Water Source Inventory and Mapping

A Report of Halesi Tuwachung – 5 (Durchhim), Khotang, Nepal

2077/078

GOVERNMENT OF NEPAL
MINISTRY OF FORESTS AND ENVIRONMENT
DEPARTMENT OF FORESTS AND SOIL CONSERVATION

BASIN MANAGEMENT CENTER, KOSHI, GAIGHAT, UDAYAPUR

Foreword

Water sources are the main source of drinking water for millions of people in the Himalayas. Most water supply schemes that have been laid in the areas have their origins in a spring. There is increasing evidence that Water Sources are drying up, their discharge is reducing, or vulnerable to climate change throughout hill areas of Nepal. The Himalayan ecosystem is quite fragile and susceptible to several changes caused due to both natural dynamism and anthropogenic interventions. Erratic rainfall, seismic activity and ecological degradation associated with land use change for infrastructural development are impacting mountain aquifer systems. With changing climatic conditions and rainfall pattern, a large number of villages, hamlets and settlements are facing potential drinking water shortages. Water Sources have been the part of livelihood, heritage, traditions and cultures of the local communities in Nepal. It is important to recognize spring water depletion as a nationally pertinent problem and address it immediately.

Paradigm shift from watershed to Springshed for springs revival is crucial and important since the watershed concept only accounts for surface water movement over slopes, while movement of spring water which is groundwater, is determined by underlying geology, and the nature and slope of such rocks underneath the surface. The concept of watershed, therefore, cannot account for water which travels outside watershed boundaries, through rock beds that slope towards an adjoining watershed. The recharge area of a Water Source in one watershed, may as well lie in an adjoining watershed.

Conservation of water resources, implementing climate change adaptation/resilience programmes to address effects of climate change on watershed resources are some of the goals of Basin Management Center, Koshi Udayapur Gaighat. In this regard, Water Sources on which rural and urban communities rely for their drinking, domestic and agricultural water needs, it is dire need to document the Water Sources in the Basin level to support the policy formulation and implementation of water resources conservation programmes effectively.

Since there is an inadequate documentation of Water Sources for their revival, this "Water Sources Inventory and Mapping" is hoped to be a milestone for further documentation in larger scale in the Basin level. I would like to thank all the concerned local communities, organizations, individuals, and the BMC Koshi team for their tremendous support in preparation of this report. The Alisha Multi Consultants, Parsa, Nepal, is highly appreciated for timely accomplishment of this report.

Uddhaw Bahadur Ghimire

Senior Watershed Management Officer
Basin Management Center, Koshi
Udayapur, Gaighat, Nepal

Table of Contents

Foreword i

Chapter 1 1

1. Introduction 1

1.1 Background 1

1.2 Rational of the study 5

1.3 Objectives of the study 7

1.4 Significance of the study 7

1.5 Scope and limitations of the study 7

Chapter 2 8

2.1 Methodology 8

2.2 Descriptions of the study area 9

Chapter 3 10

3.1 Result and Discussion 10

3.1.1 List of Water Source 13

3.1.2 Details of Water Source 14

Chapter 4 51

4.1 Conclusion 51

4.2 Recommendation 53

References 57

Chapter 1

1. Introduction

1.1 Background

Since civilization, human beings have been dependent on various services from a watershed, be it food, or water or medicine or other beneficial goods, these services are termed as watershed services. Watersheds provide numerous services such as water purification, flood and erosion control and provide places for people to relax. Water springs are one of the many services which obtained from a watershed, that human can rejoice for their existence and well-being.

'Springs' are points on the surface of the earth through which groundwater emerges and flows. They represent exfiltration of groundwater onto the surface. Springs in the Himalayan region contribute to base flows of streams and rivers. However, most significantly, spring water has been used by the mountain people since ancient times, to meet most of their basic needs. Increasing population (demand), upcoming technology, changes in rainfall patterns and a poor legal policy framework for managing groundwater resources call for a specific paradigm on spring water management in the Himalaya. (Mahamuni & Kulkarni, 2012)

The springs (or 'mul') that rise in the hills are critical to survival, supplying water for drinking, irrigation, and livestock, and generally sustaining domestic needs and the rural economy, especially during the long dry season. These Water Sources are fed by groundwater which accumulates in underground aquifers during the monsoon. But many are now drying up, threatening a whole way of life. Water Sources are the life blood of the hamlets in Nepal's midhills, nevertheless their hydrological dynamics remain poorly understood as do the livelihood implications of changes, and Water Sources are generally overlooked in matters of administration. (ICIMOD(International Center for Integrated Mountain Development), 2015)

They can be relatively short-lived, providing water for a certain period after the monsoon when the groundwater levels are high, or perennial, when they are fed from a level below the dry season water table. If the groundwater recharge rate is less than the extraction rate they eventually dry up. The precise relationship between

precipitation and recharge, and actual extraction rates, remain unknown in most parts of Nepal. (ICIMOD(International Center for Integrated Mountain Development), 2015)

The average family water requirement in rural areas is about 100 liters per day. Water use patterns are undergoing a significant transformation as a result of the availability of new technologies such as pumps, and PVC or cement tanks.

Water Sources have been providing water to both humans and ecosystems for thousands of years. Before humans began practicing agriculture, hunting-gathering communities must have depended on Water Sources before they began excavating wells for groundwater. Traditionally, Water Source water is considered clean and pure due to the natural filtering that occurs during infiltration and its movement through shallow and deep aquifers, as the case may be. Water from Water Sources sufficed for village needs in the past.

The physical aspects of Water Source hydrology are still poorly understood, as are the social science aspects related to changing water use, and considerable research is needed. It is important to elucidate how rainfall is actually stored inside a 'water tower', to determine the quantitative correlation between rainfall amount and spring flow as well as factors that affect recharge, and to evaluate how society would respond to recommendations made for water regulation. Advanced scientific methods such as tracer and geological drilling studies are more definitive and much needed, as are modelling exercises. Although they are very expensive, such studies should be carried at the micro-watershed level to establish firmer linkages between local hydrogeology, recharge ponds, and village Water Sources

The study revealed that in the hilly region of Nepal, a combination of biophysical (e.g., climate variability, changes in land use) and socioeconomic (e.g., Water Source maintenance) factors were responsible for the drying up of Water Sources. Drying up of Water Sources and water scarcity issues underscore the need to increase the understanding of Water Source hydrology, especially in the Himalayan region. In order to improve water availability for rural communities in the Himalayan regions, there had been numerous watershed interventions in the past. Most interventions were not site-specific and did not take into account karst geology and preferential pathways in aquifers (Agrawal, et al., 2012)

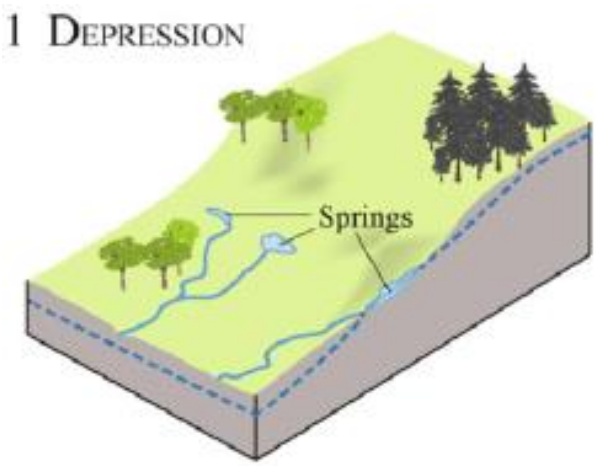
Advances in knowledge of Himalayan Water Sources is limited, due to inadequate investigations, and a lack of synthesis of existing information in published and grey literature. There are a few detailed studies in the Indian region of the Himalayas, but studies in the Nepal region are very limited.

CLASSIFICATION OF SPRINGS

Types of springs may vary according to flow rates, seasonality of flows, water temperature, water quality and the presence of dissolved gases. Fetter (1994) classified springs into six dominant types based on their geology:

Depression springs

Undulating topography intersects the water table to form depression springs.

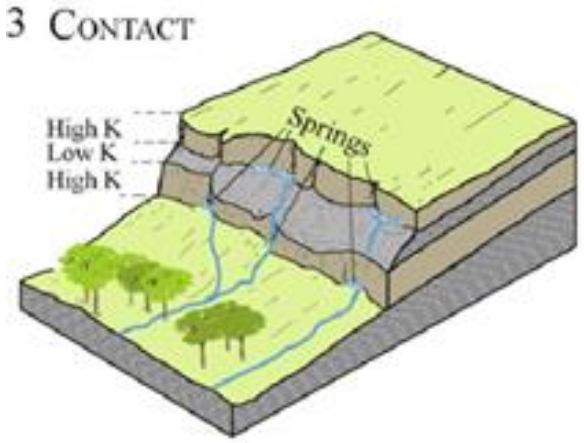


Fault springs

When faults have higher hydraulic conductivity than the material in which they are embedded in due to stress, movement or weathering, the faults can act as a regional boundary for groundwater movement and provide a preferential flow path for water. When water moves along fault lines and discharges at the surface, fault springs are formed.

Contact springs

When permeable rocks or sediments overlie less permeable units, infiltrated water flows laterally (due to higher hydraulic conductivity) rather than vertically due to gravity. Thus, preferential flow paths are created at the contact of different geologic units with variable hydraulic conductivity. Water flowing through these flow paths emerges at the surface to form contact springs.



Fracture springs

Because fractures have a higher hydraulic conductivity than adjoining rocks, water preferentially flows in these fractures, thus forming fractured springs.

Sinkhole or karst springs

Limestone bedrock can have large conduits, cavities and channels (termed karst), which act as preferential flow paths for groundwater. When water in these flow paths is under artesian pressure, sinkhole or karst springs are formed. Joint springs – Many joints with high hydraulic

conductivity may be present in low permeability rocks. When water flows in these joints, joint springs are formed.

In some cases, understanding the geology of mountainous regions using geophysical exploration is difficult due to a lack of access.

Springs are the most important freshwater source in many Himalayan villages. The causes for a decrease in spring discharge in the Himalayan region are attributed to population growth, increase in groundwater pumping, erosion of the topsoil, erratic rainfall patterns, climate change trends (especially in rainfall and temperature), deforestation, forest fires and development activities.

Community participation in Water Source protection and recommended interventions such as artificial rainwater harvesting measures, afforestation, and demarcation and protection of recharge zones from human activity.) (Chinnaswamy & Prathapar, 2016)

1.2 Rational of the study

Water Sources are the main source of water for millions of people in the mid-hills of Nepal. Both rural and urban communities depend on Water Sources to meet their drinking, domestic and agricultural water needs. There is increasing evidence that Water Sources are drying up, or their discharge is reducing throughout the mountain region. As a result, communities are facing unprecedented water stress. The exact extent of this problem is not well known, given the dearth of scientific studies.

Water Sources are an integral part of the groundwater system. However, the science of hydrogeology that governs the occurrence and movement of water in underground aquifers is not well understood in regions that depend upon springs. This often results in misconceptions regarding Water Sources. This, in turn, creates misaligned policies that exacerbate the problem. Water Sources are also part of complex sociotechnical and informal governance systems with pronounced gender and equity dimensions, and these systems are not well understood. Again, such lack to understanding leads to inappropriate policies and interventions.

Understanding socio-economic aspects and identification of proper recharge areas of the studied Water Sources, which are complementary to each other in reviving drying

springs and Springshed management. Identification of zones of recharge is very crucial for management of Springshed in mountainous areas.

Local people's traditional knowledge expert knowledge on geology, distribution of rocks, soil system and topographical variation among different places is necessary for Springshed management. Therefore, expert knowledge should be taken for technicality while locals' knowledge should be used for monitoring the intervention in the spring both in private and government land.) (BCRWME, 2017)

Climate change and change in bio- physical landscape (e.g. land-use and vegetation) are widely implicated in the drying of springs. But there is very little systematic knowledge to effectively link climate change, vegetation change and spring discharge. This is an urgent area for research and knowledge generation. Rapid socio-economic and demographic changes and infrastructure (dams, roads etc.) have also impacted springs (Shrestha, et al., 2017)

Water Sources are the water lifeline of the HKH, yet, there is a dearth of scientific knowledge on Water Sources. Our research combines the science of hydrogeology and the social science of community action to understand and document nature and the functioning of springs, and ways of reviving millions of springs in the HKH that are facing the threat of drying up. This is geared towards generating robust and up-to-date data and information on Himalayan springs using a replicable methodology. (Shrestha, et al., 2017)

But again, the exact nature of change is difficult to understand due to a dearth of studies. This is another important knowledge gap that needs to be filled. The drying of Water Sources, which comes with its own set of consequences, is a national phenomenon. A few local and national organizations have started scientific studies and policy advocacy on Water Sources, but more needs to done, especially given the extent of the problem and its regional and local dimensions. In this context, Basin Management Center (BMC), Koshi has initiated work on understanding the physical, social and governance issues related to Water Sources inventory, mapping, and management and use this knowledge to influence policymaking in the region.

Conservation of water resources, implementing climate change adaptation/resilience programmes to address effects of climate change on watershed resources are some of

the goals of Basin Management Center, Koshi Udayapur Gaighat. There is an inadequate documentation of Water Sources on which rural and urban communities rely for their drinking, domestic and agricultural water needs. Inventory and mapping of the Water Sources is required for the revival of Water Sources. It is important to document the Water Sources in the Basin level to support the policy formulation and implementation of water resources conservation programmes effectively.

1.3 Objectives of the study

The overall objective of this study was to find the status of Water Sources within watershed and document the identified Water Sources.

1.4 Significance of the study

i. The study will be helpful in the sustainable management of water resources.
ii. The study will support policy makers to formulate required policy.
iii. This study will be a milestone for further documentation of the Water Sources in larger scale.

1.5 Scope and limitations of the study

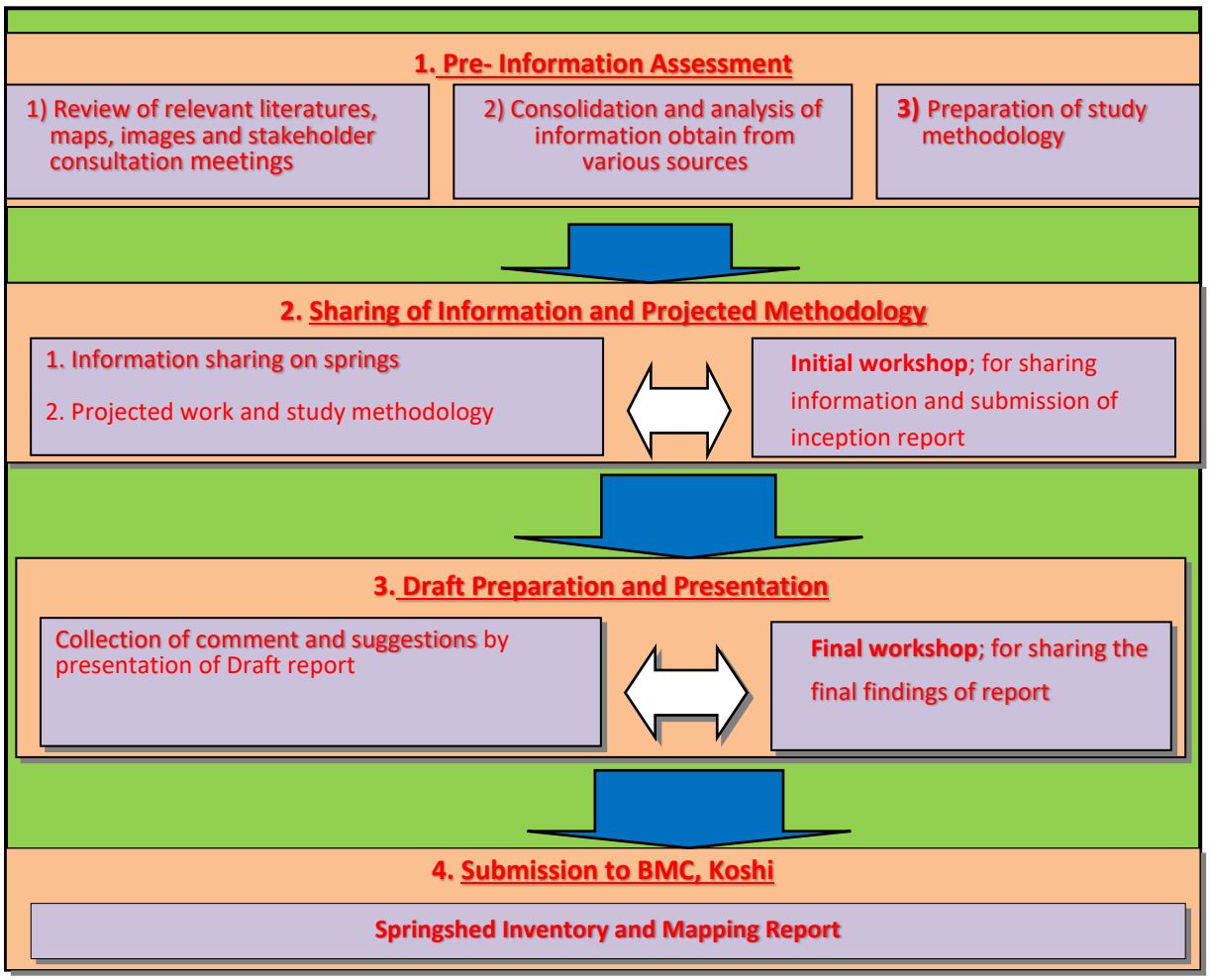
This study was expected to build common understanding among local community on Water Sources inventory and mapping for sustainable water resource management. However, the study had following limitations:

- The study was focused with Water Sources physical as well as spatial location only in a small watershed area
- All other components for the inventory were not taken into consideration
- Generalization of the study result needs much-more verifications as per the requirement.

Chapter 2

2.1 Methodology

The Water Source Inventory and Mapping was carried out as a field based and desk study work using GIS environment and collection of field inventory data. The study team was geared towards a full-fledged management plan encompassing a range of issues from bio-physical, socio-economic, hydrological, and geological and land form/system in GIS environment. But the comprehensive methodology of this study was finalized in the close consultation with the advisory committee setup by BMC, Koshi, Udayapur Gaighat. At first the study team was formulated for collection of different type of socio-economic as well as physical status of Water Sources in the field. After field work, the desk work was performed. As product of desk study, the study team prepared the maps and report of Water Sources inventory.

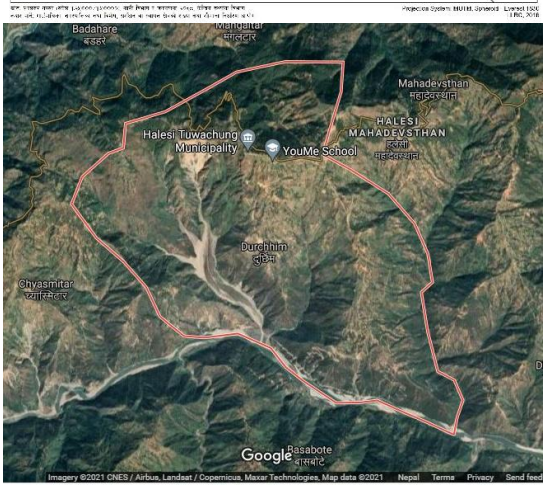


Flow-chart: Outline of Water Source Inventory methodology

In next step, the team prepared the Water Sources Inventory map using the GPS and field information in GIS environment. After preparation these maps, the team verified the product in field by visiting some sample area. The draft report was presented to the BMC, Koshi and all the comments were collected and incorporated in the final report. Finally, the report was submitted to the BMC, Koshi, Udayapur, Gaighat.

2.2 Descriptions of the study area

Halesi Tuwachung is a municipality out of two municipalities in Khotang District of Province No. 1 of Nepal. It is in western part of the district and about 40 km far from Diktel, the head-quarter of the district. It is named after the famous Halesi Mahadev.



The municipality is divided into 11 wards and total area of the municipality is 280.17 km^2. According to 2011 census of Nepal, the municipality's population is 29,532.

Durchhim is a populated village situated in ward number 5 of the Halesi Tuwachung is municipality of Khotang District in province no. 1 of Eastern Nepal. At the time of the 1991 Nepal census, it had a population of 3,283 living in 629 individual households

Chapter 3

3.1 Result and Discussion

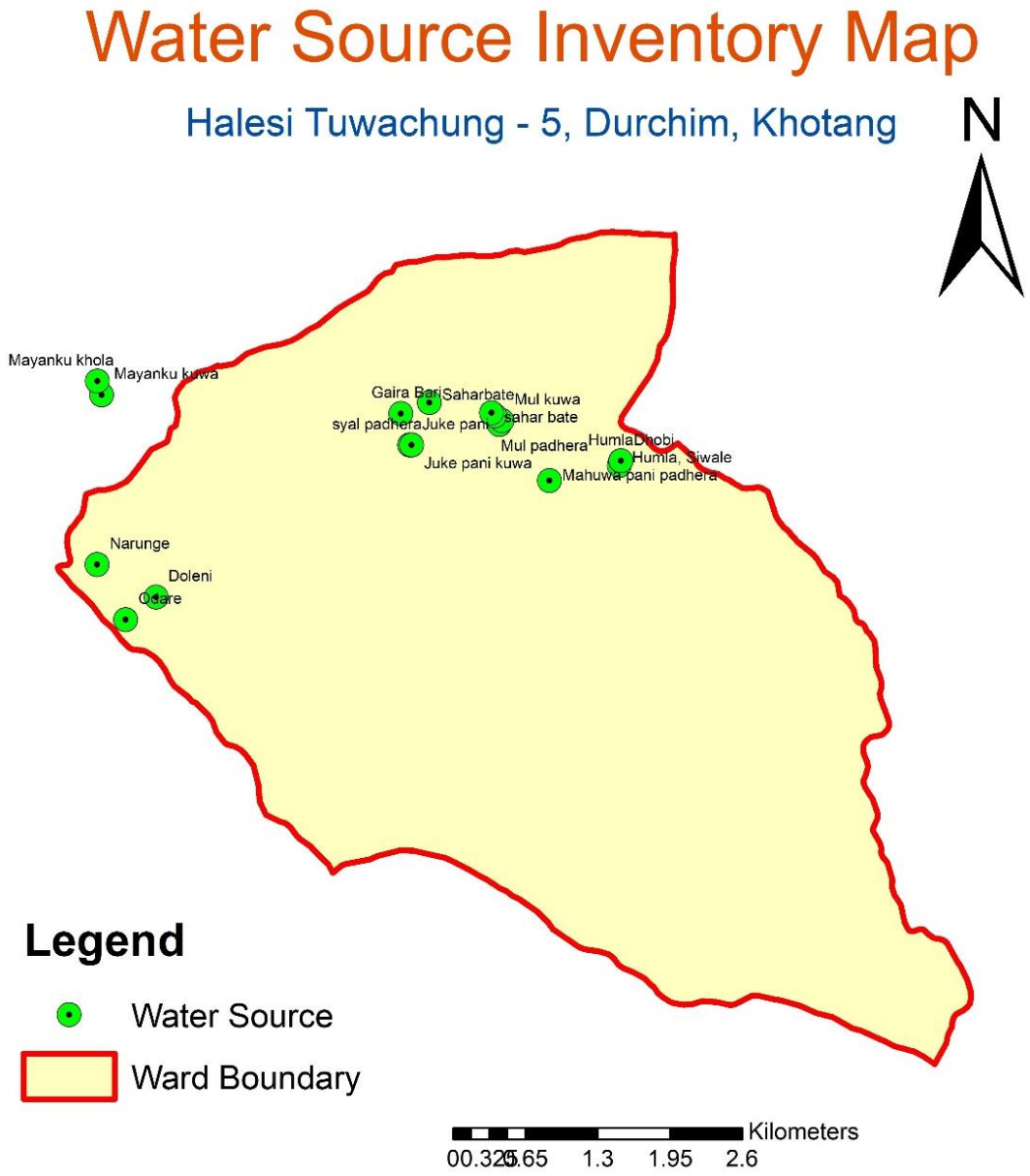
This study is both an exploratory and a descriptive in nature. The study is descriptive because it tried to bring the status quo information of the Water Sources such as the status of Water Sources and trend of water being used by the local people from the different water sources in the study area. Similarly, the study is also an exploratory one because it explored the present status and situations of Water Sources and also tried to explore people's perception towards the conservation of existing water sources.

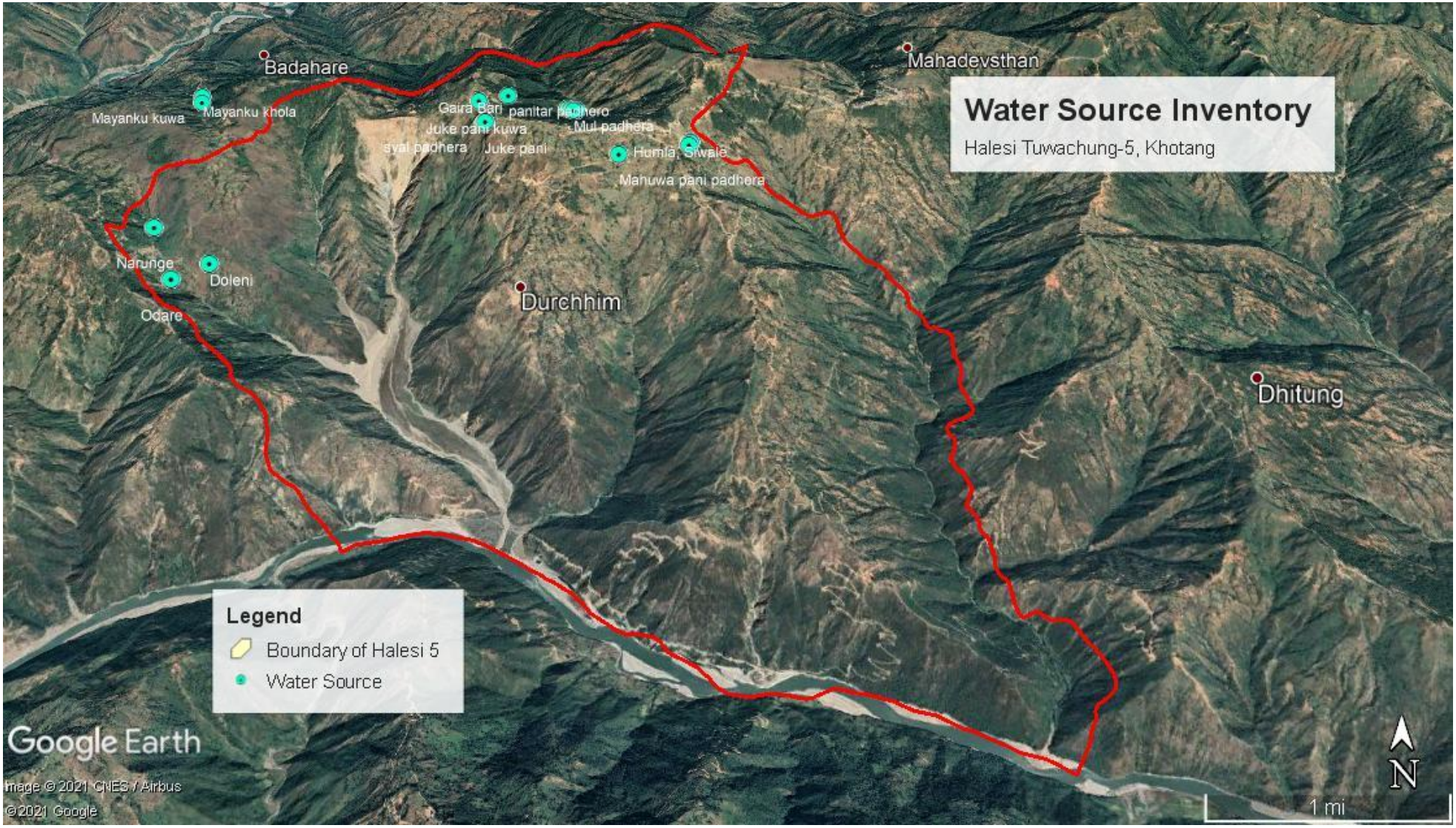
The study was conducted in a participative way. The local user groups, their federations and local level line agencies were interviewed either in a group or an individually depending on the field circumstances and nature of the information required, during the field work. This study collected and utilized quantitative information basically gathered from the study area. Relevant data/information were collected through primary and secondary sources. Study was concentrated to achieve the stated objectives and reliable information was drawn according to established specific objectives.

Most of the data were collected from field by direct observation. Direct field observation helped to internalize actual field situation and build perception regarding the research problem. Therefore, actual situation of Water Sources was observed and photographs were taken. Water source's health, available water discharge, current uses of water and their status were observed with the help of a checklist.

In the study area, the activities carried out by the upstream users have direct impacts on the services derived by the downstream users. The good and beneficial services that are used by the downstream users are the resultant of good watershed conservation activities carried out in the upstream. To ensure the continuous delivery of the services and also to keep the livelihood of the upstream users intact. Loss of forest cover, not only has impact on direct values but also various functions of forest such as loss of soil nutrition, sediment issues for downstream inhabitants, reduction in water recharge are lost which are categorized as indirect values.

It was found that inhabitants of the study area have been using various types of ecological services such as drinking water, irrigation, household uses. However, the study found that there was the prevalence of the grievances and poor collaboration between them; very limited interactions, coordination, and regulatory mechanisms do exist. During interaction with local people, they expressed that the forest cover is decreasing very rapidly was noticed, and the water sources are declined and disappeared. People also argued that using the excavators during road construction, may one of the major causes of drying up of Water Sources. Following maps explain the position and spatial distribution of the identified Water Sources and all the water sources detail information have been put in tabulate form in Table 3.1.1.




Water Source Inventory
Halesi Tuwachung-5, Khotang
Badahare
Mahadevsthan
Durchhim
Dhitung
Mayanku kuwa
Mayanku khola
Gaira Bari
panitar padhero
Juke pani kuwa
Mul padhera
syal padhera
Juke pani
Humla, Siwale
Mahuwa pani padhera
Narunge
Doleni
Odare
Legend
Boundary of Halesi 5
Water Source
Google Earth
Image © 2021 CNES / Airbus
© 2021 Google
N
1 mi

3.1.1 List of Water Source

Springs ID	Local Name of Springs	Physical location				Spatial Location		
		watershed Name	Municipality	Ward No.	Tole	Latitude	Longitude	Altitude
1	Mul Padhera	Sun Koshi	Halesi Tuwachhung	5	Chhap Danda	86.5935044333°	27.1864601596°	1421m
2	Mul Kuwa	Sun Koshi	Halesi Tuwachhung	5	Chhap Danda	86.5937556774°	27.186777075°	1400m
3	Saharbate	Sun Koshi	Halesi Tuwachhung	5	Chhap Danda	86.5931283102°	27.1871727303°	1365m
4	Sahar bate	Sun Koshi	Halesi Tuwachhung	5	Chhap Danda	86.5928143954°	27.1874336376°	1384m
5	Panitar Padhero	Sun Koshi	Halesi Tuwachhung	5	Chhap Danda	86.5872078621°	27.1883561798°	1415m
6	Gaira Bari	Sun Koshi	Halesi Tuwachhung	5	Chhap Danda	86.5845860873°	27.1875088133°	1449m
7	Juke Pani	Sun Koshi	Halesi Tuwachhung	5	Chhap Danda	86.5853325495°	27.1849470089°	1400m
8	Juke Pani Kuwa	Sun Koshi	Halesi Tuwachhung	5	Chhap Danda	86.5855042047°	27.1849384881°	1412m
9	Syal Padhera	Sun Koshi	Halesi Tuwachhung	5	Saltema	86.5855041713°	27.1849475163°	1394m
10	Mahuwa Pani Padhera	Sun Koshi	Halesi Tuwachhung	5	Saltema	86.5979529849°	27.1818419353°	1355m
11	Humla, Siwale	Sun Koshi	Halesi Tuwachhung	5	Saltema	86.6043092006°	27.1829163164°	1344m
12	Humla	Sun Koshi	Halesi Tuwachhung	5	Saltema	86.6044390697°	27.1833048968°	1353m
13	Dhobi	Sun Koshi	Halesi Tuwachhung	5	Buddha Chowk	86.6044592284°	27.1833139819°	1271m
14	Mayanku Kuwa	Sun Koshi	Halesi Tuwachhung	5	Mayanku	86.5575114829°	27.189520533°	1255m
15	Mayanku Khola	Sun Koshi	Halesi Tuwachhung	5	Mayanku	86.5571537092°	27.1906388994°	1237m
16	Doleni	Sun Koshi	Halesi Tuwachhung	5	Lahatung	86.5620684389°	27.1730583602°	949m
17	Odare	Sun Koshi	Halesi Tuwachhung	5	Shokmala, Damjale, Harde	86.5592793025°	27.1712710662°	855m
18	Narunge	Sun Koshi	Halesi Tuwachhung	5	Odare	86.5567883729°	27.1757863535°	1015m

Data Source: Field Survey 2021

3.1.2 Details of Water Source

1. Status of Individual Water Spring

Name of Respondent: Ram Kumar Raut, Matiraj Rai, Sagar Chamling Rai

Location:

Name of Watershed	Sun Koshi
Name of Sub-watershed	
Name of Micro-watershed	Mul Padhera
Municipality	Halesi Tuwachhung
Ward No.	5
Tole/Village	Chhap Danda

Geo-Spatial Location of Spring:

Spring ID	1
Latitude(x)	86.5935044333˚
Longitude(Y)	27.1864601596˚
Altitude	1421m
Aspect	Northeast
Precipitation	
Slope	>20
Dimensions	l: 9m
Distance from hamlet	150m
Sanitation (Latrine, Waste dumps etc. in the area)	No.

Social Status:

Local name of spring	Mul Padhera		
Location (land ownership)	public: ✓	Private:	
Use of Spring (User Right)	public:✓	Private:	
Use of spring (purpose)	Drinking:✓	Irrigation:	Multiuse:
Beneficiaries(HH)	Dalit:10	Janajati:15	Others:45
social/religious aspect and importance of spring	Socially important for drinking .But drying up in the recent days. Religious importance because Sulochana Devi is worshipped in the Baishakh Purnima.		

Physical status of spring:

Type of spring:	Depression:✓	Fracture:	contact:	Fault:	Sink hole:
Type of spring:		whole year:	6 month:✓	3 Month:	
current condition:		Flowing:	Drying:	Dried:✓	
Historical trend :		Increasing:	Static:	Decreasing:✓	
Any Construction:		Tanks			
Discharge:		0.0L/s			

Vegetation:

Type of Vegetation:	subtropical broad leaved forest
Upstream vegetation:	Downstream Vegetation:
Gurans,chiuri, Mageri , kafal	Gurans,chiuri, Mageri , kafal

Is there any Devastating situation in the spring? If yes, Status, Type, and Scale (People's Perception)

The construction of road has led to the drying up of the spring.

Proposed Conservation Measure (People's Perception)

Afforestation, sustainable development

Photographs of the spring:

2. Status of Individual Water Spring

Name of Respondent: Ram Kumar Raut, Matiraj Rai, Sagar Chamling Rai

Location:

Name of Watershed	Sun Koshi
Name of Sub-watershed	
Name of Micro-watershed	Mul Kuwa
Municipality	Halesi Tuwachhung
Ward No.	5
Tole/Village	Chhap Danda

Geo-Spatial Location of spring:

Spring ID	2
Latitude(x)	86.5937556774°
Longitude(Y)	27.186777075°
Altitude	1400m
Aspect	Northeast
Precipitation	
Slope	>20
Dimensions	l: 5m
Distance from hamlet	200m
Sanitation (Latrine, Waste dumps etc. in the area)	No.

Social Status:

Local name of spring	Mul Kuwa		
Location (land ownership)	public:	Private:✓	
Use of Spring (User Right)	public:	Private: ✓	
Use of spring (purpose)	Drinking:	Irrigation:	Multiuse:✓
Beneficiaries(HH)	Dalit:	Janajati:	Others:1
social/religious aspect and importance of spring	Socially important for drinking, irrigation and cultivation.		

Physical status of spring:

Type of spring:	Depression:✓	Fracture:	contact:	Fault:	Sink hole:
Type of spring:		whole year:	6 month:	3 Month:✓	
current condition:		Flowing:	Drying:✓	Dried:	
Historical trend :		Increasing:	Static:✓	Decreasing:	
Any Construction:		No			
Discharge:		0.0L/s			

Vegetation:

Type of Vegetation:	subtropical broad leaved forest
Upstream vegetation:	Downstream Vegetation:
Chilaune, Utis,kafal,Mageri	Chilaune, Utis, kafal, Mageri

Is there any Devastating situation in the spring? If yes, Status, Type, and Scale (People's Perception)

No.

Proposed Conservation Measure (People's Perception)

Afforestation and proper management.

Photographs of the spring:

3. Status of Individual Water Spring

Name of Respondent: Ram Kumar Raut, Matiraj Rai, Sagar Chamling Rai

Location:

Name of Watershed	Sun Koshi
Name of Sub-watershed	
Name of Micro-watershed	Saharbate
Municipality	Halesi Tuwachhung
Ward No.	5
Tole/Village	Chhap Danda

Geo-Spatial Location of spring:

Spring ID	3
Latitude(x)	86.5931283102˚
Longitude(Y)	27.1871727303˚
Altitude	1365m
Aspect	Northeast
Precipitation	
Slope	>20
Dimensions	l: 3m
Distance from hamlet	1km
Sanitation (Latrine, Waste dumps etc. in the area)	No.

Social Status:

Local name of spring	Saharbate		
Location (land ownership)	public: ✓	Private:	
Use of Spring (User Right)	public:✓	Private:	
Use of spring (purpose)	Drinking:✓	Irrigation:	Multiuse:
Beneficiaries(HH)	Dalit:10	Janajati:9	Others:6
social/religious aspect and importance of spring	Socially important for drinking but drying up recently.		

Physical status of spring:

Type of spring:	Depression:✓	Fracture:	contact:	Fault:	Sink hole:

Type of spring:	whole year:✓	6 month:	3 Month:
current condition:	Flowing:	Drying:✓	Dried:
Historical trend :	Increasing:	Static:	Decreasing:✓
Any Construction:	Tank		
Discharge:	0.0L/s		

Vegetation:

Type of Vegetation:	subtropical broad leaved forest

Upstream vegetation:	Downstream Vegetation:
Utis, Chilaune, kafal	Utis, Chilaune, kafal

Is there any Devastating situation in the spring? If yes, Status, Type, and Scale (People's Perception)

No.

Proposed Conservation Measure (People's Perception)

bordering for security

Photographs of the spring:

4. Status of Individual Water Spring

Name of Respondent: Ram Kumar Raut, Matiraj Rai, Sagar Chamling Rai

Location:

Name of Watershed	Sun Koshi
Name of Sub-watershed	
Name of Micro-watershed	Sahar Bate
Municipality	Halesi Tuwachhung
Ward No.	5
Tole/Village	Chhap Danda

Geo-Spatial Location of spring:

Spring ID	4
Latitude(x)	86.5928143954˚
Longitude(Y)	27.1874336376˚
Altitude	1384m
Aspect	Northeast
Precipitation	
Slope	<20
Dimensions	l: 5m
Distance from hamlet	1km
Sanitation (Latrine, Waste dumps etc. in the area)	No.

Social Status:

Local name of spring	Saharbate		
Location (land ownership)	public: ✓	Private:	
Use of Spring (User Right)	public:✓	Private:	
Use of spring (purpose)	Drinking:✓	Irrigation:	Multiuse:
Beneficiaries(HH)	Dalit:10	Janajati:9	Others:6
social/religious aspect and importance of spring	Socially important for drinking but drying up.		

Physical status of spring:

Type of spring:	Depression:✓	Fracture:	contact:	Fault:	Sink hole:
Type of spring:		whole year:✓	6 month:	3 Month:	
current condition:		Flowing:✓	Drying:	Dried:	
Historical trend :		Increasing:	Static:	Decreasing:✓	
Any Construction:		intake and Tanks			
Discharge:		0.002L/s			

Vegetation:

Type of Vegetation:	subtropical broad leaved forest
Upstream vegetation:	Downstream Vegetation:
Utis, Chilaune, kafal	Utis, Chilaune, kafal

Is there any Devastating situation in the spring? If yes, Status, Type, and Scale (People's Perception)

No. Devastated during the earthquake and kept drying from then till now. The crabs dug out the soil and diverged the water somewhere else.

Proposed Conservation Measure (People's Perception)

Proper management and bordering.

Photographs of the spring:

5. Status of Individual Water Spring

Name of Respondent: Durga Bahadur Budathoki (9815723596)

Location:

Name of Watershed	Sun Koshi
Name of Sub-watershed	
Name of Micro-watershed	Panitar
Municipality	Halesi Tuwachhung
Ward No.	5
Tole/Village	Chhap Danda

Geo-Spatial Location of spring:

Spring ID	5
Latitude(x)	86.5872078621°
Longitude(Y)	27.1883561798°
Altitude	1415m
Aspect	Northeast
Precipitation	
Slope	>20
Dimensions	l: 8m
Distance from hamlet	500m
Sanitation (Latrine, Waste dumps etc. in the area)	No.

Social Status:

Local name of spring	Panitar Padhero		
Location (land ownership)	public: ✓	Private:	
Use of Spring (User Right)	public:✓	Private:	
Use of spring (purpose)	Drinking:	Irrigation:	Multiuse:✓
Beneficiaries(HH)	Dalit:	Janajati:8	Others:27
social/religious aspect and importance of spring	Religious importance. People took bath in the spring and worshiped the local goddess nearby. Also socially important. It is used during the funerals.		

Physical status of spring:

Type of spring:	Depression:✓	Fracture:	contact:	Fault:	Sink hole:
Type of spring:		whole year:	6 month:✓	3 Month:	
current condition:		Flowing:	Drying:	Dried:✓	
Historical trend :		Increasing:	Static:	Decreasing:✓	
Any Construction:		Tank, intake and taps			
Discharge:		0.0L/s			

Vegetation:

Type of Vegetation:	subtropical broad leaved forest
Upstream vegetation:	Downstream Vegetation:
Dhungrebans, utis, Chilaune, salla	Dhungrebans,utis,chilaune,salla

Is there any Devastating situation in the spring? If yes, Status, Type, and Scale (People's Perception)

Slightly devastated because of the earth quake and road construction.

Proposed Conservation Measure (People's Perception)

Prevent deforestation, develop leasehold forest, sanitation, bordering for security.

Photographs of the spring:

6. Status of Individual Water Spring

Name of Respondent: Durga Bahadur Budathoki

Location:

Name of Watershed	Sun Koshi
Name of Sub-watershed	
Name of Micro-watershed	Gaira Bari
Municipality	Halesi Tuwachhung
Ward No.	5
Tole/Village	Chhap Danda

Geo-Spatial Location of spring:

Spring ID	6
Latitude(x)	86.5845860873˚
Longitude(Y)	27.1875088133˚
Altitude	1449m
Aspect	Northeast
Precipitation	
Slope	>20
Dimensions	l: 3m
Distance from hamlet	200m
Sanitation (Latrine, Waste dumps etc. in the area)	No.

Social Status:

Local name of spring	Gaira Bari		
Location (land ownership)	public: ✓	Private:	
Use of Spring (User Right)	public:✓	Private:	
Use of spring (purpose)	Drinking:✓	Irrigation:	Multiuse:
Beneficiaries(HH)	Dalit:	Janajati:8	Others:27
social/religious aspect and importance of spring	Socially important from history. Considered as the main spring from the past. But the condition is now worsening.		

Physical status of spring:

Type of spring:	Depression:✓	Fracture:	contact:	Fault:	Sink hole:
Type of spring:		whole year:✓	6 month:	3 Month:	
current condition:		Flowing:	Drying:	Dried:✓	
Historical trend :		Increasing:	Static:	Decreasing:✓	
Any Construction:		Tanks and intakes			
Discharge:		0.0L/s			

Vegetation:

Type of Vegetation:	subtropical broad leaved forest
Upstream vegetation:	Downstream Vegetation:
Khanyu, bamboo, Guyalo	Male bans, Chilaune, salla

Is there any Devastating situation in the spring? If yes, Status, Type, and Scale (People's Perception)

Little devastated during earthquake and drying up after the earthquake

Proposed Conservation Measure (People's Perception)

Afforestation, fencing, sanitation, make a strong committee.

Photographs of the spring:

7. Status of Individual Water Spring

Name of Respondent: Durga Bahadur Budathoki

Location:

Name of Watershed	Sun Koshi
Name of Sub-watershed	
Name of Micro-watershed	Juke Pani
Municipality	Halesi, tuwachhung
Ward No.	5
Tole/Village	Chhap Danda

Geo-Spatial Location of Spring:

Spring ID	7
Latitude(x)	86.5853325495°
Longitude(Y)	27.1849470089°
Altitude	1400m
Aspect	Northeast
Precipitation	
Slope	>30
Dimensions	l: 3m
Distance from hamlet	300m
Sanitation (Latrine, Waste dumps etc. in the area)	No.

Social Status:

Local name of spring	Juke Pani		
Location (land ownership)	public: ✓	Private:	
Use of Spring (User Right)	public:✓	Private:	
Use of spring (purpose)	Drinking:✓	Irrigation:	Multiuse:
Beneficiaries(HH)	Dalit:	Janajati:10	Others:30
social/religious aspect and importance of spring	Public used it during the funerals. But mostly important for drinking.		

Physical status of spring:

Type of spring:	Depression:	Fracture:	contact:	Fault:✓	Sink hole:

Type of spring:	whole year:✓	6 month:	3 Month:
current condition:	Flowing:	Drying:	Dried:✓
Historical trend :	Increasing:	Static:	Decreasing:✓
Any Construction:	Tanks		
Discharge:	0.0125L/s		

Vegetation:

Type of Vegetation:	subtropical broad leaved forest

Upstream vegetation:	Downstream Vegetation:
Bamboo, utis	Bamboo.

Is there any Devastating situation in the spring? If yes, Status, Type, and Scale (People's Perception)

Devastated after the earthquake.

Proposed Conservation Measure (People's Perception)

Sanitation, Bio-engineering, Proper usage.

Photographs of the spring:

8. Status of Individual Water Spring

Name of Respondent: Durga Bahadur Budathoki

Location:

Name of Watershed	Sun Koshi
Name of Sub-watershed	
Name of Micro-watershed	Juke Pani Kuwa
Municipality	Halesi Tuwachhung
Ward No.	5
Tole/Village	Chhap Danda

Geo-Spatial Location of spring:

Spring ID	8
Latitude(x)	86.5855042047°
Longitude(Y)	27.1849384881°
Altitude	1412m
Aspect	Northeast
Precipitation	
Slope	>30
Dimensions	l: 2m
Distance from hamlet	300m
Sanitation (Latrine, Waste dumps etc. in the area)	No.

Social Status:

Local name of spring	Juke Pani Kuwa		
Location (land ownership)	public: ✓	Private:	
Use of Spring (User Right)	public:✓	Private:	
Use of spring (purpose)	Drinking:✓	Irrigation:	Multiuse:
Beneficiaries(HH)	Dalit:	Janajati:10	Others:30
social/religious aspect and importance of spring	Socially important for drinking but drying up.		

Physical status of spring:

Type of spring:	Depression:	Fracture:	contact:	Fault:✓	Sink hole:
Type of spring:		whole year:✓	6 month:✓	3 Month:	
current condition:		Flowing:✓	Drying:	Dried:	
Historical trend :		Increasing:	Static:	Decreasing:✓	
Any Construction:		Intake			
Discharge:		0.012L/s			

Vegetation:

Type of Vegetation:	subtropical broad leaved forest
Upstream vegetation:	Downstream Vegetation:
Bamboo, Utis	Bamboo, Utis

Is there any Devastating situation in the spring? If yes, Status, Type, and Scale (People's Perception)

started drying after the earthquake

Proposed Conservation Measure (People's Perception)

sanitation and bio-engineering

Photographs of the spring:

9. Status of Individual Water Spring

Name of Respondent: Harka Raj Rai (9803859584) (78 years of age)

Location:

Name of Watershed	Sun Koshi
Name of Sub-watershed	
Name of Micro-watershed	Syal Padhero
Municipality	Halesi Tuwachhung
Ward No.	5
Tole/Village	Saltema

Geo-Spatial Location of spring:

Spring ID	9
Latitude(x)	86.5855041713˚
Longitude(Y)	27.1849475163˚
Altitude	1394m
Aspect	Northeast
Precipitation	
Slope	>20
Dimensions	l: 3m
Distance from hamlet	500m
Sanitation (Latrine, Waste dumps etc. in the area)	No.

Social Status:

Local name of spring	Syal Padhera		
Location (land ownership)	public: ✓	Private:	
Use of Spring (User Right)	public:✓	Private:	
Use of spring (purpose)	Drinking:✓	Irrigation:	Multiuse:
Beneficiaries(HH)	Dalit:14	Janajati:20	Others:11
social/religious aspect and importance of spring	Once Nag puja and Rudripuja was done. Socially important for drinking.		

Physical status of spring:

Type of spring:	Depression:✓	Fracture:	contact:	Fault:	Sink hole:

Type of spring:	whole year:✓	6 month:	3 Month:
current condition:	Flowing:	Drying:	Dried:✓
Historical trend :	Increasing:	Static:	Decreasing:✓
Any Construction:	No		
Discharge:	0.0L/s		

Vegetation:

Type of Vegetation:	subtropical broad leaved forest

Upstream vegetation:	Downstream Vegetation:
Khanyu, Dhangero, Bans	salla, aap, bans, tilke

Is there any Devastating situation in the spring? If yes, Status, Type, and Scale (People's Perception)

Some part slide some years ago. Dried from past 2 years.

Proposed Conservation Measure (People's Perception)

Sanitation, and afforestation.

Photographs of the spring:

10. Status of Individual Water Spring

Name of Respondent: Harka Raj Rai

Location:

Name of Watershed	Sun Koshi
Name of Sub-watershed	
Name of Micro-watershed	Mahuwa Pani Padhera
Municipality	Halesi Tuwachhung
Ward No.	5
Tole/Village	Saltema

Geo-Spatial Location of spring:

Spring ID	10
Latitude(x)	86.5979529849°
Longitude(Y)	27.1818419353°
Altitude	1355m
Aspect	Northeast
Precipitation	
Slope	>30
Dimensions	l: 3m
Distance from hamlet	1km
Sanitation (Latrine, Waste dumps etc. in the area)	No.

Social Status:

Local name of spring	Mahuwa Pani Padhera		
Location (land ownership)	public: ✓	Private:	
Use of Spring (User Right)	public:✓	Private:	
Use of spring (purpose)	Drinking:✓	Irrigation:	Multiuse:
Beneficiaries(HH)	Dalit:12	Janajati:40	Others:
social/religious aspect and importance of spring	Socially important for drinking but drying up.		

Physical status of spring:

Type of spring:	Depression:✓	Fracture:	contact:	Fault:	Sink hole:
Type of spring:		whole year:✓	6 month:	3 Month:	
current condition:		Flowing:	Drying:	Dried:✓	
Historical trend :		Increasing:	Static:	Decreasing:✓	
Any Construction:		Tanks and taps			
Discharge:		0.0L/s			

Vegetation:

Type of Vegetation:	subtropical broad leaved forest
Upstream vegetation:	Downstream Vegetation:
Bar, Pipal, Bans, Khanyu	Ritha, Simali, Bans, Khanyu

Is there any Devastating situation in the spring? If yes, Status, Type, and Scale (People's Perception)

No.

Proposed Conservation Measure (People's Perception)

Afforestation, and sanitation.

Photographs of the spring:

11. Status of Individual Water Spring

Name of Respondent: Meknath Rai (9812328217), Sailendra Rai, Harka Raj Rai

Location:

Name of Watershed	Sun Koshi
Name of Sub-watershed	
Name of Micro-watershed	Humla , Siwale
Municipality	Halesi Tuwachhung
Ward No.	5
Tole/Village	Saltema

Geo-Spatial Location of spring:

Spring ID	11
Latitude(x)	86.6043092006˚
Longitude(Y)	27.1829163164˚
Altitude	1344m
Aspect	Northeast
Precipitation	
Slope	>30
Dimensions	l: 1m
Distance from hamlet	150m
Sanitation (Latrine, Waste dumps etc. in the area)	No.

Social Status:

Local name of spring	Humla, Siwale		
Location (land ownership)	public:✓	Private:	
Use of Spring (User Right)	public:✓	Private:	
Use of spring (purpose)	Drinking:	Irrigation:	Multiuse:✓
Beneficiaries(HH)	Dalit:	Janajati:150	Others:
social/religious aspect and importance of spring	Socially important for drinking and irrigation.		

Physical status of spring:

Type of spring:	Depression:✓	Fracture:	contact:	Fault:	Sink hole:
Type of spring:		whole year:	6 month:	3 Month:✓	
current condition:		Flowing:	Drying:	Dried:✓	
Historical trend :		Increasing:	Static:	Decreasing:✓	
Any Construction:		No			
Discharge:		0.0L/s			

Vegetation:

Type of Vegetation:	subtropical broad leaved forest
Upstream vegetation:	Downstream Vegetation:
Bans, Khirra, Simali, Badahar	Bans, Kutmero, Bakaina

Is there any Devastating situation in the spring? If yes, Status, Type, and Scale (People's Perception)

Devasted during the earthquake and started drying.

Proposed Conservation Measure (People's Perception)

Tanks and taps should be made. Afforestation and sanitation should be done.

Photographs of the spring:

12. Status of Individual Water Spring

Name of Respondent: Meknath Rai, Sailendra Rai, Harka Raj Rai

Location:

Name of Watershed	Sun Koshi
Name of Sub-watershed	
Name of Micro-watershed	Humla
Municipality	Halesi Tuwachhung
Ward No.	5
Tole/Village	Saltema

Geo-Spatial Location of spring:

Spring ID	12
Latitude(x)	86.6044390697°
Longitude(Y)	27.1833048968°
Altitude	1353m
Aspect	Northeast
Precipitation	
Slope	>30
Dimensions	l: 2m
Distance from hamlet	150m
Sanitation (Latrine, Waste dumps etc. in the area)	No.

Social Status:

Local name of spring	Humla		
Location (land ownership)	public:	Private:✓	
Use of Spring (User Right)	public:✓	Private:	
Use of spring (purpose)	Drinking:	Irrigation:	Multiuse:✓
Beneficiaries(HH)	Dalit:	Janajati:150	Others:
social/religious aspect and importance of spring	Socially important not just for drinking but irrigation also.		

Physical status of spring:

Type of spring:	Depression:✓	Fracture:	contact:	Fault:	Sink hole:
Type of spring:		whole year:	6 month:	3 Month:✓	
current condition:		Flowing:	Drying:	Dried:✓	
Historical trend :		Increasing:	Static:	Decreasing:✓	
Any Construction:		No			
Discharge:		0.0L/s			

Vegetation:

Type of Vegetation:	subtropical broad leaved forest
Upstream vegetation:	Downstream Vegetation:
Bans, Khirra , Simali	Bans, Kutmero

Is there any Devastating situation in the spring? If yes, Status, Type, and Scale (People's Perception)

Dried after the earthquake.

Proposed Conservation Measure (People's Perception)

Tanks and taps should be made. Sanitation and afforestation should be done.

Photographs of the spring:

13. Status of Individual Water Spring

Name of Respondent: Min Bahadur Rai (9861202280), Falam Singh Rai

Location:

Name of Watershed	Sun Koshi
Name of Sub-watershed	
Name of Micro-watershed	Mandane Khola
Municipality	Halesi Tuwachhung
Ward No.	5
Tole/Village	Buddha Chowk

Geo-Spatial Location of spring:

Spring ID	13
Latitude(x)	86.6044592284°
Longitude(Y)	27.1833139819°
Altitude	1271m
Aspect	Northeast
Precipitation	
Slope	>30
Dimensions	l: 80m
Distance from hamlet	50m
Sanitation (Latrine, Waste dumps etc. in the area)	No.

Social Status:

Local name of spring	Dhobi		
Location (land ownership)	public:	Private:✓	
Use of Spring (User Right)	public:✓	Private:	
Use of spring (purpose)	Drinking:	Irrigation:	Multiuse:✓
Beneficiaries(HH)	Dalit:10	Janajati:70	Others:
social/religious aspect and importance of spring	A worship is done in the Chandi-Purnima .A hen is sacrificed yearly. Nag puja is also done. Socially important for drinking and irrigation.		

Physical status of spring:

Type of spring:	Depression:	Fracture:	contact:	Fault:✓	Sink hole:

Type of spring:	whole year:✓	6 month:	3 Month:
current condition:	Flowing:✓	Drying:	Dried:✓
Historical trend :	Increasing:	Static:	Decreasing:✓
Any Construction:	Tank and tap		
Discharge:	0.021L/s		

Vegetation:

Type of Vegetation:	subtropical broad leaved forest

Upstream vegetation:	Downstream Vegetation:
Kainjal, Chilaune, Utis, Bans	Bans, Chilaune

Is there any Devastating situation in the spring? If yes, Status, Type, and Scale (People's Perception)

Started drying after the earthquake. Landslide and flood has also occurred.

Proposed Conservation Measure (People's Perception)

Afforestation, nursery establishment, conservation tanks, security, scientific study of the place and sustainable development.

Photographs of the spring:

14. Status of Individual Water Spring

Name of Respondent: Falam Singh Rai

Location:

Name of Watershed	Sun Koshi
Name of Sub-watershed	
Name of Micro-watershed	Mayanku Kuwa
Municipality	Halesi Tuwachhung
Ward No.	5
Tole/Village	Mayanku

Geo-Spatial Location of spring:

Spring ID	14
Latitude(x)	86.5575114829°
Longitude(Y)	27.189520533°
Altitude	1255m
Aspect	Northeast
Precipitation	
Slope	>20
Dimensions	l: 5m
Distance from hamlet	2km
Sanitation (Latrine, Waste dumps etc. in the area)	No.

Social Status:

Local name of spring	Mayanku Kuwa		
Location (land ownership)	public:	Private:✓	
Use of Spring (User Right)	public:✓	Private:	
Use of spring (purpose)	Drinking:✓	Irrigation:	Multiuse:
Beneficiaries(HH)	Dalit:37	Janajati:200	Others:100
social/religious aspect and importance of spring	Nag Puja was done previously. Socially important for drinking only.		

Physical status of spring:

Type of spring:	Depression:✓	Fracture:	contact:	Fault:	Sink hole:

Type of spring:	whole year:✓	6 month:	3 Month:
current condition:	Flowing:	Drying:✓	Dried:
Historical trend :	Increasing:	Static:	Decreasing:✓
Any Construction:	Tanks and small well is made		
Discharge:	0.0L/s		

Vegetation:

Type of Vegetation:	subtropical broad leaved forest

Upstream vegetation:	Downstream Vegetation:
chiuri, Utis, salla, Khanyu	Chilaune, Utis, salla

Is there any Devastating situation in the spring? If yes, Status, Type, and Scale (People's Perception)

The construction of road has led to destruction. The draught and the earthquake has also had a negative impact.

Proposed Conservation Measure (People's Perception)

Afforestation, security and sanitation. Proper scientific study of the place.

Photographs of the spring:

15. Status of Individual Water Spring

Name of Respondent: Falam Singh Rai

Location:

Name of Watershed	Sun Koshi
Name of Sub-watershed	
Name of Micro-watershed	Mayanku Khola
Municipality	Halesi Tuwachhung
Ward No.	5
Tole/Village	Mayanku

Geo-Spatial Location of spring:

Spring ID	15
Latitude(x)	86.5571537092°
Longitude(Y)	27.1906388994°
Altitude	1237m
Aspect	south east
Precipitation	
Slope	>20
Dimensions	l: 5m b:4m
Distance from hamlet	2km
Sanitation (Latrine, Waste dumps etc. in the area)	Extremely required. People have been dumping some waste from the nearby village.

Social Status:

Local name of spring	Mayanku Khola		
Location (land ownership)	public:	Private: ✓	
Use of Spring (User Right)	public:✓	Private:	
Use of spring (purpose)	Drinking:✓	Irrigation:(previously)	Multiuse:
Beneficiaries(HH)	Dalit:15	Janajati: 200	Others:100
social/religious aspect and importance of spring	Religious importance, as the Nag puja was done. Uvauli and Udhauli was celebrated. Socially important for drinking and irrigation.		

Physical status of spring:

Type of spring:	Depression:✓	Fracture:	contact:	Fault:	Sink hole:
Type of spring:		whole year:✓	6 month:	3 Month:	
current condition:		Flowing:✓	Drying:	Dried:	
Historical trend :		Increasing:	Static:	Decreasing:✓	
Any Construction:		Tanks			
Discharge:		0.02L/s			

Vegetation:

Type of Vegetation:	subtropical broad leaved forest
Upstream vegetation:	Downstream Vegetation:
Bakhre, Utis, Salla, Bans	Bans, Khanyu, Utis

Is there any Devastating situation in the spring? If yes, Status, Type, and Scale (People's Perception)

Earthquake and road construction lead to the degradation.

Proposed Conservation Measure (People's Perception)

Piping, Bordering, Making taps and Afforestation.

Photographs of the spring:

16. Status of Individual Water Spring

Name of Respondent: Mitha Rai, Surya Bahadur Khatri

Location:

Name of Watershed	Sun Koshi
Name of Sub-watershed	
Name of Micro-watershed	Doleni
Municipality	Halesi Tuwachhung
Ward No.	5
Tole/Village	Lahatung

Geo-Spatial Location of spring:

Spring ID	16
Latitude(x)	86.5620684389°
Longitude(Y)	27.1730583602°
Altitude	949m
Aspect	Northeast
Precipitation	
Slope	>30
Dimensions	
Distance from hamlet	150m
Sanitation (Latrine, Waste dumps etc. in the area)	Required. A little garbage is dumped.

Social Status:

Local name of spring	Doleni		
Location (land ownership)	public:	Private:✓	
Use of Spring (User Right)	public:✓	Private:	
Use of spring (purpose)	Drinking:	Irrigation:	Multiuse:✓
Beneficiaries(HH)	Dalit:	Janajati:40	Others:3
social/religious aspect and importance of spring	Socially important for drinking but mostly washing clothes and bathing. Irrigation was also done sometimes before in the nearby rice fields.		

Physical status of spring:

Type of spring:	Depression:✓	Fracture:	contact:	Fault:	Sink hole:
Type of spring:		whole year:✓	6 month:	3 Month:	
current condition:		Flowing:✓	Drying:	Dried:	
Historical trend :		Increasing:	Static:	Decreasing:✓	
Any Construction:		A bamboo tap is made.			
Discharge:		0.0L/s			

Vegetation:

Type of Vegetation:	subtropical broad leaved forest
Upstream vegetation:	Downstream Vegetation:
Bans, Khirro, Pipal, Amba , Khanyu	Fir fire, Kera, Chilaune

Is there any Devastating situation in the spring? If yes, Status, Type, and Scale (People's Perception)

Little debris is collected sometimes in the monsoon. Local people clean it.

Proposed Conservation Measure (People's Perception)

Boundary wall, tap, Intakes and sanitation.

Photographs of the spring:

17. Status of Individual Water Spring

Name of Respondent: Surya Bahadur Khatri

Location:

Name of Watershed	Sun Koshi
Name of Sub-watershed	
Name of Micro-watershed	Odare Khola
Municipality	Halesi Tuwachhung
Ward No.	14
Tole/Village	Shokmala, Damjale, Harde

Geo-Spatial Location of Spring:

Spring ID	17
Latitude(x)	86.5592793025˚
Longitude(Y)	27.1712710662˚
Altitude	855m
Aspect	Northeast
Precipitation	
Slope	>30
Dimensions	l: 2m
Distance from hamlet	200m
Sanitation (Latrine, Waste dumps etc. in the area)	No.

Social Status:

Local name of spring	Odare		
Location (land ownership)	public: ✓	Private:	
Use of Spring (User Right)	public:✓	Private:	
Use of spring (purpose)	Drinking:✓	Irrigation:	Multiuse:
Beneficiaries(HH)	Dalit:7	Janajati:65	Others:9
social/religious aspect and importance of spring	Socially important for drinking but religious importance too as a cave is nearby and worship is done in Ekadasi, Uvauli and Udhauli.		

Physical status of spring:

Type of spring:	Depression:	Fracture:	contact:✓	Fault:	Sink hole:
Type of spring:		whole year:	6 month:✓	3 Month:	
current condition:		Flowing:✓	Drying:	Dried:	
Historical trend :		Increasing:	Static:	Decreasing:✓	
Any Construction:		Intake			
Discharge:		0.2L/s			

Vegetation:

Type of Vegetation:	subtropical broad leaved forest
Upstream vegetation:	Downstream Vegetation:
Utis ,aap, Chiuri , Khanyu	Tanki, salla, Mahuwa

Is there any Devastating situation in the spring? If yes, Status, Type, and Scale (People's Perception)

Sometimes flooding. A little Devastated during the earthquake

Proposed Conservation Measure (People's Perception)

Awareness for conservation, sanitation, and afforestation.

Photographs of the Spring:

18. Status of Individual Water Spring

Name of Respondent: Surya Bahadur Khatri, Muna Rai

Location:

Name of Watershed	Sun Koshi
Name of Sub-watershed	
Name of Micro-watershed	Narunge
Municipality	Halesi Tuwachhung
Ward No.	5
Tole/Village	Odare

Geo-Spatial Location of spring:

Spring ID	18
Latitude(x)	86.5567883729°
Longitude(Y)	27.1757863535°
Altitude	1015m
Aspect	Northeast
Precipitation	
Slope	>20
Dimensions	l: 15m
Distance from hamlet	400m
Sanitation (Latrine, Waste dumps etc. in the area)	No. Should be done during the monsoon.

Social Status:

Local name of spring	Narunge		
Location (land ownership)	public: ✓	Private:	
Use of Spring (User Right)	public:✓	Private:	
Use of spring (purpose)	Drinking:	Irrigation:	Multiuse:✓
Beneficiaries(HH)	Dalit:	Janajati:11	Others:
social/religious aspect and importance of spring	Socially important for drinking but drying up. Religious important because Kalika devi is worshipped nearby.		

Physical status of spring:

Type of spring:	Depression:✓	Fracture:	contact:	Fault:	Sink hole:

Type of spring:	whole year:	6 month:	3 Month:✓
current condition:	Flowing:	Drying:✓	Dried:
Historical trend :	Increasing:	Static:	Decreasing:✓
Any Construction:	No		
Discharge:	0.0L/s		

Vegetation:

Type of Vegetation:	subtropical broad leaved forest

Upstream vegetation:	Downstream Vegetation:
salla, Satibar, Chilaune, Tilke	salla, mahuwa, satibayar

Is there any Devastating situation in the spring? If yes, Status, Type, and Scale (People's Perception)

Landslide and erosion. Recovered recently. Road construction lead to the destruction. Slightly arose after the earthquake.

Proposed Conservation Measure (People's Perception)

Construction of tanks and wall for security. Afforestation and sanitation.

Photographs of the spring:

The study showed that, both the quantity (discharge) and quality of water issuing from the Water Sources is reported to be declining. Water Sources are clearly influenced by infiltrating water. Moreover, this water must find a place underneath the surface where it is stored and moves until it reaches the surface of the earth again. Hence, Water Sources are a consequence of recharge to and discharge from aquifers, all of which must be understood and managed by the involved communities. But after distribution line of water supply is accessed, the communities are less interested in conservation and restoration of traditional Water Sources.

The crisis around Water Source water in the study area was developing and stories of Water Sources drying up began emerging during the last 15-20 years, after development of infrastructure such as construction of Sagarmatha highway, another several rural roads. Depletion of quantity and quality of Water Source water is also affected by massive extraction of forest resources. The study showed, among 18 Water Sources more than half of them are dried or drying up in situation. There is dire need of Water Sources revival programme.

In mountainous regions, community mobilization around water can be challenging, energy intensive and arduous because of complex hydrology and hydrogeology and the scattered nature of hamlets. Protection and conservation of Water Sources in the mountains through watershed programmes must take into account the underlying geology and understanding of basic hydrogeology. The purpose behind such efforts must be to impact Water Source discharge and quality to ensure livelihood and ecological security.

Chapter 4

4.1 Conclusion

The study reveals that the water sources in the study area are of great importance for the local communities even they have piped water facilities in place for different socio-economic purposes. The documentation of the Water Sources helps understand overall scenario of the water resources status and hence the documentation of Water Sources in larger scale is equally important to manage water resources effectively on the Basin level. Paradigm shift from conventional watershed management to Water Source management for Water Sources revival is necessary for the watershed resource management effectively.

Investigation of Water Sources involves a synthesis of two fundamental branches of science – hydrology and hydrogeology. Hydrology is primarily concerned with the study and understanding of how water moves on the surface while interacting with underground water, whereas the science of hydrogeology deals mainly with water inside rocks and rock material, i.e. groundwater along with its chemical, physical and environmental characteristics. Moreover, associated sciences such as pedology or soil-science and forestry are also important. For the sustainable development and management of Water Sources, it is important to understand aspects of hydrology and hydrogeology. The study of Water Sources and the design, planning and action around Water Source water management involves:

- Hydrogeologic and hydrologic characterization of the Water Source type on the basis of simple tenets of hydrogeology, drainage (discharge) and recharge area, and recharge and discharge parameters, such as water quantity and quality.
- Reliable analysis of Water Source discharge and water quality, achieved by collecting discharge and quality data of Water Sources, also helps in understanding the conjoined system of watersheds and aquifers, together called Water Source.
- The mapping and description of Water Sources leads to the demarcation of recharge zones for aquifers feeding Water Sources. Once mapped, these recharge areas become sites for customized watershed measures such as forestation, soil and water conservation techniques like bunds, trenches and

ponds. Improving the recharge regime through such measures leads to improvement in Water Source discharge and quality.

However, conducting scientific tests and taking up appropriate engineering solutions to enhance recharge are not enough. In addition, there is also a need to address the demand side challenges to ensure that water requirements are met in times of limited resource availability by augmenting the efficiency of water use. At a local scale, this implies the involvement of the community, educating various stakeholders, especially the communities depending on Water Source water as well as those located in the recharge zone about resource protection, preventing contamination of the aquifer that supplies water to Water Sources and land use management and control. Hence, social, economic and ecological sciences must also complement hydrology and hydrogeology in the management of precious Water Source water resources in the mountains.

Water Source water management must be integrated with community-management of groundwater resources. Involvement of the community in development, monitoring and maintenance of Water Sources is essential and an achievable task, as there are cultural and religious beliefs that motivate people to protect Water Sources. Any programme attempting to develop this natural resource must broadly involve the following sets of activities:

- Assessment of the hydrogeological controls on the Water Sources (at micro level).
- Recharge potential of the Water Source through Water Sources development measures (at micro level).
- Embedding the micro-level perspective in the macro-picture of the water resources in a region.
- Maintenance and protection of Water Sources.
- Effective monitoring of the Water Source discharge and water quality during planning, implementation and impact assessment stages.
- Active participation of the community at all stages including during the stage of knowledge generation.

Development and ecological balance must go side by side, ignorance of one part results negative impact on our lifestyle. Development policy shall be developed using a twin approach that merges advanced science with community knowledge. Grassroots

scientific action research with its 'learning by doing' approach shall be coupled with advanced scientific methods using hydro-meteorological and hydrogeological modelling at sites where action research has been created an interest in water conservation.

Scientific knowledge needs to be used to identify potential conservation options and appropriate sites for recharge ponds. Local scientific research can include installing low-cost rain gauges and temperature measuring facilities at local schools and sites selected by other civic groups such as user groups, and rehabilitating old and constructing new recharge ponds and observing the contribution to Water Source flow enhancement.

Water Source management includes various aspects of water management, ranging from hydrology to governance of natural resources. The methodology has been able to successfully integrate natural science with social sciences, hydrogeology with engineering and research with implementation while also ensuring the common thread of community involvement and skill development throughout. While there is scope for further improvement, ratification and impact assessment of some of these initiatives has shown encouraging benefits on social, economic and environmental fronts (Dr. Akhilesh Gupta,, 2018,August).

4.2 Recommendation

The study came up with recommendations under five broad action areas.

A. Inventory and Mapping Water Sources

- Further systematic inventory and mapping of Water Sources across the Basin level is required for water resource management.
- Creation of a web-enabled database/web portal on which the Water Sources can be mapped/tagged.
  - Mapping to include detailed hydrological, geo-tectonic, morphological, meteorological, land use and demographic details.
  - Follow a selective methodology – based on current approaches including the 8-step methodology and more recent protocol of approaches.

  - Application of isotopes to identify origin/source of Water Sources can be an important tool. Hot-spot analysis to identify vulnerable Water Sources must also be included.
  - Aquifer mapping should be undertaken in Basin level where Water Sources are prominent. Customization of aquifer mapping approaches may also be necessary, including making the process more participatory.
  - Use high frequency sampling of Water Source discharge to extract diurnal cycle due to evapotranspiration as a basis for land-cover interventions.
  - Flow duration curves of Water Sources can be a simple and effective method for typology of aquifer heterogeneity and pathways.
  - Establishment of a national registry of Water Sources.
- Synergies between Research and Development (R&D) Institutions/Universities and community based Non-Governmental Organizations to provide assistance for scientific assessments both during the planning and impact phases needs to be established.

B. Implementing Revival of Water Sources

- Reviving Water Sources and sustaining them requires a combination of scientific knowledge (hydro-geology) and community ownership of the resource and hence the demonstration sites illustrating followings should be established:
  - Focus on 'aquifer' as the unit for planning and integrate watersheds and aquifers for a 'Springshed' approach.
  - Recharge area protection/source area protection in the form of "Water Source sanctuaries''.
  - Understanding correlation between recharge and utilization of forest land, soil, agriculture and water should be enhanced.
  - Soil conservation and watershed management measures for 'Springshed' management.
  - Demand management of water distribution, utilization conservation and management of water/Water Sources.
  - Linking the livelihoods of the communities with the interventions related to revival of Water Sources and Springshed management.

- Regular long-term monitoring of Water Sources is needed for identifying site specific groundwater recharge measures.
- Maintaining a few permanently monitored Water Sources of 3-4 distinct typologies in watershed area for assessing impacts of climate and land-cover change.

C. Capacity Building

- Capacity building at community level on Water Sources revival and Springshed management for groundwater literacy is required for sustainable water resource management in the Basin level should be mandatory.
- Awareness raising programmes on impacts of drying/depletion of Water Sources and importance of Springshed management amongst communities needs to be organized massively.

D. Policy

- The BMC Koshi should initiate to formulate comprehensive policies on Water Sources and Springshed management in mountain regions as a comprehensive ecosystem services and climate adaptation measures for water resource management sustainably.
- The BMC Koshi should produce a status report on Water Sources including inventory and current status of Water Sources, reasons for depletion/drying, and Water Source revival initiatives across its areas.
- There must be institutional coordination and collaboration mechanism among three tiers of the governments set up.
- The existing organizational set up of the BMC Koshi needs to be scaled up for its effective implementation on Basin level

E. Cross-Cutting Issues

- Gender and social dimensions must be integrated with Water Sources revival and Springshed management for livelihood improvement
- Scientific knowledge from assessments on status of Water Sources and techniques of Springshed management needs to be translated into simple

language and communicated for policymaking and development of climate change adaptation programmes.

- Effects of infrastructure development and urbanization on the springs should be integrated with Environmental Impact Assessment and Environmental Management Plan.

References

Agrawal, A., Bhatnagar, N. K., Nema, R. K. & Agrawal, N. K., 2012. Rainfall Dependence of Springs in the Midwestern Himalayan Hills of Uttarakhand., s.l.: s.n.

BCRWME, 2017. A Report on National Knowledge Sharing Seminar on " Reviving drying springs through participatory springshed management , s.l.: Deparment of Soil Conservation and Watershed Management.

Chinnaswamy, P. & Prathapar, S. A., 2016. Methods to investigate the hydrology of the Himalayan, s.l.: ICIMOD.

Dr. Akhilesh Gupta,, 2018,August. Inventory and Revival of Springs in the Himalayas for Water Security, s.l.: NITI Aayog, India.

ICIMOD(International Center for Integrated Mountain Development), 2015. Reviving the Drying Springs Reinforcing Social Development and Economic Growth in the Midhills of Nepal., s.l.: ICIMOD.

Mahamuni, K. & Kulkarni, H., 2011. GROUNDWATER RESOURCES AND SPRING HYDROGEOLOGY IN SOUTH SIKKIM, WITH SPECIAL REFERENCE TO CLIMATE CHANGE, Plot 4, Lenyadri society, Sus Road, Pashan, Pune-411021: Advanced Center for Water Resources Development and Management (ACWADAM) .

Mahamuni, K. & Kulkarni, H., 2012. Groundwater Resources and Spring Hydrogeology in South Sikkim, with Special Reference to Climate Change., s.l.: s.n.

Shrestha, R. et al., 2017. Application of Eight Steps Methodology for Reviving Springs and Improving Springshed Management in the Mid-hills of Nepal, s.l.: s.n.