

A. ENVIRONMENT IMPACT ASSESSMENT

1.1 BACKGROUND

As per the assessment of CEA the country is endowed with hydro potential of 84000 MW at 60% load factor or an installed capacity of around 1,50,000 MW. It is significant to note that the country has harnessed barely 22 percent of its hydro potential whereas only about 10 percent is under various stages of development.

1.1.1 Hydropower Development of Uttarakhand

Uttarakhand state constitutes the central Himalayan mountains and lies between latitudes $28^{\circ}43'45'' - 31^{\circ}8'10''$ N. and longitudes $77^{\circ}35'5'' - 81^{\circ}2'25''$ E. It extends from river Tons (Bandar Punchh), feeder to river Yamuna in the West, to river Kali (Panchaculi-Lipulekh) in the east. The annual average precipitation in the state is around 155 centimeter. In addition to this, higher reaches receive considerable amount of precipitation in the form of snowfall. The physiography of the region provides little chances for water to seep/percolate through the ground and therefore, an overwhelming quantity of water flows down the hills in the form of surface runoff.

The total hydro power potential in Uttarakhand as per preliminary estimates has been assessed for about 16500 MW, out of which about 2809 MW (17.02%) has already been harnessed and about 3000 MW (18.18%) is likely to be made operational by 2015-16. In a nutshell combining the Tehri Potential it may be said that about 35.2% of total potential is going to be exploited shortly. It is evident from the above that about 65.00% of the total power potential of Uttarakhand is yet to be exploited.

2. “NAITWAR MORI HE PROJECT”: AN OVERVIEW

The power demand has outstripped availability to an alarming extent in the country as a whole, and in the Northern Region in particular. Northern Region, already under severe power deficit, is expected to be in the grip of acute power shortage even after accounting for benefits from the ongoing projects. Existing projects and projects presently under execution account for only about 28552.56 MW, out of which only 8696.57 MW is hydropower whereas 18660 MW & 1180 MW are thermal and nuclear power respectively. It is anticipated that the Northern grid would be short of peak capacity of about 8161 MW by 2011-12.

The need for “Naitwar Mori H.E. Project” has, therefore, been considered in context of power shortage in Northern Region. The “Naitwar Mori HE Project” is proposed to be completed by 2016.

The “Naitwar Mori H.E.Project” (2 x 30 MW) is proposed to be constructed on river Tons which is about 580m downstream of the confluence of river Tons and Rupin at Mori in District Uttarkashi of Uttarakhand.

It is conceptualized as a run of the river scheme to harness hydro potential of river Tons. The salient features of the project are presented in table 1 and the layout plan of the project is presented in figure 1.

Table :1 Salient Features:

I	LOCATION	
1	State	Uttarakhand (formerly Uttaranchal)
2	District	Uttarkashi
3	Tehsil	Mori
4	Latitude	31 ⁰ 03'35"N
5	Longitude	78 ⁰ 05'43"E
6	Nearest Rail head	Dehradun
7	Nearest Airport/approach	Dehradun
8	Name of River/Tributary	Tons (tributary of Yamuna)
9	Name of River Basin	Yamuna River Basin
II	HYDROLOGY AND CLIMATE	
1	Catchment Area up to head works (sq. km)	1514 km ²
2	Snow Catchment area (km ²)	90.84 km ² (6 % of total)
3	Average annual Yield (Mm ³)	2055
4	Maximum/Minimum Yield	3771/1209
5	Design Flood (m ³ /s)	1600 (1 in 100 yr)
6	90% available discharge (M)	1273
7	Maximum temperature	41 ⁰ C
8	Minimum temperature	3.8 ⁰ C
III	DIVERSION STRUCTURE	
1	Type	Barrage
2	Maximum height above deepest foundation	30.5m
3	River Bed Level	EL 1249.00m
4	Elevation of top of Dam	EL 1269.5m
5	Length of Barrage of top (m)	48.9 m
6	Freeboard (m)	1.5
7	No. & size of gates	Radial gates <ul style="list-style-type: none"> ▪ 2 Nos. –9.1 m (W) x 8.0m (H) ▪ 1 No. – 9.1 m (W) x 14.5 m (H) with flap gate of 6m (W) x 4.15m (H)
IV	RESERVOIR	
1	FRL (m)	1267.0 m
2	MWL (m)	1268.0 m
3	MDDL (m)	1261.0 m
V	SUBMERGENCE (Ha)	At FRL
	Total (Ha)	4.90



VI	DIVERSION CHANNEL	
1	Size (dia. in m), type and number	20m (W) x 5.5 (D) Channel, 1 No.
2	Length (m)	210m
3	Discharge (m ³ /s) in channel	250 (m ³ /s) (for 1 in 25yr.)
4	U/s coffer dam (Height and length)	4m (H) x 15m (W) x 50m(L)
5	D/s coffer dam (Height and length)	4m (H) x 15m (W) x 57m(L)
VII	DESILTING TANK	
1	Type	Open, twin chamber.
2	Number and size- L (m) x B (m) x H (m)	Tow, 130 (L) x 25 (W) x 13.5 (H)
3	Particle size to be removed (mm)	0.2
VIII	HEAD RACE TUNNEL	
1	Length (m) and shape	4330, modified horse shoe
2	Diameter (m)	5.6 m (finished)
3	Design discharge (m ³ /s), velocity (m/sec)	73.5, 2.88
4	Number of adits	Two
IX	SURGE SHAFT	
1	Type	Simple
2	Diameter (m)	18 m
3	Height (m)	51.65 m
4	Top Elevation	EL 1291.00 m
5	Bottom Elevation	EL 1239.34 m
X	PRESSURE SHAFT/PENSTOCK	
1	Type	Pressure Shaft
2	Number of Pressure shafts/unit Penstocks	One/Two
3	Maximum discharge through pressure shaft/penstock (m ³ /s)	73.5
4	Diameter of pressure shaft (m)	4.0 m
5	Maximum velocity (m/sec)	5.85 m/sec
6	Length of pressure shaft (m)	109.0 m
7	Penstock Gate at Surge Shaft	1 no.
8	Main Inlet valve, if any (type & diameter)	2 Nos., 2.5m (Butterfly)
XI	UNDERGROUND POWER HOUSE	
1	Type	Underground
2	Location	Near Keval Village
3	Installed Capacity	2 x 30 MW = 60 MW
4	Number of Units	2
5	Rated Turbine Output (Maximum)	30.61 MW
6	Gross Head	96.76 m
7	Net Design Head	90.76 m
8	Type of turbine	Vertical Francis
9	Maximum flow through each unit (m ³ /s)	36.75 m ³ /sec
10	Speed specific & synchronous	222.9 rpm, 300 rpm



11	For Generator/Generator motor		
	-Type	Synchronous	
	-Design capacity	30 MW	
	- Power factor, generator voltage (kV)	0.9, 11	
	- Excitation system (type)	Static	
12	Size of machine Hall (including loading bay)	57.70 m(L) x 18.60 m(W) x 33.07 m (H)	
13	Size of transformer Cavern	39.60 m(L) x 11.90 m(W) x 13.65 m(H)	
14	Transformers	11/220 kV	
15	Power House Cranes		
	-Nos.	1	
	Capacity	125/30 T	
XII	TAILRACE TUNNEL /CHANNEL		
1	Tailrace Tunnel	D-shaped, 8.0 m (W) x 8m (H)	
2	Length of Tailrace Tunnel	235.62 m	
3	Tailrace Channel	6.0m (W) x 5.75m (H)	
4	Length of Tailrace Channel	60.39m	
5	EL of the downstream crest	1166.83m	
XIII	SWITCHYARD		
1	Type of Switchyard (GIS/Outdoor)	Outdoor	
2	Voltage	220 kV	
XIV	POWER BENEFITS		
1	Design Energy (GWh/annum)	265.5 MU	
XV	CONSTRUCTION PERIOD	4 years	
XVI	COST ESTIMATES (Rs. in lacs)	Present Day	Completed
1	Civil	28009.77	
2	Electrical/ Mechanical	10426.64	
3	Sub-Total (Generation)	38436.41	
4	IDC & FC	4419.26	
5	Total Cost with IDC & Front End fee and without escalation.	42855.68	
6	Total Cost with IDC & Front End fee and with escalation.		44978.38
XVII	LEVELISED TARRIF		
1	Levelised Tariff (Rs. /Kwh) (with free power to home state and without escalation)	3.04	
2	First Year Tariff (Rs./Kwh) (with free power to home state and without escalation)	3.30	
3	Cost per MW (with IDC & FC)- in Lacs	714.26	
4	Cost per MW (without IDC) – in Lacs	640.61	

3. ENVIRONMENT IMPACT ASSESSMENT



In accordance to the Environment Protection Act 1986 of Ministry of Environment & Forests, GOI, the Environment Impact Assessment study of “Naitwar Mori H.E Project” was undertaken for obtaining the Environment Clearance of the project .The study was entrusted to HNB Garhwal University, Srinagar Garhwal .Accordingly the University has conducted the Environment Impact study and the Environment Management Plan has been formulated on the basis of the findings of EIA study. The study area for this EIA/EMP study includes

- Submergence area
- Area within 10 km of the periphery of the submergence area
- Area to be acquired for setting of various project appurtenances
- Area within 10 km of various project appurtenances
- Catchment area intercepted at the barrage site

3.1 OBJECTIVES OF THE STUDY

The main objective of the study is to prepare the environmental impact assessment report for obtaining environmental clearance from the regulatory agencies. The study has been conducted to carryout Comprehensive Environmental Impact Assessment (CEIA) based on three season data covering the following:

- Assessment of the existing status of land, water, biological, climatic, socio-economic, health and cultural components of the environment.
- Identification of potential impact on various environmental components due to activities envisaged during pre-construction, construction and operational phases of the proposed Hydroelectric Project.
- Prediction of significant impacts on the major environmental components using appropriate methodology.
- Preparation of environmental impact statement based on the identification, prediction and evaluation of impacts.
- Delineation of Environmental Management Plan (EMP) out lining preventive and mitigative strategies for ameliorating adverse impacts during pre-construction, construction and operational phases of the proposed project along with the cost and time schedule for implementation of EMP.

3.2. METHODOLOGY

The methodology and techniques used for studying the various parameters of the environment viz: land, air, sound, water, flora, fauna, socioeconomics in the study area are described as below. The various surveys and sampling were carried out in three seasons during 2007-2008 and these were again validated for two seasons during 2010-2011

3.2.1 Land Environment Study

The diversion site is located at Latitude 31⁰ 03'35'' N and longitude 78⁰ 05'43' E. The catchment area up to the proposed barrage site is 1514 sq km out of which 91 sq km snow Catchment area. The cloud free Digital Satellite data IRS P6 LISS-III and 1:50,000 scale toposheets of the directly draining catchment area were used for the purpose of georeferencing and thematic mapping. The data was generated on

physiography, landuse/landcover, lithology, structure, drainage pattern, slope characteristics, landslides/slips, etc. These data sets were used for preparation of the thematic maps, calculation of sediment yield index and Erosion Intensity Units in the catchment area. Detailed field survey was conducted for the study of soil characteristics, and erosion intensity and landslides zone in the catchment area.

3.2.2 Air Quality Assessment

The ambient air monitoring was carried out at 6 sites within a radius of 10 km around the proposed dam and powerhouse sites. Air sampling was done with the help of High Volume Air Samplers (HVAS) for a period of 24 hrs at each station.

Following parameters were measured to assess the baseline data.

- 1- Suspended Particulate Matter (SPM)
- 2- Respirable Suspended Particulate Matter (RSPM)
- 3- Sulphur dioxide (SO₂)
- 4- Nitrogen oxide (NO_x)
- 5- Carbon Monoxide (CO)

3.2.3 Sound Level Measurement

This study has been conducted to know the actual noise intensity level of the project area and it will be useful to assess the impact during the construction phase of the project. The sound level was measured by sound level meter type 2230 (Digital Instrument).

3.2.4 Water Environment Assessment

The baseline data for water environment assessment were collected considering the following parameters:

1. Water quality analysis and collection of aquatic organisms at specified locations.
2. Fish population density and distribution over a span of 10 km long run from river Tons near the confluence of Rupin and Tons river to Mori Village.
3. Feeding habits, migratory pattern and coldwater adaptations of resident fish species.
4. Feeding and breeding grounds of some economically important fish species in river Tons.
5. Distribution and population density of macro-zoobenthos in river Tons and its tributaries.
6. Estimation of Coliform (MPN) and *E. coli* organisms in river water.

The physicochemical characteristics measured for water quality were:

Ambient temperature, Transparency, Water velocity, Turbidity, Total dissolved solids (TDS), pH, Alkalinity, Acidity, Chlorides, Silicates, DO, free CO₂, Zn, Mn, Fe, Pb, As and Nutrients, (Phosphorus, Sulphates), Total Ca and Mg Hardness-EDTA, Inorganic Phosphates and Nitrates, BOD, *E.coli* and Total Coliform.

3.2.5 Evaluation of Aquatic Environment

Evaluation of the parameters related to aquatic environment has been done based on the following:

- Physico-chemical and Biological characteristics of river water.
- Inventorization of phytobenthos, Zoobenthos.
- Present status of riverine fish fauna: Identification of obligate fish spp, their migratory pattern, diseases, feeding and breeding grounds.

3.2.6 Floral Study

It is based on extensive field survey in the vicinity and catchments of Mori and Naitwar between 1200 to 2000 m. msl. The seasonal study has been conducted during Feb. 2007 to January 2008 covering premonsoon, monsoon and post monsoon seasons within a year and once again during monsoon and post monsoon season during 2010. The phytosociological analysis was conducted once during entire study period. A total of 8 transects were laid in the entire study area. The vegetational data collected for phytosociological information were quantitatively determined according to formula given by Curtis and McIntosh (1950) and species diversity was determined by using Shannon Wiener information function (Shannon and Wiener, 1963).

3.2.8 Faunal Study

Various transects were identified along the villages to carryout faunal studies as the village trails were the best options to cover the complete area. Observer walked at a constant pace observing birds and butterflies using a Nikon 10 x 42 binocular. The walks were carried out between 06 to 09 hrs. The Birds, either flying or perched were recorded, similarly the butterflies observed during the survey were also recorded. The scanning for mammals were carried out during the morning and evening periods(two hours each) from suitable vantage points to ascertain the presence of mammals. The information from local people (mainly peasants and womenfolk) was also gathered regarding the presence-absence of major mammalian species, hunting and poaching pressures and attitude of local people towards wildlife.

3.2.9 Proximity Study

Study clearly showed that the area around the project is used by many species of wildlife present in the protected area. Importantly the block D, i.e, the section in the right bank of river Rupin and Tons are most important from wildlife habitat point of view. As we analysed the survey findings along the transects, there was a clear evidence of the presence of several faunal species in and around project components. But, all these areas except the Block-D are highly utilized by the Human for different livelihood purposes. Moreover the realignment of the protected area boundary is likely to exclude these areas from its protected area status. Human wildlife conflict is very common in these areas as also observed during the survey. Already the apathy of people towards the conservation of wildlife is playing negative role in the conservation of these species. However, the implementation of this project will disturb the habitat of wildlife specially, mammals. Other species are well adapted towards human disturbances, infact found in more abundance around human dominated landscapes. If

precautions are taken while constructing the project, then the negative influence can be well minimized.

3.2.10 Minimum Water Flow for aquatic Ecology

Keeping the above objectives in view the investigation was carried out according to the proposed action plan and information on the following aspects such as river orphology, preliminary data on main channel and streams, current velocity, water depth, river width, deep pools, sediment quality, fish faunal diversity, breeding and spawning ground, migratory fish species, biotic community status including plankton, periphyton, benthos were collected on Monsoon and Post Monsoon period (August 2010 January 2011).

A total of 7 Km stretch of Tons river flowing downstream from the barrage site to the TRT was surveyed and four sites i.e. Barrage, Miya Gad, Chibada Gad and Bainol were selected for the sample collection. The survey was conducted in the form of direct sites visit, observation from the top view and secondary information collection from the project officials and other sources for the first hand understanding on hydrobiology, riverine ecology, fish and fisheries, fish food organisms, and migration pattern of important fish that are likely to be affected by the proposed HE project.

It is suggested that during lean season there should be minimum of 2.7 cumec be maintained from the barrage site and no disturbance must be ensured to the flow coming from the two adjoining streams namely Chibara gad and Miya Gad. It is important that the lean seasons flood should be maintained, thus during lean season flood excess water must be released in the downstream for maintenance of pools and spawning cues.

3.2.11 Socioeconomic Study

Based on the formats devised for conducting socioeconomic survey information on socioeconomics of the affected families was collected by undertaking door to door survey. In this regard questionnaire was devised and socioeconomic survey was carried out.

Under the rapid village survey studies information on overall demography, infrastructure, availability of natural resources, livestock status etc. were evaluated by analyzing the records of village panchayats and from the local villagers. This study has provided a definite insight in analyzing the overall socioeconomic status of the villages. Besides this detailed door to door survey to collect information on: demographic structure of the households (information on family size, age and sex of the family members), number of people in working age group (18 to 60 years), division of labour, level of literacy, occupation, size of land holding, livestock holding and crops grown were also documented.

4. EXISTING STATUS OF ENVIRONMENT

The EIA study includes the study of various base line parameters of environment viz; Land, Water, Air, Noise, Flora, Fauna and Socioeconomics. Integration of these parameters gives an overall perception of positive and negative impacts due to construction of a hydroelectric project if any. The existing status of the different

components of the environment was studied in detail .The findings of the study are as follows:

4.1 PHYSICAL ENVIRONMENT

The catchment is having variable physiography, climate, geology, slope, soil types and land use/land cover. While evaluating the land environment various parameters were analyzed in detail and the environmental impact were predicted accordingly. The catchment of Tons river displays variable geomorphological and geological features. In order to study the land environment of the study area the baseline data pertaining to climate, basin characteristics, physiography, slope, geology, seismicity, soil, sedimentation and landuse/ Landcover etc. were studied.

4.1.1 Regional Geology

The project is located in the mountainous higher Himalayan region in the south of Great Himalayan range and encompasses the southern part of the NW-SE trending Dhaula Dhar ranges. The rock type exposed in the area belongs to Naitwar group which are subdivided into three units with Kalaba, Himri and Khanna formations. This group is restricted between two important structural elements Known as Mautar Thrust and Chail Thrust. The Kalaba formation comprises mainly of the gneisses and schist. The gneisses may be divided into porphyroblastic gneisses, pebbly/conglomeritic gneisses and compact gneisses and the schist is basically chlorite mica schist and biotite schist. Sericitised quartzites and schist along with phyllitic intercalations are the rock types present in the Himri formation. The Himri formation is overlain by Khanna formation. In Rupin and Supin valley this formation is overlain by the rocks of Central Crystallines (Table 2). According to Siesmo-tectonic Atlas of G.S.I. (2000), the project lies in Zone V. The soil in the project area is usually loamy or clayey loam types.

Table 2:- Litho-tectonic succession of Upper Tons basin (As per GSI Report).

		Central Crystallines
		-----Main Central Thrust (MCT)-----
		Jutogh Group
		-----Jutogh Thrust-----
		Chail Group
		-----Chail Thrust-----
	Khanna Formation	Dark grey quartz biotite schist and light grey psammatic gneiss
		White sericitised quartzite with intercalation's of dark carbonaceous phyllite.
Naitwar Group	Himri Formation	Dark grey porphyroblastic gneiss and schist along with intrusion of granite and basics.
		White sericitised quartzite with intercalation's of grey phyllite and sericite schist.



Kalaba Formation Dark grey biotite schist and compact gneisses.
 Dark grey pebbly /conglomeratic gneiss with pebbles of granite and intrusive of granite and basic bodies.
 Grey with greenish tinge quartz mica schist, chlorite mica schist with bands of porphyroblastic gneiss and basic intrusives.0

-----Mautar Thrust-----

Sankri Formation (Garhwal Group)

4.1.2 Landuse / Landcover

The area exhibits rugged topography with lofty mountains, steep slopes and a number of deep gorges. The Rupin and Tons river drain the area and are flowing NW to SE and NE to SW directions respectively. Major landforms present in the area are moderate to steep perceptions slopes, narrow & broad valleys, highly dissected ridges with deep gorges, screw slope, terraces etc. In the study area the dominating land-use class is dense & open forest categories. The free draining area of the catchment is 30405.80 ha. Which comprises of Dense Forest (7602.81ha), Open Forest (8333.64 ha), Degraded Forest (6781.56 ha), Scrub/Alpine vegetation (3940.39 ha), Agriculture & Settlement (2987.88 ha), Water body/Glacial Melts (559.87 ha.) and Cloud/Snow (199.65 ha). The free draining catchment has 3 nos. of sub-watersheds namely Rupin, Supin and Tons left (Table 3).

Table-3: Landuse Details of SWS in the Free Draining Catchment

Land Use / Land Cover	Area under Sub-Watershed (ha)			Total Free Draining Catchment (ha)
	Rupin	Supin	Tons Left	
Dense Forest	4190.40	3140.24	272.17	7602.81
Open Forest	4711.49	3450.21	171.94	8333.64
Degraded Forest	3399.67	3191.77	190.12	6781.56
Scrub/ Alpine Vegetation	2473.07	1420.23	47.09	3940.39
Agriculture & Settlements	1653.16	1203.06	131.66	2987.88
Water Body/ Glacial Melts	362.99	166.77	30.11	559.87
Clouds/Snow	153.44	44.98	1.23	199.65
Total	16944.22	12617.26	844.32	30405.80

4.1.3 Project Component Wise Total Land Requirement

The total land requirements for the various component have been estimated about 47.0575 ha comprising of 7.292 ha Government land, 32.589 ha forest land and 7.1770 ha private land. The project will submerge about 4.90 ha of land.

4.2. AIR AND NOISE ENVIRONMENT



In order to generate the data base for air and noise quality an extensive study of air and noise parameters around the project area was conducted during 2007-2008 and again during 2010. The basic parameters evaluated are as follows.

4.2.1 Ambient Air Quality

The air quality in the project area and its surroundings is free of pollution. The concentration of SPM, RSPM, SO₂, NO_x and CO in the air is well below the permissible limit as there are no industries in the area and the vehicular traffic is bare minimum. Moreover, forest cover and ground vegetation around the site serve as a carbon sink. The other gases in the atmosphere are also within safe limits. There is no dust producing sources except vehicular traffic which is also very small.

4.2.2 Ambient Noise Quality

Having no industries around the project area and not much traffic horns in the proposed site noise level was well within acceptable limits of residential area. However, continuous noise was observed from the flow of current of Tons river.

4.3. WATER ENVIRONMENT

Ten sampling sites on 10 km long run of river (from near confluence of Rupin and Tons river to near Mori Village) were selected for water sampling. The seasonal study has been conducted during Feb. 2007 to January 2008 covering pre-monsoon, monsoon and post monsoon seasons within a year and again during monsoon and post monsoon season during 2010-2011. The samples were collected from the sampling station and were either analyzed at the sampling spots or in the laboratory. The atmospheric temperature ranges from 12.5±2.0°C (winter) to 22.2±1.8°C (summer) while water temperature was recorded as 9.5±1.0°C in winter and 18.2±1.6°C in summer. This clearly indicates that since river Tons is a glacial-fed fast flowing stream, the extreme fluctuations in atmospheric temperature (extreme summer and cold) do not influence the river water temperature to a greater extent. The coliform organisms and *E.coli* are considered as indicators of pathogenicity in aquatic environment. Hence the total coliform, *E. coli* and other bacteria were estimated in river water. It is revealed from the data that the *E. coli* and total coliform increases in the river water during summer and monsoon seasons.

4.4. STATUS OF BIOLOGICAL ENVIRONMENT

The biological environment of the project area reveals that there are 145 species of trees, shrubs, herbs and climbers in the submergence zone, whereas the influence zone is characterized by 264 species of trees, shrubs, herbs and climbers. The survey of the terrestrial fauna revealed that 82 species of birds, 28 species of butterflies, 3 species of reptiles and amphibians and 6 species of mammals are present in the area. Besides this the river Tons in project area and river Rupin in influence zone is inhabited by endemic

fish species such as *Schizothorax* and *Tor* species. The results of the floral and faunal survey are as follows:

4.4.1 Flora

The survey of submergence zone revealed the presence of following species of flora. *Elaeagnus parviflora*, *Reinwardtia indica*, *Buddleja asiatica*, *Indigofera heterantha*, *Rhammus virgatus*, *Oxalis acetocella*, *Arundinella* spp., *Trigonella corniculata*, *Ranunculus laetus*, *Viola pilosa*, *Thalictrum cultratum*, etc.

In addition to flora found in submergence zone, in the influence zone the common floral species are *Pinus roxburghii*, *Alnus nepalensis*, *Prunus cerasoides*, *Pyrus pashia*, *Ficus palmata*, *Symplocos paniculata*, *Swida oblonga*, *Berberis aristata*, *Barleria cristata*, *Lyonia ovalifolia*, *Toona hexandra*, *Debregeasia salicifolia*, *Rubus ellipticus*, *Berberis lycium*, *Pyracantha crenulata*, *Inula cuspidata*, *Indigofera astragalina*, *Cynodon dactylon*, *Tagetes minuta*, *Rumex nepalensis*, *Bergenia ciliata*, *Stellaria media*, etc.

4.4.2 Terrestrial Fauna

4.4.2 .1 Birds : The most frequently sighted species of birds were Olive-backed pipit (*Anthus hodgsoni*), Common rosefinch (*Carpodacus erythrinus*), Bar-tailed tree-creeper (*Certhia himalayana*), White-capped water redstart (*Chaimarrornis leucocephalus*), Brown dipper (*Cinclus pallasi*), Oriental magpie-robin (*Copsychus saularis*), Large-billed crow (*Corvus macrorhynchos*), Grey treepie (*Dendrocitta formosae*), Brown-capped pygmy woodpecker (*Dendrocopos nanus*), Grey francolin (*Francolinus pondicerianus*), Red-rumped swallow (*Hirundo daurica*), Kalij pheasant (*Lophura leucomelanos*), Blue whistling-thrush (*Myophonus caeruleus*), Egyptian vulture (*Neophron percnopterus*), House sparrow (*Passer domesticus*) and Ashy-throated warbler (*Phylloscopus maculipennis*).

4.4.2 .2 Butterflies: The main species of Butterflies encountered and identified in the study area during pre monsoon were 18, monsoon 23 and post monsoon 12 (Total 28).

4.4.2 .3 Mammals: The mammals in the area studied have largely the population of domestic ungulates like horses, goats, sheeps, and cattles throughout the human settlements in the impact zone. While indirect evidences in the form of scats in dense forests were available for porcupine, jackal and Himalayan black bear. Secondary data and one incidence of ground scratching have suggested the possible occurrence of leopards in the area near the end of the impact zone, proximated to the Supin Range of GWLS. Other like brown bear (*Ursus arctos*) is reported only from the protected area of Govind National Park at an altitude of 2800-4500 respectively. However, there was a direct sighting of Himalayan black bear.

4.4.2 .4 Reptiles : As far as reptiles are concerned no substantial evidence could be found out except for one odd sighting of one lizard *Agama himalayana* and an ecdysed skin of one snake and thus it was not easily to predict their abundances during this survey.

4.4.3 Aquatic Fauna

In the post Chibru project scenario, the migration of *Schizothorax* sp and *Tor* sp and some other fish sp has already been curtailed/culminated over the different stretches of river Tons.

Migration in Tons is also blocked by the barrage constructed in river Yamuna at Daak pathar. The upstream migration of fish in river Tons is from Yamuna. Therefore, the decline in population beyond this barrage is obvious as the habitat of the fish is freshwater stream. It is also appropriate to mention here that beyond the barrage along river Yamuna and Tons these two species may survive in the river course and adjoining streams if proper conservation strategies are adopted.

It has been observed from the study that *Schizothorax* sp, *Tor* spp, *Labeo* sp, *Garra* sp and *Chrossocheilus* sp are permanent inhabitants of the coldwater environs of river Tons like Alaknanda and Bhagirathi and inhabit the bottom and mid waters of streams. They feed mainly upon the green matters (aquatic plants and algae etc), animal flesh, insects and other detritus matter.

The species such as *Barilius*, *Puntius*, *Glyptothorax* and *Nemacheilus* are resident fishes of small streams joining river Tons and their abundance remains noticeable during postmonsoon and winter seasons only.

The catfishes (*Glyptothorax*) and loaches (*Nemacheilus* sp) are distributed in the sub drainage streams (e.g. Kedar Ganga & others) of river Tons. The catfishes being carnivorous, feed on animal flesh whereas *Nemacheilus* sp are insectivores and larvivores. These two fish species are generally considered as scavengers and water sweepers.

The study suggests that the growth rate in *Schizothorax*, *Tor*, *Labeo*, and *Garra* is slower in winters as compared to spring and monsoon seasons due to fall in temperature. Adults and juveniles of species such as *Tor* sp, *Labeo* sp, *Garra* sp and *Schizothorax* sp move upstream and downstream respectively in rivers.

It is evident from the study that the highest population density of Ephemeroptera being followed by Trichoptera, Diptera and Coleoptera in river Tons during monsoon, winter and summer seasons of the year. However, the populations of aquatic insects decreases in rainy season and in extreme summer. Substratum of the river consists mainly of bed rock, boulders, cobbles and gravels where the macro-benthic organisms survive and grow.

4.5. SOCIAL AND CULTURAL BACKGROUND OF THE AREA

Naitwar-Mori HE Project lies in Mori tehsil of Uttarkashi district; the area is located in the upper Himalayan ranges. The social milieu of this region comprises of mixed caste Hindus, consisting of three social groups i.e., the Brahmins, Rajputs and the Scheduled Caste. The project area of “Naitwar-Mori” consists a total of seventeen villages in the influence zone as well as project affected area. Sixteen of these villages are revenue village while one village viz., Sandra is a forest village. According to the 2001 census,

the total population of these villages was 6101. Total number of PAFs would be 97 belonging to 3 villages.

The 1099 households had family size of 5.7, of whom 51.6 % were male and 48.4 % were female. The work participation rate is 54.7 % Villagers have more than one temporary hamlet called channi near their agriculture fields or orchards, villagers migrate to these channis for few months each year. The average household size of the sampled 187 families (including 56 PAFs) from the seventeen villages was 5.3 and total population was 990, of whom 47 % were male and 53 % were female. These families belonged to four communities, 78.6% households belonged to Rajputs, 4.8% were Brahmins, 16% belonged to SC category and 0.5% belonged to Vaishya category.

4.6. IDENTIFICATION, PREDICTION AND EVALUATION OF IMPACTS

Environmental impact assessment of any developmental project highlights the existing environmental status vis-à-vis the changes supposed to be generated due to the commencement and execution of the project.

4.6.1 Physical Environment

4.6.1.1 Impact on Microclimate of the Area

Due to construction of the project minor climatic change on localized scale are expected during the construction phase, however no significant change in climate is expected. In the operation phase of the project only localized fall in temperature and increase in humidity & evapo-transpiration will take place.

4.6.1.2 Change in Landuse/Landcover

Construction phase

- Due to construction of the project about 47.0575 ha land will be acquired from govt., private owners and forest department. About 5.90 ha land will be submerged in the barrage of the project thus changing the landuse and landcover of the area. The change in landuse will be from riverine environment to lacustrine environment.
- Excavation of underground components of the project will generate 7,11,269.30 cum of muck. Out of the above about 40% muck is expected to be utilized as construction material and filling of hauling roads. The disposal of remaining 60% of muck will be dumped in designated areas which may bring some change in landscape

Operation phase

During the operation phase no significant change on landuse is expected, however, the land cover will improve as the implementation of landscaping and restoration measures will take place and many of the redundant areas will be brought under plantation. Likewise the barrage area will also provide an aesthetic look to the landscape.

4.6.1.3 Soil Erosion and Siltation



Soil erosion due to excavation of different components of project, construction of roads and dumping of muck into disposal sites will accelerate soil erosion for some period.

4.6.1.4 Environmental Degradation Due To Labour Immigration:

During the construction phase congregation of about 400 workers is likely to take place in the project area, for which semi permanent/temporary accommodation would be required. Due to this pressure on land resources would definitely occur. The sanitation and sewage disposals, disposal of solid waste would be required. In the operation phase the project labour force engaged in construction will move out of the project, therefore no additional impact is expected.

4.6.2 Impacts on Air and Noise Environment

Temporary change in air quality during construction phase is expected due to emission of hydrocarbons from vehicles and gases from blasting operations. The present levels of NO_x, SO_x, SPM, RSPM and TSPM indicate that the air does not contain abnormal concentration of the above.

- The ambient air quality during the operation phase is not expected to deteriorate.
- Noise levels are not expected to rise in the operational phase as the power house is underground.

4.6.3. Impacts on Water Environment

The water environment of river Tons due to proposed project is not expected to alter in a significant way as the project would store a very little water in its barrage. Moreover the water of Tons catchment is free of pollutants since no industry is located in surroundings. During the construction phase of the project the river water is supposed to catch considerable amount of sediment laden water. The silt laden water emanating from all other open air works and underground power house works, however, will require sediment extraction before releasing the water into the river section. The muck disposal yards, quarry areas would be the areas of concerns for leaching of sediments during rains. The project reservoir will accumulate a very negligible amount of silt in its bottom for which silt flushing will be undertaken at periodic intervals. In view of the above the water quality deterioration is not anticipated considerably. The periodic monitoring of water quality will be required to evaluate the quality status. The river course beyond the Dam site will have access to migrating fish species for which fish ladder has been proposed at barrage site.

B. ENVIRONMENT MANAGEMENT PLAN

5. IMPACT MANAGEMENT

Based on the evaluation of baseline data and predicted impacts, suitable management plans have been formulated for implementation, in order to ameliorate the negative impacts in the sphere of land, water, air, noise, biological and socioeconomic environments. The implementation of all the management plans should commence



concurrent to project execution so that all the environmental ambiguities going to arise may be resolved before the project is commissioned.

It would be appropriate to have strict monitoring of implementation of the mitigatory measures at the level of MOEF for which a Monitoring Committee may be constituted to evaluate the progress during implementation of mitigative measure and to suggest any improvement thereof. Strict monitoring will also be required to watch out the implementation of air, water and noise measures to be adopted by the contractors at various project sites by the Project Authorities / Project level monitoring committee.

In order to ameliorate the negative affects of the project construction and overall improvement of the environment, following management plans are formulated for implementation concurrent to the project construction.

5.1. CATCHMENT AREA TREATMENT PLAN

The study of erosion and sediment yield from catchments is of utmost importance as the deposition of sediment in reservoir reduces its capacity, thus affecting the water availability for the designated use. The removal of top fertile soil from catchment also adversely affects the agricultural production. Another important factor that adds to the sediment load, and which contributes to soil degradation is grazing pressure. The lack of proper vegetation cover is a factor for degradation and thereby results in severe run off/soil erosion, and subsequently premature siltation of the reservoir. Thus, a well-designed Catchment Area Treatment (CAT) Plan has been formulated to mitigate the adverse affects of soil erosion. The catchment area treatment involves understanding of the erosion characteristics of the terrain and suggested remedial measures to reduce the erosion rate. The catchment area treatment plan contains the methodology of treatment measures for which Rs.769.00 lakhs has been proposed.

5.2. RESETTLEMENT AND REHABILITATION PLAN

The National Resettlement and Rehabilitation Policy (NPRR 2007), issued by the Department of Land Resources, Ministry of Rural Development, Government of India, provided the framework for preparation of this R&R plan, according to Rs. 1300 lacs has been apportioned.

According to the land records and ground truth survey the 97 families from 3 villages of Mori tehsil of Uttarakashi district will be affected due to acquisition of land for Naitwar-Mori Hydroelectric Project. The acquisition of land shall be in accordance with the provisions of the Land Acquisition Act, 1894 and the compensation will be paid as per the circle rate devised by the District Magistrate and will be disbursed by land acquisition officer appointed for the purpose.

The R&R benefits to the PAFs shall be extended in addition to the direct compensation paid for the acquisition of land, house and other assets. Under direct compensation, the assets acquired from the affected families shall be duly compensated under Land Acquisition Act 1894 immediately after notification is made by Appropriate Govt. It is proposed that in addition to the compensation of land, they will also be given landless grant. Landless grant is basically provided to enable them financially to compensate for their losses.

Whereas under other R&R benefits, the benefits like land for land, rehabilitation grant, resettlement grant, livelihood support, infrastructural facilities, community development facilities, welfare measures etc shall be provided to the PAFs.

5.2.1 Compensation for the acquired house and other Immovable Assets.

As per the socioeconomic survey conducted, it was found that no houses or other immovable assets are being acquired.

5.2.2 Compensation for Crops, fruit bearing trees and other plants

Provision has been made for the compensation of the standing crops, fruit and other trees falling in the land to be acquired by the project authorities. The compensation will be paid as per the on site assessment done and as per the rate affixed by the respective state Govt. agencies.

5.2.3 Community Development Plan

SJVN shall assist the PAFs and local residents of the project area in all facets of their community life like, education, skill development for self employment, health, women empowerment development, promotion of sports, cultural protection and support, etc. SJVN shall implement various schemes for enhancing the community life of the PAFs and local residents of the project area.

5.2.3.1 Merit scholarship scheme for the wards of PAFs: SJVN shall encourage the wards of the PAFs to pursue professional and technical courses by way of providing merit scholarship. The scholarship provided to the students shall encourage them in furtherance of their studies and enable them to pursue higher education. The benefit of the scheme shall be extended to the wards of residents of the project affected area if sufficient wards from PAFs are not available. Whereas no job commitment shall be given to the trained wards, they may be given preference in employment with SJVN subject to meeting the employment criteria of the corporation.

Under this scheme the meritorious wards of the PAF shall be provided scholarship @ Rs. 800/- per month for students of vocational training like ITI; @ Rs 1000/- per month for students of diploma engineering, pharmacy, computer etc. and @ Rs 1500/- per month for students of Engineering/Medical degree. A provision for Rs 11,52,000 has been made for it in the R&R Plan.

5.2.3.2 Technical Education Scheme for Local Youths of Project area: This scheme envisages training to rural youths in the vocational streams to be arranged by SJVN in the local Industrial Training Institutes so as to enable the local youths of affected area to become self reliant to find a suitable employment in the industrial sector or to venture out their own plan with the acquired skill. This scheme may be started even after the MoU is signed between SJVN and state govt. for construction of the project. Under this scheme A training program for the youth from the affected families shall be conducted, under this

scheme 40 youth on the basis of merit will be selected and sent for training in various trades in ITIs on paid seat basis. The examination fee and course fee will be borne by SJVN. Each candidate will also be given a monthly scholarship of Rs 700. For this provision of Rs 33,600.00 has been made.

5.2.3.3 Scheme for Infrastructural Facilities and other Aids to Schools situated in Affected Area: SJVN is committed to increase the educational standard and to strengthen the educational institutes in affected area. In order to supplement these efforts, a scheme for providing infrastructural facilities and other aids to schools from primary level to Sr. Secondary level situated in project affected area shall be implemented. Under this scheme various facilities like furniture, teaching aids, library books, laboratory equipments, education aids, sport items, enlargement of class rooms, structures etc. shall be provided to the schools. Under this scheme, an amount of Rs 15.00 lacs has been kept under the budget head Community Development.

5.2.3.4 Free Power Supply to the Project Affected Families: Each PAF shall be provided equivalent cost of 100 units of power per month for 10 years after commissioning of the project.

5.2.3.5 Entrepreneurship Training Programme: In order to address the need of people regarding self-employment/ income generation a training programme was formulated after consultation with the affected families, various government and training organizations.

It is proposed that one member of each affected family shall be selected and trained in entrepreneurship and management of small enterprises. Entrepreneurship Development Programme will be a structured training programme conducted by various government and training organizations viz., Khadi and Village Industries Board, Govind Ballabh Pant Agricultural and Technology University, Hill Campus Ranichauri, New Tehri etc. The training will be given in the field of wool-carding, Bee keeping, Mushroom cultivation, Fruit preservation, Vegetable production and Stitching. The training methodology adopted will include audio-visual aids and classroom lectures. After they complete their training of six weeks seed money of Rs 5000 will be given to each trainee to start their work. Total expenditure on providing training along with seed money etc will be Rs 16,39,000.

5.2.3.6 Health Care

SJVN is concerned about the health care of project affected families and local residents. It shall provide free medical services to the PAFs and local residents.

a) Mobile Health Van: With a view to provide free consultancy and medicines to the PAFs and local residents at their doors, a Mobile Health Van (MHV) shall be put into operation. The MHV accompanied by doctors and paramedical staffs shall visit the villages regularly. This scheme shall continue until a better provision is provided.

b) Project Health Care Unit : A small hospital with minimum required facilities and provision for indoor patient wards shall be set up in the project in order to extend medical facilities interalia for PAFs and local communities. Under the Health Care Scheme, a provision of Rs. 40 lacs has been made.

5.2.3.7 Grant on birth of Girl Child: In addition to free medical services provided to the PAFs in the project hospital a grant of Rs. 10,000 shall be provided to a PAF on a birth of girl child to meet the necessary requirement for health care of the baby and the mother.

5.2.3.8 Women Development: SJVN shall assist the women of the affected area in group formation, community participation, development of self confidence and empowerment. It shall extend assistance for construction of building for Mahila Mandal, infrastructural facilities, training programme, awareness programme to the women group etc.

5.2.3.9 Promotion of Sports Activities: SJVN is particularly conscious about overall development of the youth and children in project vicinity. SJVN shall facilitate promotion of sports activities in project affected area by way of organizing local sports tournament, financial support to local tournaments , providing of sports kits etc.

5.2.3.10 Cultural Activities:

i) Support to Local Fairs & Festivals: SJVN support is also envisaged for the local fairs and festivals which are organized from time to time in and around the project area. Since local public has strong belief in holding these fairs and festivals, support to such activities from time to time shall imbibe a sense of belongingness to the project amongst the local persons.

ii) Protection and Promotion of Cultural heritage & Old Monumental Properties in the project area and in vicinity: Displacement of people may disturb the preexisting community structure and cultural heritage. Fairs and local festivals etc. are cultural heritage in rural area. SJVN shall facilitate protection of the existing community structure by providing funds for promoting the cultural heritage and old monumental property in project vicinity.

5.2.3.11 Farm support : Farm support services for horticultural, agricultural and veterinary activities shall be provided to the farmers in affected area through training programs which shall be organized to make them aware of the technical know how to improve the farm yield and improve breeds and health of their live stock. In these programs, the participants shall also be exposed to new practices by the experts in these fields. Some incentives in the form of agricultural tools, feed to the animals, fertilizers, seeds, etc. shall also be provided to the participants attending the horticultural ,agricultural and veterinary activities during training programs.

5.2.3.12 Awareness Programs: Considering awareness as a prerequisite for social and economic change, various awareness programs shall be organized for the residents of affected area through organizing camps and field trainings in the field of health, nutrition, child care, adult education, human rights etc.

5.2.3.13 INFRASTRUCTURE DEVELOPMENT

a) Periphery Development:

SJVN shall not restrict its endeavor for development in the defined project area only but it shall also consider infrastructure developmental works in its peripheral area. SJVN shall carry out the developmental activities in the peripheral area in close coordination

with State Govt., R&R Commissioner /R&R Administrator. Normally 1.5 % of the project cost may be considered for area development works. If by some notification the state government wishes to carryout area development work on their own the SJVN will deposit the earmarked fund to them for carrying out such work.

b) Infrastructure Development Works in Project Affected Area during Construction of the Project:

Demands for additional infrastructural development works raised for the development of this area during survey suggest development of approach roads, internal roads, village paths, construction of water channel, water supply schemes, and augmentation of school, sanitation, drainage facilities, street lighting, construction of community welfare centers, bus stand, hospitals etc.

These infrastructural works would be initiated on the basis of resolution received from Gram Sabha of the affected panchayats or on the basis of discussion held with Village Development Advisory committee (VDAC) meetings.

Infrastructure development work in project affected panchayets with recurring budget plan 1.5% of project cost shall be undertaken during the construction period of NMHEP for 3 years.

c) Infrastructural Development Works in Project Affected Area after the Construction of the Project:

The infrastructural developmental works in the project affected area shall be continued for 5 years even after commissioning of the project with a recurring annual budget plan from the 1% power generated by the project and a matching grant provided by the state govt.. The scheme shall be executed in the affected panchayats as per their allocated percentage marks. The works shall be carried out based on resolutions received from the Gram Sabha of the Panchayats.

5.3. COMPENSATORY AFFORESTATION SCHEME

The Forest Department of Uttarakhand is responsible for conservation and management of forest in the state including project area. Under this scheme forest department will carry out plantation over an area of 79.761 ha., which is double of the forest land being acquired by SJVN for construction of “Naitwar Mori HE Project” The compensatory afforestation is proposed to be carried out in neighborhood of the project affected villages so that the requirement of the villages for fodder and fuel would get satisfied in the future. The compensatory afforestation scheme would be implemented as per integrated Afforestation Programme. This includes activities like soil conservation works, fencing, protection, awareness, monitoring and evaluation along with maintenance for a period of five years. A provision of 36.93 lakhs has been earmarked towards this; in addition to 336.99 lakhs as NPV of forest land.

5.4. GREEN BELT, LANDSCAPE AND RESTORATION PLAN

Green belt development in / around hydro electric power projects has a special significance as the project construction process emanates lot of dust due to excavation works, crushing of material and batching of aggregates. Beside this the air pollution also takes place due to vehicular movement during construction and operation phases.

Forest canopy has the inherent capacity to absorb pollution, increase water retention of soil and decrease sediment transport. The green belt development along the project site, roads, colonies and around other infrastructural facilities also adds to the aesthetic environment. Selection of local plant species is always advantageous for success of green belt development. The landscape and restoration plan provides landscaping, and beautification measures.

All these activities are aimed and related to the restoring the construction areas where scars would be formed and improving the landscape around the project premises. The objectives are also to improve aesthetic look in the area: develop the area as an aesthetic place, increase vegetation and enhance the socio- economic condition of the region. The restoration would also prevent land degradation and soil erosion by creating vegetation cover over soil, and stabilizing the areas. Landscaping is proposed to be done around the barrage site, colony area, office complex, hospital and the free space available for implementing various measures in the project area after the construction phase is over. A provision of 44.00 lakhs has been made toward this.

5.5. RESERVOIR RIM TREATMENT PLAN

The stretch of the reservoir will extend up to the confluence of Rupin and Tons rivers, near Naitwar. Only 4.9 ha land including the river bed will be submerged within the reservoir and along the valley it will extend about 750 m. The FRL of the proposed reservoir is located at an elevation of 1267 m. Geomorphologically, the area is characterized by various landforms such as fluvial terraces, ‘U’ and ‘V’ shaped valleys, hill escarpments or cliff, steep slopes, moraines, paleo-channel near Keval village, debris cone, hanging valley etc. are present in the area. Detailed investigations were carried out along the periphery of proposed reservoir, in order to delineate the active as well as potential landslide zones, potential slump zones and streamlets draining in the reservoir. Biological as well as engineering treatment methods have been proposed in this plan. A provision of 22.09 lakhs has been made toward this.

5.6 FISHERIES DEVELOPMENT AND MANAGEMENT PLAN

It is clear that the movement of local stock present in the course of river Tons below Jakhol – Sankri HEP will further diminish as the migration in upper reaches is not possible. Under the present circumstances the population of *Schzothorax* species can only be protected by creating fishways in the region to propagate through fingerlings in the streams between Daak pathar (down stream) and Sankri (up-stream). Hence construction of fishways/ladder has been proposed to help continue the migration of fishes beyond Naitwar Mori HEP. A provision of 100.00 lakhs has been made toward this.

5.7 WATER, AIR AND NOISE QUALITY MANAGEMENT PLAN

5.7.1 Water Quality:- During the construction of Naitwar -Mori HE Project, generation of waste water, dust and noise may increase. The following measures are, therefore, proposed for water quality management.

- It is proposed that sufficient water/ should be supplied to the labour camps and colonies. This may be possible by tapping natural spring water.
- It is proposed that proper sewage septic tank should be provided in every colony and labour camps during construction period.
- To control diseases from pathogenic organism, it is proposed that the drinking water should be treated before use.
- Sewage waste is released in river only after proper treatment. If feasible sewage water after treatment can be supplied for plantation sites during dry seasons.

Though no major impacts are anticipated on water quality yet it is proposed that various water quality parameters should be monitored. A provision of 9.0 lakhs has been made for monitoring of water quality parameters for five years during construction and two year during operation.

This analysis should be done throughout the entire life of the project. The analysis work can be entrusted to some reputed external agency in the region. Water analysis from the start of the project execution and periodical review should be made so as to adopt appropriate corrective measure immediately, if any.

5.7.2 Air Quality:- To minimize the issues related to the generation of dust during the construction phase of the project, the following measures have been identified:

- Identification of construction limits (minimal area required for construction activities).
- When practical, excavated spoils will be removed as the contractor proceeds along the length of the activity.
- When necessary, stockpiling of excavated material will be covered or staged offsite location with muck being delivered as needed during the course of construction.
- Excessive soil on paved areas will be sprayed (wet) and/or swept and unpaved areas will be sprayed and/or mulched. The use of petroleum products or similar products for such activities will be strictly prohibited.
- Contractors will be required to cover stockpiled soils and trucks hauling soil, sand, and other loose materials (or require trucks to maintain at least two feet of freeboard).
- Contractor shall ensure that there is effective traffic management at site. The number of trucks/vehicles to move at various construction sites to be fixed. Three personnel will be earmarked for this purpose.
- Dust sweeping. The construction area and vicinity (access roads, and working areas) shall be suppressed with water sprinklers.

An amount of Rs. 18.00 lacs is earmarked for air pollution control.

5.7.3 Noise Quality:- The construction equipment will be required to use available noise suppression devices and properly maintained mufflers.

- Vehicles to be equipped with mufflers recommended by the vehicle manufacturer.
- Staging of construction equipment and unnecessary idling of equipment within noise sensitive areas to be avoided whenever possible.
- Use of temporary sound fences or barriers to be evaluated.
- Notification will be given to residents within 300 feet (about 90 m) of major noise generating activities. The notification will describe the noise abatement measures that will be implemented.
- Monitoring of noise levels will be conducted during the construction phase of the project. In case of exceeding of pre-determined acceptable noise levels by the machinery the contractor(s) will require to stop work and take remedial measures prior to continuing construction again.

An amount of Rs. 2.00 lacs is earmarked for purchase of noise pollution control equipments.

5.8 MUCK DISPOSAL PLAN

For construction of different components of “Naitwar Mori HE Project”, substantial excavation in rock for underground components and barrage abutments etc would be required. This shall lead to generation of large quantity of muck. The muck thus generated will require proper disposal in designated areas and the restoration of such area will also be required to prevent the muck from being scattered. The muck disposal areas will also require creation of proper drainage networks so that the leached sediments do not get intermingled with water streams to cause turbidity in river water. A muck disposal plan therefore, has been formulated to manage the muck and restore the muck disposal areas. A provision of 387.80 lakhs has been made toward this.

5.9 RESTORATION PLAN FOR QUARRY SITES

For construction of “Naitwar Mori HE Project” an estimated quantity of 6,62,709 MT construction material will be required. The above quantity will consist of 4,79,890 MT coarse and 1,82,819 MT fine aggregates.

The construction material is excavated from river bed. From past experience it is seen that these area get filled up with silt and sand during subsequent monsoon season. Therefore, no restoration measures are necessary for these sites.

5.10 HEALTH MANAGEMENT PLAN

The project shall develop and maintain a permanent health centre at residential colony at Mori which will have substantial staff, equipments and medicines to meet out any exigency during the project construction and during operation phase as the project site is located in a remote area. All the necessary medical attendance to the local inhabitants/patients will obviously be provided by the project proponents as a gesture of public welfare. Provision is also being made for providing medicines to project affected families and labours. Similarly, provisions have also been made for organizing awareness camps, regular health checkups, vaccination, malaria control measures, mobile health

clinic and spraying of insecticide. A provision of 40.00 lakhs has been made toward this, which is included in R &R Plan.

5.11. FUEL MANAGEMENT PLAN

The subsidized fuel provision plan is a guideline to meet the demands of fuel supply for labours and workman, who are engaged through contractors during the construction of the project. The colonies for the labourers will come up near the forest areas, hence there would be a tendency to cut the trees and shrubs, easily available and free of cost, by the labourers, which would be detrimental for the ecosystem. These guidelines will not only help in controlling illegal felling of trees that may be undertaken by the laborers/ workmen to meet their fuel requirements but will also be a eco-friendly effort to make proper fuel arrangement for the laborers/ work men. At the same time it will make the project management responsible to cater the demand of fuel for laborers/ workmen and will also protect the forest environment of the region where project is being located. The alternative energy source will be in the form of LPG and Kerosene outlets.

To achieve the objective of Fuel Management the following steps are suggested:

- A clause be made mandatory in the major contracts of every contractor that they should provide community kitchen facilities to the laborers or ensure to provide supply of fuel to their labours. The expenditure will be met by contractors.
- To establish LPG godown with in the project area.
- To establish kerosene oil depot near the project area with the help of State Govt. for the consistent supply of kerosene oil for cooking as well as lighting purposes.
- To provide electricity to laborer. The expenditure will be met by contractors.
- And the project also envisages distribution of solar cooker and pressure cooker to the local people in the project area. Under this scheme the provision has been made of Rs. 3.5 Lacs/-

5.12. SOLID WASTE MANAGEMENT PLAN

During the construction phase of the project, there will be an influx of technical staff, labourers and other service providers into the project area. The proposed project has also envisaged a colony to house project staff. In addition the quantum of population influx of temporary nature is calculated to be 400 persons and therefore, sewage and solid waste will be generated from the residential colonies and labour camps and hospitals. Sewerage management and solid waste disposal plan has been prepared to maintain the health of the people and the environment. A provision of 47.17 lakhs has been made toward this.

5.13. DAM BREAK MODELLING AND DISASTER MANAGEMENT PLAN

The disaster management of any project relates to the management of any exigency arising due to failure of such projects given to natural factors such as floods, sudden release of heavy water flows due to formation of artificial lakes in the catchment and their outburst, heavy downpour, earth quakes etc. Disaster

management plans are therefore, formulated to meet the consequences of such failures if incase it happens.

The dam break analysis basically provides an insight in eventuality of failures as the quantum of water to be accumulated is known and run out calculations for the known volume of water can be made along with travel time calculations so that the people in the downstream can be forewarned in case of such eventualities. The forewarning issued in this regard will be helpful in evacuation of the people from the surge areas to be generated by sudden release and accordingly they can be shifted to safer places to avoid any casualty.

Along the Tons river and its tributaries “Jakhol – Sankri HE Project” and in down stream “Mori -Hanol” HE project, “Hanol – Tuini HE project”, “Arakot – Tuini HE project”, “Tuini - Plasu HE project” are going to be constructed and “Chhibru HE Project” in the down stream has already commissioned. The Disaster Management Plan of all the upstream and downstream projects therefore, needs to be evaluated in collaboration with all the project proponents to understand, establish and develop a comprehensive monitoring system for the valley as such and down stream areas also to meet out the threats .

In such a scenario a well knit communication between different projects will essentially be required for which all the project proponents may sit together and device the system accordingly and ensure that in case of any natural disaster there is no communication failure among them. A provision of 52.60 lakhs has been made toward this.

5.14. BIO-DIVERSITY CONSERVATION AND FOREST PROTECTION PLAN

The social, ethical, cultural and economic values of biodiversity have been long recognized in religion, art and literature of the Himalayan region and were at an all-time high and resources were freely available to sustain the population and developments. However, the current explosive growth of human population and rage pressure on nature for sustaining the ever increasing demands is causing species loss in floral and faunal components day by day. The loss of biological diversity and degradation of habitats and ecosystems will immensely affect the present and future generations as the species lost today may have food, medicine and industrial value presently not known to mankind. A total provision of Rs.43.0Lacs has been earmarked for biodiversity conservation.

5. 15. ENVIRONMENTAL AWARENESS PLAN

Environmental awareness programme in /around hydro electric power projects has a special significance as when the project construction process starts it creates lot of disturbances like air & noise pollution, soil erosion, sanitation, Health, and forest & wildlife. The various methods viz: Erection of display boards, Handouts, Posters, Organizing environment camps/workshops and Vaccination camps/health camps need to be implemented for creating environmental awareness among various target groups. Each awareness programme heads with suitable financial provisions for the implementation. A provision of 9.00 lakhs has been made toward this.

5.16. ENVIRONMENTAL MONITORING PLAN

Monitoring is an essential component for sustainability of water resource project and is an integral part of any environmental assessment process. Water resource development project introduces complex inter-relationships in the project area between people, natural resources including biota thus manipulating the overall environment. In order to have a holistic approach the overall measures for monitoring of air, noise, water related vectors and overall ecosystem have been proposed under different heads with suitable financial provisions for the implementation. A provision of 36.50 lakhs has been made toward this.

5.17 COST SUMMARY OF THE EMP

S. No.	Item	Cost (Rs. In lacs)
1	CATCHMENT AREA TREATMENT PLAN	769.00
2	RESETTLEMENT AND REHABILITATION PLAN	1300.00
3	COMPENSATORY AFFORESTATION AND NPV FOR FOREST LAND TRANSFER	374.00
4	GREEN BELT, LANDSCAPE AND RESTORATION PLAN	44.00
5	RESERVOIR RIM TREATMENT PLAN	22.09
6.	FISHERIES MANAGEMENT PLAN(Provision is Made in DPR for Construction of Fish way)	100.00
7.	WATER, AIR AND NOISE QUALITY MANAGEMENT PLAN	20.00
8.	MUCK DISPOSAL PLAN	387.80
9.	RESTORATION PLAN FOR QUARRY SITES	00
10.	HEALTH MANAGEMENT PLAN (Provision is Made in The R&R Chapter)	40.00
11.	FUEL MANAGEMENT PLAN	3.50
12.	SOLID WASTE MANAGEMENT PLAN	47.17
13.	DAM BREAK MODELLING & DISASTER MANAGEMENT PLAN	52.60
14.	BIO-DIVERSITY CONSERVATION AND FOREST PROTECTION PLAN	43.00
15.	ENVIRONMENTAL AWARENESS PLAN	9.00
16.	ENVIRONMENTAL MONITORING PLAN	36.50
	Total	3248.66

