Climate Responsive Integrated Watershed Management Plan

For



Molung Watershed, Okhaldhunga



Government of Nepal | United Nations Development Programme Forestry Complex, Babarmahal, Kathmandu, Nepal

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Executive Summary

1. Background and Objective

The initiative was taken through the "Developing climate resilient livelihoods in the vulnerable watershed in Nepal (DCRL)" project implemented jointly bu Government of Nepal and UNDP under financial support of Global environment Facility (GEF). The consortium of NESS-DSC-GES JV has been selected to complete the assignment "Preparation of Climate Responsive Integrated Watershed Management Plans (CRIWMP) for Molung Watershed". The main objective of the CRIWMP is to develop/formulate climate responsive evidences based on the baseline and problem analysis, and formulation of practical coping strategies for watershed planning and interventions to prepare climate resilient livelihood at both watershed and government unit level i.e. Palika level. This report is mainly focused on the Molung watershed.

2. Rational of the CRIWMP

Molung Watershed have a similar bio-physical condition; most fragile ecosystems characterized by steep slopes, fragile geology, poor agricultural potential, and water scarce area. The rationale behind a CRIWMP preparation is to identify the issues, problems, and solutions related to watershed management and ensure sustainable watershed resource management.

3. Thematic Area

Field level consultation and interaction identified that a climate-responsive integrated watershed management plan should incorporate several thematic components to effectively address the challenges posed by climate change. However, it's important to customize the plan based on local conditions, stakeholder priorities, and available resources to ensure its effectiveness and sustainability. Some recommended key thematic components for sub-watershed management are as follows: Sustainable Agriculture and Land Management; Forest and Biodiversity Conservation; Water Induced Disaster Risk Reduction; Water Resource Management; and Capacity building.

4. <u>Methodology</u>

The overall approach consists of primary and secondary data collection, literature review, and detailed analysis based on the baseline and field work with specific focus on study area. The work completed in three phases i.e. inception, field, and office work. In the inception phase, the team of expert initiated the collection of data, literature review of relevant studies, stakeholder consultation, detail questionnaire & checklists preparation, and ward wise high resolution google earth image in A_0 size were prepared and field execution plan were discussed and finalized with Client and stakeholder.

In field work phase, identification, selection, and training to enumerators for each Palika in consultation with Palika officials to collect the data and information from each ward of Palikas as per the prescribed format of questionnaires, checklist, maps, KII, and FGD. The team of expert did district level and Palika level consultation to validate the information collected through primary and secondary sources as discussed earlier.

In reporting phase, the collected data were analyzed, visualized, and related maps, graphs, tables, charts, and frameworks were prepared. The issue raised by client during initial sample draft presentation were incorporated and prepared draft report of all the Palikas, and those report were shared with the Client. The validation and consultation workshop at each Palika were done, information were updated and final report was prepared and submitted to the Client.

5. Plan Policy

The constitution of Nepal guarantees the fundamental right to a healthy environment and assigns powers to different levels of government for managing natural resources, including watersheds. The Local Government Operation Act empowers local governments to develop and implement watershed management plans, emphasizing community participation. The National Framework on Local Adaptation Plans for Action recognizes the importance of integrating climate change concerns into watershed management. The Fifteenth Periodic Plan focuses on coordinated implementation across all levels of government, addressing issues such as soil erosion, land rehabilitation, and water resource conservation. It emphasizes the construction of small-scale water storage facilities and renewable energy sources. However, barriers exist, including limited area coverage, funding constraints, coordination challenges, weak institutional capacity, limited awareness, and inadequate data. The plan establishes linkages between federal, provincial, and local governments. Improvised recommendations include comprehensive sub-watershed management plans, improved institutional setup, and integration of Environmental Impact Assessment with infrastructure development, capacity building, and reforestation, promotion of sustainable agriculture practices, and strengthened monitoring and evaluation.

6. Role and Responsibility

Government institutions at various levels play essential roles in implementing the watershed management plans. Federal ministries provide policy guidance, technical support, and strategic direction. Provincial ministries focus on coordination, policy formulation, and capacity building, while district-level institutions are responsible for field-level implementation. Local governments is also responsible to plan, implementation, resource mobilization, and community engagement. The successful implementation of the watershed management plan requires collaboration and coordination among these stakeholders. Through their collective efforts, they can effectively manage natural resources, address climate change impacts, and achieve sustainable watershed management, leading to improved resilience, ecosystem health, and community well-being.

7. Situation Analysis of Molung Watershed

7.1 Location and topography feature

Molung watershed is one of the sub watersheds of Sun Koshi Watershed. It lies in Okhaldhunga district of Koshi Province. The total area of Molung watershed is about 411 km² and its elevation varies from 359 m to 3,579 meters above sea level (masl). Molung watershed covers five Municipalities namely Sunkoshi, Molung, Khijidemba, Siddhicharan and Mahebhanjyang. Two Municipalities Siddhicharan and Mahebhanjyang share both Lower Dudhkosi and Molung watersheds. There are 26 wards in Molung watershed. Most parts of Molung watershed fall under elevation within 1000-2500 m. About 68% of land is covered with forest, 26.3% of land with agriculture land, 5.2% with grass land, 0.2% of water body, 0.3% with built-up area (source: four decade of land use land cover data set of ICIMOD for the year 1990, 2000, 2010, and 2019). The pattern shows the decrease of agriculture land, with increase built-up area, grassland and forest. This watershed is dominant with quartize soil covering 43% of Molung watershed followed by 39 % of Gneiss, slate/phyllite by 19% and Fluvial non calcareous by 0.02%. In Molung watershed, about 41% of Municipality come under warm temperate climate followed by Sub-tropical monsoon (39%), cool temperate climate (21%). Molung watershed is rich in water resource having wide number of large and Small River. As per primary survey, there are more than 60 small and large rivers in Molung watershed. There are 26 sub watersheds with varying area from maximum 43 km² and minimum 4 km².

7.2 Socio economic condition

According to 2021 census, conducted by Central Bureau of Statistics (CBS), Molung Watershed have total population of 49,704 with male 24,128 and female 25,576 and population density is 121 per kilometer square. Total number of household is 12,243 with average household size is 4.

The average literacy rate of Molung watershed is 74.8% of which 82.2% is Male and 67.8% is Female. Higher number of people have studied Education stream followed by Management, Humanity and Science technology. Slightly literacy rate is minimum at Sunkoshi and highest at Manebhanjyang Municipality. 74.7% of population are economically active.

7.3 Agriculture and irrigation

The main source of livelihood of the people in this watershed is agriculture which is only at subsistence level. Major crops grown and suitable on these types of soil are maize, millet, wheat, rice, potato, vegetables, fruits, spices, cash crops, pulses and oilseeds. According to field survey, productivity within last 5 years has been decreased due to climate change and especially due to increased wild animals attack, climate change, floods and landslide, lack of improved technology and youth migration for foreign jobs. The area is facing problem of poor irrigation facility, drought, soil productivity, market space and mechanism, technical

human resource, ineffective institutional arrangement, lack of implementation of crop varieties and technology, increased crop disease. In Sunkoshi Rural Municipality, only 40 households have sufficient foods for 12 months and large number of households have food self- sufficiency up to 3 months only. In Khijidemba Rural Municipality, about 55.38 % of the people involved in agriculture for their livelihood are mainly at subsistence level. Food sufficiency of Manebhyanj municipality was found for up to 6 months. In Siddhicharan, 11% of household have food sufficiency up to 12 month. . In Molung municipality there are only 37(0.879%) households who have sufficient foods for year and rest do not have sufficient food and they have to buy foods for consumption.

7.4 Forestry and NTFP

Watershed is rich in biodiversity consisting of various species of trees, shrubs, herbs, mammals, birds, and reptiles. Within this altitudinal gradient, it encompasses diverse forest types and species. At lower elevations, the forest types include tropical and subtropical broadleaf forests dominated by species such as Sal (*Shorea robusta*), Sissoo (*Dalbergia sissoo*), Simal (*Bombax ceiba*), Asna (*Terminalia tomentosa*), in mid hills, are Chir Pine (*Pinus roxburghii*), and Utis (*Alnus nepalensis*), Chestnut (*Castanopsis spp.*), and Chilaune (*Schima wallichii*). As the elevation increases, the forest types transition into temperate broadleaf forests characterized by species like Blue Pine (*Pinus wallichiana*), Oak (*Quercus semicarpifolia*), Walnut (*Juglans regia*), Silver Fir (*Abies spectabilis*), Rhododendron (*Rhododendron spp.*), etc. Different Medicinal and Aromatic plants, Edible fruits and nuts, Fiber and handicraft plants Non timber Forets product (NTFP) found here. The main problems facing (NTFPs), include limited access to markets and market information, inadequate infrastructure for collection, processing, and storage, lack of value addition and product diversification, and unsustainable harvesting practices.

7.5 Multi hazard Assessment

It is estimated that about 4.33 km², 1.75 km², 1.87 Km² areas in molung watershed are under high, moderate and low flood risk zone respectively. About 156.9 km², 253.1 km², 46.7 Km² areas in molung watershed are under high, moderate and low Landslide risk zone respectively. It is estimated that about 83.28 km², 49.77 km², 86.78 Km² areas in molung watershed are under high, moderate and low fire risk zone respectively. About 86.03 km², 204.38 km², 166.26 Km² areas in molung watershed are under high, moderate and low soil erosion risk zone respectively.

8. Gender Equality and Social Inculsion

This study assesses the current GESI scenario, identifying associated problems and opportunities. The study shows increase in awareness regarding Gender Equality and Social Inclusion (GESI), despite encountering some challenges. There has been an improvement in female literacy, however, numbers for higher education still indicate a lower representation compared to males. Additionally, marginalized groups face a disparity in education, primarily because of economic factors, household responsibilities. Approximately 59% of

females and 69% of males are actively engaged in economic activity. There are some initiatives focusing on training, awareness, and community participation. However, still various women and individuals still face challenges in actively participating and realizing the benefits of these training programs. To enhance inclusivity and equity, there is need to formulate comprehensive Gender Equality and Social Inclusion (GESI) plans and policies organize gender mainstreaming training and leadership development programs, capacity development and income generation activities, targeting women and marginalized groups.

9. Outcome, output, logical framework

The outcomes of the plans are as follows:

- Outcome 1: Sustainable Agriculture and Land Management
- Outcome 2: Forest and Biodiversity Conservation
- Outcome 3: Water Induced Disaster Risk Reduction and Management
- Outcome 4: Water Resource Management
- Outcome 5: Capacity Building and Institutional Strengthening

10. Action Plan and Budget

	Estimated cost (
Action plan	In 000,NRS)
Outcome 1: Sustainable Agriculture and Land Management	3,605,650
Outcome 2: Forest and Biodiversity Conservation:	198,983
Outcome 3: Water-Induced Disaster Risk Reduction and Management	532,100
Outcome 4: Water Resource Management	696,735
Outcome 5: Capacity Building and Institutional Strengthening	63,000
Total	5,096,468

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Chapter 1: Introduction

1.1 Background of the assignment

The initiative was taken through the "Developing climate resilient livelihoods in the vulnerable watershed in Nepal (DCRL)" project implemented jointly bu Government of Nepal and UNDP under financial support of Global environment Facility (GEF). The consortium of NESS-DSC-GES JV has been selected to complete the assignment "Preparation of Climate Responsive Integrated Watershed Management Plans (CRIWMP) for Molung Watershed". The main objective of the CRIWMP is to develop/formulate climate responsive evidences based on the baseline and problem analysis, and formulation of practical coping strategies for watershed planning and interventions to prepare climate resilient livelihood at both watershed and government unit level i.e. Palika level. This report is mainly focused on the Molung watershed.

1.2 Objectives of assignment

The main objective of the CRIWMP is to develop/formulate climate responsive evidences based on the baseline and problem analysis, and formulation of practical coping strategies for watershed planning and interventions to prepare climate resilient livelihood at both watershed and government unit level i,e, Palika level. This report is mainly focused on the Molung Watershed.

To meet the above mentioned main objective, the following are three specific objectives of the study.

- To carry out a comprehensive and collaborative climate risk assessment based on the situation analysis and locally adaptive probable solutions at Local Palikas through integrated watershed management plan (IWMP).
- To recommend the sets of impactful actions, that can be replicable and scale up in other watershed that will guide the planning and interventions of watershed management activities at local levels.
- To recommend the evidence-based policy and strategies for preparing climate resilient livelihood through cooperation and collaboration for coherent mechanisms at all three tiers of governments.

1.3 Scope and Activities of the assignment

The main scope and activities of the assignment is given below:

- i. Baseline information collection and analysis at both watershed and Palika level
- ii. Gap analysis in existing plan, program, and policies and improvised recommendation.

- iii. Assessment of watershed condition at both watershed and Palika level
- iv. Assessment and documentation of cross cutting Issues at watershed and Palika level

1.4 Limitation of the study

- This study has been carried out with limited time and limited resources. Most of the information are based on the secondary information.
- Only one FGD were carried out in each ward with the participation of all the possible stakeholders from the ward office, communities. And relevant organizations.
- Cost estimation for activities is based on the prior experience, and just a thumb rule, which is also verified and discussed during the FGD.

1.5 Methodology

1.5.1 General Methodology

A research team as indicated in TOR was deployed right after the work order issued to implement the study based on understanding of the TOR. The overall approach consists of primary and secondary data collection, literature review, and detailed analysis based on the baseline and field work with specific focus on study area. The generic approach considered are:

- Mobilized a designated research team
- Interaction and consultation regularly with the Client's representative (i.e., project coordinator /technical advisor/field staff from DCRL)
- Consultation with the concerned stakeholders in the Concerned Palika
- Collection and utilization of secondary data available with the client as well as other government agencies, research institutions, Non-Governmental Organizations (NGOs) and individual researchers
- Collection of relevant primary data and information during field study/investigation,
- Review of available relevant documents/literature and incorporate them within the study scope.
- Use of state-of-the-art techniques such as geographic information system (GIS), etc.

The below flow chart (Figure 1) shows the overall methodological framework of this study. In this study, the study team executed assignment in three phases i.e. inception, field, and office work.



Figure 1: Overall methodological framework

1. Inception Phase:

In this phase the study team did the project initiation meeting and prepared the execution plan of the assignment. As per the expertise, the team of expert initiated the collection and review of the available documents, literatures, and also did the consultation with relevant stakeholder. Based on the previous studies, scope of the assignment, the study team prepared and submitted the inception report. The findings during inception phase, the detail activities, their work plan, and execution plan were discussed during the inception workshop arranged by Client. The comments and suggestion by different experts, Client's team were incorporated, detail questionnaire, checklist, and ward wise high resolution google earth image in A₀ size (attached in Annex) were prepared and field execution plan were discussed with Client and stakeholder at Client office. The comments and suggestion were during the consultation were addressed and final inception report with detail work plan submitted to the Client.

2. Field Work Phase:

In this phase of the study, study team identified enumerators from each Palika in consultation with Palika officials and did final selection of enumerators. Training for them were provided to collect the data from each ward of Palikas as per the prescribed format of questionnaires, checklist, and map. After the training, the team of experts visited the district headquarter and did consultation with concerned officials of different thematic areas. Enumerators were did focus group discussion and key informant interview at ward level as

a primary data collection. After first phase of field work preliminary reports were prepared and submitted to the Client based on the data collected from field. In the second phase of the field work, the team of expert did Palika level consultation workshop at each Palika on the draft report shared by Consultant to Client and Palika. Those consultation workshop help to validate the information collected during first phase of the field work and also fine tuning of proposed action plan and CRIWMP of each Palika.

3. Office work and Reporting Phase:

In this phase, study team did the analysis of the past studies, literature review, collected information from the field. Those data were analyzed, visualized, and related maps, graphs, tables, charts, and frameworks were prepared. Based on the analysis and agreed table of content during inception workshop, draft report prepared and submitted to the Clients. The prepared sample draft report of one Palika was shared with Client and did consultation and presentation with concerned stakeholder. The issue raised by client during initial sample draft presentation were incorporated and prepared draft report of all the Palikas, and those report were shared with the Client. The validation and consultation workshop at each Palika were done, information were updated and final report was prepared and submitted to the Client.

1.5.2 Risk Analysis Methodology

1. Flood Risk Mapping

In this project flood risk areas have been calculated based on available database and field observation. For the calculation of flood risk area we have prepared land cover database of each local level. Similarly, elevation data were prepared using spot height, contour and prepared a digital elevation model (DEM). Hydrologic parameters such as catchment area, cross-section data at defined interval, river bank lines, flow path geometry, stream center line, were observed and analysed. Discharge data at strategic point, manning's constant, river boundary information etc were observed and calculated for flood risk analysis. Other reference data were collected from survey department. For the calculation of water discharge, river/streams data were prepared watershed level discharge data were calculated for return period.Field observation and interaction with local people are further input in the study. For field observation high resolution satellite images were used to determine the high flooded area in each local level.

There is no unique definitions about flood analysis which is globally accepted. In this project comprehensive way for defining and assessing flood risk and vulnerability in the flood-prone areas. The suggested methodology follows a three-step assessment approach: a) annualized hazard incorporating both probabilities of occurrence and the anticipated potential damages; b) vulnerability (exposure and coping capacity) in the flood-prone areas; and c) annualized flood risk (estimated on annual basis) (Figure 2). The methodology aims to assist water managers and stakeholders in devising rational flood protecting strategies.



Figure 2: Methodological Framework for Flood Risk Assessment

Losses of flood have been calculated for each municipality and major watershed. Flood Risk Matrix has classes of frequencies of hazardous events and consequences or loss in the respective axes. Risk matrix were proposed based on result and mapping the risk area presented on figure 2.

FREQUENCY	High		Moderate	High	High
	Moderate		Low	Moderate	High
	Low		Low	Low	Moderate
	None	Slight/Stable			

Figure 3: Risk Matrix.

i. Pre-Processing in GIS environment

Here in this part, RAS layers (Stream center line, river banks, flow path centerlines and crosssections) were designed as shown in flow chart Figure 4. It was later followed by layer setup, and finally, RAS-GIS import file was created which was ready for processing in Hec-Ras.



Figure 4: Pre-Processing in Hec-Georas

ii. HEC-RAS Processing

The import file thus created in HEC-Geo RAS was imported in Geometric Data Editor interface in HEC-RAS. The flood discharge for return period which was calculated using WECS/DHM method was entered in steady flow data. Reach boundary conditions were defined as critical depth for both upstream and downstream. Manning's constant for left and right bank was set as 0.04 while 0.035 was set for center of channel. Mixed analysis was done in steady flow analysis. Then the generated data is exported in GIS format. Process involved here is shown in Figure 5 and Figure 6 below.



Figure 5: Preparation of database for Watershed area determination and discharge calculation



Figure 6: Process for Watershed area determination and discharge calculation

2. Landslide Risk

Landslide Risk zoning is carried out in a GIS-based system with multi criteria analysis, MCA using number of spatial data layers so that the zoning can be readily be applied for land use planning and can be up-dated as more information becomes available. Following major database was applied for the landslide risk analysis.

i. Input data collection Method

Data collected for land use resource mapping and topographical, soil and geology data are used for landslide susceptibility analysis. Data and source of data are detailed below:

- Land cover land use (present land use, Satellite image, 2022)
- Slope and Slope Aspect (from DEM, Satellite image, 2012)
- Reference data layer of Survey Department
- Relative Relief/ Rainfall/ precipitation (derived from DEM)
- River network: Drainage density (Present land use, Satellite image 2012 & Topographical sheets, 1995-97)
- Geology: Fault and lineament, Lithology and Rock type (DoMG, 2009),
- Soil (Land system, SOTER, 2009)
- Infrastructure development data such as road construction, housing activities were used for the analysis.

ii. Landslide Risk Mapping Methodology

Landslide Risk assessments are based on different methods. Following step were taken for landslide risk assessment.

- Inventory of existing landslides from satellite image
- Verification of landslides in the field
- Mapping landslide susceptibility based on susceptibility factors integrating scientific methodology and field landslide data characteristics.

The overall methodology applied is presented in Figure 7 and the approach followed for landslide mapping includes:



Figure 7: Landslide Risk Mapping Methodology

3. Fire Risk

It is common that forest fire occurs every year in Nepal, particularly in the forests of Terai and Churia hills. Government of Nepal has given less priority in managing forest fire due to limited resources. Nepal has adopted various forest management approaches including community forestry, leasehold forestry, protected forestry and government managed forestry. In this study we applied following method for fire risk assessment (Figure 8).

- Identification of community forest or other plantation area using satellite images and field observation.
- Identification of types of forests other plantation and present management status.
- Identifying nearby settlement areas and foot trail or road along or inside the community forest other plantation.
- Identification of risk, and its characterization with environmental effects.
- Identification of extend of fire risk area.
- Identification of settlement areas and others.
- Identification of types of settlement with present status.
- Identifying nearby industries, petro-chemical station and forest.
- Identification of probable risk, its characterization with probable environmental effects.
- Identification of extend of fire risk area.
- Identification of high-tension and Transmission line

In order to identify fire risk of any area, the visible Infrared Imaging Radiometer Suite (VIIRS) having 375 m spatial resolution active fire product, petrol pump station and transmission line location was used and analyzed.



Figure 8: Fire Risk Mapping Methodology

4. Soil erosion Risk

GIS based spatial multi-criteria analysis (SMCA) method is adopted for the current assessment. The data layers used for soil erosion area were mapped using following database and methods (Figure 9).

- Land cover land use (present land use, Satellite image 2022)
- Slope (derived from DEM, Satellite image 2022)
- Slope aspect (derived from DEM, Satellite image 2022)
- River network: Drainage density (Present land use, Satellite image 2022 & Topographical sheets, 1995-97)
- Reference data layer of Survey Department
- Soil properties (Land system, SOTER 2009), and Field survey 2023
- Rainfall/ precipitation trend (DHM, 2009-2019
- Infrastructure development data such as road construction, infrastructure construction, housing activities were used for the analysis.



Figure 9: Soil Erosion Mapping Methodology

1.6 Review of documents related to assignment

Nepal is a mountainous country with a complex and fragile watershed ecosystem. The government has developed and adopted various policies, plans, programs, and strategies to manage its watersheds sustainably. During this study, some of the important policies, plans, programs, and strategies related to watershed management were reviewed.

1.6.1 Review of Policy, plan, program, and strategy at federal level

1. The Constitution of Nepal 2015: The constitution has recognized the importance of watershed management in sustainable development and conservation of the country's natural resources. It has recognized the fundamental right of every citizen

to live in a healthy and clean environment. This provision includes the right to access clean water and protection of natural resources, including watersheds.

- i. Article 51(g) of the constitution recognizes the policy related to the conservation, protection, and use of natural resources, which includes access to clean water, renewable energy, and biodiversity. This provision implies that the government has a responsibility to ensure the sustainable management of watershed resources to protect citizens' right to a healthy environment.
- ii. Concurrent Powers: The constitution has provided concurrent powers of the federal, provincial, and local governments in managing natural resources, including watersheds. This provision ensures that watershed management is integrated into the overall development planning and decision-making process at all levels of government.
- iii. National Natural Resources and Fiscal Commission: Article 250 of the constitution mandates the government to establish a National Natural Resources and Fiscal Commission, which is responsible for allocating revenue and managing natural resources, including watersheds among the federal, provincial, and local governments.
- 2. Developing Climate Resilient Livelihood (DCRL): The project aims to enhance the resilience of watersheds and promote sustainable water resource management practices in the context of climate change. The project focused on building the capacity of local stakeholders, promoting community-based approaches, and implementing climate-resilient integrated watershed management plans.

1.6.2 Review of Policy, plan, program, and strategy at Province Level

The Koshi province has formulated its own specific policies, strategies, and acts related to forest and environmental protection. Various programs and plans have been developed and implemented through different line ministries to address the issues related to soil erosion, forest degradation, water scarcity, water induces disasters, and climate change impacts.

1.6.3 Review of Policy, plan, program, and strategy at Local Level

 Local Government Operation Act, of 2017: It empowers the local government to develop and implement watershed management plans and programs at the local level, emphasizing the conservation, development, and sustainable use of water resources, forests, and other natural resources within the watershed. The act mandates the formation of a natural resource management committee in each local government to manage and conserve natural resources, including watersheds. It also emphasizes the active participation of local communities in decision-making and implementation processes. 2. National Framework on Local Adaptation Plans for Action (2011): It recognizes the integration of climate change concerns into watershed management practices, recognizing the interrelationship of water resources, ecosystems, and climate impacts. It has provisions for the identification and assessment of vulnerable areas and the development of targeted adaptation strategies for watershed management. It also emphasizes the involvement of local communities in planning and decision-making processes, ensuring their active participation and ownership. The framework also emphasizes the importance of building local capacity and knowledge on climate change adaptation and watershed management, and the need for effective coordination and collaboration among stakeholders at local levels to achieve sustainable and climate-resilient livelihood outcomes.

1.6.4 Provision of Fifteenth periodic plan (2019-2024)

The provision of integrated watershed management is an important component of this plan. The key provisions related to watershed management in the Fifteenth Periodic Plan of Nepal:

- Watershed management programs will be implemented in a coordinated manner across all three levels of government (federal, provincial, and local) to ensure effective management of water resources.
- Watershed management programs will be implemented with the active participation of local communities, especially marginalized groups such as women and ethnic minorities.
- Watershed management programs will focus on landslide treatment, river bank protection, degraded land rehabilitation, promoting sustainable land use practices, including agro-forestry, and the promotion of site-specific low-cost and bio-engineering techniques for different ecological regions.
- Watershed management programs will prioritize the conservation of water resources, including the construction of small-scale water storage facilities such as ponds and check dams.
- Watershed management programs will also focus on promoting the use of renewable energy sources such as biogas, solar, and wind power to reduce reliance on non-renewable sources of energy.

1.6.2 Barriers and gaps in the policy, plan, program and strategy to execute prescribed activities in CRIWMP

In spite of the various provisions in policies, plans, programs, and strategies related to watershed management, there are several barriers and gaps that hinder their effective

implementation. Some of the significant barriers and gaps in the policy, plan, program, and strategy of watershed management are:

- 1. Limited area coverage: One of the gaps in watershed management is limited area coverage. Sub-watershed management planning guidelines (2016) make the provision to delineate the functional sub-watershed area of 15-25 square kilometers for planning which covers small 5 to 10 % of the total area of the district. Sub-watershed management plans though implemented did not cater to poorer people's needs and problems for a lack of social parameters such as poverty information and lack of adequate community consultation in the planning process, which has been one of the stumbling blocks for non-replication of SCWM interventions by people at large.
- 2. Limited funding: Another significant barrier to effective watershed management in Nepal is the limited funding available for implementing policies, plans, programs, and strategies related to watershed management. This limits the capacity of local governments to undertake activities such as soil conservation, water resource management, and development of water infrastructure.
- 3. Lack of coordination: There is a lack of coordination and collaboration among various government agencies, non-governmental organizations (NGOs), and community-based organizations (CBOs) involved in watershed management. This hinders the effective implementation of policies, plans, programs, and strategies related to watershed management.
- 4. Weak institutional capacity: There is a lack of institutional capacity and human resources at the local level to undertake watershed management activities. This includes a lack of technical expertise, training, and resources to undertake activities such as soil conservation, on-farm conservation, water resource management, and development of water infrastructure.
- 5. Limited awareness and education: There is limited awareness and education among local communities about the importance of watershed management and the impact of their actions on water resources. This limits the capacity of local communities to participate effectively in watershed management activities.
- 6. Lack of data and information: There is a lack of accurate and up-to-date data and information on water resources and watershed management activities in Nepal. This limits the ability of government agencies, NGOs, and CBOs to make informed decisions and implement effective watershed management activities.

1.6.4 Government linkage in policy, plan, program and strategy

The management of watersheds in Nepal involves multiple tiers of government, including the federal, provincial, and local levels. The linkages between the governments in each tier are outlined below:

- Federal Level: At the federal level, the Ministry of Forests and Environment is responsible for developing policies, plans, programs, and strategies related to watershed management. The ministry collaborates with other federal agencies such as the Department of Water Resources and Irrigation, the Department of Soil Conservation and Watershed Management, and the Department of National Parks and Wildlife Conservation to implement these policies and plans.
- 2. Provincial Level: At the provincial level, the Ministry of Forests and Environment is responsible for implementing federal policies, plans, programs, and strategies related to watershed management. The provincial government works closely with local governments to identify and prioritize watershed management initiatives based on local needs and resources. The provincial government also coordinates with federal agencies to ensure that their initiatives align with federal policies and plans.
- 3. Local Level: At the local level, the Rural Municipality (RM) and Municipalities are responsible for implementing the watershed management initiatives in their respective jurisdictions. The RM/Municipality collaborates with other local government entities such as the District Coordination Committee (DCC) as well as the province level to develop and implement policies, plans, programs, and strategies related to watershed management. The local government entities also work closely with local stakeholders such as farmers, community groups, and NGOs to ensure that their initiatives meet local needs.

1.6.5 Improvised recommendation in policy, plan, program and strategy

Two watersheds DhudhKoshi and Molung both are with highly diverse landscapes, ranging from the mid Mountains, tars, and small plains. Those watershed are rich in water resources, which makes it highly dependent on water resources for agriculture, drinking water, and hydropower generation. However, due to various anthropogenic activities and climate change, these sub-watersheds are facing numerous challenges, including soil erosion, landslides, deforestation, land degradation, and water pollution. To effectively manage and conserve these vital sub-watershed resources, here are some improvised recommendations for policy, plan, program, and strategy in watershed management:

- 1. Develop and Implement Comprehensive sub-Watershed Management Plans: In order to solve the numerous sub-watershed problems project should develop and implement evidence-based comprehensive sub-watershed management plans that consider the various aspect such as biophysical conditions, environmental, economic, and social factors that affect watersheds. The plans should be based on sound scientific data and should involve all stakeholders in the process.
- 2. Institutional setup: The institutional setup for implementing watershed management activities at the district level is designed to involve all three levels of

government: federal, provincial, and local. The following institutions are found suitable for the implementation of watershed management activities in the selected sub-watersheds.

- i. Local Government Units: The local government units, including rural municipalities and municipalities, are responsible for the implementation of watershed management programs at the local level. They are also responsible for identifying the most suitable sites for the construction of small-scale water storage facilities, such as ponds, check dams and other small scale water and soil management infrastructures.
- ii. Soil and Watershed Management Office (SWMO): The SWMO is responsible for implementing soil conservation and watershed management programs in the district. It provides technical assistance to the local government units and other stakeholders in the identification, planning, and implementation of these programs.
- iii. Agriculture Knowledge Center (AKC): The AKC is responsible for implementing programs related to sustainable agriculture and land use practices at the district level. It also provides technical assistance to the local government units in the implementation of these programs.
- iv. Water Resource and Irrigation Development Division Office (WRIDDO): The WRIDDO is responsible for the construction and maintenance of medium-scale water storage facilities, such as small dams and irrigation canals. It also provides technical assistance to the local government units in the identification and implementation of these programs.
- v. Community-Based Organizations (CBOs): Various CBOs and user groups such as community forest user groups, water user groups, and farmer groups are also involved in the implementation of watershed management activities in the study area. The program should give emphasis on community-based watershed management by involving local communities in the planning and implementation of watershed management activities. This approach will ensure that local knowledge, skill, and expertise are integrated into the management of watersheds.
- 3. Tie up EIA with infrastructure development: In our context, tying up Environmental Impact Assessment (EIA) with infrastructure development in watershed management is crucial to ensure sustainable and environmentally conscious development practices. It helps in identifying and assessing the potential environmental impacts of infrastructure development projects in watersheds. It considers factors such as land use changes, soil erosion, water quality, biodiversity,

and social impacts. It provides recommendations for mitigation measures and environmental safeguards to minimize and mitigate adverse impacts. This can include measures such as erosion control, afforestation, water conservation, and proper waste management. By integrating EIA findings into infrastructure development plans, potential risks can be addressed proactively.

- 4. Capacity development and empowerment: Capacity building and empowerment play a crucial role in effective watershed management. They enhance the knowledge, skills, and participation of stakeholders, enabling them to actively contribute to sustainable watershed management practices. Some key aspects of capacity building and empowerment are knowledge and awareness raising, technical skills, stakeholder engagement, institutional strengthening, networking, and collaboration. These programs involve providing training, workshops, and educational programs to stakeholders, including local communities, government officials, and non-governmental organizations. By integrating capacity-building and empowerment strategies into watershed management initiatives, stakeholders can develop the necessary skills, knowledge, and empowerment to actively contribute to sustainable watershed management practices, resulting in improved water resource conservation, ecosystem health, and community resilience.
- 5. Encourage Reforestation and Forest Management: Local and provincial governments should encourage reforestation and community-based forest management activities in watersheds to prevent soil erosion and landslides, improve water quality, and increase water availability. This can be achieved through initiatives such as community forestry programs, leasehold forestry and public-private partnerships.
- 6. Promote Sustainable Agriculture Practices: Agriculture is a significant driver of deforestation and soil erosion in sub-watersheds. To address this issue, local governments should promote sustainable agriculture practices that reduce the use of agrochemicals and promote soil conservation practices.
- 7. Strengthen Monitoring and Evaluation of Watershed Management: Local and provincial governments should strengthen monitoring and evaluation of watershed management activities to assess the effectiveness of different policies, plans, programs, and strategies. This will enable policymakers to make informed decisions and adjust their approaches as needed.

1.7 Role and Responsibility

Recently, Nepal has transferred into a federal system and the constitution has given the roles, and responsibilities among three tiers of government for managing the natural resources, and climate change issues. Strengthening the Capacity of the federal, provincial, and local government agencies responsible for coordinating watershed management activities in the river basin, watershed, and sub-watershed level. Different agencies are

involved to implement several programs aimed at improving their capacity to manage watersheds, including capacity building for staff, development of policies and guidelines, and establishment of monitoring and evaluation systems.

In these contexts, the implementation of this Plan in the selected watershed requires the involvement and collaboration of various stakeholders. The key roles and responsibilities of different actors in the implementation process are as follows:

1. Government Institutions:

- i. Federal Level
- **Ministry of Forests and Environment, Singhdarwar, Kathmandu:** Provide policy direction, guidelines, and oversight to ensure the effective implementation of the CRIWMP.
- Ministry of Agriculture and Livestock Development, Singhdarwar, Kathmandu: Provide technical support and expertise in sustainable agriculture practices and livelihood diversification.
- Ministry of Energy, Water Resource, and Irrigation, Singhdarwar, Kathmandu: Providing policy guidance and strategic direction for the plan's implementation, allocating financial resources, addressing climate change impacts on water resources, coordinating with relevant stakeholders, and ensuring regulatory frameworks.
- **Department of Forests and Soil Conservation, Babarmahal, Kathmandu:** Lead the planning, preparing directives and guidelines, coordination, and monitoring of watershed management activities.
 - ii. Province level
- Ministry of Tourism, Forests and Environment, Koshi Province: Providing strategic guidance, policy formulation, coordination, and support to local governments, community organizations, and relevant stakeholders in implementing the plan's objectives and activities. Incorporating climate change adaptation and mitigation measures into the province's forestry, watershed management, and environmental policies and programs. Additionally, it promotes capacity building, monitoring, and evaluation, ensuring the plan's progress is regularly assessed, and necessary adjustments are made based on lessons learned.
- Ministry of Land Management, Agriculture and Cooperative, Koshi Province: Promoting sustainable agricultural practices, resource allocation, supporting farmers in adopting climate-resilient techniques, and diversifying livelihood options. It facilitates capacity-building initiatives, knowledge exchange, and technical support to local governments, farmers' cooperatives, and other stakeholders to enhance their understanding and implementation of climate-responsive watershed management practices.

• Ministry of Physical Infrastructure Development, Koshi Province: Responsible for the planning, development, and management of physical infrastructure, including roads, bridges, irrigation systems, and other related facilities within the watershed area. It has key responsibilities of integrating climate change considerations, such as flood and landslide risk management, into infrastructure planning and design. Additionally, it also has a crucial role in providing technical expertise, overseeing construction activities, and ensuring the timely and quality implementation of infrastructure projects.

• District-level institutions:

Each of these province ministries has its Directorates and Divisional Offices for field-level implementation. The Basin Management Center (BMC), Divisional Forest Office (DFO), Soil and Watershed Management Office (SWMO), Water Resource and Irrigation Development (WRIDDO), Water Supply and Sanitation Division Office (WSSDO), Agriculture Knowledge Centers (AKC), Veterinary Hospital and Livestock Expert Service Centers (VHLSEC), and Road Infrastructure Development Office (RIDO) are the main sectorial government organizations responsible to implement the annual plans and programs in the district level.

iii. Local level

- Local Governments (Municipality and Rural Municipality): Each municipality and Rural Municipality has key responsibilities including the implementation of the plan, coordination, mobilization of resources, and engagement of local communities. It facilitates the establishment and strengthening of community-based organizations, such as soil conservation user groups, forest user groups, farmers' groups, water user groups, and farmers' cooperatives and associations, etc, and promotes their active involvement in decision-making and implementation. The local government also oversees the monitoring and evaluation of plan activities, providing feedback and making necessary adjustments to ensure the plan's effectiveness and sustainability. Additionally, it collaborates with relevant stakeholders, including government agencies, NGOs, and private sector actors, to foster partnerships and resource mobilization for successful plan implementation and achieving the desired outcomes.
- Development Partners and Donor Agency:

• User Groups

User groups typically consist of local residents, farmers, and other stakeholders directly affected by watershed activities. Their responsibilities include active participation in the planning, decision-making, and implementation processes of CRIWMP initiatives. User groups collaborate with government agencies, non-governmental organizations, and other relevant stakeholders to integrate climate-responsive practices into watershed management. They contribute local knowledge and traditional practices, ensuring that the strategies adopted are culturally sensitive and contextually relevant. Additionally, user

groups are responsible for the effective communication of climate-responsive techniques to the community, promoting awareness, and building consensus to achieve sustainable watershed management outcomes.

The user groups are instrumental in implementing specific activities that enhance climate resilience within the watershed. These activities may include soil and water conservation measures, afforestation and reforestation efforts, adoption of climate-smart agricultural practices, and the development of community-based early warning system.

User groups are the custodians of natural resources, ensuring the judicious use of water, soil, and vegetation. They also facilitate the equitable distribution of benefits derived from watershed management initiatives among community members. Active involvement of local residents, user groups contribute to the long-term success of CRIWMP by fostering a sense of ownership, community empowerment, and adaptability to climate change challenges in the study area.

These actors need to collaborate closely, communicate effectively, and work in a coordinated manner to ensure the successful implementation of the CRIWMP in the selected watershed. This collective effort will contribute to building climate resilience, enhancing ecosystem services, and improving the well-being of the communities in the watershed area.

Chapter 2: Situation Analysis of Molung Watershed

2.1 Molung Watershed Location

Molung watershed is one of the sub watersheds of Sun Koshi Watershed. It lies in Okhaldhunga district of Koshi Province. The total area of Molung watershed is about 411 km2 and its elevation varies from 359 m to 3,579 meters above sea level (masl). It extends approximately between 27°13'20" and 27°30'00" N latitude and 86°21'00" E and 86°31'30" E longitude. The east boundary of Molung watershed is attached to Dudhkoshi watershed as shown in figure 15 and share two Municipalities. Molung watershed covers five Municipalities namely Sunkoshi, Molung and Khijidemba, Siddhicharan and Mahebhanjyang out of them, Siddhicharan and Mahebhanjyang municipalities shares their boundary with both Lower Dudhkosi and Molung watersheds. There are 26 wards in Molung watershed.



Figure 10: Location of Molung watershed along with its topography, river network and hydrometeorological stations within and around the watershed

2.3 Topography of Molung Watershed

The topography of Molung watershed extend from 359 m to 3,579 meters above sea level (masl) Figure 15 and Figure 16(a). The percentage area of Molung Watershed under different elevation is given in Table 2. Most part of Molung watershed fall under elevation within 1000-2500 m.

Elevation (m)	0-500	500-1000	1000-1500	1500-2000	2000-2500	>2500
Area (km ²)	3	45	100	89	92	82
Area (%)	0.8	11.0	24.2	21.7	22.3	20.0

Table 1: Distribution of topography by elevation in Molung Watershed



Figure 11: Left (a): Topography map; Right (b): Land use map of Molung watershed

2.4 Molung Watershed Land use

Land use map has been extracted from data set of International Centre for Integrated Mountain Development (ICIMOD) 2019. About 68% of land is covered with forest, 26.3% of land with agriculture land, 5.2% with grass land, 0.2% of water body, 0.3% with built-up area. The area under different land use is given in Table 3 and in Figure 16(b). Four decade of land use land cover has been analyzed for year 1990, 2000, 2010, and 2019 from the data set of ICIMOD. The pattern shows the decrease of agriculture land, with increase built-up area, grassland and forest.

LULC	Water Body	Forest	Built-up area	Cropland	Grassland
Area km ²	1	279	1	108	21
Area (%)	0.2	68.0	0.3	26.3	5.2

Table 2: Land use 2019 of Molung Watershed

2.5 Molung Watershed Soil type

As per record of National Soil Science Research Center (NSSRC), four types of soil found in Molung watershed shown in Table 4 and Figure 17 (a). This watershed is dominant with quartize soil covering 43% of Molung watershed followed by 39 % of Gneiss, slate/phyllite by 19% and Fluvial non calcareous by 0.02%.

Soil TypeGneiss, migmatiteFluvial non calcareousslate, phylliteQuartziteArea (km²)1590.177175Area (%)390.021943

Table 3: Type of soil and area covered of Lower Dudhkoshi Watershed



Figure 12: Left (a): Distribution of soil; Left (b): Climate distribution

2.6 Molung Watershed Climate situation

Nepal climate is divided into five types based on elevation namely sub-tropical Monsoon (sea level to 1200 m), Warm Temperate (1200-2100 m), cool temperate (2100-3350m), alpine (3350-5000m) and tundra (>5000 m) climate.

In Molung watershed, about 41% of Municipality come under warm temperate climate followed by Sub-tropical monsoon (39%), cool temperate climate (21%) as shown in Table 5 and Figure 17(b).

climate type	Sub-tropical Monsoon	Warm Temperate	Cool Temperate
Area (km ²)	159	167	86
Area (%)	39	41	21

Table 4: Area occupied within different types of climate

2.7 Molung Watershed River system and Sub-watershed

Molung watershed is rich in water resource having wide number of large and Small River. The major river is Molung River which join Sunkoshi River having length 28 m. As per primary survey, there are more than 60 small and large rivers in Molung watershed which is stated in Resource inventory summary of all Palika separately and in Table 12. Some main river of his are Molung River, Poting River, Kul River, Gaurabari River, Dole River, Jhagarpul River, Peku River, Selpi Stream, Chauyadi stream. As per primary survey, the river water is mostly used for drinking and domestic purposes. To increase the water productivity, the water could be used for irrigation by constructing reservoir tank, water supply system, and conservation of water sources. The sub watershed of Molung was generated from Soil and Water Assessment tool (SWAT) which generate 26 number of sub-watershed with varying area from maximum 43 km² and minimum 4 km² given in Annex Table 3.1 and shown in Annex Figure 3.1.

2.8 Molung Watershed Socio-economic profile and livelihood opportunities

According to 2021 census, conducted by Central Bureau of Statistics (CBS), Molung Watershed have total population of 49,704 with male 24,128 and female 25,576 and population density is 121 per kilometer square. Total number of household is 12,243 with average household size is 4. The ward name, population number, household number size for all ward is provided in Annex Table 1.1.

The average literacy rate of Molung watershed is 74.8% of which 82.2% is Male and 67.8% is Female (Annex Table 7.1). Higher number of people have studied Education stream followed by Management, Humanity and Science technology. Slightly literacy rate is minimum at Sunkoshi and highest at Manebhanjyang Municipality. 74.7% of population are economically active (Annex Table 7.1).

2.9 Agricultural perspectives

The main source of livelihood of the people in this watershed is agriculture which is only at subsistence level. Major crops grown and suitable on these types of soil are maize, millet, wheat, rice, potato, vegetables, fruits, spices, cash crops, pulses and oilseeds (Annex Table 6.1). According to field survey, productivity within last 5 years has been decreased due to climate change and especially due to increased wild animals attack, climate change, floods and landslide, lack of improved technology. The area is facing problem of poor irrigation facility, drought, soil productivity, market space and mechanism, technical human resource, ineffective institutional arrangement, lack of implementation of crop varieties and technology, increased crop disease. The cropping system of Molung Watershed is given in Annex 6.2 and Annex Table 6.3. Recommended domains and special features of major climate resilient crop varieties in Nepal is given in Annex Table 6.4. Major Livestock are cattle, Buffalo, Sheep, Goat, Pigs, Fowl, duck which are generally for milk, eggs, wool and transportation purpose. There is lack of feed, improved breeds, easy access of vaccines and medicines for the treatment.

Food sufficiency under Molung watershed was found deficit. In Sunkoshi Rural Municipality, only 40 households have sufficient foods for 12 months and large number of households have food self- sufficiency up to 3 months only. In Khijidemba Rural Municipality, about 55.38 % of the people involved in agriculture for their livelihood are mainly at subsistence level. Food sufficiency of Manebhyanj municipality was found for up to 6 months. In Siddhicharan, 11% of household have food sufficiency up to 12 month. In Molung municipality there are only 37(0.879%) households who have sufficient foods for year and

rest do not have sufficient food and they have to buy foods for consumption. Detail on flood sufficiency for all Palika is given in Annex Table 6.5.

2.10 Market linkages mechanism

Market linkage means connecting farmers and producers more directly with markets. It's about connecting the end consumer all the way back to the source of production. Different types of marketing channels which are prevalent in the study area Direct selling to the consumers, Assembly markets, Wholesale markets, Retail markets, On-farm sales. Flow diagram of Marketing of agricultural products is shown in Figure 18. Main problems of marketing in the municipality are transportation, storage facilities such as rustic store, cold storage, predominance of intermediaries, lack of promotion activities, defective measuring equipment, lack of technical knowledge and organized market.



Figure 13: Flow diagram of Marketing of agricultural products

2.11 Water Stress situation

According to local residents and local government representatives, the majority of villages of these districts are severely water-stressed. Uses of dozers and excavators while constructing motorable roads are affecting water sources, and resources. According to community people, traditional ponds near settlements in Okhaldhunga and Khotang districts are drying up, with some collapsing as a result of infrastructure development, primarily motor roads. According the Hydrometeorological data of Department of Hydrology and Meteorology (DHM); Okhaldhunga and Khotang districts shows that mean annual precipitation is less than the national average of 1,857.6mm, extreme rainfall in 24 hours is extremely high, and the annual precipitation trend is decreasing.

2.12 Status of irrigated agriculture

Some small irrigation project has been implemented and some are under construction by Government of Nepal (GoN) in collaboration with Government of Switzerland. About, 45 small irrigation project has been implemented of total command area of 385 ha varying from 5 to 19 hectare providing benefits to about 1783 households. About 36 small irrigation project are under construction of command area of total 395 ha varying from 5 to 34 ha. The list of completed and ongoing small irrigation project with command area is given in Annex Table 4.2 and Annex Table 4.3. 19 irrigation project has been implemented from Department of Irrigation Nepal of Net Command Area 614 ha. The detail list of source, types, gross command area is given in Annex Table 4.1.

2.13 Impact of climate change in agriculture system and livelihood

There was an unexpected heavy rainfall in October 2021 badly affecting the lives of the people with huge loss of agricultural products. As a result, damage harvested rice in Chisankhugadhi RM. In this Municipality lumpy skin diseases (LSD) is a devastating disease of cattle and buffalo caused by a capripox virus was found in animal due to drought (AKC, Okhaldhunga, 2079; Field survey 2080).

2.14 Forest and status of drought resistant NTFP

Watershed is rich in biodiversity consisting of various species of trees, shrubs, herbs, mammals, birds, and reptiles. Within this altitudinal gradient, it encompasses diverse forest types and species. At lower elevations, the forest types include tropical and subtropical broadleaf forests dominated by species such as Sal (*Shorea robusta*), Sissoo (*Dalbergia sissoo*), Simal (*Bombax ceiba*), Asna (*Terminalia tomentosa*), in mid hills, are Chir Pine (*Pinus roxburghii*), and Utis (*Alnus nepalensis*), Chestnut (*Castanopsis spp.*), and Chilaune (*Schima wallichii*). As the elevation increases, the forest types transition into temperate broadleaf forests characterized by species like Blue Pine (*Pinus wallichiana*), Oak (*Quercus semicarpifolia*), Walnut (*Juglans regia*), Silver Fir (*Abies spectabilis*), Rhododendron (*Rhododendron spp.*), etc. These diverse forest types and associated species are an important ecological zone for a variety of non-timber forest products. NTFPs refer to the resources derived from forests other than timber, such as medicinal plants, herbs, fruits, nuts, fibers, and spices. Focus group discussion and key informants reported following drought-resistant NTFPs that are commonly found in drought-prone areas and climatic variability.

1. Medicinal and Aromatic plants: Species like*Taxsus bacata* (Lauth Salla), Artemisia indica (Titepati), Glutheria fragrantissima (Dhasingre), Swertia chiraita/Swertia augustifolia (Chiraito), Bergenia ciliate (Pashanvedh), Cinnamomum tamala (Dalchini), Rubia manjith (Majitho), Picrorhiza scrophulariiflora (Kutki), Cinnamomum glaucescens (Sugandhakokila), Rheum australe and Rheum nobile (Padamchal), Paris polyphylla (Satuwa), Tinosporasinensis (Gurjo), Edgeworthia gardneri (Argeli), Asparaggus resemosus (Kurilo), Zanthozylum armatum (Timur), *Elettaria cardamomum* (cardamom), *and Thysanolaena maxima* (Broom grass), etc. Out of these Chiraito, Timur, Dalchini, Broom grass, and Kurilo have the potential for commercialcultivation on farmland, community forest, and leasehold forest. Provide budget, technical support, and subsidized seedling for commercial cultivation. There is potential to establish and promoteessential oil processing plants.

- Edible fruits and nuts: Drought-resistant fruit trees like Juglans regia(walnut), Pyrus pashia (wild pear), Phylanthus emblica (Amala), Aegle marmelos (Bel), Choerospondiasaxillaris (Lapsi), and Barberis aristata (Chutro)are commonly found in a different part of the Palika. There ispotentialfor juice and pickle making from Bel, Lapsi, and Amala. Provide budget, technical support, and subsidized seedling for commercial cultivation on public and private farmland.
- 3. Fiber and handicraft plants: Species such as *Girardinia diversifolia* (Allo Himalayan nettle), *Urtica dioica* (stinging nettle), and *Bambusa spp*(Bans) are commonly used for making textiles, ropes, Nepali handmade paper, and handicrafts. Nettle are versatile NTFP species with multiple uses. Its fibers are used for making textiles, ropes, and baskets. Nettle leaves are also used in traditional medicine as a nutritious vegetable. Bamboo is a multipurpose species used for construction, furniture making, handicrafts, and as a raw material for various household products. These are some of the key NTFP species found in this municipality, offering economic opportunities, cultural values, and ecological benefits for the local communities.

The main problems facing (NTFPs), include limited access to markets and market information, inadequate infrastructure for collection, processing, and storage, lack of value addition and product diversification, and unsustainable harvesting practices. Insufficient market linkages and knowledge about market demands restrict the income potential for collectors and processors. The lack of proper infrastructure, including drying facilities, storage spaces, and processing units, affects the quality and marketing. Unsustainable harvesting practices, such as overharvesting and destructive collection methods, pose threats to the long-term availability and regeneration of NTFP species. In order to address these challenges, accessible forests are handed over to 28 CFUGs and 12 LHFUGs for community-based forest management practices at this local level (DOF Okhaldhunga, 2078). For promoting they provide budget, technical support, and subsidized seedling for commercial cultivation. There is also the potentialfor establishing Allo based textile industry.

2.15 Indigenous knowledge

Indigenous practices provide invaluable knowledge and aid in making best use of natural resources. Some of the major indigenous technical knowledge applied.

• **Drying of harvested products:** Originally the traditional practice was that the maize cobs were kept dried by keeping them on the top floor where kitchen heat would facilitate drying of the seeds. They are also hanged outside forming a cluster called
'Suli' and 'Thangra'. Drying reduces the crop moisture content and susceptibility of the storage insect pest in grains.

- **Dusting of ash:** Ash is dusted to control aphids. It is also used to control ants in potato field. Application of ash repels insects and discourages surface feeding insects.
- Ethnobotanical use of locally available plants: Use of herbs like Neem, Bojho, Marigold, Titepati are used for the management of various pests depending on their local availability.
- Field burning: This method is performed to kill any insects or eggs of insects that may be present in the field. Field burning improves yield and reduce the requirement of pesticides and fertilizers. Slash and burn is still being practiced in different parts of Nepal including western mid hills of Nepal.
- Foliar spray of cow urine: Cow urine is sprayed over the plant as it acts as pest repellant. Cow urine, ash and soil mixture is useful for the treatment of cabbage plants. Cow urine is also used for the preparation locally made compost called 'Jhol Mol'. Nitrogen present in the urine also favors the development of the crops.
- Irrigation: Application of fresh irrigation water helps to control pest during outbreak. Drying and wetting of rice field for few days is also one of the indigenous practices followed by the farmers especially against case worm and leaf folder in rice. The grounded pulp of the 'Khirro' leaf is used in irrigation channel to control Rice stem borer.
- Planting attractant/repellent crops on border of field: Traps crops are used in the borders as attractants and repellents to protect the main crop field from insect pests. Mustard crops are planted on border of wheat field and coriander on border of Cole crop to attract the crop away from the major field. Marigold plants are also used as trap crop in many vegetable and cereal crops.
- **Ploughing:** Ploughing with traditional plough called 'Halo' is performed before plantation to remove the weeds and killing of eggs of insect.
- **Preparation of indigenous pesticide:** Indigenous pesticide is prepared using cow urine and jaggery. The toxicity of the mixture kills the insects and pests that come in contact with it.
- Storage in bamboo container
- Use of scare crow to scare birds and animals

2.16 Status of wetland and its conservation

There is a diverse range of wetlands, including ponds, marshes, and other reservoirs in this local level. These are important for biodiversity conservation, water resource management, flood control, and supporting local livelihoods. Field visit and resource survey found about 13 number of wetland area in this Molung Watershed. Ward wise wetland is of all palika is given in Annex Table 3.2. They are in the risk of sedimentation and pollution. Some of them are in a state of extinction due to shrinkage of area and sedimentation. These wetlands are adversely affected by drought, catchment areas, and forest degradation. Some of the site-

specific activities recommended to restore the wetlands are excavation, stone masonry on the periphery, and inlet-outlet maintenance. Some other activities include terracing, contour bunding, broom grass planting, and native species plantation on its catchment area. Similarly, promote the management of runoff for feeding, rainwater harvesting, contour trenching, etc. Encourage farmers to minimize the use of chemical fertilizers and pesticides and promote organic farming techniques.

2.17 Risk Analysis situation

1. Flood risk

Flood risk has been studied after detail analysis from survey data and field verification. It is estimated that about 4.33 km², 1.75 km², 1.87 Km² areas in molung watershed are under high, moderate and low flood risk zone respectively. Table 6 show flood risk across palika of molung watershed and flood risk map is shown in Figure 19.

Palika	High	Low	Medium	Total (km ²)
Molung	1.01	0.32	0.45	1.77
Sunkoshi	3.12	1.47	1.08	5.68
Khijidemba	0	0	0	0
Siddhicharan	0.1	0.04	0.11	0.24
Manebhanjyang	0.1	0.04	0.11	0.24
Total	4.33	1.87	1.75	7.93

Table 5: High, medium and low flood risk zone



Figure 14: Flood risk map

2. Landslide risk

Landslide risk has been studied after detail analysis from survey data and field verification. It is estimated that about 156.9 km², 253.1 km², 46.7 Km² areas in molung watershed are under high, moderate and low Landslide risk zone respectively. Table 7 show flood risk across palika of molung watershed and landslide risk map is shown in Figure 20.

Palika	High	Low	Medium	Total (km ²)
Molung	26.6	15.2	68.8	110.5
Sunkoshi	46.2	10.9	80.8	137.8
Khijidemba	37.1	5.6	43.2	85.9
Siddhicharan	34.2	8.7	45.0	87.9
Manebhanjyang	12.9	6.5	15.3	34.6
Total	156.9	46.7	253.1	456.7

Table 6: High, moderate and low landslide risk zone



Figure 15: Landslide risk map

3. Fire risk

Fire risk has been studied after detail analysis from survey data and field verification. It is estimated that about 83.28 km², 49.77 km², 86.78 Km² areas in molung watershed are under high, moderate and low fire risk zone respectively. Table 8 show fire risk across palika of molung watershed and fire risk map is shown in Figure 21.

Palika	High	Low	Medium	stable	Total (km ²)
Molung	8.76	20.26	13.30	69.95	112.28
Sunkoshi	31.70	24.21	11.46	76.14	143.51
Khijidemba	18.03	22.21	12.76	32.87	85.86
Siddhicharan	16.67	15.25	4.24	52.00	88.16
Manebhanjyang	8.12	4.85	8.01	14.00	34.99
Total	83.28	86.78	49.77	244.96	464.80

Table 7: High, moderate and low fire risk zone



Figure 16: Fire risk map

4. Soil erosion risk

Soil erosion has a significant impact on water resources, agriculture, forest, built-up area in various ways. It can disrupt the delicate balance of ecosystems, impair water quality, reduce water availability, loss of top soil deceasing agriculture yield and forest degradation and lead to other ecological and economic problems.

Soil erosion risk has been studied after detail analysis from survey data and field verification. It is estimated that about 86.03 km², 204.38 km², 166.26 Km² areas in molung watershed are under high, moderate and low soil erosion risk zone respectively. Table 9 show soil erosion risk across ward of Sunkoshi Rural Municipality.

Palika	High	Low	Medium	Total (km ²)
Molung	9.89	47.48	53.14	110.51
Sunkoshi	28.61	31.29	77.93	137.83
Khijidemba	18.85	42.80	24.22	85.86
Siddhicharan	23.74	28.49	35.62	87.85
Manebhanjyang	4.94	16.20	13.47	34.63
Total	86.03	166.26	204.38	456.68

Table 8: High, medium and low soil erosion risk zone

2.18 Gender Equality and Social Inclusion

The sustainable utilization and management of water resources can only be achieved by addressing various dimensions of water governance. Achieving gender and social inclusion (GESI) is an important aspect of water governance to ensure each section of society have equal access to water as well as in the management of the water resources.

This study endeavors to assess the current GESI scenario, identifying associated problems and opportunities. The methodology involves a comprehensive review of all local government profiles (palika), along with the implementation of Key Informant Interviews and analysis of the Central Bureau of Statistics (CBS) database.

The study shows increase in awareness regarding Gender Equality and Social Inclusion (GESI), despite encountering some challenges. Examining education, the literacy rate is 82.2% for males and 67.8% for females. While there has been an improvement in female literacy, the numbers for higher education still indicate a lower representation compared to males. Additionally, marginalized groups face a disparity in education, primarily because of economic factors, household responsibilities.

When it comes to economic activity, approximately 59% of females and 69% of males are actively engaged. The statistics indicate a significant presence in the sectors of agriculture, forestry, and fishery, with 73% of males and 81% of females involved in these areas. Notably, agriculture emerges as a more substantial source of economic activity for females compared to males. Inactive Female in economic activities, primarily due to household responsibilities and males may be less involved in economic activities due to pursuing education or handling household chores.

Regarding involvement in social and development activities, there are some initiatives focusing on training, awareness, and community participation. Various user groups like women group, drinking water user, irrigation user groups and community forest user group organize training and awareness programme. The community forest user groups seem to be

very inclusive because there is mandatory provision to include women in key post either in chairperson or secretary. There is special emphasis on programme addressing drinking water and sanitation as well as promoting gender equality. However, still various women and individuals from diverse groups still face challenges in actively participating and realizing the benefits of these training programs. This is often due to their existing work responsibilities, a limited appreciation of the programs, lack of suitable mechanisms to involve a wide range of individuals.

To enhance inclusivity and equity, there is need to formulate comprehensive Gender Equality and Social Inclusion (GESI) plans and policies. A sets of GESI related activities are included in capacity development and institutional development component. The recommended activities are gender mainstreaming training and leadership development programs. Furthermore, there is a necessity to involve capacity development training and income generation activities, targeting women and marginalized groups.

2.18 Summary on the resources within Palika

The team of expert did analysis based on the FGD, KII done by enumerators and district level consultation by experts. The ward wise issues, general information, causes, impact on resources and potential preventive measures are summarized in tabular form in different sector like water resources, landslide, forest and bio-diversity, road in Table 10.

Sunkoshi	General information	Key Problem/cause	Preventive measure
Water Resource	 55 spring, stream and pond sources, mainly use for drinking, irrigation and farming purpose. 	Lack of water supply structure.Less utilization of sources.	Need to conserve and protect the sources.Afforestation near the sources.Reduce the river encroachment.
Land use/agriculture	 2 and 3 crops per year. The major crops are: Maize, paddy, rajma, wheat, millet, grains, potato, and mustard. Most of the land is fertile and suitable for agriculture. 	 Productivity decreases in last five year due to climate change, wildlife attack, lack of fertilizers and lack of irrigation. 	 Uses of advance agriculture method and timely supply of fertilizers. Irrigation canal construction and sufficient supply of water. Control of wildlife attack. Rainwater collection for irrigation.
River/Flooding	 13 main rivers: Dahadkhola, matai khola, molung, sisneri, daha river, parakhola, balaute river, kakani river, laharaeni, gopae khola, solung, laharikhola, ghatta khola. Most of the river are perennial. 	 During monsoon seasons, these rivers affect on road, agricultural land and human settlement. 	 River control and training work. Afforestation in risky area. Change the direction of flow of river. Gabion mesh filling.
Forest	 24 The major and important community forest are: Titkae, dhadae, shaprakhola, jordunga, bisaune pakha, kalikadevi, satbhani, champadevi, binasa, devithan, mahurae, damankharka, purnapakha, baaspani, kauche kogun, sallaghari, nilkantha, laliguras, paharebhir, aaitabare, kalikarani, simkholsi, thulibhir etc. The major trees are: Salla, chilaune, uttis, malato, guras, saal, kalikantha, khayar, lampate etc. Medicinal herbs are : amala, koiralo, harro, barro, chiraeto, pakhanbed, titepati, pirati, kurilo, kadilo etc. 	 All the medicinal herbs are not in use due to lack of investigate. Forest are decreases day by day due to deforestation for making bare land. 	 Establishment of herbal medicine production factory. Control of deforestation. Study and investigate the available medicinal herbs.
Landslide	 26 landslides of small, medium and large size occurs in different year, 	 Obstruction on road in different places. Agricultural lands are affected due to landslides. Landslides affect the irrigation canal for supply of water. In some place human settlement are also in high risk. 	 Planting program should be organized in bare and risky area. Debris flow management and flood control. Retaining structure and bio engineering works.

Table 9: Resource summary considering general context, problem, cause and preventive measure.

Road	 28 local, branch and regional roads. Most of the roads are alluvial and some are gravel. 	 Rods are muddy and difficult to travel. All roads are not properly managed and maintenance. Road are narrow. 	 Need to upgrade the road in gravel and bitumen form. Construction of drainage and water passage structure. Need to widen the road.
Khijidemba	General information	Key Problem/cause	Preventive measure
Water Resource	 45 different sources of water, mainly use for drinking and irrigation. 	 Lack of water supply structure like tap, pipe. 	 Need to conserve and protect the sources. Afforestation near the sources. Pipe, tap and tank need to repair, expansion and management.
Land use/agriculture	 1 and 2 crops per year. The major crops are: Maize, paddy, r wheat, potato etc. Most of the land is fertile and suitable for agriculture. 	 Productivity decreases in last five year due to climate change, wildlife attack, lack of fertilizers and lack of irrigation.youth migration for foreign jobs 	 Uses of advance agriculture method and timely supply of fertilizers. Irrigation canal construction and sufficient supply of water. Control of wildlife attack. Rainwater collection for irrigation.
River/Flooding	 12 main rivers: Sisnekhola, manaikhola, linukhola, nosikhola, hatekhola, salmekhola, yolang khola, molung khola, taurekhola, nayaban khola, khundruke khola, thaha khola, khasikhola. Most of the river are perennial. 	 During monsoon seasons, these rivers affect on road, agricultural land and human settlement. 	 River control and training work. Afforestation in risky area. Change the direction of flow of river.
Forest	 The major and important community forest is: Janajati, Milijuli, saune pakha, thama thole, mehela, taure, miteri, uchha himali. Major's trees are: Salla, uttish, etc. Medicinal herbs are : machino, sunakhari, lokata harro, barro, chiraeto, satuwa, chudo, thulo okhati, pachaule etc. 	 All the medicinal herbs are not in use due to lack of investigate. Forest are decreases day by day due to deforestation for making bare land. 	 Control of deforestation. Study and investigate the available medicinal herbs.
Landslides	 10 landslides of small, medium and large size occurs in different year, 	 Obstruction on road in different places. Agricultural lands are affected due to landslides. 	 Planting program should be organized in bare and risky area. Retaining structure and bio engineering works.
Roads	 Some main road which are alluvial and narrow. 	 All the settlement are not in reach of roads. 	 Need to upgrade the road in gravel and bitumen form. Construction of drainage and water passage structure. Need to construct the road.

Molung	General information	Key Problem/cause	Preventive measure
Water Resource	• 62 for drinking and irrigation water supply	 All the sources are not in uses due to lack of investigation of sources Sources are unmanaged and pipes and reservoir tank are less effective for sufficient supply of water. Sources are polluted which causes diseases to local people 	 Need to find the all sources and make them usable. Conservation of source, Afforestation. Maintenance of sources and managed of pipes. Polluted water should make clean before supply to local peoples. Construction of intake and reserve tank. Wire mesh, fencing and grouting
Land use/agriculture	 2 to 3 crops in a year. The major crops are Maize, millet and paddy, Peanuts, Mustard, Wheat, unseason vegetable, 	 Productivity decreased in last five years due to climate change and youth migration for foreign employment, lack of irrigation facility, lack of chemical fertilizer, pesticides, and soil test and quality seeds. Wild animal destroy the agricultural crops. 	 Knowledge of modern agriculture technology. Control of wild animal. Construction of irrigation canal. Timely available of chemical fertilizers and pesticides Create better employment opportunity in the municipality
River/Flooding	 22 main rivers are: Chorey khola and dhobi khola, Molung, Poking, jhagarpur,pahirey, lipey, Prapcha khola, kulkhola, khalte khola, Gattekhola, gaukhola, Patkhari khola, ghumauni khola, seleley khola,mangalbare,amiley, kholi khola, chagekhola, bakhrekhola,khanikhola,and lapsekhola 	 During Monsoon season, these river affects agriculture land, settlement. 	 Construction of bridge and embankment, masonary wall Afforestation, river training, wire fencing Change the direction of flow,
Forest	 26 important community forests called: Dungi bilami, dadakhraka, jhagarpur, kuntadevi, thapachaur, Mahabhir hariyali, Raniban, Tekanpur, tilkhoriya ban, Aaitabare, kabuliyati, dadapahira bhalumar, saalghari kulghari, saalghari thulibhir, Khoparkhola ban, laliguras ban, Ganga jamuna ban, janajagaran ban, Tintaley ramailo ban, jalpadevi ban, panchakanya, serogari, tinjuli ban, lumlo, sunakhari, bagdip, and sakhare. Types of trees found are salla, uttis, kutmera, guras, mauwa, uttis, chilaune, paltle. 	 All the medicinal herbs are not in use due to lack of investigation Forest are decrease day by day due to deforestation. 	 Investigation of medicinal herbs. Establishment of small industry. Use modern technology for maximum use of medicinal herbs. To conduct awareness program about important of forest

	 Medicinal herb found: Amala, tej patta, nims patta, kurilo, pakhande, Hattichur, bojo, tulsi, argali, machine, satuwa. 		
Landslide	• 30 landslides occurred	 Impact on agriculture land, human settlement and road every year. No mitigation measure till now. Risk on human settlement 	 Afforestation, gabion wall, retaining structure, canal maintenance.
Road	 Regional and Branch alluvial road. Present condition of some roads are fragile. 	 Impact on forest, agriculture productivity, water supply system Difficult to travel in rainy seasons and many accident took place. 	 Proper study while setting alignment of roads. Retaining wall, wire fencing. Upgrade the road in gravel and bitumen types. Construction of motorable bridge and drainage along the road Drainage construction.
Siddhicharan	General information	Key problem/cause	Preventive measure
Water Resource	 43 spring sources use for drinking, irrigation and livestock farming. 	 Lack of water reserve tank, structure are in bad condition, unmanaged water delivered system, sources are polluted 	 Need to repair reserve tank, conservation of sources by wire fencing Improvement in water supply structure and make clean.
Land use/agriculture	 1 to 3 crops per year. The major crop are: Maize, paddy, potato, wheat, fapar, millet, orange etc. 	 Productivity decrease in last 5 year due to climate change, lack of irrigation, wildlife attack, insufficient fertilizers. 	 Use of modern irrigation technology, irrigation canal construction and management. Control of wildlife and flood er.
River/Flooding	 10 main rivers called: Jantarkhola, Aarubot, Fokteykhola, Pofitang, lipekhola, thaud khola, Nigalae khola, haribalaekhola, Amjalikhola, Chandanae khola. Some are seasonal and most are Perennial River. 	 During monsoon seasons these rivers effects on land ,road, human settlement 	 Afforestation, river training works, change the direction of flow of river.
Forest	 15 important community forest called: Ramite, holidhirdhuma, Lamelung, thuling gumba, Bhusunae, Siddaesori, chautaendada, Jyamire, Khodampa, okharai, Haribalae, school, Jalkini, Bakundae, Siddicharan. Types of tree are: salla, saal, khayer, guras uttis, chilaune, katus, pine, diyalo, patlae, kafal etc. 	 All the trees are not in use due to lack of skilled labour. Forest are decrease day by day due to taskari. Deforestation is increase. 	 To conduct awareness program about the importance of forest. Investigation of medicinal herbs that are found in those forest.

	 Medicinal herbs are: Sisno, amala, harro, barro, chiraeto, pakhenbed, thulo okhati, harchur, argali ,satuwatitepati, machino, khoseni etc. 		
Landslide	 10 landslides occurs in different years. 	 Risks on human settlement, agricultural land and affected on road. 	Afforestation. retaining wall construction, gabion worksDebris flow management.
Road	 Regional road and branch road in which some are bitumen and most of them are alluvial. 	 Affected on agricultural land, forest due to cutting. Road are muddy in rainy seasons which causes many accident. 	 Proper study while setting the alignment of roads. Construction of retaining wall and drainage Storm water management and afforestation.
Manebhanjyang	General information	Key problem/cause	Preventive measure
Water Resource	 44 spring sources ,mainly use for drinking, irrigation farming etc. 	 Lack of water supply structure. Sources are polluted due to carelessness. All the sources are not in use. 	 Construction of water supply structure. Conservation of drinking water sources. Afforestation, awareness program.
Land use/agriculture	 2 and three crops per year Mains crops are: Maize ,millet, paddy, Tobacco, potato ,fapar etc. 	 Productivity decreases in last 5 years due to climate change, lack of irrigation, lack of fertilizers. 	 Control of flood and management of irrigation canals. Control of wildlife attack, sufficient irrigation. Timely makes available of fertilizers. Using modern agricultural technology.
River/Flooding	 11 main rivers called: Molung, Dhuseni, Bhalukhola, Pankhukhola, Dumkhola, Ramdukhola, Kholakharka, Buksunkhola, Bakdukhola, Ghartikhola, and Ghalekhola. Many of these rivers are perennial land some are seasonal. 	 During monsoon seasons river affect the land, human settlement, roads. The rivers are polluted. 	 River training works, afforestation. Cleaning of rivers. Change the direction of flow of rivers.
Forest	 8 community forest are located in this rural municipality. Which are: chilauniban, salghari, chandistan, bagpahiley, ghantapadero, saunepani, deurali bajuwa, Deurali, Radhwapur, and Trishule Ratadanda. Different types of trees and medicinal herbs are found. 	 Deforestation all the trees are not in use. All medicinal herbs are not in use due to lack of investigation. Fire attack the forest every year which harm the wildlife and birds. 	 Control of deforestation. Study about the medicinal herbs that are found there. Make the tree usable by establishing the small paper industry. Need to visit the forest by local government to control deforestation.
Landslide	 9 landslides of small, medium and large sizes. 	 Effect on agricultural land, roads, human settlement. 	Need to planting tree in bare land.Construction of wall in risky area.Control of unnecessary excavation.

		 Landslides make difficult to walk and carrying goods in rainy seasons. 	
Road	 Branch and regional road. 	 All roads are alluvial so they are muddy in rainy seasons. Difficult to travel in rainy seasons. 	 Construction of drainage and retaining structure. While fixing the alignment of road, it is necessary to study in details. Afforestation is necessary. Upgrade and maintenance of roads.

Chapter 3: Climate responsive integrated watershed management plan

3.1 Vision, Goal, Thematic area

3.1.1 Vision, Goal, objective, guiding principle

Climate responsive integrated watershed management plan (CRIWMP) is a comprehensive strategy designed to address the problems of managing watershed resources within a specific watershed in the context of climate change. It gives emphasis to build resilience, adapt to climate change, and promote sustainable development for the benefit of both present and future generations. The vision of the CRIWMP is to ensure the sustainable management of watershed resources, enhance ecosystem resilience, and improve the livelihoods and well-being of communities within the vulnerable watershed in the face of changing climatic condition. The goal of the CRIWPM is to develop and implement strategies that effectively address the impacts of climate change on water resources, ecosystems, and communities within the vulnerable watershed. The ultimate aim is to achieve a balanced and equitable use of water, promote ecosystem health, and enhance the resilience capacity of the watershed to climate change. The main objective of the CR-IWMP is to analyses problem, baseline data, formulation of practical coping strategies for watershed planning and interventions for preparing climate resilient livelihood at both watershed and government unit level i.e. Palika level.

The guiding principles of this plan will be based on the set of values and considerations that will guide the decision-making and implementation process. These principles were followed to formulate the plan which is comprehensive, equitable, adaptive, and sustainable plan. Some key guiding principles of the plan are integrated approach of watershed planning; climate resilience: ecosystem-based approach; community participation and ownership, gender equity and social inclusion, knowledge and capacity building; cross-sectoral collaboration.

3.1.2 Rational of the CRIWMP

Lower Dudhkosi and Molung watershed have a similar bio-physical condition; most fragile ecosystems characterized by steep slopes, fragile geology, poor agricultural potential, and water scarce area. The rationale behind a climate responsive integrated watershed management plan preparation is also rooted in the need to address the complex challenges posed by climate change, upstream and downstream problems and ensure sustainable watershed resource management. Here are some key reasons that justify the development and implementation of such a plan:

1. Vulnerability to Climate Change: These two watersheds are highly vulnerable due to the impacts of climate change due to its unique geographical and topographical characteristics. This area is prone to a range of climate-related hazards, including floods, landslides,

droughts, and glacial lake outburst floods. These hazards are expected to intensify with climate change, posing significant risks to water resources, ecosystems, and human settlements.

2. Water Scarcity and Dependence: The project area heavily relies on water resources for various sectors, including agriculture, hydropower and domestic use. However, these watersheds area already faces water scarcity issues, particularly during the dry season, which is likely to worsen with climate change. Integrated watershed management becomes crucial to optimize water availability, enhance water-use efficiency, and sustainably meet the growing water demands.

3. Ecosystem Conservation and Biodiversity: The study areas are known as rich in biodiversity, ranging from the high Himalayas to the foot hills. Ecosystems provide critical services such as water regulation, soil conservation, and habitat for diverse flora and fauna. A climate responsive integrated watershed management plan recognizes the need to conserve and restore ecosystems to maintain their ecological integrity, support biodiversity, and enhance resilience to climate change.

4. Rural Livelihoods and Food Security: The majority of Nepal's population depends on agriculture and natural resources for their livelihoods. Climate change impacts, such as changing rainfall patterns and increased frequency of extreme events, can negatively affect agricultural productivity, food security, and rural livelihoods. Integrated watershed management strategies that promote sustainable agriculture practices, water resource management, and soil conservation can help enhance the resilience of rural communities.

5. Policy and Institutional Framework: Nepal has recognized the importance of integrated water resources management through its national policies and strategies, such as the Water Resources Strategy (2002) and the National Adaptation Programme of Action (NAPA) on Climate Change. Implementing a climate responsive integrated watershed management plan aligns with the country's policy framework, strengthening institutional capacity and coordination for effective water resource management.

6. Sustainable Development Goals (SDGs): The climate responsive integrated watershed management plan aligns with the SDGs, particularly Goal 6 (Clean Water and Sanitation), Goal 13 (Climate Action), Goal 14 (Life below Water), and Goal 15 (Life on Land). It contributes to achieving these goals by ensuring sustainable and equitable management of water resources, building climate resilience, conserving ecosystems, and promoting sustainable development.

8. Collaboration and Stakeholder Engagement: Watershed management requires collaboration among diverse stakeholders, including government agencies, local communities, NGOs, and private sectors. An integrated management plan provides a platform for effective stakeholder engagement, fostering cooperation, sharing of

knowledge, and collective action. By involving stakeholders in the decision-making process, the plan can better reflect local needs and build ownership, leading to more effective and sustainable outcomes.

3.1.3 Thematic Area

Field level consultation and interaction identified that a climate-responsive integrated watershed management plan should incorporate several thematic components to effectively address the challenges posed by climate change. However, it's important to customize the plan based on local conditions, stakeholder priorities, and available resources to ensure its effectiveness and sustainability. Some recommended key thematic components for sub-watershed management are as follows:

1. Sustainable Agriculture and Land Management: Promote climate-smart agricultural practices that improve productivity, enhance soil health, and reduce greenhouse gas emissions. This includes promoting organic farming, agro-forestry, terrace farming, and crop diversification. Integrate soil conservation measures, such as contour plowing, bunding, and terracing, to reduce soil erosion and improve water retention.

2. Forest and Biodiversity Conservation: Forest has critical role in water regulation and climate resilience, this component focuses on promoting forest conservation and biodiversity enhancement. Encourage community-based forest management approaches, afforestation, enrichment plantation initiatives, and the protection of biodiversity hot spots and critical habitats. Implement measures to reduce deforestation, mitigate soil erosion, and enhance carbon sequestration.

3. Water Induced Disaster Risk Reduction: Given the vulnerability of the mid-mountain region to climate-related disasters, this component focuses on enhancing disaster preparedness and risk reduction measures. Implement early warning systems, slope stabilization measures, and community-based disaster management plans. Promote awareness and education on disaster risk reduction and ensure the integration of climate risk considerations into infrastructure development.

4. Water Resource Management: This component focuses on the sustainable management of water resources within the sub-watershed. It includes activities such as water source protection, water conservation, rainwater harvesting, groundwater recharge, and the development and improvement of small-scale irrigation systems. Emphasize the integration of traditional skill, knowledge and modern techniques to optimize water availability and improve water use efficiency.

5. Capacity Building and Institutional Strengthening: Foster active community participation and ownership throughout the watershed management process. Strengthen the capacity of three tiers of government (Federal, province, and local) as well as local institutions and user groups to facilitate collaborative decision-making, resource management, and conflict

resolution. Promote gender equality and social inclusion in decision-making processes and ensure the representation of marginalized groups.

3.2 Outcome and Output

Climate Responsive Integrated Watershed Management Plan (CRIWMP) of Chisankhugadhi RM Lower Dudhkoshi and Molung watershed is a broad action plan document to be implemented at Chisankhugadhi RM, Okhaldhunga Districts in Koshi Province of Nepal. The outcomes, output and activities were identified based on TOR, series of consultation meetings among the technical team and key stakeholder, and understanding major problem of watershed degradation. Details of the outcomes of the plans with associated outputs and activities are as follows:

- Outcome 1: Sustainable Agriculture and Land Management
- Outcome 2: Forest and Biodiversity Conservation
- Outcome 3: Water Induced Disaster Risk Reduction and Management
- Outcome 4: Water Resource Management
- Outcome 5: Capacity Building and Institutional Strengthens

To get designated outcome, there are several specific activities under each outputs of these outcomes. A brief description of these outcomes, outputs, and activities are listed as below.

Outcome 1: Sustainable Agriculture and Land Management

Output 1: Improved sustainable agriculture, food and nutrition security and climate resilient health and hygiene.

Output 2: Economic well-being of local communities enhanced through commercial farming on agriculture and livestock to climate resilient livelihoods

Output 3: Established and functional insurance and community and peasant friendly climate induced risk sharing model expansion in both agriculture and livestock.

Output 4: Increased abundance, diversity and accessibility of landraces to strengthened livelihood

Output 5: Improved climate resilient irrigation facilities and irrigation area for agriculture production

Output 6: Climate smart transformative collective agriculture promotion adopted

Output 7: Improved integrated soil nutrient management for resilient agriculture

Output 8: Capacity of agriculture and livestock technicians, farmers substantially increased on climate change adaptation.

Output 9: Improved livelihood diversification options and income generation opportunities for communities.

Outcome 2: Forest and Biodiversity Conservation

Output 1: Increased forest cover and quality

Output 2: Enhanced biodiversity conservation.

Output 3: Reduced Dependency of local communities on natural forests

Output 4: Livelihoods of community are enhanced from community-led management of forests

Outcome 3: Water Induced Disaster Risk Reduction and Management

Output 1: Improved early warning systems and preparedness for water-induced disasters

Output 2: Enhanced infrastructure and measures for flood control and mitigation

Output 3: Strengthened community-based disaster risk reduction and preparedness.

Output 4: Improved land and water management policy to reduce erosion and sedimentation risks

Outcome 4: Water Resource Management

Outputs 1: Increased availability and access to clean water for domestic and agricultural purposes.

Output 2: Enhanced water conservation and efficiency measures.

Output 3: Increased community participation and strengthen institutional capacity in water management and decision-making.

Outcome 5: Capacity Building and Institutional Strengthening

Output 1: Enhanced knowledge and skills of stakeholders on climate-responsive integrated watershed management.

Output 2: Strengthened institutional capacity and coordination mechanisms for integrated watershed management.

Output 3: Improved coordination and collaboration among stakeholders for effective implementation of the watershed management plan.

Output 4: Enhanced gender mainstreaming and social inclusion in watershed management initiatives.

3.3 Logical Framework

Major identified outcomes of the plan for watershed are enhanced water availability and reliability through its management, forest and biodiversity conservation, increased resilience of local communities to climate-related risks, sustainable agricultural practices, reduced soil erosion and sedimentation, reduced vulnerability to water induced disasters, diversified and resilient livelihood opportunities, strengthened community institutions and participation, and improved knowledge and capacity for climate adaptation.

Similarly, outputs of the management plan would encompass the implementation of water source conservation and management measures, forest and biodiversity conservation initiatives, adoption of climate-smart agricultural practices, establishment of disaster risk reduction mechanisms, livelihood diversification programs, community-based institutions and networks, climate information services, and monitoring and evaluation systems to track progress and inform adaptive management. Based on outcomes, outputs and activities, the log frame of the project is prepared. Details of the outcomes of the plans with associated outputs, indicators, means of verification and risk and assumption is described for all components in the logical framework Table 11.

Table 10: Logical Framework

Project Name	Preparation of Climate Responsive Integrated Watershed Management Plans for Lower Dudhkoshi and Molung Watersheds
	focusing on Molung Watershed.
Project vision:	To ensure the sustainable management of watershed resources, enhance ecosystem resilience, and improve the livelihoods and well-
	being of communities within the vulnerable watershed in the face of changing climatic condition.
Project Goal:	To develop and implement strategies that effectively address the impacts of climate change on water resources, ecosystems, and
	communities within the vulnerable watershed. The ultimate aim is to achieve a balanced and equitable use of water, promote
	ecosystem health, and enhance the resilience capacity of the watershed to climate change.
Overall Objective:	To develop/formulate climate responsive evidences based on the baseline, watershed situation analysis, and problem analysis, and
	formulation of practical coping strategies for watershed planning and interventions to prepare climate resilient livelihood at
	watershed and government unit level i.e Palika level.

Outputs	Objectively Verifiable Indicators	Means of Verification	Risk and Assumption
Outcome 1: Sustainable Agriculture and	I Land Management		
 Improved sustainable agriculture, food and nutrition security. 	 695 Ropani degraded land Improved by conservation farming 8900 farmers adopted cultivation practices of crops by proper utilization of land using appropriate cropping pattern and climate resilient approach. 	 Municipality/Ward and AKC progress report 	 If LGS support continue on sustainable farming.
2.Economic well-being of local communities enhanced through commercial farming on agriculture	 3450 farmers have started Commercial agriculture and livestock farm establishment 	 Municipality/Ward and AKC progress report 	 Youth motivation on commercialization farming and LGS support on marketing of products

Outputs	Objectively Verifiable Indicators	Means of Verification	Risk and Assumption
3. Established and functional insurance and community and peasant friendly climate induced risk sharing model expansion in both agriculture and livestock.	 12,450 farmers benefited from insurance program 	 Progress report Municipality/wards and AKC and Forest. 	 Insurance agents available to provide services in remote hill district/municipality.
4.Increased abundance, diversity and accessibility of landraces to strengthened livelihood	 Increased 2000 ha area for cultivation of local landraces. 	 Progress report of Municipality/ Ward. 	 If LGs support continue to promote indigenous crops.
5.Improved climate resilient irrigation facilities and irrigation area for agriculture production	 Increased 1750 ha irrigated area. Increased crop production and productivity of cereals by 0.5 tons/ha 	 Progress report of Municipality/ Ward. 	• Continue support from DOI, SIP and LGS.
6.Promotion of climate smart agriculture adopted	 Introduced at least 20 crop varieties and 100 livestock breeds resist to extreme weather induced by climate change and resistant to diseases and pests attack. 	 Municipality/Ward and AKC progress report 	• If NARC Department of Agriculture, Department of Livestock of MOLD able to provide crop varieties seeds/saplings, breeds suitable to climate change.
7.Improved integrated soil nutrient management for resilient agriculture	 Increase soil productivity of 5,550 ha land Improve in soil nutrients content that supports the growth of all forest and agricultural plants including carbon sinks and stress tolerant varieties. 	 Municipality/Ward and AKC progress report 	LGS support continue on soil fertility improvement
8. Capacity of agriculture and livestock technicians, farmers substantially increased on climate change adaptation.	Capacity Of 100 staff enhanced.	Progress report Municipality/wards and AKC	LGS support on capacity development on climate change

Outputs	Objectively Verifiable Indicators	Means of Verification	Risk and Assumption
9. Improved livelihood diversification options and income generation opportunities for communities.	 100 Number of livelihood diversification options implemented. 	 Project reports and documentation of livelihood diversification activities. 	• Availability of technical expertise and resources to implement livelihood diversification options.
Outcome 2: Forest and Biodiversity Cor	iservation		
 Improved sustainable forest management practices and increased forest cover and quality. 	• By 2028, at least 5 no of accessible forests handed over to CFUG for community-based forest management practices.	 Division Forest Office (DFO) annual progress report, Community Forest User Group (CFUG) minute report Municipality progress report 	 Adequate funding and resources are available to implement activities.
2. Enhanced biodiversity conservation within the watershed.	 18 no hotspots and critical areas protected to restore the biodiversity within the watershed. 	 DFO annual monitoring report, CFUG minutes 	 Strong collaboration and coordination among stakeholders are maintained
3. Strengthened institutional capacity for forest and biodiversity conservation.	• 195 No of Training, and logistic support provided for an institutional capacity upgrade for forest and biodiversity conservation.	 Institutional capacity assessment reports and evaluations. 	 Supportive policies and regulations are in place to facilitate sustainable forest management
4. Increased awareness and participation of local communities in forest and biodiversity conservation activities.	• By 2027, 140 no of awareness campaigns and workshops for the participation of local communities	 DFO annual monitoring report, CFUG minutes 	• Local communities are actively engaged and empowered in forest and biodiversity conservation efforts.
Outcome 3: Water Induced Disaster Ris	k Reduction and Management	·	·

Outputs	Objectively Verifiable Indicators	Means of Verification	Risk and Assumption
 Improved early warning systems and preparedness for water-induced disasters. 	 By 2027 about 1 early warning system is established and placed in function. 	• Early warning system reports and documentation.	 Adequate funding and resources are available to support the establishment and operation.
Enhanced infrastructure and measures for flood control and mitigation.	 660 no of flood control and mitigation structures implemented. 	 Progress report of SWMO, WRIDDO, and Project reports Municipality progress report, Field assessments. 	 Adequate funds and technical manpower are available
3. Strengthened community-based disaster risk reduction and preparedness.	 385 Number of trained community members in disaster risk reduction and preparedness. 	• Training records of DAO, WRIDDO, WSSDO, community participation records, and feedback.	 Local communities are actively engaged and willing to participate in training.
4. Improved land and water management practices to reduce erosion and sedimentation risks.	 137 ha of farmland conserved and 25 km embankment for flood control. 	 Assessment report on erosion rates and sediment at the river bed. Field observation 	 Stakeholder cooperation and compliance with recommended land and water management
Outcome 4: Water Resource Manage	ment		
1. Improved water resource planning and governance	• 5 integrated water resource management plans in each ward.	Water resource management plans, reports, and monitoring data.	 Adequate funding and resources are available to support the implementation of water resource management activities.
2. Increased availability and access to clean water for domestic and agricultural purposes.	• 4150 Number of households and agricultural areas with improved access to clean water.	 WSSDO progress report Palika water quality monitoring reports WUG minute 	• Strong collaboration and coordination among stakeholders are maintained throughout the implementation process.

Outputs	Objectively Verifiable Indicators	Means of Verification	Risk and Assumption
3. Enhanced water conservation and efficiency measures.	 100 no of water use efficient technique adopted in domestic and agricultural sectors. 	 WSSDO and SWMO progress report Municipality report Water use data, project report 	 Supportive policies regulations and funding are in place to promote water conservation and efficient water use.
4. Improved watershed management practices to reduce soil erosion and enhance water quality.	• 460 water resources protected from landslides and improved water quality indicators.	 Soil erosion monitoring data, water quality monitoring reports 	 Local communities are actively engaged and empowered in watershed management activities.
5. Strengthened institutional capacity for water resource management.	 Improved logistic support in institutional capacity assessments for water resource management. 	WSSDO and SWMO progress report	• Technician and water user groups are capable to implement water resource management activities
6. Increased awareness and knowledge of water resource management practices among local communities and stakeholders.	 340 no of awareness campaigns and workshops on water resource management practices. 	 Surveys, training records, and community feedback. 	 Local communities and stakeholders actively participate in water resource management activities and decision- making processes
Outcome 5: Capacity Building and Ir	istitutional Strengthening		• •
 Enhanced knowledge and skills of stakeholders on climate-responsive integrated watershed management. 	 1390 Number of stakeholders trained on climate-responsive integrated watershed management. 	 Training reports, attendance sheets, and evaluation feedback. 	 Adequate funding is available for capacity-building activities.
2. Strengthened institutional capacity and coordination mechanisms for integrated watershed management.	• 5 no of upstream and downstream forums formed and logistic support to the service provider for IWMP.	 Institutional capacity assessment reports and evaluations. 	 Supportive policies and regulations are in place to facilitate IWM

Outputs	Objectively Verifiable Indicators	Means of Verification	Risk and Assumption
3. Improved coordination and collaboration among stakeholders for effective implementation of the watershed management plan.	 1500 Number of stakeholder meetings and collaborations performed. 	 Meeting minutes, collaboration agreements, and progress reports. 	 Strong commitment and participation from stakeholders in implementing the IWM plans
4. Enhanced gender mainstreaming and social inclusion in watershed management initiatives.	• 1650 Numbers of women and socially excluded HH involve in training and plan implementation.	 Training reports, minute records, and attendance sheets. 	 Adequate funding and resources are available to support mainstreaming activities.

3.4 Action Plan

The action plan of Molung Watershed comprises the proposed activities for 5 years period as given in TOR. Details activity wise cost calculation is given in (Table 13-Table 17) and year wise action plan is given in Table 18. The basis for selection of wards/location, cost calculation was based on field survey, interaction directly contact with experts where possible, KII, considering own experience and field observation. Summary of the cost is shown in Table 12.

Table 11: Summary of cost calculation

	Estimated cost (In
Action plan	000,NRS)
Outcome 1: Sustainable Agriculture and Land Management	3,605,650
Outcome 2: Forest and Biodiversity Conservation:	198,983
Outcome 3: Water-Induced Disaster Risk Reduction and Management	532,100
Outcome 4: Water Resource Management	696,735
Outcome 5: Capacity Building and Institutional Strengthening	63,000
Total	5,096,468

Table 12: Outcome 1: Sustainable Agriculture and Land Management

Activities	Sub-Activities	Interventions wards/Location	Estimated
			cost (In 000,
			NRS)
Output1: Improved su	stainable agriculture, food and n	utrition security	
 Increase crop production through sustainable agriculture 	 Promotion of intercropping in fruit orchard; Use indigenous knowledge for pest management; Cultivation 	 Sunkoshi: Wards 3, 4, 6 7 & 8: Subsistence farming maize, paddy, wheat & millet; Ward 5: Unirrigated area crops grown maize mustard, millet & potato; Ward 9 & 10: wheat maize paddy in Khet and potato maize, millet in Bari land. Khijidemba: Ward-5, 6 & 9 Molung: Ward-1 (Dhakal Gauon, Sahalar & Thapachour) Main crops grown are paddy 	1400 3100
practice and climate change adaptation.	crops combine with forest/fodder tree species; Home gardening utilizing waste water of kitchen. Protecting crops and animals from damaging /killing from wild animals.	maize, millet wheat, buckwheat,potato and mustard; Ward -2 (Rampur, TorisaharThuskelamidanda,DadhuwaMuhan, Tehanpur and Mahabhir) crops grown are rice, maize, millet, potato,mustard; Ward -3 (Gopehaki,Phiddim, Bhrigr, gogundanda,Chautar,prapcha) Crops grown are maize, paddy,wheat, tori and buckwheat; Ward 4 (Harkapur, Dandabensi, Rupetar, Kharkheti, Jasaptar, Jaljale,Kunduledhap, Phattegauon) crops grown are paddy, maize wheat, millet, potato, oybean, mustard; Ward 5- Main crops grown are paddy maize, millet wheat, buckwheat ,soybean, potato and mustard; Ward 6- Main crops grown are paddy maize, millet wheat, buckwheat ,soybean, potato and mustard; Ward-7 Main crops grown are maize, millet, wheat, buckwheat, potato; Ward-8 Main crops grown are maize, millet, paddy, wheat, buckwheat, potato,mustard and vegetables.	
		 Siddhicharan: Ward-6 Cereals, Vegetables; Ward 7 Cereals; Ward-8 Cereals; Ward 9 Vegetables; Ward 10 Cereals, pulses, vegetables, fruits, bee keeping; Ward 12 Cereals, pulses, vegetables, fruits. 	2350
		• Manebhanjyang: Ward 4- Millet, maize, potato; Ward-8- Maize, millet, buckwheat; Ward 9- Maize, millet, paddy, buckwheat.	2350
Output 2: Economic w	ell-being of local communities er	nhanced through commercial farming on agriculture and livestock to climate resilient livelihoods	
 Diversify rural 	Commercial cultivation of	• Sunkoshi: Nursery establishment for fruits and vegetables: one in each ward; Ward 3:	7500
livelihoods and	high value horticultural	Potato, avocado, oranges, mango Rajma beans Ward 4: Potato, vegetables, legumes,	

Activities	Sub-Activities	Interventions wards/Location	Estimated
			NRS)
increase incomes	crops. (fruit, vegetables,	Mango, Litchi; Ward 5: Potato and mustard Ward 6: potato, vegetables and fruits; Ward 7:	
through	spices crops, cash crops) ;	cardamom and lemon at Kaurini, Rayale, Parakhola and Gairebari; Ward 8: Potato; Ward	
commercialization		9: Potential for potato and vegetables at masar, Gurung gau, kakani khola, Tyasre tol and	
of agriculture and		Gopae tol; Ward 10: potato, oranges, mango, Cardamom at Babiya, Paiyabot, Kussa devi,	
Livestock farming.		and Neware Tol; Selected wards: Seed production programs of cereals and vegetables;	
		Selected wards: Bee keeping and mushroom farming	
		• Khijidemba: Ward-5, 6 & 9 - Nursery establishment for fruits and vegetables; Ward-5, 6 &	3400
		9- Commercial cultivation of vegetables, fruits, beans, ginger, turmeric, cardamom, apricot	
		and kiwi. Seed production program of vegetables and cereals; Ward-5, 6 & 9 One Rustic	
		store for selected ward; Bee keeping Mushroom cultivation; collection center; farm	
		mechanization; Livestock commercialization (cow, buffalo, goat, pig poultry and sheep).	
		• Molung: Nursery establishment for fruits and vegetables: one in each ward; Ward 1 lemon	7600
		Kiwi, coffee; Ward -2 Fruits and off season vegetables; Ward-3 Potato pocket Ward 4-	
		Potential for coffee, banana, off season vegetables and fruits; Ward 5- Potential for off	
		season vegetables; Ward 6- Fruits,apple, Kiwi and many other species) Potato and off	
		season and seasonal vegetables; Ward -7 Potential for cultivation of citrus, banana, coffee,	
		aakabre chilli, potato and off season vegetables; Ward -8 Potential for cultivation of citrus,	
		cardamom Kiwi fruit, apple, coffee and potato; Bee keeping: Potential few wards; Crops	
		commercial farming selected few Wards	
		• Siddhicharan: Nursery establishment for fruits and vegetables: one in each ward; Ward 6	11,950
		(Jantarkhani): Potato, seed potato, Rainy season Vegetables Strawberry Ward 7 (bigutar.)	
		Vegetables and potato; mushroom; Ward 8 (Salleri): Vegetables, Lime Soybean; Ward 9:	
		Vegetables; Ward 11 &12: Vegetables; Selected Wards: Livestock commercial farming.	
		• Manebhanjyang: Nursery establishment for fruits and vegetables: one in each ward;;	10,500
		Ward 4- Fruits and vegetables; Ward-8- Fruits and vegetables; Ward 9- Fruits and	
		vegetables; Mushroom cultivation; One Rustic store for selected ward only; Bee keeping:	
		Potential few wards; Livestock commercial farming All Wards	

Activities	Sub-Activities	Interventions wards/Location	Estimated cost (In 000,
Output 2: Established			NRS)
Output 3: Established	and functional insurance and cor	nmunity and peasant friendly climate induced risk sharing model expansion in both agriculture and	IIVESTOCK.
 Initiate program 	 Prepare a list of private 	All Palika wards	2000
on Crop and	insurance company of		
Livestock	agriculture and livestock		
Insurance to	and make agreement for		
minimize risk due	crop livestock insurance;		
to extreme	Awareness program and		
weather	capacity building		
conditions.			
Output 4: Increased at	oundance, diversity and accessibi	ility of landraces to strengthened livelihood	
 Identify, collect 	Establish Community Seed	 Potential wards (at least one community seed bank in the municipality) 	4,800
and proper	bank and Conduct seed		
conservation of	multiplication program of		
local land races to	different crops to make		
develop climate	self- sufficient in seeds;		
resilient crop	Promotion of indigenous		
varieties.	crops, seed production		
	and storage.		
Output 5: Conduct pro	ogram to identify and design cons	struction of irrigation canal and promote water harvesting technology	
 Identify the 	Irrigation canal support	• Sunkoshi: Ward 3: Lifting water from Dhand Khola at Daabitar; Ward-4 Lift irrigation from	291,000
potential source		Dhandha Khola at Bandare and Dula; Ward 6: Rain water collection for irrigation at	
of water for		Aalegauon; Ward 7: Irrigation canal maintenance (Source Parakhola) at Parakhola; Ward 8:	
irrigation, design		Lifting irrigation from Molung river at Agrakhe	500
and construct		Knijidemba: ward 6-irrigation canal at Bnittee	500
irrigation canal		Molung: Ward -1 Dhakal Gauon, Sahalar & Thapachour Lift irrigation; Ward -2 Rampur,	3,131,000
repair and		TorisaharThuskelamidanda,DadhuwaMuhan, Tehanpur and Mahabhir; Ward -3	
maintenance.		Gopehaki,Phiddim, Bhrigr, gogundanda,Chautar,prapcha; Ward- 4 (Harkapur, Dandabensi,	

Activities	Sub-Activities	Interventions wards/Location	Estimated cost (In 000,
			NRS)
 Rain water harvesting using roof water collection, Plastic 		Rupetar, Kharkheti, Jasaptar, Jaljale,Kunduledhap, Phattegauon) irrigation canal from kulkhola and molung khola resources; Ward -5 Lift irrigation; Ward- 6 Irrigation canal from water source of patkharikhola, nubu khola and selele khola; Ward -7 Irrigation canal improvement , lift irrigation; Ward -8. Irrigation canal, Pipes and ponds.	
ponds, small and medium sized		• Siddhicharan: Ward 12 reservoir tank (source Bandhekhola) at Sitala Gogane and bhandare and rest of the all wards of municipality (2,6,7,8,9,10 &11)	59,050
reservoir tank construction		 Manebhanjyang: Ward 4: Rolbu Kulo Sichai Marmat, Pamkhu Khola Kula Sichai Marmat, Jhamku Khola Sichai Marmat, Peku Kulo Mathillo Sichai Marmat, Peku Kulo Tallo Sichai Marmat Ward -8.: Irrigation canal repair Bhalu khola New) Ward 9: Dhurseni Simlebensi khola, Dhurseni-Bankhu, Molung-Thulobensi, Sikapu-Abdu-Gwalu, Bhalukhola-Siapu (New) 	45,850
Output 6: Climate sma	rt transformative collective agric	culture promotion adopted	
• Conduct program to explore, assess and promote climate smart technology.	 Conduct program to introduce crop varieties resistant to drought, disease and pest; Conduct Zero or minimum tillage practices of wheat in few wards of municipality; Introduce system of using Green Color Chart (GCC) to determine nitrogen level in soil; Use of SRI technology in rice cultivation. 	Selected wards	2900

Activities	Sub-Activities	Interventions wards/Location	Estimated cost (In 000,
			NRS)
Output7: Improved int	egrated soil nutrient manageme	nt for resilient agriculture	•
 Conduct program 	 Program to demonstration 	All wards	4150
to improve soil	of Compost making and		
fertility and	bio fertilizer & vermi-		
nutrient	compost; Plantation of		
management	green manure such as		
	Dhaincha demonstration;		
	Cowshed improvement		
	program; Agro forestry		
	promotion; Promote		
	plantation of legume		
	species such as IPIL-IPIL		
	and low water consuming		
	tree; carbon farming		
Output 8. Capacity of a	agriculture and livestock technici	ans, farmers substantially increased on climate change adaptation.	
 Capacity building 	• . Enhance the capacity of	All wards	4550
of agriculture	agriculture technicians;		
technicians,	Organize exposure tours		
farmers from	visit and capacity		
climate change	development program.		
perspective.			
Output 9: Improved liv	velihood diversification options a	nd income generation opportunities for communities.	
Diversify	Conduct Income	All wards	4600
livelihoods	generating activities on		
through	crop , livestock and forest		
commercialization	sectors in commercial		
	scale		

Activities	Sub-Activities	Interventions wards/Location	Estimated
			cost (In 000,
			NRS)
in agriculture and			
forestry.			

Table 13: Outcome 2: Forest and Biodiversity Conservation

Activities:	Sub-activities	Intervention location/ward	Estimated cost(in 000, NRS)
Output 1: Increased forest cove	er and quality		,
1. Forest Inventory and	Forest inventory	All wards	2400
Assessment:	Vulnerability assessment	All wards	1800
2. Community-based Forest	CFUG formation	All wards	465
Management	CFOMP renewal and preparation to incorporate climate	All wards	7,560
	change concern		
	Forest management training (silviculture, invasive species,	All CFUGs in the wards	7,230
	and regeneration management		
3 Reforestation and	Plantation (enrichment and afforestation)	The potential area of all wards	15000
Afforestation	Nursery establishment	In each ward on selected CFUG	6000
	Seedling production forest species 50,000 no	In Wards	9000
	NTFPs seedlings production 50, 000 no	In DFO nursery	12000
4 Forest Conservation and	Enhance Forest paroling	All ward	2000
Protection:	Involve CFUGs in forest monitoring and surveillance.	All ward	2000
	Control forest fires, pests, and diseases	All CFUGs in the wards	3850
Output 2: Enhanced biodiversit	y conservation		
5.Biodiversity Conservation	Protection of critical habitats and hotspots	All national and CF in the Palika	6500
	Habitat restoration	Selected forest areas of ward	400
	NTFPs and medicinal plants cultivation	In all wards	11,800
Output 3: Reduced Dependency of local communities on natural forests			
6.Public private partnership	Promote Private plantation	In all wards	4200
	Promote agroforestry on public and private land	In all potential areas of wards	40,000

Activities:	Sub-activities	Intervention location/ward	Estimated
			cost(in
			000, NRS)
Output 4: Livelihoods of comm	unity are enhanced through CBFM system		
7.Provide technical support	Promote Green IGAs (Broom grass, Cardamom, and NTFPs	In all potential areas of wards	26,500
	cultivation)		
	Promote private forest nursery	Sunkoshi: Koshbhanjyang,, Chyaman, Mulkharka, Sisneri and	2200
		Balakhu; Khijidemba: Khiji Phalate, Pokale and Patle; Molung,	
		Siddhicharan, Manbhanjyanh (All potential ward)	
	Provide support to promote eco-tourism development	Sunkoshi: Ward 9, Kakani waterfall, War 5 Jure Danda, Ward	31,750
		7, Chanchaladevi temple; Khijidemba: Ward 8, Khiji	
		Tholedemba; Molung, Siddhicharan, Manebhanjyanj (In	
		Wards)	

Table 14: Outcome 3: Water Induced Disaster Risk Reduction and Management

Activities:	Sub-activities	Intervention location/ ward	Estimated
			cost(in
			000 <i>,</i> NRS)
Output 1: Improve	ed early warning systems and preparedness for wate	r-induced disasters	
	F		1
1. Hazard	 Water-induced hazard assessment (floods, 	Rural municipality	4000
Assessment and	landslides, and debris flow)		
Mapping	Implement hazard and vulnerability maps	Rural municipality level	2000
	Analyze historical data and climate projections	Rural municipality level	2100
Early Warning	Establish early warning systems	Rural municipality level	4000
Systems			
	Install rain gauges, river level sensors, and	Rural municipality level	4000
	landslide sensors.		

Activities:	Sub-activities	Intervention location/ ward	Estimated cost(in 000, NRS)
	Develop procedures and protocols for an early warnings system	Rural municipality level	2000
Output 2: Enhance	ed conservation measures for flood control and mitig	gation	
Implement soil and water conservation measures	Promote nature-based solutions (reforestation, slope stabilization, gulley plugging, and grass planting)	 Sunkoshi: In ward 3 & ward 4: Binase and Thinkhande; ward 5: Nagibhir; ward 6 & ward 7: Dhandkhet landslide; ward 8: Mahabhir and Sisne khola landslide; ward 9: Thulo and Dayaram tol landslide; ward 10: Lapse and Mandre Dobhan landslide. Khijidemba: In potential road and sloppy area of ward 5, 6 and 9 Molung: In problematic rural access road of ward 1 to 8 Siddhicharan: ward 6 (1 no), ward 7 (2 no), ward 8 (1), ward 9 (2 no), ward 11 (1) and ward 12 (1 no). Manebhanjyang: Ward 4 Dhuseni (1 no), ward 8 Phalame landslide (1 no), ward 9 Banakhu Bhokteni and Khrtighar (2 no). 	69,000
	Construct spurs, embankments, retaining walls, integrating bioengineering.	 Sunkoshi: Ward 3: Dhadkhola Odare; ward 4: Sunkoshi jaunghat; ward 5: Dhdkhola; ward 6: Molung khola and Sisner Khola; ward 7: Para khola, ward 8: Balaute khola; ward 9: Lahareni, Kakani and Gope khola; ward 10: Solung khola and Lahareni khola Lapse Dobhan Khijidemba: Ward 5: Sisne, Mane and Linu khola; ward 6: Nosi khola, Hate khola, Salme khola, Yolang khola, Kopche Mahir khola; ward 9: Molung khola, Taure khola, Ripal khola, Nayaban khola, Khundurke khola, Thaha khola, Khasi khola Molung: Ward 1: Chore khola and Dhobi Khola; ward 2: Molung Pokting, Jhagarpur and Lipe khola; ward 3: Prapcha, Kul and Khalte khola; ward 6: Patkari, 	218,000

Activities:	Sub-activities	Intervention location/ ward	Estimated cost(in 000, NRS)
	Implement measures, such as terracing, retaining walls, landslide treatment and bioengineering techniques.	 Ghumaune, Selele, Amile and Mangalbare khola; ward 7: Khani khola, Lapse, Ghatte khola, Bakhre khola, Change khola, ward 8 Sepli, Molung and Sirese khola. Siddhicharan: Ward 6: Jantar and Aarubote khola; ward 7: Pophitang and Lipe khola; ward 8: Adhere khola; ward 9: Lipe and Adhere khola; ward 10: Nigale and Amjali khola; ward 11: Lipe khola and ward 12 Lipe, Thade and Chandane khola. Manebhanjyang: Ward 4: Molung khola, Dhuseni and Bhalu khola; ward 8: <i>Molung khola and Bhalu khola;</i> ward 9: <i>Molung khola, Bagdu khola and Dharti khola.</i> Sunkoshi: Ward 3: Bahramase landslide, Simpani landslide, Khanigaun landslide; ward 4: Phoksingtaar and Dhadebesi; ward 5: Manebhir; ward 6: Thulo landslide, Bhadaure landslide; ward 7: Beshi landslide, Rayagau landslide; ward 8: Birta tole; ward 9: Lahareni landslide; ward 10: Tallo Babiya landslide. Khijidemba: Landslides of ward 5, 6 and 9 Molung: Ward 1 (1 no), ward 2 (3 no), ward 3 (2 no), ward 4 (5 no), ward 5 (2 no), ward 6 (4 no), ward 7 (7 no), and ward 8 (6 no) Siddhicharan: ward 6 (1 no), ward 7 (1 no), ward 9 (1 no) and ward 11 (1) Manebhanjyang: Ward 4: Dhuseni, Thulojure and <i>Parangas</i> (3 no); ward 8: Murale and <i>Dhap landslide (2 no);</i> ward 9: Thulobesi, Matebesi, Simle Rai Gaun, <i>Saldanda, Dhadepakha and Chargharetar</i> (6 no). 	82,000
	Integrate climate change concerns into infrastructure design and construction	Sensitive settlements	129,750

Activities:	Sub-activities	Intervention location/ ward	Estimated cost(in 000, NRS)
Output 3: Strengt	hened community-based disaster risk reduction and	preparedness	
Community Preparedness	Conduct disaster-related training	Rural municipality level	7,800
and Capacity Building	Promote a community-based disaster management committee.	Rural municipality level and all wards	1850
Output 4: Improve	ed land and water management policy to reduce eros	sion and sedimentation risks	
Policy and Institutional	Advocate for policies and regulations	 State, district, watershed, and rural municipality level 	2000
Support	Promote coordination and collaboration	 District, watershed, and rural municipality level 	2000
	Integrate disaster risk reduction concerns into planning processes	District and rural municipality level	2000

Table 15: Outcome 4: Water Resource Management:

Activities:	Sub-activities	Intervention location/ward	Estimated cost(in 000, NRS)	
Output 1: Increased avail	ability and access to clean water for dom	estic and agricultural use		
Conduct Water Resource Assessment	Water resources survey (surface water, groundwater and availability, quality, and trends)	All wards	2350	
	Assess the impacts of climate change, scarcity and vulnerability	All wards	2250	
Develop Water Allocation and Management Plans	Improve and maintain irrigation canal	 Sunkoshi: Ward 3: Khani khola, Sisneri khola; Ward 10: Gope khola, Kopche khola, Lahareni Khola and remaining All wards. Khijidemba: Potential area of Ward no 5, 6 and 9 Molung: Pokting Mulkhark –Sikhani Irrigation, ward 8; Rampur irrigation (Branch cnanl repair)-ward 2; Ghalegaau-Bahunbari-lamakhara-ward 4; Beli chameli lower canal repair-ward 4; Piple canal repair-ward 4; Okhaldhunga Gautri Khudukri irrigation-ward 5; Molung Gara irrigation canal-ward 5. Siddhicharan: ward 11- total 3 no (Chang kholaDhunga Dhunge, Kavre khola Gahate and Lipe khola) Manebhangyanj: ward 4: Rolbu canal, Pamkhu khola canal, Jhamku khola canal, Peku canal Mathillo and Peku canal Tallo; 	139,085	
	Set up water allocation protocols	All wards	2050	
Output 2: Enhanced wate	Output 2: Enhanced water conservation and efficiency measures.			

Activities:	Sub-activities	Intervention location/ward	Estimated cost(in 000, NRS)
Implement Water Conservation and rainwater Harvesting Measures	Rainwater harvesting measures (Plastic pond, rooftop rainwater storage and ponds)	 Sunkoshi: In ward no 3 to 10 of rural municipality. Khijidemba: In ward 5 <i>Bojhatar;</i> Ward 9: <i>Maidane and Gyading;</i> and potential area of ward 6. Molung: Ward 1 (5 no), ward 2 (5 no), ward 3 (3 no), ward 4 (5 no), ward 5 (3 no), ward 6 (5 no), ward 7 (5 no), and ward 8 (11 no) Siddhicharan: ward 7 (12 no), ward 8 (19), ward 9 (16 no), ward 10 (2 no), and ward 12 (9 no) in all wards. Manebhanjyang: ward 4 (5 no), ward 8 (3 no) and ward 9 (5 no) 	146,500
	Water source protection (constructing intake, distribution system, reservoirs or ponds for water storage)	 Sunkoshi: Ward 3 Badkhola, Gudguda Okhreni, Bhandare Muhan Ward 4Jordhara, Kuwapani and Chsapani Ward 5 Paharepakha, Bandare ans Aiselukharka Ward 6 Lampate, Saune and Bhulka khola, Ward 7 Hyakula, Pakhe and Rayale khola, Ward 8 Balaute, Chisapani and Bhalukhola, Ward 9 Gangate, Kakani and Chitretaart, Ward 10 Lapse kholsi, Lahareni and Balaute; Khijidemba: Ward 5 Chading, Lampata and Bhitri, Ward 6 Mathillo kholsi, Kharbani and seti kholsi and Ward no 9 Churiding, Dhuranga and Gurung kharka; Molung: Ward 1(1 no), ward 2 (8 no), ward 3(5 no), ward 4 (6 no), ward 5(5 no), ward 6(16 no), ward 7(18 no), and ward 8 (6 no); Siddhicharan: 6 (7 no), ward 7 (12 no), ward 8 (3), ward 9 (2 no), ward 10 (14 no), ward 11 (2) and ward 12 (5 no)); Manebhanjyag: Ward 4 Dum Khola, Kettuke Bhanjyang, Baksu Khola etc. (10 no), ward 8 Chhanga Pani, Jaruwa Rana Gaun, etc. (8 no), ward 9 Bagdu khola, Chhatiwan Pagara, Dhanda Khola, etc.(26 no). 	243,000
	Wetland conservation	 Sunkoshi: Ward 3 Dhadkhola, Simapni and Dhadini, Ward 4 Danda wetland, Ward 5 Bhuta khola, Kopche and Chtrataar, Ward 6 Bhulke and Paradobhan, Ward 7 Rayale Phedi riparian and Jordhara, Ward 8 Rauta 	31,000
Activities:	Sub-activities	Intervention location/ward	Estimated cost(in 000, NRS)
------------------------------------	-------------------------------------------------------	----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-----------------------------------
		 Beshi and Kamere Pani Ward 9 Lahareni and Chisapani, Ward 10 Ghatte khet and Lahareni. Khijidemba: Potential area of Ward 5 and 6 and Ward 9 Phapre, Khundurke and Dorakharka. Molung: In ward 1 Dhamal Pandhero Kuntadevi and Simpani Pandhero, ward 2 Dunde Simle Rampur and Aale Jhagarpat, ward 4 Mahadev Khola, Opipatur Harkapur and Jaljala, ward 6 Bojotar, Chepte, Patkari, Chaite Kharka and ward 8 Sepli and Paner Danda Gaun; Siddhicharan (In ward 6 Patal Maldhar, ward7 Bigutar ward 11 Sobu, Jhapra, and Milanchok, and ward 12 Sitalpur); Manebhanjyang (In ward 5 Bhorle Pond and Simalbote pond, and ward 8 Swara Pond) 	
	Implement sprinkle and drip irrigation system	On upland sloppy area	100,100
Water Use Efficiency	Training and awareness programs (water user group)	All wards	9300
	Water pricing mechanisms	All wards	2100
Output 3: Increased com	munity participation and strengthen insti	tutional capacity	·
Capacity Building and Community	Awareness raising training to WUG	All wards	6350
participation	Logistic support to local institutions	All wards	2150

Table 16: Outcome 5: Capacity Building and Institutional Strengthening

Activities:	Sub-activities	Intervention location/ward	Estimated cost
Output 1: Enhanced knov	vledge and skills of stakeholders on CRIWM		
Conduct Training and Workshops	Provide training on climate change and adaptation measures	Rural municipality level	8850
	Workshops and exposure visits on climate adaptation planning	Rural municipality level	2000
Output 2: Strengthened in	nstitutional capacity and coordination mechanisms for CRIWMP implementation		
Develop Training Materials	Create training modules and guidelines on climate change adaptation	Rural municipality level	2000
Enhance coordination and Collaboration	Organize joint meetings among government agencies, NGOs and CBOs	Rural municipality level	2000
	Establish mechanisms for joint planning, implementation, and monitoring	Rural municipality level	2000
Output 3: Increased awar	eness and understanding of climate change impacts and resilience-building measures.		
Promote Community	Organize workshops and meetings on climate change impacts and adaptation measures	All wards	2000
Participation	Training for women, marginalized groups, and youth	All wards	8850
Output 4: Enhanced gend	ler mainstreaming and social inclusion in watershed management initiatives.		
Mainstream Gender and Social Inclusion	Gender mainstreaming training	Rural municipality level	8850
	Leadership development training to women	All wards	8850
	Involve marginalized and vulnerable groups in the planning and implementation	All wards	2000

Table 17: year wise action plan

S.N	Description of Activities	Unit	Five year		Year I		Year II		Year III		Year IV		Year V	
			Total Target	total Budget	Quantity	Budget								
C 01:	Sustainable Agriculture and L	and Manag	ement				·							
1	Increase crop production through sustainable agriculture practice and climate change adaptation.	Nos	459	14200	93	2840	91	2840	91	2840	91	2840	91	2840
2	Diversify rural livelihoods and increase incomes through commercialization of agriculture and Livestock farming.	Nos	349	40950	71	8190	70.5	8190	70	8190	70	8190	67.5	8190
3	Initiate program on Crop and Livestock Insurance to minimize risk due to extreme weather conditions.	Nos	1680	2100	336	420	336	420	336	420	336	420	336	420
4	Identify, collect and proper conservation of local land races to develop climate resilient crop varieties.	Nos	768	4800	154	960	154	960	154	960	154	960	152	960

S.N	Description of Activities	Unit	Five year		Year I		Year II		Year III		Year IV		Year V	
			Total Target	total Budget	Quantity	Budget	Quantity	Budget	Quantity	Budget	Quantity	Budget	Quantity	Budget
5	Identify the potential source of water for irrigation, design and construct irrigation canal repair and maintenance. Rain water harvesting using roof water collection, Plastic ponds, small and medium sized reservoir tank construction	No	42	3527400	11.5	267,575	8	218575	7.5	218575	7.5	218575	7.5	218575
6	Conduct program to explore, assess and promote climate smart technology.	Nos	363	2900	73	640	73	640	73	640	72	490	72	490
7	Conduct program to improve soil fertility and nutrient management.	Nos	474	4150	95.5	920	94.5	920	94.5	770	95	770	94.5	770
8	Capacity building of agriculture technicians, farmers from climate change perspective.	Nos	23.5	4550	7	1310	7	1310	7	1310	2	310	0.5	170
9	Diversify livelihoods through commercialization in agriculture and forestry.	Nos	1319	4600	145	1140	142	1140	141	1140	141	890	141	890
	Total			3605650		283995		234995		234845		233445		233305

S.N	Description of Activities	Unit	Five year		Year I		Year II		Year III		Year IV		Year V	
			Total Target	total Budget	Quantity	Budget								
C 02:	Forest and Biodiversity conse	rvation	·											
2.1	Forest inventory	No	4	2400	4	2400	0	0	0	0	0	0	0	0
2.2	Vulnerability assessment	No	4	1800	4	1800	0	0	0	0	0	0	0	0
2.3	CFUG formation 8 no	No	29.5	442.5	26.5	397.5	3	45	0	0	0	0	0	0
2.4	CFOMP renewal and preparation to incorporate climate change concern	No	151.5	7560	64.5	3225	56.5	2825	17.5	875	13	635	0	0
2.5	Forest management training (silviculture, invasive species, and regeneration management	Event	120.5	7230	28	1680	27	1620	22.5	1350	22.5	1350	20.5	1230
2.6	High tech Nursery establishment	No	52	11700	1	1500	14.5	2900	14.5	2900	11	2200	11	2200
2.7	Seedling production forest species (no in 000) for 3 years	No	153	6750	53	5250	40	600	30	450	30	450	0	0
2.8	NTFPs seedlings production (no in 000) for 3 years	No	600	9750	190	3100	160	2600	130	2100	120	1950	0	0
2.9	Plantation (Enrichment/afforestation with weeding) 24 ha	На	474	13800	140	2800	126	3600	106	3200	96	3000	6	1200

S.N	Description of Activities	Unit	Five year		Year I		Year II		Year III		Year IV		Year V	
			Total Target	total Budget	Quantity	Budget								
2.10	Enhance Forest paroling	No	20	2000	4	400	4	400	4	400	4	400	4	400
2.11	Involve CFUGs in forest monitoring and surveillance.	No	20	2000	4	400	4	400	4	400	4	400	4	400
2.14	Control forest fires, pests, and diseases	No	20	3850	4	830	5	830	5	830	5	730	4	630
2.15	Protection of endanger species and hotspots	No	13	6500	4	2000	4	2000	4	2000	0.5	250	0.5	250
2.16	NTFPs and medicinal plants cultivation	На	59	11800	2	400	15	3000	15	3000	14	2800	13	2600
2.17	Promote Private plantation	На	25	4200	1	200	6	1800	4.5	900	3.5	700	3	600
2.18	Promote agroforestry on public and private land	ha	48	40000	12	10000	9	7500	9	7500	9	7500	9	7500
2.19	Promote Green IGAs (Broom grass and Cardamom cultivation)	Package	63.5	26500	16	6250	14	5450	14	5450	9.5	4550	10	4800
2.20	Promote private forest nursery	No	4	2200	4	2200	0	0	0	0	0	0	0	0
2.21	Provide support to promote eco-tourism development	Package	38.5	38500	9	9000	8	8000	8	8000	7	7000	6.5	6500

S.N	Description of Activities	Unit	Five year		Year I		Year II		Year III		Year IV		Year V	
			Total Target	total Budget	Quantity	Budget	Quantity	Budget	Quantity	Budget	Quantity	Budget	Quantity	Budget
	Total			198983		53832.5		43570		39355		33915		28310
C 03:	Water Induce Disaster Reduct	ion and Ma	anagement											
3.1	Water-inducedhazardassessment(floods,landslides, and debris flow)	No	4	4000	4	4000	0	0	0	0	0	0	0	0
3.2	Implement hazard and vulnerability maps	No	4	2000	4	2000	0	0	0	0	0	0	0	0
3.3	Analyze historical data and climate projections	No	4	1850	4	1850	0	0	0	0	0	0	0	0
3.4	Establish early warning systems	No	4	4000	4	4000	0	0	0	0	0	0	0	0
3.5	Install rain gauges, river level sensors, and landslide sensors.	No	4	4000	4	4000	0	0	0	0	0	0	0	0
3.6	Develop procedures and protocols for an early warnings system	No	4	2000	4	2000	0	0	0	0	0	0	0	0
3.7	Implement nature-based solutions (plantation, slope stabilization, gulley plugging, and grass planting)	Package	105	83000	20	20000	22	22000	22	22000	22	22000	19	19000

S.N	Description of Activities	Unit	Five year		Year I		Year II		Year III		Year IV		Year V	
			Total Target	total Budget	Quantity	Budget								
3.8	River band protection (spurs, embankments, retaining walls, integrating bioengineering. (2 km in each ward)	Km	64.5	218000	12.9	51600	12.9	51600	12.9	51600	12.9	51600	12.9	51600
3.9	Integrated soil erosion control measures (terracing, retaining walls, landslide treatment, and bioengineering)	Package	114	68,000	24	17000	24	17000	23	17000	23	17000	20	14000
3.10	Climate change Adaptation modal Village program (5 packages for 5 years)	Package	102.5	129750	20.5	30750	20.5	30750	20.5	30750	20.5	30750	20.5	30750
3.11	Conduct disaster-related training	Event	155	7800	31	1860	31	1860	31	1860	31	1860	31	1860
3.12	Promote a community- based disaster management committee.	No	10.5	1850	4	1200	2	200	1.5	150	1.5	150	1.5	150
3.13	Advocate for policies and regulations	No	20	2000	4	400	4	400	4	400	4	400	4	400
3.14	Promote coordination and collaboration	No	4	2000	4	2000	0	0	0	0	0	0	0	0

S.N	Description of Activities	Unit	Five year		Year I		Year II		Year III		Year IV		Year V	
			Total Target	total Budget	Quantity	Budget								
3.15	Integrate disaster risk reduction concerns into planning processes	No	10.5	1850	4	1200	2	200	1.5	150	1.5	150	1.5	150
	Total			532100		143860		124010		123910		123910		117910
C04: \	Nater Resource Management													
4.1	Water resources survey (surface water, groundwater and availability, quality, and trends)	No	4	2350	4	2350	0	0	0	0	0	0	0	0
4.2	Assess the impacts of climate change, scarcity and vulnerability	No	4	2250	4	2250	0	0	0	0	0	0	0	0
4.3	Improve and maintain irrigation canal	Package	70	139085	14.5	28500	14.5	28500	14.5	28500	14.5	28500	12	25085
4.4	Set up water allocation protocols	No	4	2050	4	2050	0	0	0	0	0	0	0	0
4.5	Rainwater harvesting measures (Plastic pond, rooftop rainwater storage and ponds: a total of 40 package)	Package	163.5	146500	34	30000	34	30000	34	30000	34	30000	27.5	26500

S.N	Description of Activities	Unit	Five year		Year I		Year II		Year III		Year IV		Year V	
			Total Target	total Budget	Quantity	Budget								
4.6	Water source management (Intake, storage tank, pond, tap stand and irrigation canal as per site requirement)Total 62 packages	Package	306	243000	62	49625	62	49625	61	48625	61	48625	60	46500
4.7	Wetland conservation 12 packages	Package	28	30000	7.5	7500	7.5	7500	6	6000	4.5	4500	4.5	4500
4.8	Implement sprinkle and drip irrigation system (In dry land management) 1 package in each ward for 5 years	Package	153.5	112700	32	23600	31.5	23100	30	22000	30	22000	30	22000
4.9	Training on efficient water use techniques (water user group) 40 event	Event	150	9000	30	1800	30	1800	30	1800	30	1800	30	1800
4.10	Water pricing mechanisms	No	3	1600	3	1600	0	0	0	0	0	0	0	0
4.11	Awareness raising training to WUG	Event	100.5	6050	20.5	1230	20	1220	20	1200	20	1200	20	1200
4.12	Logistic support to local institutions	No	7.5	2150	4	1240	2	240	2	240	2	240	1.5	190
	Total			696735		151745		141985		138365		136865		127775

S.N	Description of Activities	Unit	Five year		Year I		Year II		Year III		Year IV		Year V	
			Total Target	total Budget	Quantity	Budget								
C05: (Capacity Building and Instituti	onal Streng	thening	·										
5.1	Provide training on climate change and adaptation measures (1 in each ward for 5 years)	Event	172.5	8850	34.5	1770	34.5	1770	34.5	1770	34.5	1770	34.5	1770
5.2	Workshops and exposure visits on climate adaptation planning	Event	4	2000	4	2000	0	0	0	0	0	0	0	0
5.3	Create training modules and guidelines on climate change adaptation	No	4	2000	4	2000	0	0	0	0	0	0	0	0
5.4	Organize joint meetings among government agencies, NGOs and CBOs	Event	20	2000	4	400	4	400	4	400	4	400	4	400
5.5	Establish mechanisms for joint planning, implementation, and monitoring	No	20	2000	4	400	4	400	4	400	4	400	4	400
5.6	Organize workshops and meetings on climate change impacts and adaptation measures	Event	20	2000	4	400	4	400	4	400	4	400	4	400

S.N	Description of Activities	Unit	Five year		Year I		Year II		Year III		Year IV		Year V	
			Total Target	total Budget	Quantity	Budget								
5.7	Training for women, marginalized groups, and youth (1 in each ward for 5 years)	Event	172.5	8850	34.5	1770	34.5	1770	34.5	1770	34.5	1770	34.5	1770
5.8	Gender mainstreaming training (1 in each ward for 5 years)	Event	172.5	8850	34.5	1770	34.5	1770	34.5	1770	34.5	1770	34.5	1770
5.9	Leadership development training to women (1 in each ward for 5 years)	Event	172.5	8850	34.5	1770	34.5	1770	34.5	1770	34.5	1770	34.5	1770
5.10	Involve marginalized and vulnerable groups in the planning and implementation	No	20	2000	4	400	4	400	4	400	4	400	4	400
	Total			63000		16600		11600		11600		11600		10320

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Annex

Table 1.1: Molung watershed ward area and population

Municipality War Area ward % Nur				Number	Popula	ation			Average
. ,	d no.	within	area	of	Total	Male	Female	Population	househol
		watersh	within	househo				density	d size
		ed (km²)	watershe	lds					
			d						
Sunkoshi	3	9	50	223	961	463	499	104	4.3
	4	11	81	366	1844	923	921	163	5
	5	13	100	489	1713	853	860	133	3.5
	6	18	100	403	1719	807	912	98	4.3
	7	10	100	353	1338	634	704	133	3.8
	8	7	100	307	1135	551	584	166	3.7
	9	19	100	506	1870	911	959	98	3.7
	10	7	100	496	1892	924	968	258	3.8
Khijidemba	5	6	36	158	642	316	325	100	4.1
	6	30	100	488	2278	1168	1110	77	4.7
	9	39	100	356	2153	1094	1059	56	6
Molung	1	11	100	584	2224	1055	1169	210	3.8
	2	15	100	882	3327	1601	1726	228	3.8
	3	10	100	299	1206	589	617	122	4
	4	15	100	484	1899	892	1007	127	3.9
	5	6	100	347	1441	699	742	254	4.2
	6	18	100	527	2325	1166	1159	127	4.4
	7	21	100	455	2031	1039	992	97	4.5
	8	17	100	491	1987	986	1001	114	4
Siddhicharan	6	34	100	462	2022	987	1035	60	4.4
	7	19	100	577	2285	1157	1128	119	4
	8	9	100	423	1571	717	854	175	3.7
	9	11	100	564	1982	921	1061	188	3.5
	10	13	100	472	1814	830	984	145	3.8
	12	4	100	496	1878	901	977	530	3.8
Manebhanjy	4	8	100	291	1128	554	574	134	3.9
ang	8	10	100	253	1019	466	553	99	4
	9	16	100	491	2020	924	1096	123	4.1
Total		410		12243	49,7	24,1	25,576	121	114.7
					04	28			

Annex 2: Climatic Condition

Table 2.1: Annual Average Precipitation, temperature in Study area watershed

Month	1210 station	1207 station	1206 station	1204 station	T _{max}	Tmin
1	10	11	13	17	16	5
2	13	14	16	18	18	7
3	14	17	26	41	22	10
4	52	53	65	69	25	14
5	77	100	155	170	25	15

Month	1210 station	1207 station	1206 station	1204 station	T _{max}	Tmin
6	130	180	285	358	25	17
7	288	285	424	549	25	18
8	183	217	415	506	25	18
9	112	128	265	302	25	17
10	36	34	67	88	24	14
11	10	7	12	17	21	10
12	8	9	10	10	17	7
Grand Total	933	1058	1753	2145	22	13

Table 2.2: Annual average discharge at Rawabesi station

Year	Annual average discharge	Year	Annual average discharge
1992	141	2003	283
1993	180	2004	279
1994	155	2005	209
1995	207	2006	166
1996	224	2007	217
1997	176	2008	185
1998	317	2010	193
1999	137	2011	179
2000	167	2013	171
2001	246	2014	145
2002	263	Average discharge (m ³ /s)	202

3. Biophysical Characteristic

Table 3.1: Sub-watershed number, area of Molung watershed

Sub basin	Area (km ²)	Sub basin	Area (km ²)	Sub basin	Area (km ²)
1	11	10	11	19	19
2	43	11	6	20	20
3	13	12	23	21	13
4	15	13	14	22	4
5	10	14	6	23	12
6	10	15	12	24	18
7	11	16	31	25	9
8	26	17	12	26	28
9	13	18	18		



Figure 3.1: Sub-watershed number and Mu	unicipality of Molung Watershed
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Municipality	Ward no	Wetland Name	Condition	Recommended conservation measures
Sunkoshi	3	Dhad khola, Simpani and Dhadini	Vulnerable	Excavation, Stone masonry, plantation
-	4	Dhada wetland	Highly risk	Stone masonry, inlet outlet construction, plantation
	5	Bhukta khola, Kopche wetland and Chitrataar	Vulnerable	Excavation, Stone masonry, plantation
	6	Bhulke, Thulo simal and Dhada khola	Vulnerable	Stone masonry, inlet outlet construction, plantation
	7	Rayale Phendi, Dhod Wetland, Jordhara	Highly risk	Excavation, Stone masonry, plantation
	8	Kamerepani wetland	Vulnerable	Excavation and Stone masonry

Table 3.2: Wetland of all Palika of Molung watershed	across all ward as per primary survey, 202

Municipality	Ward no	Wetland Name	Condition	Recommended conservation measures
	9	Gope wetland, Lahareni wetland and Kakani	Highly risk	Excavation, Stone masonry, plantation
	10	Simkholsi, Gahakhet and Hyabulai	Highly risk	Stone masonry, inlet outlet construction, plantation
Khijidemba		Phapre, Khundurke, and Dorakharka.		
Siddhicharan	6	Patal Maldhar	Highly risk	Stone masonry, inlet outlet construction, plantation
	8	Dhungrebas	Vulnerable	Excavation, Stone masonry, plantation
	12	Sitalpur	Highly risk	Excavation, Stone masonry, plantation
Manebhanjyang	8	Swara wetland	Highly risk	Stone masonry, inlet outlet construction, plantation

4. Status of irrigation in Molung watershed

Table 4.1: List of Molung Watershed irrigation project from Department of Irrigation

Municipa lity	Irrigation project name	VDC	War d no	Progra mme	Sourc e name	Sourc e type	Irrigati on status	GCA(ha)	NCA (ha)
sunkoshi	BALAUTE KHOLA AAPSWORA MAHABHIRT ILKETAR ISP	Katunje & Chyanam	8	CMIAS P	Balaut e Khola	Local Strea m	Non Operati onal	31	31
	DOBHAN ISP	Katunje VDC	9, 10	CMIAS P	Dovan Khola	Pere nnial	Operati onal	109	81
	BHULBHULE BIKASE IP	Sisneri	3	SIP	Bhulb hule Khola	Pere nnial	Operati onal	14	10
	DEUTHE DOVAN IP	Sisneri	3, 4	SIP	Deuth e Dobh an Paira Khola	Local Strea m	Under Constru ction	11	8.8
molung	BELI CHAMELI ISP	Harkapur	4	CMIAS P	Kakan i Khola	Pere nnial	Operati onal	59	50
	KAKANI KHOLA IP	Harkapur	4	SIP	Kakan i Khola	Local Strea m	Operati onal	14	13.2

Municipa lity	Irrigation project name	VDC	War d no	Progra mme	Sourc e name	Sourc e type	Irrigati on status	GCA(ha)	NCA (ha)
	GADI BHULBHULE TATHA SOPHALI DHADE MUL KULO ISP	Harkapur & Prapcha	3	CMIAS P	Sopli Khola	Local Strea m	Operati onal	35	28
	LIPE KHOLA BASERI ISP	Kuntadev i	1	CMIAS P	Lipe Khola	Pere nnial	Non Operati onal	33	30
	SOPLI PANCHGHAR E IP	Prapcha	3	SIP	Sopli Khola	Local Strea m	Operati onal	22	17
	MOLUNG IP	Shree chaur	5, 3	MIP	Moul ong Khola	Pere nnial	Operati onal	83	66.4
Siddhicha ran	HARIBOLE ISP	Amajani Betini VDC	10	CMIAS P	Harib ale Khola	Pere nnial	Operati onal	56	44
	BHAISE IP	Barnalu & Rumjatar VDC	4	MIP	Sisne Khola	Pere nnial	Non Operati onal	42	33.6
	DHANBUDH A IP	Barnalu & Rumjatar VDC	4	MIP	Thota ne Khola	Pere nnial	Non Operati onal	79	60
	BARSA POKHARI IP	Rumjatar	4	NITP	Bahun ne Khola	Pere nnial	Operati onal	24	20
	NAYA GHARE IP	Rumjatar	4	NITP	Chiuri bote Kholsi	Pere nnial	Operati onal	20	16
	PIPALTAR RANIBEDA IP	Rumjatar	4	MIP	Sisne Khola	Pere nnial	Operati onal	42	35
Manebha njyang	SUDE DEVITHAN DHUSENI IP	Madhavp ur	9	SIP	Dhuse ni Khola	Local Strea m	Operati onal	10.5	10
	RIFIN KHOLA KULO IP	Manebha njyang	5	SIP	Rifin Khola	Local Strea m	Under Constru ction	12	11
	DHYAPLU PANKHU KHOLA ISP	Moli	1	CMIAS P	Dhypl u Khola and Pankh u Khola	Local Strea m	Operati onal	54	49

Municipa	Irrigation	VDC	War	Progra	Sourc	Sourc	Irrigati	GCA(NCA
lity	project		d no	mme	е	e	on	ha)	(ha)
	name				name	type	status		
Total								751	614

Table 4.2: Completed small irrigation project in Molung watershed

Municipality	SNo	Project Name	Comma nd Area (ha)	Benefici ary HHs	Disadvanta ged Group HHs	Small Land Holde rs HHs	Wom en Head ed HHs
Sunkoshi	1	Lapse bhumesthan sinchai kulo	7	31	0	27	0
	2	Thulokhet Muhan Gari Bhulketar Sichai Yojana	12	34	2	33	0
	3	Bikase kulo sichai yojana	18	56	16	36	4
	4	Doban Pahare Khola Sichai Kulo	9	24	10	20	0
	5	Dipsingkhola muhan sakhedaduwa sichai yojana	6	43	43	43	0
	6	Matekhola Polung Sichai Yojana	6	15	10	9	1
	7	Kunakhet tallo babiya sinchai kulo	8	23	3	21	3
	8	Lapse Katunje Besi Sinchai Yojana	5	15	1	10	3
	9	Dhad Khola Odare Muhan Dhade Sichai Yojana	5	19	10	19	5
	10	Dhad Khola Muhangari Dhamalatol Sichai Kulo	12	56	32	49	3
khijidemba	11	Salpu Kalidaha Sinchai Yojana	5	17	16	10	1
	12	Devithan Sichai Yojana	7	33	13	33	3
	13	Pelu Khola Thado Bagar Sinchai Yojana	5	21	5	18	3
	14	Koirale Theldim Irrigation Project	12	47	15	39	5
	15	Senikhola Sinchai Yojana	5	9	7	0	2

Municipality	SNo	Project Name	Comma nd Area (ha)	Benefici ary HHs	Disadvanta ged Group HHs	Small Land Holde rs HHs	Wom en Head ed HHs
Molung	16	Tallotar dalit basti IP	16	85	41	83	3
	17	Gaukhola Kolchaur Dovan IP	7	44	9	39	0
	18	Khalte khola phuyalgau ghale bada sichai yojana	9	63	27	56	8
	19	Saitar Dhagerni Irrigation Project	10	55	9	52	3
	20	Kool Khola Dhad Besi Sichai Yojana	10	91	33	90	8
	21	Dipli IP	6	43	43	38	7
	22	Khahare Khola Mane Salleri Gurukul Harkpur Sichai Yojana	11	74	18	68	3
Siddhichara	23	Urbe Khola IP	19	48	4	31	2
n	24	Tunikhola Kamikhet Sichai Yojana	5	17	11	15	2
	25	Charkhu Chakle Kulo Sichai Yojana	6	14	13	9	0
	26	Gahate Rumti Khet Irrigation Program	5	30	10	25	4
	27	Tinghare Sichai Yojana	7	26	5	20	2
	28	Devisthan Dharapani Sichahi Yojana	13	29	9	21	5
	29	Danda Kateri IP	7	23	12	18	3
	30	Tarali Kulo Sichai Yojana	8	19	9	10	2
	31	Adheri Khola Kolebesi Sichai Yojana	11	27	4	23	2
	32	Mathillo Dhanmude Sinchai Yojana	7	168	62	126	18
	33	Argeli Taksar Irrigation Project	15	63	48	54	17
	34	Balaiche Muhan Gari Jalkini Sinchai Yojana	6	12	5	2	0
	35	Gangatay Khola Mul Kulo	6	23	2	13	3

Municipality	SNo	Project Name	Comma nd Area (ha)	Benefici ary HHs	Disadvanta ged Group HHs	Small Land Holde rs HHs	Wom en Head ed HHs
	36	Pokting Surke Sinchai	9	61	37	34	7
	37	Mulkulo Sicha Yojana	11	70	6	64	6
Manebhanjy ang	38	Chayamlayang Dhuska Maslo IP	7	24	23	21	3
	39	Bhalu Khola Sano Sichai IP	5	25	7	23	0
	40	Banchari Sichai Yojana	6	40	12	27	3
	41	Salghari Sichai Yojana	12	44	6	37	1
	42	Thulakhanda IP	9	45	3	43	0
	43	Kabre Mahabir Sichai Yojana	8	30	26	27	3
	44	Tallo Richuwa Sichai IP	6	17	17	0	3
	45	Majhitar Sichai yojana	6	30	29	20	0
Total			385	1783	723	1456	151

Table 4.3: Ongoing small irrigation project in Molung watershed

Municipalit Y	SNo	Project Name	Command Area (ha)	Beneficia ry HHs	Disadvanta ged Group HHs	Small Land Holders HHs	Wom en Head ed HHs
Sunkoshi	1	Balautekhol a muhan gari aambote gangreko sinchai kulo	8	34	6	28	2
	2	Gauthalidh unga kulo sinchai yojana	26	56	7	46	6
	3	Mate khola muhan aagri kulo IP	6	39	14	39	9
	4	Kattike Khola Muhan gari	6	46	46	41	5

Municipalit Y	SNo	Project Name	Command Area (ha)	Beneficia ry HHs	Disadvanta ged Group HHs	Small Land Holders HHs	Wom en Head ed HHs
		Magar tole IP					
	5	Ghatta Khet muhangari magar tole IP	5	29	27	24	4
	6	Narsing Muhangari Gyamlo IP	5	56	16	56	3
	7	Parakhola Muhan gari Mahabir IP	6	37	37	26	2
	8	Paranche IP	8	32	6	5	1
	9	Solungkhola Muhan Bhae Bairage Sichai Kulo Yojana	7	49	12	49	5
	10	Kholme Bhasme Muhan gari Kanle Jamune IP	6	31	2	27	2
	11	Bandre Dovan Muhan Gari Danda Gaun Sinchai Yojana	34	74	15	21	2
	12	Gauthalidh unga kulo sinchai yojana	26	56	7	46	6
	13	Bikase kulo sichai yojana	18	56	16	36	4
	14	Doban Pahare Khola Sichai Kulo	9	24	10	20	0
Khijidemba	15	Pelungkhola Sanjabari IP	14	35	33	18	4

Municipalit y	SNo	Project Name	Command Area (ha)	Beneficia ry HHs	Disadvanta ged Group HHs	Small Land Holders HHs	Wom en Head ed HHs
	16	Manekhola Majhgau Sichai Yojana	18	39	31	18	4
	17	Devithan Sichai Yojana	7	33	13	33	3
Molung	18	Kakani Khola Muhan Hudai Dumse IP	6	22	19	19	3
	19	Pharsi Gaira Simle Chilaune IP	6	36	13	31	7
	20	Jalum Juldikha kulo IP	7	25	15	21	1
	21	Gairikhet IP	5	30	14	30	4
	22	Bungkati Chiuribote IP	9	38	18	18	6
	23	Dude Simlekhet IP	9	44	11	43	0
Siddhichara n	24	Saurabote kulo sinchai yojana	6	31	28	29	3
	25	Tallo Dolpu IP	20	56	39	56	7
	26	Uttisekhola Doban Sisnekhola Chuplebesi Sichai Yojana	15	50	32	42	11
	27	Sallijabuk Irrigation Project	6	24	21	17	4
	28	Dolpu IP	11	60	51	57	1
	29	Adheri Naya Kulo Sichai Yojana	13	35	23	26	2
	30	Jhagar Surma IP	15	60	3	35	4

Municipalit Y	SNo	Project Name	Command Area (ha)	Beneficia ry HHs	Disadvanta ged Group HHs	Small Land Holders HHs	Wom en Head ed HHs
	31	Tunikhola Hulak Khet Sichai Yojana	19	27	0	0	3
Manebhya ng	32	Polam Khet IP	6	36	35	36	3
	33	Kolbote sichai kulo tatha pokhari IP	10	41	41	38	0
	34	Dhusini Khola Simlebesi IP	6	43	17	41	4
	35	Pipale IP	9	46	44	44	0
	36	Masar Batase Sichai Kulo Tatha Pokhari IP	8	36	32	21	2
Total		Total	395	1466	754	1137	127

6. Agriculture Sector

Table 6.1: Major crops cultivated in Molung watershed

S No.	Crop Type	Crops
1	Cereals	Maize, millet, rice , wheat, buckwheat
2	Pulses	Black gram, Lentil, White gram, Horse gram, cowpea, rice bean
3	Oilseed	Mustard, sesame
4	Vegetables	Cabbage, Cauliflower, Broccoli, Broad Leaf Mustard (Rayo), Potato, tomato,
		capsicum, chilli, tomato, brinjal, Beans, cucurbits (Cucumber, sponge gourd,
		snake gourd, bitter gourd, Ash gourd, chayote etc) coriander, Fenugreek,
		onion, garlic
5	Fruits	Citrus, mango, banana, pineapple, Jackfruit, pear, peach, plum, guava,
		papaya, litchi, avocado
6	Cash crops	Sugarcane, coffee, Avocado
7	Spice crops	Large cardamom, ginger, turmeric, onion, garlic,
8	Indigenous	Junelo, millet, Kaguno, buckwheat
	crops	

Source: AKC, Okhaldhunga 2079. Agriculture center Okhaldhunga.

Table 6.2: Cropping system in Molung watershed

S	Сгоррі	ng system	Mix cr	opping
No	Khet land	Bari land	Khet land	Bari land
1	Rice -wheat-maize	Maize-millet-	Wheat+ Tori	Maize+ beans
		buckwheat		
2	Rice-tori-maize	Maize-potato-fallow	Wheat+ pea	Maize + Potato
3	Rice-wheat-rice	Maize-Wheat-Fallow	Potato + radish	Millet+ Radish+
				Rayo
4	Rice-Potato-maize	Maize-Buckwheat-		Millet + Black gram
		Fallow		
5	Rice-buckwheat-	Potato-Fallow-Fallow		Maize + millet
	maize			
6	Rice-vegetables-	Maize-Black gram-		
	maize	Fallow		
7	Rice-fallow-maize	Maize-Soybean-		
		Fallow		
8	Rice-fallow-rice	Maize-vegetables-		
		Fallow		

(Source: AKC, Okhaldhunga, 2079. Annual Progress Report and Statistics Pustika 2078/79)

Crop	Jan	Feb	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec
Rice												
Maize												
Millet												
Wheat												
Potato												
Winter vegetables												
Summer vegetables												
Pulses												
Oilseeds												
Planting /sowing time:				Harvesti	ing Time	:						

Table 6.3: Crop calendar for various crops in Molung watershed.

Table 6.4: Recommended domains and special features of major climate resilient crop varieties in Nepal.

Crop	Variety	Recommended Zone	Special Feature	
	Chandanath 1, Chandanath 3,		Cold tolerant	
	Lekalidhan 1, Lekalidhan 3	righ-hills		
	Swarna sab 1, Saba Mansuli	Torai and mid hills	Flood tolerant	
Rice	sab 1, Sworng sab 1			
	Sukkhadhan 1, Sukkhadhan 2,		Drought tolerant	
	Sukkhadhan 3, Sukkhadhan 4,	Terai and mid-hills		
	Sukkhadhan 5			

Сгор	Variety	Recommended Zone	Special Feature	
	Sukkhadhan 6, Bahuguni 1,	Toroi and mid hills	Drought and flood	
	Bahuguni 2	rerar and mid-mils	tolerant	
	Makawanpur 1	Terai	Leaf Folder resistant	
	Mankamana 3, Ganesh 1,	Mid bills	CLS registant	
	Shitala		GLSTESISLATIL	
			Drought tolerant and	
	Deuti	Mid hills	Grey Leaf Spot (GLS)	
Maiza			resistant	
IVIdize	Arun 2, Arun 3, Arun 4, Arun	6 High-hills and winter crop	Early maturity	
		for Terai	Early maturity	
	Khumal Hybrid 2	Mid-hills	winter crop for Terai	
	Poshilomakai 1	Mid-hills (below 1,600 m)	Rich in protein	
	Poshilomakai 2	Terai	(winter season)	
	Bijava	Terai, river basin and valley	Tolerant to heat stress	
	Біјауа	up to 500 meter	and blight resistant	
	Cautam	Terai, river basin and valley	Toloropt to opt stross	
\A/boot	Gautam	up to 500 meter	Tolerant to eat stress	
wheat	Munal	Chyakhura Mid-hills and high-		
	IVIUITAI	hills	Rust resistant	
	Danfe	Mid and high hills	Blight resistant	
	Tilottama	Terai		
		Mid to high hills and winter		
	JanakDev	crops for the kathmandu	Late blight resistant	
		valley and Terai		
Dotato	Khumalbikas	Mid-hills, to high-hills		
FOIALO	Khumalujjwal, Khumal Rato 2			
	Torai Khumal Soto 1	Mid hills in autumn and high		
		hill in summer season		
	Khumal Upahar	Terai to mid-hills		
Rapeseed	Lumle tori 1	Mid and high-hills	Drought tolerant	
Amaranthus	Ratomarse, Ladimarse,	Mountain region (high and	Drought tolerant	
Amarantitus	Suntale latte	mid-hills)		

(Source: NARC Diary 2077 & Released and Promising Crop Varieties of Mountain Agriculture in Nepal (1959-2016).

Table 6.5: Food Sufficiency of all Palika of Molung watershed (Source Field survey 2023 and Municipality profile)

Municipality name	Month	Household number
Sunkoshi	Upto 3 month	4342
	3-6 months	500
	6-9 months	200
	9-12 months	50
	12 months	40
Khijidemba		
Molung		
Manebhanjyang	up to 6 month	

Municipality name	Month	Household number	
Siddhicharan	< 3month	1044	
	3-6 month	1391	
	6 to 9 month	2087	
	9 to 12 month	1600	
	Year round	769	

7. Socio Economic

Table 7.1: Education literacy rate, economic rate of all Palika of Molung watershed.

Municipality	Education literacy rate	Literacy male	Literacy female	Economic active rate
Sunkoshi	71.4	78.8	64.3	71.4
Khijidemba	74.8	82.3	67.2	76.1
Molung	73.8	80.7	67.4	75.5
Siddhicharan	76.2	84.4	68.7	74.4
Manebhanjyang	77.6	84.6	71.2	76.2
Average	74.8	82.2	67.8	74.7

Annex 7: Field work



Figure 7.1: Orientation programme to enumerator and field survey by Enumerator.



Figure 7.2: Sharing at Palika Level