CATCHMENT AREA TREATMENT PLAN

of

PATIKARI HYDRO ELECTRIC PROJECT
(NACHAN FOREST DIVISION)
Mandi District
Himachal Pradesh

September, 2005

Patikari Power Private Limited
2, Rajdoot Marg, Chanakayapuri, New Delhi – 110021
Tel : 011- 51456789, 51456778 E-mail: patikaripower@sify.com

CONTENTS

List of Tables

List of Figures

CHAPTER -1

INTRODUCTION

1.1 Introduction

Proper utilization of natural resources is central to the steady progress of a country like India. Problems of scarcity of resources and associated degradation of environment all common although the country. It is the severity of such problems and the consequences, which vary from one region to the other depending on the physical biological and socio-economical attributes. In view of this variability, resources analysis at local, regional and national level becomes equally important. Himalayan region deserves special attention because of extreme physical constraints for production oriented land users, poor communications strong dependence of hill people on the natural resources and significant influence of the Himalayas on the adjacent Indo-gangetic plans.

Relevant information on quantity of natural resources thus becomes basic to development planning. Amongst a variety on natural resources, soil losses are the first and foremost problems in the Himalayas, which cause siltation problems in the plains and cause reservoir sedimentation. The loss of productive substrata is both due to direct human development action and indirect ecosystem changes. The direct human development action pertains to cultivation and development activities like road construction. The indirect human induced ecosystem changes like change in land use, excessive use of natural resources cause over the limits prescribed are causing erosive forces to erode most of the productive soil from the already depleted system.

1.2 Soil Erosion- Definition, Factors and Types

Erosion may be defined as the detachment and transportation of soil. Mainly water is responsible for this erosion. In many locations winds, glaciers etc., are also the agents causing soil erosion. In the catchment area of a hilly terrain being considered for this project, water erosion mostly prevalent and has been estimated. It is estimated that 53.3% of the total geographical area of the country is subject to various land degradation and erosion problems like saline alkali soil, water logged areas, marshy and gullied land, area under shifting cultivation, desertification etc. Various types of water erosion are as described below.

1.2.1 Splash Erosion

When vegetative cover is stripped away, the soil surfaces are directly exposed to raindrop impact. If the soil is on a slope, gravity will cause the splashed particles to move downhill. When raindrop strike bare soil, the soil aggregates are broken up. Fine particles and organic matter are separated from the heartier soil

particles. This pounding action destroys the soil structure. Splash erosion is closely related to raindrop size, the impact increasing with the size of raindrops.

1.2.2 Sheet Erosion

Sheet erosion is caused by shallow sheets of water flowing over the soil surface. These very shallow moving sheets of water are seldom the detaching agents, but the flow transports soil particles that have been detached by raindrop impact.

1.2.3 Rill Erosion

Rill erosion begins when shallow surface flow starts to concentrate in low spots in the soil surface. The energy of this concentrated flow is able to detach and transport soil particles. This action begins to cut tiny channels into rills. Rills are small but well defined channels that are mostly a few inches deep.

1.2.4 Gully Erosion

Gully information is an advanced stage of rill erosion. It occurs on a bigger scale than rill erosion. The cross sections of gullies frequently assumed a V or a U shape. It usually occurs, either where runoff from a slope increases sufficiently in volume or velocity to cut deep incisions or where runoff from a slope increases sufficiently in volume or velocity to cut deep incisions.

1.2.5 Channel Erosion

Channel erosion occurs when bank vegetation is disturbed or when the volume or velocity of flow in the stream is increased. Common points where erosion occurs are at stream bends and at constrictions. Repair of eroded stream banks is difficult and costly.

1.3 Damages of Soil Erosion

The damages of the soil erosions can be participated into costs on the site where soil erosion is taken place and off the site where sediment depositions take place. Following are the major damages of soil erosion:

- Loss in production potential
- Reduction in infiltration rates
- Reduction in water holding capacity
- Loss of nutrients
- Increase in tillage operation costs
- Reduced transport and storage capacity
- Reduction in water supply
- Depletion of wildlife etc.,

1.4 Catchment Area Treatment (CAT)

Assured water supply and electric power are the prime necessities for increasing farm production to meet the ever growing demand for food, fodder, fiver and many other commodities. As a result multipurpose river valley projects are still being emphasized in the development planning of the country. Such development projects, specifically those targeting magnificent production levels are accompanied by various problems of environmental degradation and may often negate the benefits accruing from the commissioning of such projects. The common environmental problems encountered during execution and operational phases of major hydro electric project include land degradation in the catchment area. Also, reduction in life and efficiency of impounded reservoirs and threat to life and properly in downstream area the serious manifestations of the increased silt load.

Excessive erosion and sedimentation thus cause both environmental and economic impacts. Economic impacts may be more prominent and easier to assess, whereas environmental impacts build slowly for years and may be irreversible.

Eroded soil contains nitrogen, phosphorous and other nutrients which when carried into water body, promote algae growths that reduces water clarity, deplete oxygen, lead to fish kills, and created odors. Erosion removes the smaller and less dense constitutes of top soil, which are required for plant growth. The remaining sub-soil is often hard, rocky, infertile and droughty. Thus, re-establishment of vegetation is difficult and eroded soil produces less growth.

CHAPTER –II

PROJECT DESCRIPTION

2.1 Brief Description of Project

The development of 16 MW Patikari Hydro Electric Project, Mandi District, Himachal Pradesh was entrusted to M/s Patikari Power Private Limited, New Delhi and an Implementation Agreement to this effect was signed by Government of Himachal Pradesh and Patikari Power Private Limited.

The project is a run of the river scheme and envisages utilization of part of Bakhli Khad, a tributary of river Beas and head of available between diversion weir and Power house situated near Gudah Village. The project consists of following components:

- Trench Weir
- Underground Desilting chamber
- Water conductor system
- Penstocks
- Powerhouse

The diversion weir is a Trench type of 2 m wide, 1.5 m deep and 15 m long covered with steel grating below river bed to draw part of water for the Hydro power generation, while river flow is continuous as usual. This is unlike the structures made of masonry or concrete standing above the river bed to obstruct and store the river water for the purpose of irrigation or hydro power. Thus this causes no disturbance to the river features nor stores the water except to draw the water from the run-of-the river. The water thus drawn thru this Trench is made to pass thru Desilting chamber, Aqueduct, 3.8 Km long Tunnel, Surge Tank, 1.5 m dia penstock to drive the turbine housed in the Power House to generate the Hydro Power to the extent of 16 MW.

The water conveyance arrangements are mostly underground in nature. These being a small hydro electric power the dimension n of entire water conveyance system are also small requiring small area of land.

2.2 Project Features

The salient features of the Patikari H.E. Project are outlined in **Table-1**. The location map is shown in **Figure-1**.

Table -1 : Salient features of the Patikari Hydroelectric project

1	**LOCATION**	
	State	Himachal Pradesh
	District	Mandi
	River	Bakhli Khad (a tributary of river Beas)
	Vicinity	Diversion weir at Bakhli Khad below the confluence of Surah Khad and Power house on the left bank of Bakhli Khad near village Gudah
2	**HYDROLOGY**	
	Catchment Area at Diversion site	214 Sq.Kms
	Firm Discharge for 90 % dependability	2.20 cumec
	Firm Discharge for 50 % dependability	5.00 cumec
	Design Discharge at Diversion Weir	5.40 cumec
	Availability corresponding to design discharge of 5.4 cumec	44%
3	**DIVERSION WEIR**	
	Type	Trench Weir
	Length	15.00 m
	Bed Level	EL 1387.13 m
	High Flood Level	EL 1394.40 m
	Bed Slope of Khad	
	U/S of weir axis	1:18.60
	D/S of weir axis	1:133
	Trash rack level	EL 1389.40 m
	De-gravelling Tunnel	
	Length	±100 m
	Type	D-shape
	Size	1.80 m X 1.80 m
	Bed Slope	1:20
4	**DESILTING ARRANGEMENT**	
	Type	Underground
	Size	8.5 m X 8.5 m X 90 m
	Particle size to be removed	0.20 mm and above
	No. of Chambers	One
5	**WATER CONDUCTOR SYSTEM**	
	Feeder Tunnel	
	Type	D- Shape
	Length	± 66 m
	Size	2.0 m X 2.0 m

	Bed Slope	1: 352
	Head Race Tunnel	
	Type	D –Shape
	Length	3.8 Km
	Size	1.8 m X 1.8 m
	Bed Slope	1:247
	Design Discharge	5.4 cumec
	Adit	
	Type	D-Shape
	Length	200 m
	Size	1.8 m X 1.8 m
6	**SURGE TANK**	
	Type	Underground
	Diameter	11 m
	Height	23 m
	Max.Surge	EL 1383.00 m
	Full Supply Level (FSL)	EL 1379.85 m
	Max. Draw Down Level (MDDL)	EL 1374.20 m
7	**POWER HOUSE**	
	Type	Surface
	Size	45.5 m X 21.2 m
	Installed Capacity	16 MW
	Type of Turbine	Pelton (Horizontal axis)
	No. of Units	2 Nos.
	Capacity of units	8 MW
	Gross Head	± 351 m
	Net Head	± 341 m
8	**SWITCH YARD**	
	Type	Surface
	Transformers	2 Nos. 6.6 /33KV
9	**TAIL RACE TUNNEL**	
	Type	Cut & Cover Rectangular
	Nos.	2 Nos.
	Length	± 15 m
	Size	1.5 m X 1.2 m
10	**POWER GENERATION**	
	Generation Capacity	16 MW
	Annual energy generation in 90% dependable year	78.02 GWH

2.3 Diversion Arrangements of Patikari Hydro Electric Project

A general layout of the Patikari Hydro Electric Project is at **Figure-2**. The project envisages a trench weir with no submergence. A small trench covered with steel gratings is made below the riverbed level to draw a part of water into the water conductor system, while the river flow is continuous as usual. The diversion is below the riverbed unlike any masonry or concrete barrier or a weir, standing above the river causing inundation or storage. As such, this type of a trench construction will not cause any inundation or submergence. The schematic diagram of Trench Weir proposed for Patikari Hydro Electric Project is given at **Figure-3**.

2.4 Need for Catchment Area Treatment

It is a general observation that reservoirs formed by Dam on a river for irrigation or Hydro Power or Multi Purpose Project is subjected to siltation or sedimentation in a long run. The storage capacity of the reservoir of late is affected because of siltation or sedimentation thereby reducing the life of reservoir as originally planned. The anticipated benefits from such projects are not derived. The process of sedimentation embodies the sequential processes of erosion, entrainment, transportation, deposition and compaction of sediment. The study of erosion and sediment yield from catchment is of utmost importance as the deposition of sediment in reservoir reduces its capacity, and thus affecting the water availability for the designated use. The eroded sediment from catchment when deposited on streambeds and banks causes braiding of river reach. The removal of top fertile soil from catchment adversely affects the agricultural production.

Soil erosion may be defined as the detachment and transportation of soil. Water is the major agent responsible for this erosion. In many locations, winds, glaciers, etc. also cause soil erosion. Soil erosion leads to:

- loss in production potential
- reduction in infiltration rates
- reduction in water-holding capacity
- loss of nutrients
- increase in tillage operation costs
- reduced transport and storage capacity and
- reduction in water supply

In the catchment area of a hilly area, soil erosion is a common phenomenon and the same has been studied as a part of the Catchment Area Treatment (CAT) Plan. The Catchment Area Treatment (CAT) plan pertains to preparation of a management plan for the treatment of erosion prone areas in the catchment area of a water resources project involving the storage structures. It has been observed from past experience that the life span of a reservoir is greatly reduced

due to erosion in its catchment area. The costs of dredging and disposal of the sediment increases, whereas the storage capacity of the reservoir decreases. Thus, adequate preventive measures are needed for the treatment of catchment area so that the area is stabilized against future erosion, and the project runs up to its design life.

Ministry of Environmental and Forest (MOEF), understanding the importance of restoring the life of storage reservoir has emphasized the need for CAT Plan for River valley project and implementation of the same by the developing agencies while according the necessary clearance.

As explained above, construction of Patikari Hydro Electric Project does not involve storage structures of any kind. It just taps part of river water to divert the flow into the water conductor system by way of small trench weir built below the river bed. As no reservoir is involved, Hence, Patiakri diversion structure is not subjected to any sedimentation and as such technically no Catchment Area Treatment Plan is required. However as Hydro-electric projects with capacity of more than 10 MW are required to prepare a Catchment Area Treatment (CAT) plan, Patikari Hydro Electric Project being 16 MW also required to prepare some CAT Plan. As such it is attempted to prepare a CAT plan to ensure treatment of the catchment area in the vicinity of diversion point as per consultation with the Forest Department.

CHAPTER – III

WATERSHED MANAGEMENT – AVAILABLE TECHNIQUES

3.1 Introduction

Watershed management is the optimal use of soil and water resources within a given geographical area so as to enable sustainable production. It implies changes in land use, vegetative cover, and other structural and non-structural action that are taken in a watershed to achieve specific watershed management objectives. The overall objectives of watershed management programme are to:

- increase infiltration into soil;
- control excessive runoff;
- manage & utilize runoff for useful purpose.

Watershed management is defined as the process of formulating and carrying out a course of action involving manipulation of natural, agricultural and human resources of a watershed to provide resource that are desired by and suitable to the watershed community, but under the condition that soil and water resources are not adversely attached.

The watershed management measures suggested for the CAT Plan are :

- Afforestation
- Silvo-Pastoral
- Check Dams
- Loose stone Masonry

3.2 Afforestation

Afforestation is proposed to be done in barren or degraded areas with moderate slope. If the area under plantation is gullied, and cut up with natural drainage channels, the planting has to be supplemented with engineering/vegetative works like gully plugging and check dam.

The planting area should be closed for grazing, lopping, quarrying, etc. For proper protection, it is necessary that the area is fenced and the fence is maintained properly. It has been generally observed that after some time, these fences get damaged, with the result that plants get grazed and damaged leading to failures. Plants need to be protected till they attain a height which is above grazing level.

Pits to be dug should be 30 cm x 30 cm x 30 cm size. Planting distance should be 2.5 m x 2.5 m. Preference should be given to fuel and fodder species especially when the planting area is in the vicinity of habitation. On exposed

spurs, even Chill tree may also be desirable. Depending upon the locality factors, species suggested for Afforestation are Deodar, Chill, Kali, Ban and other BL (fuel & fodder) species

3.2.1 Selection of species for planting

The species selected for afforestation should eater to the fodder/forage, fuel wood, timber, etc. The species should fit into the geographic conditions, climatic conditions and socio-economic realities. In hilly catchments, where the aim is to get maximum yield of usable water in the stream flow, species with low transpiration rate need to be selected. Species with leaves containing growth inhibiting substance should be avoided. Mixture of species at plantation site ensures natural resistance to insects, pests and fungi. Mixture of species would be able to fulfill fodder, forage, firewood, food and small timber demands of the community.

3.2.2 Selection of nursery site

The nursery site should be established on a slightly sloping fertile land. Growth of saplings in nursery requires continuous and sufficient source of water supply, hence, the nurseries should be located close to the perennial source of water. Natural or artificial fencing is needed for protection from stray cattle and others. If nursery is close to a road then transportation of seedlings to plantation site would be easy.

The following criteria should be kept in mind for selection of site for raising nursery:

- slightly sloping, fertile land;
- proximity to permanent source of water for irrigation;
- natural or artificial fencing;
- shadow trees in proximity;
- proximity to road for transportation, and
- closeness to plantation site.

3.2.3 Size of nursery

It is important to estimate the number of seedlings to be raised in a nursery. The nursery size can be accordingly estimated. The size of polythene container to be used also needs to be taken into account. With 25 x 17 cm polythene bags of 150 gauge, usually 1 ha nursery can support 200,000 seedlings.

3.2.4 Preparation of site

The nursery site needs to be cleaned in preceding winter. The whole nursery can be first ploughed and all stumps, roots, deeper grass roots and stones should be removed. This needs to be done at the end of the monsoons and the land can be

kept fallow till the following season. In very light soil, deep working should not be done. Site which needs draining out in the beginning should not be selected. In hilly areas, such as catchment of the proposed project, Ridge-ditches are preferable. These are partly filled in trenches.

Every species has an optimal spacing, which depends on numerous factors. Wider spacing is recommended for fast growing species. Wider spacing is also recommended when three tiers of vegetation providing fuel, fodder and timber is envisaged.

3.2.5 Soil preparation

The optimal mixture of soil, sand and manure in the nursery soil is 6:3:1 respectively. Use of chemical fertilizers should be as minimum as possible. Cheaper manures like leaf litter, animal dung and wood ash are also easier to obtain and are quite effective. A cheap nursery manure is made by piling alternate layers, 15-20 cm thick of soil, dung and vegetable matter and covered with a layer of soil 20 cm thick left for a year. When mixed with wood ash, this makes excellent manure.

3.2.6 Preparation of seed germination beds

Seed beds are prepared just before sowing. Standard beds are of 1x10 m size, rectangular in shape. Longer side of the bed should normally be towards hottest run or wind. Sapling from one bed in nursery should be sufficient for plantation in 1 ha.

3.2.7 Time of sowing

Seeds of most species where potted plants are used for planting, are sown between January and March, and those where stumps are required, between May and June.

3.2.8 Transportation of seedlings

The modern nursery practices recommend planting the seedlings at site with ball of earth, wrapped around the woodstock. The procedure of transplanting involves transferring of the germinated seedling from primary bed to a container, packed with good mixture of earth. The seedlings establishes well itself in the polythene bag nustured by fertile soil and moisture. At appropriate time, the seedlings are transported to the planting site, where they are planted in the pits keeping the earthen ball undisturbed, after removing the polythene film. Each seedling needs to be carefully separated from its neighbors. If its roots are crushed, or are too long, they are trimmed. The seedling is then placed in the centre of the polybag, already filled with soil and kept moist for some period. The root portion of the soil

is gently placed in the hole and the soil is then lightly heaped around the seedling to cover the vacant spaces in the hole and then watered.

3.2.9 Weeding and soil working

The nursery area should be kept of weeds from the time, the young plants appear till they are finally transplanted. As soon as the beds are full of seedlings, they should be thinned out so as to avoid competition.

3.2.10 Removing the plants from nursery for plantation

The stock is thoroughly watered 24 hours before transport. They are transported with bags, but bags are torn off before planting without disturbing the ball of earth.

3.3 Silvo-Pastoral

The role of pastures in protecting the soil is based on their ability to prolong the hydrologic cycle from its inception as falling precipitation to its final disposal as runoff in streams. The grasses control water erosion through a three-tier action outlined as below:

- Dense thatched roof action of the leaves and stems of grasses exposing innumerable little surfaces aggregating an area several times greater than that of the ground beneath.
- Grass provides resistance to erosion and runoff constituting mechanical resistance by plant clump, stolom or runners and the protective blanket of litter mass of leaves and fragments of stem in various shapes, stages of disintegration, performing double function of increased surface friction, which reduces volume and velocity of runoff and absorbing a part of water for deeper percolation.
- Knitting and binding effect of grass root and rhizome system protect the soil from detachment and washing. Grass holds the soil particles together and provides a mesh of reinforcement that both anchors the soil and resists the scouring action of water flowing over it.

3.3.1 Management of grasslands

The management of grass requires the use of the vegetation so as to preserve it in its highest state of protection and production. The other major objective of management is the harvesting of the products of the land. Grazing by animals, exerts three important influences, i.e. removal of herbage, dissemination of seed and trampling of soil. Under certain conditions, grazing has a stimulating effect on growth, and as a general rule, if the grazed plants are given sufficient opportunity to make substantial regrowth. Balancing numbers of animals with grazing capacity is probably the biggest and the most serious problem of grassland management.

Grazing capacity is defined as the ability of a grassland unit to give adequate support to a constant number of livestock for a stated period each year without deteriorating with respect to this and/or other proper land use. The effects of grazing will depend largely on the degree to which the forage is utilized. The quantity of herbage left after grazing will govern the growth and development of forage plant roots. The rate of root development depends on the availability of carbohydrates manufactured by plant and not needed immediately from top growth. Heavy grazing reduces surplus carbohydrate production. Those carbohydrates which are produced are primarily needed to replace the parts that have been cropped. The management of grasslands, and the balancing of numbers of animals with grazing capacity cannot be based on individual plants alone but on the aggregate all the forage producing vegetation. Greater emphasis should be accorded to those species, which furnish a large part of the forage.

These plants should not be grazed beyond their safe limits even though there appears to be considerable ungrazed herbage remaining. Grazing capacity should not include heavy utilization of the less desirable plants because under such a practice, the more desirable and palatable plants will be overgrazed. Considerable herbage from ungrazed or partially grazed plants, left on the ground is important in maintaining or rebuilding good soil and watershed conditions.

In the beginning, before domestic livestock began using the grasslands, the vegetation is undoubtedly in a high stage of development. But with the beginning of grazing by livestock, the grasslands begin to deteriorate. The first impact is that the most palatable and most desirable plants are overgrazed, their growth becomes stunted, the root reserves are depleted and the roots become shorter and smaller. With continued pressure these desirable plants die leaving some part of the ground surface unoccupied momentarily.

This space is soon invaded by seedlings of less desirable types of plants. As the adverse practices continue, the next most desirable types of plants begin to be overgrazed and trampled and they too are forced to give up their places. At this point, and particularly in areas where the animals tend to concentrate, the cover may become insufficient to hold and erosion begins. As soon as the soil begins to move, the deterioration process becomes more rapid and more difficult to stop and soon the grassland is producing very little forage for livestock and is providing very little protection to the soil surface.

3.4 Check Dams

For control of soil erosion, the erosive velocities are reduced by flattening out the steep uniform gradient of the gully, by constructing a series of checks, which transform the longitudinal gradient into a series of steps with low risers, and long flat treads. Where these types of structures are used, they are intended only to provide necessary protection until the vegetation becomes well-established. Check dams of this type are usually made of brush, wire, poles or loose rock.

Substantial checks of masonry, concrete or earth are built where it is necessary to rely upon these alone for permanent control. Temporary check dams across the bed serve two purposes:

- To collect sufficient soil and water to enable the proper growth of vegetative cover, and
- To check channel erosion until sufficient stabilizing vegetation can be established at that critical point.

Check dams have to be repaired annually, or after every heavy storm. For bigger gullies or rivers, there is a danger that improperly designed or constructed check dams get removed in a big storm. Maintenance is needed regularly.

3.5 Loose Stone Masonry

If loose stones of fairly good size are available in large quantities, they can be used for making loose check dams. These types of structures have longer life and usually do not require any maintenance. These dams are very effective in steep gullies and mountainous regions. They are also useful in ravines where passage for livestock has to be provided for.

The site where the dam will be erected is cleared and the sides sloped to 1:1. The bed of the gully will be excavated to a uniform depth of about 0.3 m and dry stones are packed from that level. In the center of the dam portion, sufficient water-way is allowed to discharge the maximum runoff from the catchment. The stone filling will go up to 0.3 m – 0.6 m into the stable portion of the gully side to prevent end cutting. In the rear, sufficient length and width of apron has to be provided to prevent scour. The thickness of the apron packing will be not less than 0.45 m and the gully sides above the apron have to be protected with stone pitching to a height of at least 0.3 m above the anticipated maximum water level to prevent side scores being formed by the falling water. Care should be taken to place bigger sized stones on top to prevent the pitching being dislodged or carried away by the current. It is common practice to hold down this dry stone fill with wire mesh. The stability is secured by using stones as large as can be procured and careful packing, bedding and wedging.

CHAPTER –IV

CATCHMENT AREA TREATMENT PLAN

With a view to treat the catchment area in the vicinity of the diversion point, all the relevant watershed management plans have been considered and incorporated in the CAT plan for this project.

The following measures were emphasized for finalization of the CAT plan:

The areas to be treated with various treatment measures under different years are given in Table-2.

Table -2 : Areas to be treated with Various Treatment Measures

Treatment Measures	Years							Total
	I	II	III	IV	V	VI	VII	
Afforestation	15	10	10	10	5	5	5	60
Silvo-pastoral	8	6	5	5	2	2	2	30
Natural Regeneration	10	10	10	5	5	5	5	50
Check Dams	6	5	4	4	2	2	2	25
Loose stone masonry	6	4	5	4	2	2	2	25
Water Storage Tank	-	1	-	-	-	-	-	1
Construction of B/Pillars	20	20	15	15	10	10	10	100
Repair of B/ Pillars	40	40	30	30	20	20	20	200

The implementation of the CAT Plan will take 7 years and the maintenance period will be spread over further 7 years.

The CAT plan will be implemented by the Forest Department, Government of Himachal Pradesh. The expenditure for the same is to be borne by the project proponents, i.e. M/s Patikari Power Private Limited. The various area under *Nachan Forest Division* for the Catchment Area Treatment measures being implemented by the Forest Department of Government of Himachal Pradesh are given in Table-3

Table -3 : Details of Area of CAT Plan

Name of Range	Block	Beat	Name of Area	Afforestation	Silvo-Pastoral	Check Dams	Loose Stone Masonry	Natural Regeneration
Seraj	Janjehli	Janjehli	*Gadagalu*	5	3	2	2	0
			Chakaruhan C-II	0	0	0	0	10
			Kandhipres C-II	5	3	2	2	0
		Baila	*Baila C-Ia*	0	0	0	0	10
		Rahkot	*Choparu*	5	3	2	2	0
			KalaKameshwar C-III	0	0	0	0	10
			Bara C-I	5	2	2	2	0
		Thunag	*Sandrot C-IVa*	5	3	2	2	0
			Khamrar C-I	5	2	2	2	0
			Bakhrar	5	2	2	2	0
			Total	*35*	*18*	*14*	*14*	*30*
	Bagsaid	Ghatadhar	*Bharari C-IIb*	5	3	3	2	0
			Shikawari C-I	0	0	0	0	10
			Soor	5	2	2	2	0
			Bainal	5	2	2	2	0
		Raindhar	*Khapori C-I*	5	3	2	3	0
			Jabal Sanjour	5	2	2	2	0
			Raingalu	0	0	0	0	10
			Total	*25*	*12*	*11*	*11*	*20*
			Grand Total	**60**	**30**	**25**	**25**	**50**

CHAPTER –V

COST ESTIMATES

The total cost required for Catchment Area Treatment including Forest and Rural Infrastructure Development is **Rs. 57,13,100/-** Lac. The details are given in Table -4

Table -4 : Cost of Catchment Area Treatment Plan

A	Treatment Measure	Area (Ha)	Unit Rate (Rs)	Cost (Rs)
1	Afforestation	60	21900	13,14,000
2	Silvo-Pastrol	30	9700	2,91,000
3	Natural Regeneration	50	5500	2,75,000
4	Construction of Boundary pillars	100	1500	1,50,000
5	Repair of Boundary pillars	200	250	50,000
	Other Treatments			
6	Check Dams	25	9500	2,37,500
7	Loose Stone Masonry Check Dams	25	8000	2,00,000
8	Water Storage Tank near Majol village	1	80000	80,000
			Total	**25,97,500**
B	**Operation & Maintance for 7 years**			
1	Afforestation as per norms			8,58,000
2	Silvo-Pastoral as per norms			1,05,600
3	Natural Regeneration as per norms			2,85,000
4	Other Treatments (LS)			70,000
			Total	**13,18,600**
C	**Forest Infrastructure Development**			
1	Vehicle to DFO to be provided in kind			5,25,000
2	Fire Management Activities			1,00,000
3	Machinery & Equipment (Computers for Divisional office & Range office in kind)			1,50,000
4	Repair of Bridal path			1,00,000
			Total	**8,75,000**
D	**Rural Infrastructure Development**			
	Provision of computers @ 30,000 per school to be provided			
1	Primary School at Bara			30,000
2	Primary School at Parwara			30,000
3	Primary School at Majol			30,000
			Total	**90,000**
E	**Agricultural Land Development** *(Details are given in Table 11)*			**5,92,000**

F	Contingency	
1	Repair of Rest house at Bijni & Janjeli	1,00,000
2	Maintenance of vehicle as per need to be provided for five year @ Rs.25,000/-per year	1,25,000
3	Maintenance /Repair/Software	15,000
	Total	**2,40,000**
	Grand Total	**57,13,100**

Table -5: Norms of Various Treatment Measures

Year	Afforestation	Pasture Development	Natural Regeneration	Other Treatment
	(Rs/Ha)	(Rs/Ha)	(Rs/Ha)	(LS)
I	3200	1120	1500	10000
II	2800	700	1000	10000
III	2300	380	800	10000
IV	2000	330	600	10000
V	1500	330	600	10000
VI	1250	330	600	10000
VII	1200	330	600	10000

Table -6: Year-wise Financial Budget for O&M

Year	Afforestation	Silvo-Pastrol	Natural Regeneration	Other Treatments
I	0	0	0	0
II	48000	8960	15000	10000
III	74000	12320	25000	10000
IV	94500	12840	33000	10000
V	113000	14020	31500	10000
VI	109500	12260	32500	10000
VII	106750	11810	34500	10000
VIII	107750	12320	37500	10000
IX	75500	8100	27000	-
X	54000	5380	19000	-
XI	36250	3630	12000	-
XII	20000	1980	9000	-
XIII	12500	1320	6000	-
XIV	6250	660	3000	-
Total	**858000**	**105600** ✓	**285000** ✓	**70000** ✓

1318600

Table -7: Year-wise Financial Budget for Various Treatment Measures

Treatment Measures	Years						
	I	II	III	IV	V	VI	VII
Afforestation	328500	219000	219000	219000	109500	109500	109500
Silvo-Pastrol	77600	58200	48500	48500	19400	19400	19400
Natural Regeration	55000	55000	55000	27500	27500	27500	27500
Check Dams	57000	47500	38000	38000	19000	19000	19000
Loose stone Masonry	48000	32000	40000	32000	16000	16000	16000
Water Storage Tank	0	80000	0	0	0	0	0
Construction of B/Pillar	30000	30000	22500	22500	15000	15000	15000
Repair of B/Pillar	10000	10000	7500	7500	5000	5000	5000
Total	**606100**	**531700**	**430500**	**395000**	**211400**	**211400**	**211400**

2597500

Table -8: Year-wise Financial Budget for Forest Infrastructure

Forest Infrastructure Development	I	II	III	IV	V	VI
Vehicle to DFO, Nachan Forest Division	525,000	0	0	0	0	0
Repair of Bridal Path	0	20,000	20,000	20,000	20,000	20,000
Fire Management Activity	0	20,000	20,000	20,000	20,000	20,000
Machinery & Equipment	50,000	50,000	50,000	0	0	0
Total	**575,000**	**90,000**	**90,000**	**40,000**	**40,000**	**40,000**

875000

Table -9: Year-wise Financial Budget for Rural Infrastructure

Provision of Computer	I	II	III	IV	V
Primary school at Bada	30,000	0	0	0	0
Primary school at Parwara	0	30,000	0	0	0
Primary school at Majol	0	0	30,000	0	0
Total	**30,000**	**30,000**	**30,000**	**0**	**0**

90000

Table -10: Year-wise Financial Budget for Contingency

Provision of Contingency	I	II	III	IV	V	VI
Vehicle Maintenance to DFO	0	25000	25000	25000	25000	25000
Repair of Rest House at Bijni Bridal & janjeli (LS)	0	50000	50000	0	0	0
Maintenance/Repair of computers at schools	0	5000	5000	5000	0	0
Total	**0**	**80000**	**80000**	**30000**	**25000**	**25000**

CHAPTER –VI

AGRICULTURAL LAND TREATMENT

With a view to treat the agricultural land in catchment area, the various treatments measures have been incorporated in the CAT Plan for this project. The agricultural land treatment will be implemented by the Agricultural Department, Government of Hibachi Pradesh. The cost of the same will be bourn by the project proponents. The various agricultural treatment measures are given in Table-11.

Table -11 : Strategy Plan for Agricultural Land Treatment

S.No	Component/ Activity	Related Problem	Strategy	Action Required	Estimated Cost
1	*Natural Resources Development*				
a	Arable Land				
	Soil & Moisture conservation activities	Serve soil erosion scarcity of water	Required water during summer and autum seasons to conserve soil and moisture by vegetative means	Farm Pond	Rs. 60,000 (4 nos @ Rs.15000)
				Farm ponds with UV poly sheet (along with vegetative filter strips)	Rs.80,000 (4 nos @ Rs.20000)
b	Non Arable land				
	Run of management structure / construction & development of Bio-mass	Heavy rains during monsoon seasons scarcity of fodder and fuel wood	To avoid soil erosion trenching is required and agro forestry plantation improvement in grasses land	Trenching with vegetative banding and agro forestry plantation improvement in grasses seeding plantation	Rs. 1,92,000 (32 ha & Rs 6000)
c	Drainage Line				
	Upper reaches middle reaches lower reaches	Soil Erosion	To check the soil erosion	Loose boulder structure with vegetative measures	Rs. 64,000 (8 Nos @ Rs. 8000)

CAT Plan of Patikari Hydro Electric Project

				Check dam/spurs with vegetative measures	Rs.76,000 (8 nos @ Rs. 9500)
				Gabbium with vegetative measures	Rs. 1,20,000 (8 nos @ Rs.15000)
				Total	**Rs. 5,92,000**

Table 12 : Year wise financial budget for Agricultural Land Treatment

Panchayat Area	Activity	Physical	Financial	Years							Total
				I	II	III	IV	V	VI	VII	
Janjelhi	Farm ponds with poly-sheets	1 no	20000	0	0	0	20000	0	0	0	20000
	Trenching	4 Ha	24000	0	0	0	0	12000	12000	0	24000
	Loose stone masonry	1 no	8000	8000	0	0	0	0	0	0	8000
	Check dam	1 no	9500	0	0	9500	0	0	0	0	9500
	Gabbium	1 no	15000	0	15000	0	0	0	0	0	15000
			76500	**8000**	**15000**	**9500**	**20000**	**12000**	**12000**	**0**	**76500**
Tungalahar	Farm ponds	1 no	15000	0	15000	0	0	0	0	0	15000
	Trenching	4 Ha	24000	12000	0	0	0	12000	0	0	24000
	Loose stone masonry	1 no	8000	0	0	8000	0	0	0	0	8000
	Check dam	1 no	9500	0	0	0	9500	0	0	0	9500
	Gabbium	1 no	15000	0	0	0	0	0	15000	0	15000
			71500	**12000**	**15000**	**8000**	**9500**	**12000**	**15000**	**0**	**71500**
Thung	Farm ponds with poly-sheet	1 no	20000	0	20000	0	0	0	0	0	20000
	Trenching	4 Ha	24000	12000	0	0	12000	0	0	0	24000

	Loose stone masonry	1 no	8000	0	0	0	0	8000	0	0	8000
	Check dam	1 no	9500	0	0	9500	0	0	0	0	9500
	Gabbium	1 no	15000	0	0	0	0	0	15000	0	15000
			76500	**12000**	**20000**	**9500**	**12000**	**8000**	**15000**	**0**	**76500**
Pakharan	Farm ponds	1 no	15000	0	0	15000	0	0	0	0	15000
	Trenching	4 Ha	24000	12000	0	0	0	12000	0	0	24000
	Loose stone masonry	1 no	8000	0	8000	0	0	0	0	0	8000
	Check dam	1 no	9500	0	0	0	0	0	0	9500	9500
	Gabbium	1 no	15000	0	0	0	0	15000	0	0	15000
			71500	**12000**	**8000**	**15000**	**12000**	**15000**	**0**	**9500**	**71500**
Shikawari	Farm ponds with poly sheet	1 no	20000	0	20000	0	0	0	0	0	20000
	Trenching	4 Ha	24000	12000	0	12000	0	0	0	0	24000
	Loose stone masonry	1 no	8000	0	0	0	8000	0	0	0	8000
	Check dam	1 no	9500	0	0	0	0	0	9500	0	9500
	Gabbium	1 no	15000	0	0	0	0	0	0	15000	15000
			76500	**12000**	**20000**	**12000**	**8000**	**0**	**9500**	**15000**	**76500**
Sunah	Farm ponds	1 no	15000	0	15000	0	0	0	0	0	15000
	Trenching	4 Ha	24000	12000	0	0	12000	0	0	0	24000
	Loose stone	1 no	8000	0	0	8000	0	0	0	0	8000

	masonry										
	Check dam	1 no	9500	0	0	0	0	0	9500	0	9500
	Gabbium	1 no	15000	0	0	0	0	15000	0	0	15000
			71500	**12000**	**15000**	**8000**	**9500**	**12000**	**15000**	**0**	**71500**
Muragh	Farm ponds	1 no	15000	0	15000	0	0	0	0	0	15000
	Trenching	4 Ha	24000	12000	0	0	12000	0	0	0	24000
	Loose stone masonry	1 no	8000	0	0	8000	0	0	0	0	8000
	Check dam	1 no	9500	0	0	0	0	0	9500	0	9500
	Gabbium	1 no	15000	0	0	0	0	0	0	15000	15000
			71500	**12000**	**15000**	**8000**	**12000**	**0**	**9500**	**0**	**71500**
Basaid	Farm ponds with poly-sheet	1 no	20000	0	20000	0	0	0	0	0	20000
	Trenching	4 Ha	24000	12000	0	12000	0	0	0	0	24000
	Loose stone masonry	1 no	8000	0	0	0	8000	0	0	0	8000
	Check dam	1 no	9500	0	0	0	0	9500	0	0	9500
	Gabbium	1 no	15000	0	0	0	0	0	15000	0	15000
			76500	**12000**	**20000**	**12000**	**8000**	**9500**	**15000**	**0**	**76500**
		G. Total	**592000**	**92000**	**128000**	**82000**	**93500**	**71500**	**85500**	**39500**	**592000**

CHAPTER –VII

PLANTATION AND MAINTENANCE SCHEME

The year wise the plantation and maintenance at various area under Nachan Forest Division being implemented by the Forest Department is given under Table 13.

Table13: Plantation & Maintenance at Various area of *'Nachan Forest Division'*

Name of Range	Name of Block	Name of Beat	Name of Area	Afforestation	Silvo-Pastrol	Check Dams	Loose stone Masonry	Natural Regeneration
First year New Plantation								
Seraj	Janjelhi	Janjelhi	Gadagalu	5	3	2	2	0
	Janjelhi	Rahkot	Chopra	5	3	2	2	0
	Bagsaid	Ghatadhar	Soor	5	2	2	2	0
	Janjelhi	Baila	Baila C-Ia	0	0	0	0	10
Total First Year Plantation				15	8	6	6	10
Second year New Plantation								
Seraj	Janjelhi	Janjelhi	Kandipress C-II	5	3	2	2	0
	Bagsaid	Ghatadhar	Bharari C-II b	5	3	3	2	0
	Janjelhi	Janjelhi	Chakruhan C-II	0	0	0	0	10
Total Second Year Plantation				10	6	5	4	10
First Year Maintenance								
Seraj	Janjelhi	Janjelhi	Gadagalu	5	3	2	2	0
	Janjelhi	Rahkot	Chopra	5	3	2	2	0
	Bagsaid	Ghatadhar	Soor	5	2	2	2	0
	Janjelhi	Baila	Baila C-Ia	0	0	0	0	10
Total First Year Maintenance				15	8	6	6	10
Third Year New Plantation								
Seraj	Janjelhi	Rahkot	Bara CI	5	2	2	2	0
	Bagsaid	Raindhar	Kapori CI	5	3	2	3	0
	Bagsaid	Ghatadhar	Shikawari C-I	0	0	0	0	10
Total Third Year Plantation				10	5	4	5	10
Second Year Maintenance								
Seraj	Janjelhi	Janjelhi	Gadagalu	5	3	2	2	0
	Janjelhi	Rahkot	Chopra	5	3	2	2	0
	Bagsaid	Ghatadhar	Soor	5	2	2	2	0
	Janjelhi	Baila	Baila C-Ia	0	0	0	0	10
Total Second Year Maintenance				15	8	6	6	10
First Year Maintenance								
Seraj	Janjelhi	Janjelhi	Kandipres	5	3	2	2	0

			s C-II					
	Bagsaid	Ghatadhar	Bharari C-II b	5	3	3	2	0
	Janjelhi	Janjelhi	Chakruhan C-II	0	0	0	0	10
Total First Year Maintenance				10	6	5	4	10
Fourth Year New Plantation								
Seraj	Janjelhi	Thunag	Sandroot C IV a	5	3	2	2	0
	Bagsaid	Ghatadhar	Bainal	5	2	2	2	0
	Janjelhi	Rahkot	Kalkamesh ar CIII	0	0	0	0	5
Total Fourth Year				10	5	4	4	5
Third Year Maintenance								
Seraj	Janjelhi	Janjelhi	Gadagalu	5	3	2	2	0
	Janjelhi	Rahkot	Choparu	5	3	2	2	0
	Bagsaid	Ghatadhar	Soor	5	2	2	2	0
	Janjelhi	Baila	Baila C Ia	0	0	0	0	10
Total Third Year Maintenance				15	8	6	6	10
Second Year Maintenance								
Seraj	Janjelhi	Janjelhi	Kandhipress CII	5	3	2	2	0
	Bagsaid	Ghatadhar	Bharari CII b	5	3	3	2	0
	Janjelhi	Janjelhi	Chakruhan CII	0	0	0	0	10
Total Second Year Maintenance				10	6	5	4	10
First Year Maintenance								
Seraj	Janjelhi	Rahkot	Bara CI	5	2	2	2	0
	Bagsaid	Raindhar	Kapori CI	5	3	2	3	0
	Bagsaid	Ghatadhar	Shikawari CI	0	0	0	0	10
Total First Year Maintenance				10	5	4	5	10
FIfth Year New Plantation								
Seraj	Janjelhi	Thunag	Khamrar CI	5	2	2	2	0
	Bagsaid	Raindhar	Raingalu	0	0	0	0	5
Total Fifth Year				5	2	2	2	5
Fourth Year Maintenance								
Seraj	Janjelhi	Janjelhi	Gadagalu	5	3	2	2	0
	Janjelhi	Rahkot	Choparu	5	3	2	2	0
	Bagsaid	Ghatadhar	Soor	5	2	2	2	0
	Janjelhi	Baila	Baila CIa	0	0	0	0	10
Total Fourth Year Maintenance				15	8	6	6	10
Third Year Maintenance								
Seraj	Janjelhi	Janjelhi	Kandhipress CII	5	3	2	2	0
	Bagsaid	Ghatadhar	Bharari CII b	5	3	3	2	0

	Janjelhi	Janjelhi	Chakruhan CII	0	0	0	0	10
Total Third Year Maintenance				10	6	5	4	10
Second Year Maintenance								
Seraj	Janjelhi	Rahkot	Bara CI	5	2	2	2	0
	Bagsaid	Raindhar	Kapori CI	5	3	2	3	0
	Bagsaid	Ghatadhar	Shikawari CI	0	0	0	0	10
Total Second Year Maintenance				10	5	4	5	10
First Year Maintenance								
Seraj	Janjelhi	Thunag	Sandroot C IV a	5	3	2	2	0
	Bagsaid	Ghatadhar	Bainal	5	2	2	2	0
	Janjelhi	Rehkot	Kalkameshar CIII	0	0	0	0	5
Total First Year Maintenance				10	5	4	4	5
Sixth Year New Planatation								
Seraj	Janjelhi	Thunag	Bhakharar	5	2	2	2	0
	Bagsaid	Raindhar	Raingalu	0	0	0	0	5
Total Sixth Year				5	2	2	2	5
Fifth Year Maintenance								
Seraj	Janjelhi	Janjelhi	Gadagalu	5	3	2	2	0
	Janjelhi	Rahkot	Choparu	5	3	2	2	0
	Bagsaid	Ghatadhar	Soor	5	2	2	2	0
	Janjelhi	Baila	Baila CIa	0	0	0	0	10
Total Fifth Year Maintenance				15	8	6	6	10
Forth Year Maintenance								
Seraj	Janjelhi	Janjelhi	Kandhipress CII	5	3	2	2	0
	Bagsaid	Ghatadhar	Bharari CII b	5	3	3	2	0
	Janjelhi	Janjelhi	Chakruhan CII	0	0	0	0	10
Total Forth Year Maintenance				10	6	5	4	10
Third Year Maintenance								
Seraj	Janjelhi	Rahkot	Bara CI	5	2	2	2	0
	Bagsaid	Raindhar	Kapori CI	5	3	2	3	0
	Bagsaid	Ghatadhar	Shikawari CI	0	0	0	0	10
Total Third Year Maintenance				10	5	4	5	10
Second Year Maintenance								
Seraj	Janjelhi	Thunag	Sandroot C IV a	5	3	2	2	0
	Bagsaid	Ghatadhar	Bainal	5	2	2	2	0
	Janjelhi	Rehkot	Kalkameshar CIII	0	0	0	0	5
Total Second Year Maintenance				10	5	4	4	5
First Year Maintenance								
Seraj	Janjelhi	Thunag	Bhakharar	5	2	2	2	0

	Bagsaid	Raindhar	Raingalu	0	0	0	0	5
Total First Year Maintenance				5	2	2	2	5
Seventh Year New Plantation								
Seraj	Janjelhi	Raindha	Jabal Sanjour	5	2	2	2	0
	Bagsaid	Rahkot	Kalakameshar CIII	0	0	0	0	5
Total Seventh Year				5	2	2	2	5
Sixth Year Maintenance								
Seraj	Janjelhi	Janjelhi	Gadagalu	5	3	2	2	0
	Janjelhi	Rahkot	Choparu	5	3	2	2	0
	Bagsaid	Ghatadhar	Soor	5	2	2	2	0
	Janjelhi	Baila	Baila Cla	0	0	0	0	10
Total Sixth Year Maintenance				15	8	6	6	10
Fifth Year Maintenance								
Seraj	Janjelhi	Janjelhi	Kandhipress CII	5	3	2	2	0
	Bagsaid	Ghatadhar	Bharari CII b	5	3	3	2	0
	Janjelhi	Janjelhi	Chakruhan CII	0	0	0	0	10
Total Fifth Year Maintenance				10	6	5	4	10
Fourth Year Maintenance								
Seraj	Janjelhi	Rahkot	Bara CI	5	2	2	2	0
	Bagsaid	Raindhar	Kapori CI	5	3	2	3	0
	Bagsaid	Ghatadhar	Shikawari CI	0	0	0	0	10
Total Fourth Year Maintenance				10	5	4	5	10
Third Year Maintenance								
Seraj	Janjelhi	Thunag	Sandroot C IV a	5	3	2	2	0
	Bagsaid	Ghatadhar	Bainal	5	2	2	2	0
	Janjelhi	Rehkot	Kalkameshar CIII	0	0	0	0	5
Total Third Year Maintenance				10	5	4	4	5
Second Year Maintenance								
Seraj	Janjelhi	Thunag	Khamrar CI	5	2	2	2	0
	Bagsaid	Raindhar	Raingalu	0	0	0	0	5
Total Second Year Maintenance				5	2	2	2	5
First Year Maintenance								
Seraj	Janjelhi	Thunag	Bhakhrar	5	2	2	2	0
	Bagsaid	Raindha	Raingalu	0	0	0	0	5
Total First Year Maintenance				5	2	2	2	5
Eight Year New Plantation								
				0	0	0	0	0
First Year Maintenance								
Seraj	Janjelhi	Raindha	Jabal Sanjour	5	2	2	2	0

	Bagsaid	Rahkot	Kalakameshar CIII	0	0	0	0	5
Total First Year Maintenance				5	2	2	2	5
Second Year Maintenance								
Seraj	Janjelhi	Thunag	Bhakharar	5	2	2	2	0
	Bagsaid	Raindhar	Raingalu	0	0	0	0	5
Total Second Year Maintenance				5	2	2	2	5
Third Year Maintenance								
Seraj	Janjelhi	Thunag	Khamrar CI	5	2	2	2	0
	Bagsaid	Raindhar	Raingalu	0	0	0	0	5
Total Third Year Maintenance				5	2	2	2	5
Fourth Year Maintenance								
Seraj	Janjelhi	Thunag	Sandroot C IV a	5	3	2	2	0
	Bagsaid	Ghatadhar	Bainal	5	2	2	2	0
	Janjelhi	Rehkot	Kalkameshar CIII	0	0	0	0	5
Total Fourth Year Maintenance				10	5	4	4	5
Fifth Year Maintenance								
Seraj	Janjelhi	Rahkot	Bara CI	5	2	2	2	0
	Bagsaid	Raindhar	Kapori CI	5	3	2	3	0
	Bagsaid	Ghatadhar	Shikawari CI	0	0	0	0	10
Total Fifth Year Maintenance				10	5	4	5	10
Sixth Year Maintenance								
Seraj	Janjelhi	Janjelhi	Kandhipress CII	5	3	2	2	0
	Bagsaid	Ghatadhar	Bharari CII b	5	3	3	2	0
	Janjelhi	Janjelhi	Chakruhan CII	0	0	0	0	10
Total Sixth Year Maintenance				10	6	5	4	10
Seventh Year Maintenance								
Seraj	Janjelhi	Janjelhi	Gadagalu	5	3	2	2	0
	Janjelhi	Rahkot	Choparu	5	3	2	2	0
	Bagsaid	Ghatadhar	Soor	5	2	2	2	0
	Janjelhi	Baila	Baila Cla	0	0	0	0	10
Total Seventh Year Maintenance				15	8	6	6	10
Ninth Year New Plantation								
				0	0	0	0	0
Second Year Maintenance								
Seraj	Janjelhi	Raindha	Jabal Sanjour	5	2	2	2	0
	Bagsaid	Rahkot	Kalakameshar CIII	0	0	0	0	5
Total Second Year Maintenance				5	2	2	2	5
Third Year Maintenance								
Seraj	Janjelhi	Thunag	Bhakharar	5	2	2	2	0

	Bagsaid	Raindhar	Raingalu	0	0	0	0	5
Total Third Year Maintenance				5	2	2	2	5
Fourth Year Maintenance								
Seraj	Janjelhi	Thunag	Khamrar CI	5	2	2	2	0
	Bagsaid	Raindhar	Raingalu	0	0	0	0	5
Total Fourth Year Maintenance				5	2	2	2	5
Fifth Year Maintenance								
Seraj	Janjelhi	Thunag	Sandroot C IV a	5	3	2	2	0
	Bagsaid	Ghatadhar	Bainal	5	2	2	2	0
	Janjelhi	Rehkot	Kalkamesh ar CIII	0	0	0	0	5
Total Fifth Year Maintenance				10	5	4	4	5
Sixth Year Maintenance								
Seraj	Janjelhi	Rahkot	Bara CI	5	2	2	2	0
	Bagsaid	Raindhar	Kapori CI	5	3	2	3	0
	Bagsaid	Ghatadhar	Shikawari CI	0	0	0	0	10
Total Sixth Year Maintenance				10	5	4	5	10
Seventh Year Maintenance								
Seraj	Janjelhi	Janjelhi	Kandhipress CII	5	3	2	2	0
	Bagsaid	Ghatadhar	Bharari CII b	5	3	3	2	0
	Janjelhi	Janjelhi	Chakruhan CII	0	0	0	0	10
Total Seventh Year Maintenance				10	6	5	4	10
Tenth Year New Plantation								
				0	0	0	0	0
Third Year Maintenance								
Seraj	Janjelhi	Raindha	Jabal Sanjour	5	2	2	2	0
	Bagsaid	Rahkot	Kalakameshar CIII	0	0	0	0	5
Total Third Year Maintenance				5	2	2	2	5
Fourth Year Maintenance								
Seraj	Janjelhi	Thunag	Bhakharar	5	2	2	2	0
	Bagsaid	Raindhar	Raingalu	0	0	0	0	5
Total Fourth Year Maintenance				5	2	2	2	5
Fifth Year Maintenance								
Seraj	Janjelhi	Thunag	Khamrar CI	5	2	2	2	0
	Bagsaid	Raindhar	Raingalu	0	0	0	0	5
Total Fifth Year Maintenance				5	2	2	2	5
Sixth Year Maintenance								
Seraj	Janjelhi	Thunag	Sandroot C IV a	5	3	2	2	0
	Bagsaid	Ghatadhar	Bainal	5	2	2	2	0

	Janjelhi	Rehkot	Kalkamesh ar CIII	0	0	0	0	5
Total Sixth Year Maintenance				10	5	4	4	5
Seventh Year Maintenance								
Seraj	Janjelhi	Rahkot	Bara CI	5	2	2	2	0
	Bagsaid	Raindhar	Kapori CI	5	3	2	3	0
	Bagsaid	Ghatadhar	Shikawari CI	0	0	0	0	10
Total Seventh Year Maintenance				10	5	4	5	10
Eleventh Year New Plantation								
				0	0	0	0	0
Fourth Year Maintenance								
Seraj	Janjelhi	Raindha	Jabal Sanjour	5	2	2	2	0
	Bagsaid	Rahkot	Kalakames har CIII	0	0	0	0	5
Total Fourth Year Maintenance				5	2	2	2	5
Fifth Year Maintenance								
Seraj	Janjelhi	Thunag	Bhakharar	5	2	2	2	0
	Bagsaid	Raindhar	Raingalu	0	0	0	0	5
Total fifth Year Maintenance				5	2	2	2	5
Sixth Year Maintenance								
Seraj	Janjelhi	Thunag	Khamrar CI	5	2	2	2	0
	Bagsaid	Raindhar	Raingalu	0	0	0	0	5
Total Fifth Year Maintenance				5	2	2	2	5
Seventh Year Maintenance								
Seraj	Janjelhi	Thunag	Sandroot C IV a	5	3	2	2	0
	Bagsaid	Ghatadhar	Bainal	5	2	2	2	0
	Janjelhi	Rehkot	Kalkamesh ar CIII	0	0	0	0	5
Total Seventh Year Maintenance				10	5	4	4	5
Tweelth Year New Plantation								
				0	0	0	0	0
Fifth Year Maintenance								
Seraj	Janjelhi	Raindha	Jabal Sanjour	5	2	2	2	0
	Bagsaid	Rahkot	Kalakames har CIII	0	0	0	0	5
Total Fifth Year Maintenance				5	2	2	2	5
Sixth Year Maintenance								
Seraj	Janjelhi	Thunag	Bhakharar	5	2	2	2	0
	Bagsaid	Raindhar	Raingalu	0	0	0	0	5
Total Sixth Year Maintenance				5	2	2	2	5
Seventh Year Maintenance								
Seraj	Janjelhi	Thunag	Khamrar CI	5	2	2	2	0
	Bagsaid	Raindhar	Raingalu	0	0	0	0	5

Total Seventh Year Maintenance				5	2	2	2	5
Thirteenth Year New Plantation								
				0	0	0	0	0
Sixth Year Maintenance								
Seraj	Janjelhi	Raindha	Jabal Sanjour	5	2	2	2	0
	Bagsaid	Rahkot	Kalakameshar CIII	0	0	0	0	5
Total Sixth Year Maintenance				5	2	2	2	5
Seventh Year Maintenance								
Seraj	Janjelhi	Thunag	Bhakharar	5	2	2	2	0
	Bagsaid	Raindhar	Raingalu	0	0	0	0	5
Total Seventh Year Maintenance				5	2	2	2	5
Fourteen Year New Plantation								
				0	0	0	0	0
Seventh Year Maintenance								
Seraj	Janjelhi	Raindha	Jabal Sanjour	5	2	2	2	0
	Bagsaid	Rahkot	Kalakameshar CIII	0	0	0	0	5
Total Seventh Year Maintenance				5	2	2	2	5

CHAPTER –VIII

CONCLUSION

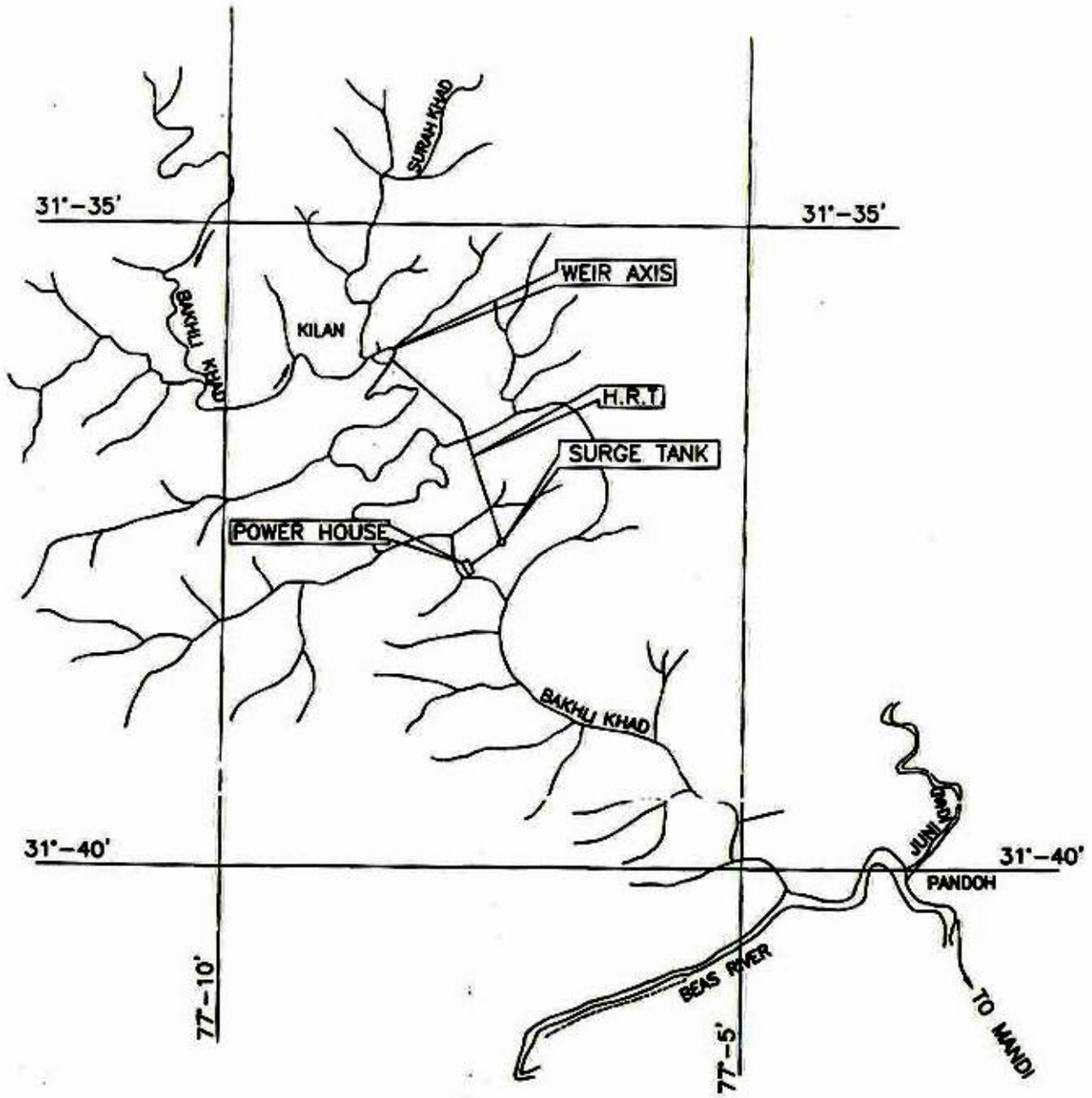
The proposed project envisages a trench weir with no submergence. A trench of 2m wide and 1.5m deep and 15m long covered with steel gratings is made below the river bed level to draw a part of water into the water conductor system, while the river flow is continuous as usual. The diversion is below the river bed unlike any masonry or concrete barrier or a weir, standing above the river causing inundation or storage. As such, this type of a trench construction will not cause any inundation or submergence. Hence it is not subjected to any sedimentation. However, as Hydro-electric projects with capacity of more than 10 MW are required to prepare a Catchment Area Treatment (CAT) plan, Patikari Hydro Electric Project being 16 MW also required to prepare a CAT Plan.

As such it is a CAT plan to ensure treatment of the catchment area in the vicinity of diversion weir was prepared providing for various water shed management plans applicable to the area around the diversion structure costing Rs.57,13,100/- (Rupees Fifty seven lacs Thirteen Thousand and one hundred only).

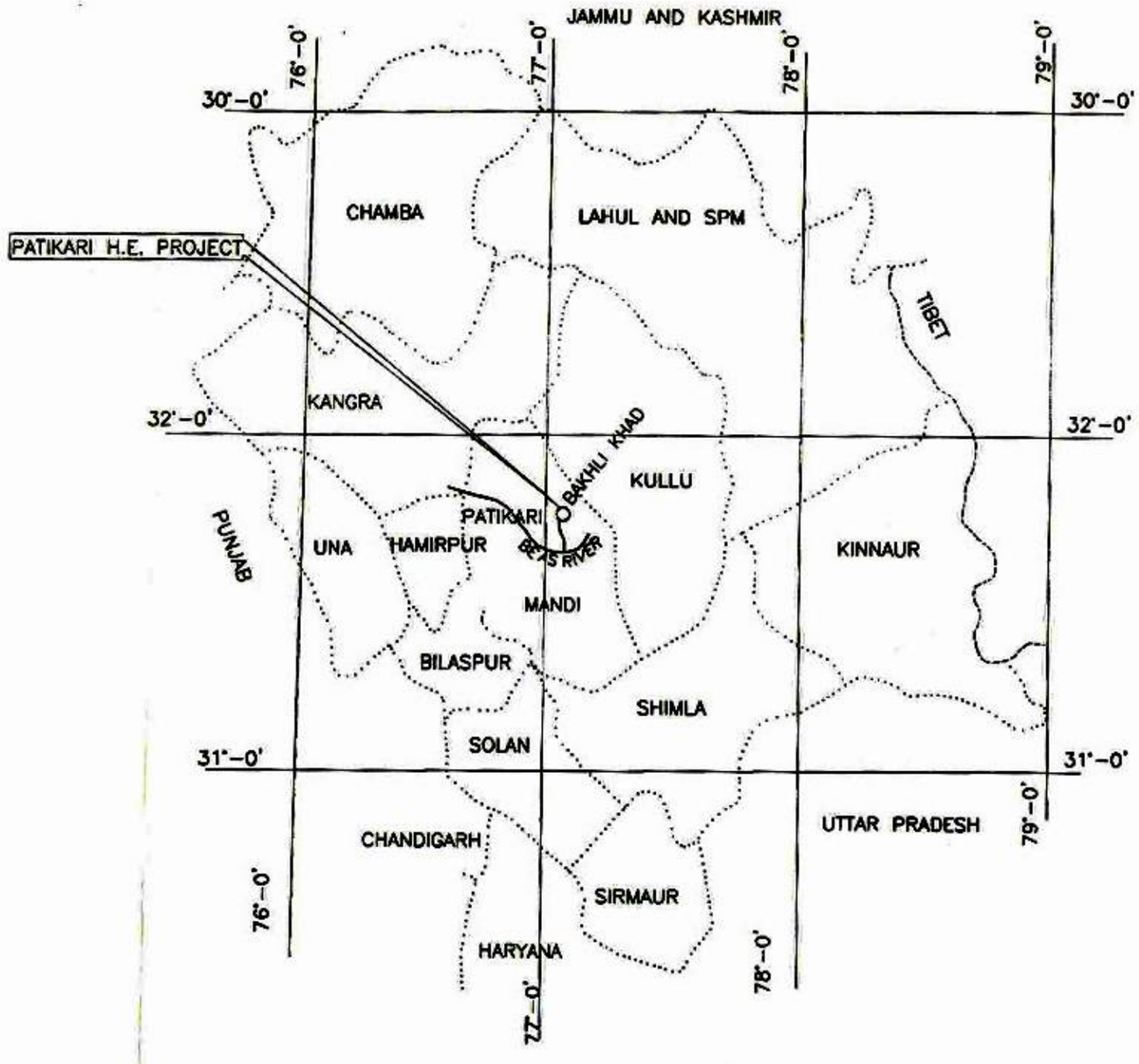
Divisional Forest Office
Nachan Forest Division
MANDI (H.P.)

For PATIKARI POWER PRIVATE LIMITED

Authorised Signatory

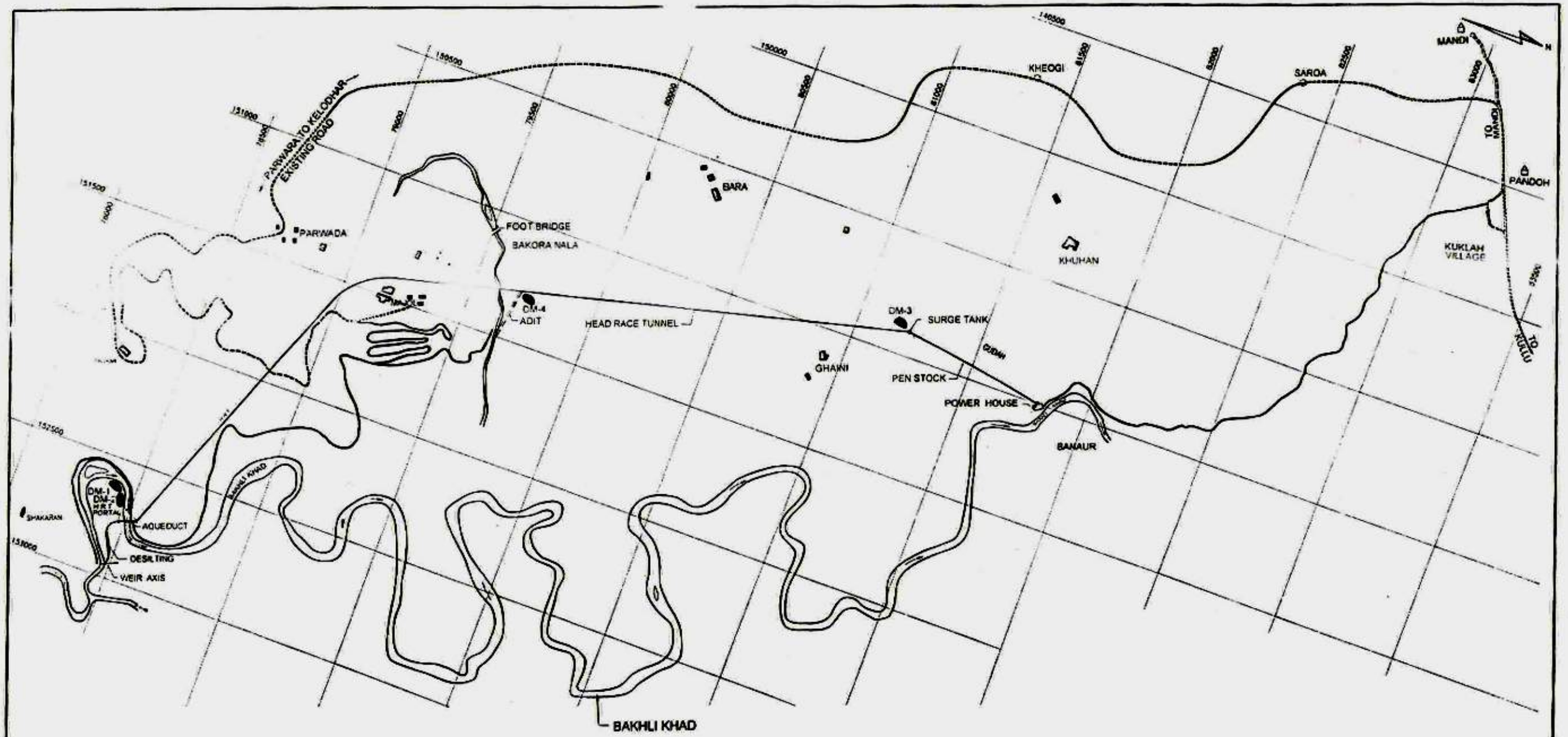


VICINITY PLAN



LOCATION PLAN

PATIKARI POWER PRIVATE LIMITED					
16 MW PATIKARI HYDRO ELECTRIC PROJECT DISTRICT MANDI, HIMACHAL PRADESH					
VICINITY PLAN & LOCATION MAP					
SCALE	DATE			DRAWING NO	R
DRAWN		CHECKED	APPROVED	PPPL-T-01	0



LEGEND :-

PROPOSED ROAD ═══

EXISTING ROAD ==========

DM-1	MUCK DISPOSAL AREA NEAR INLET PORTAL
DM-2	MUCK DISPOSAL AREA NEAR WEIR AXIS
DM-3	MUCK DISPOSAL AREA NEAR SURGE SHAFT
DM-4	MUCK DISPOSAL AREA NEAR ADIT

PATIKARI POWER PRIVATE LIMITED

16 MW PATIKARI HYDRO ELECTRIC PROJECT

DISTRICT MANDI, HIMACHAL PRADESH

GENERAL LAYOUT OF PROJECT & MUCK DISPOSAL AREA

SCALE / DATE			DRAWING NO	R
DRAWN	CHECKED	APPROVED	PPPL-T-02	0

FIGURE-3 : SCHEMATIC DIAGRAM OF TRENCH WEIR