other material assets will become increasingly vulnerable to the impacts of catastrophic outburst flooding from Imja Lake. Such an event would potentially not only wreak havoc in terms of human fatalities and injuries and damage to property, but it could also be potentially disastrous for Nepal's mountain tourism sector, something, which the country can ill-afford, given the contribution of this sector to both the local and national economies and the limited alternative livelihoods options available to local communities.

With LDCF intervention (adaptation alternative)

152. LDCF resources will enable the Government of Nepal (GoN) to undertake critical structural and non-structural means of reducing the direct and indirect risks of a GLOF event to local residents, tourists and valuable economic assets including buildings, hydropower stations, tourism infrastructure and agricultural land. Based on PPG consultations and analyses, it has been agreed that LDCF resources will be used to finance a controlled, artificial drainage project at Imja Lake, increase local GLOF risk preparedness through the development of a community-based EWS and institutionalize GLOF risk management knowledge and skills at local, district and national levels. Building on the experience of other LDCF projects, notably the Bhutan GLOF project, as well as the government's experience of lowering the level of Tsho Rolpa, LDCF support will be used to put in place stringent Safety & Evacuation Plans for the construction phase of the artificial drainage system. Protocols for continued monitoring of GLOF risks arising from Imja Lake and for the monitoring and management of the artificial controlled drainage system will also be developed and put in place.

153. The implementation of this component of the project will be managed by DHM, who will play a particularly large direct role in the design and implementation of the drainage

channel and the development and implementation of a GLOF risk monitoring system for Imja Lake that can be subsequently scaled up to manage GLOF risks across the High Mountains of Nepal. DHM staff will receive targeted training on glacial lake inventory and monitoring of GLOF risks and systems and capacity developed to enable DHM to analyze real-time rainfall and basin discharge in order to forecast potential site-specific impacts and forecast flood warnings.

154. While DHM has continued to maintain the artificial drainage system at Tsho Rolpa, this is logistically difficult and costly. Although DHM will do the same in Imja, ideally, the Department is keen to have much greater local community engagement in the monitoring and management the drainage system after the construction phase. Thus, the project will also explore options for increasing and sustaining community engagement in subsequent lake and channel monitoring. The CBEWS will contribute to increasing community engagement in this area. Another potential mechanism for incentivizing local communities would be through the construction of a microhydro power station that would use the extra water drained from Imja Lake as has been done at Tsho Rolpa (although the power has not been distributed to local communities there). While LDCF resources cannot be used for the development of a microhydro power station, the project will explore the possibility of leverage additional finance for constructing a microhydro at Imja, for which pre-feasibility studies and preliminary costings have also been made by Kathmandu University and ADAPT-Asia (Annex 5).The project will also coordinate closely with ICIMOD to benefit from the extensive knowledge and experience on GLOF risk monitoring, especially in relation to Imja Tsho and Tsho Rolpa.

Output 1.1 Water level of Imja Lake lowered through controlled drainage

155. Pre-feasibility studies of the options for reducing the level of Imja Lake were undertaken during the PPG by Kathmandu University with technical assistance from the USAID-supported ADAPT-Asia Programme. These suggest that the level of risk from Imja Lake could be reduced significantly by deepening the existing natural channel draining the lake from the end moraine to lower the level of the lake by at least 3 metres at this stage, over a period of about 4 years. The study also suggests for a continuous lowering of the lake as the water volume is increasing at a fast rate in this Lake and hence it also recommends a diversion channel to be cut (see details in Annex 6) to support the natural channel in times of repair/maintenance as well as when to outflow more volume of water when required. However, additional technical assessments and feasibility studies are needed to finalize the design of the artificial drainage system, verify current studies in particular, to determine the best design for long-term sustainability under different possible future climate scenarios, for example, whether a second artificial channel is desirable or feasible and whether either or both should have sluice gates to regulate water flow. Other important considerations include the extent to which the work will involve manual versus mechanical labour. The project also plans to consider recruiting local communities from the region for the required manual work. While the former provides benefits in the form of income for construction workers, there are also important safety considerations. The

experiences of the Bhutan GLOF project, underscore the many difficulties of undertaking hard physical labour at high altitudes.

Proposed Activities

1.1.1 Form a Technical Advisory Team or Start-up Team comprised of technical experts and researchers, who have undertaken research and risk appraisal works on Imja Lake and surroundings, together with key local community representatives, women and national and local government stakeholders such as the DHM, including technical staff of DHM such as hydrologists and glaciologists, and the relevant District Authorities.

1.1.2 Review scientific assessment data on glacier melt and GLOF risk arising from Imja Lake and compile a detailed risk profile for Imja Lake taking into account lessons learned from the lowering of Tsho Rolpa and other glacial lakes in the HKH region.

1.1.3 Evaluate technical options for reducing GLOF risks through controlled drainage and undertake engineering design of the drainage system including appropriate location of the artificial channel, depth of the channel, benefits of digging a second channel, need for sluice gates, subsequent maintenance requirements of the channel(s) and other features, including the costs and benefits of specific options.

1.1.4 Conduct an Initial Environmental Assessment/Environmental Impact Assessment (as per Government of Nepal's regulation) of the proposed drainage system and further adapt the proposed design based on IEA/EIA findings.

1.1.5 Develop an Implementation and Management Plan (IMP) for the construction of the controlled drainage system that includes identification of suitable workforce, the appropriate ratio of manual labour to mechanized work, timing of work, how materials and other inputs needed to construct the drainage system will be procured and defines a monitoring system.

1.1.6 Develop gender sensitive Safety & Evacuation Plans for the communities as well as the construction team during the construction phase of the drainage channel.

1.1.7 Obtain approval of the proposed technical design of the drainage system, construction Implementation and Management plan and Safety and Evacuation Plans from the Technical Advisory Team, the Project Management Board and local stakeholders.

1.1.8 Put in place approved Safety & Evacuation Plans and undertake construction of the controlled drainage system of Imja Lake in accordance with the approved technical design and the Implementation and Management Plan.

1.1.9 Monitor, evaluate and document the implementation of the controlled drainage system and whether the proposed target for lowering lake level is achieved by the end of the project.

1.1.10 Assess options for microhydro development at Imja Lake and the sources of potential finance for such development, with a view to establishing more visible upstream-downstream linkages and benefits from the drainage works for local communities

Output 1.2 Protocols for GLOF risk monitoring and maintenance of artificial drainage system of Imja Lake developed and implemented

156. Once the artificial drainage system has been developed and implemented, its effectiveness and long-term sustainability will depend on regular monitoring of GLOF risk and the condition of the channel as well as proper maintenance of the channel to ensure it continues to operate smoothly and to keep the lake at or below the target level of 3m below baseline. Again, DHM's experiences at Tsho Rolpa have guided the activities planned under this output, which emphasize greater community engagement in the day-to-day monitoring of both lake and channel and in the maintenance of the channel. Thus, gauges to measure the lake water level along with a low-cost automatic data logger will be installed near the drainage channel. These will be managed by DHM in collaboration with the local community. The automatic data logger is a critical element of the community-based EWS developed under Output 1.3. A few key phone numbers (e.g. of point people in DHM, the DDRC and within the local community) will be entered into automatic data logger and text messages will be simultaneously sent to these numbers when the lake water level rises above a certain critical point. Gauges are already in place downstream at Dingboche (Annex 2 and 3) and monitored manually by DHM observers. There is already a system in place to monitor weekly snow cover data through SERVIR-Himalaya (Section 2.3.3) and the lake monitoring undertaken by this project may ultimately be linked to SERVIR- Himalaya and/or other monitoring systems developed by DHM. DHM will continue to play an important role in more detailed technical monitoring and in data management, analysis and storage.

157. In Tsho Rolpa a gauge station was established by DHM and three gauge observers were hired to operate and monitor the station. However, during the winter, no one stays back to monitor because of the extreme weather conditions. This indicates the critical importance of obtaining local community recognition of the value of regular monitoring and their buy-in to continue such monitoring even during the winter season. Manual monitoring and observation also involves greater potential risk to gauge observers who are in the front line of any potential GLOF or extreme weather event. Thus, additional incentives or motivation packages may be required to ensure that community members will either agree to become gauge observers and to undertake regular monitoring and/or recruit people from outside the community to work as gauge observers. A key incentive, particularly for the closest and most vulnerable 4 villages, will be the Community-Based Early Warning System that will be developed by the project under Output 1.3. This may include amongst other things providing health and safety insurance to gauge observers.

Proposed Activities

1.2.1 Develop a system for regular monitoring of changes in lake water level, the condition and operation of the artificial drainage channel and other key parameters linked to GLOF risks such as increase in temperature leading to increase in snow melt, increase in rainfall, intactness of the end and side moraines, ice avalanches into the lake, and waves generated by avalanches. This will include a schedule of regular monitoring by the gauge

observers as well as periodic more detailed technical monitoring by DHM engineers and specialists. The system will be developed by DHM together with relevant technical experts in close consultation with local communities and local authorities.

1.2.2 Define a schedule of channel maintenance work with agreed budget and clear definition of the roles and responsibilities of DHM and local communities for undertaking the required work. DHM will undertake a more detailed technical assessment of the drainage channel and any oversee and guide any maintenance work required at least once a year.

1.2.3 Develop guidelines for both regular monitoring and periodic, more detailed monitoring of GLOF risks and the channel by a) local gauge observers and b) technical experts from DHM. The guidelines will clearly specify what data to collect, when and how and where and how data are to be recorded, reported and stored in order to general time-series data for long-term GLOF risk management of Imja Lake.

1.2.4 Install gauges to measure lake water level near the drainage outlet and the automatic data logger with a data transfer system.

1.2.5 Train local community representatives including women, who will work as representatives for DHM (based on incentives to be provided by DHM), on using the monitoring and maintenance protocols developed under 1.2.1 so that they are able to undertake regular monitoring of lake level, channel condition and operation as well as to record and report relevant monitoring information to DHM and others as needed (e.g. the relevant Task Forces established as part of the CBEWS under Output 1.3).

1.2.6 Implement lake and channel monitoring and reporting by local DHM representatives trained under 1.2.5.

1.2.7 Implement more detailed regular monitoring of changes in level of GLOF risk by DHM technical experts.

1.2.8 Maintain systematic records of all monitoring information and maintenance work both locally and at DHM Headquarters in Kathmandu.

Output 1.3 Community-based GLOF Early Warning System developed and implemented

158. Despite being one of the most studied lakes in Nepal, Imja Lake still does not have a functional EWS that can inform people about disaster risks in real time. EWSs are an integral component of risk management for natural hazards and have been listed as one of the five priorities under Hyogo Framework for Action (HFA) for building disaster resilient nations and communities. Past EWSs in Nepal have tended to focus on the protection of major infrastructure rather than on people per se. However, Community Based Early Warning Systems (CBEWSs) go far beyond mere monitoring and communication of information about hazards and vulnerabilities. The development and implementation of a CBEWS can serve to build communities especially women's knowledge on risk and encourage communities to work with technical agencies to

monitor hazards and develop a warning service to communicate and disseminate information on disasters as well as motivate them to take proactive action to better protect their lives and livelihoods. Thus, where properly designed and implemented, a CBEWS can serve as a tool for comprehensive and socially inclusive community engagement in DRM and greater empowerment generally (see Annex 7). Such an approach is particularly valuable in the context of the remote High Mountains of Nepal, where major facilities such as hospitals and key local government institutions may be many days walk from a given area, as in the case of Imja (see earlier & Annex 2).

159. Under this output, the project will support the development of a practical, low-tech, and gender sensitive low-maintenance EWS for the communities at risk from an Imja Lake GLOF event. In designing this output, the project has built on existing experiences of community-based EWSs (CBEWSs) in Nepal, particularly in mountain areas, such as UNDP, DHM and Practical Action's experience in Tsho Rolpa in Dolakha District, as well as other projects implemented by UNDP, Practical Action, Mercy Corps and Nepal Red Cross, notably under the NRRC's Flagship 4 programme, which has CBEWS as one of its major intervention. Some 10 CBEWSs have been established in various districts across Nepal so far according to Practical Action. UNDP /CDRMP is also conducting an assessment for the establishment of CBEWS in other watersheds, including one targeted by this project in the Tarai (Rukum, Sunsari, Kaski, Chitwan and Mahottari). Key lessons learned from these different initiatives, which are also pertinent to the development CBEWSs under Outcome 2 of this project, are summarized in Annex 7

160. EWSs in mountainous areas must be designed in such a way that they can respond effectively to rapid increases in water level and/or the rate of flow of water as a result of GLOF and flash flood due to steep gradients. In such a situation, an effective CBEWS has to combine both automatic and manual approaches as will be done at Imja Lake (see 1.2.1). However, a major lesson from Tsho Rolpa and other CBEWS experiences is that high tech/high cost systems are not only often inappropriate but generally unsustainable because of they need high levels of technical capacity and costly maintenance to remain operational beyond the life of a project. Thus, under this output, the focus is on simple, low-cost technologies such as the use of cellphones, hand-held sirens and megaphones and CDMA wireless mobile phones to relay important information and communicate warnings. Hazard detection will be based on the system developed under Output 1.2 to monitor lake levels and other parameters.

161. Timely and effective dissemination of information and warnings represents the biggest challenge for an effective CBEWS. Successful EWSs are the product of effective person-to-person communication, efficient social networks and strong locally appropriate institutional arrangements for information management, communication and action in the case of an emergency. This requires that users of information must be active participants in the system and not just passive its beneficiaries and also that the information and communication systems must be simple enough to be accessible and usable by women, the elderly and even older children. The project will therefore work closely with communities to increase their understanding of GLOF risks and GLOF risk

management options and to identify the most appropriate institutional arrangements for monitoring and communicating GLOF warnings to vulnerable people in the high risk settlements of GLOF Impact Zone as well as to the nearest relevant government authorities and DHM. One option is to create a gender sensitive local GLOF Risk Management Committee (GRMC) for the Khumbu Region, especially given that there is no nearby District Disaster Relief Committee or Emergency Operation Centre (EOC).

162. The project will work especially closely with TMI's HMGWP to deliver this output (see Para 98, 99 and 100) as well as other major local institutions, NGOs, women's groups and CBOs. HMGWP have already established good relations with local communities and will be training local champions in the community to undertake more comprehensive Vulnerability Needs Assessments, building on the earlier work undertaken by ICIMOD in Chukhung-Larja, Jorsalle-Chaubas, Jubing-Distbound, Rabuwa-Sunkoshi areas in Nepal and in connection with the GLOF risk assessment of Imja Lake (ICIMOD, 2011). HMGWP's work with local communities will ensure that the design of the EWS meets the needs of the most vulnerable groups among the local communities, including women. Additionally, the project will involve the HMGWP trained local champions to engage and train other community members in the downstream villages on the effective management and operation of the EWS.

163. There are also a number of locally active NGOs and CBOs with good experience of training and mobilizing local communities on different issues, such as the Khumbu Alpine Conservation Council (KACC), which already works with TMI. These currently do not have sufficient knowledge or experience of the options available for managing GLOF Risks but will be the focus of targeted training under the project under Output 1.3 and 1.4.

Proposed Activities

1.3.1 Verify and refine existing vulnerability assessments undertaken by ICIMOD and others by using participatory vulnerability and risk mapping as a tool for engaging communities and increasing their knowledge about GLOF risks and risk management options.

1.3.2 Identify specific local needs and constraints for the implementation of a cost-effective and sustainable GLOF Community-Based Early Warning System (CBEWS) through discussions with key stakeholders, including local communities and authorities as well as development practitioners with experience of developing and implementing CBEWSs, including UNDP, Practical Action, Mercy Corps and Nepal Red Cross. Particular attention will be paid to the differential vulnerabilities of men, women, children, the elderly and any other marginalized groups.

1.3.3 Identify the most appropriate institutional arrangements for a CBEWS in the Imja GLOF Impact Zone (focusing on high risk settlements) such as management by a local GLOF Risk Management Committee established under Output 1.4 and individual Task Forces or teams with responsibility for different aspects of disaster preparedness and response in the event of a GLOF such as a Search and Rescue Team, First Aid team and DRM volunteers who can be called upon to assist the community in case of an emergency.

The project will liaise with existing committees in the Imja area such as the Sagarmatha Buffer Zone Management Committee, Tourism Crisis Management Group, Tourism-related committees and Youth Groups, but it is likely that a new dedicated DRM committee of some kind will be needed to operationalize a CBEWS. Additionally, mechanisms for linking key local government stakeholders, such as Sagarmatha National Park headquarters in Namche and district headquarters will also be defined.

1.3.4 Identify the most effective and sustainable mechanisms for relaying hazard monitoring information from real time automatic data logger and transfer system to the gauge observer(s) and then further to the GLOF RMC and to three (3) downstream communities (Chukkung, Dingboche and Pangboche) of Imja Lake for example, through the use of hand-operated sirens to the 3 vulnerable communities and 20 hand-held microphones, and CDMA mobile phones each to the 27 downstream communities within 50-75 km. The information will be further shared with DDRC and Tourism Crisis Management Group (who work to ensure the safety of tourist at times of disasters) at the District level to cover 120 km

1.3.5 Test and finalize the design of the Community-based EWS for the Imja Lake GLOF Impact Zone (focusing on 27 high risk settlements) that takes into account differences in specific vulnerabilities of different groups and includes warning mechanisms and identifies evacuation protocols, routes and sites, and the roles and responsibilities of different community members before, during and after a GLOF and/or other flood-related natural disasters.

1.3.6 Familiarize wider community with the features and operation of the EWS through local workshops and mock drills, with specific targeting of vulnerable groups and those most at risk, such as women, children, the elderly, the disabled and/or those living in especially remote and vulnerable areas.

1.3.7 Train the GLOF Risk Management Committee (or equivalent) members and other relevant community-members and local government representatives (i.e. VDC/Ward members from the three VDCs in Upper Khumbu in the GLOF Impact Zone (within the 27 high risk settlements) and Sagarmatha BZMC members on operationalizing, testing, maintaining and periodically updating the CBEWS as needed, including mechanisms for ensuring CBEWS remains functional and relevant.

1.3.8 Implement and periodically monitor the operation of the CBEWS through mock drills.

1.3.9 Document the design and implementation of Imja Lake CBEWS for knowledge-sharing purposes with others involved in CBEWS development in other parts of Nepal and internationally, particularly in areas at risk from GLOFs.

Output 1.4 GLOF Risk Management Skills and Knowledge Institutionalized at Local and National Levels

164. Given the challenging distances and terrain between settlements and towns in Solokhumbu District and in the High Mountains generally, there is a need for greater self-

reliance and disaster preparedness at the local level, particularly among the residents especially women, elder, children and disabled people of the Imja GLOF Impact Zone and other key local, regional and stakeholders. As explained under Output 1.3, as there is no nearby DDRC, the project proposes to establish a local GLOF Risk Management Committee (GRMC) with adequate capacity to develop, implement and update a comprehensive community-based GLOF risk management plan that encompasses the monitoring and management of the controlled drainage channel established under Outputs 1.1 and 1.2 the CBEWS established under 1.3, as well as any additional related activities not covered under the project.

165. Additionally, the project will also develop the capacity of other key local stakeholders such as the Sagarmatha National Park Office (SNPO), the Sagarmatha Buffer Zone Management Committee and the relevant Buffer Zone User Committees (including women) in the Imja GLOF Impact Zone (focusing on 27 high risk settlements) and members of the DDRC in Solo, who will still have a role to play in disaster preparedness and management in lower areas when there is GLOF warning. The Tourism Crisis Management Group which is established under the guidance of Nepal Tourism Board and operated by Himalayan Rescue Association will be linked and strengthened for better coordination between the local bodies in the region. While doing these activities, special consideration will be given in building capacity of local women on disaster preparedness trainings and awareness initiatives. At the national level, the project will focus on strengthening DHM's technical capacity for GLOF risk management, including the effective dissemination of hazard information from national to local disaster management committees as a recent capacity assessment of DHM by UNDP has identified this as a major gap.

Proposed Activities:

1.4.1 Establish a local GLOF Risk Management Committee for the Imja GLOF Impact Zone (focusing on high risk settlements) with representation from all potentially affected sections of the local community, women, including those who are most vulnerable.

1.4.2 Train members of the GLOF Risk Management Committee, including training of trainers/local resource people, on hazard mapping, Vulnerability Assessments, disaster risk reduction and preparedness activities in addition to the training undertaken under Output 1.3 on the effective use and maintenance of the CBEWS. Ensure that the trainings on risk management are gender sensitive.

1.4.3 Undertake a participatory and inclusive planning process to develop a comprehensive community-based GLOF risk management plan for Imja that will be implemented by the GLOF Risk Management Committee and updated annually.

1.4.4 Provide targeted training on DRM to staff (including women) from the Sagarmatha National Park Office and the Buffer Zone Management Committee including the Toursim Crisis Management Group to enable/support to revise the Sagarmatha National Park Management Plan and integrate gender sensitive risk reduction and mitigation

measures in the management plans for the park and the buffer zone, respectively. Although both plans address the management of tourism in the park and the surrounding buffer zone, respectively, neither takes into account the potential implications or management of GLOF risks in the park and the buffer zone, particularly for the tourism sector.

1.4.5 Develop information materials and the capacity of the Sagarmatha National Park Office staff to disseminate information through the SNP Information Centre at Namche to tourists and local people on GLOF risks arising from Imja Lake, risk reduction measures that are being undertaken and what to do in the event of a GLOF. All visitors to Sagarmatha and Imja Lake must first pass through Namche, which about 4-5 days walk from Imja. Namche is an important hub on the trekking route to Sagarmatha. Most visitors stay there overnight on their way in and out of the park. The SNPO is the only government office in Namche and the BZMC also has an office there. SNPO information centres. The dissemination of GLOF-related information will be integrated with existing practices of SNPO information centres, which already disseminate information on different aspects of Sagarmatha NP, including its biodiversity and habitats.

1.4.6 Strengthen DHM's capacity to evaluate GLOF risks and communicate GLOF warnings to key partners such as the Imja Lake GRMC established by the project, and via MoHA to the DDRC and the NEOC. This will include assisting DHM obtain the technologies and develop the skills and systems needed to analyse real-time data on changes in lake water level, moraine conditions and other relevant parameters to forecast and communicate risk levels and warnings. A system to analyze, codify and store GLOF risk knowledge and experiences electronically within DHM's Hydrology Section will also be developed.

1.4.7 Document and analyze knowledge and lessons generated from the implementation of the Imja GLOF Risk Reduction Programme (i.e. Outputs 1.1 to 1.4) and disseminate to key stakeholders including: i) DRM practitioners in Nepal and the HKH region; ii) CBOs working in high GLOF risk areas; iii) local and national government institutions with a key role to play in the management of GLOF risks and other hazards in the High Mountains, such as DHM, MoHA, the concerned DDRCs, DNPWC.

1.4.8 Conduct one national workshop at the end of the project to share knowledge and lessons generated by the Imja GLOF Risk Reduction Programme with key stakeholders.

1.4.9 Conduct one regional workshop to exchange GLOF risk reduction knowledge and experiences with key stakeholders engaged in addressing GLOF risks in other parts of the region, notably Bhutan and Pakistan.

1.4.10 Develop an exit strategy by mainstreaming the interventions established and achieved by the project into the existing Government mechanisms for further continuity and sustainability.

Outcome 2 Human and material losses from recurrent flooding events in 4 flood-prone districts of the Tarai and Churia Range reduced

Without LDCF intervention (baseline)

166. In the Tarai and the Churia Range, the monsoon period from June to September is characterized by intense rainfall. Up to around 80% of the country's total annual rainfall occurs during the monsoon. At this time, rivers flowing into the Tarai floodplains are extremely prone to flooding as river banks overflow, depositing large amounts of silt, sediment and debris on the Tarai floodplains, causing extensive damage to human life and property in the region (Section 2.3.5, para 124-126). Riverine flooding is a slow onset phenomenon that may take place over a period of days or even weeks. Flash floods, however, occur with little or no warning, and are particularly dangerous because of the suddenness and speed with which they occur.

167. At the community level, as flooding is a recurring annual event in the Tarai, local communities are well aware of the risks and have developed various coping mechanisms, but these are fairly rudimentary. People continue to live and farm in the floodplains as it is beneficial to do so most of the year. Some live in raised platform houses. During the monsoon, people watch the water levels and eventually leave their homes and field for a raised area where they will camp for a few until the water level goes back down.

168. Government response to flooding in the Tarai and Churai Range to date has mainly targeted the Tarai, with a heavy focus on protecting major infrastructure such as highways, bridges, major irrigation facilities and power stations. In relation to people, the emphasis to date has been more on post-disaster relief and recovery rather than pre-disaster planning and preparedness. Furthermore, while there are many institutions and actors working on flood risk management at the central and local levels, there are no mechanisms in place for systematic information sharing to improve coordination, minimize duplication and build on potential synergies. At present there is also no integration of flood risk reduction measures into the district development plans. However, in recent years under the leadership of DRRC, attention has been given towards pre-disaster planning and preparedness, which includes preparation of annual District Disaster Management Plans (DDMP) and Emergency Preparedness Plans (EPP), which are prepared specifically to prepare for the monsoons in the Tarai. DDMPs are still in a pilot phase and have been prepared for four districts thus far including two targeted by the project the Tarai (see Outcome 2 below). The DDMP proposes to integrate risk reduction activities into the district development plan, while the EPP is focused on responding to an actual disaster. Additionally, at the local level CDO (Chief District Officer), as the head of DRRC, has identified Emergency (Evacuation) Shelters in elevated areas.

169. DWIDP is the main government department mandated to reduce the impact of water-induced disasters on life and properties in Nepal (Section 2.2.2). DWIDP's main work in the Tarai in recent years has been through the People's Embankment Programme (PEP), which has been running for the last 3 years and is implemented in the middle and

southern Tarai (south of the East-West Highway). The focus of the project is to strengthen and construct embankments along some 12 rivers in the Tarai. For example, on the Ratu River, the government is constructing embankments and spurs downstream along a 60 km stretch of river south of the East-West Highway. There is also a parallel support from Government of India of around USD 12 million (NRs. 1 billion, USD 1= NRs.85) to construct embankments in several rivers including Khando and Gagan to confine the rivers within the embankments when they reach India.

170. The emphasis to date has been on hard construction as thee is relatively little local buy-in for bioembankments (or biodykes) as opportunities for cash-for-work for communities are more limited in this type of soft construction. Additionally, bioembankments must be protected against grazing and any major use until grasses and other vegetation are well established. However, community engagement in the PEP has been relatively limited to date other than cash for work, but even this has been on a small-scale thus far as most of the work is undertaken through contractors who may not necessarily use local labour.

171. A key gap in interventions by DWIDP to date is sediment management in the upper catchments of rivers that flow into the Tarai. Sedimentation is increasing the Upper Tarai (towards north) down to the Middle Tarai where the major depositions of coarse sediment occur, with finer sediment deposited further downstream. As a result of sedimentation, river levels are increasing, rivers are changing course, as channels narrow in some places as sediments are deposited and widen in others due to erosion. Higher sediment load in rivers means less natural scouring and deepening of the riverbed by water. Instead, riverbeds are rising in some areas due to combined impact of sedimentation and less natural scouring, such that villages and embankments are at or even below the height of the river basin in some areas. Such villages are especially vulnerable to flooding. Additionally, people have traditionally coped with flooding by shifting to raised embankment areas and roads during floods, but in some areas embankments are at the same level as the river within 2-3 years of construction due to sedimentation.

172. While there has been considerable discussion about sedimentation control within DWIDP, there is as yet no programme that seeks to manage upstream and downstream aspects of flood risk management and there is a pressing need to demonstrate the value of implementing a more comprehensive approach to flood control that also includes improved management of upstream areas. Local communities also do not understand the upstream-downstream linkages in flood risk management. Separate projects exist to address the problem of soil erosion in the Churia Range, such as one supported by the President's Fund for Soil Conservation implemented by the Ministry for Soil Conservation, but these are proving difficult to implement given the challenges of addressing the root causes of deforestation and degradation in the Churias. Furthermore, the Soil Conservation Department only addresses the problem of topsoil protection. DWIDP also has a small project, the Community-Based Natural Resource Regeneration project to regenerate wood stock in Jhapa in Eastern Nepal within 300-500 m of a river working through local NGOs and CBOs. At present there is little coordination between the

different Ministries and Departments to manage flood risks in a more integrated manner.

173. UNDP has undertaken a number of concrete disaster risk reduction efforts to address climate-induced flooding, landslide and erosion threats in some of the most vulnerable districts in the Churia and Tarai region. Through cooperation with Action Aid, UNDP has financed embankment protection; construction of culverts; raising of hand pumps; construction of emergency shelters; installation of gabion boulder blocks along riverbeds to prevent erosion; installation of Community-Based Early Warning Systems; and the design of Emergency Plans of Action. These efforts have been complemented by integrated watershed management approaches for flood risk reduction in the Pasaha Khola Watershed of Bara District, and Kerunge Khola Watershed in Nawalparasi District in collaboration with the Department of Soil Conservation and Watershed Management (DSCWM) and DWIDP. UNDP is also conducting an assessment for the establishment of CBEWS in five other watersheds in seven districts under the UNDP /CDRMP, including Mahottari, one of the project target areas. Increasing disaster preparedness as well as development of CBEWSs in the Tarai has been a major area of focus for several NGOs such as Practical Action, Mercy Corps, Action Aid as well as UNDP's DRM Programme.

174. In addition, UNDP-FAO's project **"Enhancing Capacities for Climate Change Adaptation and Disaster Risk Management for Sustainable Livelihoods in Agriculture Sector"** is assisting the Ministry of Agriculture and Cooperatives (MoAC) in testing and operationalizing the process of shifting from a reactive emergency response intervention approach towards a pro-active natural hazard risk prevention/preparedness oriented approach in the agricultural sector. The project has demonstrated climate change adaptation practices in two selected pilot districts (Banke and Surkhet) to address climate variability on crops and increase awareness by local communities about evolving climate risks. These efforts not only provide insights into the factors that underpin the vulnerabilities of rural livelihoods, but also a range of complementary experiences to draw on with regards to what has worked in assessing, communicating and responding to climate risks in flood-prone agricultural areas.

175. Historically, government interventions have also tended to be more top-down without full engagement of local communities from the start. However, the Local Adaptation Plan for Action (LAPA), a new GoN initiative and NRRC Flagship 4 project that will be implemented in Western Nepal, seeks to provide a framework to ensure that climate change adaption planning follows a bottom up, community-based approach that is inclusive, flexible and responsive. It involves a process that will identify those who are the most vulnerable to the impacts of climate change and include them in the decision-making process from the start in identifying climate-related hazards and risks and prioritizing adaptation strategies to reduce risk and increase resilience. Thus, the LAPA framework is to be used as a tool to establish a vertical link between national, top-down climate change adaptation planning and community-based assessments of hazards, risks and adaptation priorities. The intent is to mainstream climate change adaptation approaches from local to national level planning processes and to ultimately integrate these approaches into district development planning. Specifically, the LAPA process is

expected to be led by the District Authorities (i.e. the Chief District Officer's office) but implemented by CBOs and community mobilizers at the VDC/community level. This project will make use of any relevant knowledge and lessons generated by the LAPA project in local flood risk planning and management in project target areas. The LAPA project, however, is just starting implementation in 2012 after the project document is signed by GoN.

With LDCF intervention (adaptation alternative)

176. By the end of the project, vulnerable local communities living around flood-prone river basins in four districts of the Teria and Churia Range will experience fewer human and material losses due to flooding as a result of a number of additional structural and non-structural measures to reduce flood risks. This will include the implementation of a sediment control system and stabilization of hazard-prone slopes and river banks in at least one river basin, most probably the Ratu. This will be the first time that a comprehensive sediment control program is undertaken in the Tarai and Churia range and will serve as a valuable demonstration of the critical importance of upstream-downstream linkages and a holistic approach to flood risk management. At least 5 km of river bank in total will have been strengthened through the construction of gabions and biodykes. Additional structural measures will include at least 2 flood-proofed drainage systems each in Ratu river basin (Sarpallo VDC and Nainhi VDC) and Khando river basin (Didhawa VDC and Pakari VDCs) will be strengthened. Similarly, access to drinking water supplies will be flood-proofed through the construction of at least 24 raised tube wells in inundation-prone areas of 6 VDCs in 3 river basins, namely Sarpallo and Nainhi VDC of Mahattori district (Ratu River), Didhawa and Pakari VDC of Saptari district (Khando River) and Tulsipur and Pipra Pra Pi VDC in Siraha district (Gagan River). Elevated zones will be constructed for the purpose of emergency shelter in 8 VDCs of four targeted districts (Jogidaha VDC and Hadia VDC in Udaypur District and the flood-prone VDCs mentioned above).

177. Additionally, Community-Based Early Warning Systems (CBEWSs) will be fully operational in at least 8 VDCs in five targeted river basins, including the ones with greatest flood impacts, the Ratu and the Khando. These will be based on low-cost, low-tech systems that can be easily managed and operated by illiterate people, women, children and the elderly. Warnings will rely on observations of rain gauges and river gauges installed at suitable points, with mikes, sirens and mobile phones used to communicate warnings. Village Disaster Management Committees and Task Forces with different responsibilities will have been trained and have sufficient capacity oversee the smooth operation of the CBEWSs. Village Disaster Management Plans prepared under the leadership of the VDMCs with LDCF support and which particularly address the needs of the most vulnerable will be under implementation by the end of the project. Thus, LDCF resources will have been used to empower local communities in Udayapur, Siraha, Saptari and Mahottari districts of east and central east Nepal, including the most vulnerable among them, such as the extreme poor, women, and the elderly. The project recognises that women can act as a

major change agent in any awareness programme and one of the key indicators of disaster risk reduction is gender equity in disaster preparedness. Hence the LDCF project will ensure representation of women in disaster risk managment committees and groups as formed for their increased and sustained involvement during different stages of project. Additionally, by flood-proofing water supplies, LDCF support will have also ensured the availability of safe drinking water during flooding events, which in turn will help reduce the incidence of water-borne diseases in these areas during times of flood, particularly among new-born babies and children.

178. By the end of the project, institutional capacity for managing flood risks in the Tarai and Churia range will also have been greatly strengthened, particularly the capacity of DWIDP and DSCWM - the main government agencis tasked with preventing water-induced disasters, top soil protection and of the DDRCs in the project districts. Notably, LDCF support will also enable the development of a sediment monitoring system within DWIDP to track sediment load in river basins, after piloting and testing in one river basin by the project while working together with PEP-programme. The project will also coorindate and work together with DSCWM's RCCP (Rastrapati Churia Conservation Project) in the common districts to implement activites in the upstream area of Churia range to build synergy and collaboration. Key district line agency personnel will be trained in flood risk management and options for integrating such risk reduction measures in their sector plans as well as the district development plans. Greater understanding of upstream and downstream linkages will have been created, including among communities living these two different areas through exchange visits.

Output 2.1 Sediment control and stabilization of hazard-prone slopes & river banks through structural and non-structural mechanisms

Proposed Activities:

2.1.1. Form Technical Advisory Team/Start-up Team led by DHM and DWIDP, comprising relevant national and local government counterparts, technical experts and local community representatives

2.1.2. Undertake detailed technical studies and cost-effectiveness analyses to evaluate options for controlling sediment at source and stabilizing hazard-prone slopes and riverbanks in one of the four project river basins. Options for sediment control are expected to include: a series of checkdams, which may be made of concrete, stone masonry, gabion boxes and/or a combination. River bank and slope stabilization will target the most erosion-prone areas and/or the most vulnerable settlements and agricultural lands and involve biodykes, bioengineering and/or gabion mattresses in the areas north of the East-West Highway in the upper Tarai and a small part of the Churia Range; in collaboration with DSCWM's RCCP. South of the East-West Highway, riverbank stabilization will be undertaken through the DWIDP's PEP.

2.1.3. Conduct consultations with flood-affected communities, with special focus to women, local government authorities, key CBOs, women groups and NGOs in target river basin

to identify most locally appropriate structural and non-structural mechanisms for reducing erosion and stabilizing hazard-prone slopes and river banks, including embankments, biodykes, bioengineering and/or gabion mattresses

2.1.4. Finalize most appropriate methods for slope/river bank stabilization (e.g. biodykes, gabion mattresses, riveting etc.) and structures for upstream sediment control, including number, type (e.g. concrete check dam, gabion boxes, concrete or stone masonry) and where these should be located based on findings from 2.1.2 & 2.1.3.

2.1.5. Undertake detailed technical design of the program for sediment trapping and stabilization of at least 5 km of slope/river banks in the target river basin using gabions, biodykes and other suitable measures.

2.1.6. Conduct EIA/IEA of proposed sediment control and slope/river bank stabilization program and further adapt design of the program as needed based on EIA/IEA findings.

2.1.7. Develop a plan for the implementation and management of the proposed program for sediment control and hazardous slope/river bank stabilization in one target river basin including mechanisms for engaging local communities, assuring the quality of materials procured and works undertaken and a monitoring and evaluation system for assessing effectiveness of sediment control and reduction in flood risk

2.1.8. Obtain approval from the Technical Advisory Team, the Project Management Board and local stakeholders of the final design and implementation and management plans of the proposed sediment control program and slope/river bank stabilization program.

2.1.9. Establish baseline data on sedimentation rates and erosion in areas to be targeted by project and implement the approved sediment control and slope/river bank stabilization programs.

2.1.10. Undertake annual monitoring to assess impact of project interventions on rates of sedimentation and erosion.

Output 2.2 Floodproofing of Water and Sanitation systems in selected VDCs in target river basins

Proposed Activities:

2.2.1 Identify suitable sites for flood-proofing drainage systems and/or access to drinking water supplies based on results of participatory vulnerability assessments in order to selectively target the most vulnerable groups and areas, with particular attention to the needs of women, children, the elderly and the infirm or disabled.

2.2.2 Prepare technical design and implementation plan for the location and construction of elevated tubewells in the selected sites (in consultation with local communities especially women) and obtain approval from the Technical Advisory Team and DDC (District Development Committee)/District line agencies (especially District Soil and Forest Office) of the proposed design and implementation plan. Particular attention will

be paid to the issue of access to safe drinking water by women and other marginalized groups in choosing a site and the design of elevated tubewells.

2.2.3 Prepare technical design and implementation plan for flood-proofing drainage system in selected sites (in consultation with local communities especially women), including mechanisms for community engagement, quality assurance and monitoring of implementation, and obtain approval from the Technical Advisory Team and DDC (District Development Committee)/District line agencies (particularly District Soil and Forest Office) of the proposed design, implementation plan and monitoring and quality assurance mechanisms.

2.2.4 Construct 24 elevated tubewells in inundation-prone sites in at least 6 vulnerable VDCs in the Ratu, Khando and Gagan river basins (i.e. 2 VDCs in each river basin), in line with the approved design and implementation plan.

2.2.5 Undertake flood-proofing of drainage systems in 1 VDC in Ratu river basin and 1 VDC in Khando river basin in line with the approved design and implementation plan.

2.2.6 Monitor, evaluate and document the implementation process and results achieved.

Output 2.3 Institutionalization of flood risk management skills and knowledge

Proposed Activities:

2.3.1 Conduct exchange visits between downstream and upstream communities in the project river basins to promote peer-to-peer learning about the role of upstream-downstream linkages in relation to flood risk management.

2.3.2 Train relevant district line agency representatives on flood risk management and options for integrating flood preparedness activities into their annual and longer-term district plans so that these are properly budgeted and reflected in the District Development Plan. Key line agencies that will be trained include: the Department of Soil Conservation, DWIDP and district level line agencies such as Irrigation, Forestry, Soil Conservation, Agriculture and Drinking Water.

2.3.3 Develop a monitoring system to track sediment load in at least one target river basin to measure and evaluate the impacts of the structural measures implemented by the project for upstream sediment control. The monitoring system will be institutionalized within DWIDP and expanded to cover other river basins.

2.3.4 Undertake targeted training on sediment monitoring in river basins and flood risk management options in the Tarai and Churia Range for members of DWIDP within its national headquarters, with emphasis on increasing capacity of the Training & Monitoring Unit, as well as of Divisional and Subdivisional staff within the project areas.

2.3.5 Conduct annual meetings of all key stakeholders (e.g. line agencies mentioned in 2.3.2, donors, NGOs/CBOs) at the national level and quarterly meetings at the subregional and/or district level in the project target districts in order to increase information and knowledge sharing as well as improve coordination between the key agencies and

actors in flood-risk management in the Tarai and Churia Range, thereby maximize the potential for synergies and minimizing the risks of duplication. These meetings will be coordinated by DWIDP. Minutes and outcomes of the meetings will be reported to MoHA and the concerned DDRCs and Village Disaster Management Committees. The project will support DWIDP to do this in the first two years, after which DWIDP will manage the process internally. Minutes of the meetings will also be disseminated through the NRRC Flagship 4 communication platform and coordination meetings.

Output 2.4 Flood preparedness training for district and VDC representatives, NGOs, CBOs and local communities in 4 flood-prone districts

Proposed Activities:

2.4.1 Undertake a comprehensive review of Community Based EWS experiences in Nepal and lessons learned with particular reference to experience of other agencies working on EWS in the Tarai region such as Practical Action, Mercy Corps, UNDP and NRRC Flagship 4 projects.

2.4.2 Conduct an assessment of flood preparedness in selected high-risk villages, including: Kong River - Jogidaha VDC (Ward Nos. 1, 2m, 3, 5, 6 and 8) and Hadia River - Hadia VDC (Ward Nos 1, 2, 4, 5, 6, 7 and 9) in Udaypur District; Gagan River – Tulsipur VDC (Ward Nos. 1-9) and Pipra Pra Pi VDC (Ward Nos. 1-9) in Siraha District; Khando River - Didhwa VDC (Ward Nos. 1, 2, 3, 5, 6, 7, 8 and 9) and Pakari VDC in Saptari District; Ratu River - Sarpallo VDC (Ward Nos. 1-9), and Nainhi VDC (Ward Nos. 1-9) in Mahottari District.

2.4.3 Establish a community-level gender sensitive Village Disaster Management Committee (VDMC) and individual Task Forces or teams with responsibility for different aspects of disaster preparedness and during a flood such as a Search and Rescue Team, First Aid team, Evacuation Team and a range of DRM volunteers who can be called upon as need.

2.4.4 Evaluate options for a practical, low-cost, low-tech CBEWS in at least two river basins (Ratu and Khando), i.e. one that involves manual data collection through observation of rain gauges and transmission of flood risk information and warnings between upstream and downstream communities through mikes/sirens/mobile phones. Emphasis will be placed on developing a simple system that can be operated by women, children and/or old people.

2.4.5 Undertake technical assessments for the location of river gauges at appropriate spots along at least two river basins (Ratu and Khando) and identify suitable evacuation routes and emergency shelters for vulnerable communities.

2.4.6 Prepare gender sensitive and inclusive village-level Disaster Risk Management Plans (DRMPs) for at least 8 VDCs under the leadership of Village Disaster Management Committees (VDMCs). Building on the findings of Activity 2.4.2, these will identify the most vulnerable in terms of their location, identity, evacuation routes and shelters as well as the agreed roles and responsibilities of different VDMC members and Task Forces during a flood.

2.4.7 Design, approve and install a CBEWS in consultation and participation with concerned local communities and representatives of DDRC, VDCs, relevant CBOs, women groups and NGOs. The number of villages to be covered and other design features will be guided by the results of Activities 2.4.1-2.4.6. The CBEWS is expected to cover at least 8 VDCs and will use low-cost technology such as hand-held sirens, microphones and CDMA mobile phones. At least 4 elevated evacuation zones will be constructed in the most flood-prone areas of the Ratu and Khando river basins in Sarpallo VDC, Nainhi VDC, Didhawa VDC and Pakri VDC The design of the CBEWS will be subject to approval from the Technical Advisory Team.

2.4.8 Undertake training on flood preparedness and monitoring and communicating flood risk warnings for representatives of DDRC, VDCs, VDMCs, relevant NGOs, women groups and CBOs and communities in project river basins, ensuring participation of women (at least 50% of participants), children and the elderly. Training programmes will be designed together with DDRC, NGOs, women groups and CBOs with experience in this area. Simple pictorial guidelines in colour will be developed that will be suitable for both literate and non-literate audiences.

2.4.9 Analyze, document and share experiences and lessons generated by the project on flood preparedness and community-based EWS in Ratu and Khando flood-prone river basins in the Tarai and Churia districts with other key stakeholders and the public through targeted reports, the media, websites.

2.4.10 Conduct one district-level workshop and one national workshop at the end of the project to disseminate project knowledge, experiences and key lessons learned.

2.4.11 Develop an exit strategy by mainstreaming the interventions established and achieved by the project into the existing Government mechanisms for further continuity and sustainability.

2.5. Key indicators, risks and assumptions

179. The project strategy builds on various past and on-going government programmes, particularly in the fields of Glacial Lake Lowering (Tsho Ropla Lake), upgrading systems and mechanisms at the Department of Hydrology and Meteorology, Glacial lake management, Flood risk management (People's Embankment Programme (PEP), President's Churia Programme and disaster risk management. Similarly, the achievement of planned outcomes of this project will depend largely on strong engagement/involvement of Government Counterparts and key stakeholders, particularly the different departments and ministries, for effective inter-sectoral coordination. The project assumes that the Government of Nepal (especially the Ministry of Environment, Science and Technology/Department of Hydrology and Meteorology) will bring all the key stakeholders together for consultation and implementation of the activities as planned. In addition, it is assumed that the GON will ensure that the monitoring and maintenance of the systems established by the project are well functioning and operational for the benefit of the local communities. However, the current political disturbances, upcoming election and re-organising of an impending constitutional development process in Nepal, have the potential to influence the project implementation to a large extent.

180. There is uncertainty over the local governance and administrative structure that will eventually emerge once the constitution is in place. This will have implications during project implementation because the local government and other local bodies are seen as the key stakeholders of the project at the district and village level. The project assumes that the institutions established at the community and district level are functional and supportive to the implementation of project activities as planned. However, the institutionalization of project results at the local level will depend on continuity in the project's relationship with local government officials and civil servants at the national and district levels in addition to a smooth transition when the new governance and administrative structures are in place. Other risks include turn-over (transfers) of technically sound/trained government staff working with the project which may also result in delays to implement project activities as planned. The project assumes that the commitment by the GoN to implement the project will ensure the maintenance of technically sound staff to support the implementation of the project.

181. The project assumes that there will be strong community support for the project and that communities will perceive real added value in engaging with the project. However, stakeholder consultations during the PPG phase revealed 'development fatigue' and disillusionment with consultation processes, especially in the GLOF Risk areas due to the absence of tangible benefits that have yet to materialize for community members (see Annex 2). Furthermore, a volatile political environment and the tendency for greater political interference at the local level in the Tarai region could possibly pose a challenge when it comes to ensuring objectivity in the community and locations enlisting for

project investment. A major challenge will be to manage local stakeholder expectations and also find appropriate ways of securing tangible benefits for local communities. The project, through its community development efforts and participation and consultation at the local level, plans to address those challenges to ensure that the communities at the targeted areas support the project's initiatives as well as maintain the systems that have been established with project's investments.

182. The project has two distinct components, one focused on working in the Mountain region and the other focused on working in the Tarai (lowland) and Churia region based on its diverse objectives; the stakeholders and agencies involved to support the implementation also vary for each outcome. However, under the Ministry of Science, Technology and Environment (MoSTE), the Department of Hydrology and Meteorology (DHM) will be the implementing agency for this project and also responsible for both of these the components. To support DHM, the GON has chosen the Department of Water Induced Disaster and Prevention (DWIDP) to undertake the monitoring and oversight role for activities implemented under Component 2. The project assumes that a strong coordination mechanism will be established, maintained and continued between these two agencies as well as its district line bodies for efficient and effective implementation. Likewise, the project has designed a detailed stakeholder involvement plan (Annex 5) to be followed during the implementation process.

183. The main indicators of the project will be the successful lowering of water levels in Imja Lake and a well-functioning Community Based Early Warning System (CBEWS) at the targeted downstream communities under Outcome 1; and a reduction of the loss of lives and livelihood assets due to flooding events over the duration of the project and a well-functioning Community Based Early Warning System (CBEWS) in the targeted communities under Outcome 2. The project assumes that the climate change induced glacier melt remains at or below the level indicated by the current climate change projection and that the rate of glacier melt at Imja does not accelerate due to other non-climatic factors. Furthermore, the project assumes that during the project period there are less/no extreme weather and climatic events that accelerate intensive rainfall that will trigger floods, debris flow and landslides in the targeted locations. The project also assumes that extra precautions are taken by the contractor to ensure the health and safety of workers in the harsh and high altitude working environment.

184. The proposed project is based on strong government support and plans to draw important pilot experiences that have been derived from DHM/GON and UNDP-supported disaster risk reduction projects in and around the project target areas. These experiences will support the project in minimising and addressing the strategic and organisational risks of the project in a more effective manner.

More details on risks and assumptions are provided in the Project Results Framework, and in the standard UNDP risk log (Annex 8).

2.6. Cost-effectiveness

185. Records show that on average, GLOF events in Nepal occur every 3-10 years, with substantive socio-economic impact. On 11 July, 1981, the diversion weir at the Sunkoshi Hydro-electricity Project in Nepal was struck by a large GLOF and incurred significant damage. The flood also destroyed two bridges and extensive sections of the Arniko Highway, resulting in some US $ 3.0 million in damages. On 4 August, 1985, an outburst flood from Dig Tsho (a glacial lake in the Khumbu Himal, Nepal), totally destroyed the nearly completed Namche Small Hydel Project, 14 bridges and caused numerous other losses farther downstream.

186. With regards to assessing which course of action is most suitable and cost-effective to prevent such large-scale losses, a joint study by ICIMOD, ISDR and GFDRR ("Formation of Glacial Lakes in the Hindu Kush-Himalayas and GLOF Risk Assessment"15 from 2010 provides clear indication that the set of adaptation measures proposed under this project does not have a justifiable alternative in terms of achievable vulnerability reduction and adaptive capacity. The study considers glacier lake drainage and GLOF Early Warning systems as an essential part of disaster preparedness that has excellent potential to reduce loss of life and property. Alternative options, such as the retrofitting of critical infrastructure in highly dispersed settlements, would ultimately imply much higher investments. In addition, the project's two-pronged approach of risk reduction and preparedness has a far better cost-benefit ratio than the scaling up of disaster response and Search & Rescue systems in Nepal, which require repeated re-equipment and do not address the root causes of the underlying climate risk issue.

187. At the operational level, cost effectiveness of the project will be enhanced through the following efforts:

- Throughout the project, LDCF resources will be allocated on the basis of competitive procurement to ensure best value for money, including options for joint procurement;
- A number of project activities under both Outcomes will involve local communities and connect directly to local opportunities for the purchase of goods and services;
- The project's approach also has greater potential for up-scaling and replication across Nepal covering more GLOF & Flood risk areas unlike the more costly structural adaptation measures. By the end of the project, it will be possible to assess the proportion of the population and the value of critical infrastructure and other economic assets protected as a result of the adaptation measures implemented through the project and to make comparisons with the costs and benefits of alternative hard adaptation measures that have been implemented elsewhere in the country.

[15] http://www.unisdr.org/preventionweb/files/14048_ICIMODGLOF.pdf

2.7. Sustainability

188. The project was designed through close consultation with key stakeholders (see Annex 5). It has the full support of the GoN and other key stakeholders as it addresses urgent and immediate adaptation priorities identified through the NAPA. These relate to two of the most vulnerable issues in Nepal, in the Tarai and the High Mountain regions. The project is strongly anchored in several major national policies and programmes on disaster risk management in the country, particularly on flood risk management (Sections 2.4). To make the project more sustainable the results need to be and will be institutionalized in the following ways. Structural and non-structural adaptation measures developed through the project will be monitored regularly by respective Departments as identified in the project and also mainstreamed into key sector-based planning guidelines, such as Disaster Risk Reduction (DRR) and climate risk management into local and national development processes. Through these means, project results can be sustained long beyond the life of the project. The long-term viability and sustainability of the project will also depend greatly on support from the local communities and as such the project will have a strong emphasis on community engagement, empowerment and social inclusion.

189. Sustainability has also been built into the project approach by a strong emphasis on developing institutional and individual capacity by complementing other capacity development initiatives supported by CRDMP and RCRRP. The capacity-building components of the project will empower stakeholders at all levels, from communities to district authorities to national government line agencies, to deal with climate induced disaster such as floods and GLOF. When LDCF funding ends, up-scaling and replication will be taking place and project impacts will have been institutionalized through the combined impacts of the project's work on capacity development, policy changes, additional technical knowledge and education and advocacy. An exit strategy will be developed under Output 1.4.9 and 2.4.11 (see Section 2.4).

2.8. Replicability

190. Demonstrated adaptation measures will be further up-scaled and replicated through integration of climate risk reduction measures into key policy guidelines and development plans at national, district and community levels. For example, the implementation of a sediment control program in at least one river basin will be the first of its kind in the Tarai and Churia range. This will serve as a valuable demonstration of the critical importance of upstream-downstream linkages and a holistic approach to flood risk management. Another example is the capacity built for CBDRM in Solukhumbu region which will be used to develop a national CBDRM system for GLOF risk reduction over time. Mainstreaming of Disaster Risk Reduction (DRR) and climate risk management into key policies such as the guidelines for both regular monitoring and periodic monitoring of GLOF risks will also help to ensure that adaptation considerations including the measures demonstrated by the project, become more widely adapted across Nepal. Replication will be further supported by the project's emphasis on capacity development, which promotes knowledge transfer and skills development through training workshops at national, district and community levels. Outcomes 1 and 2 focus particularly on district, national and international learning and

knowledge transfer including dissemination of knowledge, experiences and lessons learned with key stakeholders and the public through a range of communication media.

2.9 Stakeholder involvement plan

191. See Annex 5

III. PROJECT RESULTS FRAMEWORK

This project will contribute to achieving the following Country Programme Outcome as defined in CPAP or CPD:

People living in areas vulnerable to climate change and disasters benefit from improved risk management and are more resilient to hazard-related shocks (Outcome 7).

Country Programme Outcome Indicators (UNDAF/CPD Outcome 7 indicators):

# of districts covered by government-owned emergency operation networks for communicating relief needs
# of VDCs meeting minimum criteria for disaster-resilient communities as defined by Nepal Risk Reduction Consortium Flagship 4 on integrated community-based disaster risk reduction/ disaster risk management

Additional linkage - UNDP CPAP Output 7.3.2:

Reduction of water level in Imja Glacial Lake and risk mitigation measures adopted in 4 most vulnerable tarai districts.

***Indicator**: # of meters of lake water reduced in Imja Glacier Lake.*

Primary applicable Key Environment and Sustainable Development Key Result Area: *3. Promote climate change adaptation*

Applicable Strategic Objective from LDCF Results-Based Management Framework:

The project will contribute primarily to **Objective CCA-1**: *Reduce vulnerability to the adverse impacts of climate change, including variability, at local, national, regional and global level*

The project will also contribute to:
Objective CCA-2: *Increase adaptive capacity to respond to the impacts of climate change, including variability, at local, national, regional and global level*
Objective CCA-3: *Promote transfer and adoption of adaptation technology*

Applicable Expected Outcomes from LDCF Results-Based Management Framework:
Outcome 1.2: Reduced vulnerability to climate change in development sectors

Applicable Outcome Indicators from LDCF Results-Based Management Framework:

1.2.3 Number of additional people provided with access to safe water supply and basic sanitation services given existing and projected climate change

Applicable AMAT Indicators
Objective 1: Reduce vulnerability to the adverse impacts of climate change, including variability, at local, national, regional and global level
Outcome 1.2: Reduced vulnerability in development sectors
1.2.3 Number of additional people provided with access to safe water supply and basic sanitation services given existing and projected climate change

Output 1.2.1: Vulnerable physical, natural and social assets strengthened in response to climate change impacts, including variability
1.2.1.2 Resilient infrastructure measures introduced to prevent economic losses

Objective 2: Increase adaptive capacity to respond to the impacts of climate change, including variability, at local, national, regional and global level
Outcome 2.1: Increased knowledge and understanding of climate variability and change-induced risks at country level and in targeted vulnerable areas
2.1.1 Relevant risk information disseminated to stakeholders (yes/no)

Output 2.1.2: Systems in place to disseminate timely risk information
2.1.2.1 Type & no. of monitoring systems in place

Outcome 2.2: Strengthened adaptive capacity to reduce risks to climate-induced economic losses
2.2.1: No. and type of targeted institutions with increased adaptative capacity to reduce risks and response to climate variability

Output 2.2.1: Adaptive capacity of national and regional centers and networks strengthened to rapidly respond to extreme weather events
2.2.1.1: No of options (Row 184): monitoring/forecasting capacity, capacity development, community based adaptation, erosion control/soil water conservation, special programs for women.
Output 2.2.2: Targeted population groups covered by adequate risk reduction measures
2.2.2.1 % of population covered by climate change risk measures (disaggregated by gender)

Output 2.3.1: Targeted population groups participating in adaptation and risk reduction awareness activities
2.3.1.1 No of options – see AMAT tracking tool – Row 204: monitoring/forecasting capacity, capacity development, community based adaptation, erosion control/sustainable land and water management, special programs for women.
2.3.1.2 No. and type of community groups trained in climate change risk reduction

Objective 3: Promote transfer and adoption of adaptation technology
Outcome 3.1: Successful demonstration, deployment, and transfer of relevant adaptation technology in targeted areas

Output 3.1.1: Relevant adaptation technology transferred to targeted groups
3.1.1.1 Type of adaptation technologies transferred to targeted groups.

Outcome 3.2: Enhanced enabling environment to support adaptation-related technology transfer

Output 3.2.1: Skills increased for relevant individuals in transfer of adaptation technology
3.2.1.1 No. of individuals trained in adaptation-related technologies

	Indicator	Baseline	Targets End of Project	Source of verification	Risks and Assumptions
Project Objective[15] **To reduce human and material losses from Glacier Lake Outburst Flooding (GLOF) in Solukhumbu District and catastrophic flooding events in the Tarai and Churia Range**	Number of high risk settlements of the GLOF Impact Zone of Solukhumbu district downstream of Imja lake area covered by an Early Warning System (EWS) [refer to AMAT 1.2.1.2]	More than 31,862 people live in the high risk settlements of Imja GLOF Impact Zone and are directly vulnerable to GLOF impacts. They have no EWS. Other forms of disaster preparedness are also limited. c. 7,400 ropani (377 ha) of agricultural land at risk from GLOF impacts C. 800 houses at risk from GLOF impacts Infrastructure:5.5 km road, 94 km trail, 25 truss and suspension bridges, 0.5 river embankment, 0.5 irrigation canal, 3 schools, 4 office buildings, 137 hotels, 64 teashops, 3 temple, gomba and mosque, 2 hydropower dam, 5 water mills, 7 transmission lines and 1 industry. Total direct & indirect costs of potential GLOF damages including replacement of major infrastructure estimated as $8.98	By the end of the project, at least 100% of the population (men and women) who are directly vulnerable to GLOF impacts within the 27 high risk settlements GLOF Impact Zone are covered by a comprehensive community-based Early Warning System (CBEWS)	Project monitoring records on CBEWS including results of random tests and mock drills Independent end of project evaluation report Existing Imja GLOF risk models used to estimate change in GLOF risks with a reduced Imja lake volume following the lake lowering and additional assumptions regarding impact of EWS in providing additional lead time that allows people to safeguard their lives and a certain proportion of livelihood assets. (Assumptions to be determined in Year 2.) Revised hazard maps combined with field verification Trekkers evaluation surveys (end of trek evaluation done by the SNP Office)	The artificial drainage channel constructed by the project is stable and continues to be maintained regularly by DHM Local communities perceive value and support in developing and maintaining a community-based EWS for the Imja GLOF Impact Zone. Climate change induced glacier melt at Imja remains at or below the level indicated by current climate change projections. The rate of glacier melt at Imja does not accelerate due to other non-climate change-related factors

[16] Objective (Atlas output) monitored quarterly ERBM and annually in APR/PIR

	Indicator	Baseline	Targets End of Project	Source of verification	Risks and Assumptions
		billion (see Section 2.3.5 & Annex 1 and 4)			
	Number of institutions with increased capacity to minimize human and material losses from potential GLOF events in the High Mountains and climate-related flooding in the Tarai and Churia Range [refer to AMAT 2.2.1]	Weak system for flood risk management (only construction work is done) in DWIDP and no GLOF risk management committee in Solukhumbu district. Number of trained staff in DHM is limited to work in GLOF risk reduction. DDRC is mostly involved in rescue and relief for post disaster work and their activity in the targeted districts is limited.	By the end of the project, targeted training/on the job training in gender sensitive flood risk management including disaster preparedness will have been provided to least 32 technical staff from 2 key government departments, DHM (2 – senior level) and DWIDP (30 – district and regional level), 30 representatives from 5 DDRCs, 64 representatives from 1 GLOF Risk Management Committee and atleast 2 university students. DHM will have the necessary technologies, skills & systems to assess and effectively communicate GLOF risk levels and warnings. DWIDP will have the necessary technologies, skills & systems to monitor sediment load in flood-prone river basins in the Tarai & Churia Range The Annual District Plans of at least 3 of the 5 target project districts , incorporate budgeted flood risk preparedness activities	Capacity assessment report done at the end of the project. Functional institutions in place.	Political stability and security situation is favourable to implement planned activities. There will be no/limited transfers of trained technical staff in other ministries/departments or in other non-government organisations Institutions established at the community and district level are functional and supportive to implement the project activities.
OUTCOME 1[17]	Average depth of	Average water depth 35.1	Average depth of lake kept below dangerous levels by ensuring	Project assessments with DHM at start and end of	The artificial drainage channel constructed by the project is

[17] Outcomes are equivalent to activity in ATLAS. All outcomes monitored annually in the APR/PIR.

	Indicator	Baseline	Targets End of Project	Source of verification	Risks and Assumptions
Risks of human and material losses from Glacial Lake Outburst Flooding (GLOF) events from Imja Lake reduced	Imja lake [refer to AMAT 1.2.1.2]	m in May 2009 New baseline to be established before channel constructed and water level markers placed in the outlet.	average water depth during spring and summer months is at least 3 metres or more below the baseline level prior to the construction of the channel.	project Annual DHM monitoring of lake depth	stable and continues to be maintained regularly by DHM Local communities perceive value and support in developing and maintaining a community-based EWS for the Imja GLOF Impact Zone. Climate change induced glacier melt at Imja remains at or below the level indicated by current climate change projections. The rate of glacier melt at Imja does not accelerate due to other non-climate change-related factors
	Percentage of high risk settlements of Imja GLOF Impact Zone residents (including women, children and elderly people) with a clear understand of how the EWS works and what to do in the event of a GLOF [refer to AMAT 2.1.2.1 / 3.1.1.1]	90% of the community have heard about GLOF risks but are not prepared for it. (Source Regional GLOF Risk Reduction Project) Baseline to be established in Year 1 of Project to identify the gender-disaggregated population (male and female) who are aware of the potential benefits of an EWS.	100% of residents from Solukhumbu district of the high risk settlements of the GLOF Impact Zone (within 75 km of outlet) understand how the EWS works and know what to do in the event of a GLOF, including men and women and elder residents.	Interview-based questionnaire surveys at the start and end of the project Project monitoring records on the CBEWS. Simulation of GLOF event and random tests of effectiveness of EWS system in a sample of villages in the GLOF Impact Zone	Communities participate in project awareness generation and training activities on GLOF risk reduction, learn how to operate and maintain the CBEWS and see value in maintaining it beyond the life of the project
	Number of targeted institutions with increased capacity to minimize exposure to GLOF risks [refer to AMAT	No local institution to address or understand the GLOF risks which is creating unnecessary havoc of outbursts.	No. of representatives from Solokhumbu DDRC, Sagarmatha National Park, the Imja GLOF Risk Management Committee, the CBEWS Task Forces trained to manage and minimize GLOF risks.	Project monitoring reports Terminal Evaluation Report Targeted surveys on awareness and	Political stability and security situation is favourable to implement planned activities. There will be no/limited transfers of trained technical

	Indicator	Baseline	Targets End of Project	Source of verification	Risks and Assumptions
	2.2.1.1 / 2.2.2.1 / 2.3.1.1/2 / 3.2.1.1]	Limited access to information as well as Government level institution in the Khumbu region (Imja lake and surrounding) to address or disseminate GLOF risks	No. & type of information materials disseminated to local and non-local people (i.e. tourists) by different agencies on GLOF risks, risk reduction measures and what to do in the event of a GLOF. By the end of the project, DHM is operating a GLOF Risk Monitoring System and has a mechanism in place to communicate GLOF risk warnings to MoHa and NEOC.	availability of GLOF-risk information materials at the start and end of the project. Information materials on GLOF risks DHM Annual Report District Disaster Management Plans District Development Plans	staff in other ministries/departments or in other non-government organisations Institutions established at the community and district level are functional and supportive to implement the project activities.
Outcome 2[18]: **Human and material losses from recurrent flooding events in 4 flood-prone districts of the Tarai and Churia Range reduced**	Number of additional people provided with access to safe water supply and basic sanitation services [refer to AMAT 1.2.3]	Existing tubewells in 6 VDCs get flooded during the flooding season making it difficult for 22,500 population. Water Supply/drainage systems in 4 VDCs gets flooded in monsoon making it difficult for 14,500 population	At least 70% population in 3 Districts/6 VDCs have access to 24 elevated tubewells and/or a flood-proofed drainage system	Survery, Gender disaggregrated Interviews, field monitoring and testing	If concentrated rainfall occurs for 24 hours currently the districts are not equipped to deal with floods like 1993 flood disaster in central and eastern Nepal. In such a scenari the activities and modalities of the current project will be affected. Political stability and security situation in Tarai is favourable to implement planned activities. Less/no extreme climate events occur that can accelerate intensive rainfall by triggering floods, debris

[18] *All outcomes monitored annually in the APR/PIR.*

	Indicator	Baseline	Targets End of Project	Source of verification	Risks and Assumptions
					flow and landslides in the targeted locations. Tube well and drainage system remain functional through the year (during monsoon) Local community/ authorities value and support the interventions undertaken by the project Land to install tube-wells made available by local people and Government authorities.
	Number of people and value of their material assets covered by a CBEWS in the four target project districts [refer to AMAT 2.2.2.1 / 3.1.1.1 / 3.2.1.1]	There are no EWS in the 4 project target districts; 3 VDCs (Mahisthan, Hattilet and Aurahi) communities in Mahottari district – Janagha River) have been trained in CBEWS UNDP/CDRMP-programme. The total population of the most flood-prone VDCs in all the is: 64,700 people Value of material assets vulnerable to flood impacts in these VDCS will be established at the start of the project.	100 % f population covered by Community Based Early Warning Systems in all target flood-prone river basins (Refer to the previous section page 4- target 3rd paragraph)	Gender disaggregated interviews, Field survey, Monitoring and mock drill	Local community/ authorities value and support the interventions undertaken by the project including CBEWS Linkages among community, DEOC and NEOC should be intact...thereby establishing a last mile connectivity. Local community/ authorities value and support the interventions undertaken by the project

	Indicator	Baseline	Targets End of Project	Source of verification	Risks and Assumptions
	Number of targeted institutions with increased capacity to minimize exposure to flood risks in the Tarai & Churia Range [refer to AMAT 2.2.1.1 / 3.2.1.1]	Weak system for flood risk management. DWIDP currently focuses only construction work. Number of trained staff in DWIDP on flood risk management is very limited. DDRC is mostly involved in rescue and relief for post disaster work and their activity in the targeted districts is limited.	By the end of the project, at least 8 gender sensitive Village Disaster Management Plans prepared by Village Disaster Management Committees in the Tarai & Churia Range By the end of the project, at least two vulnerable VDCS of four districts will have CBEWSs and which are being effectively maintained by local communities (including women) under the leadership of the Village Management Committees.	Project monitoring reports Terminal Evaluation Report Village Disaster Management Plans are incorporated into the Districts and VDC development plans Results of random testing of CBEWS operation in a sample of villages by the project. DWIDP Annual Report District Disaster Management Plans District Development Plans	Political stability and security situation in Tarai is favourable to implement planned activities. There will be no/limited transfers of trained technical staff in other ministries/departments or in other non-government organizations Institutions established at the community and district level are functional and supportive to implement the project activities.

IV. TOTAL BUDGET AND WORKPLAN

Award ID:	00069781	Project ID(s):	00084148
Award Title:	PIMS 4567 FSP LDCF: Country Name Project Title: Community Based Flood and Glacial Lake Outburst Risk Reduction Project		
Business Unit:	*NPL 10*		
Project Title:	Country Name Project Title: Community Based Flood and Glacial Lake Outburst Risk Reduction Project		
PIMS no.	4657		
Implementing Partner (Executing Agency)	Ministry of Science, Technology and Environment / Department of Hydrology and Meteorology (DHM)		

GEF Outcome/Atlas Activity	Responsible Party/ Implementing code	Fund ID	Donor Name	Atlas Budgetary Account Code	ATLAS Budget Description	Amount Year 1 (USD)	Amount Year 2 (USD)	Amount Year 3 (USD)	Amount Year 4 (USD)	Total (USD)	See Budget Note:
OUTCOME 1: Risks of human and material losses from Glacial Lake Outburst Flooding (GLOF) events from Imja Lake reduced	DHM[19]	62160	LDCF	71200	International Consultants	60,000	12,500	-	-	72,500	a.
				72600	Grant to CBOs	10,000	10,000	10,000	-	30,000	b.
				72200	Equipment and Furniture	67,800	4,000	4,000	4,000	79,800	c.
				72100	Contractual Services (Companies)	607,700	1,159,700	903,900	217,027	2,888,327	d.
				71600	Travel and DSA	48,498	16,570	11,820	11,820	88,708	e.
				71300	Local Consultants	99,950	16,000	10,550	10,550	137,050	f.
				75700	Training and meetings and workshops	54,520	52,920	42,250	42,150	191,840	g.
				74200	Audio-visual & Print Production Costs	6,658	-	-	-	6,658	h.

[19] Upon the request from the Implementing Partner (DHM) UNDP may provide support services. The Implementing Partner will need to formalize this via a Letter of Agreement with UNDP-Nepal. Direct project service costs will apply in such an eventuality. Direct project service costs (based on actual or transaction costs) for these kind of activities will be separately mentioned in the budget note (on the last row).

				73400	Rental and Maintenance of other	1,000	1,500	1,500	1,000	5,000	i.
	Sub-Total of LDCF					**956,126**	**1,273,190**	**984,020**	**286,547**	**3,499,883**	
	UNDP	**04000**	**UNDP**	71200	International Consultants	10,000	-	-	-	10,000	j.
				72100	Contractual Services (Companies)	7,000	-	-	-	7,000	k.
	DHM	**04000**	**UNDP**	71600	Travel and DSA	34,000	-	-	-	34,000	l.
				71300	Local Consultants	8,000	-	-	-	8,000	m.
				75700	Training and meetings and workshops	1,000	-	-	-	1,000	n.
	Sub-Total of UNDP					**60,000**	-	-	-	**60,000**	
	Total Outcome 1					**1,016,126**	**1,273,190**	**984,020**	**286,547**	**3,559,883**	
OUTCOME 2: (Human and material losses from recurrent flooding events in 4 flood-prone districts of the Terai and Churia range reduced)	**DHM[20]**	**62160**	**LDCF**	71300	Local Consultants	78,000	49,000	8,800	8,800	144,600	o.
				75700	Training and meetings and workshops	35,200	33,600	29,900	27,100	125,800	p.
				71600	Travel and DSA	53,627	48,860	21,560	21,560	145,607	q.
				72200	Equipment and Furniture	35,000	-	-	-	35,000	r.
				72100	Contractual Services (Companies)	415,610	629,500	589,000	125,000	1,759,110	s.
	Sub-Total of LDCF					**617,437**	**760,960**	**649,260**	**182,460**	**2,210,117**	
	DHM	**04000**	**UNDP**	71300	Local Consultants	-	-	20,000	20,000	40,000	t.
	Sub-Total of UNDP					-	-	**20,000**	**20,000**	**40,000**	
	Total Outcome 2					**617,437**	**760,960**	**669,260**	**202,460**	**2,250,117**	
MONITORING AND EVALUATION	**UNDP**	**04000**	**UNDP**	71200	International Consultant	-	-	-	40,000	40,000	u.

[20] Upon the request from the Implementing Partner (DHM) UNDP may provide support services. The Implementing Partner will need to formalize this via a Letter of Agreement with UNDP-Nepal. Direct project service costs will apply in such an eventuality. Direct project service costs (based on actual or transaction costs) for these kind of activities will be separately mentioned in the budget note (on the last row).

				74110	Audit	3,000	3,000	3,000	3,000	12,000	v.
				75700	Training and meetings and workshops	10,000	-	-	-	10,000	w.
	Sub-Total of UNDP					**13,000**	**3,000**	**3,000**	**43,000**	**62,000**	
	DHM	**62160**	**LDCF**	71300	Local Consultants	-	-	40,000	-	40,000	x.
					Sub-Total of LDCF	-	-	**40,000**	-	**40,000**	
	Total M&E					**13,000**	**3,000**	**43,000**	**43,000**	**102,000**	
PROJECT MANAGEMENT UNIT	**DHM[21]**	**62160**	**LDCF**	71400	Contractual Services (Indv) - salaries	25,500	25,500	25,500	25,500	102,000	y.
				71600	Travel and DSA	3,000	3,000	3,000	3,000	12,000	z.
				74599	UNDP Cost Recovery Chrgs-Bills	31,118	31,118	31,118	31,118	124,472	aa.
				72200	Equipment and Furniture	311,528	-	-	-	311,528	ab.
					Sub-Total of LDCF	**371,146**	**59,618**	**59,618**	**59,618**	**550,000**	
	UNDP	**04000**	**UNDP**	71400	Contractual Services (Indv) - salaries	196,858	196,858	196,858	196,856	787,430	ac.
					Sub-Total of UNDP	**196,858**	**196,858**	**196,858**	**196,856**	**787,430**	
	Total for Project Management Cost					**568,004**	**256,476**	**256,476**	**256,474**	**1,337,430**	
PROJECT TOTAL						**2,214,567**	**2,293,626**	**1,952,756**	**788,481**	**7,249,430**	

Summary of Funds:[22]

[21] Upon the request from the Implementing Partner (DHM) UNDP may provide support services. The Implementing Partner will need to formalize this via a Letter of Agreement with UNDP-Nepal. Direct project service costs will apply in such an eventuality. Direct project service costs (based on actual or transaction costs) for these kind of activities will be separately mentioned in the budget note (on the last row).

[22] Summary table should include all financing of all kinds: GEF financing, cofinancing, cash, in-kind, etc...

	Amount Year 1	Amount Year 2	Amount Year 3	Amount Year 4	Total
GEF – LDCF (cash)	1,944,709	2,093,768	1,732,898	528,625	**6,300,000**
UNDP (in-cash)	269,858	199,858	219,858	259,856	**949,430**
UNDP (in-kind)	1,920,725	1,920,725	1,920,725	1,920,725	**7,682,900**
NRRC (parallel co-financing)	714,452	714,452	714,453	714,454	**2,857,811**
Government of Nepal/DWIDP (in-kind)	1,750,000	1,750,000	1,750,000	1,750,000	**7,000,000**
USAID - ADAPT ASIA (FSP stage-parallel co-financing)	157,369	-	-	-	**157,369**
ICIMOD (parallel co-financing)	426,250	426,250	426,250	426,250	**1,705,000**
TOTAL	**7,183,363**	**7,105,053**	**6,764,184**	**5,599,910**	**26,652,510**

BUDGET NOTES:

Budget Note	Description of cost item
OUTCOME 1	
a.	**International consultants** ▪ Outputs 1.1.3: Hire an international consultant, a glaciologist to help in the detail study and design work. The consultant shall support for evaluating the technical option for reducing GLOF risk through controlled drainage and undertake engineering design of the drainage system including appropriate location of the channel, depth, need of sluice gates, subsequent maintenance and including the cost and benefit of such specific options. The consultant is to be hired for 60 days@ $500/day ($30,000) in the year 1 and 25 days @ 500/day ($12,500) in the year 2. ▪ Outputs 1.1.5: Hiring two consultants – one Hydrologist and other geo-tech/geologist for developing an implementation and management plan for the construction of the controlled drainage system. The consultants to be hired for 30 days in total @ $500/day ($60,000) in the year 1. The total budget planned for the international consultant is $ 72,500.
b.	**Grant to CBOs** ▪ Outputs 1.2.5: One local service providing CBOs to be selected for monitoring, protection and logistics of the activities of the Project which includes undertaking sub activities like - photo monitoring, weekly monitoring visits to the lake and surroundings; water level monitoring in the lake and Imja River; inform about changes in the moraine features & maintain channel as instructed by DHM. ▪ Other function also include conducting mock drills (link with 1.3.8) to the peoples from three most vulnerable local communities close from Lake Chukung, Dinboche and Panboche. Three people from each settlement will be trained to do these monitoring works. The grant allocated is $ 30,000 ($10,000 each for first 3 years).
c.	**Equipment and Furniture** ▪ The project site is located at the remote place of Solukhumbu district which is at the high altitude area and distant from the various supplies and the transportation routes. Therefore, it is necessary to procure the Trekking Equipment which includes tents, trekking gears and other necessary items as a security measures for staffs working at the site. The total budgeted amount for such equipment is $ 16,000 which is spread uniformly for 4 years ($4000 each). ▪ Output 1.3.3: Procurement of Early Warning System equipments in the downstream settlements of Chukkung, Dinboche and Panboche. These includes procurement of 3 hands operated sirens, 20 hand-held microphones, 20 CDMA mobile phones budgeted for $ 9,800, installation and freight charges $ 5,000 (total of $ 14,800 in year 1). Total cost provisioned under this activity is $ 14, 800. ▪ Output 1.4.5: As there are a number of flows of the tourists in this area, a support to SNP Tourists Information Centre at Namche is also planned. It comprises of the procurement of furniture and flooring for $ 2000, laptop and projector for $ 5000 and IEC material for $ 2000. The total procurement value is $ 9,000 planned for the first year of the project. ▪ Output 1.4.6: The project activities requires, manipulation and study of the various data, monitor and forecast the result of the real time data therefore it is imperative to procure the high end computer systems and software for strengthening the technical capacity of the program unit. Thus, budget amounting to $ 40,000 is planned to set up the required technology at the DHM Hydrology Division by linking

	with the SPCR component 2 activities for real time data recording and maintenance.
d.	**Contractual Services** ▪ In order to facilitate the project staffs and the consultants at the sites for their work at this difficult terrain, trekking agents are to be hired for cooking foods, arranging the logistics such as tents and security. The total amount budgeted is $ 27,000 for the project period. ▪ Output 1.1.8: Outsource to a contractual company to undertake artificial lowering system of Imja Glacial Lake water including design and construction based on the approved implementation and management plan. The detailed activities includes the study for $ 210,900, lake lowering works $ 1,415,527, operation and management for $ 678,200, to set up local mobile clinic by linking with the existing hospital including the health worker $ 148,500 and monitoring ne evaluation and security for $ 250,000. The total planned budget for this output 1.1.8 is $ 2,703,127 ▪ Output 1.1.6: Outsourcing a contractual company to develop a safety and evacuation plan (for workers) by linking with existing hospital and security system. Further, develop a safety and evacuation plan and involve CBOs to undertake training drills, awareness of the safety and security including acclimatisation awareness required during the construction period. The total budgeted amount is $ 15,000 for the entire project period. ▪ Output 1.2.1/1.2.2: One service providing organisation will be contracted to procure of satellite images of the Imja Lake to assist the experts identify the changes in snow cover over the period of the project. The image will be analysed twice in a year through put the project period. The total cost of the contact is planned for $ 5,600. ▪ Output 1.2.1/1.2.2: Develop a monitoring plan and channel maintenance work including schedule with budget by the project team, DHM and local stake holders and GLOF RR committee to ensure that the plan is implemented. The total budget allocated for is $ 10,000. ▪ Output 1.2.4: Outsource to a Company to procure and install 1 data logger and 1 water level gauge for amount estimated at $ 10,000 and logistics/transportation for $ 5,000 to be installed near the Imja Lake. The total cost amounts to $ 15,000. ▪ Output 1.3.1/1.3.4: Outsource to a company to verify and refine vulnerability assessment and identify needs for cost effective CBEWS and design CBEWS for assessing what is to be installed and set up for $ 10,000. ▪ Output 1.3.5/1.3.6: Outsource design and construction with local materials to set up develop Community based small adaptation works including evacuation centre and routes in 27 high risk settlements for $ 102,600; spread equally for two years . It includes training to local communities and, mock drills, with special focus on the marginalised groups, participatory hazard mapping, vulnerability assessment and local disaster management plan. The total cost provisioned under the Contractual services amounts to $2,888,327.
e.	**Travel and DSA** ▪ This expense includes the official visits of experts, project associates, research assistants, and members of the Project Board or representatives from the government for purposes of program activities, coordination and oversight. The total budget calculated for the period amounts to $ 88,708.
f.	**Local consultants** ▪ Output 1.1.1: Hiring a local consultants to set up seven team members to conduct fourteen meetings in the year 1 and ten meetings in year 2 thereafter seven meetings in year 3 and 4 respectively. The local consultants are paid at the rate of $ 200 per day for 38 days total budget amounts to $ 53,200. ▪ Output 1.1.2: local consultants to be hired to conduct the review of the scientific assessment for ten days @ $200 per day. Total allocated budget amounts to $ 2,000.

	▪ Similarly, hiring a local consultant to help the international consultant (glaciologist) to accompany the field visit for 85 days @ $ 50 per day amounting to $ 4,250. ▪ Output 1.1.4: Five local consultants to be hired for IEA/EIA and vulnerability assessment for 30 days @ $200 per day amounting to $ 30,000. Similarly, two research assistants also to be hired for 30 days @ $ 50 per day to help the consultants amounting to $ 3,000. ▪ Output 1.1.5: One local community development expert to be hired for 30 days@ $ 200 per day amounting in total $ 6,000. ▪ Output 1.1.8: A Consultant (University student) to be hired to document the implementation process of the artificial lowering system of the Imja Lake for 15 days in a year for four years. Thus, It is provisioned for 15 days*4 years*$50 which equivalents to $3000 in total. ▪ Output 1.2.3: Hire a local consultant to develop guidelines on Glacial Lake Monitoring @ $200 for 30 days amounting to $ 6,000 in total. ▪ Output 1.3.9: Hire 3 experts for TOT for 21 days@ $200 per day amounting $12,600 in total. ▪ Further, hire a consultant to support for documentation and publication for 40 days@ $200 per day for $ 8,000 in total. ▪ Output 1.3.10: Hire a local consultant for 30 days to establish base line data amounting to $6,000. ▪ Output 1.4.3: (Link with 1.2.5) a Consultant to be hired for 15 days@ $200 per day to prepare a comprehensive community based GLOF risk management plan and train the community or CBOs to update annually. Total budget amounts to $ 3,000. The total budget allocated for the local consultants for conducting the various activities as explained above amount to $137,050.
g.	**Trainings and meetings and Workshops** Meetings with various stakeholders, GLOF risk reduction committee and trainings/workshops for the period of the project; total costs amounting to $ 191,840. ▪ Output 1.1.7: For Stakeholder consultation cost in Kathmandu: $23,680 for 4 years ▪ Set up a 27 member "GLOF Risk Redcution Committee" from 27 setttlements which are under risk (27 settlements are Chhukung, Dingoboche, Pangboche, Churo, Orso, Syomare, Jorsalle, Tawa, Chhamuwa, Bengkar, Toktok, Gumela, Rakding, Phakding, Dukdingma, Chhermading, Ghat, Nakchung, Chokha and Jubhing) - link to 1.2.1/1.2.2, 1.3.7, 1.4.1 amounting to $ 19,140 for year 1 and year 2. ▪ Output 1.2.5: to conduct trainings by 2 trainers to local communities through CBOs once a year @ 8,400 per year amounting to $ 33,600 in total. ▪ Further, refresher training by trained local trainers by the CBO every 6 month for 3 days each on an average to 30 people and refreshments 40 per people amounting to $ 28,800. ▪ Output 1.4.1: Link to 1.2.5 cost estimated for meeting cost @ $40 per person for 27 members GLOF RR Committee once in every two months for 4 years total amounting to $ 28,320. ▪ Output 1.4.8: Organise an Interaction workshops in collaboration with other agencies; 2 day knowledge workshop in a year for four years total budgeted amount is $ 42,200. ▪ Other small expenses for training and meetings link with output 1.1.1 ($ 7,600); output 1.1.2 ($300); output 1.1.10 ($300); output 1.3.2 ($1500); output 1.4.1 ($4,000) and output 1.4.7 ($2,400) totalling $16,100
h.	**Audio-visual & Print Production Costs** ▪ Link with output 1.2.3: For production of the modules based on the guidelines amounting to $ 6,658 in year 1.
i.	**Rental and Maintenance of other** For rental and general maintenance of equipments amounting to $ 5,000 from year 1-4.

	▪ Link with output 1.1.3 and 1.4.5: For maintenance of the procured EWS equipment and equipment given as a support to SNP amounting to $ 1,000 and $ 4,000 respectively.
j.	**International consultants** ▪ Output 1.4.9: Organizing a regional workshop in the region (Bhutan or Pakistan) to exchange GLOF RR knowledge and experiences: Cost of 2 international consultant @ US$ 500*2 (totalling $ 10,000) persons for 10 days in year 1.
k.	**Contractual Services** ▪ Link with 1.4.5: Support SNP to revise and update a SNP management plan and integrate GLOF risk reduction initiatives for $ 7,000 in year 1.
l.	**Travel and DSA** ▪ Link with 1.4.9: Cost of travel and DSA for organizing a regional workshop in the region (Bhutan or Pakistan) to exchange GLOF RR knowledge and experiences for an amount of $ 34,000.
m.	**Local consultants** ▪ Output 1.4.6: Hiring a local consultant to develop a mechanism /plan to link DHM with GRMC and then to MOHA and NEOC including detail consultation with all the key stakeholders for 40 days @ $200 amounting to $ 8,000 in year 1.
n.	**Trainings and meetings and Workshops** ▪ Link with output 1.1.3: Meetings with various stakeholders to identify the institutional arrangements for CBEWS in Imja for 2 local consultation and 2 meeting costs at the central level for an amount of $ 1,000; spread equally for year 1 and year 2.
Budget Note	**Description of cost item**

OUTCOME 2	
o.	**Local consultants** Hiring a local consultants at the rate of $ 200 per day to collect the baseline data, for documentation, train the CBOs, develop a monitoring protocols for sediment control, review and conduct an assessment of flood preparedness, analyze and document best practices from the project etc. The total cost provisioned under the Local consultants is $ 144,600 for the project period. ▪ Output 2.1.1: Hiring a local consultants to set up seven team members to conduct fourteen meetings in the year 1 and ten meetings in year 2 thereafter seven meetings in year 3 and 4 respectively. The local consultants are paid at the rate of $ 200 per day for 38 days total budget amounts to $ 53,200. ▪ Output 2.1.9: to establish a base line data by hire a local consultant for 30 days@ $ 200 per day amounting to $ 6,000 in total. ▪ Link with output 2.2.6: Consultant to document the monitoring or the implementation process for 8 days*4 times @ $200 equivalents to $ 6,400 for the project period. ▪ Link with 2.3.2: Hire a Trainer at $200*20 days in four districts to conduct trainings in year 1 and year 2 for $ 32,000 in total ▪ Link with output 2.3.3: to develop monitoring protocols for sediment control by Consultant for 25 days @ $200 per day amounting to $ 5000. ▪ Link with output 2.3.4: to hire a Trainer / Consultant for 20 days per year @ $ 200 per day for four years in total amounting to $ 16,000. ▪ Link with 2.4.1 and 2.4.2 to Review and conduct an assessment of flood preparedness in selected high risk villages by a consultant for 15 days in a year for 4 years @ $ 200 amounting to $12,000. ▪ Link with 2.4.4. and 2.4.5: Hire a local consultant to study to evaluate options of low-cost, low-tech CBEWS to develop a simple system that can be operated by women, children and/or old people and identify technical assessments for river gauges in appropriate spots and identify suitable evacuation routes and emergency shelters for vulnerable communities for 30 days @ $200 per day amounting to $6,000. ▪ Link with 2.4.6: To prepare a DRMP plans for 8 VDCs; therefore a consultant is to be hired for 30 days in a year for 4 years@ $ 200 to assist the planning process at the VDMC to assist to integrate into the District Level planning in total amounting to $ 24,000 in 4 years period. ▪ Link with output 2.4.10 and 2.4.11: A Consultant is to be hired to analyse and document the best practices from the project for 30 days in a year @ $200 per day for four years amounting to $ 24,000 in total.
p.	**Trainings and meetings and Workshops** Meetings or workshops for PEB members, within DWIDP members, annual and district level meetings with various stake holders and trainings to various community level for better coordination and knowledge sharing amounting to $ 125,800. ▪ Per meeting cost link with 2.1.1 amounting to $ 7,600 ▪ Link with 2.1.4 and 2.1.5: Meeting costs to finalise the most appropriate methods for strengthening the river bank in critical areas $ 800; Organising a consultation meeting at the national level $ 10,800 and a consultation meeting at four vulnerable districts for 20 people each budgeted for $24,000 for the project period. ▪ Link with 2.1.8: Consultation meeting at the national level with TA, PEB and local stakeholders for $12,800 and for meeting costs to finalise the most appropriate methods for $3,200.

	▪ Link with 2.3.2: Conducting a two day training for relevant district's 30 line agency representatives for $ 6,200 ▪ Link with 2.3.4: Organising training to DWIDP members on sediment monitoring and management working in Terai and Churia range amounting to $ 7,600 ▪ Link with 2.3.5: Organising annual meetings with 30 key stakeholders at the national level for $8,400 and a quarterly meetings for better coordination between different projects for11, 200. ▪ Link with 2.4.3: Planning to establish a community level VDMC and task force team in close coordination with NRRC; hold two meetings in each vulnerable 8 VDCs, two times in a year (before and during the monsoon) the budget allocated for $12,800 ▪ Link with 2.4.9: To conduct an evaluation meeting to evaluate the trainings and the learning of the mock drills on flood preparedness to the vulnerable groups one time in a year for three years (pre monsoon) in four districts as per the design plan for an amount of $8,400. ▪ Link with 2.4.10/11: Organise knowledge sharing workshop to share experiences and disseminate lessons generated by the project the budget allocated is $12,000.
q.	**Travel and DSA** ▪ Cost of travel and DSA for organizing a regional exchange visits of 4 districts on knowledge and experiences, monitoring by the DWIDP officials and the PEB members for an amount of $ 145,607 for year 1-4.
r.	**Equipment and Furniture** ▪ Link with output 2.4.8: Procurement of EWS equipments in the 8 VDCs – 32 hand operated sirens, 32 hand-held microphones and 24 CDMA mobile phones to the focal persons appointed by the VDRRC amounting to $ 35,000 for year 1.
s.	**Contractual Services** ▪ Link with 2.1.2 and 2.1.3: Outsource a company to conduct technical studies and cost effectiveness analyses to evaluate option for controlling sediments and conduct Topographical and Hydrological Field Survey in four selected rivers cost amounting to $ 40,000 in year 1. ▪ Link with 2.1.4 and 2.1.5: Procuring works for riverbank strengthening in critical areas applying bio dykes and gabion embankment in vulnerable rivers in 4 districts to be constructed for an amount of $ 725,000 for year 1-4. ▪ Link with 2.1.4/2.1.5: Procuring works for concrete / gabion for large and small check dam for $ 760,000. ▪ Link with 2.1.6 and 2.1.7 and 2.2.1/2.2.2: Procurement of services from a consulting company to undertake a study to identify the vulnerable sites in 6 VDCs of 3 river basins and prepare technical design and implementation plan with a focus to marginalized communities for $ 64,110 in year 1. ▪ Link with 2.2.4: Installing tube wells above inundation level and constructing raised earthen platform 4*4 meters at 2 meter height for $ $45,000 spread equally for year 1, 2 and 3. ▪ Link with 2.2.5: Procuring works for strengthening and improving drainage system in Ratu and Khando river basins in 2 VDCs each for $ 25,000 equally spread for year 1 and 2. ▪ Link with 2.4.9: Cost for Mock drills allocated for year 1, 2 and 3 amounting to $24,000 each (Total of $ 72,000) ▪ Link with 2.4.9: Construct one elevated zone based on the identified flood prone areas in Ratu and Khando river basins to be constructed in school/community grounds for an amount totalling $28,000 in year 2. The total budgeted amount for the contractual services is $ 1,759,110.

t.	Hiring a local consultants amounting to $ 40,000 for third and fourth quarter amounting to $ 20,000 each
MONITORING AND EVALUATION	
u.	**International consultants** ▪ Hiring International consultants for $ 40,000 for conducting the final evaluation of the Project at the mid of Year 4.
v.	**Audit** ▪ Annual audit cost @ $3,000 per year for 1-4 years ($ 12,000 in total)
w.	**Trainings and meetings and Workshops** ▪ Conducting the Inception Workshop and Report for better coordination and planning between PEB members, DWIDP members and with various other stake holders amounting to $ 10,000 for year 1.
x.	**Local consultants** Hiring local consultants for $ 40,000 for conducting the midterm evaluation of the Project at the beginning of the year 3.

PROGRAM MANAGEMENT UNIT	
y.	**Contractual Services - Individual/salaries** ▪ Salaries to be absorbed by the LDCF for the staffs @ $25,500 per year *4 years = $ 102,000
z.	**Travel and DSA** ▪ Cost of travel and DSA for various administrative functions amounting to $ 3,000 per year ($ 12,000 in total)
aa.	**Direct Project Services (Cost based on the Nepal Price List as applied by UNDP Nepal)**
	▪ **Direct Costs for recruitment and payroll processing for each <u>international consultant</u> will be based on following cost structure** *There are two rates for more than USD 100,000 of total contract amount and less than USD 100,000)* *Consultant Recruitment per post USD 370.96* *Procurement not involving CAP(for less than Total USD100,000)per case 197.27* *or* *Procurement not involving ACP (for more than Total USD100,000)per case 1098.41* *Payment processing Per transaction USD 19.20* ▪ **Direct Cost for recruitment and payroll processing for each Local consultant will be based on following cost structure** Local consultants exceeding $ 10,000 *Consultant Recruitment per post USD 370.96*

	Procurement not involving CAP(for less than Total USD100,000)per case 197.27 *Payment processing Per transaction USD 19.20* ▪ **Direct Cost for recruitment and payroll processing for each project staffs will be based on following cost structure** [Provisioned for 14 posts - 5 professional staffs, 6 Project staffs and 9 field office staffs] *Service Contract package per post 1766.03* *Staff selection and recruitment USD 1417.58* *Contract Management issue and Separation USD 112.28* *Recurrent cost Payroll Cost 236.17 per* year ▪ **Direct Cost for procurement and payments of each contractual services – companies will be based on following cost structure** *Above 10,000 with CAP 784.83* *Less than 10,000 without CAP 197.2* *Above 100,000 with ACP USD 1098.41* *Payment Processing: USD 19.20 each Payment* ▪ **Direct Cost for travel *(ticket request, payment of ticket, payment of DSA for an indicative approx.* 10): USD 256.20** *Ticket booking USD 25.62 per transaction* ▪ **Direct Cost for international workshops (procurement, meeting arrangement, payments to hotel and to event organizer will be based on following cost structure** *USD 54.11 for Management Workshop 19.20 for each payment USD 197.20 for Non CAP Procurement*
ab.	**Equipment and Furniture** Cost allocated for procurements amounting to $ 311,528 during the period of year 1. ▪ Procurement of 4 vehicles, 6 motor bikes $ 182,000. ▪ 16 laptops, 11 desktops, 2 servers, 3 master printers and their allied accessories (stabilizers, personal printers etc.) for $56,028 ▪ Procurement of furniture and fixtures including for renovation and partitions for $ 48,300. ▪ Generators for $ 18,000. ▪ Telephones, internets, fax and cablings for EPABX for $ 7,200.

ac.	**Contractual Services - Individual/salaries** Salaries to be absorbed by UNDP @ $ 196,858 per year for 4 years (amounting to $ 787,432 in 4 years). The components of the service costs are: ▪ Salaries of 5 professional staffs @ $ 97,132 per year *4 years = $ 388,530 ▪ Salaries of 6 project support staff @ $ 32,258 per year * 4 years = $ 129,033 ▪ Salaries of 9 project field office staffs @ $ 70,613 per year * 4 years = $ 282,454 ▪ Provision for the Provident Funds and Medical Insurance amounting to $ 89,413

V. MANAGEMENT ARRANGEMENTS

182. This project will be implemented over the course of four years starting from the beginning of 2013. The project will be nationally executed under UNDP National Implementation Guidelines. The project's lead Implementing Partner will be the Department of Hydrology and Meteorology (DHM) under the Ministry of Science, Technology and Environment (MoSTE) of the Government of Nepal. DHM shall be responsible for implementing both components of the project and will also house the Project Central Office. For implementation of Component 2, a dedicated project office will be set up in the field in one of the project districts in the Tarai and made operational under the overall guidance of the DHM.

183. The Department of Water Induced Disaster and Prevention (DWIDP) under the Ministry of Irrigation and Department of Soil Conservation and Watershed Management (DSCWM) shall be responsible for providing technical oversight and monitoring of activities under Component 2 of this project. The DWIDP and DSCWM will be involved in planning of project activities under Component 2.

184. UNDP will serve as the GEF Agency for the Project and be responsible for the provision of project cycle management services (i.e. General Management support) via the Country Office and specialized technical and oversight support from the UNDP-GEF unit. DHM/MoSTE, DWIDP/MOI and UNDP will jointly monitor and evaluate all project activities. The project will be governed in accordance with UNDP's Results Based Management Guideline (RBM), LDCF rules and procedures and the Government of Nepal's operational principles within the governance structure as described in Annex 10 (also see Terms of Reference for the key positions).

185. **Government Cooperating Agency: The Ministry of Science, Technology and Environment** as a coperating agency shall do high-level monitoring of the project on behalf of the GON, promote initiatives undertaken by the project nationally as best practice case, and ensure appropriateness of interventions in meeting national priorities. The MoSTE may co-ordinate with other relevant ministries and departments in order to provide inputs to the project as and when needed.

- **Role of cooperating agency:** The cooperating agency/MOSTE will form a steering mechanism (Government Project Steering Committee/ PSC) to provide overall oversight, and strategic and policy guidance to the Project Executive Board (PEB) to help achieve the project results in a timely and cost-effective manner. The PSC will also be responsible for making decisions as required regards to approval of major revisions in the project strategy and implementation approaches. The PSC will meet at least once a year.

- The Secretary of MoSTE of the Government of Nepal will be the chair of the PSC. The Chair of the PSC will formally set up the PSC by inviting the below mentioned institutions and agencies, for nomination of one representative, to work as the member in the PSC. On consultation with UNDP, the Chair will also identify representatives from donors, civil society and private sector as the members of the PSC. Government agencies are expected to represent in the PSC at the level of Joint Secretary.

The composition of the PSC is given below:

1. *Chair, Secretary, MoSTE*
2. *Representative, Office of the PM and Council of Ministers*
3. *Representative, National Planning Commission Secretariat*
4. *Representative, Ministry of Finance*
5. *Representative, Ministry of Forests and Soil Conservation*
    a. *Department of National Park and Wildlife Conservation*
    b. *Department of Soil Conservation and Watershed Management*
6. *Representative, Ministry of Energy*
7. *Representative of Ministry of Irrigation/Department of Water Induced Disaster and Prevention*
8. *Representative, Water and Energy Commission Secretariat*
9. *Representative, Ministry of Federal Affairs and Local Development*
10. *Representative, Ministry of Home Affairs*
11. *Representative, Donor Community*
12. *Representative, Kathmandu University and Tribhuwan University*
13. *Representative, Civil Society/NGO*
14. *Representative, Private Sector*
15. *Ministry of Tourism and Civil Aviation (and/or Nepal Tourism Board)*
16. *UNDP/GEF representative in the role of Senior Advisor (representing the interests of the parties providing funding to the project)*
17. *Representative from ICIMOD*
18. *National Project Director (NPD) appointed by the implementing partner (Member Secretary)*

- Additional functions of the PSC are to: (i) ensure that LDCF resources exclusively utilized to implement the activities that relate to the achievement of the approved project objectives and outcomes (ii) provide guidance to resolve an issue or a problem which PEB cannot settle, and facilitate with external partners to seek support for the project. There will be no remuneration to the PSC members funded by the project.

186. **Implementing Partner:** The implementing partner of this project will be responsible and accountable for achieving the project objective, outcomes and outputs in an effective and efficient manner. **The Department of Hydrology and Meteorology** as a national implementing partner under the guidance of the MoSTE will implement the project under National Implementation Guidelines of UNDP. DHM shall be overall responsible and accountable for the delivery of the project objectives, while working closely with DWIDP and DSCWN who will be responsible for providing inputs to planning, and technical oversight and monitoring of Component 2 of the project.

187. **Responsible Parties:** Under the overall guidance of MoSTE and direction of national implementing partner/DHM (who is responsible and accountable for the project implementation) the agencies below have been identified and confirmed as responsible parties who will be consulted and approached for collaboration and support during the project implementation.

- **The Department of Water Induced Disaster and Prevention** and **Department of Soil Conservation (DWIDP) and Watershed Management (DSCWM)** shall be responsible for providing inputs to planning, technical oversight and monitoring of the field activities under Component 2 of this project.

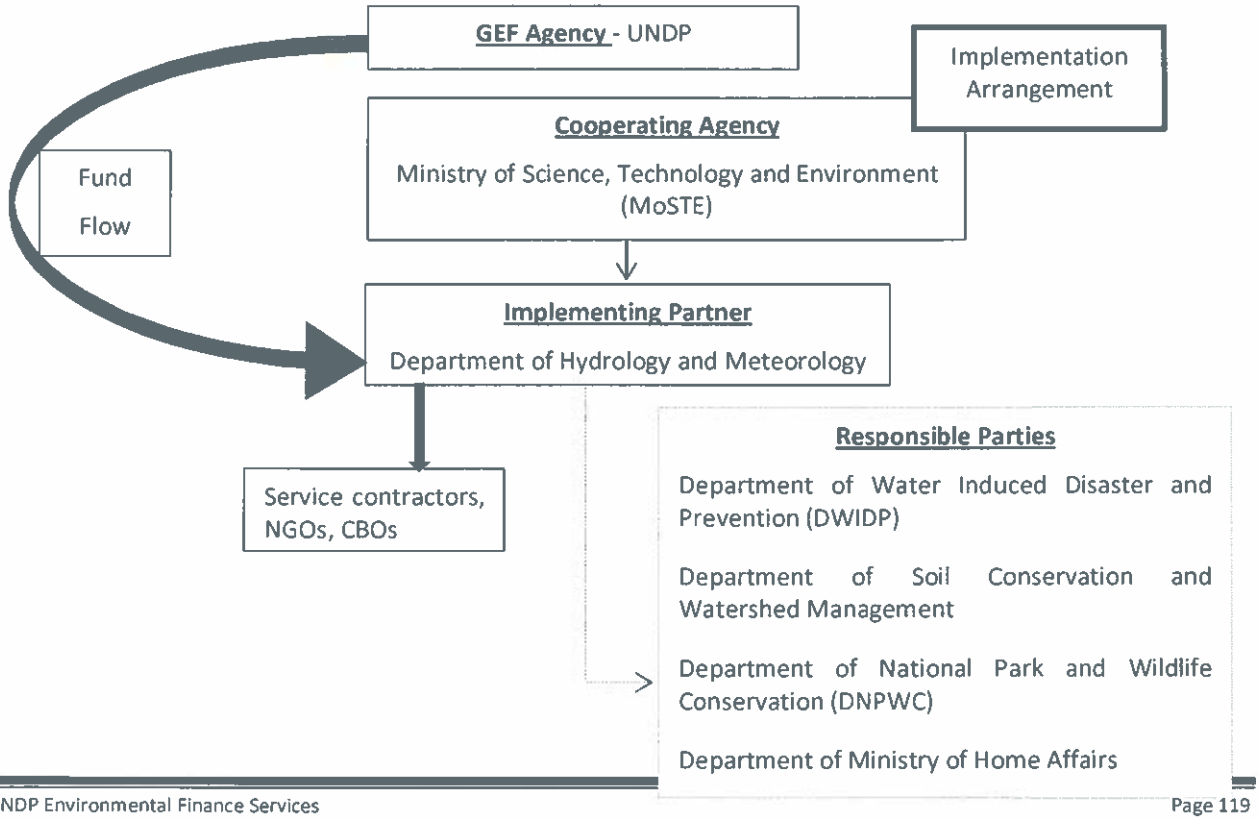
DSCWM will work closely with the DWIDP and Project management team to plan and implement field activities and deliver outputs that are under their mandate in accordance with the Stakeholder Involvement Plan (Annex 5), and the Annual Work Plan, once prepared and approved. They will also provide inputs to PEB and PSC meetings.

- The cooperating agency and national implementing partner will coordinate with **Ministry of Home Affairs (MoHA)** to establish linkages between local institutions, district line agencies of different sectors working on climate disaster risk reduction efforts with National Disaster Emergency centres and District Disaster Relief committees.

- The national implementing partner will coordinate with **Department of National Park and Wildlife Conservation (DNPWC)** to establish linkages between the project team and national park and buffer zone management committee in order to work smoothly in the Imja Glacial Lake and its surroundings (as it is situated in the Sagarthmatha National Park).

182. To facilitate smooth and effective implementation of project activities, a Project Steering Committee (PSC) and a Project Executive Board (PEB) will be established. The PSC will provide high-level strategic guidance to the project, while the Project Executive Board (PEB), under the guidance of the PSC, will be responsible for taking decisions with respect to project implementation and management, in line with the project mandates, work plans and guidelines.

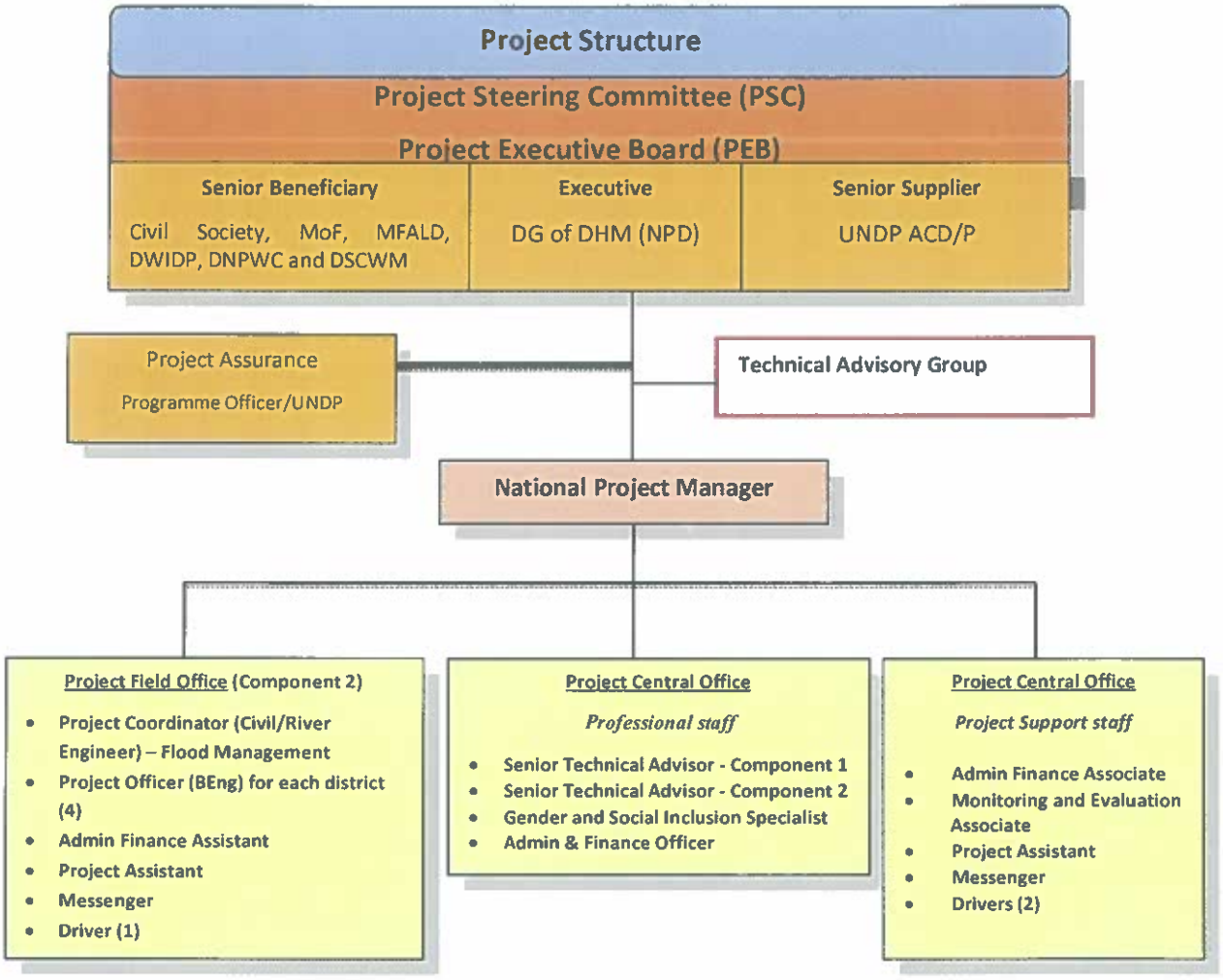
183. Due to highly technical nature of the project, the project will set up a *Technical Advisory Group* that will provide technical guidance and support to the project team during planning and implementation. The technical support and the guidance provided by the TAG will be discussed in the PEB or PSC (as relevant) and a decision will be taken if needed.



Project Executive Board: The Project Executive Board, under the guidance of the PSC, is the decision making body responsible for ensuring that the project implementation follows the agreed strategies of implementation, project outputs are produced as per the project objectives, and project inputs are best utilized for producing maximum outputs in a timely and cost effective manner. It reviews the progress of the project performance (substantive and financial) and approves the annual work plans, budgets and reports. The members of the Project Management Team (senior technical and admin/finance staff) may participate in the PEB meetings to provide clarifications and answer to the questions raised by the PEB members.

The PEB will have three roles described as follows:

- Project executive role – will be played by the National Executive Director of DHM as the representative of the Implementing Partner. S/he will chair the Board;
- Senior Supplier role – will provide guidance regarding the technical feasibility of the project which will be played by the Assistant Country Director of Energy, Environment and Climate Change unit of UNDP;
- Senior Beneficiary role – will be played by the representative from civil society organization (still to be decided), Ministry of Finance, Ministry of Local Development, Department of Hydrology and Meteorology, Department of Water Induced Disaster and Prevention, Department of Soil Conservation and Watershed Management and Department of National Park and Wildlife Conservation to ensure the interest of beneficiaries. PEB might also consider to invite local representatives from the project site if found appropriate during the implementation period.



182. **The National Project Director (NPD)** shall be appointed from DHM/MOSTE and will be responsible for overseeing overall project implementation and ensuring that the project objective and outcomes are achieved. The MoSTE will appoint a senior joint secretary from DHM to work as **The National Project Director (NPD)**. The NPD, assisted by Project Manager, will report to the PSC on project progress. The NPD will be responsible for coordinating the flow of results, financial authority and knowledge from the project to the PSC. The NPD will provide guidance to the Project Manager and Technical Advisors on both strategic and project implementation issues. The NPD will ensure that the inputs required from the implementing partners are secured in a timely fashion and that the project, in turn, works effectively with these agencies. The NPD will be supported by a full-time National Project Manager appointed by the project to enable him to discharge his responsibilities.

183. **National Project Manager (NPM):** The **NPM is a full-time project-funded staff member** who will be the Executive of the PEB/ NPD and will perform the following key functions. The NPM will be appointed by the project as per the NIM Guidelines, and will report to the NPD and receive guidance from the NPD and PEB. The NPM is responsible for the day-to-day management, administration, coordination, and technical supervision of project implementation. S/he will monitor work progress and ensure timely delivery of outputs in a cost effective manner as per the Annual Work Plans and the Project Results Framework. The Project Manager will ensure a high quality of project planning, management, implementation, technical

and financial compliance, progress reporting and monitoring. Additional required staff (see TORs in Annex 10) will be hired to support the NPM as follows.

184. ***Project Management and Support Staff:*** The Project Central Office will be housed within DHM/MOE, and headed by the National Programme Director (NPD). The project team, headed by the NPD, will be composed of a full-time project manager, specialists and advisors, engineers and support staff. The DHM will designate at least two of its senior technical staff to work in the project with other team members and they will spend at least 20% of their time in the project work. The DHM will provide necessary logistics support such as telephone, fax and electricity services on cost recovery basis for effective operation of the project office on day-to-day office.

185. Following staff will be hired by the project as per the NIM Guidelines for the entire duration of the project to ensure delivery of results as specified in the Project Results Framework. The professional and support staff team will work under the guidance of NPD and NPM.

Required project positions	Duties	Remarks
Senior Technical Advisors (STAs): 2	Component Team Leaders will be responsible for technical quality control and advisory services of both components of this project.	Both the STAs will be housed in the Project Central Office. One STA will be assigned to each component and will be responsible to lead/undertake activities as planned in the work plan.
Gender and Social Inclusion Specialist (GSIS): 1	GSIS will be responsible to ensure that gender and social inclusion aspects are integrated with all aspects of the project.	GSIS will oversee work of both components.
Project Coordinator (Civil Engineer) : 1	Support STA - Component 2 in designing structural and non-structural activities. PC will possess a good knowledge of flood risk management.	PC will be stationed at the Project Field Office (Component 2) and will head the field office.
Project Officers : 4	Support STA - Component 2 and PC to undertake activities as planned in the AWP in each district.	One PO will be assigned to each district and be responsible to undertake activities in close coordination with District level authorities.
Administration and Finance Officer (AFO): 1	AFO will be responsible for overall administrative and financial management as per the NIM regulations.	AFO will be housed at Project Central Office and will provide guidance to the AFAs both at Central and field offices for the overall project administrative and finance related activities.
Monitoring and Evaluation Associate (MEA): 1	MEA will be responsible for providing overall support to DWIDP and DHM as well as professionals in monitoring interventions along the project timeline	MEA will be housed in Project Central Office and will be supervised by NPM.
Administration and Finance Associate/Assistant (AFAs): 2	AFAs will assist AFO on overall administrative and financial management as per the NIM regulations.	One AFA will be housed at Project Central Office to assist the AFO on overall work. Another AFA will be housed at the Project Field Office to undertake project administrative and finance activities related to Component 2.
Project Assistants (PA): 2	PAs will be responsible for logistic, administration support and transport management tasks	One PA will be housed at Project Central Office to and the other will be housed at the Project Field Office.
Messenger: 2	Messengers will be recruited to assist both project offices directly under the AFAs to ensure smooth administration, managing documents/mails and cleanliness of the office premises.	One messenger will be housed in Project Central Office and the other will be housed in the Project Field Office.
Drivers : 3	-	Two drivers will be housed at Project Central Office and one will be housed

		at the Project Field Office.

182. **Technical Advisory Group:** The Technical Advisory Group (TAG) will be a 5-7 member team chaired by a senior expert with the knowledge of climatic hazard and supported by expert members from different fields including flood management, glacial lake inventory and risk management, hazard mapping and vulnerability assessment, policy and institution, and hydrologist and water engineers. During the implementation process, the group will be formed by involving experts within and outside the Government. The experts involved outside the Government will be remunerated for their time and effort as per the long term agreements that are relevant to achieving project outcomes and objective.

183. The TAG may also include international and national advisors who may be called upon to assist in technical matters. The TAG will be linked to technical specialists in the project and will help identify most technically appropriate climate risk reduction and adaptation options. The TAG will provide support on a need basis during the achievements of different outputs and outcomes of the project. The group will undertake the following tasks:

- Guide the PMT to finalize the structural design related to flood and GLOF risks.
- Guide the PMT to help manage engineering works in both of the components so that appropriate and cost-effective designs are chosen to meet project objectives.
- Review and verify the feasibility study, other relevant studies and data collected by the project team.
- Provide technical guidance and advice on overall project implementation work on both of the components.

182. **Project Assurance** - UNDP will ensure the application of UNDP administrative and financial procedures for the use of LDCF funds. UNDP will ensure project monitoring and evaluation according to an agreed upon schedule and in line with UNDP and LDCF requirements, as described further in Section 6. UNDP will assist in compiling lessons learned and sharing project experiences on a regional, national and international basis. Although the PEB has the overall quality assurance role of the project, project implementation will be supported through an additional assurance role performed by a designated UNDP Programme Officer/ Analyst.

VI. MONITORING FRAMEWORK AND EVALUATION

183. The project will be monitored through the following M& E activities. The M& E budget is provided in the table below.

Project start:

184. A Project Inception Workshop will be held within the first 4 months after the project is signed off on, providing a platform for all project stakeholders to review the project document in line with their envisaged roles and responsibilities. The Inception Workshop is crucial to building ownership for the project results and to plan the first year annual work plan.

185. A fundamental objective of the Inception Workshop will be to present the modalities of project implementation and execution, document mutual agreement for the proposed executive arrangements amongst stakeholders and assist the project team to understand and take ownership of the project's goals and objectives. Another key objective of the Inception Workshop is to introduce project staff with the UNDP expanded team which will support the project during its implementation, namely the UNDP CO, responsible RTA and other RCU staff.

186. The Inception Workshop will address a number of key issues including:

a) Assist all partners to fully understand and take ownership of the project. Detail the roles, support services and complementary responsibilities of UNDP CO and RCU staff vis à vis the project team. Discuss the roles, functions, and responsibilities within the project's decision-making structures, including reporting and communication lines, and conflict resolution mechanisms. The Terms of Reference for project staff and other project-related structures will be discussed again as needed in order to clarify for all, each party's responsibilities during the project's implementation phase.

b) Based on the project results framework and the relevant GEF Tracking Tool, finalize the first annual work plan. Review and agree on the indicators, targets and their means of verification, and recheck assumptions and risks.

c) Provide a detailed overview of reporting, monitoring and evaluation (M&E) requirements including roles and responsibilities for different M&E functions, with particular emphasis on the Annual Project Implementation Reviews (PIRs) and related documentation, the Annual Project Report (APR) as well as midterm and terminal evaluations. The Monitoring and Evaluation work plan and budget should be agreed and scheduled.

d) Plan and schedule Project Board meetings. Roles and responsibilities of all project organisation structures should be clarified and meetings planned. The first Project Board meeting should be held within the first 3 months following the inception workshop.

187. An Inception Workshop report is a key reference document and must be prepared and shared with participants to formalize various agreements and plans decided during the meeting.

188. Project audit will follow UNDP Financial Regulations and Rules and applicable Audit policies.

First Annual Workplan

189. After the Inception Workshop, the Project Management Team (PMT) will prepare the project's first Annual Work Plan (AWP), on the basis of the Project Results Framework (PRF). This will include reviewing the PRF (indicators, means of verification, assumptions and risks), imparting additional detail as needed on the basis of this exercise finalize the AWP with precise and measurable performance indicators and in a manner consistent with the expected outcomes for the project.

Quarterly:

190. Project progress made will be monitored in the UNDP Enhanced Results Based Managment Platform. Quarterly Progress Reports (QPR) will be prepared by the PMT and submitted to the UNDP CO for sharing with the UNDP Regional Team.

191. On a quarterly basis, a quality assessment shall record progress towards the completion of key results, based on quality criteria and methods captured in the Quality Management table as per the UNDP Nepal Project M & E Framework.

192. Based on the initial risk analysis submitted, the risk log will be regularly updated in ATLAS by reviewing the external environment that may affect the project implementation. Risks become critical when the impact and probability are high. Note that for UNDP GEF projects, all financial risks associated with financial instruments such as revolving funds, microfinance schemes, or capitalization of ESCOs are automatically classified as critical on the basis of their innovative nature (high impact and uncertainty due to no previous experience justifies classification as critical).

193. An Issue Log shall be activated in Atlas and updated by the Project Manager to facilitate tracking and resolution of potential problems or requests for change.

194. Based on the above information recorded in Atlas, a Project Progress Reports (PPR) shall be submitted by the Project Manager to the Project Board through Project Assurance, using the standard report format available in the Executive Snapshot.

195. A project Lesson-learned log shall be activated and regularly updated to ensure on-going learning and adaptation within the organization, and to facilitate the preparation of the Lessons-learned Report at the end of the project.

196. A Monitoring Schedule Plan shall be activated in Atlas and updated to track key management actions/events. The use of these functions is a key indicator in the UNDP Executive Balanced Scorecard.

Annually:

197. An Annual Review Report (ARR) shall be prepared by the Project Manager and shared with the Project Board and the Outcome Board. As minimum requirement, the Annual Review Report shall consist of the Atlas standard format for the QPR covering the whole year with updated information for each above element of the QPR as well as a summary of results achieved against pre-defined annual targets at the output level.

198. Annual Project Review/Project Implementation Reports (APR/PIR): This key report is prepared to monitor progress made since project start and in particular for the previous reporting period (30 June to 1 July). The APR/PIR combines both UNDP and GEF reporting requirements. Based on the ARR, an annual project review shall be conducted during the fourth quarter of the year or soon after, to assess the performance of the project and appraise the Annual Work Plan (AWP) for the following year. In the last year, this review will be a final assessment. This review is driven by the Project Board and may involve other stakeholders as required. It shall focus on the extent to which progress is being made towards outputs, and that these remain aligned to appropriate outcomes.

199. The APR/PIR includes, but is not limited to, reporting on the following:

- Progress made toward project objective and project outcomes - each with indicators, baseline data and end-of-project targets (cumulative)
- Project outputs delivered per project outcome (annual).
- Lesson learned/good practice.
- AWP and other expenditure reports
- Risk and adaptive management
- ATLAS QPR
- Portfolio level indicators (i.e. GEF focal area tracking tools) are used by most focal areas on an annual basis as well.

Periodic Monitoring through site visits:

200. UNDP CO and the UNDP RCU will conduct visits to project sites based on the agreed schedule in the project's Inception Report/Annual Work Plan to assess first hand project progress. Other members of the Project Board may also join these visits. A Field Visit Report/BTOR will be prepared by the CO and UNDP RCU and will be circulated no less than one month after the visit to the project team and Project Board members.

Mid-term of project cycle:

201. The project will undergo an independent Mid-Term Evaluation at the mid-point of project implementation (March 2015). The Mid-Term Evaluation will determine progress being made toward the achievement of outcomes and will identify course correction if needed.

It will focus on the effectiveness, efficiency and timeliness of project implementation; will highlight issues requiring decisions and actions; and will present initial lessons learned about project design, implementation and management. Findings of this review will be incorporated as recommendations for enhanced implementation during the final half of the project's term. The organization, terms of reference and timing of the mid-term evaluation will be decided after consultation between the parties to the project document. The Terms of Reference for this Mid-term evaluation will be prepared by the UNDP CO based on guidance from the Regional Coordinating Unit and UNDP-GEF. The management response and the evaluation will be uploaded to UNDP corporate systems, in particular the UNDP Evaluation Office Evaluation Resource Center (ERC).

202. The relevant GEF Focal Area Tracking Tool, the AMAT, will also be completed during the mid-term evaluation cycle.

End of Project:

203. An independent Final Evaluation will take place three months prior to the final Project Board meeting and will be undertaken in accordance with UNDP and GEF guidance. The final evaluation will focus on the delivery of the project's results as initially planned (and as corrected after the mid-term evaluation, if any such correction took place). The final evaluation will look at impact and sustainability of results, including the contribution to capacity development and the achievement of global environmental benefits/goals. The Terms of Reference for this evaluation will be prepared by the UNDP CO based on guidance from the Regional Coordinating Unit and UNDP-GEF.

204. The Terminal Evaluation should also provide recommendations for follow-up activities and requires a management response which should be uploaded to PIMS and to the UNDP Evaluation Office Evaluation Resource Center (ERC).

205. The GEF Focal Area Tracking Tool, the AMAT, will also be completed during the final evaluation.

206. During the last three months, the project team will prepare the Project Terminal Report. This comprehensive report will summarize the results achieved (objectives, outcomes, outputs), lessons learned, problems met and areas where results may not have been achieved. It will also lay out recommendations for any further steps that may need to be taken to ensure sustainability and replicability of the project's results.

Learning and knowledge sharing:

207. Results from the project will be disseminated within and beyond the project intervention period through existing information sharing networks and forums like national knowledge management institutions, national/regional and international workshops and seminars.

208. The project will identify and participate, as relevant and appropriate, in scientific, policy-based and/or any other networks, which may be of benefit to project implementation

though lessons learned. The project will identify, analyze, and share lessons learned that might be beneficial in the design and implementation of similar future projects.

209. Finally, there will be a two-way flow of information between this project and other projects of a similar focus nationally, regionally and internationally. Experiences from Tsho Rolpa in Nepal, LDCF project on GLOF in Bhutan and GLOF project in Pakistan will be most relevant during the implementation of this project. Experiences between other mountain countries will also be promoted through projects like High Mountain Glacial Watershed Project.

Communications and visibility requirements:

210. Full compliance is required with UNDP and GEF Branding Guidelines. These can be accessed at http://intra.undp.org/coa/branding.shtml, and specific guidelines on UNDP logo use can be accessed at: http://intra.undp.org/branding/useOfLogo.html. Among other things, these guidelines describe when and how the UNDP logo is required to be used, as well as how the logos of donors to UNDP projects are required to be used. To avoid any misuse, when logo use is required, the UNDP logo needs to be used alongside the GEF logo. The GEF logo can be accessed at: http://www.thegef.org/gef/GEF_logo. The UNDP logo can be accessed at http://intra.undp.org/coa/branding.shtml.

211. Full compliance is also required with the GEF's Communication and Visibility Guidelines ("GEF Guidelines") which can be accessed at: http://www.thegef.org/gef/sites/thegef.org/files/documents/C.40.08_Branding_the_GEF%20final_0.pdf. Among other things, the GEF Guidelines describe when and how the GEF logo needs to be used in project publications, vehicles, supplies and other project equipment. The GEF Guidelines also describe other GEF promotional requirements regarding press releases, press conferences, press visits, visits by Government officials, productions and other promotional items.

Where other agencies and project partners have provided support through co-financing, their branding policies and requirements should be similarly applied.

M&E Workplan and Budget

Type of M&E activity	Responsible Parties	Budget US$ *Excluding project team staff time*	Time frame
Inception Workshop and Report	▪ NPD, NPM and Project Board ▪ UNDP CO, UNDP GEF	10,000	Within first four months of project start up
Measurement of Means of Verification	▪ UNDP GEF RTA ▪ Project Manager will	To be finalized in Inception	Start, mid and end of project (during evaluation cycle) and

Type of M&E activity	Responsible Parties	Budget US$ *Excluding project team staff time*	Time frame
of project results/Impacts (Outcomes & Objective Indicators).	oversee the hiring of specific studies and institutions, and delegate responsibilities to relevant team members.	Phase and Workshop.	annually when required.
Measurement of Means of Verification for Project Progress on *output and implementation*	▪ Oversight by Project Manager ▪ Project team	To be determined as part of the Annual Work Plan's preparation.	Annually prior to APR/PIR and to the definition of annual work plans
ARR/PIR	▪ NPD, NPM and team ▪ UNDP CO ▪ UNDP RTA ▪ UNDP EEG	None	Annually
Periodic status/ progress reports	▪ Project manager and team	None	Quarterly
Project Board Meetings	▪ PB Members, including NPD, Ministry of Finance, Ministry of Federal Affairs and Local Development, Department of Sagarmatha National Park and Wildlife Conservation; Department of Water Induced Disaster and Prevention & UNDP CO ▪ NPM & PMT	None	Every quarter (four times in a year, once on completion of the APR/PIR and more frequently if needed
ATLAS QPR	▪ PMT ▪ UNDP CO	None	Quarterly
Mid-term Evaluation	▪ Project manager and team ▪ UNDP CO	40,000[23]	At the mid-point of project implementation.

[23] USD 40,000 will be charged to LDCF

Type of M&E activity	Responsible Parties	Budget US$ *Excluding project team staff time*	Time frame
	▪ UNDP RCU ▪ External Consultants (i.e. evaluation team)		
Final Evaluation	▪ NPD, Ministry of Science, Technology and Environment, Project manager and team, ▪ UNDP CO ▪ UNDP RCU ▪ External Consultants (i.e. evaluation team)	40,000	At least six months before the end of project implementation
Project Terminal Report	▪ NPD, Project manager and team ▪ UNDP CO ▪		At least three months before the end of the project
Audit	▪ UNDP CO ▪ Project manager and team	12,000	Yearly
Visits to field sites	▪ UNDP CO* ▪ UNDP RCU* (as appropriate) ▪ Government representatives	For GEF supported projects, paid from IA fees and operational budget	Yearly
TOTAL indicative COST[1] **Excluding project team staff time and UNDP staff and travel expenses**		US$ 102,000 (+/- 5% of total budget)	

- Costs covered by IA fee: USD 62,000
- Costs covered by LDCF: USD 40,000

VII. LEGAL CONTEXT

If the country has signed the *Standard Basic Assistance Agreement (SBAA)*, the following standard text must be quoted:

212. This document together with the CPAP signed by the Government and UNDP which is incorporated by reference constitute together a Project Document as referred to in the SBAA [or other appropriate governing agreement] and all CPAP provisions apply to this document.

213. Consistent with the Article III of the Standard Basic Assistance Agreement, the responsibility for the safety and security of the implementing partner and its personnel and property, and of UNDP's property in the implementing partner's custody, rests with the implementing partner.

214. The implementing partner shall:

a) put in place an appropriate security plan and maintain the security plan, taking into account the security situation in the country where the project is being carried;

b) assume all risks and liabilities related to the implementing partner's security, and the full implementation of the security plan.

215. UNDP reserves the right to verify whether such a plan is in place, and to suggest modifications to the plan when necessary. Failure to maintain and implement an appropriate security plan as required hereunder shall be deemed a breach of this agreement.

216. The implementing partner agrees to undertake all reasonable efforts to ensure that none of the UNDP funds received pursuant to the Project Document are used to provide support to individuals or entities associated with terrorism and that the recipients of any amounts provided by UNDP hereunder do not appear on the list maintained by the Security Council Committee established pursuant to resolution 1267 (1999). The list can be accessed via http://www.un.org/Docs/sc/committees/1267/1267ListEng.htm. This provision must be included in all sub-contracts or sub-agreements entered into under this Project Document.

Local Project Appraisal Committee Meeting
for
Community Based Flood and Glacial Lake Outburst Risk Reduction Project
10 April 2013

UN Conference Hall
Pulchowk, Lalitpur

Minutes

Participants: As per Annex 1

Agenda:

1. Welcome remarks by Mr. Jorn Sorensen, Deputy Country Director (DCD), UNDP
2. Presentation of "Community Based Flood and Glacial Lake Outburst Risk Reduction Project" by Vijaya Singh and Anupa Rimal Lamichhane - Energy, Environment and Climate Change Unit (EECCU), UNDP
3. Discussion
4. Closing remarks by Dr. Rishi Ram Sharma, Director General – Department of Hydrology and Meteorology
5. Vote of thanks by Ms. Lazima Onta Bhatta, Assistant Country Director – Strategic Planning and Development Effectiveness Unit (SPDEU), UNDP

Proceedings:

Mr. Jorn Sorensen welcomed all the participants and highlighted the purpose of holding Local Project Appraisal Committee (LPAC) meeting of the first NAPA follow up project that has been successful to access funds from the "Least Developed Countries Fund (LDCF)" managed by GEF. He expressed UNDP's continued interest to work and support the Government of Nepal on Climate Change Adaptation issues in the years to come. He also shared that proposed project will pave the way for more coordinated efforts in this sector by collaborating with relevant partners.

He commended on Energy, Environment and Climate Change Unit's efforts in fulfilling GEF requirements and designing a strong project document within the given time frame. He also shared that during the process, efforts of UNDP Regional Centre in Bangkok and UNDP Headquarter have been very effective in assuring the quality and timeliness of this project formulation process. Having said this, he requested the Energy, Environment and Climate Change Unit to proceed with the presentation as per the agenda.

Mr. Vijaya Singh, Assistant Country Director, EECC Unit briefed the significance and background of the 1st LDCF funded project after the submission of NAPA document from Nepal. He emphasized that the Government of Nepal based on the priorities identified under NAPA document; requested UNDP based on its comparative advantage to spearhead the project formulation. As per the NAPA document, UNDP was requested to develop a project by combining profile 3 and 4 (Community-based Disaster Management for Facilitating Climate

Adaptation and Glacial Lake Outburst Flood Monitoring and Disaster Risk Reduction) and submit to GEF Secretariat with approval from Government of Nepal.

The full size project was submitted to GEF Secretariat on November 2012 by incorporating inputs from all relevant ministries and key stakeholders – Ministry of Finance, Ministry of Science, Technology and Environment, Ministry of Forest and Soil Conservation, Department of Water Induced Disaster and Prevention, Department of Soil Conservation and Watershed Management to name a few. He especially mentioned the role of International Centre for Integrated Mountain Development (ICIMOD) in providing technical support in formulation of the project document and support of Kathmandu University (KU) through ADAPT Asia facility of USAID.

The technical part of the presentation was made by Ms. Lamichhane explaining about the context - situational analysis, project objectives, outcomes, outputs, sites, challenges/risks and the way forward of the proposed project (Please find Presentation as enclosed in Annex 2). She also shared that UNDP conducted an Environmental and Social Screening assessment during the project formulation stage and the recommendations from the screening will be undertaken during the project implementation stage (Summary in Annex 2).

Points raised and discussed:

Mr. Jorn Sorensen (UNDP) appreciated the presentation and opened the floor for queries, suggestions and clarification. He also enquired if the drainage of the Imja Glacial Lake will be maintained at 3 meters after the project intervention. He gave emphasis that sharing the knowledge from other countries will be important.

Mr. Tulsi Sharma (DNPWC) enquired about the size of the lake as there were many different figures being found in various articles. He also questioned if the formulation team had taken inputs and communicated with University of Tokyo team who have conducted various kind of work for long time. He also enquired if Ministry of Soil Conservation and Forestry have been contacted during the formulation process and if projects like President Churia Conservation have been taken into consideration while designing activities under Component 2.

Dr. Arun Bhakta Shrestha (ICIMOD) appreciated the good work and also shared that UNDP has taken a good approach by coordinating and collaborating with all the relevant partners right from the beginning who are working in the proposed project sites. Since there have been many un-coordinated activities especially in the Imja Glacial Lake, a good coordinated collective effort is necessary to benefit the community and this project exhibits this approach. He also shared that in the past many researchers have gone to Imja and have done various kind of research but not disseminated widely. He shared his observations on the project document as follows.

a) He emphasized that it is very important to understand the actual status of the Imja Lake and its surroundings before any intervention takes place.
b) He commented that community based is a good approach but it is important for the project to identify good mechanism to work with the community by linking with technical inputs needed for establishing Early Warning Systems in place.
c) He responded that the size of the lake is 0.9596 km^2. He further suggested that though the project document has indicated an outline of what needs to be done, there will be a need to review/conduct many studies/assessments before the intervention starts.
d) He enquired the role of ICIMOD as well as others attending the LPAC during the implementation of the project.

Dr. Ramesh Maskey (KU) commended UNDP's efforts in coordinating non-coordinated approaches in and around Imja Glacial Lake. He suggested that during implementation a team of experts should be sent to oversee the drainage work done at Tsho Rolpa Glacial Lake and also figure out options if further lowering of Imja Glacial Lake is required than 3 meters. Dr. Maskey also shared that without collaborating with locals it will be difficult to work there. In addition to the project intervention, the demand of the locals is to install a micro/mini-hydro system downstream of Imja River, if possible. He suggested the project to re-assess their demand and see if it is possible to incorporate in the project document.

Mr. Yam Nath Sharma (UNDP) appreciated the efforts of developing such a technical sound project and requested clarification on community's role, their involvement and their perception about the risk that persists in the area. He also enquired that the District Headquarters in context to Solukhumbu district is far from the project site (Imja Glacial Lake) and what approach is the proposed project taking to coordinate with the community on a regular basis. He also wanted to know how the local Government Agencies will be involved in the project.

Mr. Binod Parajuli (DHM) shared that Early Warning System is Tsho Rolpa was a failure because it was not sustainable and enquired how the Community Based Early Warning System will be sustainable after the completion of the project.

Ms. Lazima Onta Bhatta (UNDP) pointed out that the proposed project has many partners and different governing committees like Steering Committee and Project Board Committee. She suggested for clarity on roles of these different committees.

Ms. Jenty Kirch-Wood (UNDP), while appreciating the new project, commended on efforts and dedication of Government of Nepal/DHM for leading the Nepal Risk Reduction Consortium and promoting Community Based Early Warning Systems through various initiatives. She said the partnership with GON/DHM has been very fruitful during the implementation of Comprehensive Disaster Risk Management Programme and likewise this project provides opportunity for UNDP to work collaborative with GON/DHM on this globally significant project.

Mr. Arjun Thapa (MOSTE) requested clarification on the kind of activities that the project has proposed to implement and was there any connection between the component 1 and component 2 during site selection.

Mr. Jorn Sorensen (UNDP) welcomed all inputs, comments and suggestions and assured the participants that the EECC team will try to incorporate their inputs as appropriate in the project document, during the inception workshop and the implementation of the project. He also emphasized that now the country does not need any more data but needs action to benefit vulnerable community to climate induced disasters, which is the focus of UNDP Nepal. He supported the idea of setting up a Technical Advisory Group to help the project in making decisions on technical matters and emphasized the need for collaborating with partners working in Imja Lake area. Having said this he excused himself from providing vote of thanks because of time limitation and handed over the responsibility to Ms. Lazima Onta Bhatta, ACD to represent him.

Mr. Vijaya Singh and Ms. Anupa Rimal Lamichhane (UNDP) thanked everyone for all their queries / contribution and provided inputs and clarifications. They shared that the queries

received are more towards clarification and recommendation during the implementation time. They assured that the suggestions received today will be reviewed / incorporated during the inception workshop of this project as well as during the implementation.

- In response to the size, management and intervention on the Imja Lake, it was clarified that the project will constantly maintain drainage/reduction of the water from the lake at 3 meters. The project will be reviewing all the relevant assessments and research reports from all researchers (including University of Tokyo) to verify and validate the existing information before making any intervention in the lake. It was also shared that due to the technical nature of the project, setting up of a Technical Advisory Group has been proposed in the management arrangement who will be the team of experts (nationals and internationals) working in the region and/or on Glacial Lakes management to ensure, make scientific decisions any validation of data, research and assessments.

- It was shared that currently UNDP Nepal is also coordinating with research institutions like University of Texas and TMI who is implementing High Mountain Glacial Watershed Project and undertaking various kinds of studies in the Imja Glacial Lake. The purpose of coordination is to bring all the actors together to collectively work on this area to benefit the community during the implementation process.

- Clarifying the role of community and their perception of risk, it was shared that locals are concerned and in fact the lake is worshiped by the local community. Hence any activity in the project site has to be consulted with the community. The project has understood the dynamics of local community living downstream of Imja Lake and plans to work together with DDC, Buffer Zone community, Local Youth clubs, local tourism associations and other community organizations. Since DDC is very far, the project has proposed to set up a Glacial Lake Risk Management Committee including local leaders, school teachers, youth, women and people from marginalized vulnerable communities who live downstream of the lake. In addition, to also get locals confidence and to conserve of forest (for fuelwood); the project document has listed this option to explore further on the development of micro/mini hydro system downstream of Imja River. With the help of ADAPT Asia and KU during the project formulation period, as pre-feasibility was undertaken to see the possibilities. Mr. Sharma (DNPWC) acknowledge this good move and shared that there is a possibility to work collaboratively with the community who are capable of making monetary contributions to establish such a plant.

- Responding to the query on roles of key partners and committees (as mentioned in the management arrangement), it was clarified that these partners will be the members of the steering committee. The role of Steering Committee will be to provide guidance to this project and it is chaired by MOSTE. MOSTE is the focal Ministry for UNFCCC and has a mandate to coordinate CC project in the country. ICIMOD is seen as technical partner to the project during implementation of both components due to their strengths in the

subject matter. ICIMOD as a knowledge organization together with Universities may also support the project for knowledge exchange for both the components. They can support/coordinate to package the learnings' of similar projects that UNDP has supported in the region like Bhutan and Pakistan along with this proposed project for policy dialogue and advocacy in the region. They will also be part of the Technical Advisory Group.

- Likewise the project team based at DHM will closely work with Government Agencies like DWIDP, DSCWM, DNPWC, MOFALD during the implementation of the project at the field level. And agencies like DWIDP and DSCWM and DNPWC will also play oversight and monitoring role during the implementation. The role of PEB as per the NEX standards will be the main decision making body to support project execution in a timely, efficient and effective manner.

- Responding to the queries on Component 2, it was clarified that the project formulation team consulted MOFSC during most of the consultation meetings. To create synergy and align with Government's initiatives like President Churia Conservation Project and People's Embankment Programme, the proposed project plans to work with DSCWM and DWIDP collectively on the upstream and downstream of the Churia range. The activities identified under this project are aligned with the two initiatives mentioned.

- Responding the query on project activities and site, it was clarified that the activities of both the component are limited to its context and there is no connection between the Upstream (GLOF) and Downstream (Flood) site except they are on the same region which was identified based on the vulnerability assessment report published by NAPA project.

Closing Remarks:

Dr. Rishi Ram Sharma (DHM), in his remarks thanked all the participants for their valuable contribution in the LPAC meeting. He shared that the inputs provided will help to improve the project document and hence the suggestions shall be taken into consideration during the inception workshop and implementation of project. He shared that the risk and threat are different in context to GLOF in the mountain and Floods in the Tarai. DHM as the implementing agency with the help of other partners plans to implement effective Community Based Early Warning Systems (CBEWS) that can minimize the risk/threat levels in both regions (mountain and terai). He shared that it is important for the GoN to ensure safety of the community living downstream of the GLOF impact zone and also understanding that it might not happen ever as GLOF is very uncertain. He emphasized that getting the community prepared and making them climate resilient is important and hence this will be a priority for DHM.

He also shared that DHM has been working on generating real time data in the West Rapti and Karnali region which has improved the information flow among the vulnerable communities. He also added that sustainability of these installed CBEWS in the vulnerable communities is important for which monitoring/maintenance is required on a regular basis. DHM plans to

discuss this matter with Ministry of Finance to allocate budget for monitoring these installed systems for smoother long term operation.

He also emphasized that this proposed project is challenging in order to reduce risks of the vulnerable communities living downstream of GLOF and Flood Impact Zone. The achievements and learnings' of this project hence should be well disseminated and shared in the region which can assist to undertake similar projects in Nepal and/or in the region.

Lastly, he again thanked all the partners for their active participation and especially to the Government officials who attended the event despite a Government holiday. He endorsed the project document and suggested the team to submit the improved project document to the Government of Nepal for signatures. He also shared that the team at DHM are interested and eagerly waiting to launch this significant programme.

Vote of Thanks:

At the end, **Ms. Bhatta (UNDP)** provided a vote of thanks to all the distinguished participants for their valuable remarks and comments made on the proposed project document. She concluded the LPAC meeting with following note.

a. The proposed project document on Community Based Flood and Glacial Lake Outburst Floods Risk Reduction Project has been approved by LPAC.
b. The project document will be revised / improved based on the review, suggestions and comments received.
c. UNDP will present the revised document to the Government for signatures.
d. The LPAC minute will be shared to all the participants for further comments, if any.

With this assurance, she thanked all participants for their valuable contribution and endorsement of the project. The meeting adjourned at 13:00 hours.

ANNEX 1: PARTICIPATION LIST

S.N.	Name	Organization	Designation	Signature
1.	Rishi Sharma	DHM	Director General	
2.	Jorn Sorensen	UNDP	DCD	
3.	Vijaya Singh	UNDP	ACD	
4.	Arun Bhakta Shrestha	ICIMOD	Programme Manager	
5.	Lazima Onta Bhatta	UNDP	ACD	
6.	Jenty Kirsch-Wood	UNDP	DRM Unit Head	
7.	Ramesh Kumar Maskey	Kathmandu University	Professor/Head of Department	
8.	Yam Nath Sharma	UNDP	ACD	
9.	Tulasi R Sharma	DNPWC	Planning Officer	
10.	Dennis Curry	UNDP	ACD, Peace building and Recovery Unit	
11.	Rijan Bhakta Kayastha	Kathmandu University	Assistant Professor	
12.	Arjun Kumar Thapa	MoSTE	Under Secretary	
13.	Anupa Rimal Lamichhane	UNDP	Climate Change Program Analyst	
14.	Shreekamal Dwivedi	DWIDP	Eng. Geologist	
15.	Binod Lamsal	UNDP	Program Finance Analyst	
16.	Rajendra Sharma	DHM	S.D Hydrologist	
17.	Binod Parajuli	DHM	Hydrologist	
18.	Binda Magar	UNDP	Gender and Social Inclusion Programme Specialist	
19.	John Narayan Parajuli	UNDP	Communications Analyst	
20.	Bikram Shrestha Zoowa	DHM	Hydrologist	
21.	Dhanbir Yadav	DHM	Hydrologist	

ANNEX 2: ENVIRONMENTAL AND SOCIAL SCREENING SUMMARY

Name of Proposed Project: Community Based Flood and Glacier Lake Outburst Risk Reduction Project

A. Environmental and Social Screening Outcome

Select from the following:

Category 1. No further action is needed

✓ Category 2. Further review and management is needed. There are possible environmental and social benefits, impacts, and/or risks associated with the project (or specific project component), but these are predominantly indirect or very long-term and so extremely difficult or impossible to directly identify and assess.

✓ Category 3. Further review and management is needed, and it is possible to identify these with a reasonable degree of certainty. If Category 3, select one or more of the following sub-categories:

✓ Category 3a: Impacts and risks are limited in scale and can be identified with a reasonable degree of certainty and can often be handled through application of standard best practice, but require some minimal or targeted further review and assessment to identify and evaluate whether there is a need for a full environmental and social assessment (in which case the project would move to Category 3b).

Category 3b: Impacts and risks may well be significant, and so full environmental and social assessment is required. In these cases, a scoping exercise will need to be conducted to identify the level and approach of assessment that is most appropriate.

B. Environmental and Social Issues (for projects requiring further environmental and social review and management)

The development activities proposed under this project are within the natural reserves and protected areas, their effect on the conservation of biodiversity would need special consideration. The project also involve in significant extraction and diversion of surface water. Imja Lake - the project location, has spiritual significance for the local community and would raise certain concerns from the community. While sufficient precautionary activities through scientific reviews and impact assessments are envisaged, the vulnerability assessment could be considered to make the safety and evacuation plan more inclusive. Altitude sickness could also be of one of the areas of concerns for the people involved in implementing the project activities.

C. Next Steps (for projects requiring further environmental and social review and management):

Since the project activities cover adequate precautions related to environmental effects, no immediate actions prior to the approval of the project is required. However, during the implementation stage, specific activities addressing the issues raised above need to be ensured during the preparation of annual work plans.

D. Sign Off

Project Manager Imja Lanichhane **Date** 28 March 2013

PAC **Date** 10 April 2013

Programme Manager **Date** 29 April 2013