Catchment Area Treatment Plan

of

Shahpurkandi Dam Project

Shahpurkandi Dam Project

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1. INTRODUCTION

Shahpurkandi Dam Project comprising of 55.5m high concrete dam with overflow section of 418 m long and non over flow sections of 158.314 m on left bank and 142.780 m on right bank , 2 number Head Regulators one for Shahpurkandi hydel channel (PB) & other for Ravi canal (J&K), 7.70 Km. long Shahpurkandi Hydel Channel and 2 Number Power Houses having installed capacity of 206 MW is being constructed on River Ravi at a distance of 11 Km. D/S of Ranjit Sagar Dam Project and 8 Km. U/S of Madhopur Head Works to Harness the diurnal water releases to the UBDC system off taking from Madhopur Head Works and Ravi Canal (J&K) which will off take from U/S of the SPK Main Dam on its R/S and to ensure optimum power generation from RSD Project during peaking hours. The expeditious completion of Shahpurkandi dam is of utmost importance for optimum utilization of Ravi water for power generation and irrigation. Shahpurkandi Dam will act as balancing reservoir for working of Ranjit Sagar Power Plant as a peaking station.

With Completion of this project, increased and intensive irrigation benefits will get a boost in 1.18 lacs hectares in existing UBDC system and in 5000 hectare new command area in Punjab & 32173 hectares in J&K state will come under irrigation Command.

2 .NEED FOR CATCHMENT AREA TREATMENT

It is a well-established fact that reservoirs formed by dams and barrages on rivers are subjected to sedimentation. 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 catchments 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. Thus, a well-designed Catchment Area Treatment (CAT) Plan is essential to ameliorate the above-mentioned adverse process of soil erosion .

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. In a hilly catchment area, as in the present case erosion due to water 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 highlights the management techniques to control erosion in the catchment area. Life span of a reservoir in case of a seasonal storage dams and barrages is greatly reduced due to erosion in the catchment area. The catchment area intercepted at the diversion structure of Shahpurkandi Dam Project.Figure 1 shows a map showing sub watershed (ARELI- MATTI- DOONG B3b) Shahpurkandi Dam Catchement. The catchment area treatment involves

☐ Understanding of the erosion characteristics of the terrain and,

☐ Suggesting remedial measures to reduce the erosion rate.

In the present study `**Silt Yield Index**' (SYI), method has been used. In this method, the terrain is subdivided into various watersheds and the

erodibility is determined on relative basis. SYI provides a comparative erodibility criteria of catchment (low, moderate, high, etc.) and do not provide the absolute silt yield. SYI method is widely used mainly because of the fact that it is easy to use and has lesser data requirement. Moreover, it can be applied to larger areas like sub-watersheds, etc.

FIGURE 1:MAP SHOWING SUB WATERSHED (ARELI- MATTI-DOONG B3b) SHAHPURKANDI DAM CATCHMENT

3. APPROACH FOR THE STUDY

A detailed database on natural resources, terrain conditions, soil type of the catchment area, socio-economic status, etc. is a pre-requisite to prepare treatment plan keeping in view the concept of sustainable development. Various thematic maps have been used in preparation of the CAT plan. Due to the spatial variability of site parameters such as soils, topography, land use and rainfall, not all areas contribute equally to the erosion problem. Several techniques like manual overlay of spatially in-

dex-mapped data have been used to estimate soil erosion in complex landscapes.

Geographic Information System (GIS) is a computerized resource data base system, which is referenced to some geographic coordinate system. In the present study, real coordinate system has been used. The GIS is a tool to store, analyze and display various spatial data. In addition, GIS because of its special hardware and software characteristics, has a capacity to perform numerous functions and operations on the various spatial data layers residing in the database. GIS provides the capability to analyze large amounts of data in relation to a set of established criteria.In order to ensure that latest and accurate data is used for the analysis, satellite data has been used for deriving land use data and ground truth studies too have been conducted. The various steps covered in the study are as follows:

☐ Data acquisition

☐ Data preparation

☐ Output presentation

The above mentioned steps are briefly described in the following paragraphs.

3.1 DATA AQUISITION

The requirement of the study was first defined and the outputs expected were noted. The various data layers of the catchment area used for the study are as follows:

☐ Slope Map

☐ Soil Map

☐ Land use Classification Map

☐ Current ManagementPractices

☐ Catchment Area Map.

3.2 DATA PREPARATION

The data available from various sources was collected. The ground maps, contour information, etc. were scanned, digitized and registered as per the requirement. Data was prepared depending on the level of accuracy required and any corrections required were made. All the layers were geo-referenced and brought to a common scale (real coordinates), so that overlay could be performed. A computer programme was used to estimate the soil loss. The formats of outputs from each layer were firmed up to match the formats of inputs in the program. The grid size to be used was also decided to match the level of accuracy required, the data availability and the software and time limitations. The format of output was finalized. Ground truthing and data collection was also included in the procedure. For the present study Resourcesat-2 LISS III digital satellite data was used for interpretation & classification. The classified land use map of the catchment area considered for the study is shown as Figure-2. The land use pattern of the catchment is summarized in Table-1.

Table 1: Land use pattern of the catchment area:-

Category	Area (ha)	Percentage
Dense Vegetation	1844	50.13
Barren/Open Land	214	5.81
Agricultural Land	1216	33.06
River/ Water body	206	5.60
Settlements	198	5.40
Total	**3678**	**100.00**

FIGURE 2: **CLASSIFIED IMAGERY OF THE CATCHMENT AREA FOR SHAHPURKANDI DAM**

Digitized contours from toposheets were used for preparation of Digital Elevation Model (DEM) of the catchment area and to prepare a slope map. The first step in generation of slope map is to create surface using the elevation values stored in the form of contours or points. After marking the catchment area, all the contours on the top sheet were digitized (100 m interval). The output of the digitization procedure was the contours as well as points contours in form of x, y & z points. (x, y location and their elevation). All this information was in real world coordinates (latitude, longitude and height in meters above sea level). A Digital Terrain Model (DTM) of the area was then prepared, which was used to derive a slope map. The slope was divided in classes of slope percentages. The slope map is enclosed as Figure-3
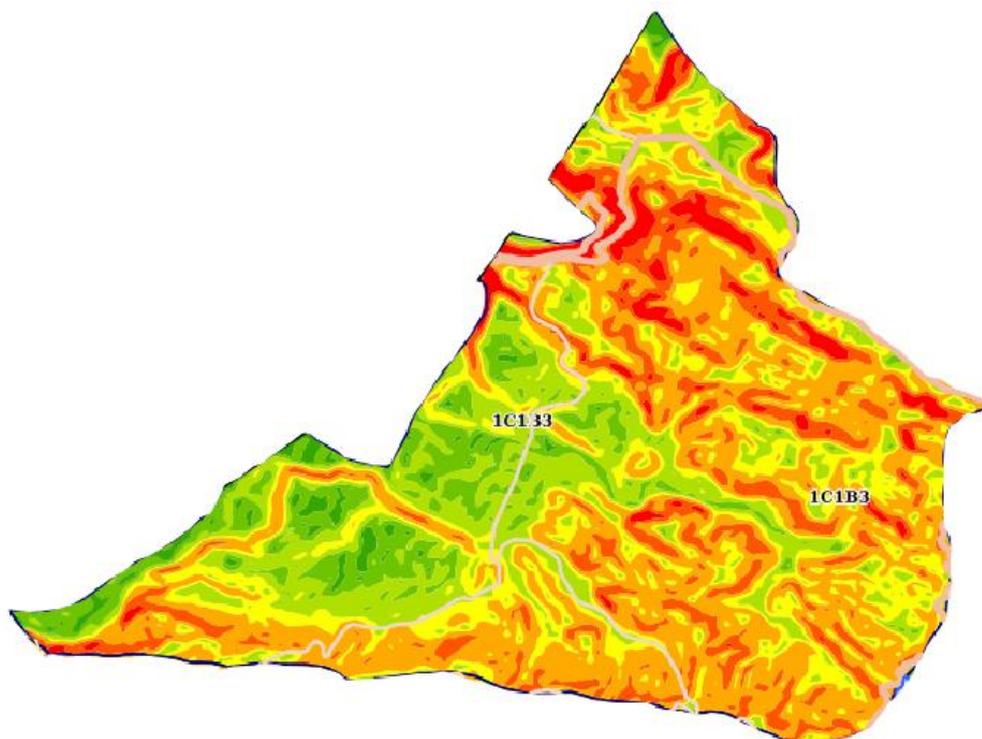
FIGURE 3: SLOPE MAP OF CATCHMENT AREA FOR SHAHPUR-KANDI CATCHMENT

Various layers thus prepared were used for Modeling. Software was prepared to calculate the soil loss using input from all the layers.

3.3 OUTPUT PRESENTATION

The result of the modeling was interpreted in pictorial form to identify the areas with high soil erosion rates. The primary and secondary data collected as a part of the field studies were used as an input for the model.

4. ESTIMATION OF SOIL LOSS USING SILT YIELD INDEX (SYI) METHOD

The Silt Yield Index Model (SYI), considering sedimentation as product of erosivity, erodibility and arial extent was conceptualized in the All India Soil and Land Use Survey (AISLUS) as early as 1969 and has been in operational use since then to meet the requirements of prioritization of smaller hydrologic units.The erosivity determinants are the climatic factors and soil and land attributes that have direct or reciprocal bearing on

the unit of the detached soil material. The relationship can be expressed as:

Soil erosivity = f (Climate, physiography, slope, soil parameters, land use/land cover, soil management)

Silt Yield Index:-The Silt Yield Index (SYI) is defined as the Yield per unit area and SYI value for hydrologic unit is obtained by taking the weighted arithmetic mean over the entire area of the hydrologic unit by using suitable empirical equation

Prioritization of Watersheds/Subwatersheds: The prioritization of smaller hydrologic units within the vast catchments are based on the Silt Yield Indices (SYI) of the smaller units. The boundary values or range of SYI values for different priority categories are arrived at by studying the frequency distribution of SYI values and locating the suitable breaking points. The watersheds/ sub-watersheds are subsequently rated into various categories corresponding to their respective SYI values.

The application of SYI model for prioritization of sub watersheds in the catchment areas involves the evaluation of:

a) Climatic factors comprising total precipitation, its frequency and intensity,

b) Geomorphic factors comprising land forms, physiography, slope and drainage characteristics,

c) Surface cover factors governing the flow hydraulics and

d) Management factors

The data on climatic factors can be obtained for different locations in the catchment area from the meteorological stations whereas the field investigations are required for estimating the other attributes.

The various steps involved in the application of model are:

- Preparation of a framework of sub-watersheds through systematic delineation

- Rapid reconnaissance surveys on 1:50,000 scale leading to the generation of a map indicating erosion-intensity mapping units.

- Assignment of weight age values to various mapping units based on relative silt-yield potential.

 - Computing Silt Yield Index for individual watersheds/sub watersheds.

 - Grading of watersheds/sub watersheds into very high, high medium, low and very low priority categories.

The area of each of the mapping units is computed and silt yield indices of individual sub watersheds are calculated using the following equations:

Silt Yield Index

$$SYI = \frac{\Sigma \, (A_i \times W_i) \times 100}{A_w} \; ; \text{ where } i = 1 \text{ to } n$$

Where

   A_i = Area of ith unit (EIMU)
   W_i = Weightage value of ith mapping unit
   n = No. of mapping units
   A_w = Total area of sub-watershed.

Process involved in calculation of silt yield index of mini watersheds and their prioritisation

The total catchment area of the watershed is 3678 ha and as per All India Land Use Survey classification it is designated as ICIB4 J as shown below .
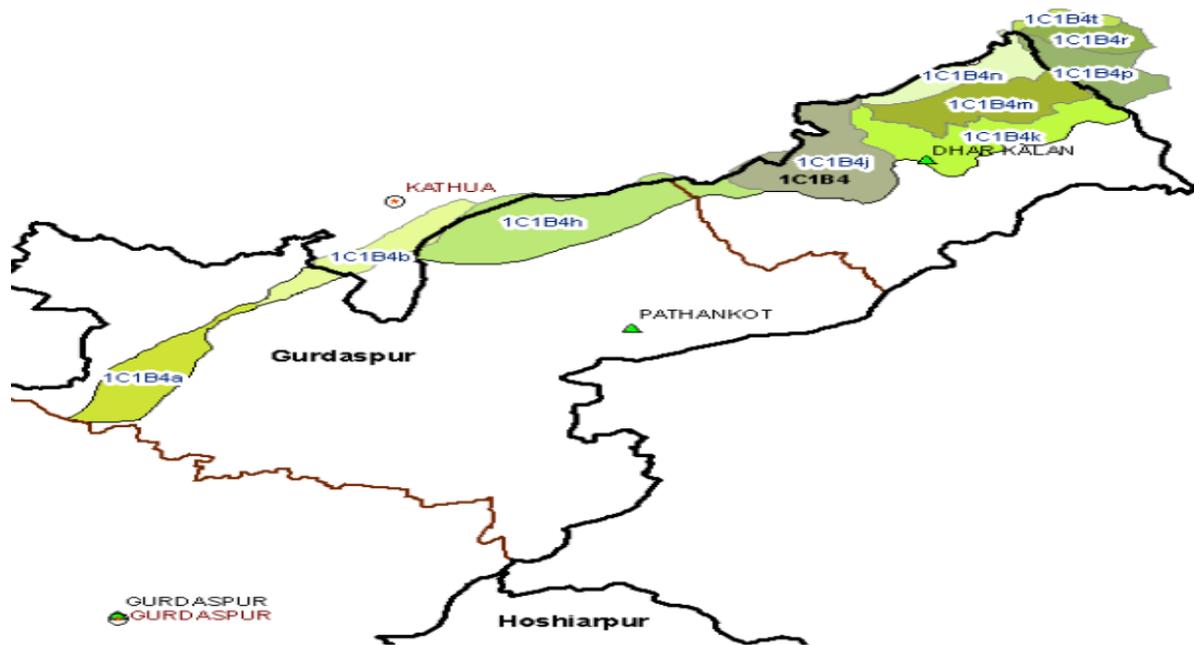
This unit is further divided into nine mini-watershed named from J1 to J9 as shown below.
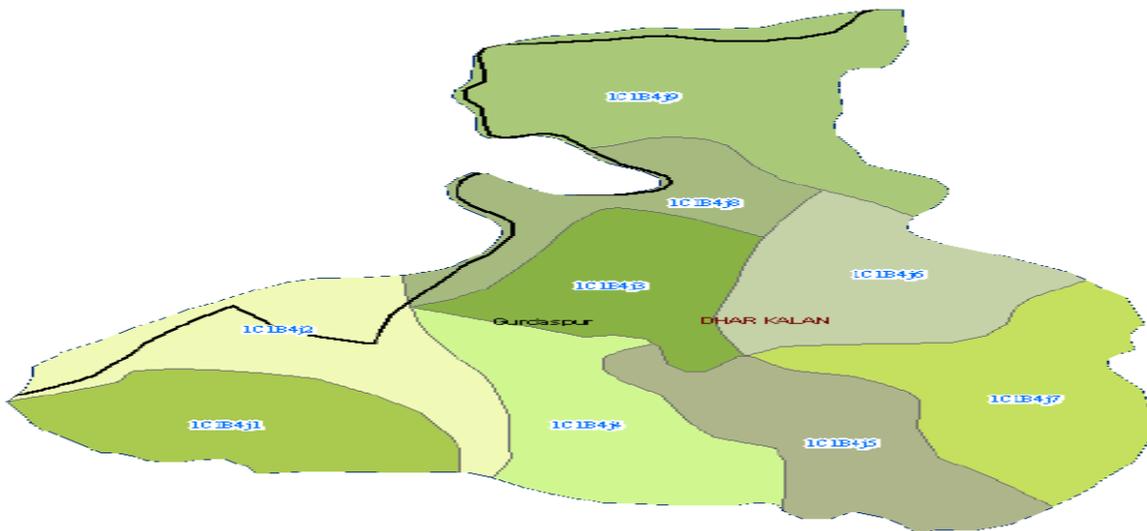
.The same map was also taken from google to understand the land features as shown below.

Map of Shahpur Kandi Micro- Watershed

Geographical Map of Shahpur Kandi Micro-Watershed

From the geo-referenced map, the area under different land uses was calculated plannimetrically (table).

Table: Area under different land uses (ha)

S. No	Mini- Watershed Code	Area under different land uses (ha)					To-tal
		Moder-ately Densed Forest	De-graded Scrub Forest	Agri.	Road/ Settle-ment	River on Pun-jab Side	
1	1C1B4J1	184	15	370	48	43	**660**
2	1C1B4J2	4	23	270	32	57	**386**
3	1C1B4J3	104	10	171	48	0	**333**
4	1C1B4J4	68	5	339	12	24	**448**
5	1C1B4J5	392	43	13	10	0	**458**
6	1C1B4J6	390	30	0	11	0	**431**
7	1C1B4J7	503	35	11	5	0	**554**
8	1C1B4J8	158	32	10	6	71	**277**
9	1C1B4J9	41	21	32	26	11	**131**
		1844	**214**	**1216**	**198**	**206**	**3678**

Seven parameters were identified to work out the silt yield index and weighted values namely, overland slope, land use, soil type, drainage density, erosion intensity, presence of landslides and intensity of soil conservation measures already adopted. The weighted values ranged from 10 to 20 are worked for each parameter and SYI is found following a standard equation.

Weighted values ranged from 10 to 20 of seven parameters having potential for silt load generation

% Slope	Weighted Value	Land Use	Weighted Value	Soil Type	Weighted Value
<2	10.5	Moderately Dense Forest	14	Sandy	10
2-7	11	Degraded Scrub Forest	18	Sandy Loam	12
7-15	12	Agriculture	11	Loam	14
15-30	14	Settlement/Road	12	Silty Clay	16
30-45	16	River/ water bodies		Silty Clay Loam	18
45-60	18				
>60	20				

Drainage Density (Km/Km^2)	Weighted Value	Erosion Intensity (Ton/ha)	Weighted Value	Land Slides (No./Km^2)	Weighted Value	Intensity of Works	Weighted Value
0-1	11	<1	11	0-2	11	Very Good	11
1-3	12	1-5	12	2-4	12	Good	12
3-5	14	5-10	14	4-6	14	Moderate	14
5-7	16	10-20	16	6-8	16	Slight	16
7-10	18	20-40	18	>8	18		
		40-80	18				
		>80	22				

10 means soil detached= soil arrested in transit and not reached the reservoir. Higher the value means higher the transport of detached silt to the water body.

DELIVERY RATIO – Distance from the watershed to the nearest drainage point (km)

0-0.9	1.00
1-2	0.95
2-5	0.90
5-15	0.80
15-30	0.70

Calculation of Silt Yield Index of Mini-Watersheds

Geographical area = 660ha Code = 1C1B4J1

S. No	Parameters	Description of Mini-WS		Area (ha)	Weighted Value	Calculation	Value	Index Unit
1	Slope	MD Forest	51%	184	18	184 x 18	3312	8547.5 / 660
		DS	15-30%	15	14	15 x 14	210	
		Agri.	3-5%	370	11	370 x 11	4070	
		Settl/Roads	<2%	91	10.5	91 x 10.5	955.5	
		River						
		TOTAL		**660**			**8547.5**	12.95
2	Land Use	MD Forest		184	14	184 x 14	2576	8008 / 660
		DS		15	18	15 x 18	270	
		Agri.		370	11	370 x 11	4070	
		Settl/Roads		91	12	91 x 12	1092	
		River						
		TOTAL		**660**			**8008**	12.13
3	Soil Type	MD Forest	Silty Clay	184	16	184 x 16	2944	9456 / 660
		DS	Silty Clay	15	16	15 x 16	240	
		Agri.	Loam	370	14	370 x 14	5180	
		Settl/Roads	Sandy Loam	91	12	91 x 12	1092	
		River	Sandy Loam					
		TOTAL		**660**			**9456**	14.33
4	Drainage Density	MD Forest	3-5km/km^2	184	14	184 x 14	2576	8227 / 660
		DS	3-5km/km^2	15	14	15 x 14	210	
		Agri.	1-3km/km^2	370	12	370 x 12	4440	
		Settl/Roads	0-1km/km^2	91	11	91 x 11	1001	
		River						
		TOTAL		**660**			**8227**	12.47
5	Erosion Intensity	MD Forest	40-80 t/ha	184	18	184 x 18	3312	10968 / 660

		DS	40-80 t/ha	15	20	15 x 20	300	
		Agri.	10-20 t/ha	370	16	370 x 16	5920	
		Settl/Roads	1-5 t/ha	48	12	48 x 12	576	
		River		43	20	43 x 20	860	
		TOTAL		**660**			**10968**	16.62
6	Land slide	MD Forest	4-6/km^2	184	14	184 x 14	2576	7887 / 660
		DS	6-8/km^2	15	16	15 x 16	240	
		Agri.	0-2/km^2	370	11	370 x 11	4070	
		Settl/Roads	0-2/km^2	48	11	48 x 11	528	
		River	0-2/km^2	43	11	43 x 11	473	
		TOTAL		**660**			**7887**	11.95
7	Intensity of Soil Cons. Works	MD Forest	Mod	184	14	184 x 14	2576	8394 / 660
		DS	Mod	15	14	15 x 14	210	
		Agri.	Good	370	12	370 x 12	4440	
		Settl/Roads	-	48	10	48 x 10	480	
		River	Slight	43	16	43 x 16	688	
		TOTAL		**660**			**8394**	12.72

Calculation of Silt Yield Index of Mini-Watersheds
Geographical area = 386ha Code = 1C1B4J2

S. No	Parameters	Description of Mini-WS		Area (ha)	Index Value	Calculation	Value	Index Unit
1	Slope	MD Forest	2-7%	4	11	4 x 11	44	4089.5 / 386
		DS	7-15%	23	12	23 x 12	276	
		Agri.	<2%	270	10.50	270 x 10.50	2835	
		Settl/Roads	<2%	32	10.50	32 x 10.50	336	
		River	<2%	57	10.50	57 x 10.50	598.5	
		TOTAL		**386**			**4089.5**	10.59
2	Land Use	MD Forest		4	14	4 x 14	56	4430 / 386
		DS		23	16	23 x 16	368	
		Agri.		270	11	270 x 11	2970	
		Settl/Roads		32	11	32 x 11	352	
		River		57	12	57 x 12	684	
		TOTAL		**386**			**4430**	11.48
3	Soil Type	MD Forest	Sandy Loam	4	12	4 x 12	48	4518 / 386

		DS	Sandy Loam	23	12	23 x 12	276	
		Agri.	Sandy Loam	270	12	270 x 12	3240	
		Settl/Roads	Sandy Loam	32	12	32 x 12	384	
		River	Sandy Loam	57	10	57 x 10	570	
		TOTAL		**386**			**4518**	11.70
4	Drainage Density	MD Forest	3-5 km/km^2	4	14	4 x 14	56	
		DS	3-5 km/km^2	23	14	23 x 14	322	
		Agri.	0-1 km/km^2	270	11	270 x 11	2970	4384 / 386
		Settl/Roads	0-1 km/km^2	32	11	32 x 11	352	
		River	1-3 km/km^2	57	12	57 x 12	684	
		TOTAL		**386**			**4384**	11.36
5	Erosion In-tensity	MD Forest	1-5 t/ha	4	12	4 x 12	48	
		DS	1-5 t/ha	23	12	23 x 12	276	4330 / 386
		Agri.	<1 t/ha	270	11	270 x 11	2970	
		Settl/Roads	<1 t/ha	32	11	32 x 11	352	
		River	1-5 t/ha	57	12	57 x 12	684	
		TOTAL		**386**			**4330**	11.22
6	Land slide	MD Forest	0-2	4	11	4 x 11	44	
		DS	0-2	23	11	23 x 11	253	4246 / 386
		Agri.	0-2	270	11	270 x 11	2970	
		Settl/Roads	0-2	32	11	32 x 11	352	
		River	2-4	57	11	57 x 11	627	
		TOTAL		**386**			**4246**	11.00
7	Intensity of Soil Cons. Works	MD Forest	Mod	4	14	4 x 14	56	
		DS	Mod	23	14	23 x 14	322	4768 / 386
		Agri.	Good	270	12	270 x 12	3240	
		Settl/Roads	V Good	32	11	32 x 11	352	
		River	Mod	57	14	57 x 14	798	
		TOTAL		**386**			**4768**	12.35

Calculation of Silt Yield Index of Mini-Watersheds
Geographical area = 333ha Code No. 1C1B4J3

S. No	Parameters	Description of Mini-WS		Area (ha)	Index Value	Calculation	Value	Index Unit
1	Slope	MD Forest	7-15%	104	12	104 x 12	1248	
		DS	7-15%	10	12	10 x12	120	
		Agri.	2-7%	171	11	171 x11	1881	3777 / 333
		Settl/Roads	2-7%	48	11	48 x11	528	
		River		0				
		TOTAL		**333**			**3777**	
2	Land Use	MD Forest		104	14	104 x 14	1454	
		DS		10	14	10 x 14	140	
		Agri.		171	11	171 x11	1881	4005 / 333
		Settl/Roads		48	11	48 x 11	528	
		River		0				
		TOTAL		**333**			**4005**	
3	Soil Type	MD Forest	Loam	104	14	104 x 14	1456	
		DS	Loam	10	14	10 x 14	140	
		Agri.	Sandy Loam	171	12	171 x 12	2052	4224 / 333
		Settl/Roads	Sandy Loam	48	12	48 x 12	576	
		River		0				
		TOTAL		**333**			**4224**	
4	Drainage Density	MD Forest	3-5	104	14	104 x 14	1456	
		DS	3-5	10	14	10 x 14	140	4179 / 333
		Agri.	1-3	171	12	171 x 12	2052	
		Settl/Roads	0-1	48	11	48 x 11	528	
		River		0				
		TOTAL		**333**			**4179**	
5	Erosion Intensity	MD Forest	10-20 t/ha	104	16	104 x 16	1664	
		DS	10-20 t/ha	10	16	10 x 16	160	4404 / 333
		Agri.	1-5 t/ha	171	12	171 x 12	2052	
		Settl/Roads	<1 t/ha	48	11	48 x 11	528	
		River		0				
		TOTAL		**333**			**4404**	
6	Land slide	MD Forest	2-4/km^2	104	12	104 x 12	1248	3777
		DS	2-4/km^2	10	12	10 x 12	120	/ 333

S. No	Parameters	Description of Mini-WS		Area (ha)	Index Value	Calculation	Value	Index Unit
		Agri.	0-2/km²	171	11	171 x 11	1881	
		Settl/Roads	0-2/km²	48	11	48 x 11	528	
		River		0				
		TOTAL		**333**			**3777**	
7	Intensity of Soil Cons. Works	MD Forest	Mod	104	14	104 x 14	1456	4224 / 333
		DS	Mod	10	14	10 x 14	140	
		Agri.	Good	171	12	171 x 12	2052	
		Settl/Roads	Good	48	12	48 x 12	576	
		River		0				
		TOTAL		**333**			**4224**	

Calculation of Silt Yield Index of Mini-Watersheds
Geographical area = 448ha Code No. 1C1B4J4

S. No	Parameters	Description of Mini-WS		Area (ha)	Index Value	Calculation	Value	Index Unit
1	Slope	MD Forest	15-30%	68	14	68 x 14	952	5147 / 448
		DS	15-30%	5	14	5 x 14	70	
		Agri.	2-7%	339	11	339 x 11	3729	
		Settl/Roads	2-7%	12	11	12 x 11	132	
		River	2-7%	24	11	24 x 11	264	
		TOTAL		**448**			**5147**	11.49
2	Land Use	MD Forest		68	14	68 x 14	952	5147 / 448
		DS		5	14	5 x 14	70	
		Agri.		339	11	339 x 11	3729	
		Settl/Roads		12	11	12 x 11	132	
		River		24	11	24 x 11	264	
		TOTAL		**448**			**5147**	11.49
3	Soil Type	MD Forest	Sandy Loam	68	12	68 x 12	816	5328 / 448
		DS	Sandy Loam	5	12	5 x 12	60	
		Agri.	Sandy Loam	339	12	339 x 12	4068	
		Settl/Roads	Sandy Loam	12	12	12 x 12	144	
		River	Sandy	24	10	24 x 10	240	
		TOTAL		**448**			**5328**	11.89
4	Drainage Density	MD Forest	1-3 Km/km²	68	12	68 x 12	816	5025 / 448

		DS	1-3 Km/km^2	5	12	5 x 12	60	
		Agri.	0-1 Km/km^2	339	11	339 x 11	3729	
		Settl/Roads	0-1 Km/km^2	12	11	12 x 11	132	
		River	1-3 Km/km^2	24	12	24 x 12	288	
		TOTAL		**448**			**5025**	11.22
5	Erosion Intensity	MD Forest	10-20 t/ha	68	16	68 x 16	1088	
		DS	10-20 t/ha	5	16	5 x 16	80	5716 / 448
		Agri.	1-5 t/ha	339	12	339 x 12	4068	
		Settl/Roads	1-5 t/ha	12	12	12 x 12	144	
		River	5-10 t/ha	24	14	24 x 14	3365	
		TOTAL		**448**			**5716**	12.76
6	Land slide	MD Forest	2-4/km^2	68	12	68 x 12	816	
		DS	2-4/km^2	5	12	5 x 12	60	5025 / 448
		Agri.	0-2/km^2	339	11	339 x 11	3729	
		Settl/Roads	0-2/km^2	12	11	12 x 11	132	
		River	2-4/km^2	24	12	24 x 12	288	
		TOTAL		**448**			**5025**	11.22
7	Intensity of Soil Cons. Works	MD Forest	Moderate	68	14	68 x 14	952	
		DS	Moderate	5	14	5 x 14	70	5618 / 448
		Agri.	Good	339	12	339 x 12	4068	
		Settl/Roads	Good	12	12	12 x 12	144	
		River	Slight	24	16	24 x 16	384	
		TOTAL		**448**			**5618**	12.54

Calculation of Silt Yield Index of Mini-Watersheds
Geographical area = 458ha Code No. 1C1B4J5

S. No	Parameters	Description of Mini-WS		Area (ha)	Index Value	Calculation	Value	Index Unit
1	Slope	MD Forest	30-45	392	16	392 x 16	6272	
		DS	15-30	43	14	43 x 14	602	7122 / 448
		Agri.	2-7	13	11	13 x 11	143	
		Settl/Roads	<2	10	10.5	10 x 10.5	105	
		River		0				

		TOTAL		**448**			**7122**	15.90
2	Land Use	MD Forest		392	14	392 x 14	5488	
		DS		43	14	43 x 14	602	6343 / 448
		Agri.		13	11	13 x 11	143	
		Settl/Roads		10	11	10 x 11	110	
		River		0				
		TOTAL		**448**			**6343**	14.16
3	Soil Type	MD Forest	Sandy Loam	392	12	392 x 12	4704	
		DS	Loam	43	14	43 x 14	602	5608 / 448
		Agri.	Loam	13	14	13 x 14	182	
		Settl/Roads	Sandy Loam	10	12	10 x 12	120	
		River		0				
		TOTAL		**448**			**5608**	12.52
4	Drainage Density	MD Forest	3-5 km/km^2	392	14	392 x 14	5488	
		DS	3-5 km/km^2	43	14	43 x 14	602	6353 / 448
		Agri.	0-1 km/km^2	13	11	13 x 11	143	
		Settl/Roads	1-3 km//km^2	10	12	10 x 12	120	
		River		0				
		TOTAL		**448**			**6353**	14.18
5	Erosion Intensity	MD Forest	10-20 t/ha	392	16	392 x 16	6272	
		DS	10-20 t/ha	43	16	43 x 16	688	7226 / 448
		Agri.	1-5 t/ha	13	12	13 x 12	156	
		Settl/Roads	<1 t/ha	10	11	10 x 11	110	
		River		0				
		TOTAL		**448**			**7226**	16.13
6	Land slide	MD Forest	2-4 No/km^2	392	12	392 x 12	4704	
		DS	2-4 No/km^2	43	12	43 x 12	516	5473 / 448
		Agri.	0-2 No/km^2	13	11	13 x 11	143	
		Settl/Roads	0-2 No/km^2	10	11	10 x 11	110	
		River		0				
		TOTAL		**448**			**5473**	12.22
7	Intensity of Soil Cons. Works	MD Forest	Moderate	392	14	392 x 14	5488	
		DS	Slight	43	16	43 x 16	688	6452 / 448
		Agri.	Good	13	12	13 x 12	156	
		Settl/Roads	Good	10	12	10 x 12	120	

		River		0				
		TOTAL		**448**			**6452**	14.40

Calculation of Silt Yield Index of Mini-Watersheds
Geographical area = 431ha Code No. 1C1B4J6

S. No	Parameters	Description of Mini-WS		Area (ha)	Index Value	Calculation	Value	Index Unit
1	Slope	MD Forest	45-60%	390	18	390 x 18	7020	
		DS	30-45%	30	16	30 x 16	480	7616 / 431
		Agri.	-	0	-	-		
		Settl/Roads	<2	11	10.5	11 x 10.5	116	
		River		0	-			
		TOTAL		**431**			**7616**	17.67
2	Land Use	MD Forest		390	14	390 x 14	5460	
		DS		30	16	30 x 16	480	6072 / 431
		Agri.		0	-	-		
		Settl/Roads		11	12	11 x 12	132	
		River		0	0			
		TOTAL		**431**			**6072**	14.09
3	Soil Type	MD Forest	Silty Clay	390	16	390 x 16	6240	
		DS	Silty Clay	30	16	30 x 16	480	6874 / 431
		Agri.	-	0	-	-		
		Settl/Roads	Loam	11	14	11 x 14	154	
		River		0				
		TOTAL		**431**			**6874**	15.95
4	Drainage Density	MD Forest	5-7 km/km^2	390	16	390 x 16	6240	
		DS	5-7 km/km^2	30	16	30 x 16	480	6841 / 431
		Agri.	-	0	-	-	0	
		Settl/Roads	0-1 km/km^2	11	11	11 x 11	121	
		River		0				
		TOTAL		**431**			**6841**	15.87
5	Erosion Intensity	MD Forest	40-80 t/ha	390	20	390 x 20	7800	
		DS	40-80 t/ha	30	20	30 x 20	600	8532 / 431
		Agri.	-	0	-	-		
		Settl/Roads	1-5 t/ha	11	12	11 x 12	132	
		River		0				

S. No	Parameters	Description		Area	Index Value	Calculation	Value	Index Unit
		TOTAL		**431**			**8532**	19.80
6	Land slide	MD Forest	4-6/km^2	390	14	390 x 14	5460	
		DS	4-6/km^2	30	14	30 x 14	420	6001 / 431
		Agri.	-	0	-	-		
		Settl/Roads	0-2/km^2	11	11	11 x 11	121	
		River		0				
		TOTAL		**431**			**6001**	13.92
7	Intensity of Soil Cons. Works	MD Forest	Slight	390	16	390 x 16	6240	
		DS	Slight	30	16	30 x 16	480	6852 / 431
		Agri.	-	0	-	-		
		Settl/Roads	Good	11	12	11 x 12	132	
		River		0				
		TOTAL		**431**			**6852**	15.90

Calculation of Silt Yield Index of Mini-Watersheds
Geographical area = 554 ha Code 1C1B4J7

S. No	Parameters	Description of Mini-WS		Area (ha)	Index Value	Calculation	Value	Index Unit
1	Slope	MD Forest	45-60%	503	18	503 x 18	9054	
		DS	30-45%	35	16	35 x 16	560	
		Agri.	2-7%	11	11	11 x 11	121	9787.5 / 554
		Settl/Roads	<2%	5	10.5	5 x 10.5	52.5	
		River	-	0	0	-	-	
		TOTAL		**554**			**9787.5**	17.67
2	Land Use	MD Forest		503	14	503 x 14	7042	
		DS		35	16	35 x 16	560	
		Agri.		11	11	11 x 11	121	7778 / 554
		Settl/Roads		5	11	5 x 11	55	
		River		0	-			
		TOTAL		**554**			**7778**	14.04
3	Soil Type	MD Forest	Silty Clay	503	16	503 x 16	8048	
		DS	Silty Clay	35	16	35 x 16	560	
		Agri.	Loam	11	11	11 x 11	121	8789 / 554
		Settl/Roads	Loam	5	12	5 x 12	60	
		River	Sandy	0	10			
		TOTAL		**554**			**8789**	15.86
4	Drainage Density	MD Forest	5-7 km/km^2	503	16	503 x 16	8048	8795 / 554

		DS	5-7 km/km^2	35	16	35 x 16	560	
		Agri.	1-3 km/km^2	11	12	11 x 12	132	
		Settl/Roads	0-1 km/km^2	5	11	5 x 11	55	
		River	-	0	-	-		
		TOTAL		**554**			**8795**	15.87
5	Erosion Intensity	MD Forest	40-80 t/ha	503	20	503 x 20	10060	
		DS	40-80 t/ha	35	20	35 x 20	700	10947 / 554
		Agri.	1-5 t/ha	11	12	11 x 12	132	
		Settl/Roads	<1 t/ha	5	11	5 x 11	55	
		River	-	0	-	-	-	
		TOTAL		**554**			**10947**	19.76
6	Land slide	MD Forest	4-6/km^2	503	14	503 x 14	7042	
		DS	4-6/km^2	35	14	35 x 14	490	7703 / 554
		Agri.	0-2/km^2	11	11	11 x 11	121	
		Settl/Roads	-	5	10	5 x 10	50	
		River	-	0	-	-		
		TOTAL		**554**			**7703**	13.90
7	Intensity of Soil Cons. Works	MD Forest	Moderate	503	14	503 x 14	7042	
		DS	Slight	35	16	35 x 16	560	7858 / 554
		Agri.	Slight	11	16	11 x 16	176	
		Settl/Roads	Slight	5	16	5 x 16	80	
		River	Slight	0	0	-		
		TOTAL		**554**			**7858**	14.18

Calculation of Silt Yield Index of Mini-Watersheds
Geographical Area = 277ha Code = 1C1B4J8

S. No	Parameters	Description of Mini-WS		Area (ha)	Index Value	Calculation	Value	Index Unit
1	Slope	MD Forest	>60	158	20	158 x 20	3160	
		DS	45-60	32	18	32 x 18	576	4690 / 277
		Agri.	2-7	10	11	10 x 11	110	
		Settl/Roads	<2	6	10.5	6 x 10.5	63	
		River	2-7	71	11	71 x 11	781	
		TOTAL		**277**			**4690**	16.93
2	Land Use	MD Forest		158	14	158 x 14	2212	3688 / 277
		DS		32	14	32 x 14	448	

		Agri.		10	11	10 x 11	110	
		Settl/Roads		6	11	6 x 11	66	
		River		71	12	71 x 12	852	
		TOTAL		**277**			**3688**	13.31
3	Soil Type	MD Forest	Sandy Loam	158	12	158 x 12	1896	
		DS	Sandy Loam	32	12	32 x 12	384	3202 / 277
		Agri.	Loam	10	14	10 x 14	140	
		Settl/Roads	Sandy Loam	6	12	6 x 12	72	
		River	Sandy	71	10	71 x 10	710	
		TOTAL		**277**			**3202**	11.56
4	Drainage Density	MD Forest	3-5	158	12	158 x 12	1896	
		DS	3-5	32	12	32 x 12	384	3308 / 277
		Agri.	0-1	10	11	10 x 11	110	
		Settl/Roads	0-1	6	11	6 x 11	66	
		River	1-3	71	12	71 x 12	852	
		TOTAL		**277**			**3308**	11.94
5	Erosion Intensity	MD Forest	20-40 t/ha	158	18	158 x 18	2844	
		DS	20-40 t/ha	32	18	32 x 18	576	4748 / 277
		Agri.	1-5 t/ha	10	12	10 x 12	120	
		Settl/Roads	1-5 t/ha	6	12	6 x 12	72	
		River	10-20 t/ha	71	16	71 x 16	1136	
		TOTAL		**277**			**4748**	17.14
6	Land slide	MD Forest	4-6	158	14	158 x 14	2212	
		DS	4-6	32	14	32 x 14	448	3688 / 277
		Agri.	0-2	10	11	10 x 11	110	
		Settl/Roads	0-2	6	11	6 x 11	66	
		River	2-4	71	12	71 x 12	852	
		TOTAL		**277**			**3688**	13.31
7	Intensity of Soil Cons. Works	MD Forest	Slight	158	16	158 x 16	2528	
		DS	Slight	32	16	32 x 16	512	4542 / 277
		Agri.	Mod	10	14	10 x 14	140	
		Settl/Roads	Mod	6	14	6 x 14	84	
		River	Not	71	18	71 x 18	1278	
		TOTAL		**277**			**4542**	16.40

Calculation of Silt Yield Index of Mini-Watersheds
Geographical area = 131 ha Code = 1C1B4J9

S. No	Parameters	Description of Mini-WS		Area (ha)	Index Value	Calculation	Value	Index Unit
1	Slope	MD Forest	45-60%	41	18	41 x 18	738	
		DS	45-60%	21	18	21 x 18	378	1875 / 131
		Agri.	2-7%	32	11	32 x 11	352	
		Settl/Roads	2-7%	26	11	26 x 11	286	
		River	2-7%	11	11	11 x 11	121	
		TOTAL		**131**			**1875**	14.31
2	Land Use	MD Forest		41	14	41 x 14	574	
		DS		21	14	21 x 14	294	1696 / 131
		Agri.		32	12	32 x 12	384	
		Settl/Roads		26	12	26 x 12	312	
		River		11	12	11 x 12	132	
		TOTAL		**131**			**1696**	12.95
3	Soil Type	MD Forest	Sandy Loam	41	12	41 x 12	492	
		DS	Sandy Loam	21	12	21 x 12	252	1614 / 131
		Agri.	Loam	32	14	32 x 14	448	
		Settl/Roads	Sandy Loam	26	12	26 x 12	312	
		River	Sandy	11	10	11 x 10	110	
		TOTAL		**131**			**1614**	12.32
4	Drainage Density	MD Forest	3-5 km/km^2	41	14	41 x 14	574	
		DS	3-5 km/km^2	21	14	21 x 14	294	1638 / 131
		Agri.	0-1 km/km^2	32	11	32 x 11	352	
		Settl/Roads	0-1 km/km^2	26	11	26 x 11	286	
		River	1-3 km/km^2	11	12	11 x 12	132	
		TOTAL		**131**			**1638**	12.50
5	Erosion Intensity	MD Forest	20-40 t/ha	41	18	41 x 18	738	
		DS	20-40 t/ha	21	18	21 x 18	378	1984 / 131
		Agri.	1-5 t/ha	32	12	32 x 12	384	
		Settl/Roads	<1 t/ha	26	11	26 x 11	286	

		River	0 – 40 t/ha	11	18	11 x 18	198	
		TOTAL		**131**			**1984**	15.15
6	Land slide	MD Forest	2-4/km^2	41	12	41 x 12	492	
		DS	2-4/km^2	21	12	21 x 12	252	1503 / 131
		Agri.	0-2/km^2	32	11	32 x 11	352	
		Settl/Roads	0-2/km^2	26	11	26 x 11	286	
		River	0-2/km^2	11	11	11 x 11	121	
		TOTAL		**131**			**1503**	11.47
7	Intensity of Soil Cons. Works	MD Forest	Slight	41	16	41 x 16	656	
		DS	Slight	21	16	21 x 16	336	1958 / 131
		Agri.	Mod	32	14	32 x 14	448	
		Settl/Roads	Mod	26	14	26 x 14	364	
		River	Mod	11	14	11 x 14	154	
		TOTAL		**131**			**1958**	14.95

Summary Tables

Code = 1C1B4J1			Code = 1C1B4J2		
Code = 1C1B4J1			**Code = 1C1B4J2**		
S. No	Parameters	Index Unit	S. No	Parameters	Index Unit
1	Slope	12.95	1	Slope	10.59
2	Land Use	12.13	2	Land Use	11.48
3	Soil Type	14.33	3	Soil Type	11.70
4	Drainage Density	12.47	4	Drainage Density	11.36
5	Erosion Intensity	16.62	5	Erosion Intensity	11.22
6	Land slide	11.95	6	Land slide	11.00
7	Intensity of Soil Cons. Works	12.72	7	Intensity of Soil Cons. Works	12.35
		93.16			79.70
	93.16 / 7	13.31		79.70 / 7	11.39
SYI	13.31 x 0.95 x 100	1264	SYI	11.39 x 0.95 x 100	1082

Code No. 1C1B4J3			**Code No. 1C1B4J4**		
S. No	Parameters	Index Unit	S. No	Parameters	Index Unit
1	Slope	11.34	1	Slope	11.49

2	Land Use	12.03	2	Land Use	11.49
3	Soil Type	12.68	3	Soil Type	11.89
4	Drainage Density	12.55	4	Drainage Density	11.22
5	Erosion Intensity	13.23	5	Erosion Intensity	12.76
6	Land slide	11.34	6	Land slide	11.22
7	Intensity of Soil Cons. Works	12.68	7	Intensity of Soil Cons. Works	12.54
		85.86			82.60
	85.86 / 7	12.27		82.60 / 7	11.80
SYI	**12.27 x 0.95 x 100**	**1165**	**SYI**	**11.80 x 0.95 x 100**	**1121**

	Code No. 1C1B4J5			Code No. 1C1B4J6	
S. No	Parameters	Index Unit	S. No	Parameters	Index Unit
1	Slope	15.90	1	Slope	17.67
2	Land Use	14.16	2	Land Use	14.09
3	Soil Type	12.52	3	Soil Type	15.95
4	Drainage Density	14.18	4	Drainage Density	15.87
5	Erosion Intensity	16.13	5	Erosion Intensity	19.80
6	Land slide	12.22	6	Land slide	13.92
7	Intensity of Soil Cons. Works	14.40	7	Intensity of Soil Cons. Works	15.90
		99.50			113.20
	99.50 / 7	14.21		113.20 / 7	16.17
SYI	**14.21 x 0.90 x 100**	**1279**	**SYI**	**16.17 x 0.90 x 100**	**1455**

	Code 1C1B4J7			Code = 1C1B4J8	
S. No	Parameters	Index Unit	S. No	Parameters	Index Unit
1	Slope	17.67	1	Slope	16.93
2	Land Use	14.04	2	Land Use	13.31

3	Soil Type	15.86	3	Soil Type	11.56
4	Drainage Density	15.87	4	Drainage Density	11.94
5	Erosion Intensity	19.76	5	Erosion Intensity	17.14
6	Land slide	13.90	6	Land slide	13.31
7	Intensity of Soil Cons. Works	14.18	7	Intensity of Soil Cons. Works	16.40
		111.28			100.60
	111.28 / 7	15.90		100.60 / 7	14.37
SYI	**15.90 x 0.90 x 100**	**1431**	**SYI**	**14.37 x 0.95 x 100**	**1365**

	Code = 1C1B4J9	
S. No	Parameters	Index Unit
1	Slope	14.31
2	Land Use	12.95
3	Soil Type	12.32
4	Drainage Density	12.50
5	Erosion Intensity	15.15
6	Land slide	11.47
7	Intensity of Soil Cons. Works	14.95
		93.65
	93.65 / 7	13.38
SYI	**13.38 x 0.95 x 100**	**1271**

Summary table of composite units

S. N o	Parameters	1C1 B4J1	1C1B 4J2	1C1B 4J3	1C1B 4J4	1C1B 4J5	1C1B 4J6	1C1B 4J7	1C1B 4J8	1C1B 4J9
1	Slope	12.95	10.59	11.34	11.49	15.90	17.67	17.67	16.93	14.31
2	Land Use	12.13	11.48	12.03	11.49	14.16	14.09	14.04	13.31	12.95
3	Soil Type	14.33	11.70	12.68	11.89	12.52	15.95	15.86	11.56	12.32
4	Drainage Density	12.47	11.36	12.55	11.22	14.18	15.87	15.87	11.94	12.50
5	Erosion Intensity	16.62	11.22	13.23	12.76	16.13	19.80	19.76	17.14	15.15

6	Land slide	11.95	11.00	11.34	11.22	12.22	13.92	13.90	13.31	11.47
7	Intensity of Soil Cons. Works	12.72	12.35	12.68	12.54	14.40	15.90	14.18	16.40	14.95
	Total	93.16	79.70	85.86	82.60	99.50	113.20	111.28	100.60	93.65
	MEAN	13.31	11.39	12.27	11.80	14.21	16.17	15.90	14.37	13.38
	DR Value	0.95	0.95	0.95	0.95	0.90	0.90	0.90	0.95	0.95
	SYI	1264	1082	1165	1121	1279	1455	1431	1365	1271

The SYI values for classification of various categories of erosion intensity rates are given as follows:

Priority Rating	Silt Yield Index
Very High	More than 1400
High	1300-1399
Medium	1200-1299
Low	1100-1199
Very Low	Less than 1100

Higher the number means high priority for treatment.

Based upon the standard methodology adopted in the study and results framework it is concluded that **o**ut of nine mapping units, two are prone to generation of very high silt load ana prioritized as very high, one as high, three as medium, two as low and one as very low as per categorization given below.

S. No	MINI WATERSHED CODE	SYI	PRIORITY
1	1C1B4J6	1455	Very High
2	1C1B4J7	1431	Very High
3	1C1B4J8	1365	High
4	1C1B4J5	1279	Medium
5	1C1B4J9	1271	Medium
6	1C1B4J1	1264	Medium
7	1C1B4J3	1165	Low
8	1C1B4J4	1121	Low
9	1C1B4J2	1082	Very Low

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These prioritized mini-watersheds are marked on the catchment area maps redrawn from Survey of India topo-sheet of 1:50,000 scale (map).
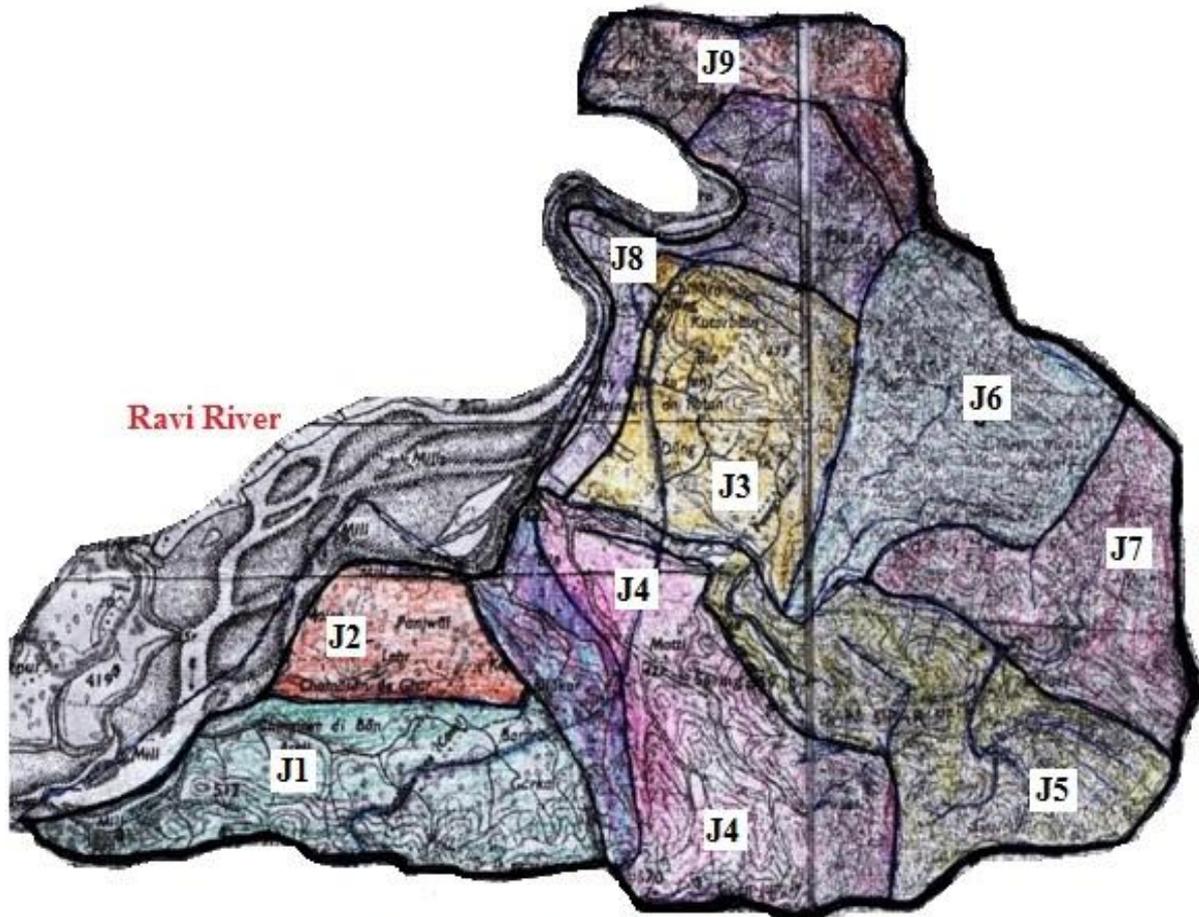
MAP OF PRIORITIZED MINI-WATERSHEDS IN THE CATCHMENT OF SHAHPURKANDI DAM

LEGEND

Priority Rating	COLOR
Very High	
High	
Medium	
Low	
Very Low	

5 .WATERSHED MANAGEMENT – AVAILABLE TECHNIQUES

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.

Following Engineering and Biological measures have been suggested for the catchment area treatment.

5.1. ENGINEERING MEASURES

-Brush wood checkdam
-Dry stone check dam
-Cement Masonry
-Crate wire
-Retaining wall
-Live hedge
-Land slip treatment
-Barbed grass plantation

5.2. BIOLOGICAL MEASURES

- Development of nurseries
- Plantation/afforestation and maintenance
- Pasture development
- Barbed wire fencing

The basis of site selection for different biological and engineering treatment measures under CAT are given in the table 2

Table 2: Basis for selection of catchment area treatment measures

Treatment measure	Basis for selection
Contour Bunding	Control of soil erosion from agricultural fields.
Pasture Development	Open canopy, barren land, degraded surface
Afforestation	Open canopy, degraded surface, high soil erosion, gentle to moderate slope. 25% of the plants to be planted should be of bamboo and they should be planted near choes and khuds.
Barbed wire fencing	In the vicinity of afforestation work to protect it from grazing etc.
Engineering methods	To check soil erosion in small streams, steps with concrete base are prepared in sloppy area where silt erosion in the stream and bank erosion is high due to turbidity of current.
Nursery	Centrally located points for better supervision of proposed afforestation, minimize cost of transportation of seedling and ensure better survival.

6. FOREST PROTECTION MEASURES

These measures include patrolling of sites by the forest staff and fire protection measures undertaken by them. Forest fire protection measures include establishment of fire lines ,controlled burning , zonation of fire prone sites and using equipments for fire fighting like rakes ,fire tenders , gumboots etc.

7. MONITORING AND EVALUATION

Monitoring and evaluation is very essential for the various types of activities in CAT plan on daily, monthly and annual basis for proper execution of planned works. M & E studies including impact evaluation studies should be scheduled for the later years of the CAT Plan implementation calendar.

Indicators for Monitoring impact of CAT Plan would include:

 Change in silt load and establishment of silt observation centres and continuous evaluation. The silt load captured by various engineering structures and biological measures will be studied over time in different villages in a scientific manner.

 Survival of plantations

 Changes in land-use [private holdings]

 Changes in man-animal conflicts.

 Trend of fire incidences in vulnerable areas.

50 percent of this cost will be for third party monitoring and remaining 50 percent for monitoring of soil and moisture conservation related works .

8.ECO-DEVELOPMENT THROUGH COMMUNITY PARTICIPATION

There is an urgent need to reduce the dependency of local population on the forest and other natural resources which are under severe pressure. The eco-development works and other activities related to income generation are suggested and should be carried out through JFMCs of local villages. List of villages that come under Areli-Matti-Doong sub water-shed are :

1.Dhar Dalla
2.Tika Salari
3.TIka Bansipur

4.Tika Mansuh

5.Tika Sukret

6.Tika Surah

7. Baleva

8.Shahpur Kandi

9.Areli

10.Tika Maira

11.Kot

12.Dung

13.Tika Matti

14.Tika Awan

15.Jalakhri

16.Bhoon

The following measures are suggested, which would help in rejuvenating the ecosystems and also augmenting incomes of forest dependent communities:

- To reduce the consumption of forest produce, fuel-wood efficient devices shall be introduced and measures shall be taken up to promote alternative energy sources. Distribution of fuel wood efficient devices and LPG cylinders, promotion of solar devices, bio-gas plants depending on the need will be facilitated in the selected area.

- Entry point activities in all the villages for executing the works that address the urgent needs of village communities that will help in rapport building and community mobilisation.

- Giving seed money to existing JFMCs and SHGs and the new ones that will be created which can be a part of revolving fund and can be used for income generating activities like producing and marketing of organic finished products like juices,candies and pickles of amla ,suhanjna,giloy and other forest produce,dairy farming,poultry farming, pasture development for fodder and eco-tourism related activities.

- Strengthening of Forest Establishment and JFMCs by organizing JFMC level and Division level workshops, training and awareness generation programs and skill development. Training will be provided to field staff and members on PRA micro-planning, watch and ward activities on establishing convergence.

- Capacity building of JFMC members. Young and educated youth will be selected from JFMCs and they will be trained in account keeping and forest management aspects so that they act as community foresters.They help in making villagers more aware about the benefits of ecological balance and enhancing forest cover.

- Assistance shall be provided in livelihood improvement activities like cultivation of prioritized medicinal and aromatic plants on farmer's land, establishment of nurseries for supply of quality planting material, providing trainings,post-harvest management,purchase of primary processing marketing infrastructure and certification to ensure Good Agricultural Practices (GAPs) and Good Field Collection Practices (GFCPs) to enhance quality and safety of their produce.etc. Plants like palmarosa,geranium,lemon grass,suhanjna ,giloe are in huge demand and can be harvested sustainably to earn revenue with a little handholding.

9. ADMINISTRATIVE EXPENSES

The works of the catchment area treatment plan will be executed by the forest department These works will be an added responsibility for the Forest Department that may not have adequate facilities and infrastructure to execute the work as suggested in the plan. Therefore, provision has been made under CAT plan to develop infrastructure of forest department in the region.Also during the implementation of the project some retired consultants related to soil and moisture conservation will have to be hired . Such costs are also included in the administrative expenses.

Annexure 1: Abstract of total cost of Catchment Area Treatment plan of Shahpur Kandi HEP		
Sr.no	Activity	Amount
1	Biological Treatment Measures	40928400
2	Engineering Treatment Measures	85417685
3	Protection methods	7177775
4	Eco-development through community participation	10000000
6	Monitoring and Evaluation	2870477
7	Miscellaneous(Administration and contingency)	5740954
	Total	152135292
	Or Say	15.21 crore

Annexure 2 : Year wise cost break up for CAT measures for Shahpurkandi HEP

S.No	Operations	Unit	year-I		Year-II		Year-III		Year-IV		Year-V		Year-VI		TOTAL	
			Phy.	Fin.	Phy.	Fin.	Phy.	Fin.	Phy.	Fin.	Phy.	Fin.	Phy.	Fin.	Phy.	Fin.
	BIOLOGICAL TREATMENT															
1	Nursery	No	60000	1282800	60000	1282800	60000	1282800	0	0	0	0	0	0	180000	3848400
2	Plantation	Ha.	50	4570000	50	4570000	50	4570000	0	0	0	0	0	0	150	13710000
	Maintance 1st Year	Ha.	0	0	50	2770000	50	2210000	50	1610000	0	0	0	0	150	6590000
	Maintance 2nd Year	Ha.	0	0	0	0	50	2770000	50	2210000	50	1610000	0	0	150	6590000
	Maintance 3rd Year	Ha.	0	0	0	0	0	0	50	2770000	50	2210000	50	1610000	150	6590000
3	Barbed wire fencing	KM	2.5	875000	2.5	875000	2.5	875000	0	0	0	0	0	0	7.5	2625000
4	Contour bunding	Ha.	10	150000	10	150000	10	150000	10	150000	10	150000	0	0	50	750000
5	Pasture development	Ha.	5	75000	5	75000	5	75000	0	0	0	0	0	0	15	225000
	TOTAL(BIOLOGICAL TREATMENT)															40928400
	ENGINEERING METHODS															
6	Bhabbar Grass Plantation	Ha.	3	37500	3	37500	2	25000	2	25000	2	25000	0	0	12	150000
7	Brush Wood Check Dam	Mtr.	700	107730	500	76950	800	123120	500	76950	400	61560	0	0	2900	446310
8	Dry Stone Check Dam	m3	1200	1057776	1500	1322220	1200	1057776	1500	1322220	750	661110	0	0	6150	5421102
9	Cement Masonary Check Dam	m3	1700	6265247	1517	5532445	1096	4010235	719	2602666	0	0	0	0	5031	18410592
10	Crate wire Structure	m3	1200	2172084	1500	2715105	1350	2443594.5	750	1357552.5	0	0	0	0	4800	8688336
11	Retaining Wall	cum	3230	10606763	3443	11301639	3152	10320216	3742	12275327	0	0	0	0	13566	44503945
12	Live hedge	KM	3	307800	2	205200	10	1026000	6	615600	3	307800	0	0	24	2462400
13	Land Slip treatment (Agave,Ipomia Plantation and Butting)	Mtr.	1000	45000	1000	45000	1000	45000	0	0	0	0	0	0	3000	135000
14	New Construction of pond	No	1	1000000	1	1000000	1	1000000	1	1000000	0	0	0	0	4	4000000
15	Renovation of pond	No	1	400000	1	400000	1	400000	0	0	0	0	0	0	3	1200000
	TOTAL(ENGINEERING METHODS)															85417685
	PROTECTION MEASURES															
16	Motor Boat for patrolling	No	0	0	1	2500000	0	0	0	0	0	0	0	0	1	2500000
17	Field Vehicle for patrolling(TATA 407)	No	0	0	1	1050000	0	0	0	0	0	0	0	0	1	1050000
18	Creation and maintenance of fire lines	km	5	550670	5	115421.02	5	115421.02	5	115421.02	5	115421.02	5	115421.0		1127775
19	Fire Protection equipments(Fire Brigade truck)	L/S		0		2500000		0		0		0				2500000
	TOTAL(PROTECTION MEASURES)															7177775
	ECO-DEVELOPMENT THROUGH COMMUNITY PARTICIPATION	L/S		2000000		2000000		2000000		2000000		2000000				10000000
	TOTAL			31503370		40524280		34499162		28130737		7140891		1725421		143523860
	MONITORING AND EVALUATION(2%)			630067		810486		689983		562615		142818		34508		**2870477**
	ADMINISTRATIVE EXPENSE(1%)			315034		405243		344992		281307		71409		17254		1435239
	CONTINGENCY(3%)			945101		1215728		1034975		843922		214227		51763		4305716
	G.Total			33393572		42955737		36569112		29818581		7569344		1828946		152135292
	Or Say															**15.21 cr**

EXECUTIVE ENGINEER
SPK DAM DIVISION NO.II
SHAHPURKANDI T/SHIP

Annexure 3.1 Nursery :Site Location of nursery

| Sr. No	Location	Quantity	Cost(RS.21.38 PER PLANT)	GPS Co-ordinate		Remarks
				Longitude	Latitude	
1	Matti Nursery	180000	3848400	32°24'26.190" N	75°44'33.534" E	KML FILE ATTACHED
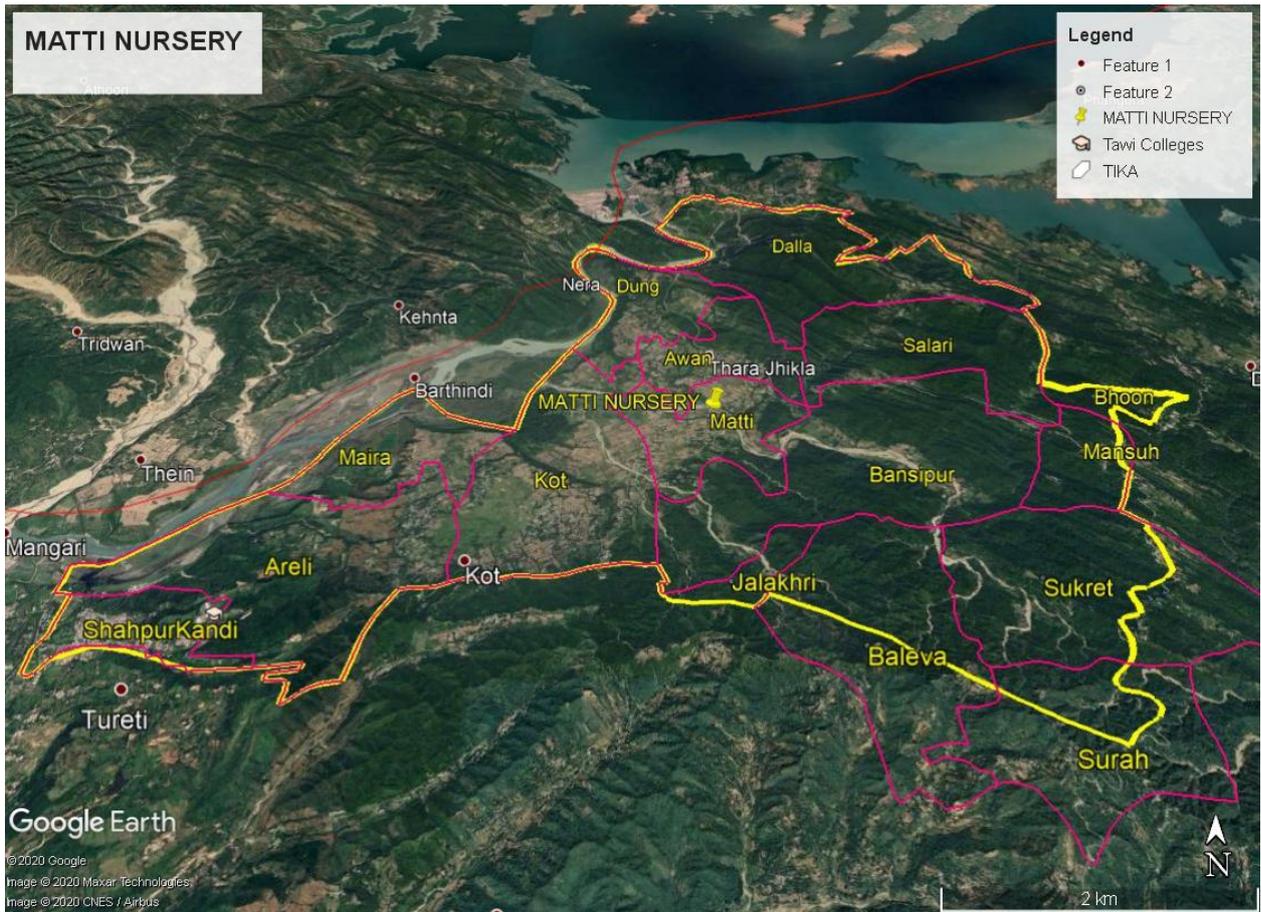
Annexure 3.2 Plantation:Site Location of Plantation

Sr. No	Location	Quantity(IN HA)	Cost(Rs.91400 per ha)	GPS Co-ordinate		Remarks
				Longitude	Latitude	
1	UP Barukli	10	914000	32°22'58.649"N	75°46'30.525"E	KML ATTACHED
2	UP and Section-4 Matti	20	1828000	32°23'18.302"N	75°44'45.682"E	KML ATTACHED
3	UP and section-4 Mansuh	20	1828000	32°24'33.994"N	75°45'06.023"E	KML ATTACHED
4	P-11 Bansipur	50	4570000	32°24'06.708"N	75°44'58.477"E	KML ATTACHED
5	P5 Dalla C 4,5,6	20	1828000	32°24'56.440"N	75°46'48.642"E	KML ATTACHED
6	UP &Sec 4 Areli	30	2742000	32°23'29.373"N	75°42'32.284"E	KML ATTACHED
	Total	150	13710000			

Annexure 3.3 Barbed Wire Fencing :Site Location of Barbed wire fencing

Sr. No	Location	Quantity(m)	Cost(RS.350 PER METRE)	GPS Co-ordinate		Remarks
				Longitude	Latitude	
1	UP Barukli	500	175000	32°22'48.575"N	75°46'21.856"E	KML FILE ATTACHED
2	UP and Section-4 Matti	1000	350000	32°23'18.302"N	75°44'45.682"E	KML FILE ATTACHED
3	UP and section-4 Mansuh	1000	350000	32°24'33.994"N	75°45'06.023"E	KML FILE ATTACHED
4	P-11 Bansipur	2500	875000	32°24'06.708"N	75°44'58.477"E	KML FILE ATTACHED
5	P5 Dalla C 4,5,6	1000	350000	32°24'56.440"N	75°46'48.642"E	KML FILE ATTACHED
6	UP &Sec 4 Areli	1500	525000	32°23'29.373"N	75°42'32.284"E	KML FILE ATTACHED
	Total	7500	2625000			
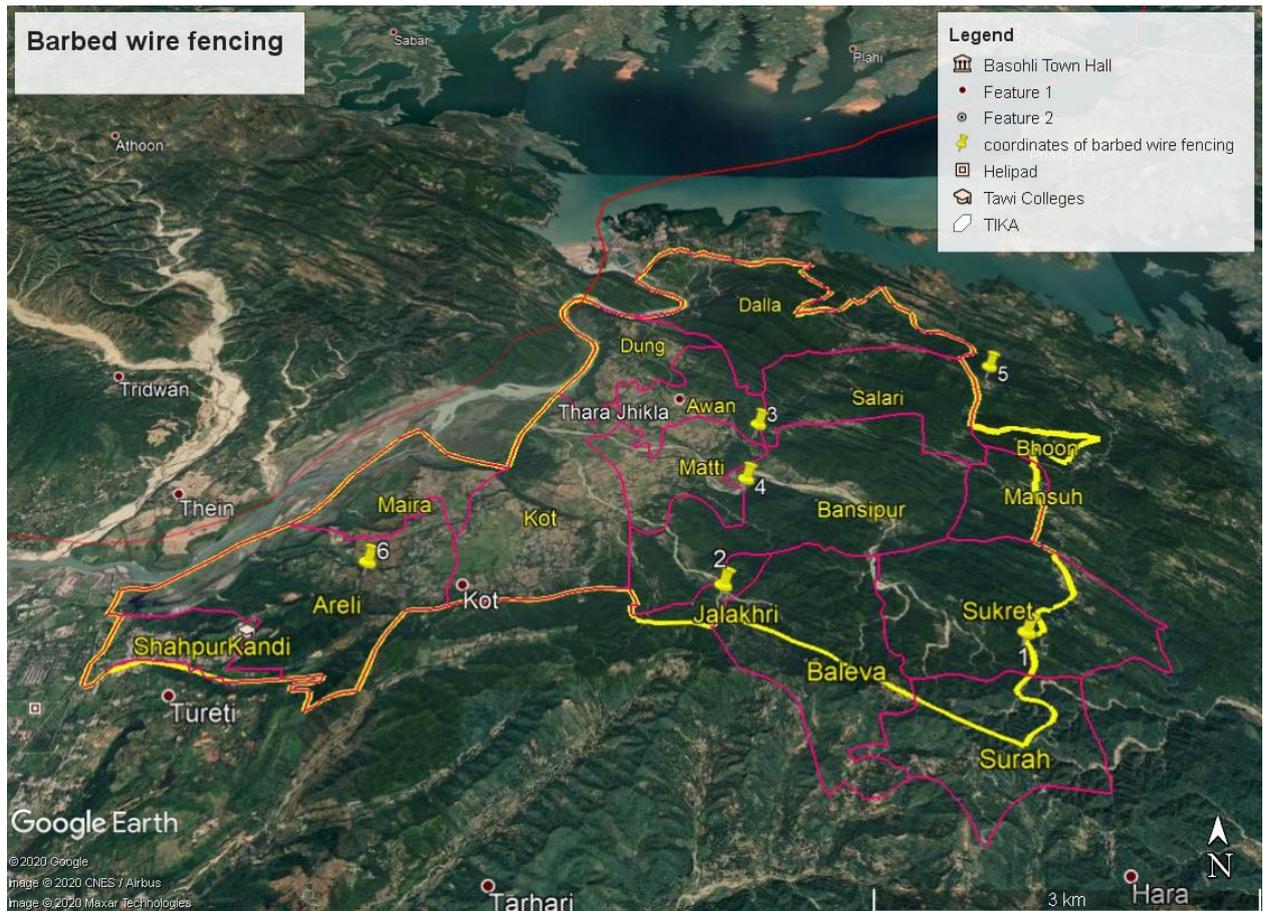
Annexure 3.4 Brush Wood Check Dam:Site locations for brush wood check dam

Sr. No	Location	Quantity (mtr)	Cost(RS.153.9 PER mtr)	GPS Co-ordinate		Remarks
				Longitude	Latitude	
1	Birkuli Gully	500	76950	32°23'05.748" N	75°45'90.338" E	KML ATTACHED
2	Dobala Danga	200	30780	32°22'52.022" N	75°46'33.153" E	KML ATTACHED
3	Atth Gully	300	46170	32°22'59.370" N	75°46'31.939" E	KML ATTACHED
4	Mansuh Gully/Plata Gully Dalla Gully/Awa Gully	200	30780	32°24'35.706" N	75°45'24.541" E	KML ATTACHED
5	Bansipur Gully	800	123120	32°24'05.507" N	75°45'22.736" E	KML ATTACHED
6	Gharar Gully	200	30780	32°24'05.286" N	75°45'40."020 E	KML ATTACHED
7	Plakhi Gully	100	15390	32°23'52.006" N	75°44'48.934" E	KML ATTACHED
8	Matti Gully	200	30780	32°23'10.334" N	75°44'48.747" E	KML ATTACHED
9	Malade Gully	200	30780	32°23'22.239" N	75°44'22.242" E	KML ATTACHED
10	Aralli Gully	200	30780	32°23'15.104" N	75°42'36.693" E	KML ATTACHED
	Total	**2900**	446310			

BRUSHWOOD CHECK DAM
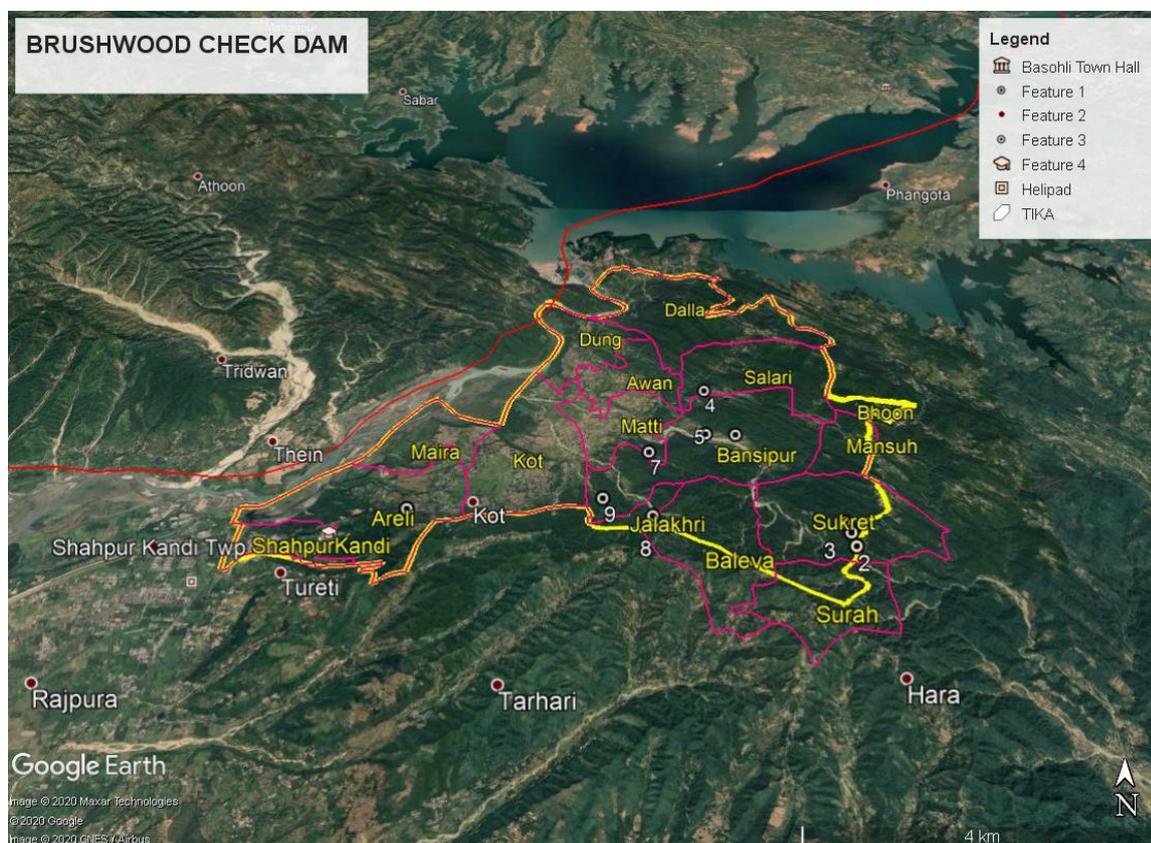
Annexure 3.5 Dry stone check dam:Site locations for brush wood check Dam

Sr. No	Location	Quantity (CUM)	Cost(RS.881.48 PER CUM)	GPS Co-ordinate		Remarks
				Longitude	Latitude	
1	Birkuli Gully	500	440740	32°23'05.748" N	75°45'90.338" E	KML ATTACHED
2	Dobala Danga	200	176296	32°22'52.022" N	75°46'33.153" E	KML ATTACHED
3	Atth Gully	500	440740	32°22'59.370" N	75°46'31.939" E	KML ATTACHED
4	Mansuh Gully/Plata Gully Dalla Gully/Awa Gully	1500	1322220	32°24'35.706" N	75°45'24.541" E	KML ATTACHED
5	Salari Gully	1200	1057776	32°24'13.516" N	75°45'25.911" E	KML ATTACHED
6	Bansipur Gully	800	705184	32°24'05.507" N	75°45'22.736" E	KML ATTACHED
7	Gharar Gully	400	352592	32°24'05.286" N	75°45'40."020 E	KML ATTACHED
8	Plakhi Gully	300	264444	32°23'52.006" N	75°44'48.934" E	KML ATTACHED
9	Matti Gully	100	88148	32°23'10.334" N	75°44'48.747" E	KML ATTACHED
10	Malade Gully	450	396666	32°23'22.239" N	75°44'22.242" E	KML ATTACHED
11	Aralli Gully	200	176296	32°23'15.104" N	75°42'36.693" E	KML ATTACHED
	TOTAL	6150	5421102			
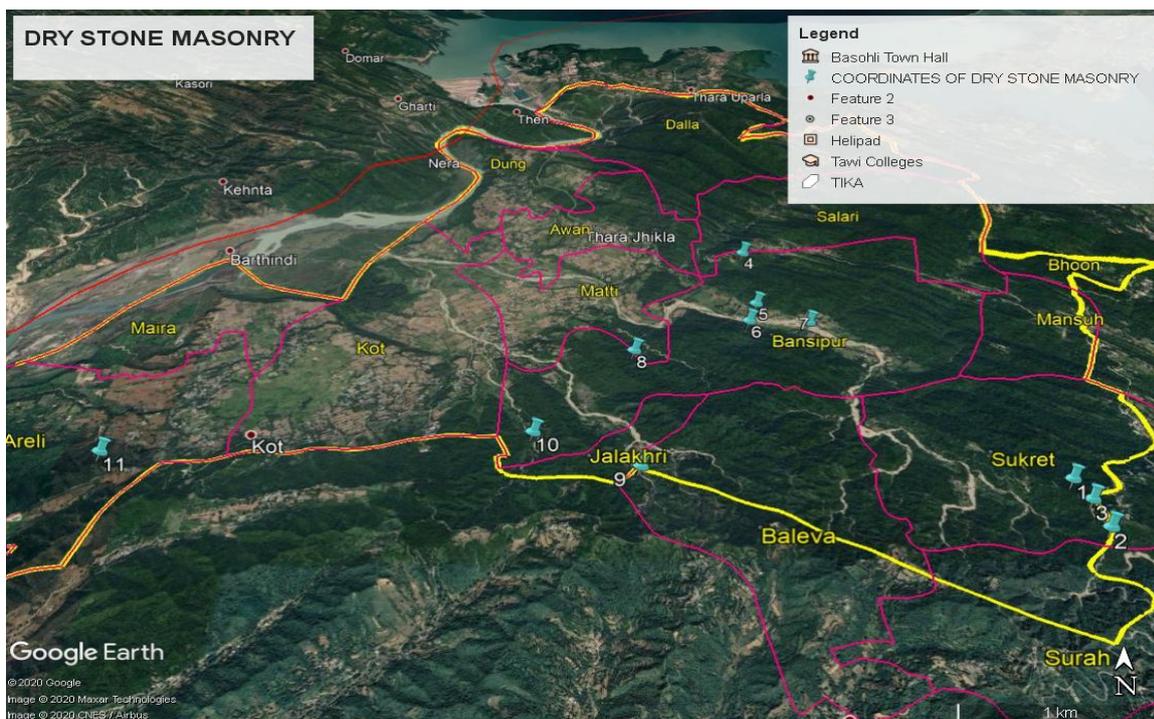
Annexure 3.6 Cement Masonry Dam:Site locations for cement masonry structures

Sr. No	Location	Quantity (CUM)	Cost	GPS Co-ordinate		Remarks
				Longitude	Latitude	
1	Dabala Dangla Nala	80.63	295412	32°22'52.53600" N	75°46'27.75600" E	KML attached
2	Dabala Dangla Nala	104.3	383090	32°22'52.63200" N	75°46'24.84600" E	KML attached
3	Dabala Dangla Nala	55.69	204154	32°22'51.62400" N	75°46'32.6800" E	KML attached
4	Dabala Dangla Nala	57.82	211922	32°22'57.73400" N	75°46'22.54200" E	KML attached
5	Opposite Temple	50.22	184336	32°22'26.11200" N	75°45'52.26740" E	KML attached
6	Old House Balsir Sarpanch	294.91	1081597	32°23'08.3800" N	75°45'39 .07800" E	KML attached
7	Mango Nala	74.69	273592	32°23'05.4840" N	75°45'46.33800" E	KML attached
8	Mango Nala	56.76	205513	32°23'80.7001" N	75°45'48.129" E	KML attached
9	Land of Balbir sarpanch	82.19	300592	32°23'13.10400" N	75°45'53.41000" E	KML attached
10	Mata Mandir	158.29	579601	32°23'29.35600" N	75°45'42.47000" E	KML attached
11	Back side Mata Mandir	89.05	325427	32°23'20.73600" N	75°45'35.74000" E	KML attached
12	Main Nala Near Salari	237.36	904019	32°23'43.23000" N	75°45'49.86000" E	KML attached
13	ATH Naal Nala	112.2	409333	32°23'34.272" N	75°46'10.74" E	KML attached
14	ATH Naal Nala	124.08	460794	32°23'38.037" N	75°46'91.35" E	KML attached
15	ATH Naal Nala	121.89	445866	32°23'47.823" N	75°45'57.17" E	KML attached
16	Mansuh Nala	79.85	291619	32°23'49.839" N	75°46'07.639" E	KML attached
17	Mansuh Nala	195.01	711465	32°23'50.891" N	75°46'07.067" E	KML attached
18	Sadik Ali	175.56	641372	32°24'04.950" N	75°45'49.979" E	KML attached
19	School Salari	97.3	354788	32°24'04.256" N	75°45'49.506" E	KML attached
20	Opposite School	92.06	335459	32°24'00.451" N	75°45'43.438" E	KML attached
21	Sandho di Nali	82.94	302432	32°24'11.902" N	75°45'33.069" E	KML attached
22	Land Balbir	140.79	513149	32°24'04.730" N	75°46'36.710" E	KML attached
23	Land Balbir	97.23	355147	32°24'30.668" N	75°46'35.666" E	KML attached
24	Paniaro Nala	137.65	501076	32°24'00.501" N	75°45'22.736" E	KML attached
25	Tarsem House	96.26	350797	32°24'12.991" N	75°45'25.70" E	KML attached
26	Land of Bishamber	87.32	318574	32°24'16.572" N	75°45'17.238" E	KML attached
27	Land of Bishamber	74.66	272552	32°24'17.099" N	75°45'17.690" E	KML attached
28	Land of Bishamber	47.15	170988	32°24'18.320" N	75°45'18.099" E	KML attached
29	Land of Bishamber	52.73	193720	32°24'19.146" N	75°45'18.167" E	KML attached
30	Land of Bishamber	60	219306	32°24'19.403" N	75°45'20.091" E	KML attached
31	Gharet Nala	88.1	319658	32°24'20.140" N	75°45'06.523" E	KML attached
32	Gharet Nala	101.08	397274	32°24'22.770" N	75°45'09.567" E	KML attached
33	Gharet Nala	77.21	279503	32°24'25.917" N	75°45'11.153" E	KML attached
34	Gharet Nala	205.3	746971	32°24'31.263" N	75°45'05.487" E	KML attached
35	Bansipur nala	47.09	170631	32°24'10.777" N	75°45'03.329" E	KML attached
36	Bansipur nala	109.2	396538	32°24'10.132" N	75°45'04.065" E	KML attached
37	Joshi (Awan)	39.19	141114	32°24'21.645" N	75°44'46.901" E	KML attached
38	land of jassi ram	55.28	200405	32°24'28.080" N	75°44'47.28" E	KML attached
39	basant singh	77.95	284253	32°24'43.825" N	75°44'50.661" E	KML attached
40	basant singh	50.85	184257	32°24'3.228" N	75°44'51.167" E	KML attached
41	Land of gagan	66.6	243281	32°24'31.435" N	75°44'52.063" E	KML attached
42	Land of Hemraj	26.31	94906	32°24'33.898" N	75°44'54.078" E	KML attached
43	land of yashpal	75.51	275779	32°24'34.236" N	75°44'55.113" E	KML attached
44	land of yashpal	50.2	182147	32°24'36.051" N	75°44'50.537" E	KML attached
45	Land of basant	25.91	93518	32°24'37.226" N	75°44'50.547" E	KML attached
46	Land of basant	28.55	103062	32°24'38.142" N	75°44'51.271" E	KML attached

| 47	Land of basant	21.52	77789	32°24'40.2986" N	75°44'40.604" E	KML attached
48	Land of Onkar	20.52	74141	32°24'43.490" N	75°44'48.832" E	KML attached
49	Land of Paras	20.52	74107	32°24'62.175" N	75°44'49.215" E	KML attached
50	Land of Ramesh	40.19	145920	32°24'47.702" N	75°44'50.252" E	KML attached
51	Land of Kaku Ram	40.19	146007	32°24'49.096" N	75°44'50.928" E	KML attached
52	Som Raj Dungh	52.92	193572	32°25'20.068" N	75°44'37.04" E	KML attached
53	Kartar Dungh	47.15	171151	32°25'10.867" N	75°44'11.703" E	KML attached
54	Parmeshwar Nath Dungh	46.56	169161	32°25'09.180" N	75°44'12.330" E	KML attached
55	Parmeshwar Nath Dungh	28.55	102935	32°25'05.918" N	75°44'12.344" E	KML attached
56	Sawar Singh Dungh	40.26	145304	32°25'08.897" N	75°44'15.023" E	KML attached
57	Pinka Dungh	34.32	123742	32°25'02.963" N	75°44'25.732" E	KML attached
58	Pinka Dungh	34.32	123742	32°25'04.608" N	75°44'26.696" E	KML attached
59	Badhri Dungh	51.26	184976	32°24'54.422" N	75°44'28.135" E	KML attached
60	Sunny Dungh	40.26	145117	32°24'52.466" N	75°44'28.534" E	KML attached
61	Dharam Singh Awan	66.67	241568	32°24'48.417" N	75°44'26.547" E	KML attached
62	Dharam Singh Dungh	43.31	156559	32°24'46.335" N	75°44'25.502" E	KML attached
63	Des Raj Awan	61.94	223813	32°24'45.030" N	75°44'21.679" E	KML attached
	TOTAL	5031	18410592			
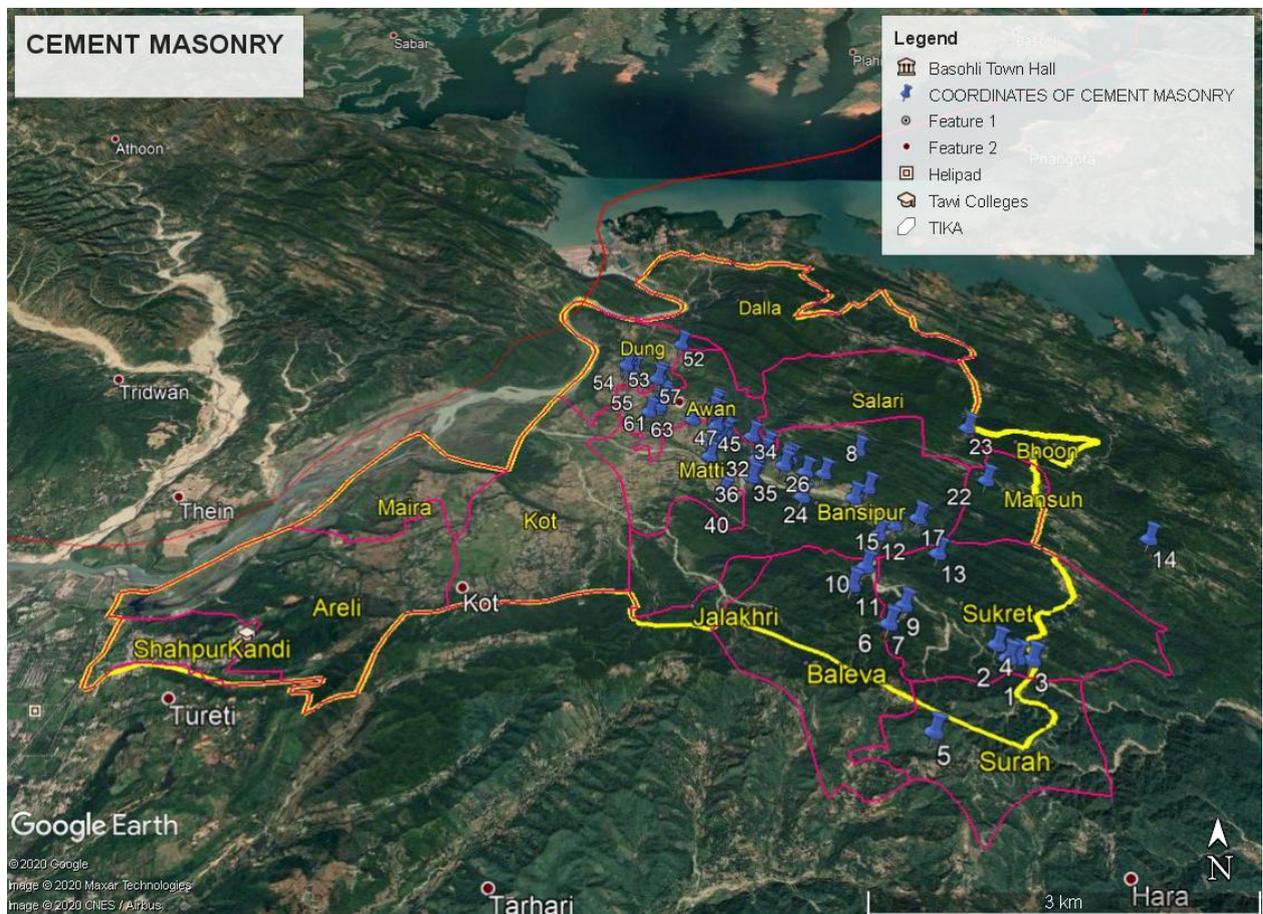
Annexure 3.7 Crate wire Structures:Site locations for crate wire structures

Sr. No	Location	Quantity (cum)	Cost(RS.1810.07 PER CUM)	GPS Co-ordinate		Remarks
				Longitude	Latitude	
1	Birkuli Gully	600	1086042	32°23'05.748" N	75°45'90.338" E	KML ATTACHED
2	Dobala Danga	150	271510.5	32°22'52.022" N	75°46'33.153" E	KML ATTACHED
3	Atth Gully	450	814531.5	32°22'59.370" N	75°46'31.939" E	KML ATTACHED
4	Mansuh Gully/Plata Gully Dalla Gully/Awa Gully	300	543021	32°24'35.706" N	75°45'24.541" E	KML ATTACHED
5	Salari Gully	900	1629063			KML ATTACHED
6	Bansipur Gully	300	543021	32°24'05.507" N	75°45'22.736" E	KML ATTACHED
7	Gharar Gully	300	543021	32°24'05.286" N	75°45'40."020 E	KML ATTACHED
8	Plakhi Gully	300	543021	32°23'52.006" N	75°44'48.934" E	KML ATTACHED
9	Matti Gully	750	1357552.5	32°23'10.334" N	75°44'48.747" E	KML ATTACHED
10	Malade Gully	450	814531.5	32°23'22.239" N	75°44'22.242" E	KML ATTACHED
11	Aralli Gully	300	543021	32°23'15.104" N	75°42'36.693" E	KML ATTACHED
	Total	4800	8688336			

Annexure 3.8 Land slip treatment :Site location for land slip treatment

Sr. No	Location	Quantity(M)	Cost(RS.45 PER M)	GPS Co-ordinate		Remarks
				Longitude	Latitude	
1	Salari Gully	1000	45000	32°23'07.528" N	75°46'19.090" E	KML ATTACHED
2	Sukret to Salari Road	1000	45000	32°24'06.708" N	75°44'58.477" E	KML ATTACHED
3	Bhoon-Mansuh-Awa Road	1000	45000	32°24'38.624" N	75°45'13.589" E	KML ATTACHED
	Total	3000	135000			
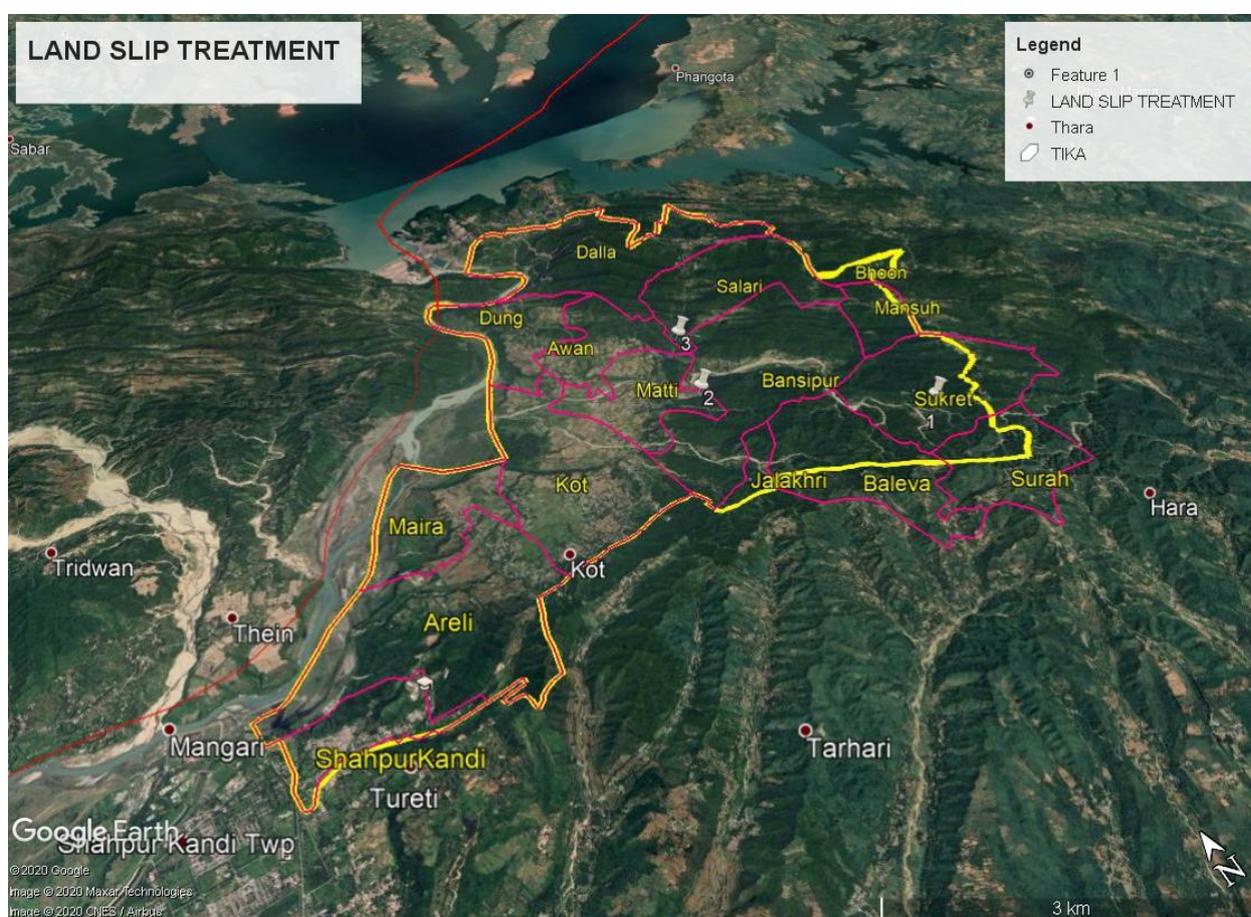
Annexure 3.9 Retaining walls:Site Location for retaining wall

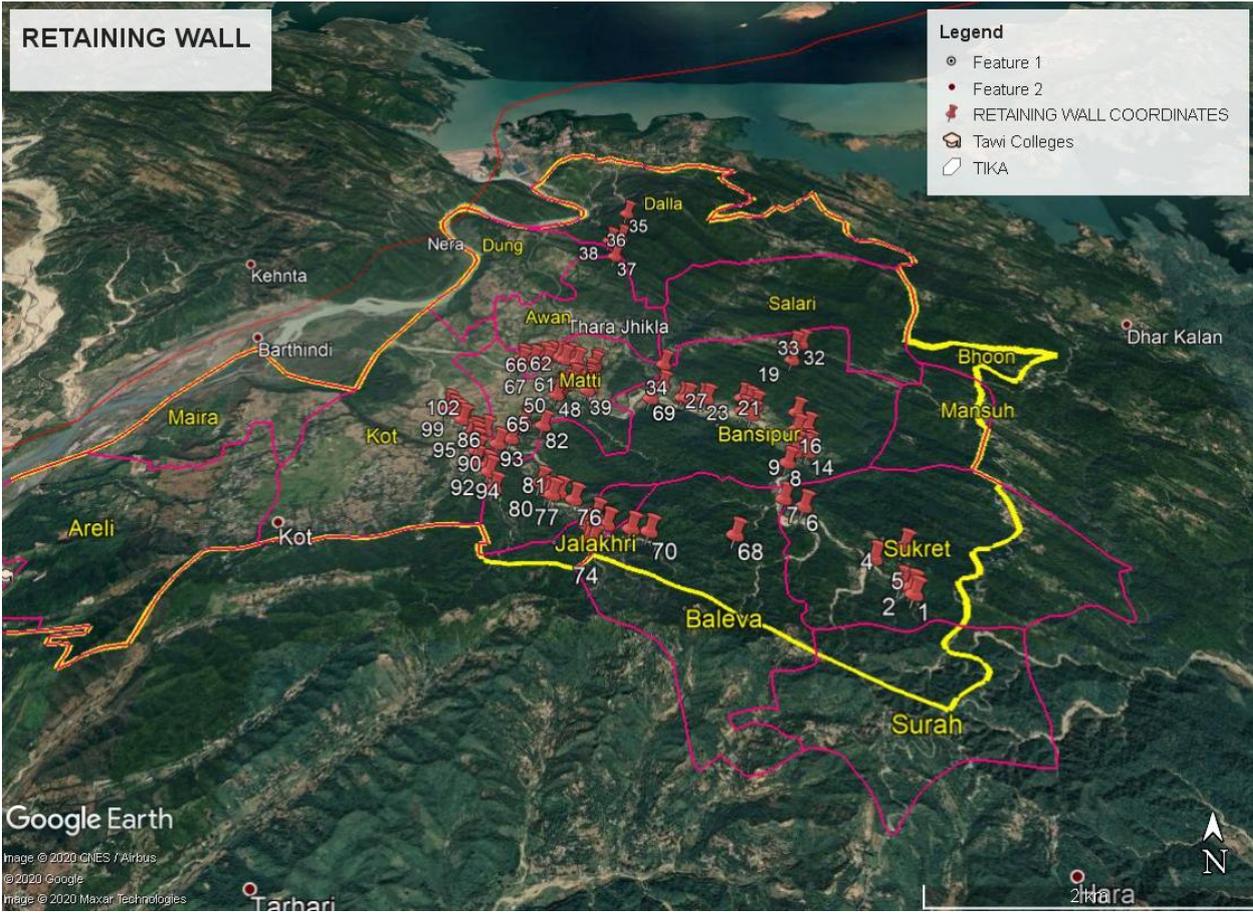| Sr. No	Location	Quantity (cum)	Cost	GPS Co-ordinate		Remarks
				Longitude	Latitude	
1	Harbans Singh Land & Balwant Singh Land	107.4	350731	32°22'56.20800" N	75°46'19.86600" E	kml file attached
2	Raj Singh land	55.74	182496	32°22'58.46200" N	75°46'19.63800" E	kml file attached
3	Tarsem Singh Land	107.4	350731	32°22'59.43000" N	75°46'16.77000" E	kml file attached
4	Ashok Kumar land	111.5	364992	32°23'08.1000" N	75°46'10.76400" E	kml file attached
5	Mahasu Ram Land	111.5	364992	32°23'10.78600" N	75°46'19.86600" E	kml file attached
6	Mata Mandir Land	86	280870	32°23'26.14200"N	75°45'52.67400"E	kml file attached
7	Main Nala Salari	26.76	87598	32°23'29.35600"N	75°45'47.000"E	kml file attached
8	Margo Land	535	1768216	32°23'43.23000"N	75°45'49.86600"E	kml file attached
9	Salari Village	102.38	335668	32°23'47.5800"N	75°45'52.5300"E	kml file attached
10	Dharwara	71.36	233595	32°23'49.69800"N	75°45'54.90800"E	kml file attached
11	Pappu House	207.6	680187	32°23'49.60000"N	75°45'54.96800"E	kml file attached
12	Ajit singh House	254.6	838029	32°23'50.31600"N	75°45'57.48100"E	kml file attached
13	Balwant House	231.45	761845	32°23'50.49400"N	75°45'56.7400"E	kml file attached
14	Ajit singh Khoo	129.75	425117	32°23'47.823"N	75°45'57.165"E	kml file attached
15	Pritam Singh House	94.39	308137	32°23'48.824"N	75°45'57.166"E	kml file attached
16	Om Parkash land	116.78	382606	32°23'57.067"N	75°45'54.565"E	kml file attached
17	Bobby land	94.39	308137	32°23'57.468"N	75°45'58.170"E	kml file attached
18	Bobby land	51.9	170047	32°23'57.444"N	75°45'58.133"E	kml file attached
19	Kulwinder land	83.9	273900	32°24'23.816"N	75°45'56.201"E	kml file attached
20	Shom Lal Land	48.83	157974	32°24'03.115"N	75°45'55.299"E	kml file attached
21	Basir Deen Street	64.88	212559	32°24'07.571"N	75°45'41.888"E	kml file attached
22	Basir Deen Street	33.74	110530	32°24'09.222"N	75°45'39.869"E	kml file attached
23	Bobby land	77.15	253948	32°24'10.493"N	75°45'37.669"E	kml file attached
24	Balbir Land	254.6	838029	32°24'05.200"N	75°45'37.442"E	kml file attached
25	Balbir Land	171.2	565829	32°24'03.471"N	75°45'40.320"E	kml file attached
26	Basir Deen House	308.6	1015793	32°24'10.560"N	75°45'25.470"E	kml file attached
27	Tarsem Singh House	270.03	888818	32°24'10.721"N	75°45'23.866"E	kml file attached
28	Mata Mandir Land	123.44	406317	32°24'10.840"N	75°45'18.749"E	kml file attached

29	Mata Mandir Land	129.75	425117	32°24'11.022"N	75°45'17.156"E	kml file attached
30	Mata Mandir Land	115.06	377742	32°24'11.022"N	75°45'17.156"E	kml file attached
31	Koor Nala	90.83	297582	32°24'25.917"N	75°45'11.153"E	kml file attached
32	Karedh nala	231.45	761844	32°24'31.259"N	75°45'60.32"E	kml file attached
33	Karedh nala	115.06	377742	32°24'30.535"N	75°45'57.55"E	kml file attached
34	Annar Bagh	231.45	761844	32°24'16.626"N	75°45'10.420"E	kml file attached
35	Annar Bagh	129.75	425117	32°24'98.70"N	75°44'57.944"E	kml file attached
36	Bhati Joshi	90.83	297582	32°24'84.14"N	75°44'55.575"E	kml file attached
37	Bhati Babu Ram	252.45	832783	32°24'74.87"N	75°44'53.287"E	kml file attached
38	Bhati Shubash	206.55	681368	32°24'84.406"N	75°44'51.137"E	kml file attached
39	Land of Chatarsingh	150.19	488741	32°24'14.924"N	75°44'44.302"E	kml file attached
40	Jassi Ram	259.5	850234	32°24'16.199"N	75°44'45.382"E	kml file attached
41	Gagana	129.75	425117	32°24'17.054"N	75°44'45.215"E	kml file attached
42	Babu Ram	128.15	419065	32°24'18.669"N	75°44'44.696"E	kml file attached
43	Subash	116.78	382605	32°24'20.029"N	75°44'44.467"E	kml file attached
44	Jugindre singh	129.75	425117	32°24'22.922"N	75°44'44.255"E	kml file attached
45	Sundar Baba	64.88	212558	32°24'26.481"N	75°44'46.023"E	kml file attached
46	Juginder awan	22.41	73022	32°24'26.311"N	75°44'46.336"E	kml file attached
47	Jassi Ram awan	20.3	66046	32°24'27.424"N	75°44'46.725"E	kml file attached
48	Chain Singh Matti	40.6	132092	32°24'12.241"N	75°44'33.780"E	kml file attached
49	Balwant Singh Matti	48.72	158510	32°24'12.697"N	75°44'33.994"E	kml file attached
50	Balwant Singh Matti	36.54	118883	32°24'14.195"N	75°44'34.458"E	kml file attached
51	Sadhu Ram Matti	91.35	297207	32°24'15.337"N	75°44'34.808"E	kml file attached
52	Lekh Raj Matti	160.65	528149	32°24'15.136"N	75°44'34.891"E	kml file attached
53	Lekh Raj Matti	142.8	469466	32°24'16.250"N	75°44'35.529"E	kml file attached
54	Lekh Raj Matti	122.65	401492	32°24'17.115"N	75°44'37.263"E	kml file attached
55	Parkash Matti	133.8	437991	32°24'20.083"N	75°44'39.062"E	kml file attached
56	Lekh Raj Matti	144.95	474490	32°24'20.054"N	75°44'39.796"E	kml file attached
57	Surjeet Awan	55.75	182496	32°24'28.021"N	75°44'40.156"E	kml file attached
58	Sham Awan	100.33	328493	32°24'29.346"N	75°44'35.506"E	kml file attached
59	Sham Awan	111.5	364992	32°24'30.240"N	75°44'37.712"E	kml file attached
60	Sham Awan	200.7	656986	32°24'30.799"N	75°44'33.801"E	kml file attached
61	Sham Awan	178.4	583988	32°24'31.111"N	75°44'30.353"E	kml file attached
62	khem Raj Awan	189.55	620487	32°24'28.730"N	75°44'29.090"E	kml file attached

| 63	Ramesh Awan	144.95	474490	32°24'30.877"N	75°44'27.564"E	kml file attached
64	Rana Awan	144.95	474490	32°24'29.577"N	75°44'24.352"E	kml file attached
65	Deepa Awan	196.24	642387	32°2430.310"N	75°44'23.432"E	kml file attached
66	Tarlok Awan	156.1	510989	32°24'28.303"N	75°44'20.252"E	kml file attached
67	Water Supply Matti	167.25	547489	32°24'30.296"N	75°44'19.711"E	kml file attached
68	Surinder Singh	156.1	510989	32°23'14.556"N	75°45'30.466"E	kml file attached
69	Nandi Matti	66.9	218995	32°24'10.543"N	75°45'06.221"E	kml file attached
70	Nandi Matti	89.2	291994	32°23'16.632"N	75°45'04.852"E	kml file attached
71	Nandi Matti	55.75	182496	32°23'17.634"N	75°44'59.387"E	kml file attached
72	Opposite Guddu House	111.5	364992	32°23'19.756"N	75°44'51.997"E	kml file attached
73	Opposite Guddu House	66.9	218995	32°23'19.376"N	75°44'45.978"E	kml file attached
74	Bittu	89.2	291994	32°23'13.466"N	75°44'47.877"E	kml file attached
75	Bittu	74.2	243679	32°23'14.211"N	75°44'46.420"E	kml file attached
76	Raja Matti	148.4	487358	32°23'23.118"N	75°44'48.562"E	kml file attached
77	Raja's Farm	89.2	291994	32°23'29.126"N	75°44'41.690"E	kml file attached
78	Land of Kallu	111.5	364992	32°23'30.890"N	75°44'34.737"E	kml file attached
79	Kaka's Farm	66.9	218995	32°23'31.727"N	75°44'36.904"E	kml file attached
80	Kaka's Farm	66.9	218995	32°23'31.634"N	75°44'33.362"E	kml file attached
81	Opposite Dharam	78.05	255494	32°23'35.438"N	75°44'30.811"E	kml file attached
82	Opposite Dharam	223	729985	32°23'57.955"N	75°44'30.137"E	kml file attached
83	Water Bolli	167.25	547489	32°23'53.535"N	75°44'19.795"E	kml file attached
84	Road side	185.5	609198	32°23'57.164"N	75°44'10.767"E	kml file attached
85	Back side Rishu House	185.5	609198	32°23'56.576"N	75°44'07.243"E	kml file attached
86	Madan	129.5	426439	32°23'54.423"N	75°44'07.585"E	kml file attached
87	Madan	185.5	609198	32°23'51.772"N	75°44'08.247"E	kml file attached
88	Madan	92.75	304599	32°23'49.044"N	75°44'09.278"E	kml file attached
89	Madan	111.3	365519	32°23'48.642"N	75°44'08.978"E	kml file attached
90	Romi House	89.2	291994	32°23'44.436"N	75°44'09.069"E	kml file attached
91	PACL	66.99	218995	32°23'42.346"N	75°44'12.829"E	kml file attached
92	PACL	55.75	182496	32°23'40.119"N	75°44'13.965"E	kml file attached
93	Ramesh	55.75	182496	32°23'51.513"N	75°44'15.570"E	kml file attached
94	Land of Kallu	296.8	974717	32°23'55.503"N	75°44'05.825"E	kml file attached
95	School	278.25	913798	32°23'56.339"N	75°44'06.640"E	kml file attached
96	Matti Pull	111.3	365519	32°24'02.474"N	75°44'02.895"E	kml file attached
97	Matti Pull	111.3	365519	32°24'02.406"N	75°44'02.489"E	kml file attached
98	Matti Pull	259.7	852878	32°24'04.490"N	75°44'00.500"E	kml file attached
99	Electrical Pole	129.85	426439	32°24'06.215"N	75°43'58.335"E	kml file attached
100	Shisham Tree	222.6	731038	32°24'07.054"N	75°43'56.827"E	kml file attached
101	Toot Tree	223	729985	32°24'08.680"N	75°43'56.668"E	kml file attached
	TOTAL	**13566.43**	**44503945**			

Annexure 3.10 Live hedge :Site Location for live hedge

| Sr. No	Location	Quantity (KM)	Cost(RS.102600 PER KM)	GPS Co-ordinate		Remarks
				Longitude	Latitude	
1	Birkuli Gully	1	102600	32°22'59.430" N	75°46'16.770" E	KML ATTACHED
2	Atth Gully	2	205200	32°23'24.823" N	75°46'57.165" E	KML ATTACHED
3	Mansuh Gully/Plata Gully Dalla Gully/Awa Gully	2	205200	32°23'49.839" N	75°46'07.639" E	KML ATTACHED
4	Salari Gully	10	1026000	32°23'04.730" N	75°45'36.710" E	KML ATTACHED
5	Plakhi Gully	3	307800	32°23'52.006" N	75°44'48.934" E	KML ATTACHED
6	Matti Gully	3	307800	32°23'10.334" N	75°44'48.747" E	KML ATTACHED
7	Malade Gully	3	307800	32°23'22.239" N	75°44'22.242" E	KML ATTACHED
	Total	24	2462400			
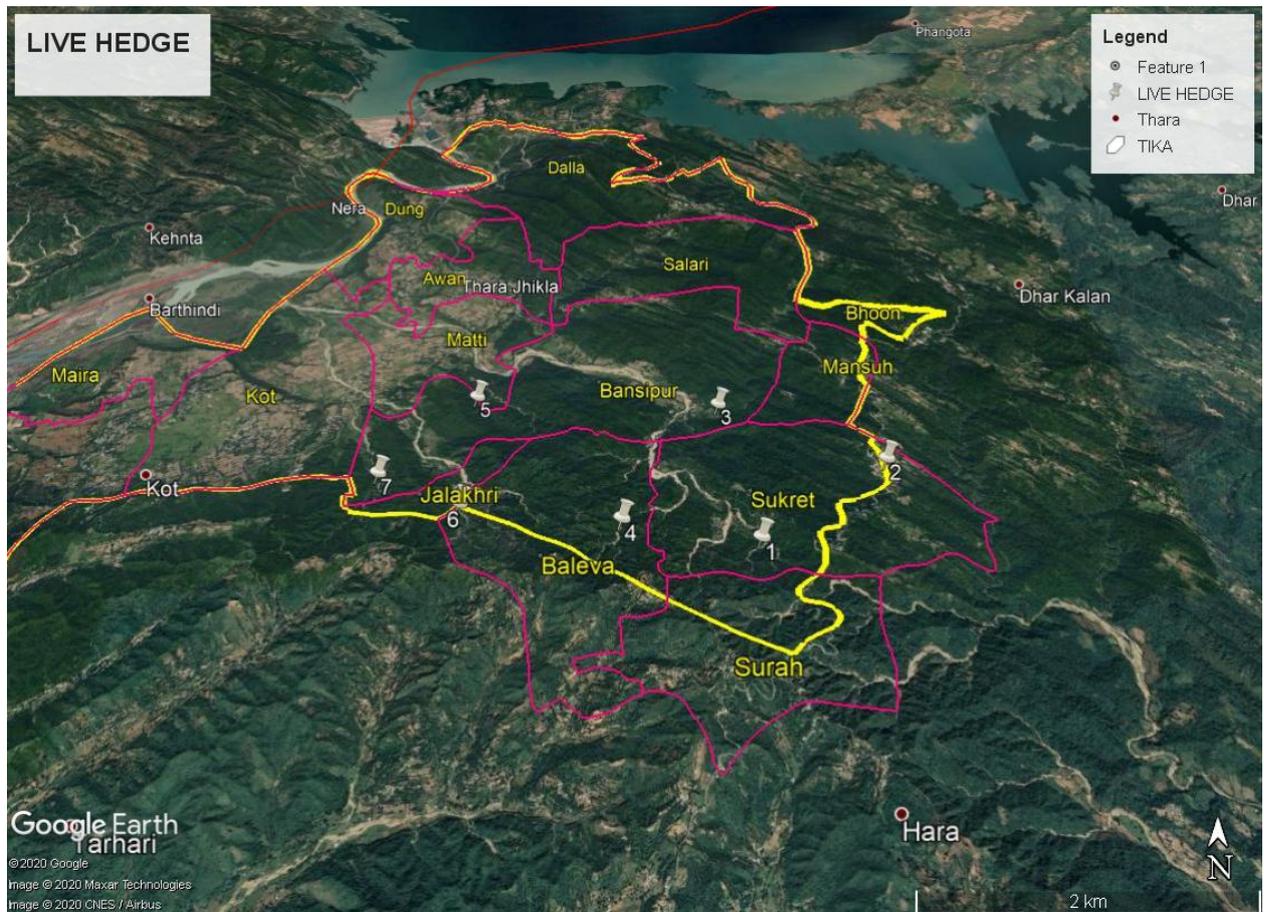
Annexure 3.11 Bhabhar Grass: Site Location for Bhabhar Grass

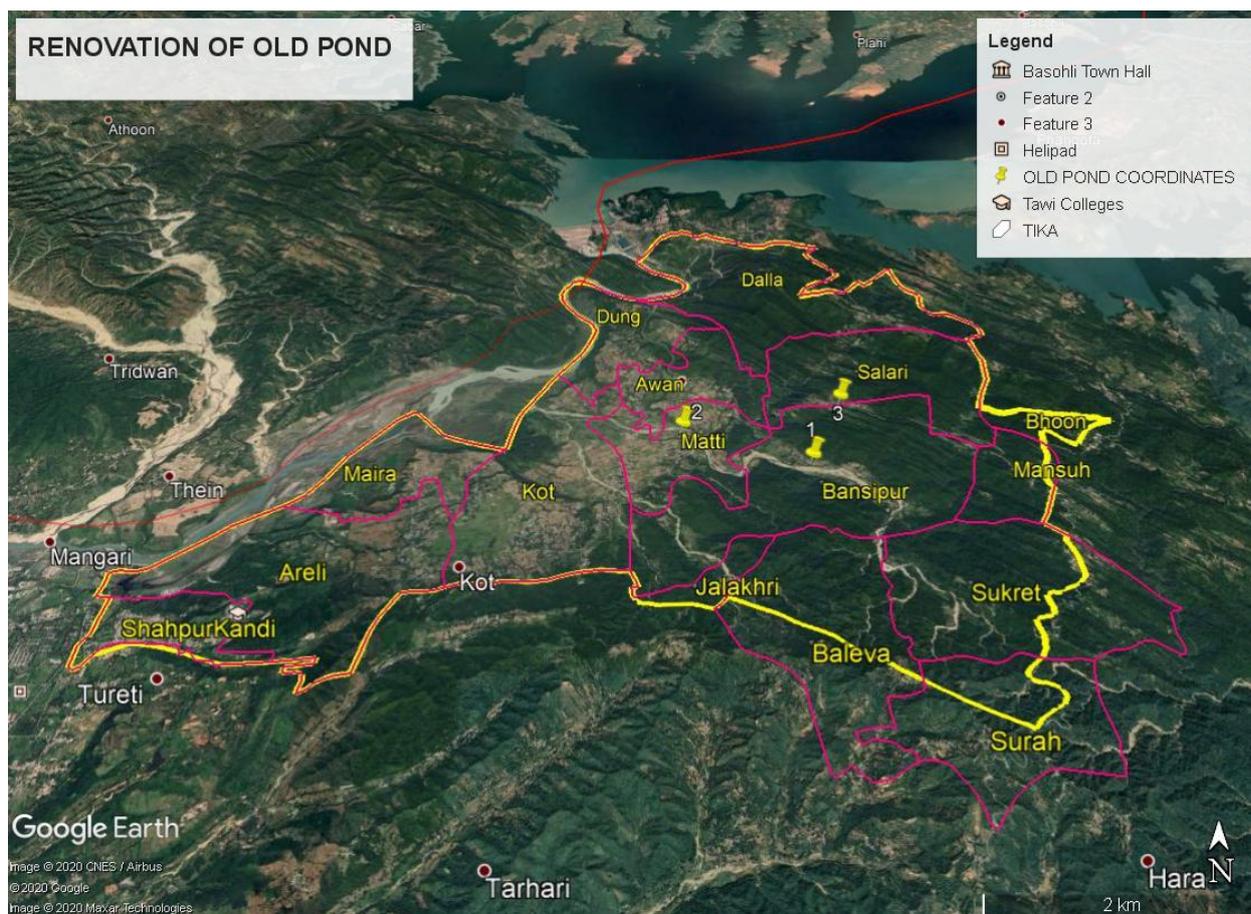| Sr. No	Location	Quantity (HA)	Cost(RS.12500 PER HA)	GPS Co-ordinate		Remarks
				Longitude	Latitude	
1	Dobala Danga	2	25000	32°22'52.536" N	75°46'27.756" E	KML ATTACHED
2	Atth Gully	1	12500	32°23'47.823" N	75°45'57.170" E	KML ATTACHED
3	Mansuh Gully/Plata Gully Dalla Gully/Awa Gully	2	25000	32°23'50.891" N	75°46'07.067" E	KML ATTACHED
4	Salari Gully	2	25000	32°23'30.753" N	75°45'43.657" E	KML ATTACHED
5	Bansipur Gully	2	25000	32°24'10.777" N	75°45'03.329" E	KML ATTACHED
6	Matti Gully	1	12500	32°24'27.424" N	75°44'46.725" E	KML ATTACHED
7	Sukret to Salari Road	1	12500	32°23'07.528" N	75°46'19.090" E	KML ATTACHED
8	Bhoon-Mansuh-Awa Road	1	12500	32°24'38.624" N	75°45'13.589" E	KML ATTACHED
	Total	12	150000			
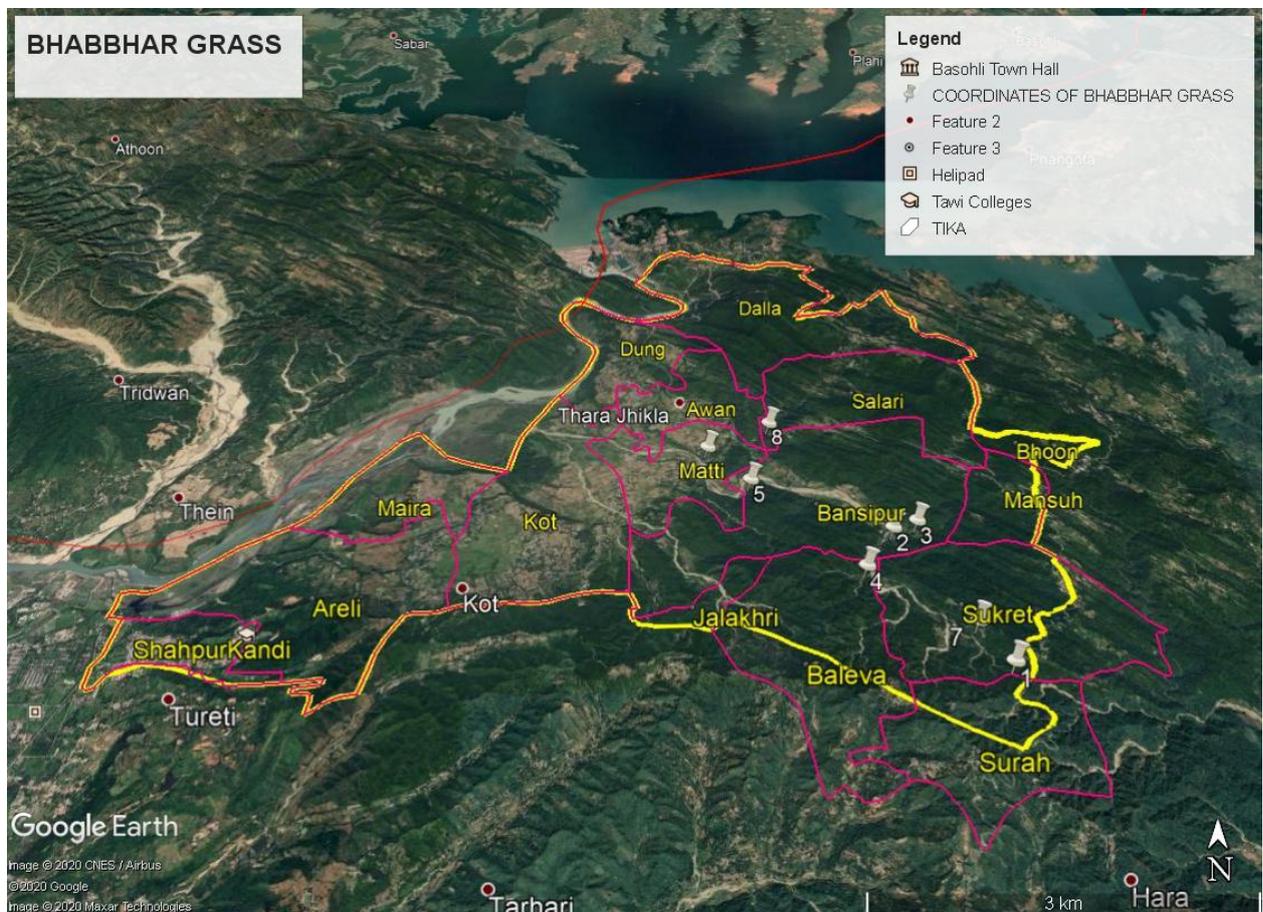
Annexure 3.12 Creation of new pond: Site Location for creation of new pond

Sr. No	Location	Quantity (NO.)	Cost(RS 10 LAC PER POND)	GPS Co-ordinate		Remarks
				Longitude	Latitude	
1	Salari Gully	1	1000000	32°23'49.698" N	75°45'54.908" E	kml attached
2	Matti Gully	1	1000000	32°23'05.151" N	75°44'49.691" E	kml attached
3	Matti Gully	1	1000000	32°24'26.190" N	75°44'33.534" E	kml attached
4	Malade Gully	1	1000000	32°23'34.665" N	75°44'06.241" E	kml attached
	Total	4	4000000			

CREATION OF NEW POND
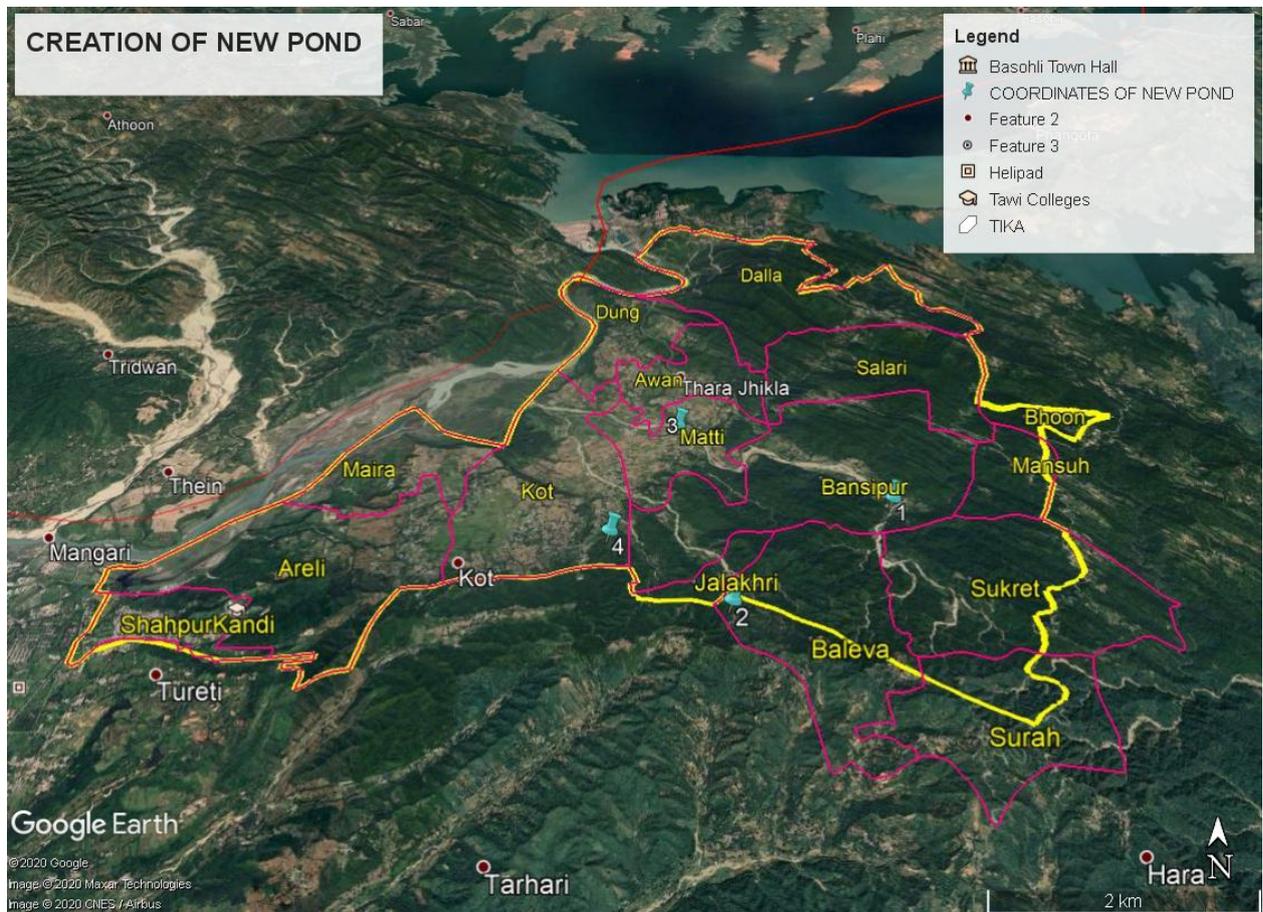
Annexure 3.13 Renovation of old pond

| Sr. No	Location	Quantity (NO.)	Cost(RS.4 LAKH PER POND)	GPS Co-ordinate		Remarks
				Longitude	Latitude	
1	Salari Gully	1	400000	32°24'10.867" N	75°45'24.593" E	KML ATTACHED
2	Matti Gully	1	400000	32°24'27.268" N	75°44'32.947" E	KML ATTACHED
3	Bhoon-Mansuh-Awa Road	1	400000	32°24'38.000" N	75°45'39.282" E	KML ATTACHED
	TOTAL	3	1200000			

Annexure 3.14 Pasture Development

Sr. No	Location	Quantity (HA)	Cost(RS. 15000 PER HA)	GPS Co-ordinate		Remarks
				Longitude	Latitude	
1	Village matti near nursery	5	75000	32°24'28.730" N	75°44'29.090" E	KML ATTACHED
2	village salari	5	75000	32°24'07.127" N	75°45'25.446" E	KML ATTACHED
3	village kot	5	75000	32°23'22.239" N	75°44'22.242" E	KML ATTACHED
	Total	15	225000			
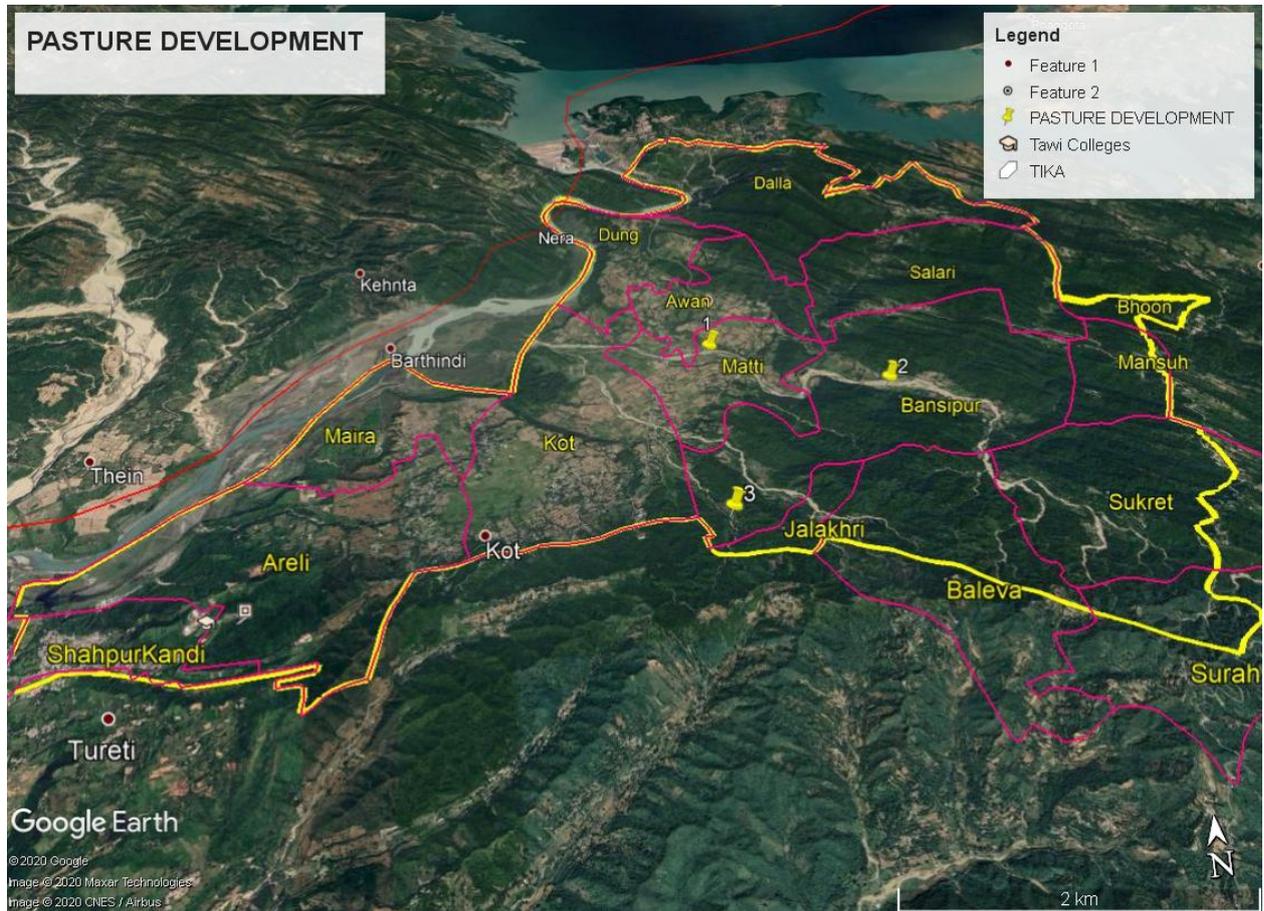
Annexure 3.15 Fire Protection

Sr. No	Location	Fire line (km)	Cost (Rs.110134 per km)	GPS Co-ordinate		Remarks
				Longitude	Latitude	
1	Dalla to Salari	2	220268	32°25'30.733" N	75°45'55.851" E	KML FILE ATTACHED
2	Sukret to Salari	2	220268	32°23'44.672" N	75°46'03.859" E	KML FILE ATTACHED
3	Balewa to Matti Bansipur	1	110134	32°23'57.800" N	75°44'52.467" E	KML FILE ATTACHED
	Total	5	550670			
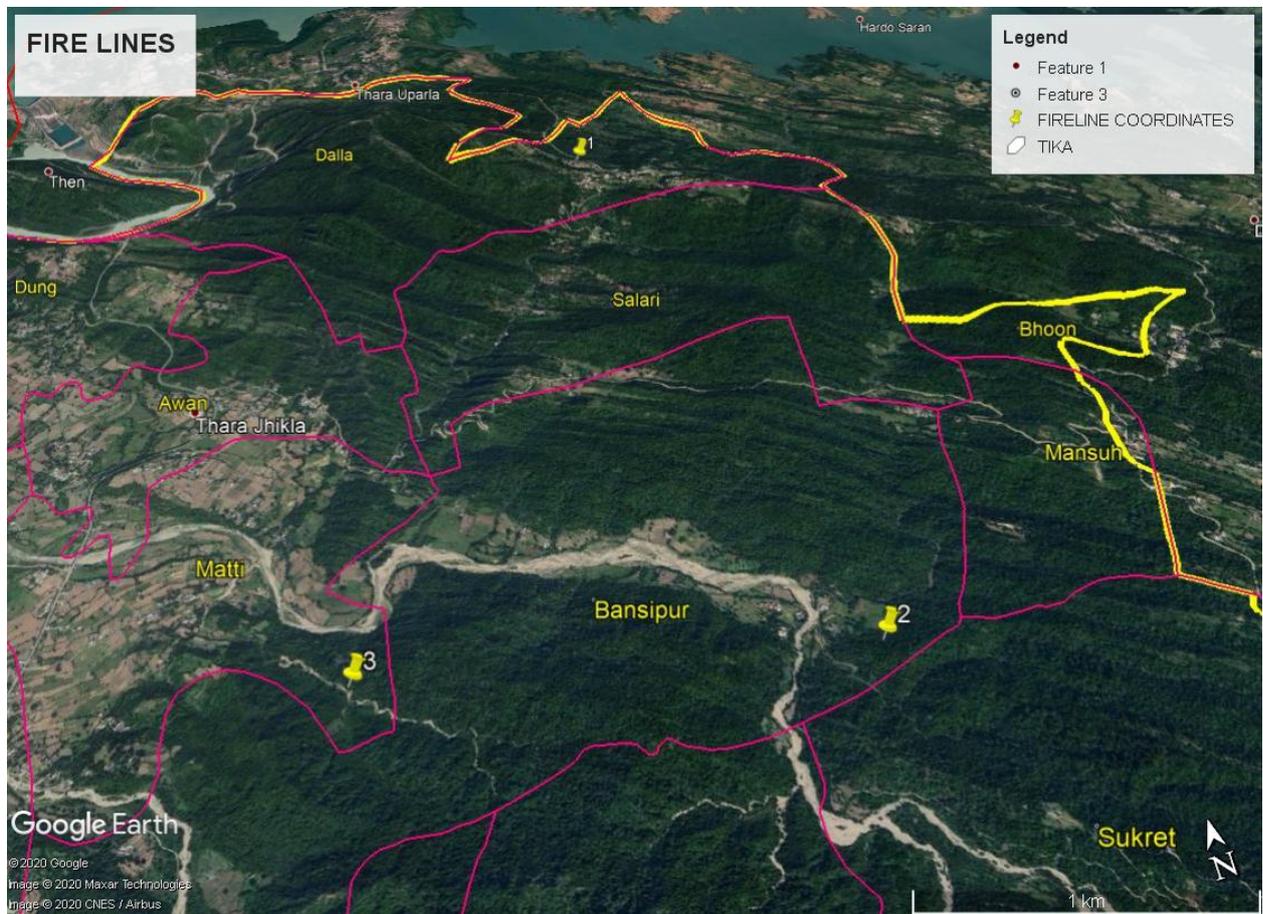
Annexure 3.16 :Estimate for eco-development through community participation(Total villages=16)		
Sr.No	Components	Rs.in lakhs
1	Entry point activities in all villages (2 lakhs per village)	32
2	Cooking gas supply(LPG)and energy conservation measures likre biogas and solar devices(1 lakh per village)	16
3	Training, awareness, extension and other activities	16
4	Investment in income generating schemes for JFMCs and SHGs for sustainable development	24
5	Purchase of Processing units for Medicinal and Aromatic Plants	12
	Total	100

VILLAGE BOUNDARIES
FALLING UNDER ARELI MATTI DOONG SUBWATERSHED