Alha Micro Plan

Himachal Pradesh Forest Ecosystem Services (HP-FES) Project

Ministry of Environment, Forest and Climate Change

Himachal Pradesh Forest Department

german cooperation
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Address
A-2/18, Safdarjung Enclave,
New Delhi- 110029, India
T +91 11 4949 5353

E biodiv.india@giz.de
W www.indo-germanbiodiversity.com
I www.giz.de

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HP-FES

Responsible:
Dr. Konrad Uebelhör, Director
Indo-German Biodiversity Programme, GIZ

Dr. Joachim Schmerbeck, Team leader
HP-FES Project

Authors:
Dr. Joachim Schmerbeck, Team Leader, HP-FES Project, GIZ
Satyan Chauhan, Advisor, HP-FES Project, GIZ
A.S Thakur, Consultant

Photo credits:
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Maps:
Jyoti Kashyap, Technical Expert, GIZ

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Shimla, 2019

Micro plan for Alha

Himachal Pradesh Forest Ecosystem Services (HP-FES) Project

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List of Abbreviations

ACFMS	Alha Catchment Forest Management Society
BMZ	German Federal Ministry for Economic Cooperation and Development
CBD	Convention on Biological Diversity
CGI	Corrugated Galvanized Iron
CHF	Compartment History File
dbh	diameter at Breast Height
DEFRA	Department for Environment, Food & Rural Affairs
DSCW	Dry Stone Check Wall
DSCD	Dry Stone Check Dam
FES	Forest Ecosystem Services
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
Ha	Hectare
hh	Household
HDP	High Density Plastic
HPFD	Himachal Pradesh Forest Department
HP-FES	Himachal Pradesh Forest Ecosystem Service
HPTD	Himachal Pradesh Tourism Department
INR	Indian Rupees
IPH	Irrigation and Public Health Department
JFM	Joint Forest Management
JFMC	Joint Forest Management Committee
M&E	Monitoring & Evaluation
mt	Metric Ton
MoU	Memorandum of Understanding
NDPF	New Demarcated Protected Forest
PES	Payment for Ecosystem Services
PRA	Participatory Rural Appraisal
PS	Planning Site
VFDS	Village Forest Development Society

1 Introduction

1.1 Forest Ecosystem Service (FES) Approach

The ecosystem approach, as defined by the Convention on Biological Diversity (CBD) in 2000, is the integrated management of ecosystems to promote conservation and sustainable use of the services and goods provisioned by these ecosystems to be enjoyed equitably by all sections of society. These services and goods are together termed as "Ecosystem Services".

The ecosystem services derived from forests came to be referred to as "Forest Ecosystem Services" or FES. The FES Approach may be defined as "Forest Management that aims at sustainable provision of a set of ecosystem services based on stakeholder choices".

The FES Approach states that stakeholders prioritize ecosystem services based on their needs.

The forest management under FES Approach will be guided by the ecosystem service/s thus prioritized, with due importance given to the remaining goods and services.

1.2 Himachal Pradesh Forest Ecosystem Service (HP-FES) Project

1.2.1 Project Background

The German Federal Ministry for Economic Cooperation and Development (BMZ) commissioned Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) to partner with the Himachal Pradesh Forest Department (HPFD) to integrate FES Approach in forest management. The project activities started from April 2016. Using the FES approach in a microplan can facilitate institutionalizing of the approach in management and planning processes of HPFD.

1.2.2 Project Objective

The overall objective of the HP-FES Project is to enable HPFD to introduce the ecosystem approach into its forest management.

Microplan for the HP-FES planning site, Alha, has been prepared considering the prioritized FES by the stakeholders of the Alha catchment forest. The prioritized FES were water regeneration and soil conservation. Upon interactions with different stakeholders, it was decided that a Payment for Ecosystem Services (PES) model will be set up on the HP-FES site of Alha. Therefore, the stakeholders will share the cost of forest management interventions.

1.3 Role of Microplan in New Working Plan Code

Since 1837, the Indian forests are managed under working plan (WP) guidelines. However, it evolved with changing society and policy demands. Until the National Working Plan Code (2004), the major focus of these codes was on timber extraction which in turn determined the amount to be planted and harvested. The Honourable Supreme Court of India with its ruling (Dec 1996) towards a blanket ban on green tree felling triggered a policy evolution, of which the first step was the Forest Working and Management Plan Code (2014). This Code facilitates management of Indian forests to improve the provision of ecosystem services to dependent

population. This enabled FES approach in forest management. The FES approach makes participatory forest management plans (now known as microplans) essential in the new working plan code.

The National Working Plan Code 2014 has made provisions for use of microplans as tools for participatory forest management for forest areas under Joint Forest Management Committees (JFMCs) and working circle within the scope of the Forest Right Act 2006 and the Biodiversity Act 2002.

1.3.1 Objectives of the Microplan

The objective of this microplan is to incorporate ecosystem services into the forest management of Alha catchment forest. Forest assessment and participatory rural appraisal (PRA) were carried out as a base to formulate the management objectives of the plan provided in Chapter 6. Based upon interactions with different stakeholders, it was agreed that a payment for ecosystem services model will be set up wherein stakeholders share the cost of forest management interventions.

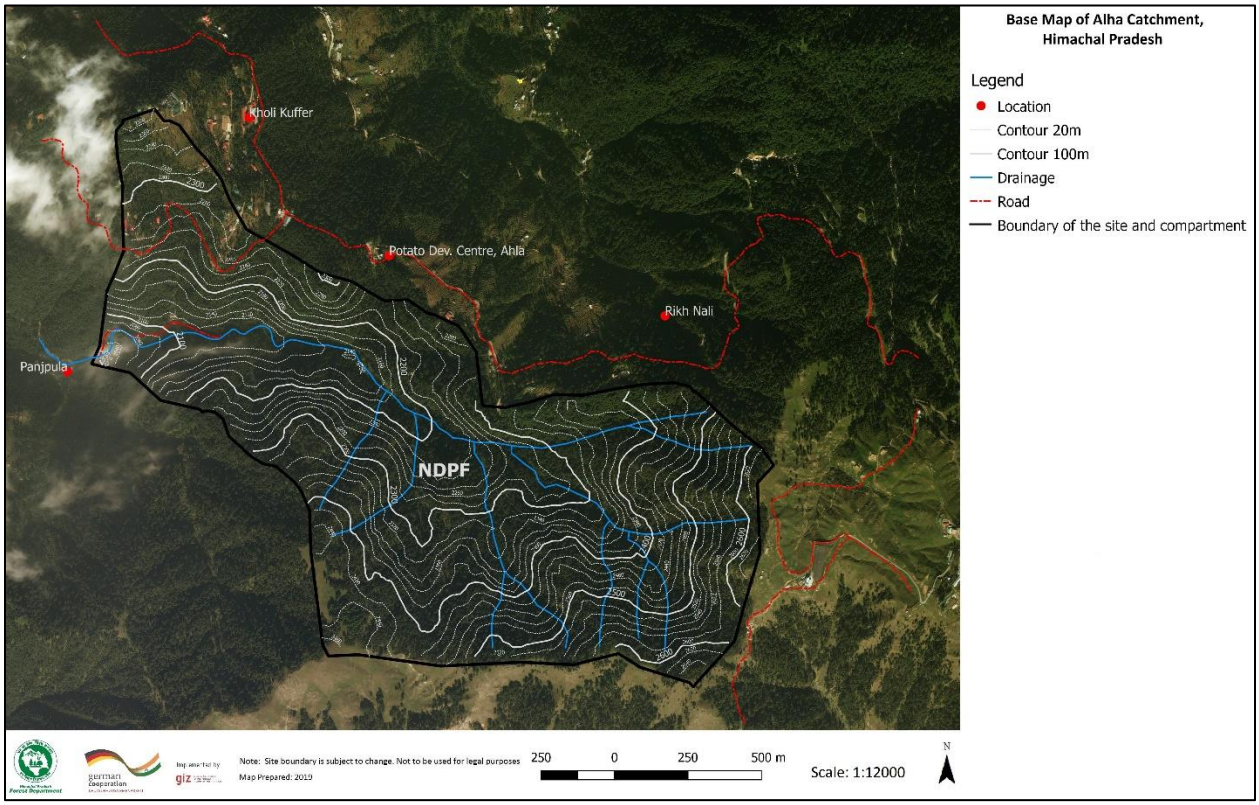
1.3.2 Description of Subsequent Chapters of the Microplan

Chapter 2 describes the planning site. It also includes data collection and results of data collection process. Chapter 3 provides the list of elected members of the Alha Catchment Forest Management Society (ACFMS), Dalhousie and their contact details. Chapter 4 describes the concept of Payment for Ecosystem Services (PES) and its implementation in Alha Catchment. Chapter 5 discusses the aims of forest management clearly spelling out the short-term management objectives that leads to mid-term forest management objectives, resulting in long-term objectives of forest management. It is to be ensured that these objectives are in line with the visioning exercise undertaken with stakeholder participants during the PRA exercise. Chapter 6 dwells into the details of activities undertaken for meeting the short-term forest management goals for the prioritized FESs. Chapter 7 discusses the Monitoring and Evaluation plan for activities undertaken to meet the short-term forest management objectives. This chapter will also enlist the indicators for ex-post assessment of the project and its long-term impacts. Chapter 8 mentions the recommendations given. This is followed by Annexures that support the microplan.

2 Description of the Planning Site

The project site of Alha Catchment is approximately 9 km to the northeast of Dalhousie Town. The elevation range varies from 2080 m to 2580 m above mean sea level. This site falls in the upper catchment (Map 2.1) of Panchpula khad in Gram Panchayat Osal in the forest beat of Jandrighat in Dalhousie forest block, range and division in the district of Chamba. Forest namely New Demarcated Protected Forest (NDPF) Alha catchment forest is included in the PES.

Around two thousand coniferous trees have been removed under salvage felling in the forest in the past two to three years. The multi-layers in the forest canopy are missing with clear cut degradation in some parts of the forest. The water sources or springs in the forest have been reported to have either gone dry or with reduced discharge of water (as reported during the PRA with different stakeholders). The latitude and longitude values of the extreme points of project boundary are given in Table 2.1.



Map 2.1: Base Map of Alha Catchment

Table 2.1: Coordinates of Extreme Points of Alha Catchment

Direction	Latitude	Longitude
Northern mostpoint	32^0 31' 42.1" N	76^0 00' 18.5" E
Southern mostpoint	32^0 31' 10.0" N	75^0 59' 58.4" E
Eastern mostpoint	32^0 31' 33.7" N	76^0 00' 56.5" E
Western mostpoint	32^0 31' 44.2" N	75^0 59' 43.6" E

Upper central and north eastern part of the forest has several water supply pipes of varying diameters (upto 8 cm). The water distribution scheme has water storage tanks in cement masonry with or without corrugated galvanized iron (CGI) sheet roofs, and high-density plastic (HDP) water tanks. There are several pipelines, mainly of the government with a few private water supply schemes. The private water supply schemes are currently non-functional due to lack or low availability of water in water sources such as springs. There has also been evidence of increasing litter in the catchment forest comprising plastic, rubber, glass bottles, metal cans etc. This was also contributed by the housing of labourers in catchment forest by the Himachal Pradesh State Forest Development Corporation for felling and conversion of salvage trees.

2.1 Methodology

2.1.1 Environmental Data

The environmental data describes the salient features of the environment of the planning site. This data has been collected based on field measurements, Working Plan of Dalhousie Forest Division and Compartment History File (CHF) of NDPF Alha catchment forest in Jandrighat beat of Dalhousie forest block, Range & Division. There is no meteorological station located at Alha. Therefore, data record of meteorological stations at Surkhigala were used as mentioned in the Working Plan of Dalhousie forest division (2013-14 to 2027-28). The environment data of the planning site is listed in Table 2.3 in section 2.2.1 of this plan.

2.1.2 Demographic Data

The data was collected from the Municipal Council office in Dalhousie. The demographic data is presented in Table 2.4 under section 2.2.2.

2.1.3 Stakeholder Mapping

A standard model of stakeholder map was used to understand the stakeholders at the planning site. PRA participants were explained the concept of stakeholder. A diagram (Figure 2.1) on a chart with four concentric circles and three axes emerging from the central point almost creating equal sections with HP-FES as the centre theme was shared with the PRA participants. The participants were asked to write names of institutions falling in the three broad categories namely, civil society, private players and state actors, whom they considered as having potential to influence the Project. The information provided by participants is given Table 2.5 under section 2.2.3.

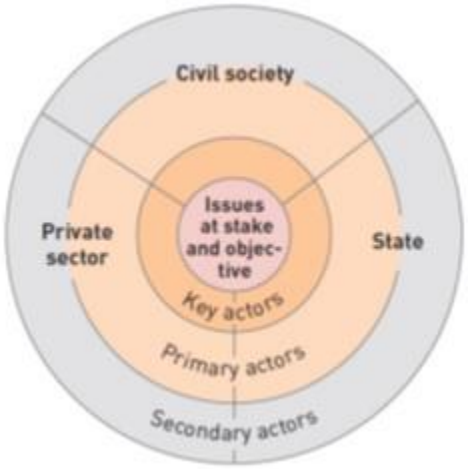


Figure 2.1: Stakeholder Diagram

2.1.4 Institutional Mapping

During PRA, Chapati or a Venn diagram (Figure 2.2), was used to get information on existing institutions of stakeholders in Alha Catchment Forest. A chart with X-axis representing relevance of institution with reference to Alha Catchment Forest Management Society (ACFMS), Dalhousie, was prepared with inputs from the PRA participants. The importance of identified institutions was shown by the size of circle representing the institution while the interrelationship between organizations represented by the distances between the representing circles. They were also asked to suggest placement of these institutions on the chart to understand its importance (depicted by the circle size) and relationship (distance) regarding the circle depicting ACFMS. The information thus gathered is provided in Table 2.6 under section 2.2.4 .

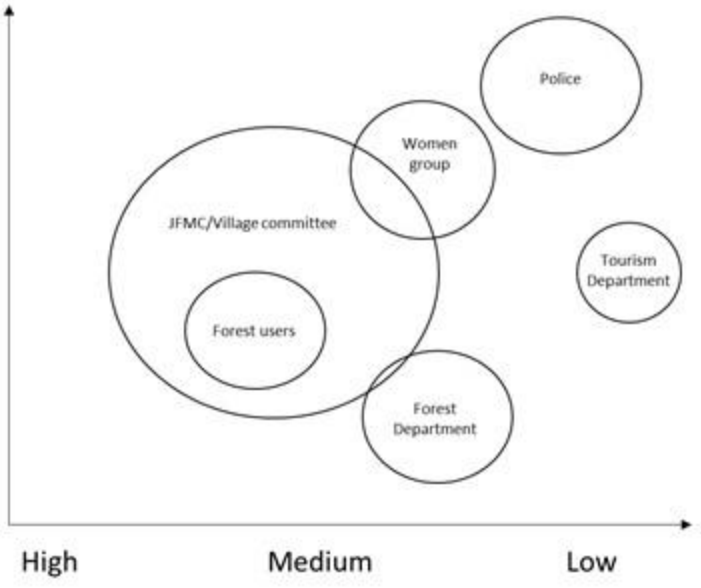


Figure 2.2: Example of Venn Diagram [The big circle is the group for which the relations to institutions is looked at (Village Forest Management Committee or Village community)]

2.1.5 Forest

Data on forest was collected through forest assessment during baseline survey and from documents of HPFD like the Divisional Working Plans, Compartment History Files (CHF) and data on forest rights was collected from CHF which in turn is based on the Forest Settlement Report.

2.1.5.1 Forest Assessment during Baseline Survey

This section states in brief the methodology for forest assessment used in the baseline survey. The forest assessment served three objectives as given below:

i) Knowing the regenerating tree species
ii) Knowing the human impacts on different forest types
iii) Information of the basal area for each forest type

The assessment was based on circular plots arranged on a transect. A forest type was represented by at least two transects. The transects were placed in a way that they represent the forest type. Stands or parts of the forest type that were significantly different from other parts were assessed separately.

Allocation of the Transect: The investigator chose a spot representative of the forest type at the beginning of the transect in the forest 10 m from the edge. The transect was oriented along the longest site of the forest type. The first plot was allocated 30m away from the starting point of the transect and all subsequent plots were placed at similar intervals. Holes, riverbeds and similar locations unrepresentative of the stand were skipped and plots installed 30 m further along the transect.

Assessment of Regeneration: Regenerating tree individuals of different sizes were assessed in circular plots of different sizes. Details are shown in Table 2.2. For analysis, the existing data were combined into two categories: seedlings and saplings.

Table 2.2: Plot Size and Data Collected for Different Sizes of Regeneration Trees

Type	Definition	Plot used for assessment	Area of each plot	Data collected (Same for all plots)
Seedling 1	Tree species >0-0.30 m height	Circular plot (r=1 m)	3.14 sq. m	• Species Name • Number of individuals • Number of individual grazed/burnt/cut/others • Number of coppiced individuals • Photo number of species • Herbarium sheet number
Seedling 2	Tree species >0.30 m-1.3 m height	Circular plot (r=1.5 m)	7.06 sq. m	
Sapling 1	Tree species >1.3 m height and DBH <3.18 cm	Circular plot (r=2.5 m)	19.62 sq. m	
Sapling 2	Tree species DBH >3.18 cm-<7 cm	Circular plot (r=4 m)	50.24 sq. m	

Assessment of Human Impact: Signs of human impact (trampling, fire, livestock dung, lopping, resin tapping) were assessed using ocular method within 12m radius and noted as present or absent.

Assessment of Basal Area: Basal area gives an insight about the number and size of trees in an area. The basal area was assessed with the Angle Count Method in seven locations in each forest type. This method calculates the basal area for one tree based on the distance between the tree and the investigator and the diameter at breast height (dbh). The investigator counts the trees that fall in a certain range of dbh (count factor 4 or 2) while turning 360°. The number of trees counted in this manner are multiplied by the chosen count factor to get the basal area for the stand. The figures of all locations were averaged to get the value for the forest type.

2.1.5.2 HPFD Documents like Divisional Working Plan and Compartment History Files

Documents of HPFD used in planning and forest management were also referred. The Compartment History File (CHF) and Divisional Working Plans were referred to study the management objectives used historically, as well as forest use rights and practices by local communities.

2.1.6 Assessment of Forest Ecosystem Services (FES)

Information on the extent of FES use and the quantity used by different households were verified during the PRA exercise. Information was also gathered on the trend on the demand as well as the FES availability. Information on the factors/drivers for such changes in trends was also gathered. PRA group was further probed for understanding whether the FES received was sufficient to fulfill the current demand. Though information was collected both from men and women, ranking done by women is used for microplanning. All information thus collected is presented in Table 2.9 under section 2.2.6.

2.2 Results

This chapter provides the results of the data collected as described under the section 2.1 and includes information generated in PRA, baseline survey, census data and forest records. It is reproduced in this section in the form of tables and figures, supported by text.

2.2.1 Environmental Data

The results of environmental data are discussed in Table 2.3.

Table 2.3: Environmental Characteristics of Alha Catchment

Features	Value	Source
Name of the Site	Alha Catchment	-
Elevation Range (m)	2080-2580	Field measurement
Annual Average Precipitation (mm)	2045.2	Working Plan Dalhousie, (2013-14 to 2027-28) for the period 1995-2012
As Rain (%)	100	
Maximum Rainfall recorded (mm)	3074 in 2003	
Minimum Rainfall recorded (mm)	1237 in 1999	
As Snow (%)	NA	
Dry Months (with precipitation <50 mm)	October, November and December	
Number of days with frost	0	
Period of Frost	NA	
Temperature (°C/No. of days)	Data not available but the climatic conditions conform to temperate one	Working Plan Dalhousie (2013-14 to 2027-28).
Planning Area (ha)	202.34	Forest Working Plan, CHF & baseline data
Forest Type and Area (ha)	• 12C1c – Moist Deodar forests (20.34 ha) • Spruce mixed forest (182 ha)	

2.2.2 Demographic Data

Dalhousie is a famous hill-station of Himachal Pradesh. Majority of people living in the town are involved directly or indirectly with the tourism sector. There is a huge influx of tourists during the summer season and winter season. People from adjoining villages are employed (either part-time or full-time) in the hospitality industry. The demographic data of Dalhousie Town is presented in Table 2.4.

Table 2.4: Demographic Data of Dalhousie

Name of the Ward (Ward No)	Male	Female	Total
Bakrota (1)	1506	994	2450
Lohali (2)	320	324	644
GPO (3)	307	282	589
Hindu Lane (4)	359	355	714
Upper Sadar Bazar (5)	155	128	283
Kathlig (6)	249	221	470
Convent School (7)	140	481	621
Moti Tibba (8)	505	306	811
Dalhousie Club (9)	280	189	469
Total	**3821**	**3230**	**7051**

Source: Office of Executive Office, Municipal Council Dalhousie

2.2.3 Stakeholder Mapping

The local communities living in the vicinity of Alha Catchment Forest do not have rights of grazing, lopping, fuelwood/timber collection etc. in the forest. The Alha Catchment Forest was exclusively managed for the provisioning of water services. The benefactors of the water provisioning services of Alha catchment are the residents of Dalhousie town, Cantonment board and Gram Panchayat Osal and Jiunta. In addition, some residential Public Schools also had access to water from Alha forest.

Stakeholder analysis revealed stakeholders benefiting from other services of the Alha Catchment Forest such as cultural and aesthetic services. All stakeholders using various services emanating from Alha were mapped, consulted, and their interests and roles were discussed in PRA. Table 2.5 gives the stakeholder categories based on the current and potential roles of identified stakeholder groups in planning and implementation of HP-FES project activities.

Table 2.5: Stakeholders of Alha Catchment

Type	Key	Primary	Secondary
Civil Society	Gram Panchayats of Osal and Jiunta,	• Gram Panchayats of Kahari, Padrotu and Balehra • Municipal Corporation Dalhousie	Nil
Private	• Hotel Association • Tanker Association	Public/Private Schools	• Taxi Operators Association • Adventure Tourism Association
State	HPFD	Irrigation and Public Health Department	Military Engineering Services of Dalhousie Cantt.

2.2.4 Institutional Mapping

An institutional map was prepared during the PRA and institutions with which villagers engaged were identified. The institutions their importance, relevance and relations with ACFMS Dalhousie were probed. The results of the exercise are presented in Table 2.6.

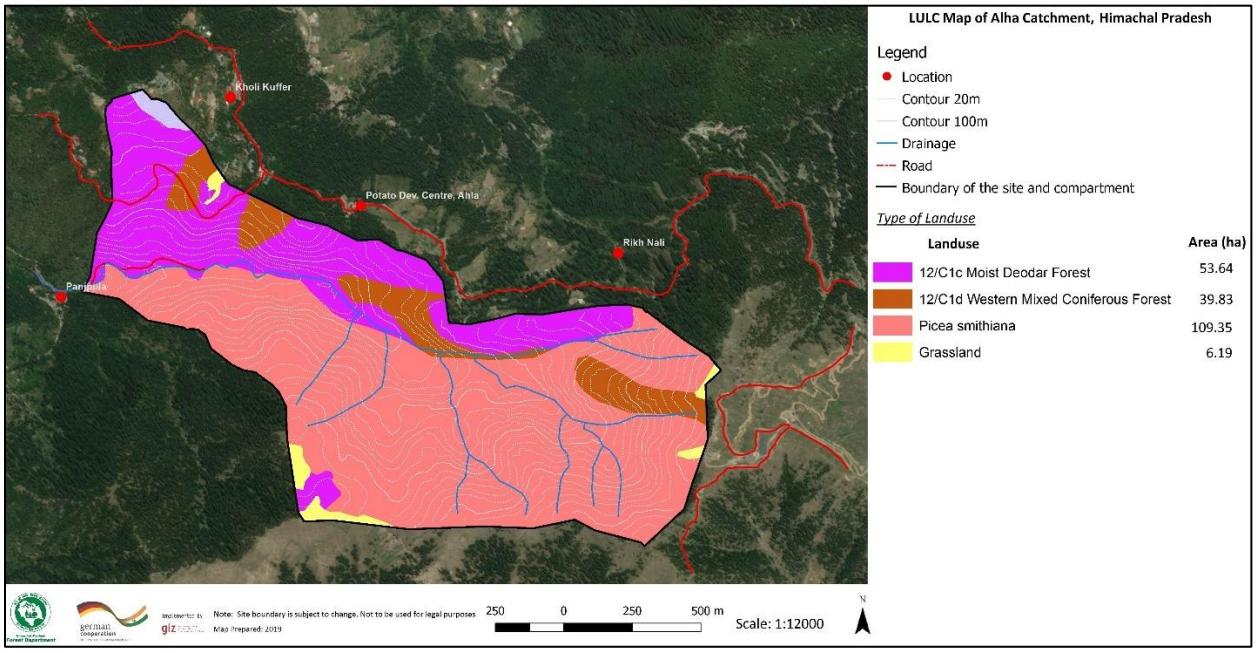
Table 2.6: Institutional Mapping of Alha Catchment

Particulars/Item	Institutions								
	HPFD	Dalhousie MC	Adventure Tourism	Tanker Association	Taxi Association	Schools	IPH	Cantonment Board	Hotel Association
Importance	H	H	M	H	L	H	H	M	H
Relevance	H	M	M	H	L	H	H	L	H
Relation with ACFMS	G	G	G	G	G	Mo	Mo	Mo	G
Conflict	N	N	N	N	N	N	N	N	N

Note: H: High, M: Medium, Mo: Moderate, L: Low, G: Good, N: None

2.2.5 Forest

The site consists basically of three forest types: Moist Deodar Forest and *Picea smithiana*/mix Forest (Map 2.2). A total of five plots were laid in Moist Deodar Forest and 15 in *Picea smithiana*/mix Forest for the assessment of the human disturbance, tree species regeneration and basal area.



Map 2.2: Landuse/Landcover Map of Alha Catchment

2.2.5.1 Forest Assessment during Baseline Survey

- **Human disturbances in different forest types of Alha**

All forests in the demonstration site are disturbed. While the Moist Deodar Forest is mainly disturbed by cutting and trampling, the *Picea smithiana*/mix Forest is disturbed by grazing and cutting (Table 2.7).

Table 2.7: Percentage of Plots in which Signs of Human Interference were observed in Alha Catchment

Forest Type	Fire	Cutting	Trampling	Lopping	Resin	Track	Dung
12/C1c Moist Deodar Forest	0	100	100	0	0	100	20
Picea smithiana/mix Forest	0	80	93	20	0	100	73

- **Regeneration in different forest types of Alha (Figure 2.3)**
  - Regeneration in Moist Deodar Forest: In this forest type, no species was found under seedling stage but very low number of saplings of *Pinus wallichiana* and *Picea smithiana* were found.
  - Regeneration in *Picea smithiana*/mix Forest: *Quercus leucotricophora* and *Picea smithiana* was found in very low number and in sapling stage only.

- **Basal Area in different forest types of Alha (Figure 2.3)**
  - Basal Area in Moist Deodar Forest: In this forest type, *Cedrus deodara* has the highest basal area followed by *Picea smithiana*.
  - Basal Area in *Picea smithiana*/mix Forest: In this forest, *Picea smithiana* has the highest basal area followed by *Cedrus deodara* and *Abies pindrow*.

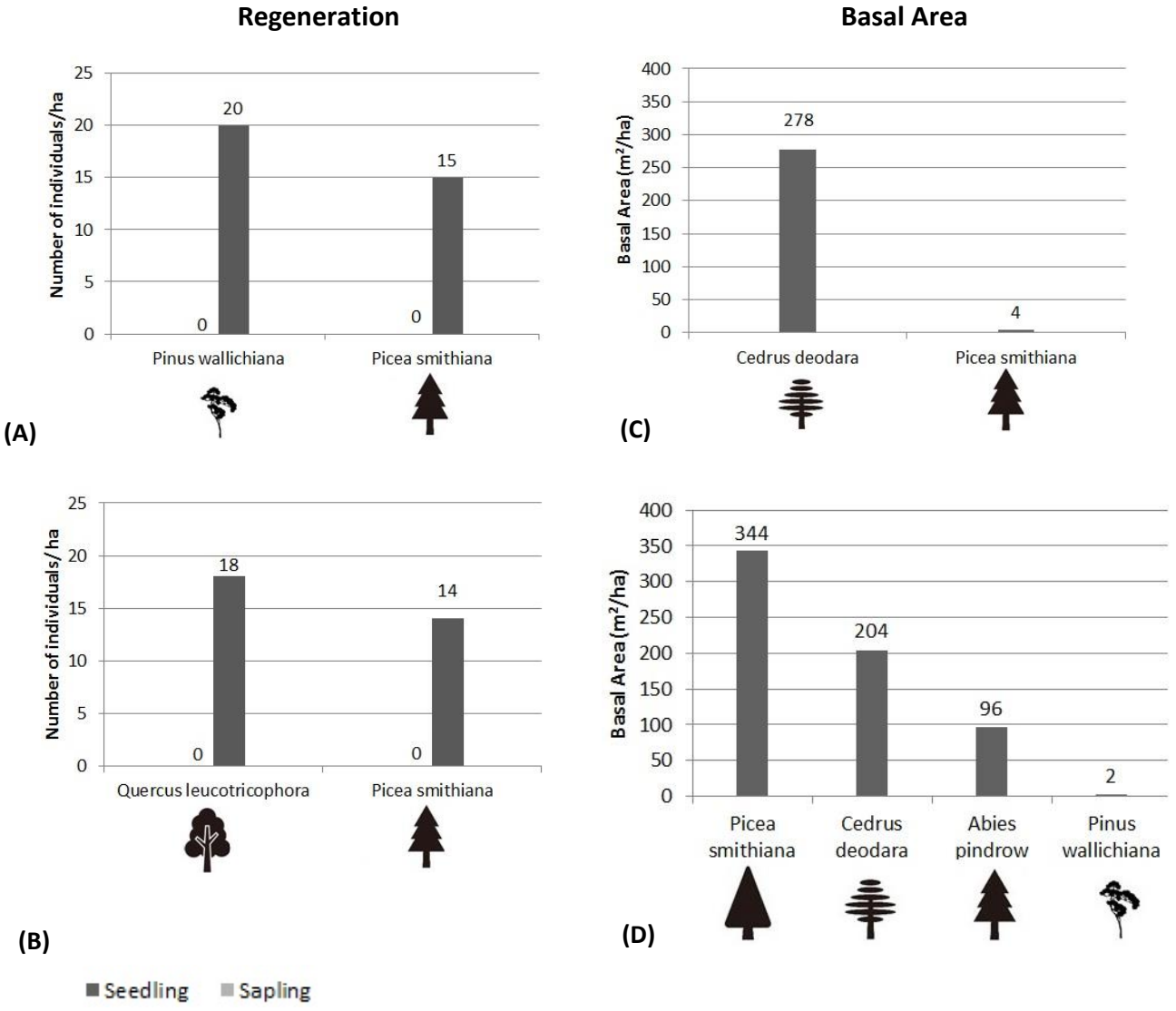


Figure 2.3: Regeneration and Basal area in different forest types of Alha Catchment [A: Regeneration in Moist Deodar Forest, B: Regeneration in *Picea smithiana*/mix Forest, C: Basal Area in Moist Deodar Forest, D: Basal area in *Picea smithiana*/mix Forest]

2.2.5.2 HPFD Document like Divisional Working Plan and Compartment History Files

The description of Alha Catchment Forest is shown in Table 2.8.

Table 2.8: Description of Alha Catchment Forest

Compartment	Forest Type	Area (ha)	Vegetation structure & composition
NDPF Alha Catchment	12/C1c (Moist Deodar Forest) and Upper Himalayan Coniferous Mixed Forests	202.34	• The South-western aspect along the ridge separates the Alha Catchment from Alha UPF. • The NDPF Alha catchment forest is largely a natural mixed coniferous forest with scattered saplings of isolated Kharsu oak (*Quercus semicarpifolia*) in water recharge zone, mature to over mature *Aesculus indica* trees along nalas/ streams in upper part of the forest and young aged trees of Ban oak (*Quercus incana*) and isolated Brah (*Rhododendron arboreum*) trees in lower altitude on western and north western part. • The forest on its eastern and southern boundary along ridge slopes has mature crop of the West Himalayan Fir (*Abies pindrow*) and West Himalayan Spruce (*Picea smithiana*) in predominance with sprinkling of Blue Pine (*Pinus wallichiana*) trees. • Some patches have young to middle aged crop. • The proportion of Deodar (*Cedrus deodar*) increases in lower western part of forest adjoining Gharatgala forest and northern part of the forest near MC forest boundary. • The forest is degrading particularly near Rikh-nali habitations & Kikar-gali where erosion is conspicuous due to poor canopy cover and biotic interference. • Regeneration in the entire catchment is also problematic.

2.2.6 Forest Ecosystem Service

The list of forest ecosystem services derived, their rank of preference among users, its trends and the drivers responsible for this trend are given in Table 2.9.

Table 2.9: Forest Ecosystem Services: its rank, trends and drivers of change in Alha Catchment

Category	Service	Rank	Sub-category	Quantity sufficient (Y/N)	Trend	Driver
Regulating	Watershed protection	1	Soil moisture conservation & water regeneration	Y	↓	• Reduced forest density • Lack of multi- layered forest • Illegal grazing in some parts • Change in pattern of precipitation from less snow to more rain
	Air	2	Cool and clean breathing air	Y	↔	Vegetation is sufficient to provide the much-needed clean air for breathing
Cultural	Aesthetic	3	Greenery	NA	↔	Marginal decrease in green cover due to forest degradation

Note: Trend – Decreasing: ↓ Increasing: ↑ No change: ↔, NA: No Data available

3 Alha Catchment Forest Management Society (ACFMS), Dalhousie

ACFMS Dalhousie was formed in December 2018 with the objective of supporting Management of Alha Catchment Forest jointly with HPFD for receiving water as the main FES. The Executive Body of the Society comprise representatives from Hotelier's Association, Tanker's Union, Public Schools, Municipal Council of Dalhousie, the Dalhousie Cantonment Board and Pradhans (Presidents) of adjoining Gram Panchayats etc (refer Table 3.1). The Deputy Ranger from HPFD is an ex-officio member of ACFMS. The membership of General Body of ACFMS is open to all the stakeholders using water from Alha Catchment Forest.

Table 3.1: Current Office Bearers of ACFMS Dalhousie and their Contact Details

S. No.	Name and Address	Age	Caste category	Position/Rank	Phone
1	Sh. Vyas Dev Tandon	58	Gen.	President	8219412791
2	Sh. Deepak Raj Verma	48	Gen.	Vice President	9418130774
3	Sh. Anshu Gandotra	34	Gen.	General Secretary	9418042080
4	Sh. Suraj Walia	33	Gen.	Treasurer	9418144136
5	Sh. Ashok Kumar	45	Gen.	Member	88940 83577
6	Sh. Dhani Ram (Dy. Ranger – HPFD)	50	Gen.	Ex-officio Member	88948 84414
7	Sh. Des Raj (MCD – Forest Guard)	54	ST	Ex-officio Member	94184 85342
8	Ajay Kumar	46	Gen.	Member	94595 52081
9	Kuldeep Singh	52	ST	Member	94591 90955

Note: Gen.: General; ST: Schedule Tribe

4 Payment for Ecosystem Services (PES): Concept and Approach in Alha Catchment Forest

4.1 Definition of PES

For all PES, the buyer must be identified, the market conditions understood (including any terms and conditions conditionalities) and the service provider legally and institutionally recognized. A widely quoted definition[1] of a PES is that it is:

1. a voluntary transaction where
2. a well-defined ecosystem service (or a land use likely to secure that service)
3. is "bought" by a (minimum of one) ecosystem service buyer
4. from a (minimum of one) ecosystem service provider; if and only if
5. the service provider secures ecosystem service provision (conditionality).

4.2 PES Concept

The basic idea behind PES is that those who provide any ecosystem services should be paid for doing so. PES involves a series of payments to land or other natural resource managers in return for a guaranteed flow of ecosystem services (or, more commonly, for management actions likely to enhance their provision) over-and-above what would otherwise be provided in the absence of payment. Payments are made by the beneficiaries of the services in question, for example, individuals, communities, business houses or government acting on behalf of various parties. The PES concept[2] in relation to payments for watershed services is given in Figure 4.1.

1 PES: A Practical Guide to Assessing Feasibility of PES Projects, CIFOR

2 Payment for Ecosystem Services: A Best Practice Guide, DEFRA

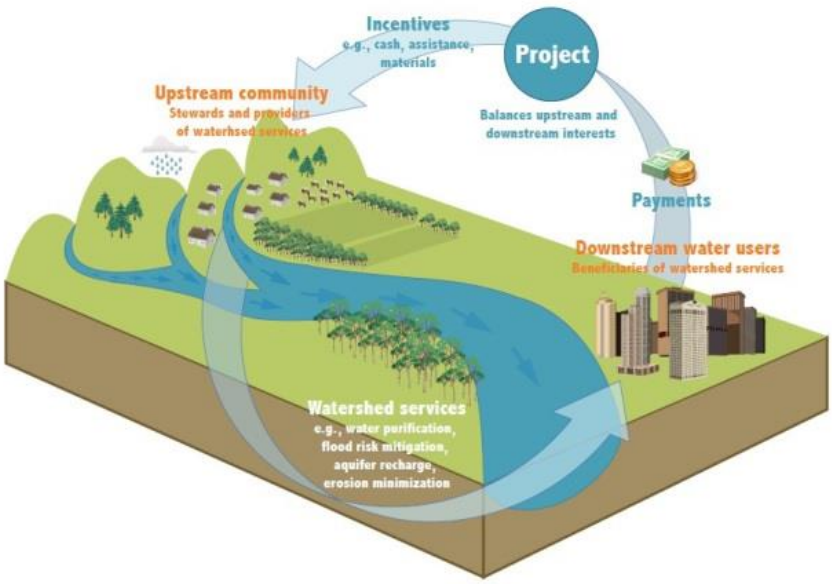


Figure 4.1: PES Concept in Relation to Payments for Watershed Services

4.3 Need for PES Approach for Management of Alha Catchment Forest

Alha catchment forest has its historical significance of water provisioning to Dalhousie town. The Alha catchment forest was carved out on watershed principles to generate water for Dalhousie town /settlement during British rule in India. Biotic interference including cattle grazing, fuelwood collection and felling of trees were not allowed in order to maintain water level in springs along with hygienic conditions. The catchment forest was also guarded with controlled human entry. However, once transferred to wildlife and subsequently to the forest territorial division, the forest conditions deteriorated. Extensive gully erosion explicitly marks the landscape. In addition to this, tourists have open access to this forest. Plastic litter can be seen scattered along with cow dung due to open grazing. Some cases of disposal of cattle carcass were also reported in this forest. In its current state, the Alha forest does not support generation of water as FES to its optimum capacity.

Dalhousie is a prominent tourist destination, famous for its schools and colonial era buildings. On an average, every third person in the town is a tourist (estimates of HPTD). Moreover, tourists exacerbate the situation by visiting the hill station during summers when water scarcity is at its peak. Water supplied to the town by the Irrigation & Public Health Department is sufficient just for the residents. There is acute water shortage during the tourist season and the deficit is met through tankers. Most of the springs that are used by the tankers to supply water to the Hotels are recharged from Alha catchment forest.

During consultations with the stakeholders, it came out clearly that all stakeholders of Alha Catchment Forest were aware of the deteriorating condition of the forest and expressed strong willingness to participate and contribute to ease the existing conditions. The stakeholder groups, especially Hotel Associations, Tanker Associations and Gram Panchayats using water from Alha forest for commercial gains were convinced to make monetary contribution to HP-FES.

4.4 PES Model for Alha Catchment Forest

During the PRA exercise, users and providers of the FES water from Alha forest were identified; users being Hotel Associations, Tanker Associations, Public Schools, Gram Panchayats of Osal and Jiunta and the provider being HPFD. It was agreed that users of water will contribute towards the costs for implementing the activities identified in the microplan to improve the water regeneration, sanitation and overall management of Alha Catchment Forest for enhancing its water provisioning services.

Subsequently, Alha Catchment Forest Management Society (ACFMS) Dalhousie was registered with local administration as the nodal institution, under the aegis of HPFD. ACFMS will be the custodian of a corpus created for the purpose of forest management activities in Alha forest. Contributions in the form of donations and membership fee will be sought from end users who are also the members of ACFMS. Grants from other donors, including HPFD and HP-FES will also contribute to the corpus. The objectives of ACFMS are to create awareness on environmental issues, plan and monitor activities and raise funds to support implementation of activities enlisted in the microplan, etc. The technical inputs for the preparation of microplan have been provided by HP-FES and HPFD. The implementation of activities identified in the microplan will be done by HPFD. Figure 4.2 shows the PES Model to be implemented in Alha Catchment Forest.

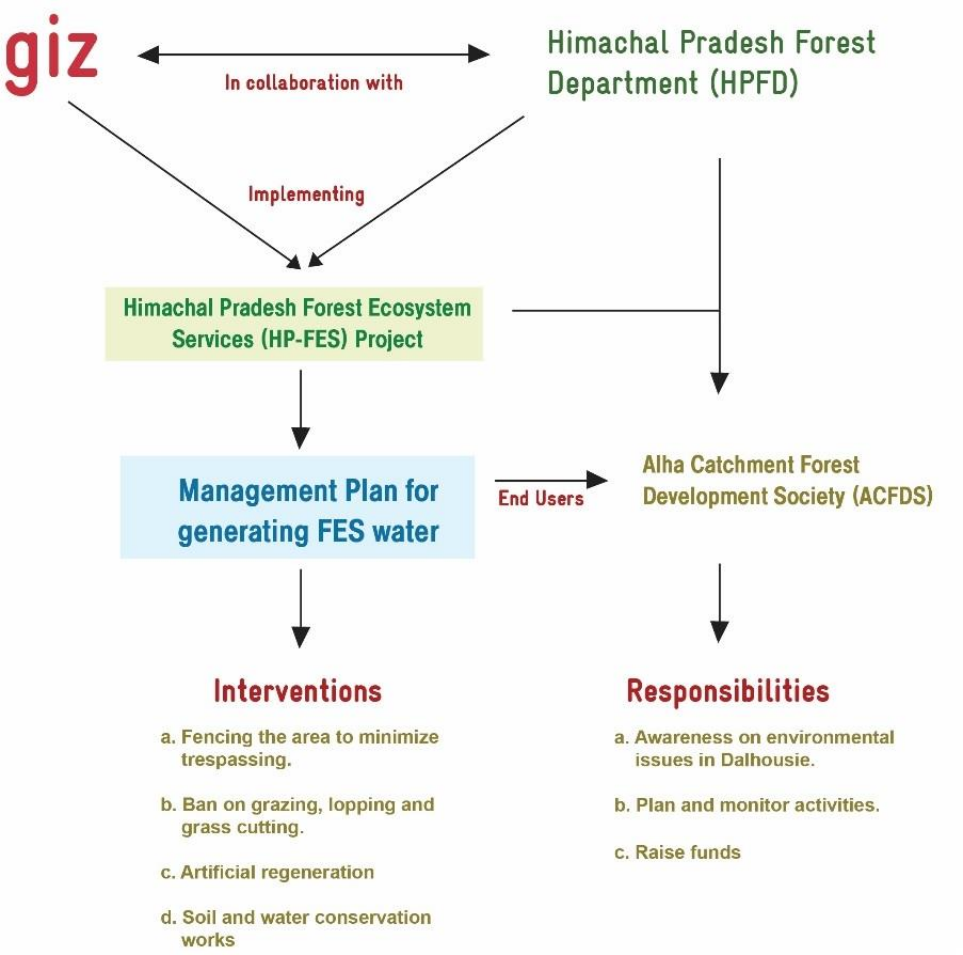


Figure 4.2: PES Model for Alha Catchment Forest

4.5 Economic Valuation of Water FES from Alha Catchment Forest

(Inputs awaited from IORA study on PES)

5 Aims of the Management Plan

Based on the meetings with end users of FES, the forest vegetation assessment and discussions with all stakeholders, the objectives for long-term, mid-term and short-term planning periods are defined (Table 5.1). The mico plan therefore elaborates the aims and measures according to the mid and long-term target.

Table 5.1: Management Plan for Alha Catchment Forest

Plan Term	Water	Soil Conservation	Forest Crop Composition	Measures
Long Term (30 years)	• Increased flow of water in springs/ water sources in Panchpula & Goon Nalas at intake point of Irrigation and Public Health (IPH) Department. • In head zone of Panchpula Khad, increased water flow in springs / water sources at intake points of piped water supply schemes in Jari Naki Nala. • Increased water flow in Panchpula Khad at tanker filling points in Jiunta and Osal Panchayats.	• Deepening and widening of gullies/nullahs is contained. • With reduction in depth and width of eroded features banks of drainage lines are stabilized and soil erosion controlled.	• Visible changes in crown density and forest structure • Increase in natural regeneration by 10% in the stands • Plantations in forest attains pole stage.	ACFMS ensures equitable usufruct sharing, regulated use of forest and protection against fire and illicit felling.
Mid Term (15 years)	Increased flow of water in Goon and Jarp Naki Nalas sustains flow of water in Panchpula Khad.	• Soil erosion is contained • banks of drainage lines are stabilized	Regenerated areas in 25 ha have attained sapling/pole stage forest with moderate density	• ACFMS strictly protects plantation against lopping/ illicit cutting • ACFMS is encouraged through appreciation of good protection work undertaken

Plan Term	Water	Soil Conservation	Forest Crop Composition	Measures
Short Term (5 years)	• Reduced silt load in run-off from Jari Naki Nala originating from Kikar gali • water availability in springs/water sources at intake points of flow water supply schemes / channels increases up to 5 % of base discharge	Reduced silt load in run-off due to increased grass & vegetation cover	Treated areas have well grown sapling stage plantations with 90% survival	• ACFMS supports effective protection of forest and plantation against grazing, fire and use of forest area for recreation by tourist etc. by putting watchmen on duty • Potential future conflicts on water sharing will be resolved by ACFMS • ACFMS is strengthened to raise funds from end users of FES, donors and other cooperating agencies
HP-FES Project Period (first 2 years of 5-year period)	• Planned activities towards soil and water conservation implemented as per agreed timelines • Set up a baseline and system for measuring stream water flows and run off silt load	• Soil and moisture conservation activities are implemented as per agreed timelines • Reduction in biotic interference resulting in decreased silt load in water runoff.	• ACFMS ensures protection of plantation against grazing and fire; • Plantation of suitable tree species carried out with survival percentage up to 80%; • Grass/ground cover in treated area increased upto 30% • More forest area closed for grazing; • VFMS members are motivated for active involvement in forest	• Degraded and denuded areas are brought under regeneration and plantation • Rules for protection and FES sharing are in place and followed • Soil and water conservation measures are planned and implemented

6 The Plan (for 5 years)

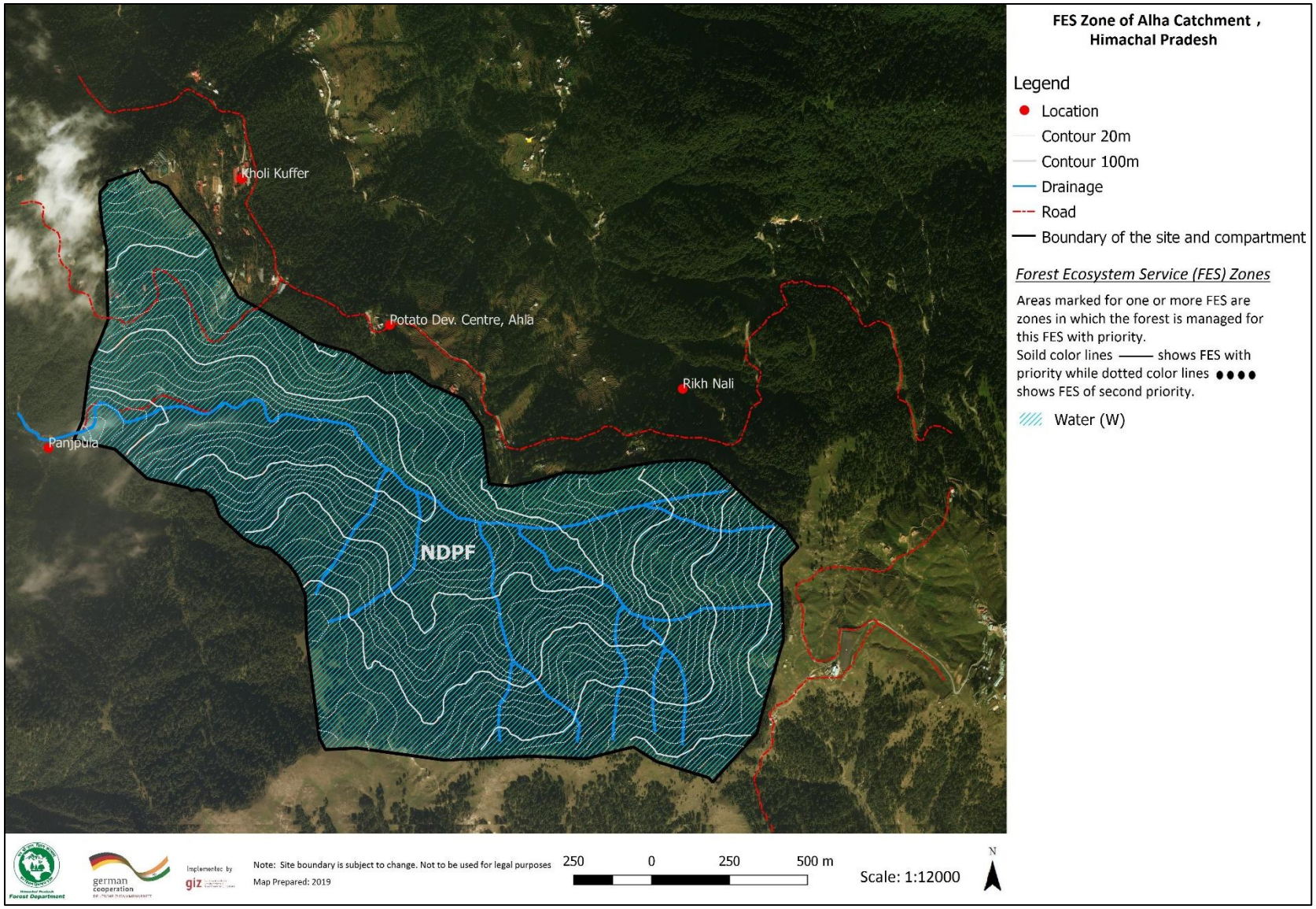
6.1 FES: Increase of Water Supply (Target - Increase of Hydrological Function)

The zone wise treatment of Alha catchment is presented Table 6.1. The FES zones of water are shown in Map 6.1. The activities planned for increase of water supply is given in Table 6.2 and Table 6.3 which are also shown on Map 6.2.

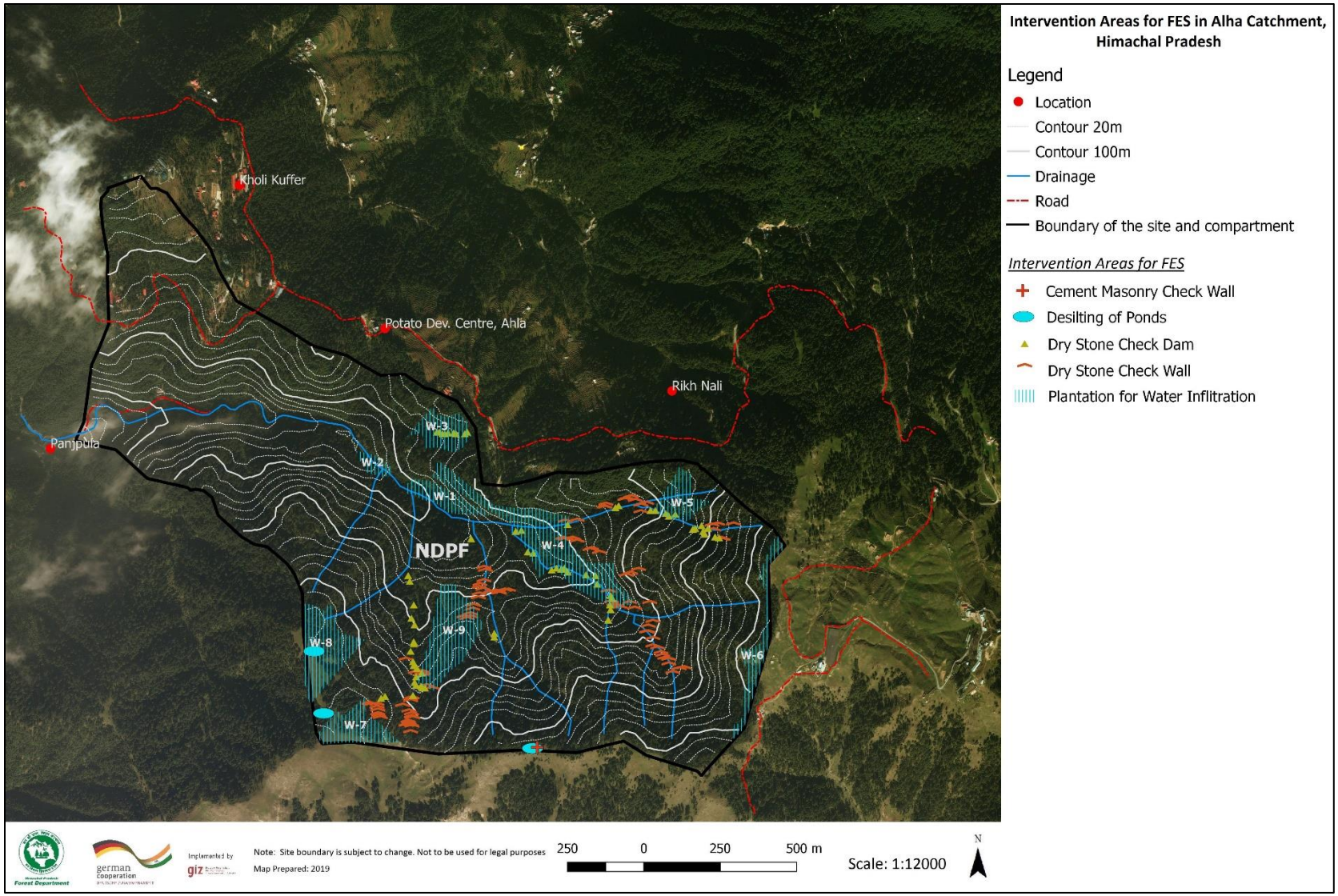
Table 6.1: Zone-Wise Management Plan of Alha Catchment

FES Zones	Priority FES	Area (Ha)	Compartment No.	Description	Treatment Planned	Proposed Species
W-1 (Plot 1)	Water	2	NDPF	• Gently sloping along the nala bank • Deodar with spruce and solitary trees of *Aesuclus indica*	Plantation	*Cedrus Deodar* and *Quercus leucotrichophora*
W-2 (Plot 2)	Water	0.5	NDPF	• Gently sloping along the nala bank • Deodar with spruce and solitary trees of *Aesuclus indica*	Plantation	*Cedrus Deodar* and *Quercus leucotrichophora*
W-3 (Plot 3)	Water	2.25	NDPF	• Gently sloping Western exposition • Deep soils • Deodar, Fir, Spruce with young age Ban oak	Plantation	*Cedrus Deodar* and *Quercus leucotrichophora*
W-4 (Plot 4)	Water	5	NDPF	• Gentle to steep, • South western exposed • Deodar in dominance • Scattered young regeneration of Ban oak	Plantation	*Cedrus Deodar* and *Quercus leucotrichophora*

FES Zones	Priority FES	Area (Ha)	Compartment No.	Description	Treatment Planned	Proposed Species
W-5 (Plot 5)	Water	1.5	NDPF	• North Western exposition, gentle to steep sloping • Predominantly spruce forest mixed with Fir	Plantation	Fir and spruce
W-6 (Plot 6)	Water	4	NDPF	• Northern exposition • Predominantly spruce forest mixed with Fir	Plantation	Fir and spruce
W-7 (Plot 7)	Water	2	NDPF	• Northern exposition • Predominantly deodar, mixed with Spruce • Gentle slope • Deep soil	Plantation	*Cedrus deodara*
W-8 (Plot 8)	Water	4	NDPF	• Northern exposition • Mix of Spruce and Deodar forest • Moderately to steep slope	Plantation	*Cedrus deodara*
W-9 (Plot 9)	Water	4	NDPF	• Northern and Eastern exposition • Moderate soil depth • Slope moderate to steep • Predominantly spruce mixed with Deodar	Plantation	*Cedrus deodara* and Spruce



Map 6.1: FES Zone Map of Alha Catchment



Map 6.2: Intervention Map of Alha Catchment based on 5-year plan

Table 6.2: Activity Plan for Enhancing Infiltration of Water into Ground and Soil Erosion Control

S. No.	Activities	Location	Year-I		Year -II		Year - III		Year - IV		Year -V		Total	
			Phy	Fin. (Rs.)	Phy	Fin. (Rs.)	Phy	Fin. (Rs.)	Phy	Fin. (Rs.)	Phy	Fin. (Rs.)	Phy	Fin. (Rs.)
1	Check walls in dry stone masonry	Panchpula Nala origin, Goon nala, Jari Naki Nala	-	-	17	1,36,000	30	2,40,000	30	2,40,000	30	2,40,000	107	8,56,000
2	Check wall in cement masonry	NDPF Alha Top ridge	1	35,000	-	-	-	-	-	-	-	-	1	35,000
3	Check dams in dry stone masonry	Panchpula Nala origin, Goon nala, Jari Naki Nala	-	-	9	1,08,000	20	2,40,000	20	2,40,000	20	2,40,000	69	8,28,000
4	Desilting of Ponds	NDPF Alha upper zone	1	20,000	-	-	-	-	1	15,000	1	15,000	3	50,000
5	Staggered Contour Trenches 1m x 45m x 45m In forest (Rm)	NDPF Alha upper zone over an area of 10 ha. approx.	-	-	5,000	2,07,684	5,000	2,07,684	5,000	2,07,684	5,000	2,07,684	20,000	8,30,736
6	Staggered contour bunds 20cm rise (Rm)	NDPF Alha upper zone over 5ha of area	-	-	1,500	18,750	1,500	18,750	1,500	18,750	1,500	18,750	6,000	75,000
Total (6.2)			-	**55,000**	-	**4,70,434**	-	**7,06,434**	-	**7,21,434**	-	**7,21,434**	-	**26,74,736**

Table 6.3: Activity Plan for Plantations of Coniferous Species & Water Infiltration Measures for Increasing Stream Water in Springs/Nalas

S. No.	Activities (e.g.)	Year-I		Year -II		Year - III		Year - IV		Year -V		Total	
		Phy	Fin. (INR)	Phy (ha)	Fin. (INR)	Phy (ha)	Fin. (INR)	Phy (ha)	Fin. (INR)	Phy	Fin. (INR)	Phy (ha)	Fin. (INR)
1	Digging, trenching and planting*	25.25 ha (Tall & normal plants)	11,28,445		-	-	-	-	-	-	-	25.25	11,28,445
2	**Labour cost (trenching & planting)**	**25.25 ha**	**11,28,445**									**25.25**	**11,28,445**
3	Material & supply (New)		4,02,687	-	-	-	-	-	-	-	-	-	4,02,687
4	**Total (labour & M&S)**	**25.25 ha**	**15,31,132**	-	-	-	-	-	-	-	-	**25.25**	**15,31,132**
5	Plant cost (new planting) Normal	25500 no.	1,06,425	-	-	-	-	-	-	-	-	25500	3,61,845
	Plant cost (new planting) Tall	3000 no.	1,50,420	-	-	-	-	-	-	-	-	5000	1,50,420
6	**Grand Total (New Planting)**	**25.25**	**20,43,397**	-	-	-	-	-	-	-	-	**25.25**	**20,43,397**
7	Maintenance of plantation (3 yr.)	-	-	25.25	1,21,705	25	67,418	25.25 h	40,400	-	-	25.25	1,04,535

8	**Total maintenance cost (3yr) (B)**	-	-	25	1,21,705	25	67,418	25	40,400	-	-	25.25	1,04,535
Total FES water (6.2+ 6.3)													**49,47,656.00**

Note: *Digging, 60 cm^3 and 45cm^3 filling pits & Planting of Ban oak (*Quercus incana*), Deodar (*Cedrus deodara*), Fir (*Abies pindrow*), Spruce (*Picea smithiana*), Horse chestnut (*Aesculus indica*), barbed wire fencing.

7 Monitoring and Evaluation (M&E) Framework

A participatory framework for monitoring and evaluation will be established to monitor the activities and process of participation of stakeholders in the implementation of the microplan. The monitoring plan will monitor the activities, the impact of these activities on the flow of ecosystem service and related forest management goals. In order to effectively monitor the project impacts, baseline data corresponding to the activities needs to be generated.

The framework will be segregated into two sections, namely, Monitoring and Evaluation (M&E) by the HPFD: This is in-house/outsourced infrastructure support. The M&E will timely evaluate vegetation and flow of other related ecosystem services. This will be done through GIS-based map of the joint forest management (JFM) area.

- Participatory Monitoring by ACFMS: This participatory monitoring unit will comprise of local forest guard, one member of ACFMS, representatives of IPH department and Dalhousie Public School. This group will provide report against indicators after ground truthing of vegetation growth and impact of the development and protection measures on ecosystem service flow.
- Every two years improvement in water discharge in springs / sources will be measured.

Monitoring and Evaluation Plan with Indicators are provided in Table 7.1.

Table 7.1: Monitoring and Evaluation Plan with Indicators

S. No.	FES	Measures to be monitored	Baseline value	Target value	Indicator	Means of verification	Responsibility
1	Increase of water flow in water resources, springs and streams	M1: Flow of water in springs/sources of water supply and Panchpula Nala (source of water supply) in dry seasons of the year (April to mid-June and October to mid-December) M2: Measurement of silt runoff in streams originating from the forest during rainy season	X Litre/Sec water flow in springs/Nala source of water supply to IPH Department supply schemes in dry months	Increase upto 10% of water flow in Panchpula Nala (source of water supply through tankers)	• Reduction in silt load in the runoff in Nala in NDPF Alha Catchment Forest • Increase in flow of water springs and Panchpula Nala (source of water supply in containers)	Record keeping by Participatory Monitoring Unit	Participatory Monitoring unit (part of VFMS unit)

8 Recommendations

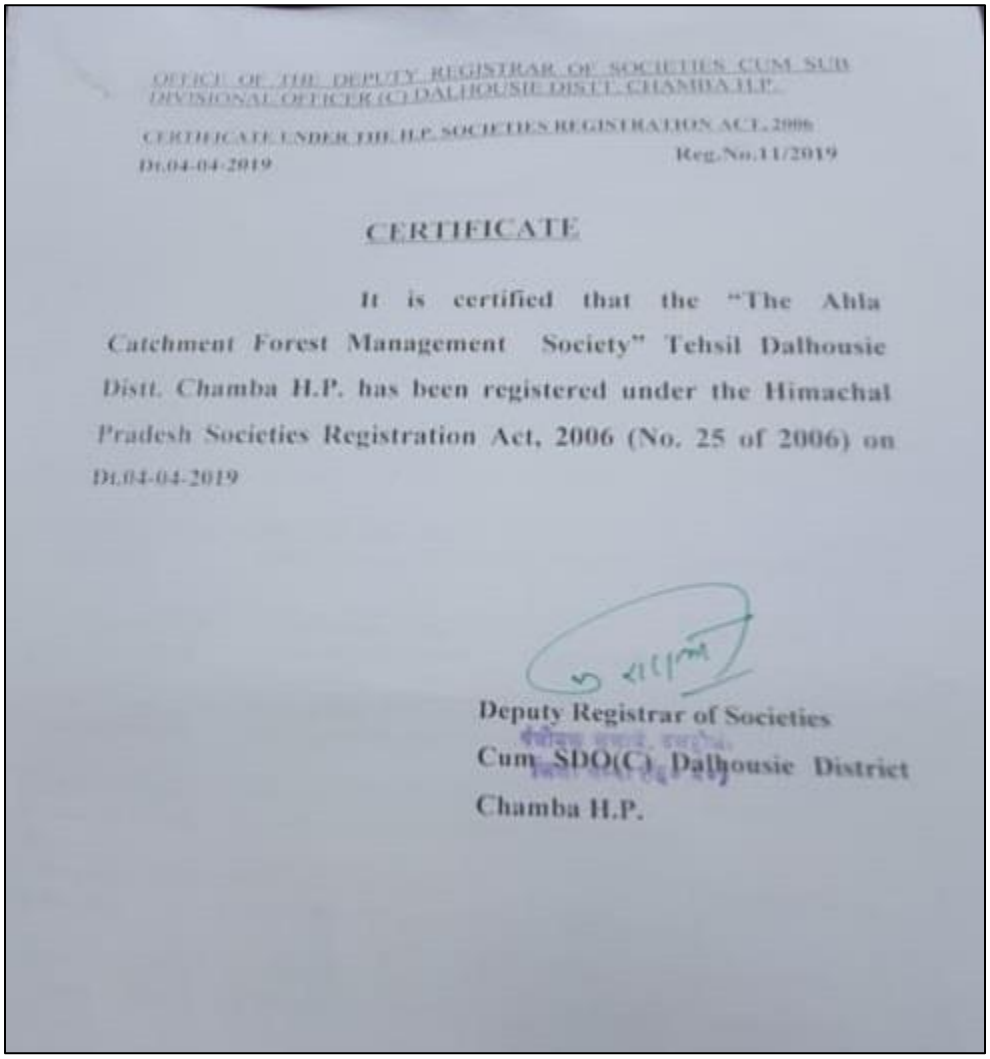
The activities as envisaged in the microplan will support the ACFMS's objective of preventing collapse of the existing systems of water supply. This will be achieved by improving the situation of water availability in springs and other water sources including Nalas. Water is the main FES prioritized by stakeholders. The possibility of generating income from PES area in PS Alha is an issue for raising funds for sustainable management of catchment forest.

A study commissioned by HP-FES on PES mechanisms is expected to provide inputs to strengthen the PES model in Alha Catchment Forest. The study will provide economic value of water services generated from Alha forest. These values will used as the basis for rationalizing the contributions from different stakeholders to the corpus for the management of Alha forest.

It is recommended that mechanism to monitor improvements in water flow in streams need to be put in place.

9 Annexures

Annexure I: Society Registration Certificate



OFFICE OF THE DEPUTY REGISTRAR OF SOCIETIES CUM SUB DIVISIONAL OFFICER (C) DALHOUSIE DISTT. CHAMBA H.P.

CERTIFICATE UNDER THE H.P. SOCIETIES REGISTRATION ACT, 2006

Dt.04-04-2019 Reg.No.11/2019

CERTIFICATE

It is certified that the "The Ahla Catchment Forest Management Society" Tehsil Dalhousie Distt. Chamba H.P. has been registered under the Himachal Pradesh Societies Registration Act, 2006 (No. 25 of 2006) on Dt.04-04-2019

Deputy Registrar of Societies
Cum SDO(C) Dalhousie District
Chamba H.P.

Annexure II: Memorandum of Understanding (MoU)/Memorandum of Agreement (MoA)

An MoU must be signed with stakeholders-- primarily between the forest department and the ACFMS.

Rights and Responsibilities should be mentioned giving specific roles of specific stakeholders on various protection and regeneration works as well as benefit sharing. The benefit sharing need to be based on the principles of transparency, trust, empowerment and accountability

MoU should clearly mention:

i) Short term, long term roles and responsibilities, powers, implementation plan, sharing usufructs, and conflict resolution
ii) Local needs, restoration plan
iii) Transparent accounting of seasonal, annual and periodical produce, financial accountability and distribution of sharing mechanism including flow to central funds for restoration
iv) Contribution by ACFMS

Annexure III: Geo-coordinates for Locations for Engineering Structures

S. No.	Type of Structure	Longitude and Latitudes		Dimensions (m)	
				Length	Height
1	Dry Stone Check Wall (DSCW)	32 31'31.7" N	076 00'49.5" E	(3.3+4.0)/2	1.0
2	-do-	32 31'30.1" N	076 00'48.2" E	(1.2+1.7)/2	1.2
3	-do-	32 31'30.1" N	076 00'48.0" E	(1.5+1.7)/2	1.0
4	-do-	32 31'30.2" N	076 00'47.9" E	(3.1+3.7)/2	0.9
5	Dry Stone Check Dam (DSCD)	32 31'30.7" N	076 00'47.7" E	(3.5+4.5)/2	1.0
6	-do-	32 31'30.8" N	076 00'47.2" E	(4.2+5.3)/2	1.25
7	Dry Stone Check Wall (DSCW)	32 31'31.7" N	076 00'47.5" E	(4.9+5.4)/2	1.0
8	-do-	32 31'31.1" N	076 00'47.0" E	(3.4+4.3)/2	0.9
9	-do-	32 31'31.6" N	076 00'46.8" E	(2.3+3.0)/2	1.2
10	Dry Stone Check Dam (DSCD)	32 31'31.7" N	076 00'46.3" E	(3.0+4.0)/2	1.25
11	-do-	32 31'31.1" N	076 00'45.9" E	(3.1+4.0)/2	1.25
12	-do-	32 31'31.4" N	076 00'45.7" E	(4.2+4.9)/2	1.5
13	-do-	32 31'32.0" N	076 00'45.5" E	(2.7+3.8)/2	1.2
14	-do-	32 31'31.7" N	076 00'44.7" E	(5.4+5.8)/2	1.2
15	-do-	32 31'31.6" N	076 00'44.4" E	(2.8+3.5)/2	1.2
16	-do-	32 31'33.2" N	076 00'42.2" E	(5.3+6.3)/2	1.2
17	-do-	32 31'33.0" N	076 00'41.4" E	(5.3+7.5)/2	1.2
18	-do-	32 31'33.3" N	076 00'41.0" E	(8.0+9.0)/2	1.2
19	-do-	32 31'33.6" N	076 00'39.7" E	(3.8+4.5)/2	1.0
20	-do-	32 31'33.6" N	076 00'39.1" E	(5.7+6.9)/2	1.0

S. No.	Type of Structure	Longitude and Latitudes		Dimensions (m)	
				Length	Height
21	Dry Stone Check Wall (DSCW)	32 31'33.9" N	076 00'38.6" E	(5.7+6.0)/2	1.0
22	-do-	32 31'33.7" N	076 00'37.9" E	(3.8+4.4)/2	1.0
23	-do-	32 31'33.0" N	076 00'37.9" E	(2.8+4.7)/2	1.2
24	-do-	32 31'34.2" N	076 00'37.2" E	(2.8+3.1)/2	1.2
25	-do-	32 31'34.6" N	076 00'36.7" E	(3.3+4.4)/2	1.2
26	-do-	32 31'34.4" N	076 00'36.1" E	(2.8+4.0)/2	1.5
27	-do-	32 31'34.3" N	076 00'35.9" E	(4.6+5.7)/2	1.2
28	Dry Stone Check Dam (DSCD)	32 31'34.1" N	076 00'35.1" E	(6.2+8.0)/2	1.5
29	-do-	32 31'33.9" N	076 00'34.7" E	(6.3+7.5)/2	1.2
30	Dry Stone Check Wall (DSCW)	32 31'33.8" N	076 00'33.5" E	(2.6+4.4)/2	1.0
31	-do-	32 31'33.5" N	076 00'33.3" E	(4.0+5.0)/2	1.2
32	-do-	32 31'33.5" N	076 00'33.4" E	(7.0+7.5)/2	1.0
33	-do-	32 31'32.1" N	076 00'29.9" E	(5.4+6.9)/2	1.5
34	Dry Stone Check Dam (DSCD)	32 31'32.1" N	076 00'28.7" E	(4.0+6.4)/2	1.2
35	Dry Stone Check Wall (DSCW)	32 31'32.0" N	076 00'28.4" E	(4.4+5.4)/2	1.2
36	Dry Stone Check Dam (DSCD)	32 31'31.5" N	076 00'22.9" E	(4.2+4.8)/2	1.0
37	-do-	32 31'31.4" N	076 00'22.2" E	(7.0+8.5)/2	1.2
38	-do-	32 31'29.2" N	076 00'23.7" E	(3.4+5.4)/2	1.0
39	-do-	32 31'29.1" N	076 00'24.4" E	(6.0+7.5)/2	1.2
40	-do-	32 31'27.3" N	076 00'26.7" E	(4.5+6.0)/2	1.2
41	-do-	32 31'27.5" N	076 00'27.3" E	(3.0+4.8)/2	1.0

S. No.	Type of Structure	Longitude and Latitudes		Dimensions (m)	
				Length	Height
42	-do-	32 31'27.4" N	076 00'27.9" E	(3.3+6.0)/2	1.0
43	-do-	32 31'27.5" N	076 00'28.3" E	(3.2+4.7)/2	1.2
44	-do-	32 31'27.1" N	076 00'28.7" E	(5.5+7.1)/2	1.2
45	-do-	32 31'26.8" N	076 00'31.0" E	(4.3+6.0)/2	1.0
46	-do-	32 31'26.7" N	076 00'32.2" E	(5.5+5.8)/2	1.0
47	-do-	32 31'25.8" N	076 00'32.4" E	(3.4+3.5)/2	1.0
48	Dry Stone Check Wall (DSCW)	32 31'24.6" N	076 00'33.8" E	7.5+9.5)/2	1.0
49	Dry Stone Check Dam (DSCD)	32 31'24.6" N	076 00'34.1" E	(4.6+7.0)/2	1.2
50	-do-	32 31'24.3" N	076 00'34.3" E	(3.6+5.0)/2	1.2
51	-do-	32 31'23.6" N	076 00'34.0" E	(5.3+6.3)/2	1.2
52	-do-	32 31'23.1" N	076 00'34.1" E	(5.5+6.7)/2	1.0
53	-do-	32 31'22.0" N	076 00'33.8" E	(7.0+9.0)/2	1.2
54	Dry Stone Check Wall (DSCW)	32 31'23.5" N	076 00'34.2" E	(4.0+6.3)/2	1.0
55	-do-	32 31'23.2" N	076 00'34.5" E	(2.8+4.6)/2	1.2
56	-do-	32 31'23.0" N	076 00'34.7" E	(2.2+5.0)/2	1.0
57	-do-	32 31'22.9" N	076 00'35.3" E	(3.9+5.8)/2	1.0
58	-do-	32 31'23.4" N	076 00'36.5" E	(4.0+7.5)/2	1.5
59	-do-	32 31'22.8" N	076 00'37.1" E	(6.0+7.5)/2	1.0
60	-do-	32 31'23.4" N	076 00'39.0" E	(2.6+4.6)/2	1.2
61	-do-	32 31'21.4" N	076 00'39.4" E	(3.5+5.0)/2	1.0
62	-do-	32 31'20.9" N	076 00'38.8" E	(3.8+4.5)/2	1.2

S. No.	Type of Structure	Longitude and Latitudes		Dimensions (m)	
				Length	Height
63	-do-	32 31'20.3" N	076 00'38.6" E	(3.0+5.0)/2	1.2
64	-do-	32 31'20.3" N	076 00'38.8" E	(3.3+4.8)/2	1.2
65	-do-	32 31'19.6" N	076 00'39.4" E	(1.4+1.7)/2	1.5
66	-do-	32 31'18.8" N	076 00'39.4" E	(3.2+5.3)/2	1.2
67	-do-	32 31'18.6" N	076 00'40.0" E	(2.0+3.3)/2	1.3
68	-do-	32 31'18.1" N	076 00'40.4" E	(3.0+4.0)/2	1.2
69	-do-	32 31'17.8" N	076 00'40.6" E	(4.6+5.7)/2	1.3
70	-do-	32 31'17.5" N	076 00'40.9" E	(2.8+4.4)/2	1.3
71	-do-	32 31'17.4" N	076 00'41.4" E	(1.6+2.8)/2	1.5
72	-do-	32 31'16.9" N	076 00'41.4" E	(4.0+5.0)/2	1.2
73	-do-	32 31'16.0" N	076 00'41.9" E	(4.0+5.3)/2	1.3
74	-do-	32 31'16.4" N	076 00'42.7" E	(2.6+4.0)/2	1.2
75	-do-	32 31'16.5" N	076 00'43.3" E	(2.7+4.7)/2	1.5
76	-do-	32 31'26.9" N	076 00'37.6" E	(3.0+5.2)/2	1.5
77	-do-	32 31'26.5" N	076 00'36.6" E	(2.0+2.5)/2	1.5
78	-do-	32 31'26.3" N	076 00'36.1" E	(1.4+2.7)/2	1.5
79	-do-	32 31'26.3" N	076 00'36.1" E	(2.4+3.7)/2	1.2
80	-do-	32 31'28.7" N	076 00'32.7" E	(3.6+5.3)/2	1.0
81	-do-	32 31'29.1" N	076 00'31.7" E	(2.1+3.3)/2	1.0
82	-do-	32 31'29.0" N	076 00'31.5" E	(1.7+3.0)/2	1.0
83	-do-	32 31'29.9" N	076 00'29.9" E	(1.6+3.0)/2	1.0

S. No.	Type of Structure	Longitude and Latitudes		Dimensions (m)	
				Length	Height
84	-do-	32 31'30.1" N	076 00'29.5" E	(1.4+2.0)/2	1.2
85	-do-	32 31'30.2" N	076 00'29.3" E	(1.7+2.8)/2	1.5
86	-do-	32 31'30.1" N	076 00'28.5" E	(2.4+3.5)/2	1.2
87	-do-	32 31'30.2" N	076 00'28.1" E	(2.0+4.0)/2	1.5
88	-do-	32 31'24.7" N	076 00'21.3" E	(1.7+2.9)/2	1.5
89	-do-	32 31'24.7" N	076 00'20.8" E	(1.9+3.0)/2	1.5
90	-do-	32 31'24.5" N	076 00'20.1" E	(1.6+3.0)/2	1.5
91	-do-	32 31'24.4" N	076 00'20.1" E	(2.0+4.8)/2	1.5
92	-do-	32 31'24.6" N	076 00'19.7" E	(2.0+3.5)/2	1.5
93	-do-	32 31'24.5" N	076 00'19.0" E	(3.5+6.0)/2	1.2
94	-do-	32 31'24.8" N	076 00'18.1" E	(3.5+5.4)/2	1.5
95	-do-	32 31'21.9" N	076 00'15.7" E	(3.0+4.7)/2	1.5
96	-do-	32 31'21.7" N	076 00'16.1" E	(1.6+2.9)/2	1.5
97	-do-	32 31'21.9" N	076 00'16.5" E	(2.0+3.0)/2	1.2
98	-do-	32 31'22.2" N	076 00'16.5" E	(1.5+4.0)/2	1.5
99	-do-	32 31'22.7" N	076 00'16.8" E	(2.6+4.3)/2	1.5
100	-do-	32 31'23.1" N	076 00'16.9" E	(4.2+6.0)/2	1.2
101	-do-	32 31'23.9" N	076 00'17.5" E	(3.6+5.0)/2	1.2
102	-do-	32 31'24.3" N	076 00'17.6" E	(4.0+5.0)/2	1.2
103	-do-	32 31'25.0" N	076 00'17.6" E	(1.8+3.0)/2	1.2
104	-do-	32 31'25.3" N	076 00'17.7" E	(3.7+4.7)/2	1.2

S. No.	Type of Structure	Longitude and Latitudes		Dimensions (m)	
				Length	Height
105	-do-	32 31'25.7" N	076 00'18.2" E	(4.0+5.0)/2	1.0
106	-do-	32 31'26.8" N	076 00'18.4" E	(4.0+5.0)/2	1.0
107	-do-	32 31'27.1" N	076 00'18.2" E	(6.0+8.0)/2	1.0
108	Dry Stone Check Dam (DSCD)	32 31'30.6" N	076 00'16.6" E	(5.7+6.5)/2	1.0
109	-do-	32 31'41.9" N	076 00'12.3" E	(3.3+4.8)/2	1.0
110	-do-	32 31'41.9" N	076 00'12.6" E	(2.6+5.0)/2	1.2
111	-do-	32 31'41.7" N	076 00'13.0" E	(2.3+3.7)/2	1.2
112	-do-	32 31'41.8" N	076 00'13.7" E	(1.3+3.4)/2	1.0
113	-do-	32 31'41.7" N	076 00'13.3" E	(1.7+5.0)/2	1.0
114	-do-	32 31'41.8" N	076 00'13.7" E	(1.8+3.6)/2	1.0
115	-do-	32 31'41.8" N	076 00'14.4" E	(1.2+3.4)/2	1.0
116	-do-	32 31'41.7" N	076 00'14.7" E	(1.2+3.4)/2	1.0
117	-do-	32 31'41.7" N	076 00'15.8" E	(1.3+3.2)/2	1.0
118	-do-	32 31'41.9" N	076 00'16.1" E	(1.4+3.2)/2	1.0
119	-do-	32 31'20.6" N	076 00'19.5" E	(2.5+4.7)/2	1.0
120	-do-	32 31'20.2" N	076 00'19.5" E	(3.2+5.4)/2	1.2
121	Dry Stone Check Wall (DSCW)	32 31'14.3" N	076 00'11.7" E	(2.3+4.7)/2	1.2
122	-do-	32 31'14.6" N	076 00'11.0" E	(2.6+4.0)/2	1.2
123	Dry Stone Check Dam (DSCD)	32 31'14.8" N	076 00'10.8" E	(2.0+4.0)/2	1.2
124	-do-	32 31'14.8" N	076 00'10.5" E	(2.0+3.7)/2	1.2
125	-do-	32 31'14.9" N	076 00'10.4" E	(2.0+3.9)/2	1.0

S. No.	Type of Structure	Longitude and Latitudes		Dimensions (m)	
				Length	Height
126	-do-	32 31'15.0" N	076 00'10.3" E	(1.7+4.2)/2	1.0
127	-do-	32 31'15.0" N	076 00'10.3" E	(2.0+4.0)/2	1.2
128	Dry Stone Check Wall (DSCW)	32 31'15.9" N	076 00'10.6" E	(2.0+3.3)/2	1.2
129	-do-	32 31'15.8" N	076 00'10.4" E	(2.0+3.7)/2	1.2
130	-do-	32 31'16.0" N	076 00'10.4" E	(2.3+3.3)/2	1.2
131	-do-	32 31'16.1" N	076 00'10.4" E	(2.6+3.6)/2	1.2
132	Dry Stone Check Dam (DSCD)	32 31'16.4" N	076 00'10.4" E	(2.3+4.1)/2	1.2
133	-do-	32 31'16.9" N	076 00'09.8" E	(2.0+4.3)/2	1.5
134	-do-	32 31'17.2" N	076 00'09.4" E	(4.0+5.5)/2	1.2
135	-do-	32 31'17.6" N	076 00'09.3" E	(4.2+6.7)/2	1.0
136	-do-	32 31'16.0" N	076 00'09.7" E	(3.3+5.2)/2	1.2
137	Dry Stone Check Wall (DSCW)	32 31'16.0" N	076 00'09.7" E	(2.0+2.7)/2	1.0
138	-do-	32 31'16.0" N	076 00'09.6" E	(2.5+3.8)/2	1.0
139	Dry Stone Check Dam (DSCD)	32 31'15.4" N	076 00'09.5" E	(4.0+4.6)/2	1.0
140	-do-	32 31'15.1" N	076 00'09.7" E	(4.0+6.2)/2	1.2
141	-do-	32 31'14.0" N	076 00'09.3" E	(4.4+6.0)/2	1.0
142	Dry Stone Check Wall (DSCW)	32 31'13.3" N	076 00'09.2" E	(2.3+3.8)/2	1.2
143	-do-	32 31'13.2" N	076 00'09.0" E	(1.0+4.2)/2	1.2
144	-do-	32 31'13.0" N	076 00'09.0" E	(1.4+3.3)/2	1.5
145	-do-	32 31'12.5" N	076 00'08.0" E	(2.0+3.5)/2	1.0
146	-do-	32 31'11.9" N	076 00'08.8" E	(1.5+3.0)/2	1.5

S. No.	Type of Structure	Longitude and Latitudes		Dimensions (m)	
				Length	Height
147	-do-	32 31'11.6" N	076 00'09.1" E	(1.2+2.4)/2	1.2
148	-do-	32 31'11.3" N	076 00'09.1" E	(2.7+3.6)/2	1.2
149	-do-	32 31'11.2" N	076 00'09.2" E	(1.7+2.6/2	1.2
150	-do-	32 31'11.2" N	076 00'09.3" E	(1.3+2.2)/2	1.0
151	-do-	32 31'10.8" N	076 00'08.7" E	(2.0+3.6)/2	1.2
152	-do-	32 31'10.6" N	076 00'08.8" E	(1.5+3.0)/2	1.5
153	-do-	32 31'10.4" N	076 00'08.5" E	(1.1+2.5)/2	1.2
154	-do-	32 31'10.4" N	076 00'08.4" E	(1.0+2.2)/2	1.7
155	-do-	32 31'10.4" N	076 00'09.1" E	(2.2+4.0)/2	1.2
156	-do-	32 31'10.3" N	076 00'09.2" E	(1.1+3.0)/2	1.0
157	-do-	32 31'09.7" N	076 00'09.0" E	(3.2+4.4)/2	1.0
158	-do-	32 31'11.2" N	076 00'05.2" E	(1.4+4.5)/2	1.0
159	-do-	32 31'11.4" N	076 00'05.0" E	(1.1+3.1)/2	1.2
160	-do-	32 31'11.6" N	076 00'04.9" E	(2.0+3.2)/2	1.0
161	-do-	32 31'12.0" N	076 00'04.9" E	(1.4+3.3)/2	1.2
162	-do-	32 31'12.3" N	076 00'04.8" E	(1.5+2.8)/2	1.2
163	-do-	32 31'12.6" N	076 00'04.8" E	(2.1+3.6)/2	1.2
164	-do-	32 31'12.7" N	076 00'03.8" E	(4.0+5.2)/2	1.2
165	-do-	32 31'12.6" N	076 00'04.1" E	(1.3+4.0)/2	1.2
166	Dry Stone Check Dam (DSCD)	32 31'13.7" N	076 00'05.3" E	(2.0+4.4)/2	1.5
167	-do-	32 31'13.9" N	076 00'05.8" E	(3.2+5.0)/2	1.2

S. No.	Type of Structure	Longitude and Latitudes		Dimensions (m)	
				Length	Height
168	Dry Stone Check Wall (DSCW)	32 31'17.4" N	076 00'08.4" E	(3.2+4.0)/2	1.2
169	Dry Stone Check Dam (DSCD)	32 31'18.7" N	076 00'09.0" E	(2.2+4.0)/2	1.2
170	-do-	32 31'19.5" N	076 00'09.4" E	(2.9+6.0)/2	1.2
171	-do-	32 31'19.7" N	076 00'09.4" E	(6.0+7.2)/2	1.2
172	-do-	32 31'21.5" N	076 00'09.5" E	(3.3+6.3)/2	1.5
173	-do-	32 31'22.2" N	076 00'09.1" E	(5.4+6.2)/2	1.0
174	-do-	32 31'23.6" N	076 00'09.4" E	(3.0+4.3)/2	1.0
175	-do-	32 31'26.1" N	076 00'08.9" E	(3.6+6.7)/2	1.2
176	-do-	32 31'26.7" N	076 00'08.7" E	(5.0+6.5)/2	1.2
177	Cement Masonry Check Wall	32 31'08.5" N	076 00'24.9" E	11x (1.3+.7)/2	1.35
178	Desilting of Ponds	32 31'08.4" N	076 00'24.3" E	8.0 x 5.0	1.0
179	-do-	32 31'12.1" N	075 59'58.1" E	9.0 x 5.0	1.0
180	-do-	32 31'18.7" N	075 59'56.9" E	6.0 x 5.0	1.0

Deutsche Gesellschaft für
Internationale Zusammenarbeit (GIZ) GmbH

Matsubara Building, Village Sargheen
(Near HFRI), Shimla - 171013
Himachal Pradesh (India)

For further Information
Principal Chief Conservator of Forest, Forest Department,
Himachal Pradesh, Talland, Shimla- 171001, India