Annex 7: Geological Survey Report

Lower Jhimruk Project (W-05)

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Introduction

This Report deals with the engineering geological investigations in the Lower Jhimruk hydroelectric dam projects. This project area was surveyed by Dr Subesh Ghimire, Mr Pratap Bohora, and Mr Ajit Sapkota between 10 and 16 June 2012. Geology and engineering geology of this project are summarized below.

1 Lower JhimrukProject

The Lower Jhimruk Reservoir Project is located in Pyuthan and Arghakhanchi Districts of mid-western Nepal. The project covers middle reaches of the Jhimruk Khola. The dam site is proposed near the Chheda village and the powerhouse lies in the lowe reaches of the Jhimruk Khola.

1.1 Geology of project area

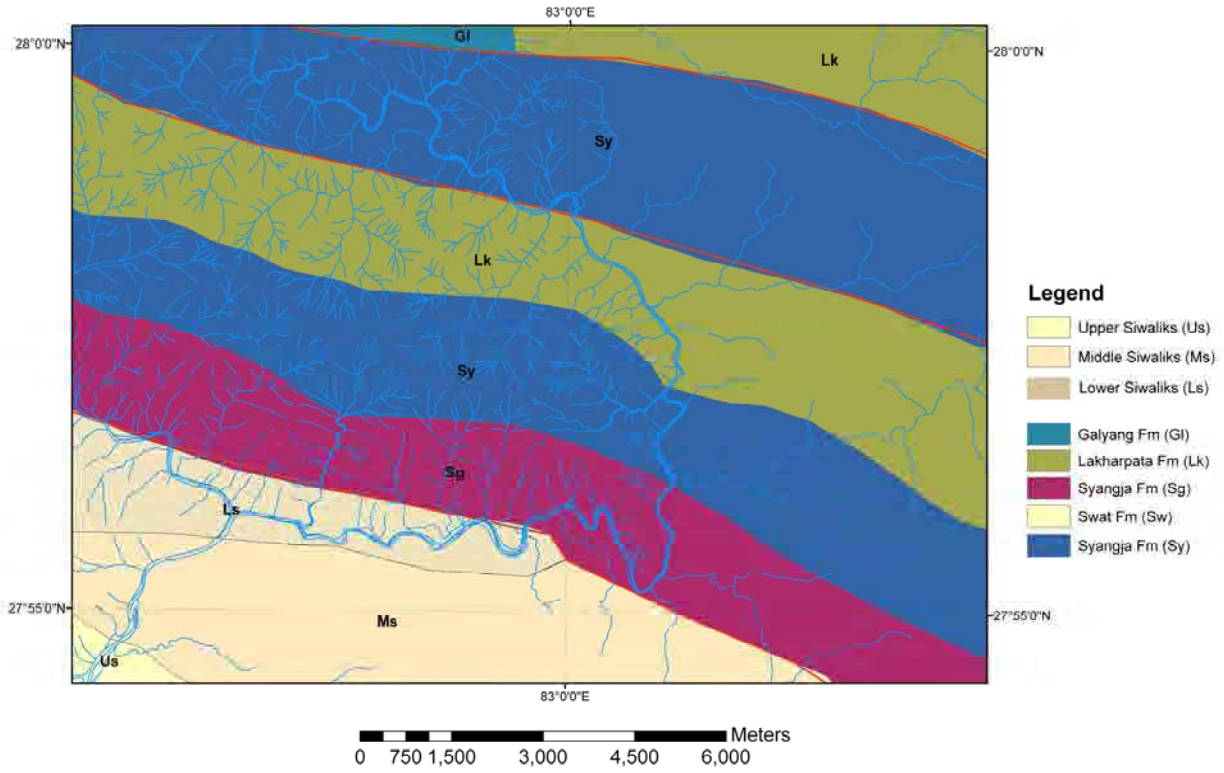

Figure 1.1 Regional geological map in and around the project area.

The project area is comprised of metasedimentary rocks of the Lesser Himalaya with slates, sandstones, limestones, and quartzties as dominant rock types. The geological map prepared by the Department of Mines and Geology of Government of Nepal (Figure 1.1) divides the lithology of the Lesser Himalaya of this area into five formations namely: Sangram Formation, Swat Formation, Syangja Formation, Lakharpata Formation and Galyang Formation separated from the Siwalik rocks in the south by the Main Boundary Thrust. The location of the observation points in the area is shown in Figure 1.2 and Table 1.1.

Lithology: The main lithology is comprised of gray to dark, laminated shale with fewer intercalation of gray, medium grained, medium bedded sandstone at the lower part (Figure 1.3). This lithology is comparable with the Ranagaon Formation of Salyan Area (Dhital and Kizaki 1984). The lithology changes to a thick succession of thick bedded, pink, coarse grained sandstone and red-green, laminated shale of Khamari Formation. Sedimentary structures like ripple marks (Figure 1.4) and mud cracks are abundantly

found in this formation. Further north, the Khamari Formation is overlain by Eocene Beds with predominant sandstones. The Eocene beds are truncated by a fault and the rocks of Khamari Formation repeats to the north. Finally the rocks of Khamari Formation are overlain by thick beds by gray dolomite of Dhurbang Khola Formation. The dolomite is characterized by dome shaped stromatolite (Figure 1.5). Small scale folds are abundantly found in the area (Figure 1.6)

Quaternary deposits: Colluvial deposits, and debris flow deposits (alluvial fans) are found on the valley floors of the Jhimruk Khola its main tributaries. The colluvial deposits predominate on upper moderately steep to gentle slopes and spurs.

The alluvial deposits are distributed in the lower reaches of the Jhimruk Khola and they are less than 10 m thick.

Rock mass condition: The dolomite in the upper reaches of the Jhimruk Khola is comparatively strong but it may suspect the water tightness due to the probable cavern structures. The rocks of Khamari Formation are strong and relatively less permeable whereas the Eocene rocks and the rocks of Ranagaon formation are moderately fractured.. The overall stability of the rock mass is good to very good. The resistant quartzites form steep cliffs, gorges, and sharp peaks, whereas the schist forms a smooth spur and ridge or gently valley.

Weathering: Water and air are the main sources of weathering. Apart from them, sunshine (temperature variation) has also played a significant role in weathering of quartzites. The overall weathering depth in rocks reaches up to 5 m and sometimes more than that.

Jointing: Three discontinuity sets are seen in the Lowr Jhimruk project area, the three sets are almost perpendicular to each other, especially in quartzites. The shales are characterized by very irregular joints. The joints are straight to slightly wavy in the quartzites, where their aperture ranges from less than 1 mm to 5 mm, but some joints are rather wide (up to 1 cm) and continue for several tens of metres.

Stability conditions: The rock soil slopes in the project area are generally stable. The main source of sediments is the debris flow in the Jhimruk River from its tributaries, such as the Chirling Khola, Lasune Khola. Landslides are seen to occur on colluvial slopes and steep rock slopes (controlled by joints). Mainly debris slides, wedge slides, and plane rockslides are found.

The highest flood level in the Jhimruk River is about 2.5 to 3 m from the general flow level. Owing to the frequent debris flows from the tributary streams, the water in the Jhimruk River becomes excessively turbid most of the time in the monsoon season. Hence, some measures are required to deal with this problem. On the other hand, it is clean and clear during the dry period.

Groundwater conditions: The Jhimruk River, Chirling Khola, and other smaller tributaries are perennial whereas minor gullies are seasonal. The quartzites and shales are quite impervious and the dam constructed on them or the tunnel passing through them should not pose any serious water ingress problems.

1.2 Dam axis

The proposed dam axis (Figure 1.7) lies in the pink, medum grained quartzite exposed on the left bank of the Jhimruk River, while on the right bank gray, laminated shale is observed (Figure 1.8). The proposed dam axis (Figure 1.8) has rock exposures on both banks. The rock is categorised as good or fair.

The area around the dam axis is stable and the Jhimruk River has a more or less straight course to the downstream of that area where the slopes are dry. The dam foundation and the area around the dam axis are impervious and do not pose any serious threat of seepage.

It is proposed to construct a rock-fill dam, the quartzites exposed around Simpani and the Chheda village can be utilised to obtain boulders, and the red shales is available in the vicinity of the dam site, located about 2-3 km downstream.

1.3 Reservoir

The water level (594 m) in the proposed reservoir extends up to Juda, Angri, Chukaha and Baireni. The engineering geological map of the reservoir and its surrounding areas is presented in Figure 1.9.
The stability in the surrounding areas of the reservoir is relatively sound. There are no significant weak or vulnerable zones leading to dam collapse or large failures obstructing the reservoir.
The area to be under water consists of bedrock with some minor instabilities. The deep, straight gorge is quite suitable for the dam construction. However, there will be significant sediment transport from the Lasune Khola and Cirling Khola. Hence some check dams and other sediment retention structures are required to prevent the sediment inflow in the reservoir.

1.4 Powerhouse

The proposed powerhouse site is located on the right bank of the Jhimruk Khola on its alluvial terrace (Figure 1.10 and Figure 1.11). On the uphill side the lithology is comprised of light gray, red purple shale and orthoquartzite. The powerhouse site is quite suitable for the given project.

1.5 Waterway

An intake tunnel (Figure 1.12) is proposed on the right bank of the Jhimruk River, about 3km upstream of the dam. The area is made up of quartzite it has a moderately steep rock cliff.

The proposed tunnel passes basically through the quartzite and shales of Khamari Formation. Then it intersects a fault and enters the Eocene rocks. Then the rocks of Khamari formation repeats and are underlain by the rocks of Ranagaon Formation (Figure 1.13).
The overburden along the proposed headrace tunnel varies from less than 50 m to about 700 m. Owing to the gentle dip of rock beds some precautions are required during construction to overcome roof collapse.

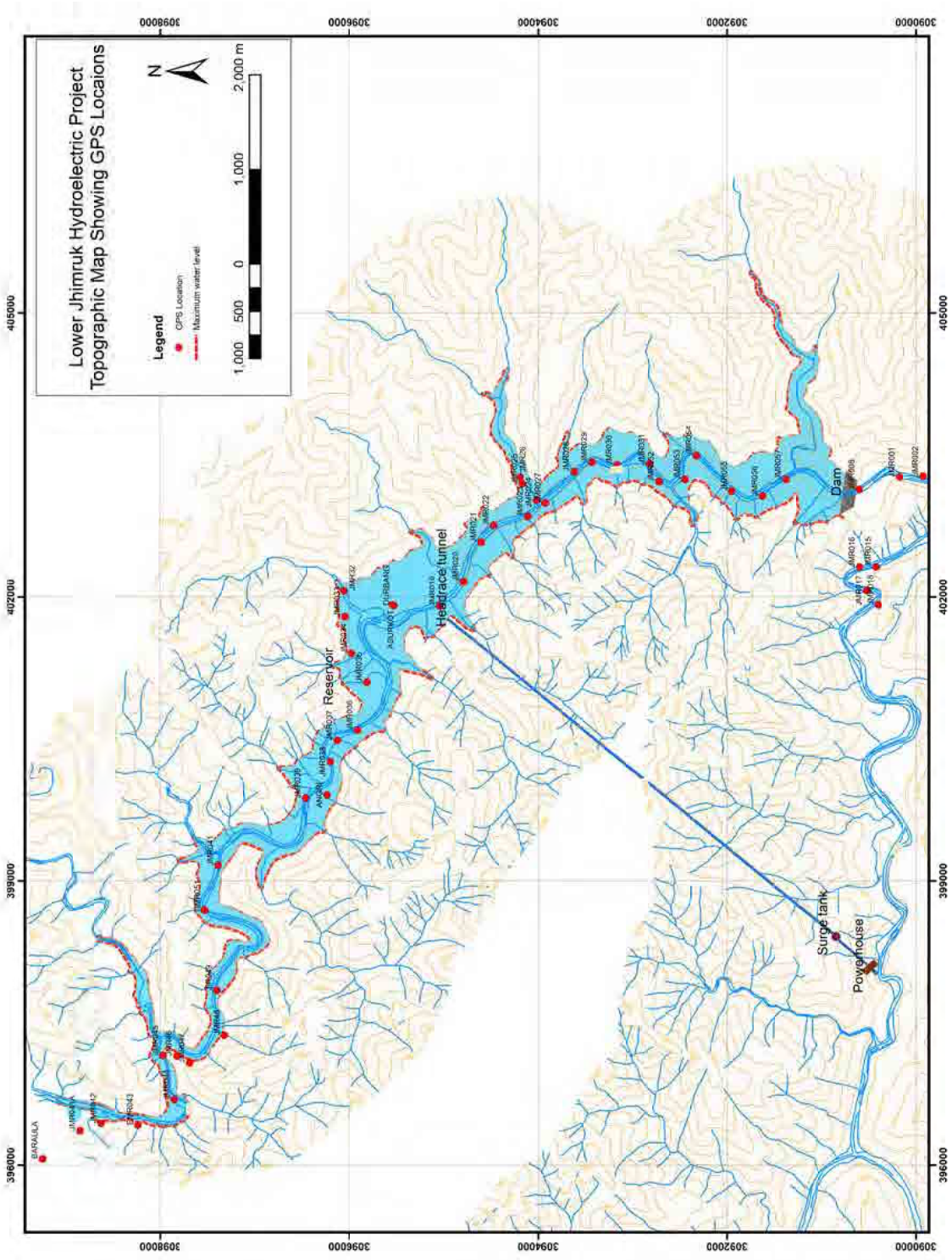

Figure 1.2: Topographic Map Showing the location of different observation points

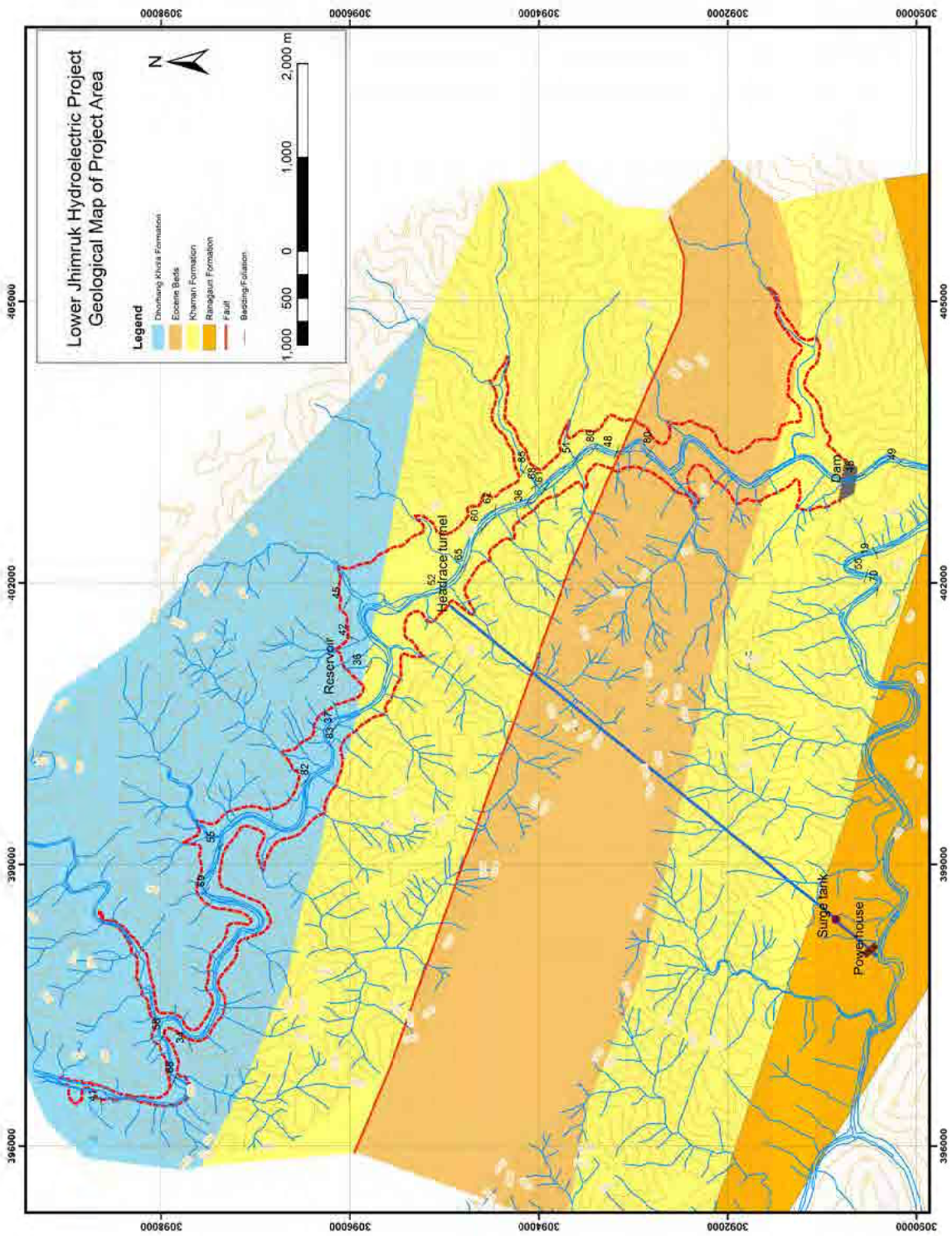

Figure 1.3: Detailed geology of the project area

Figure 1.4: Photograph showing the ripple marks in quartzite on the right bank of the Jhimruk Khola near Damar Village at location JMR 036

Figure 1.5: Photograph showing the stromatolitic dolomite on the left bank of the Jhimruk Khola near Angri Village at location JMR 038.

Figure 1.6: Photograph showing a small scale fold (the lithology is gray sandstone) observed at location JMR 010 in the Besare Khola (View to E).

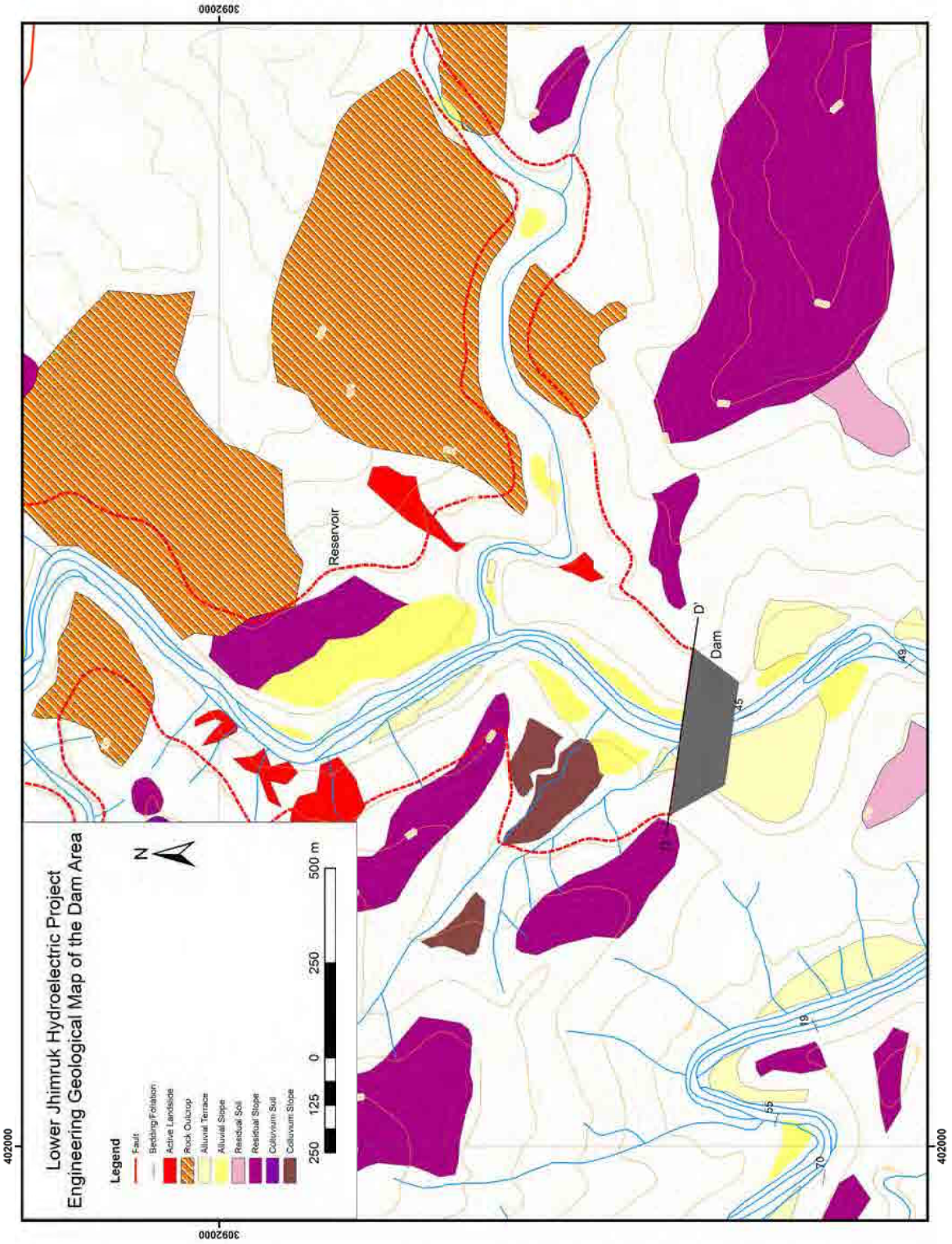

Figure 1.7: Engineering Geological Map of the Dam Area. Line DD' shows the line of cross section

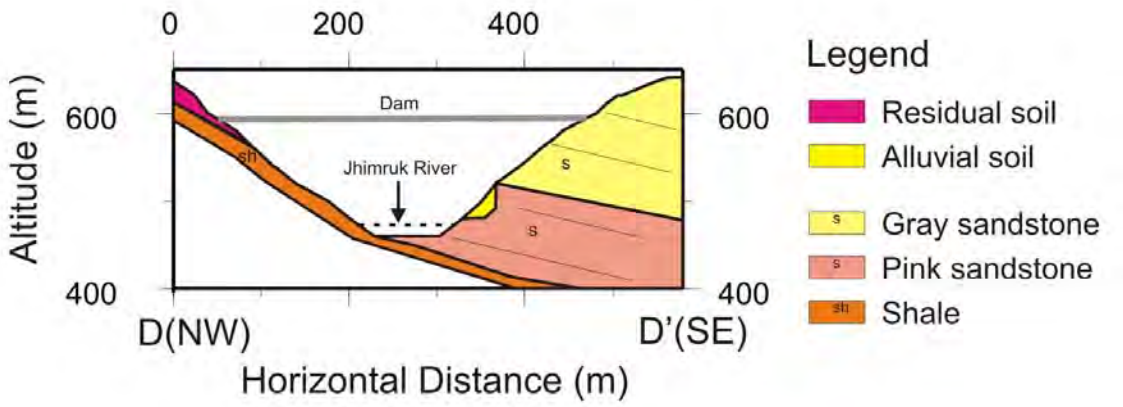

Figure 1.8: Geological cross section along DD' in the dam area.

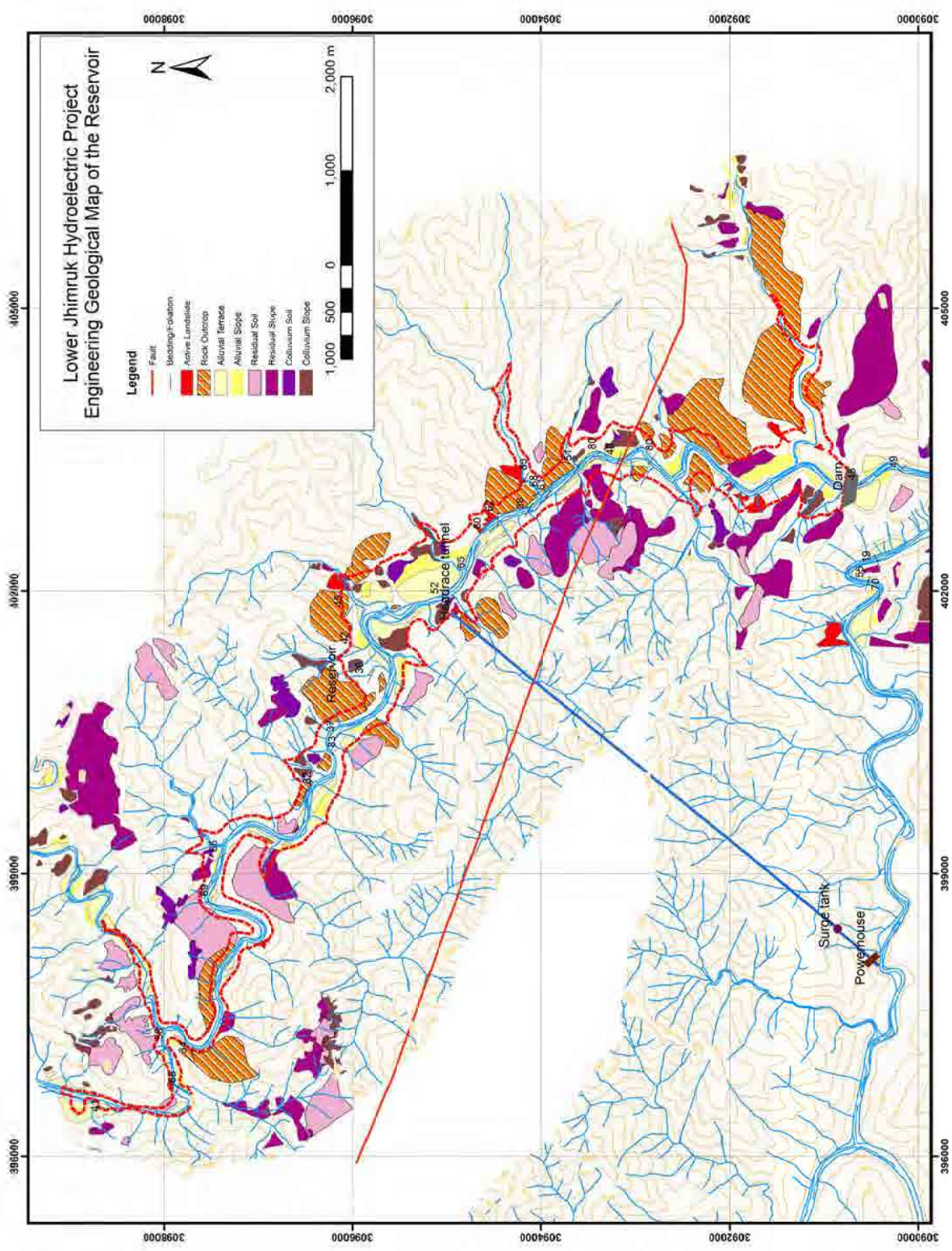

Figure 1.9: Engineering geological map of the reservoir area

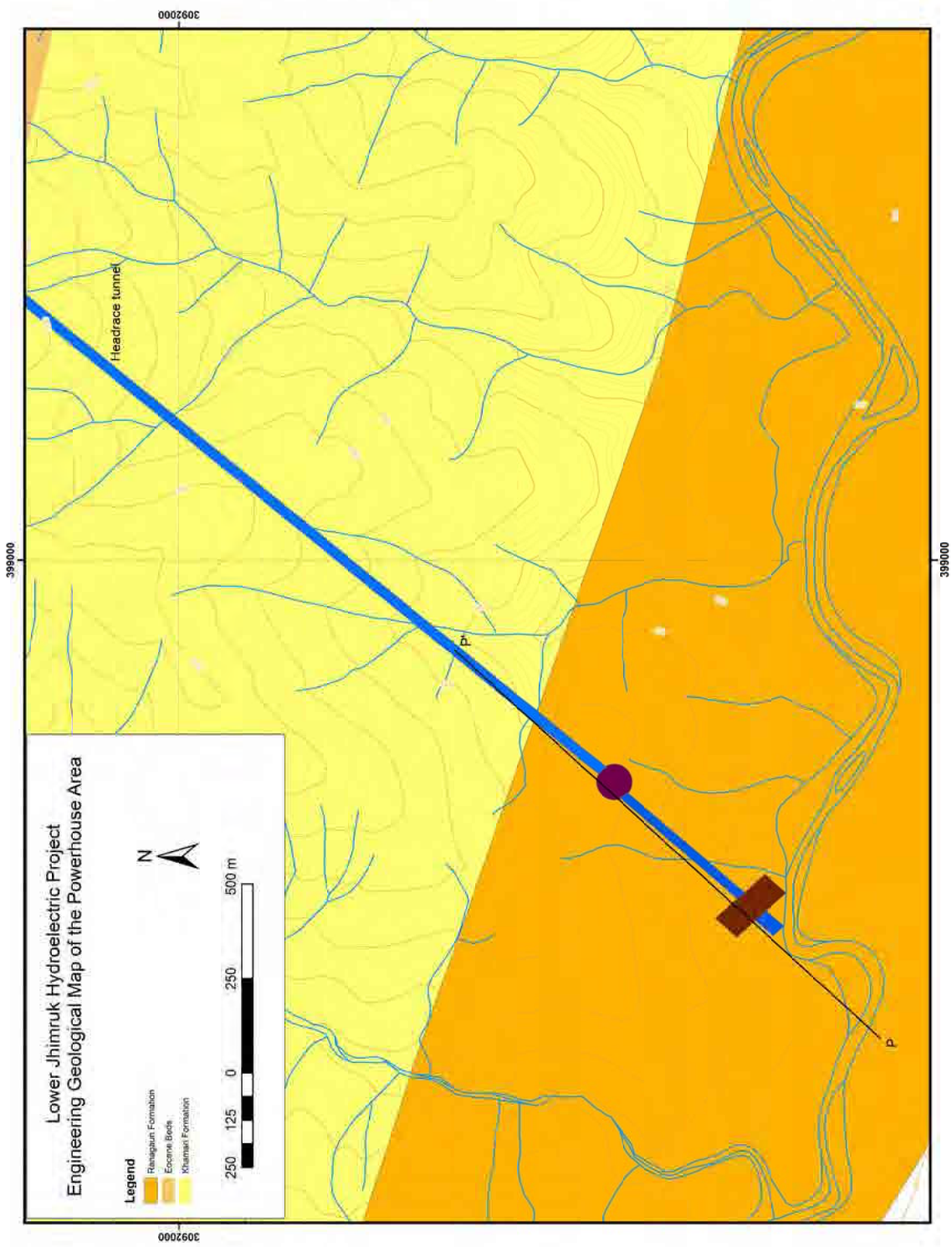

Figure 1.10: Engineering geological map of the powerhouse area. Line PP' shows the line of cross section

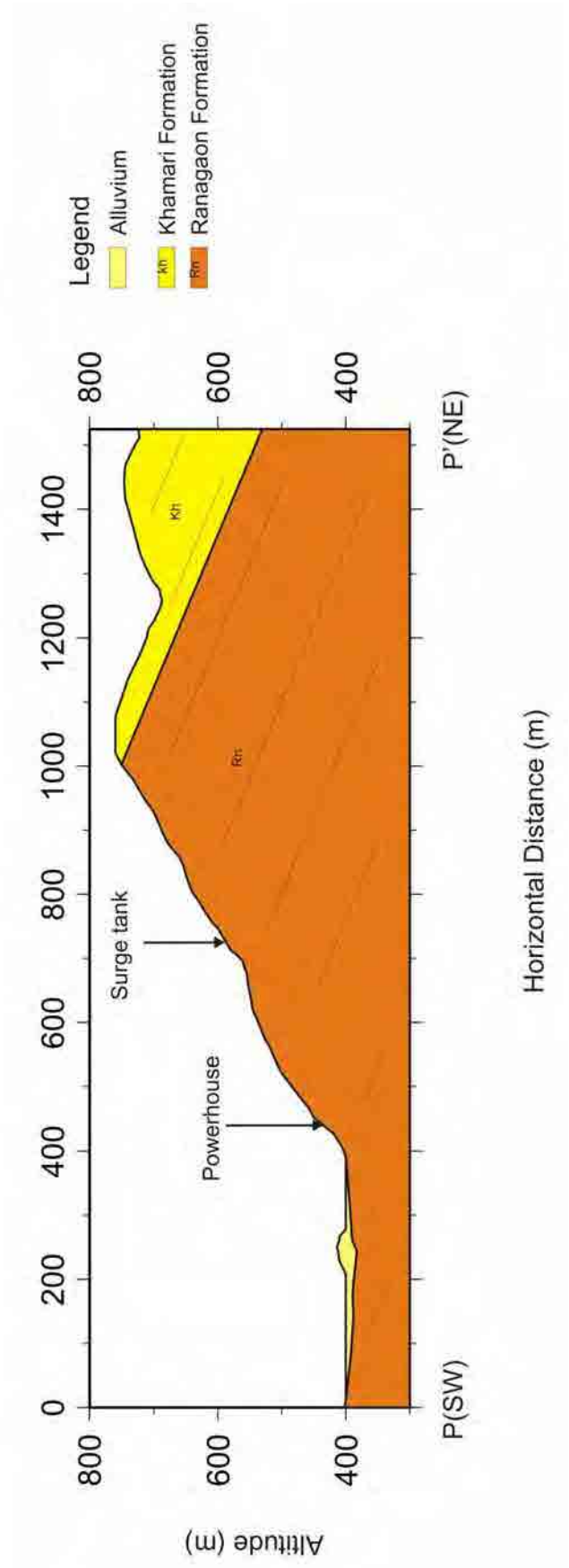

Figure 1.11: Geological cross section along PP' in the powerhouse area

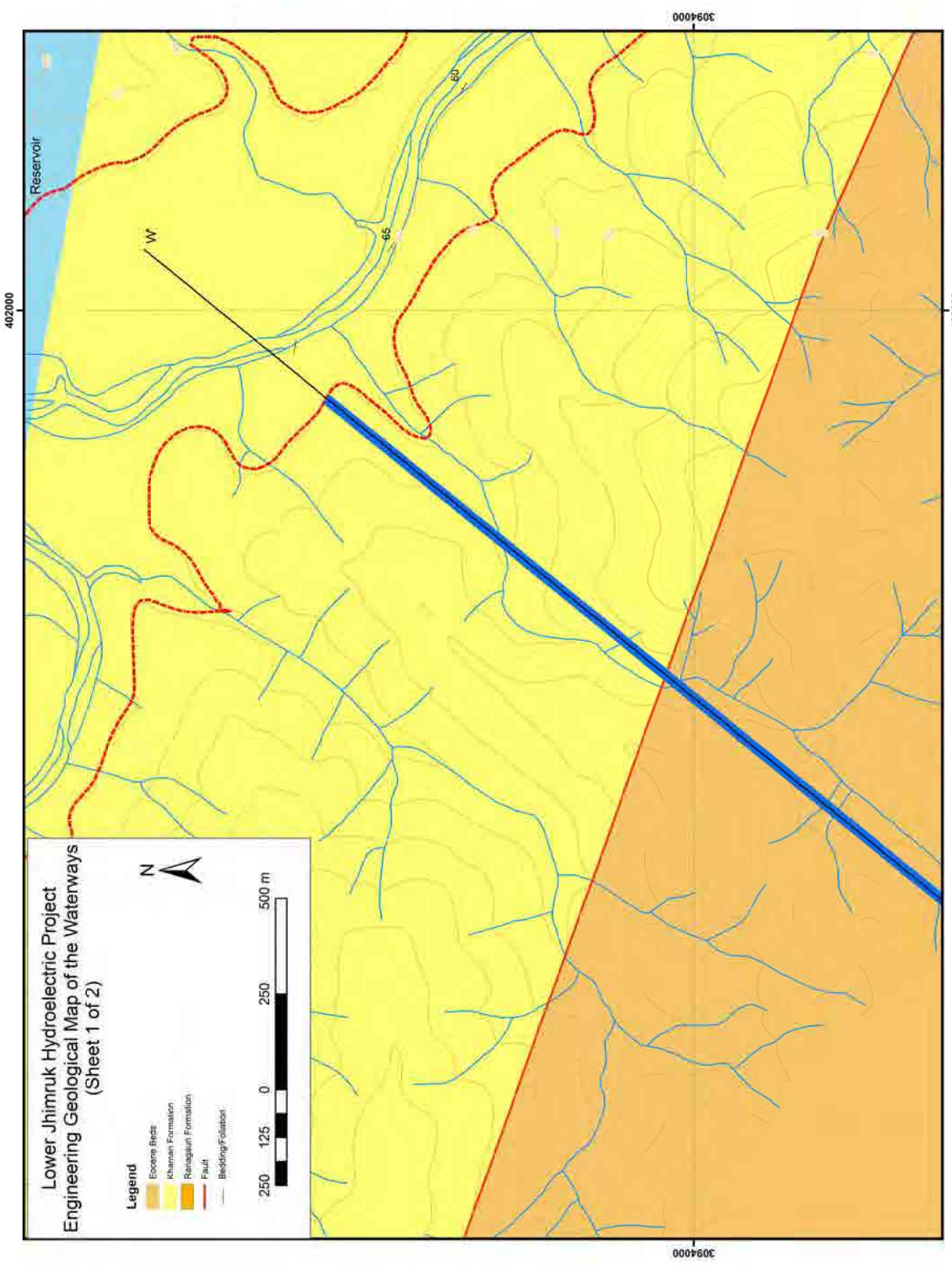

Figure 1.12: Engineering geological map of the waterway. Line WW' shows the line of cross section

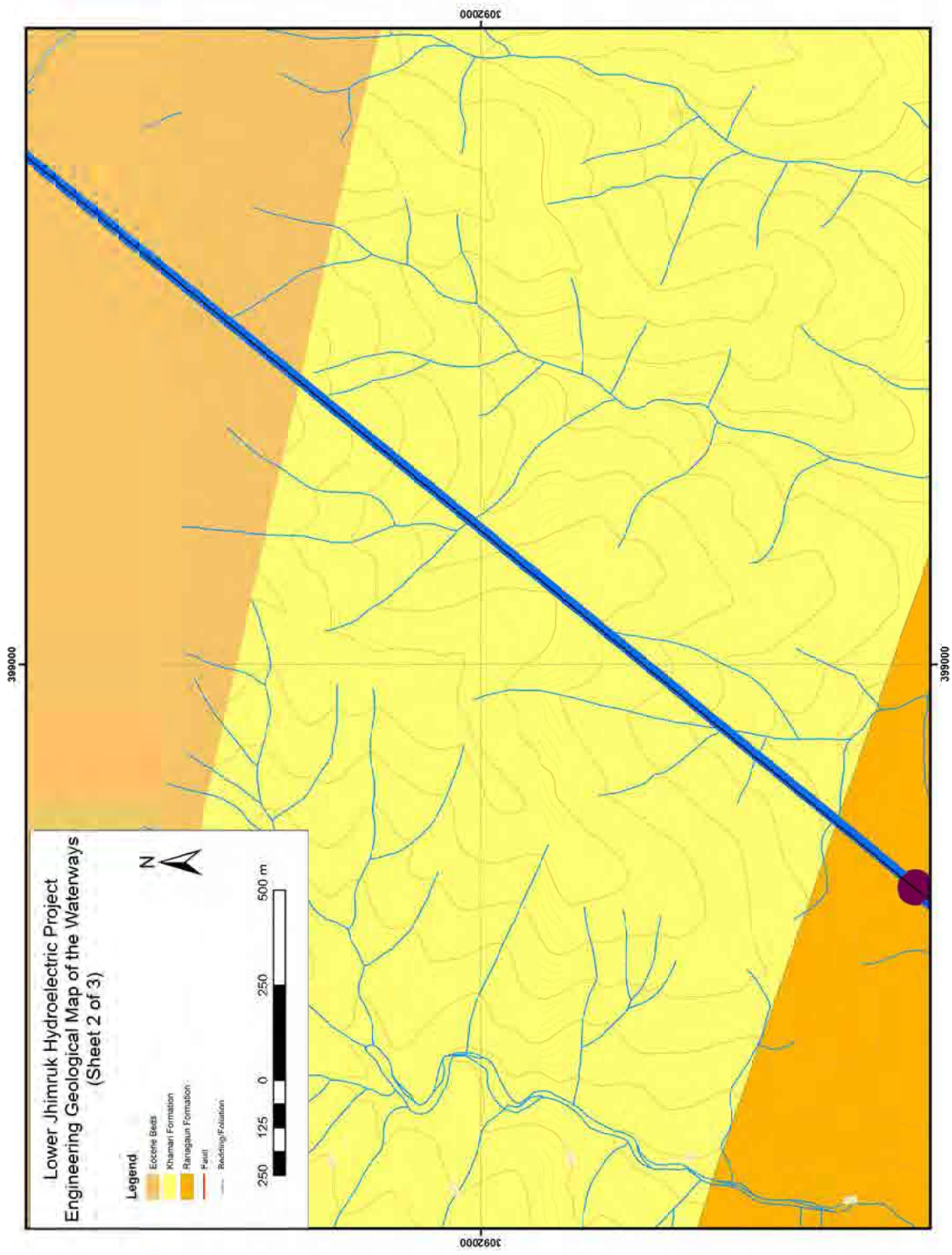

Figure 1.12: Engineering geological map of the waterway (continued)

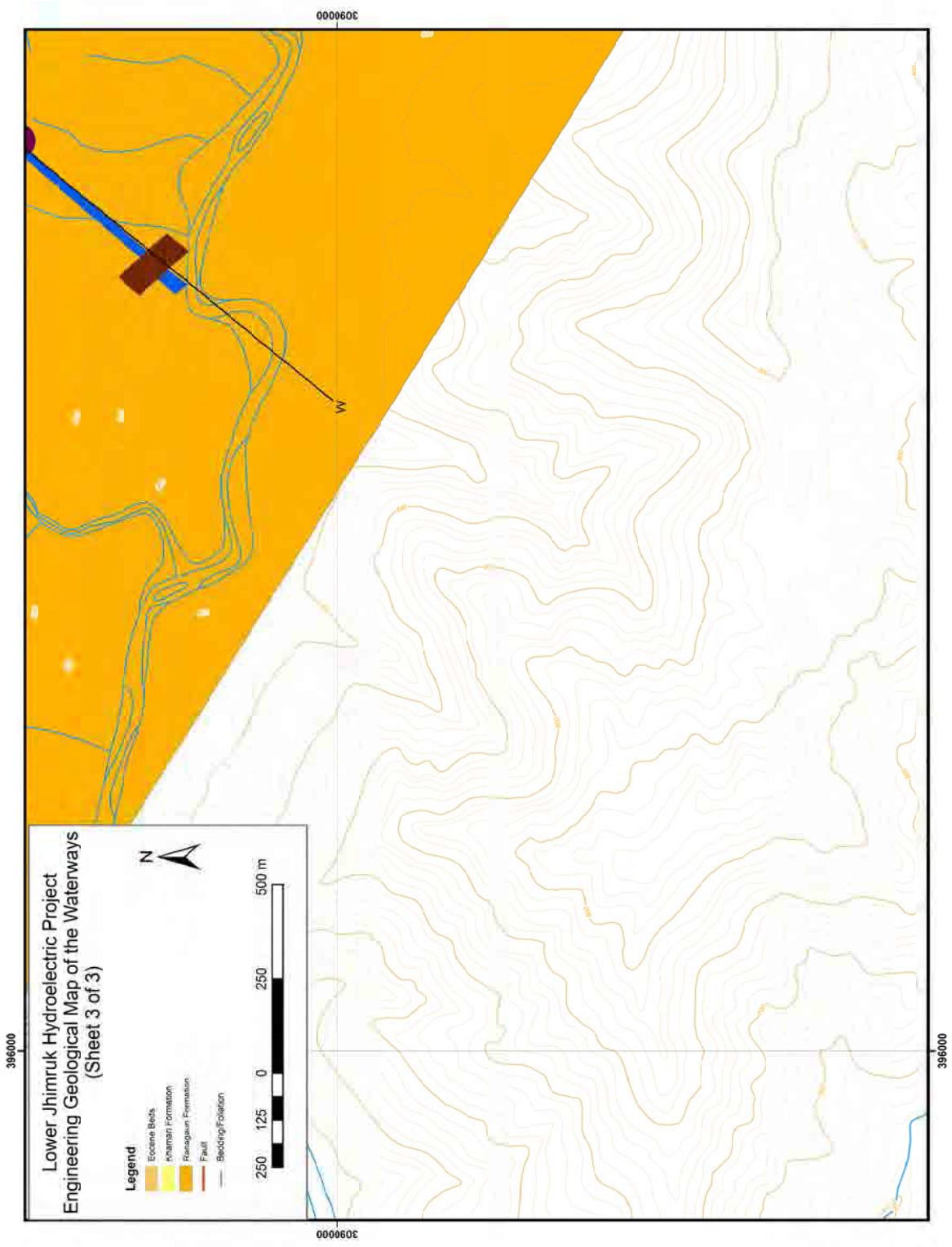

Figure 1.12: Engineering geological map of the waterway (continued)

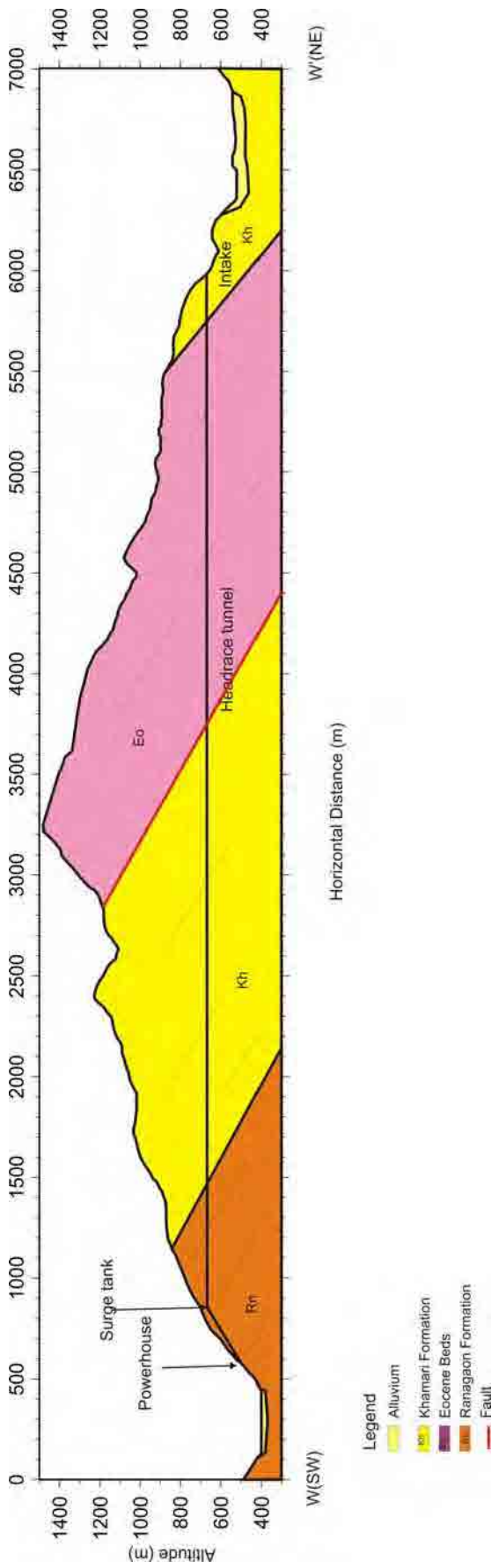

Figure 1.13: Cross section along WW'

1.6 Instabilities

Mainly rockslides (wedge and plane failures) are observed on quartzites, and shales. The landslide and other instability distribution (Figure 1.9) in the reservoir and its vicinity was assessed from field observations and satellite image interpretations.

1.7 Construction materials

The required amount of gravel, sand, and fines is available at the dam site and near the confluence of the Jhimruk River and its tributaries.

1.8 Further recommendations

The Lowe Jhimruk hydroelectric project is geologically sound and feasible. However some further investigations are required to asses the dam site and the headrace tunnel for stability.

1.9 GPS survey and photos

Since each group had three geologists and only one GPS, the two geologists put the observation points directly on the map without the help of GPS, based on ground truth. The GPS data and photos are already submitted.

Table 1.1: The observations sites and their locations

TYPE	IDENT	LAT	LONG	ALTITUDE	TIME	Photographs
WAYPOINT	JMR001	27.92722400	83.01508500	454.96	2012-06-12T02:19:33Z	-
WAYPOINT	JMR002	27.92497800	83.01519700	456.28	2012-06-12T02:20:33Z	1-4
WAYPOINT	JMR003	27.92353600	83.01485500	456.31	2012-06-12T02:20:37Z	5-6
WAYPOINT	JMR004	27.92276900	83.01426200	481.04	2012-06-12T04:59:46Z	7
WAYPOINT	JMR005	27.92220700	83.01511100	484.74	2012-06-12T05:00:48Z	8-10
WAYPOINT	JMR006	27.92250400	83.01749600	484.61	2012-06-12T05:01:56Z	11-13
WAYPOINT	JMR007	27.92258100	83.02225800	480.81	2012-06-12T05:02:15Z	14-15
WAYPOINT	JMR008	27.93108000	83.01372700	472.33	2012-06-12T06:58:47Z	16-17
WAYPOINT	JMR009	27.91843300	83.01491100	521.96	2012-06-13T01:54:44Z	20
WAYPOINT	JMR010	27.91505700	83.01595800	512.60	2012-06-13T02:01:39Z	-
WAYPOINT	JMR011	27.92134900	83.01246700	519.46	2012-06-13T02:09:54Z	-
WAYPOINT	JMR012	27.92066700	83.01184300	517.11	2012-06-13T02:17:20Z	-
WAYPOINT	JMR013	27.91975400	83.01032800	520.54	2012-06-13T02:22:40Z	-
WAYPOINT	JMR014	27.92222600	83.00903500	521.43	2012-06-13T02:29:33Z	-
WAYPOINT	JMR015	27.92941900	83.00541300	528.02	2012-06-13T02:47:46Z	-
WAYPOINT	JMR016	27.93099800	83.00539900	530.15	2012-06-13T02:53:05Z	-
WAYPOINT	JMR017	27.93030300	83.00286500	531.40	2012-06-13T02:55:38Z	-
WAYPOINT	JMR018	27.92916400	83.00135200	531.95	2012-06-13T03:00:08Z	-
WAYPOINT	JMR019	27.97101400	83.00082400	498.12	2012-06-13T05:37:59Z	-
WAYPOINT	JMR020	27.96877500	83.00349300	499.05	2012-06-13T05:36:32Z	22-23
WAYPOINT	JMR021	27.96715600	83.00773100	494.23	2012-06-13T07:28:33Z	24
WAYPOINT	JMR022	27.96599500	83.00954700	488.81	2012-06-13T07:25:17Z	27
WAYPOINT	JMR023	27.96271500	83.01052700	483.71	2012-06-13T08:04:20Z	28-29
WAYPOINT	JMR024	27.96191200	83.01230100	499.65	2012-06-13T08:34:30Z	30-33
WAYPOINT	JMR025	27.96329900	83.01401800	522.11	2012-06-13T09:21:09Z	34-36
WAYPOINT	JMR027	27.96103800	83.01199600	493.52	2012-06-13T10:15:04Z	37-38
WAYPOINT	JMR028	27.95830200	83.01538500	479.73	2012-06-13T10:43:30Z	-
WAYPOINT	JMR029	27.95662100	83.01639500	468.23	2012-06-13T11:17:14Z	39
WAYPOINT	JMR030	27.95420900	83.01610900	470.94	2012-06-13T11:50:11Z	40
WAYPOINT	JMR031	27.95116400	83.01627000	471.17	2012-06-13T12:16:57Z	-
WAYPOINT	JMR033	27.98012100	82.99961100	526.71	2012-06-14T02:50:34Z	41-42
WAYPOINT	JMR034	27.97946500	82.99567100	540.96	2012-06-14T03:10:23Z	-
WAYPOINT	JMR035	27.97796200	82.99259100	543.19	2012-06-14T03:36:17Z	-
WAYPOINT	JMR036	27.97882100	82.98742600	515.42	2012-06-14T05:13:52Z	43
WAYPOINT	JMR037	27.98076900	82.98632200	514.73	2012-06-14T05:11:46Z	44
WAYPOINT	JMR038	27.98141200	82.98402600	519.97	2012-06-14T05:51:47Z	45-46
WAYPOINT	JMR039	27.98373800	82.98009200	532.40	2012-06-14T07:21:31Z	47-49
WAYPOINT	JMR041	27.99202200	82.97279600	529.23	2012-06-17T02:08:23Z	-
WAYPOINT	JMR041A	28.00496200	82.94416500	1256.05	2012-06-17T02:11:28Z	-
WAYPOINT	JMR042	28.00295600	82.94499800	581.28	2012-06-17T02:10:34Z	58
WAYPOINT	JMR043	27.99949600	82.94484500	600.71	2012-06-15T02:20:47Z	-
WAYPOINT	JMR044	27.99604600	82.94762100	582.01	2012-06-15T02:55:24Z	59-60
WAYPOINT	JMR045	27.99713900	82.95235300	582.67	2012-06-15T03:23:26Z	-
WAYPOINT	JMR045	27.99713900	82.95235300	582.67	2012-06-15T03:23:26Z	-
WAYPOINT	JMR047	27.99458600	82.95155500	587.48	2012-06-15T04:00:51Z	61
WAYPOINT	JMR049	27.99205000	82.95937900	563.15	2012-06-15T05:13:10Z	62
WAYPOINT	JMR051	27.99325000	82.96797100	534.43	2012-06-15T06:11:33Z	-
WAYPOINT	JMR052	27.95023900	83.01436900	1261.85	2012-06-17T02:27:22Z	-
WAYPOINT	JMR053	27.94775900	83.01464500	1260.68	2012-06-17T02:46:37Z	-
WAYPOINT	JMR054	27.94665000	83.01719600	1260.66	2012-06-17T02:43:34Z	-
WAYPOINT	JMR055	27.94323900	83.01341600	1259.80	2012-06-17T02:51:05Z	-
WAYPOINT	JMR056	27.94030200	83.01293500	1260.11	2012-06-17T02:56:54Z	-
WAYPOINT	JMR057	27.93805900	83.01473300	1262.02	2012-06-17T03:01:35Z	-
WAYPOINT	JMR26	27.96346700	83.01472100	529.32	2012-06-13T09:56:23Z	-
WAYPOINT	JMR46	27.99582900	82.95227700	591.39	2012-06-15T03:41:58Z	-
WAYPOINT	JMR48	27.99126600	82.95456000	582.61	2012-06-15T04:34:15Z	-

Table 1.2: Attitude of Bedding (B)/Foliation (F) at observation sites

Way Point	Strike	Dip direction	Dip Angle	Type
JMR001	318	SW	49	B
JMR003	276	SW	70	B
JMR006	270	N	61	B
JMR007	115	NE	72	B
JMR008	155	NE	45	B
JMR009	316	SW	35	B
JMR010	114	SW	66	B
JMR011	297	SW	60	B
JMR012	310	SW	19	B
JMR013	102	SW	75	B
JMR014	140	SW	45	B
JMR015	65	SE	19	B
JMR017	287	SW	55	B
JMR018	100	SE	70	B
JMR019	100	SE	52	B
JMR020	123	SE	65	B
JMR021	300	NE	60	B
JMR022	273	NE	62	B
JMR023	300	SW	36	B
JMR024	151	SW	68	B
JMR025	121	NE	85	B
JMR027	121	SW	61	B
JMR028	120	NE	51	B
JMR029	130	NE	80	B
JMR030	290	SW	48	B
JMR031	125	NE	80	B
JMR033	300	NE	45	B
JMR034	25	NW	42	B
JMR035	295	NE	36	B
JMR037	125	SW	37	B
JMR038	130	SW	83	B
JMR039	312	SW	82	B
JMR040	110	SW	56	B
JMR041	143	SW	55	B
JMR042	85	SE	41	B
JMR043	315	SW	52	B
JMR044	112	SW	68	B
JMR045	115	SW	58	B
JMR046	290	SW	74	B
JMR047	249	SE	34	B
JMR048	112	SW	46	B
JMR049	116	SW	35	B
JMR050	305	SW	54	B
JMR051	315	SW	69	B

Table 1.3: Geological Study Team Members and Itinerary of the Field Visits

Name of Project	District	Date of field visit	Name of the Geologlist	Investigation method
Lower Jhimruk	Pyuthan and argakhanchi	10^{h} June - 16th June, 2012	Dr. Subesh Ghimire Mr. Pratap Bohora Mr. Ajit Sapkota	Geological reconnaissance survey

Annex 8: Geological Survey Report

Madi Project (W-06)

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Introduction

This Report deals with the engineering geological investigations in the Madi hydroelectric dam projects. This project area was surveyed by Dr. Kamala Kant Acharya, Mr. Nirmal Kaphle, and Mr. Laxman Subedi between 10 and 16 June 2012.Geology and engineering geology of this project are summarized below.

1 Madi Project

The Madi HEP lies about 500 km west of Kathmandu in the Rolpa district of mid-west Nepal. The project utilizes the water from the Madi and Dhansi Khola and other tributaries. The Dam site is located at about 500 m downstream from the Harneban village. The water ways passes along the left bank of the Madi Khola and Powerhouse is located at the terrace of the Madi Khola near the confluence of the Pyuri Khola and the Madi Khola, opposite of the Phurkatup village. The reservoir and headworks area of the project can be accessed by local foot trails. The entire project area lies in the Lesser Himalaya. The location points are presented in Table 1.1 and the major attitude of bedding/foliation are presented in Table 1.2. The topographic map showing the observation points is given in Annex 1.

1.1 Geology of project area

Geologically, the project area lies in the Lesser Himalayan Zone which consists of meta-sedimentary rocks like slate, phyllite, sandstone and limestone. Map prepared by the Department of Mines and Geology has separated the area into different formations (Fig. 1.1). Among these formations, dam, headrace tunnel, surge tank and powerhouse of the project lies in the Lakharpata Formation. The Lakharpata Formation consists of siliceous limestone and dolomite with few bands of dark grey to black slate. These formations can be correlated with the geological work of Dhital and Kizaki (1987) done in northern Dang area. The rocks of the project can be grouped into Ranibas Formation, Srichaur Formation and Sattim Formation of Dhital and Kizaki (1987). The garnet-schist unit has not mentioned by any previous researchers.

Lithology: The reservoir area comprises four units of rocks. A rock unit comprising chlorite to garnet schist is observed along the Hungri Khola at the upper reaches of the reservoir. This unit of metamorphic rock thrust over the metasedimentary rock. Then unit of rock comprising shale, phyllite and thin-bedded limestone comes which is named as Srichaur Formation. The unit of shale and thin-bedded limestone thrust over the unit of rock comprising sandstone and shale with some coal seams and red purple shale (Figure 1.2).This unit is named as Sattim Formation. On the lower part of the reservoir another unit of rock is observed which consists of medium-to thick-bedded limestone with few bands of black slate. The proposed dam axis, waterway and powerhouse lie on this unit of the rock. This unit is named as Ranibas Formation.

Quaternary deposits: Alluvial deposits are found on the alluvial terraces of the Madi Khola, Dhansi Khola and their main tributaries. The colluvial deposits predominate on upper moderately steep to gentle slopes and spurs.

Rock mass condition: The pelitic rocks like slate, shale and phyllite are relatively soft rocks and form a subdued topography with smooth hilltops. In the project area, all of these pelitic rocks occur in alternating pattern with relatively stronger rocks like sandstone and limestone. The schist unit is relatively stronger than the shale and phyllite.

Weathering: Water and air are the main sources of weathering. Apart from them, sunshine (temperature variation) has also played a significant role in weathering of rockss. The overall weathering depth in rocks reaches up to 5 m and sometimes more than that. Most of the rocks of the area except limestone and sandstone show high grade of weatherability. Weathered shale and phyllite forms smooth colluvial soil.

Jointing: The rocks of the area are moderately jointed consisting three sets of joints with random joints.

Stability conditions: the project area comprises maximum colluvium, so the rate of soil erosion is high. Minor slides on the colluviums along the major rivers and tributaries are common. Major slides are observed along the Dhansi Khola.

Groundwater conditions: The field work was conducted before the monsoon so very rare springs and seeps are observed near the riverbed whereas the upper parts of the ridges and spurs are dry. Schist, shale, sandstone and slate are relatively impervious but limestone present in the most part of the project will create some problem.

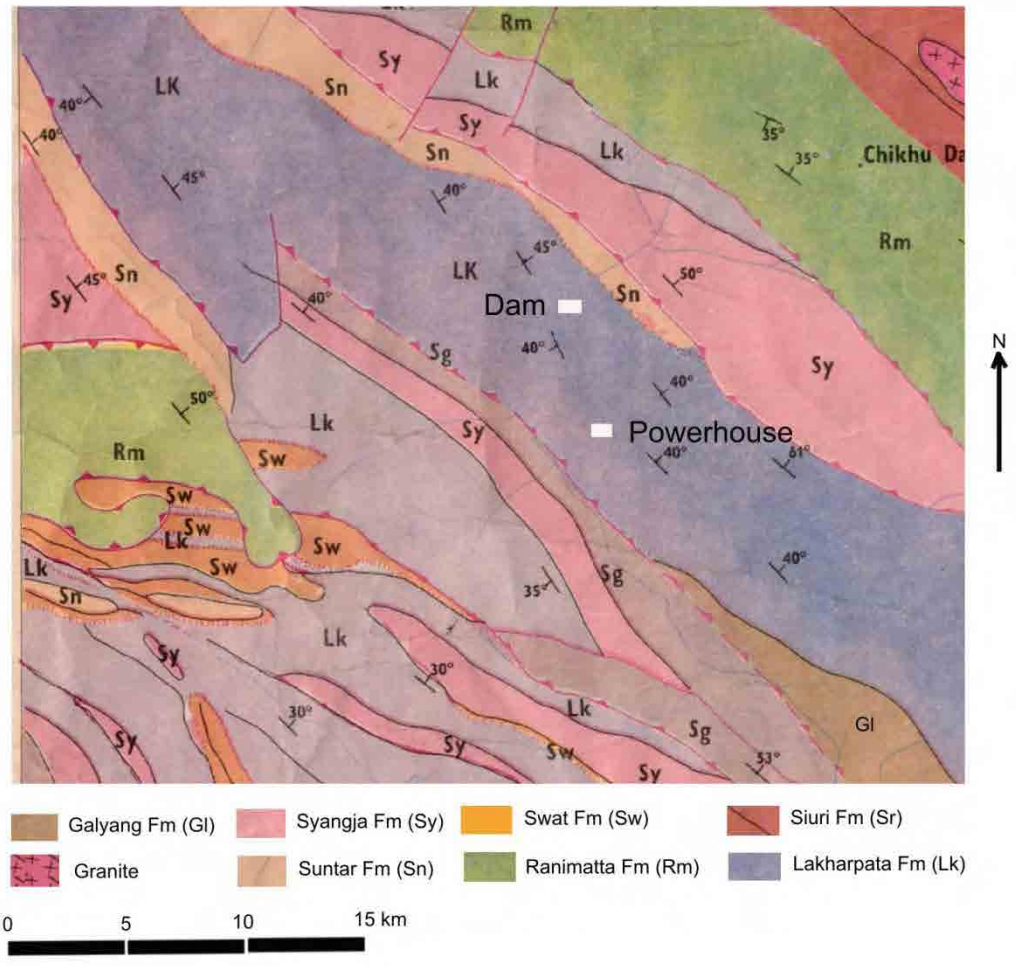


Figure 1.1: Regional geological map of the project area (modified from DMG).

1.2 Reservoir

The water level (1090 m) in the proposed reservoir extends up to the village of Barban in the Dhansi Khola, Banahar in the Hungri Khola, and up to Sariga Danda in the Madi River.

The engineering geological map of the reservoir and its surrounding areas is presented in Figure 1.3.
Except the soil erosion from the huge volume of colluviums and large landslides along the Dhansi Khola, no other significant weak or vulnerable zones leading to dam collapse or large failures obstructing the reservoir are observed.
The area to be under water consists of bedrock, alluvial terraces, colluvium and minor instabilities. There will be significant sediment transport from the Dhansi Khola, which has many landslides on the as well as upstream from the reservoir area. Hence some check dams and other sediment retention structures are required to prevent the sediment inflow in the reservoir.
Water tightness: As there is no chance to flow water of the reservoir in other drainage basins, the reservoir is perfectly water tight.

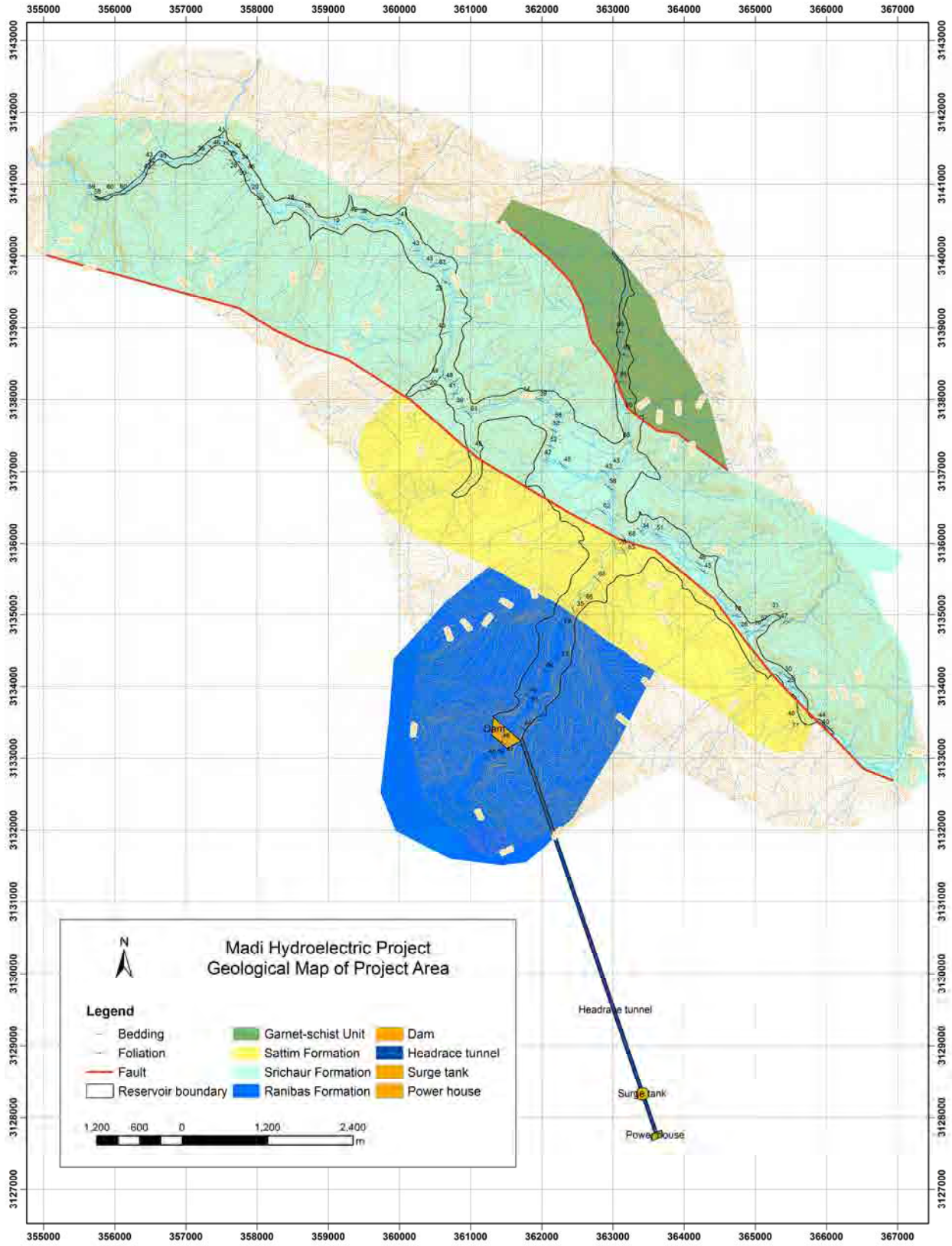


Figure 1.2: Geological map of the project area

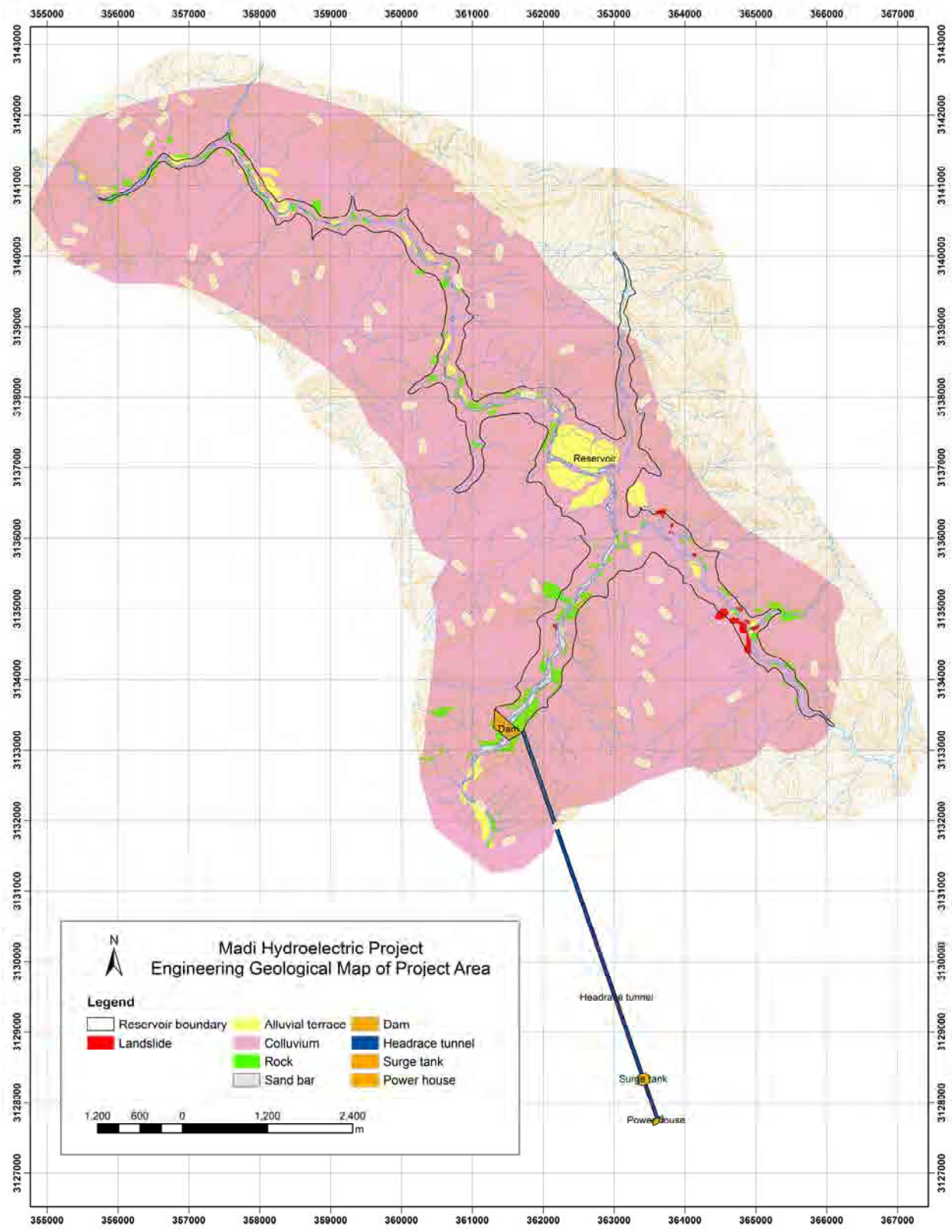


Fig. 1.3: Engineering geological map of the reservoir and its surrounding region

1.3 Dam axis

The earlier proposed dam axis lies at about 800 m downstream from the Harneban village (Figure 1.4). At the dam site, the rock is represented by slates and limestones. At the proposed site, rocks are highly folded (Figure 1.5), so it is not wise to put dam axis on the folded bed. If the dam axis is shifted about 300 m upstream, both the banks consist of sound limestone cliff (Figure 1.6). So it is recommended to shift the dam axis at near to location 93. Three sets of joints are observed at the dam site (Figure 1.7). The proposed dam axis lies in moderate water tight zone. The cross-section along the dam is shown in figure 1.8.

1.4 Waterway

The waterway or headrace tunnel which is about 7 km long passes along the left bank of the Madi Khola. Along the waterway dominantly slate and limestone are common. Limestone beds are medium to thick while the slates are thinly foliated. The tunnel passes through the Lakharpata Formation according to the map prepared by the Department of Mines and Geology. Although, detailed work was not carried out along the entire headrace tunnel, the work in the northern part of the tunnel shows that the tunnel passes making very low angle with the bedding of the bed. Three major disconitinuity sets were observed along the waterway. The overburden along the tunnel is satisfactory but as tunnel passes along the carbonate rocks some cavern may encounter. Based on the given TWL = 800 m, which lies about 7 km downstream, at the village of Phurkatop, on the left bank of the Madi River, on the alluvial terrace near the confluence of the Pyuri Khola and the Madi River. The cross-section along the headrace tunnel is shown in figure 1.9.

1.5 Powerhouse

Based on the given TWL = 800 m, which lies about 7 km downstream, the is located at the terrace of the Madi Khola near the confluence of the Pyuri Khola and the Madi Khola, opposite of the Phurkatup village. At the powerhouse site there is a alluvial terrace above which lies colluviums with few patches of rocks. The present of colluviums above the terrace may create problem during the construction of Penstock.

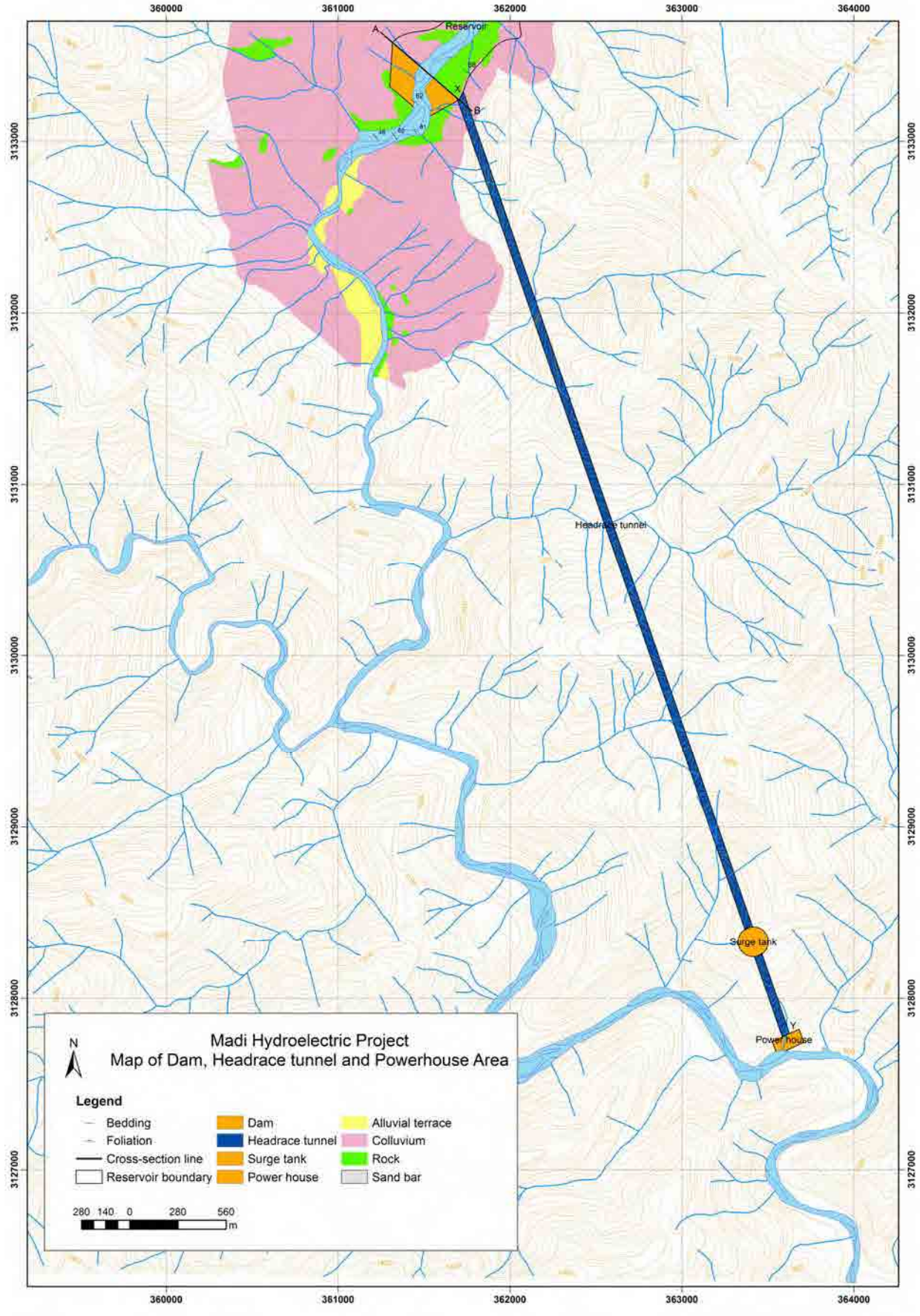


Figure 1.4: Map of the dam, headrace tunnel and powerhouse area.

Figure 1.5: Folded rock downstream of the dam site at location 094. View to SE.

Figure 1.6: Proposed dam site, downstream of location 093. View to SW.

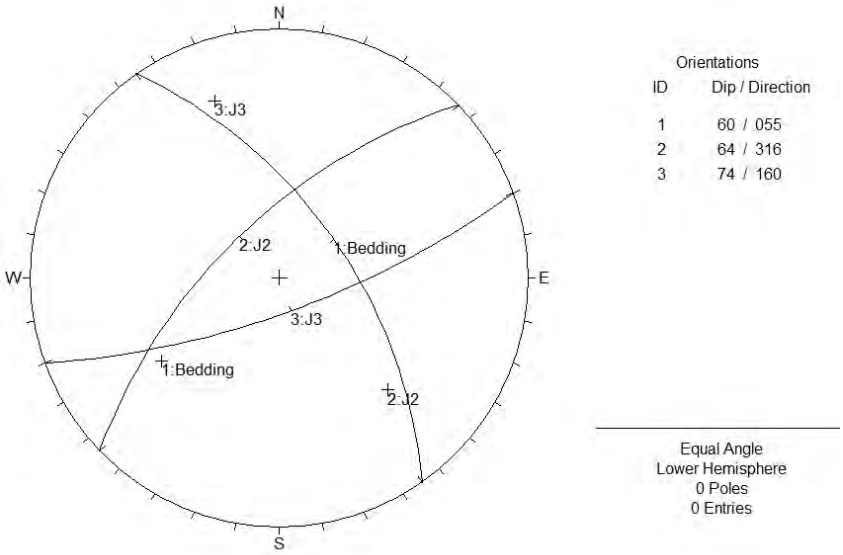


Figure 1.7: Stereoplot of the major discontinuities at the dam site of the project area.

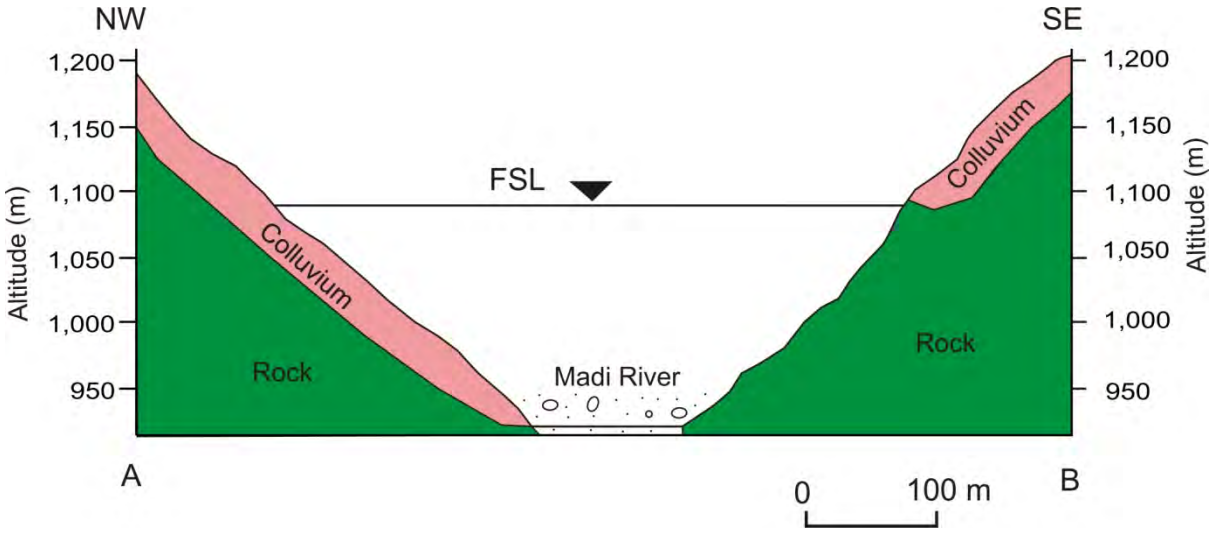


Figure 1.8: Cross-section along the dam

1.6 Instabilities

Two thrusts are observed on the reservoir area. Among these the thrust which seperates the Garnet schist Unit and the Srichaur Formation lies in the upper reaches of the reservoir and the thrust which seperates the Srichaur Formation and the Sattim Formation passes along the Dhansi Khola. No mass wasting phenomenon and no shear zone is observed along the northern thrust but the thrust passing along the Dhansi Khola shows abundant slides. Slides observed along the Dhansi Khola lies both on rock and colluviums. The landslide and other instability distribution in the reservoir and its vicinity was assessed from field observations and satellite image interpretations. Some important landslides are shown in Figures 1.10 and 1.11.

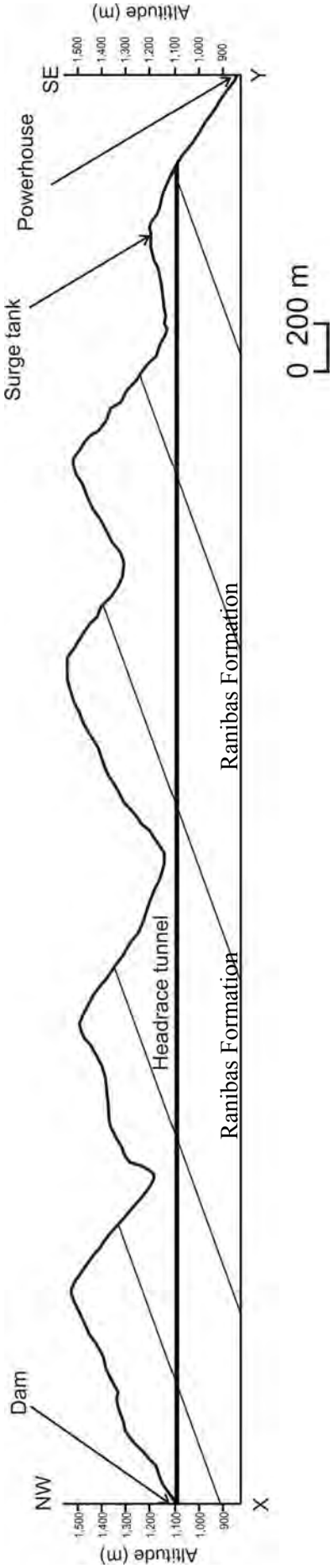


Figure 1.9: Cross-section along the headrace tunnel

Figure 1.10: Landslide along the Dhansi Khola, at location 104. View to SW.

Figure 1.11: Landslide along the Dhansi Khola, at location 079. View to NE.

1.7 Construction material

The required quantity of construction material (aggregates and sands) is available in the Madi Khola (between the dam site and the confluence of the Dhansi Khola and Madi Khola). Presently, the villagers are obtaining limestone blocks from several quarries. The construction material is sufficient for building the dam and related structures. Sketch of one of the construction material s shown in figure 1.12.

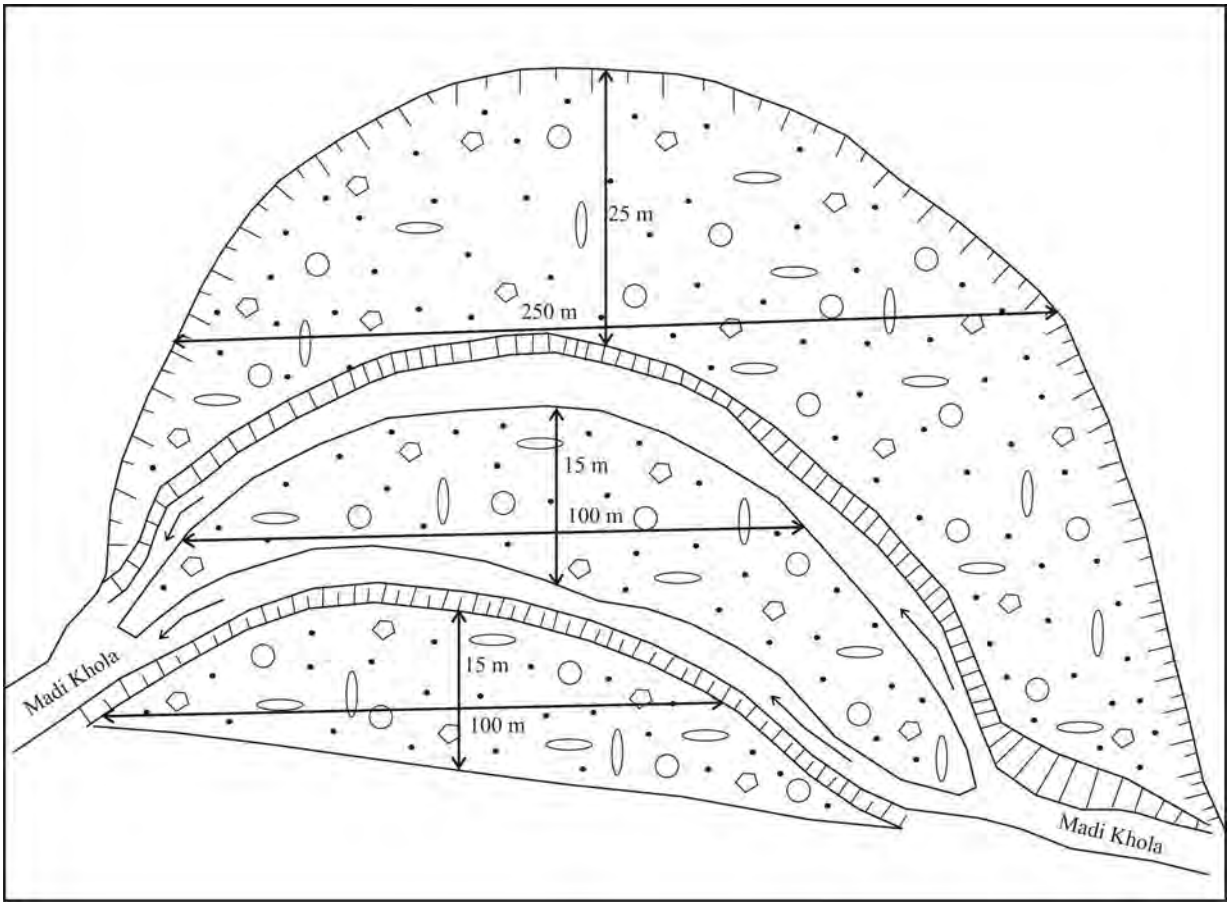


Figure 1.12: Sketch of the construction material site along the Madi Khola at location 097.

1.8 Recommendation

As the headrace tunnel passes through the carbonate rocks, some cavern structures may encounter, consideration should be made for these problems. It is recommended to conduct geophysical investigation in the powerhouse area**.**

Table 1.1: GPS locations in the project area with photo number

TYPE	IDENT	LAT	LONG	ALTITUDE	Photo number
WAYPOINT	102	28.32814800	82.61846200	988.47	DSC02376-2382
WAYPOINT	103	28.32619100	82.61986300	987.65	DSC02383-2388
WAYPOINT	104	28.32636500	82.62159700	1000.94	DSC02389-2393
WAYPOINT	105	28.32697900	82.62253200	1026.80	DSC02398-2402
WAYPOINT	106	28.32864400	82.62440500	1038.19	DSC02402-2407
WAYPOINT	107	28.32738400	82.62516000	1051.30	DSC02408-2411
WAYPOINT	108	28.32748400	82.62591100	1066.07	DSC02408-2417
WAYPOINT	109	28.32470900	82.62052100	1026.84	DSC02419-2422
WAYPOINT	110	28.32224900	82.62194100	1041.68	DSC02423-2428
WAYPOINT	111	28.32156900	82.62297000	1043.89	DSC02429-2433
WAYPOINT	112	28.32084100	82.62541500	1053.35	DSC02434-2438
WAYPOINT	113	28.31924300	82.62658700	1059.35	DSc02439-2442
WAYPOINT	114	28.31663300	82.62735300	1069.33	DSC02447-2450
WAYPOINT	115	28.31464200	82.62838000	1076.67	DSC02451-2455
WAYPOINT	116	28.31495100	82.63065600	1082.38	DSC02456-2459
WAYPOINT	117	28.31408000	82.63168400	1083.46	DSC02460-2468
WAYPOINT	087	28.32668200	82.59340000	923.16	DSC02271-2278
WAYPOINT	088	28.32498300	82.59300700	922.20	DSC02279-2284
WAYPOINT	089	28.32255200	82.59298700	918.26	DSC02285-2288
WAYPOINT	090	28.32108200	82.59096300	915.71	DSC02289-2295
WAYPOINT	091	28.31911000	82.59066400	918.75	DSC02296-2299
WAYPOINT	092	28.31775500	82.58897000	918.31	DSC02300-2305
WAYPOINT	093	28.31682200	82.58869800	918.13	DSC02306-2313
WAYPOINT	094	28.31362200	82.58823200	930.68	DSC02314-2316
WAYPOINT	095	28.31011600	82.58288500	940.38	DSC0 2338-2340
WAYPOINT	096	28.30421700	82.58030000	919.64	DSC02318-2321
WAYPOINT	097	28.30936400	82.58079900	880.33	DSC02340-2342
WAYPOINT	098	28.31021400	82.58398900	901.68	DSC02348-2353
WAYPOINT	099	28.31043100	82.58524800	905.36	DSC02354-2359
WAYPOINT	100	28.31198800	82.58516100	906.95	DSC02360-2363
WAYPOINT	101	28.31259500	82.58538800	910.19	DSC02366-2369
WAYPOINT	062	28.35563000	82.58753500	969.74	5301-5305
WAYPOINT	063	28.35511500	82.58992500	972.84	5306-5319
WAYPOINT	064	28.35387900	82.59178800	980.77	5320-5330
WAYPOINT	065	28.35224400	82.59273700	978.19	5331-5341
WAYPOINT	066	28.35134200	82.59190000	977.90	5342-5353
WAYPOINT	067	28.34932900	82.59156800	979.84	
WAYPOINT	068	28.34758000	82.59095300	977.52	5354-5368
WAYPOINT	069	28.34699200	82.59333800	972.22	5369-5381
WAYPOINT	070	28.34582600	82.59565000	971.12	5382-5395
WAYPOINT	071	28.34520200	82.59756900	951.71	5396-5408
WAYPOINT	072	28.34612500	82.59934900	952.53	5409-5417
WAYPOINT	073	28.34426600	82.59996400	956.23	5418-5422
WAYPOINT	074	28.34244200	82.60054200	956.31	5423-5430
WAYPOINT	075	28.34115700	82.59912800	962.05	5431-5439
WAYPOINT	076	28.33706200	82.60088600	954.25	5440-5447
WAYPOINT	077	28.33616200	82.60228000	955.71	5448-5456
WAYPOINT	078	28.33782300	82.60232400	965.38	5457-5463
WAYPOINT	079	28.33750400	82.60406800	964.69	5464-5470

TYPE	IDENT	LAT	LONG	ALTITUDE	Photo number
WAYPOINT	080	28.33875400	82.60464300	965.05	5471-5479
WAYPOINT	081	28.33835400	82.60693900	972.45	5480-5491
WAYPOINT	082	28.33468500	82.61302600	993.21	5501-5509
WAYPOINT	083	28.33368500	82.61378300	992.58	5510-5515
WAYPOINT	084	28.33155300	82.61344800	995.28	5516-5523
WAYPOINT	085	28.33056300	82.61468000	997.15	5524-5533
WAYPOINT	086	28.32912700	82.61649200	998.90	5534-5541
WAYPOINT	034	28.37922000	82.55385400	1038.45	5266-5269
WAYPOINT	035	28.37844000	82.55569500	1035.61	DSC02057-2059
WAYPOINT	036	28.37715100	82.55728200	1042.08	DSC02060-2065
WAYPOINT	037	28.37639300	82.56017400	1050.52	DSC02066-2068
WAYPOINT	038	28.37806200	82.56228800	1039.43	5275-5279
WAYPOINT	039	28.37756400	82.56444600	1032.90	DSC02069-2072
WAYPOINT	040	28.37703300	82.56675300	1029.17	DSC02073-2077
WAYPOINT	041	28.37700300	82.56941400	1022.89	DSC02079-2082
WAYPOINT	042	28.37746700	82.56958100	1030.97	DSC02083
WAYPOINT	043	28.37366000	82.57206600	1019.46	DSC02085-2087
WAYPOINT	044	28.37185500	82.57447800	1018.00	
WAYPOINT	045	28.37129900	82.57593000	1017.69	DSC02092-2098
WAYPOINT	046	28.36977400	82.57582800	1034.91	
WAYPOINT	047	28.36501300	82.57621800	1040.19	DSC02101-2103
WAYPOINT	048	28.36330500	82.57606400	1043.80	DSC02104 and 2105
WAYPOINT	049	28.35724300	82.57384000	1043.22	DSC02109-2111
WAYPOINT	050	28.35641200	82.57398300	1053.31	DSC02112-2113
WAYPOINT	051	28.35794700	82.57573700	1013.54	5287-5292
WAYPOINT	052	28.35723600	82.57749900	1004.89	DSC02115-2119
WAYPOINT	053	28.35580400	82.57758500	1003.39	DSC02120-2123
WAYPOINT	054	28.35401000	82.57874300	999.36	DSC02124-2127
WAYPOINT	055	28.35323500	82.57984400	996.32	DSC02128-2131
WAYPOINT	056	28.35245800	82.58010600	1013.54	DSC02133-2136
WAYPOINT	057	28.34877800	82.58065100	1035.70	DSC02138-2144
WAYPOINT	058	28.35379400	82.58364500	1034.82	DSC02148-2150 and 5299
WAYPOINT	059	28.35438700	82.58630800	1033.32	DSC02151-2154
WAYPOINT	060	28.35465600	82.58799000	1036.26	DSC02155-2160
WAYPOINT	061	28.35364700	82.58990300	1036.27	DSC02161-2165
WAYPOINT	001	28.30410600	82.63555200	1303.39	
WAYPOINT	004	28.30409800	82.63554400	1305.00	
WAYPOINT	005	28.38538100	82.54169400	1118.14	5205-5209 and DSC02026,27
WAYPOINT	006	28.38616800	82.54264800	1117.50	5212 and 5213
WAYPOINT	007	28.38586300	82.54424900	1121.92	
WAYPOINT	008	28.38469100	82.54519200	1118.83	
WAYPOINT	009	28.38338900	82.54632900	1112.55	5214 and 5215
WAYPOINT	010	28.38068100	82.54804700	1107.81	5216 and 5217
WAYPOINT	011	28.38221400	82.54727900	1105.25	5218-5220
WAYPOINT	012	28.38402900	82.53432400	1137.68	5221, 5222 and DSC020,30
WAYPOINT	013	28.38363700	82.53385500	1127.83	DSC02033,34
WAYPOINT	014	28.38291700	82.53341000	1125.75	

TYPE	IDENT	LAT	LONG	ALTITUDE	Photo number
WAYPOINT	015	28.38142000	82.53208100	1110.53	
WAYPOINT	016	28.38033500	82.53010500	1115.41	
WAYPOINT	017	28.37949800	82.52671000	1093.56	5229,30,31
WAYPOINT	018	28.38025300	82.52528100	1095.80	5226,27,28
WAYPOINT	019	28.37965400	82.52637900	1100.87	
WAYPOINT	020	28.38022500	82.52794600	1096.81	
WAYPOINT	021	28.38305800	82.53279900	1079.19	5235-5238
WAYPOINT	022	28.38430800	82.53383200	1077.83	DSC02038-2041
WAYPOINT	023	28.38501500	82.53512700	1079.38	DSC02043 and 44
WAYPOINT	024	28.38426200	82.53593300	1083.94	DSC02045-2048
WAYPOINT	025	28.38530400	82.54049900	1079.63	5239-5243 and DSC02049-51
WAYPOINT	026	28.38685000	82.54252100	1089.46	5244-5248
WAYPOINT	027	28.38758200	82.54397800	1069.02	DSC02052-2054
WAYPOINT	028	28.38568700	82.54591600	1148.21	5249and 5250
WAYPOINT	029	28.38431700	82.54678100	1123.42	5251-5253
WAYPOINT	030	28.38311000	82.54776100	1092.27	
WAYPOINT	031	28.38186000	82.54837600	1074.21	
WAYPOINT	032	28.38052700	82.54915700	1060.98	5254-5256
WAYPOINT	033	28.37912700	82.54994700	1085.20	5260-5265

Table 1.2: Attitude of bedding (B) and foliation (F) planes measured at different locations

Waypoint	Strike	Dip Amount	Dip direction	Type
005	102	36	N	B
006	125	46	N	F
007	105	35	N	B
008	113	25	N	B
009	50	28	N	B
011	75	50	N	B
012	92	40	N	B
013	94	42	N	B
014	72	56	N	B
016	80	60	N	B
017	92	60	N	B
018	95	59	N	B
019	80	58	N	B
020	94	60	N	B
021	120	43	N	B
022	77	43	N	B
024	70	45	N	B
025	120	38	N	F
027	88	41	N	F
028	110	43	N	F
029	120	34	N	F
030	115	46	N	B
032	70	20	N	B
033	70	30	N	B
034	95	26	N	B
035	130	16	N	B
037	105	19	N	B
038	135	42	N	B
039	87	39	N	B
041	85	45	N	B
042	125	43	N	B
043	84	43	N	B
044	59	45	N	B
045	80	63	N	B
046	118	25	S	F
048	76	40	N	B
049	105	31	N	B
050	130	20	N	B
051	40	38	N	F
052	59	48	N	B
053	80	41	N	B
054	78	39	N	B
055	134	61	N	B
057	127	45	N	B
057a	75	46	N	B
062	119	14	N	B
063	122	39	N	B
065	86	58	N	B
066	114	52	N	B
067	116	52	N	B
068	104	42	N	B
069	132	46	N	B
072	124	43	N	B
073	126	58	N	B
075	126	62	N	B
076	162	26	N	B

Waypoint	Strike	Dip Amount	Dip direction	Type
077	149	63	N	B
078	150	68	N	B
080	132	34	N	B
081	116	51	N	B
082	119	46	N	B
083	122	45	N	B
R1	21	61	N	B
R2	85	45	N	B
R4	70	68	N	B
R5	85	42	N	B
R6	90	60	N	B
R8	89	56	N	B
R9	105	85	N	B
R11	80	50	N	F
R12	94	65	N	F
R14	80	68	N	F
R16	140	64	N	B
R17	130	65	N	B
R19	170	66	N	B
R20	150	35	N	B
087	143	28	N	B
089	152	57	N	B
090	140	66	N	B
092	120	49	N	B
093	150	83	N	B
094	124	64	N	B
095	140	48	N	B
098	145	60	N	B
099	147	81	N	B
100	121	46	N	B
102	102	78	N	B
103	75	26	N	B
104	88	59	N	B
105	86	57	N	B
106	71	31	N	B
107	51	52	N	B
108	55	47	N	B
112	126	30	N	B
113	80	25	N	B
114	141	40	S	B
115	175	71	S	B
116	105	44	N	B
117	75	40	N	B

Table 1.3: Geological Study Team Members and Itinerary of the Field Visits

Name of Project	District	Date of field visit	Name of the Geologlist	Investigation method
Madi	Rolpa	10th June – 16th June, 2012	Dr. Kamala K. Acharya Mr. Nirmal Kaphle Mr. Laxman Subedi	Geological reconnaissance survey

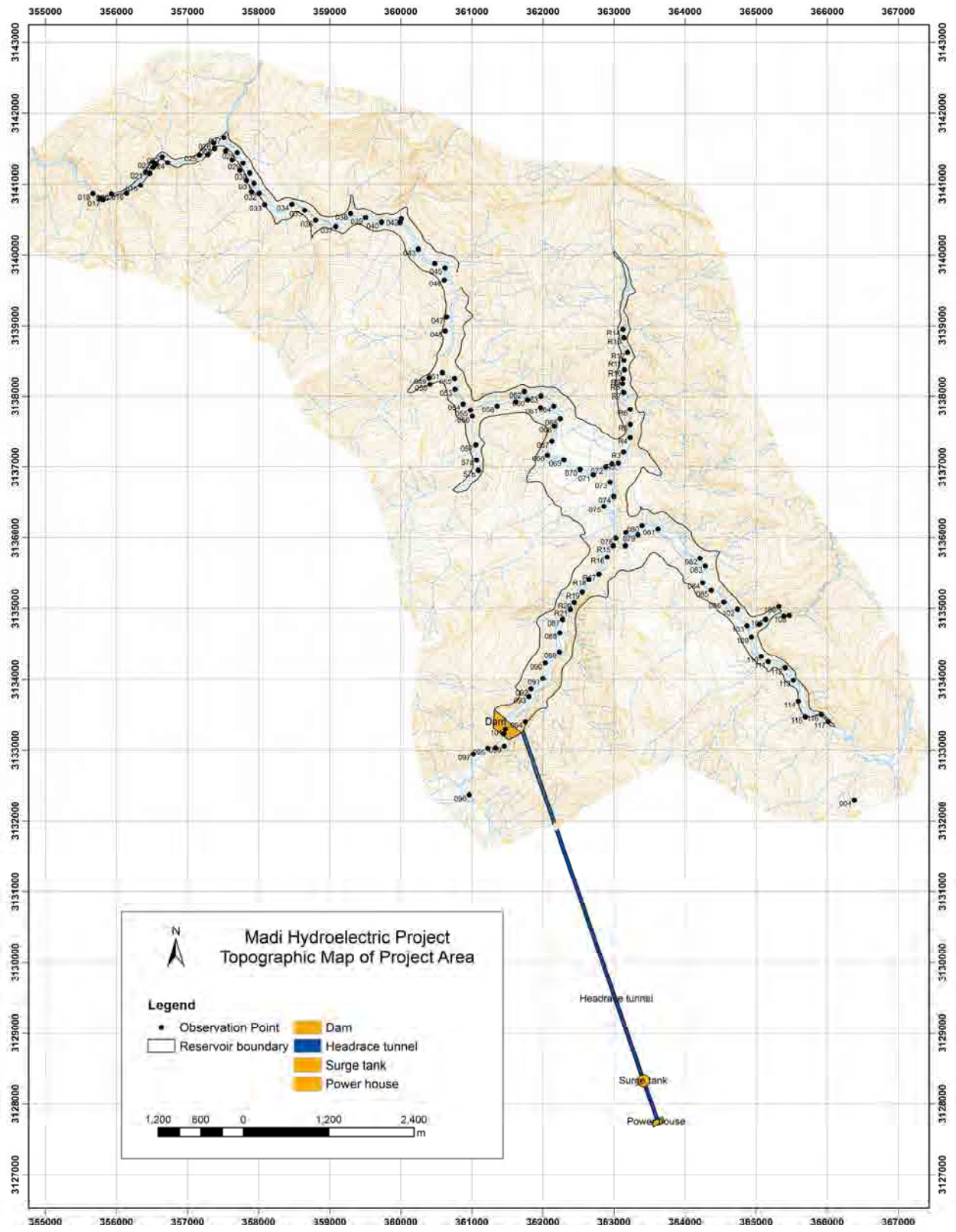


Figure 1.13: Topographic map of the Madi HEP showing the observation points

Annex 9: Geological Survey Report

Nalsyau Gad (W-23)

Table of Contents

Introduction

This Report deals with the engineering geological investigations in the Nalsyau Gad oelectric dam projects. FS report (2010) and Pre-FS report (2004) were reviewed. Geology and engineering geology of this project are summarized below.

1 Nalsyau Gad Project

1.1 Regional Geology

The Nalsyau Gad project area belongs to Jajarkot district, west in Nepal. The dam site is located in the valley of Nalsyau Gad river. The powerhouse site is located on the left bank of the Nalsyau Gad river about 8 km downstream of the dam site.

In the regional geological framework of Nepal, the project site is located in the Lesser Himalayan Zone. The delimiting regional thrust structures, Main Central Thrust in the north and Main Boundary Thrust in the south lie several 10s of kilometer from the project site.

The DMG regional geological map (1987, Figure 1.1) shows the area to be reprewsented by the rock sequences of Surkhet Group (Mid-Miocene Pliestocene) and the Midland Group (Upper –precambrian – Late Paleozoic). The Surkhet Group is comprised of Melpani Formation (dominantly quartzite with purple shale and fossiliferous limestone) and Swat Formation (dominantly carbonaceous shale with fossiliferous limestone). The Midland Group (Lesser Himalayan meta-sediments) is made up of Galayng Formation (dominantly dark greylaminated slates with quartzites and calcareous slates), Syangja Formation (purple slates, quartzites and flesh coloured limestones) and Lakharpata Formation (dominantly dolomite with slates).

The inter- relationship of the various formation is ill defined and mostly shown as tectonic in the regional geological map delimited by fault and thrusts.

1.2 Site Geology

The project area lies in the Lesser Himalayan Zone, and is mainly underlain by dolomite and slate (Feasibility study report, 2010)

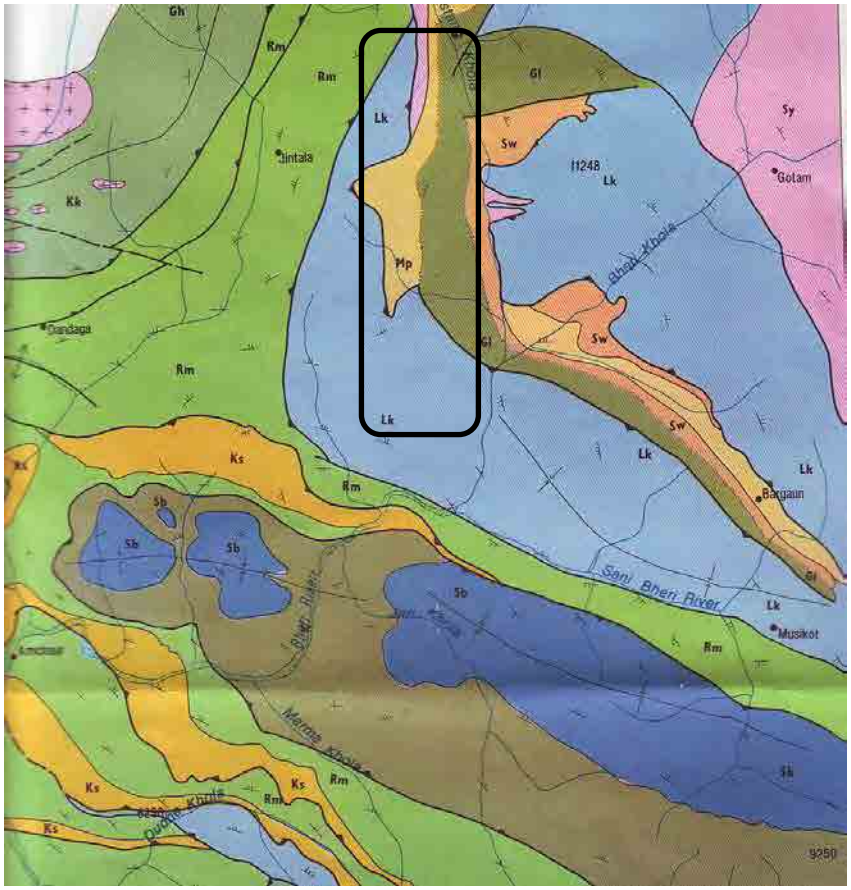
Reservoir and its surrounding area are underlain by slate except the potion close to the dam site (Figure 1.2), where is underlain by dolomite. While permeability of slate is impervious, that of dolomite would be confirmed after further investigation. There is a fault which passes near the dam site and crosses the upstream portion of the reservoir area.

Dam site is underlain by dolomite, which bedding planes incline toward upstream and right bank at mean angles of 50 degrees. Permeability of dolomite would be confirmed after further investigation. 10m deep river deposit was confirmed on the left bank close to river bed (Figure 1.3).

Headrace tunnel route passes on the left bank of Nalsyau Gad river, where is underlain by dolomite. Bedding planes, which strikes are almost perpendicular to tunnel direction, incline toward intake at angles of 30 to 70 degrees. This route encounters 2 sheared zones. Overburden of this tunnel is up to 500m.

Powerhouse site is located on the alluvial terrace on the left bank of Nalsyau Gad river. Bed rock of this site is composed of phyllite, quartzite and shale, which bedding planes, incline toward northwest at angles of about 60 degrees. The depth of river deposits is assumed to be 15 m.

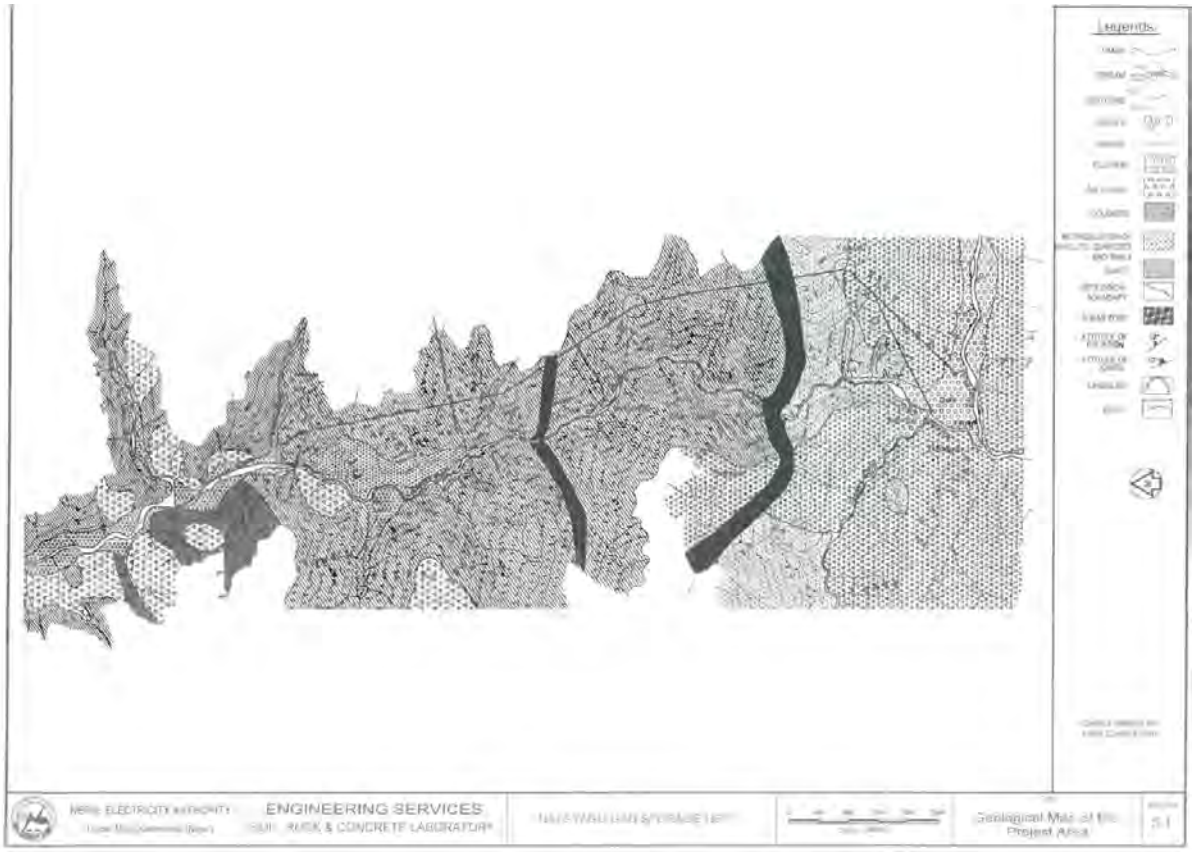
Sand and gravel distributed in the vicinity of the dam site was studied for aggregates. Dolomite distributed in the vicinity of the dam site was studied for aggregate and rock materials. Colluviom and residual soil distributed on the slopes in the reservoir was studied for soil materials.



Surkhet Group

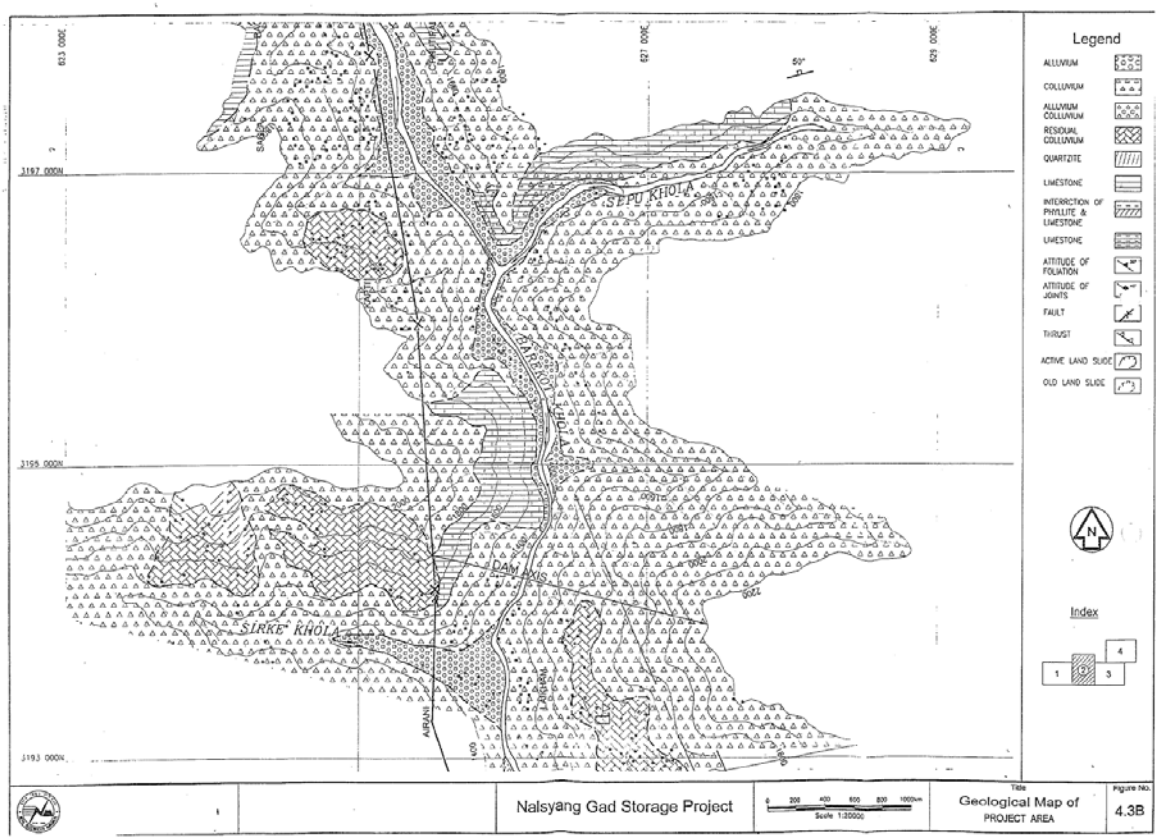
Sn	Suntar Formation	Fine to medium grained, greenish grey sandstones and purple shales with intercalations of green splintary shales.
Sw	Swat Formation	Grey to dark grey, Carbonaceous crumpled shales with bands and lenses of fine grained fossiliferous limestones (Nummulites sp, assilina sp. etc.) and ferrugenous quartzites of the base.
Mp	Melpani Formation	White , grey , ferruginous well bedded massive or the quartzites interbedded with grey carbonaceous crumpled and reddish brown shales and occassional conglomerates and fossiliferous limestones Gastropodes (Promothildia) Pelcypods (Modiolo, Peuromya, Homomyol) and Underminable.
		MID–LAND GROUP (Upper Pre–Cambrian –Late Paleozoic) Gondwana Sub Group
Tk	Takure Formation	Black shales psammitic schists and conglomeratic phyllites.
		Lakharpata Sub – group
Lk Du Rb	Lakharpata Formation	Fine grained, grey limestones and dolomitic limestones with thin intercalations of black to grey shales At places whites, pink dolomitic limestones, purple and green shales of the top Algal structures and stromatolites are present
Sy	Syangja Formation	White to milky white, pale orange, pinkish or purplish calcareous quartzites and dolomitic limestones with dark grey and purple shales and pale green shales at base .
Sg	Sangram Formation	Black, dark grey to greenish grey, splintary pencil structured shales with thin intercolation of limestones white, fine grained cross–bedded quartzites at base .
Gl Ba	Galyang Formation	Dark grey shales finely intercolated with thin grey calcareous slates and sandstones giving brown, yellow and grey lamination in oblique joint planes on weathering Frequent dark grey to bluish grey fine grained limestones and dolomitic limestones of various sizes within the slates .

Figure 1.1: Regional Geological Map (DMG, 1987)



Source: FS Report

Figure 1.2: Geological map of the project area



Source: Pre-FS Report

Figure 1.3: Geological map of the damsite

Annex 10: Geological Survey Report

Naumure Project (W-25)

Table of Contents

Introduction

This Report deals with the engineering geological investigations in the Naumure hydroelectric dam projects. This project area was surveyed by Dr. Sunil Kumar Dwivedi, Mr. Lalit Rai, and Mr. Saunak Bhandari between 10 and 16 June 2012.Geology and engineering geology of this project are summarized below.

1 Naumure Project

The Naumure HEP is located about 800 km west of Kathmandu in the Arghakhachi and Pyuthan districts of western Nepal. The project utilizes water from Madi Khola and Jhimruk Khola that flows northwest to southeast and northeast to southwest to meet together at south to form Rapti Nadi. The dam site, waterways and powerhouse site is located at about 3 km downstream of the confluence of Madi and Jhimruk Khola. The project area is well accessible by motorable road and local foot trails.

1.1 Geology of project area

Geologically, the project area lies partly in the Lesser Himalayan Zone composed of meta-sedimentary rocks such as shale, slate, phyllite, quartzite, limestone and dolomite and partly in the Sub- Himalayan Zone comprises of sedimentary rocks such as sandstone, siltstone and mudstone (Figure 1.1). The Lesser Himalayan Zone is characterized by the rugged and dissected topography. The main boundary thrust (MBT) passes about 3 km upstream of the Dam site. The rocks are intensely folded in the reservoir area.

The geological map by the Department of Mines and geology (Figure 1.1) (DMG 1983) shows the Middle Miocene to Pleistocene Siwalik rocks represented by Upper Siwaliks (Us), Middle Siwaliks (Ms) and Lower Siwaliks (Ls); Precambrian Lesser Himalayan rocks represented by the Sangram Formation (Sg) of shales with interaction of limestones and quartzites; the Syangja Formation (Sy) of pinkish or purplish calcareous quartzites and quartzitic limestones intercalated with dark grey purple and green shales; Lakharpatta Formation (Lk) of light blue, grey limestones and dolomites with thin interactions of grey shales, white, pink dolomite limestones, purple quartizes and green shales and dark grey slates intercalated with thin grey calcareous slates of Galyang Formation (Gl).

Lithology: The Middle Miocene to Pleistocene Siwalik rocks constituting the Naumure dam site is represented by fine grained, hard, grey sandstones interbedded with purple and chocolate colored shales in the lower part and fine to medium grained, arkosic, pebbly sandstones, occasionally silty sandstones in the upper part.

The oldest rocks of the project area are exposed in the Mutaha and Thadi Odar areas (Figure 1.2). They consist of fine grained, light blue, grey limestones and dolomites with thin interactions of grey shales, white, pink dolomite limestones, purple quartizes and green shales at the top. Algal structure & stromatotites are present. The overlying rocks are purple calcareous quartzites and quartzitic limestones intercalated with dark grey purple shales. Black, dark grey to greenish grey shales with interaction of limestones and quartzites transitionally overlies former succession all along the river valley in the reservoir area.

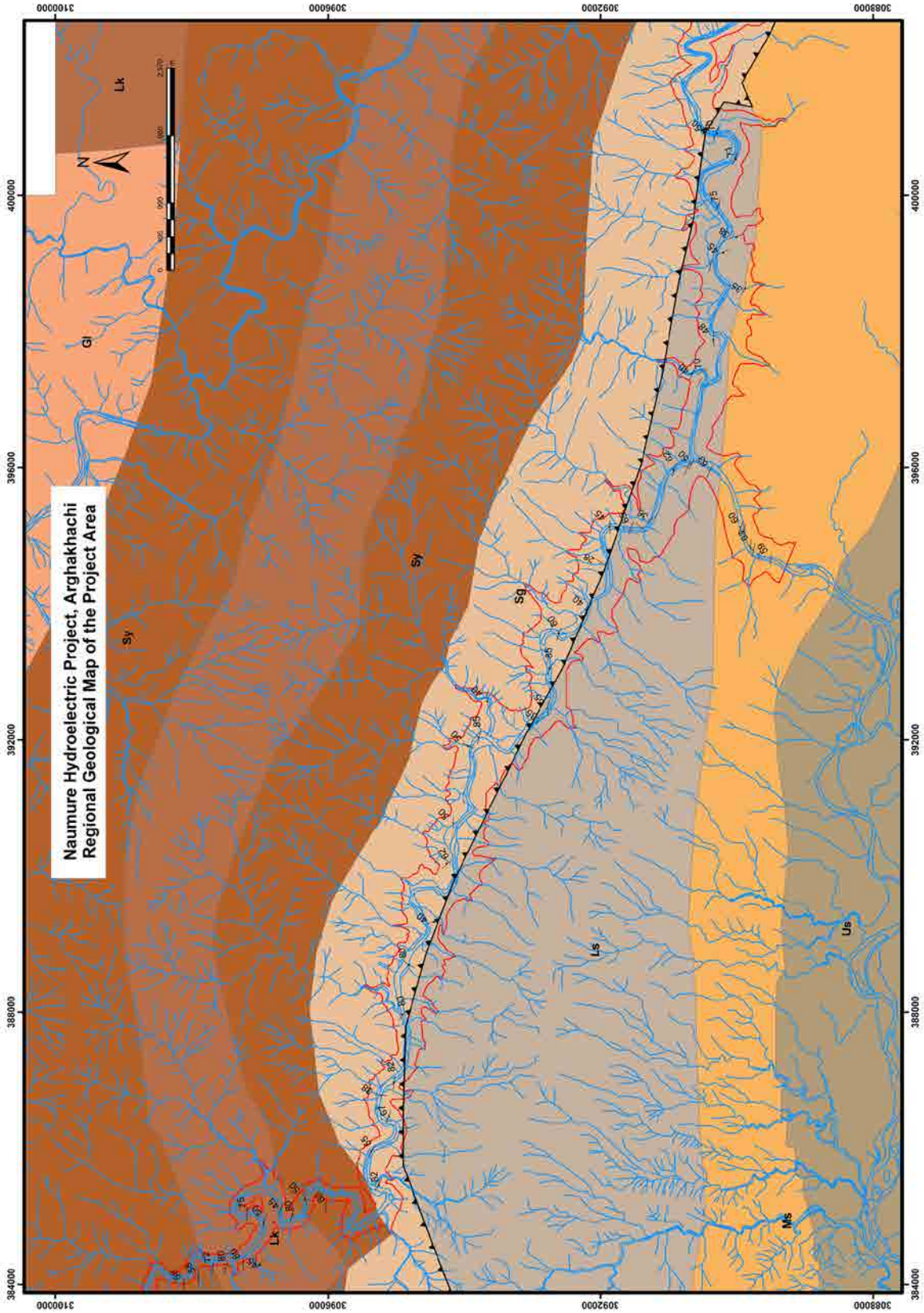


Figure 1.1: Regional geological map of the Naumure hydroelectric project (Modified from DMG 1983).

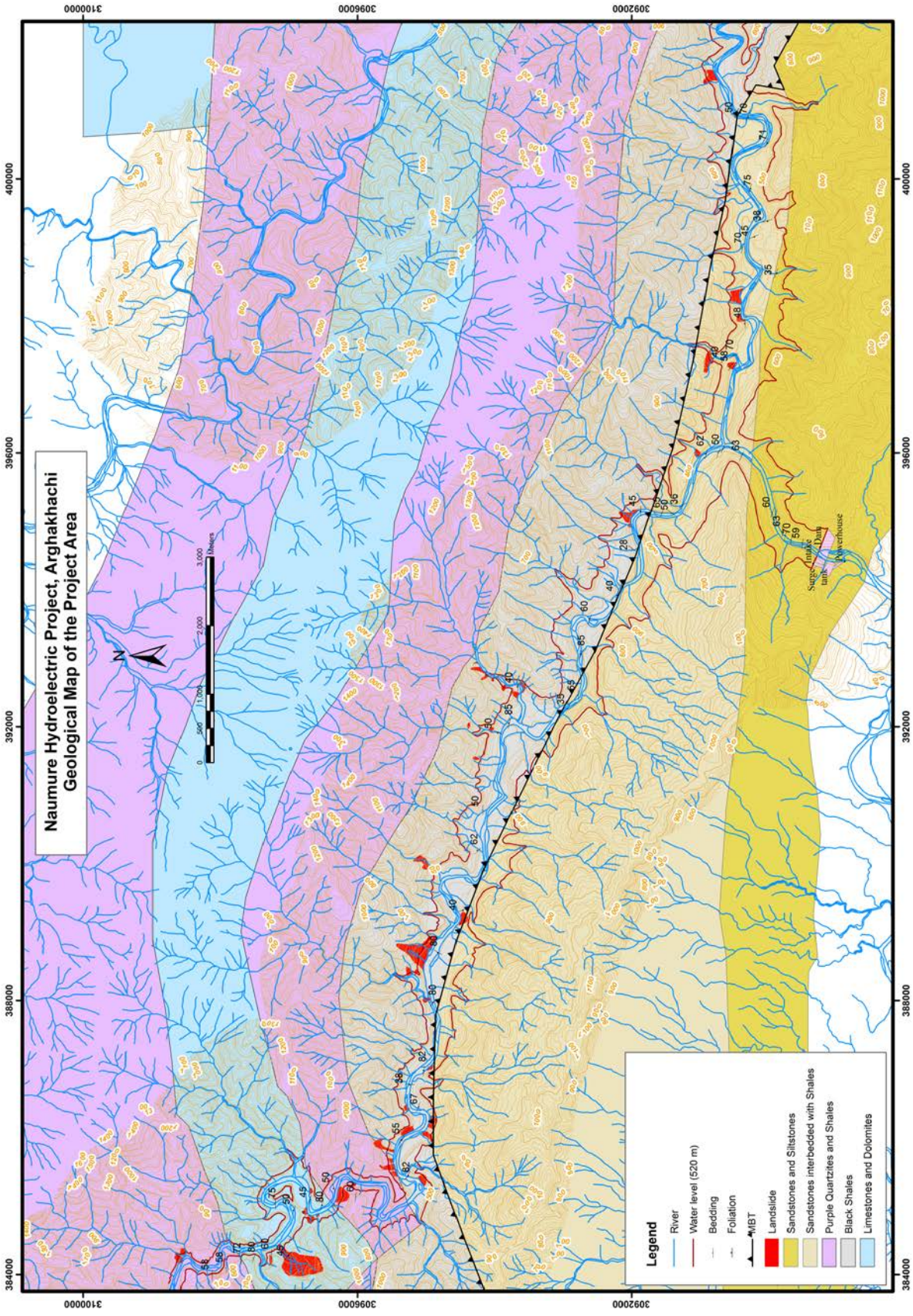


Figure 1.2: Geological map of the project area with the reservoir, dam site, intake and powerhouse area.

Fault: The major fault that exists in the project area is the main boundary thrust (MBT) which passes about 3 km upstream of the Dam site. There are no other faults in the dam site, water route and powerhouse area.

Quaternary deposits: Alluvium, colluvium, residual soil, debris flow deposits (alluvial fans) and sand bar deposits are distributed along the valley of the Naumure and its main tributaries. The alluvial deposits are well distributed in the lower valley slopes in Panaha, Sujanpur, Sikhre, Machhedi, Kudule and Majhi Damar and are less than 20 m thick.

The colluvium is dominantly found on moderately steep to gentle slopes and spurs while residual soil is limited in the upper slopes of the reservoir area. Residual soil is mostly found in Khal Kamare, Hamsapur, Kattike, Airabati, and Kalleri.

Colluvium is significantly distributed along the reservoir area along MBT while the upper reaches of the reservoir near Thadi Odar and Mutaha shows insignificant development of alluvial terraces. This points out to active tectonic uplift of the area from the past to the present.

Rock mass condition: The sedimentary and meta sedimenary rocks of the project area are comparatively moderate to strong. The overall stability of the rock mass is good to very good. The resistant sandstones, limestone and quartzites form steep cliffs, gorges, and sharp peaks, whereas the shales and slate forms a smooth spur and ridge or gentle valley with well developed vegetation. The Limestone and Dolomite of the reservoir are stronger, and they are followed by the stronger Purple Quartzite and weaker Shale. The weakest unit is the Black Shales, which are followed by moderately stronger Sandstone interbedded with Shales and stronger Sandstones and Siltstones of the dam site.

Weathering: Water, air and sun has played a significant role in weathering of rock in the project area. The weathering depth in rocks of project area reaches up to 4-5 m and sometimes more.

Weathering of resistant quartzite beds, limestone, dolomite and shale has resulted into the widespread distribution of talus cones and debris flow fans. The talus cones well developed at Chuna with angular quartzite and shale blocks. The rounded quartzite and limestone boulders also constitute the alluvial terraces. Weathering of the Purple Quartzite and Shale has developed colluvial soils on the middle slopes, especially around the village of Mandre and Dahachaur. The weathered Black Shale of reservoir yield finer colluvial soil near Damar and Khasre, and sporadically residual soil on ridges near Khal Kamare and Masina.

The effect of weathering on quartzites is seen in widening of joints, their slight discoloration, or infilling by silt. But the rock generally remains strong. On the other hand, the shales strongly change their colour (become yellow, pink, yellow, green and brown), get a smoother surface, and the rock around joints and bed loses its strength. On the other hand, limestone and dolomite either are transformed into dissolution cavities or their colour has yellow or brown tints.

Jointing: Three discontinuity sets are seen in the Naumure project area (Table.1.2) the three sets are almost perpendicular to each other, especially in quartzites and sandtones. The shale contains rough and wavy joints that do not continue for more than 4 or 5 m. On the other hand, the limestone and dolomite contains very irregular joints. The joints are straight to slightly wavy in the quartzites and sandstones, where their aperture ranges from less than 1 mm to 5 mm, but some joints are rather wide (up to 1 cm) and continue for several tens of metres.

Stability conditions: The rock and soil slopes in the project area are generally stable. Some past instabilities, which are difficult to delineate at present, were noticed in the right bank of dam site. The main source of sediments in the Rapti Nadi is the debris flow from Madi Khola and Jhimruk Khola and its tributaries, such as the Hapur Khola, Adheri Khola, Ghakse Khola and Sisne Khola. Landslides are observed mostly on colluvial slopes and joint controlled steep rock slopes such as seen near the village of Gyakhora (Figure 1.11). Mainly debris slides, wedge slides, and plane rockslides are found in the project area. The frequent debris flows from the tributary streams of Rapti Nadi causes the water excessively turbid most of the time in the monsoon season. Therefore, some measures are required to deal with this problem. On the other hand, it is clean and clear during the dry period.

Groundwater conditions: The Madi and Jhimruk Khola, and associated smaller tributaries are perennial whereas some minor gullies are seasonal. In the reservoir area quartzites and shale are quite impervious while limestone and dolomite are relatively pervious. On the other hand, sandstone and siltstone of dam site seems slightly pervious, therefore, protective measures are required during the dam construction as well as tunnelling to prevent serious water ingress problems.

1.2 Dam axis

The proposed dam axis (Figures 1.6 and 1.7) lies in the sandstone and siltstones as well as thick colluvial deposits exposed on both banks of the Rapti Khola. Sandstones are fine to medium grained, arkosic, with occasionally silty. Sandstones are hard and massive. The dam axis is found appropriate owing to the stability of both banks and the river has a straight course to the downstream where the slopes are dry. Sandstone and siltstone have poorly developed joints where the rock is categorised as good to fair.

The foundation and the area around the dam axis are slightly pervious and could pose threat of minor seepage during dam construction. In situ rock permeability tests are required for more detailed confirmation.

The distribution of bedding and joints around the dam axis is presented in Figure 1.3, where the steeply dipping prominent bedding and rather random but gently to steeply dipping joints are evident.

It is proposed to construct a rock-fill dam, since there is a narrow gorge, and the boulders of quartzites are easily available near the confluence of Madi and Jhimruk Khola around Airabati, and the red clay is available in the vicinity of the Ratamata, located about 2 km downstream on the left bank of the Rapti Nadi.

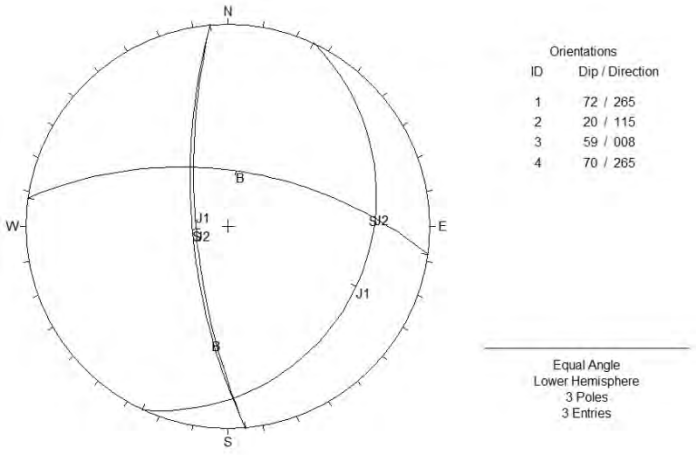


Figure 1.3: Stereographic projection of the bedding plane (B), major discontinuity planes (J1 and J2) and hill slope (S) at the left bank of dam site.

1.3 Reservoir

Rapti Nadi has two main tributaries, the Madi Khola and Jhimruk Khola covering the proposed reservoir area. The water level (520 m) in the reservoir extends up to Mutaha in Madi Khola (northwestern part) and Majhkhanda in the Jhimruk Khola (northeastern part). The villages that will be underwater are Panaha, Thar Damar, Bangge, Sujanpur, Khasre, Khara, Chidi Damar, Machhedi, Lami Damar, Dumai, Kudule, Siyala, Takura, Kalleri, Majhi Damar, Tarule, and Majhkhanda. The engineering geological map of the reservoir and its surrounding areas is presented in Figure 1.4.

The stability in the surrounding areas of the reservoir is relatively sound. The present study reveals no significant weak or vulnerable zones leading to dam collapse or large failures obstructing the reservoir. The area to be under water consists of bedrock and colluvium with some minor instabilities. Since the reservoir area mostly consists of moderately permeable rocks like sandstone, siltstone and slates the reservoir area is moderately water tight. The deep, straight gorge is quite suitable for the dam construction. However, there will be significant sediment transport from the Madi Khola and Jhimruk Khola, which has many landslides and debris flow deposits upstream from the reservoir area. Hence some check dams and other sediment retention structures are required to prevent the sediment inflow in the reservoir.

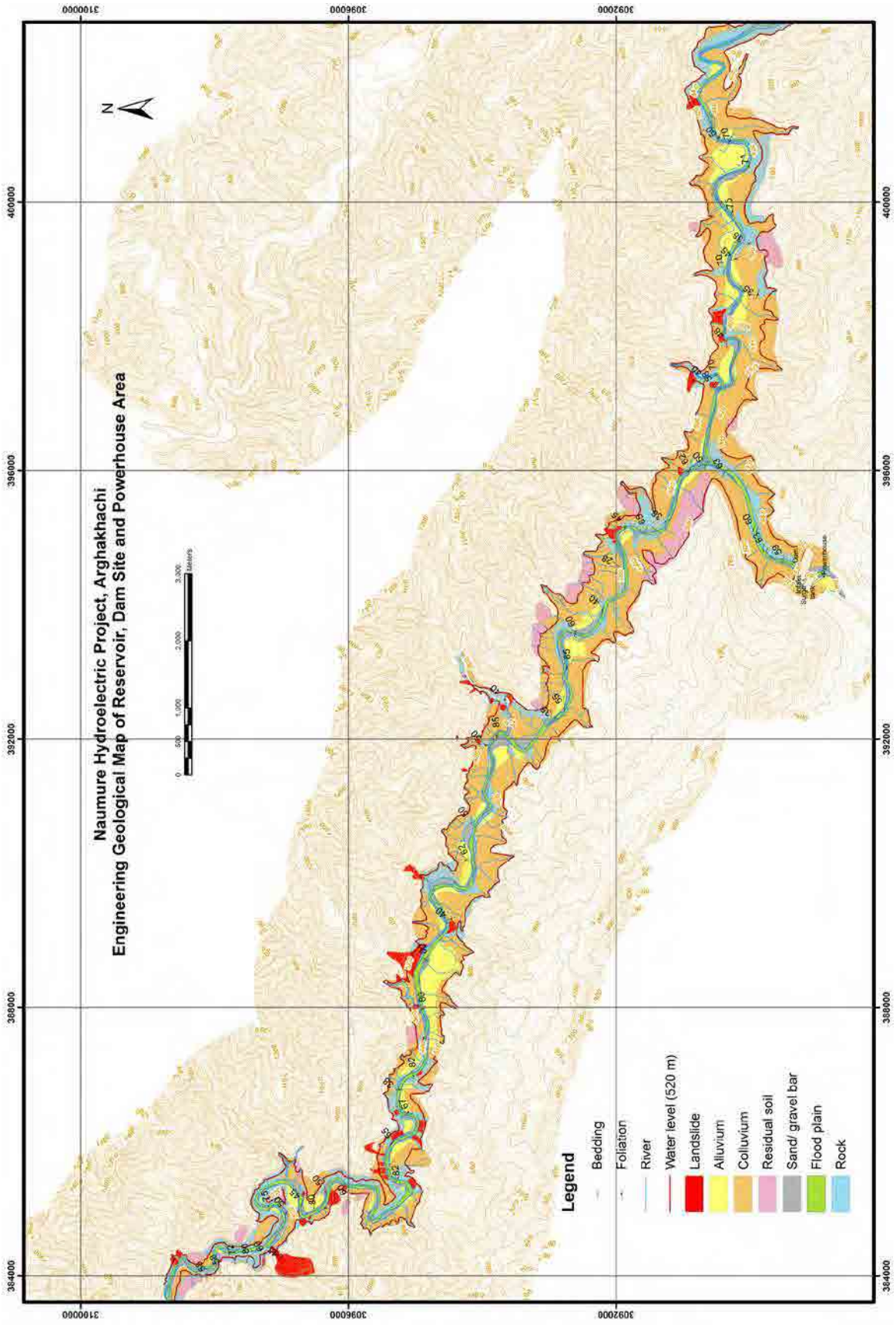


Figure 1.4: Engineering geological map of Reservoir, Dam Site and Powerhouse Area.

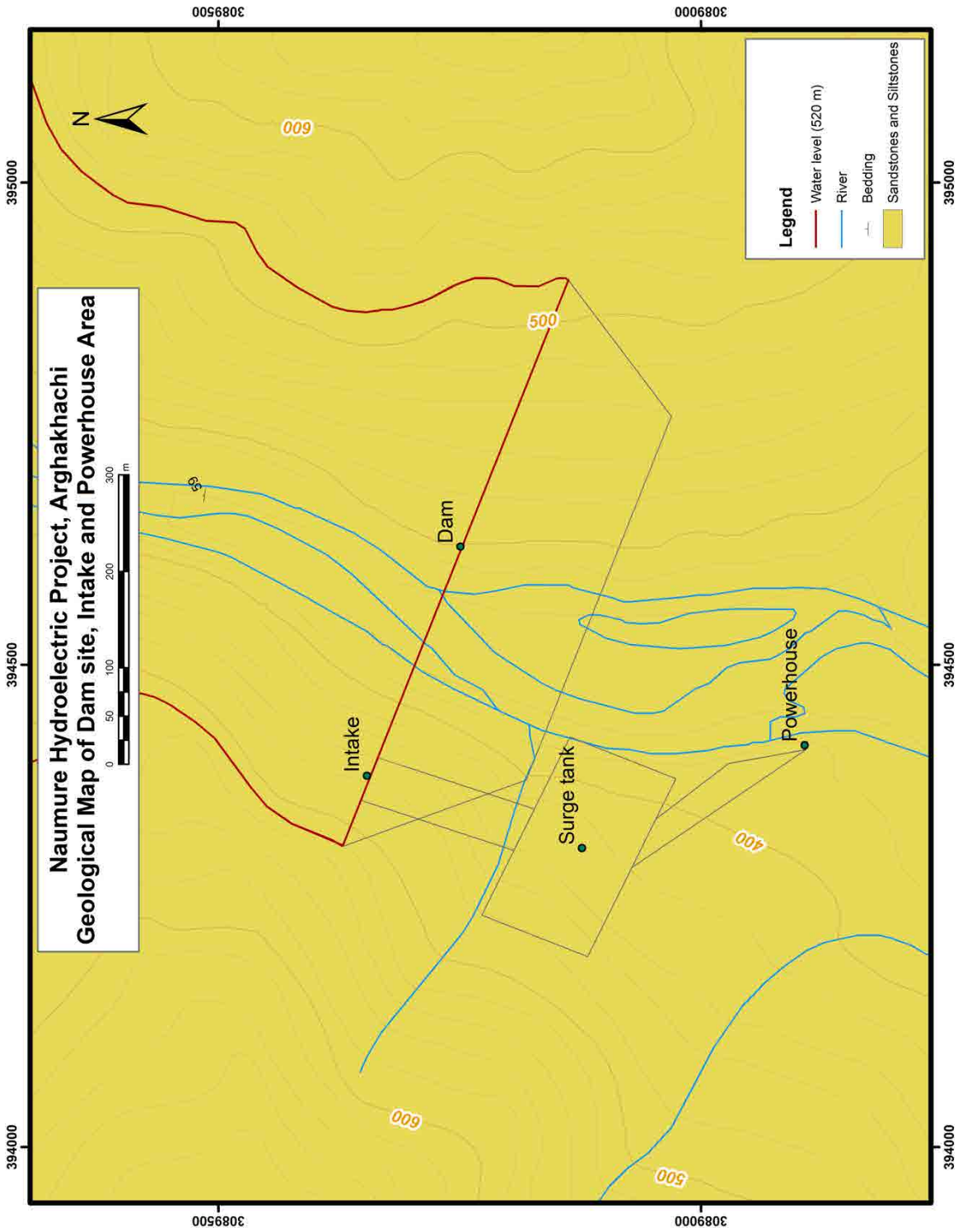


Figure 1.5: Geological map of Dam site, Intake, Water route and Powerhouse Area

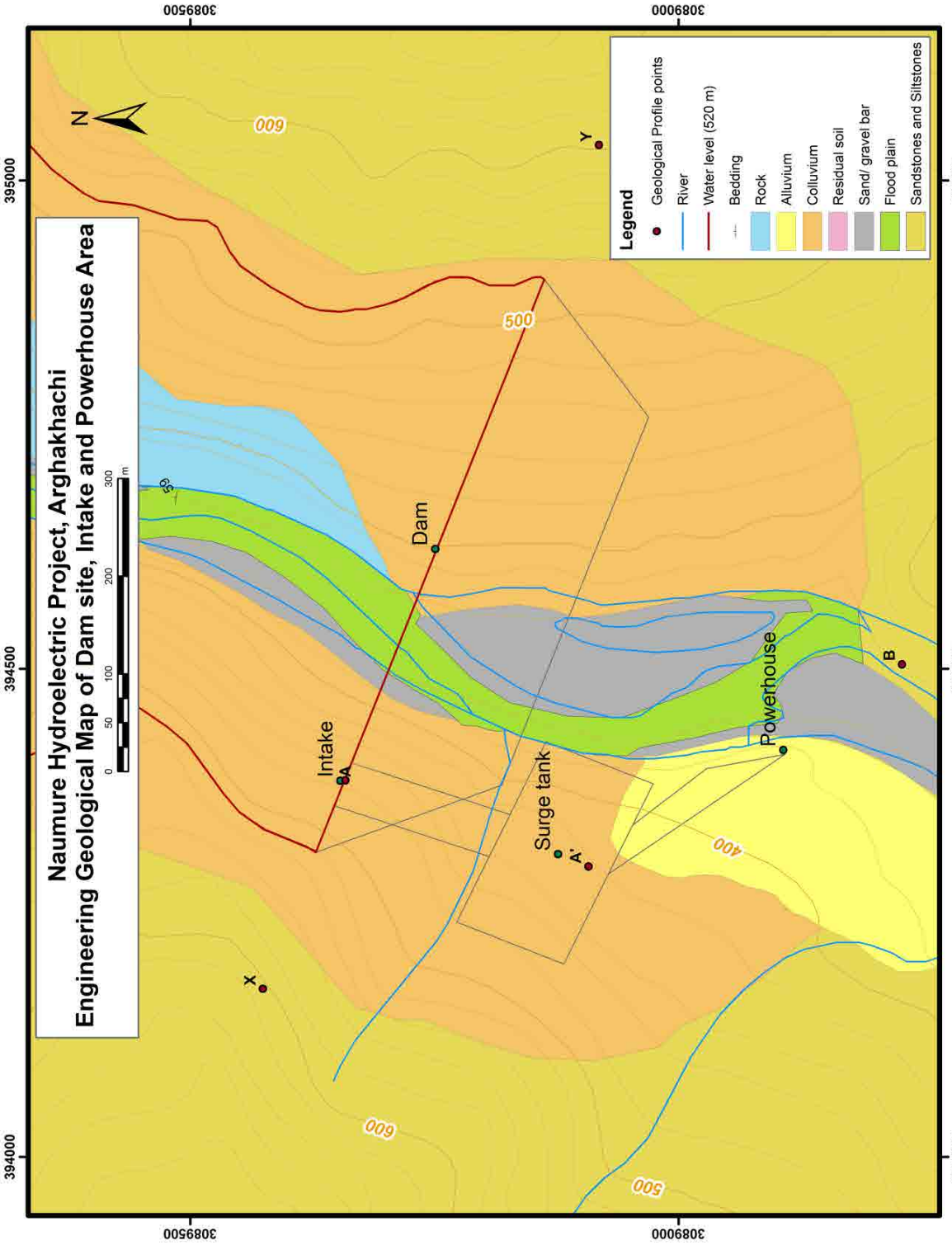


Figure 1.6: Engineering geological map of dam site, intake, water route and powerhouse area.

1.4 Waterway

An intake tunnel (Figure 1.5) is proposed on the right bank of the Rapti Nadi, near the west end of the dam. The area is made up of sandstone and siltstone rock beds and has a steep rock cliff with colluvial deposits along the slope.

The proposed 350 m long tunnel passes through fine to medium grained, arkosic, occasionally silty sandstones (Figure 1.5). The overburden along the proposed headrace tunnel varies from less than 50 to 60 m (Figure 1.8). Generally the headrace tunnel alignment makes an acute angle with the bedding plane. In this area, the bedding is moderately dipping due north to northeast. The moderate dip of beds is favourable in terms of stability for tunnel construction.

1.5 Powerhouse

The powerhouse site is located about 450 m downstream, to the north of the Ratamata, on the right bank of the Rapti Nadi on an alluvial terrace at Jabune (Figure 1.5, Figure 1.6) which is about 250 m wide, 450 m long and about 30 m depth. Below the powerhouse site, there is about 500 m long (from the east to west) and about 80 m wide sand and gravel bar of the Rapti Nadi. The bedrock that can be expected at the powerhouse site is at the depth of more than 20 m (Figure 1.8). The bedrock, joints and valley slope behind powerhouse shows stable slope conditions. However, there is some possibility of channel shifting (by scouring the alluvial terrace, about 100 m upstream from the powerhouse site) by the Rapti Nadi, hence protective measures should be adopted before construction of foundation at powerhouse.

1.6 Instabilities

Mainly rockslides (wedge and plane failures) are observed on sandstones, quartzites, and shales. The landslide and other instability distribution (Figure 1.4) in the reservoir and its vicinity were assessed from field observations and satellite image interpretations. Some important landslides are shown in Figures 1.11 and submitted photographs whereas a large alluvial fan to be submerged in the reservoir area is depicted in Figures 1.4 and 1.12.

1.7 Construction materials

The required amount of gravel, sand, and fines is available at the dam site (Figures 1.4 and 1.13) and near the confluence of the Madi Khola and Jhimruk Khola. Also the quartzites and their talus around Chidi Damar and Lami Damar could be good sources of boulders and gravel. However, sand is not available in significant quantity in the reservoir area, it is needed to transport from the Rapti Nadi, about 5 km downstream from the dam site.

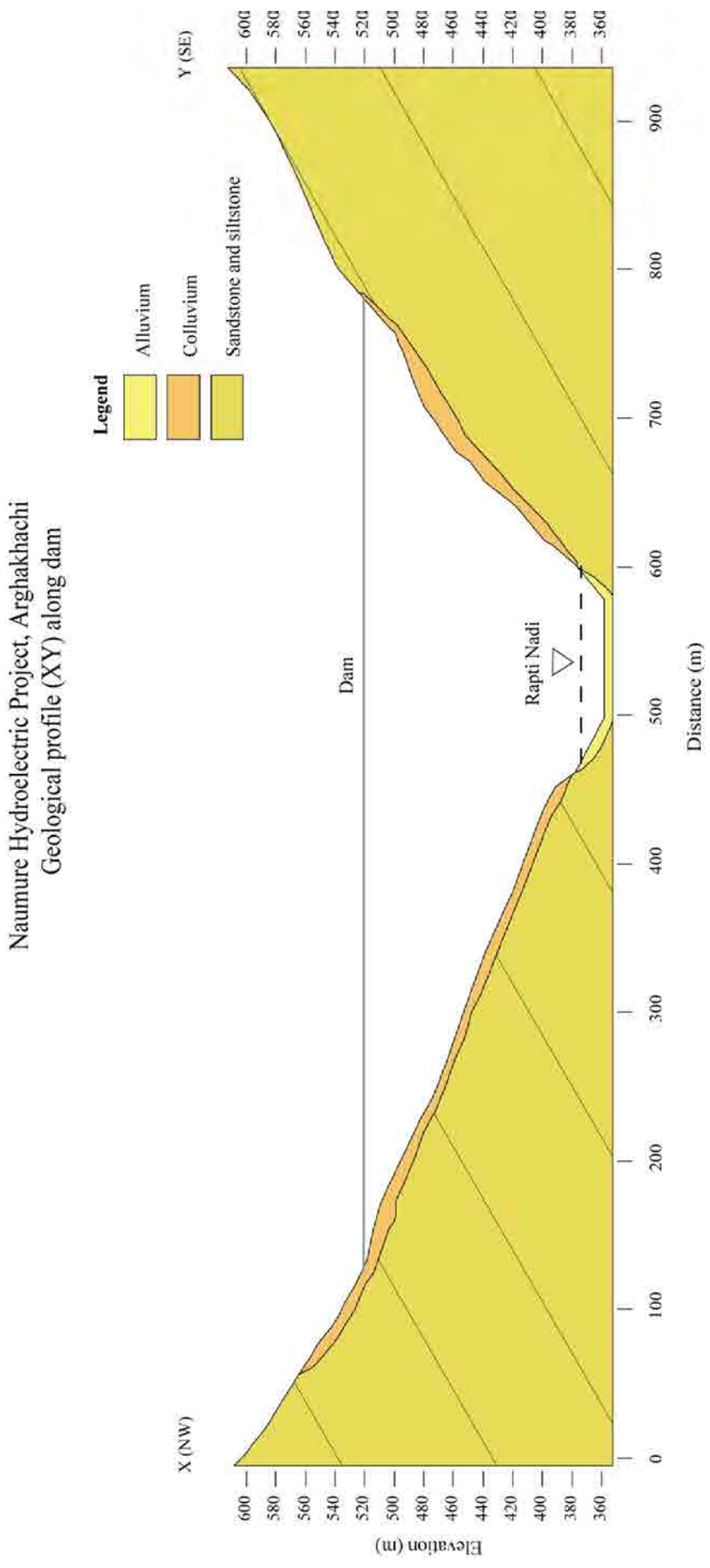


Figure 1.7: Geological profile (XY) along dam.

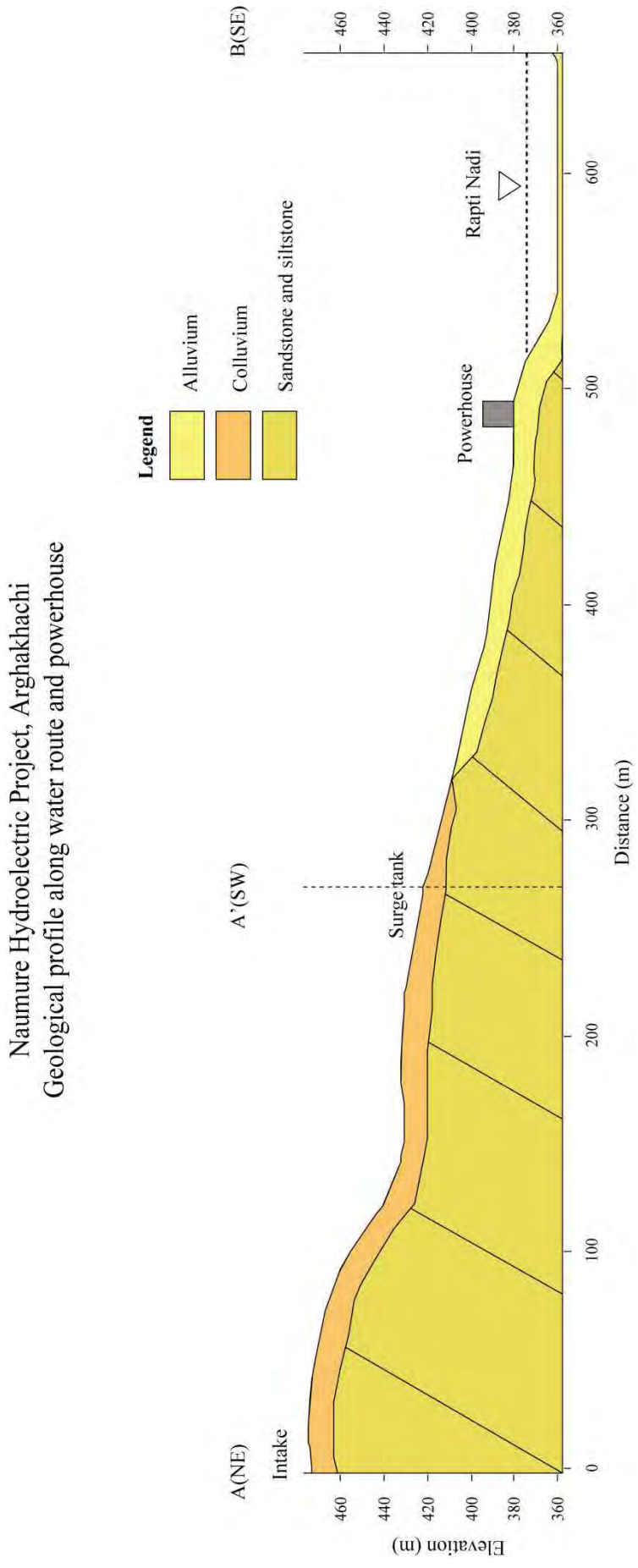


Figure 1.8: Geological profile (AA'B) along water route and powerhouse.

1.8 Further recommendations

The Naumure hydroelectric project is geologically sound and feasible. However some further investigations are required to assess the dam site for permeability of sandstones, investigation of the headrace tunnel alignment for its stability, and study of channel shifting in the powerhouse area.

Figure 1.9: Downstream view of the dam site, near waypoint NAU01. View to S.

Figure 1.10: Thickly bedded and jointed sandstone beds, at left bank of dam site, at waypoint NAU03. View to SE.

Figure 1.11: Rock slides at pink quartzite and purple shale observed at road section near the village of Gyakhora, near waypoint NAU052. View to SW.

Figure 1.12: Alluvial fan of the Madi Khola at Chidi Damar, right bank of the Madi Khola, near waypoint NAU037. View to S.

Figure 1.13: The construction material (Gravel) available at dam site, at waypoint NAU04. View to NE.

1.9 GPS survey and photos

Fieldwork was carried out for five days. During the field work primary geological data was collected throughout the project area. Since each group had three geologists and only one GPS, the two geologists put the observation points directly on the map without the help of GPS, based on ground truth. The GPS data and photos are already submitted. The location points are presented in Table 1.1 and the major attitude of bedding/foliation are presented in Table 1.2. GPS locations are shown in Figure 1.14 while submitted photograph numbers and their locations are shown in Figure 1.15.

Table 1.1: GPS locations in the Naumure hydroelectric project area

TYPE	IDENT	LAT	LONG	ALTITUDE	Photo No.
WAYPOINT	NAU057	27.98642200	82.82672400	492.66	
WAYPOINT	NAU058	27.98674500	82.82857100	472.46	5385
WAYPOINT	NAU059	27.98921000	82.82908300	462.80	5387
WAYPOINT	NAU060	27.98454500	82.82981900	442.63	5389
WAYPOINT	NAU061	27.98307700	82.82859200	445.53	
WAYPOINT	NAU062	27.98161600	82.83185200	436.28	5399
WAYPOINT	NAU62	27.98161600	82.83185200	436.59	
WAYPOINT	NAU063	27.97851500	82.83026500	619.87	
WAYPOINT	NAU041	27.96841600	82.86678500	410.38	
WAYPOINT	NAU042	27.96850500	82.85957600	416.94	
WAYPOINT	NAU043	27.96978800	82.84954400	419.86	
WAYPOINT	NAU044	27.97194200	82.84701100	427.28	5366, 5367, 5368
WAYPOINT	CF07	27.97148500	82.84406400	421.56	
WAYPOINT	NAU045	27.97047100	82.84334500	422.33	
WAYPOINT	NAU046	27.97251100	82.83914600	430.98	5369
WAYPOINT	NAU047	27.97276100	82.83478400	429.09	5370
WAYPOINT	NAU048	27.97183900	82.83317400	429.39	
WAYPOINT	NAU049	28.00510400	82.80901200	528.40	5377
WAYPOINT	NAU050	28.00301300	82.81011600	531.46	
WAYPOINT	NAU051	28.00200700	82.81223700	517.25	5378
WAYPOINT	NAU052	27.99746500	82.81848300	533.26	5379
WAYPOINT	NAU052	27.99559300	82.81958800	540.57	
WAYPOINT	NAU053	27.99367000	82.82089700	543.40	5382
WAYPOINT	NAU054	27.99198200	82.82106600	546.68	
WAYPOINT	NAU055	27.98966500	82.82165300	539.47	
WAYPOINT	NAU056	27.98750900	82.82116500	525.24	5383
WAYPOINT	NAU025	27.93648100	82.93344900	368.27	
WAYPOINT	NAU026	27.93788100	82.93218300	384.07	
WAYPOINT	NAU027	27.93917000	82.93219100	395.26	5354
WAYPOINT	NAU028	27.94196000	82.93283200	398.87	
WAYPOINT	NAU029	27.94304000	82.92681600	431.27	
WAYPOINT	CF-04	27.94533100	82.92365400	454.86	5357
WAYPOINT	NAU030	27.94481700	82.92030700	387.97	
WAYPOINT	NAU031	27.94842700	82.91673000	376.82	
WAYPOINT	NAU032	27.94947900	82.91154400	390.68	
WAYPOINT	NAU033	27.94995700	82.90505500	395.51	
WAYPOINT	NAU034	27.95112600	82.90362500	397.29	5359
WAYPOINT	NAU035	27.95893600	82.90115100	401.65	
WAYPOINT	CF05	27.95752600	82.90426600	432.02	
WAYPOINT	NAU036	27.95800100	82.90658000	453.23	5360
WAYPOINT	NAU037	27.96079400	82.89946900	405.69	5362

TYPE	IDENT	LAT	LONG	ALTITUDE	Photo No.
WAYPOINT	NAU038	27.96238100	82.88788900	424.61	
WAYPOINT	NAU039	27.96276500	82.88214200	411.76	
WAYPOINT	NAU040	27.96512300	82.87278500	416.34	5365
WAYPOINT	CF06	27.96487800	82.86739900	442.39	
WAYPOINT	NAU08	27.93178900	82.94118700	358.80	5378, 5379
WAYPOINT	NAU09	27.93121200	82.94191300	354.32	
WAYPOINT	NAU010	27.93063400	82.94994900	374.36	
WAYPOINT	NAU011	27.93024100	82.95406000	396.62	5335
WAYPOINT	NAU012	27.92988500	82.95568300	395.02	
WAYPOINT	NAU013	27.93129000	82.95520700	408.61	5337
WAYPOINT	NAU014	27.92844700	82.96079000	411.21	5343
WAYPOINT	CF02	27.92766700	82.96778600	400.23	
WAYPOINT	NAU015	27.92889800	82.97150300	403.47	
WAYPOINT	NAU016	27.93044500	82.98460200	405.29	
WAYPOINT	CF03	27.92787400	82.98908200	422.24	5348, 5349
WAYPOINT	NAU017	27.92963500	82.99132000	408.92	
WAYPOINT	NAU017	27.92979900	82.99119700	407.02	
WAYPOINT	NAU018	27.92829900	82.99071200	409.84	5352
WAYPOINT	NAU019	27.92575300	82.98686800	403.62	
WAYPOINT	NAU020	27.92784000	82.98005400	387.88	
WAYPOINT	NAU021	27.92582600	82.97549600	376.26	
WAYPOINT	NAU022	27.92751600	82.97307700	391.94	
WAYPOINT	NAU023	27.92432100	82.96756200	409.74	
WAYPOINT	NAU024	27.93337800	82.94139900	353.45	
WAYPOINT	CF01	27.93369900	82.93615300	438.00	
WAYPOINT	NAU01	27.92063800	82.92784500	355.74	5320
WAYPOINT	NAU02	27.92214100	82.92842700	371.93	5322
WAYPOINT	NAU03	27.92288700	82.92907400	362.84	
WAYPOINT	NAU04	27.92328500	82.92956100	361.38	5323, 5325
WAYPOINT	NAU05	27.92419900	82.93213500	358.92	
WAYPOINT	NAU06	27.92463300	82.93240700	352.85	
WAYPOINT	NAU07	27.92878000	82.94079300	354.52	

Table 1.2: GPS locations with attitude of bedding, foliation and joints in the Naumure hydroelectric project area.

Waypoint	Strike	Dip Amount	Dip Direction	Type
NAU01	98	59	N	B
NAU02	100	70	N	B
NAU03	103	68	N	B
NAU04	270	63	N	B
NAU05	105	70	N	B
NAU06	110	60	N	B
NAU07	115	63	N	B
NAU08	112	75	N	B

Waypoint	Strike	Dip Amount	Dip Direction	Type
NAU09	114	50	N	B
NAU11	120	58	S	B
NAU12	150	70	N	B
NAU13	115	40	N	B
NAU14	89	48	N	F
NAU15	105	70	N	B
NAU17	110	50	N	F
NAU18	113	70	N	F
NAU19	114	71	S	F
NAU20	108	75	S	F
NAU23	110	35	S	F
NAU24	105	62	S	F
NAU25	145	36	S	B
NAU27	112	65	S	B
NAU28	90	45	S	F
NAU30	98	40	N	F
NAU31	110	60	N	F
NAU32	115	85	N	F
NAU33	90	55	N	B
NAU34	120	35	N	B
NAU35	105	85	N	F
NAU37	25	50	N	F
NAU38	90	50	N	B
NAU39	135	62	N	F
NAU40	160	40	N	F
NAU42	130	80	N	F
NAU43	98	82	N	F
NAU44	5	38	N	F
NAU45	110	67	N	F
NAU46	120	55	N	F
NAU48	120	82	N	F
NAU49	110	55	S	F
NAU50	95	70	N	F
NAU52	90	58	N	B
NAU53	95	72	N	B
NAU54	110	80	N	B
NAU55	90	60	S	B
NAU56	130	45	N	F
NAU58	107	50	N	F
NAU59	90	75	S	B
NAU60	110	45	S	B
NAU61	105	80	N	F
NAU62	75	50	N	F
NAU63	95	60	N	B

Table 1.3: Geological Study Team Members and Itinerary of the Field Visits

Name of Project	District	Date of field visit	Name of the Geologlist	Investigation method
Naumure	Argakhanchi and Pyuthan	10th June - 16th June, 2012	Dr. Sunil K. Dwivedi Mr. Lalit Rai Mr. Saunak Bhandari	Geological reconnaissance survey

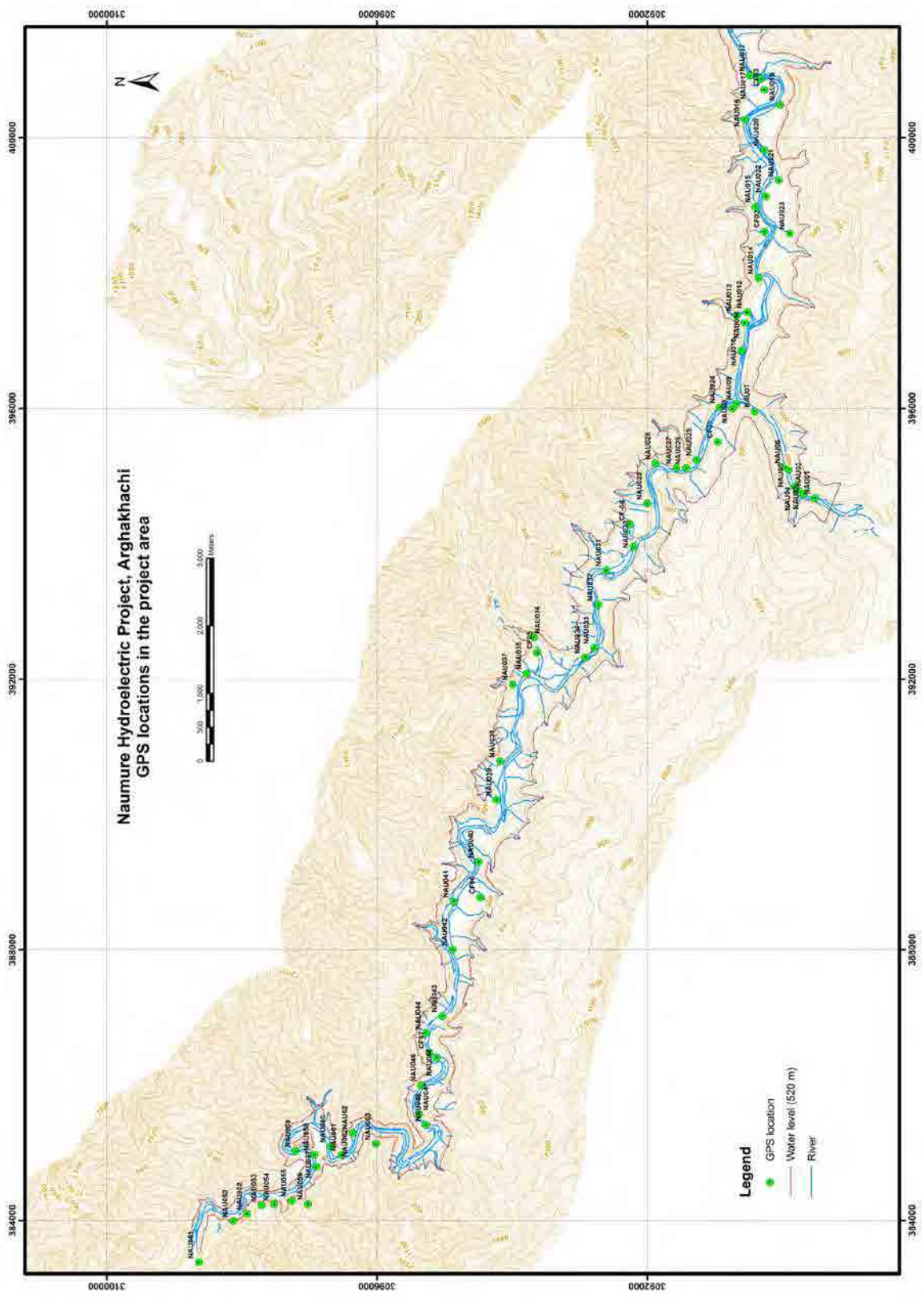


Figure 1.14: GPS locations in the Naumure hydroelectric project.

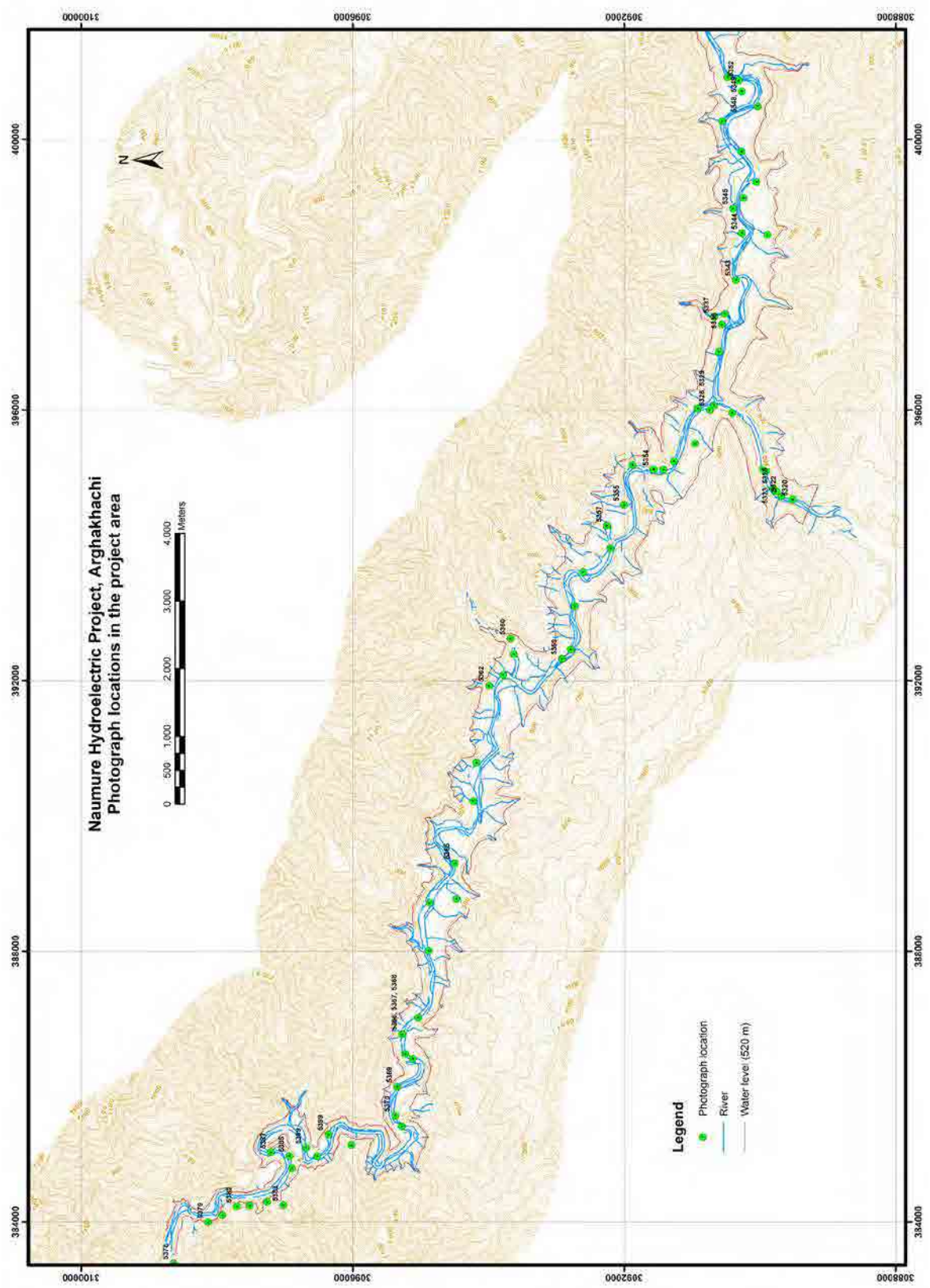


Figure 1.15: Photograph numbers and locations in the project area.

Annex 11: Environmental Survey Summary Report

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1. SOCIO-ECONOMIC AND CULTURAL ENVIRONMENT

1.1 Methodology

The socio-economic and cultural environment of the "National Master Plan study on Storage-type Hydroelectric Power Development was assessed using following methods and tools.

- Collection and review of social environment related policy documents / legislations/ directives/ guidelines/ manuals etc. of the government of Nepal particularly Ministry of Science, Technology, and Environment, Ministry of Energy and its cross-sectorial agencies (Department of Electricity Development, Roads, agriculture, Tourism, irrigation etc.) and that of the JICA relating to socio-economic and cultural environment
- Secondary literature review relating to the social, economic and cultural aspects of the screened project areas available at the central bureau of statistics, ministries, departments, districts and village development committees
- Procurement of the 1:25000 or 1:50000 topographic maps (as available) of the project sites and delineate the project layout particularly the reservoir area, dam, headrace tunnel and powerhouse site to list out the Village development committees, settlements, agricultural lands, infrastructures directly affected by the project.
- Procurement of recent satellite images of the project site, covering areas of reservoir formation by the project, and preparation of detailed land use, built structure, infrastructure map of the reservoir area.
- Identification of data gaps for the assessment study and preparation of the checklists for the field level surveys (district and project sites) incorporating the various indicators.
- Design of the field survey methods and tools and conduct training to the field survey teams to ensure that all the project sites are surveyed with the same instruments and tools to gather information of the desired indicators at equal footing for assessment purpose.
- Participatory Method is the survey methods employed for field level survey. The key tools used under this method are:
    - Focus Group Discussions (FGD) at the settlement level within the reservoir area. Combined and separate FGDs are conducted based on gender, ethnic minority, disadvantageous groups etc. as applicable.
    - Key Informant Survey (KIS) with the knowledgeable informants (teachers, village elites, VDC secretary, Office heads of the district level sector offices etc.)

Altogether 1057 persons were met in this process in different project sites (Table 1). The detail of the FGD /KIS participants' name list is provided in the sites specific reports (SEA Annex 02 - 11).

Table 1 Total Number of People Met Under FGD/KIS Process

Project Name	Total Number of Persons Met
E-01 Dudh Koshi	93
E-06 Kokhajor-1	81
E-17 Sun Koshi No.3	184
C-02 Lower Badigad	179
C-08 Andhi Khola	58
W-02 Chera-1	114
W-05 Lower Jhimruk	41
W-06 Madi	134
W-23 Nalsyau Gad	26
W-25 Naumure (W.Rapti)	147
Total	1057

Besides field level participatory study, the observation tools are also used to depict the key features of the project sites using a checklists (**See Appendix 1**).
Apart from the above District Level Information were collected from different line agencies using a Checklist **(See Appendix 2**) wherever possible. **Appendix 3** presents the name of the social study team members participating in the field visits along with the filed visit dates and duration of the filed visits for each of the candidate projects.

1.2 Limitations

The information collected for assessment of the socio-economic and social status of the candidate projects is a rapid assessment with limited field visits of 5 to 10 days in one candidate project. Further the information gathered for assessment has a spatial coverage limiting to the reservoir inundation area with limited information for other structural sites. Since most of the information collected is based on the participatory methods and not verified through household surveys, population, number of households, area of agricultural lands, number of structures, etc. is only approximate than actual. It is therefore the area under different land uses and number of houses determined by GIS experts using recent satellite images may not tally with the information provided by the FGD/KIS participants.

1.3 Demographic Features of the Study Districts

Altogether 12 districts fall within the proposed 10 storage type hydropower projects and they occupy more than 3 million population and 0.67 million families which is 11.4% of total country population and 11.9 % of the total country households. The average family size in the project districts varies from 4.08 to 5.51 and the population density from 77 to 279 persons/sq. km. compared to national average family size of 4.7 and average density of 181 (Table 2).

Table 2 Demographic Data of Project Districts

Project	District	Demographic Data of the Project Districts						
		Total Population	Sex Ratio (Males/100 Females)	Absent Population (Abroad)	Number of Houses	Number of Households	Av. HH Size	Population Density (Persons/sq. km)
E-01 Dudh Koshi	Okhaldhunga	147,984	86.6	10,552	31,741	32,502	4.55	138
	Khotang	206,312	88.9	17,662	41,337	42,664	4.84	130
E-06 Kokhajor-1	Sinduli	296,192	92.2	15,287	54,375	57,581	5.14	119
	Kavre	381,937	91.9	14,531	63,868	80,720	4.73	274
E-18 Sun Koshi No.3	Kavre	381,937	91.9	14,531	78,560	80,720	4.73	274
C-02 Lower Badigad	Gulmi	280,160	76	58,561	62,704	64,921	4.32	244
C-08 Andhi Khola	Syanja	289,148	77	50,476	62,735	68,881	4.20	248
W-02 Chera-1 and W-23 Nalsyau Gad	Jajarkot	171,304	99.7	4,174	28,439	30,472	5.62	77
W-05 Lower Jhimruk and W-25 Naumure (W.Rapti)	Argakhanchi	197,632	77.5	39,929	44,332	46,835	4.22	166
	Pyuthan	228,102	78.1	36,858	45,642	47,730	4.78	174
W-06 Madi	Rolpa	224,506	84.9	23,597	42,121	43,757	5.13	119
	Sindhupalchok	287,798	92.6	19,712	63,868	66,688	4.32	113
Total Project Districts		3,093,012	86.44	305,870	619,722	663,471	4.72	173
Total Nepal		26,494,504	94.2	5,423,297	4,767,196	5,427,302	4.88	180
% occupied by Project District		11.67		5.64	13.0	12.22		

Source: Central Bureau of Statistics (CBS), 2012

1.4 Summary of the Key findings

Table 3 below presents summary of the key findings of the socio-economic and cultural aspects while detail is provided in the site specific reports of each of the schemes.

Table 3 Summary of Key Socio-economic and Cultural Environment Indicators

Description	Findings of the Indicators by Project Sites									
	E-01 Dudh Koshi	**E-06 Kokhajor-1**	**E-18 Sun Koshi No.3**	**C-02 Lower Badigad**	**C-08 Andhi Khola**	**W-02 Chera-1**	**W-05 Lower Jhimruk**	**W-06 Madi**	**W-23 Nalsyau Gad**	**W-25 Naumure (W.Rapti)**
Number of Resettlements										
No. Of HH reported in field Survey	63	92	1599	1606	542	566	229	336	263	456
Schools	-	6	19	18	9	3	4	2	2	5
Industries	-	0	2 (Brick Factories)	11	6	-	3	-	-	-
Agriculture										
Irrigation schemes	1	2	20	58	23	7	3	16	-	25
Ethnic Group										
Total Number of Type of Ethnic Groups	6	5	8	10	5	4	7	4	3	5
Ethnic/ Caste Groups in the project site										
Brahmin	×	×	√	√	√	√	√	√	√	√
Thakuri/Chhetri	√	√	√	√	×	√	√	√	√	√
Dalit	√	×	√	√	√	√	√	√	√	√
Adivasi/janjati										
Magar (disadvantaged)	√	√	√	√	√	√	√	√	×	√
Gurung (Disdavnataged)	×	√	×	√	√	×	√	×	×	√
Newar (Advanced)	√	×	√	√	√	×	√	×	×	×
Thakali (Advanced)	×	×	×	√	×	×	×	×	×	×
Tamang (Disadvantaged)	√	√	√	×	×	×	×	×	×	×
Majhi (Marginalised)	√	×	√	×	×	×	×	×	×	×
Kumal (Marginalised)	×	×	×	×	×	×	√	×	×	×
Bote (Highly Marginalised)	×	×	×	√	×	×	×	×	×	×
Majhi (High Marginalised)	×	×	×	√	×	×	×	×	×	×
Tharu (Marginalised)	×	×	√	√	×	×	×	×	×	×
NOTE: √ =presence , × = Absence										
Cultural Aspects										
Number of Cultural Structures (Temples)	2	0	>10	9	5	1	1	4	-	2

Description	Findings of the Indicators by Project Sites									
	E-01 Dudh Koshi	**E-06 Kokhajor-1**	**E-18 Sun Koshi No.3**	**C-02 Lower Badigad**	**C-08 Andhi Khola**	**W-02 Chera-1**	**W-05 Lower Jhimruk**	**W-06 Madi**	**W-23 Nalsyau Gad**	**W-25 Naumure (W.Rapti)**
Type of Cultural Festivals	Hindu Culuture (Dasain, Tihar, Teeja, Manghe Sankrati) and Magar Diwas, Lhosar,Sonam Losar Bisket Sankrati, Ekadashi, Pitri Puja, Ghatu Nach, Lakhe, Botre (Barki, Dhanya Purne and Purnima among Janjati/Adivasi in all the project sites.									
Unique Handicraft	-	-	-	-	Nepali Bag and Woollen Products	-	Gundri/Dok o/Mandro for self use	-	Bakral from Goat wool	Mandal as per need
Tourism										
Number of Tourist Facilities	2 (Rafting)	-	10	-	None	None	-	-	-	-
Number of Tourists/Yr	10	-	20,000	-	None	none	-	-	-	-
Water Mill/Turbine	--	10	15	24	-	9	-	2	20	-
Hydropower		1(1.5 kw)	-	2 (28 KW& .7 MW)			-	4(.23 kw)	-	-
Drinking Water Schemes	5	10	22	29	10	2	7	22	-	17
Market	1	0	5	5	4	4	-	2	1	3 Shops
Ongoing/Proposed Development Plans	None	2 irrigation, 1 micro hydro, 1 hospital, 2 road project	2 Irrigation, 1 Ring Road, 1 Bridge,1 Water Pump, 1 Kinmbu Farming, 4 Road Expansion	58Irrigation, 2 HP (2.725 MW)	1 HP (9.5 MW), Aquatic Firm and Adhikhola Developmen t Programme	None	1 Drinking Water Scheme	4 HP (0.023 MW), 1 Irrigation	1 Suspension Bridge, 1 DW Scheme	1 CF, I Irrigation, 1 Alternative Energy
Previous Experience/Issues	None	Had trouble related to construction of Salimar cement industry	Minor Disputes during road expansion	None		None	None	None	None	None

2. PHYSICAL AND BIOLOGICAL ENVIRONMENT

2.1 Methodology

For the assessment of the physical and biological environment of the candidate projects a range of methods were applied which are briefly described below;

2.1.1 Physical Environment

The physical environment of the candidate projects screened for the study in the "National Master Plan study on Storage-type Hydroelectric Power Development" was assessed using following methods and tools.

- Secondary literature review which included:
    - Collection and review of physical environment related policy documents / legislations/ directives/ guidelines/ manuals etc of the government of Nepal particularly Ministry of Science, Technology, and Environment, Ministry of Energy and its cross-sectoral agencies (Department of Electricity Development, Roads, agriculture, Tourism, irrigation etc.) and that of the JICA .
    - Collection and review of the literatures relating the physical environment of the candidate project sites from various sources
    - Collection of the available topographic maps 1: 25000 or 1:50000 for the screened candidate projects and analysis of topographic features, land use, built structures, motorable roads, foot trails, bridges, sites of archaeological significance, areas of land instability etc covering the reservoir area and key structural layouts of the candidate projects.
    - Acquisition of the recent satellite imageries (2011 or 2012) and analysis of the topographic features, land use, built structures, motorable roads, foot trails, bridges and areas of land instability etc covering the reservoir area and key structural layouts of the candidate projects.
    - Comparison of the topographic features, land uses, built structures, motorable roads, foot trails, bridges, land instability and other geomorphic characteristics obtained from the analysis of available topographic maps and the recent land sat imageries to unravel the changes in the last decades.
- Identification of data gaps for assessment from the review of secondary literatures and preparation of check lists for the field investigation (***Appendix 4***)
- Field survey at the candidate project site with the checklists for the verification of the changes in topography, land use, built structures, foot trails, bridges, motorable roads, and geomorphic characteristics etc. Filed survey also uses the participatory methods and tools for the data collection on disaster incidents such as landslides, floods, earthquake etc within the candidate project influence area.

Apart from the above District Level Information were collected from district level line agencies particularly District forest Office using a Checklist **(Appendix 2**) wherever possible. ***Appendix 5*** presents the name of the physical environment study team members participating in the field visits along with the filed visit dates and duration of the filed visits for each of the candidate projects

2.1.2 Biological Environment

The biological environment of the candidate projects screened for the study in the "National Master Plan study on Storage-type Hydroelectric Power Development" was assessed using following methods and tools.

- Secondary literature review which included:
  - Collection and review of biological environment related policy documents / legislations/ directives/ guidelines/ manuals etc of the government of Nepal particularly Ministry of Science, Technology, and Environment, Ministry of Energy, Ministry of Forest and Soil Conservation and its cross-sectoral agencies (Department of Electricity Development, Forest, Roads, agriculture, Tourism, irrigation etc.) and that of the JICA.
  - Collection and review of the literatures relating the biological environment of the candidate project sites from various sources
  - Collection of the available topographic maps 1: 25000 or 1:50000 for the screened candidate projects and analysis of forest, shrub, and grass lands etc covering the reservoir area and key structural layouts of the candidate projects.
  - Acquisition of the recent satellite imageries (2010 or 2012) and analysis of forest, shrub, and grass lands etc covering the reservoir area and key structural layouts of the candidate projects.
  - Comparison of forest, shrub, and grass land areas obtained from the analysis of available topographic maps and the recent land sat imageries to unravel the changes in the last decades.
- Identification of data gaps for assessment from the review of secondary literatures and preparation of check lists for the field investigation (***Appendix 6***)
- Field survey at the candidate project site with the checklists for the verification of the changes in forests, shrub and grass lands etc. Filed survey also uses the participatory methods and tools for the data collection on floristic and faunal assemblages, apart from direct observations within the reservoir and areas affected by water regulations. Adopted participatory methods were focus group discussions at the community level, community forest user groups, and interviews with the key informants such as chairperson of the community forest user groups for terrestrial vegetation and terrestrial animals and fishermen for the households involved in fishing as occupational, part time and recreational for livelihood and recreation and fish assemblages in the river stretch affected by the candidate project. Direct observation tools used for the forest related parameter is the forest plot sampling using standard practices of forest plot sampling within the reservoir area.

Apart from the above District Level Information were collected from district level line agencies particularly District forest Office using a Checklist **(Appendix 2**) wherever possible. ***Appendix 7*** presents the name of the biological environment study team members participating in the field visits along with the filed visit dates and duration of the filed visits for each of the candidate projects.

2.2 Limitation of the Study

Published secondary information on the natural environment at the site level of candidate project is very scanty. Unpublished information on the project sites at the district level offices is also lacking. The information collected for the natural environment assessment are primarily based on the information gathered during the limited site visits using participatory methods and direct observations.

2.3 Summary of Findings

Table 4 below present's summary of the key findings of the physical and biological environment and detail is provided in the site specific reports of each of the schemes.

Table 4 Summary table - Project Design, Physical Environment and Biological Environment

No.	E-01	E-06	E-17	C-02	C-08	W-02	W-05	W-06	W-23	W-25
Project Name	**Dudh Koshi**	**Kokhajor-1**	**Sun Koshi No. 3,**	**Lower Badigad**	**Andhi Khola**	**Chera-1**	**Lower Jhimruk**	**Madi**	**Nalsyau Gad**	**Naumure (W. Rapti)**
River	Dudh Koshi River	Kokhajor Khola	Sun Kosi River	Badigad Khola	Andhi Khola	Chera Khola	Jhimruk Khola	Madi Khola	Nalsyau Gad Khola	Rapti River
PROJECT DESIGN FEATURES										
Location of Dam Site										
Longitude	86° 39' 17.3	85° 29' 59.6	85° 48' 14.3	83° 27' 22.2	83° 36' 30.6	82° 1' 12.3	83° 1' 1	82° 35' 15.5	82° 17' 42.8	82° 55' 42.9
Latitude	27° 15' 47.2	27° 22' 21.9	27° 29' 50.5	28° 0' 0.6	27° 58' 2.6	28° 42' 56.4	27° 55' 30.8	28° 18' 48.5	28° 52' 4.7	27° 55' 6.1
Catchment Area (km2)	4100	281	5520	2050	475	809	995	674	571	3430
Dam Height (m)	180	107	140	191	157	186	167	190	200	190
Total Storage Volume (MCM)	687.4	218.7	1,220.00	995.9	336.5	254.9	386	359.5		1,021.00
Effective Storage Volume (MCM)	442.1	166.1	555	505.5	238.7	141.1	211.6	235.1	296	580
FSL (mamsl)	580	437	700	688	675	866	597	1,090	1,570.0	517
MOL (mamsl)	530	390	674	654	626.7	814	557	1,030	1,462.0	474.2
TWL (mamsl)	303.35	200	575	475	368.48	640	390	800	870	358
Rated Gross Head (m)	275	226.3	116.3	196	307	220	194.6	280.8	652	162.6
Rated Discharge (m3/s)	136	63.9	109.34	232.6	81.4	80.5	88.1	84.9	84	185.6
Installed Capacity (MW)	300	111.5	536	180.3	180	148.7	142.5	199.8	410	245
PHYSICAL ENVIRONMENT										
Project District (VDCs)	Okhaaldhunga (Bhadaure) Khotang (Lamidanda, Dumre dharapani, and Kharpa)	Sindhuli (Hariharpurgadhi, Kopilakot, Mahendrajhyadi); Kavrepalanchok (Gokule,)	Kavrepalanchowk (Birtadeurali, Sarsyukharka, Bhumlutar, Jyamdi, Madan Chandani, Madan Kudari, Kattike Deurali, Kosidekha, Phalate, Saramthali,	Gulmi (Aanpchaur, Johang, Rimuwa, Balithum, Rupakot, Tarung, Hasara, Jubhung, Hunga, Bamgha, Limgha, Juniya, and Badagaun)	Syangja (Nibuwakharka, Jagatradevi, Pelakot, Tulsi Bhanjyang)	Jajarkot (Dashera, Karkigaun, Jhapra, Salma, and Pajaru)	Pyuthan (Dangwang and Barula), Arghakhachi (Asurkot, Khilji and Danchaur)	Rolpa (Korchabang, Kotagaun, Jamkot, Bhabhang, Libang, Hama, Reuka and Kareli)	Jajarkot (Nayakbada, Ramdanda, Rokayagaon and Sakala)	Argakhanchi (Jaluke) , Puythan (Dangwang, Hansapur, Baraula, Pakala, Dhuwang and Dhungegadi)

No.	E-01	E-06	E-17	C-02	C-08	W-02	W-05	W-06	W-23	W-25
Project Name	**Dudh Koshi**	**Kokhajor-1**	**Sun Koshi No. 3,**	**Lower Badigad**	**Andhi Khola**	**Chera-1**	**Lower Jhimruk**	**Madi**	**Nalsyau Gad**	**Naumure (W. Rapti)**
			Thuloparsel, Dolalghat) Sindhupalcowk (Bhimtar,Kadambas, Bhotsipa, Sanagachwok, Thulo Sirubari)							
Number of settlements in Reservoir	9	7	31	30	12	19	14	25	7	31
Reservoir (km2)	11.02	4.61	30.07	13.62	5.52	4.01	5.68	7.65	6.24	19.84
Land Use Reservoir Area (2010 TO 2012)										
Forest land (km2)	4.10	2.89	8.16	3.304	1.51	1.46	1.87	1.64	0.76	7.85
Bush/Shrub land (km2)	0.32	0.02	2.57	0.589	0.38	0.72	0.51	2.02	0.89	1.22
Cultivated land (km2)	3.30	0.59	9.39	5.896	1.65	1.08	2.04	1.92	2.54	6.11
Water and Sand Bodies etc. (km2)	3.03	1.04	9.49	2.930	1.07	0.71	0.89	1.04	0.54	4.27
Grass Land (km2)	0.27	0.06	0.47	0.908	0.91	0.02	0.30	1.04	0.90	0.03
land Use Change (1996/2010, 2011) - Reservoir Area										
Forest land (km2)	0.29	-0.005	3.09	-0.444	-1.03	0.12	-0.60	-0.50	-0.25	-1.28
Bush/Shrub land (km2)	-0.16	0.02	-0.91	0.275	0.25	-0.09	0.40	0.38	-0.43	0.88
Cultivated land (km2)	-0.87	0.25	-0.46	-0.800	0.07	-0.10	-0.22	-0.75	0.28	0.00
Water and Sand Bodies etc. (km2)	0.62	-0.33	-1.35	0.074	-0.16	0.32	0.05	0.00	-0.33	0.01
Grass Land (km2)	0.13	0.06	-0.36	0.908	0.86	-0.04	0.30	0.87	0.05	0.03
No of Structures 1996 (Reservoir Area)	52	43	507	364	99	76	206	165	168	607
No of structures (2010/2012) Reservoir Area	234	95	1238	1794	406	224	386	318	263	1192
Change in Nos of Structures (1996/2010) - Reservoir Area	182	52	731	1430	307	148	180	153	95	585
No of HH reported in field Survey	63	92	1599	1606	542	566	229	336	263	456
Ratio of current structures	2.82	1.03	0.77	1.12	0.75	0.40	1.69	0.95	1	2.61

No.	E-01	E-06	E-17	C-02	C-08	W-02	W-05	W-06	W-23	W-25
Project Name	**Dudh Koshi**	**Kokhajor-1**	**Sun Koshi No. 3,**	**Lower Badigad**	**Andhi Khola**	**Chera-1**	**Lower Jhimruk**	**Madi**	**Nalsyau Gad**	**Naumure (W. Rapti)**
with the HH (HH:ST)										
Motorable Bridge - Reservoir Area (Nos)	0	0	1	1	0	0	0	0	0	2
Suspension Briddge - reservoir Area (Nos)	5	0	13	11	11	1	3	6	4	11
Gravel motorable road - Reservoir Area (m)	4978	0	24439	26061	3430	3758	3324	11246	0	1830
Black Topped Motorable Road - Reservoir Area (m)	0	0	15042	0	0	0	0	0	0	0
Main Foot Trail - Reservoir Area (m)	3198	0	24055	2520	0	255	0	13636	1970	9759
Local Foot trail - Reservoir Area (m)	17910	5214	63646	16092	12971	4583	19519	14633	20922	50515
Fords -Reservoir Area (Nos)	2	2	32	3	0	2	0	2	2	5
DISASTER RECORDS										
Disaster: Flood	1995 and 1999	1993	1995 ,2000 and 20005	1918, 1961, 1980, 1982, 1990, 1991, 2007, 2008 and 2009	1938, 1961, and 1971	2005 and 1987	None in the memory	1961, 1966, 1998, 2001, 2003, and 2004	1994, 2007, 2010, 2011	None in the memory
Disaster : Landslide	1999	1993	1995	1918, 1943, 1962, 1968, 1975, 1981, 1982, 1985, 1996, 2003, 2006, 2007, 2008, 2009, and 2011	Not in the recent memory of 50 years or so	2010	None in the memory	1937, 1981, 1983, 1986, 1988, 1997, 1998, 2003, 2006 and 2009	1994, 1995, 2007, 2010, 2011	None in the memory
Disaster : Earthquake	None in the memory	1988, 2011	None in the memory	Not in the memory after 1934 earthquake	Not in the recent memory of 50 years or so	None in the memory	None in the memory	Not in the local people memory	1992	None in the memory
BIOLOGICAL ENVIRONMENT										
FLORAL INFORMATION										
VEGETATION COMPOSITION	Upper Sub-tropical species	Sub-tropical Species	Sub-tropical species	Upper Sub-tropical speceis	Sub-tropical species	Upper Sub-tropical species	Sub-tropical species	Subtropical species	Upper Sub-tropical species	Sub-tropical species
FOREST TYPE	Mixed broad	Hill Sal	Khyar and	. Khayar	Khyar and	Mainly Hill	Mainly hill	Hill Sal	Mixed	Mainly Hill

No.	E-01	E-06	E-17	C-02	C-08	W-02	W-05	W-06	W-23	W-25
Project Name	**Dudh Koshi**	**Kokhajor-1**	**Sun Koshi No. 3,**	**Lower Badigad**	**Andhi Khola**	**Chera-1**	**Lower Jhimruk**	**Madi**	**Nalsyau Gad**	**Naumure (W. Rapti)**
	leaved forests and Hill sal Forest.	forest	Hill sal forest	/Sisso forest, Hill sal forest and Mixed broad leaved forest	Hill sal forest	sall Forest	sall	Forest and Pine Forest	hardwood forest and Pine forest	sall forest
DOMINANT TREE SPECIES	Shoera robusta (Sal)	Shorea robusta, Acacia catechu, Adina cardifolia, Terminalia alata, Bombax ceiba	*Acacia catechu* (Khayar), *Bombax ceibia* (Simal),Shoera robusta (Sal) and Schima wallichii (chilaune)	*Acacia catechu* (Khayar), *Bombax ceibia* (Simal),Shoera robusta (Sal) and Schima wallichii (chilaune)	*Acacia catechu* (Khayar), *Bombax ceibia* (Simal),Shoera robusta (Sal) and Schima wallichii (chilaune)	Shoera robusta (Sal)	Shoera robusta (Sal)	Shorea robusta and Pinus roxburgii	Bombax ceiba , : Celtis australis , Pinus roxburgii	Shoera robusta (Sal)
NO OF COMMUNITY FOREST IN RESERVOIR AREA	11	4	4	12	3	12	6	24	9	25
NO OF GOVERNMENT FOREST IN RESERVOIR AREA	2	1	0	2	1	0	3	0	0	2
NO OF LEASEHOLD FOREST IN RESERVOIR AREA	0	0	0	0	0	1	0	0	0	0
No OF PRIVATE FOREST IN RESERVOIR	1	0	0	0	0	0				0
AVERAGE TREE NOS PER HECTOR OF FOREST	592	700	638	392	521	529	426	225	323	618
AVERAGE CROWN COVERAGE	53	70	38	38	38	41	26	15	20	40
NO OF TREES IN THE RESERVOIR AREA	242720	202300	520608	129360	77312	38088	83776	36982	24580	485130
No OF PLANT SPECIES REPORTED	67	10	46	>45	41	35	55	74	59	55
NO OF SPECIES OF CONSERVATIONSIGNIFICANCE	3	3	5	5	5	3	4	6	1	4
NO OF IUCN	0	0	0	0	0	0	0	0	0	0

No.	E-01	E-06	E-17	C-02	C-08	W-02	W-05	W-06	W-23	W-25
Project Name	**Dudh Koshi**	**Kokhajor-1**	**Sun Koshi No. 3,**	**Lower Badigad**	**Andhi Khola**	**Chera-1**	**Lower Jhimruk**	**Madi**	**Nalsyau Gad**	**Naumure (W. Rapti)**
CONSERVATION SPECEIS IN RESERVOIR										
NO OF CITES CONSERVATION SPECIES IN RESERVOIR	0	0	0	1(II)	1 (II)	0	1(II)	1 (II)	0	1(II)
NO OF GOVERNMENT PROTECTED SPECEIS IN RESERVOIR	3	3	5	4	5	3	4	5	1	4
FAUNAL INFORMATION										
NO OF MAMMAL SPECIES REPORTED	24	13	11	21	12	15	23	18	11	24
NO OF BIRD SPECIES REPORTED	51	21	50	30	16	28	49	21	13	49
NO OF HERPETOFAUNA SPECIES REPORTED	17	8	9	9	6	13	17	9	8	17
HABITAT CONDITIONS	Disturbed by human interference	Fragmented and degraded due to intervening of settlement fodder collection	Degraded and fragmented by human encroachment	Disturbed and fragmented due to human encroachment	Degraded and fragmented due to human encroachment	Degraded and fragmented	Partially degraded by human encroachment	DEGRADED AND FRAGMENTED	high degree of human encroachment /degraded	Good habitat area for wildlife
MIGRATION ROUTE	Seasonal feeding ground for jalewa	seasonal feeding ground for a number of species	Seasonal feeding ground	seasonal feeding ground for a number of species	Seasonal ground for feeding only	Seasonal habitat for feeding	Seasonal habitat for feeding	SEASONAL FEEDING SITE	seasonal feeding habitat of jaleva and a few mammalian species	Seasonal ground for feeding only
NO OF CONSERVATION MAMMALIAN SPECIES REPORTED (RESERVOIR)	9	5	6	9	7	7	8	7	6	9
NO OF IUCN CONSERVATION SPECEIS IN RESERVOIR	5 (NT), 1 (VU)	2(NT)	1(EN), 1 (NT)	2 (NT), 1 (VU), 1 (EN)	2(NT), 1 (VU)	3(NT), 1 (VU)	3 (NT), 1 (VU)	4 (NT)	3 (NT), 1 (VU)	5(NT), 1 (VU)
NO OF CITES CONSERVATION SPECIES IN RESERVOIR	3 (III), 3 (I)	2(I), 1 (II), 1 (III)	2(III), 2 (II), 2 (I)	3 (III), 3 (I), 2(II)	3 (III), 2 (I) and 1 (II)	3 (III), 2 (I)	3(III), 3 (I)	4 (I) AND 3 (III)	4(I), 2 (III)	3(III), 3 (I)

No.	E-01	E-06	E-17	C-02	C-08	W-02	W-05	W-06	W-23	W-25
Project Name	**Dudh Koshi**	**Kokhajor-1**	**Sun Koshi No. 3,**	**Lower Badigad**	**Andhi Khola**	**Chera-1**	**Lower Jhimruk**	**Madi**	**Nalsyau Gad**	**Naumure (W. Rapti)**
NO OF GON CONSERVATION SPECIES IN RESERVOIR	1	1	1	0	0	1	1	1	1	2
NO OF CONSERVATION BIRD SPECIES REPORTED (RESERVOIR)	3	2	4	3	1	2	3	1	0	3
NO OF IUCN CONSERVATION SPECEIS IN RESERVOIR	1(EN)	1(VU)	2(VU), 1(CR), 1 (NT)	1(CR), 1(EN), 1 (VU)	0	1 (EN)	1(EN)	0	0	1 (EN)
NO OF CITES CONSERVATION SPECIES IN RESERVOIR	1(I), 1 (II)	1(I), 1 (III)	1 (I)	0	I(I)	1(I)	1(I), 1 (II)	1 (I)	0	1(I), 1 (II)
NO OF GON CONSERVATION SPECIES IN RESERVOIR	1	1	0	0	1	1	0	1	0	0
NO OF CONSERVATION HERPETOFAUNA SPECEIS REPORTED (RESERVOIR)	5	1	3	0	2	4	4	1	1	4
NO OF IUCN CONSERVATION SPECEIS IN RESERVOIR	0	0	1(VU)	0	0	0	0	0	0	0
NO OF CITES CONSERVATION SPECIES IN RESERVOIR	3(II), 1 (III), 1 (I)	1 (I)	2(II), 1 (I)	0	1(I) AND 1 (II)	2(III), 2 (II)	2(II), 1 (III), 1 (I)	1 (II)	1 (I)	3(II), 1 (III)
NO OF GON CONSERVATION SPECIES IN RESERVOIR	1	1	1	0	1	0	1	1	1	1
REVERINE FISHERY INFORMATION										
NO OF FISHERMEN (RESERVOIR)										
OCCUPATIONAL FISHERMEN (RESERVOIR)	20	0	80	86	0	23	4	0	12	0
PART TIME FISHERMEN	71	0	450	91	50	2	21	39	45	43
RECREATIONAL FISHERMEN	All	0	182	40	106	0	All	61	58	0
AVERAGE CATCH (KG)	2	0	2	3	1.5	1.5	2	1	1.5	1

No.	E-01	E-06	E-17	C-02	C-08	W-02	W-05	W-06	W-23	W-25
Project Name	**Dudh Koshi**	**Kokhajor-1**	**Sun Koshi No. 3,**	**Lower Badigad**	**Andhi Khola**	**Chera-1**	**Lower Jhimruk**	**Madi**	**Nalsyau Gad**	**Naumure (W. Rapti)**
/DAY/Fishermen										
CONSUMED AT HOME	50%	0	25%	25%	50%	50%	50%	75%	35%	50%
SOLD IN THE MARKET	50%	0	75%	75%	50%	50%	50%	25%	65%	50%
NO OF NEAREST FISH MARKET	7	0	7	7	3	3	3	3	3	2
AVAILABILITY OF FISH IN THE MARKET IN A DAY/KG	5 to 15	0	10 to 30	4 to 25	2 to 15	5 to 20	2 to 25	3 to 5	2 to 5	2 to 13
AVERAGE COST OF FISH (NRS/KG)	250	0	250 to 350	250	250 to 350	200	180	300	200	250 to 300
AVERAGE ANNUAL INCOME BY OCCUPATIONAL AND PART TIME FISHERMEN	20000	0	7000	10 to 12000	10000 to 12000	15000	9000	7000	20000	9000
FISH AVAILABILITY COMPARED TO PAST	Less	No record	Less	Increased	Less	Less	Less	Less	Less	Less
NO OF FISH SPECEIS REPORTED	24	7	21	12	6	11	11	8	8	16
NO OF FISH SPECEIS OF CONSERVATION SIGNIFICANCE	3	2	3	4	2	2	2	3	2	2
NO OF IUCN CONSERVATION SPECEIS IN RESERVOIR	3 (NT)	2(NT)	3 (NT)	2 (NT), 1 (VU), 1 (EN)	1 (NT), 1 (VU)	2 (NT)	2(NT)	2(NT) , 1(VU)	1 (NT), 1 (VU)	2 (NT)
NO OF CITES CONSERVATION SPECIES IN RESERVOIR	0	0	0	0	0	0	0	0	0	0
NO OF GON CONSERVATION SPECIES IN RESERVOIR	0	0	0	0	0	0	0	0	0	0

Note:

IUCN Red List Categories: *Extinct (EX), Extinct In the Wild (EW), Critically Endangered (CR), Endangered (EN), Vulnerable (VU), Near Threatened (NT)*

GOV Categories: *P Protected by legislation*

CITES Categories: *I -Appendix I (are species that are threatened with extinction and are or may be affected by trade), II - Appendix II (re species that are not necessarily threatened with extinction, but may become so unless trade in specimens of such species is subject to strict regulation in order to avoid utilization incompatible with the survival of the species in the wild), and III - Appendix III (are species that are listed after one member country has asked other CITES Parties for assistance in controlling trade in a species)*

3. ENVIRONMENTAL COST

Environmental costs are briefly calculated for each project. Table 5 shows basis of cost estimations and Table 6 shows the estimated cost.

Table 5 Basis of Cost Estimations

Particulars		Costs (NRs)
Aquatic ecology and Fishery		
	Fish hatchery establishment (lumpsum)	25000000
	fish stocking 500 fingerling/ha of reservoir /20 years	50000
	Occupational fishermen compensation/20 years	200000
	Aquatic habitat management/20 years	5000000
Forest and Watershed Management		
	Forest survey and numbering /100 trees	5162.5
	Forest clearance /100 trees	14700
	Nursery preparation/10000	39750
	Seedling preparation /10000	157500
	Plantation and 5 year caretaking /ha	466000
	Forest and govt. Land lease cost/ 20 years	45820
	Catchment watershed management/km2	12000
	Assistance to community forest /affected community forests each	500000
	Wildlife management/km2 of catchment	5000
Replacement cost		
	Motorabnle bridge /m	250000
	Suspension Bridge - reservoir Area /m	17500
	Gravel motorable road - Reservoir Area (m)	5000
	Black Topped Motorable Road - Reservoir Area /m	17500
	Main Foot Trail - Reservoir Area /m	750
	Local Foot trail - Reservoir Area /m	450
	Fords -Reservoir Area /location	15000
	Temples /temple	150000
	Schools/School	3000000
Rehabilitation costs		
	Rental allowance for 6 months/family	60000
	Livelihood Allowances for 6 months/family	60000
	Transportation of salvage material /family	15000
	Livelihood skill enhancement /family	30000
Structure acquisition costs		
	per structure average	1500000
Land acquisition cost /ha		
1	Madi, Lower Jhimruk, Sun Kosi, Naumure, Andhi Khola. Lower Badigad	19660000
2	Nalsyau Gad, Dudh Kosi, Chera-1, Kokhajor	11796000

Table 6 Social and Environmental Costs

		E-01 Dudh Koshi	E-06 Kokhajor	E-17 Sun Koshi No.3	C-02 Lower Badigad	C-08 Andhi Khola	W-02 Chera-1	W-05 Lower Jhimruk	W-06 Madi	W-23 Nalsyau Gad	W-25 Naumure
Replacement of affected Infrastrucres											
Permanent Land acquisition cost Reservoir Area		3892680000	695964000	18460740000	11591536000	3243900000	884700000	4010640000	3774720000	2996184000	12012260000
Aquition of built structures		351000000	142500000	1857000000	2691000000	609000000	336000000	579000000	477000000	394500000	1788000000
Rerhabilitation assistence to Aps		10395000	36135000	263835000	264990000	89430000	93390000	37785000	55440000	20460000	75240000
In NRP		4254075000	874599000	20581575000	14547526000	3942330000		4627425000	4307160000	3411144000	13875500000
NRP (million)		4254.075	874.599	20581.575	14547.526	3942.33	1314.09	4627.425	4307.16	3411.144	13875.5
Replacement of affected Infrastrucres											
Motorable Bridge - Reservoir Area		0	0	62500000	62500000	0	0	0	0	0	125000000
Suspension Briddge - reservoir Area (Nos)		26250000	0	68250000	57750000	57750000	5250000	15750000	31500000	21000000	57750000
Gravel motorable road - Reservoir Area (m)		0	0	0	0	0	0	0	0	0	9150000
Black Topped Motorable Road - Reservoir Area (m)		0	0	263235000	0	0	0	0	0	0	0
Main Foot Trail - Reservoir Area (m)		3733500	0	18329250	19305750	2571000	2818500	1477500	8434500	0	0
Local Foot trail - Reservoir Area (m)		9498600	2346300	39465450	8375400	5805900	2177100	9414900	12728700	4523850	27127800
Fords -Reservoir Area (Nos)		30000	15000	480000	45000	0	30000	0	30000	0	75000
Temple		300000	0	1500000	1350000	750000	150000	150000	600000	0	300000
Schools		0	18000000	57000000	54000000	27000000	9000000	12000000	6000000	6000000	15000000
In NRP		39812100	20361300	510759700	203326150	93876900	19425600	38792400	59293200	31523850	234402800
NRP (million)		39.8121	20.3613	510.7597	203.32615	93.8769	19.4256	38.7924	59.2932	31.52385	234.4028
Forest And Watershed Management											
Forest survey and numbering		12530420	10443737.5	26876388	6678210	3991232	1966293	4324936	1909195.75	1268942.5	25044836.25
Forest clearance		356798400	297381000	765293760	190159200	113648640	55989360	123150720	54363540	36132600	713141100

		E-01 Dudh Koshi	E-06 Kokhajor	E-17 Sun Koshi No.3	C-02 Lower Badigad	C-08 Andhi Khola	W-02 Chera-1	W-05 Lower Jhimruk	W-06 Madi	W-23 Nalsyau Gad	W-25 Naumure
Nursary preparation		19296240	16082850	41388336	10284120	6146304	3027996	6660192	2940069	1954110	38567835
Seedling preparation		76456800	63724500	163991520	40748400	24353280	11997720	26389440	11649330	7742700	152815950
Plantation and 5 year caretaking		141384400	117839750	303254160	75352200	45034240	22186260	48799520	21542015	14317850	282588225
Forest and govt. Land lease cost		20252440	13333620	49164860	17837726	8659980	8247600	10905160	16770120	7560300	41558740
Catchment watershed management		49200000	3372000	66240000	24600000	5700000	9708000	11940000	8088000	6852000	41160000
Assistance to community forest		5500000	500000	2000000	6000000	1500000	6000000	3000000	12000000	4500000	12500000
Wildlife management		20500000	1405000	27600000	10250000	2375000	4045000	4975000	3370000	2855000	17150000
	In NRP	701918700	524082458	1445809024	381909856	211408676	123168229	240144968	132632270	83183502.5	1324526686
	NRP (million)	701.9187	524.0824575	1445.809024	381.909856	211.408676	123.168229	240.144968	132.63227	83.1835025	1324.526686
Aquatic Ecology and Fishery											
Fish hatchery		25000000	25000000	25000000	25000000	25000000	25000000	25000000	25000000	25000000	25000000
Freshwater Fish stocking for 20 years		55250000	23050000	119950000	68250000	27600000	20000000	24900000	38300000	31200000	98800000
Occupational fishermen compensation/20 years		4000000	0	16000000	17200000	0	4600000	800000	0	2400000	0
Aquatic habitat management/20 years		5000000	5000000	5000000	5000000	5000000	5000000	5000000	5000000	5000000	5000000
	In NRP	89250000	53050000	165950000	115450000	57600000	54600000	55700000	68300000	63600000	128800000
	NRP (million)	89.25	53.05	165.95	115.45	57.6	54.6	55.7	68.3	63.6	128.8
Grand Total											
	In NRP	5085055800	1472092758	22704093724	15248212006	4305215576	1511283829	4962062368	4567385470	3589451353	15563229486
	NRP (million)	5085.06	1472.09	22704.09	15248.21	4305.22	1511.28	4962.06	4567.39	3589.45	15563.23
US $ conversion NRS 85 = 1 US$	US$ (million)	59.82	17.32	267.11	179.39	50.65	17.78	58.38	53.73	42.23	183.1

4. EVALUATION

The high late and low rate of evaluation results were mixed for all projects as a result of relative evaluation based on the evaluation criteria. The Chera-1, the impact on natural environment is relatively low and the impact on cultivated land and tourism are small. On the other hand, there are some issues such as distribution of protected areas in the downstream and the number of household relatively significant. (See

Figure 1). The Lower Jhimruk, relatively large number of rare species and the ethnic minority groups are reported. But the impact on infrastructure and tourism are not so significant (see Figure 2). The Madi, diversity of plants is high and relatively large numbers of rare fishes are reported. Impact on cultivated land and tourism are not so significant (see
Figure 3). The Nalsyau Gad, the length of transmission line is long and protected areas and protected species are distributed in the downstream. However, almost no impact on households, cultivated land and infrastructures (see Figure 4). The Naumure, the impact on forest, flora, fauna, and cultivated land are relatively high. On the other hand, the impact on fisheries and tourism are relatively low (see
Figure 5). The Lower Badigad, in comparison with the other projects, the impact on rare mammals and fishes are relatively high as well as the impact on households, temples, roads and bridges (see Figure 6). The Andhi Khola, the impact on forest, birds and fish are relatively low and the impact on cultivated land is not so significant. However, there is an existing hydroelectric power plant of 11MW which will be submerged and the impact on households, school, retails and etc. is relatively significant (see
Figure 7). The Dudh Koshi, while the impact on mammals, birds and fishes are relatively high, the impact on households and existing infrastructures are relatively low (see
Figure 8). The Kokhajor-1, the impact on forest is relatively high and there are many ethnic minority groups. But the impact on cultivated land, fisheries, and existing infrastructures are relatively low (see

Figure 9). The Sun Kosi No.3, the length of transmission line is short and there is no recession area. However the impact on household, infrastructures, cultivated land and fisheries are relatively significant due to the large reservoir area (see
Figure 10).

Table 7 Result of the Evaluation about Natural Environment

Project Name		W-02	W-05	W-06	W-23	W-25	C-02	C-08	E-01	E-06	E-17
		Chera-1	Lower Jhimruk	Madi	Nalsyau Gad	Naumure	Lower Badigad	Andhi Khola	Dudh Koshi	Kokhajor-1	Sun Koshi No.3
Impact on Forest											
Forest land (km2)	Point	0.72	1.87	1.64	0.3055	7.85	3.304	1.51	4.1	2.89	8.16
	P/MW	0.005	0.013	0.008	0.001	0.032	0.009	0.008	0.014	0.026	0.015
	Score	87	60	76	100	0	75	76	59	20	54
Average Crown Coverage (%)	Point	41	26	15	20	40	38	38	53	70	38
	Score	53	80	100	91	55	58	58	31	0	58
Number of trees	Point	38,088	83,776	36,982	9,776	485,130	129,360	77,312	242,720	202,300	520,608
	P/MW	256.1	587.9	185.1	23.8	1980.1	340.2	429.5	809.1	1814.3	971.3
	Score	88	71	92	100	0	84	79	60	8	52
Impact on Flora											
Number of Plant species reported	Point	35	55	74	59	55	45	41	67	10	46
	Score	61	30	0	23	30	45	52	11	100	44
Number of Plant species of conservation significance	Point	3	4	6	1	4	5	5	3	3	5
	Score	60	40	0	100	40	20	20	60	60	20
Impact on Fauna											
Number of Mammal species reported	Point	15	23	18	11	24	21	12	24	13	11
	Score	69	8	46	100	0	23	92	0	85	100
Number of conservation Mammalian species reported	Point	7	8	7	6	9	9	7	9	4	6
	Score	40	20	40	60	0	0	40	0	100	60
Number of Bird species reported	Point	28	49	21	13	49	30	16	51	21	50
	Score	61	5	79	100	5	55	92	0	79	3
Number of conservation Bird species reported	Point	2	3	1	0	3	3	1	3	2	4
	Score	50	25	75	100	25	25	75	25	50	0
Number of Herpetofauna species reported	Point	13	17	9	8	17	9	6	17	8	9
	Score	36	0	73	82	0	73	100	0	82	73
Number of conservation Herpetofauna species reported	Point	4	4	1	1	4	0	2	5	1	3
	Score	20	20	80	80	20	100	60	0	80	40
Impact on Protected Area											
Number of the protected area downstream	Point	3	2	2	3	2	3	3	2	1	2
	Score	0	50	50	0	50	0	0	50	100	50

Project Name		W-02	W-05	W-06	W-23	W-25	C-02	C-08	E-01	E-06	E-17
		Chera-1	Lower Jhimruk	Madi	Nalsyau Gad	Naumure	Lower Badigad	Andhi Khola	Dudh Koshi	Kokhajor-1	Sun Koshi No.3
Number of the protected species downstream	Point	6	4	4	6	4	5	5	3	3	3
	Score	0	67	67	0	67	33	33	100	100	100
Impact on Aquatic fauna											
Length of recession area (km)	Point	7	8	10	11	0.5	4	60	60	21	0.5
	Score	89	87	84	82	100	94	0	0	66	100
Number of Fish species reported	Point	11	11	8	8	16	12	6	24	7	21
	Score	72	72	89	89	44	67	100	0	94	17
Number of Fish species of conservation significance	Point	2	2	3	2	2	4	2	3	2	3
	Score	100	100	50	100	100	0	100	50	100	50
Impact of Transmission Line											
Length of Transmission Line (km)	Point	66	75	62	112	79	49	49	43	62	35
	Score	60	48	65	0	43	82	82	90	65	100

Table 8 Result of the evaluation about Social Environment

Project Name		W-02	W-05	W-06	W-23	W-25	C-02	C-08	E-01	E-06	E-17
		Chera-1	Lower Jhimruk	Madi	Nalsyau Gad	Naumure	Lower Badigad	Andhi Khola	Dudh Koshi	Kokhajor-1	Sun Koshi No.3
Impact on buildings											
Household	Point	566	229	336	291.4	456	1606	542	63	219	1599
	P/MW	3.8	1.6	1.7	0.7	1.9	4.2	3.0	0.2	2.0	3.0
	Score	10	65	63	88	59	0	30	100	56	31
Schools	Point	3	4	2	2	5	18	9	0	6	19
	P/MW	0.02	0.03	0.01	0.00	0.02	0.05	0.05	0.00	0.05	0.04
	Score	63	48	81	91	62	12	7	100	0	34
Industries	Point	0	3	0	0	0	11	6	0	0	2
	P/MW	0.000	0.021	0.000	0.000	0.000	0.029	0.033	0.000	0.000	0.004
	Score	100	37	100	100	100	13	0	100	100	89
Ethnic Minority Group											
Ethnic Minority Groups	Point	1	3	1	0	2	5	2	3	5	4
	Score	80	40	80	100	60	0	60	40	0	20
Agriculture											
Cultivated land (km2)	Point	1.08	2.04	1.92	2.7025	6.11	5.896	1.65	3.3	1.72	9.39
	P/MW	0.007	0.014	0.010	0.007	0.025	0.016	0.009	0.011	0.015	0.018
	Score	96	58	84	100	0	51	86	76	52	40
Irrigation system	Point	7	3	16	0	25	58	23	1	2	20
	Score	88	95	72	100	57	0	60	98	97	66
Impact on Fishery											
Fishermen	Point	25	254	100	115	43	217	156	154	0	712
	Score	96	64	86	84	94	70	78	78	100	0
Fish markets	Point	4	3	3	3	2	7	3	7	0	7
	Score	43	57	57	57	71	0	57	0	100	0
Fish catch	Point	50	40.5	12	10.5	15	101.5	25.5	70	0	140

Project Name		W-02	W-05	W-06	W-23	W-25	C-02	C-08	E-01	E-06	E-17
		Chera-1	Lower Jhimruk	Madi	Nalsyau Gad	Naumure	Lower Badigad	Andhi Khola	Dudh Koshi	Kokhajor-1	Sun Koshi No.3
(kg/day)	Score	64	71	91	93	89	28	82	50	100	0
Total sale of fish (Rs./day)	Point	10000	7290	3600	2100	4125	25375	7650	17500	0	42000
	Score	76	83	91	95	90	40	82	58	100	0
Total income (Rs./year)	Point	375000	225000	273000	1140000	387000	1062885	550000	1820000	0	3710000
	Score	90	94	93	69	90	71	85	51	100	0
Tourism and culture											
Number of Cultural Structures (Temples)	Point	1	1	4	0	2	9	5	2	0	10
	Score	90	90	60	100	80	10	50	80	100	0
Number of Tourist Facilities	Point	0	0	0	0	0	0	0	2	0	10
	Score	100	100	100	100	100	100	100	80	100	0
Number of Tourists/Yr	Point	0	0	0	0	0	0	0	410	0	20000
	Score	100	100	100	100	100	100	100	98	100	0
Infrastructure											
Length of Road (paved and graveled, km)	Point	3.8	0.0	11.2	0.0	1.8	25.7	3.4	5.0	0.0	39.5
	Score	90	100	72	100	95	35	91	87	100	0
Number of Bridges	Point	1	3	6	1	13	12	11	5	0	14
	Score	93	79	57	93	7	14	21	64	100	0
Number of Water Mill/Hydropower	Point	9	0	6	20	0	26	1	0	11	15
	Score	65	100	77	23	100	0	96	100	58	42
Number of Drinking Water Schemes	Point	2	7	22	0	17	29	10	5	10	22
	Score	93	76	24	100	41	0	66	83	66	24
Economy and Development Plan											
Number of Market	Point	4	0	2	1	3	5	4	1	0	5
	Score	20	100	60	80	40	0	20	80	100	0
Number of Ongoing/Proposed Development Plans	Point	0	1	3	2	3	3	2	0	6	10
	Score	100	90	70	80	70	70	80	100	40	0
Previous Experience/Issues	Point	0	0	0	0	0	0	0	0	1	1
	Score	100	100	100	100	100	100	100	100	0	0

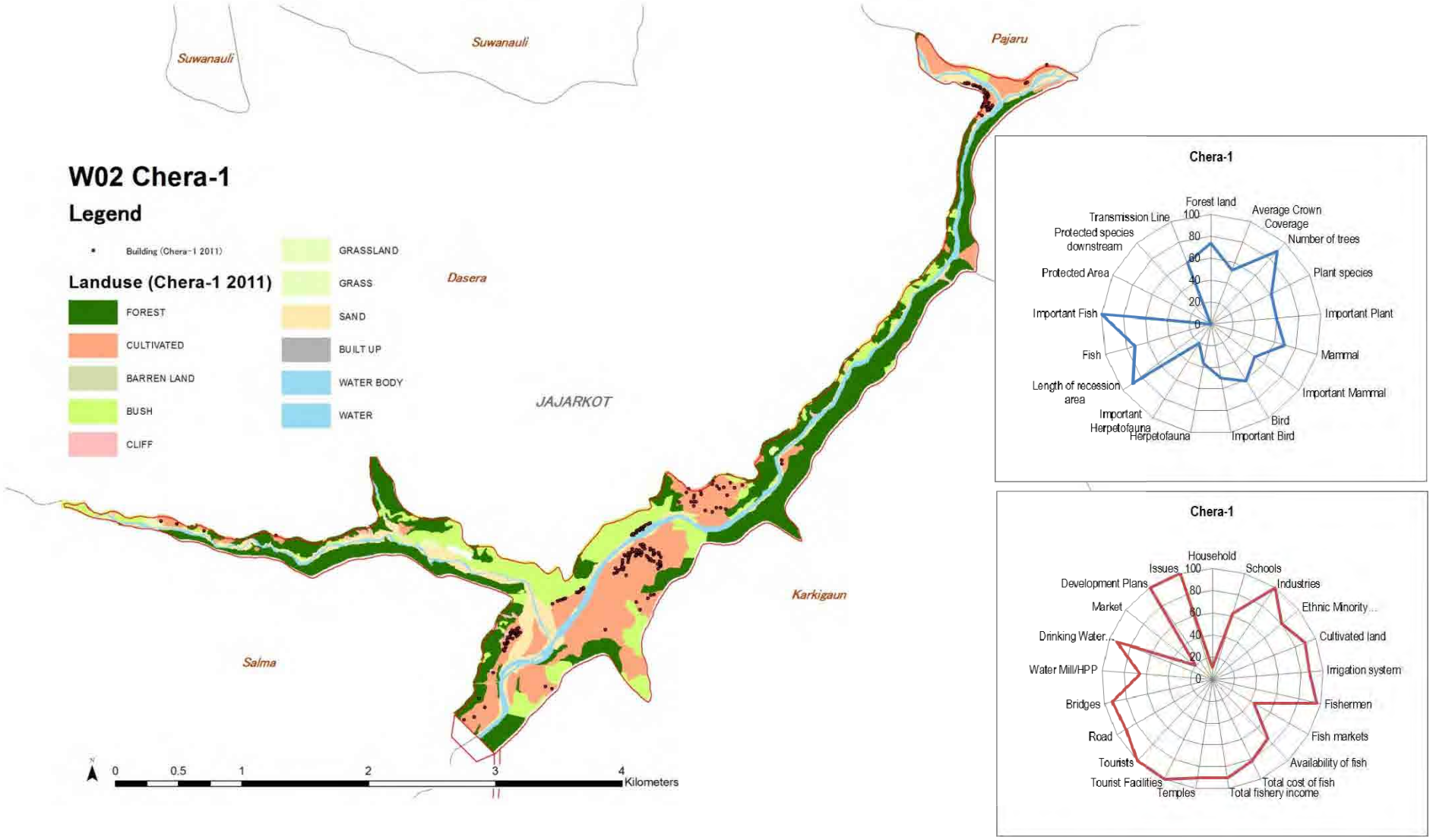


Figure 1 Land Use and Buildings in the Reservoir Area of Chera-1

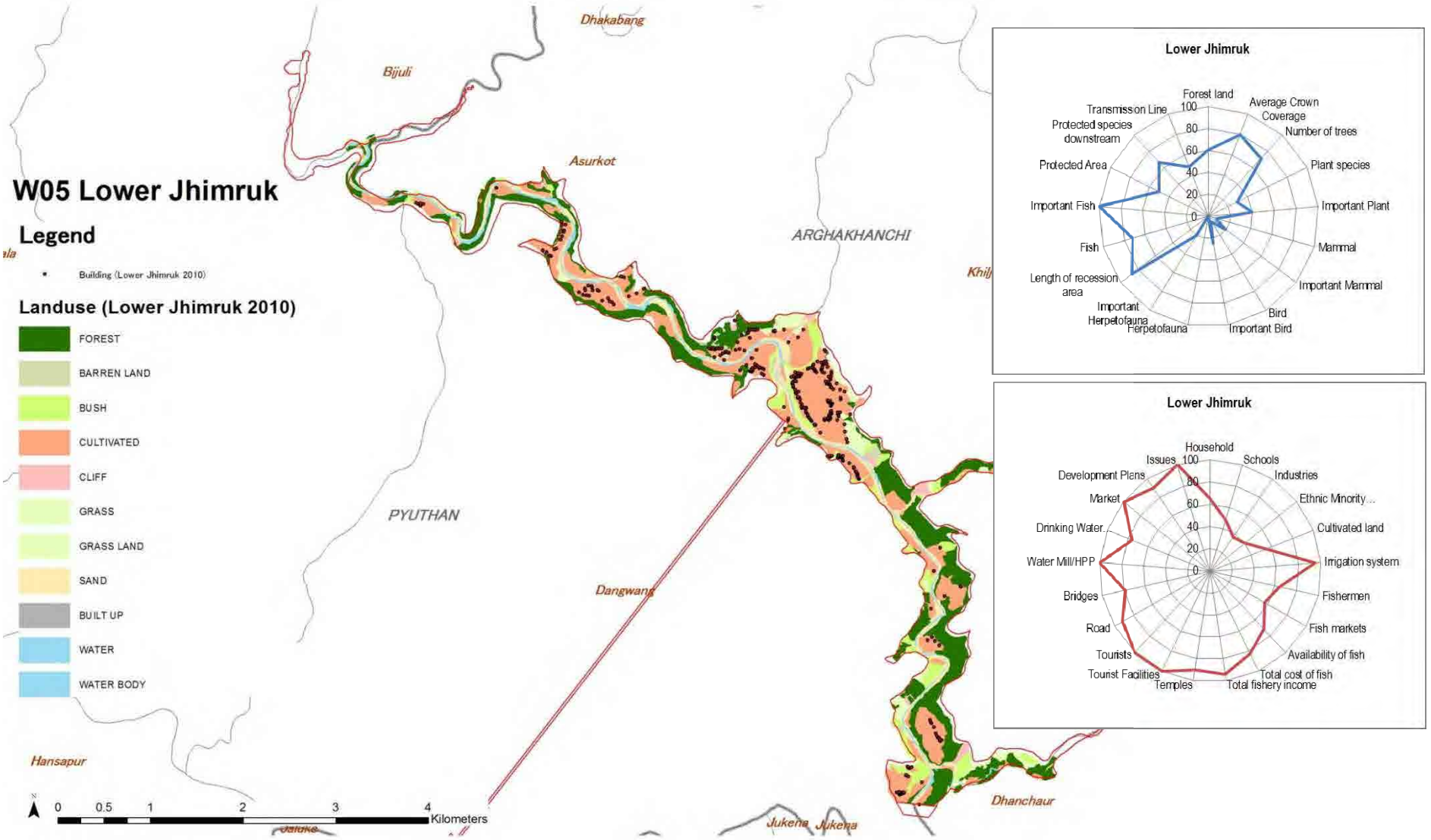


Figure 2 Land Use and Buildings in the Reservoir Area of Lower Jhimruk

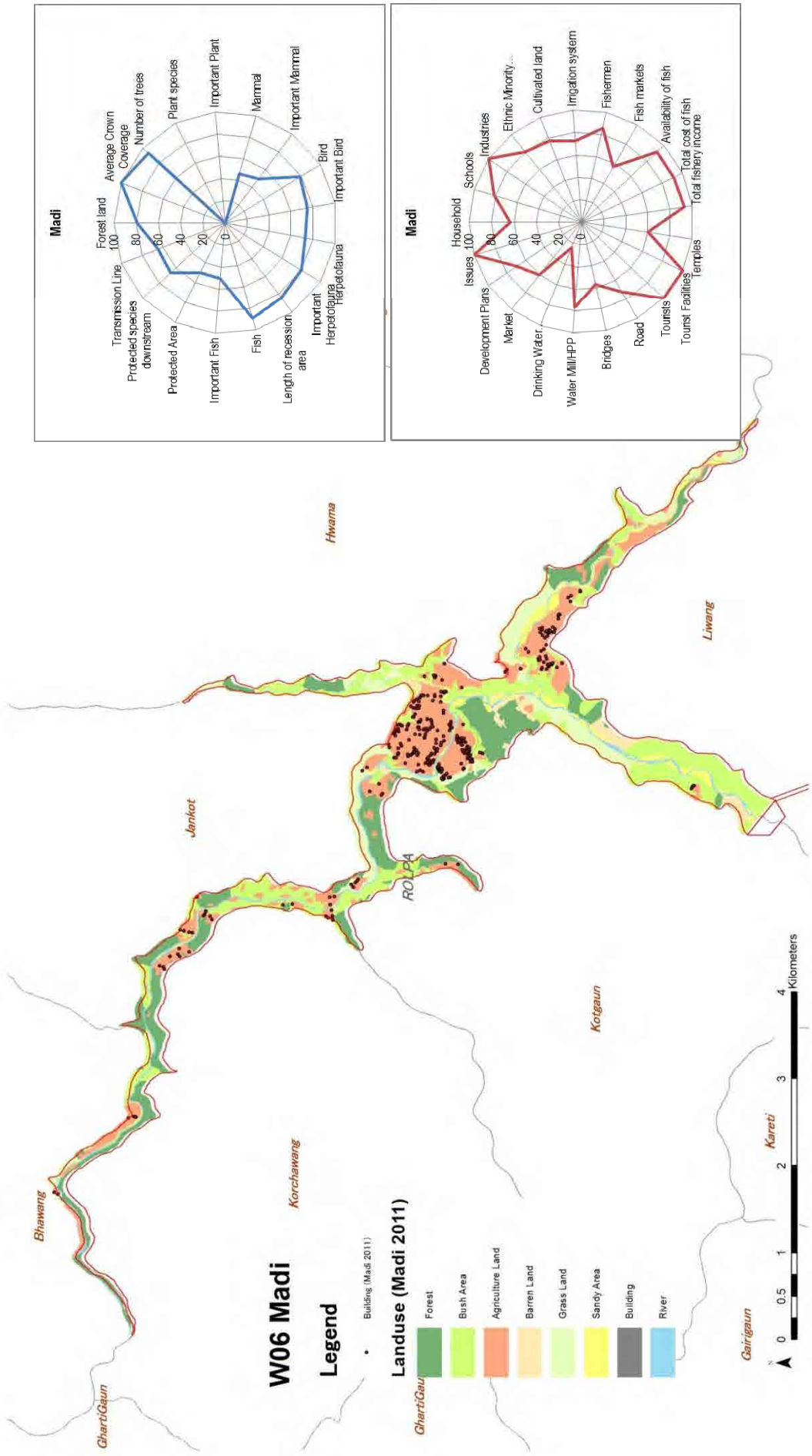


Figure 3 Land Use and Buildings in the Reservoir Area of Madi

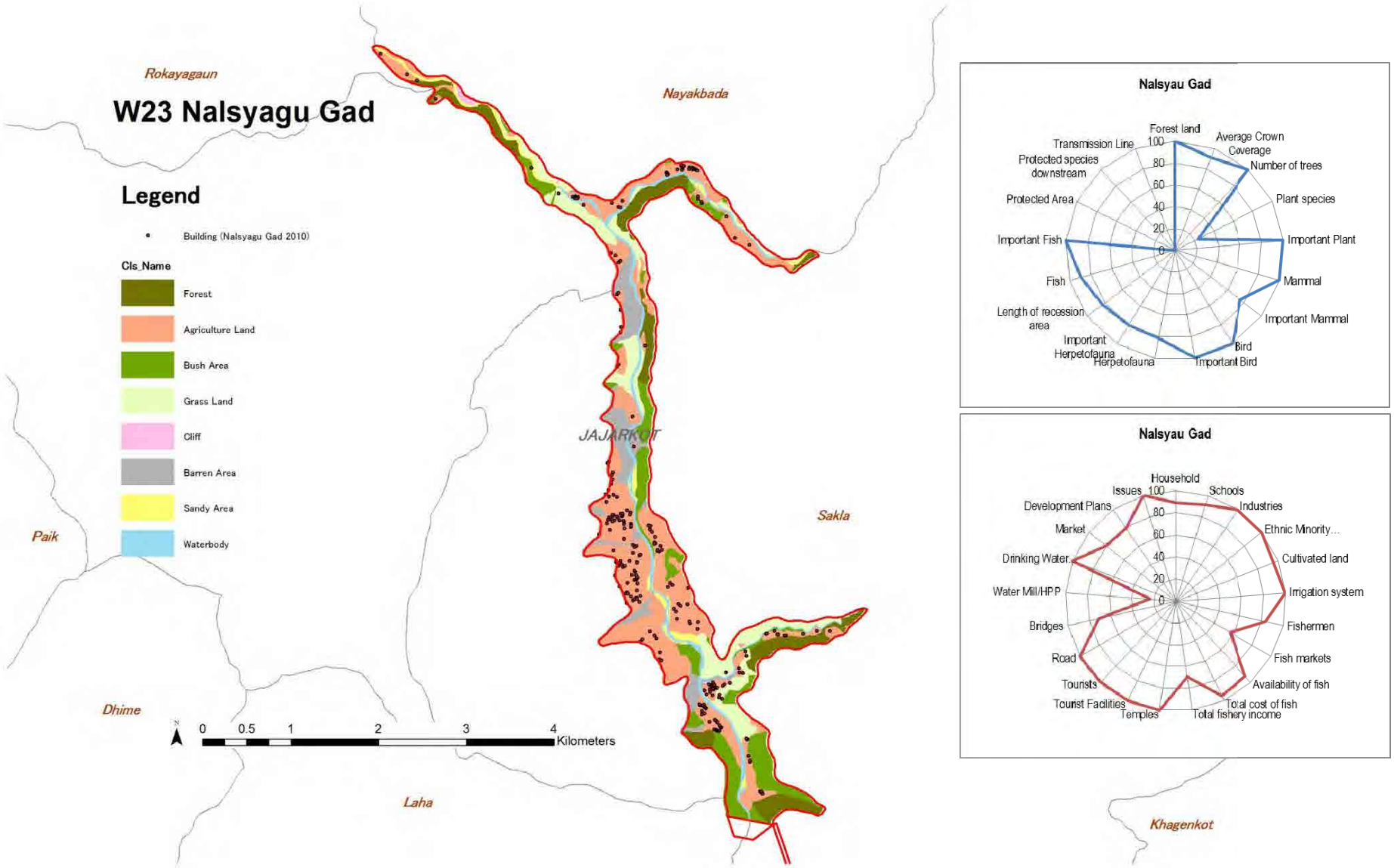


Figure 4 Land Use and Buildings in the Reservoir Area of Nalsyau Gad

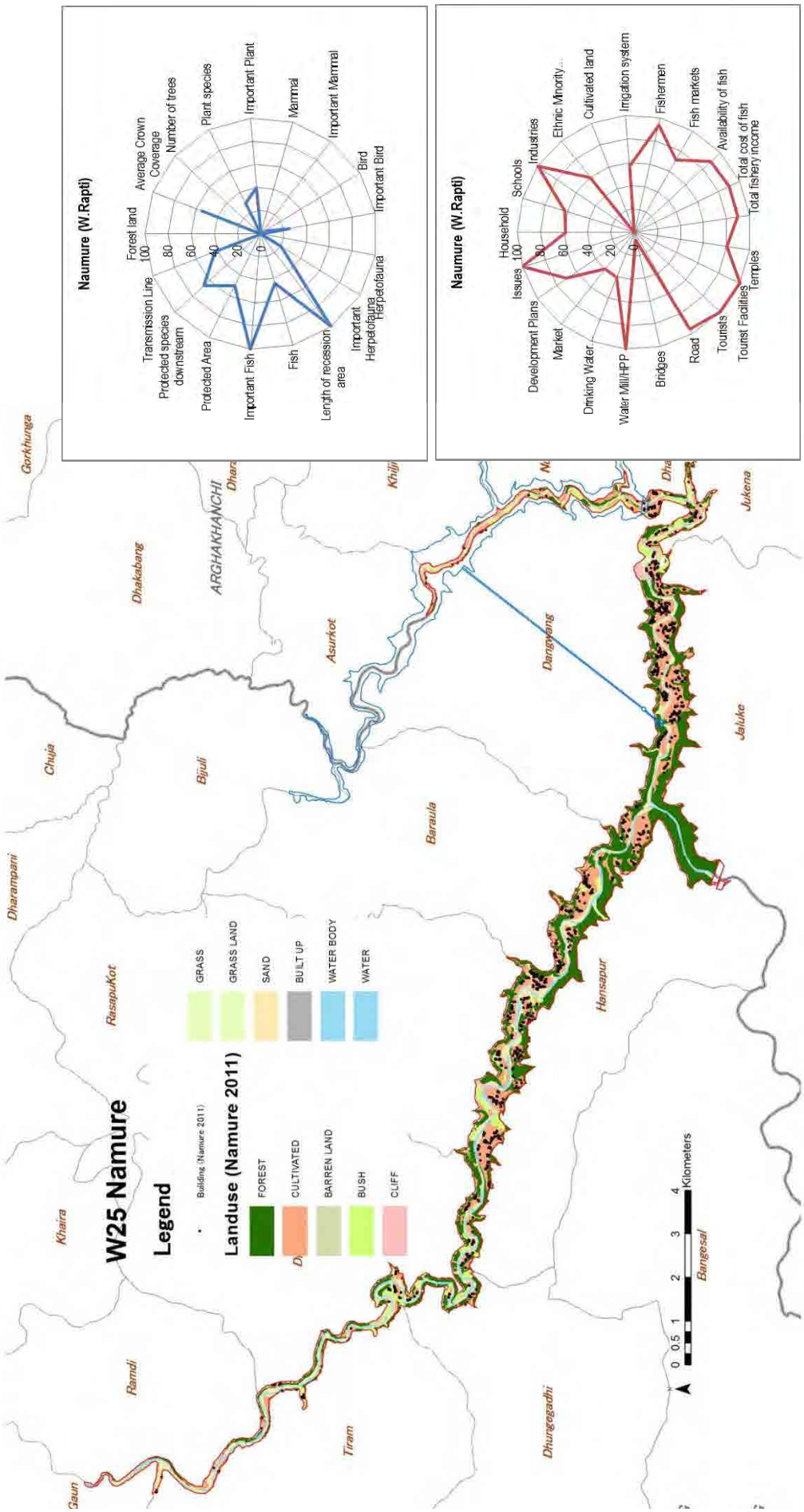


Figure 5 Land Use and Buildings in the Reservoir Area of Naumure

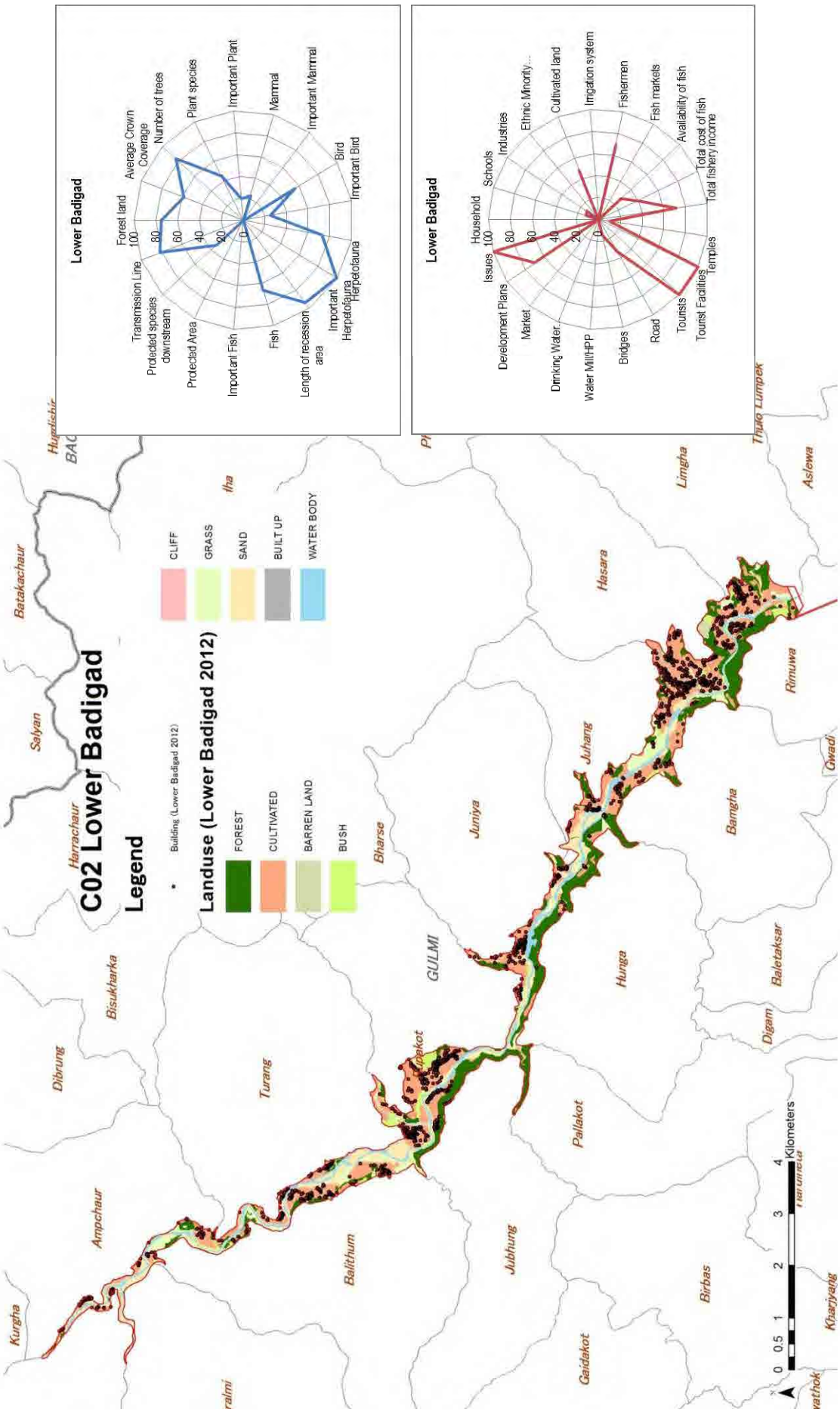


Figure 6 Land Use and Buildings in the Reservoir Area of Lower Badigad

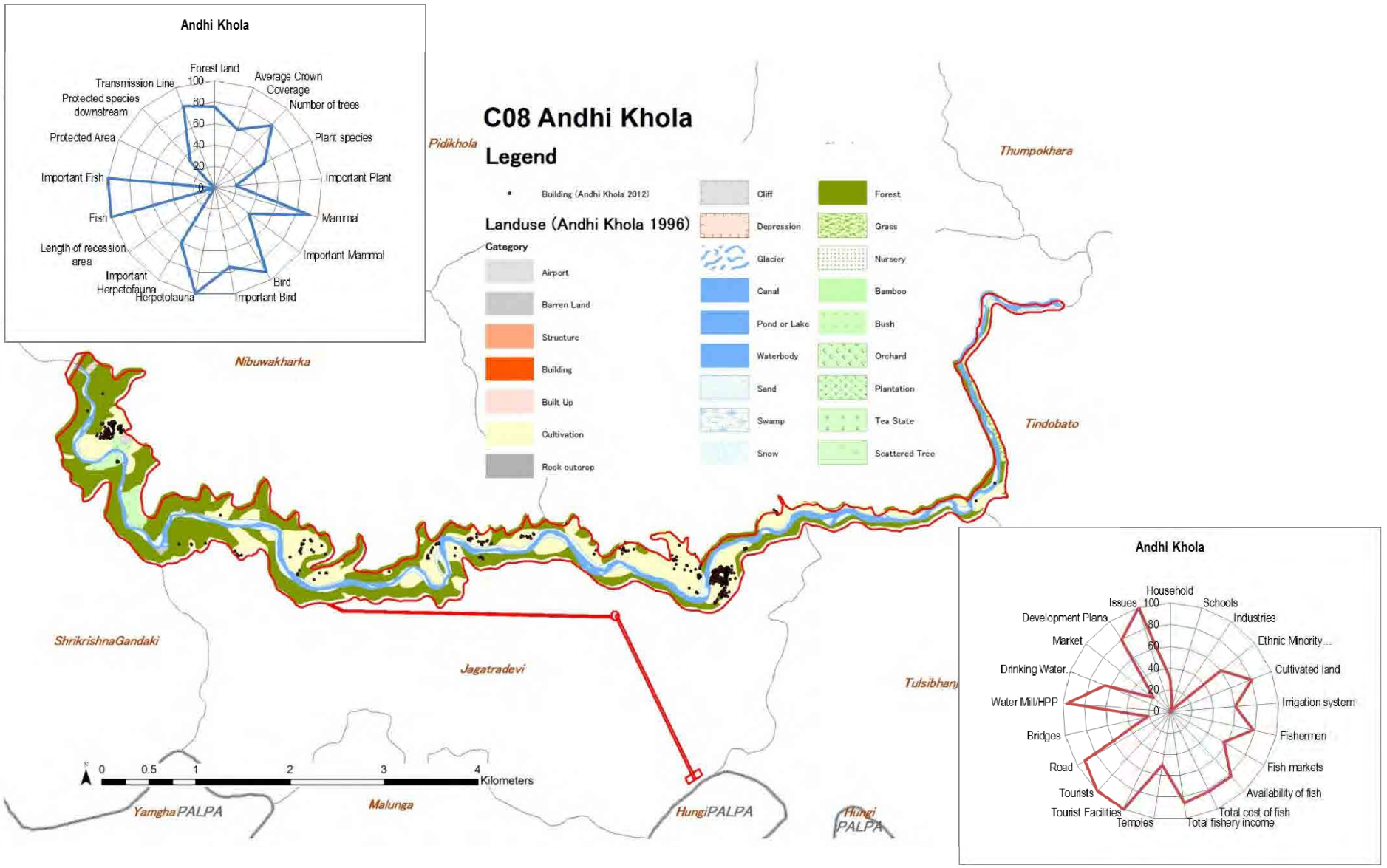


Figure 7 Land Use and Buildings in the Reservoir Area of Andhi Khola

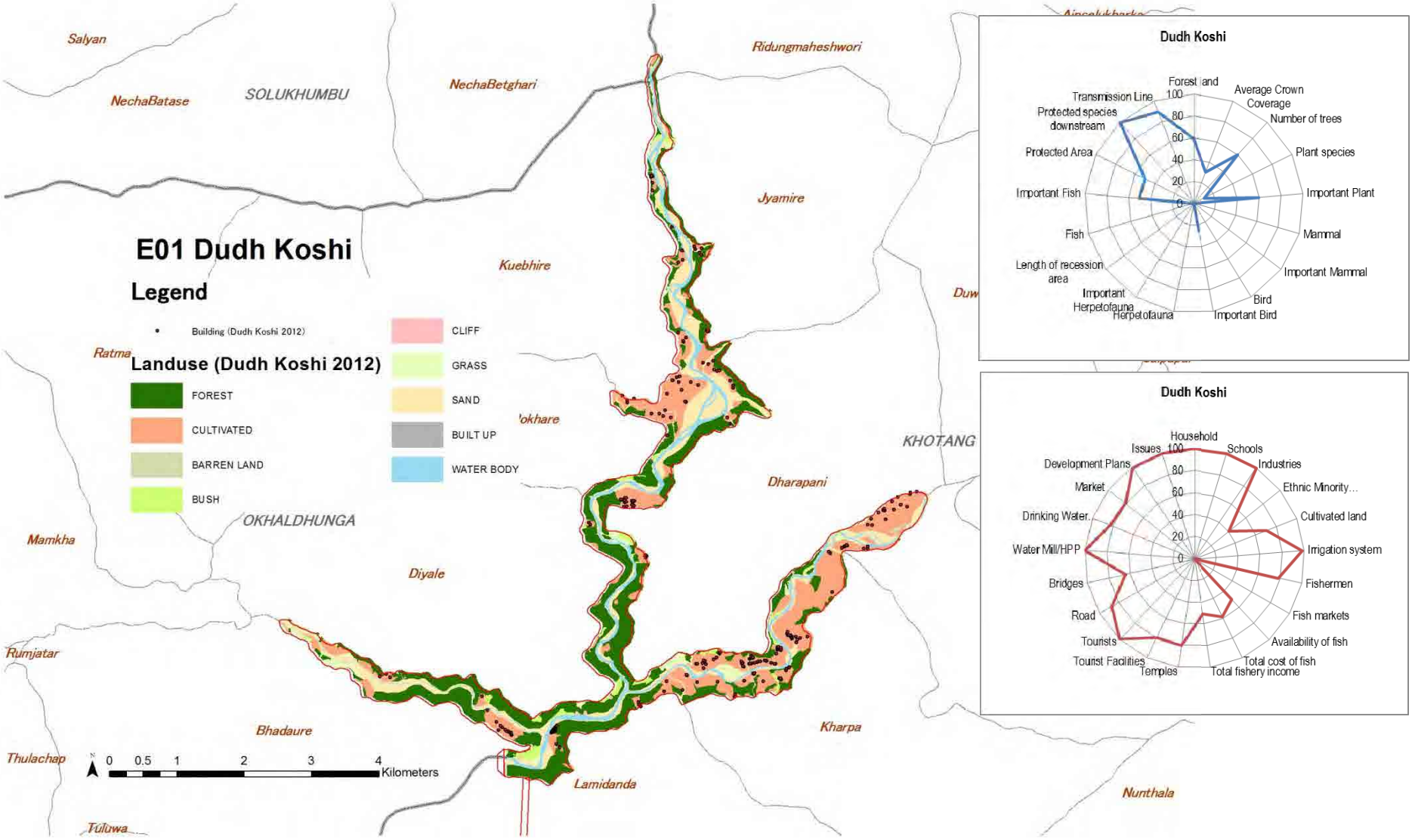


Figure 8 Land Use and Buildings in the Reservoir Dudh Koshi

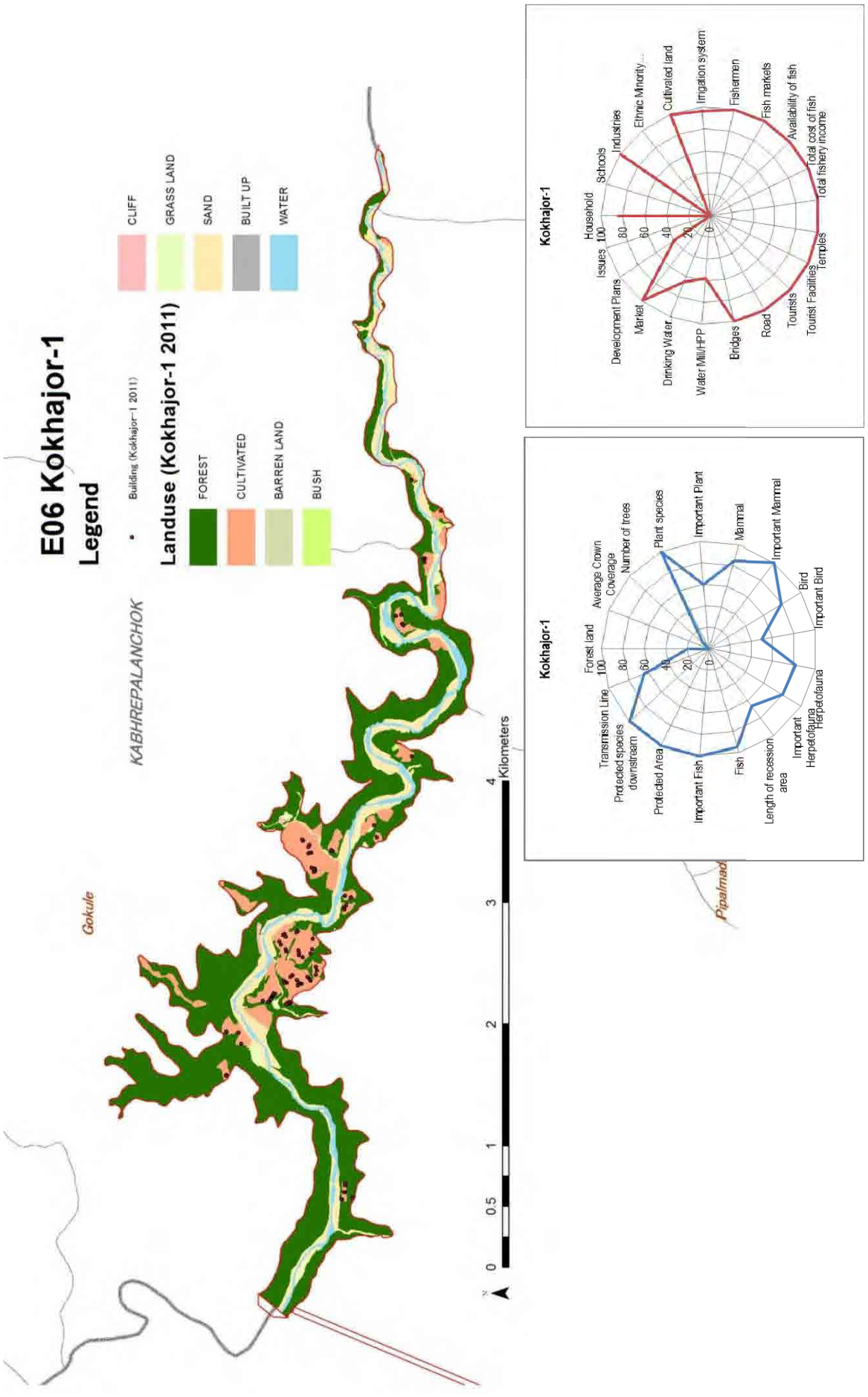


Figure 9 Land Use and Buildings in the Reservoir Area of Kokhajor-1

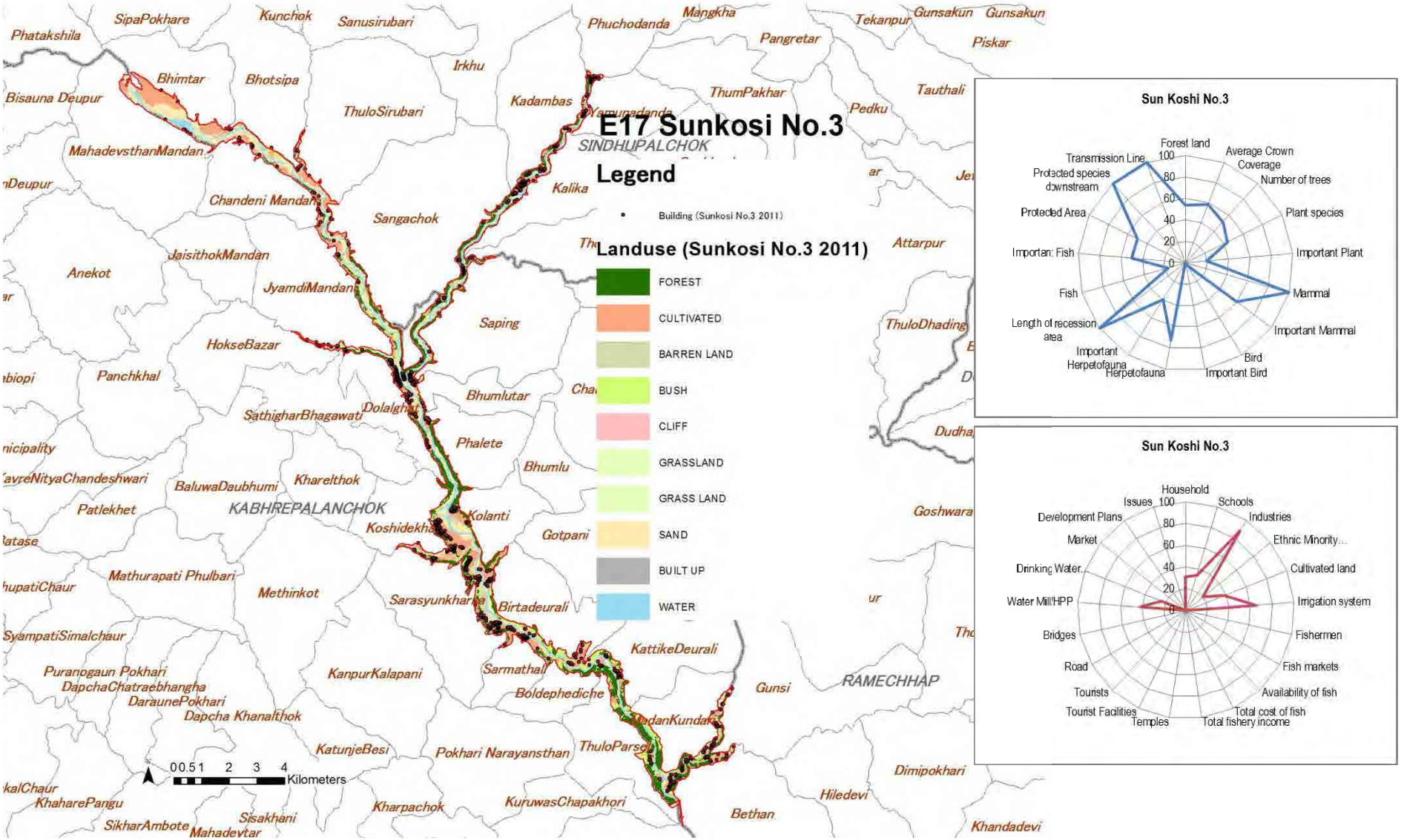


Figure 10 Land Use and Buildings in the Reservoir Area of Sun Koshi No.3

APPENDIX 1: SOCIAL SURVEY SHEET – LOCAL LEVEL

National Master Plan study
On
Storage-type Hydroelectric Power Development (JICA/GON)

(Format for Local Level Information Collection)

District Name: Project Name:
VDC: Ward No: Village/Toe/Cluster
Project Area Location: Reservoir Site/ Upstream Site/Down Stream:

S.N.	Description	Information Detail	Remarks
A. Details of the Households to be inundated by the reservoir			
1	Total Number of Houses		
2	Number of Households by Ethnicity		
a)			
b)			
c)			
d)			
e)			
3	Total Population		
4	Population by ethnicity		
a)			
b)			
c)			
d)			
e)			
5	Total Land in the Submergence area (Ropani)		
a)	Khet		
b)	Bari		
c)	Other		
6	Average Land ownership (Ropani)		
	Maximum (Ropani) and HH	Ropani HH	
	Average (Ropani) and HH	Ropani HH	
	Minimum (Ropani) and HH	Ropani HH	
7	Types of Houses	House Nos	Roof and wall
	Kacchi		
	Pakki		
8	Occupation	No of people	

a	Agriculture					
b	Service					
c	Wage Labor					
d	Migrate to 3rd country for job					
B. Culture						
1.	Main Festivals					
2.	Any festivals of Janajatis					
3.	Religious site at the River (name location)					
4.	Cremation Ghats (name location)					
C. Basic Services and Infrastructures						
1.	School Buildings	Primary	LS	Secondary		Note down by name also
	Number					
	Students					
2.	Number Irrigation Canals and Command Area	No------	Command Area----------	Note down the name of the schemes		
3.	Number of Drinking Water Schemes and Community and Individual taps	No of Schemes-------	No Of Taps: a) Individual------ b) Community	Note down the name of each scheme		
4.	Community Forest Users group and area under reservoir			Note down the name of each scheme		
5	Wetlands/ Recreation Centers			Note down, no, name location, and uses		
6.	Number of markets /Shed			Note down the name of market and types (weekly/monthly/permanent)		
7.	Number of Service Centers	Agri:-----	Livestock---	Health:---	Security---	Note down Agri/ Livestock/ Health related

8.	Water Turbines (Ghatta)			Specify Source of water		
9.	Industries					
	No by Type					
	Employees					
	Annual production			Quantity and production Type		
	Annual sale			Product and Rs		
	Unique Handicraft	Type	Volume of Production	Sale (Rs)		
10.	Micro/Small Hydro	No	Capacity			Mention the name also
11.	Tourist and Facilities	Annual Flow of Tourists	Type and Number of Facilities			Number of Hotels/Lodges/ Guest Houses
12	Roads	Number	Type (Paved/Gravel Earthen) and /Lengths (Km)			Mention the name
13	Bridges	Number	Type (Suspension/wooden/---)			Mention the name
14	Water Sources	For Drinking Water	For Irrigation	For water mill		Mention the name

D. Land Use Pattern, Cropping Pattern , Production and Sale					
1	Uses	Area under different uses (Ropani			
	Agriculture				
	Pasture				
	Forest				
	Other				
	Total				
2.	Crops	Area (Ropani)		Production (---)	
A	Paddy				
B	Maize				
C	Millet				
D	Wheat/Barley				
E	Potato				
F	Pulses				
G	Oilseeds				
H	Vegetables				
3	Sale of Crops	Crop Name	Quantity	Value	Note the place of sale/export

4	Pocket Area	Agriculture	Livestock	Fish	Note down the number and other detail

E. Development Plans and Programmes (ongoing /Proposed)						
		Agriculture	Forestry	Irrigation	Hydropower	Tourism and Other
	Ongoing					
	Planned					
	Private Sector					
	Government Sector					

F. Past Experience/Trouble of the Community with Regards to Development Project			
	Hydro Power Development	Other Development	Other issues

G .Community Perception on Impact of Storage Type Hydroelectric Project			
	Positive Impact	Negative Impact	

H. Prevalence Of Disaster in last 5 years (Flood/Fire/Landslides/Storm/Epidemics			
	Type	Occurrence	Magnitude of Damage

I Wildlife and other Issues

1. Wild animals seen in the village surroundings

II. Fish and fishing in the River (types of fish (name, and the number of fishing HH and fishing season)

III. Name of the trees in the forest Areas

IV. Give historical aspect of the village or settlement and the recent trends related to settlement expansion, forest degradation etc,

Name of the Surveyor/ Facilitator Date:

List of Participants/Respondents

SN	Name and Address	Occupation/Position
1.		
2.		
3.		
4.		
5		

APPENDIX 2: SOCIAL SURVEY SHEET – DISTRICT LEVEL

National Master Plan study
On
Storage-type Hydroelectric Power Development

(District Level Checklist for Socio-economic Institutional Aspects)

S.N.	Office to be visited	Information to be Collected
1	DDC	Visit DDC, Collect District Profile and confirm Periodic Plan and other Development Plan of the district and Reservoir Area /Project Affected Area. Collect information on the settlement details in the reservoir area including number of houses, ethnicity population economic activities etc. Collect information on number and types of small infrastructures (roads, bridges, market centers, water turbines , cultural sites, etc –number and location) in the district and reservoir area from the Technical of DDC Collect information on type and number of cultural sites in the district and Reservoir Area /Project Affected Area. Also collect the types of minor and indigenous ethnic population in the district and reservoir area and their social, economic and cultural practices. Previous troubles with local people when formulating and implementing development programmes and plan (hydropower development, other development, other issues) . Information on private sector development plan on hydropower and other development sectors Collect their view on the potential benefit and impact of reservoir project in their district (upstream and downstream).
2	District Agriculture Development Office	Visit the office, Collect Agricultural Profile of the District and confirm, Land use patter Cropping pattern, area under different crop , production, yield , irrigated area , production pocket area, services centers , aquaculture/fish , agricultural plan and irrigation plan in the district and proposed reservoir area / project affected area. Collect their view on the potential benefit and impact of reservoir project in their district (upstream and downstream)..

3	District Livestock Service Office	Visit the office, Collect Livestock Profile of the District and confirm, types of livestock, their population, production of milk, meat and egg, livestock pocket area, service centers in the district and proposed reservoir area / project affected area and future livestock development plan.. Collect their view on the potential benefit and impact of reservoir project in their district(upstream and downstream)..
4	District Forest Office	Visit the office, Collect Forest Profile of the District and confirm, types of forest, NTFP, community Forestry Users Group, Leasehold Forestry Users Group with details of location, number of beneficiaries, volume of NTFP production in the district, presence of wildlife and biodiversity, pasture land , wetlands and lakes in the proposed reservoir area / project affected area and future forest development plans.. Collect their view on the potential benefit and impact of reservoir project in their district (upstream and downstream)..
5.	District Irrigation Office	Visit the office, Collect Irrigation Profile of the District and confirm existing and planned irrigation projects in the district and proposed reservoir area / project affected area with details of command area, number of beneficiaries and cost estimate of each of the projects. Collect their view on the potential benefit and impact of reservoir project in their district (upstream and downstream)..
6	District Drinking Water Office	Visit the office, Collect District Drinking Water and Sanitation Profile of the district and confirm existing and planned drinking water projects in the district and proposed reservoir area / project affected area with details of location, number of beneficiaries and estimated costs of each of the project and name and location of potential water sources for drinking water . Collect their view on the potential benefit and impact of reservoir project in their district(upstream and downstream).
7	District Small and Cottage Industry office	Visit the office, collect the industrial profile of the district and confirm exiting and planned industries in the districts and proposed reservoir area / project affected area with details of location, types, production capacity, number of employees, annual production and sale and future industrial plan.. Collect their view on the potential benefit and impact of reservoir project in their district (upstream and downstream)..
8	District Administration Office/ CDO	Visit the office, collect disaster profiles of the district and proposed reservoir area / project affected area with details incidence of earthquake, landslide, flood, fire, storms, epidemics etc, year, places and magnitude of

	Office	losses. Collect information of social and ethnic conflicts registered and solved by types Previous troubles with local people when formulating and implementing development programmes and plan (hydropower development, other development, other issues) . Collect data on flow of tourists by year in the district and places of interest around the reservoir area. Collect their view on the potential benefit and impact of reservoir project in their district (upstream and downstream).
9	District Electricity Office of NEA	Visit the office, collect electricity profiles of the district with existing and proposed micro, small and medium energy projects in the district and proposed reservoir area / project affected area. Collect their view on the potential benefit and impact of reservoir project in their district (upstream and downstream).
10	District Education Office	Visit the office, collect educational profile of the districts and proposed reservoir area / project affected area including numbers and types of schools. Collect their view on the potential benefit and impact of reservoir project in their district (upstream and downstream).

APPENDIX 3: SOCIAL STUDY TEAM MEMBERS

Social Study Team Members and Itinerary of the Field Visits

S.N.	Name of Project	District	Date of field visit	Name of the Environmentalist
1	Sunkoshi	Kavrepalanchowk and Sindhuli	8th July - 15th July	Mr. Kedar Man Joshi Mr. Bharat Acharya
2	Andhi khola	Syanja	10th July - 15th July	Ram Kumar Sharma Mr. Rajesh Silwal
3	Chheda khola	Jajarkot	14th July - 27th July	Mr. Hari Pd. Bhattarai Sagar Tiwari
4	Dudhkoshi	Okhaldhunga and Khotang	27th August - 12th September	Ram Kumar Sharma Mr. Rajesh Silwal
5	Lower bodigad	Gulmi	17th July - 23h July	Mr. Kedar Man Joshi Mr. Bharat Acharya
6	Nalsyagu gad	Jajarkot	16th July - 29th July	Ram Kumar Sharma Mr. Rajesh Silwal
7	Lower Jhimruk	Pyuthan and argakhanchi	12th August - 18th August	Mr. Hari Pd. Bhattarai Sagar Tiwari
8	Madi	Rolpa	10th August - 20th August	Mr. Kedar Man Joshi Mr. Bharat Acharya
9	Naumure	Argakhanchi and Pyuthan	9th August - 15th August	Ram Kumar Sharma Mr. Rajesh Silwal
10	Kokhajor	Kavrepalanchowk	1st October - 6th October	Mr. Hari Pd. Bhattarai Sagar Tiwari

APPENDIX 4: DISASTER STUDY SURVEY SHEET

DISASTER STUDY

1. MAJOR FLOOD EVENTS

a. Name of respondent: Date:

Age: Occupation: Location:

I. Year of the occurrence:

ii. Cause of the flood:

iii. Affected field by the flood (by river)

Loss or Damages	Local Area	Upstream Area	Downstream Area
Land			
Life			
Build properties			
Crops			
Others			

2. DISASTROUS LANDSLIDE

a. Name of respondent: Date:

Year	Location	Cause	Affected Fields	

3. DISASTROUS EARTHQUAKE

Year	Loss of life	Loss of Build Structures

APPENDIX 5: PHYSICAL AND BIOLOGICAL ENVIRONMENTAL STUDY TEAM MEMBERS

Physical Environmental Study Team Members and Itinerary of the Field Visits

S.N.	Name of Project	District	Date of field visit	Name of the Environmentalist
1	Sunkoshi	Kavrepalanchowk and Sindhuli	8th July - 15th July	Mr. Bhaiya Khanal Mr. Jitendra Biswas
2	Andhi khola	Syanja	10th July - 15th July	Dr. Toran Sharma Mr. Sibish Bhandari
3	Chheda khola	Jajarkot	14th July - 27th July	Mr. Raj Kapur Napit Dr. Mukesh Chalise Mr. Nir singh Rai
4	Dudhkoshi	Okhaldhunga and Khotang	27th August - 12th September	Dr.Madan Koirala Mr. Kishore K Upadhyay Mr. Nir singh Rai
5	Lower bodigad	Gulmi	10th July - 16th July	Dr. Mahendra Nath Subedi Mr. Ram Krishna Adhikari
6	Nalsyagu gad	Jajarkot	14th July - 29th July	Er. Dinesh Manandar Mr. Bikash Chand Shrestha Mr Puran Bhandari, Mr. Biswanath Rizal
7	Lower Jhimruk	Pyuthan and argakhanchi	12th August - 18th August	Dr. Mahendra Nath Subedi Mr. Raj Kapur Napit Mr. Jitendra Biswas
8	Madi	Rolpa	10th August - 20th August	Dr. Mukesh Chalise Mr. Ram Krishna Adhikari Mr. Puran Bhandari
9	Naumure	Argakhanchi and Pyuthan	9th August - 15th August	Mr. Kishore K Upadhyay Mr. Nir singh Rai
10	Kokhajor	Kavrepalanchowk	1st October - 6th October	Dr.Madan koirala Mr. Raj Kapur Napit Dr. Mahendra Nath Subedi Mr. Ujwal Tiwari

APPENDIX 6-1: FLORA SURVEY SHEET

I. FLORAL SURVEY

1. VEGETATION LIST FROM CONSULTAION AND OBSERVATION

S.N.	Local Name	Common Name	Scientific Name	Uses

2. FOREST TYPE

Local (Within Reservoir)	Regional(Out of the reservoir)

3. FOREST AS PER FOREST CLASSIFICATION (COMMUNITY FOREST, GOVERNMENT FOREST, LEASEHOLD FOREST, PRIVATE FOREST, RELIGIOUS FOREST ETC.)

Local Area (Within the reservoir)

S.N.	Ownership	Name of the forest	Dominant Species	V.D.C.
1				
2				

Regional Area (Outside the reservoir)

S.N.	Ownership	Name of the forest	Dominant Species	V.D.C.
1				
2				

4. FOREST PLOT ANALYSIS

I. Forest name:
Location:
G.P.S. Altitude:

S.N.	Local Name	Common Name	Scientific Name	DBH(cm)	Ht (aprox)
1					
2					
3					
Total					

Calculation:
Forest Density:
Dominant species
Crown coverage of the forest:

5. PUBLIC DEPENDENCY ON THE FOREST

6. FLORAL SPECIES OF THE CONSERVATION SIGNIFICANCE

S.N.	Common Name	Scientific Name	Status		
			IUCN	CITES	GON
1					
2					
3					

APPENDIX 6-2: FAUNA SURVEY SHEET

II. FAUNAL SURVEY

1 . WILD FAUNA LISTED FROM THE PROJECT SITE (Consultation & Observation)

A. Mammals

S.N.	Consultation	Observed	Common name	Scientific Name	Habitat	Remark
1						
2						

B. Birds

S.N.	Consultation	Observed	Common name	Scientific Name	Habitat	Remark
1						
2						

C.Herpetofauna

S.N.	Consultation	Observed	Common name	Scientific Name	Habitat	Remark
1						
2						

2. HABITAT TYPE IN THE RESERVOIR AREA

3. MIGRATORY CORRIDOR

4. WILD ANIMALS OF CONSERVATION SIGNIFICANT

S.N.	Common Name	Scientific Name	Status		
			IUCN	CITES	GON
1					
2					

APPENDIX 6-3: FISHERY SURVEY SHEET

III. FISHERY SURVEY

1. FISHER MEN AND THEIR OCCUPATIONAL /SOCIAL/ECONOMIC STATUS AND FISH MARKET, AVAILABILITY AND COST

a. Village/Tole: Date:

Name of the respondent: Age:

a. Detail of fishermen

Presence of fisherman in the village						
If yes no. of fishermen						
Fishing Type	occupational		Part time		Occasional	
	No.	Ethnicity	No.	Ethnicity	No.	Ethnicity
Status	Social Status			Economic Status		
	Low*	Medium*	High*	Low	Medium	High

Low=No jobs, No education, Medium*=Education but no jobs, High*=Both Education & jobs*

Low=Not enough for hand to mouth, Medium=Fairly enough to hand to mouth, High=Surplus and save or sell

b. Market detail of the fishermen

Name of the Market /s	Daily availability of the fish in that market		Average cost of fish Rs/Kg
	Daily availability	Amount Kg/day	

2. FISHING SEASON, FISH CATCH AND USE OF CAUGHT FISH

Location: Date:

Name of the fisherman: Age: Address:

Fishing detail	Fishing season:				
	Fishing days/week:				
	Maximum catch/day (kg):				
	Minimum catch/day (kg):				
	Average catch/day (kg):				
using way	All consumed	At home		Average cost (Nrs)	Income last year (Nrs)
		Market			

3. FISH DETAIL OF THE CATCHMENT STREAM OR RIVER

Name of stream:

Name of fish	Found in abundance	Trend of fish availability		
		Decreasing	Same as before	Increasing

4. LIST OF THE FISH REPORTED FROM THE RESERVOIR AREA

Local Name	Common Name	Scientific Name

5. LIST OF FISH SPECIES OF CONSERVATION SIGNIFICANCE

S.N	Local Name	Common Name	Scientific Name	Conservation Status		
				IUCN	GON	CITES

Annex 12: Environmental Survey Report

Dudh Koshi Project (E-01)

Table of Contents

Introduction

Federal Democratic Republic of Nepal is rich in water resources, its potential water power is 83,000 MW and economically exploitable water power is 42,000 MW. However, as of 2011, the total generating capacity of the country is only about 718.62 MW. Of the total installed capacity 92% is from the hydroelectric power plants. In addition, since most of hydroelectric power plants are run-of-river type, their output decreases seriously in the dry seasons. Consequently, there is a rolling blackout of as long as 14 hours a day which poses many problems including affects in livelihood and industries which severely impact the national economy.

To cope with these situations, the government of Nepal has worked out "National Electricity Crisis Resolution Action Plan" and "10-Year Hydropower Development Task Force" at the end of 2008. The above action plan and task force recommended need of storage-type hydroelectric power plants able to supply sustainable electricity uninterruptedly even in dry seasons to solve current power shortage at an early date.

However, construction of storage-type hydroelectric power plants should be carried out systematically taking into consideration of various aspects including the overall water resource development policy of Nepal, hydrological and geological characteristics, environmental impact, etc. Therefore, the Government of Nepal has requested the Government of Japan to work out a nationwide master plan for storage-type hydroelectric power development.

Electric Power Development Company Limited (J–Power) appointed by the JICA for the nationwide master plan study based on the desk level study in close association with NEA screened 10 candidate projects for the master plan study out of the list of 67 promising projects identified by NEA all over Nepal. **Table 1a and 1b** presents the salient features of the 10 promising projects screened for the master plan study, while **Figure 1** presents the location of the projects.

Table 1a: Salient Features of Potential Projects

No.	Project Name	Location (District)	Location of Dam Site		River	Installed Capacity (MW)	Catchment Area (km^2)
			Longitude	Latitude			
E-01	Dudh Koshi	Okhaldhunga/Khotang Dist.	86° 39' 17.3	27° 15' 47.2	Dudh Koshi to Baiku Khola	300.0	4100
E-06	Kokhajor-1	Sinchuli, Sindhupalchok	85° 29' 59.6	27° 22' 21.9	Kokhajor	111.5	281
E-17	Sun Koshi No.3, Kosi MP	Ramechhap, Kavre and Sindhupalanchok	85° 48' 14.3	27° 29' 50.5	Sun Koshi	536.0	5520
C-02	Lower Badigad	Gulmi	83° 27' 22.2	28° 0' 0.6	Badigad	180.3	2050
C-08	Andhi Khola	Syangja	83° 36' 30.6	27° 58' 2.6	Andhi Khola	180.0	475
W-02	Chera-1	Jajarkot	82° 1' 12.3	28° 42' 56.4	Chera	148.7	809
W-05	Lower Jhimruk	Arghakhachi, Pyuthan	83° 1' 1	27° 55' 30.8	Jhimruk	142.5	995
W-06	Madi	Rolpa	82° 35' 15.5	28° 18' 48.5	Madi	199.8	674
W-23	Nalsyau Gad	Jajarkot	82° 17' 42.8	28° 52' 4.7	Nalsyau Gad	410.0	571
W-25	Naumure (W. Rapti)	Argakhanchi, Pyuthan	82° 55' 42.9	27° 55' 6.1	West Rapti	245.0	3430

Table 1b: Salient Features of Potential Projects

No.	Project Name	Dam Height (m)	Total Storage Volume (MCM)	Effective Storage Volume (MCM)	Reservoir Area (km2)	FSL (m)	MOL (m)	TWL (m)	Rated Gross Head (m)	Rated Power Discharge (m3/sec)
E-01	Dudh Koshi	180.0	687.40	442.10	11.05	580.0	530.00	303.35	275.0	136.00
E-06	Kokhajor-1	107.0	218.70	166.10	8.92	437.00	390.00	200.00	226.3	63.90
E-17	Sun Koshi No.3, Kosi MP	140.0	1,220.00	555.00	23.99	700.0	674.00	575.00	116.3	109.34
C-02	Lower Badigad	191.0	995.90	505.50	13.65	688.00	654.00	475.00	196.0	232.60
C-08	Andhi Khola	157.0	336.50	238.70	5.52	675.00	626.70	368.48	307.0	81.40
W-02	Chera-1	186.0	254.90	141.10	4.00	866.0	814.00	640.00	220.0	80.50
W-05	Lower Jhimruk	167.0	386.00	211.60	4.98	597.0	557.0	390.0	194.6	88.10
W-06	Madi	190.0	359.50	235.10	7.66	1,090	1,030.00	800.00	280.8	84.90
W-23	Nalsyau Gad	200.0	419.6	296.3	6.3	1,570.0	1,498.00	872.0	644.0	75.00
W-25	Naumure (W.Rapti)	190.0	1,021.00	580.00	19.76	517.0	474.00	358.00	162.6	185.60

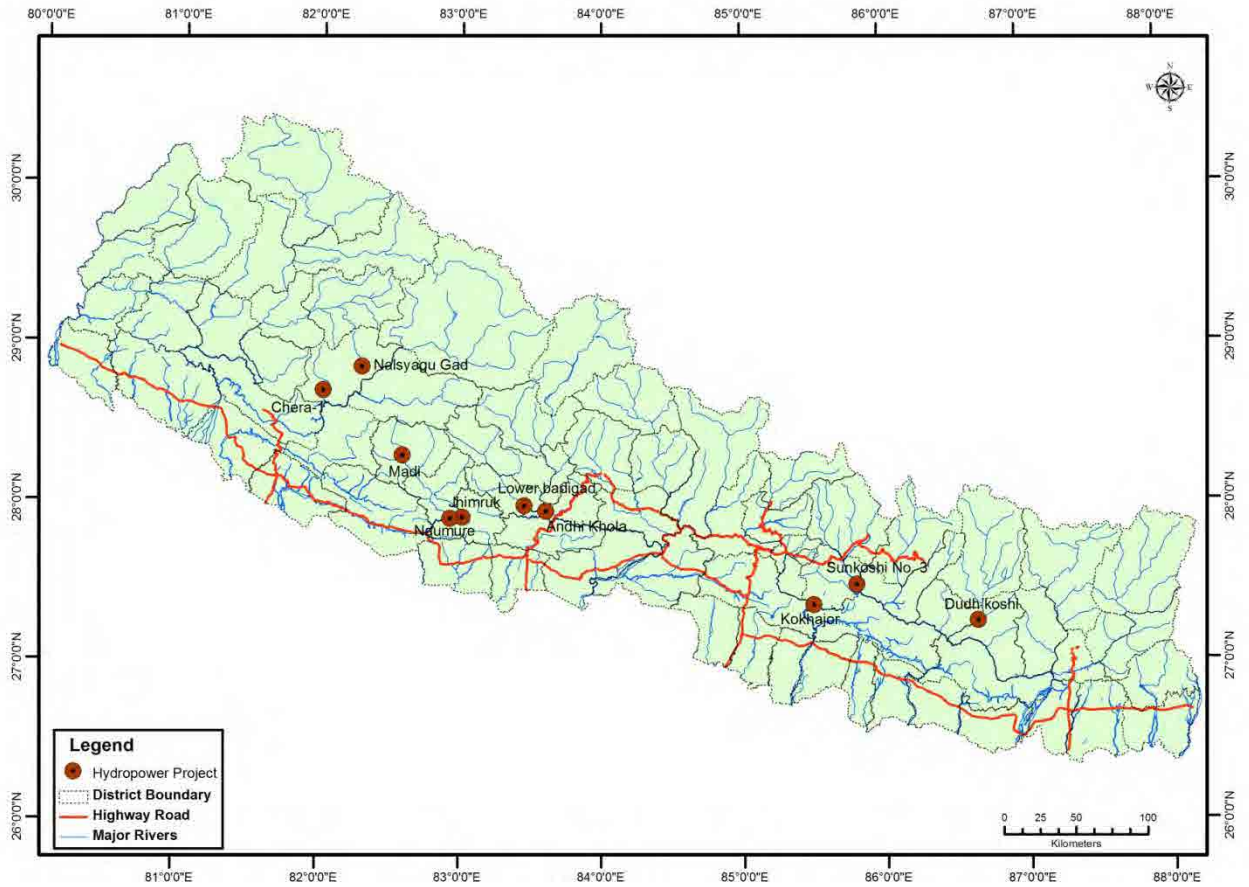


Figure 1: Ten Promising Sites Identified for Survey

The NESS, a local consulting firm of Nepal was entrusted by J-Power for the required SEA field studies of the 10 candidate projects. As per the ToR of works, there are basically two types of surveys required namely; geological, geotechnical, construction material and seismicity study, and environmental and social study. This report deals with the field survey findings of social and environmental study on **Dudh Koshi Project** identified as one of the candidate project in the western Nepal.

1 Socio-economic Environment

The information regarding the social and economic conditions of the people in Nepal is available in the publications of the Central Bureau of Statistics. But such information is limited to administrative units such as VDCs, DDCs, Development Zones and at national level. As the candidate projects cross cut the administrative units, the available data on the social and economic concerns could not be used effectively to characterize the direct impact areas by the projects. To fill this gap field level studies on Socio-economic and Environmental Concerns[1] are conducted through participatory methods. The findings of the field surveys are presented in the section below.

1.1 Demographic Concerns

1.1.1 VDCs, Settlements and Population

The proposed Dudh Koshi storage type project is located in Okhaldhunga, Khotang and Solukhumbu districts, Eastern Development region of Nepal and covers 11 VDCs, 9 settlements, 25 wards and 63 households. The total population of the reservoir area is estimated to be 448 with the average family size of 7.11 which is significantly higher than the national average family size (4.7- 2011 Census estimate). The reservoir area occupies only 0.12% of the total population of two districts[2] (Table 1c).

Table 1c: VDCS and Settlements and Population under the Storage Project, Okhaldhunga and Khotang Districts

S.N.	VDC	Settlement	Ward Number	Households	Population
A	**Okhaldhunga**				
1	Bhadaure	Bambai	6,7	1	13
		Dobhantar		8	60
2	Diyale		5,6		
3	Kuebhire		2,3,4,5		
4	Pokhare		9		
B	**Solukhumbu**				
5	Necha Betahari		1		
C	**Khotang**				
6	Lamidanda	Rabuwa Bazar	9	14	88
		Tilke Tar		6	36
7	Dumre Dharapani	Gothpani	1,5,6,7,8,9	6	60
		Kaniu Ban		3	23
		Kharpatar		12	80
		Jaljale Guth		3	28
8	Kharpa	Kharpa Tallo Gau	4,7,9	10	60
9	Ridungmaheshowari		1		
10	Jyamire		4,5,9		
11	Kubhinde		5		
Total	**11**	**9**	**25**	**63**	**448**

Source: NESS Field Survey, 2012

[1] The findings are based on the NESS Rapid Field Survey Assessment (2012) using Focus Group Discussions (FGD) and Observation tools. Refer **Appendix 4** for the List of FGD participants.

[2] The total population of Okgaldhunga and Khotang districts according to preliminary estimate of CBS Census 2011 is estimated to be 156,702 and 231,385 respectively.

1.1.2 Ethnicity / Caste

Out of the 11 VDC in the submerged area, only 6 VDCs have settlements within the reservoir. The population of the reservoir area is dominated by the Adivasi/Janjati mainly Magar (disadvantaged group-40%), followed by Newar (advanced group-22%). The Chhetri group constitutes third largest group of the population (21%). Another disadvantaged group, the Tamangs represents 10% of the population, while few (6%) marginalized group (Majhi) are also residing in the vicinity (Table 2).

Table 2: Ethnic Composition of Reservoir Area Households

S.N.	VDC	Settlement	Chetri	Janjati/Adivasi				Dalit
				Magar (Disadvantaged)	Tamang (Disadvantaged)	Newar (Advanced)	Majhi (Marginalized)	
1	**Okhaldhunga /** Bhadaure	Bambai	0	1	0	0	0	0
2	Bhadaure	Dobhantar	0	8	0	0	0	0
3	**Khotang** / Lamidanda	Rabuwa Bazar	0	0	0	14	0	0
4	Lamidanda	Tilke Tar	0	2	0	0	4	0
5	Dumre Dharapani	Gothpani	0	0	6	0	0	0
		Kaniu Ban	0	3	0	0	0	0
		Kharpatar	10	2	0	0	0	0
		Jaljale Guth	3	0	0	0	0	0
9	Kharpa	Kharpa Tallo Gau	0	9	0	0	0	1
Total	**6**	**9**	**13**	**25**	**6**	**14**	**4**	**1**
%			**20.64**	**39.68**	**9.53**	**22.22**	**6.35**	**1.58**

Source: NESS Field Survey, 2012

1.2 Economic Concern

1.2.1 Land Use Pattern[3] and Land Holding Size

The land use pattern in the submerged area is described in two pattern, i) land use under residential communities and ii) land use pattern of non residential communities. Under the first category, the total land area utilized by the households in the reservoir area is estimated to be 1819 ropanies (1 ropani=20 hectare), a large proportion of which is used for agriculture (60%) followed by forest and pasture (15% each) and other (10%) (Table 3).

Table 3: Land Use Pattern of the Reservoir Area (used by residence communities)

S.N.	VDC	Settlement	Land Use Area (Ropani), 1 Ropani=20 Ropani				
			Agriculture	Pasture	Forest	Other	Total
1	**Okhaldhunga/** Bhadaure	Bambai	27	10	0	40	77
2	Bhadaure	Dobhantar	110	40	60	0	210
3	**Khotang**/Lamidanda	Rabuwa Bazar	200	10	90	30	330

[3] The Land Use Pattern mentioned here may not match with the GIS map presented elsewhere as this information is based on the tentative estimation of the communities.

S.N.	VDC	Settlement	Land Use Area (Ropani), 1 Ropani=20 Ropani				
			Agriculture	Pasture	Forest	Other	Total
4	Lamidanda	Tilke Tar	100	20	50	10	180
5	Dumre Dharapani	Gothpani	94	25	19	10	148
		Kaniu Ban	35	5	25	0	65
		Kharpatar	290	100	0	40	430
		Jaljale Guth	34	15	25	0	74
6	Kharpa	Kharpa Tallo Gau	205	50	0	50	305
Total	**6**	**9**	**1095**	**275**	**269**	**180**	**1819**
%			**60.20**	**15.12**	**14.79**	**9.89**	**100.00**

Source: NESS Field Survey, 2012

Besides, lands area used by the residing communities of the reservoir area, additional land area of about 15000 ropanies is also reported in the submerged area from different VDCs, detail of which is given in Table 4.

Table 4: Land Use Pattern in the Submerged Area (used by non-residence communities)

S.N.	District/VDC	Settlement	Ward No.	Land Use (Ropani)				
				Agriculture	Pasture	Forest	Other	Total
A.1	**Okhaldhunga** /Bhadaure	Kuwapani	7	8	35	40	10	93
		Dehikhet	6	46	10	0	0	56
A.2	Diyale	Kathahare	5	236	0	3	0	239
		Kuvinde	6	27	0	0	0	27
A.3	Kuebhire	Ratmate	2,3	90	35	55	50	230
		Atmara	4	120	45	15	20	200
		Thuli Besi	4,5	4000	15	0	60	4075
A.4	Pokhare	Pokhare Besi	9	60	30	20	24	134
B.1	**Solukhumbu** Necha Betghari	Tuintar	1	56	15	40	0	111
C.1	**Khotang** / Ridungmaheshowari	Tallomaheshorari	1	25	5	10	0	40
C.2	Jyamire	Mathilo Salle	4	30	25	45	15	115
		Tallo Salle	5	74	25	40	15	154
		Kaniu Ban	9	140	30	25	10	205
C.3	Dumre Dharapani	Dharapani	1,6,7, 8,9	230	100	150	60	540
		Kathahare	5	500	0	0	0	500
C.4	Lamidanda	Tilke Tar	9	300	25	50	0	375
C.5	Kharpa	Jyamire Phat	9	780	15	0	10	805
		Til pung Khet	7	50	10	0	20	80
		Tinpatan Jaljale	4	460	16	0	15	491
		Dasmure Phat	4,5	6000	20	0	25	6045
C.6	Kubhinde	Amle Phat	5	425	0	0	0	425
Total	**11**	**21**	**25**	**13657**	**456**	**493**	**334**	**14940**

Source: NESS Field Survey, 2012

The total agricultural land utilized by the reservoir area residing households is estimated to be 1395 ropanies. Of the total agricultural land 54% are *pakho* (un-irrigated up land), 24% *khet* (irrigated paddy field) and 21% other (kharbari). The average land holding size of a household is calculated to be 22

ropanies with the minimum and maximum range of holding size of 13.0 and 77.0 ropanies (Table 5**).** All the households of the reservoir area fall in the marginal and small to medium category, based on the[4], Central Bureau of Statistics (CBS) land holding classification.

Table 5: Land Holding of the Reservoir Area

S.N.	VDC	Settlement	Land Area and Holding Size				
			Khet	Bari	Others	Total	Average Holding Size/HH
1	**Okhaldhunga/** Bhadaure	Bambai	2	25	50	77	77.0
2	Bhadaure	Dobhantar	0	110	0	110	13.8
3	**Khotang**/Lamidanda	Rabuwa Bazar	0	200	0	200	14.3
4	Lamidanda	Tilke Tar	80	20	20	120	20.0
5	Dumre Dharapani	Gothpani	0	94	10	104	17.3
		Kaniu Ban	15	20	5	40	13.3
		Kharpatar	90	200	100	390	32.5
		Jaljale Guth	28	6	15	49	16.3
6	Kharpa	Kharpa Tallo Gau	125	80	100	305	30.5
Total	**6**	**9**	**340**	**755**	**300**	**1395**	**22.1**
%			**24.37**	**54.12**	**21.51**	**100**	

Source: NESS Field Survey, 2012

The reservoir area is producing cereals such as paddy, maize, millet, wheat and cash crops such as potato, pulses, oilseeds and vegetables. Among the cereals, maize is grown in the largest area (340 ropanies) followed by paddy (340 ropanies), millet (245 ropanies) and wheat (210 ropanies). Similarly, among the cash crops, pulses occupy the largest area (102 ropanies) followed by potato (57 ropanies), oilseeds (15 ropanies) and vegetables (4 ropanies).

The quantity of production is recorded highest for paddy followed by maize, wheat and millet. Among the cash crops, the production is recorded to be highest for potato followed by pulses oilseeds and vegetables. The cropping intensity of the area is 146% (Table 6 and **Appendix 2).**

Table 6: Crop Production and Yield

S.N.	Crop	Area (Ropani)	Production (Kg)	Yield (Kg/Ropani)
1	Paddy	340	47850	140.7
2	Maize	625	45990	73.6
3	Millet	245	15695	64.1
4	Wheat	210	17386	82.8
5	Potato	57	11400	200.0
6	Pulse	102	3471	34.0
7	Oilseeds	15	160	10.7
8	Vegetables	4	160	40.0
	Cropping Intensity	**145.94%**		

Source: NESS Field Survey, 2012

More than half of the settlements are selling their agricultural products in the nearby village and Rabuwa Bazar. The total volume of sold quantity is calculated to be 53,622 kg which is valued at Rs. 1,677,343 (**Table 7**).

[4] According to CBS, a households holding < 15 ropani of land is classified as marginal farmer, holding 15-135 ropanies as small to medium farmers and holding > 135 ropani as large farmers.

Table 7: Sale of Crops

Crops	Paddy	Maize	Wheat	Potato	Pulses	Millet	Total
Quantity Sold (Kg)	18350	15435	7560	7750	1607	2920	53622
Total Value of Sold Crops	Rs. 1,677,343						

Source: NESS Field Survey, 2012

1.2.2 Occupation

About 50% population of the area is estimated to be involved in economic earning activities. Of the working population, a majority (71%) area engaged in agriculture followed by foreign employment (13%). Almost an equal number of populations are also engaged in service and wage labour (8% each) (Table 8).

Table 8: Occupation of the Reservoir Area Population

S.N.	VDC	Settlement	Agriculture	Service	Wage labor	Foreign employment	Total
1	**Okhaldhunga/** Bhadaure	Bambai	4	0	4	1	9
2	Bhadaure	Dobhantar	12	0	8	2	22
3	**Khotang**/Lamidanda	Rabuwa Bazar	8	10	0	6	24
4	Lamidanda	Tilke Tar	15	1	3	3	22
5	Dumre Dharapani	Gothpani	30	2	2	2	36
		Kaniu Ban	8	0	1	1	10
		Kharpatar	35	2	0	5	42
		Jaljale Guth	8	1	0	4	13
6	Kharpa	Kharpa Tallo Gau	30	0	0	3	33
Total	**6**	**9**	**150**	**16**	**18**	**27**	**211**
%			**71.09**	**7.58**	**8.54**	**12.79**	**100.00**

Source: NESS Field Survey, 2012

1.2.3 Housing Type

Two types of houses are categorized in the reservoir area: i) Pakki house i.e permanent types of house built generally using cement and stone and roofed by using galvanized sheet (tin) or cemented and ii) kachhi house i.e built by using mud and stone and roofed using thatch.

Almost 70% of population of the area are residing in kacchi (temporary) types of house and remaining in pakki (permanent) types of house (Table 9**).**

Table 9: House Types

S.N.	VDC	Settlement	House Types		
			Kachhi	Pakki	Total
1	**Okhaldhunga/** Bhadaure	Bambai	1	0	1
2	Bhadaure	Dobhantar	8	0	8
3	**Khotang**/Lamidanda	Rabuwa Bazar	0	14	14
4	Lamidanda	Tilke Tar	4	2	6
5	Dumre Dharapani	Gothpani	6	0	6
		Kaniu Ban	3	0	3
		Kharpatar	12	0	12
		Jaljale Guth	0	3	3
6	Kharpa	Kharpa Tallo Gau	9	1	10
Total	**6**	**9**	**43**	**20**	**63**
%			**68.25**	**31.75**	**100.00**

Source: NESS Field Survey, 2012

1.3 Service related Infrastructures

1.3.1 Roads and Bridges

One thirds of the settlements are connected with paved road. The total road length within the settlement is estimated at 4.97 km. The reservoir area is also served with five suspension bridges (Table 10).

Table 10: Road and Bridges in the Reservoir Area

S.N.	VDC	Settlements	Road			Bridge	
			Type	Length	Name of Road	Type	Name
1	**Okhaldhunga/** Bhadaure	Bambai	NA	0	0	0	0
2	Bhadaure	Dobhantar	paved	1.5 km	Okhaldhunga Road	Suspension	Phurketar, Dovan
3	**Khotang**/ Lamidanda	Rabuwa Bazar	paved	1.5 km	Lamidanda Rabuwa	Suspension	Rabuwa Bazar
4	Lamidanda	Tilke Tar	0	0	0	Suspension	Tilke Tar Bange Pul
5	Dumre Dharapani	Gothpani	0	0	0	0	0
		Kaniu Ban	0	0	0	Suspension	Sisneri Dovan pul
		Kharpatar	paved	1,97 km	Kharpatar Road	Suspension	Bange Pul
		Jaljale Guth	0	0	0	0	0
6	Kharpa	Kharpa Tallo Gau	0	0	0	0	0
Total	**6**	**9**	**3**	**4.97 km**	**3**	**5**	**5**

Source: NESS Field Survey, 2012

1.3.2 Irrigation and Drinking Water

Juge khola irrigation scheme located at Tilke Tar, Lamidanda VDC is the only one systematic irrigation scheme operated in the reservoir area. Similarly, five water supply schemes with 15 taps are also serving the area (Table 11).

Table 11: Drinking Water and Irrigation Schemes in the Reservoir Area

S.N.	VDC	Settlements	Drinking Water			Irrigation	
			No.	No. of taps	Name of scheme/Source	Name of the scheme	Command area (ropani)
1	**Okhaldhunga/** Bhadaure	Bambai	1	1	Thotne Bhir	0	0
2	Bhadaure	Dobhantar	1	3	Thotne Khola	0	0
3	**Khotang**/ Lamidanda	Rabuwa Bazar	1	3	Lampane Khanepani	0	0
4	Lamidanda	Tilke Tar	1	3	Juge Khola	Juge khola	50
5	Dumre Dharapani	Gothpani	1	5	Gothpani	0	0
		Kaniu Ban	0	0	NA	0	0
		Kharpatar	0	0	Raha Khola	0	0
		Jaljale Guth	0	0	Raha Khola	0	0
6	Kharpa	Kharpa Tallo Gau	0	0		0	0
Total	**6**	**9**	**5**	**15**		**1**	**50**

Source: NESS Field Survey, 2012

1.3.3 Industries and Services

There are no any specific industries in the reservoir area. Neither there are other service centres such as agriculture, livestock, security, health etc. and schools in the reservoir area.

Rabhuwa bajar of Lamidanda VDC is the major and permanent market of the area. There are about 8 restaurents with limted lodding facility for the tourists at Raduwa bajar. One or two tea stalls are common in the settlements affected by the reservoir.

Two rafting are in operation in Rabuwa Bajar of Lamidanda VDC and at least 10 tourists visit the area for rafting in a season.

1.4 Culture and Religious Site

The major festivals celebrated in the reservoir area are: *Dasain, Tihar, Tija, Majhe Sankarati*, etc which are based on Hindu tradition and culture. Besides these festivals, the Janjati dwelling in the area also celebrate *Bisket Sankranti, Thulo Aakadasi, Pitri Puja and Sonam Losar*. Two temples (Shiva and Devi) are located in Rabuwa Bazar. There are four permanent types of cremation ghats within the reservoir area (Table 12).

Table 12: Cultural Sites and Festivals

S.N.	VDC	Settlement	Main festival	Any festivals of Janajati	Religious site at the river	Cremation Ghats
1	**Okhaldhunga** / Bhadaure	Bambai	Dashain, Tihar,Teej			
2	Bhadaure	Dobhantar	Dashain, Tihar, Teej, Maghe Sankranti		no such site	1
3	**Khotang** / Lamidanda	Rabuwa Bazar	Dashain, Tihar,Teej, Maghe Sankranti	Bisket Sankranti, Thulo Aakadasi	shiva and devi mandir	1
4	Lamidanda	Tilke Tar	Dashain, Tihar, Teej, Maghe Sankranti	Pitri Puja	no such site	
5	Dumre Dharapani	Gothpani	Dashain, Tihar,Teej, Maghe Sankranti	Sonam Losar	no such site	
		Kaniu Ban	Dashain, Tihar,Teej, Maghe Sankranti	no	no such site	1
		Kharpatar	Dashain, Tihar,Teej, Maghe Sankranti	no	no such site	1
		Jaljale Guth	Dashain, Tihar,Teej, Maghe Sankranti	no	no such site	
6	Kharpa	Kharpa Tallo Gau	Dashain, Tihar,Teej, Maghe Sankranti	no	no such site	
Total	**6**	**9**			**1**	**4**

Source: NESS Field Survey, 2012

1.5 Ongoing and Proposed Development programmes

There are no any ongoing development programmes in the reservoir area.

1.6 Past Experience with community and their perception

The reservoir area people have not experience any types of conflict with regards to the development projects in the past as there were noany large scale development projects implemented in the past.

The people have perceived different positive and negative impacts from the storage type hydropower project. Submerge of house and land; loss of houses, land and property, resettlement problems, losses of fertile agriculture land etc. are reported to be the major negative impacts perceived by the community. The communities have also expected different development activities from the project such as availability of electricity, infrastructure development and employment (Table 13).

Table 13: Perceived Impacts of the Storage Type Hydropower Project

S.N.	VDC	Settlement	Positive impact	Negative impact
1	**Okhaldhunga/** Bhadaure	Bambai	electricity and employment	loss of land and property
2	Bhadaure	Dobhantar	electricity	loss of houses
3	**Khotang**/Lamidanda	Rabuwa Bazar	electricity and employment	resettlement problems
4	Lamidanda	Tilke Tar	infrastructure development	losses of fertile agriculture land
5	Dumre Dharapani	Gothpani	available of electricity	loss of houses &land
		Kaniu Ban	employment and electricity	submerge of house and land
		Kharpatar	employment and electricity	submerge of house and land
		Jaljale Guth	electricity and employment	loss of land and property
6	Kharpa	Kharpa Tallo Gau	infrastructure development	submerge of house and land
Total	**6**	**9**		

Source: NESS Field Survey, 2012

1.7 Disasters

Flood and landslides are reported to be the common natural disasters faced by the reservoir area each year. However, the area has not recorded serious losses due to such disasters in the recent years.

2 DISASTER STUDY

There are no records of the disaster at the site specific level of the candidate project at the central level and district level offices of the government of Nepal. It is therefore, the disaster information is collected from the project site based on the key informant survey. The findings of the results are presented in the sections below.

2.1 Types of Disaster

Within the influence area of the Dudh Koshi Project, the flood and landslide disaster have been reported by the key informants. The earthquake as a disaster event is not in the memory of the local people.

2.1.1 Flood

In the memory of the local people, flood disaster is of common occurrence within the project site. Two flood events (B.S 2052 and 2056) have a widespread damage of life and property. The cause of the floods as reported by the informants is the heavy precipitation in the catchment areas of the Dudh Koshi Project in the monsoon season. The loss of life and property caused by the flood events in the candidate reservoir area are presented below.

a) Name of respondent: RANA BAHADUR RAI **Date:** 15/05/2069 B.S.
Age: 68 **Occupation:** Agriculture **Location:** Sano Salle-4, Jyamire
i) Year of the occurrence: 2052 B.S. Asar 2
ii) Cause of the flood: Heavy Precipitation
iii) Affects of the flood event (by river **Dudh Koshi):**

Loss or Damages	Local Area	Upstream Area	Downstream Area
Land	~26r	~60r	~650r(50b) Thuli Bensi
Life	1	X	X
Build properties	x	X	X
Crops	50 m, Paddy	130m, Paddy	1400m, Paddy
Others	X	x	x

b) Name of respondent: MITHU KUMAR SHRESTHA **Date:** 16/05/2069 B.S.
Age: 45 **Occupation:** Business/Agriculture **Location:** Majhitar, Kuivir
i) Year of the occurrence: 2056 B.S. Asoj
ii) Cause of the flood: Heavy Precipitation
iii) **Affects of the flood event** (by river **Dudh Koshi**):

Loss or Damages	Local Area	Upstream Area	Downstream Area
Land	~1000r	~100r	~30r Dumre, Gothpani
Life	1,Indian army, Majhi	X	X
Build properties	30H	X	X
Crops	~2500m Paddy	~200m Paddy	~60m Paddy
Others	1 suspension bridge	x	X

c) Name of respondent: GOVINDA THAPA MAGAR **Date:** 18/05/2069 B.S.
Age: 41 **Occupation:** Business/Agriculture **Location:** Tilketar-9, Lamidanda
i) Year of the occurrence: 2052 B.S., Asar 2
ii) Cause of the flood: Heavy Precipitation and blockage of the river by Dudh Koshi flood
iii) Affects of the flood event (by river **Rawa Khola**)**:**

Loss or Damages	Local Area	Upstream Area	Downstream Area
Land	~10r	~600r,Kharpa	X
Life	X	X	X
Build properties	X	X	X
Crops	~30m Paddy	~1800m Paddy	X
Others	X	x	X

2.1.2 Landslide

Landslide events are relatively rare in the influence area of candidate project. A major landslide is reported from the area 13 years back after heavy precipitation in the monsoon season with the loss of life and property. Table below presents the details of the landslide event as preported by the key informants.

a) Name of respondent: PURNA BAHADUR TAMANG **Date:** 16/05/2069 B.S.
(Dudh Koshi)

Year	Location	Cause	Affected Fields	
2056 B.S., Asoj	Gothpani-7,Dumre Dharapani	Heavy Precipitation and vibration of Koshi river water current	Affected Area	Gothpani-7
			Loss of life	x
			Loss of Build	5
			Loss of Crops	Gahat,Filinge
			Loss of Land	~200r

2.1.3 Earthquake

In the memory of the local people the candidate project site communities have not experienced earthquake causing loss of life and property.

3 FLORAL STUDY

Though the floral information at the regional level is available, there is no published literature on the site specific level of the candidate project at the central and district level offices of the government of Nepal. It is therefore, candidate project site is visited by the biological study team to gather information based on direct observation and through the participatory methods with the local key informants. Findings of the field study are presented in sections below.

3.1 Vegetation Diversity

The information on the vegetation diversity is gathered from the direct observation by the members of biology study team during site visit. Besides, information is also collected from the key informants of the local area through interviews and focus group discussions with the local community forest user groups.
The candidate project site is rich in floral diversity. About 67 plant species were recorded through direct observation and interviews with the key informants. The list of plant species is presented in the table below.

S.N.	Local Name	Common Name	Scientific Name
1	Khayer	Cuth tree	*Acacia catechu*
2	Karam	Yellow teak	*Adina cardifolia*
3	Bell	Wood Apple	*Aegle marmelos*
4	Chiuri	Nepal butter fruit	*Aesandra butyracea*
5	Siris	Tee-coma	*Albezia sps.*
6	Sungure Kanda	Prickly poppy	*Argemone maxicana*
7	Vorla	Camel's footclimber	*Bauhinia vahlii*
8	Koiralo	Pink bauhinia	*Bauhinia variegate*
9	Simal	Silk cotton tree	*Bombax ceiba*
10	Bhuletro		*Butea buteiformis*
11	Rajbrichha	Cassia pods	*Cassia fistula*
12	Sinkauli	Garlic pear	*Cinnamomum glanduliferum*
13	Kaulo		*Cinnamomum glanduliferum*
14	Thakal		*Cirsium wallichii*
15	Kyamuna		*Cleistocalyx operculatus*
16	Sandan	Sandan	*Desmodium oojeinense*
17	Githe tarul	Air potato	*Dioscorea bulbifera*
18	Tidu	River boney	*Diospyras malabarica*
19	Unyoo	Eadible fern	*Dryopteris cochleata*
20	Mouwa		*Engelhardia spicata*
21	Dhendufule		*Eupatorium adenophorum*
22	Dudhilo		*Ficus neriifolia*
23	Khamari	Malay bush beech	*Gmelina arborea*
24	Vimal	Bush	*Grewia optiva*
25	Nigaalo		*Himalayacalamus spp.*
26	Bhate Khirro	Kavessi banrk easter tree	*Holarrhena pubescens*
27	Sajiwan	Physic nut	*Jatropha spp.*
28	Hade		*Lagerstroemia parviflora*
29	Hallude	Wodier wood	*Lannea coromandelica*
30	Mauaa		*Madhuca longifolia*
31	Rain	Kamala	*Mallotus philipensis*
32	Pudina	Peppermint	*Menthe arvensis*
33	Kafal	Bay berry	*Myrica esculenta*
34	Amala	Emblic	*Phyllanthus emblica*
35	Khareto		*Phyllanthus parvifolius*
36	Khote Sallo	Pine	*Pinus roxburgii*

S.N.	Local Name	Common Name	Scientific Name
37	Gideri	Headache tree	*Premna integrifolia*
38	Valayo	Chinese sunmac	*Rhus javanica*
39	Anderi	Castor oil plant	*Ricinus communis*
40	Ainselu	Golden raspberry	*Rubus spp.*
41	Ritho	Soap –nut	*Sapindus mukorossi*
42	Khirro	Tallow tree	*Sapium insigne*
43	Chilaune		*Schima wallichii*
44	Sall	Sall tree	*Sorea robusta*
45	Debre lahara		*Spatholobus parviflorus*
46	Chiraito	Chirretta	*Swertia chirayita*
47	Jamun	Black berry	*Syzgium cumini*
48	Titri	Tamarind Indian date	*Tamarindus inidca*
49	Niguro		*Tectaria coadunata*
50	Sajh	Laurel tree	*Terminalia alata*
51	Toono	Cedrela tree	*Toona sps.*
52	Uttis	Nepal black ceder	*Ulnus nepalensis*
53	Sisnoo	Stinging nettle	*Urtica dioca*
54	Dhayaro	Fire flame bush	*Woodfordia fruticosa*
55	Timur	Nepal pepper	*Zanthoxylum armatum*
56	Bayer	Indian plum	*Zizypulus mauritiana*
57	Totala		
58	Syalfusre		
59	Patmero		
60	Paineti		
61	Archal		
62	Lampate		
63	Lamichhane		
64	Dar		
65	Parijat		
66	Datrungo		

3.2 Forest Types

The candidate project site is characterized by the mixed braod leave forests, hill sal forest and *Pinus roxburgii* forest. The reservoir site is dominated by mixed braod leave forests and hill sal forest while higher altitudes of the influence area has *Pinus roxburgii* forest. Table below presents the forest types and associated species in the reservoir area and outside reservoir area.

Local(Within Reservoir)	Regional(Out of the reservoir)
Generally the lower parts of all the catchment areas are covered by mixed broad leaved forests and Hill sal Forest. It has consisted many deciduous tree like Hill Sal (*Shorea robusta*),Karam (*Adina cardifolia*), Sanj(*Terminalia alata*)etc.	The regional area of the project are mainly covered with Hill Sal (*Shorea robusta*) forest and few Chir Pine (*Pinus roxbergii*) forest. ▪ Pure Hill Sal forest are in Rani Ban of Sillouri, Salghari of Gothpani Dumreetc. ▪ Chir Pine forest are seen above >1000m mainly in Lamidanda top of Rabuwa.

3.3 Forest as per Forest Classification (Community Forest, Government Forest, Leasehold Forest, Private Forest, Religious Forest etc.)

The forests of the candidate project influence area are the government and community forests. The community forest are managed by the local community forest user groups within the framework of the community forest management plan approved by the district forest offices, while the government managed

forest is managed by the district forest office. The reservoir occupied area has 11 community forests and 2 government managed forest and 1 private forest. The name of the government and community forests, dominant species of plants and the location of the forests in the local administrative zone (VDCs) is presented in the tables below for the reservoir area and outside the reservoir area.

a) Local Area (Within the reservoir)

S.N.	Ownership	Name of the Forest	Dominant Species	V.D.C.
1	Community	Langur Pakha C.F.	Sall and Sallo	Lamidanda
2	Community	Bal Kanya C.F.	Sall and Sallo	Vadoure
3	Community	Gaikhure C.F.	Sall Mixed	Diyale
4	Private	Privata Forest (Khatiwada Group)	Sall Mixed	Diyale-7
5	Community	Patale C.F.		Diyale
6	Community	Bhainsi Dure C.F.		Diyale
7	Community	Sallo Salghari C.F.		Jyamire
8	Community	Vorle Tmaban C.F.	Sall Mixed	Necha Betghari
9	Government Managed Forest	National Forest of Fataksi	Sal Mixed	Maheswori
10	Community	Bolaune C.F.		Kuivir
11	Community	Dharma Pani C.F.		Pokhare
12	National	Raniban National Forest	Sall Dominated	Jyamire
13	Community	Prakritic Pakha C.F.		Kharpa
14	Community	Salghari C.F.		Kharpa

b) Regional Area (Outside the reservoir)

S.N.	Ownership	Name of the Forest	Dominant Species	V.D.C
1	Community	Langur Pakha C.F.	Sall and sallo	Lamidanda
2	Community	Bal Kanya C.F.	Sall and sallo	Vadoure
3	Community	Gaikhure C.F.	Sall mixed	Diyale
4	Private	Privata Forest (khatiwada group)	Sall mixed	Diyale-7
5	Community	Patale C.F.		Diyale
6	Community	Bhainsi Dure C.F.		Diyale
7	Community	Sallo Salghari C.F.		Jyamire
8	Community	Vorle Tmaban C.F.	Sall mixed	Necha Betghari
9	Government Managed Forest	National Forest of Fataksi	Sal mixed	Maheswori
10	Community	Bolaune C.F.		Kuivir
11	Community	Dharma Pani C.F.		Pokhare
12	Government Managed Forest	Raniban National Forest	Sall dominated	Jyamire
13	Community	Prakritic Pakha C.F.		Kharpa
14	Community	Salghari C.F.		Kharpa

3.4 Forest Plot Analysis

For the analysis of the forest status and characteristics 3 sample plots were measured within the reservoir area of the candidate project. The sample plots measured has a size of 25 x 25 meter. The detail of the sample plot measurements is presented in the tables below.

a) Forest: Sallo Salghari Co.Fo.
Location: Tallo Salle, Jyamire
G.P.S. 04-68-800E 30-25-600N **Altitude**:590m

S.N.	Local Name	Common Name	Scientific Name	DBH(cm)	Height (approx.)
1	Sindure	Kamala	*Mallotus philippensis*	30	*5*
2	Sindure	Kamala	*Mallotus philippensis*	*40*	*5*
3	Sindure	Kamala	*Mallotus philippensis*	*60*	*8*
4	Sindure	Kamala	*Mallotus philippensis*	*70*	*9*

S.N.	Local Name	Common Name	Scientific Name	DBH(cm)	Height (approx.)
5	Sindure	Kamala	*Mallotus philippensis*	*50*	*6*
6	Sindure	Kamala	*Mallotus philippensis*	*50*	*6*
7	Sindure	Kamala	*Mallotus philippensis*	*50*	*5cut*
8	Hallude		*Lannea coromandelica*	*90*	*12*
9	Hallude		*Lannea coromandelica*	*80*	*11*
10	Hallude		*Lannea coromandelica*	*90*	*11*
11	Hallude		*Lannea coromandelica*	*100*	*13*
12	Hallude		*Lannea coromandelica*	*120*	*14*
13	Hallude		*Lannea coromandelica*	*150*	*14*
14	Hallude		*Lannea coromandelica*	*150*	*20*
15	Hallude		*Lannea coromandelica*	*80*	*5*
16	Karam	Yellow teak	*Adina cardifolia*	*150*	*15*
17	Karam	Yellow teak	*Adina cardifolia*	*50*	*8*
18	Karam	Yellow teak	*Adina cardifolia*	*30*	*5*
19	Karam	Yellow teak	*Adina cardifolia*	*100*	*10*
20	Karam	Yellow teak	*Adina cardifolia*	*120*	*9*
21	Siris	Tee-coma	*Albezia sps.*	*50*	*6*
22	Siris	Tee-coma	*Albezia sps.*	*60*	*6*
23	Hade		*Lagerstroemia parviflora*	*60*	*7*
24	Khirro	Tallow tree	*Sapium insigne*	*50*	*6*
25	Sajh	Laurel tree	*Terminalia alata*	*60*	*5*
26	Chilaune		*Schima wallichii*	*30*	*4*
	Sindure-7, Hallude-8, karam-5, Siris-2, Hade-1, Khiro-1, Sajh-1, Chilaune-1				

Forest Density: total no of tree/area of the quadrate= 26/625) X10000 per Hector=416/Hector
Dominant species: Hallude=(8/26) X100%,=31%; Sindure=(7/26) X100%=27%, Karam=(5/26), 100%, =19%
Crown coverage of the forest: 60%

b) Forest: Salghari Co. Fo.
Location: Sanghutar, Gothpani V.D.C.-Dumre Dharapani
G.P.S. 04-67-600E,30-19-850 **Altitude**:650m

S.N.	Local Name	Common Name	Scientific Name	DBH(cm)	Height (approx.)
1	Sall	Hill Sal	*Shoerea robusta*	80	10
2	Sall	Hill Sal	*Shoerea robusta*	70	10
3	Sall	Hill Sal	*Shoerea robusta*	60	9
4	Sall	Hill Sal	*Shoerea robusta*	50	8
5	Sall	Hill Sal	*Shoerea robusta*	100	11
6	Sall	Hill Sal	*Shoerea robusta*	90	11
7	Sall	Hill Sal	*Shoerea robusta*	120	13
8	Sall	Hill Sal	*Shoerea robusta*	110	13
9	Sall	Hill Sal	*Shoerea robusta*	60	10
10	Sall	Hill Sal	*Shoerea robusta*	70	9
11	Sall	Hill Sal	*Shoerea robusta*	70	8
12	Sall	Hill Sal	*Shoerea robusta*	90	10
13	Sall	Hill Sal	*Shoerea robusta*	100	12
14	Sall	Hill Sal	*Shoerea robusta*	120	14
15	Sall	Hill Sal	*Shoerea robusta*	90	12
16	Sall	Hill Sal	*Shoerea robusta*	120	14
17	Sall	Hill Sal	*Shoerea robusta*	100	13
18	Sall	Hill Sal	*Shoerea robusta*	100	13
19	Sall	Hill Sal	*Shoerea robusta*	100	12
20	Sall	Hill Sal	*Shoerea robusta*	70	8
21	Sall	Hill Sal	*Shoerea robusta*	110	13

S.N.	Local Name	Common Name	Scientific Name	DBH(cm)	Height (approx.)
22	Sall	Hill Sal	*Shoerea robusta*	80	10
23	Sall	Hill Sal	*Shoerea robusta*	120	14
24	Sall	Hill Sal	*Shoerea robusta*	150	18
25	Sall	Hill Sal	*Shoerea robusta*	*100*	*12*
26	Sall	Hill Sal	*Shoerea robusta*	*200*	*20*
27	Sall	Hill Sal	*Shoerea robusta*	*120*	*14*
28	Sall	Hill Sal	*Shoerea robusta*	*120*	*15*
29	Sall	Hill Sal	*Shoerea robusta*	*80*	*11*
30	Sall	Hill Sal	*Shoerea robusta*	*140*	*16*
31	Sall	Hill Sal	*Shoerea robusta*	*120*	*15*
32	Sall	Hill Sal	*Shoerea robusta*	*100*	*13*
33	Sall	Hill Sal	*Shoerea robusta*	*120*	*13*
34	Sall	Hill Sal	*Shoerea robusta*	*120*	*14*
35	Sall	Hill Sal	*Shoerea robusta*	*140*	*16*
36	Sall	Hill Sal	*Shoerea robusta*	*80*	*12*
37	Sall	Hill Sal	*Shoerea robusta*	*120*	*16*
38	Sall	Hill Sal	*Shoerea robusta*	*120*	*14*
39	Sall	Hill Sal	*Shoerea robusta*	*140*	*16*
40	Chilaune		*Schima wallichii*	*20*	*5*
	Hill Sal-39, Chilaune-1				

***Forest Density**: total no of tree/area of the quadrate=(40/625)X10000 per Hector=640 /Hector*
***Dominant species:** Hill Sal= (39/40)100%=97.5*
***Crown coverage of the forest**: 50%*

c) Forest: Langur Pakha Co. Fo.
Location: Rabuwa, Lamidanda
G.P.S. 04-67450E, 30-16-750N **Altitude**: 510m

S.N.	Local Name	Common Name	Scientific Name	DBH(cm)	Heightt (approx.)
1	Sall	Sall Tree	*Shorea robusta*	120	14
2	Sall	Sall Tree	*Shorea robusta*	80	10
3	Sall	Sall Tree	*Shorea robusta*	60	8
4	Sall	Sall Tree	*Shorea robusta*	90	10
5	Sall	Sall Tree	*Shorea robusta*	30	5
6	Sall	Sall Tree	*Shorea robusta*	50	7
7	Sall	Sall Tree	*Shorea robusta*	60	8
8	Sall	Sall Tree	*Shorea robusta*	30	5
9	Sall	Sall Tree	*Shorea robusta*	40	5
10	Sall	Sall Tree	*Shorea robusta*	30	5
11	Sall	Sall Tree	*Shorea robusta*	50	5
12	Sall	Sall Tree	*Shorea robusta*	80	9
13	Sall	Sall Tree	*Shorea robusta*	120	14
14	Sall	Sall Tree	*Shorea robusta*	120	14
15	Sall	Sall Tree	*Shorea robusta*	120	12
16	Sall	Sall Tree	*Shorea robusta*	90	10
17	Sall	Sall Tree	*Shorea robusta*	30	5
18	Sall	Sall Tree	*Shorea robusta*	60	7
19	Sall	Sall Tree	*Shorea robusta*	90	10
20	Sall	Sall Tree	*Shorea robusta*	30	5
21	Sall	Sall Tree	*Shorea robusta*	80	9
22	Sall	Sall Tree	*Shorea robusta*	70	9
23	Sall	Sall Tree	*Shorea robusta*	90	11
24	Sall	Sall Tree	*Shorea robusta*	80	9
25	Sall	Sall Tree	*Shorea robusta*	70	9

S.N.	Local Name	Common Name	Scientific Name	DBH(cm)	Heightt (approx.)
26	Sall	Sall Tree	*Shorea robusta*	60	8
27	Sall	Sall Tree	*Shorea robusta*	65	9
28	Sall	Sall Tree	*Shorea robusta*	80	9
29	Sall	Sall Tree	*Shorea robusta*	90	10
30	Sall	Sall Tree	*Shorea robusta*	90	10
31	Sall	Sall Tree	*Shorea robusta*	80	10
32	Sall	Sall Tree	*Shorea robusta*	120	14
33	Sall	Sall Tree	*Shorea robusta*	90	11
34	Sall	Sall Tree	*Shorea robusta*	100	12
35	Sall	Sall Tree	*Shorea robusta*	100	12
36	Sall	Sall Tree	*Shorea robusta*	80	10
37	Sall	Sall Tree	*Shorea robusta*	90	11
38	Sall	Sall Tree	*Shorea robusta*	70	8
39	Sall	Sall Tree	*Shorea robusta*	80	10
40	Sall	Sall Tree	*Shorea robusta*	70	8
41	Sall	Sall Tree	*Shorea robusta*	90	11
42	Bhalayo	Chinese sunmac	*Rhus javanica*	30	5
43	Bhalayo	Chinese sunmac	*Rhus javanica*	30	5
44	Hade		*Lagerstroemia parviflora*	70	6
45	Hade		*Lagerstroemia parviflora*	80	6
Total	*Hill Sal-41,Hade-2, Bhalayo-1*				

Forest Density: total no of tree/area of the quadrat=(45/625) X10000 per Hector=720 trees/hector
Dominant species=Sal Tree=(41/45) X100%=91.11%
Crown coverage of the forest: 50%

3.5 Public Dependency on the Forest

The forests of the candidate project site provide a range of goods and services to the local communities. The local community extracts followings resources from the forest areas to support their livelihood.

- Fodder
- Firewood
- For thatch and other purposes as to make ceiling of local house mainly from Kachurani Co.Fo.
- Woods
- Vegetable like Ramenta of fern, Bankhu etc.
- Medicine from tree like Khirro, Dabdabey etc.

3.6 Floral Species of the Conservation Significance

Of the recorded floral species only 3 species have been categorized under the protection lists of the government of Nepal. However, none of the floral species have been listed in the IUCN red list and CITES. The table below presents the list of the protected species.

S.N.	Local Name	Common Name	Scientific Name	Status			Sources		
				IUCN	CITES	GON	Site survey	Hearing survey	Literature survey
1	Khayer	Cuth tree	*Acacia catechu*			P		Hearing at Jyamire, Sanghutar	
2	Simal	Silk cotton tree	*Bombax ceiba*			P		Hearing at Jyamire, Sanghutar	
3	Sall	Sall tree	*Sorea robusta*			P	Confirmed at site		

***IUCN Red List Categories**: Extinct (EX), Extinct In the Wild (EW), Critically Endangered (CR), Endangered (EN), Vulnerable (VU), Near Threatened (NT)*

***GOV Categories**: P Protected by legislation*

***CITES Categories**: I -Appendix I (are species that are threatened with extinction and are or may be affected by trade), II - Appendix II (are species that are not necessarily threatened with extinction, but may become so unless trade in specimens of such species is subject to strict regulation in order to avoid utilization incompatible with the survival of the species in the wild), and III - Appendix III (are species that are listed after one member country has asked other CITES Parties for assistance in controlling trade in a species)*

4 FAUNAL STUDY (WILDLIFE)

Information on the wildlife of the candidate project site is scarce in the published literatures. It is therefore site investigations are conducted to gather information through direct observation and the participatory methods with the local communities and the key informants. The findings of the filed investigations are presented in section hereunder.

4.1 Wildlife Diversity

Information on wildlife diversity is gathered through direct observation and participatory methods which included focus group discussion with the local communities and key informant surveys.

a) Mammals

A total of 24 mammalian species were recorded from the focus group discussion and key informant surveys. Of the total reported species 5 mammalian species were directly observed by the field biological team. The details of the mammalian species and habitat types are presented in the table below.

S.N.	Consultation	Observed	Common Name	Scientific Name
1	Lokharke(dhwanse)	*	Irrawaddy Squirrel	*Callosciurus pygerythrus*
2	Jackal		Golden Jackal	*Canis aureus*
3	Banbiralo		Wild cat	*Felis chaus*
4	Lokharke (dharke)		Northen palm Squirel	*Funambulus pennanti*
5	Nyauri Muso	*	Common mongoose	*Herpetes edwardsi*
6	Bhede Bagh		Hyena	*Hyena hynea*
7	Udne Lokharke		Particolored flying sqirel	*Hylopetes alboniger*
8	Sara(dumsi)		Porcupine	*Hystrix indica*
9	Pakha Ott		Common otter	*Lutra lutra*
10	Pani Ot		Smooth coated otter	*Lutra perspicillata*
11	Pahare Bandar		Assam Macaque	*Macaca assamensis*
12	Rato Bandar	*	Rhesus Monkey	*Macaca mulata*
13	Malsapro		Yellow throated martin	*Martef Flabigula*
14	Ban Chamero		Small bent wing bat	*Miniopterus pusillus*
15	Ratuwa		Barking Deer	*Muntiacus munjak*
16	Dukure Muso		Xeastern House Mouse	*Mus musculus*
17	Ghoral		Goral	*Naemorhed goral*
18	Kharayo		Rabit	Oryctolagus cuniculus
19	Chituwa		Common leopard	*Panthera pardus*
20	Ghar Chamero	*	Least Pipistrelle	*Pipistrellus tenuis*
21	Langur(Guna)	*	Hanuman langur	*Presbytus entelus*
22	Chhuchundro		Ground Shrew	*Soriculus sps.*
23	Bandel		Wild Bore	*Sus scroffa*
24	Phyauro		Bengal fox	*Vulpus bengalensis*

b) Birds

A total of 51 bird species are reported by the local communities and key informants. Of the total reported species 24 species are directly observed by the field biological team. Table below presents list of the reported and observed species in the candidate project influence area.

S.N.	Consultation	Observed	Common Name	Scientific Name
1	Sari	*	Common maina	*Acredotheres tristis*
2	Chuinya		Upland Pipit	*Anthus Sylvanus*
3	Vudrung (Huchil)		Great horned owl	*Bubo bubo*
4	Oolloo		Owl	*Bubo zeylonensis*
5	Seto Bakulla	*	Cattle egret	*Bubulcus ibis*
6	Petkaile Koili		Plaintive Cuckoo	*Cacomantis merulinus*
7	Kaliz		Chir pheasant	*Catreus wallichii*
8		*	Orange-bellied Leafbird	*Chloropsis hardwickii*
9	Hile Gidha	*	Wooly-necked stork	*Ciconia episcopus*
10	Dhobi Chara	*	Oriental-magpi Robin	*Copsychus saularis*
11	Kalo Kag	*	Jungle Crow	*Corvus macrorhybchos*
12	Kag (house)	*	House Crow	*Corvus splendens*
13	Bhuputi Dove	*	Mountain emperial pigeon	*Dacula badia*
14	Kokale		Tree pie	*Dendrocitta vagabunda*
15		*	Spangled Drongo	*Dicrurus hottentottus*
16	Kalo Chibe	*	Black Drongo	*Dicrurus macrocercus*
17	Chiute Chara		Black-backed Forktail	*Enicurus immaculatus*
18	Kalo Titra	*	Black francolin	*Francolinus francolinus*
19	Luinche		Jungle fawl	*Gallus gallus*
20	Toriganda	*	White crested laughingthrus	*Garrulax leucolophus*
21		*	Long-tailed Sibia	*Heterophasia picaoides*
22	Bhadrayu	*	Long-tailed Shrike	*Lanius schach*
23	Kotero	*	Scaly-breasted Munia	*Lonchura sps.*
24	Chhirbire Matikore	*	Crested kingfisher	*Megaceryle lugubris*
25	Nyauli	*	Blue-eared barbet	*Megalaima australis*
26	Kuturke	*	Goldenthroted barbet	*Megalaima franklinii*
27	Chil	*	Black Kite	*Milvus migrans*
28	Kalchoda	*	Blue whistling thrus	*Myophonus caeruleus*
29	Seto Gidha		Egyptian vulture	Neophron Percnopterus
30	Sunchari		Golden Oriole	Oriolus oriolus
31	Vangero	*	House Sparrow	*Passer domesticus*
32	Jungali Vagero		Tree sparrow	Passer montanus
33	Mujur		Indian peafowl	*Pavo cristatus*
34	Rani chari		Scarlet minivet	*Pericrocotus flammeus*
35	Kalo Jalewa		Great Cormorant	*Phalacrocorax carbo*
36	Fisto		Leaf warbler	Phylloscopus schwarzi
37	Thulo Kathfora	*	Greyheaded woodpecker	*Picus canus*
38	Seto Jalewa		Great-crested Gerbe	*Podiceps cristatus*
39	Selo Jalewa		Great Creasted Grebe	*Podiceps cristatus*
40	Kalo Jalewa		Darter	*Podiceps melanogaster*
41	Suga	*	Rose ringed parakeet	Psittacula krameri
42	Kalo Jureli	*	Red Vented Bulbul	*Pycnonotus cafer*
43	Khairo Jureli	*	Himalayan bulbul	*Pycnonotus leucogenys*
44		*	White-throated Fantail	*Rhipidura albicollis*
45		*	Common stonechat	S. toquota

S.N.	Consultation	Observed	Common Name	Scientific Name
46	Tame Dhukur	*	Spotted dove	*Streptopelia chinensis*
47	Kalo Gidha		Black vulture	Torgos calvus
48	Haleso	*	Yellowfooted greenp pigeon	*Treron phoenicoptera*
49	Fafare Chara		Hoopoe	*Upupa epops*
50	Lampuchhre	*	Redbilled Blue Magpi	*Urocissa erythrorynca*
51	Hutityau		Grey-headed lapwing	*Vanellus duvaucelii*

c) Herpetofauna

The key informants and the local community reported a total of 17 herpetofauna species from the reservoir area. Of the total reported 5 of the species are observed by the field study team. Details of the herpetofauna species and their habitat types are presented in the table below.

S.N.	Consultation	Observed	Common Name	Scientific Name
1	Tiris Sarpa			*Amphisema stolata*
2	Khasre Vyaguto	*	Toad	*Bufo melanostictus*
3	Chheparo		Callotes	*Calotes versicolor*
4	Uduwa Sarpa		Flying snake	*Chrysopelia paradise*
5	Batasay Sarpa			*Dendrelethis tristis*
6	Pate Girgiti		Forest agma	*Japalura tricarnata*
7	Goraya Sarpa			*Lycodon aulicus*
8	Valemungro	*		*Mabuia carinata*
9	Sepe Sarpa		Cobra	*Naja naja*
10	Pani Sarpa	*		*Natrix piscator*
11	Dhamil Sarpa	*	Rat snake	*Ptyas mucosus*
12	Paha (Pahenlo pate)		Bull frog	*Rana carrasus*
13	Vyaguto	*	Frog	*Rana tigrina*
14	Hariyokano Sarpa		Green pit viper	*Trimeresurus albolabris*
15	Sun Gohoro		Yellow Monitor	*Varanus flevescens*
16	Gohoro		Monitor lizard	*Varanus sps*
17	Chichinde Sarpa			*Xenochrophis sps*

4.2 Habitat Type in the Reservoir Area

The wildlife habitat of the reservoir area has the following characteristics.

- Mostly the forests are sparsely distributed and open type.
- Frequently the sites covered by forests are fragmented by human settlements and cultivation.
- Such type of forest is suitable habitat for monkeys such as Macaca mulata and Macaca assamensis.
- Fragmented by different settlements and fields.
- Degraded and disturbed by fodder collection and cattle grazing.
- Mostly the habitat is sparse and does not seems suitable for leopard or other tigers but people say there is Chituwa Bagh (Panthera pardus) that eats goats and sometimes calves; as in Raniban of Silouri and Batase Ban of near Tallo Salle of Jyamire V.D.C.

4.3 Migratory Corridor

The area is seasonally used as feeding habitat by the wildlife of the area and is not reported to be a migratory corridor and shows following characteristics.

- From the consultation it was found that Dudh Koshi is the feeding place for the Jalewa in winter season generally when water becomes clean.
- According to locals the Jalewa are white and Black type i.e. white Jalewa is Podiceps cristatus and black Jalewa is *Podiceps melanogaster*.

4.4 Wild Animals of Conservation Significance

The reported wildlife of the candidate project site are cross checked with the protected wildlife lists of the government of Nepal, IUCN red book and the CITES Appendices. The lists of the wildlife which fall in the protection category of the government of Nepal, IUCN red book and the CITES Appendices are presented in the sections below.

a) Mammals

Of the reported species of mammal, 9 of the species are listed under the protection category of either government of Nepal or IUCN red list or under CITES Appendices. Of the recorded species 1 is listed under government of Nepal protection list, 6 under IUCN red list and 6 under CITES Appendices. Table below presents the species and thier protection category under various protection lists.

S.N.	Local Name	Common Name	Scientific Name	Status			Sources		
				IUCN	CITES	GON	Site survey	Hearing survey	Literature survey
1	Jackal	Golden Jackal	Canis aureus		III		Hearing at Jyamire, Sanghutar		
2	Nyauri Muso	Common mongoose	Herpetes edwardsi		III	P	Hearing at Jyamire, Sanghutar		
3	Bhede Bagh	Hyena	Hyena hynea	NT			Hearing at Jyamire, Sanghutar		
4	Pakha Ott	Common otter	Lutra lutra	NT	I		Hearing at Jyamire, Sanghutar		
5	Pani Ot	Smooth coated otter	Lutra perspicillata	VU			Hearing at Jyamire, Sanghutar		
6	Pahare Bandar	Assam Macaque	Macaca assamensis	NT			Hearing at Jyamire, Sanghutar		
7	Ghoral	Goral	Naemorhed goral	NT	I		Hearing at Jyamire, Sanghutar		
8	Chituwa	Common leopard	Panthera pardus	NT	I		Hearing at Jyamire, Sanghutar		
9	Phyauro	Bengal fox	Vulpus bengalensis		III		Hearing at Jyamire, Sanghutar		

***IUCN Red List Categories**: Extinct (EX), Extinct In the Wild (EW), Critically Endangered (CR), Endangered (EN), Vulnerable (VU), Near Threatened (NT)*

***GOV Categories**: P Protected by legislation*

***CITES Categories**: I -Appendix I (are species that are threatened with extinction and are or may be affected by trade), II - Appendix II (are species that are not necessarily threatened with extinction, but may become so unless trade in specimens of such species is subject to strict regulation in order to avoid utilization incompatible with the survival of the species in the wild), and III - Appendix III (are species that are listed after one member country has asked other CITES Parties for assistance in controlling trade in a species)*

b) Birds

Of the recorded avian species 3 are listed under the protection category of government of Nepal, IUCN red list and in the CITES Appendices. Table below presents the details of the protected species and the protection category as per the government of Nepal and CITES Appendices.

S.N.	Local Name	Common Name	Scientific Name	Status			Sources		
				IUCN	CITES	GON	Site survey	Hearing survey	Literature survey
1	Kaliz	Chir pheasant	Catreus wallichii		I	P		Hearing at Jyamire, Sanghutar	
2	Kotero	Scaly-breasted Munia	Lonchura sps.		II		Confirmed at site		
3	Seto Gidha	Egyptian vulture	Neophron Percnopterus	EN				Hearing at Jyamire, Sanghutar	

***IUCN Red List Categories**: Extinct (EX), Extinct In the Wild (EW), Critically Endangered (CR), Endangered (EN), Vulnerable (VU), Near Threatened (NT)*

***GOV Categories**: P Protected by legislation*

***CITES Categories**: I -Appendix I (are species that are threatened with extinction and are or may be affected by trade), II - Appendix II (are species that are not necessarily threatened with extinction, but may become so unless trade in specimens of such species is subject to strict regulation in order to avoid utilization incompatible with the survival of the species in the wild), and III - Appendix III (are species that are listed after one member country has asked other CITES Parties for assistance in controlling trade in a species)*

c) Herpetofauna

Five of the herpetofauna species out of the recorded species are listed as protection category species of CITES Appendices. Table below presents the details of the protection category under various protection lists.

S.N.	Local Name	Common Name	Scientific Name	Status			Sources		
				IUCN	CITES	GON	Site survey	Hearing survey	Literature survey
1	Sepe Sarpa	Cobra	Naja naja		II			Hearing at Jyamire, Sanghutar	
2	Dhamil Sarpa	Rat snake	Ptyas mucosus		II		Confirmed at site	Hearing at Jyamire, Sanghutar	
3	Sun Gohoro	Yellow Monitor	Varanus flevescens		I	P		Hearing at Jyamire, Sanghutar	
4	Gohoro	Monitor lizard	Varanus sps		II			Hearing at Jyamire, Sanghutar	
5	Chichinde Sarpa		Xenochrophis sps		III			Hearing at Jyamire, Sanghutar	

***IUCN Red List Categories**: Extinct (EX), Extinct In the Wild (EW), Critically Endangered (CR), Endangered (EN), Vulnerable (VU), Near Threatened (NT)*

***GOV Categories**: P Protected by legislation*

***CITES Categories**: I -Appendix I (are species that are threatened with extinction and are or may be affected by trade), II - Appendix II (are species that are not necessarily threatened with extinction, but may become so unless trade in specimens of such species is subject to strict regulation in order to avoid utilization incompatible with the survival of the species in the wild), and III - Appendix III (are species that are listed after one member country has asked other CITES Parties for assistance in controlling trade in a species)*

5 FISHERY STUDY

There is scanty information in the fish diversity, fishermen, fish market, and cost of fish in the candidate project site at the central and district level offices. To fill the data gap fish related information was gathered from the field surveys using a checklist. The fish survey is based on the participatory method and key informant survey methods along the influence area of the candidate project. The findings of the field survey are presented in the sections below.

5.1 Fishermen and their Occupational / Social / Economic Status and Fish Market, Availabilit and Cost

Participatory and key informant interviews reported nearly 20 occupational, 71 part time fishermen in the limits of the reservoir area. While all the members of communities' practice occasional fishing. Majority of the fishermen belong to Majhi, Magar and Rai ethnic group with a low social and economic status among the other communities.

About 50% of the fish caught by the fishermen is sold in the fish market, while rest is consumed by the fishermen family. There are altogether 7 fish markets in the nearby areas. Every day about 5 to 15 kg of fish is sold in each of the fish markets. Average cost of the fish in the market varies between 250 rupees.

Table below presents the details of information on the fishermen, their fishing status, economic and social status, fish market and availability of fish in the fish market and the average cost of the fish in the different parts of the reservoir area of the candidate project.

a) Village/Tole: Majhigau, Lamidanda(Dudh Koshi) **Date:** 11/05/2069 B.S.
Name of the respondent: NIR KUMAR SHRESTHA **Age**: 54

Fishermen

Presence of fisherman in the village						Yes
If yes no. of fishermen						5
Fishing Type	Occupational		Part time		Occasional	
	No.	Ethnicity	No.	Ethnicity	No.	Ethnicity
	5	Majhi, Vujel			All	Chheri
Status	Social Status			Economic Status		
	Low*	Medium*	High*	Low	Medium	High
	Majhi, Vujel		-		Majhi, Vujel	-

Low=No jobs, No education, Medium*=Education but no jobs, High*=Both Education & jobs*
Low=Not enough for hand to mouth, Medium=Fairly enough to hand to mouth, High=Surplus and save or sell

Fish Market, Fish Availability and Cost

Name of the Market/s	Daily availability of the fish in that market		Average cost of fish Rs/Kg
	Daily availability	Amount Kg/day	
Rabuwa Bazar	Except rainy season	10	250 Fresh
Lamidanda Bazar	No	N/A	250 Fresh

NOTE:

- *After consultation it was found that the Majhi community is professional fisher man community traditionally but in the recent years they are more dependent on agriculture.*
- *Socially their status seems low, but due to remittance earnings in the recent years their economic status is relatively better. At least one member from one family is working out in the foreign country.*
- *It is important to note that just downstream of dam site i.e.in Valdhunga there are also presence of Majhi community. About 10 members of the community are professional fishermen.*

b) Village/Tole: Bhadoure-7, Dovantar,(Thotne Khola) **Date:**11/05/2069 B.S.
Name of the respondent: Nir Bahadur Magar **Age**: 50

Fishermen

Presence of fisherman in the village						Yes
If yes no. of fishermen						3
Fishing Type	Occupational		Part time		Occasional	
	No.	Ethnicity	No.	Ethnicity	No.	Ethnicity
	X	X	3	Magar	X	X
Status	Social Status			Economic Status		
	Low*	Medium*	High*	Low	Medium	High
	X	Magar	X	X	Magar	X

Low= No jobs, No education, Medium*=Education but no jobs, High*= Both Education & jobs*
Low= not enough for hand to mouth, Medium= fairly enough to hand to mouth, High= Surplus and save or sell

Fish Market, Fish Availability and Cost

Name of the Market/s	Daily availability of the fish in that market		Average cost of fish Rs/Kg
	Daily availability	Amount Kg/day	
Rabuwa Bazar	Except rainy season	10	250 Fresh

c) Village/Tole: Tuintar,Necha Betghari (Dudh Koshi **Date:**15/05/2069 B.S.
Name of the respondent: Man Dhoj Rai **Age**: 63

Fishermen

Presence of fisherman in the village						Yes
If yes no. of fishermen						6
Fishing Type	Occupational		Part time		Occasional	
	No.	Ethnicity	No.	Ethnicity	No.	Ethnicity
	X	X	6	Rai	All	Rai,Chhetri
Status	Social Status			Economic Status		
	Low*	Medium*	High*	Low	Medium	High
	X	Rai	X	X	Rai	x

Low=No jobs, No education, Medium*=Education but no jobs, High*=Both Education & jobs*
Low=Not enough for hand to mouth, Medium=Fairly enough to hand to mouth, High=Surplus and save or sell

Fish Market, Fish Availability and Cost

Name of the Market/s	Daily availability of the fish in that market		Average cost of fish Rs/Kg
	Daily availability	Amount Kg/day	
Tuintar	Yes	20	250 Fresh
Bihibare Bazar	Only in winter	5	250 Fresh

d) Village/Tole: Majhi Tar, Kuivir (Dudh Koshi) **Date:** 17/05/2069 B.S.
Name of the respondent: Mithu Kumar Shretha **Age**: 45

Fishermen

Presence of fisherman in the village						Yes
If yes no. of fishermen						35
Fishing Type	Occupational		Part time		Occasional	
	No.	Ethnicity	No.	Ethnicity	No.	Ethnicity
	X	X	35	Majhi	All	Chetri
Status	Social Status			Economic Status		
	Low*	Medium*	High*	Low	Medium	High
	Majhi	X	X	Majhi	Chetri	x

Low=No jobs, No education, Medium*=Education but no jobs, High*=Both Education & jobs*
Low=Not enough for hand to mouth, Medium=Fairly enough to hand to mouth, High=Surplus and save or sell

Fish Market, Fish Availability and Cost

Name of the Market/s	Daily availability of the fish in that market		Average cost of fish Rs/Kg
	Daily availability	Amount Kg/day	
Khani Vanjyang	Only in winter	30	250 Fresh

e) Village/Tole: Gothpani, Dumre Dharapani (Dudh Koshi) **Date:**17/05/2069 B.S.
Name of the respondent: Purna Bahadur Tamang **Age**: 50

Fishermen

Presence of fisherman in the village						Yes
If yes no. of fishermen						10
Fishing Type	Occupational		Part time		Occasional	
	No.	Ethnicity	No.	Ethnicity	No.	Ethnicity
	X	X	10	Tamang	X	X
Status	Social Status			Economic Status		
	Low*	Medium*	High*	Low	Medium	High
	X	Tamang	X	X	Tamang	x

Low=No jobs, No education, Medium*=Education but no jobs, High*=Both Education & jobs*
Low=Not enough for hand to mouth, Medium=Fairly enough to hand to mouth, High=Surplus and save or sell

Fish Market, Fish Availability and Cost

Name of the Market/s	Daily availability of the fish in that market		Average cost of fish Rs/Kg
	Daily availability	Amount Kg/day	
Local Village	No	N/A	200 Fresh
Aiselukharka (if large amount cought)	No	N/A	250 Fresh

f) Village / Tole: Vorleni, Dumre Dharapani(Dudh Koshi) **Date:**17/05/2069 B.S.
Name of the respondent: Voj Raj Basnet **Age**: 47

Fishermen

Presence of fisherman in the village						Yes
If yes no. of fishermen						15
Fishing Type	Occupational		Part time		Occasional	
	No.	Ethnicity	No.	Ethnicity	No.	Ethnicity
	X	X	15	Magar,Chhetri	X	X
Status	Social Status			Economic Status		
	Low*	Medium*	High*	Low	Medium	High
	X	Magar,Chhetri	X	X	Magar,Chhetri	x

Low=No jobs, No education, Medium*=Education but no jobs, High*=Both Education & jobs*
Low=Not enough for hand to mouth, Medium=Fairly enough to hand to mouth, High=Surplus and save or sell

Fish Market, Fish Availability and Cost

Name of the Market/s	Daily availability of the fish in that market		Average cost of fish Rs/Kg
	Daily availability	Amount Kg/day	
Rabuwa	Except rainy season	10	250 Fresh
Local village	No	N/A	200 Fresh

g) Village/Tole: Tilketar Khoria, Lamidanda (Rawa Khola) **Date:** 20/05/2069 B.S.
Name of the respondent: Govinda Thapa Magar **Age**: 41

Fishermen

Presence of fisherman in the village						Yes
If yes no. of fishermen						15
Fishing Type	occupational		Part time		Occasional	
	No.	Ethnicity	No.	Ethnicity	No.	Ethnicity
	15	Majhi,Vujel	X	X	X	X
Status	Social Status			Economic Status		
	Low*	Medium*	High*	Low	Medium	High
	X	Majhi, Vujel	X	X	Majhi, Vujel	x

Low=No jobs, No education, Medium*=Education but no jobs, High*=Both Education & jobs*
Low=Not enough for hand to mouth, Medium=Fairly enough to hand to mouth, High=Surplus and save or sell

Fish Market, Fish Availability and Cost

Name of the Market /s	Daily availability of the fish in that market		Average cost of fish Rs/Kg
	Daily availability	Amount Kg/day	
Rabuwa	In season only	10	250 Fresh
Lamidanda	Only in winter	5	250 Fresh

h) Village/Tole: Kharpa Tar,Dumre Dharapani(Rawa Khola) **Date:**19/05/2069 B.S.
Name of the respondent: Bhadra Bahadur Niroula **Age**: 77

Fishermen

Presence of fisherman in the village						Yes
If yes no. of fishermen						2
Fishing Type	occupational		Part time		Occasional	
	No.	Ethnicity	No.	Ethnicity	No.	Ethnicity
	X	X	2	Magar	All	Chhetri
Status	Social Status			Economic Status		
	Low*	Medium*	High*	Low	Medium	High
	X	Magar	X	X	Magar	x

Low=No jobs, No education, Medium*=Education but no jobs, High*=Both Education & jobs*
Low=Not enough for hand to mouth, Medium=Fairly enough to hand to mouth, High=Surplus and save or sell

Fish Market, Fish Availability and Cost

Name of the Market /s	Daily availability of the fish in that market		Average cost of fish Rs/Kg
	Daily availability	Amount Kg/day	
Rabuwa Bazar	Only in season	10	250 Fresh

5.2 Fishing Season, Fish Catch, and Use of Caught Fish

Fishing in the river is carried out during the pre-monsoon and post monsoon seasons. Normally in the cold winter months (December - February) and monsoon months (June - September) fishing by the local fishermen is a rare activity. On an average daily catch of the fish by the occupational fishermen ranges between 2 kg with a maximum of 20kg. Nearly 50% of the fish caught is sold in the nearby fish market. On an average the part time fishermen earn about 20,000 rupees annually. According to the local fishermen, the fish population in the candidate project sites is declining over the years due to illegal fishing practices.

The tables below present the details of the fishing season, fish catch, types of fish available, annual income of the fishermen etc. based on the key informant survey in different location of the candidate project sites.

a) Location: Reservoir area **Date: 11/05/2069 B.S.**
Name of the fisherman: Damar Bahadur Magar **Age: 49** **Address:** Bhadoure-7, Okhaldhuga

Fishing detail	Fishing season:	All seasons but Shrawan and Vadra (July – Sep) is difficult			
	Fishing days/week:	7 days/week			
	Maximum catch/day:	20 kg			
	Minimum catch/day:	0 kg			
	Average catch/day:	2 kg			
using way	Surplus from home for sell	At home	Partly	Average cost	Income last year
		In market	2 Kg	Rs.250/kg	25,000

b) Location: Reservoir area **Date: 15/05/2069 B.S.**
Name of the fisherman: Man dhoj Rai **Age:** 63 **Address:** Tuintar

Fishing detail	Fishing season:	Rainy season less otherwise all season			
	Fishing days/week:	6 days/week			
	Maximum catch/day:	10 kg			
	Minimum catch/day:	0 kg			
	Average catch/day:	3 kg			
using way	Surplus from home for sell	At home	1 Kg	Average cost	Income last year
		In market	2 Kg	250 Fresh	25,000 to 30,000

c) Location: Reservoir area **Date: 17/05/2069 B.S.**
Name of the fisherman: Man Bahadur Majhi **Age:** 44 **Address:** Majhitar, Kuivir

Fishing detail	Fishing season:	All season but I rainy less sue to paddy field work			
	Fishing days/week:	5 days/week			
	Maximum catch/day:	3 kg			
	Minimum catch/day:	0 kg			
	Average catch/day:	1 kg			
using way	All consumed	At home	-	Average cost	Income last year
		In market	1Kg	250 Fresh	15,000

Name of fish	**Found in abundance**	**Trend of fish availability**		
		Decreasing	**Same as before**	**Increasing**
Asala (*Schizothorax progastus*), Fagite (*Barilius bendelisis)*, Buduno (*Chrossochelius lattius*), Sahar (*Tor tor*), Jalkapur (*Clupisoma garua*), Katle (*Neolirocneilus hexagonolepis*), Kande (*Pseudochenensis sulcatus*)	Asala, Katle, Kande	*		
		Increasing number of fisherman Increasing means of fishing as gillnet, fishing net, hook, electric and etc. Due to flood stream became more sharp and swept away most of huge stone; place to hide for fish		

5.3 Fish Diversity

A total of 24 fish species is reported by the local fishermen during the key informant survey. The lists of the fish species reported in the candidate project site are presented in the table below.

S.N.	Local Name	Common Name	Scientific Name
1	Panpa	Copper Mahaseer	*Acrosocheilus hexagonolepis*
2	Bam		*Anguila bengalensis*
3	Gonch		*Bagarius bagarius*
4	Taate		*Barilius barna*
5	Fagite		*Barilius bendelisis*
6	Chale		*Barillius schacra*

S.N.	Local Name	Common Name	Scientific Name
7	Baghi		*Botia lohachata*
8	Hile		*Channa spp.*
9	Buduno	Stone Carp	*Chrossochelius latius*
10	Lohari		*Garra annandalei*
11	Kavre		*Glyptothorax cavia*
12	Dhami		*Glyptothorax alaknandi*
13	Singhi		*Heteropneustes fossilis*
14	Gardi		*Labeo dyochailus*
15	Kande		*Pseudochenesis sulcatus*
16	Tite		*Psilorhinchus pseudechenensis*
17	Sidre		*Puntius ticto*
18	Chuche Asala	Point nosed snow trout	*Schizothorax progastus*
19	Buchche Asala		*Schizothox plagiostomus*
20	Sahar		*Tor tor*
21	Jalkapur		
22	Katle		
23	Nakata		
24	Therd		

5.4 List of Fish Species of Conservation Significance

Of the 24 reported fish species, 3 of the fish species are listed in the IUCN red list. Table below presents the list of the fish species of conservation significance.

S.N.	Local Name	Common Name	Scientific Name	Status			Sources		
				IUCN	CITES	GON	Site survey	Hearing survey	Literature survey
1	Panpa	Copper Mahaseer	Acrosocheilus/ Neolissochilus hexagonolepis	NT				Hearing at Bhadoure, Majhitar,	
2	Gonch		Bagarius bagarius	NT				Hearing at Bhadoure, Majhitar	
3	Sahar		Tor tor	NT				Hearing at Bhadoure, Majhitar	

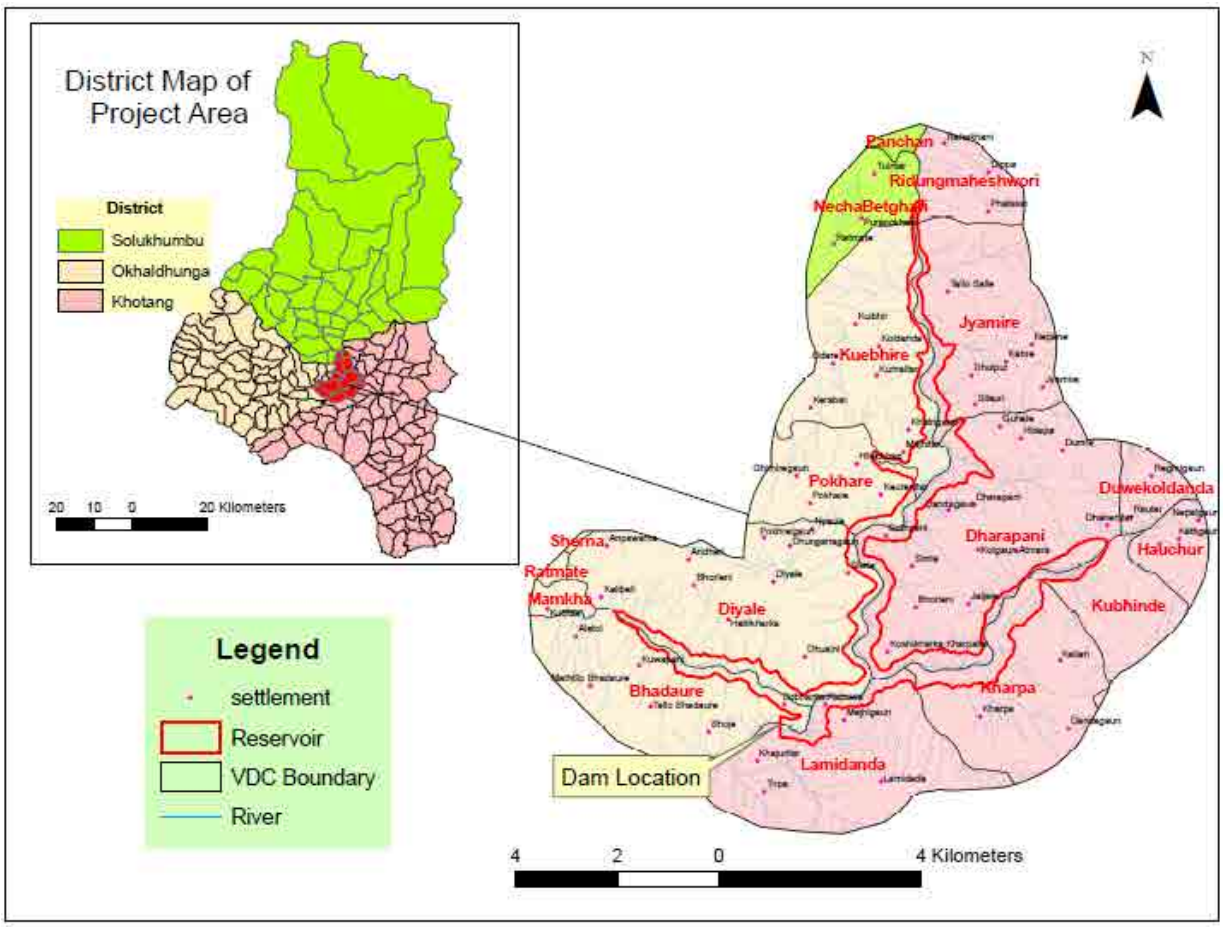
***IUCN Red List Categories**: Extinct (EX), Extinct In the Wild (EW), Critically Endangered (CR), Endangered (EN), Vulnerable (VU), Near Threatened (NT)*

***GOV Categories**: P Protected by legislation*

***CITES Categories**: I -Appendix I (are species that are threatened with extinction and are or may be affected by trade), II - Appendix II (are species that are not necessarily threatened with extinction, but may become so unless trade in specimens of such species is subject to strict regulation in order to avoid utilization incompatible with the survival of the species in the wild), and III - Appendix III (are species that are listed after one member country has asked other CITES Parties for assistance in controlling trade in a species)*

6 Topographic Map and Satellite Imagery Study

6.1 Project Location



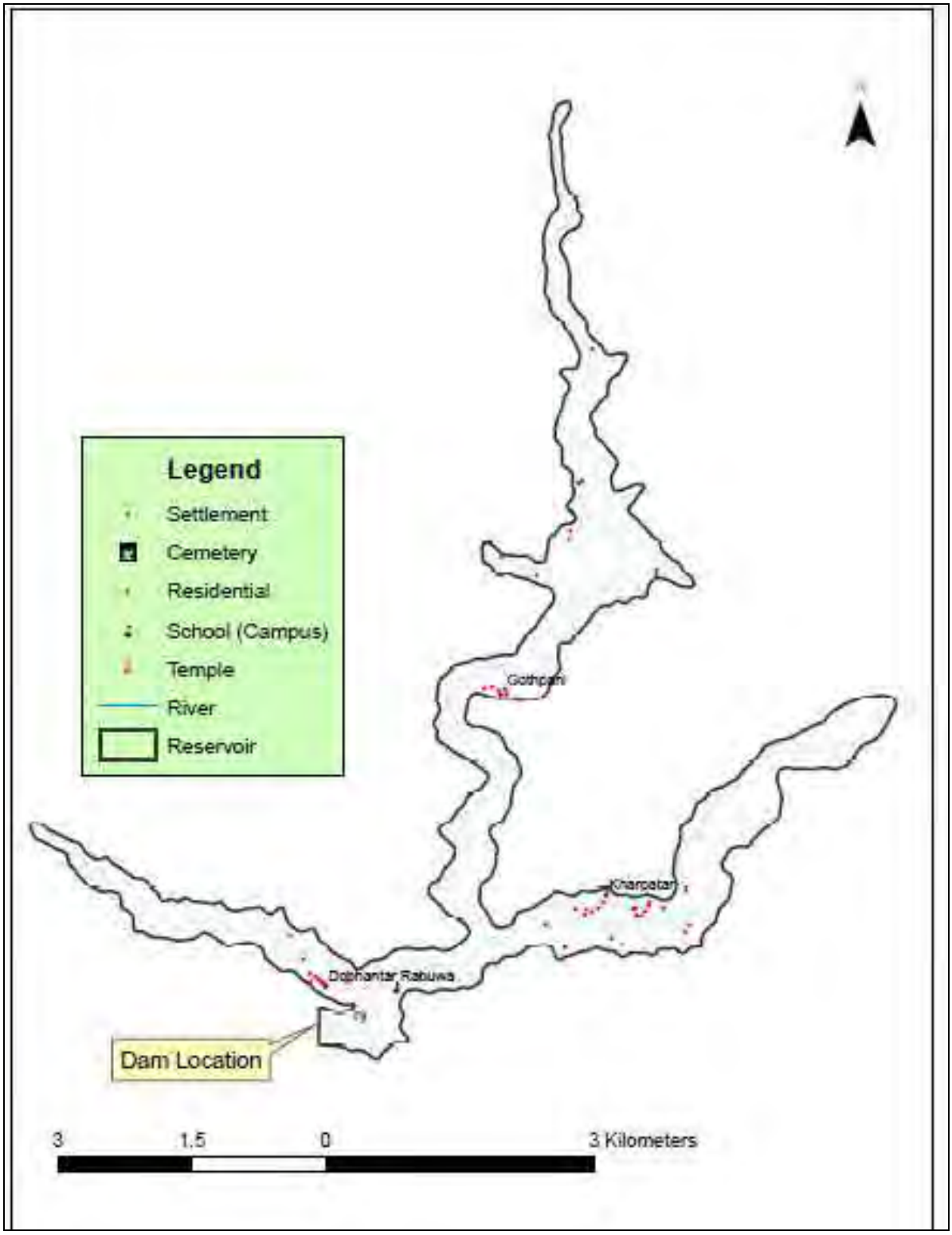
6.2 Topographic Maps

For this study, topographical maps of the scale of 1:25000 prepared by the Government of Nepal, Survey Department (1996) has been used for the analysis of land cover, and built structures, after digitizing. All data used for the topographic map study were projected to the Universal Transverse Mercator (UTM) projection system that is World Geodetic System 1984 for the analysis of topographic maps.

The analysis results are presented in the table and maps below.

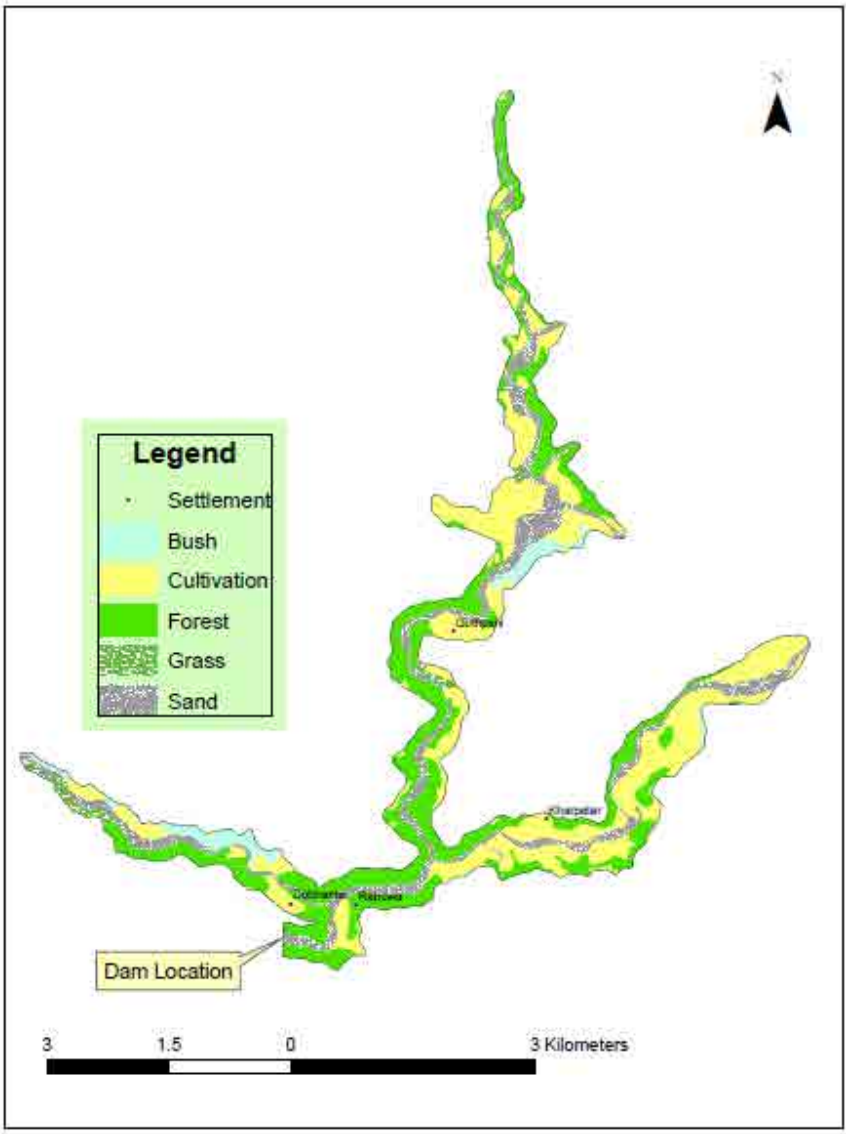
6.2.1 Built Structures

Nos. of building as per the Topographic maps	52



6.2.2 Land Use

S.N.	Land Use Class	Land Use Topographic Maps (1996), Km^2	Percentage
1	FOREST	3.806411	34.5409
2	BUSH	0.477755	4.3353
3	SAND	2.411886	21.8864
4	CULTIVATED	4.175245	37.8879
5	CLIFF		
6	WATER		
7	GRASS LAND	0.148709	1.3494
8	BARREN LAND		
	TOTAL	**11.02**	**100**



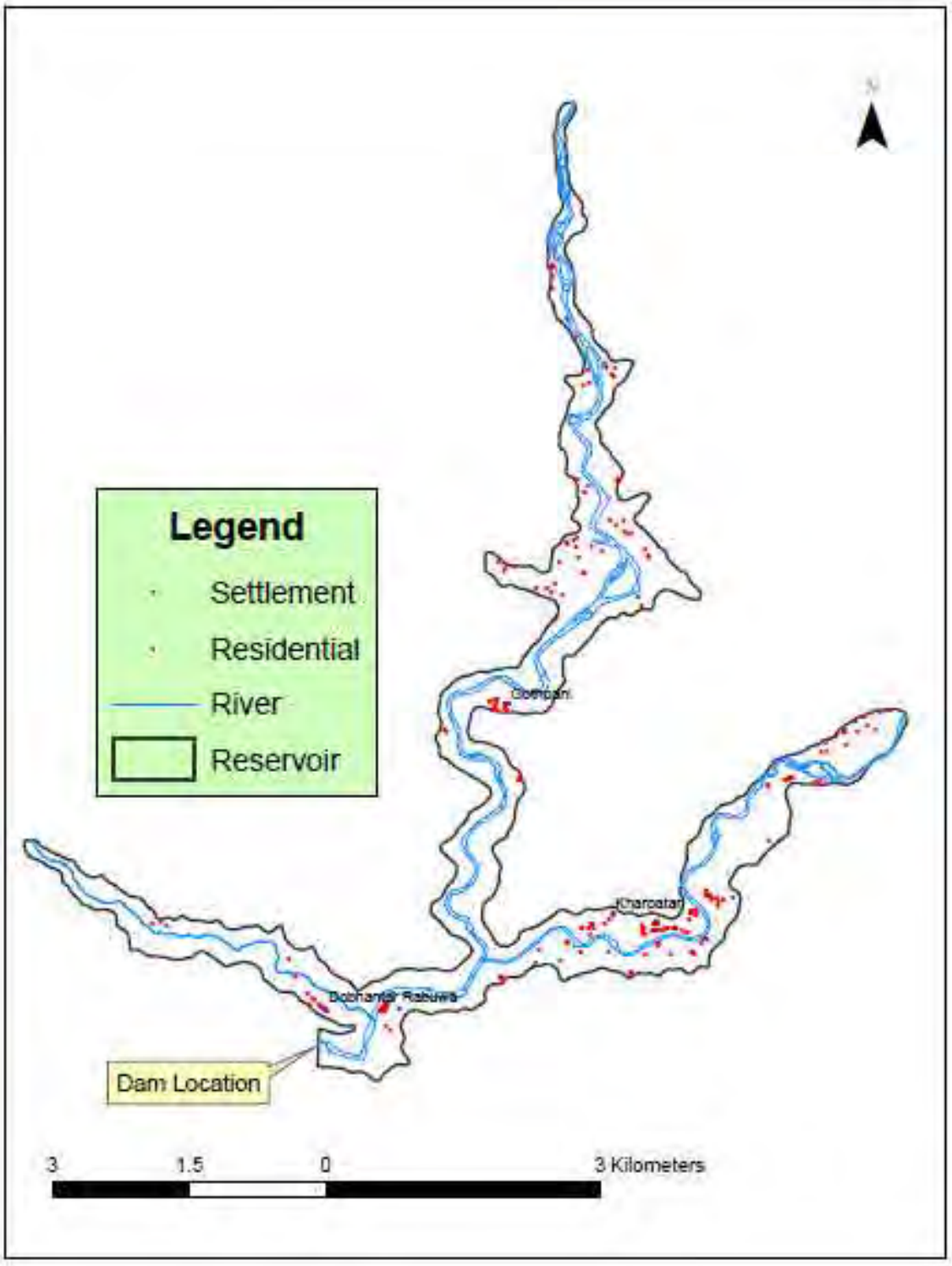
6.3 Satellite Image Maps

The Arc GIS 9.3 has been used for the analysis of image. Quickbird satellite image of 2012 is used for the land use and other parameters such as built structures, road networks, bridges etc. analysis of the area.

The analysis results are presented in tables and Map below.

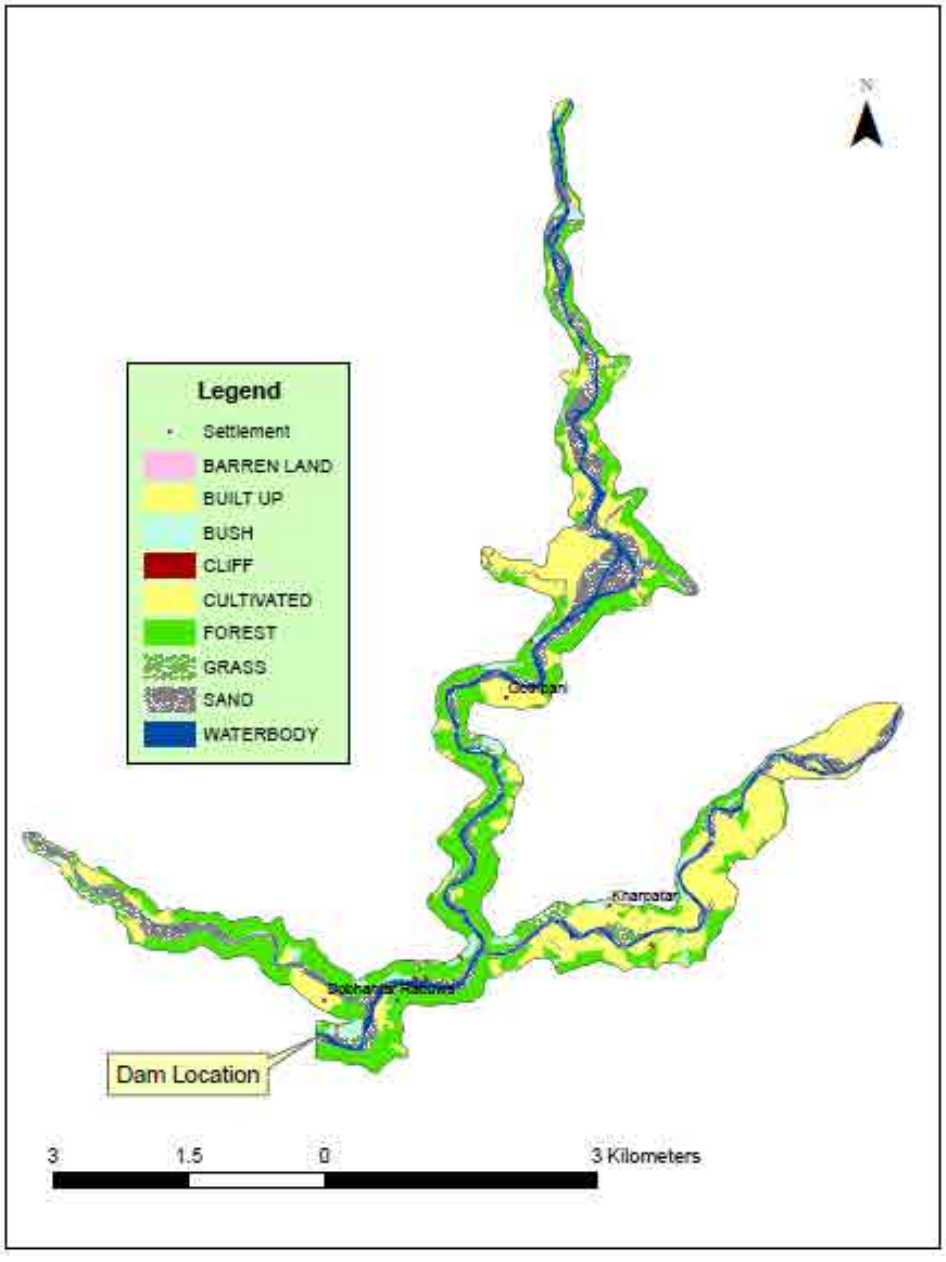
6.3.1 Building Structures

Nos. of building as per the Satellite Image	234



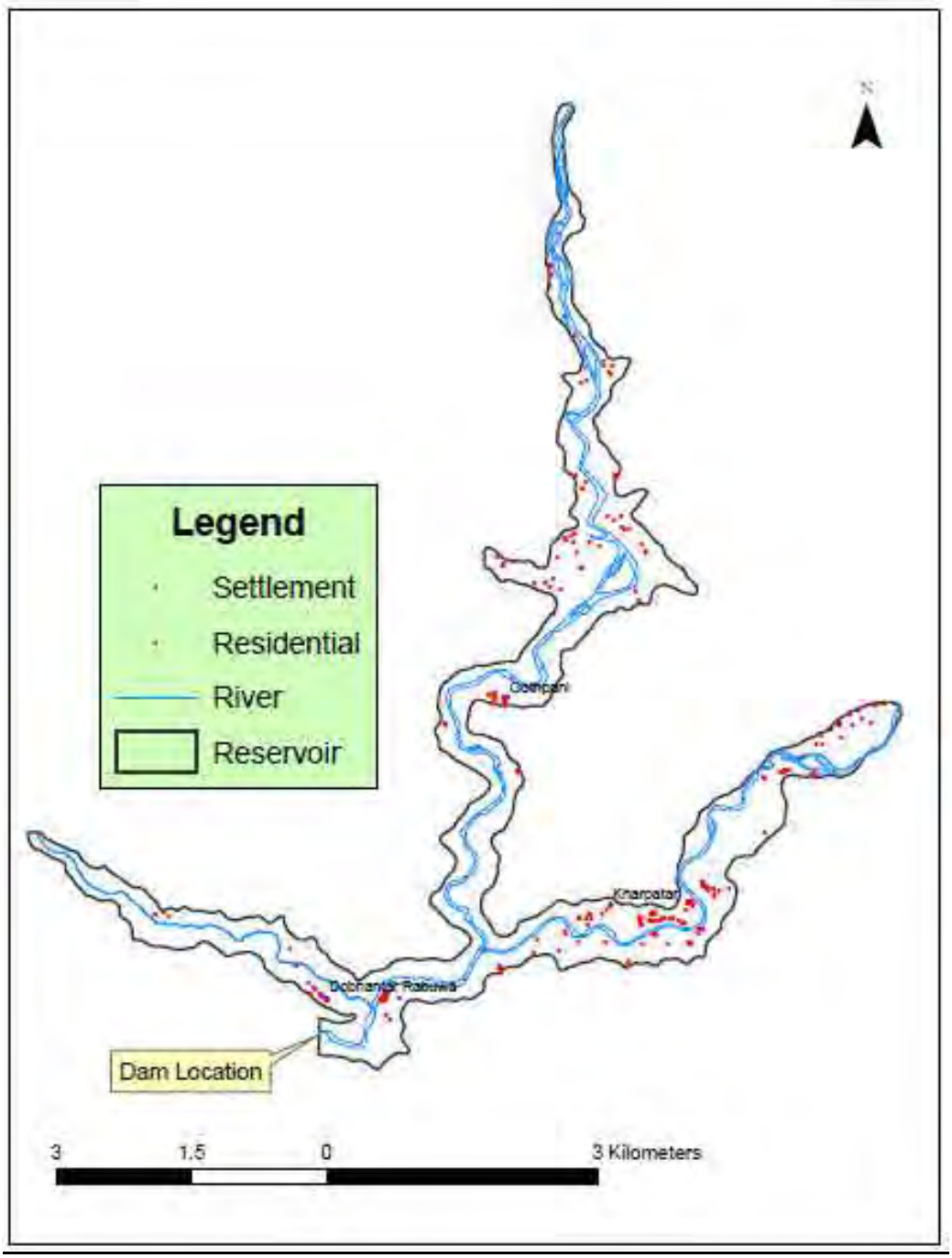
6.3.2 Land use

S.N.	Land Use Class	Land Use Satellite Image (2012), Km^2	Percentage
1	FOREST	4.100628	37.2108
2	BUSH	0.316262	2.8699
3	SAND	1.947703	17.6743
4	CULTIVATED	3.3008	29.9528
5	CLIFF	0.027241	0.2472
6	WATER	1.037144	9.4115
7	GRASS LAND	0.274327	2.4894
8	BARREN LAND	0.018179	0.165
TOTAL		**11.02**	**100**



6.3.3 Infrastructures

Infrastructures	Nos. / Length
Total Nos. of bridge on motorable road	0
Total Nos. of bridge on trail	5
Total Nos. of fords	2
Gravel road (m)	4978
Paved road (highway) (m)	0
Main trail (m)	3198
Foot path (m)	17910



References

1. Bibhuti Ranjan Jha, 2006; *Fish Ecological Studies and its application in assessing Ecological Integrity of Rivers in Nepa*l; Thesis Submitted in partial fulfillment of the requirement for the degree of Doctor of Philosophy in The Department of Biological Sciences and Environmental Science, School of Science, Kathmandu University, Dhulikhel, Nepal, January 2006
2. CBS (2002), *Population Census 2001, National Report*, Kathmandu: Central Bureau of Statistics/UNFPA
3. CBS, 2012; *National Population and Housing Census 2011 (Village Development Committee/Municipalities), Government of Nepal,* National Planning Commission Secretariate, Central Bureau of Statistics, Kathmandu, Nepal, November 2012.
4. Disaster Preparedness Network, Nepal, 2009; *Nepal Disaster Report: The hazardscape and vulnerabilities*, Ministry of Home Affairs, Nepal Disaster Preparedness Network, Nepal with support from with support from European Commission for Humanitarian Aid Department, United Nations Development Nepal and Oxfam Nepal
5. IUCN, 2011; *The Status of Nepal's Mammals*: The National Red List Series
6. NARMSAP, 2002; *Forest and Vegetation Types of Nepal*, TISC Document Series No 105, GoN/MOFSC/NARMSAP, 1-179.
7. Petr, T, 2002; *Cold water fish and fisheries in countries of the high mountain arc of Asia (Hindu Kush-Pamir-Karakoram-Himalayas) A review*, Symposium on coldwater fish species in the trans-Himalayan region. 10-14 July 2001. Kathmandu, Nepal
8. Rajbansi K.J, 1982; *A General Bibliography on Fish and Fisheries of Nepal*, Royal Nepal Academy, Kamaladi, Kathmandu, Nepal.
9. Rajbansi K.J, 2002; *Zoogeographical distribution and the status of cold water fishes of Nepal*. Paper presented in symposium on coldwater fish species in the trans-himalayan region. 10-14 July 2001.Kathmandu, Nepal
10. Shrestha et.al, 2012; *Fishes of Nepal: Mapping distributions based on voucher specimens*, Emporia State Research StudiesVol. 48, no. 2, p. 14-21 (2012)
11. Shrestha, J. (1995); *Enumeration of the Fishes of Nepal*, Bio-diversity Profiles Project, Publication No. 10, Department of National Parks and wildlife Conservation, Ministry of Forest & Soil Conservation, GoN, Kathmandu, Nepal.
12. Shrestha, T. K., 2008; *Icology of Nepal A study of Fishes of the Himalayan Waters*
13. Stainton, J.D.A., 1972; *Forests of Nepal*, John Murray, London.

Photographs


Child aarrying dried fish for sell, Tuintar, Solu


Fisherman in Dudh Koshi throwing fishing net


Group for gill net preparation, Dudh Koshi


Interacting with locals at Rabuwa Bazar of Lamidanda VDC


Land slide site near Rabuwa


With respondents at Rabuwa


Fodder from forest


Fishermar making fishing net for the season

Appendixes

Appendix 1: Name list of FGD Participants (DUDH KOSHI)
District: Okhaldhunga and Khotang

SN	Name of Respondent	Address	Occupation
A Okhaldhunga			
1	Yek Raj Khatiwada	Bhadaure VDC - 7	Community Leader
2	Sekharaj Khatiwada	Bhadaure VDC - 7	Agriculture
3	Damber B. Magar	Bhadaure VDC - 7	Agriculture
4	Nir B. Magar	Bhadaure VDC - 7	Agriculture
5	Kul B. Magar	Bhadaure VDC - 7	Agriculture
6	Hutman Magar	Bhadaure VDC - 7	Agriculture
7	Pitamber Khatiwda	Bhadaure VDC - 6	Teacher
8	Khil B. Yale Magar	Bhadaure VDC - 6	Political Leader
9	Mekha Man Yale Magar	Bhadaure VDC - 6	Agriculture
10	Chandra B. yale Magar	Bhadaure VDC - 6	Agriculture
11	Tul B. Magar	Bhadaure VDC - 6	Agriculture
12	Bir B. Magar	Bhadaure VDC - 6	Agriculture
13	Bhup B. kepchhaki	Bhadaure VDC - 6	Agriculture
14	Dal B. kepchhaki	Bhadaure VDC - 6	Agriculture
15	Babar B. kepchhaki	Bhadaure VDC - 6	Agriculture
16	Prem B. Magar	Bhadaure VDC - 6	Business
17	Damber B. Yale	Diyale VDC - 5	Teacher
18	Dal B. Thapa Magar	Diyale VDC - 5	Agriculture
19	Khat B. Rana Magar	Diyale VDC - 5	Agriculture
20	Hutraj Khatiwada	Diyale VDC - 5	Teacher
21	Bishnu B. Thapa	Diyale VDC - 5	Business
22	Durha B. Magar	Diyale VDC - 5	Agriculture
23	Gopal Karki	Diyale VDC - 5	Teacher
24	Meg B. Karki	Diyale VDC - 5	Teacher
25	Gokarna Karki	Diyale VDC - 5	Political Leader
26	Deepak Karki	Diyale VDC - 5	Political Leader
27	Ghan Shayam Karki	Diyale VDC - 5	Teacher
28	Purna B. Karki	Diyale VDC - 5	Teacher
B Khotang			
29	Nir Kumar Shrestha	Lamidanda VDC - 9	Business
30	Naresh Kumar Shrestha	Lamidanda VDC - 9	Teacher
31	Buddhi Shristha	Lamidanda VDC - 9	Job/ Business
32	Nir Kumar Joshi	Lamidanda VDC - 9	Business
33	Basuram Joshi	Lamidanda VDC - 9	Business
34	Lila B. Shrestha	Lamidanda VDC - 9	Poltical Leader
35	Dhan B. Shrestha	Lamidanda VDC - 9	Farmer
36	Raja Shrestha	Lamidanda VDC - 9	Business
37	Govidn Thapa Magar	Lamidanda VDC - 9	Business
38	Deep B. Majhi	Lamidanda VDC - 9	Farmer
39	Desi Majhi	Lamidanda VDC - 9	Fisher Man
40	Laxman Majhi	Lamidanda VDC - 9	Fisher Man
41	Tek B. Tamang	Dumre Dharapani VDC -8	Agriculture
42	Maku Tamang	Dumre Dharapani VDC - 8	Agriculture
43	Sovit Tamang	Dumre Dharapani VDC -8	Agriculture
44	Dal B. Tamang	Dumre Dharapani VDC - 8	Agriculture
45	Some Tamang	Dumre Dharapani VDC - 8	Agriculture
46	Bhoj Raj Basnet	Dumre Dharapani VDC - 9	Teacher
47	Pahalman Magar	Dumre Dharapani VDC - 9	Teacher
48	Bhadra B. Niraula	Dumre Dharapani VDC - 9	Agriculture
49	Netra B. Niraula	Dumre Dharapani VDC - 9	Agriculture
50	Kal B. Niraula	Dumre Dharapani VDC - 9	Agriculture
51	Gugal B. Magar	Dumre Dharapani VDC - 9	Agriculture
52	Dilli B. Niraula	Dumre Dharapani VDC - 9	Teacher
53	Tek B. Niraula	Dumre Dharapani VDC - 9	Agriculture

SN	Name of Respondent	Address	Occupation
54	Mum B. Niraula	Dumre Dharapani VDC - 9	Agriculture
55	Ladu Dahal	Dumre Dharapani VDC - 9	Agriculture
56	Om B. Magar	Kharpa VDC - 9	Agriculture
57	Tul B. Magar	Kharpa VDC - 9	Business
58	Pahalman Magar	Kharpa VDC - 9	Business
59	Netra B. Magar	Kharpa VDC - 9	Agriculture
60	Bal B. Magar	Kharpa VDC - 9	Teacher
61	Samber Nepali	Kharpa VDC - 9	Business
62	Ram B. Baidya	Kharpa VDC - 9	Business
63	Tek B. Ghimire	Ridungmaheshowari VDC - 5	Teacher
64	Sampurn Ram Ghimire	Ridungmaheshowari VDC - 5	Teacher
65	Balaram Rai	Ridungmaheshowari VDC - 5	Business
66	Bekh B. Rai	Jyamire VDC - 4	Agriculture
67	Ganesh Rai	Jyamire VDC - 4	Agriculture
68	Bhaire Rai	Jyamire VDC - 4	Agriculture
69	Ghanshayam Rai	Jyamire VDC - 5	Agriculture
70	Gam B. Rai	Jyamire VDC - 5	Agriculture
71	Jaya B. Adhikari	Jyamire VDC - 5	Agriculture
72	Shayam B. Adhikari	Jyamire VDC - 5	Agriculture
73	Dhan B. Rai	Jyamire VDC - 9	Agriculture
74	Jumg B. Rai	Jyamire VDC - 9	Agriculture
75	Mithu Shrestha	Kuebhire VDC - 4	Business
76	Min B. Shrestha	Kuebhire VDC - 4	Business
77	Din B. Majhi	Kuebhire VDC - 4	Agriculture
78	Bhakte Majhi	Kuebhire VDC - 5	Agriculture
79	Dhanpati Majhi	Kuebhire VDC - 5	Agriculture
80	Rana Bahadur Rai	Sano Salle-4, Jyamire	Agriculture
81	Mithu Kumar Shrestha	Majhitar, Kuivir	Business/Agriculture
82	Govinda Thapa Magar	Tilketar-9, Lamidanda	Business/Agriculture
83	Nir Kumar Shrestha	Majhigau, Lamidanda	NA
84	Nir Bahadur Magar	Bhadoure-7, Dovantar	NA
85	Man Dhoj Rai	Tuintar, Necha Betghari	NA
86	Mithu Kumar Shretha	Majhi Tar, Kuivir	NA
87	Purna Bahadur Tamang	Gothpani,Dumre dharapani	NA
88	Voj Raj Basnet	Vorleni, Dumre Dharapani	NA
89	Govinda Thapa Magar	Tilketar Khoria, Lamidanda	NA
90	Bhadra Bahadur Niroula	Kharpa Tar, Dumre Dharapani	NA
91	Damar Bahadur Magar	Bhadoure-7, Okhaldhuga	Fishermen
92	Man Dhoj Rai	Tuintar	Fishermen
93	Man Bahadur Majhi	Majhitar, Kuivir	Fishermen

Source: NESS Field Survey, 2012

Appendix 2: Area (ropani) and Production (Kg) under Different Crops of the Project Area

VDC	Settlements	Paddy		Maize		Millet		Wheat		Potato		Pulse		Oilseeds		Vegetable	
		Area	Prod	Area	Prod	Area	Prod	Area	Prod	Area	Prod	Area	Prod	Area	Prod	Area	Prod
Okhaldhunga/Bhadaure	Bambai	2	200	25	1890	10	581.6	0	0	0	0	3	73.5	0	0	0	0
Bhadaure	Dobhantar	0	0	60	7560	60	7270	0	0	0	0	3	73.5	0	0	0	0
Khotang/Lamidanda	Rabuwa Bazar	0	0	100	9450	0	0	0	0	0	0	50	1837	0	0	0	0
Lamidanda	Tilke Tar	80	12000	15	630	5	218	60	6300	5	1000	5	220	5	80	2	80
Dumre Dharapani	Gothpani	0	0	60	1260	50	720	0	0	0	0	15	210	10	80	0	0
	Kaniu Ban	15	1500	20	945	6	436	0	0	0	0	0	0	0	0	0	0
	Kharpatar	90	12500	150	12600	50	3635	40	5040	30	6000	15	616	0	0	0	0
	Jaljale Guth	28	4150	15	1575	4	290	10	1006	2	400	1	73	0	0	0	0
Kharpa	Kharpa Tallo Gau	125	17500	180	10080	60	2544	100	5040	20	4000	10	368	0	0	2	80
Total	**9**	**340**	**47850**	**625**	**45990**	**245**	**15694.6**	**210**	**17386**	**57**	**11400**	**102**	**3471**	**15**	**160**	**4**	**160**
	Cropping Intensity 145.94%																

Source: NESS Field Survey, 2012

Appendix 3: Sale of Crops

S.N.	VDC	Settlement	Crop Sale Detail			
			Crop name	Quantity (Kg)	Value (Rs)	Place of sale
1	**Okhaldhunga/** Bhadaure	Bambai	0	0	0	
2	Bhadaure	Dobhantar	0	0	0	0
3	**Khotang**/Lamidanda	Rabuwa Bazar	Maize & pulses	M(4725),P(1460)	M(32),P(100)	Rabuwa Bazar
4	Lamidanda	Tilke Tar	Paddy,wheat,patatoes,pulse	P(5000),W(3150),Pa(600),P(147)	P(28),W(26),Pa(36),P(100)	Local Places
5	Dumre Dharapani	Gothpani	0	0	0	0
6		Kaniu Ban	0	0	0	0
7		Kharpatar	Paddy,Maize,Millet,Patato	P(5000),M(3150),Mi(2920),Pa(4500)	P(28),M(32),Mi(32),Pa(35)	Local Places
8		Jaljale Guth	Paddy,Maize,wheat,Patato	P(2250),M(1260),W(630),Pa(250)	P(28),M(32),Mi(32),W(30),Pa(35)	Local Places
9	Kharpa	Kharpa Tallo Gau	Paddy,Maize,wheat,Patato	P(5000),M(6300),W(3780),Pa(2400)	P(28),M(32),W(30),Pa(35)	Local Places
Total	**6**	**9**	**5**	**53622 kg**	**1677343**	

Source: NESS Field Survey, 2012

Appendix 4: Public Consultation Dudh Koshi Project (Khotang, Okhaldhunga and Solukhumbu Districts)

Field visit to the Dudh Koshi Project site was made on 27th to 12th September 2012. The objective of the visit was to collect primary information on the social, socio-economic, cultural, forest resources, wildlife, disaster records and aquatic ecological aspects from the reservoir area and the key structural locations of the project.

Since the study period was limited, most of the information related to the above aspects was derived based on the public consultations and interviews with the key informants. The socio-economic information was solicited from the focus group discussions at various settlements within the reservoir area. Information on disaster, fishermen, and fish diversity is based on the key informant interviews, while information on the forest, floral and wildlife diversity is based on the direct observation and interviews with the key informants of the local area. Focus group consultation meetings were held at 8 sites within the reservoir area (Table 1), while 9 key informants were interviewed for in depth knowledgeable information (Table 2).

Table 1: Participants of the Focus Group Discussion

S.N.	NAME OF PARTICIPANTS	OCCUPATION/POSITION	LOCATION
BHADAURE-6; BAMBAI			
1	YEK RAJ KHATIWADA	YEK RAJ KHATIWADA	BHADAURE-6; BAMBAI
2	SEKHARAJ KHATIWADA	SEKHARAJ KHATIWADA	BHADAURE-6; BAMBAI
3	DAMBER B. MAGAR	DAMBER B. MAGAR	BHADAURE-6; BAMBAI
4	NIR B. MAGAR	NIR B. MAGAR	BHADAURE-6; BAMBAI
BHADAURE-7; DOBHANTAR			
1	KUL B. MAGAR	AGRICULTURE	BHADAURE-7; DOBHANTAR
2	HUTMAN MAGAR	AGRICULTURE	BHADAURE-7; DOBHANTAR
3	PITAMBER KHATIWDA	TEACHER	BHADAURE-7; DOBHANTAR
4	KHIL B. YALE MAGAR	POLITICAL LEADER	BHADAURE-7; DOBHANTAR
LAMIDANDA-9; RABUWA BAZAR			
1 NIR KUMAR SHRESTHA		BUSINESS	LAMIDANDA-9; RABUWA BAZAR
2	NARESH KUMAR SHRESTHA	TEACHER	LAMIDANDA-9; RABUWA BAZAR
3	BUDDHI SHRISTHA	JOB/ BUSINESS	LAMIDANDA-9; RABUWA BAZAR
4	NIR KUMAR JOSHI	BUSINESS	LAMIDANDA-9; RABUWA BAZAR
LAMIDANDA-9; TILKE TAR			
1	DHAN B. SHRESTHA	FARMER	LAMIDANDA-9; TILKE TAR
2	RAJA SHRESTHA	BUSINESS	LAMIDANDA-9; TILKE TAR
3	GOVIDN THAPA MAGAR	BUSINESS	LAMIDANDA-9; TILKE TAR
4	DEEP B. MAJHI	FARMER	LAMIDANDA-9; TILKE TAR
5	DESI MAJHI	FISHER MAN	LAMIDANDA-9; TILKE TAR
DUMRE DHARAPANI-8; GOTHPANI			
1	TEK B. TAMANG	AGRICULTURE	DUMRE DHARAPANI-8; GOTHPANI
2	MAKU TAMANG	AGRICULTURE	DUMRE DHARAPANI-8; GOTHPANI
3	SOVIT TAMANG	AGRICULTURE	DUMRE DHARAPANI-8; GOTHPANI
4	DAL B. TAMANG	AGRICULTURE	DUMRE DHARAPANI-8; GOTHPANI
5	SOME TAMANG	AGRICULTURE	DUMRE DHARAPANI-8; GOTHPANI
DUMRE DHARAPANI-9; KANIU BAN			
1	BHOJ RAJ BASNET	TEACHER	DUMRE DHARAPANI-9; KANIU BAN
2	PAHALMAN MAGAR	TEACHER	DUMRE DHARAPANI-9; KANIU BAN
3	BHADRA B. NIRAULA	AGRICULTURE	DUMRE DHARAPANI-9; KANIU BAN

S.N.	NAME OF PARTICIPANTS	OCCUPATION/POSITION	LOCATION
4	NETRA B. NIRAULA	AGRICULTURE	DUMRE DHARAPANI-9; KANIU BAN
5	KAL B. NIRAULA	AGRICULTURE	DUMRE DHARAPANI-9; KANIU BAN
6	GUGAL B. MAGAR	AGRICULTURE	DUMRE DHARAPANI-9; KANIU BAN
7	DILLI B. NIRAULA	AGRICULTURE	DUMRE DHARAPANI-9; KANIU BAN
DUMRE DHARAPANI-9; KHARPATAR			
1	GUGAL B. MAGAR	AGRICULTURE	DUMRE DHARAPANI-9; KHARPATAR
2	DILLI B. NIRAULA	TEACHER	DUMRE DHARAPANI-9; KHARPATAR
3	TEK B. NIRAULA	AGRICULTURE	DUMRE DHARAPANI-9; KHARPATAR
4	MUM B. NIRAULA	AGRICULTURE	DUMRE DHARAPANI-9; KHARPATAR
5	LADU DAHAL	AGRICULTURE	DUMRE DHARAPANI-9; KHARPATAR
DUMRE DHARAPANI-9; JALJALE GUTH			
1	BHOJ RAJ BASNET	TEACHER	DUMRE DHARAPANI-9; JALJALE GUTH
2	PAHALMAN MAGAR	TEACHER	DUMRE DHARAPANI-9; JALJALE GUTH
3	BHADRA B. NIRAULA	AGRICULTURE	DUMRE DHARAPANI-9; JALJALE GUTH
4	NETRA B. NIRAULA	AGRICULTURE	DUMRE DHARAPANI-9; JALJALE GUTH
5	KAL B. NIRAULA	AGRICULTURE	DUMRE DHARAPANI-9; JALJALE GUTH
KHARPA-9; KHARPA TALLO GAU			
1	OM B. MAGAR	AGRICULTURE	KHARPA-9; KHARPA TALLO GAU
2	TUL B. MAGAR	BUSINESS	KHARPA-9; KHARPA TALLO GAU
3	PAHALMAN MAGAR	BUSINESS	KHARPA-9; KHARPA TALLO GAU
4	NETRA B. MAGAR	AGRICULTURE	KHARPA-9; KHARPA TALLO GAU
5	BAL B. MAGAR	TEACHER	KHARPA-9; KHARPA TALLO GAU
6	SAMBER NEPALI	BUSINESS	KHARPA-9; KHARPA TALLO GAU

Table 2: Key Informant for Interview

S.N.	NAME OF KEY INFORMANT	OCCUPATION/POSITION	LOCATION
1	RANA BAHADUR RAI	AGRICULTURE	SANO SALLE-4, JYAMIRE
2	MITHU KUMAR SHRESTHA	BUSINESS/AGRICULTURE	MAJHITAR,KUIVIR
3	GOVINDA THAPA MAGAR	BUSINESS/AGRICULTURE	TILKETAR-9, LAMIDANDA
4	PURNA BAHADUR TAMANG		GOTHPANI,DUMRE DHARAPANI(DUDH KOSHI)
5	NIR KUMAR SHRESTHA		MAJHIGAU,LAMIDANDA
6	NIR BAHADUR MAGAR		BHADOURE-7,DOVANTAR
7	MAN DHOJ RAI		TUINTAR,NECHA BETGHARI
8	VOJ RAJ BASNET		VORLENI, DUMRE DHARAPANI
9	BHADRA BAHADUR NIROULA		KHARPA TAR,DUMRE DHARAPANI

To solicit the information from the project site's local communities the strategic approach taken was to aware people on the Nationwide Master Plan Study of the Storage Type Hydro-electric Projects before seeking information on the local environmental and social resources and the concerns of the people regarding the Dudh Koshi Project.

It is therefore the field survey team, before initiating dialogue with the local communities described why the Nationwide Master Plan Study for Storage type hydroelectric project is needed? Who is undertaking the study? What will be the output of the study? In this process the team also highlighted on how this project in this area was selected for further study? And what the study team will like to get information from the local area communities not limiting to the social and environmental information but also the concerns of the people with regard to the project and their aspirations with the project if it is screened for further study and development.

This section describes the local people knowledge on the project apart from the concerns and aspirations of the people from the project.

The local people have heard about the project since 10 to 12 years. They did not have the detail knowledge about the project key structural location and the level of water inundating their land and built property. The local people aspired that the project officials should provide information on the project as the study progress to make them aware on the projects likely impacts and thanked the study team for giving some level of information on the project progress.

The local people are concerned on their future prospects if the project is developed. A number of questions were asked with the field team. Few examples of the questions are:

- Will the project provide them compensation of the land and built property?
- Will the project provide them relocation and resettlement?
- What will be the mode of compensation?
- Will the compensated money or property will be sufficient to sustain their livelihood?
- Will the local people get job opportunities in the project?
- Will the energy generated from the project also be distributed to the local surrounding areas etc?

Despite many difficult questions, the local people are happy to learn that the project development in the area is under progress. Given the appropriate measures of resettlement and rehabilitation, the affected people have no objection to the project development. They believe that the project will open the door of social and economic development not only for the local area but also to the entire region. Their aspiration with the project is the employment of the local people in the project and a host of the community development issues such as water supply, electrification, road network development, enhancement of educational institutions and health institutions.

Annex 13: Environmental Survey Report

Kokhajor-1 (E-06)

Table of Contents

Introduction

Federal Democratic Republic of Nepal is rich in water resources, its potential water power is 83,000 MW and economically exploitable water power is 42,000 MW. However, as of 2011, the total generating capacity of the country is only about 718.62 MW. Of the total installed capacity 92% is from the hydroelectric power plants. In addition, since most of hydroelectric power plants are run-of-river type, their output decrease seriously in the dry seasons. Consequently, there is a rolling blackout of as long as 14 hours a day which poses many problems including affects in livelihood and industries which severely impact the national economy.

To cope with these situations, the government of Nepal has worked out "National Electricity Crisis Resolution Action Plan" and "10-Year Hydropower Development Task Force" at the end of 2008. The above action plan and task force recommended need of storage-type hydroelectric power plants able to supply sustainable electricity uninterruptedly even in dry seasons to solve current power shortage at an early date.

However, construction of storage-type hydroelectric power plants should be carried out systematically taking into consideration of various aspects including the overall water resource development policy of Nepal, hydrological and geological characteristics, environmental impact, etc. Therefore, the Government of Nepal has requested the Government of Japan to work out a nationwide master plan for storage-type hydroelectric power development.

Electric Power Development Company Limited (J–Power) appointed by the JICA for the nationwide master plan study based on the desk level study in close association with NEA screened 10 candidate projects for the master plan study out of the list of 67 promising projects identified by NEA all over Nepal. **Table 1a and 1b** presents the salient features of the 10 promising projects screened for the master plan study, while **Figure 1** presents the location of the projects.

Table 1a: Salient Features of Potential Projects

No.	Project Name	Location (District)	Location of Dam Site		River	Installed Capacity (MW)	Catchment Area (km^2)
			Longitude	Latitude			
E-01	Dudh Koshi	Okhaldhunga/Khotang Dist.	86° 39' 17.3	27° 15' 47.2	Dudh Koshi to Baiku Khola	300.0	4100
E-06	Kokhajor-1	Sinchuli, Sindhupalchok	85° 29' 59.6	27° 22' 21.9	Kokhajor	111.5	281
E-17	Sun Koshi No.3, Kosi MP	Ramechhap, Kavre and Sindhupalanchok	85° 48' 14.3	27° 29' 50.5	Sun Koshi	536.0	5520
C-02	Lower Badigad	Gulmi	83° 27' 22.2	28° 0' 0.6	Badigad	180.3	2050
C-08	Andhi Khola	Syangja	83° 36' 30.6	27° 58' 2.6	Andhi Khola	180.0	475
W-02	Chera-1	Jajarkot	82° 1' 12.3	28° 42' 56.4	Chera	148.7	809
W-05	Lower Jhimruk	Arghakhachi, Pyuthan	83° 1' 1	27° 55' 30.8	Jhimruk	142.5	995
W-06	Madi	Rolpa	82° 35' 15.5	28° 18' 48.5	Madi	199.8	674
W-23	Nalsyau Gad	Jajarkot	82° 17' 42.8	28° 52' 4.7	Nalsyau Gad	410.0	571
W-25	Naumure (W. Rapti)	Argakhanchi, Pyuthan	82° 55' 42.9	27° 55' 6.1	West Rapti	245.0	3430

Table 1b: Salient Features of Potential Projects

No.	Project Name	Dam Height (m)	Total Storage Volume (MCM)	Effective Storage Volume (MCM)	Reservoir Area (km2)	FSL (m)	MOL (m)	TWL (m)	Rated Gross Head (m)	Rated Power Discharge (m3/sec)
E-01	Dudh Koshi	180.0	687.40	442.10	11.05	580.0	530.00	303.35	275.0	136.00
E-06	Kokhajor-1	107.0	218.70	166.10	8.92	437.00	390.00	200.00	226.3	63.90
E-17	Sun Koshi No.3, Kosi MP	140.0	1,220.00	555.00	23.99	700.0	674.00	575.00	116.3	109.34
C-02	Lower Badigad	191.0	995.90	505.50	13.65	688.00	654.00	475.00	196.0	232.60
C-08	Andhi Khola	157.0	336.50	238.70	5.52	675.00	626.70	368.48	307.0	81.40
W-02	Chera-1	186.0	254.90	141.10	4.00	866.0	814.00	640.00	220.0	80.50
W-05	Lower Jhimruk	167.0	386.00	211.60	4.98	597.0	557.0	390.0	194.6	88.10
W-06	Madi	190.0	359.50	235.10	7.66	1,090	1,030.00	800.00	280.8	84.90
W-23	Nalsyau Gad	200.0	419.6	296.3	6.3	1,570.0	1,498.00	872.0	644.0	75.00
W-25	Naumure (W.Rapti)	190.0	1,021.00	580.00	19.76	517.0	474.00	358.00	162.6	185.60

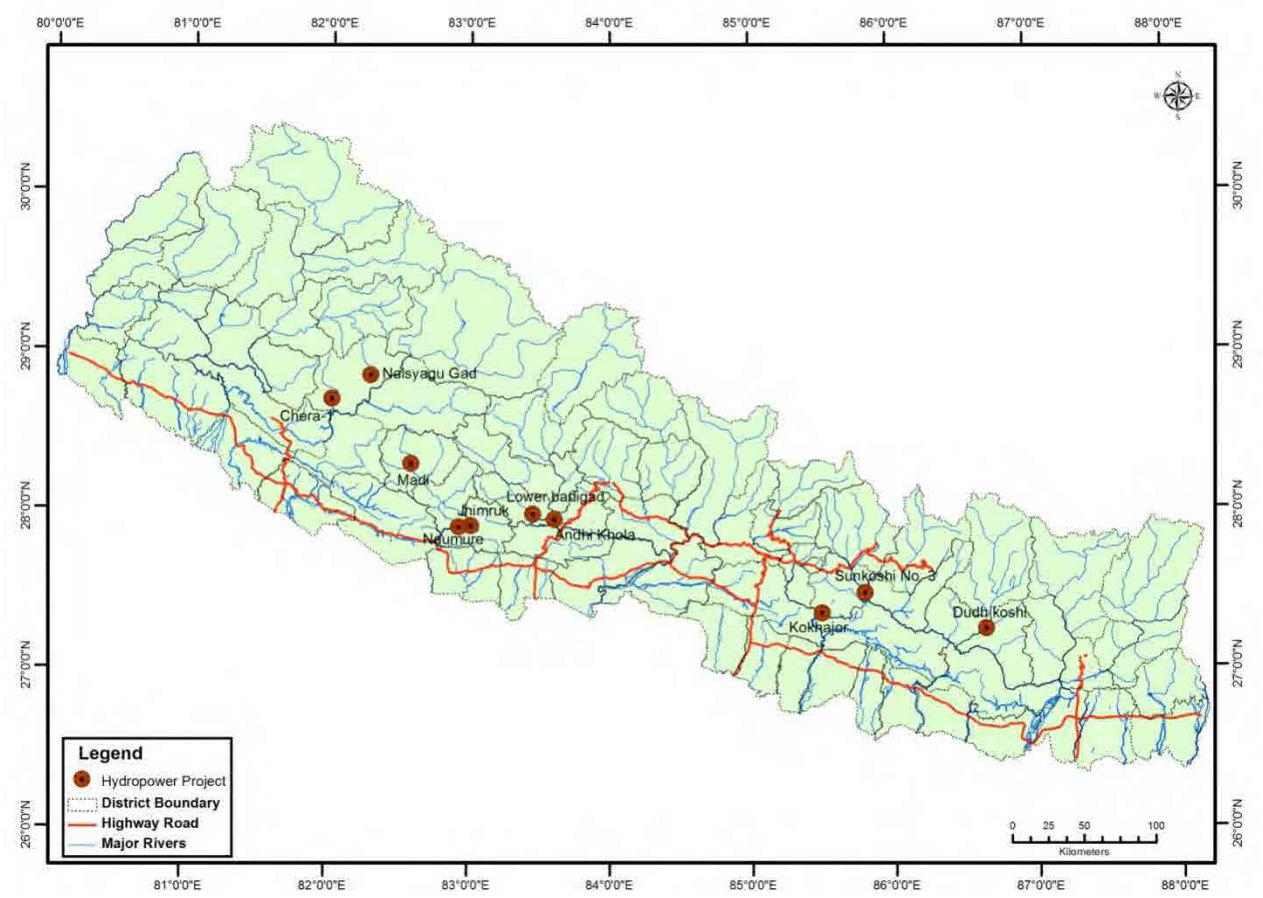


Figure 1: Ten Promising Sites Identified for Survey

The NESS, a local consulting firm of Nepal was entrusted by J-Power for the required SEA field studies of the 10 candidate projects. As per the ToR of works, there are basically two types of surveys required namely; geological, geotechnical, construction material and seismicity study, and environmental and

social study. This report deals with the field survey findings of social and environmental study on **Kokhajor-1 Project** identified as one of the candidate project in the western Nepal.

1 Socio-economic Environment

The information regarding the social and economic conditions of the people in Nepal is available in the publications of the Central Bureau of Statistics. But such information is limited to administrative units such as VDCs, DDCs, Development Zones and at national level. As the candidate projects cross cut the administrative units, the available data on the social and economic concerns could not be used effectively to characterize the direct impact areas by the projects. To fill this gap field level studies on Socio-economic and Environmental Concerns[1] are conducted through participatory methods. The findings of the field surveys are presented in the section below.

1.1 Demographic Concerns

1.1.1 VDCs, Settlements and Population

The proposed Kokhajor storage type project is located in Kavre and Sindhuli districts in the Central Development region of Nepal and covers 45 VDCs, 7 settlements, 7 wards and 92 households. The total population of the reservir area is estimated to be 597 with the average family size of 6.5 which is higher than the national average family size (4.70) (Table 1c). The project occupies 0.08% population of the two project districts.

Table 1c: VDCS and Settlements and Population under the Storage Project, Kavre and Sindhuli

S.N.	District/VDCs	Settlements	Ward No.	Households	Population
A.	**Kavre**				
1	Gokule	Aanptar	2	36	135
2	Ghartichhap				
B.	**Sindhuli**				
3	Hariharpur gadhi	Ratamata	1	2	25
		Dubhigai	1	25	205
		Goran	1	11	92
4	Kopilakot	Paharigaun	1	1	10
		Lamibagar	1	8	68
5	Mahendra jhyadi	Chakali	5	9	62
Total	**45**	**7**	**7**	**92**	**597**

Source: NESS Field Survey, 2012

1.1.2 Ethnicity / Caste

The population of the reservoir area is dominated by the marginalized Adivasi/Janjati mostly Tamang (51.09%). The disadvantaged group of Magar constitutes the second largest population (48.91%). No Dalits and upper caste group are reported in the reservoir area (Figure 2). VDC and cluster wise ethnic population is presented in **Appendix 2**.

[1] The findings are based on the NESS Rapid Field Survey Assessment (2012) using Focus Group Discussions (FGD) and Observation tools. Refer Appendix 19 for the List of FGD participants.

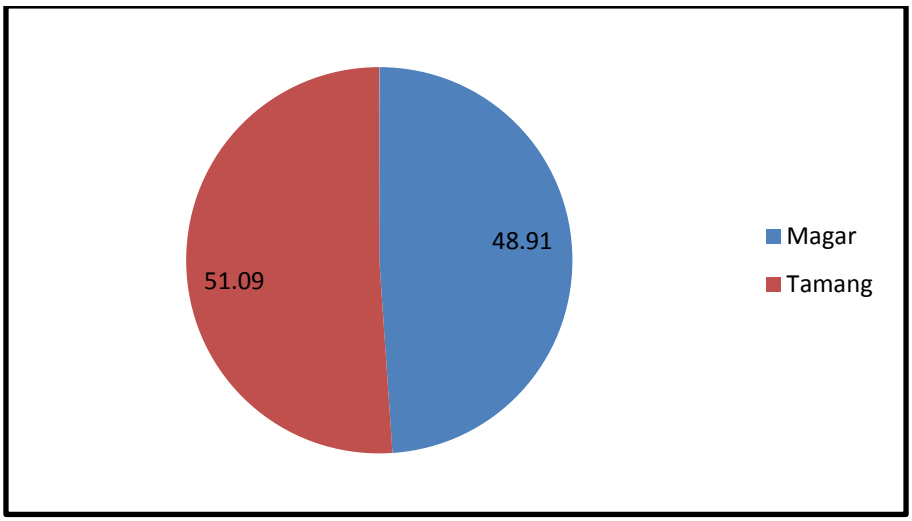
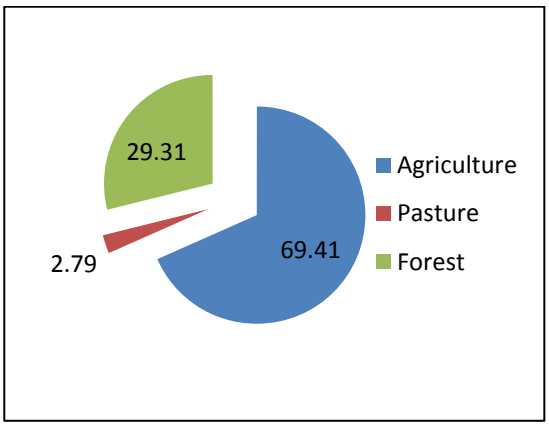


Figure2: Ethnic Composition of Reservoir Area Population

1.2 Economic Concern

1.2.1 Land Use Pattern and Land Holding

The total land area in the reservoir area is estimated to be 2648 ropanies (1 ropani=20 hectare), a large proportion of which is occupied by agriculture (68%) followed by agriculture (29.31%) and pasture land (2%) (Figure 3 and **Appendix 3).**



The total agricultural land of the reservoir area is estimated to 1838 ropanies. Of the total agricultural land 92.76% is khet (irrigated paddy field), and 7.24% pakho (un-irrigated up land). The average land holding of a household is calculated to be 19.97 ropanies with the minimum and maximum range of holding 5 and 23.33 ropanies.

Figure 3: Land Use Pattern

Based on the Central Bureau of Statistics (CBS) classification[2], all the households fall in the marginal to medium categories (Table 2 and **Appendix 4).**

Table 2: Total and Average Land Holding Size (Ropani)

Description	Total	%	Average/HH
Khet	1705	63.0	18.53
Pakho	133	37.0	1.44
Total	**4723**	**100**	**19.97**

Source: NESS Field Survey, 2012

[2] According to CBS, a households holding < 15 ropani of land is classified as marginal farmer, holding 15-135 ropanies as small to medium farmers and holding > 135 ropani as large farmers.

The reservoir area is producing as paddy, maize, and millet among the cereals and pulses, oilseeds and vegetables among the cash crops. Among the cereals, paddy is grown in the largest area (1607 ropanies) followed by maize (1355 ropanies) and millet (564 ropanies).

Among the cash crops, vegetables occupy the small area (19 ropanies) while pulse occupy larger areas (58 ropanies). Unlike the area, the quantity of production is highest for maize followed by paddy and millet. Among the cash crops, the production is recorded to be highest for vegetables followed by pulses. The cropping intensity of the area is 167% (Table 3 and **Appendix 5**).

Table 3: Crop Production and Yield

S.N.	Crop	Area (Ropani)	Production (Kg)	Yield (Kg/Ropani)
1	Paddy	1607	**351420**	728
2	Maize	1355	**988510**	420
3	Millet	564	**35850**	124
4	Pulses	58	**23000**	423
5	Oilseeds	0	0	75
6	Vegetables	19	**257300**	3787
	Cropping Intensity	**199.4%**		

Source: NESS Field Survey, 2012

According to field study most of the productions are consumed locally.

1.2.2 Occupation

More than 53 percent population of the reservoir area is economically active and engaged in different occupations. One third of the population (75%) is involved in agriculture followed by wage labour (12%), foreign employment (10%) and services (3%) (Figure 4).

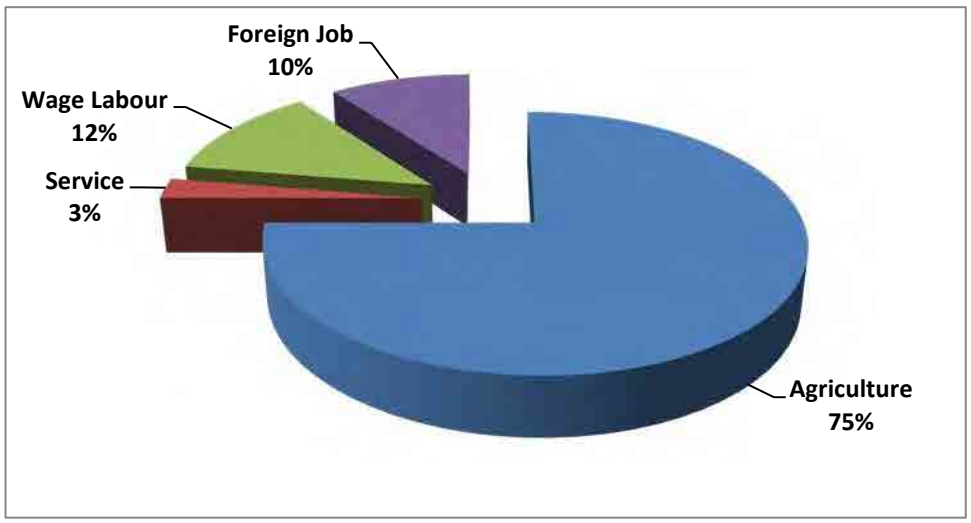


Figure 4: Occupation of Population

1.2.3 Housing Type

All the households of the reservoir area are reported to be dwelling in kachhi (temporary) types of houses which are generally built by using mud and stone and roofed using thatch / stone / tile.

1.3 Service related Infrastructures

1.3.1 Road and Bridges

The reservoir area has no access to motorable road. However, they are connected with each other by four suspension types of bridges installed in different places outside the reservoir area (Table 4).

Table 4: Location of Suspension Bridges

S.N.	District/VDCs	Settlements	Number	Type	Name of the Bridge
A.	**Kavre**				
1	Gokule	Chotte sahan	1	suspension	Chamero pakha bridge
B.	**Sindhuli**				
2	Hariharpur gadhi	Kotati	1	suspension	kokhajor khola bridge
		Sotighat	1	suspension	NA
3	Kopilakot	Paharigaun	1	suspension	jhata khola bridge
Total	**4**	**4**	**4**		4

Source: NESS Field Survey, 2012

1.3.2 Schools

Altogether two primary schools are set up in the reservoir area where 211 students are estimated to be enrolled (Table 5).

Table 5: Number of Schools in the Reservoir Area

District	VDC	Settlement	Name of school	No. of students
Kavre	Gokule	Aanptar	Ganyodaya PS	60
Sindhuli	Hariharpur gadhi	Dubhigai	Shree devi PS	151
Total	2	2	2	**211**

Source: NESS Field Survey, 2012

1.3.3 Irrigation Infrastructure

Only two irrigation schemes namely Dubli Khola Irrigation scheme located at Dubligai, Hariharpur Gadhi and Fulbike Khola Irrigation Scheme located at Lamibagar Kopilkot VDC of Sindhuli district are reported to be functioning in the reservoir area.

1.3.4 Drinking Water

Altogether 5 schemes with 26 numbers of taps are serving the reservoir area for drinking water. The minimum and maximum number of taps installed in each of the schemes ranges between 1 and 14 (Aanptar of Gokule VDC Kavre) (Table 6).

Table 6: Drinking Water Scheme in the Reservoir Area

S.N.	District	VDC	Settlement	Drinking Water Scheme Detail		
				Number	Number of Taps	Name of scheme
1	Kavre	Gokule	Aanptar	1	14	Phedi gaira WSS
2	Sindhuli	Hariharpur gadhi	Tintale	1	1	Sotighat kholsa (temporary)
3	Sindhuli	Hariharpur gadhi	Dubhigai	1	6	Dubigaun WSS
4	Sindhuli	Hariharpur gadhi	Goran	1	2	Goran WSS
5	Sindhuli	Kopilakot	Lamibagar	1	2	Lamebagar WSS
	Total	**3**	**5**	**5**	**26**	

Source: NESS Field Survey, 2012

1.3.5 Community Forest

The people of 4 settlements out of 7 are affiliated with different community forest as indicated in Table 7.

Table 7: Community Forests in the Reservoir Area

S.N.	District	VDC	Settlement	Name of the Community Forests
1	Kavre	Gokule	Aanptar	Deurali aaptar CF
2	Sindhuli	Hariharpur gadhi	Ratamata	Panchakanya CF
3	Sindhuli	Hariharpur gadhi	Dubhigai	Panchakanya CF
4	Sindhuli	Hariharpur gadhi	Goran	Panchakanya CF
	Total	**2**	**4**	**2**

Source: NESS Field Survey, 2012

1.3.6 Industries and Services

The inundated area do not possesses any types of industries or the services centers. However, altogether 5 water turbines are being operated by utilizing the water of four streams and rivulets for grain processing purpose (Table 8).

Table 8: Water Turbine and Hydropower Schemes in the Reservoir Area

S.N.	District	VDC	Settlement	Water Turbines		Micro Hydro	
				Number	Source	Capacity	Name
1	Kavre	Gokule	Aanptar	1	Aap kholse		
2	Sindhuli	Hariharpur gadhi	Dubhigai	2	Dubi kholachi		
3	Sindhuli	Hariharpur gadhi	Goran	1	Simreti khola		
4	Sindhuli	Kopilakot	Lamibagar	1	Khura khola		
	Total			**5**			

Source: NESS Field Survey, 2012

1.4 Culture and Religious Site

The major festivals celebrated in the reservoir area are: *Dasain, Tihar, Tija, Majhe Sankarati*, which are based on Hindu tradition and culture. Besides, the Janjati groups celebrate *Sonam Lotsar*, Lotsar, Mansir Purnima. There are no any specific religious structures in the reservoir area **(Appendix 6**).

1.5 Ongoing and Proposed Development programmes

There is one irrigation, related planned development programmes in one of the settlements of the area (Table 9).

Table 9: Ongoing and Planned Development Projects

S.N.	District	VDC	Settlement	Types of Ongoing Development Projects	Remarks
1		Gokule	Aanptar	Irrigation canal	Planned

Source: NESS Field Survey, 2012

1.6 Past Experience with community and their perception

People from the two settlements of the reservoir area had some sort of confrontation and troubles during the establishment of Salimar Cement Industry that was resolved with mutual understanding (Table 10).

Table 10: Problems with Development Works

S.N.	District	VDC	Settlement	Problems Related with Development Works
1	Kavre	Gokule	Aanptar	Had trouble related to construction of Salimar cement industry
2	Sindhuli	Hariharpur gadhi	Dubhigai	Had trouble related to construction of Salimar cement industry

Source: NESS Field Survey, 2012

The people have perceived different positive and negative impacts from the project. Loss of land displacement of settlements and people, are reported to be the major negative impacts of the hydropower perceived by the community. The communities have also expected different development activities from the project such as availability of electricity, local employments and contribution to poverty eradication (**Appendix 7**).

2 DISASTER STUDY

There are no records of the disaster at the site specific level of the candidate project at the central level and district level offices of the government of Nepal. It is therefore, the disaster information is collected from the project site based on the key informant survey. The findings of the results are presented in the sections below.

2.1 Types of Disaster

Within the influence area of the Kokhajor Project, the flood and landslide disaster have been reported by the key informants. The earthquake as a disaster event is not in the memory of the local people.

2.1.1 Flood

In the memory of the local people flood disaster has occurred once in 1993. The flood have a widespread damage of life and property. The cause of the floods as reported by the informants is the heavy precipitation in the catchment areas of the Kokhajor in the monsoon season. The loss of life and property caused by the flood events in the candidate reservoir area are presented below.

a) Name of respondent: Uttar Bahadur Gyandish and Devi Bahadur Rakhel **Date:** 2069/06/15 B.S.
Age: 48, 29 **Occupation:** Agriculture **Location:** Kapilakot-1, Lamibagar
i) Year of the occurrence: 2050 B.S.
ii) Cause of the flood: Heavy Precipitation
iii) Area affected by the flood:

Loss or Damages	Local Area	Upstream Area	Downstream Area
Land	5 ropani		
Life	-	-	-
Build properties	-	-	-
Crops	20 muri	-	-
Others	-	-	-

b) Name of respondent: Bir Bahadur Tamang Contact No: X **Date:** 2069/06/15 B.S.
Age: 50 **Occupation:** Agriculture **Location:** Mahendrajhyadu-9, Chakali
i) Year of the occurrence: 2050 B.S.
ii) Cause of the flood: Heavy Precipitation
iii) Area affected by the flood:

Loss or Damages	Local Area	Upstream Area	Downstream Area
Land	10 ropani	3 ropani	15 ropani
Life	-	-	-
Build properties	-	-	-
Crops	45 muri	10 muri	60 muri
Others	-	-	-

c) Name of respondent: Gupta Bahadur Rana **Date:** 2069/06/16 B.S.
Age: 51 **Occupation:** Agriculture **Location:** Gokule-2 Aaptar
i) Year of the occurrence: 2050 B.S.
ii) Cause of the flood: Heavy Precipitation
iii) Area affected by the flood:

Loss or Damages	Local Area	Upstream Area	Downstream Area
Land	4 ropani	2 ropani	-
Life	-	-	-
Build properties	-	-	Few shade
Crops	15 muri	6 muri	-
Others	-	-	-

d) Name of respondent: Bir Dhwoj Yonjan **Date:** 2069/06/16 B.S.
Age: 45 **Occupation:** Agriculture **Location:** Hariharpur Gadhi-1, Dubhigaun
i) Year of the occurrence: 2050 B.S.
ii) Cause of the flood: Heavy Precipitation
iii) Area affected by the flood:

Loss or Damages	Local Area	Upstream Area	Downstream Area
Land	~18 Ropanies	-	-
Life	-	-	-
Build properties	-	-	-
Crops	~Paddy, 250 muri	-	-
Others	-	-	-

e) Name of respondent: Bhim Bahadur Thing **Date:** 2069/06/16 B.S.
Age: 29 **Occupation:** Agriculture **Location:** Gokule-3, Chotte shan
i) Year of the occurrence: 2050B.S.
ii) Cause of the flood: Heavy Precipitation
iii) Area affected by the flood:

Loss or Damages	Local Area	Upstream Area	Downstream Area
Land	~55 Ropanies	-	-
Life	-	-	-
Build properties	-	-	-
Crops	~Paddy, 200 muri	-	-
Others	-	-	-

f) Name of respondent: Nirmaya Tamang **Date:** 2069/06/17 B.S.
Age: 35 **Occupation:** Agriculture **Location:** Dadagaun-1, Beltar
i) Year of the occurrence: 2050 B.S.
ii) Cause of the flood: Heavy Precipitation
iii) Area affected by the flood:

Loss or Damages	Local Area	Upstream Area	Downstream Area
Land	~15 Ropanies	~50 Ropanies	~12 Ropanies
Life	-	-	-
Build properties	-	-	-
Crops	~Paddy, 100 muri	~Paddy,350 muri	~Paddy,100 muri
Others	-	-	-

g) Name of respondent: Devan Singh Waiwa **Date:** 2069/06/17 B.S.
Age: 62 **Occupation:** Agriculture /Ex-Indian Army Location: Dadagaun-8, Aaptar
i) Year of the occurrence: 2050 B.S.
ii) Cause of the flood: Heavy Precipitation
iii) Area affected by the flood:

Loss or Damages	Local Area	Upstream Area	Downstream Area
Land	~25 Ropanies	-	20
Life	-	-	-
Build properties	-	-	-
Crops	~Paddy, 100 muri	-	Paddy, 80 muri
Others	-	-	-

h) Name of respondent: Big Man Ghising **Date:** 2069/06/17 B.S.
Age: 59 **Occupation:** Agriculture **Location:** Hariharpur Gadhi-9, Kokti
i) Year of the occurrence: 2050 B.S.
ii) Cause of the flood: Heavy Precipitation
iii) Area affected by the flood:

Loss or Damages	Local Area	Upstream Area	Downstream Area
Land	~10 Ropanies	-	-
Life	-	-	-
Build properties	-	-	-
Crops	~Paddy, 40 muri	-	-
Others	-	-	-

2.1.2 Landslide

Landslide event recorded in the candidate project was associated with the floods of 1993. Table below presents the details of the landslide event as preported by the key informants.

a) Name of respondent: Big Man Ghising

Year	Location	Cause	Affected Fields	
2050 B.S.	Hariharpur Gadhi-9, Kokti	Heavy Precipitation	Affected Area	Kokti
			Loss of life	x
			Loss of Build	x
			Loss of Crops	Paddy
			Loss of Land	9 Ropanies

b) Name of respondent: Devan Singh Waiwa

Year	Location	Cause	Affected Fields	
2050 B.S.	Dadagaun-8, Aaptar	Heavy Precipitation	Affected Area	Aaptar
			Loss of life	x
			Loss of Build	3 houses
			Loss of Crops	Paddy and millet
			Loss of Land	7 Ropanies

c) Name of respondent: Nirmaya Tamang

Year	Location	Cause	Affected Fields	
2050 B.S.	Dadagaun-8, Beltar	Heavy Precipitation	Affected Area	Chaure
			Loss of life	-
			Loss of Build	-
			Loss of Crops	Paddy
			Loss of Land	8 Ropany

d) Name of respondent: Prithvi Bal Ale

Year	Location	Cause	Affected Fields	
2050 B.S.	MahendraJhyadi-9, Chakali	Heavy rainfall and river cutting	Affected Area	Chakali
			Loss of life	-
			Loss of Build	3 Shade (goth)
			Loss of Crops	Paddy and Millet
			Loss of Land	4 Ropany

2.1.3 Earthquake

In the memory of the local people the candidate project site communities have experienced earthquake causing loss of property in B.S. 1945 (1988) and B.S. 2068 (2011). The table below presents the details of loss of property.

a) Name of respondent: Gupta Bahadur Rana

Age: 51 **Occupation:** Agriculture **Location:** Gokule-2, Aaptar

Year	Loss of life	Loss of Build Structures
2045 B.S.	-	Few loss over buildings

b) Name of respondent: Bhim Bahadur Thing

Age: 29 **Occupation:** Agriculture **Location:** Gokule-3, Chotte shan

Year	Loss of life	Loss of Built structure
2068 B.S.	-	2 houses

3 FLORAL STUDY

Though the floral information at the regional level is available, there is no published literature on the site specific level of the candidate project at the central and district level offices of the government of Nepal. It is therefore, candidate project site is visited by the biological study team to gather information based on direct observation and through the participatory methods with the local key informants. Findings of the field study are presented in sections below.

3.1 Vegetation Diversity

The information on the vegetation diversity is gathered from the direct observation by the members of biology study team during site visit. Besides, information is also collected from the key informants of the local area through interviews and focus group discussions with the local community forest user groups.

The candidate project site is has relatively low floral diversity. About 10 plant species were recorded through direct observation and interviews with the key informants. The list of plant species is presented in the table below.

Local Area			Within Regional Area		
S.N.	**Local Name**	**Scientific Name**	**S.N.**	**Local Name**	**Scientific Name**
1	Khayer	*Acacia catechu*	1	Sal	*Shorea robusta*
2	Karam	*Adina cardifolia*	2	Chilaune	*Schima wallichi*
3	Saj	*Terminalia alata*	3	Katus	*Castanopsis indica*
4	Bot dhayaro	*Lagerstroemia parviflora*			
5	Bakaino	*Melia azedarach*			
6	Amla	*Phyllanthus emblica*			
7	Simal	*Bombax ceiba*			
8	Katus	*Castanopsis indica*			
9	Chilaune	*Schima wallichi*			
10	Sal	*Shorea robusta*			

3.2 Forest Types

The candidate project site is characterized by the sal forest. Table below presents the forest types and associated species in the reservoir area and outside reservoir area.

Local (Within Reservoir)	Regional (Out of the reservoir)
Mostly Sal dominated forest, but local people have planted various fodder trees for their benefit.	Almost every forest is Sal dominated forest.

3.3 Forest as per Forest Classification (Community Forest, Government Forest, Leasehold Forest, Private Forest, Religious Forest etc.)

The forests of the candidate project influence area are the government and community forests. The community forest are managed by the local community forest user groups within the framework of the community forest management plan approved by the district forest offices, while the government managed forest is managed by the district forest office. The reservoir occupied area has 4 community forests and 1 government managed forest. The name of the government and community forests, dominant species of plants and the location of the forests in the local administrative zone (VDCs) is presented in the tables below for the reservoir area and outside the reservoir area.

a) Local Area (Within the reservoir)

S.N.	Ownership	Name of the forest	Dominant Species	V.D.C.
1	Government	Lamibagar forest	Sal	Kopilakot
2	Community forest	Bal Bhairav	Sal	Mahendra jhyadi
3	Community	Panchaknya	Sal	Hariharpur gadhi
4	Community	Chankhare	Sal	Gokule
5	Community	Kali bisare	Sal	Hariharpur gadhi

b) Regional Area (Outside the reservoir)

S.N.	Ownership	Name of the forest	Dominant Species	V.D.C.
1	Government	Lamibagar forest	Sal	Kopilakot
2	Community forest	Bal Bhairav	Sal	Mahendrajhyadi
3	Community	Deurali Aaptar	Sal	Gokule
4	Community	Panchaknya	Sal	Hariharpur gadhi
5	Community	Chankhare	Sal	Gokule
6	Community	Beltarpakha	Sal	Dadagaun
7	Community	Durbar dada	Sal	Dadagaun
8	Community	Kali bisare	Sal	Hariharpurgadhi
Rest of the region are all forested and are National forest				

3.4 Forest Plot Analysis

For the analysis of the forest status and characteristics 3 sample plots were measured within the reservoir area of the candidate project. The sample plots measured has a size of 10 x 10 meter. The detail of the sample plot measurements is presented in the tables below.

a) Forest: Deurali Aaptar community forest

Location: Aaptar

G.P.S. E00355954, N03026748 **Altitude:** 442m

S.N.	Tree Species	DBH (cm)	Height m (approx.)
1	*Shorea robusta*	27	10
2	*Shorea robusta*	18	8.5
3	*Shorea robusta*	20	12
4	*Shorea robusta*	18	8
5	*Shorea robusta*	34	15
6	*Shorea robusta*	35	18
7	*Shorea robusta*	25	13
8	*Bot dhayero*	12	5
Regeneration: 80% and crown cover: 70%			

Forest Density: *total no of tree/area of the quadrate=0.1*

b) Forest: Kali Bisare community forest

Location: Hariharpur gadhi-9, Kokti

G.P.S. E00352045, N03028909 **Altitude:** 339m

S.N.	Tree Species	DBH (cm)	Height m (approx.)
1	*Schima wallichi*	24	6
2	*Shorea robusta*	20	8
3	*Schima wallichi*	15	5.5
4	*Shorea robusta*	19	5
5	*Shorea robusta*	24	5
6	*Shorea robusta*	21	7
7	*Shorea robusta*	15	4.5
8	*Schima wallichi*	13	5

S.N.	Tree Species	DBH (cm)	Height m (approx.)
9	*Schima wallichi*	18	5

Forest Density: *total no of tree/area of the quadrate=0.09*
Crown coverage of the forest: *80%*

c) Forest: Chakhutte community Forest (Dam site)
Location: Dadagaun-8, Chakhutte
G.P .S. E00351544, N03029585 **Altitude:** 307m

S.N.	Tree Species	DBH (cm)	Height (ft)
1	Khayer	36	19
2	Karam	10	5
3	Khayer	33	17
4	Asare	16	6

Forest Density: *total no of tree/area of the quadrate=0.04*
Crown coverage of the forest: *60%*

3.5 Public Dependency on the Forest

The forests of the candidate project site provide a range of goods and services to the local communities. The local community extracts followings resources from the forest areas to support their livelihood.

- Firewood.
- Timber for domestic purpose as well as supplying out of village.
- Fodder.
- Grazing domestic animal.
- Medicine.
- Ornamental.
- Agricultural implements.
- Religious.
- Edibles, etc.

3.6 Floral Species of the Conservation Significance

Of the recorded floral species only 3 species have been categorized under the protection lists of the government of Nepal and CITES. The table below presents the list of the protected species.

S.N.	Local Name	Common Name	Scientific Name	Status			Source		
				IUCN	GON	CITES	Site survey	Hearing survey	Literature survey
1	Sal	Sal	*Shorea robusta*		Protected		Confirmed at the site		
2	Khayer	Catch Tree	*Acacia catechu*	Enlisted	Protected	III	Confirmed at the site		
3	Simal	Silk Cotton Tree	*Bombax ceiba*		protected		Confirmed at the site		

IUCN Red List Categories*: Extinct (EX), Extinct In the Wild (EW), Critically Endangered (CR), Endangered (EN), Vulnerable (VU), Near Threatened (NT)*
GOV Categories*: P Protected by legislation*
CITES Categories: *I -Appendix I (are species that are threatened with extinction and are or may be affected by trade), II - Appendix II (are species that are not necessarily threatened with extinction, but may become so unless trade in specimens of such species is subject to strict regulation in order to avoid utilization incompatible with the survival of the species in the wild), and III - Appendix III (are species that are listed after one member country has asked other CITES Parties for assistance in controlling trade in a species)*

4 FAUNAL STUDY (WILDLIFE)

Information on the wildlife of the candidate project site is scarce in the published literatures. It is therefore site investigations are conducted to gather information through direct observation and the participatory methods with the local communities and the key informants. The findings of the filed investigations are presented in section hereunder.

4.1 Wildlife Diversity

Information on wildlife diversity is gathered through direct observation and participatory methods which included focus group discussion with the local communities and key informant surveys.

a) Mammals

A total of 13 mammalian species were recorded from the focus group discussion and key informant surveys. The details of the mammalian species and habitat types are presented in the table below.

S.N.	Consultation	Common name	Scientific Name
1	Ratuwa	Barking Deer	*Muntiacus muntjak*
2	Badel	Eurasian Wild Boar	*Sus scrofa*
3	Pahare bandar	Assam Macaque	*Macaca assamensis*
4	Dhedu	Langur	*Semnopithecus entellus*
5	Shyal	Jackal	*Canis aureus*
6	Chituwa	Stripped Leopard	*Panthera pardus*
7	Nyauli musho	Nyauri Muso	*Herpestes edwardsii*
8	Lokharke (dharke)	Lokharke (dharke)	*Funambulus sps.*
9	Chamero	Bat	*Pteropus giganteus*
10	Bhalu	Bear	*Ursus arctos isabellinus*
11	Dumsi	Indian Crested Porcupine	*Hystrix indica*
12	Salak	Pangolin	*Manis crassicaudata*
13	Ghoral	Goral	*Naemorhed goral*

b) Birds

A total of 21 bird species are reported by the local communities and key informants. Table below presents list of the reported and observed species in the candidate project influence area.

S.N.	Consultation	Common Name	Scientific Name
1	Nyauli	Great Barbet	*Megalaima virens*
2	Kurle Dhukur	Kurle Dhukur	*Streptopelia orientalis*
3	Lamphuchre	Redbilled Blue Magpi	*Urocissa erythrorynca*
4	Tame Dhukur	Wood Pigeon	*Columbia palumbelus*
5	Jureli	Himalayan Bulbul	*Pycnonotus leucogenys*
6	Chichin kothe	Green Backed Tit	*Parus monticolus*
7	Kade bhyakur	Spiny Babbler	*Turdoides nipalensis*
8	Huchil	Great Horned Owl	*Bubo bubo*
9	Owloo	Owl	*Bubo zeylonensis*
10	Suga	Rose-ring Parakeet	*Psittacula krameri*
11	Koeli	Asian Cuckoo	*Cuculus sparverioides*
12	Gauthali	Alpine Swift	*Tachymarptis melba*
13	Maticore	White Throated Kingfisher	*Halcyon smyrnensis*
14	Maticore	Stork-billed Kingfisher	*Halcyon capensis*
15	Luiche	Jungle Fowl	*Gallus gallus*
16	Maina	Talking Myna	*Gracula religiosa*
17	Jungali Vagero	Tree Sparrow	Passer montanus
18	Rupi	Black Headed Munia	*Lonchura malaca*

S.N.	Consultation	Common Name	Scientific Name
19	Kalo Chibe	Black Drongo	*Dicrurus macrocercus*
20	Ranichari	Scarlet Minivet	*Pericrocotus flammeus*
21	Lahache	Brown-fronted Pied Wood Pecker	*Dendrocops curiceps*

c) Herpetofauna

The key informants and the local community reported a total of 8 herpetofauna species from the reservoir area. Details of the herpetofauna species and their habitat types are presented in the table below.

S.N.	Consultation	Common Name	Scientific Name
1	Sun Gohoro	Golden monitor Lizard	Varanus flavescens
2	Bhale Mungro		*Mabuia carinata*
4	Cobra	Indian Cobra	*Naja naja*
5	Laxmi or Bhakari sap	Banded Krait	*Bungarus fasciatus*
6	Sirise	Flying Snake	*Chrysopelia paradise*
7	Hareu	Bamboo Pit Viper	*Trimersurus albolabris*
8	Dhaman	Rat Snake	*Ptyus mucosus*

4.2 Habitat Type in the Reservoir Area

The wildlife habitat of the reservoir area has the following characteristics.

- Fragmented due to intervening of settlement areas
- Degraded due to fodder collection and cattle grazing

4.3 Migratory Corridor

The area is seasonally used as feeding habitat by the wildlife of the area and is not reported to be a migratory corridor for wildlife. Seasonally, Porcupine is found to be reported in the maize field in the Aaptar of Gagane VDC, Kabhre.

4.4 Wild Animals of Conservation Significance

The reported wildlife of the candidate project site are cross checked with the protected wildlife lists of the government of Nepal, IUCN red book and the CITES Appendices. The lists of the wildlife which fall in the protection category of the government of Nepal, IUCN red book and the CITES Appendices are presented in the sections below.

a) Mammal

Of the reported species of mammal, 5 of the species are listed under the protection category of either government of Nepal or IUCN red list or under CITES Appendices. Of the recorded species 1 is listed under government of Nepal protection list, 6 under IUCN red list and 6 under CITES Appendices. Table below presents the species and their protection category under various protection lists.

S.N.	Local Name	Common Name	Scientific Name	Status			Sources		
				Gov	IUCN	CITES	Site survey	Hearing survey	Literature survey
1	Dhedu	Langur	*Semnopithecus entellus*			I	Confirmed at site		
2	Pahare bandar	Assam Macaque	*Macaca assamensis*		NT		Confirmed at site		
3	Ghoral	Goral	*Naemorhed goral*		NT	I		Hearing at Kopilakot and Gokule VDC	
4	Shyal	Jackal	*Canis aureus*			III		Hearing at Hariharpur gadhi	
5	Salak	Pangolin	*Manis crassicaudata*	P		II		Hearing at Kopilakot and Gokule VDC	

b) Birds

Of the recorded avian species 2 are listed under the protection category of government of Nepal, IUCN red list and in the CITES Appendices. Table below presents the details of the protected species and the protection category as per the government of Nepal and CITES Appendices.

S.N.	Local Name	Common Name	Scientific Name	Status			Source		
				GoV	IUCN	CITES	Site survey	Hearing survey	Literature survey
1	Kalij	Chir pheasant	*Catreus wallichii*	P	VU	I	Confirmed at site		
2	Suga	Rose-ring Parakeet	*Psittacula krameri*			III	Confirmed at site		

***IUCN Red List Categories**: Extinct (EX), Extinct In the Wild (EW), Critically Endangered (CR), Endangered (EN), Vulnerable (VU), Near Threatened (NT)*

***GOV Categories**: P Protected by legislation*

***CITES Categories**: I -Appendix I (are species that are threatened with extinction and are or may be affected by trade), II - Appendix II (are species that are not necessarily threatened with extinction, but may become so unless trade in specimens of such species is subject to strict regulation in order to avoid utilization incompatible with the survival of the species in the wild), and III - Appendix III (are species that are listed after one member country has asked other CITES Parties for assistance in controlling trade in a species)*

c) Herpetofauna

One of the herpetofauna species out of the recorded species are listed as protection category species of CITES Appendices. Table below presents the details of the protection category under various protection lists.

S.N.	Local Name	Common name	Scientific name	Status			Source		
				GoV	IUCN	CITES	Site survey	Hearing survey	Literature survey
1	Sun Gohoro	Golden monitor lizard	*Varanus flavescens*	P		I		Hearing at Mahendra jhyadi	

***IUCN Red List Categories**: Extinct (EX), Extinct In the Wild (EW), Critically Endangered (CR), Endangered (EN), Vulnerable (VU), Near Threatened (NT)*

***GOV Categories**: P Protected by legislation*

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5 FISHERY STUDY

There is scanty information in the fish diversity, fishermen, fish market, and cost of fish in the candidate project site at the central and district level offices. To fill the data gap fish related information was gathered from the field surveys using a checklist. The fish survey is based on the participatory method and key informant survey methods along the influence area of the candidate project. The findings of the field survey are presented in the sections below.

5.1 Fisher men and their Occupational /Social/Economic Status and Fish Market, Availability and Cost

The candidate project site is devoid of the fishermen.

5.2 Fishing Season, Fish Catch, and Use of Caught Fish

The candidate project site is devoid of the fishermen and fish market.

5.3 Fish Diversity

A total of 7 fish species is reported by the key informant. The lists of the fish species reported in the candidate project site is presented in the table below.

a) Fishes

S.N.	Consultation	Common Name	Scientific Name
1	Buduna	Stone Carp	*Chrossochelius latius*
2	Bage		*Botia lohachata*
3	Kande		*Pseudochenesis sulcatus*
4	Hile		*Channa spp.*
5	Katle		*Neolissochilus hexagonolepis*
6	Sahar		*Tor tor*
7	Bam		*Anguila bengalensis*

5.4 List of Fish Species of Conservation Significance

Of the 7 reported fish species 2 of the fish species are listed in the IUCN red list. Table below presents the list of the fish species of conservation significance.

S.N.	Local Name	Common Name	Scientific Name	Status			Source		
				IUCN	CITES	GON	Site survey	Hearing survey	Literature survey
1	Katle	Copper Mahaseer	Acrosocheilus/ Neolissochilus hexagonolepis	NT				Hearing at Gokule, Harihar gadhi	
2	Sahar		Tor tor	NT					

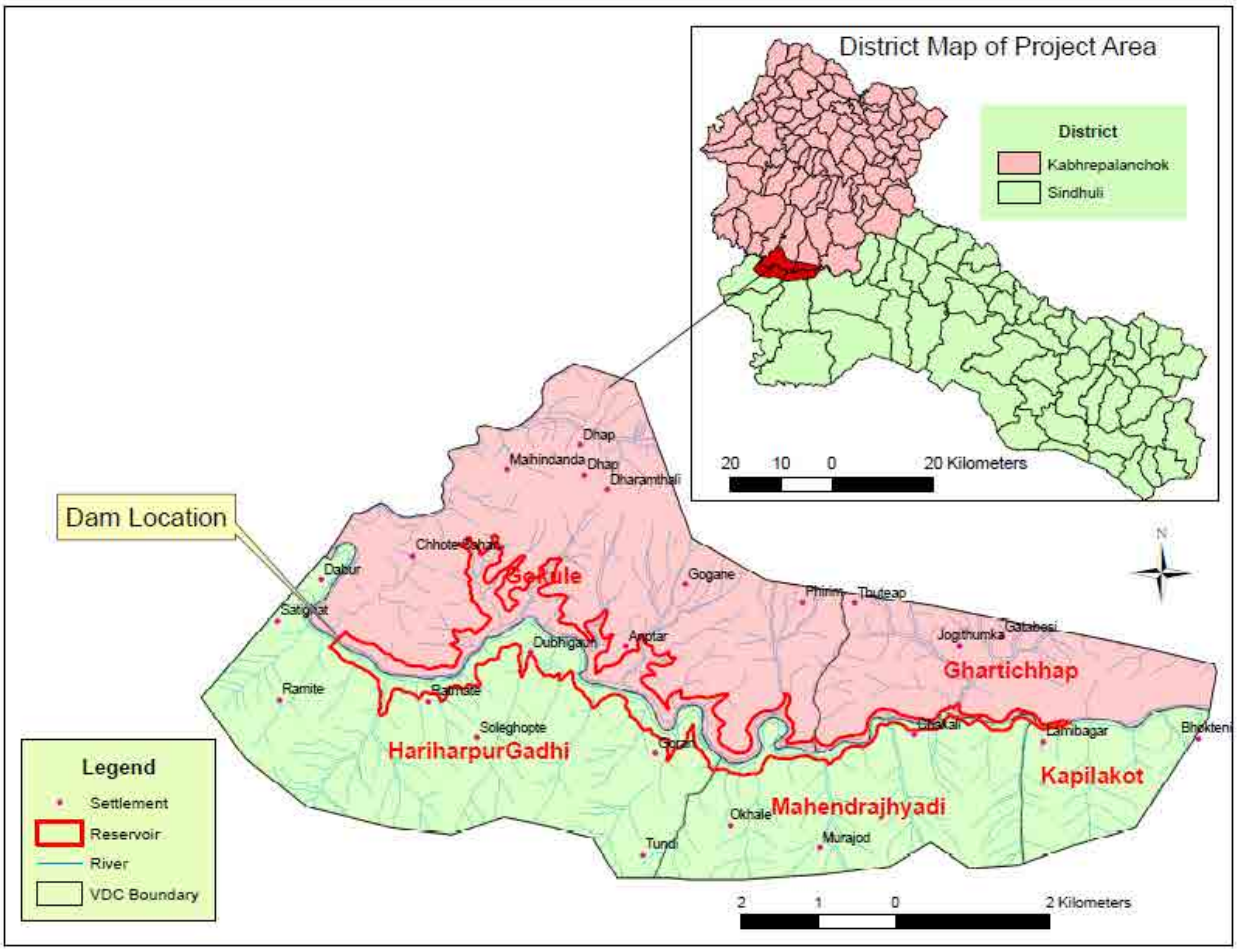
***IUCN Red List Categories**: Extinct (EX), Extinct In the Wild (EW), Critically Endangered (CR), Endangered (EN), Vulnerable (VU), Near Threatened (NT)*

***GOV Categories**: P Protected by legislation*

***CITES Categories**: I -Appendix I (are species that are threatened with extinction and are or may be affected by trade), II - Appendix II (are species that are not necessarily threatened with extinction, but may become so unless trade in specimens of such species is subject to strict regulation in order to avoid utilization incompatible with the survival of the species in the wild), and III - Appendix III (are species that are listed after one member country has asked other CITES Parties for assistance in controlling trade in a species)*

6 Topographic Map and Satellite Imagery Study

6.1 Project Location



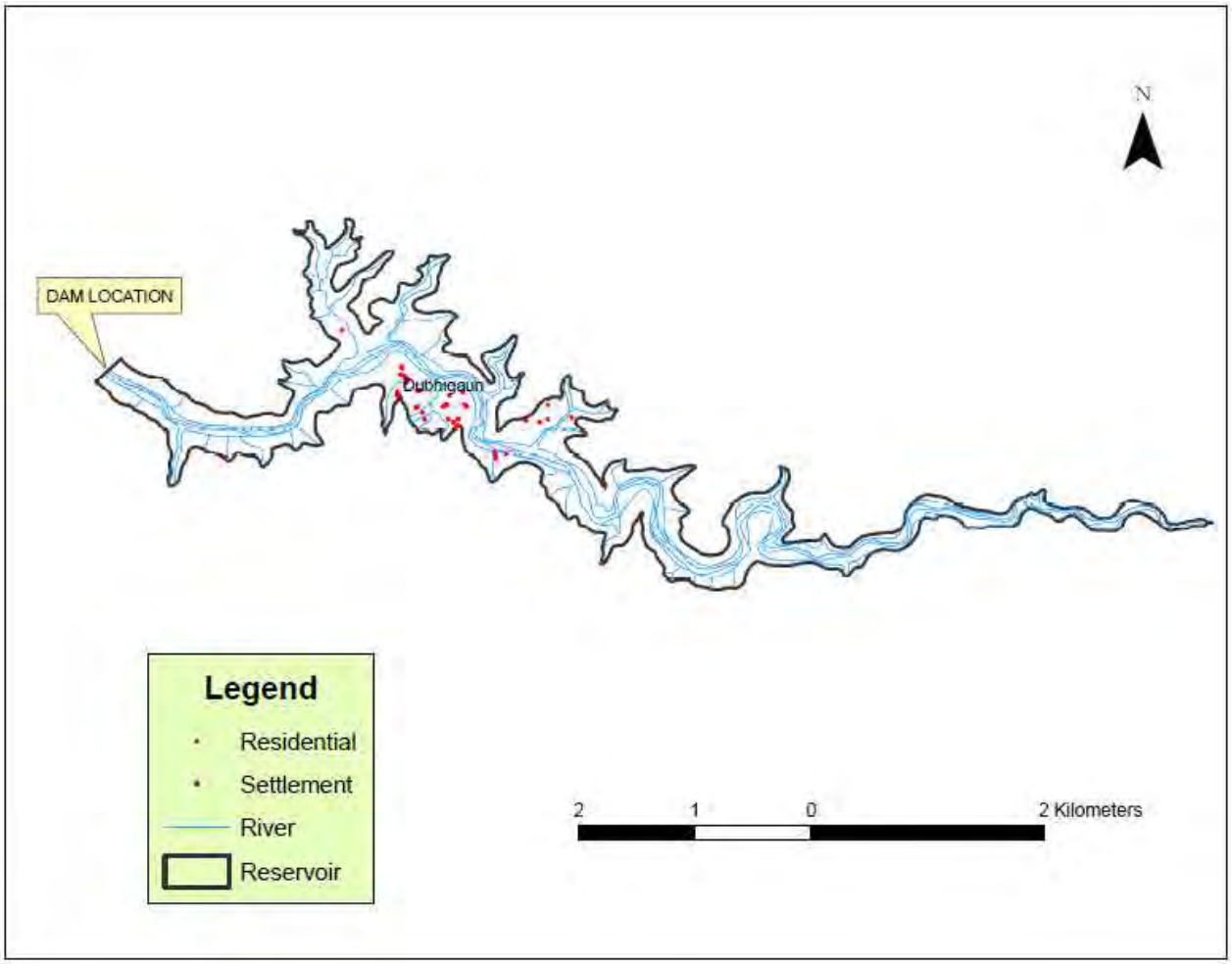
6.2 Topographic Maps

For this study, topographical maps of the scale of 1:25000 prepared by the Government of Nepal, Survey Department (1996) has been used for the analysis of land cover, and built structures, after digitizing. All data used for the topographic map study were projected to the Universal Transverse Mercator (UTM) projection system that is World Geodetic System 1984 for the analysis of topographic maps.

The analysis results are presented in the table and maps below.

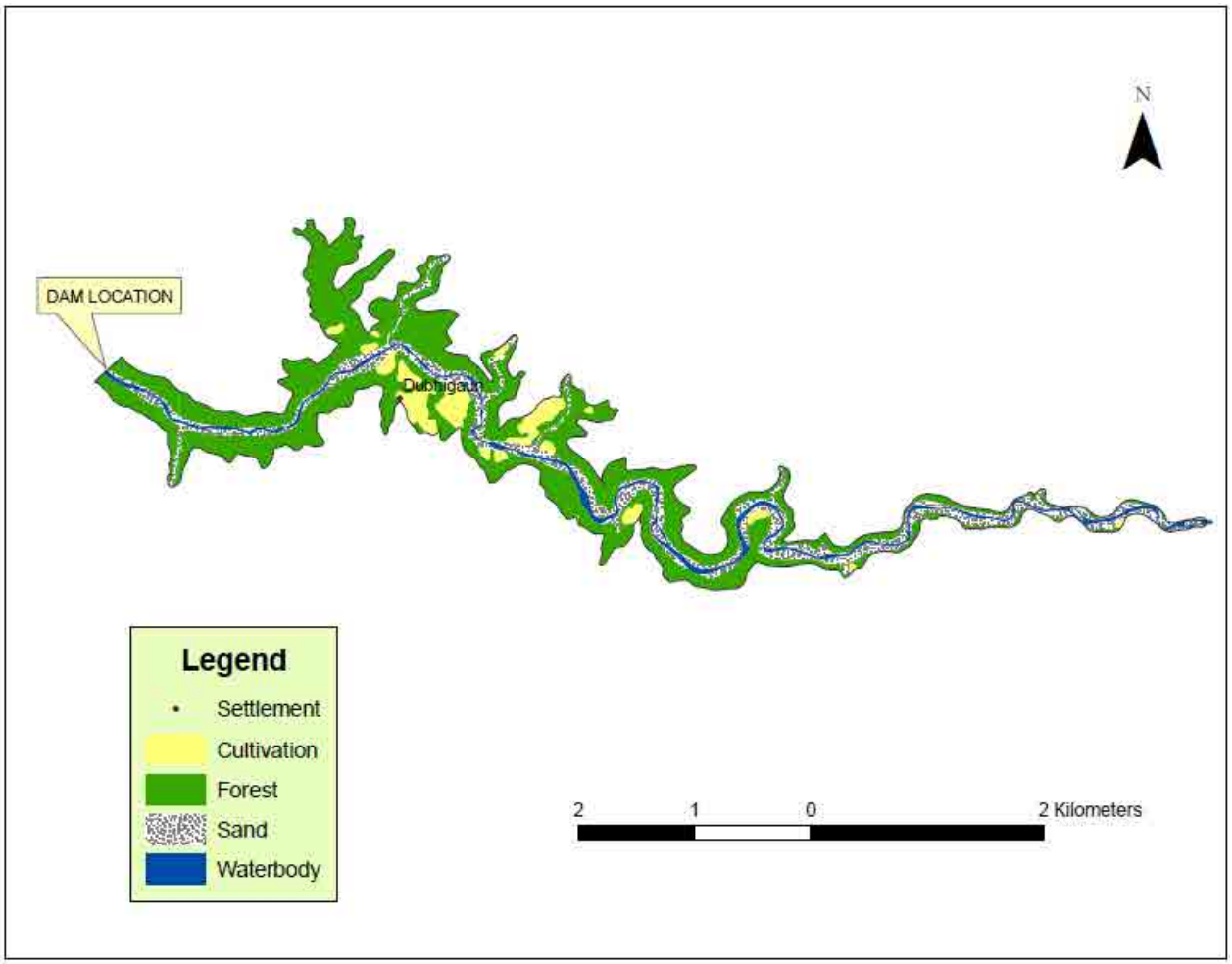
6.2.1 Built Structures

Nos. of building as per the Topographic maps	43



6.2.2 Land Use

S.N.	Land Use Class	Land Use Topographic Maps (1996), Km^2	Percentage
1	FOREST	2.8927	62.7487
2	BUSH		0.0000
3	SAND	0.9744	21.1368
4	CULTIVATED	0.3488	7.5658
5	CLIFF		0.0000
6	WATER	0.3948	8.5643
7	GRASS LAND		0.0000
	Total	**4.6100**	100.0000



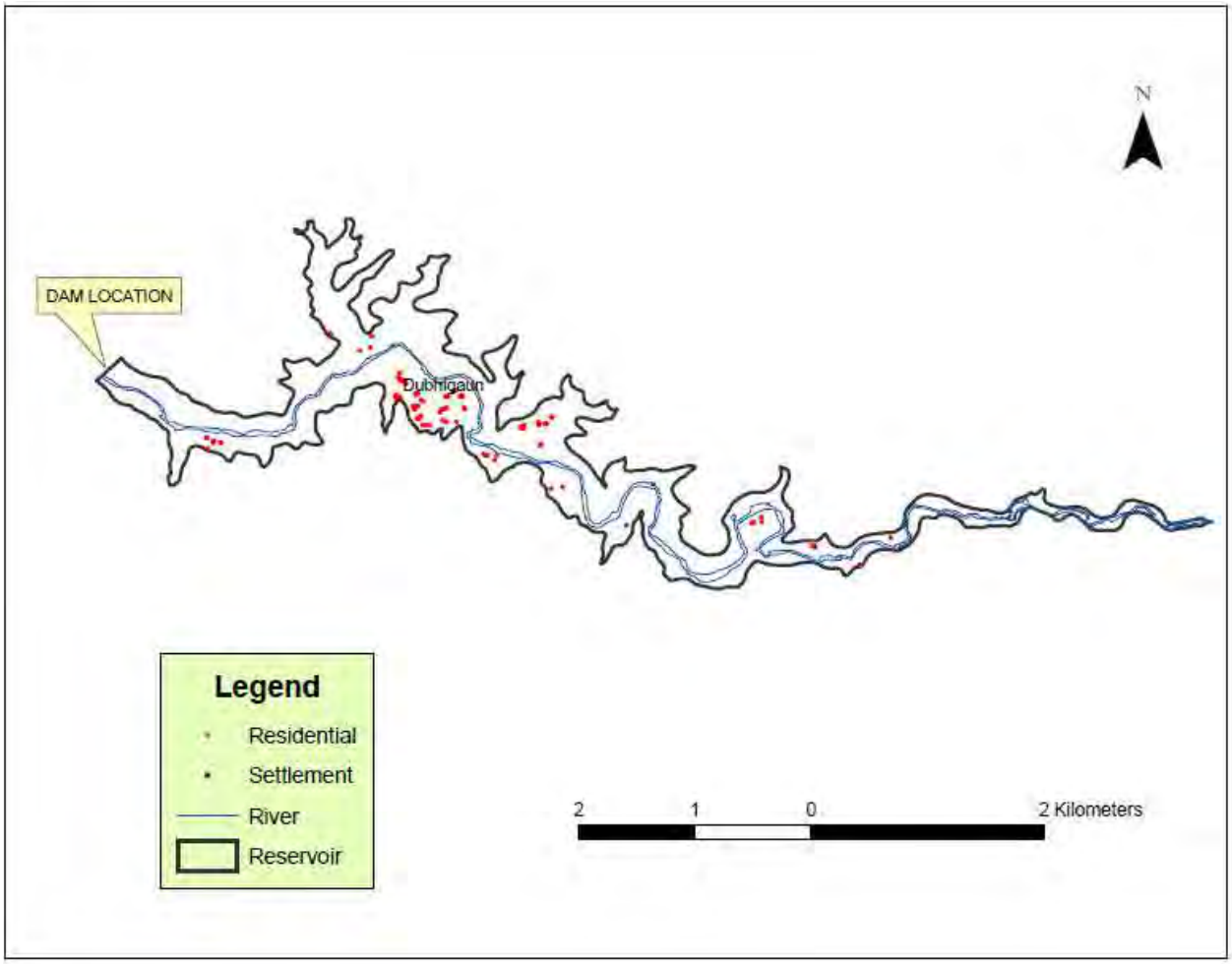
6.3 Satellite Image Maps

The Arc GIS 9.3 has been used for the analysis of image. World view 2 image of 2011 has been used for the land use and other parameters such as built structures, road networks, bridges etc. analysis of the area.

The analysis results are presented in tables and Map below.

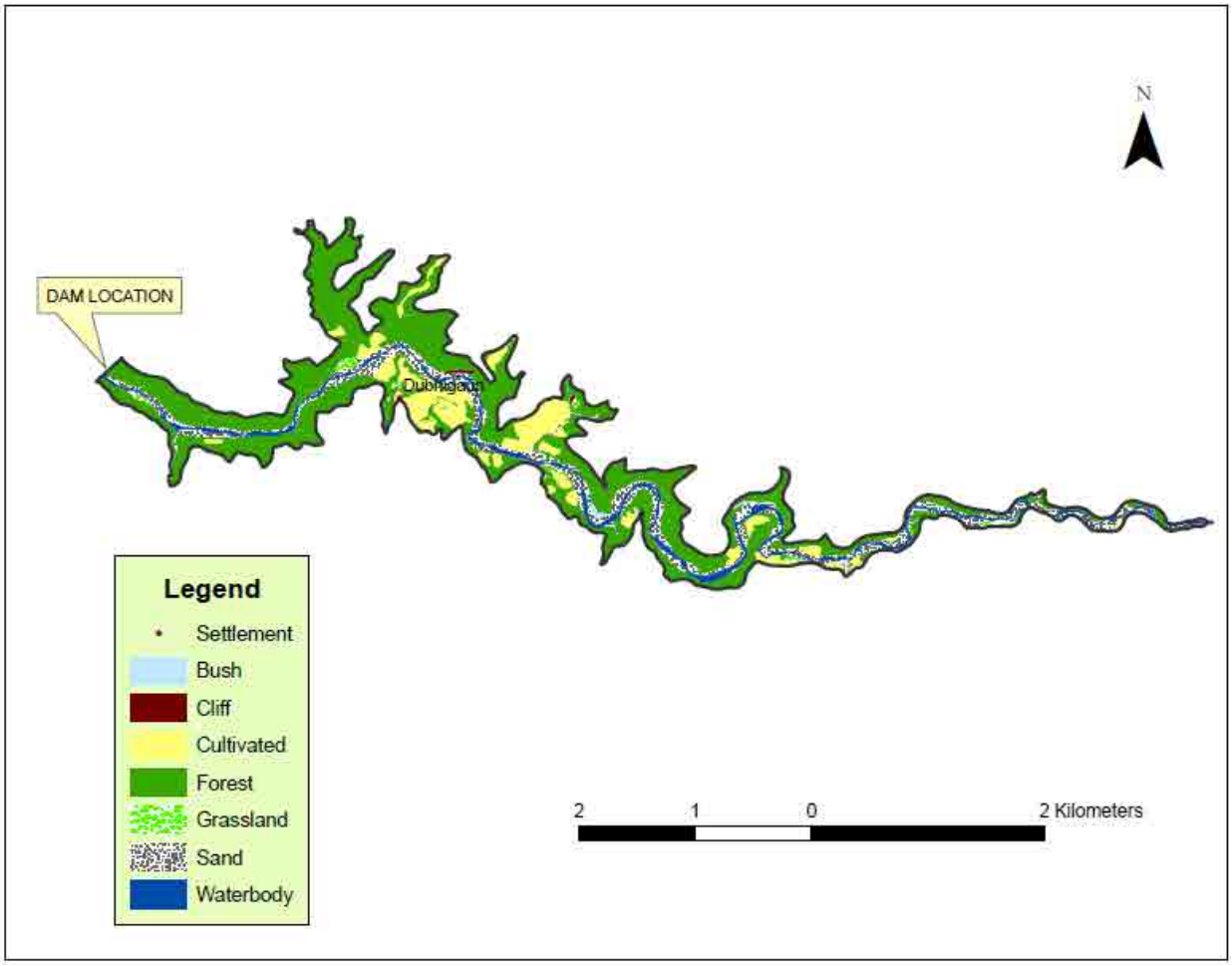
6.3.1 Building Structures

Nos. of building as per the Satellite Image	95



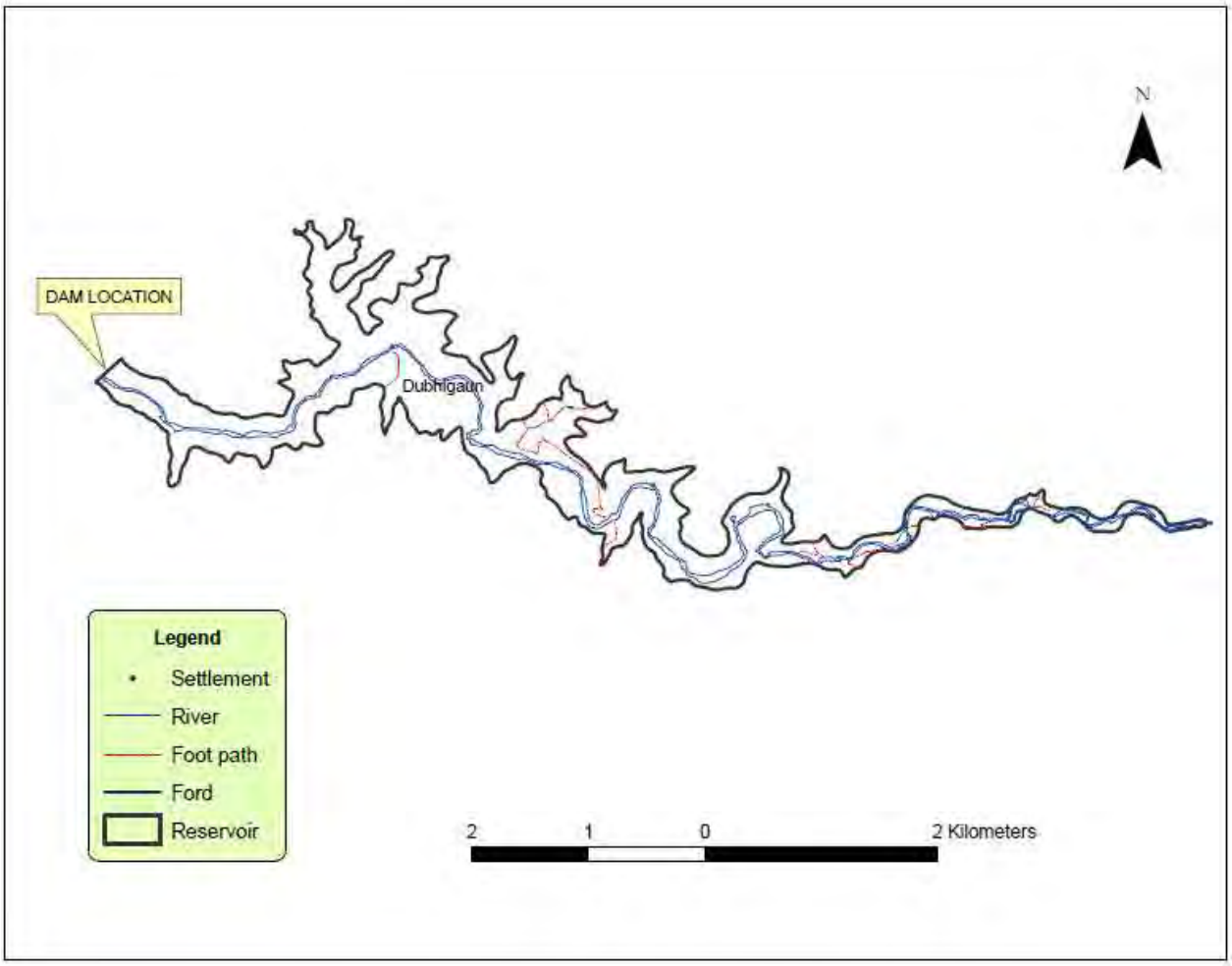
6.3.2 Land use

S.N.	Land Use Class	Land Use Satellite Image (2011), Km^2	Percentage
1	FOREST	2.8882	62.6500
2	BUSH	0.0180	0.3912
3	SAND	0.6915	15.0006
4	CULTIVATED	0.5964	12.9380
5	CLIFF	0.0110	0.2389
6	WATER	0.3497	7.5865
7	GRASS LAND	0.0557	1.2075
	Total	**4.6100**	100.0000



6.3.3 Infrastructures

Infrastructures	Nos. / Length
Total Nos. of Bridge on motorable road	0
Total Nos. of bridge on trail	0
Total Nos. of fords	2
Gravel road (m)	0
Paved Road (Highway) (m)	0
Main Trail (m)	0
Foot path (m)	5214



References

1. Bibhuti Ranjan Jha, 2006; *Fish Ecological Studies and its application in assessing Ecological Integrity of Rivers in Nepa*l; Thesis Submitted in partial fulfillment of the requirement for the degree of Doctor of Philosophy in The Department of Biological Sciences and Environmental Science, School of Science, Kathmandu University, Dhulikhel, Nepal, January 2006
2. CBS (2002), *Population Census 2001, National Report*, Kathmandu: Central Bureau of Statistics / UNFPA
3. CBS, 2012; *National Population and Housing Census 2011 (Village Development Committee / Municipalities), Government of Nepal,* National Planning Commission Secretariat, Central Bureau of Statistics, Kathmandu, Nepal, November 2012.
4. Disaster Preparedness Network, Nepal, 2009; *Nepal Disaster Report: The hazardscape and vulnerabilities*, Ministry of Home Affairs, Nepal Disaster Preparedness Network, Nepal with support from with support from European Commission for Humanitarian Aid Department, United Nations Development Nepal and Oxfam Nepal
5. IUCN, 2011; *The Status of Nepal's Mammals*: The National Red List Series
6. NARMSAP, 2002; *Forest and Vegetation Types of Nepal*, TISC Document Series No 105, GoN / MOFSC/NARMSAP, 1-179.
7. Petr, T, 2002; *Cold water fish and fisheries in countries of the high mountain arc of Asia (Hindu Kush-Pamir-Karakoram-Himalayas) A review*, Symposium on coldwater fish species in the trans-Himalayan region. 10-14 July 2001.Kathmandu, Nepal
8. Rajbansi K.J, 1982; *A General Bibliography on Fish and Fisheries of Nepal*, Royal Nepal Academy, Kamaladi, Kathmandu, Nepal.
9. Rajbansi K.J, 2002; *Zoogeographical distribution and the status of cold water fishes of Nepal*. Paper presented in symposium on coldwater fish species in the trans-himalayan region. 10-14 July 2001.Kathmandu, Nepal
10. Shrestha et.al, 2012; *Fishes of Nepal: Mapping distributions based on voucher specimens*, Emporia State Research Studies Vol. 48, no. 2, p. 14-21 (2012)
11. Shrestha, J. (1995); *Enumeration of the Fishes of Nepal*, Bio-diversity Profiles Project, Publication No. 10, Department of National Parks and wildlife Conservation, Ministry of Forest & Soil Conservation, GoN, Kathmandu, Nepal.
12. Shrestha, T. K., 2008; *Icology of Nepal A study of Fishes of the Himalayan Waters*
13. Stainton, J.D.A., 1972; *Forests of Nepal*, John Murray, London.

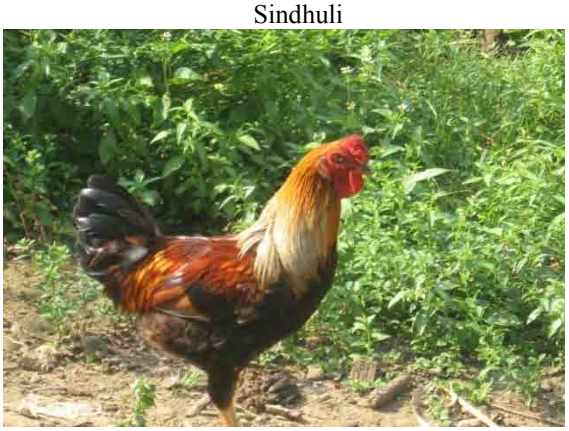
Photographs

Women carrying fodder at Aaptar, Gokule, Kabhre

Dabur, Hariharpur gadhi, Sindhuli

Interaction in Chha khutte, Hariharpur gadhi, Sindhuli

Interaction with local people at Ghattabesi, Kabhre



Local breed of Gallus, Bhogateni, Kapilakot, Sindhuli (2)

Quadrate sampling at Hariharpurgadhi VDC

Sal forest from Chhote San, Gokule VDC 3, Kabhre

Tintale, on the way to Kokti, HH Gadhi, Sindhuli

Appendixes

Appendix 1: Name list of FGD Participants (KOKHAJOR)

S.N.	Name of Respondent	Address	Occupation
1.	Surya Lama	Dandagaun-8, Ghaibari	Business
2.	Dil Maya Lama	Dandagaun-8, Tinkhutte	Busness
3.	Kaj Man Lama	Dandagaun-8, Tinkhutte	Farmer
4.	Chandra Man Lama	Dandagaun-8, Ghaibari	Farmer
5.	Dil Man Lama	Dandagaun-8, Ghaibari	Politics
6.	Devan Singh Waiba	Dandagaun-8, Appetar	Retired army
7.	Krishna Bdr Thowkar	Dandagaun-8, Appetar	Farmer
8.	Hom Waiba	Dandagaun-8, Appetar	Teacher
9.	Purna Maya Moktan	Dandagaun-8, Appetar	Farmer
10.	Patali Maya Waiba	Dandagaun-8, Appetar	Farmer
11.	Nima Devi Waiba	Dandagaun-8, Appetar	Student
12.	Nirmaya Tamang	Dandagaun-8, Belter	Farmer
13.	Bal Kumari Tamang	Dandagaun-8, Belter	Farmer
14.	Daiba Lal Tamang	Dandagaun-8, Belter	Student
15.	Ek Bdr. Rana	Gokule -2, Aaptar	Farmer
16.	Bhola Darlami	Gokule -2, Aaptar	Farmer
17.	Shyam Bdr Rana	Gokule -2, Aaptar	Farmer
18.	Chandra Bdr Rana	Gokule -2, Aaptar	Farmer
19.	Dhakal Bdr Rana	Gokule -2, Aaptar	Teacher
20.	Gupta Bdr Rana	Gokule -2, Aaptar	Farmer
21.	Bhim Bdr Thing	Gokule-3, Chotte Sahan	Farmer
22.	Pratima Moktan	Gokule-3, Chotte Sahan	Social mobilize
23.	Shankar Moktan	Gokule-3, Chotte Sahan	Teacher
24.	Priti Bdr Moktan	Gokule-3, Chotte Sahan	Farmer
25.	Bir Bdr Moktan	Gokule-3, Chotte Sahan	Farmer
26.	Woras Man Blown	Tal dhunga-7, Chakhutte	Farmer
27.	Prakash Bdr. Blown	Tal dhunga-7, Chakhutte	Farmer
28.	Babukaji Rumba	Tal dhunga-7, Chakhutte	Farmer
29.	Lal kaji Rumba	Tal dhunga-7, Chakhutte	Farmer
30.	Gopilal Thing	Hariharpur Gadhi-1, Ratamatta	Farmer
31.	Beacher Man Pahari	Hariharpur Gadhi-1, Ratamatta	Farmer
32.	Bire Bdr Sangya	Hariharpur -9, Kotati	farmer
33.	Rame Bdr Ghasing	Hariharpur -9, Kotati	Farmer
34.	Big Man Ghasing	Hariharpur -9, Kotati	Farmer
35.	Krishna Bdr Ghasing	Hariharpur -9, Kotati	Farmer
36.	Indra Bdr Bholan	Hariharpur -9, Kotati	Farmer
37.	Padam Bdr Sangya	Hariharpur -9, Kotati	Farmer
38.	Sancha Man Thakar	Hariharpur Gadhi -9, Tintale	Farmer
39.	Man Bdr Younjan	Hariharpur Gadhi -9, Tintale	Farmer
40.	Namga dorjhe younjan	Hariharpur Gadhi -9, Tintale	Farmer
41.	Suku Bdr Bal	Hariharpur Gadhi -9, Tintale	Farmer
42.	Hasta Bdr Bal	Hariharpur Gadhi -9, Tintale	Farmer
43.	Bir Dhowj Tamang	Hariharpur Gadhi -1, Dubhigai	Farmer
44.	Chakra Bdr Younjan	Hariharpur Gadhi -1, Dubhigai	Farmer
45.	Sher Bdr Waiba	Hariharpur Gadhi -1, Dubhigai	Farmer
46.	Pancha Lal Ghole	Hariharpur Gadhi-1, Goran	Farmer
47.	Ram Bdr Gimba	Hariharpur Gadhi-1, Goran	Farmer
48.	Bir Dhoj Thing	Hariharpur Gadhi-1, Goran	Farmer
49.	Dharma Dhoj Thing	Hariharpur Gadhi-1, Goran	Farmer
50.	Suk Bdr Thing	Hariharpur Gadhi-1, Goran	Farmer
51.	Hira Maya Younjan	Hariharpur Gadhi-5, Sotighat	Farmer
52.	Tanka Bdr Younjan	Hariharpur Gadhi-5, Sotighat	Politician
53.	Nema Bholan	Hariharpur Gadhi-5, Sotighat	Farmer

S.N.	Name of Respondent	Address	Occupation
54.	Harka Man Bholan	Hariharpur Gadhi-5, Sotighat	Farmer
55.	Kancha Ram Himlun	Hariharpur Gadhi-5, Sotighat	Farmer
56.	Git Bdr Pahari	Kapilkot-1, Paharigaun	Farmer
57.	Autar Bdr Magar	Kapilkot-1, Lamibagar	Farmer
58.	Karna Bdr Magar	Kapilkot-1, Lamibagar	Farmer
59.	Huck Bdr Magar	Kapilkot-1, Lamibagar	Farmer
60.	Parbin Darmali	Kapilkot-1, Lamibagar	Farmer
61.	Ackal Bdr Ale	Kapilkot-1, Lamibagar	Farmer
62.	Sabitra Magar	Kapilkot-1, Lamibagar	Farmer
63.	Bir Bdr Tamang	Mahendra Jhyadi-5,Chakali	Farmer
64.	Dhawa Lama	Mahendra Jhyadi-5,Chakali	Farmer
65.	Dhan Bdr Tamang	Mahendra Jhyadi-5,Chakali	Farmer
66.	Man Bdr Tamang	Mahendra Jhyadi-5,Chakali	Farmer
67.	Sanu Ram Pahari	Mahendra Jhyadi-5,Chakali	Farmer
68.	Dhan Bdr Magar	Mahendra Jhyadi-5,Chakali	Farmer
69.	Som Bdr Magar	Mahendra Jhyadi-5,Chakali	Farmer
70.	Tek Bdr Magar	Mahendra Jhyadi-5,Chakali	Farmer
71.	Uttar Bahadur Gyandish	Kapilakot-1, Lamibagar	Farmer
72.	Devi Bahadur Rakhel	Kapilakot-1, Lamibagar	Farmer
73.	Bir Bahadur Tamang	Mahendrajhyadu-9, Chakali	Farmer
74.	Gupta Bahadur Rana	Gokule-2 Aaptar	Farmer
75.	Bir Dhwoj Yonjan	Hariharpur Gadhi-1, Dubhigaun	Farmer
76.	Bhim Bahadur Thing	Gokule-3, Chotte shan	Farmer
77.	Nirmaya Tamang	Dadagaun-1, Beltar	Farmer
78.	Devan Singh Waiwa	Dadagaun-8, Aaptar	Farmer
79.	Big Man Ghising	Hariharpur Gadhi-9, Kokti	Farmer
80.	Gupta Bahadur Rana	Gokule-2, Aaptar	Farmer

Appendix 2: Number of Households by Caste/Ethnic Groups

S.N.	District /VDCs	Settlements	Chhetri	Magar (Disadvantage Group)	Gurung (Disadvantage group)	Tamang (Marginalized group)	Pahari (Marginalized group)
A.	**Kavre**						
4	Gokule	Aanptar	0	32	0	4	0
B.	**Sindhuli**						
7	Hariharpur gadhi	Ratamata	0	0	0	2	0
10		Dubhigai	0	0	0	25	0
11		Goran	0	0	0	11	0
13	Kopilakot	paharigaun	0	0	0	1	0
14		Lamibagar	0	8	0	0	0
15	Mahendra jhyadi	Chakali	0	5	0	4	0
Total	**4**	**7**	**0**	**45**	**0**	**47**	**0**
%			**0**	**48.91**	**0.00**	**51.09**	**0**

Source: NESS Field Survey, 2012

Appendix 3: Land Use by VDCs and Cluster

S.N.	District	VDC	Settlement	Land Use (Area Ropani)				
				Agriculture	pasture	forest	other	Total
4	Kavre	Gokule	Aanptar	840	7	30	0	837
7	Sindhuli	Hariharpur gadhi	Ratamata	10	0	150	0	160
10	Sindhuli	Hariharpur gadhi	Dubhigai	700	30	150	0	880
11	Sindhuli	Hariharpur gadhi	Goran	91	12	150	0	253
13	Sindhuli	Kopilakot	paharigaun	13	0	20	0	33
14	Sindhuli	Kopilakot	Lamibagar	67	13	26	0	106
15	Sindhuli	Mahendra jhyadi	Chakali	117	12	250	0	379
	Total			**1838**	**74**	**776**	**0**	**2648**
	%			**69.41**	**2.79**	**29.31**	**0**	**100**

Source: NESS Field Survey, 2012

Appendix 4: Types of Agricultural Land and Holding Size by VDCs and Cluster

S.N.	District	VDC	Settlement	Land Area (Ropani)			
				Khet	Pakho	Total	Av Holding Size
4	Kavre	Gokule	Aanptar	800	40	840	23.33
7	Sindhuli	Hariharpur gadhi	Ratamata	7	3	10	5
10	Sindhuli	Hariharpur gadhi	Dubhigai	700	0	700	28
11	Sindhuli	Hariharpur gadhi	Goran	91	0	91	8.27
13	Sindhuli	Kopilakot	paharigaun	7	6	13	13
14	Sindhuli	Kopilakot	Lamibagar	38	29	67	8.38
15	Sindhuli	Mahendra jhyadi	Chakali	62	55	117	13
	Total			**1705**	**133**	**1838**	**14.14**
	%			**92.76**	**7.24**	**100**	**14.14**

Source: NESS Field Survey, 2012

Appendix 5: Crop Area and Production by VDCs and Cluster

S.N.	District/VDC	Settlement	Area (Ropani) and Production (Kg)											
			Paddy		Maize		Millet		Pulses		Oilseeds		Vegetables	
			Area	Prod	Area	Prod	Area	Prod	Area	Prod	Area	Prod	Area	Prod
4	Gokule	Aanptar	800	160000	700	808500	450	25000	50	20000	0	0	2	3000
7	**Sindhuli/** Hariharpur gadhi	Ratamata	7	8000	9	9500	4	3500	0	0	0	0	2	2300
10		Dubhigai	700	154000	500	120000	0	0	0	0	0	0	13	250000
11		Goran	21	8750	50	41250	25	2750	8	3000	0	0	0	0
13	Kopilakot	paharigaun	13	650	4	240	2	120	0	0	0	0	0	0
14		Lamibagar	67	10720	70	7700	50	2500	0	0	0	0	2	2000
15	Mahendra jhyadi	Chakali	62	9300	22	1320	33	1980	0	0	0	0	0	0
	Total		**1670**	**351420**	**1355**	**988510**	**564**	**35850**	**58**	**23000**	**0**	**0**	**19**	**257300**

Source: NESS Field Survey, 2012

Appendix 6: Festivals and Religious sites

District	VDC	Settlement	Main festival	Any festivals of Janajatis	Religious site at the river
Kavre	Gokule	Aanptar	Dashain, tihar	Mangsir purnima	no such site
Sindhuli	Hariharpur gadhi	Ratamata	Dashain, tihar	No	no such site
Sindhuli	Hariharpur gadhi	Dubhigai	Dashain ,tihar	No	no such site
Sindhuli	Hariharpur gadhi	Goran	Dashain, tihar	No	no such site
Sindhuli	Kopilakot	paharigaun	Dashain, Maghesangranti	No	kokhajor khola
Sindhuli	Kopilakot	Lamibagar	Dashian, Maghesangranti	No	no such site
Sindhuli	Mahendra jhyadi	Chakali	Dashian, Maghesangranti,tihar	No	no such site

Source: NESS Field Survey, 2012

Appendix 7: Perceived Impact from Hydropower Projects

District	VDC	Settlement	Perceived Impact	
			Positive impact	Negative impact
Kavre	Gokule	Aanptar	local employment and electricity	Loss of Land
Sindhuli	Hariharpur gadhi	Ratamata	local employment and electricity	NA
Sindhuli	Hariharpur gadhi	Dubhigai	Employment opportunity, eletricity	NA
Sindhuli	Hariharpur gadhi	Goran	electricity, employment	NA
Sindhuli	Kopilakot	Paharigaun	Employment opportunity, electricity	NA
Sindhuli	Kopilakot	Lamibagar	Poverty eradication , electricity	NA
Sindhuli	Mahendra jhyadi	Chakali	Local employment and electricity	NA

Source: NESS Field Survey, 2012

Appendix 8: Public Consultation Kokhajhor-1 Project (Sindhuli and Kavre Districts)

Field visit to the Kokhajhor project site was made on 14th to 27th July 2012. The objective of the visit was to collect primary information on the social, socio-economic, cultural, forest resources, wildlife, disaster records and aquatic ecological aspects from the reservoir area and the key structural locations of the project.

Since the study period was limited, most of the information related to the above aspects was derived based on the public consultations and interviews with the key informants. The socio-economic information was solicited from the focus group discussions at various settlements within the reservoir area. Information on disaster, fishermen, and fish diversity is based on the key informant interviews, while information on the forest, floral and wildlife diversity is based on the direct observation and interviews with the key informants of the local area. Focus group consultation meetings were held at 13 sites within the reservoir area (Table 1), while 6 key informants were interviewed for in depth knowledgeable information (Table 2).

Table 1: Participants of the Focus Group Discussion

S.N.	NAME OF RESPONDENT	OCCUPATION / POSITION	
DANDAGAUN – 8; GHAIBARI (TINKHUTE)			
1	SURYA LAMA	SHOPKEEPER	DANDAGAUN – 8; GHAIBARI (TINKHUTE)
2	DIL MAYA LAMA	SHOPKEEPER	DANDAGAUN – 8; GHAIBARI (TINKHUTE)
3	KAJ MAN LAMA	AGRICULTURE	DANDAGAUN – 8; GHAIBARI (TINKHUTE)
4	CHANDRA MAN LAMA	AGRICULTURE	DANDAGAUN – 8; GHAIBARI (TINKHUTE)
DANDAGAUN – 8; APPETAR			
1	DEVAR SINGH WAIBA	EX- INDIAN ARMY	DANDAGAUN – 8; APPETAR
2	KRISHNA BDR THOKAR	FARMER	DANDAGAUN – 8; APPETAR
3	HOM WAIBA	TEACHER	DANDAGAUN – 8; APPETAR
4	PURNA MAYA MOKTAN	FARMER	DANDAGAUN – 8; APPETAR
5	PATALI MAYA WAIBA	FARMER	DANDAGAUN – 8; APPETAR
6	NIMA DEVI WAIBA	STUDENT	DANDAGAUN – 8; APPETAR
DANDAGAUN – 8; BELTAR			
1	NIRMAYA TAMANG	FARMER	DANDAGAUN – 8; BELTAR
2	BAL KUMARA TAMANG	FARMER	DANDAGAUN – 8; BELTAR
3	DAIBA LAL TAMANG	STUDENT	DANDAGAUN – 8; BELTAR
GOKULE – 2; AANPTAR			
1	EK BDR RANA	FARMER	GOKULE – 2; AANPTAR
2	BHOLA DARLAMI	FARMER	GOKULE – 2; AANPTAR
3	SHYAM BDR RANA	FARMER	GOKULE – 2; AANPTAR
4	CHANDRA BDR RANA	FARMER	GOKULE – 2; AANPTAR
5	DHAKAL BDR RANA	TEACHER	GOKULE – 2; AANPTAR
6	GUPTA BDR RANA	FARMER	GOKULE – 2; AANPTAR
GOKULE - 3; CHOTTE SAHAN			
1	BHIM BDR THING	FARMER	GOKULE - 3; CHOTTE SAHAN
2	PRATIMA MOKTAN	SOCIAL MOBILIZER	GOKULE - 3; CHOTTE SAHAN
3	SHANKAR MOKTAN	TEACHER	GOKULE - 3; CHOTTE SAHAN
4	PRITI BDR MOKTAN	FARMER	GOKULE - 3; CHOTTE SAHAN
5	BIR BDR MOKTAN	FARMER	GOKULE - 3; CHOTTE SAHAN
TALDHUNGA -7; CHA KHUTTE (BAHUN GAUN)			
1	BORAS MAN BLOWN	FARMER	TALDHUNGA -7; CHA KHUTTE (BAHUN GAUN)

S.N.	NAME OF RESPONDENT	OCCUPATION / POSITION	
2	PRAKASH BDR BLOWN	FARMER	TALDHUNGA -7; CHA KHUTTE (BAHUN GAUN)
3	BABUKAJI RUMBA	FARMER	TALDHUNGA -7; CHA KHUTTE (BAHUN GAUN)
4	LAL KAJI RUMBA	FARMER	TALDHUNGA -7; CHA KHUTTE (BAHUN GAUN)
HARIHARPUR GADHI -1; RATAMATA			
1	GOPI LAL THING	AGRICULTURE	HARIHARPUR GADHI -1; RATAMATA
2	BICHERMAN PAHARI	AGRICULTURE	HARIHARPUR GADHI -1; RATAMATA
HARIHARPUR GADHI -9; KOTATI			
1	BIRE BHD SANGYA	FARMER	HARIHARPUR GADHI -9; KOTATI
2	RAME BHD GHASING	FARMER	HARIHARPUR GADHI -9; KOTATI
3	BIG MAN GHASING	FARMER	HARIHARPUR GADHI -9; KOTATI
4	KRISHNA BHD GHASING	FARMER	HARIHARPUR GADHI -9; KOTATI
5	INDRA BHD BHOLAN	FARMER	HARIHARPUR GADHI -9; KOTATI
6	PADAM BHD SANGYA	FARMER	HARIHARPUR GADHI -9; KOTATI
HARIHARPUR GADHI -9; : TINTALE			
1	SANCHA MAN THAKAR	FARMER	HARIHARPUR GADHI -9; **:** TINTALE
2	MAN BDR YOUNJAN	FARMER	HARIHARPUR GADHI -9; **:** TINTALE
3	NAMGA DORJE YONJAN	FARMER	HARIHARPUR GADHI -9; **:** TINTALE
4	SUKU BDR BAL	FARMER	HARIHARPUR GADHI -9; **:** TINTALE
5	HASTA BHD BAL	FARMER	HARIHARPUR GADHI -9; **:** TINTALE
HARIHARPUR GADHI -1; DUBHIGA			
1	BIR DHOWJ TAMANG	FARMER	HARIHARPUR GADHI -1; DUBHIGA
2	CHAKRA BDR YONJAN	FARMER	HARIHARPUR GADHI -1; DUBHIGA
3	SHER BDR WAIBA	FARMER	HARIHARPUR GADHI -1; DUBHIGA
HARIHARPUR GADHI -1; GORAN			
1	PANCHA LAL GOLE	FARMER	HARIHARPUR GADHI -1; GORAN
2	RAM BDR GIMBA	FARMER	HARIHARPUR GADHI -1; GORAN
3	BIR DHOWJ THING	FARMER	HARIHARPUR GADHI -1; GORAN
4	DHARMA DHOWJ THING	FARMER	HARIHARPUR GADHI -1; GORAN
5	SUK BDR THING	FARMER	HARIHARPUR GADHI -1; GORAN
HARIHARPUR GADHI -5; SOTIGHAT			
1	HIRA MAYA YONJAN	FARMER	HARIHARPUR GADHI -5; SOTIGHAT
2	TANKA BDR YONJAN	FARMER	HARIHARPUR GADHI -5; SOTIGHAT
3	NEMA BHOLAN	FARMER	HARIHARPUR GADHI -5; SOTIGHAT
4	HARKA MAN BHOLAN	FARMER	HARIHARPUR GADHI -5; SOTIGHAT
5	KANCHA RAM HIMLUN	FARMER	HARIHARPUR GADHI -5; SOTIGHAT
	KOPILAKOT – 1; PAHARIGAUN		
1	JEET BDR PAHARI	NA	KOPILAKOT – 1; PAHARIGAUN
KOPILAKOT – 1; LAMIBAGAR			
1	AUTTAR BHD MAGAR	FARMER	KOPILAKOT – 1; LAMIBAGAR
2	KARNA BDR MAGAR	FARMER	KOPILAKOT – 1; LAMIBAGAR
3	HUCK BDR MAGAR	FARMER	KOPILAKOT – 1; LAMIBAGAR
4	PARBIN DARMALI	FARMER	KOPILAKOT – 1; LAMIBAGAR
5	AKKAL BDR ALE	FARMER	KOPILAKOT – 1; LAMIBAGAR
6	SHABITRA MAGAR	FARMER	KOPILAKOT – 1; LAMIBAGAR
MAHENDRA JHYADI -5; CHAKALI			
1	BIR BDR TAMANG	FARMER	MAHENDRA JHYADI -5; CHAKALI
2	DHAWA LAMA	FARMER	MAHENDRA JHYADI -5; CHAKALI
3	DHAN BDR TAMANG	FARMER	MAHENDRA JHYADI -5; CHAKALI
4	MAN BDR TAMANG	FARMER	MAHENDRA JHYADI -5; CHAKALI
5	SANU RAM PAHARI	FARMER	MAHENDRA JHYADI -5; CHAKALI
6	DHAN BDR MAGAR	FARMER	MAHENDRA JHYADI -5; CHAKALI
7	SOM BDR MAGAR	FARMER	MAHENDRA JHYADI -5; CHAKALI
8	TEK BDR MAGAR	FARMER	MAHENDRA JHYADI -5; CHAKALI

Table 2: Key Informant for Interview

S.N	NAME OF KEY INFORMANTS	OCCUPATION/POSITION	LOCATION
1	UTTAR BAHADUR GYANDISH AND DEVI BAHADUR RAKHEL	AGRICULTURE	KAPILAKOT-1, LAMIBAGAR
2	BIR BAHADUR TAMANG	AGRICULTURE	MAHENDRAJHYADU-9, CHAKALI
3	GUPTA BAHADUR RANA	AGRICULTURE	GOKULE-2 AAPTAR
4	BIR DHWOJ YONJAN	AGRICULTURE	HARIHARPUR GADHI-1, DUBHIGAUN
5	BHIM BAHADUR THING	AGRICULTURE	GOKULE-3, CHOTTE SHAN
6	NIRMAYA TAMANG	AGRICULTURE	DADAGAUN-1, BELTAR
7	DEVAN SINGH WAIWA	AGRICULTURE / EX-INDIAN ARMY	DADAGAUN-8, AAPTAR
8	BIG MAN GHISING	AGRICULTURE	HARIHARPUR GADHI-9, KOKTI
9	PRITHVI BAL ALE		

To get the information from the project site's local communities the strategic approach taken was to aware people on the Nationwide Master Plan Study of the Storage Type Hydro-electric Projects before seeking information on the local environmental and social resources and the concerns of the people regarding the Kokhajor project.

It is therefore the field survey team, before initiating dialogue with the local communities described why the Nationwide Master Plan Study for Storage type hydroelectric project is needed? Who is undertaking the study? What will be the output of the study? In this process the team also highlighted on how this project in this area was selected for further study? and what the study team will like to get information from the local area communities not limiting to the social and environmental information but also the concerns of the people with regard to the project and their aspirations with the project if it is screened for further study and development.

This section describes the local people knowledge on the project apart from the concerns and aspirations of the people from the project.

For the overall development of the region and to ease the current electricity crisis, the communities were ready to support the project development. The major concern of the people is regarding the resettlement and rehabilitation. The concern was whether they will be resettled and rehabilitated in a nearby area. The other concern is the potential landslide, as the soil and rock of the area is relatively weak compared to the other areas in the north.

The local community aspiration is that the affected communities should get job opportunities in the project considering their contribution to the project. The community infrastructures such as schools, health posts, and road network are not adequate to meet the needs and aspired that the project will contribute significantly in the development of the community infrastructures. They also aspired to get skill trainings so as to maximize the benefit of the available job opportunities in the project.

Annex 14: Environmental Survey Report

Sun Koshi No.3 Project (E-17)

Table of Contents

Introduction

Federal Democratic Republic of Nepal is rich in water resources, its potential water power is 83,000 MW and economically exploitable water power is 42,000 MW. However, as of 2011, the total generating capacity of the country is only about 718.62 MW. Of the total installed capacity 92% is from the hydroelectric power plants. In addition, since most of hydroelectric power plants are run-of-river type, their output decreases seriously in the dry seasons. Consequently, there is a rolling blackout of as long as 14 hours a day which poses many problems including affects in livelihood and industries which severely impact the national economy.

To cope with these situations, the government of Nepal has worked out "National Electricity Crisis Resolution Action Plan" and "10-Year Hydropower Development Task Force" at the end of 2008. The above action plan and task force recommended need of storage-type hydroelectric power plants able to supply sustainable electricity uninterruptedly even in dry seasons to solve current power shortage at an early date.

However, construction of storage-type hydroelectric power plants should be carried out systematically taking into consideration of various aspects including the overall water resource development policy of Nepal, hydrological and geological characteristics, environmental impact, etc. Therefore, the Government of Nepal has requested the Government of Japan to work out a nationwide master plan for storage-type hydroelectric power development.

Electric Power Development Company Limited (J–Power) appointed by the JICA for the nationwide master plan study based on the desk level study in close association with NEA screened 10 candidate projects for the master plan study out of the list of 67 promising projects identified by NEA all over Nepal. **Table 1a and 1b** presents the salient features of the 10 promising projects screened for the master plan study, while **Figure 1** presents the location of the projects.

Table 1a: Salient Features of Potential Projects

No.	Project Name	Location (District)	Location of Dam Site		River	Installed Capacity (MW)	Catchment Area (km^2)
			Longitude	Latitude			
E-01	Dudh Koshi	Okhaldhunga/Khotang Dist.	86° 39' 17.3	27° 15' 47.2	Dudh Koshi to Baiku Khola	300.0	4100
E-06	Kokhajor-1	Sinchuli, Sindhupalchok	85° 29' 59.6	27° 22' 21.9	Kokhajor	111.5	281
E-17	Sun Koshi No.3, Kosi MP	Ramechhap, Kavre and Sindhupalanchok	85° 48' 14.3	27° 29' 50.5	Sun Koshi	536.0	5520
C-02	Lower Badigad	Gulmi	83° 27' 22.2	28° 0' 0.6	Badigad	180.3	2050
C-08	Andhi Khola	Syangja	83° 36' 30.6	27° 58' 2.6	Andhi Khola	180.0	475
W-02	Chera-1	Jajarkot	82° 1' 12.3	28° 42' 56.4	Chera	148.7	809
W-05	Lower Jhimruk	Arghakhachi, Pyuthan	83° 1' 1	27° 55' 30.8	Jhimruk	142.5	995
W-06	Madi	Rolpa	82° 35' 15.5	28° 18' 48.5	Madi	199.8	674
W-23	Nalsyau Gad	Jajarkot	82° 17' 42.8	28° 52' 4.7	Nalsyau Gad	410.0	571
W-25	Naumure (W. Rapti)	Argakhanchi, Pyuthan	82° 55' 42.9	27° 55' 6.1	West Rapti	245.0	3430

Table 1b: Salient Features of Potential Projects

No.	Project Name	Dam Height (m)	Total Storage Volume (MCM)	Effective Storage Volume (MCM)	Reservoir Area (km2)	FSL (m)	MOL (m)	TWL (m)	Rated Gross Head (m)	Rated Power Discharge (m3/sec)
E-01	Dudh Koshi	180.0	687.40	442.10	11.05	580.0	530.00	303.35	275.0	136.00
E-06	Kokhajor-1	107.0	218.70	166.10	8.92	437.00	390.00	200.00	226.3	63.90
E-17	Sun Koshi No.3, Kosi MP	140.0	1,220.00	555.00	23.99	700.0	674.00	575.00	116.3	109.34
C-02	Lower Badigad	191.0	995.90	505.50	13.65	688.00	654.00	475.00	196.0	232.60
C-08	Andhi Khola	157.0	336.50	238.70	5.52	675.00	626.70	368.48	307.0	81.40
W-02	Chera-1	186.0	254.90	141.10	4.00	866.0	814.00	640.00	220.0	80.50
W-05	Lower Jhimruk	167.0	386.00	211.60	4.98	597.0	557.0	390.0	194.6	88.10
W-06	Madi	190.0	359.50	235.10	7.66	1,090	1,030.00	800.00	280.8	84.90
W-23	Nalsyau Gad	200.0	419.6	296.3	6.3	1,570.0	1,498.00	872.0	644.0	75.00
W-25	Naumure (W.Rapti)	190.0	1,021.00	580.00	19.76	517.0	474.00	358.00	162.6	185.60

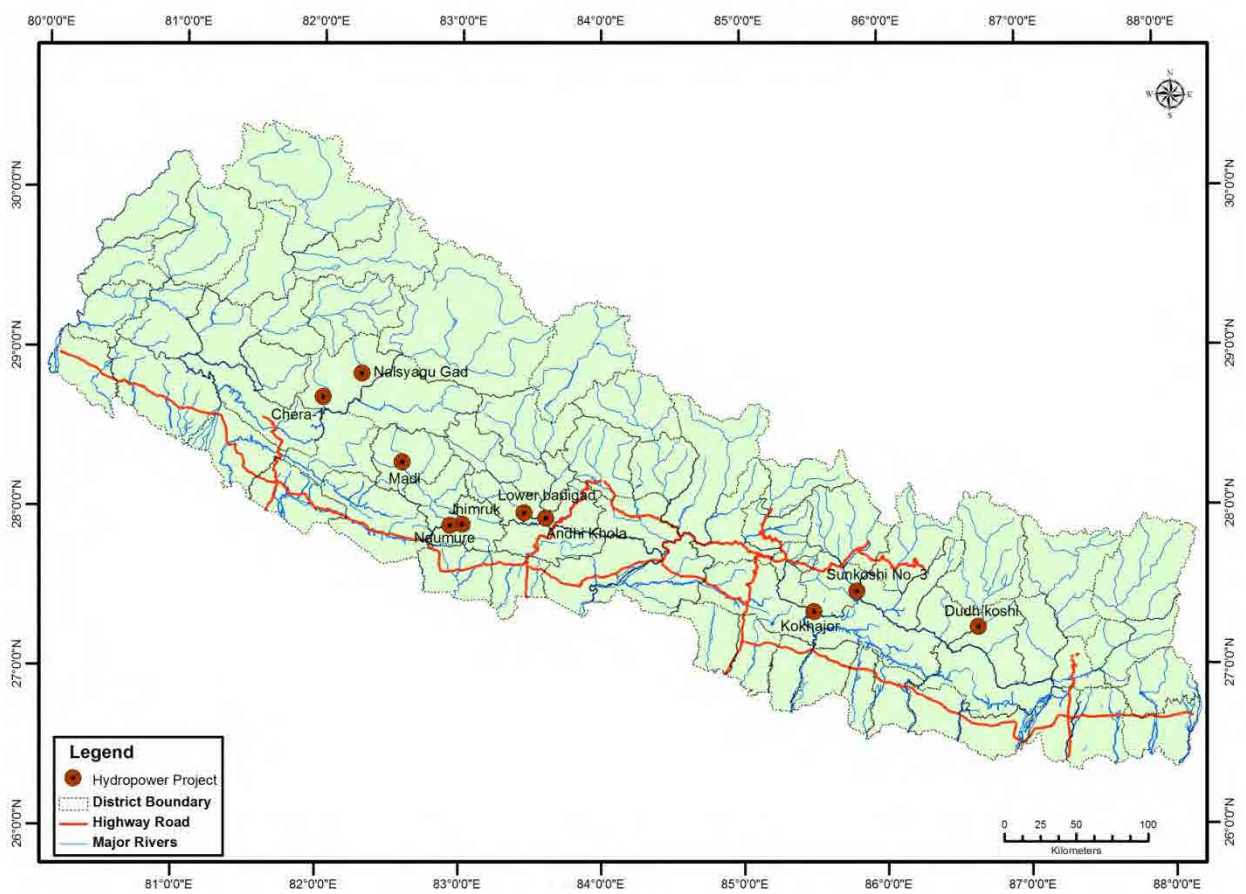


Figure 1: Ten Promising Sites Identified for Survey

The NESS, a local consulting firm of Nepal was entrusted by J-Power for the required SEA field studies of the 10 candidate projects. As per the ToR of works, there are basically two types of surveys required namely; geological, geotechnical, construction material and seismicity study, and environmental and

social study. This report deals with the field survey findings of social and environmental study on **Sun Koshi No.3 Project** identified as one of the candidate project in the central Nepal.

1 SOCIO-ECONOMIC ENVIRONMENT

The information regarding the social and economic conditions of the people in Nepal is available in the publications of the Central Bureau of Statistics. But such information is limited to administrative units such as VDCs, DDCs, Development Zones and at national level. As the candidate projects cross cut the administrative units, the available data on the social and economic concerns could not be used effectively to characterize the direct impact areas by the projects. To fill this gap field level studies on Socio-economic and Environmental Concerns[1] are conducted through participatory methods. The findings of the field surveys are presented in the section below.

1.1 Demographic Concerns

1.1.1 VDCs, Settlements and Population

The proposed Sun Koshi No.3 Project is located in Kavre, Sindhupalchok and Ramechap districts of Central Development Region of Nepal and covers 27 VDCs, 31 settlements, >34 wards and 1599 households within the reservoir area. The total population of the reservoir area is estimated to be 10,075 with the average family size of 6.93 which is significantly higher than the national average family size (4.7- 2011 Census estimate) (Table 1 and **Appendix 1**). The reservoir area occupies about 1.89% of the total population of the projects districts[2].

Table 1: VDCs, Settlements and Population under the Sun Koshi No 3 Project, Kavre, Sindhupalchok and Ramechap Districts

S.N.	District/VDC	Settlement	Ward No.	HH	Population
A Kavre					
1	Birtadeurali	Pachuwarghat, Timrenibesi, Potagaira, Kharebesi	1,5,67 and 8	171	1389
2	Sarsyukharka	Chukhabesi, Khareghat, Amaltari,	3 and 8	140	1080
3	Kolanti				
4	Bhumlutar	Dolalghat, Puranobazar	6	51	293
5	Saping				
6	Hoksebazzar				
7	Mahadevthan Mandan				
8	Jyamdi	Thuldi, Sandi	1,3 and 6	75	649
9	Madan chandani	Maitar ,Jogitar,aapchaur majigaun	2 and 4	103	526
10	Madan kudari	Bhumesthan, Ghatte besi, Dobhantar	4 and 6	57	333
11	Kattike deurali	Arubot ranidaha, Jakhadi	1 and 4	107	744
12	Kosidekha	Timal besi	2,8,9	141	569
13	Phalate	Raspat	9	22	170
14	Saramthali	Pachuwarghat	5	15	110
15	Thulo parsel	Pakuwal	3	53	350
16	Dolalghat	Dolalghat	1	80	594
B Sindupalchok					
17	Bhimtar	Bodgaun, Neupanetar, Jamune and	1, 6, 8 and 9	397	2783

[1] The findings are based on the NESS Rapid Field Survey Assessment (2012) using Focus Group Discussions (FGD) and Observation tools. Refer **Appendix 19** for the List of FGD participants.

[2] The total population of Kavre and Sindhupalchok districts according to preliminary estimate of CBS Census 2011 is estimated to be 385,672 and 305,857 respectively.

S.N.	District/VDC	Settlement	Ward No.	HH	Population
		asimure			
18	Kadambas	Sukute	5	11	55
19	Bhotsipa	Rayle	9	28	230
20	Sangachwok	Majigaun	9	28	150
		Sukute	1	80	800
21	Thulosirubari	jhyadi	9	40	250
22	Phuchodanda				
23	Kemunadanda				
24	Kalika				
25	Thokarpa				
C.	**Ramechap**				
26	Bethan				
27	Gunsi				
Total	**17**	**31**	**>34**	**1599**	**11075**

Source: NESS Field Survey, 2012

1.1.2 Ethnicity/Caste

The population of the reservoir area is dominated by the highly marginalized Majhi group (44%). The second largest population is recorded for Brahmin (24%) and third for Tamang, (the disadvantaged community - 14%). Chhetries are occupying 8% of the population followed by the advanced Janjati Newar (7%). Magar (disadvantaged Janjati), Dalit and Thakuri represent almost an equal percent of population (1% each) (Figure 2 and **Appendix 2**).

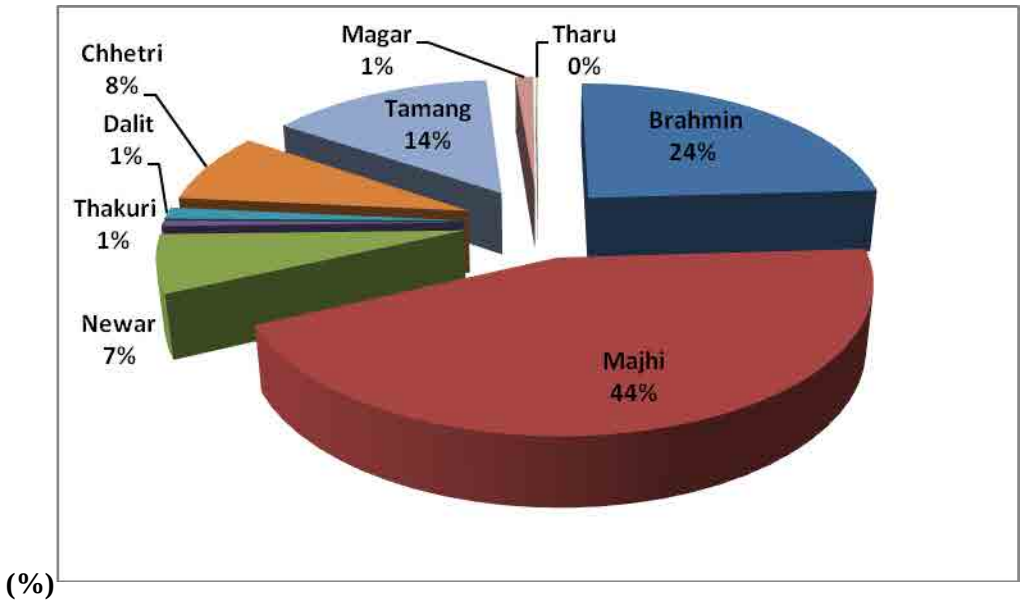


Figure 2: Ethnic Composition of Population

1.2 Economic Concern

1.2.1 Land Use Pattern and Land Holding Size

The total land area in the reservoir area is estimated to be 33,956 ropanies (1 ropani=20 hectare), 47% of which is under forest followed by agriculture (43%), pasture (9%) and other (kharbari-1%) (Figure 2). **Appendix 3** presents details on the land use pattern by each cluster of the VDC.

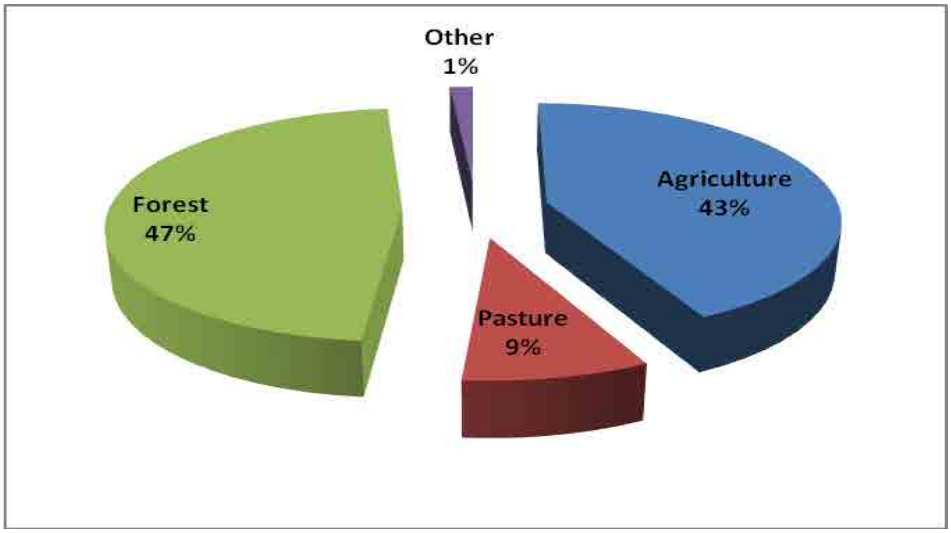


Figure 3: Land Use Pattern of the Reservoir Area

The total agricultural land of the reservoir area is estimated to be 14,986 ropanies including *kharbari* (thatch growing land). Of the total agricultural land 84% is *khet* (irrigated paddy field), 13% *pakho* (un-irrigated up land), and 5% *kharbari.* The average land holding of a household is calculated to be 9.87 ropanies with the minimum and maximum range of holding size of 3-39 ropanies except in one cluster of Bhimtar VDC where two households alone own 1500 ropanies of land (Table 2 and **Appendix 4).** Based on the Central Bureau of Statistics (CBS) classification[3], most of the households fall in the marginal and small to medium farmers group when examined from the view point average land holding size except those two households of Bhimtar who are ranked as large farmers.

Table 2: Total and Average Land Holding Size (Ropani)

Description	Total	%	Average/HH
Khet	12541	83.68	7.84
Pakho	1945	12.98	5.05
Other (Kharbari)	500	5.34	3.91
Total	**14986**	**100**	**9.87**

Source: NESS Field Survey, 2012

The reservoir area is producing cereals such as paddy, maize and wheat and cash crops such as potato, pulses, and vegetables. Among the cereals, paddy is grown in largest area (13037 ropanies) followed by maize (12053 ropanies) and wheat (3170 ropanies). Among the cash crops, potato followed by vegetables and pulses occupy the largest area.

Unlike the area, the quantity of production is also highest for paddy followed by maize and, wheat. Among the cash crops, vegetables fetch the highest production followed by potato and pulses. The cropping intensity of the area is 255% (Table 3 and **Appendix 5**).

[3] According to CBS, a households holding < 15 ropani of land is classified as marginal farmer, holding 15-135 ropanies as small to medium farmers and holding > 135 ropani as large farmers.

Table 3: Crop Production and Yield

S.N.	Crop	Area (Ropani)	Production (Kg)	Yield (Kg/Ropani)
1	Paddy	13037	**4386420**	336
2	Maize	**12053**	**1615100**	134
3	Wheat	**3170**	**330000**	104
4	Potato	**4276**	**1786450**	418
5	Pulses	**1350**	**65000**	48
6	Vegetables	**4380**	**2828700**	646
	Cropping Intensity	**255.34%**		

Source: NESS Field Survey, 2012

Most of the reservoir area settlements sale cereals, potato and vegetables and the products especially potato and vegetables are carried away up to Kathamandu, Banepa for sale (Table 4 and **Appendix 6).**

Table 4: Sale of Crops

Crop	Paddy	Maize	wheat	potato	Vegetables	Pulse
Volume of Sale (KG)	234750	42815	14405	1228000	2436500	35480
Markets	Kathmandu, Dolalghat, Banepa, Sipaghat, Panchkhal , Dolaghat and Local Villages					

Source: NESS Field Survey, 2012

1.2.2 Occupation

Almost 70% of the total reservoir area population is reported to be involved in economic earning activities. Of the total working population, a large numbers area engaged in agriculture (47%) and wage labor (42%). About 5% are engaged in service and 4% in foreign employment. A fewer population (2%) is doing business (Figure 3 and **Appendix 7**).

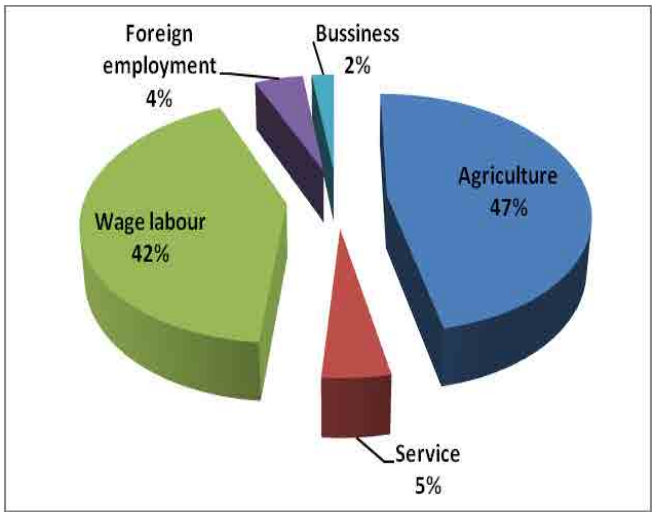


Figure 4: Occupation of Population

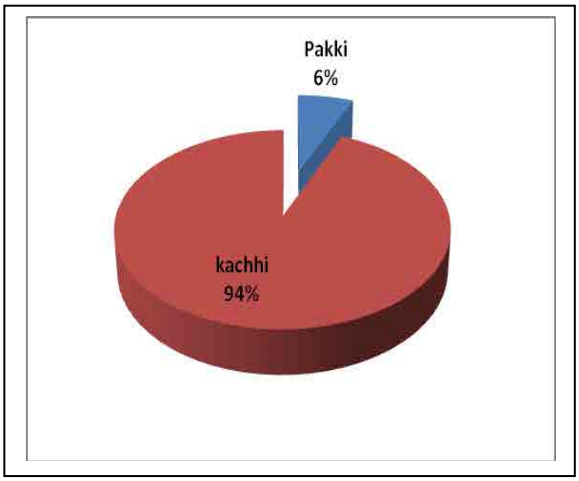


Figure 5: Types of Houses

1.2.3 Housing Type

Two types of houses are categorized in the reservoir area: i) Pakki house i.e permanent types of house built generally using cement and stone and roofed by using galvanized sheet (tin) or cemented and ii) kachhi house i.e built by using mud and stone and roofed using thatch.

A large majority of the population of the reservoir area (94%) own *Kacchi* (temporary) types of house while a few (6%) are residing in Pakki (permanent) types of houses (Figure 4 and **Appendix 8).**

1.3 Service related Infrastructures

1.3.1 Road

Most of the settlements are connected with gravel roads and few with Arniko Highway and Jiri-Dolalghat Road. The total road lengths within the settlements are estimated to be more than 39.4 km, a major portion of which is earthen / graveled. The settlements are facilitated with 13 suspension bridges, 1 concrete bridges and 1 tuwin (Table 5 and **Appendix 9**).

Table 5: Number of Roads and Bridges in the Reservoir Area

Road		Bridges	
Type	**km**	**Type**	**Number**
Earthen	24.4 Kkm	Suspension	13
Paved	25 km	Concrete	1
		Tuwin	1
Total	**39.4 km**		**15**

Source: NESS Field Survey, 2012

1.3.2 Schools

Altogether 19 different levels of schools are located in the reservoir area and 3090 students from the reservoir area are estimated to be enrolled (Table 6 and **Appendix 10**).

Table 6: Number of Schools and Students

School Type	Number of Schools	Number of Students
Primary	8	480
Lower Secondary	6	995
Secondary	2	665
Higher Secondary	3	950
Total	**19**	**3090**

Source: NESS Field Survey, 2012

1.3.3 Irrigation Infrastructure

Almost 50% of the settlements have farmer managed irrigation schemes and the total number of irrigation schemes in the reservoir area is estimated to be 20 **(Appendix 11).**

1.3.4 Drinking Water

Each of the 20 settlements has drinking water schemes under operation. Altogether 22 schemes with 539 water taps are reported in the settlements with minimum and maximum number of taps installed between 1 and 141 in each of the schemes (**Appendix 12**).

1.3.5 Community Forest and Recreation Centers

The reservoir area enjoys the facilities and services of 23 community forests located at different locations of the reservoir area **(Appendix 13).**

Dolalghat Bazar (Dolaghat and Bhumlutar VDC) is the famous picnic spot and touristic place of the reservoir area where10 lodges are operated and more than 20,000 tourists (both Nepali and foreigners) are

estimated to visit annually. Similarly at Sukute, there is a camping facility for the whit eater rafters for the whit eater rafters for night halt and recreation.

1.3.6 Industries and Services

The survey team did not found any record of establishments of any agriculture and forest based small cottage industries in the reservoir area except two brick factories located at Sukete of Sangachok VDC. These factories are producing bricks equivalent to 1500 truck/year and providing employments to 50 persons.

Similarly, 15 water mills are installed in different settlements for grain grindings by utilizing water of five major streams of the area (**Appendix 14**).

The area is served with 5 markets of which 54 are permanent type, three police station, one livestock service centre and 6 health related services including pharmacy, clinic and health posts (Table 7 and **Appendix 15**).

Table 7: Number of Markets and Service Centers

Service Type	Markets	Service Centers		
		Security	Livestock	Health
Number	5	3	1	6

Source: NESS Field Survey, 2012

1.4 Culture and Religious Site

The major festivals celebrated in the reservoir area are: *Dasain, Tihar, Tija, Majhe Sankarati,* which are based on Hindu tradition and culture. Besides these festivals, the Janjati of the area celebrate *Lhosar, Dhanya purne* and *Purnima*. Temples such as Mahadev, Krishna, Ganesh, Bhimsen are some of the important temples located in the reservoir area. Each of the settlement have their cementation places located near the rivers and streams most of which have no bult structures. *Maisadaha Ghat, Dovantar Ghat, Sunkosi Sisso Ghat, Pachwarghat* and *Pakuwal Ghat* are the main famous cremation sites of the area (**Appendix 16).**

1.5 Ongoing and Proposed Development programmes

There are about 10 different development projects under implementation in the reservoir area and most of them area related to road expansion and construction (Table 8 and **Appendix 17**).

Table 8: Ongoing Development Projects in the Reservoir Area

Project Types	Agriculture	Irrigation	Road Expansion	Bridge Construction	Ring Road Construction
Number	1	2	5	1	1
Remarks	Kimbu farming (sericulture)	Timal Besi Irrigation Project and Water Pumping			Tamsalin Ringroad

Source: NESS Field Survey, 2012

1.6 Past Experience with Community and their Perception

The reservoir area people have not experience severe disputes with regards to the development projects in the past. However, minor disputes were experienced in three settlements during the road expansion and construction of drinking water supply (Table 9).

Table 9: Past Experience of Disputes on Development Projects

District/VDC	Settlement	Ward No	Related Disputes
Kavre/Birtadeurali	Potagaira	5	Disputes in ongoing road expansion activities
Birtadeurali	Kharebesi	1 and 6	Minor disputes during water supply project
Sindhupalchok/Kadambas	Sukute	5	There were minute dispute regarding road construction

Source: NESS Field Survey, 2012

The people have perceived different positive and negative impacts from the storage type hydropower project. Submerge of house and land, displacement of village and local communities, losses of markets, submerge of house and agricultural land, losses of roads etc. are reported to be the major negative impacts perceived by the community. The communities have also expected different development activities from the project such as availability of electricity, infrastructure and employment, local development etc (Table 10 and **Appendix 18**).

Table 10: Perceived Impacts of the Storage Type Hydropower Project

Positive impacts	Negative Impact
Electricity	Loss of land and property
Tourism development	Loss of houses
Infrastructure development	People will be like refugee if not addressed properly
Employment and development activities	Submerge of house and land
Rid of energy crisis	Displacement of village and local community
Local development	Displacement of markets and Market worth millions Rs will be destroyed
	Nepal -Tibet road will get damaged

Source: NESS Field Survey, 2012

1.7 Disasters

Flood and landslides are reported to be the common natural disasters faced by the reservoir area each year, however severe losses are not recorded yet.

2 DISASTER STUDY

There are no records of the disaster at the site specific level of the candidate project at the central level and district level offices of the government of Nepal. It is therefore, the disaster information is collected from the project site based on the key informent survey. The findings of the results are presented in the sections below.

2.1 Types of Disaster

Within the influence area of the Sun Koshi No.3 Project, the flood and land slide disaster have been reported by the key informants. The earthquake as a disaster event is not in the memory of the local people.

2.1.1 Flood

In the memory of the local people, flood disater is of common occurrence within the project site. Three flood events (B.S 2048, 2057, and 2062) have a widespread damage of life and property. The cause of the floods as reported by the informants is the heavy precipitation in the catchment areas of the Sun Koshi river in the monsoon season. The loss of life and property caused by the flood events in the candidate reservoir area are presented below.

a) Name of Respondent: Ram Krishna Chhetri **Date of Interview:** 24/03/2069 B.S**.**
Age: 38 **Occupation:** Agriculture **Location:** Madan Kundari, Bhumithan
i) Year of the occurrence: 2057 B.S. Baisakh (Around 12 years ago)
ii) Cause of the flood: Heavy Precipitation in the upstream and blockade in the river
iii) Affects of the flood event:

Loss or Damages	Local Area	Upstream Area	Downstream Area
Land	~20-25 Ropani	~10 Ropani	~40-50 Ropani
Life	-	-	5 People died
Build properties	-	3 House	-
Crops	~Paddy , 80-100 muri	~Paddy ,40 muri	~Paddy,160-200 muri
Others	-	-	-

b) Name of Respondent: Ratne Moktan **Date Interview: 25/03/2069 B.S.**
Age: 45 **Occupation:** Agriculture **Location:** Madan Kundari, Chaurikhola-6
i) Year of the occurrence: 2048 B.S. Sharawan 27 (Around 21 Years ago)
ii) Cause of the flood: Heavy Precipitation
iii) Affects of the flood event:

Loss or Damages	Local Area	Upstream Area	Downstream Area
Land	~15-20 rpns	~20-30 rpns,	~80-100 rpns,
Life	-	-	-
Build properties	2 House	Cattle sheds	Dozens of Cattle seds and House
Crops	~Paddy, 75-100 muri	~Paddy, 100-150 muri	~Paddy, 400-1000 muri
Others	-	-	-

c) Name of respondent: Shilu Bdr. Tamang **Date of Interview:** 25/03/2069 B.S.
Age: 42 **Occupation:** Agriculture **Location:** MandanKundari-5, Chaurikhola
i) Year of the occurrence: 2062 B.S. Shrawan (Around 7yrs ago)
ii) Cause of the flood: Heavy Precipitation in the upstream and blockade in the river
iii) Affects of the flood event:

Loss or Damages	Local Area	Upstream Area	Downstream Area

Land	~30-40 Ropani	~20-25 Ropani	~40-60 Ropani
Life	-	-	-
Build properties	-	-	Dozens of Cattle sheds
Crops	~Paddy, 120-160 muri	~Paddy, 80-100 muri	~Paddy, 160-240 muri
Others	-	-	-

2.1.2 Landslide

Landslide events are relatively rare in the influence area of candidate project. A major landslide is reported from the area some 18 years back after heavy precipitation in the monsoon season with the loss of life and property. Table below presents the details of the landslide event as preported by the key informants.

a) Name of Respondent: Ram Krishna Chhetri **Date of Interview:** 24/3/2069 B.S.

Year	Location	Cause	Affected Fields	
2052 Shrawan	Mandan Kundari,Chaurikhola	Heavy Precipitation	Affected Area	Downstream
			Loss of life	20 people died
			Loss of Build	-
			Loss of Crops	Paddy, 200-300 Muri
			Loss of Land	40-60 rpns

2.1.3 Earthquake

In the memory of the local people the candidate project site communities have not experienced earthquake causing loss of life and property.

3 FLORAL STUDY

Though the floral information at the regional level is available, there is no published literature on the site specific level of the candidate project at the central and district level offices of the government of Nepal. It is therefore, candidate project site is visited by the biological study team to gather information based on direct observation and through the participatory methods with the local key informents. Findings of the field study are presented in sections below.

3.1 Vegetation Diversity

The information on the vegetation diversity is gathered from the direct observation by the members of biology study team during site visit. Besides, information is also collected from the key informents of the local area through interviews and focus group discussions with the local community forest usergroups.

The candidate project site is rich in floral diversity. About 46 plant species were recorded through direct observation and interviews with the key informents. The list of plant species is presented in the table below.

S.N.	Local Name	Common Name	Scientific Name	Uses
1	Uttis	Alder tree	*Alnus nipalensis*	
2	Khayar	Cutch	*Acacia catechu*	Medicine
3	Bojho	Sweet flag calamus root	*Acorus calamus*	Medicine
4	Karam	Yellow teak	*Adina cardifolia*	Timber
5	Bell	Wood apple	*Aegle marmelos*	Aesthetic
6	Shiris	Siris	*Albizia sps.*	
7	Ghiukumari	Indian aloe	*Aloe vera*	Leaves, roots etc.
8	Katahar	Jackfruit	*Artocarpus heterophyllus*	Fruit
9	Kurilo	Wild Asparagus	*Asparagus racemosus*	Medicine
10	Neem	Neem	*Azadirachta indica*	Medicine
11	Bans	Bamboo	*Bambusa sp.*	
12	Simal	Simal	*Bombax ceiba*	Timber and making boat
13	Bhang	Hemp	*Cannabis sativa*	
14	Ghodtapre	Water Pennywort	*Cantella asiatica*	Medicine
15	Sisso	Sisso	*Dalbergia sisso*	Timber
16	Dhaturo	Devil's apple	*Datura stramonium*	Medicine
17	Nigalo	Himalayan bamboo	*Drepanostachyum intermedium*	
18	Abijalo	Lightining weed	*Drymaria diandra*	
19	Unyu	Edible Fernshoot	*Dryopteris cochleata*	Vegetable
20	Mauva	Bay-berry	*Engelhardia spicata*	
21	Banmara	Crofton weed	*Eupatorium sps*	Medicine
22	Bar	Banyan sps.	*Ficus benghalensi L*	Aesthetic
23	Pipal	Peepal tree	*Ficus religiosa*	Aesthetic
24	Okhar	Walnut	*Juglans regia*	
25	Epilipi or Epil	Leucaena/ Ipil-Ipil	Leucaena leucocephala	
26	Aap	Mango	*Magnifera indica*	Fruit
27	Pudina	Pudina	*Mentha spicata*	Medicine
28	Kaphal	Box myrtle	*Myrica esculanta*	
29	Chariamilo	Creeping sorrel	*Oxalis corniculata*	
30	Narkatt	Common reed grass	*Pharagmites karka*	
31	Amala	Indian gooseberry	*Phyllanthus emblica*	Medicine
32	Pinus	Chir pine	*Pinus roxburghii*	
33	Bajradanti	Silver Leaf	*Potentilla fulgens*	Medicine
34	Amba	Guava	*Psidium guajava*	
35	Anar	Pomegranate	*Punica granatum*	
36	Naspati	Pear	*Pyrus communis*	

S.N.	Local Name	Common Name	Scientific Name	Uses
37	Phalanth	Blue Japanese oak	*Quercus glauca*	
38	Chilaune	Needle wood	*Schima wallichi*	
39	Sal	Sal	*Shorea rubsta*	Timber
40	Jamuna	Blackberry	*Syzygium cumini*	
41	Saj	Lourel Tree	*Terminalia alata*	Timber
42	Barro	Bastard Murobalan	*Terminalia bellirica*	Medicine
43	Harro	Chebulie Myrobalan	*Terminalia chebula*	Medicine
44	Tuni	Cedrela tree	*Tooni sps.*	
45	Sisnu	Stinging neetle	*Urtica dioca*	Leaves for vegetable
46	Bayar	Indian Plum	*Zizyphus mauritiana*	Fruit

3.2 Forest Types

The candidate project site is characterised by the hill sal forest within the reservoir area, while upslope the Schima wallichi forest and pine forests are dominant. Table below presents the forest types and associated speceis in the reservoir area and outside reservoir area.

Local(Within Reservoir)	Regiona l(Out of the reservoir)
Mainly Acacia *catechu* (Khayar) and *Shorea robusta* (Sal) forest in association with Saj (Terminalia alata *Bombax ceiba* (Simal) and Schima wallichi (Chilaune) etc.	>1000m altitude m. Schima wallichi forest in association with pine forest in dry slopes.

3.3 Forest as per Forest Classification (Community forest, Government Forest, Leasehold forest, Private forest, Religious Forest etc.)

The forests of the candidate project influence area are the community forests managed by the local community forest user groups within the framework of the community forest management plan approved by the district forest offices. The reservoir occupied area has four community forests, while the project influence area has about 15 community forests. The name of the community forests, dominant species of plants and the location of the forests in the local administrative zone (VDCs) is presented in the tables below for the reservoir area and outside the reservoir area.

a) Local Area (Within the reservoir)

S.N.	Ownership	Name of the forest	Dominant Species	V.D.C.
1	Community	Chaurikhola C. F.	Khayar and Sal	Madan Kundari
2	Community	Dhwaje Khoriya C.F.	Khayar and Sal	Katike Deurali
3	Community	Birta Deurali C.F.	Sal	Birta Deurali
4	Community	Khalte Pakha C.F.	Sal	Syarsyukharka

b) Regional Area (Outside the reservoir)

S.N.	Ownership	Name of the forest	Dominant Species	V.D.C.
1	Community forest	Saagin Danda C.F.	Sal	Koshi Dekha
2	Community forest	Mankholcha C.F.	Sal	Bhumlutar
3	Community forest	Bandeo Patle C.F.	Sal	Sangachowk
4	Community forest	Khatrithok C.F.	Sal	Kadambas
5	Community forest	Karkitaar C.F.	Sal	Sangachowk
6	Community forest	Bhalokhop Chisapani C.F.	Sal and Phadil	Kalika
7	Community forest	Seradanda khaplede C.F.	Sal and Phadil	Kalika
8	Community forest	Amatte C.F.	Sal	Jyamadi
9	Community forest	Baskharka C. F.	Sal and Phadil	Jyamdi
10	Community forest	Sano Kharka C. F.	Sal and Sisso	Madan Chandani
11	Community forest	Thuli taar C.F.	Sal, Phadil and Jamun	Bhotasippa
12	Community forest	Indrāvati Davi C.F.	Sal	Bhimtaar

S.N.	Ownership	Name of the forest	Dominant Species	V.D.C.
13	Community forest	Kholekhauke C.F.	Sal	Sirwari
14	Community forest	Tinpakhe C.F.	Sal and Phadil	Bhotasippa
15	Community forest	Neupane C.F.	Sal and Phadil	Bhimtaar

3.4 Forest Plot Analysis

For the analysis of the forest status and characteristics 3 sample plots were measured within the reservoir area of the candidate project. The sample plots measured has a size of 25 x 25 meter. The details of the sample plot measurements are presented in the tables below.

a) Forest: Bhalokhop Chisapani Community Forest
Location: VDC. Kalika
G.P.S. **Altitude:** 654m

S.N.	Tree Species	DBH (inch)	Height (ft) Approx.
1	*Shorea robusta*	54	54
2	*Shorea robusta*	48	48
3	*Shorea robusta*	45	42
4	*Shorea robusta*	45	38
5	*Shorea robusta*	42	52
6	*Shorea robusta*	34	38
7	*Shorea robusta*	38	42
8	*Shorea robusta*	44	47
9	*Shorea robusta*	41	51
10	*Shorea robusta*	39	45
11	*Shorea robusta*	37	46
12	*Shorea robusta*	45	43
13	*Shorea robusta*	32	41
14	*Shorea robusta*	34	44
15	Epilipi or Epil (Local name)	23	30
16	Epilipi or Epil	19	38
17	Epilipi or Epil	36	38
18	*Terminalia alata*	34	37
19	*Terminalia alata*	21	35
20	*Terminalia alata*	31	31
21	*Terminalia alata*	29	26
22	*Terminalia alata*	32	35
23	*Syzygium cumini*	41	40
24	*Syzygium cumini*	25	35
25	*Syzygium cumini*	28	35
26	*Syzygium cumini*	35	32
27	*Syzygium cumini*	26	30
28	*Syzygium cumini*	25	34
29	*Syzygium cumini*	24	38
30	*Syzygium cumini*	34	32
31	*Syzygium cumini*	37	23
32	*Bombax ceiba*	46	58
33	*Schima wallichi*	32	35
34	*Schima wallichi*	41	42

***Forest Density per Hectare**: 544*
***Dominant species:** Sal =41%*
***Crown coverage of the forest**: 50%*

b) Name of forest: **Karki Tar Community Forest**
Location: VDC-Sangachowk, Sukute-1 **Altitude:**

S.N.	Name of spp.	DBH (inch.)	Height (ft.)
1	*Shorea robusta*	35	41

S.N.	Name of spp.	DBH (inch.)	Height (ft.)
2	*Shorea robusta*	38	42
3	*Shorea robusta*	32	45
4	*Shorea robusta*	35	42
5	*Shorea robusta*	42	48
6	*Shorea robusta*	37	41
7	*Shorea robusta*	36	40
8	*Shorea robusta*	34	42
9	*Shorea robusta*	40	46
10	*Shorea robusta*	35	45
11	*Shorea robusta*	54	55
12	*Shorea robusta*	52	58
13	*Shorea robusta*	45	51
14	*Shorea robusta*	35	40
15	*Shorea robusta*	46	44
16	*Shorea robusta*	32	42
17	*Shorea robusta*	28	40
18	*Shorea robusta*	25	38
19	*Shorea robusta*	37	45
20	*Shorea robusta*	34	41
21	*Shorea robusta*	37	44
22	*Shorea robusta*	35	45
23	*Shorea robusta*	28	35
24	*Shorea robusta*	32	42
25	*Shorea robusta*	28	40
26	*Shorea robusta*	35	48
27	*Shorea robusta*	25	42
28	*Shorea robusta*	32	41
29	*Delbergia sisso*	40	48
30	*Delbergia sisso*	35	45
31	*Schima wallichi*	22	35
32	*Schima wallichi*	28	36
33	*Schima wallichi*	25	40
34	*Castanopsis indica*	28	35
35	*Castanopsis indica*	24	36
36	*Terminalia alata*	22	35
37	*Terminalia alata*	25	36
38	*Adina cardifolia*	24	32

***Forest Density per Hectare**: 608*
***Dominant Species: Sal** = 73%*
***Crown Coverage:** 35%*

c) Name of forest: **Amatte Community Forest**
Location: Jyamdi, Sandibesi-1 **Altitude:**

S.N.	Name of Tree Species	DBH (inch.)	Height (ft.)
1	*Shorea robusta*	38	40
2	*Shorea robusta*	32	42
3	*Shorea robusta*	35	45
4	*Shorea robusta*	40	48
5	*Shorea robusta*	35	41
6	*Shorea robusta*	28	32
7	*Shorea robusta*	25	38
8	*Shorea robusta*	34	44
9	*Shorea robusta*	30	42
10	*Shorea robusta*	32	44
11	*Shorea robusta*	28	34
12	*Shorea robusta*	36	42
13	*Shorea robusta*	35	45

S.N.	Name of Tree Species	DBH (inch.)	Height (ft.)
14	*Shorea robusta*	30	43
15	*Shorea robusta*	25	40
16	*Shorea robusta*	32	40
17	*Shorea robusta*	28	35
18	*Shorea robusta*	22	36
19	*Shorea robusta*	32	40
20	*Shorea robusta*	28	42
21	*Shorea robusta*	34	44
22	*Shorea robusta*	30	45
23	*Shorea robusta*	25	40
24	*Shorea robusta*	32	45
25	*Shorea robusta*	26	46
26	*Shorea robusta*	35	52
27	*Pinus roxburghii*	32	48
28	*Pinus roxburghii*	25	40
29	*Pinus roxburghii*	22	35
30	*Pinus roxburghii*	18	32
31	*Albizia sps.*	22	35
32	*Syzygium cumini*	25	42
33	*Syzygium cumini*	30	42
34	*Syzygium cumini*	22	38
35	*Syzygium cumini*	21	36
36	*Schima wallichi*	28	38
37	*Schima wallichi*	25	35
38	*Terminalia alata*	25	36
39	*Terminalia alata*	22	35
40	*Terminalia alata*	23	36
41	*Castanopsis indica*	20	35
42	*Castanopsis indica*	22	35
43	*Acacia catechu*	18	35
44	*Acacia catechu*	20	36
45	*Acacia catechu*	22	40
46	*Acacia catechu*	18	36
47	*Acacia catechu*	22	40

Forest density per Hectare: 752
***Dominant spec**ies: Sal 55%*
***Crown Covera**ge: 30%*

3.5 Public Dependency on the Forest

The forests of the candidate project site provide a range of goods and services to the local communities. The local community extracts followings resources from the forest areas to support their livelihood.

- Firewood
- Fodder
- For thatch and other purposes as to make ceiling of local house
- For Timber Purposes

3.6 Floral Species of the Conservation Significance

Of the recorded floral species only 5 species have been categorized under the protection lists of the government of Nepal. However, none of the floral species have been listed in the IUCN red list and CITES Appendices. The table below presents the list of the protected species.

S.N.	Local Name	Common Name	Scientific Name	Status			Sources		
				IUCN	GON	CITES	Site survey	Hearing survey	Literature survey
1	Khayar	Cutch	*Acacia catechu*		P		Confirmed at site		
2	Simal	Simal	*Bombax ceiba*		P			Hearinbg at Madan kundari, Katike Deurali, etc	
3	Okhar	Walnut	*Juglans regia*		P			Hearinbg at Madan kundari, Katike Deurali, etc	
4	Phalanth	Blue Japanese oak	*Quercus glauca*		P			Hearinbg at Madan kundari, Katike Deurali, etc	
5	Sal	Sal	*Shorea robusta*		P		Confirmed at site		

***IUCN Red List Categories**: Extinct (EX), Extinct In the Wild (EW), Critically Endangered (CR), Endangered (EN), Vulnerable (VU), Near Threatened (NT)*

***GOV Categories**: P Protected by legislation*

***CITES Categories:** I -Appendix I (are species that are threatened with extinction and are or may be affected by trade), II - Appendix II (are species that are not necessarily threatened with extinction, but may become so unless trade in specimens of such species is subject to strict regulation in order to avoid utilization incompatible with the survival of the species in the wild), and III - Appendix III (are species that are listed after one member country has asked other CITES Parties for assistance in controlling trade in a species)*

4 FAUNAL STUDY (WILDLIFE)

Information on the wildlife of the candidate project site is scarce in the published literatures. It is therefore site investigations are conducted to gather information through direct observation and the participatory methods with the local communities and the key informants. The findings of the filed investigations are presented in section hereunder.

4.1 Wildlife Diversity

Information on wildlife diversity is gathered through direct observation and participatory methods which included focus group discussion with the local communities and key informant surveys.

a) Mammals

A total of 11 mammalian species were recorded from the focus group discussion and key informant surveys. Of the total reported species 4 mammalian speices were directly observed by the field biological team. The details of the mammalian species and habitat types are presented in the table below.

S.N.	Consultation	Observation	Common Name	Scientific Name	Habitat
1	Khaire Lokharke	*	Hoary-billed Himalayan Squirrel	*Callosciurus pygerythrus*	Found in Mixed Sal forest
2	Sayal	*	Jackal	*Canis aureus*	Lives in colonies in burrows on the high flat grass land
3	Ban Biralo		Jungle Cat	*Felis chaus*	Lives in Sal forest.
4	Tin dharke Lokharke		Common Three Striped Palm Squirrel	*Funambulus palmarum*	Found in Mixed Sal forest
5	Nayauri	*	Common Mongoose	*Herpestes edwardsi*	Lives in colonies in burrows on the high flat grass land
6	Bandar	*	Rhesus monkey	*Macaca mulatta*	Agriculture Land and Sal forest.
7	Seto Salak		Chinese Pangolin	*Manis pentadactyla*	Lives in burrows and Crevices of the rock
8	Ratuwa		Barking Deer	*Muntiacus muntijak*	Mixed Sal forest
9	Bagh or Nighale Chituwa		Common Leopard	*Panthera pardus*	Found in the cave of rock, mountain and Sal forest.
10	Lokherke		Squirrel	*Ratufa indica*	Mixed Sal forest
11	Langur		Langur	*Semnopithecus entellus*	Mixed Sal forest Agriculture field

b) Birds

A total of 50 bird species are reported by the local communities and key informents. Of the total reported species, 24 species are directly observed by the field biological team. Table below presents list of the reported and observed species in the candidate project influence area.

S.N.	Local Name	Observation	Common Name	Scientific Name
1		*	Bank Myna	*Acridotheres ginginianus*
2		*	Common Myna	*Acridotheres tristis*
3		*	Greater Spotted Eagle	*Aquila clanga*
4	Chirbire latokosero	*	Spot-bellied Eagle Owl	*Bubo nipalensis*
5		*	Himalayan Swiftlet	*Callocalia brevirostris*
6	Koeli		Pied Cuckoo	*Clamator jacobinus*

S.N.	Local Name	Observation	Common Name	Scientific Name
7	Malewa	*	Blue Rock	*Columba livia*
8		*	Oriental Magpie Robin	*Copsychus scularis*
9	Thehuwa		Indian Roller	*Coracias benghalensis affinis*
10		*	House Crow	*Corvus splendens*
11	Kaphal Pakyo		Indian Cuckoo	*Cuculus micropterus*
12	Koeli		Oriental Cuckoo	*Cuculus saturatus*
13		*	Spangled Drongo	*Dicrurus hottentottus*
14	Bagaale Bagedi		Yellow-breasted Bunting	*Emberiza aureola*
15	Koeli	*	Asian Cuckoo	*Eudynamys scolopacea*
16	Lagar Baaz		Laggar Falcon	*Falco jugger*
17	Shahi Baaz	*	Peregrinus Falcon	*Falco peregrinus*
18	Kalo Titra		Black Fracolin	*Francolinus francolinus*
19	Luiche		Red Jungle Fowl	*Gallus gallus*
20	Luiche		Red Jungle Fowl	*Gallus gallus*
21		*	Asian Barred Owlet	*Glaucidium cuculoides*
22	Giddh		White-rumped Vulture	*Gyps bengalensis*
23		*	Scarlet Finch	*Haematospiza sipahi*
24	Matikore		Stork-billed Kingfisher	*Halcyon capensis*
25	Matikore	*	White Throated Kingfisher	*Halcyon smyrnensis*
26	Chil		White- tailed Eagle	*Heliaeetus albicilla*
27	Dronak Chil	*	Black Eagle	*Ictinaetus malayensis*
28	Kalij		Kalij Pheasant	*Lophura leucomelanos*
29	Kalij		Kalij Pheasant	*Lophura leucomelanos*
30	Nayuli		Great Barbet	*Megalaima virens*
31	Kalo Chil	*	Black Kite	*Milvus migrans*
32	Latokosero	*	Brown Hawk Owl	*Ninox scutulata*
33		*	Black-crowned Night Heron	*Nycticorax nycticorax*
34	Mayur		Indian Peafowl	*Pavo cristatus*
35	Mayur		Indian Peafowl	*Pavo cristatus*
36	Fiste	*	Common Chiffchaff	*Phylloscopus collybita*
37	Suga		Plum-headed Parakeet	*Psittacula cyanocephala*
38	Suga	*	Rose-ring Parakeet	*Psittacula krameri*
39		*	Red-vented Bulbul	*Pycnonotus cafer*
40	Kurle Dhukur	*	Spotted Dove	*Streptopelia chinensis*
41	Kanthe Dhukur		Eurasian Collared Dove	*Streptopelia decaocto*
42	Tame Dhukur	*	Oriental Turtle Dove	*Streptopelia orientalis*
43	Sano Tame Dhukur		Red-Collared Dove	*Streptopelia tranquebarica*
44	Gouthali		Alpine Swift	*Tachymarptis melba*
45	Haleso		Orange-	*Treron bicincta*
46	Haleso	*	Wedge-tailed Green Pigeon	*Treron sphenura*
47	Phapre		Common Hoopoe	*Upupa epops*
48	Khole Hutitau		River Lapwing	*Vanellus duvaucelii*
49	Hutitau		Red-wattled Lapwing	*Vanellus indicus*
50	Jure Hutitau		Northern Lapwing	*Vanellus vanellus*

c) Herpetofauna

The key informants and the local community reported a total of 9 herpetofauna species from the reservoir area. Of the total reported 4 of the species are observed by the field study team. Details of the herpetofauna species and their habitat types are presented in the table below.

S.N.	Consultation	Observation	Common Name	Scientific Name	Habitat
1	Vyaguto	*	Black Spined Toad	*Bufo melanostictus*	Found in dry and grasses
2	Krait and Ganguali		Banded Krait	*Bungarus fasciatus*	Found in burrows and wooden forest
3	Uduwa Sarp			*Dendrelaphis tristis*	Found in Dense and wooded forest and also found in climbers plant
4	Vyaguto	*	Indian Bull Frog	*Hoplobatrachus tigrinus*	Wet land area and bank of river
5	Goman		Cobra	*Naja naja*	Dense and wooden forest and Human settlement
6	Naag		King Cobra	*Ophiophagus hannah*	Found in burrows, Tall grasses and wooden forest
7	Rukh Vyaguto	*	Terai Tree Frog	*Polypedates leucomystax leucomystax*	Branches of trees and crevices of rocks
8	Hariu Sarp			*Trimeresurus albolabris*	Found in Broad leaved forest
9	Sungohoro		Yellow Monitor Lizard	*Varanus flavescens*	Found in burrows in the tall grasses and agriculture field.

4.2 Habitat Type in the Reservoir Area

The wildlife habitat of the reservoir area has the following characteristics.

- Fragmented and encroached by nearby settlements
- Degraded by fodder collection and cattle grazing by the communities
- Scattered forest due to annual forest fire

4.3 Migratory Corridor

The reservoir area does not form a part of the migratory corridor for the wildlife of the region. However, locally some wildlife use the reservoir area as feeding ground seasonally and visit the site for the feeding purpose. Some of avian species such as Peafowl (Pavo cristatus) and Woolly-necked Storks (Ciconia episcopus) seasonally visit the reservoir sites.

4.4 Wild Animals of Conservation Significance

The reported wildlife of the candidate project site are cross checked with the protected wildlife lists of the government of Nepal, IUCN red book and the CITES Appendices. The lists of the wildlife which fall in the protection category of the government of Nepal, IUCN red book and the CITES Appendices are presented in the sections below.

a) Mammal

Of the reported 11 species of mammal, 6 of the species are listed under the protection category of either government of Nepal or IUCN redlist or under CITES Appendices. Of the recorded speceis 2 are listed under government of Nepal protection list, 2 under IUCN red list and all 6 under CITES Appendices. Table below presents the species and thier protection category under various protection lists.

S.N.	Local Name	Common Name	Scientific Name	Status			Sources		
				GON	IUCN	CITES	Site survey	Hearing survey	Literature survey
1	Sayal	Jackal	Canis aureus			III	Confirmed at site		
2	Nayauri	Common mongoose	Herpestes edwardsi	P		III	Confirmed at site		
3	Seto Salak	Chinese Pangolin	Manis pentadactyla	P	EN	II		Hearinbg at Madan kundari, Katike Deurali, etc	
4	Bagh or Chituwa	Common leopard	Panthera pardus		NT	I		Hearinbg at Madan kundari, Katike Deurali, etc	
5	Lokherke	Squirrel	Ratufa indica			II		Hearinbg at Madan kundari, Katike Deurali, etc	
6	Langur	Langur	Semnopithecus entellus			I		Hearinbg at Madan kundari, Katike Deurali, etc	

IUCN Red List Categories*: Extinct (EX), Extinct In the Wild (EW), Critically Endangered (CR), Endangered (EN), Vulnerable (VU), Near Threatened (NT)*

GOV Categories*: P Protected by legislation*

CITES Categories: *I -Appendix I (are species that are threatened with extinction and are or may be affected by trade), II - Appendix II (are species that are not necessarily threatened with extinction, but may become so unless trade in specimens of such species is subject to strict regulation in order to avoid utilization incompatible with the survival of the species in the wild), and III - Appendix III (are species that are listed after one member country has asked other CITES Parties for assistance in controlling trade in a species)*

b) Birds

Of the 50 recorded avian species 4 are listed under the protection category of IUCN redlist while only is listed in the CITES Appendices. Table below presents the details of the protected speceis and the protection category as per the IUCN and CITES Appendices.

S.N.	Local Name	Common Name	Scientific Name	Status					
				GON	IUCN	CITES	Site survey	Hearing survey	Literature survey
1		Greater Spotted Eagle	*Aquila clanga*		VU		Confirmed at site		
2	Bagaale Bagedi	Yellow-breasted Bunting	*Emberiza aureola*		VU			Hearinbg at Madan kundari, Katike Deurali, etc.	
3	Lagar Baaz	Laggar Falcon	*Falco jugger*		NT	I		Hearinbg at Madan kundari, Katike Deurali, etc.	

4	Giddh	White-rumped Vulture	*Gyps bengalensis*		CR			Hearinbg at Madan kundari, Katike Deurali, etc.	

***IUCN Red List Categories**: Extinct (EX), Extinct In the Wild (EW), Critically Endangered (CR), Endangered (EN), Vulnerable (VU), Near Threatened (NT)*

***GOV Categories**: P Protected by legislation*

***CITES Categories:** I -Appendix I (are species that are threatened with extinction and are or may be affected by trade), II - Appendix II (are species that are not necessarily threatened with extinction, but may become so unless trade in specimens of such species is subject to strict regulation in order to avoid utilization incompatible with the survival of the species in the wild), and III - Appendix III (are species that are listed after one member country has asked other CITES Parties for assistance in controlling trade in a species)*

c) Herpetofauna

Three of the herpetofauna species out of 9 recorded species are listed as protection category speceis of either government of Nepal protection list or IUCN red list or CITES Appendices. Table below presents the details of the protection category under various protection lists.

S.N.	Local Name	Common Name	Scientific Name	Status			Sources		
				GON	IUCN	CITES	Site survey	Hearing survey	Literature survey
1	Goman	Cobra	*Naja naja*		II			Hearinbg at Madan kundari, Katike Deurali, etc	
2	Naag	King cobra	*Ophiophagus hannah*		VU	II		Hearinbg at Madan kundari, Katike Deurali, etc	
3	Sungoh oro	Yellow monitor Lizard	*Varanus flavescens*	P	I			Hearinbg at Madan kundari, Katike Deurali, etc	

***IUCN Red List Categories**: Extinct (EX), Extinct In the Wild (EW), Critically Endangered (CR), Endangered (EN), Vulnerable (VU), Near Threatened (NT)*

***GOV Categories**: P Protected by legislation*

***CITES Categories:** I -Appendix I (are species that are threatened with extinction and are or may be affected by trade), II - Appendix II (are species that are not necessarily threatened with extinction, but may become so unless trade in specimens of such species is subject to strict regulation in order to avoid utilization incompatible with the survival of the species in the wild), and III - Appendix III (are species that are listed after one member country has asked other CITES Parties for assistance in controlling trade in a species)*

5 FISHERY STUDY

There is scanty information in the fish diversity, fishermen, fish market, and cost of fish in the candidate project site at the central and district level offices. To fill the data gap fish related information was gathered from the field surveys using a checklist. The fish survey is based on the participatory method and key informent survey methods along the influence area of the candidate project. The findings of the field survey are presented in the sections below.

5.1 Fishermen and their Occupational / Social / Economic Status and Fish Market, Availability and Cost

Participatory and key informent interviews reported nearly 80 occupational, 450 part time and and about 182 occasional fishermen in the limits of the Sun Koshi reservoir area. Majority of the fishermen belong to Majhi ethnic group, which is also an ethnic minority of the candidate project with a low social and economic status among the other communities. Apart from this Tamangs and other ethnic groups also practice fishing in the Sun Koshi river.

About 75% of the fish caught by the fishermen is sold in the fish market, while rest is consumed by the fishermen family. There are altogether 7 fish markets in the nearby areas. Every day about 10 to 30 kg of fish is sold in each of the fish markets. Average cost of the fish in the market varies between 250 to 350 rupees.

Table below presents the details of information on the fishermen, their fishing status, economic and social status, fish market and availability of fish in the fish market and the average cost of the fish in the different parts of the reservoir area of the candidate project.

a) Village / Tole: Madan Kundari-6, Bhumithan **Date:**24/03/2069 B.S.
Name of the respondent: Ram Krishna Chhetri **Age**: 38

Fishermen

Presence of fisherman in the village						Yes
If yes no. of fishermen						72
Fishing Type	Occupational		Part time		Occasional	
	No.	Ethnicity	No.	Ethnicity	No.	Ethnicity
	-	-	50	Majhi	22	Tamang and Chhetri
Status	Social Status			Economic Status		
	Low*	Medium*	High*	Low	Medium	High
	Majhi and Tamang	Chhetri	-	Majhi	Chhetri and Tamang	-

Low=No jobs, No education, Medium*=Education but no jobs, High*=Both Education & jobs*
Low=Not enough for hand to mouth, Medium=Fairly enough to hand to mouth, High=Surplus and save or sell.

Fish Market, Fish Availability and Cost

Name of the Market /s	Daily availability of the fish in that market		Average cost of fish Rs/Kg
	Daily availability	Amount Kg/day	
Lubughat	Yes	25-30	Rs. 300-320/Kg
Jhomsa	Yes	15-20	Rs. 300-350/kg
Milan Chowk	Yes	10-15	Rs.300-350/Kg
Nepal Thok	Yes	20-25	Rs. 300-320/kg

b) Village / Tole: Birta Deurali-6 Saramthali **Date:** 26/03/2069 B.S.
Name of the respondent: Sano Majhi **Age**: 46

Fishermen

Presence of fisherman in the village						Yes
If yes no. of fishermen						150
Fishing Type	Occupational		Part time		Occasional	
	No.	Ethnicity	No.	Ethnicity	No.	Ethnicity
	10	Majhi	100	Majhi, Tamang, Bhujel and Newar	40	Tamang, Brahaman and Newar
Status	Social Status			Economic Status		
	Low*	Medium*	High*	Low	Medium	High
	Tamang, Bhujel and Majhi	Newar	Brahaman	Tamang , Bhujel and Majhi	Newar	Brahaman

Low=No jobs, No education, Medium*=Education but no jobs, High*=Both Education & jobs*
Low=Not enough for hand to mouth, Medium=Fairly enough to hand to mouth, High=Surplus and save or sell.

Fish Market, Fish Availability and Cost

Name of the Market /s	Daily availability of the fish in that market		Average cost of fish Rs/Kg
	Daily availability	Amount Kg/day	
Pachwarghat	Yes	15-20	Rs. 250-300/Kg
Parsel	Yes	10-15	Rs. 250-350/kg
Dolalghat	Yes	25-30	Rs.300-350/Kg

c) Village / Tole: Birta Deurali-6, Potagaira **Date:** 26/03/2069 B.S.
Name of the respondent: Man Bahadur Majhi **Age**: 48

Fishermen

Presence of fisherman in the village						Yes
If yes no. of fishermen						80
Fishing Type	occupational		Part time		Occasional	
	No.	Ethnicity	No.	Ethnicity	No.	Ethnicity
	-	-	50	Majhi and Tamang	30	Tamang and Brahaman
Status	Social Status			Economic Status		
	Low*	Medium*	High*	Low	Medium	High
	Tamang and Majhi	Brahaman	-	Tamang and Majhi	Brahaman	-

Low=No jobs, No education, Medium*=Education but no jobs, High*=Both Education & jobs*
Low=Not enough for hand to mouth, Medium=Fairly enough to hand to mouth, High=Surplus and save or sell.

Fish Market, Fish Availability and Cost

Name of the Market / s	Daily availability of the fish in that market		Average cost of fish Rs/Kg
	Daily availability	Amount Kg/day	
Pachwarghat	Yes	10-15	Rs. 250-300/Kg
Dolalghat	Yes	15-20	Rs. 250-350/kg
-	-	-	-

d) Village / Tole: Phalante-9, Majhibasti or Raspath **Date:** 27/03/2069
Name of the respondent: Dhurba Bahadur Majhi **Age**: 35

Fishermen

Presence of fisherman in the village						Yes
If yes no. of fishermen						150
Fishing Type	occupational		Part time		Occasional	
	No.	Ethnicity	No.	Ethnicity	No.	Ethnicity
	20	Majhi	100	Majhi and Tamang	30	Tamang
Status	Social Status			Economic Status		
	Low*	Medium*	High*	Low	Medium	High
	Tamang and Majhi	-	-	Tamang and Majhi	-	-

Low=No jobs, No education, Medium*=Education but no jobs, High*=Both Education & jobs*
Low=Not enough for hand to mouth, Medium=Fairly enough to hand to mouth, High=Surplus and save or sell.

Fish Market, Fish Availability and Cost

Name of the Market /s	Daily availability of the fish in that market		Average cost of fish Rs/Kg
	Daily availability	Amount Kg/day	
Dolalghat	Yes	15-20	Rs. 300-350/Kg

e) Village / Tole : Sangachowk-9, Majhigaun **Date:** 27/03/2069 B.S.
Name of the respondent: Min Bahadur Majhi **Age**: 43

Fishermen

Presence of fisherman in the village						Yes
If yes no. of fishermen						250
Fishing Type	occupational		Part time		Occasional	
	No.	Ethnicity	No.	Ethnicity	No.	Ethnicity
	50	Majhi	150	Majhi	50	Majhi
Status	Social Status			Economic Status		
	Low*	Medium*	High*	Low	Medium	High
	Majhi	-	-	Majhi	-	-

Low=No jobs, No education, Medium*=Education but no jobs, High*=Both Education & jobs*
Low=Not enough for hand to mouth, Medium=Fairly enough to hand to mouth, High=Surplus and save or sell.

Fish Market, Fish Availability and Cost

Name of the Market /s	Daily availability of the fish in that market		Average cost of fish Rs/Kg
	Daily availability	Amount Kg/day	
Dolalghat	Yes	20-25	Rs. 300-350/Kg

5.2 Fishing Season, Fish Catch, and Use of Caught Fish

Fishing in the river is carried out during the pre-monsoon and post monsoon seasons. Normally in the cold winter months (December - February) and monsoon months (June - September) fishing by the local fishermen is a rare activity. On an average daily catch of the fish by the occupational fishermen ranges between 1 to 2 kg with a maximum of 5 kg. Nearly 70% of the fish caught is sold in the nearby fish market. On an average the occupational and part time fishermen earn about 7000 rupees annually. According to the local fishermen the fish population in the candidate project sites is declining over the years due to illegal fishing practices.

The tables below present the details of the fishing season, fish catch, types of fish available, annual income of the fishermen etc. based on the key informant survey in different location of the candidate project sites.

a) Location: in the catchment **Date:** 26/03/2069 B.S.
Name of the fisherman: Narayan Majhi **Age:** 32 **Address:** Birtadeurali-6, Saramthali

Fishing detail	Fishing season:	All months except Push, Magh and Kartik.			
	Fishing days/week:	3-6days/ week			
	Maximum catch/day:	1-5kg			
	Minimum catch/day:	0.5kg			
	Average catch/day:	1-3 kg			
using way	All consumed	At home	NO	Average cost	Income last year
		In market	All	Rs300	Rs5000-7000

Name of stream: Sun Koshi

Name of fish	Found in abundance	Trend of fish availability		
		Decreasing	**Same as before**	**Increasing**
Sahar, Katle , Bam, Sidre, Kaande, Gahana, Gonch, Buduna, Fageta, Baghi, Chuche and Buche Asla, Hile, Cherakha, Kothe, Jalkapoor, Gagar and Chali Machha etc.	Asla, Buduna and Fageta Machha etc.	*		
		-Fishing by Electric Shock that causes high mortality of fingerlings to adult of all species which are abundant in River or stream. -Due to Poison and Chemical Fertilizer		

b) Location: in the catchment **Date:** 28/03/2069 B.S.
Name of the fisherman: Man Bahadur Majhi **Age:** 42 **Address:** Birtadeurali-6, Potagaira

Fishing detail	Fishing season:	Magh –Chaitra and Baisakh- Asadh			
	Fishing days/week:	3-5 days/ week			
	Maximum catch/day:	3-4 kg			
	Minimum catch/day:	1 kg			
	Average catch/day:	1-2 kg			
using way	All consumed	At home	No	Average cost	Income last year
		In market	All	Rs. 250-300	Rs.6000-8000

Name of river: Sun Koshi

Name of fish	Found in abundance	Trend of fish availability		
		Decreasing	**Same as before**	**Increasing**
Sahar, Katle , Bam, Sidre, Kaande, Gahana, Gonch, Buduna, Fageta, Baghi, Chuche and Buche Asla, Hile, Cherakha, Kothe, Jalkapoor, Gagar and Chali Machha etc.	Asla and Fageta	*		
		Fishing by Electric Shock that causes high mortality of fingerlings to adult of all species which are abundant in River or stream. -Due to Poison and Chemical Fertilizer.		

c) Location: i**n the catchment** **Date:** 227/03/2069 B.S.
Name of the fisherman: Shyam Majhi **Age:** 28 **Address:** Phalante-9, Majhibasti or Raspath

Fishing detail	Fishing season:	Magh- Chaitra and Baisakh-Jestha			
	Fishing days/week:	2-4days/ week			
	Maximum catch/day:	3-5 kg			
	Minimum catch/day:	1kg			
	Average catch/day:	1-2 kg			
using way	All consumed	At home	Part	Average cost	Income last year
		In market	Part	Rs300	Rs3000-5000

Name of river: Sun Koshi

Name of fish	Found in abundance	Trend of fish availability		
		Decreasing	Same as before	Increasing
Sahar, Katle , Bam, Sidre, Kaande, Gahana, Gonch, Buduna, Fageta, Baghi, Chuche and Buche Asla, Hile, Cherakha, Kothe, Jalkapoor, Gagar and Chali Machha etc.	Asla and Buduna	*		
		-Fishermen use to fishing by electric -Poison and Tremendous use of Chemical fertilizers in their agriculture farm, which contact with water and causes decreasing the population of all fish species.		

d) Location: in the catchment **Date:** 27/03/2069 B.S.

Name of the fisherman: Netra Bahadur Majhi **Age:** 37 **Address:** Sangachowk-9, Majhigaun

Fishing detail	Fishing season:	Falgun-Chaitra and Baisakh-Asadh			
	Fishing days/week:	3-5 days/ week			
	Maximum catch/day:	3-5 kg			
	Minimum catch/day:	0.5 kg			
	Average catch/day:	1-2 kg			
using way	All consumed	At home	Part	Average cost	Income last year
		In market	Part	Rs350	Rs3000-4000

Name of stream: Sun Koshi

Name of fish	Found in abundance	Trend of fish availability		
		Decreasing	Same as before	Increasing
Sahar, Katle , Bam, Sidre, Kaande, Gahana, Gonch, Buduna, Fageta, Baghi, Chuche and Buche Asla, Hile, Cherakha, Kothe, Jalkapoor, Gagar and Chali Machha etc.	Asla and Fageta	*		
		-Fishermen use to fishing by electric -Poison and Tremendous use of Chemical fertilizers in their agriculture farm, which contact with water and causes decreasing the population of all fish species.		

e) Location: in the catchment **Date:** 29/03/2069 B.S.

Name of the fisherman: Sukh Bahadur Majhi **Age:** 47 **Address:** Sirwari-9, Jhyadigaun

Fishing detail	Fishing season:	Baisakh, Chaitra, Asadh and Shrawan			
	Fishing days/week:	3-4 days/week			
	Maximum catch/day:	2-4 kg			
	Minimum catch/day:	0.25 kg			
	Average catch/day:	1-2 kg			
using way	All consumed	At home	All	Average cost	Income last year
		In market	No	-	-

Name of stream: Indrāvati

Name of fish	Found in abundance	Trend of fish availability		
		Decreasing	Same as before	Increasing
Sahar, Katle , Bam, Sidre, Kaande, Gahana, Gonch, Buduna, Fageta, Baghi, Chuche and Buche Asla, Hile, Cherakha, Kothe, Jalkapoor, Gagar and Chali Machha etc.	Asla and Sidre	*		
		-The no. of fishes decrease because of tremendous use of poison and agro chemical fertilizers in farm -10years ago there were frequently found Bam, now it is rare.		

5.3 Fish Diversity

A total of 21 fish species is reported by the local fishermen during the key informant survey. The lists of the fish species reported in the candidate project site is presented in the table below.

S.N.	LOCAL NAME	SCIENTIFIC NAME
1	Katle machha	*Acrossocheilus hexagonolepis*
2	Baam machha	*Amphipnous cuchia*
3	Gouch machha	*Bagarius bagarius*
4	Fageta machha	*Barilius vegra*
5	Baaghi or Singhe machha	*Botia dario*
6	Hile machha	*Channa gachua*
7	Jalakapoor	*Clupisoma garua*
8	Buduna or Lohari	*Garra gotyla*
9	Kapre machha	*Glyptothorax cavia*
10	Nakata machha	*Lepidocephaichthys guntea*
11	Chali machha	*Ompok bimaculatus*
12	Kaande machha	*Puntius guganio*
13	Sitre or sidre	*Puntius ticto*
14	*Chuche Asla*	*Schizotharaichthys progastus*
15	*Buche Asla*	*Schizothorax plagiostomus*
16	Sahar machha	*Tor tor*
17	Gahana machha	
18	Cherkha machha(like hile)	
19	Sule like Baam	
20	Kothe machha	
21	Gagar machha	

5.4 List of Fish Species of Conservation Significance

Of the 21 reported fish speceis 3 of the fish species are listed in the IUCN red list. Table below presents the list of the fish speceis of conservation significance.

S.N.	Local Name	Common Name	Scientific Name	Status					
				GON	IUCN	CITES	Site survey	Hearing survey	Literature survey
1	Katle machha	Acrossocheilus hexagonolepis		NT				Hearing at Saramthali, Potagaira, Majhibasti etc.	
2	Gouch machha	Bagarius bagarius		NT				Hearing at Saramthali, Potagaira, Majhibasti etc.	
3	Sahar machha	Tor tor		NT				Hearing at Saramthali, Potagaira, Majhibasti etc.	

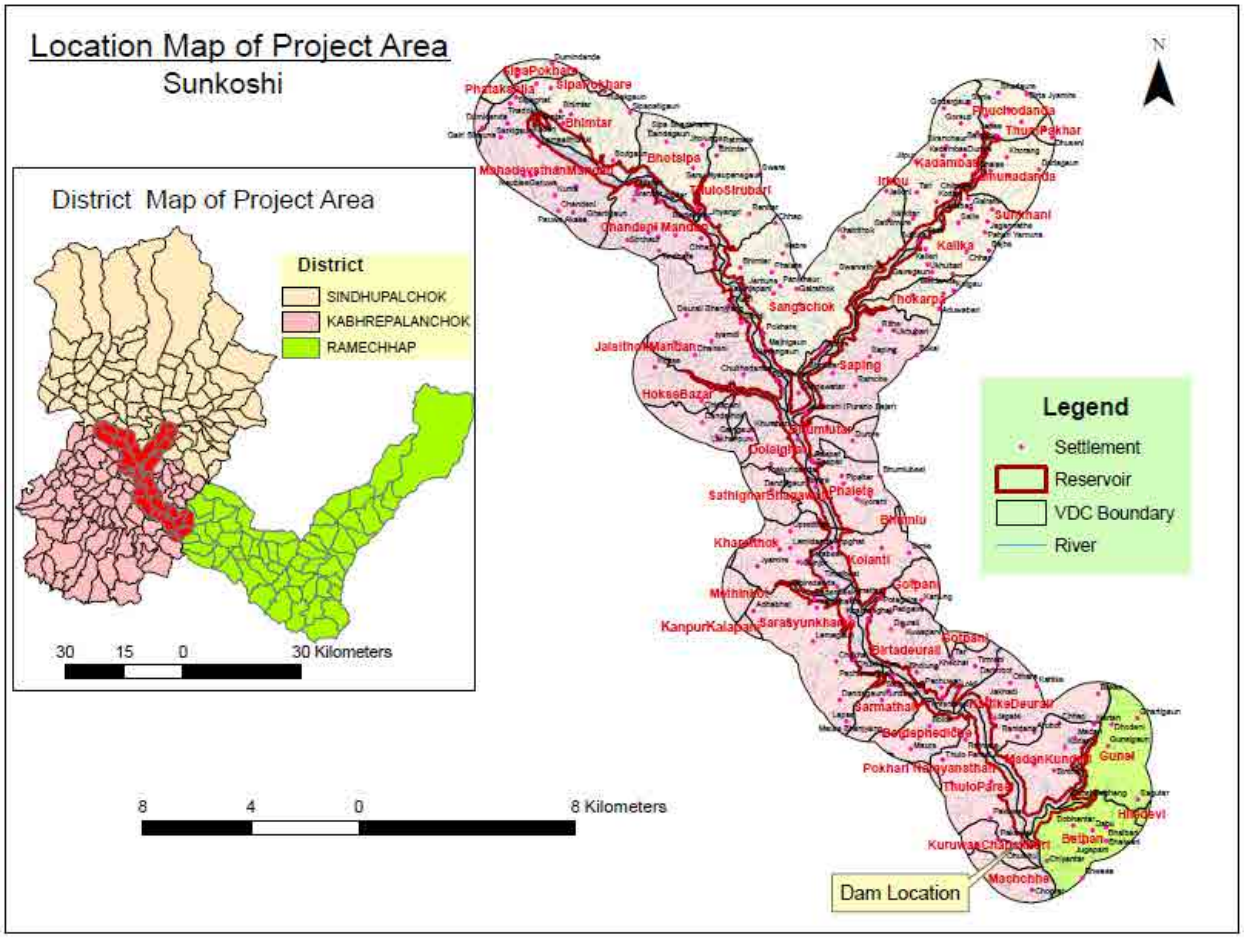
***IUCN Red List Categories**: Extinct (EX), Extinct In the Wild (EW), Critically Endangered (CR), Endangered (EN), Vulnerable (VU), Near Threatened (NT)*

***GOV Categories**: P Protected by legislation*

***CITES Categories:** I -Appendix I (are species that are threatened with extinction and are or may be affected by trade), II - Appendix II (are species that are not necessarily threatened with extinction, but may become so unless trade in specimens of such species is subject to strict regulation in order to avoid utilization incompatible with the survival of the species in the wild), and III - Appendix III (are species that are listed after one member country has asked other CITES Parties for assistance in controlling trade in a species)*

6 Topographic Map and Satellite Imagery Study

6.1 Project Location



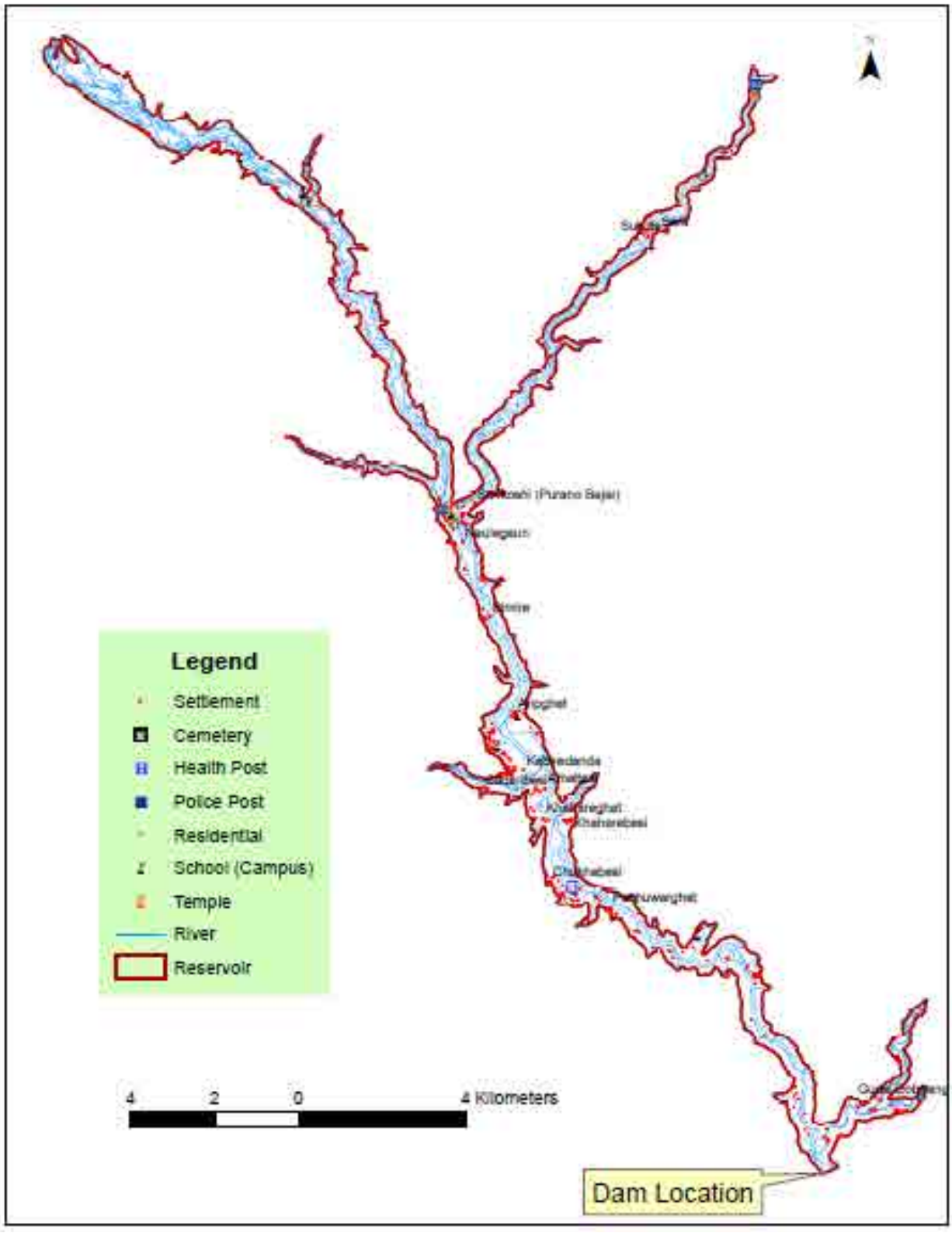
6.2 Topographic Maps

For this study, topographical maps of the scale of 1:25000 prepared by the Government of Nepal, Survey Department (1996) has been used for the analysis of land cover, and built structures, after digitizing. All data used for the topographic map study were projected to the Universal Transverse Mercator (UTM) projection system that is World Geodetic System 1984 for the analysis of topographic maps.

The analysis results are presented in the table and maps below.

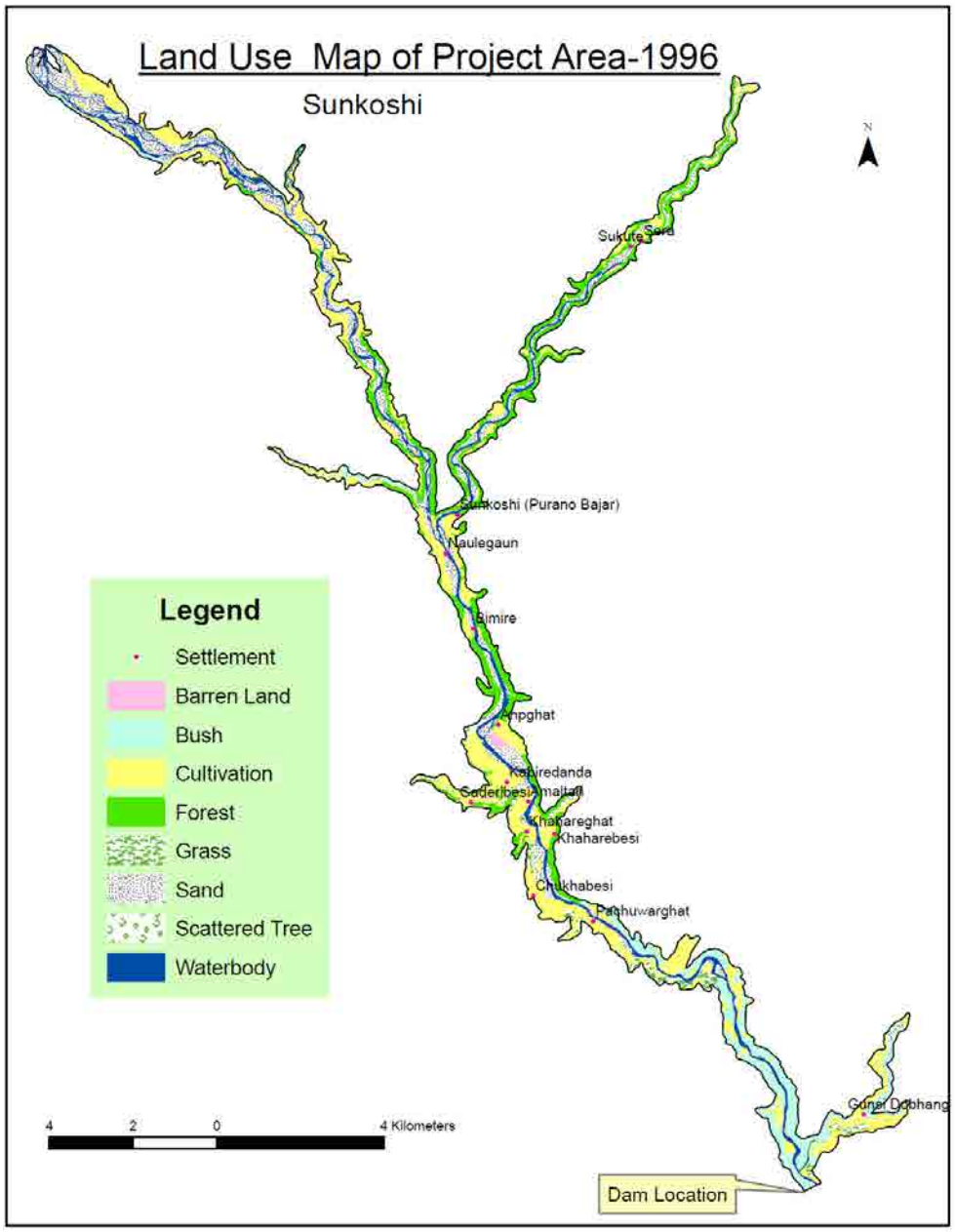
6.2.1 Built Structures

Nos. of building as per the Topographic maps	507



6.2.2 Land Use

S.N.	Land Use Class	Land Use Topographic Maps (1996), Km^2	Percentage
1	FOREST	5.069772	16.8599
2	BUSH	3.402574	11.3155
3	SAND	6.56694	21.8388
4	CULTIVATED	9.855112	32.7739
5	CLIFF		
6	WATER	4.107949	13.6613
7	GRASS LAND	0.82102	2.7304
8	BARREN LAND	0.170203	0.566
9	SCATTERED TREE	0.074167	0.2466
	TOTAL	**30.07**	**100**



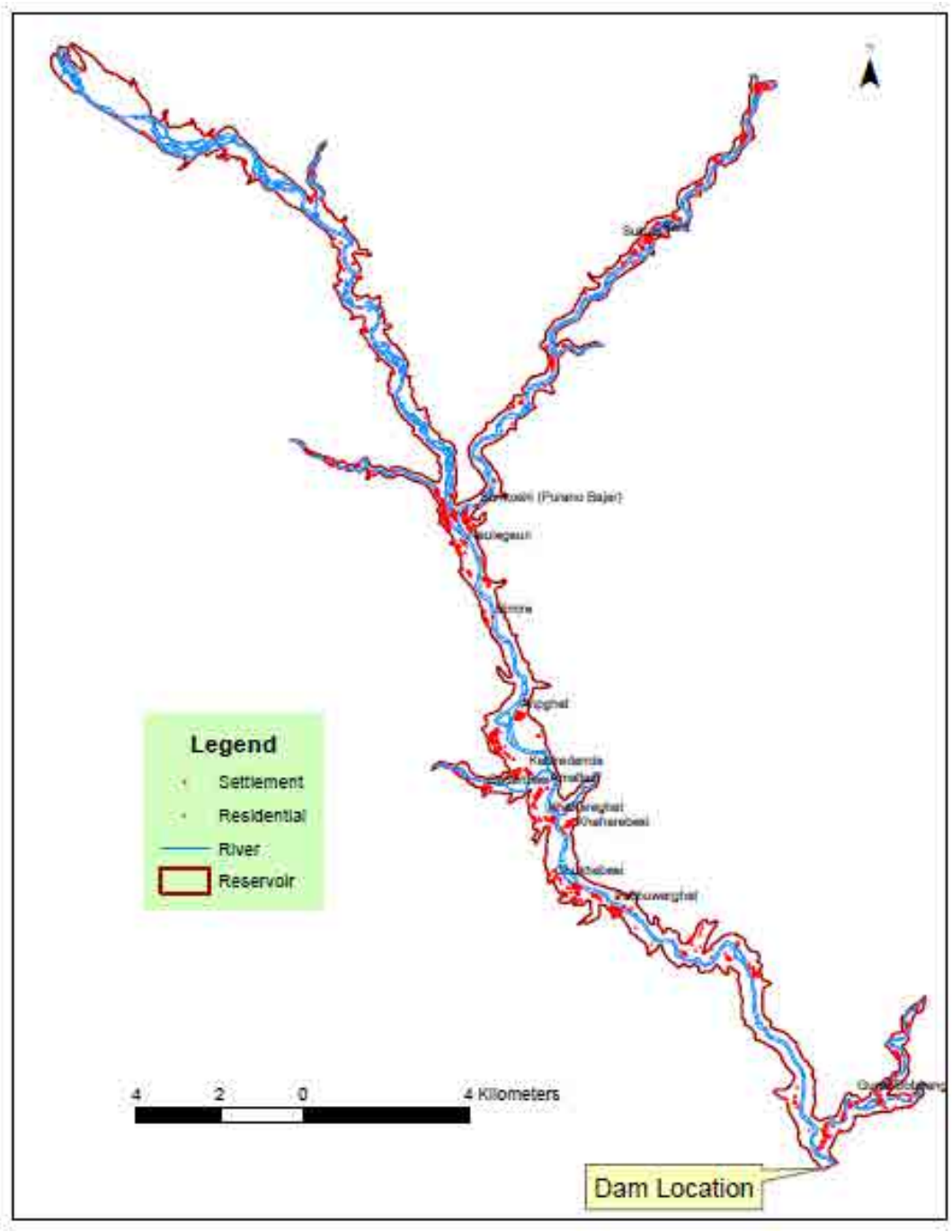
6.3 Satellite Image Maps

The Arc GIS 9.3 has been used for the analysis of image. World view 2 image of 2011 has been used for the land use and other parameters such as built structures, road networks, bridges etc. analysis of the area.

The analysis results are presented in tables and Map below.

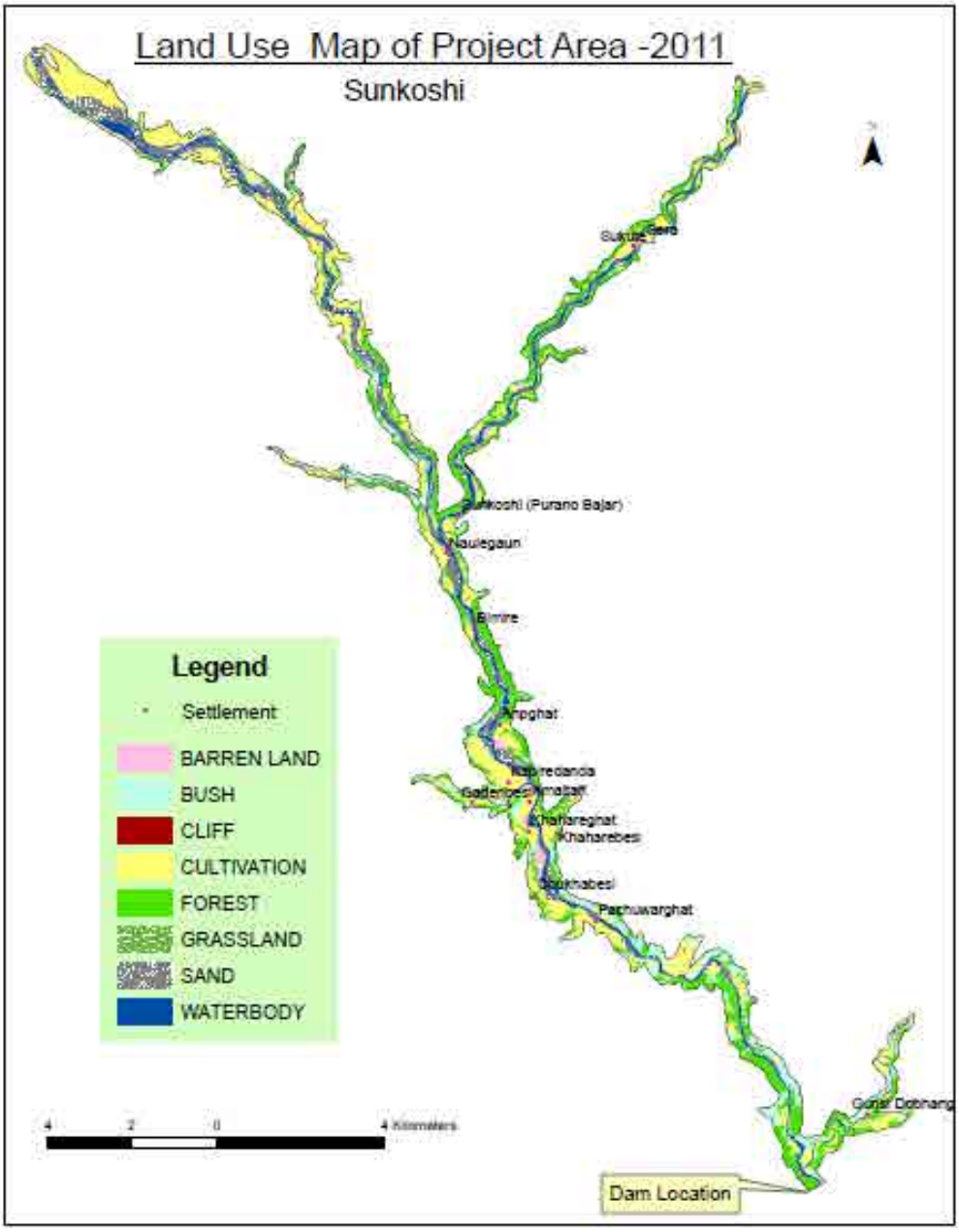
6.3.1 Building Structures

Nos. of building as per the Satellite Image	1238



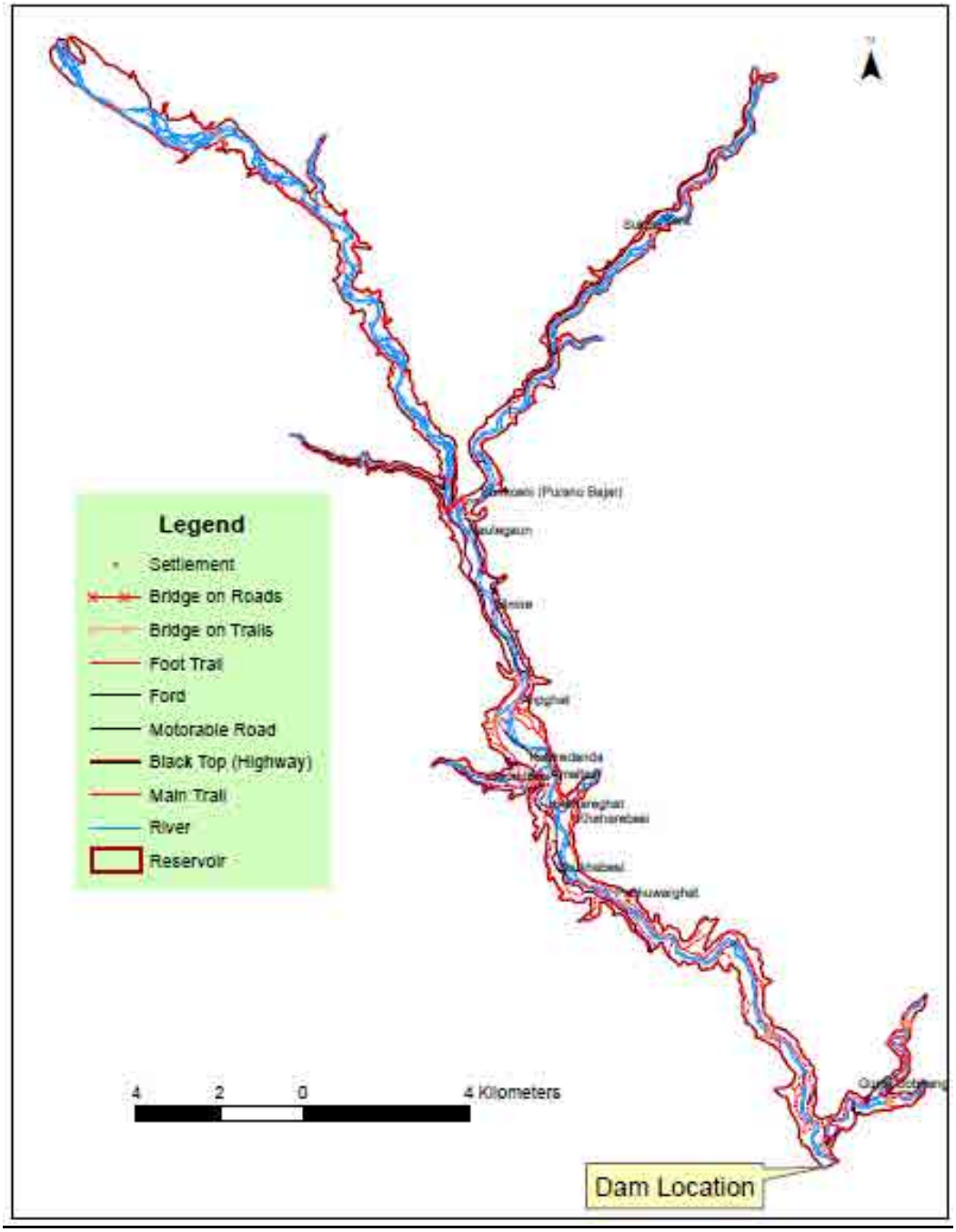
6.3.2 Land use

S.N.	Land Use Class	Land Use Satellite Image (2011), Km^2	Percentage
1	FOREST	8.157232	27.1275
2	BUSH	2.571527	8.5518
3	SAND	4.943815	16.441
4	CULTIVATED	9.393132	31.2376
5	CLIFF	0.020519	0.0682
6	WATER	4.11081	13.6708
7	GRASS LAND	0.465748	1.5489
8	BARREN LAND	0.417019	1.3868
	SCATTERED TREE		
	TOTAL	**30.07**	**100**



6.3.3 Infrastructures

Infrastructures	Nos. / Length
Total Nos. of bridge on motorable road	1
Total Nos. of bridge on trail	13
Total Nos. of fords	32
Gravel road (m)	24439
Paved road (Highway) (m)	15042
Main trail (m)	24055
Foot path (m)	63646



References

1. Bibhuti Ranjan Jha, 2006; *Fish Ecological Studies and its application in assessing Ecological Integrity of Rivers in Nepa*l; Thesis Submitted in partial fulfillment of the requirement for the degree of Doctor of Philosophy in The Department of Biological Sciences and Environmental Science, School of Science, Kathmandu University, Dhulikhel, Nepal, January 2006
2. CBS (2002), *Population Census 2001, National Report*, Kathmandu: Central Bureau of Statistics/UNFPA
3. CBS, 2012; *National Population and Housing Census 2011 (Village Development Committee/Municipalities), Government of Nepal,* National Planning Commission Secretariate, Central Bureau of Statistics, Kathmandu, Nepal, November 2012.
4. Disaster Preparedness Network, Nepal, 2009; *Nepal Disaster Report: The hazardscape and vulnerabilities*, Ministry of Home Affairs, Nepal Disaster Preparedness Network, Nepal with support from with support from European Commission for Humanitarian Aid Department, United Nations Development Nepal and Oxfam Nepal
5. IUCN, 2011; *The Status of Nepal's Mammals*: The National Red List Series
6. NARMSAP, 2002; *Forest and Vegetation Types of Nepal*, TISC Document Series No 105, GoN / MOFSC/NARMSAP, 1-179.
7. Petr, T, 2002; *Cold water fish and fisheries in countries of the high mountain arc of Asia (Hindu Kush-Pamir-Karakoram-Himalayas) A review*, Symposium on coldwater fish species in the trans-Himalayan region. 10-14 July 2001.Kathmandu, Nepal
8. Rajbansi K.J, 1982; *A General Bibliography on Fish and Fisheries of Nepal*, Royal Nepal Academy, Kamaladi, Kathmandu, Nepal.
9. Rajbansi K.J, 2002; *Zoogeographical distribution and the status of cold water fishes of Nepal*, Paper presented in symposium on coldwater fish species in the trans-himalayan region. 10-14 July 2001.Kathmandu, Nepal
10. Shrestha et.al, 2012; *Fishes of Nepal: Mapping distributions based on voucher specimens*, Emporia State Research StudiesVol. 48, no. 2, p. 14-21 (2012)
11. Shrestha, J. (1995); *Enumeration of the Fishes of Nepal*, Bio-diversity Profiles Project, Publication No. 10, Department of National Parks and wildlife Conservation, Ministry of Forest & Soil Conservation, GoN, Kathmandu, Nepal.
12. Shrestha, T. K., 2008; *Icology of Nepal A study of Fishes of the Himalayan Waters*
13. Stainton, J.D.A., 1972; *Forests of Nepal*, John Murray, London.

Photographs

Crusher factory near Sun Koshi, sukute

Fish farming near Sun Koshi ,sukute

Fisherman ready for fishing in Sun Koshi, pacharghat

Reservoir affected area in Sun Koshi

Interacting with people at Jyamdi VDC

Landslide causes by Sun Koshi annualy at Khaharebesi

Local peoples depends on forest for fodder at Pacharghat

Small boy fishing in Sun Koshi at pacharghat

Appendixes

Appendix 1: VDCs, Settlements and Population under the Sun Koshi No.3 Storage Project, Kavre, Sindupalchok Districts

S.N.	District/VDC	Settlement	Ward No.	HH	Population
1	**Kavre**/Birtadeurali	Pachuwarghat	1	6	42
2		Timrenibesi	7 and 8	89	772
3		Potagaira	5	45	360
4		Kharebesi	1 and 6	31	215
5	Sarsyukharka	Chukhabesi	8	63	480
6		Khareghat	3	14	120
7		Amaltari	3	63	480
8	Bhumlutar	Dolalghat	6	38	223
9		Puranobazar	6	13	70
10	Jyamdi	Thuldi	3 and 6	30	330
11		Sandi	1	45	319
12	Madan chandani	Maitar	4	18	76
13		Jogitar, Aapchaur Majigaun	2	85	450
14	Madan Kudari	Bhumesthan	6	12	90
15		Ghatte Besi	6	9	63
16		Dobhantar	4	36	180
17	Kattike Deurali	Arubot Ranidaha	1	70	450
18		Jakhadi	4	37	294
19	Kosidekha	Timal Besi	2,8,9	141	569
20	Phalate	Raspat	9	22	170
21	Saramthali	Pachuwarghat	5	15	110
22	Thulo Parsel	Pakuwal	3	53	350
23	Dolalghat	Dolalghat	1	80	594
24	**Sindupalchok**/Bhimtar	Bodgaun	1 and 9	395	2765
25		Neupanetar	1	0	0
26		Jamune and Asimure	6 and 8	2	18
27	Kadambas	Sukute	5	11	55
28	Bhotsipa	Rayle	9	28	230
29	Sangachwok	Majigaun	9	28	150
30		Sukute	1	80	800
31	Thulosirubari	Jhyadi	9	40	250
Total	**17**	**31**	**34**	**1599**	**11075**

Source: NESS Field Survey, 2012

Appendix 2: Ethnic / Caste Division of the Reservoir Area Population

S.N.	VDC	Settlement	Brahmin	Chhetri	Magar (Disadvantage Group)	Tamang (Disadvantage group)	Newar (Advanced group)	Majhi (Highly marginalized group)	Tharu (Marginalized group)	Thakuri	Dalit
1	**Kavre**/Birtadeurali	Pachuwarghat	0	0	0	5	0	0	0	0	1
2		Timrenibesi	0	6	0	5	0	65	0	0	13
3		Potagaira	11	0	0	5	0	29	0	0	0
4		Kharebesi	31	0	0	0	0	0	0	0	0
5	Sarsyukharka	Chukhabesi	16	0	0	30	14	0	0	0	3
6		Khareghat	8	1	0	5	0	0	0	0	0
7		Amaltari	30	25	0	5	3	0	0	0	0
8	Bhumlutar	Dolalghat	0	1	0	2	35	0	0	0	0
9		Puranobazar	0	0	0	0	13	0	0	0	0
10	Jyamdi	Thuldi	29	0	0	0	0	1	0	0	0
11		Sandi	36	8	0	0	0	1	0	0	0
12	Madan Chandani	Maitar	12	0	0	6	0	0	0	0	0
13		Jogitar, Aapchaur Majigaun	1	0	0	0	0	84	0	0	0
14	Madan Kudari	Bhumesthan	5	0	0	6	0	0	0	0	1
15		Ghatte Besi	3	0	4	2	0	0	0	0	0
16		Dobhantar	3	1	0	30	2	0	0	0	0
17	Kattike Deurali	Arubot Ranidaha	20	0	0	40	0	0	0	10	0
18		Jakhadi	3	6	2	19	0	7	0	0	0
19	Kosidekha	Timal Besi	120	2	0	16	0	0	0	0	3
20	Phalate	Raspat	0	0	0	0	0	22	0	0	0
21	Saramthali	Pachuwarghat	8	0	0	1	6	0	0	0	0
22	Thulo parsel	Pakuwal	4	0	7	42	0	0	0	0	0
23	Dolalghat	Dolalghat	35	10	0	7	25	3	0	0	0
24	**Sindupalchok**/Bhimtar	Bodgaun	0	0	0	0	0	395	0	0	0
25		Neupanetar	0	0	0	0	0	0	0	0	0
26		Jamune and Asimure	0	0	0	0	0	0	2	0	0
27	Kadambas	Sukute	0	3	4	0	4	0	0	0	0
28	Bhotsipa	Rayle	0	0	0	0	0	28	0	0	0
29	Sangachwok	Majigaun	0	0	0	0	0	28	0	0	0
30		Sukute	10	65	1	1	2	1	0	0	0
31	Thulosirubari	Jhyadi	0	0	0	0	0	40	0	0	0
Total	**17**	**31**	**385**	**128**	**18**	**227**	**104**	**704**	**2**	**10**	**21**
%			**24.08**	**8.01**	**1.13**	**14.20**	**6.50**	**44.03**	**0.13**	**0.63**	**1.3**

Source: NESS Field Survey, 2012

Appendix 3: Land Use Pattern of the Reservoir Area

S.N.	VDC	Settlement	Agriculture	pasture	forest	other	Total
1	**Kavre /** Birtadeurali	Pachuwarghat	120	0	150	0	270
2		Timrenibesi	1035	2000	2000	0	5035
3		Potagaira	300	0	0	0	300
4		Kharebesi	150	0	0	0	150
5	Sarsyukharka	Chukhabesi	1200	0	0	0	1200
6		Khareghat	200	0	0	0	200
7		Amaltari	1000	0	0	0	1000
8	Bhumlutar	Dolalghat	0	0	500	0	500
9		Puranobazar	100	0	0	0	100
10	Jyamdi	Thuldi	700	0	2000	0	2700
11		Sandi	258	0	1760	0	2018
12	Madan Chandani	Maitar	200	0	0	500	700
13		Jogitar, Aapchaur Majigaun	300	0	800	0	1100
14	Madan Kudari	Bhumesthan	70	200	500	0	770
15		Ghatte Besi	48	60	800	0	908
16		Dobhantar	365	300	500	0	1165
17	Kattike Deurali	Arubot Ranidaha	120	0	700	0	820
18		Jakhadi	220	0	0	0	220
19	Kosidekha	Timal Besi	1200	0	0	0	1200
20	Phalate	Raspat	100	0	0	0	100
21	Saramthali	Pachuwarghat	150	0	0	0	150
22	Thulo parsel	Pakuwal	200	300	200	0	700
23	Dolalghat	Dolalghat	0	0	0	0	0
24	**Sindupalchok /** Bhimtar	Bodgaun	1500	0	0	0	1500
25		Neupanetar	1500	0	1700	0	3200
26		Jamune and Asimure	1500	0	0	0	1500
27	Kadambas	Sukute	280	0	500	0	780
28	Bhotsipa	Rayle	150	0	300	0	450
29	Sangachwok	Majigaun	550	100	1000	0	1650
30		Sukute	270	0	1400	0	1670
31	Thulosirubari	Jhyadi	700	0	1200	0	1900
Total	**17**	**31**	**14486**	**2960**	**16010**	**500**	**33956**
%			**42.66**	**8.72**	**47.15**	**1.47**	**100**

Source: NESS Field Survey, 2012

Appendix 4: Land Holding of the Reservoir Area

S.N.	District/VDC	Settlement	Khet	Bari	Other	Total	Average Hiding Size
1	**Kavre** / Birtadeurali	Pachuwarghat	0	120	0	120	20.0
2		Timrenibesi	1000	35	0	1035	11.6
3		Potagaira	300	0	0	300	6.7
4		Kharebesi	150	0	0	150	4.8
5	Sarsyukharka	Chukhabesi	500	700	0	1200	19.0
6		Khareghat	200	0	0	200	14.3
7		Amaltari	1000	0	0	1000	15.9
8	Bhumlutar	Dolalghat	0	0	0	0	0.0
9		Puranobazar	40	60	0	100	7.7
10	Jyamdi	Thuldi	700	0	0	700	23.3
11		Sandi	8	250	0	258	5.7
12	Madan Chandani	Maitar	200	0	500	700	38.9
13		Jogitar, Aapchaur Majigaun	300	0	0	300	3.5
14	Madan Kudari	Bhumesthan	70	0	0	70	5.8
15		Ghatte Besi	48	0	0	48	5.3
16		Dobhantar	365	0	0	365	10.1
17	Kattike Deurali	Arubot Ranidaha	120	0	0	120	1.7
18		Jakhadi	90	130	0	220	5.9
19	Kosidekha	Timal Besi	1200	0	0	1200	8.5
20	Phalate	Raspat	100	0	0	100	4.5
21	Saramthali	Pachuwarghat	150	0	0	150	10.0
22	Thulo parsel	Pakuwal	200	0	0	200	3.8
23	Dolalghat	Dolalghat	0	0	0	0	0.0
24	**Sindupalchok** / Bhimtar	Bodgaun	1500	0	0	1500	3.8
25		Neupanetar	1500	0	0	1500	0.0
26		Jamune and Asimure	1500	0	0	1500	750.0
27	Kadambas	Sukute	200	80	0	280	25.5
28	Bhotsipa	Rayle	150	0	0	150	5.4
29	Sangachwok	Majigaun	50	500	0	550	19.6
30		Sukute	200	70	0	270	3.4
31	Thulosirubari	Jhyadi	700	0	0	700	17.5
Total	**17**	**31**	**12541**	**1945**	**500**	**14986**	**9.4**
%			**83.68**	**12.98**	**3.34**	**100**	

Source: NESS Field Survey, 2012

Appendix 5: Area (ropani) and Production (Kg) under Different Crops of the Project Area

Settlement	Paddy		Maize		Wheat		Potato		Pulse		Oilseeds		Vegetable	
	Area	Prod	Area	Prod	Area	Prod	Area	Prod	Area	Prod	Area	Prod	Area	Prod
Pachuwarghat	0	0	80	12000	50	6000	30	5000	0	0	0	0	0	0
Timrenibesi	1000	30000	1000	12000	1000	7000	300	2000	300	1000	0	0	50	15000
Potagaira	300	115500	300	72000	100	15000	80	8000	0	0	0	0	20	12000
Kharebesi	150	53625	100	27000	0	0	20	6500	0	0	0	0	100	300000
Chukhabesi	500	60000	1200	126000	800	81900	200	200000	0	0	0	0	100	30000
Khareghat	200	77000	180	43200	100	12000	100	20000	0	0	0	0	150	50000
Amaltari	1000	385000	1000	220000	200	30000	100	25000	0	0	0	0	700	700000
Dolalghat	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Puranobazar	6	12000	70	7000	0	0	3	300	0	0	0	0	25	1200
Thuldi	700	269500	500	90000	0	0	100	22000	0	0	0	0	700	720000
Sandi	8	2640	200	60000	0	0	0	0	0	0	0	0	100	100000
Maitar	200	77000	200	48000	0	0	50	11250	0	0	0	0	150	175000
Jogitar, Aapchaur Majigaun	300	107250	300	72000	100	42000	50	12000	0	0	0	0	100	15000
Bhumesthan	70	26250	70	22000	0	0	0	0	0	0	0	0	0	0
Ghatte Besi	48	18480	48	12000	30	4800	18	3600	0	0	0	0	0	0
Dobhantar	365	140525	365	87600	250	50000	115	57500	0	0	0	0	10	20000
Arubot Ranidaha	120	36000	120	14400	90	13200	0	0	0	0	0	0	0	0
Jakhadi	90	3150	200	56700	100	18900	50	11000	0	0	0	0	20	50000
Timal Besi	1200	462000	1000	150000	0	0	200	50000	0	0	0	0	1000	100000
Raspat	100	33000	100	24000	50	4000	50	20000	0	0	0	0	100	15000
Pachuwarghat	150	37500	150	32000	80	20000	30	15000	0	0	0	0	0	0
Pakuwal	200	40000	200	25000	100	15000	80	20000	0	0	0	0	0	0
Dolalghat	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bodgaun	1500	577500	1500	42000	0	0	500	15000	200	12000	0	0	200	150000
Neupanetar	1500	577500	1500	30000	0	0	300	90000	400	27000	0	0	400	100000
Jamune and Asimure	2000	761500	0	0	0	0	1500	1135600	0	0	0	0	25	93500
Sukute	250	74250	250	60000	80	7200	120	18000	0	0	0	0	150	27000
Rayle	150	57750	150	3200	0	0	50	2200	0	0	0	0	0	0
Majigaun	50	10000	400	4000	50	5000	30	4500	200	15000	0	0	80	80000
Sukute	180	72000	250	62500	40	4000	80	12000	0	0	0	0	100	25000
Jhyadi	700	269500	700	212500	0	0	150	25000	250	10000	0	0	100	50000
Total	**13037**	**4386420**	**12053**	**1615100**	**3170**	**330000**	**4276**	**1786450**	**1350**	**65000**	**0**	**0**	**4380**	**2828700**
Cropping Intensity= 255.34%														

Source: NESS Field Survey, 2012

Appendix 6: Sale of Crops

S.N.	VDC	Settlement	crop name	quantity (kg)	value	place of sale
1	**Kavre**/Birtadeurali	Pachuwarghat	0	0	0	
2		Timrenibesi	Paddy,maize,wheat	P(13750),M(15000),W(10000)	P(21),M(21),W(20)	Banepa
3		Potagaira	0			
4		Kharebesi	Vegetables	300000	20/kg	Banepa
5	Sarsyukharka	Chukhabesi	Vegetables	30000	15/kg	Banepa and panckhal
6		Khareghat	vegetables and potato	V(40000) ,P(10000)	V(20) , P(12)	Banepa
7		Amaltari	vegetables	650000	15 /kg	banepa
8	Bhumlutar	Dolalghat	0	0	0	
9		Puranobazar	0	0	0	
10	Jyamdi	Thuldi	vegetables	720000	20 / kg	Kathmandu
11		Sandi	vegetables	75000	20/kg	dolaghat
12	Madan Chandani	Maitar	vegetables	100000	15/kg	dolaghat
13		Jogitar, Aapchaur Majigaun	vegetables	10000	20/kg	banepa
14	Madan Kudari	Bhumesthan	Paddy,maize,wheat	P(750),M(5040),W(1575)		NA
15		Ghatte Besi	Paddy,maize,wheat	p(2750),M(1575),W(630)		NA
16		Dobhantar	Paddy,maize,wheat	p(3000),M(2000),W(500)	P(22),M(20),W(20)	Local village
17	Kattike Deurali	Arubot Ranidaha	Paddy,maize,wheat	P(1500),M(1200),W(700)	P(21),M(21),W(20)	Local village
18		Jakhadi	0			
19	Kosidekha	Timal Besi	paddy,maize,vegetable	P(30000),M(15000),V(100000)	P(31),M(20),V(20)	NA
20	Phalate	Raspat	vegetables	15000	20/kg	Banepa
21	Saramthali	Pachuwarghat	0	0		
22	Thulo parsel	Pakuwal	Paddy,maize,wheat	P(3000),M(3000),W(1000)	P(22),M(22),W(22)	Local village
23	Dolalghat	Dolalghat				
24	**Sindupalchok**/Bhimtar	Bodgaun	pullse,vegetable,potato	Pu(8000),V(130000),Pot(8000)	Pu(70),V(20),Pot(12)	sipaghat
25		Neupanetar	Pulle,vegetable,potato	Pu(15000),V(90000),pot(50000)	Pu(70),V(20),Pot(12)	Kathmandu
26		Jamune and Asimure	Paddy, potato,vegetable	Pad(150000),Pot(1125000),V(51500)	Pad(22),Pot(15),V(20)	Local village
27	Kadambas	Sukute	Potato ,vegetable	P(15000),V(25000)	P(12),V(20)	Kathmandu
28	Bhotsipa	Rayle	0			
29	Sangachwok	Majigaun	Vegetable,pullse	V(75000),P(480)	V(20),P(70)	dolaghat
30		Sukute	vegetables ,potato	V(25000), P(12000)	V(20) , P(12)	NA
31	Thulosirubari	Jhyadi	vegetable	30000	15 / kg	dolaghat
Total	**17**	**31**				

Source: NESS Field Survey, 2012

Appendix 7: Occupation of Working Population

S.N.	VDC	Settlement	Agriculture	Service	Wage labor	Foreign employment	Business
1	**Kavre /** Birtadeurali	Pachuwarghat	15	1	0	0	0
2		Timrenibesi	250	4	400	8	0
3		Potagaira	150	2	150	15	0
4		Kharebesi	60	10	50	20	0
5	Sarsyukharka	Chukhabesi	150	10	50	50	0
6		Khareghat	50	8	10	10	0
7		Amaltari	200	12	100	4	0
8	Bhumlutar	Dolalghat	0	15	0	0	85
9		Puranobazar	13	2	3	3	0
10	Jyamdi	Thuldi	100	15	150	7	0
11		Sandi	110	2	50	20	0
12	Madan Chandani	Maitar	25	3	40	4	0
13		Jogitar, Aapchaur Majigaun	200	2	100	8	0
14	Madan Kudari	Bhumesthan	45	2	15	4	0
15		Ghatte Besi	27	5	0	0	0
16		Dobhantar	50	7	70	20	0
17	Kattike Deurali	Arubot Ranidaha	200	3	50	8	0
18		Jakhadi	100	3	50	7	0
19	Kosidekha	Timal Besi	200	100	200	25	0
20	Phalate	Raspat	4	0	18	10	0
21	Saramthali	Pachuwarghat	40	5	30	12	0
22	Thulo parsel	Pakuwal	120	1	150	15	0
23	Dolalghat	Dolalghat	20	50	100	30	70
24	**Sindupalchok** / Bhimtar	Bodgaun	800	4	1200	25	0
25		Neupanetar	0	0	0	0	0
26		Jamune and Asimure	10	0	0	0	0
27	Kadambas	Sukute	15	0	5	10	3
28	Bhotsipa	Rayle	120	0	15	3	0
29	Sangachwok	Majigaun	70	0	20	4	0
30		Sukute	300	80	150	15	0
31	Thulosirubari	Jhyadi	100	0	20	8	0
Total	**17**	**31**	**3544**	**346**	**3196**	**345**	**158**
%			**46.70**	**4.56**	**42.11**	**4.55**	**2.08**

Source: NESS Field Survey, 2012

Appendix 8: House Type

S.N.	VDC	Settlement	Kacchi	Pakki	Total
1	**Kavre**/Birtadeurali	Pachuwarghat	6	0	6
2		Timrenibesi	89	0	89
3		Potagaira	45	0	45
4		Kharebesi	31	0	31
5	Sarsyukharka	Chukhabesi	63	0	63
6		Khareghat	14	0	14
7		Amaltari	63	0	63
8	Bhumlutar	Dolalghat	7	31	38
9		Puranobazar	11	2	13
10	Jyamdi	Thuldi	30	0	30
11		Sandi	45	0	45
12	Madan Chandani	Maitar	18	0	18
13		Jogitar, Aapchaur Majigaun	85	0	85
14	Madan Kudari	Bhumesthan	12	0	12
15		ghatte besi	9	0	9
16		Dobhantar	36	0	36
17	Kattike Deurali	Arubot Ranidaha	70	0	70
18		Jakhadi	37	0	37
19	Kosidekha	Timal Besi	141	0	141
20	Phalate	Raspat	22	0	22
21	Saramthali	Pachuwarghat	12	3	15
22	Thulo parsel	Pakuwal	53	0	53
23	Dolalghat	Dolalghat	21	59	80
24	**Sindupalchok**/Bhimtar	Bodgaun	395	0	395
25		Neupanetar	0	0	0
26		Jamune and Asimure	2	0	2
27	Kadambas	Sukute	11	0	11
28	Bhotsipa	Rayle	28	0	28
29	Sangachwok	Majigaun	28	0	28
30		Sukute	72	8	80
	Thulosirubari	Jhyadi	40	0	40
Total	**17**	**31**	**1496**	**103**	**1599**
%			**93.56**	**6.44**	**100.00**

Source: NESS Field Survey, 2012

Appendix 9: Roads and Bridges in the Reservoir Area

S.N.	VDC	Settlement	Roads			Bridges	
			Type	Length	Name of road	Type	Name of bridge
1	**Kavre /** Birtadeurali	Pachuwarghat		0 km		Suspension	Pachuwarghat bridge
2		Timrenibesi				Tuwin	
3		Potagaira					
4		Kharebesi				Suspension	Khareghat
5	Sarsyukharka	Chukhabesi	Graveled Earthen	NA	Boredovan to thuloparsel		
6		Khareghat	Graveled Earthen	0.5 km	NA		
7		Amaltari	Graveled Earthen	0.6 km	Boredovan to thuloparsel		
8		Puranobazar	Graveled Earthen	0.3 km	zero kilo chauri-dolalghat road	steel trust bridge	NA
9	Jyamdi	Thuldi				Suspension	Thuldi sanghu
10		Sandi	NA	1.3 km	Dolalghat leuwapati road		
11	Madan chandani	Maitar	Graveled Earthen	1.5 km	NA		
12		Jogitar,aapchaur majigaun	NA	0.2 km	NA	Suspension	Jogitar bridge
13	Madan kudari	Bhumesthan				Suspension	dovantar
14		ghatte besi	Graveled Earthen	6 km	NA	Suspension	tokidovan
15		dobhantar	Graveled Earthen	0.4 km	NA	Suspension	dovantar saghu bridge
16	Kattike deurali	arubot ranidaha	Graveled Earthen	3 km	NA	Suspension	Rani daha bridge
17		Jakhadi	Graveled Earthen	1.2 km	kattike-jakhadi road		
18	kosidekha	timal besi	NA	2.3 km	Bir bhadra road	Suspension	ghikukhola bridge
19	Phalate	Raspat	Graveled Earthen	0.5 km	Dolalghat-madankudari road		
20	saramthali	Pachuwarghat	Graveled Earthen	0.5 km	NA		
21	Thulo parsel	Pakuwal				Suspension	Pakuwal bridge
22	Dolalghat	Dolalghat	Graveled Earthen	0.2 km	Araniko highway	Concrete	dolalghat pool
23	**Sindupalchok/** Bhimtar	Bodgaun	Graveled Earthen	0.5 km	Tamsalin ringroad		
24		Neupanetar	Graveled Earthen	0.4 km	Tamsalin ringroad		
25		Jamune and asimure					
26	Kadambas	sukute	under construction	0.2 km	NA	suspension	Sukute pool
27	Bhotsipa	Rayle	Graveled earthen	0.1 km	Tamsalin ringroad		
28	Sangachwok	Majigaun	Graveled earthen	2 km	Tamsalin ringroad		

S.N.	VDC	Settlement	Roads			Bridges	
			Type	Length	Name of road	Type	Name of bridge
29		Sukute	Graveled earthen	2.5 km	Araniko highway	suspension	Sukute pool
30	Thulosirubari	jhyadi	Graveled earthen	0.2 km	Tamsalin ringroad		
Total	**17**	**31**		24.5Km		14	
	Shidhartha Hihway		Paved	15 km			

Source: NESS Field Survey, 2012

Appendix 10 Schools and Students in the Reservoir Area

S.N.	VDC	Settlement	School Detail		
			Name of school	No. of school	No. of students
1	**Kavre /** Birtadeurali	Pachuwarghat		0	0
2		Timrenibesi	Bacheswor PS	1	130
3		Potagaira		0	0
4		Kharebesi		0	0
5	Sarsyukharka	Chukhabesi	Sunkoshi LSS	1	250
6		Khareghat		0	0
7		Amaltari	Bupaleswor PS	1	120
8	Bhumlutar	Dolalghat	Shree dulaleshowr HSS	1	500
9		Puranobazar		0	0
10	Jyamdi	Thuldi	0	0	0
11		Sandi	Shree indrawati SS	1	300
12	Madan chandani	Maitar		0	0
13		Jogitar,aapchaur majigaun	Bindabaseni HS	1	200
14	Madan kudari	Bhumesthan	Shrijansil Janata SS	1	365
15		Ghatte Besi	Sunkoshi PS	2	70
16		Dobhantar		0	0
17	Kattike deurali	Arubot Ranidaha	Sunkoshi LSS	1	170
18		Jakhadi	Navajyoti Baikalpik School	1	20
19	Kosidekha	Timal Besi	Ganga LSS	1	75
20	Phalate	Raspat	NA	1	5
21	Saramthali	Pachuwarghat	0	0	0
22	Thulo parsel	Pakuwal	Mahankal LSS	1	150
23	Dolalghat	Dolalghat	Dolaleshowr HS	1	250
24	**Sindupalchok/** Bhimtar	Bodgaun	Seti Devi LSS	1	250
25		Neupanetar	0	0	0
26		Jamune and Asimure		0	0
27	Kadambas	Sukute		0	0
28	Bhotsipa	Rayle		0	0
29	Sangachwok	Majigaun	Pokhare PS	1	15
30		Sukute	Sukute LSS	1	100
31	Thulosirubari	Jhyadi	Shree Jhamala Devi PS	1	120
Total	**17**	**31**		**19**	**3090**

Source: NESS Field Survey, 2012

Appendix 11: Number of Irrigation Schemes and Command Area in the Reservoir Area

S.N.	VDC	Settlement	Name[4]	
			Number	Command Area (Ropani)
1	**Kavre /** Birtadeurali	Pachuwarghat	0	
2		Timrenibesi	0	
3		Potagaira	0	
4		Kharebesi	4	Khare besi
5	Sarsyukharka	Chukhabesi	1	NA
6		Khareghat	0	
7		Amaltari	2	No specefied name
8	Bhumlutar	Dolalghat	0	
9		Puranobazar	1	
10	Jyamdi	Thuldi	1	NA
11		Sandi	1	Sandi Indrawati(lift suystem)
12	Madan chandani	Maitar	0	
13		Jogitar, Aapchaur Majigaun	1	NA
14	Madan Kudari	Bhumesthan	1	NA
15		Ghatte Besi	1	NA
16		Dobhantar	1	dobhan tar irrigation project
17	Kattike deurali	Arubot Ranidaha	0	
18		Jakhadi	0	
19	Kosidekha	Timal Besi	2	Rajkulo and majkulo
20	Phalate	Raspat	0	
21	Saramthali	Pachuwarghat	0	
22	Thulo parsel	Pakuwal	1	shova khola -gidde khola scheme
23	Dolalghat	Dolalghat	0	
24	**Sindupalchok** / Bhimtar	Bodgaun	0	
25		Neupanetar	1	Bodgaun-neupanetar irrigation project
26		Jamune and Asimure	2	bhimtar besi
27	Kadambas	Sukute	0	
28	Bhotsipa	Rayle	0	
29	Sangachwok	Majigaun	0	
30		Sukute	0	
31	Thulosirubari	Jhyadi	0	
Total	**17**	**31**	**20**	

Source: NESS Field Survey, 2012

[4] The information on command area could not be made available.

Appendix 12: Number of Drinking Water Schemes in the Reservoir Area

S.N.	VDC	Settlement	Drinking Water Scheme Detail		
			Number of Schemes	Number of Taps	Name of the Scheme
1	**Kavre /** Birtadeurali	Pachuwarghat	0	0	
2		Timrenibesi	1	6	Kattike khola water supply sheme
3		Potagaira	1	8	Kurtum khola WSS
4		Kharebesi	1	4	Birtadeurali WSS
5	Sarsyukharka	Chukhabesi	1	63	Chukabesi WSS
6		Khareghat	1	NA	Khareghat WSS
7		Amaltari	1	63	Amaltari WSS
8	Bhumlutar	Dolalghat	1	38	NA
9		Puranobazar	1	1	Ghatte khola WSS
10	Jyamdi	Thuldi	1	10	Sandi WSS
11		Sandi	1	NA	Ghatte danda WSS
12	Madan Chandani	Maitar	1	7	Himjyoti WSS
13		Jogitar, Aapchaur Majigaun	1	25	Biste WSS
14	Madan kudari	Bhumesthan	0		
15		Ghatte Besi	0	0	
16		Dobhantar	1	36	Dovan rar drinking WSS
17	Kattike Deurali	Arubot Ranidaha	1	13	thdo khola tapte pani WSS
18		Jakhadi	0		
19	Kosidekha	Timal Besi	2	141	paharikhola timalbesi WSS
20	Phalate	Raspat	1	22	Rastpat WSS
21	saramthali	Pachuwarghat	1	2	simpakha WSS
22	Thulo parsel	Pakuwal	0	0	
23	Dolalghat	Dolalghat	1	80	kalleri WSS
24	**Sindupalchok /** Bhimtar	Bodgaun	1	8	Bodgaun WSS
25		Neupanetar	0	0	
26		Jamune and Asimure	0	0	
27	Kadambas	Sukute	0	0	
28	Bhotsipa	Rayle	0	0	
29	Sangachwok	Majigaun	0	0	
30		Sukute	1	NA	NA
31	Thulosirubari	Jhyadi	1	12	Jhadi WSS
Total	**17**	**31**	**22**	**539**	

Source: NESS Field Survey, 2012

Appendix 13: Number of Community Forests and Wetland/Recreation Centers in the Reservoir Area

S.N.	VDC	Settlement	Community Forests Detail	
			Number	Name
1	**Kavre** / Birtadeurali	Pachuwarghat	1	Birtadeurali CF
2		Timrenibesi	1	Maluwawoda-dobara khola CF
3		Potagaira	0	
4		Kharebesi	1	Birtadeurali CF
5	Sarsyukharka	Chukhabesi	0	
6		Khareghat	0	
7		Amaltari	0	
8	Bhumlutar	Dolalghat	1	Bandevi CF
9		Puranobazar	1	Maankholcha CF
10	Jyamdi	Thuldi	1	Baaskharka CF
11		Sandi	1	Aambote CF
12	Madan Chandani	Maitar	1	Sanukharka CF
13		Jogitar, Aapchaur Majigaun	0	
14	Madan kudari	Bhumesthan	1	chaulaganga CF
15		Ghatte Besi	1	NA
16		Dobhantar	2	pipalchaur CF and Garkot sampakha CF
17	Kattike deurali	Arubot Ranidaha	1	dhoje khoria CF
18		Jakhadi	0	
19	Kosidekha	Timal Besi	0	
20	Phalate	Raspat	0	
21	Saramthali	Pachuwarghat	0	
22	Thulo parsel	Pakuwal	0	
23	Dolalghat	Dolalghat	0	
24	**Sindupalchok/** Bhimtar	Bodgaun	1	thulitar CF
25		Neupanetar	1	Bhimtar CF
26		Jamune and Asimure	0	
27	Kadambas	Sukute	2	Bhalukhop CF and Sera danda kafledi CF
28	Bhotsipa	Rayle	1	Tinpakhe CF
29	Sangachwok	Majigaun	3	Patle khola CF,gaye khola CF,padhera khola CF
30		Sukute	1	khatrikot CF
31	Thulosirubari	Jhyadi	1	kholekhole CF
Total	**17**	**31**	**23**	

Source: NESS Field Survey, 2012

Appendix 14: Number of Water Mill and Sources in the Reservoir Area

S.N.	VDC	Settlement	Number of Water Mill	Water Mill Sources
1	**Kavre** / Birtadeurali	Pachuwarghat	0	0
2		Timrenibesi	1	Timrine khola
3		Potagaira	5	Khare khola
4		Kharebesi	0	
5	Sarsyukharka	Chukhabesi	2	Ghatte khola
6		Khareghat	0	
7		Amaltari	0	
8	Bhumlutar	Dolalghat	0	0
9		Puranobazar	0	
10	Jyamdi	Thuldi	0	
11		Sandi	0	
12	Madan chandani	Maitar	0	
13		Jogitar, Aapchaur Majigaun	0	
14	Madan kudari	Bhumesthan	1	chauri khola
15		Ghatte Besi	4	Chauri khola
16		Dobhantar	1	chauri khola
17	Kattike deurali	Arubot Ranidaha	0	
18		Jakhadi	0	
19	kosidekha	Timal Besi	0	
20	Phalate	Raspat	0	
21	saramthali	Pachuwarghat	0	
22	Thulo parsel	Pakuwal	0	
23	Dolalghat	Dolalghat	0	
24	**Sindupalchok**/Bhimtar	Bodgaun	0	
25		Neupanetar	0	
26		Jamune and Asimure	0	
27	Kadambas	Sukute	0	
28	Bhotsipa	Rayle	0	
29	Sangachwok	Majigaun	0	
30		Sukute	0	
31	Thulosirubari	Jhyadi	1	jhadi khola
Total	**17**	**31**	**15**	**5**

Source: NESS Field Survey, 2012

Appendix 15: Markets and Service Centres in the Reservoir Area

S.N.	VDC	Settlement	Markets		Service Centers		
			Name of markets	Types	Llivestock	Health	Security
1	**Kavre** / Birtadeurali	Pachuwarghat			0	0	0
2		Timrenibesi			0	1 (clinic)	0
3		Potagaira			0	0	0
4		Kharebesi			0	0	0
5	Sarsyukharka	Chukhabesi			0	1 (health post)	
6		Khareghat			0	0	0
7		Amaltari			0	0	0
8	Bhumlutar	Dolalghat	dolalghat bazar	permanent	0	0	0
9		Puranobazar	purano bazar	permanent	0	0	0
10	Jyamdi	Thuldi			0	0	0
11		Sandi			0	0	0
12	Madan chandani	Maitar			0	0	0
13		Jogitar, Aapchaur Majigaun			0	1 (health post)	0
14	Madan kudari	Bhumesthan			0	0	0
15		Ghatte Besi	kundari bazar	weekly	1	1	0
16		dobhantar			0	0	0
17	Kattike deurali	Arubot Ranidaha			0	0	0
18		Jakhadi			0	0	0
19	Kosidekha	Timal Besi			0	0	1 (police station
20	Phalate	Raspat			0	0	0
21	saramthali	Pachuwarghat	Pachuwar ghat bazar	NA	0	0	1 (police station
22	Thulo parsel	Pakuwal			0	0	0
23	Dolalghat	Dolalghat	Dolaghat bazar		0	3 (pharmacy)	1 (police station
24	**Sindupalchok** / Bhimtar	Bodgaun			0		0
25		Neupanetar			0	0	0
26		Jamune and Asimure			0	0	0
27	Kadambas	Sukute			0	0	0
28	Bhotsipa	Rayle			0	0	0
29	Sangachwok	Majigaun			0	0	0
30		Sukute			0	0	0
31	Thulosirubari	Jhyadi			0	0	0
Total	**17**	**31**	**5**	**4 Permanent, 1 Temporary**	**1**	**6**	**3**

Source: NESS Field Survey, 2012

Appendix 16: Culture and Religious Places

S.N.	VDC	Settlement	Main festival	Any festivals of Janajatis	Religious site at the river	Cremation ghats
1	**Kavre /** Birtadeurali	Pachuwarghat	Dashain, tihar,teej	No	no such site	NA
2		Timrenibesi	Dashain,tihar,teej	Lhosar	Mahadev temple near sunkoshi river	Maisadaha ghat
3		Potagaira	Dashain, tihar,teej,maghe sankranti	Lhosar	NA	NA
4		Kharebesi	Dashain, tihar,teej,maghe sankranti	NA	NA	NA
5	Sarsyukharka	Chukhabesi	Dashain, tihar,teej,maghe sankranti	Lhosar	NA	2 site near river (no built structure)
6		Khareghat	Dashain, tihar,teej,maghe sankranti	Lhosar	Shiva temple below suspension bridge at kahareghat	NA
7		Amaltari	Dashain, tihar,teej,maghe sankranti	Lhosar	shiva temple near riverside	near river(no built structure)
8	Bhumlutar	Dolalghat	Dashain, tihar, janaipurnima	no	Mahadevsthan ,Ganesthan	No built structre
9		Puranobazar	Dashain, tihar,teej,maghe sankranti	NA	Shiva madir(displaced dur to flood)	NA
10	Jyamdi	Thuldi	Dashain, tihar,teej,maghe sankranti	NA	no such site	No built structre
11		Sandi	Dashain, tihar,teej,maghe sankranti	NA	shree krishna temple	NA
12	Madan chandani	Maitar	Dashain, tihar,teej,maghe sankranti	Lhosar	Mahadev temple (50 m above river)	NA
13		Jogitar, Aapchaur Majigaun	Dashain, tihar,teej,maghe sankranti	NA	NA	NA
14	Madan kudari	Bhumesthan	Dashain, tihar,teej,maghe sankranti	Lhosar	NA	dovantar ghat
15		Ghatte Besi	Dashain, tihar,teej,maghe sankranti	NA	Khimti beshi devi	Dobhantar ghat
16		Dobhantar	Dashain, tihar,teej,maghe sankranti	Lhosar	pauwa on the name of harka singh lama	Dhovantar ghat
17	Kattike deurali	Arubot Ranidaha	Dashain, tihar,teej,maghe sankranti	Lhosar	NA	NA
18		Jakhadi	Dashain, tihar,teej,maghe sankranti	Lhosar	NA	NA
19	kosidekha	timal besi	Dashain, tihar,teej,maghe sankranti	Lhosar	shiva temple,krishna temple,bhimsen temple	sunkoshi sisso ghat
20	Phalate	Raspat	Dashain, tihar,teej,maghe sankranti	Dhanya purne	NA	NA

S.N.	VDC	Settlement	Main festival	Any festivals of Janajatis	Religious site at the river	Cremation ghats
21	saramthali	Pachuwarghat	Dashain, tihar,teej,maghe sankranti	Lhosar	NA	Pachuwar ghat (near sunkoshi)
22	Thulo parsel	Pakuwal	Dashain, tihar,teej,maghe sankranti	Lhosar	NA	Pakuwal ghat
23	Dolalghat	Dolalghat	Dashain, tihar,teej,maghe sankranti	Lhosar	NA	NA
24	**Sindupalchok** /Bhimtar	Bodgaun	Dashain, tihar,teej,maghe sankranti	NA	devi mandir,krishna mandir (near bank of river)	NA
25		Neupanetar	Dashain, tihar,teej,maghe sankranti	NA	Santaneshwor mahadev mandir	NA
26		Jamune and asimure	Dashain, tihar,teej,maghe sankranti	sankranti ,p urnima	NA	NA
27	Kadambas	Sukute	Dashain, tihar,teej,maghe sankranti	NA	NA	NA
28	Bhotsipa	Rayle	Dashain, tihar,teej,maghe sankranti	NA	NA	NA
29	Sangachwok	Majigaun	Dashain, tihar,teej,maghe sankranti	NA	NA	NA
30		Sukute	Dashain, tihar,teej,maghe sankranti	NA	mahadev temple at the bank of sunkoshi	NA
31	Thulosirubari	Jhyadi	Dashain, tihar,teej,maghe sankranti	NA	kali devi temple	NA
Total	**17**	**31**				

Source: NESS Field Survey, 2012

Appendix 17: Ongoing Development Projects of the Area

S N	VDC	Settlement	Agriculture	Irrigation	Infrastructure Development
1	**Kavre**/Birtadeurali	Potagaira	0	0	1(road expansion)
2	Sarsyukharka	Chukhabesi	0	1(water pump)	0
3	Jyamdi	Thuldi	0	0	0
4		Sandi	0	0	1(road expansion)
5	Madan chandani	Maitar	0	0	1(road expansion)
6	Kosidekha	Timal Besi	0	1(timal besi irrigation project)	0
7	Thulo parsel	Pakuwal	0	0	1(road expansion)
8	**Sindupalchok** Kadambas	Sukute	0	0	Road expansion and bridge construction
9	Sangachwok	Majigaun	1(kimbu farming)	0	0
10	Thulosirubari	Jhyadi	0	0	1(Tamsalin ringroad)
Total	**9**	**10**	1	2	7

Source: NESS Field Survey, 2012

Appendix 18: Community Perception on Hydropower

S.N.	VDC	Settlement	Perception	
			Positive Impact	**Negative Impact**
1.	**Kavre** /Birtadeurali	Pachuwarghat	employment and development activities	They will be like refugee if not addressed properly
2.		Timrenibesi	electricity	loss of land and property
3.		Potagaira	electricity	loss of land ,migration to other place
4.		Kharebesi	infrastucture development	displacement of settlement
5.	Sarsyukharka	Chukhabesi	available of electricity	displacement of settlement and loss of agricultural land
6.		Khareghat	NA	Loss of land and displacement of settlement
7.		Amaltari	employment and electricity	loss of land , people will loss their economic source
8.	Bhumlutar	Dolalghat	Electricity	market worth millions Rs will be destroyed ,nepal tibet road wiil get damaged
9.		Puranobazar	infrastucture development	submerge of house and land
10.	Jyamdi	Thuldi	employment and development activities	displacement of whole village
11.		Sandi	tourism devlopment	NA
12.	Madan chandani	Maitar	Electricity	loss of land
13.		Jogitar, Aapchaur Majigaun	electricity	loss of land
14.	Madan kudari	Bhumesthan	Job opportunity	loss of land
15.		Ghatte Besi	electricity	submerge of house and land
16.		Dobhantar	employment	displacement of settlement
17.	Kattike deurali	Arubot Ranidaha	local development	submerge of house and land
18.		Jakhadi	solution to energy crisis, local employment	loss land and house
19.	Kosidekha	Timal Besi	Rid of energy crisis	loss of fertile land
20.	Phalate	Raspat	electricity	submerge of house and land
21.	Saramthali	Pachuwarghat	development	NA
22.	Thulo parsel	Pakuwal	infrastructure development	submerge of house and land
23.	Dolalghat	Dolalghat	electricity and tourism	displacement of whole market
24.	**Sindupalchok/** Bhimtar	Bodgaun	NA	NA
25.		Neupanetar	electricity	loss of fertile land
26.		Jamune and asimure	tourism development	NA
27.	Kadambas	sukute	employment opportunity	loss of fertile land
28.	Bhotsipa	Rayle	good thing for nation	displacement of whole village
29.	Sangachwok	Majigaun	employment opportunity	loss of land
30.		Sukute	electricity	displacement of local community
31.	Thulosirubari	jhyadi	employment	loss of land

Source: NESS Field Survey, 2012

Appendix 19: Name list of FGD Participants (SUN KOSHI)
District: Kavrepalanchowk and Sindhupalchowk

S N	Name of Respondent	Address	Occupation
1.	Chini Maya Lama	Birtadeurali-1, Pachuwarghat	Farmer
2.	Purna Singh Lama	Birtadeurali-1, Pachuwarghat	Farmer
3.	Targan Lama	Birtadeurali-1, Pachuwarghat	Tourist guide
4.	Chatur Man Lama	Birtadeurali-1, Pachuwarghat	Tourist guide
5.	Babu Lama	Birtadeurali-1, Pachuwarghat	Tourist guide
6.	Arjun BK	Birtadeurali-1, Pachuwarghat	Business
7.	Pradip Lama	Birtadeurali-1, Pachuwarghat	Farmer
8.	Ganesh Bdr. Kadel	Birtadeurali-7, Timrenibesi	Farmer
9.	Hari Kadel	Birtadeurali-7, Timrenibesi	Farmer
10.	kancho B.K	Birtadeurali-7, Timrenibesi	Farmer
11.	Bishnu Ghatani	Birtadeurali-7, Timrenibesi	Farmer
12.	Bal Krishna Majhi	Birtadeurali-7, Timrenibesi	Farmer
13.	Kaji Majhi	Birtadeurali-7, Timrenibesi	Farmer
14.	Chaure Majhi	Birtadeurali-7, Timrenibesi	Farmer
15.	Man Bdr. Majhi	Birtadeurali-5, Potagaira	Farmer
16.	Gun Nidhi Panta	Birtadeurali-5, Potagaira	Farmer
17.	Naran Prasad Panta	Birtadeurali-5, Potagaira	Teacher
18.	Gopal Majhi	Birtadeurali-5, Potagaira	Farmer
19.	Saila Majhi	Birtadeurali-5, Potagaira	Farmer
20.	Chandra Prasad Panta	Birtadeurali-1, Kharebesi	Teacher
21.	Ramesh Panta	Birtadeurali-1, Kharebesi	Farmer
22.	Subarna Raj Panta	Birtadeurali-1, Kharebesi	Farmer
23.	Amanti Nath Panta	Birtadeurali-1, Kharebesi	Farmer
24.	Ganesh Panta	Birtadeurali-1, Kharebesi	Farmer
25.	Bashudev	Birtadeurali-1, Kharebesi	Farmer
26.	Purushotam Shrestha	Sarsyukharka-8, Chukabeshi	Teacher
27.	Sudip Shrestha	Sarsyukharka-8, Chukabeshi	Agriculture
28.	Suman Shrestha	Sarsyukharka-8, Chukabeshi	Student
29.	Man Bdr. Tamang	Sarsyukharka-8, Chukabeshi	Agriculture
30.	Ram Chandra Panta	Sarsyukharka-8, Chukabeshi	Agriculture
31.	Netra Prasad Tripathi	Sarsyukharka-3, Khareghat	Farmer
32.	Keshab Tripathi	Sarsyukharka-3, Khareghat	Teacher
33.	Krishna Prasad Tripathi	Sarsyukharka-3, Khareghat	Farmer
34.	Bharat Tripathi	Sarsyukharka-3, Khareghat	Farmer
35.	Jeevan Bhandari	Sarsyukharka-3, Khareghat	Farmer
36.	Madhav Tirpathi	Sarsyukharka-3, Amaltari	Farmer
37.	Ram Prasad Pande	Sarsyukharka-3, Amaltari	Farmer
38.	Netra Bdr. Bhandari	Sarsyukharka-3, Amaltari	Farmer
39.	Gagan Bdr. Bhadari	Sarsyukharka-3, Amaltari	Farmer
40.	Tanka Prasad Tripathi	Sarsyukharka-3, Amaltari	Farmer
41.	Hom Narayan Shrestha	Sarsyukharka-3, Amaltari	Farmer
42.	Santa Bir Tamang	Sarsyukharka-3, Amaltari	Farmer
43.	Sahaadev Bhandari	Sarsyukharka-3, Amaltari	Farmer
44.	Hari Krishna Shrestha	Bhumlutar-6, Dolalghat	Business
45.	Prem Lal Shrestha	Bhumlutar-6, Dolalghat	Business
46.	Jeevan Ram Shrestha	Bhumlutar-6, Dolalghat	Business
47.	Ek Raj Shrestha	Bhumlutar-6, Dolalghat	Business
48.	Indra Bhakta	Bhumlutar-6, Dolalghat	Business

S N	Name of Respondent	Address	Occupation
49.	Lok Darshan Raj	Bhumlutar-6, Purano Bazar	Agriculture
50.	Dirgha Bhd Shrestha	Bhumlutar-6, Purano Bazar	Agriculture
51.	Binod Shrestha	Bhumlutar-6, Purano Bazar	Agriculture
52.	Raju Shrestha	Bhumlutar-6, Purano Bazar	Driver
53.	Lila Bhakta Pradhananga	Bhumlutar-6, Purano Bazar	Business
54.	Dilip Shrestha	Bhumlutar-6, Purano Bazar	Wage labour
55.	Hari Prasad Parajuli	Jyamdi-3, Thuldi	Farmer
56.	Deepak Parajuli	Jyamdi-3, Thuldi	Farmer
57.	Purushottam Parajuli	Jyamdi-3, Thuldi	Farmer
58.	Batul Majhi	Jyamdi-3, Thuldi	Fisherman
59.	Laxman Majhi	Jyamdi-3, Thuldi	Farmer
60.	Badri Parajuli	Jyamdi-1, Sandi	Politician
61.	Dilli Parajuli	Jyamdi-1, Sandi	Farmer
62.	Ganesh Prasad Parajuli	Jyamdi-1, Sandi	Politician
63.	Krishna Prasad Parajuli	Jyamdi-1, Sandi	Farmer
64.	Dwarika Prasad Parajuli	Jyamdi-1, Sandi	Farmer
65.	Ram Prasad Parajuli	Jyamdi-1, Sandi	Farmer
66.	Bharat Parajuli	Jyamdi-1, Sandi	Farmer
67.	Yadav Nepal	Madanchandani-4, Maitar	Farmer
68.	Hari Prasad Nepal	Madanchandani-4, Maitar	Farmer
69.	Ram Prasad Nepal	Madanchandani-4, Maitar	Farmer
70.	Dhurba Prasad Nepal	Madanchandani-4, Maitar	Farmer
71.	Badri Prasad Nepal	Madanchandani-4, Maitar	Farmer
72.	Raj Kumar Majhi	Madanchandani-2, Jogitar	Teacher
73.	Raju Majhi	Madanchandani-2, Jogitar	Teacher
74.	Ram Krishna Majhi	Madanchandani-2, Jogitar	Farmer
75.	Bichari Majhi	Madanchandani-2, Jogitar	Farmer
76.	Sakuntala Majhi	Madanchandani-2, Jogitar	Female village server
77.	Thal Prasad Gautam	Madankundari-6, Bhumesthan	Farmer
78.	Min Prasad Gautam	Madankundari-6, Bhumesthan	farmer
79.	Sanu Lama	Madankundari-6, Bhumesthan	Farmer
80.	Rakam Singh Lama	Madankundari-6, Bhumesthan	Farmer
81.	Chandra Bdr. Lama	Madankundari-6, Bhumesthan	Farmer
82.	Rate Kami	Madankundari-6, Bhumesthan	Farmer
83.	Kumar Pande	Madankundari-6, Ghatte Besi	Business
84.	Gopal Bhujel	Madankundari-6, Ghatte Besi	Agriculture
85.	Ratna Lama	Madankundari-6, Ghatte Besi	Driver and agriculture
86.	Naran Bhujel	Madankundari-6, Ghatte Besi	Agriculture
87.	Sanohasta Lama	Madankundari-6, Ghatte Besi	Agriculture
88.	Ramjhi Pathak	Madankundari-6, Ghatte Besi	Agriculture
89.	Ram Krishna Ghising	Madankundari-4, Dobhantar	Farmer
90.	Chatra Bdr. Ghising	Madankundari-4, Dobhantar	Farmer
91.	Maili Moktan	Madankundari-4, Dobhantar	Farmer
92.	Chandra Bdr. Tamang	Madankundari-4, Dobhantar	shopkeeper
93.	Kancha Man Tamang	Kattike Deurali-1, Arubot Ranidaha	Farmer
94.	Harka Singh Tamang	Kattike Deurali-1, Arubot Ranidaha	Farmer
95.	Khadga Bdr. Panta	Kattike Deurali-1, Arubot Ranidaha	Farmer
96.	Ramesh Thakuri	Kattike Deurali-1, Arubot Ranidaha	Farmer
97.	Santa Lama	Kattike Deurali-1, Arubot Ranidaha	Farmer
98.	Tara Prasad Gautam	Kattike Deurali-1, Arubot Ranidaha	Teacher

S N	Name of Respondent	Address	Occupation
99.	Gandhi Pahari	Kattike Deurali-4, Jakhadi	Business
100.	Dilli Man Pahari	Kattike Deurali-4, Jakhadi	Farmer
101.	Kancha Man Majhi	Kattike Deurali-4, Jakhadi	Farmer
102.	Gopal Pahari	Kattike Deurali-4, Jakhadi	Farmer
103.	Thakur Prasad Humagain	Kattike Deurali-4, Jakhadi	Farmer
104.	Yoga Prasad Thapalaya	Koshidekha-2, Timalbesi	Teacher
105.	Madhav Prasad Thapalaya	Koshidekha-2, Timalbesi	Teacher
106.	Dambar Bdr.Tamang	Koshidekha-2, Timalbesi	Farmer
107.	Chamar Singh Tamang	Koshidekha-2, Timalbesi	Farmer
108.	Daya Raj Thapalaya	Koshidekha-2, Timalbesi	Farmer
109.	Lal Krishna Charmakar	Koshidekha-2, Timalbesi	Farmer
110.	Dhurba Majhi	Phalate-9, Raspat	Fisherman
111.	Bom Bdr.Majhi	Phalate-9, Raspat	Farmer
112.	Keshab Bdr.Majhi	Phalate-9, Raspat	Farmer
113.	Gyan Bdr.Majhi	Phalate-9, Raspat	Farmer
114.	Ram Bdr.Majhi	Phalate-9, Raspat	Farmer
115.	Mukunda Prasad Panta	Saramthali-5, Pachuwarghat	Teacher
116.	Chalakh Tamang	Saramthali-5, Pachuwarghat	Farmer
117.	Nalak Tamang	Saramthali-5, Pachuwarghat	Farmer
118.	Jem Tamang	Saramthali-5, Pachuwarghat	Teacher
119.	Aita Man Tamang	Saramthali-5, Pachuwarghat	Farmer
120.	Sodip Man Tamang	Thuloparsel-3, Pakuwal	Farmer
121.	Mandas Tamang	Thuloparsel-3, Pakuwal	Farmer
122.	Chewang Tamang	Thuloparsel-3, Pakuwal	Farmer
123.	Bed Bdr.Magar	Thuloparsel-3, Pakuwal	Farmer
124.	Durga Prasad Mainali	Thuloparsel-3, Pakuwal	Farmer
125.	Chandra Prasad Mainali	Thuloparsel-3, Pakuwal	Teacher
126.	Hira Kaji Shrestha	Dolaghat-1, Dolalghat	Business
127.	Achut Bdr.Shrestha	Dolaghat-1, Dolalghat	Business
128.	Prem Shrestha	Dolaghat-1, Dolalghat	Business
129.	Bal Krishna Shrestha	Dolaghat-1, Dolalghat	Business
130.	Pitambar Parajuli	Dolaghat-1, Dolalghat	Business
131.	Tok Bdr.Majhi	Bhimtar-1, Bodgaun	farmer
132.	Subit Bdr.Majhi	Bhimtar-1, Bodgaun	Farmer
133.	Kul Bdr. Majhi	Bhimtar-1, Bodgaun	Farmer
134.	Bidur Majhi	Bhimtar-1, Bodgaun	Farmer
135.	Sarroj Majhi	Bhimtar-1, Bodgaun	Farmer
136.	Punya Prasad Adhikari	Bhimtar-1, Neupanetar	Farmer
137.	Govinda Acharya	Bhimtar-1, Neupanetar	Farmer
138.	Dum Prasad Neupane	Bhimtar-1, Neupanetar	Farmer
139.	Rajendra Parajuli	Bhimtar-1, Neupanetar	Farmer
140.	Ram Hari Neupane	Bhimtar-1, Neupanetar	Service
141.	Madhav Prasad Neupane	Sipa pokhari-5	Teacher
142.	Ram Chandra Ghimire	Bhot Sipa-5	Farmer
143.	Ramesh Neupane	Sipa Pokhari-5	Student
144.	Gyan Bdr. Danuwar	Bhimtar-1	Farmer
145.	Jaya Ram	Bhimtar-1	Farmer
146.	Purna Bdr. Paudel	Bhot Sipa-5	Farmer
147.	Bhimsen Lamsal	Bhot Sipa-5	Farmer
148.	Binita Paudel	Bhot Sipa-5	Farmer

S N	Name of Respondent	Address	Occupation
149.	Mani Raj Giri	Kalika-4	Farmer
150.	Moti Raj Giri	Kalika-4	Farmer
151.	Yadav Giri	Kalika-4	Farmer
152.	Basu Khadka	Kalika-6	Farmer
153.	Nani Kahi Khadka	Kalika-6	Farmer
154.	Budune Majhi	Bhotsipa-9, Rayle	Farmer
155.	Bhunte Majhi	Bhotsipa-9, Rayle	Farmer
156.	Bibal Majhi	Bhotsipa-9, Rayle	Farmer
157.	Govinda Majhi	Bhotsipa-9, Rayle	Farmer
158.	Gyani Majhi	Bhotsipa-9, Rayle	Farmer
159.	Netra Bdr. Majhi	Sangachowk-9, Majhigaun	Farmer
160.	Som Bdr. Majhi	Sangachowk-9, Majhigaun	Farmer
161.	Buddha Bdr. Majhi	Sangachowk-9, Majhigaun	Farmer
162.	Min Bdr. Majhi	Sangachowk-9, Majhigaun	Farmer
163.	Bom Bdr. Majhi	Sangachowk-9, Majhigaun	Farmer
164.	Bharat Khadka	Sangachowk-1, Sukute	Farmer
165.	Hari Sapkota	Sangachowk-1, Sukute	Farmer
166.	Krishna Bdr. Khadka	Sangachowk-1, Sukute	Farmer
167.	Dal Bdr. Khadka	Sangachowk-1, Sukute	Farmer
168.	Bal Bdr. Sapkota	Sangachowk-1, Sukute	Farmer
169.	Sup Bdr. Majhi	Thulosirubari-9, Jhyadi	Farmer
170.	Prem Majhi	Thulosirubari-9, Jhyadi	Farmer
171.	Sunchari Majhi	Thulosirubari-9, Jhyadi	Farmer
172.	Sukute Majhi	Thulosirubari-9, Jhyadi	Farmer
173.	Tilak Bdr. Majhi	Thulosirubari-9, Jhyadi	Farmer
174.	Ram Krishna Chhetri	Madan Kundari, Bhumithan	Agriculture
175.	Ratne Moktan	Madan Kundari, Chaurikhola-6	Agriculture
176.	Shilu Bdr. Tamang	Mandankundari-5, Chaurikhola	Agriculture
177.	Sano Majhi	Birta Deurali-6 Saramthali	Fisherman
178.	Man Bahadur Majhi	Birta Deurali-6, Potagaira	Fisherman
179.	Dhurba Bahadur Majhi	Phalante-9, Majhibasti	Fisherman
180.	Min Bahadur Majhi	Sangachowk-9, Majhigaun	Fisherman
181.	Narayan Majhi	Birtadeurali-6, Saramthali	Fisherman
182.	Shyam Majhi	Phalante-9, Majhibasti	Fisherman
183.	Netra Bahadur Majhi	Sangachowk-9, Majhigaun	Fisherman
184.	Sukh Bahadur Majhi	Sirwari-9, Jhyadigaun	Fisherman

Source: NESS Field Survey, 2012

Appendix 20: Public Consultation Sun Koshi Project (Sindhupalchowk, Kavre and Ramechap Districts)

Field visit to the Sunkoshi project site was made on 8th to 15th July 2012. The objective of the visit was to collect primary information on the social, socio-economic, cultural, forest resources, wildlife, disaster records and aquatic ecological aspects from the reservoir area and the key structural locations of the project.

Since the study period was limited, most of the information related to the above aspects was derived based on the public consultations and interviews with the key informants. The socio-economic information was solicited from the focus group discussions at various settlements within the reservoir area. Information on disaster, fishermen, and fish diversity is based on the key informant interviews, while information on the forest, floral and wildlife diversity is based on the direct observation and interviews with the key informants. Focus group consultation meetings were held at 30 sites within the reservoir area (Table 1), while 11 key informants were interviewed for in depth knowledgeable information (Table 2).

Table 1: Participants of the Focus Group Discussion

S.N.	NAME OF PARTICIPANTS	OCCUPATION / POSITION	LOCATION
BIRTADEURALI-1, PACHUWARGHAT			
1	CHINI MAYA LAMA	FARMER	BIRTADEURALI -1, PACHUWARGHAT
2	PURNA SINGH LAMA	FARMER	BIRTADEURALI -1, PACHUWARGHAT
3	TARGAN LAMA	TOURIST GUIDE	BIRTADEURALI -1, PACHUWARGHAT
4	CHATUR MAN LAMA	TOURIST GUIDE	BIRTADEURALI -1, PACHUWARGHAT
5	BABU LAMA	TOURIST GUIDE	BIRTADEURALI -1, PACHUWARGHAT
6	ARJUN BK	BUSINESS	BIRTADEURALI -1, PACHUWARGHAT
7	PRADIP LAMA	FARMER	BIRTADEURALI -1, PACHUWARGHAT
BIRTADEURALI-7,8; TIMRENI BESI			
1	GANESH BDR KADEL	FARMER	BIRTADEURALI-7,8; TIMRENI BESI
2	HARI KADEL	TEACHER	BIRTADEURALI-7,8; TIMRENI BESI
3	KANCHO B.K	FARMER	BIRTADEURALI-7,8; TIMRENI BESI
4	BISHNU GHATANI	FARMER	BIRTADEURALI-7,8; TIMRENI BESI
5	BAL KRISHNA MAJHI	FARMER	BIRTADEURALI-7,8; TIMRENI BESI
6	KAJI MAJHI	FARMER	BIRTADEURALI-7,8; TIMRENI BESI
BIRTADEURALI-5; POTAGAIRA			
1	MAN BDR MAJHI	FARMER	BIRTADEURALI-5; POTAGAIRA
2	GUN NIDHI PANTA	FARMER	BIRTADEURALI-5; POTAGAIRA
3	NARAN PD PANTA	TEACHER	BIRTADEURALI-5; POTAGAIRA
4	GOPAL MAJHI	FARMER	BIRTADEURALI-5; POTAGAIRA
5	SAILA MAJHI	FARMER	BIRTADEURALI-5; POTAGAIRA
BIRTADEURALI-1,6; KHAREBESI			
1	CHANDRA PD PANTA	TEACHER	BIRTADEURALI-1,6; KHAREBESI
2	RAMESH PANTA	FARMER	BIRTADEURALI-1,6; KHAREBESI
3	SUBARNA RAJ PANTA	FARMER	BIRTADEURALI-1,6; KHAREBESI
4	AMANTI NATHA PANTA	FARMER	BIRTADEURALI-1,6; KHAREBESI
5	GANESH PANTA	FARMER	BIRTADEURALI-1,6; KHAREBESI
6	BASUDEV PANTA	FARMER	BIRTADEURALI-1,6; KHAREBESI
SARSYUKHARKA-8; CHUKHABESI			
1	PURSHOTAM	TEACHER	SARSYUKHARKA-8; CHUKHABESI

S.N.	NAME OF PARTICIPANTS	OCCUPATION / POSITION	LOCATION
	SHRESTHA		
2	SUDIP SHRESTHA	FARMER	SARSYUKHARKA-8; CHUKHABESI
3	SUMAN SHRESTHA	STUDENT	SARSYUKHARKA-8; CHUKHABESI
4	MAN BDR TAMANG	FARMER	SARSYUKHARKA-8; CHUKHABESI
5	RAM CHANDRA PANTA	FARMER	SARSYUKHARKA-8; CHUKHABESI
SYEUSIMKHARKA-3; KHAREGHAT			
1	NETRA PD TRIPATHI	FARMER	SYEUSIMKHARKA-3; KHAREGHAT
2	KESHAB TRIPATHI	TEACHER	SYEUSIMKHARKA-3; KHAREGHAT
3	KRISHNA PD TRIPATHI	FARMER	SYEUSIMKHARKA-3; KHAREGHAT
4	BHARAT TRIPATHI	FARMER	SYEUSIMKHARKA-3; KHAREGHAT
5	JEEVAN BHANDARI	FARMER	SYEUSIMKHARKA-3; KHAREGHAT
SARSYUKHARKHA -3; AMALTARI			
1	MADHAV TRIPATHI	FARMER	SARSYUKHARKHA-3; AMALTARI
2	RAM PD PANDEY	FARMER	SARSYUKHARKHA-3; AMALTARI
3	NETRA BDR BHANDARI	FARMER	SARSYUKHARKHA-3; AMALTARI
4	GAGAN BDR BHANDARI	FARMER	SARSYUKHARKHA-3; AMALTARI
5	TANKA PD TRIPATHI	FARMER	SARSYUKHARKHA-3; AMALTARI
6	HOM NARAYAN SHRESTHA	FARMER	SARSYUKHARKHA-3; AMALTARI
7	SANTA BIR TAMANG	FARMER	SARSYUKHARKHA-3; AMALTARI
8	SAHADEV BHANDARI	FARMER	SARSYUKHARKHA-3; AMALTARI
BHUMLUTAR–6; DOLALGHAT			
1	HARI KRISHNA SHRESTHA	BUSINESS	BHUMLUTAR–6; DOLALGHAT
2	PREM LAL SHRESTHA	BUSINESS	BHUMLUTAR–6; DOLALGHAT
3	JEEVAN RAM SHRESTHA	BUSINESS	BHUMLUTAR–6; DOLALGHAT
4	EK RAJ SHRESTHA	BUSINESS	BHUMLUTAR–6; DOLALGHAT
5	INDRA BHAKTA SHRESTHA	BUSINESS	BHUMLUTAR–6; DOLALGHAT
BHUMLUTAR– 6; PURANO BAZAR			
1	LOK DARSHAN RAI	FARMER	BHUMLUTAR–6; PURANO BAZAR
2	DIRGHA BDR SHRESTHA	FARMER	BHUMLUTAR–6; PURANO BAZAR
3	BINOD SHRESTHA	FARMER	BHUMLUTAR–6; PURANO BAZAR
4	RAJU SHRESTHA	DRIVER	BHUMLUTAR–6; PURANO BAZAR
5	LILA BHAKTA PRADHANANGA	BUSINESS	BHUMLUTAR–6; PURANO BAZAR
6	DILIP SHRESTHA	WAGE LABOUR	BHUMLUTAR–6; PURANO BAZAR
JYAMDI -3; THULDI			
1	HARI PRASHAD PARAJULI	FARMER	JYAMDI-3; THULDI
2	DEEPAK PARAJULI	FARMER	JYAMDI-3; THULDI
3	PURUSHOTTAM PARAJULI	FARMER	JYAMDI-3; THULDI
4	BATUL MAJHI	FISHING	JYAMDI-3; THULDI

S.N.	NAME OF PARTICIPANTS	OCCUPATION / POSITION	LOCATION
5	LAXMAN MAJHI	FARMER	JYAMDI-3; THULDI
JYAMDI– 1; SANDI			
1	BADRI PARAJULI	POLITICIAN	JYAMDI–1; SANDI
2	DILLI PARAJULI	FARMER	JYAMDI–1; SANDI
3	GANESH PD PARAJULI	POLITICIAN	JYAMDI–1; SANDI
4	KRISHNA PARAJULI	FARMER	JYAMDI–1; SANDI
5	DWARIKA PARAJULI	FARMER	JYAMDI–1; SANDI
6	RAM PD PARAJULI	FARMER	JYAMDI–1; SANDI
7	BHARAT PARAJULI	FARMER	JYAMDI–1; SANDI
MADANCHOWK–4; MAITAR			
1	YADAV NEPAL	AGRICULTURE	MADANCHOWK–4; MAITAR
2	HARI PD NEPAL	AGRICULTURE	MADANCHOWK–4; MAITAR
3	RAM PD NEPAL	AGRICULTURE	MADANCHOWK–4; MAITAR
4	DHURBA PD NEPAL	AGRICULTURE	MADANCHOWK–4; MAITAR
5	BADRI PD NEPAL	AGRICULTURE	MADANCHOWK–4; MAITAR
MADANCHANDANI -2; JOGITAR, AAPCHAUR			
1	RAJ KUMAR MAJHI	TEACHER	MADANCHANDANI-2; JOGITAR, AAPCHAUR
2	RAJU MAJHI	TEACHER	MADANCHANDANI-2; JOGITAR, AAPCHAUR
3	RAM KRISHNA MAJHI	FARMER	MADANCHANDANI-2; JOGITAR, AAPCHAUR
4	BICHARI MAJHI	FARMER	MADANCHANDANI-2; JOGITAR, AAPCHAUR
5	SAKUNTALA MAJHI	FEMALE VILLAGE SERVER	MADANCHANDANI-2; JOGITAR, AAPCHAUR
MADAN KNDARI – 6; BHUMESTHAN			
1	THAL PD GAUTAM	FARMER	MADAN KNDARI– 6; BHUMESTHAN
2	MIN PD GAUTAM	FARMER	MADAN KNDARI– 6; BHUMESTHAN
3	SANU LAMA	FARMER	MADAN KNDARI– 6; BHUMESTHAN
4	RAKAM SINGH LAMA	FARMER	MADAN KNDARI– 6; BHUMESTHAN
5	CHANDRA BD LAMA	FARMER	MADAN KNDARI– 6; BHUMESTHAN
6	RATE KAMI	FARMER	MADAN KNDARI– 6; BHUMESTHAN
MADAN KUNDARI -6; GHATTE BESI			
1	KUMAR PANDEY	MINERAL WATER INDUSTRY	MADAN KUNDARI -6; GHATTE BESI
2	GOPAL BHUJEL	FARMER	MADAN KUNDARI-6; GHATTE BESI
3	RATNA LAMA	DRIVER / FARMER	MADAN KUNDARI-6; GHATTE BESI
4	NARAN BHUJEL	FARMER	MADAN KUNDARI-6; GHATTE BESI
5	SANOHASTA LAMA	FARMER	MADAN KUNDARI-6; GHATTE BESI
6	RAMJI PATHAK	FARMER	MADAN KUNDARI-6; GHATTE BESI
MADAN KUNDARI -4; DOBHANTAR			
1	RAM KRISHNA GHISING	FARMER	MADAN KUNDARI-4; DOBHANTAR
2	CHATRA BDR GHISING	FARMER	MADAN KUNDARI-4; DOBHANTAR
3	CHANDRA BDR TAMANG	FARMER	MADAN KUNDARI-4; DOBHANTAR
4	MAILAI MOKTAN	SHOPKEEPER	MADAN KUNDARI-4; DOBHANTAR
KATTIKE DEURALI -1; ARUBOT RANIDAHA			

S.N.	NAME OF PARTICIPANTS	OCCUPATION / POSITION	LOCATION
1	KANCHA MAN TAMANG	FARMER	KATTIKE DEURALI-1; ARUBOT RANIDAHA
2	HARKA SINGH TAMANG	FARMER	KATTIKE DEURALI-1; ARUBOT RANIDAHA
3	KHADGA BDR PANTA	FARMER	KATTIKE DEURALI -1; ARUBOT RANIDAHA
4	RAMESH THAKURI	FARMER	KATTIKE DEURALI-1; ARUBOT RANIDAHA
5	SANTA LAMA	FARMER	KATTIKE DEURALI-1; ARUBOT RANIDAHA
6	TARA PD GAUTAM	TEACHER	KATTIKE DEURALI-1; ARUBOT RANIDAHA
KATTIKE DEURALI -4; JAKHADI			
1	GANDHI PAHARI	BUSINESS	KATTIKE DEURALI-4; JAKHADI
2	DILLI MAN PAHARI	FARMER	KATTIKE DEURALI-4; JAKHADI
3	KANCHA MAN MAJHI	FARMER	KATTIKE DEURALI-4; JAKHADI
4	GOPAL PAHARI	FARMER	KATTIKE DEURALI-4; JAKHADI
5	THAKUR PD HUMAGAIN	FARMER	KATTIKE DEURALI-4; JAKHADI
KOSIDEKHA- 2,8,9; TIMAL BESI			
1	YOGA PD THAPALAYA	TEACHER	KOSIDEKHA-2,8,9;TIMAL BESI
2	MADHAV PD THAPALAYA	TEACHER	KOSIDEKHA-2,8,9; TIMAL BESI
3	DAMBER BDR TAMANG	FARMER	KOSIDEKHA-2,8,9; TIMAL BESI
4	CHAMAR SINGH TAMNG	FARMER	KOSIDEKHA-2,8,9; TIMAL BESI
5	DAYA RAJ THAPALAYA	FARMER	KOSIDEKHA-2,8,9; TIMAL BESI
6	LAL KRISHNA CHARMAKAR	FARMER	KOSIDEKHA-2,8,9; TIMAL BESI
PHALATE–9; RASPAT			
1	DHURBA MAJHI	FISHERMAN	PHALATE–9; RASPAT
2	BOM BDR MAJHI	FARMER	PHALATE–9; RASPAT
3	KESHAB BDR MAJHI	FARMER	PHALATE–9; RASPAT
4	GYAN BDR MAJHI	FARMER	PHALATE–9; RASPAT
5	RAM BDR MAJHI	FARMER	PHALATE–9; RASPAT
SARAMTHALI – 5; PACHUWAGHAT			
1	MUKUNDA PD PANTA	TEACHER	SARAMTHALI–5; PACHUWAGHAT
2	CHALAKH TAMANG	FARMER	SARAMTHALI–5; PACHUWAGHAT
3	NALAK TAMANG	FARMER	SARAMTHALI–5; PACHUWAGHAT
4	JEM TAMANG	TEACHER	SARAMTHALI–5; PACHUWAGHAT
5	AITA MAN TAMANG	FARMER	SARAMTHALI–5; PACHUWAGHAT
THULO PARSEL – 3; PAKUWAL			
1	SODIP MAN TAMANG	FARMER	THULO PARSEL–3; PAKUWAL
2	MANDAS TAMANG	FARMER	THULO PARSEL–3; PAKUWAL
3	CHEWING TAMANG	FARMER	THULO PARSEL–3; PAKUWAL
4	BED BDR MAGAR	FARMER	THULO PARSEL–3; PAKUWAL
5	DURGA PD MAINALI	FARMER	THULO PARSEL–3; PAKUWAL
6	CHANDRA PD MAINALI	TEACHER	THULO PARSEL–3; PAKUWAL
DOLALGHAT – 1; DOLALGHAT			

S.N.	NAME OF PARTICIPANTS	OCCUPATION / POSITION	LOCATION
1	HIRA KAJI SHRESTHA	BUSINESS	DOLALGHAT–1; DOLALGHAT
2	ACHUT BDR SHRESTHA	BUSINESS	DOLALGHAT–1; DOLALGHAT
3	PREM SHRESTHA	BUSINESS	DOLALGHAT–1; DOLALGHAT
4	BAL KRISHNA SHRESTHA	BUSINESS	DOLALGHAT–1; DOLALGHAT
5	PITAMBER PARAJULI	BUSINESS	DOLALGHAT–1; DOLALGHAT
BHIMTAR– 1,9; BODGAUN			
1	TOK BDR MAJHI	FARMER	BHIMTAR–1, 9;BODGAUN
2	SUBIT BDR MAJHI	FARMER	BHIMTAR–1, 9;BODGAUN
3	KUL BDR MAJHI	FARMER	BHIMTAR–1, 9;BODGAUN
4	BIDUR MAJHI	FARMER	BHIMTAR–1, 9;BODGAUN
5	SAROJ MAJHI	FARMER	BHIMTAR–1, 9;BODGAUN
BHIMTAR -1; NEUPANETAR			
1	PUNYA PD ADHIKARI	FARMER	BHIMTAR-1; NEUPANETAR
2	GOVINDA ACHARYA	FARMER	BHIMTAR-1; NEUPANETAR
3	DUM PD NEUPANE	FARMER	BHIMTAR-1; NEUPANETAR
4	RAJENDRA PARAJULI	FARMER	BHIMTAR-1; NEUPANETAR
5	RAM HARI NEUPANE	SERVICE	BHIMTAR-1; NEUPANETAR
BHIMTAR- 8,6; JAMUNE			
1	MADHAV PD NEUPANE	TEACHER	BHIMTAR-8,6; JAMUNE
2	RAM CHANDRA GHIMERE	FARMER	BHIMTAR-8,6; JAMUNE
3	RAMESH NEUPANE	STUDENT	BHIMTAR-8,6; JAMUNE
4	GYAN BDR DANUWAR	FARMER	BHIMTAR-8,6; JAMUNE
5	JAYA RAM	FARMER	BHIMTAR-8,6; JAMUNE
6	PURNA BDR PAUDEL	FARMER	BHIMTAR-8,6; JAMUNE
7	BHIMSEN LAMSAL	FARMER	BHIMTAR-8,6; JAMUNE
8	BNITA PAUDEL	FARMER	BHIMTAR-8,6; JAMUNE
KADAMBAS- 5; SUKUTE			
1	MANI RAJ GIRI	FARMER	KADAMBAS-5; SUKUTE
2	MOTI RAJ GIRI	FARMER	KADAMBAS-5; SUKUTE
3	YADAV GIRI	FARMER	KADAMBAS-5; SUKUTE
4	BASU KHADKA	FARMER	KADAMBAS-5; SUKUTE
5	NANI KAJI KHADKA	FARMER	KADAMBAS-5; SUKUTE
BHOTSIPA -9; RAYLE			
1	BUDUNE MAJHI	FARMER	BHOTSIPA -9; RAYLE
2	BHUNTE MAJHI	FARMER	BHOTSIPA -9; RAYLE
3	BIRBAL MAJHI	FARMER	BHOTSIPA -9; RAYLE
4	GOVINDA MAJHI	FARMER	BHOTSIPA -9; RAYLE
5	GYANI MAJHI	FARMER	BHOTSIPA -9; RAYLE
SANGACHOWK -9; MAJHIGAUN			
1	NETRA BDR MAJHI	FARMER	SANGACHOWK-9; MAJHIGAUN
2	SOM BDR MAJHI	FARMER	SANGACHOWK-9; MAJHIGAUN
3	BUDDHA MAJHI	FARMER	SANGACHOWK-9; MAJHIGAUN
4	MAIN MAJHI	FARMER	SANGACHOWK-9; MAJHIGAUN
5	BOM MAJHI	FARMER	SANGACHOWK-9; MAJHIGAUN
SANGACHOWK-1; SUKUTE			
1	BHARAT KHADKA	FARMER	SANGACHOWK-1; SUKUTE

S.N.	NAME OF PARTICIPANTS	OCCUPATION / POSITION	LOCATION
2	HARI SAPKOTA	FARMER	SANGACHOWK-1; SUKUTE
3	KRISHNA BDR KHADKA	FARMER	SANGACHOWK-1; SUKUTE
4	DAL BDR KHADKA	FARMER	SANGACHOWK-1; SUKUTE
5	BAL BDR SAPKOTA	FARMER	SANGACHOWK-1; SUKUTE
THULOSIRUBARI- 9; JHYADI			
1	SUP BDR MAJHI	FARMER	THULOSIRUBARI-9; JHYADI
2	PREM MAJHI	FARMER	THULOSIRUBARI-9; JHYADI
3	SUNCHARI MAJHI	FARMER	THULOSIRUBARI-9; JHYADI THULOSIRUBARI-9; JHYADI
4	SUKULE MAJHI	FARMER	THULOSIRUBARI-9; JHYADI
5	TILAK BDR MAJHI	FARMER	THULOSIRUBARI-9; JHYADI

Table 2: Key Informant for Interview

S.N.	NAME OF KEY INFORMANT	OCCUPATION / POSITION	LOCATION
1	RAM KRISHNA CHHETRI	AGRICULTURE	MADAN KUNDARI, BHUMITHAN
2	RATNE MOKTAN	AGRICULTURE	MADAN KUNDARI, CHAURIKHOLA-6
3	SHILU BDR. TAMANG		MANDANKUNDARI-5, CHAURIKHOLA
4	SANO MAJHI	FISHERMAN	BIRTA DEURALI-6 SARAMTHALI
5	MAN BAHADUR MAJHI	FISHERMAN	BIRTA DEURALI-6, POTAGAIRA
6	DHURBA BAHADUR MAJHI	FISHERMAN	PHALANTE-9, MAJHIBASTI OR RASPATH
7	MIN BAHADUR MAJHI	FISHERMAN	SANGACHOWK-9, MAJHIGAUN
8	NARAYAN MAJHI	FISHERMAN	BIRTADEURALI-6, SARAMTHALI
9	SHYAM MAJHI	FISHERMAN	PHALANTE-9, MAJHIBASTI OR RASPATH
10	NETRA BAHADUR MAJHI	FISHERMAN	SANGACHOWK-9, MAJHIGAUN
11	SUKH BAHADUR MAJHI	FISHERMAN	SIRWARI-9, JHYADIGAUN

To get the information from the project site's local communities the strategic approach taken was to aware people on the Nationwide Master Plan Study of the Storage Type Hydro-electric Projects before seeking information on the local environmental and social resources and the concerns of the people regarding the Sunkoshi project.

It is therefore the field survey team, before initiating dialogue with the local communities described why the Nationwide Master Plan Study for Storage type hydroelectric project is needed? Who is undertaking the study? What will be the output of the study? In this process the team also highlighted on how this project in this area was selected for further study? And what the study team will like to get information from the local area communities not limiting to the social and environmental information but also the concerns of the people with regard to the project and their aspirations with the project if it is screened for further study and development.

This section describes the local people knowledge on the project apart from the concerns and aspirations of the people from the project.

The local people have a little knowledge on the project. The local people thanked the study team for giving some level of information on the project progress.

The local people are concerned on their future prospects if the project is developed. Many of the people located in the reservoir have all their property (land and building) within the reservoir area only. The land and the property is the only source of their livelihood. Though the people were not against the project development would want a proper resettlement and rehabilitation to sustain their livelihood. The other concern of the local people is the road network developed within the reservoir area. The road infrastructure provide means of connectivity with the district and the capital. As the entire network falls within the reservoir area, they were eager to know whether the project reestablish these road network as a part of the project.

They believe that the project will open the door of social and economic development not only for the local area but also to the entire region. Their aspiration with the project is the employment of the local people in the project and a host of the community development issues such as water supply, electrification, road network development, enhancement of educational institutions and health institutions.