ENVIRONMENTAL IMPACT ASSESSMENT

INTRODUCTION

Dibang Multipurpose Project (3000 MW) is being conceived on River Dibang which originates from snow covered southern flank of the Himalayas close to Tibet border at an altitude of more than 5000 M. The river emerges from the hills and enters sloping plain area near Nizamghat in Arunachal Pradesh, from where the river flows a distance of 50 Km. to meet the river Lohit. The total catchment area of Dibang up to the dam site is 11276 sq km which lies entirely in India. The Project is located in Lower Dibang Valley district of Arunachal Pradesh and its site is found to be a good combination of geological and topographical features for development of hydro-potential, with negligible R&R problems and no submergence of archaeological/other installations. However, the project area is extremely remote & inaccessible. The reservoir created behind Dam will provide flood moderation benefit in the down stream. The back water in the reservoir will travel up to a length of 43 km in Dibang river and its various tributaries - Airi Pani, Ilu Pani, Imu Pani, Ahi river, Ithun river, Emra river etc. which will facilitate promotion of navigation by connecting inaccessible upstream villages/areas. The Project after construction will be one of the biggest projects in terms of generation of power in India. The project headquarters is proposed to be at Pathar Camp on the right bank of river Dibang approximately 6 km downstream of dam site. The project has a poor connectivity from the railhead and the nearby towns (viz. Tinsukia, Dibrugarh, Pasighat, Itanagar, Tezpur etc.). The project is about 43 km from Roing which is at a distance of 110 km from Tinsukia the nearest railhead. Airport at Mohanbari (Dibrugarh) is further 45 km from Tinsukia.

Boosting up of electricity generating capacity is an urgent national need, because of the growing power demand year by year. NE region has huge hydel potential for electricity generation and also has the advantage of exporting the same to other SAARC/South Asian Countries due to its strategic location.

PREFERENTIAL ASPECTS OF THE PROPOSED SITE

The present dam site is found to be a good combination of geological and topographical features for development of hydro potential, with negligible R&R problems and no submergence of archaeological / other installations. In addition, its

other advantageous points are:

i. Exposed Gneissic rock at dam site
ii. Reasonable distance from Mishimi and Lohit Thrusts
iii. Devoid of any active or significant slides
iv. Topographic stability to accommodate all appurtenances
v. No submergence of mineral resources
vi. Easy availability of construction materials, like quartzite etc., and
vii. Having more storage capacity due to gentle river slope,

ENVIRONMENTAL IMPACT ASSESSMENT

EIA is a planning tool that is now generally accepted as an integral component of sound decision-making. The objective of EIA is to foresee and address potential environmental problems/concerns at an early stage of project planning and design .EIA/EMP should assist planners and government authorities in the decision making process by identifying the key impacts/issues and formulating mitigation measures. Ministry had issued sectoral guidelines some time ago.

OBJECTIVES OF THE STUDY

The present study covers:

- Assessment of the existing status of water, land, biological, climatic, socioeconomic, health and cultural component of environment.
- Identification of potential impacts 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 mathematical/simulation models.
- Preparation of environmental impact statement based on the identification, prediction and evaluation of impacts.
- Delineation of environmental management plan (EMP) outlining preventive and curative strategies for minimising adverse impacts during pre-construction, construction and operational phases of the proposed project along with the cost and time-schedule for implementation of EMP.
- Formulation of environment quality monitoring programme for construction and operational phases to be pursued by the project proponent.

SALIENT FEATURES OF THE PROJECT

1. LOCATION

❑ STATE	:	ARUNACHAL PRADESH
❑ DISTRICT	:	LOWER DIBANG VALLEY DISTRICT
❑ RIVER	:	DIBANG / TANGON
❑ DAM SITE	:	1.5 km U/S OF CONFLUENCE OF ASHUPANI WITH DIBANG LATITUDE : 28°20'07" N LONGITUDE : 95°46'38" E
❑ NEAREST BG RAIL HEAD	:	TINSUKIA/ DIBRUGARH
❑ NEAREST AIRPORT	:	DIBRUGARH

2. HYDROLOGY

❑ CATCHMENT AREA	:	11276 km^2.
❑ LOCATION OF CATCHMENT		
❑ LATITUDE	:	28°11' 50" N TO 29°25' 59" N
❑ LONGITUDE	:	95°14' 47" E TO 96°36' 49" E
❑ AVERAGE ANNUAL RAINFALL	:	4405 mm
❑ MAXIMUM TEMPERATURE	:	45° C
❑ MINIMUM TEMPERATURE	:	2° C

3. RESERVOIR

❑ MAXIMUM WATER LEVEL (MWL)	:	EL 548 m
❑ FULL RESERVOIR LEVEL (FRL)	:	EL 545 m
❑ MIN. DRAW DOWN LEVEL (MDDL)	:	EL 490 m

- GROSS STORAGE

  - AT MWL : 3850.3 Mcum
  - AT FRL : 3748.21 Mcum
  - AT MDDL : 1983.89 Mcum

- AREA UNDER SUBMERGENCE AT FRL : 40.09 km^2
- LENGTH OF RESERVOIR : 43 km

4. DIVERSION TUNNEL

- NUMBER : 5
- SIZE : 12.0 m DIAMETER
- SHAPE : HORSESHOE
- LENGTH : 1175 m TO 1325 m
- DIVERSION CAPACITY : 8680 m^3/sec
- HEIGHT OF U/S RCC COFFER DAM (OVERFLOW PORTION) : 25 m (Above RBL)
- HEIGHT OF D/S COFFER DAM : 7 m (Above RBL)

5. CONSTRUCTION SLUICE

- NUMBER : 6
- SIZE (W X H) : 4 m x 5 m
- CREST LEVEL : EL 300 m

6. DAM

- TYPE : CONCRETE GRAVITY DAM
- TOP ELEVATION OF DAM : EL 550.00 m
- HEIGHT OF DAM ABOVE DEEPEST FOUNDATION LEVEL : 288 m
- LENGTH OF DAM AT TOP : 816.3 m

6.1 SPILLWAY

- DESIGN FLOOD : 19000 m^3/sec
- TYPE : ORIFICE TYPE
- CREST ELEVATION

LOWER LEVEL : EL 455 m

UPPER LEVEL : EL 500 m

- NUMBER & SIZE OF SPILLWAY OPENING

LOWER LEVEL

NUMBER : 7

SIZE (W x H) : 6 m x 8 m

UPPER LEVEL

NUMBER : 4

SIZE (W x H) : 9 m x 12 m

- ENERGY DISSIPATION : SKI JUMP
- LENGTH OF SPILLWAY : 154.0 m

7. HEAD RACE TUNNEL INTAKE

- INVERT LEVEL : EL 465.00 m
- NUMBER : 6
- SIZE OF GATE OPENING : 8.0 m x 9.0 m
- TRASH RACK : INCLINED TYPE

8. HEAD RACE TUNNEL

- NUMBER : 6
- SIZE : 9 m DIAMETER
- SHAPE : HORSESHOE
- LENGTH (VARYING FROM) : 300 m TO 600 m

- DESIGN DISCHARGE : 237.80 m^3/sec

9. PRESSURE SHAFT

- NUMBER : 6
- SHAPE : CIRCULAR
- DIAMETER : 7.5 m
- HEIGHT : 184.8 m

10. MIV CAVERN

- CAVERN SIZE : 15 m(W) x 23.5 m(H) x 277.8 m(L)
- MIV DIAMETER : 4.75 m

11. POWER HOUSE CAVERN

- TYPE : UNDERGROUND
- INSTALLED CAPACITY : 3,000 MW
- NUMBER OF UNITS : 12
- POWER HOUSE CAVERN SIZE : 24.5 m(W) x 54.8 m(H) x 356.8 m (L)
- TYPE OF TURBINE : FRANCIS
- NET RATED HEAD : 233 m

12. DRAFT TUBE GATE CUM TRANSFORMER CAVERN

- CAVERN SIZE :17 m (W) x 20.5 m (H) x 295.8 m (L)
- DRAFT TUBE GATE SIZE : 2 NOS. EACH OF 4.5 m x 7.1 m WITH CENTRAL PIER OF 2.0 m

13. TAIL RACE TUNNEL

- NUMBER : 6
- SIZE : 9 m DIAMETER
- SHAPE : HORSESHOE
- LENGTH : 320 m TO 470 m

- DESIGN DISCHARGE : 237.80 m^3/sec

14. POTHEAD YARD AND GIS

- SIZE AND ELEVATION : 300 m x 100 m AT EL 310.0 m

15. ACCESS TUNNELS/ ADITS

- SIZE AND SHAPE : 9.0 m / 6.5 m DIA D-SHAPED
- TOTAL LENGTH : 3200 m

16. POWER GENERATED

- INSTALLED CAPACITY : 3000 MW
- ANNUAL ENERGY GENERATION IN 90% DEPENDABLE YEAR
  - WITH RULE CURVE : 12270 MU
  - WITHOUT RULE CURVE : 13194 MU
- ANNUAL ENERGY GENERATION IN 50% DEPENDABLE YEAR
  - WITH RULE CURVE : 13904 MU
  - WITHOUT RULE CURVE : 14925 MU

17. PROJECT COST

- TOTAL COST (AT NOVEMBER 2005 PRICE LEVEL)

WITH COST OF EXTERNAL ROAD : Rs. 14530.48 CRORES

WITHOUT COST OF EXTERNAL ROAD : Rs. 13854.22 CRORES

- COST OF GENERATION AT BUS BAR PER UNIT (INCLUDING 12% STATE SHARE AND 14% RETURN ON EQUITY

WITH COST OF EXTERNAL ROAD

WITH FLOOD MODERATION : Rs. 2.12

WITHOUT FLOOD MODERATION : Rs.1.97

WITHOUT COST OF EXTERNAL ROAD

WITH FLOOD MODERATION : Rs. 2.02

WITHOUT FLOOD MODERATION : Rs.1.87

In Dibang Multipurpose project, most of the submergence area falls in the gorge area therefore, it is restricted longitudinally and no major submergence is observed laterally. In such conditions, impacts do not spill over to a large area. Thus, beyond the designated study area, the impacts likely to accrue as a result of project construction and operation are not expected to be significant.

DIBANG CATCHMENT

Dibang Multipurpose Project is located on river Dibang. The river originates from the snow covered southern flank of the Himalayas / Trans Himalayas close to the Tibet border at an elevation of more than 5000 m. The river Dibang cuts through deep gorges and difficult terrains in its upper reach through the mountains of the Dibang Valley and Lower Dibang Valley districts of Arunachal Pradesh. The total length of Dibang from its source to its confluence with Lohit river at Sadia in Assam is 195 km. The major tributaries of Dibang river are Mathun, Tangon, Dri, Ithun & Emra. A number of small tributaries i.e. Ahi, Ari Pani, Ilu Pani, Ashu Pani, Ephi Pani, Deo Pani etc also join the river. The important feature is that all the tributaries barring Ephi Pani & Deo Pani join Dibang in its hilly catchment. The three major tributaries viz Tangon, Dri and Mathun are almost equal in size because of which the shape of the Dibang catchment is comparatively wide in its upper reach. Out of the total catchment of 11276 sq km (=1127600 ha), the directly draining catchment constitutes an area of 59811.88 ha.

LANDUSE/LAND COVER DETAILS

About 48.76 % (29163.44 ha) of the directly draining catchment is dense forest whereas 12.41 % (7419.88 ha) is open forest. In the proposed submergence area the dense mixed forest is limited along the bank of the river. Areas under agriculture /

current jhum / habitation works out to be 6.44 % (3851.64 ha) while degraded forest / abandoned jhum works out to be 17.19 % (10281.64 ha) of the directly draining catchment. Snow covered areas constitute about 0.23 % (139.52 ha) of directly draining catchment. They occur generally as isolated exposure. The area under this category is 13.13 % (7852.32 ha). Water bodies, mainly comprising of river Dibang and its tributaries, constitute about 1.84 % (1103.44 ha) of the directly draining catchment.

CAPABILITY CLASSIFICATION

In capability classification, lands are divided into two groups, i.e. (a) suitable for cultivation, and (b) unfit for cultivation but suitable for permanent vegetation, namely pastures, orchards and forest vegetation. However, in both the groups, degree of hazards is involved. It is observed that the areas under current and abandoned jhum is grossly mismanaged, misused or even made hazardous mainly due to shift cultivation and that's why it should be brought under permanent terrace cultivation or under silvi-pasture vegetation by persuasion as well as by applying improved technology.

PHYSIOGRAPHICAL, TOPOGRAPHICAL AND RELIEF FEATURES OF THE CATCHMENT

The Dibang Basin lies between Lat 28°11'50" N to 29°25'59" N and Long 95°14'47" E to 96°36'49" E and has a very severe and rigorous topographic feature. Its elevation ranges from 300 m in the outer Siwalik type hills rising from plains of Assam to as high as 5500 to 6000 m in the Greater Himalayas, bordering China.

The Basin has a catchment area of 11,242sq km. In the hills, the upper reach of the river is known as R. Mathun, R. Dri and then R. Tangon. As per Agro-climatic Zone, the area falls within (i) Alpine Zone, and (ii) Mild Tropical Plain Zone. Within the Dibang basin, the hills. and mountains occupy nearly 66.7% of the total land area and the relief difference vary from 540 m to 5400 m. the relief map of the entire catchment

DIBANG CATCHMENT DRAINAGE SYSTEM AND DRAINAGE PATTERN

The Dibang River is snow as well as rainfed. At its upper reach, it is known as R. Mathun, R. Dri and R. Tangon in chronological descending order. It is known as R.

Dibang from the confluence point with R. Ahi. It originates at an altitude of 5355 m to 5375 m in the glacial ranges of Great Himalayas and flows in a general southward direction.

METEOROLOGY

The Dibang basin falls partly in climatic zone I and partly in zone III. Zone I comprises of North and North Eastern part of India including Myanmar, Nepal, Bhutan, Bangladesh and part of Pakistan. Zone No. III comprises of China, Tibet and portion of North and North Eastern part of Arunachal Pradesh. Two distinct climatic conditions prevail over the entire Dibang Catchment. The upper reach starts from the Indo-Tibet border up to Mayudiya Hill Range and the lower reach starts from Mayudiya Hill range to the confluence of Lohit. The rainfall in the basin is mainly influenced by the mountain system and occurs due to the Southwest monsoon, which sets in by the second week of May and continues upto the middle of October. On the basis of the available data, average rainfall in the basin upto the dam site has been estimated to be 4405 mm

GEOLOGY OF THE RESERVOIR AREA

Regionally, the reservoir area lies at the junction of Eastern Himalayan mobile belt which terminate against N-W tending Parametamorpites and Diorite-Granodiorite Complex of *Mishmi block* in the Dibang Valley. The Eastern Himalayan mobile belt embodies a succession of northern dipping thrust sheets that occupy almost the whole of Arunachal Pradesh. It consist of high grade biotite gneiss and garnetiferous mica schist termed as ***Ithun Formation*** and low grade chlorite schist with intercalations of phyllites and carbonate rocks termed as ***Hunli Formation***.

In Dibang river valley, structural elements related to five phases of deformation are present. Each phase has produced folds with distinct characteristic geometry. Broad wraps along sub-horizontal axial plane having joint set as their axial planar structure represent fifth phase of folding (F5) that are of local importance.

Planar structures observed in the area are bedding, schistosity/gneissosity, cleavage, joint, shear and fault. Of these bedding is the only primary planar structure and the rest are secondary. Bedding is well developed in quartz-chlorite schist; carbonate rock

and green quartzite of Hunli formation and quartzite of Ithun formation. Schistosity is well developed in chlorite schist and phyllite of Hunli Formation and gneissosity in gneissic rock of Ithun Formation

Following major thrust/faults are present in reservoir area: Lohit Thrust, Tidding Suture. The rock exposure along the river banks, nala section, foot tracks were studied for reservoir mapping and it is noted that a variety of rocks belonging to different formations/groups are present. The litho units of the area are briefed hereunder.

In the reservoir area upstream of dam axis along the course of Dibang river and its tributaries viz *Ilu Pani* and *Ar Pani*, rocks of Ithun formation comprising of quartzo-feldspathic biotite gneiss, biotite amphibolite gneiss with bands of amphibolite chlorite schist are exposed.

The major rock type belonging to Hunli formation exposed in Ahi river section are quartzite gneiss with amphibolites and mica, graphite mica schist with occasional carbonaceous bands, crystalline limestone and quartz chlorite schist.

LANDSLIDES

During the course of reservoir mapping of Dibang Multipurpose Project several active and potential landslide along with other zones of mass movement were identified. Following categories of unstable zones were identified within the reservoir area:

(i) Ancient/passive slide debris cone covered with vegetation.

(ii) Active landslide in overburden material.

(iii) Active landslide in bedrock.

(iv) Potential area of mass-movement and soil creep.

In the entire reservoir area overall 60 number of active landslide zones forming unstable slopes has been identified.

Most of larger landslides are developed in bedrock. However smaller and medium size landslides are observed in both rock and overburden cover along the proposed reservoir rim. The other large landslide zones are located in the upstream reaches of

the reservoir; many of them are at higher elevations in various tributaries of Dibang and may not pose much threat.

SEISMOLOGY

The North Eastern Region of India and its environment are both tectonically as well as seismically very dynamic and active. This region has been a source of two of the greatest earthquakes in the world with magnitude greater than 8.5, besides which, several earthquakes of magnitude 7.0 and more occurred in the region.

TECTONO-STRATIGRAPHIC SET UP

Regional tectonics and seismic history of the North Eastern Region is highly significant. It constitutes active, unparallel relief, complex geological set up and anomalous crustal structure, which are attributed to the direct collision between Indian plate (Himalaya) and China / Tibet plate in the north and Indo- Burma subduction plate tectonics in the south east.

TECTONIC SETTING

The East West structural trend of the Himalaya has- taken a sharp bend towards North East - North in the Siang Valley, Arunachal Pradesh The available geological information do not indicate physical continuity of the Himalayan rock units across the Siang fracture (Nandy, 1980) into the Mishimi block, rather the north east trending elements of Arunachal Himalaya with its thrust sheets abut against the north-west trending structural grain of the Mishimi block.

The most prominent and significant tectonic feature around the project site is apparently parallel NW trending Mishimi thrust and Lohit Thrust. The Great Assam Eartquake of 1950 (M=8.7), originating from this domain, illustrates similar right lateral sense of displacement (Ben-Menahem etal, 1974).

SEISMICITY OF THE REGION

In a very generalized way epicenter clustering can be visualized around (1) Western part of Shillong Plateau, (2) Central Assam & Western Arunachal Pradesh, (3) Indo Burma Border, and (4) North Eastern part of Arunachal Pradesh.

From the study of seismicity and tectonics of the region, the following active seismo-

tectonic domains that have bearing on the construction of projects in the region, have been visualized.

a) Mishimi tectonic domain,

b) Kopili Bomdila tectonic domain (Himalayan),

c) Sylhet tectonic domain,

d) Indo Burma plate tectonic domain, and

e) Shillong plateau domain.

The proposed Dibang Multipurpose project falls within **Zone V** of the Earthquake Zoning Map of India.

WATER QUALITY

The Dibang river basin has low population density, with low irrigation intensity. In addition, there are no major sources of organic pollution also in the catchment area intercepted till the dam site. The absence of industries implies that there is no pollution loading from this source as well. From the water sample analysis of the Dibang River it is clear that that the quality of water of river Dibang is good. The hardness levels indicate the soft quality of water. Most of the residents in the area were using water of adjacent rivers and streams without any disinfection. Low BOD levels indicate the absence of organic pollution source.

SOIL QUALITY

Soil is sandy loam type with presence of free acids & likely occurrence of exchangeable Aluminium. From dispersion ratio it is assumed that Hydraulic conductivity is very low. Electrical Conductivity is normal & porosity is good for drainage. This soil is good for agriculture and horticulture crops & pH shows strongly acidic nature and also the organic carbon content is also good. Nitrogen level is normal & good.

Crops that can be grown are Rice , Wheat, Maize, Auto, Mustard, Sugarcane, fruit crops like Citrus, Lemon, Banana, Pineapple, Litchi etc.

AMBIENT AIR QUALITY

Ambient air quality is a complex interwoven network involving interaction of emissions, chemical changes and transport of pollutants in the atmosphere. A well-designed monitoring programme was designed to assess the status of ambient air quality in the

project area. The ambient air quality monitoring established by the Consultants are Munli Camp and Pather Camp. The prime objective of the ambient air quality monitoring was to assess the existing level of air pollutants. The parameters monitored were SPM, SO_2 and NO_x. 24 hourly sampling for two consecutive days was done at each station. The SPM, SO_2, NO_x levels in the study area are much below the desirable limits.

TERRESTRIAL ECOLOGY

The catchment area, which has an altitudinal range from 300 m to 5400 m, has a very interesting floristic composition representing changes in forest types, typical of the Eastern Himalayas with the change in altitude. The favourable rainfall, temperature and high humidity have caused the vegetation to acquire the general characteristics of the Northern Tropical Semi- Evergreen & North Indian Moist Deciduous Forests.

The major forest types are as follows-

a) Assam Valley & Eastern Sub-montane Semi-evergreen Forests b) Subtropical Moist Deciduous Forests c) East Himalayan Subtropical Wet Temperate Forests d) Subalpine or Temperate Montane Forests e) Major Floral Species found in submergence area

FLORISTIC DIVERSITY

The Lower Dibang Valley and Dibang Valley districts of Arunachal Pradesh are true representatives of East Himalayan Biodiversity. The area comprises a large number of economically important plants. Many herbs and shrubs including tree and climbers have been used traditionally by the local people as medicinal plants for the treatment of different ailments. Some of these plants have been smuggled through international borders by the active participation of the local people for money. Due to this reason and other ecological factors many of these plants are on the verge of extinction. The whole Arunachal Reserve Forests can be termed as reservoir of ornamental plants mostly orchids and other flowering plants. These ornamental plants mostly include orchids, rhododendrons, begonias and some others. The project area has several valuable timber yielding plants.

ENDANGERED SPECIES OF FLORA

Endangered species of plants (as per Botanical Survey of India Red Data Book) found in the submergence area and 7 km radius are presented in table below:

Sl. No.	Endangered species	Whether found in Submergence area	Whether found in 7 km radius
1	*Aconitum ferox*	Yes	Yes
4	*Coelogyne mossiae*	Yes	Yes
5	*Dendrobium aurantiacum*	Yes	Yes
6	*Paphiopedilum fairieanum*	Yes	Yes
7	*Paphiopedilum venustum*	Yes	Yes
8	*Vanda coerulea*	Yes	Yes
9	*Bombax insigne* var. *polystemon*	No	Yes
10	*Pterospermum reticulatum*	No	Yes
13	*Psilotum nudum*	No	Yes

PHYTO-SOCIOLOGICAL STUDIES

The sampling was done within 1 km of the riverbed. Considering the difficult terrain, quadrate method was used for vegetation sampling. During the survey, number of plants of different species identified in each quadrate was counted. The height of individual trees was estimated using a Binocular and the DBH of all trees having height more than 8 m was measured.

Based on the quadrate data, Frequency, Density and Cover (basal area) of each species was calculated. The Importance Value Index (IVI) values for different tree species were determined by summing up the Relative Density, Relative Frequency and Relative Cover values. The Relative Density and Relative Frequency values were used to calculate the IVI of shrubs and herbs. The volume of wood for trees was estimated using the data on DBH (measured at 1.5 m above the ground level) and height. Rare and endangered species were identified referring to the Red Data Book

of BSI and other available literature, flora and herbarium pertaining to the rare/endangered species of Arunachal Pradesh.

FAUNAL DIVERSITY

The entire land of the proposed Dibang valley multipurpose project has fairly rich forest cover. The animal habitat is concentrated on lower slopes and terraces edging to major river system .The animals also adapted according to the riverine environment. Many arthropods such as Coleopterans, Arachnids and insects were observed. However, due to the short span of time of the EIA study it was not possible for a detailed survey of the lower animals. The surveyed data were recorded as per the following list of fauna.

Mammals:	*43 no. of species*
Avifauna:	*93 no. of species*
Reptiles:	*20 no. of species*
Lizards:	*9 no. of species*
Amphibians:	*10 no. of species*
Fishes:	*71 no. of species*
Butterfly:	*2. no. of species*
Zooplankton	*11 no. of species*
Phytoplanktons:	*22 no. of species*
Benthos:	*11 no. of species*

MIGRATORY FISH SPECIES

Out of 71 fish species, five species viz. *Schizothorax richardsonii*, *Tort tor, Tor putitora, Neolissocheilus hexagonolepis* and *Chagunius chagunio* are migatory in nature for breeding purpose. Four species viz. *Crossocheilus latius latius*, *Garra annadalei*, *Garra gotyla gotyla* and *Psilorhnchus balitora* are local migratory for feeding purpose.

High river discharge, fast water currents and want of suitable spawning ground in the lower reaches of the river are the reasons which force the fish to swim upstream in search of suitable eco-system to spawn. Mahaseers attain maturity in the size range from 30-40 cm. The fish lay eggs in sandy/ gravelly pits in the river bed or beneath rocks boulders in shallow waters receiving moderate current at a depth of 40-60 cm

and in water sufficiently clean and transparent. Size of putitora mahaseer fry and fingerlings found during the investigation ranged from 18 to 120 mm.

Putitora mahaseer species starts spawning from the onset of south-west monsoon in mid July which continues till the middle of October in flooded river. The peak breeding occurs in August-September in ambient water temperature from 18^0C to 22^0C.

The other important migratory species *Tor tor* have a prolonged breeding period commencing from July-August continuing sometimes till November in water temperature 17^0C - 22^0C and transparency 20-30 cm.

SOCIO-ECONOMIC STUDIES

Socio-economic and cultural impacts arising from project construction and environmental transformation are rooted in the complex interactivity between social and biophysical environments.

Broadly the people, which are residing in the project affected area, may be divided into three cultural groups on the basis of their socio-religious affinities. The first group of people comprises tribes like Monpas and Sherdukpens of Tawang and West Kameng districts, who follow the lamaistic tradition of Mahayana Buddhism. The second group of the people are Adis, Akas, Apatanis, Bangnis, Nishis, Mishmis, Mijis, Thongsas etc., who worship Sun and Moon God namely Donyi-Polo and Abo-Tani, the original ancestors for most of these tribes. The third group comprises Noctes and Wanchos, adjoining Nagaland in the Tirap District. These are hardy people known for their strictly structured village society in which hereditary village chief still plays a vital role. The Noctes also practice elementary form of Vaishnavism.

PLAN OF APPROACH

A Detailed socio-economic survey was undertaken to understand the overall social and economic status of the Project Affected Families (PAFs), their life style and to assess the likely impacts of the proposed project in terms of loss of personal and community property of the PAFs. In the proposed project, five villages comprising of 72 families and population of 243 will be fully affected. Out of the five villages, three villages viz. Sukla Nagar, Eprali and Peely lie in Lower Dibang Valley District while two

villages viz. New Anaya and Kano lie in Dibang Valley District. Due to construction of project component /project activities, 14 families, with a population of 58, residing between Pathar Camp and Dambuk as well as Roing, will be partially affected. The total land of fully affected families getting affected is 938.8 ha and land of partially affected families getting affected is 557 ha. Also, an additional 1080.5 ha of community land will be getting affected due to project construction (total private land getting affected is 2576.3 ha). All the families belong to Idu-mishmi tribe, which is scheduled tribe.

FINDINGS OF THE SOCIO – ECONOMIC SURVEY

As a part of the field studies, survey of the affected households was conducted. The survey covered 8 villages comprising of 86 households. The total population of these households is 301. The estimation of land details of partially as well as fully affected families is based on field survey only as there is no land record available.

DETAILS OF PROJECT AFFECTED VILLAGES

Details of the fully affected villages are given below:

1. Suklanagar / 132 km Point

The location of the village is at the River Bank of the River Ithun. The elevation of the village from the mean sea level is 482.22 m. The place was basically a Border Road Construction Camp, where now the villagers also from nearby villages have settled. A total of 18 local tribal families are residing here in huts made up of locally available wood and bamboo.

2. Eprali

This is a characteristic type of village situated in the left bank of river Ithun. The elevation of this village is 472.4095 m above the mean sea level. Further, the village consists of only three (3) households. These houses are also made of locally available materials with an average plinth area of 150-180 sq feet.

3. Peely

The village is located at the right bank of the River Ithun and the elevation for the same being nearly 540.19 m above the mean sea level. The survey of the households

revealed that seven families of Idu - Mishmi tribes are the residents of this village. Total area being covered under cultivation is about 7.2 ha. The estimated plinth area of the houses is 80 sq feet to 240 sq feet.

4. New Anaya

The village is located at the right bank of the River Ithun and the elevation of the same is 557.91 m above the mean sea level. The survey of the households revealed that thirty six (36) families of Idu - Mishmi tribes are the residents of this village. The village can be cut out of into two parts, i.e. one part at lower terrace, elevation of which is in the range of 540 m to 550 m, and the other part at upper terrace where elevation range is between 555 m to 580.0 m. There are 14 houses in lower terrace that avail the good and favorable condition of riverbank for Rabi cultivation only.

5. Kano

The location of the village is at the right Bank of the River Ithun. The elevation of the village from the mean sea level is 496.50 m. A total of 7 local tribal families are residing here in huts made up of locally available wood and bamboo. The houses are stilt types. The estimated plinth area of the houses is 100 sq feet to 300 sq feet.

Five villages are falling in the submergence areas of Dibang Multipurpose Project and field study was carried out to have a clear picture of the socio economic status of the 72 nos. of the fully affected families residing in these 5 villages. The total population of these households is 243. It was seen that among all the five villages the highest population is in New Anaya village followed by Sukla Nagar, Kano, Peely and Eprali, respectively. The female to male ratio was moreover uniform in the region except for the Eprali village where it was highly varying. This may be attributed to the lower population within the village.

Occupational Profile

It was observed that most or the people or the affected villages are primarily engaged in agriculture and horticulture.

Occupational profile of the project affected population

S. No.	Category	Total	Percentage
1.	Agriculture	14	5.76
2.	Agriculture & Forestry	184	75.72
3.	Forestry	8	3.29
4.	Services	17	7.00
5.	Business	20	8.23

Estimated Area of Span for the Affected Village

Villages	Estimated area of village (in ha)
New Anaya	319
Suklanagar	285
Eprali	38
Kano	110
Peely	116
Total	**868**

The total area under agriculture (WRC) in the affected area is 70.8 ha.

Estimated Average Area under Agriculture (In ha)

Villages	PAF	Villages
New Anaya	0.85	30.5
Suklanagar	1.16	22.0
Eprali	0.63	1.9
Kano	1.31	9.2
Peely	1.03	7.2
Overall Average	**1.00**	**70.8**

Household Information and the Average Family Size for the PAFs

Villages	Total Households	Average Family Size
New Anaya	36	3.42
Sukla Nagar	19	3.68

Eprali	3	3.33
Kano	7	3.57
Peely	7	2.14
Total	**72**	**3.42**

INFRASTRUCTURE AVAILABILITY

The availability of the transportation facilities is restricted to road transport only due to the mountainous terrain and that also is not much effective since there is the problem of landslides on the road passing through the affected villages. In general, the Pucca road passes through all the villages except in the Eprali village where the local population primarily uses the rope bridge to move across the river from the Pucca road. The network of the village roads (kuccha) is well established within the villages except for Kano village where three houses are located on the hill side.

During the survey it was found that the overall literacy rate of the affected villages was 23.4 %. The highest literacy rates of 31.6 % amongst all the affected villages were found in village Kano. The overall infrastructure facility in the affected villages for education is very poor.

LIVE STOCK DETAILS

In the affected villages the livestock details have been surveyed and are presented in Table 5.11. The livestock, which are predominant in the affected village, are Mithun, Pigs and Poultry. There are 202 nos. of Mithun, 189 nos. of Pigs and 348 nos. of Poultry Birds covering all the affected villages. The village people are keeping the livestock mainly for the consumption use.

DRINKING WATER SOURCE

The people of the affected villages generally use the Water being supplied from PHED. In case of the villages Peely and Eprali the local population primarily depends on river and streams through appropriate arrangements by utilizing bamboos for siphoning streams for drinking water.

PATTERNS OF POPULATION GROWTH AND WORKING POPULATION

The age group composition of the villages indicate that there is very good chance for strategies to be developed for provision of vocational education to the affected population and the adaptation also would be high due to high percentage of working population in the villages

Village name	<5 yrs	5 -15 Yrs	15 - 60 yrs (Working Population)	>60 yrs	Percentage of working population to total population
Anaya	8	33	76	6	61.79
Sukla Nagar	8	18	42	2	60.00
Eprali	0	4	4	2	40.00
Kano	0	7	14	4	56.00
Peely	1	2	11	1	73.33
Total	**17**	**64**	**147**	**15**	**60.49**

ETHNOGRAPHIC DETAILS

Almost all of the population directly going to be affected by the project is of Idu Mishimi Tribes. The traditions and cultures of this tribe are discussed in the preceding paragraphs: The Idu Mishmi is one of the two major tribes of the district. The Idu Mishmis can be distinctively identified among other tribal groups of Arunachal Pradesh by their typical hairstyle, distinctive costumes and artistic patterns embedded on their clothes.

People of sober nature, they still maintain deep-rooted aesthetic values in their day-to-day life with great pride and honour. All pervading goddess Nani-Intaya is the sole creator of the universe for the Idus. The Idus have their distinct dialect, which falls under the Tibeto-Burman group of languages. Traditionally, Idus believe in animism. They worship several benevolent and malevolent spirits. Nani-Intaya and Masello Zino are worshipped as creators of mankind and universe as a whole.

The major festivals of the Idus are ‘Reh’ and ‘Ke-meh-ha’. Reh festival is held during the month of February.

Apparently the Idu-Mishmis migrated towards the south to present habitat from Tibet through Dibang and Lohit Valleys. Some of the prominent migration points from the Tibet indicated by the ancestors are :

(i) ANDIKU - the direction towards North-Pole Star, (ii) ASE-ALE - the course of Lohit river and, (iii) INNI LON PON - the region where the first rays of the sun falls. There are about seventy-six clans. Some clan counts their genealogy up-to about twenty-eight generations

Idus believe that to have pregnancy is a great blessing of the Divine mother "INNI MASELO ZINU AYA" or Sun Goddess. After pregnancy is noticed, two cocks are tamed as sacrificial bird to offer their blood to beneficent and maleficent spirits at the time of birth ceremony for the welfare of newborn. The Idu-Mishmi society is patriarchal and patrilineal. The son from the father inherits the property. The Idu-Mishmis used to practice polygamy, but incestuous marriage is prohibited. Marriage is through elopement and abduction but the most preferable one is by negotiation or arranged marriage.

The younger or elder brother can marry the widow of his deceased brother. A man may marry his step-mother (other than his mother's sister) after the death of his father. If the step-mother refuses to remarry, she or her parent or guardian has to pay back the bride price. To marry a girl it involves a huge expenditure in cash and kind for the bride price.

An Idu-Mishmi house is a long one like a bus, rectangular size, raised above two feet from the ground and supported on wooden posts usually accommodates a joint family. Bamboo, cane, wood and leaves of toku and straws are used for construction. The Idu-Mishmi practice both terrace and wet rice cultivation. Rice, Maize and Millet are the staple food of the Idu–Mishmis. The home brewed rice beer (YU) is quite popular. Modern education had a late start among the Idu Mishmis as they didn't have early contact with the British colonizers. But educational institutions and literacy have multiplied rapidly since independence, Idus are expert in handicraft and weaving..To die at the old age is treated as normal death but if it is accidental or premature, past acts of the deceased are believed to have indirect effect on the death of the deceased.

ASSESSMENT OF IMPACTS

Based on the project details and the baseline environmental status, potential impacts, as a result of the construction and operation of the proposed Dibang Multipurpose

Project have been identified which are as under:.

IMPACTS ON LAND ENVIRONMENT

The major anticipated impacts during the construction phase are as follows:

- Impacts due to Quarrying operations
- Impacts due to Operation of construction equipment
- Impacts due to Soil erosion
- Impacts due to Muck disposal
- Impacts due to Construction of roads

Impacts due to quarrying operations

During DPR stage investigation of Dibang Multipurpose Project, availability of construction material was studied keeping in view the requirement of the construction material. About 0.74 lakh cum of shell material, 193 lakh cum of coarse aggregate, 96.50 lakh cum of fine aggregate and 0.26 lakh cum of impervious material will be required for construction of the project. The requirement of the construction material is to be met from river shoal/fan deposits only.

During construction phase, various types of equipment will be brought to the site. These include crushers, batching plants, drillers, earth movers, rock bolters, etc. The siting of these construction equipment would require significant amount of space. Similarly, space will be required for storing of various other construction equipments. In addition, land will also be temporarily acquired, i.e. for the duration of project construction for storing the quarried material before crushing, crushed material, cement, rubble etc. Efforts must be made for proper siting of these facilities.

During construction phase, there will be increased vehicular movement for transportation of various construction materials to the project site. Large quantity of dust is likely to be entrained due to the movement of trucks and other heavy vehicles. However, such ground level emissions do not travel for long distances. In addition, there are no major habitations in the project area. Thus no significant impacts are anticipated on this account.

Impacts due to soil erosion

The runoff from the construction sites will have a natural tendency to flow towards river Dibang or its tributaries. For some distance downstream of major construction sites, such as dam, power house, etc. there is a possibility of increased sediment levels which will lead to reduction in light penetration, which in turn could reduce the photosynthetic activity to some extent as it depends directly on sunlight. This change is likely to have an adverse impact on the primary biological productivity of the affected stretch of river Dibang and its tributaries. The impact is likely to be greater for the smaller rivers/rivulets, where large flow is not available for dilution, or are seasonal in nature.

Impacts due to muck disposal

The total excavation quantity likely to be generated at the project will be around 177 lakh cum, out of which 59 lakh cum will be common excavation. Effectively, total rock excavation will be 117.8 lakh cum. Out of 117.8 lakh cum of total rock excavation, approximately 35 lakh cum will be used for production of aggregate and remaining 82.84 lakh cum will have to be disposed of. Adding 25% to 60% bulkage factor for common excavation and rock excavation, the quantity to be disposed of would be 198 lakh cum.

The above said quantity of muck generated needs proper disposal, so that the disposed muck would not cause any ecological damage in the dumping area. In addition, necessary care should be taken to avoid any flushing down of the excavated material in the river during monsoon, as it may significantly bring down changes in the aquatic ecosystem of the river. Proper phytoremediation plan for muck disposal areas needs to be formulated and be applied during construction phase.

TOTAL LAND REQUIREMENT

The total land required for the project is 5827.80 ha (excluding 28.40 ha of land in Tinsukia district of Assam). The details are given in table below

Land Required for the Proposed Dibang Multipurpose Project

Sl. No.	Name of Project Component	Area (ha)
1	**Reserve Forest Land**	Nil
2	Forest Land	
A	Submergence area	
(i)	River bed area	1000.00
(ii)	Steep slope	2001.50
B	Project area	
(i)	River bed area	100.00
(ii)	Rest area	150.00
	Sub-total (a)	**3251.50**
3	**Private Agricultural Land**	
A	WRC land (under submergence)	70.00
	Sub-total (b)	**70.00**
4	**Private Land with Forest Cover**	
A	Submergence area	
(i)	River bed area	262.00
(ii)	Flat land	150.00
(iii)	Gentle slope	350.00
(iv)	Steep slope	175.50
B	Project Components & Construction Facilities	
(i)	Area for Dam, DT, HRT, Pressure Shaft, Power House, TRT, cable crane on right bank & left bank	100.06
(ii)	Area for muck disposal, batch plant, switch yard & aggregate processing plant on right bank just d/s of dam	20.00
(iii)	Area for NHPC, contractor camp & office on right & left bank	79.25
(iv)	Area for permanent magazine opposite to Pathar Camp on left bank	2.50
(v)	Rest area for project	165.92
C	Epali clay quarry	4.52

D	Colony area at Roing	100.00
E	Land for Rehabilitation purposes	137.02
F	Road land – New Road 24 m wide (Roing-Hunli road from 19 km point to project site on left bank – 22 km, Road from Aka Korong to Dambuk – 22 km, realignment of road in Ithun Valley – 20 km), Widening of existing road (12 m to 24 m) of Roing-Hunli road from 0.	177.00
G	Area for Towers for 66 KV Line from Chimari to Project site and substation at Chimari, 5 towers/km with 9 sq m area for each tower & 250 sq m for substation	0.2275
H	Area for Right of Way for 66 KV Line from Chimari to Project site area (45 km long and 18 m wide)	81.00
	Sub-total (c)	**1805.00**
5	**Private Land without Forest Cover**	
A	Project Components & Construction Facilities	
(i)	Area for DT outlet & TRT outlet on right bank	13.30
(ii)	Area for muck disposal, fabrication yard & aggregate processing plant on right bank near Pathar Camp	40.00
B	Eme river / Diri Korong deposit	167.00
C	Nizamghat-Sirki	108.00
D	Aya Korong / Aka Korong fan deposit	373.00
	Sub-total (d)	**701.30**
	Total (a)+(b)+(c)+(d)	**5827.80**
	Total Reserve Forest Land	Nil
	Total Forest Land (e)	3251.50
	Total Private Land with Forest Cover (f)	1805.00
	Total Private Land without Forest Cover	701.30
	Total Private Agricultural Land	70.00

IMPACTS ON WATER QUALITY

The major sources of water pollution during project construction phase are as follows:

- Sewage from labour camps/colonies
- Effluent from crushers

Sewage from labour camps

The project construction is likely to last for a period of 8 years. About 5000 workers and 800 NHPC employees (including family) are likely to congregate during project construction phase. The domestic water requirement of the labour / employee population is expected to be of the order of 0.40 mld @ 70 lpcd. It is assumed that about 80% of the water supplied will be generated as sewage. Thus, the total quantum of sewage generated is expected to be of the order of 0.30 mld. The BOD load contributed by domestic sources will be about 237 kg/day. Even if the sewage is discharged without treatment in river Dibang, the flow required for dilution will be of the order of 9 cumecs. The minimum flows in river Dibang much higher than this flow, hence no major adverse impacts are anticipated.

However, the sewage generated from labour colonies should be treated before disposal. Normally, during project construction, the labour population will be concentrated at 2 or 3 locations. Thus, the sewage/BOD loading would outfall into river Dibang at 2 or 3 locations.

Effluent from crushers

During construction phase, at least two crushers, one near the dam site and another near the powerhouse site will be commissioned. The total capacity of the crusher is likely to be of the order of 120-150 tph. Water is required to wash the boulders and to lower the temperature of the crushing edge. About 0.1 m^3 of water is required per tonne of material crushed. The effluent from the crusher would contain high-suspended solids. The quantum of effluent generated is of the order of 12-15 m^3/hr. The discharge from the crushers is required to be treated before its disposal on land and/or water.

The various aspects covered as a part of impact on water quality during project operation phase are:

- effluent from project colony
- impacts on reservoir quality
- eutrophication risks.

Effluent from project colony

During the operation phase, due to absence of any large-scale construction activity, the cause and source of water pollution will be much different. Since, only a small number of O & M staff will reside in the area in a well-designed colony with sewage treatment plant and other infrastructural facilities, the problem of water pollution due to disposal of sewage is not anticipated. In the operation phase, about 500 families (total population of 2500) are likely to be residing in the project area. About 50 kiloliter/day of sewage will be generated @ 20 liter/person. Proper disposal measures for sewage are required to be implemented at the project.

Impacts on reservoir water quality

The flooding of previously forested and agricultural land in the submergence area will increase the availability of nutrients from decomposition of vegetative matter. Phytoplankton productivity can supersaturate the euphotic zone with oxygen before contributing to the accommodation of organic matter in the sediments. Enrichment of impounded water with organic and inorganic nutrients will be the main water quality problem immediately on commencement of the operation. However, this phenomenon is likely to last for a short duration of few years from the filling up of the reservoir.

Eutrophication risks

Another significant impact observed in the reservoir is the problem of eutrophication, which occurs mainly due to the disposal of nutrient rich effluents from the agricultural fields. The fertilizer use in the project area is negligible, hence runoff at present does not contain significant amount of nutrients. Even in the post project phase, the use of fertilizers in the project catchment is not expected to rise significantly. Thus, in the post-project phase, problems of eutrophication, which is primarily caused by enrichment of nutrients in water, are not anticipated.

IMPACTS ON TERRESTRIAL FLORA

The direct impact of construction activity for any water resource project in a mountainous terrain, similar to that of proposed project, is generally limited in the vicinity of the construction sites only. As mentioned earlier, a large population (5800) including technical staff and workers are likely to congregate in the area during the project construction phase. It can be assumed that the technical staff will be of higher economic status and will live in a more urbanized habitat, and will not use wood as fuel, if adequate alternate sources of fuel are provided. However, workers and other population groups residing in the area may use fuel wood (if no alternate fuel is provided) for whom firewood/coal depot could be provided. There will be an increase in population by about 5,800 of which about 4500 are likely to use fuel wood. On an average, the fuel wood requirements will be 10^{-3} m^3 per person per day. Therefore, the fuel wood requirement of 4500 labourers per year will be of the order of (10^{-3} x 365 x 4500) = 1643 m^3. The wood generated by cutting one tree is 3 m^3. Thus, every year, fuel wood equivalent to about 548 trees will be cut, which means 0.6 ha of forest area will be cleared for meeting fuel wood requirement, if no alternate sources of fuel are provided. The workers may also cut trees to meet their requirements for construction of houses, furniture. Normally in such situations, lot of indiscriminate use or wastage of wood is also observed. Hence, to avoid felling of trees by the labourers alternate fuel supply facilities has to be provided.

ACQUISITION OF FOREST LAND

The total land requirement for the project is 5856.20 ha, of which 5056.50 ha is under forest cover (including private land with forest cover). For this land compensatory afforestation will be required to be undertaken by the State Forest Department. Eight species of plants in the submergence area reported to be endangered. Propagation of these eight species should be proposed under Biodiversity Conservation and Management Plan.

DISTURBANCE TO WILDLIFE

The total land required for the project is 5856.20 ha (including 4009 ha of submergence area). Out of above, 5056.50 ha of area are under forest cover. Based on the interaction with locals, it was confirmed that within the submergence area, no major wildlife is observed. It would be worthwhile to mention here that most of the

submergence area lies within the gorge portion. The river acts as a barrier to movement of wildlife for even in the pre-project stage. Thus, the creation of a reservoir due to the proposed project is not expected to cause any adverse impact on wildlife movement.

IMPACTS ON MEHAO AND DIBANG WILDLIFE SANCTUARIES

Mehao Wildlife Sanctuary is located in south-east direction at a distance of about 11 km from reservoir periphery. Likewise, Dibang Wildlife Sanctuary is located in north-east direction at a distance of about 35 km from tail end of the reservoir. Since, no portion of these wildlife sanctuaries is getting affected, as a result of the proposed project, hence no impact on fauna is anticipated as a result of the construction and operation of the proposed project.

IMPACTS ON AQUATIC ECOLOGY

During construction phase of the proposed Dibang Multipurpose Project, large quantity of building material like stones, pebbles, gravel and sand would be needed for construction of various project appurtenances. The cumulative impact of this activity may result in increase in turbidity level. Good dredging practice can however minimize turbidity.

The second important impact is on the spawning areas of cold-water fisheries. Almost all the cold-water fish breed in the flowing waters. The spawning areas of these fish species are found amongst pebbles, gravel, sand etc. The eggs are sticky in nature and remain embedded in the gravel and subsequently hatch. Any disturbance of stream bottom will result in adverse impacts on fish eggs. Thus, if adequate precautions during dredging operations are not undertaken, than significant adverse impacts on aquatic ecology are anticipated.

The damming of River Dibang will result in creation of 4009 ha of submergence area. The dam will change the fast flowing river to a quiescent / lacustrine environment. The positive impact of the project will be the formulation of a water body which can be used of fish stocks on commercial basis to meet the protein requirement of region.

Since construction of the dam affects the flow of water in the river, the river bed below

the dam site gets invariably affected and many a time a long stretch of river bed down stream of a dam gets affected due to reduction in the quantum of water. However, in case Dibang Multipurpose project, the Power House is proposed to be constructed very close to the dam and as such there are very low chances of the down stream of the dam getting dried up. However, the minimum flow of water required for the maintenance of aquatic flora and fauna, especially fish, be maintained in the downstream of the dam atleast upto tail water discharge point. Proper measures for fish conservation and management may be proposed in the EMP report.

The construction of dam also will not affect the water requirement of the population residing in the downstream areas. This population generally depends upon the local streams and springs for drinking purpose and for other domestic uses. There is also no competitive use of water downstream of dam for industrial purposes. Therefore, the impact of damming on the downstream areas is not anticipated.

IMPACTS ON MIGRATORY FISH SPECIES

The obstruction created by the dam would hinder the migration of certain commercial species especially the Mahseers (from downstream to upper reaches) and Schizothorax (from upper reaches to the lower reaches). These fishes undertake annual migration for feeding and breeding. Finding their migratory path obstructed due to high dam, they are expected to congregate below the dam wall and will be indiscriminately caught by the poachers.

Proper mitigatory measures are, therefore, required to be proposed in the EMP report.

IMPACTS ON NOISE ENVIRONMENT

In a water resource project, the impacts on ambient noise levels are expected only during the project construction phase, due to operation of various construction equipments. Likewise, noise due to quarrying, blasting, vehicular movement will have some adverse impact on the ambient noise levels in the area. The noise is also generated due to blasting during tunneling operations. Since there are no major habitations in the nearby areas of project site, it is not likely to have any effect on habitations. No major wildlife is observed in and around the project site. Hence, no significant impacts on wildlife are anticipated as a result of blasting activities in the proposed project.

AIR POLLUTION

In a water resources project, air pollution occurs mainly during project construction phase. The major sources of air pollution during construction phase are pollution due to fuel combustion in various equipments, emission from various crushers and fugitive emissions from various sources.

The short-term increase in SO_2, even assuming that all the equipments are operating at a common point, is quite low. Hence, no major impact is anticipated on this account on ambient air quality. However, plan for air quality management is required to be formulated especially for the construction stage of the project in which there will be large movement of vehicles and operation of various equipment, generators etc. which may impair the air quality of the project area

IMPACTS ON SOCIO-ECONOMIC ENVIRONMENT

The construction phase will last for about 8 years. The peak strength of labour force and NHPC staff is estimated at about 5800. During construction phase, the basic problem will be related to management of large population which migrate to the construction area in search of jobs. Those who would migrate to this area are likely to come from various parts of the country having different cultural, ethnic and social backgrounds. Such a mixture of population has its own advantages and disadvantages. The advantages include exchange of ideas and cultures between various groups of people which would not have been possible otherwise. Due to longer residence of this population in one place, a new culture, having a distinct socio-economic similarity would develop which will have its own entity.

The availability of infrastructure is generally a problem during the initial construction phase, though the construction workers can be compensated for certain facilities like health, education, etc. The facilities of desired quality are often not made available in the initial stages. The adequacy of water supply, sewage treatment, housing, etc. should therefore be ensured before and adequate measures would be taken at the very start of the project.

The proposed project involves acquisition of Jhum lands and other lands. In the proposed project, five villages comprising of 72 families and population of 243 will be

fully affected. Out of the five villages, three villages viz. Sukla Nagar, Eprali and Peely fall in Lower Dibang Valley District while two villages viz. New Anaya and Kano fall in Dibang Valley District. Due to construction of project component /project activities, 14 families, with a population of 58, residing between Pathar Camp and Dambuk as well as Roing, will be partially affected. The total land of fully affected families getting affected is 938.8 ha and land of partially affected families getting affected is 557 ha. Also, an additional 1080.5 ha of community land will be getting affected due top project construction (total private land getting affected is 2576.3 ha). All the families belong to Idu-mishmi tribe, which is scheduled tribe. Proper R&R measures are required to be proposed for the PAFs.

ENVIRONMENTAL MANAGEMENT PLAN

Environmental Protection and Sustainable Development have been the cornerstones of the policies and procedures governing the industrial and other developmental activities in India. The Ministry of Environment and Forests has taken several policy initiatives and enacted legislations to prevent indiscriminate exploitation of natural resources. One such initiative is the Notification on Environmental Impact Assessment (EIA) of developmental projects issued on 27.1.1994 under the provisions of Environment (Protection) Act, 1986 making EIA mandatory for 30 categories of developmental projects.

Any water resource management project that requires the construction of dam and/or a reservoir can provide significant economic and environmental benefits in its capacity as a renewable energy source. However, the adverse environmental effects of such a project can also be substantial. In order to make the Dibang Hydroelectric Project fully eco-friendly and ameliorate all possible negative impacts on the economy and ecology of the area, the Environmental Management Plan for the proposed project, including Resettlement and Rehabilitation Program for the project - affected human population, has been prepared based on the findings of the EIA study of the catchment area, following management measures are suggested so as to ameliorate the negative impacts as well as to enhance the positive impacts.

CATCHMENT AREA TREATMENT

In order to minimise the damage to the project as well as the immediate environment, the watershed management programmes involving extensive soil conservation measures in the catchment have assumed tremendous importance.

The total catchment area of the Dibang River up to the proposed Dam site 11276 sq km. The directly draining catchment is 59811.88 ha, which constitutes the study area for CAT. The directly draining catchment comprises of nine sub-watersheds around the proposed reservoir area from the confluence of river Tangon with river Dibang up to the Dam site. The hierarchical delineation system developed by AISLUS (AISLUS Technical Bulletin - 9) was followed for the demarcation of sub-watersheds within the study area. The codification system as given in Watershed Atlas of India (AISLUS)

was followed for Dibang catchment on 1:50,000 Survey of India topographical sheets. Directly draining catchment of river Dibang divides into nine sub watersheds.

Land use and land cover mapping of the study area was carried out by standard methods of analysis of data through remote sensing technique coupled with GIS, followed by ground truthing. Geo-coded LISS-III data on CD ROMs and hard copies on the scale 1: 50,000 (available for the year 2003) were procured for digital image processing and preparation of thematic maps. The landuse landcover map is prepared using GIS mapping where inputs of toposheets of the catchments area and satellite imageries are used to come out with the land use / land cover pattern. The prioritization of the hydrologic units within the vast catchments is based on the Sediment Yield Indices (SYI) of the smaller units. The subwatersheds are subsequently rated into various categories corresponding to their respective values.

For the catchment area treatment areas falling under very severe and severe erosion intensity categories i.e., 10539.56 ha will be required for treatment. Various engineering and bioengineering measures like brushwood check dams, contour bunding, gabion structures, loose boulder check dams and silt retention dams are suggested for the very severe and severe erosion intensity areas. In addition, biological measures like plantation of shrubs and trees are also suggested for these areas.

In the upper catchment of the subwatersheds brushwood check dams are proposed to control the erosion in the first order basin. The whole length of the streams are segmented into 50 m interval and depending upon the gradient a total of 1276 brushwood check dams are proposed. In first order basin in the lower reaches, where discharge is higher and valley length is less, at 30 m intervals loose boulder check dams are proposed. Therefore, a total of 768 loose boulder check dams are proposed. In those areas where discharge is much higher, 259 gabion structures are proposed. In those areas where erosion intensity is severe and very severe contour bunding is proposed. Therefore, a total of 82 contour bunding will be constructed. In third order and more than third order basin 124 silt retention dams are proposed. It is seen that about 12 % and 18 % of the area are composed of open forest and degraded forest /

abandoned jhum, respectively. Therefore, about 12 % of the total area of subwatershed shall be treated by means of plantation.

The plan needs to be implemented in a phased manner so as to attain the goals set successfully. Keeping in view the local topography and climate, it is proposed to complete the CAT programme in five years.

In order to help reduce the erosion of soil and its transport to the reservoir it is suggested to undertake plantation of shrubs as well as trees, wherever the soil characteristics permit, in the various subwatersheds. A total of 770 ha of land are proposed to be planted by different plant species.

BIODIVERSITY CONSERVATION & MANAGEMENT PLAN

The management plan for the conservation of the biodiversity of the area would include the planting of local shrubs in the catchment area so as to compensate the damage caused due to human interference that might occur during the project construction. It is proposed to afforest rare and endangered species over an area of 5 ha (as a part of compensatory afforestation) as a measure for ex-situ conservation and propagation. The propagation and cultivation of these species shall be done in co-ordination with the State Forest Research Institute (SFRI), Itanagar. During construction and operation phases and to prevent poaching in forest area around the project area, it is recommended that check posts be installed near major construction sites and labour camps. It is proposed to develop 4 check posts, which will have 8 guards and a range officer to ensure that poaching does not become a common phenomenon in the area.

FISH MANAGEMENT

High river discharge, fast water currents and want of suitable spawning ground in the lower reaches of the river are the reasons which force the fish to swim upstream in search of suitable eco-system to spawn.

Creation of a barrier in the form of a dam across the migratory path of some fishes may considerably undermine the survival and breeding of fishes. Hence hatchery in the nearby areas is the most suitable proposition for the fish population.

For the development of cold-water fishery in the area, construction of a Hatchery is the most important. The location of the hatchery can be identified somewhere near Etalin in consultation with the State Fisheries Department and State Fishery Colleges. The fish hatchery can be managed by the State Fisheries Department, which may be equipped with the technical know-how for running trout and carp culture fisheries. The total hatchery of 1.5 ha area would require about 15-20 kg seeds for the stocking in the first year.

GREEN BELT DEVELOPMENT

Although the forest loss due to the reservoir submergence and construction of other project appurtenances have been compensated as a part of compensatory afforestation. However, in addition to above, it is proposed to develop greenbelt around the perimeter of various project appurtenances, selected stretches along reservoir periphery, etc.

GEO-ENVIRONMENTAL MANAGEMENT PLAN

Geo-Environmental Management Plan is formulated to protect and/or improve the reservoir zone and to provide stability to the reservoir. There are 60 landslides in the reservoir area that are classified into small (10 landslides), medium (38 landslides) and large (12 landslides) categories based on their dimension and area. Following are the Mitigation Measures suggested for controlling the Landslide in the Project area

a. Rock anchoring, carving out of slopes, shot creting etc. should be planned.
b. The impact of landslide on the project could be managed by arresting the potential landslides zones through suitable engineering treatments like retaining walls, afforestation etc.
c. Landslide Control with Coir-Geotextile.

MUCK DISPOSAL PLAN

The Dibang Dam of 288 m height is proposed at 1.5 km upstream from Ashu Pani river near Munli in Lower Dibang Valley district of Arunachal Pradesh. The proposed project would involve a number of civil engineering activities leading to production of large quantities of muck. This muck would be excavated from the HRTs & TRTs

during the tunnelling, construction of desilting arrangement, underground power house complex, approach roads etc. Even though some of the muck will be utilized for back filling, yet a large quantity of the excavated material will need to be relocated and dumped in such a manner that it does not impose any negative impact on terrestrial and aquatic environment.

The total excavation quantity likely to be generated at the project will be around 177 lakh cum, out of which 59 lakh cum will be common excavation. Effectively, total rock excavation will be 117.8 lakh cum. Out of 117.8 lakh cum of total rock excavation, approximately 35 lakh cum will be used for production of aggregate and remaining 82.84 lakh cum will have to be disposed of. Adding 25% to 60% bulk factor for common excavation and rock excavation respectively, the quantity of muck to be disposed of would be 198 lakh cu.m. Three muck disposal areas have been identified for accommodating 198 lakh cum of muck generated. However, the capacity of the three dumping sites is 220 lakh cum. The unused material (198 lakh cum of muck) would be piled at an angle of repose at the proposed dumping sites. For the stabilization of dumped materials various engineering and phyto-remedial measures are being proposed in the management plan. The work plan formulated for re-vegetation of the muck disposal areas through “Integrated Biological and Biotechnological Approach”. The afforestation with suitable plant species of high ecological and economic value, which can adapt to local habitat, will be undertaken.

Areas of approximately 120 ha, would require phytoremediation measures. The Cost for remediation includes the cost of turfing of slopes, preparation of ground, spreading of manure, providing 5 cm of soil cover, provision of retaining wall and transportation and carriage etc. It also includes the cost of fencing, watch and ward, irrigation, etc.

RESTORATION PLAN FOR QUARRY AREAS

Three rock quarries namely DBR-1, DBR-2 and DBR-4 located within 5 km upstream of dam axis have been explored. The possibility of utilising excavated muck likely to be generated during excavation from dam abutments, powerhouse and tunnels (DBR-3, DBR-5 & DBR-6) was also explored to minimize quarrying from rock quarries.

Three shoals / fan deposits namely DBG-1, DBG-2 &DBG-3, located within 13.5 km downstream of dam axis have been identified and explored extensively to establish the suitability of the same for use as coarse and fine aggregate for concrete.

Only two quarry sites i.e. Epali Impervious soil deposit site DBC -2 (located 13.5 km downstream of Dam between Aya Korang fan deposit and Eme river), and Yagang Impervious soil deposit DBC-3 (30km downstream of Dam) will only require restoration. It is suggested that for stabilization, grass, herbs & shrubs should be grown over these slopes. An area of 82 ha will be required to be restored through engineering and biological measures. The plantation could be proposed over 60% of the quarry area to be restored. Remaining area i.e. 33 ha will be taken up for turfing.

LANDSCAPING AND RESTORATION OF CONSTRUCTION AREAS

As a part of various project related activities it is also proposed to develop nature parks, Children parks, gardens, and other recreation facilities near the project area once the construction activities of the project are over. During the construction of main features like Dam, Tunnels, Power House and other building structures of the project including residential and project roads, various slopes may be disturbed which shall be stabilized using bio-engineering measures like benching and terracing and plantation of grasses, herbs, shrubs and trees.

PUBLIC HEALTH DELIVERY SYSTEM

During the construction period of the project about 5000 workers who are migrant labourers along with their family members needs to get vaccinated against infectious diseases. The identified possible health threat due to dam construction and other peripheral activities as identified in the EIA study were analysed and suitable measures are suggested for mitigating the threats. Recommendations for regular health check-up and programme for checking endemic disease is also suggested. Suggestion for health facilities and infrastructure is made and cost estimation for the same also is given.

SOLID WASTE MANAGEMENT AND SANITATION FACILITIES

The residential colonies of the Dibang project will be located on the right and left bank of the Dibang River. The colonies will be of two types, one for the NHPC employees

and their families, with an approximate population of 800, and, the other for labourers, with an approximate population of 5000 (peak labour requirement). In addition to this, during construction stage it is expected that about 100-200 people from nearby villages will visit project site everyday for commercial purposes and constitute the regular floating population. This floating population may also generate Solid Waste Management System.

The quantity of waste generated in Indian cities reported to be in the range of 0.2-0.6 kg/capita /day as per the "Manual on Solid Waste Management" prepared by Central Public Health & Environment Engineering Organisation (CPHEEO), Ministry of Urban Development, Govt. of India. As the major share of the population is labour force in Dibang, the waste generation factor of 0.3 kg/capita/day has been taken into consideration.

The recommended Solid Waste Management system for the project is presented below:

- Segregation of Solid Waste at source
- Storage & primary collection of waste from project colonies, offices, guest houses, labour colonies/sheds, minor commercial establishments, market, community centre, Hospitals, workshops, canteen/mess, school, garden, parks etc.
- Waste Transportation mechanism
- Waste Storage Depots/enclosures
- Waste Processing & Disposal

Administratively, a Solid Waste Management Committee (SWMC) comprising of the project representatives will look after the management of solid waste. The SWMC will be supported by sanitary workers, sweepers etc., the number of which may be decided by the SWMC after assessing the work requirement.

For biodegradable part of SW, it is recommended to plan a Composting Plant of about 1 ton per day capacity. The land requirement etc. could be based on 1 ton per day capacity, but initially, the composting process may be started with requirement of present day only (0.8 ton/day capacity). The compost plant may follow Windrow

Composting Technology which has been recommended as a suitable technology for Indian conditions.

In order to handle the present load of biodegradable waste (around 1 ton/day), around 267 m^2 of area would be required for windrow-platform. As per the requirements of the Municipal Solid Waste (Solid Waste Management & Handling) Rules 2000, land filling would be restricted to non-biodegradable, inert waste and other waste that are not suitable either for recycling or for biological processing.

ENERGY CONSERVATION MANAGEMENT PLAN

It is estimated that during the construction of the project, which would last for about 8 years, around 5000 labourers will be working. To provide an alternate for the energy requirement of the workers, contractor/s will be made responsible to provide subsidized kerosene/LPG to their workers which will in turn discourage them from illegal tree felling and removal of fuel wood and timber from the adjoining forests. Further, community kitchen facilities would also be provided to the labourers by the contractors. Conventional Kerosene oil Stoves is a good substitute for fuel wood and will be distributed amongst the workers and the locals in the nearby villages. The distribution of the pressure cookers may also be taken as one of the attractive option for energy saving. Improved chulhas are scientifically designed for optimal regulation of heat flow and better fuel utilization

RESETTLEMENT AND REHABILITATION PLAN

As presented in the EIA report five villages falling in the submergence areas of Dibang Multipurpose Project will be fully affected. The number of the families inhabiting in these villages are 72. The total population of these households is 243. Seventy-two families staying in five villages are to be relocated. Total land of fully affected families getting affected is 938.8 ha.

It was seen that among all the five villages the highest population was in New Anaya village (36) followed by Sukla Nagar (19), Kano(13), Peely(7) and Eprali (6) respectively.

Due to project activities some 14 families will be partially affected having a population

of 58. The total lands of these families are estimated as 557 ha and also an additional land area of 1080.5 ha of community land will be affected. Thus total private land getting affected is 2576.3 ha.

Majority of the affected families are involved in wet rice cultivation and jhum cultivation. So they would have to be compensated for their cultivable land as well as homestead. Following are the major R & R measures, which are proposed:

1. Project Affected Families will be resettled to a new location of their choice. The resettlement colony shall be selected in consultation with the District / State Administration.
2. **Cultivable land:** One-hectare land to be provided to each fully affected family. The PAF will be compensated for remaining cultivable land coming under submergence. If the land is not available the cost @ Rs. 1.75 lakh/ha shall be provided.
3. **Homestead land:** Each fully affected family will be provided homestead land of 200 sq m (0.02 ha) in resettlement site.
4. **House construction grant:** A sum of Rs. 1.5 lakh (Rupees One lakh fifty thousand only) will be paid to each displaced fully affected family for the construction of houses in the resettlement colony.
5. Landless grant @ Rs. 50,000 per PAF will be given to PAFs rendered landless after acquisition.
6. Eligible person grant to @ Rs. 40,000 per PAF will be given to PAFs left with less than 1 ha land after land acquisition.
7. **House shifting grant:** The PAFs will be allowed to retrieve materials from their original house. In addition an amount of Rs. 20,000 per PAF will be given to each fully affected family as house shifting grant (transportation grant).
8. Financial assistance @ Rs. 15,000 per PAF will be given for construction of cattle shed.
9. Land development charges @ Rs. 20,000 per PAF will be given.
10. Livelihood grant of 1000 days minimum agricultural wages (MAW) @ Rs. 100/day (tentative) to PAFs rendered landless after land acquisition.
11. Livelihood grant of 750 days minimum agricultural wages (MAW) @ Rs. 100/day (tentative) to PAFs left with less than 1 ha of land after acquisition.
12. Monthly subsistence allowance @ Rs. 2,000 per month for one year will be

given to fully affected families.

13. **Infrastructure facilities:** In addition to above, the following infrastructure is proposed to be developed in the resettlement colony:
    - Piped water supply
    - Community toilets
    - Sewage treatment facilities & sewerage system
    - Electrification
    - Shopping complex
    - Primary health centre (PHC) / Hospital
    - Community centre
    - Vocational activity centre
    - School complex including playground
    - Children park
    - Avenue plantation & block plantation
    - Approach road up to resettlement colony
    - Internal roads in resettlement colony
    - Irrigation facilities
14. Vocational training and scholarship shall be provided for PAFs.
15. For land of partially affected families and for community land compensation will be given @ Rs. 1.75 lakh/ha. (Budget for this has already been kept in DPR under B-land).

DISATER MANAGEMENT PLAN

The study of catastrophic flooding that may occur in the event of a dam failure is of great concern and importance because of the risk of life and property in the potentially inundated reaches downstream of the structure. In fact the evaluation or determination of the submersion wave of dam break due to extreme flood events is an initiative needed for defining the risk of submergence of areas located downstream of the existing dams and consequently to prepare protective measures, both active (reservoirs, dikes) and passive (emergency and evaluation plans) in the areas affected.

The topographic characteristic varies significantly within the computation domain. The river passes through deep gorges, terrains with pebbles and boulders and then through alluvial plains. Most of the portion on downstream of the dam lies in the plains.

The expected flood due to the failure of the proposed dam has been analyzed. The channel sections for the entire width presented in the fig 15.6 have been approximated as parabolic channel for the purpose of computing dam break flow passing over the terrain. The difference in flow depth computed by the (i) concept of rectangular channel of limited width and (ii) concept of parabolic channel of entire cross section. From the comparison it is clear that the flow depth computed by considering the parabolic channel is realistic as the depth drops with the expansion of the channel, which is logical. However, for making disaster management plan we suggest to increase the depth by 10% than that computed by the parabolic section, as the channel section has been approximated.

In the event of any breach, it is to be ascertained that losses to lives and properties could be kept at minimum by administering the feasible measures. To achieve this, non-structural measures are found to be substantially affective. The important measures are:

i. To provide flood forecasting services and quick dissemination of forecasts to important and heavily populated towns, villages, including other potential areas.
ii. To formulate flood proof communication system, and
iii. To form a disaster mitigation network/system, including relief fund.

It is suggested that the project authorities should prepare some thing like a mission plan which can be called as master plan setting out the over all frame work within well laid policies.

Plans at lower levels like districts, sub division should be worked out in consultation with local administration and communities. At this level it should be tailor made to more specific confidences.

The project area being under seismic Zone-V disaster management gains much

importance both due to earthquake, change of river courses and floods. Financial provisions for a corpus fund and annual budgetary provisions for ten years are included in the EMP. However the project authorities in collaboration with the district administration, concerned Flood Control Boards and disaster management cells established under Govt. of India should collaborately plan out a strategy for making full preparedness to reduce the damage to life and property and misery of the people.

Emergency Action Plan includes evacuation plans and procedures for implementation based on local needs. These are:

- demarcation/prioritization of areas to be evacuated,
- notification procedures and evacuation instructions, .
- safe routes, transport and traffic control.
- Shelter areas, and
- functions and responsibilities of members of evacuation team.

The flood prone zone in the event of dam break of Dibang shall be marked properly at the village locations with adequate, factor of safety. As the flood wave takes sufficient time in reaching these villages, its population shall be informed well in time through wireless and sirens etc. so that people may take shelter at some elevated place beyond the flood zone which has been already marked as safe.

The copies of the Emergency Action Plan should also include the inundation map, which would be displayed at prominent locations and in the rooms and locations of the personnel named in the notification chart. Inundation maps will be displayed in the Village Panchayats nearby the project area and also of the villages falling under flood prone zone. For speedy and unhindered communication, a wireless system will be a preferable mode of communication. Telephones would be kept as backup, whenever required.

The Dam break analysis of Dibang dam has been carried out using three different FD schemes. Out of all these schemes the most convenient one, namely the FD Diffusive scheme has been tested for its validity with laboratory data generated elsewhere and then adopted for computing various information, required for preparation of disaster management plan to mitigate flood hazard in the event of failure of the dam. Computed result has shown that several villages located at the downstream side of

the dam is expected to be flooded in the event of instantaneous failure. The inundation area shown in the fig will be more by 10% in terms of depth of submergence. This has to be taken into consideration as a safety margin, while preparing the actual disaster management plan for any eventuality of breaking of the DAM.

MAINTENANCE OF AIR, WATER AND NOISE QUALITY

At present no developmental activities such as industries etc. are going on in the upstream of the catchments as well as proposed reservoir, therefore, any probabilities of water quality degradation are minimal. From the water testing results as shown in EIA report it can be well inferred that the quality of water of the Dibang river is reasonably of good quality. Also, that there are hardly any human habitations draining their refuse into the river which could charge the nutrient status of the river waters and bring about degradation of the Dibang aquatic eco-system. However, the project authority should take effective and proactive measures to ensure that such activities would not be carried out in the upstream catchment, which may bring about water quality degradation in the future as well. Necessary financial outlay for establishing water quality testing has been kept in the Plan for Environmental Monitoring.

In case of Hydropower Projects the Air and Noise pollution basically occur during the construction period when different project related activities like stone crushing, use of diesel generators, muck disposal, etc are undertaken. It is therefore recommended that necessary preventive measures be taken during all those activities that can lead to air and Noise pollution. The various crushers need to be provided with wet scrubbers to control the dust generated while crushing the stone aggregates. It should be made mandatory for the Contractor involved to install cyclone separators/ scrubbers in crushing plants. During the execution of the project, due care has to be exercised to minimise the exposure of workers to excessive noise. As far as possible even consideration is to be given to locate the Site office, Stores, etc. in the minimal noise locations. Appropriate safety measures for workers (e.g., protective equipment for workers like ear protectors, ear muffs, ear plugs / defenders) to protect from high noise levels need to be adopted.

ENVIRONMENTAL MONITORING PROGRAMME

Monitoring becomes essential to ensure that the mitigation measures planned for

environmental protection function effectively during the entire period of project operation. It will also allow for validation of the assumption and assessments made in the present study.

An Environmental Monitoring Cell (EMC) will be formed in order to assess and review the progress of the various mitigation measures suggested in the Environmental Management Plan. The committee will sit at predetermined intervals for verifying progress and reporting the same. The project authority shall depute a Senior Officer to coordinate with the monitoring committee.

The project authority will engage neutral agency or organization for supervision and monitoring of the environmental management components as discussed below. The project authority will also depute a full time Sr. Officer to look and co-ordinate the progress of the environmental management activities. The independent supervising agency will work closely with the project environmental cell and will carry out necessary laboratory analysis, collection of data's and information regarding the progress and will prepare the progress report in every two months and will present to the Monitoring Committee through the environmental cell. For any major comments or obstacles the independent agency may call a meeting where representatives from independent agency, project authority and environmental committee will be present and any issue may be discussed in the meeting. The major progress report will be with respect to:

- Progress of Catchment Area Treatment works, fish management etc.
- Status of protection measures, sausage / gabion walls etc. at the dumping and quarry sites.
- Whether dumping is done so as to avoid spillage of muck into the river, especially during rains.
- Leveling and slope stabilization works at dumping sites.
- Status of afforestation / turfing works on the dumping/quarry sites.

Based on the findings of the Environmental Impact Assessment study in various Environmental Management Plan the important parameter viz. Catchments Area Treatment, Biodiversity Conservation & Management, Public Health Delivery System,

Fish Management, Restoration of Dumping Sites, Quarry areas, Landscaping and Restoration of Construction Area, Green Belt Development etc. have been proposed.

The surface water quality of the proposed reservoir and river Dibang should be monitored twice a year (one in a pre-monsoon and another in a post-monsoon season). About 6 samples need to be analysed. This analysis shall be done up to the commissioning of the project.

Air Quality will also be monitored by the cell in terms of SPM, SO_x and NO_x quarterly so that degradation of ambient air quality if any is brought into notice in a particular period. Status of afforestation programmes, changes in migration patterns of the aquatic and terrestrial fauna species soil erosion rates, slope stability of embankment, etc. should be studied. The study could be undertaken with a frequency of every 5 years till the commissioning of the project.

Identification of water-related diseases, sites, adequacy of local vector control and curative measures, status of public health are some of the parameters which should be closely monitored once in two year with the help of data maintained in the government dispensaries/hospitals.

In addition to above following parameters will also be monitored by the EMC:

- Status of protection measures, sausage/gabion walls etc. at the dumping and quarry sites.
- Levelling and slope stabilization works at dumping sites.
- Status of afforestation / turfing on the dumping/quarry sites.

COST OF EMPs

Total cost of Environment Management Plans is Rs. 3686 lakhs, the break-up of which is as below:

Sl. No.	**EMP Component**	**Rs. (Lakhs)**
1.	Catchment Area Treatment	**813.00**
2.	Bio-diversity Conservation & Management Plan	**40.00**

3.	Fish Management	**112.00**
4.	Green Belt Development	**80.00**
5.	Geo-Environmental Management Plan	**755.00**
6.	Muck Disposal Plan	**213.00**
7.	Restoration Plan for quarry areas	**91.00**
8.	Landscaping And Restoration of Construction Area	**135.00**
9.	Public Health Delivery System	**214.00**
10.	Solid Waste Management and Sanitation Facilities	**185.00**
11.	Energy Conservation Management Plan	**40.00**
12.	Resettlement And Rehabilitation Plan	**671.00**
13.	Disaster Management Plan	**255.00**
14.	Maintenance of Air, Water And Noise Quality	**4.00**
15.	Environmental Monitoring Programme	**78.00**
	TOTAL	**3686.00**