INTEGRATED WATERSHED MANAGEMENT PLAN
THEMNANGBI-JAIBAB WATERSHED

ROYAL GOVERNMENT OF BHUTAN
JUNE, 2018

Integrated Watershed Management Plan for Themnangbi-Jaibab watershed, Mongar, Bhutan

(July 2018 – June, 2023)

June, 2018

Dzongkhag Administration,
Mongar Dzongkhag,
&
Watershed Management Division,
Department of Forests & Park Services,
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PERIOD OF THE PLAN

This Plan is valid for the period of 5 years from July 2018 to June 2023

AUTHORITY FOR PREPARATION, REVIEW AND APPROVAL

The authority for preparation of this plan was given to the Watershed Management Division, Department of Forests & Park Services, Ministry of Agriculture & Forests, Royal Government of Bhutan.

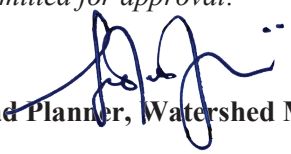
PROVISION FOR REVISIONS AND CHANGES

This Plan may be revised during the period when it is in effect. If major changes occur in the watershed, or if new information becomes available, that may have significant bearing on the implementation of the Plan, Mongar Dzongkhag Administration can authorise a revision of this plan.

APPROVAL

This plan has been examined by a wide section of stakeholders and organisations and endorsed by the Dzongkhag Administration of Mongar Dzongkhag. The plan was presented and endorsed by the 8th TAC meeting. It has been further reviewed and recommended for implementation by the Director, Department of Forests & Park Services (DoFPS) and approved by the Honourable Secretary, Ministry of Agriculture & Forests, Royal Government of Bhutan.

Submitted for approval:



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Hon'ble Secretary
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Thank you and Trashi Delek.

Glossary of Bhutanese terms

Chhu	River
Chiwog	Village or a group of villages
Chuzhing	Paddy field
Dzong	Fort/monastery
Dzongda	District Administrator/Governer
Dzongkhag	District
Geog	Block/administrative unit
Gup	Elected leader of a geog
Kamzhing	Dryland
Mangmi	Deputy elected leader of a geog
RNRTshogpa	Village agriculture/livestock cooperative
Tshogpa	Chiwog representative

List of abbreviations

AI	Artificial Insemination
CF	Community Forest
CFMG	Community Forest Management Group
CFO	Chief Forest Officer
DAO	Dzongkhag Agriculture Officer
DHMS	Department of Hydromet Services
DE	Dzongkhag Engineer
DoA	Department of Agriculture
DoL	Department of Livestock
DoFPS	Department of Forest and Park Services
DoR	Department of Roads
DWMC	Dzongkhag Water Management Committee
DzEdu.O	Dzongkhag Education Officer
DzEnv.O	Dzongkhag Environment Officer
EFRC	Environmentally Friendly Road Construction
FMU	Forest Management Unit
FNCRR	Forest & Nature Conservation Rules & Regulations
GAEO	Geog Agriculture Extension Officer
GAO	Geog Administrative Officer
GLEO	Geog Livestock Extension Officer
Ha	Hectare
HH	Household
HP	Hydropower Plant
HWC	Human Wildlife Conflict
Km	Kilometer
LRO	Land Record Officer
m.a.s.l	meters above sea level
M & E	Monitoring & Evaluation
MoAF	Ministry of Agriculture and Forests
MoH	Ministry of Health
MoE	Ministry of Education
MoWHS	Ministry of Works & Human Settlement
MP	Management Plan
MW	Mega Watt
NDDC	National Dairy Development Cooperation
NFFDP	National Feed & Fodder Development Program
NSSC	National Soil Service Center
NPPC	National Plant Protection Center
NWFP	Non-wood Forest Product

PA	Protected Area
PES	Payment for Environmental Services
RGoB	Royal Government of Bhutan
RDC	Research Development Center
SFED	Social Forestry & Extension Division
SLM	Soil & Land Management
ToR	Terms of Reference
WMC	Watershed Management Committee
WMD	Watershed Management Division
WMP	Watershed Management Plan
WUA	Water Users' Associations

Contents

1. Introduction

Bhutan's topographical and climatic features put together results in a mosaic of watersheds with wide array of ecosystems and immense biodiversity, which provide the basis of people's wellbeing. While most of the watersheds are in good condition owing to the strong environmental policies and practices put in place by our visionary leaders, some watersheds are now showing signs of degradation due to increasing population and infrastructure developments (DoFPS, 2013; FRMD, 2013). The pressure on the watershed resources are intense in the areas with dense settlements (Tenzin and Hasenauer, 2016). Such watersheds need to be identified through watershed assessment and accordingly develop watershed management plans to mitigate the degrading influences (Tsering, 2011).

As outlined in the Forest and Nature Conservation Rules & Regulations 2017 (FNCRR 2017) (DoFPS, 2017), a watershed management plan is required if a watershed is classified as "degraded" or "critical" following the application of the watershed classification guidelines (WMD, 2010). The purpose of such watershed management plans is to address the degrading influences and attempt (to the greatest extent possible) to return the watersheds to a "normal" or "pristine" condition. Watershed management plans are also developed to protect and manage the watersheds which are important drinking water source (Tenzin *et al.*, 2018).

In the current 11th FYP (2013-2018), watershed management features as one of the three major programs of the Department of Forests & Park Services (DoFPS) (GNHC, 2013). The Watershed Management Division (WMD) under the DoFPS in consultation with relevant stakeholders carries out watershed assessment, classification and planning for the watersheds in the country (Figure 1) (Tenzin, 2011; Tsering, 2011). The assessment and classification of watersheds have been completed for the river basins of Wangchhu, Punatsangchhu river basins and sub-basins of Mangdechhu, Chamkharchhu, Kurichhu and Kholongchhu. Following the process, WMD has developed watershed management plans for degraded watersheds in the Wangchhu, Punatsangchhu and Manas river basins (Mangdechhu, Chamkharchhu, Kurichhu and Kholongchhu sub-basins).

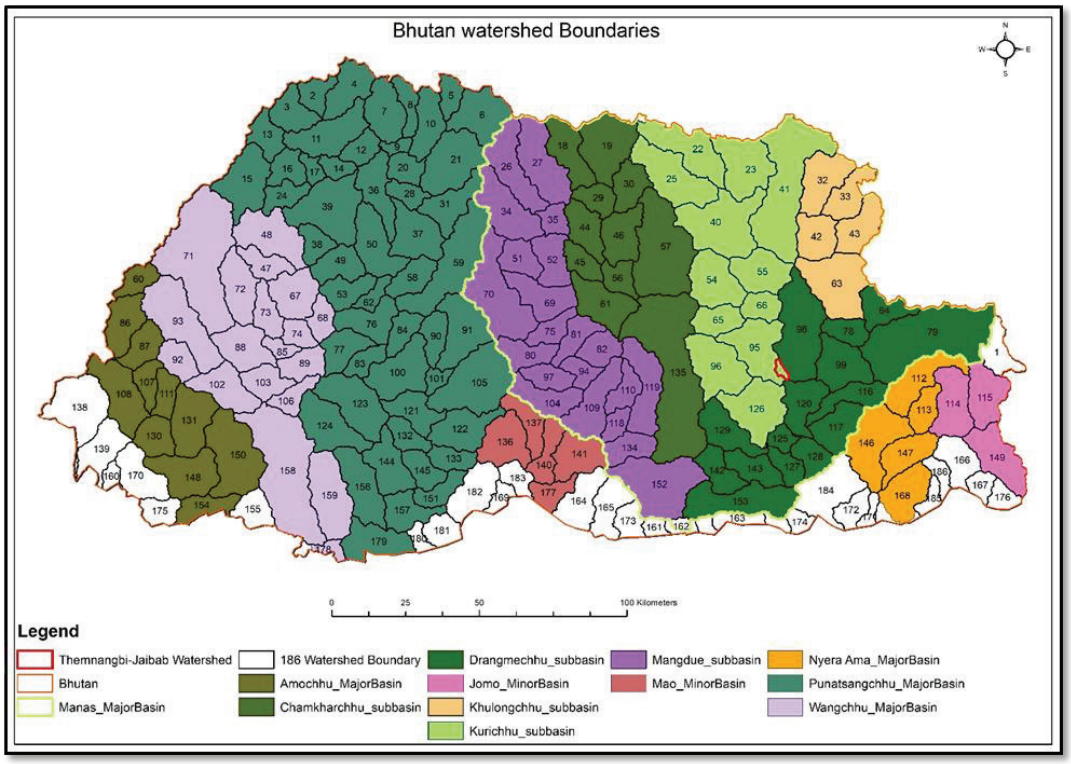


Figure 1: River basins of Bhutan with the 186 delineated watersheds

1.1 Rationale for watershed management planning

This management plan was developed for the Themnangbi-Jaibab watershed of the Kurichhu sub-basin. The Themnangbi-Jaibab watershed consist of numerous streams which serves as the drinking water source for the Mongar municipality and the communities within the watershed. The perpetual shortage of drinking water for Mongar Municipality during the lean season has necessitated Mongar Municipal Office to tap additional drinking water from the streams flowing from Themnangbi-Jaibab watershed. The infrastructure to tap the water has been already put in place with support from the National Adaptation Plan of Action II (NAPA II) project which will be used to supply the water during the lean season.

As an important water source for the resident communities within the watershed and the beneficiary downstream (Mongar municipality, Mongar Referral Hospital, Wengkhar Research Center and Schools), it is important that the Themnangbi-Jaibab watershed is managed in a way that can sustain this valuable watershed resources. Therefore, to complement the activities downstream, the same project entrusted WMD to develop watershed management plan for the Themnangbi-Jaibab watershed to protect and manage the drinking water source areas. The NAPA II project implemented by the National Environmental Conservation Secretariat (NECS) provided financial support for the

preparation of this management plan. The NAPA II project has an overriding objective of enhancing the resilience of ecosystems and communities.

2. Description of the watershed

The WMD has delineated 186 watersheds in the whole country for effective watershed management planning and implementation (Figure 1). As per this delineation, Kurichhu sub-basin of the Manas river basin (Figure 1) has 12 watersheds and Themnangbi-Jaibab watershed is part of the watershed ID 95 which is one of the watersheds within the Kurichhu sub-basin (Figure 2).

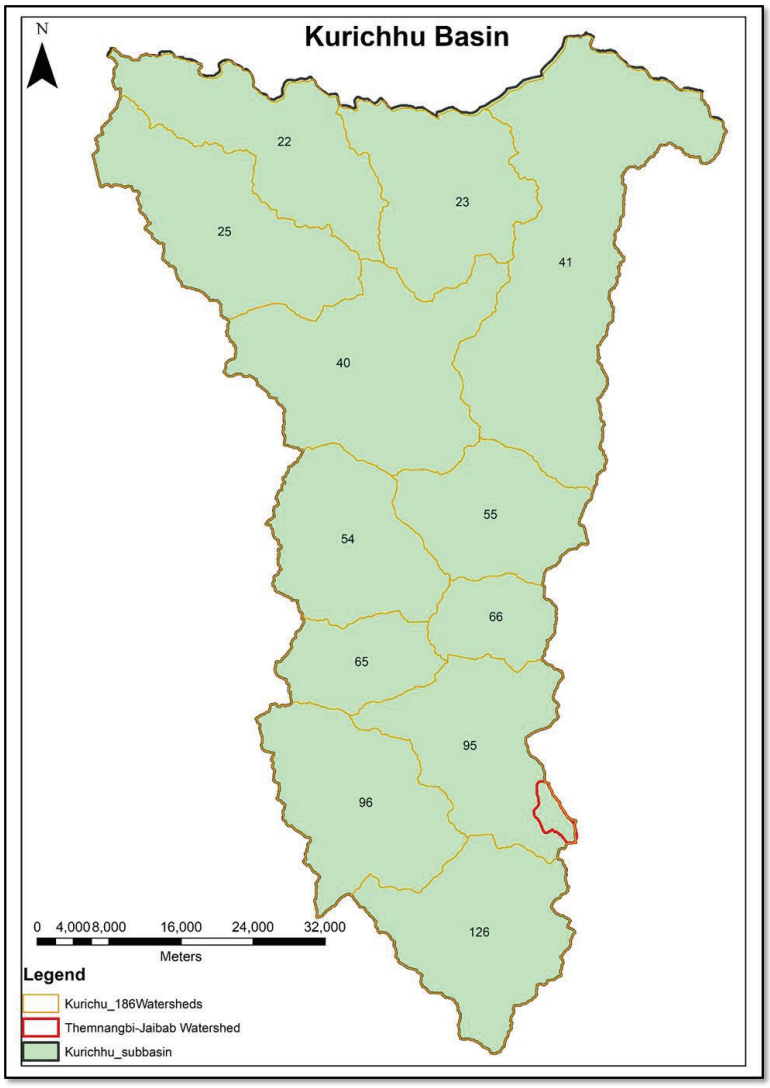


Figure 2: *Kurichhu sub-basin with the sub-watersheds*

2.1 Geographic and administrative description

The Themnangbi-Jaibab watershed is located in Monggar geog and consists of two villages namely Themnangbi and Jaibab (Figure 3). It has a total area of 1645.5 ha with elevation ranging from about 1600 to 2800 m.a.s.l. There are 59 households in the watershed and population of 6000 people in municipal area which are the beneficiaries located downstream of the watershed.

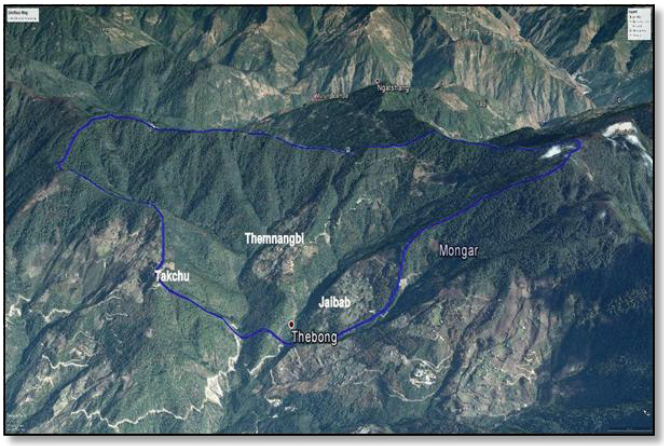


Figure 3: Watershed with villages of Themnangbi and Jaibab

The watershed falls within the Gang-gola Block of Korilla Forest Management Unit (FMU) under Territorial Forest Division, Mongar. The block is retained as watershed working circle since the beginning of the first Forest Management Plan of the FMU in year 1995. The Themnangbi-Jaibab watershed falls under the dry sub-tropical agro-ecological zone with Broadleaf forest in the upper catchment and Chir Pine forest towards the base of the watershed.

2.2 Hydrology

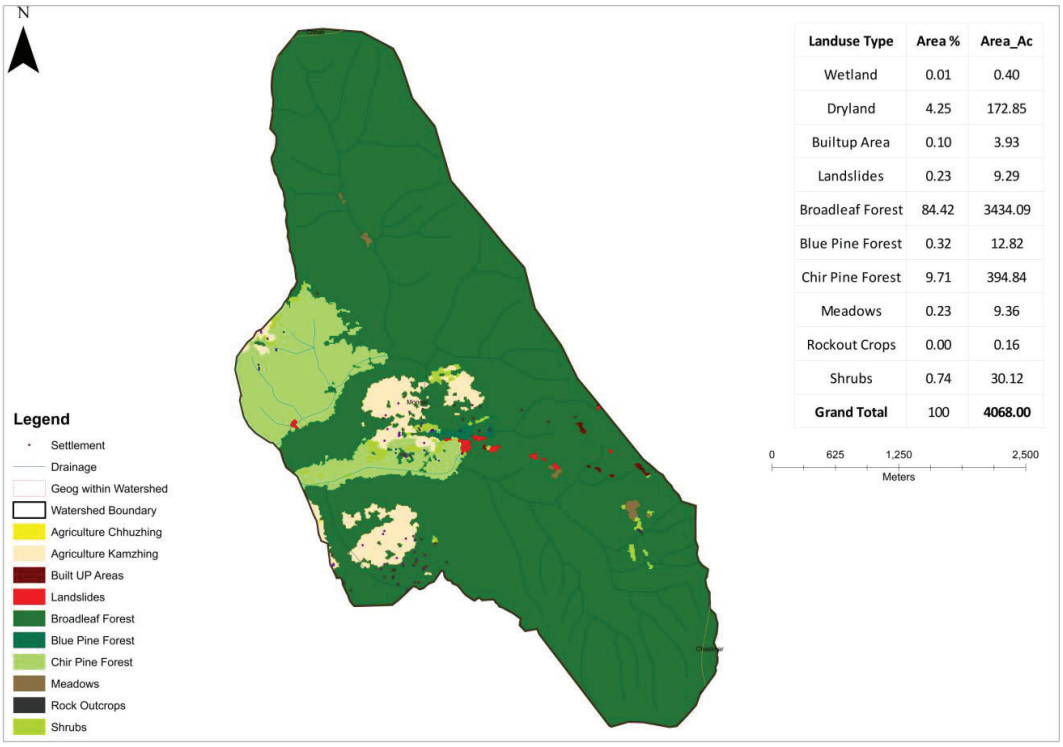
The Themnangbi-Jaibab watershed is drained by two main streams which are Wengkharjugchhu and Themnangbijugchhu (Figure 4). The two streams are the main tributaries of the Gang-gola chhu, which ultimately drains to Kurichhu sub-basin.

Figure 4: Wengkharjugchhu (left) and Themnangbijugchhu (right)

Themnanbijugchhu originates from the Themnangbi part of the watershed with contributions from the smaller streams. The Wengkharjugchhu originates from the upstream areas in Korila and comprises of Chompa I and II and other smaller streams of Takshingwang I and II, Rijoke, Charshingzor and Tsazor. Smaller streams upstream supplies drinking water to the communities, while Chompa I & Chompa II are tapped by the Mongar Municipality. The Wengkharjugchhu and Themnangbijugchhu are tapped from downstream to provide additional drinking water to Mongar municipality especially during the lean season.

2.3 Land use in the watershed

The major land use in the watershed is under forests (Figure 5). The forest is dominated by the broadleaved forests with few patches of Chirpine and Bhutan pine. As per the Management Plan for Korila Forest Management Unit, the growing stock in the FMU consisting of Themnangbi-Jaibab watershed is 53.34 m^3/ha. Around 25.5 hectares of plantations comprising mostly of broadleaf species have been established at various locations in the watershed.



Landuse Type	Area %	Area_Ac
Wetland	0.01	0.40
Dryland	4.25	172.85
Builtup Area	0.10	3.93
Landslides	0.23	9.29
Broadleaf Forest	84.42	3434.09
Blue Pine Forest	0.32	12.82
Chir Pine Forest	9.71	394.84
Meadows	0.23	9.36
Rockout Crops	0.00	0.16
Shrubs	0.74	30.12
Grand Total	100	**4068.00**

Figure 5: Land use in the watershed

Agriculture and livestock farming are the main source of livelihood and income. The main crops grown include maize, paddy, vegetables, fruits and oil seeds (Figure 6). Fertilizers in the form of urea and other agro-chemicals are used in the agriculture farming. Despite shortage of drinking and irrigation water, there is increasing number of farmers growing horticulture crops and vegetables with improvement in market access

Livestock consists of cattle and poultry. Cattle holding consists of 90% Jersey cross and 10% indigenous breeds (Annual Livestock Census, 2015). There are also stray horses and other *tsethar* animals in the watershed. *Tsethar* animals are those animals which are left free in the forests. Although 90% of cattle is stall fed and existence of about 21 acres of improved pastures, majority of the cattle (around 200 heads) still graze in the forest.

Figure 6: Agriculture field in the watershed (Themnangbi)

3. Policy framework and process for watershed management planning

3.1 Policy framework

The approach to watershed management planning for sustained watershed services are stressed in many important policy and legal documents such as the Constitution of the Kingdom of Bhutan (Article 5), Bhutan Vision 2020, National Forest Policy 2011, Bhutan Water Policy 2007, Forest and Nature Conservation Act 1995, Water Act 2011, Land Act 2007 and Waste Management Act 2009. The Water Regulations 2014 and the Roadmap for watershed management in Bhutan clearly sets the framework for carrying out watershed management in Bhutan.

3.2 Planning process

The Themnangbi-Jaibab watershed management planning process was initiated under NAPA II project coordinated by NECS. Under this project, Mongar Municipal Office has set up infrastructures at the downstream of Themnangbi-Jaibab watershed for tapping additional drinking water for Municipal areas. While the infrastructure for the tapping is well in place, it was felt important to develop watershed management plan to secure provision of water in the long run.

The plan is developed in a participatory manner with the active involvement of key stakeholders. As there are numerous stakeholders in the watershed, it is intended that the activities planned for watershed will be reflected in the operational plans of the stakeholders. Accordingly, consultative meetings were conducted with stakeholders at the Dzongkhag, geog and chiwog levels and findings were refined through technical field assessments and expert write-shops. Information gaps were filled using information from various focal agencies/persons. A range of issues and problems that contribute to the degradation of the watershed was identified from this process, and addressing these issues was the basis for formulating the plan. The consultation process is outlined below.

3.2.1 Consultations at Dzongkhag level

The planning process started by holding consultative meetings with the Mongar Dzongkhag Administration. The meeting at Dzongkhag level discussed on the overview of the watershed and its importance as a water source area. The team along with relevant stakeholders visited the watershed sites to check on the watershed boundary. The watershed boundary demarcation is an important activity for any watershed management planning as it determines the extent of activities to be covered in the watershed. The field visit was useful for actual observation and understanding of the watershed boundary. The consultation workshop was attended by RNR and other sector heads at the Dzongkhag. Problems causing degradation of the watersheds were discussed and measures to resolve them were suggested.

3.2.2 Consultations at Geog level

After the meeting with stakeholders at the Dzongkhag level, meetings were held for Monggar geog as it is the only geog encompassing the watershed (Figure 7). The consultation at the geog helped narrow down the problems and come up with possible remedial measures. During the meetings, results of the Dzongkhag level meeting including an overview of problems and suggested remedial measures were presented. In addition, geog officials were asked to present the problems and suggest remedial measures from the perspective of their geog. The meeting came up with a list of prioritized issues and relevant activities to solve those issues in the watershed.

3.2.3 Field visits and consultations at chiwog level

Field verification followed by prioritization of the site specific issues and management activities were done at the chiwog level. At the chiwog meetings, the representatives included Chiwog Tshogpa(s) and members from the majority of households (Figure 7). The chiwog level meeting was by far the most important meeting, as it facilitated the identification of site specific issues in the watershed. For each issue, appropriate measures were discussed. This was followed by field visits and detailed assessments to validate the issues of the watershed.

Figure 7: Consultation meetings: Left (Chiwog level) and Right (Geog level)

4. Issues impacting watershed services

The problems or issues in the watershed were identified and listed at various stages of the planning period. The first record of the issues were made during the rapid watershed assessment and classification of the sub-watersheds. All those factors with a very low score were marked as issues of concern. Various community consultations meetings were held to list and verify the issues recorded during the assessment. Further, field verification visits were carried out to understand the issues and also to verify the issues raised during the consultative meetings.

The various issues commonly reported by the stakeholders are drying up of water sources (shortage of drinking & irrigation water), human-wildlife conflicts, forest and agricultural land degradation (resource extraction, livestock grazing, landslides due to seepage from paddy field, poor drainage farm road, rill & gully erosion from steep dry land farming and forest fire). These key issues which are discussed below forms the basis for designing interventions in the watershed management plan.

4.1 Deterioration of quantity and quality of drinking water

The decentralization policy of government in the recent past has helped Mongar Dzongkhag to expand and develop both in terms of population and infrastructure. There are about 6000 people living in the Mongar municipal area and about 59 households in the two villages located within the watershed. Additionally there are about 31 laborers living inside the watershed working for the ongoing East-West Highway widening project (Mongar to Korila section). The need of water over the years has drastically increased due to changing lifestyle as well as adoption of more intensive farming system. The expansion of the municipality also saw setting up of industries like vehicle workshop/car washing and constructions which shares the water meant for drinking. Further, poor infrastructures like lack of reservoirs or leakage in the distribution networks and too many tapping points has increased the problem of water shortage.

Figure 8: Stream impacted by the road widening: Left (above) and right (below the road)

Water quality was one of the issue reported in the watershed. Surface runoff from the farm roads and dumping of excavated materials of the ongoing east west highway widening project (Mongar town to Korila top) have led to water sources contamination (Figure 8). About six streams which ultimately flow to the lower tapping points are affected by the road widening works (Table 1).

Table 1: Streams affected by the road widening works

ID	Name of stream	Northing	Easting	Elevation
1	TakshingwangI	27°16'04.5''	91°18'22.0''	2226 m
2	TakshingwangII	27°16'01.0''	91°18'19.5''	2225 m
3	Rijoke	27°16'00.8''	91°17'57.5''	2182 m
4	Charshingzor	27°16'08.2''	91°17'31.4''	2146 m
5	Tsazor	27°16'11.0''	91°17'23.1''	2132 m
6	Phajo Ritsang	27°16'11.9''	91°18'15.2''	2125 m

Additionally, contamination of the water sources by the use of agro-chemicals in the agriculture field, open grazing, improper waste disposal, pit toilets of labor camps (Figure 9) were reported as probable cause for deteriorating the quality of drinking water during the consultation meetings. Commercial chemicals like urea and mancozeb are used annually by the communities as per the data from the field offices. It was also observed that in certain places, garbage were dumped improperly despite having disposal pits and waste bins in place (Figure 9) which was also raised as one of the concern during the meetings. There is also proposal for leasing of State Reserve Forest Land (SRFL) in the upstream of the watershed for development of commercial agriculture and which if not done properly might further affect the water quality and quantity downstream.

Figure 9: Labor camps (left) and dumped garbage along the trail to a Lhakhang (right)

Mongar, as one of the regional hubs of the east, the water requirements (quality and quantity) over the years is bound to increase and this will mean putting in place standard infrastructure and management to avoid multiple tapping points as a priority strategy to comfortably supply the water.

4.2 Agricultural land degradation

The presence of fallow lands and consequent loss of agriculture productivity due to steep terrain and traditional agricultural practices is one of the issues in the watershed. Steep terrain coupled with high precipitation and inappropriate land-use practices have led to considerable erosion of agricultural land. Only about 15 acres of land are under land management regime as reported by the communities of the watershed. As per the data gathered, there are incidences of fallow land in the two villages (Themnangbi & Jaibab) within the watershed.

According to the communities and field experts, the lack of proper irrigation facilities, poor water management and surface erosions have led to increase in the incidences of leaving the agriculture lands fallow. The use of chemical fertilizers such as urea and other insecticides/pesticides would also gradually deplete soil and land over the years.

4.3 Forest degradation

The watershed falls within the Gang-gola Block of Korila Forest Management Unit (FMU) under Territorial Forest Division, Mongar. The block is retained as watershed working circle since the beginning of the FMU in 1995. As per the FMU management plan, the area is only to be utilized for meeting the resource needs of the local communities within the block (Table 2). Resources allocation is only done through single tree selection system and cable line operation is not allowed. The areas is regularly monitored and patrolled by the local staffs from the Mongar Forest Division.

However, during the community consultation meetings, higher exploitation of forest resources (illegal or legal) and forest fires in the watershed were some of the issues reported. As per the records, only one fire incidence was reported in 2017, which occurred in the Chirpine zone in the lower part of the watershed burning around 120 hectares of the forests.

Table 2: Quantity of forest produce supplied from watershed area 2014-2017

Tree	Cham	Pole	Fence post	Flag post	Fire wood	Sand	Stone	Bamboo	Top soil	Leaf mould
61 nos.	43 nos.	462 nos.	320 nos.	390 nos.	980 m^3	1 TL	78 TL	300 nos.	21 TL	2 TL

TL is Truck Load

With the increase of the population in the watershed, pressure on the forest resources in terms of timber and firewood is expected to increase constantly. Increasing accessibility in the forest areas due to increasing farm roads might have further led to increasing resources extraction as reported by Tenzin and Hasenauer (2016). Records maintained with the FMU Office at Korila confirmed the presence of illegal resources extraction from the watershed (Figure 10).

Regeneration status of the areas harvested following the single tree selection system is lacking at the moment. Regeneration both natural and artificial is important to ensure sustainability of the resources for future use. Several plantation have been created in the watershed by the divisional forest office and the erstwhile Dzongkhag Forestry Sector (now clubbed with Mongar Forest Division). However, most of the plantation were with poor survival category and some of the reasons for the poor survival were grazing, lower maintenance budget, lack of weeding etc.

Figure 10: Resources extraction (left) and cowshed in the watershed (right)

The damage caused by the cattle is one of predisposing factor for degradation, although the intensity of the impact remains unassessed. Most of Themnangbi-Jaibab community practices stall feeding, however, free release of *tshethar* animals (scrub cattle & horse), permanent settlement of herders at watershed and temporary cattle migration from the adjacent geogs (mostly from Chaskar and Nagtshang geog of Mongar) are the some of the causes of degradation (Figure 10). As per Tshogpa, there are 10 horses, 90 scrub cattle and three herds (permanent- 2 & semi-permanent- 1) with approximately 100 heads of cattle foraging in the watershed.

4.4 Landslides/erosions

Landslides and erosions as discussed briefly in the above sections was also one of the issue reported and observed in the watershed. The landslides and erosions could be happening due

to natural phenomenon such as unstable geology, steep slopes and steep stream gradients. However, certain landslides/erosions are exacerbated by land-use practices and infrastructure development such as poorly constructed farm roads, leakage from irrigation channels & drinking water infrastructures and highway widening works.

Poorly constructed farm roads are reported as one of the causes of landslides and erosions in most of the watersheds across the country. For instance a study done by Waiba (2015) observed absence of drainage facilities such as side drains, culverts and fords leading to excessive runoff over the road surface rendering it unusable for vehicles during rainy season. Similarly in the watershed, poor farm road without proper drainage and steep gradient have increased the frequencies of landslides and erosions. From the total length of 16.5 km farm road in the watershed, only around 5 km is with proper drainage.

Around 8 km of the ongoing national highway is within the watershed. The highway widening works have further aggravated the landslides and erosions in the watershed (Figure 11). The loose materials dumped below the road from the highway widening has constantly blocked the farm road leading to the communities at the following points:

- Chompa to Themnangbi at two points at 27^0 16'39.04''N 91^0 18'04.28''E and 27^0 16'34.99''N 91^0 18'13.90''E
- Pangsar to Jaibab at one point 27^0 16'15.79''N 91^0 17'09.47''E.

Figure 11: Landslides from road erosions

There are 3 – 4 irrigation schemes which are only partially functional and requires immediate attention in order to safely supply the water to the communities. Leakage from the irrigation channel in the watershed can lead to erosion and gully formation. Earthen channels are prone to leakage along their length and this water loss contributes to a reduction in water availability for irrigation.

5. The Plan

5.1 Plan formulation

Following the above mentioned consultations, write-shops were organized to discuss the format and contents of the plan as well as synthesizing information collected from the field. Participants of the write-shops consisted of the management planning team and technical experts from relevant agencies within the Ministry of Agriculture & Forests.

During the consultation and write-shops, the Logical Framework Analysis (LFA) Matrix was developed, building from the issues and problems (the degrading influences) identified during the various stages of the planning process. This led to the construction of a problem tree with causes and effects of the issues/problems, which led in turn to the construction of an objective tree, with outputs, objectives and a goal (Figure 12). A "filter" was applied to ensure that only those issues/problems that contribute directly to the purpose of removing or mitigating degrading influences were addressed in the plan.

As the watershed falls within Korila FMU, the planning team also referred the FMU plan to align with it following the core principle of watershed management planning process.

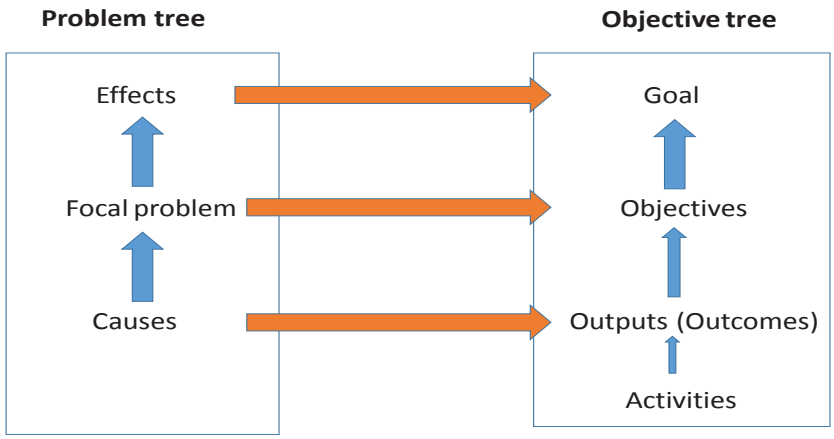


Figure 12: Problem tree and objective tree used to convert issues/problems identified during the planning process into an intervention strategy to mitigate the degrading influences.

5.2 Goal and objectives

The goal and objectives for managing Themnangbi-Jaibab watershed was framed after series of consultation meetings with the relevant stakeholders. The basic purpose of the plan is to identify interventions that can mitigate the effect of degrading influences and return the watersheds to normal or pristine condition (to the greatest extent possible).

The overall goal of the watershed management plan is:

Themangbi-Jaibab watershed sustainably managed to maintain healthy ecosystem for providing quality water in the context of climate change.

The objectives set to attend the goal are:

Objective 1. To minimize forest and land degradation in the watershed for ensuring sustainable supply of ecosystem goods and services

Objective 2. To provide adequate quality and quantity water for all end users and for enhancing biodiversity conservation

5.3 Outputs and description of activities

A total of five outputs followed by set of activities are proposed for achieving the goal and objectives of this plan. The outputs and activities along with verifiable indicators, an indicative budget, the relevant local area-based plan where the activities can occur and the person/official responsible for ensuring the implementation takes place are detailed in the Table 3.

Objective 1. To minimize forest and land degradation in the watershed for ensuring sustainable supply of ecosystem goods and services

Output 1: Sustainable forest management in the watershed enhanced

The whole of Themnangbi-Jaibab watershed falls within the Korila FMU. As the source area for drinking water for Mongar town, there is need to manage the forest in the watershed sustainably for provision of quality water for now and future.

The watershed provides route to some of the sacred neys in Mongar Dzongkhag. Many people are reported to be visiting those neys and travel through the watershed and dispose their waste improperly. While there are waste disposal measures put in place, those infrastructure are not always properly used. There is need to sensitize the commuters on proper waste management and put in measures. Besides there are labor camps and cattle grazing activities taking place in the watershed that need to be regularly monitored.

Output 2: Sustainable land management in the watershed enhanced

The watershed is located in a relatively steep terrain dominated by dry land farming. Surface erosion due to inappropriate land use practices is common during the rainy season. In addition, erosion caused by inappropriate handling of irrigation water discharged from paddy fields was observed to lead to rill and later to gully erosion in several locations. Therefore,

SLMP activities aimed to enhance sustainable land management in the watershed need to be implemented.

Thimphu-Trashigang highway cuts right across the watershed. Currently road widening activities are taking place in the watershed. There is need to monitor that proper interventions are undertaken to minimize negative impacts from this activity on the water quality.

Output 3: Cattle herd management in the watershed promoted

Free cattle grazing in the upper catchment of the watershed was found as one of the common practices that affect water quality and degradation of vegetation. Activities to reduce cattle grazing in the watershed will contribute to improving overall health of watershed.

Objective 2. To provide adequate quality and quantity water for all end users and for enhancing biodiversity conservation

Outputs 4: Standard infrastructures for water storage and supply in place.

Water supply infrastructure are either old or not adequate to provide water to the communities efficiently. Activities to establish standard infrastructure for water storage and supply will contribute to improving the water supply to the communities.

Outputs 5: Knowledge on water sources drying up, pollution and drinking water use enhanced

There is limited awareness on the water use and management among the communities. While there are laws and policies enabling the efficient management of water resources, activities to educate local people on the same is required for translating these laws and policies in to action in the field. Drying of water sources is repeatedly mentioned by local stakeholders. There is need to assess the claim and come up with appropriate measures wherever the issues exist.

Table 3: Logical Framework Matrix for Themnangbi-Jaibab watershed

Outputs/Activities/Sub-Activities	Verifiable indicators	Lead /Collaborating agency	Location/ name of streams	Local area based plan	Budget (M Nu)
Objective 1. To minimize forest and land degradation in the watershed for ensuring sustainable supply of ecosystem goods and services					
Output 1: Sustainable forest management in the watershed enhanced					
Activity 1.1 Improve forest management in the watershed					
Sub-Activities: 1.1.1 Train power chain saw operators for efficient and sustainable harvesting of trees….**efficient operations (20 heads) and harvesting techniques (2 groups)**	Number of power chain operators trained	UWICER/TD/Geog	Themnangbi & Jaibab	TD plan	0.5
1.1.2 Train forest managers on sustainable forest management techniques	Number of staffs trained	UWICER/TD	Mongar Forest Division	TD plan	1.0
1.1.3 Regeneration survey within the openings created by tree felling	Report	TD, Geog, UWICER	Themnangbi-Jaibab	TD plan	0.2
1.1.4 Creation of plantation in the open areas	Area under plantation	TD, Geog	Themnangbi-Jaibab	TD plan	1.0
Activity 1.2 Strengthen forest fire management in the watershed					
Sub-Activities: 1.2.1 Formation of forest fire management groups… **3**	Number of Groups formed	TD/Geog	Themnangbi - Jaibab	Geog plan	0.2
1.2.2 Creation of forest fire line…..**10 Km**	Length of fire line created	TD/Geog	Themnangbi - Jaibab	Geog plan	0.2
1.2.3 Procurement of forest fire fighting equipment	Number of firefighting equipment	TD	Themnangbi - Jaibab	TD plan	0.5

1.2.4 Carry out awareness program on forest fire management	Number of people covered by the program	TD	Themnangbi - Jaibab	TD plan	0.2
Activity 1.2 Strengthen waste management in the watershed					
Sub-Activities: 1.3.1 Awareness program and regular monitoring	Number of people benefitted from the awareness	Dz and Geog	Themnangbi & Jaibab watershed	Geog plan	0.2
1.3.2. Install proper sinages and waste collection system	Number of sinages and waste collection installed	Dz and Geog	Themnangbi & Jaibab watershed	Geog plan	0.5
1.3.2 Initiate waste collection from the collection points	Number of initiatives	Dz and Geog	Themnangbi & Jaibab watershed	Dz/Geog plan	0.5
Output 2: Sustainable land management in the watershed enhanced					
Activity 2.1 Carry out bio-engineering activities for stabilizing exposed roads in the watershed					
Sub-Activities: 2.1.1. Carry out bio-engineering work along the National Highway……**5 acres**	Areas under plantation/ Numbers of Check dams constructed	Dz & Geog/DOR	Watershed area	Dz/Geog plan	1.0
2.1.2. Carryout bio-engineering activities along farm roads	Areas under plantation/ Numbers of Check dams constructed	Dz. & Geog/ TD	Themnangbi & Jaibab	Dz/Geog plan/FMU	0.9
2.1.3. Construct L-Drain along the farm road ….**10 km**	Length of L-Drain constructed	Dz. & Geog	Themnangbi & Jaibab	Dz/Geog plan	5.0
Activity 2.2 Carry out land management activities in conformity with SALT					
Sub-Activities: 2.2.1. Hedge row plantation…..**10 acres**	Area under hedge row plantation	Dz. & Geog	Themnangbi & Jaibab	FMU/Geog	0.3

2.2.2. Train farmer on land management….**70 farmers**	Community trained on SLM	Dz. & Geog	Themnangbi & Jaibab	Geog	0.1
Activity 2.3 Carry out proper monitoring and regulation of the developmental activities in the watershed					
Sub-Activities: 2.3.1 Monitoring of developmental activities in the watershed	Negative impacts from developmental activities reduced	Dz/TD/Geog	Themnangbi & Jaibab	Dz plan	0.2
Output 3: Cattle herd management in the watershed promoted					
Activity 3.1 Provide support to livestock sectors in breeding programme					
Sub-Activities: 3.1.1. Supply necessary equipment for breeding program (AI facilities/training)…. **2 nos for CAIT technicians and** Mobility (Bike)…**2 nos @ 150000 per bike.**	Number of AI, breeding bulls, no. of progeny	Dz Livestock office	Themnangbi & Jaibab community	Dz. Livestock plan	2.3
3.1.2 Expand Contract Heifer and Bull Production Program….**30 households**	Number of households	Dz. Livestock office	Themnangbi & Jaibab	Dz. Livestock plan	0.150
Activity 3.2 Carry out pasture development and fodder tree plantation					
Sub-Activities: 3.2.1 Promote green farming through dairy shed construction materials supply (micro farm- Average 3 cow capacity)….**10 households**	Number of households	GLEO/ Dz. Livestock sector	Themnangbi & Jaibab	Dz. Livestock plans	0.750
3.2.2 Develop improved pasture/fodder crop, tree fodder plantation and grass slips plantation	Area under pasture development/ Length of barbed wire fenced	GLEO/ Dz. Livestock sector	Themnangbi & Jaibab	Geog plan	1.033

3.2.3 Supply of Chaff cutter (60 : 40 subsidy scheme)	Area under pasture development/ Length of barbed wire fenced	GLEO/ Dz. Livestock sector	Themnangbi & Jaibab	Geog plan	0.231
3.2.4 Supply of barbed wire for fencing the improved pasture land.		Dz/Geog	Themnangbi & Jaibab	Geog plan	0.192
Activity 3.3 Promote cattle management in areas outside the watershed					
Sub-Activities: 3.3.1 Carry out awareness on the herd management for cattle from other areas.	Number of people covered	Geog/ Dz. livestock office, Range office	Ngatshang, Chaskhar, Mongar geog	Dz/Geog plan	0.150
3.3.2 Propose for the endorsement from GT/DT for cattle encroachment from other areas.	Endorsement sought	DT, GT and relevant stakeholders	Dzongkhag Tshogdu	Dz.livestock plan	0.100
Objective 2. To provide adequate quality and quantity water for all end users and enhancing biodiversity conservation					
Output 4: Standard infrastructures for water storage and supply established					
Activity 4.1 Construct and maintain reservoir tanks for improving water storage and supply					
Sub-Activities: 4.1.1. Planning for proper distribution of water	2 No. of consultation meeting held	Dz. & Geog	Themnangbi & Jaibab	Dz. Plan	0.05
4.1.2. Consolidate the present structure at source (intake Tank)	5 No. of Storage tank reconsolidated	Dz. & Geog	Themnangbi & Jaibab	Geog plan	0.5
4.1.3. Construction of reservoir Tank in between source and the communities	4 No. of reservoir tank constructed	Dz. & Geog	Themnangbi & Jaibab	Geog plan	3.0
4.1.4. Rectification of existing pipeline (4km)	4 km Length of pipeline rectified	Dz. & Geog	Themnangbi & Jaibab	Geog plan	1.5

Activity 4.2 Construct water treatment plan for improving water quality					
Sub-Activities: 4.2.1. Construction of water treatment plant for treating the water	Number of water treatment plan constructed	Dzongkhag, Municipal office	Themnangbi & Jaibab	Dz. Plan	40.0
Output 5: Knowledge on water sources drying up, pollution and drinking water use enhanced					
Activity 5.1 Conduct awareness on water use and management					
Sub-Activities: 5.1.1 Sensitize on, Water Act, Water Regulation & FNCRR2017 (2 times)	Training Reports	Dz/TD/Geog	Themnangbi & Jaibab	Geog plan/TD Plan	0.10
Activity 5.2 Carry out study on water sources drying up and pollution in the watershed					
Sub-Activities: 5.2.1 Water discharge Assessment (2 streams) 1.3.1.1. Capacity Building 1.3.1.2. Data Collection	Reports (Assessment/Capacity building/Data collection)	WMD/TD	Chompa 1 & II	TD plan	4.45
5.2.2 Plantation creation (15 Ha)	Plantation Reports	TD	Themnangbi & Jaibab	TD plan	
5.2.3. Maintenance of Plantation (15 Ha)	Maintenance Reports	TD	Themnangbi & Jaibab	TD plan	
Total					67.206

6. Implementation strategies and mechanisms

6.1 Implementation strategy

This plan for the Themnangbi-Jaibab watershed will be implemented from the July 2018-June 2022 (12FYP). As such the activities proposed in the plan should be mainstreamed in to the FYP and annual work plan of the relevant stakeholders. It should be implemented in a manner that is consistent with other natural resource and water related policies. The operational and organizational framework involving relevant institutions and agencies to implement the plan is shown in Figure 13.

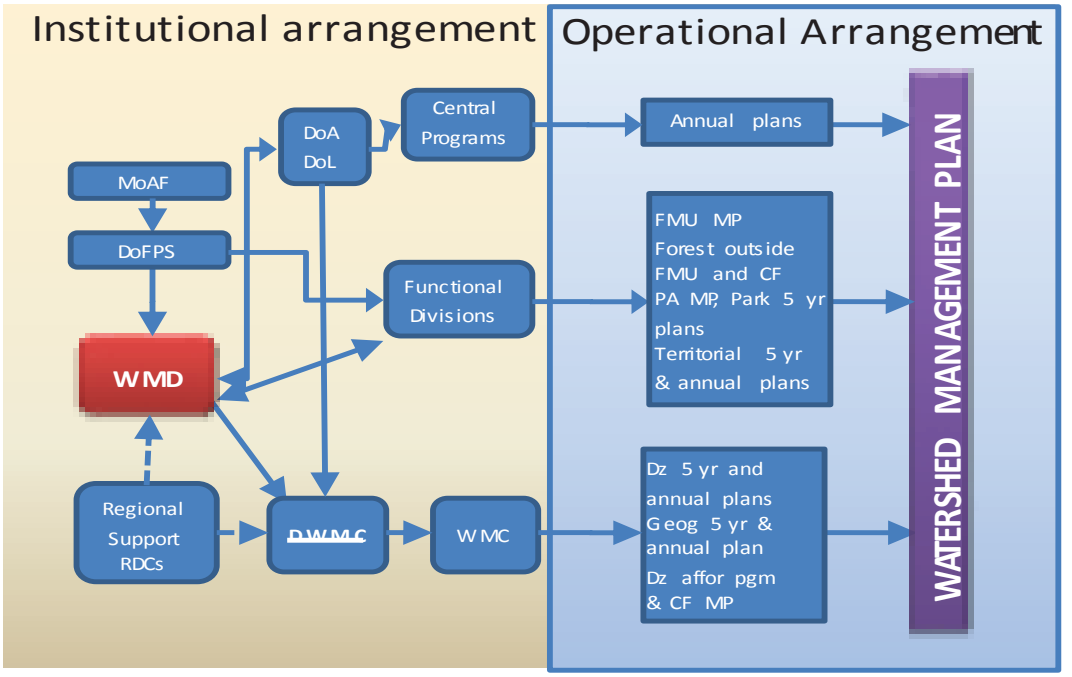


Figure 13: Implementation arrangement framework

To ensure effective implementation of the plan, it is also imperative to operationalize watershed management committees at various government levels. Key stakeholders include the relevant Watershed Management Committees (WMC) and Dzongkhag Water Management Committees (DWMC), as well as the River Basin Management Committees (RBMC). At the Dzongkhag level, the DWMC will be established as per Water Regulation of Bhutan and will facilitate the implementation of this plan. Similarly, at the watershed level, the WMC will be instituted to coordinate the implementation of this plan. This committee will be consulted for various activities within the watershed (Annex 1 and 2).

Coordination between different line agencies at the Dzongkhag and geog levels will be critical to ensure overall implementation of this plan. In particular, the central agencies under MoAF such as the Territorial Divisions and RDCs inter alia will be involved to ensure that

the planning and implementation of watershed activities are harmonized with other land uses within the watershed.

In view of area-based planning, the geog level plan becomes the major vehicle for bringing together the different interests of the various sectors (including livestock, agriculture, forestry and others) irrespective of land ownership.

6.2 Funding

Implementation of planned watershed activities will be funded from the regular government budget. However, in case this is insufficient or unavailable, the management plan can be used as a basis to solicit funds from hydro-power projects or other donors. As the coordinating agency, the DWMCs will facilitate the relevant agencies to incorporate watershed activities in their plans and accordingly seek budgetary provisions from RGoB during the annual and five yearly planning processes. The incorporation of activities of the watershed management plan into respective plans and budgets of local administration will be done in consultation with the WMD.

The possibility to apply Payment for Environmental Services (PES) mechanisms as a financial strategy could be explored in order to ensure sustainable funding to support watershed management activities. Under such a scheme, downstream water users such as hydropower plants and other major water users benefiting from watershed management activities are encouraged to contribute financially to implement remedial activities under an appropriate and mutually agreed framework.

6.3 Monitoring and evaluation

The activities identified in this management plan as being necessary to achieve the goal and objectives of the plan are designed to be integrated into the area based management plans of various agencies and organizations, particularly the geog and Dzongkhag annual and 5-year plans. These organizations will monitor implementation and submit the progress report to WMD. The verifiable indicators given in the log frame matrix in Table 6 will assist in the monitoring task.

Evaluation of the impact of the management plan and the extent to which it has achieved its objectives and contributed to attaining the goal should be carried out by the WMD towards the end of the plan period.

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8. Annexes

Annex 1: Terms of reference for committees

Committee	Members	Roles and responsibilities
Watershed Management Committee (WMC)	Gup, GAO, GAEO, GLEO, TD, Tshogpas, School Principal,	1. Plan and implement watershed management related activities in the Geog. 2. Mediate conflicts in implementation of WM plans and activities. 3. Ensure reporting of watershed activities of WMD through DzWMC.
Dzongkhag Water Management Committee (DWMC)	Dzongda, DAO, DLO, DzEdu.O, DE, DzEnvi.O, LRO, DPO, TD-CFO, BPC, DoR, WMD	1. Identify, plan, and implement watershed management activities involving more than one geog 2. Administer linkages with the WMD and the RBMC 3. Integrate and synchronize watershed related activities into annual geog plans 4. Mediate conflicts in implementation of WM plans/activities 5. Ensure reporting of watershed activities annually to WMD
WMD		1. Facilitate periodic watershed and Dzongkhag level committee meetings 2. Coordinate with relevant agencies and ensure that prioritized watershed activities are integrated into sectoral plans 3. Discharge any entrusted tasks related to ToR of the committees from time to time 4. Facilitate the provision of technical backstopping on watershed planning and management

Annex 2. Stakeholders

Sl	Main Stakeholder	Roles & responsibilities
1	GT of the respective Geogs	• Preparation of annual work plan based on WSM plan • Implementation of the plan • Monitoring & evaluation
2	Geog RNR sectors	• Support in preparation of the annual work plan WSM plan • Support & implement WSM plan • Report WSM activities to Dzongkhag RNR Sector Heads
3	Divisional Forest Office, Mongar	• Regulate access to natural resources in critical watersheds • Assist in establishing private & community forests • Assist in managing the natural grazing land • Assist in riparian protection of the streams
4	Mongar Dzongkhag RNR Sectors	• Support the GT in preparation of the WSM plan • Support in implementation of the WSM plan • Mobilize funds & other assistances for the WSM plan • Monitoring & evaluation of the overall plan by the Dzongkhag WSM Committee • Report WSM activities to WMD
5	WMD	• Conduct awareness programs on the importance of WSM • Support in preparation of WSM Plan • Mobilize funds to implement the WSM plan • Investigate possibilities to initiate PES programs • Monitoring & Evaluation • Provide overall guidance
6	Communities	• Cooperate with GT in conserving the watersheds

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