ENVIRONMENTAL IMPACT ASSESSMENT (EIA)
SUBANSIRI UPPER HYDROELECTRIC PROJECT (1605 MW)
UPPER SUBANSIRI DISTRICT, ARUNACHAL PRADESH
(Sector 1(c); Cat "A")

Executive Summary
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Prepared for:

M/s NHPC Ltd.

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QCI Certificate No.	**NABET/EIA/25-28/RA 0415**
Laboratory	**AGSS Analytical and Research Lab (P) Ltd.** **An ISO-9001 : 2015 Accredited Laboratory** **(NABL Accredited Testing Laboratory)**
Baseline Data Monitoring Period	**Winter (December 2024 - January 2025)**
	Pre-monsoon (April 2025 – May 2025)
	Monsoon (June 2025 – July 2025)

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EXECUTIVE SUMMARY

1.0 INTRODUCTION

This Environmental Impact Assessment (EIA) report has been prepared for the Subansiri Upper Hydroelectric Project (HEP), which proposes an installed capacity of 1605 MW. The objective is EIA study is to ensure that potential environmental impacts are comprehensively evaluated and addressed during the planning, construction, and operational phases of the project. The report has been developed in compliance with the EIA Notification, 2006, and its subsequent amendments, which outline the mandatory procedures for conducting EIA studies and obtaining Environmental Clearance for such projects.

Subansiri Upper HEP has been indicated to NHPC Ltd. vide Ministry of Power letter dated 22.12.2021 for its development and Government of Arunachal Pradesh (GoAP) approved allotment in favour of NHPC Ltd. on 21.07.2023. Subsequently, a Memorandum of Agreement was signed between GoAP and NHPC Ltd. on 12.08.2023 for development, commissioning, implementation, operation and maintenance of Subansiri Upper HEP on Build, Own, Operate and Transfer (BOOT) basis for a lease period of 40 years from the commercial operation date (COD).

Scoping clearance of Subansiri Upper HEP with installed capacity of 1605 MW was accorded by Ministry of Environment, Forests & Climate Change (MoEF&CC), Government of India vide Terms of Reference (TOR) Identification No.: TO24A0501AR5351670N dated 07/09/2024.

2.0 PROJECT LOCATION & APPROACH

Subansiri Upper HEP Dam site is proposed at about 1.5 km upstream of Menga village, about 25 km upstream of Daporijo, the Head Quarters of Upper Subansiri District of Arunachal Pradesh. It is 285 km away from State Capital Itanagar. The project is well connected with metalled road from various important locations. The nearest Railhead is at Naharlagun which is 265 km from Daporijo and Dibrugarh Airport which is about 265 km from Daporijo. The Co-ordinates of Subansiri Upper HEP dam site are Latitude: 28°06’45” N and Longitude: 94°09’48” E. Location map of the project is given as **Figure 1**.

The project headquarters and township will be at Pissa Village located at 8 km from project site and 16 km for Daporijo, the district headquarter of Upper Subansiri District of Arunachal Pradesh. Daporijo is 265 km from Itanagar, the capital city of Arunachal Pradesh and 286 km from Hollongi airport. On the other side Daporijo is 275 km from Dibrugarh airport via Silapathar-Likabali-Basar (HQ of district Liporada) road. The nearest broad gauge railhead is Naharlagun (Itanagar) and also Silapathar in Assam. However, when road from Daporijo via Pakka Gongo to Gerukamukh is completed the nearest rail head shall be Gogamukh in district Dhemaji (Assam). The nearest operational airport is Hollongi and Dibrugarh which is 286 km and 275 km respectively from district HQ Daporijo. However, airport at Zero is also operational which connects to Itanagar and the airport at Zero is 161 km from Daporijo.

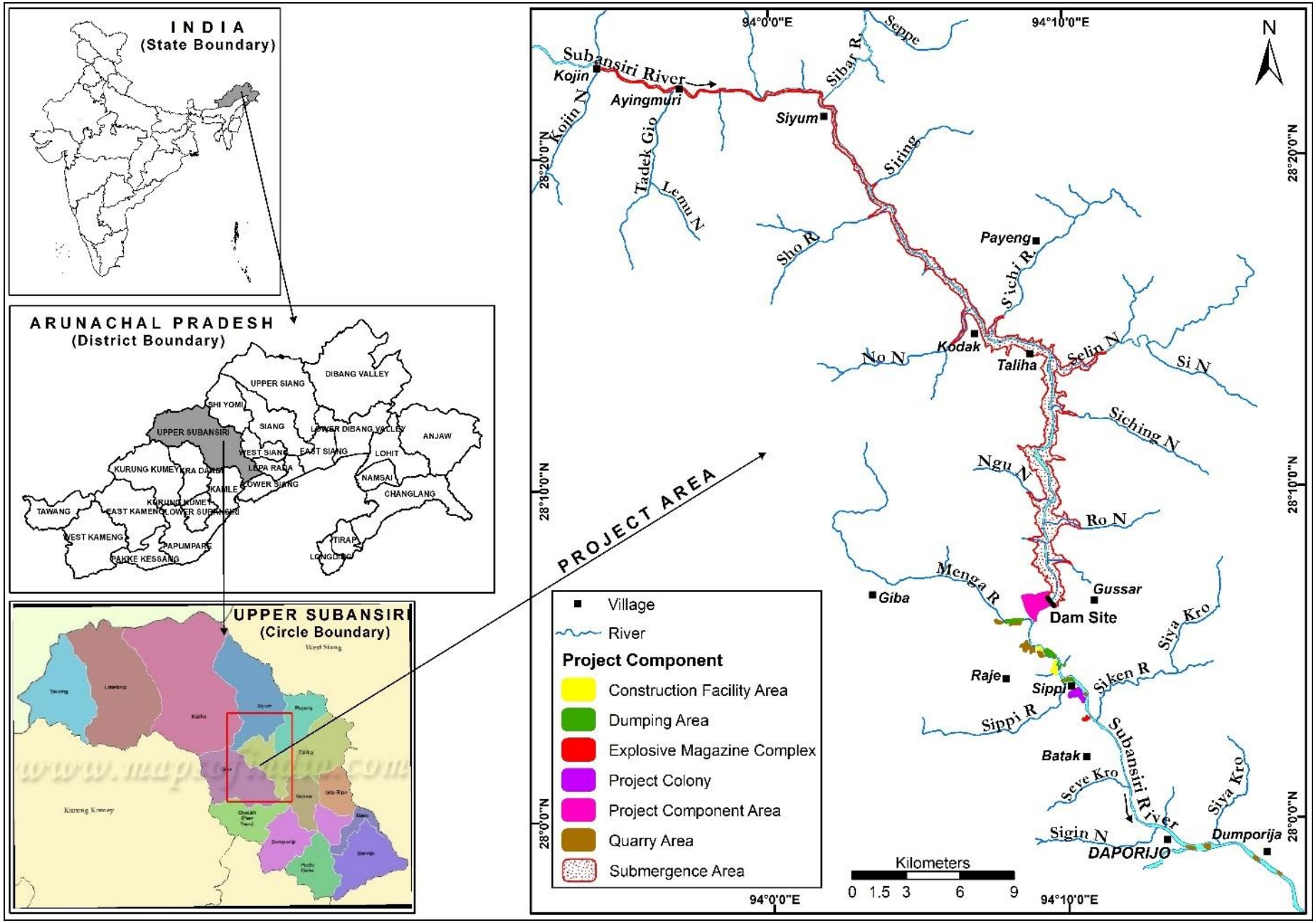

Figure 1: Location Map of Subansiri Upper HEP

3.0 PROJECT DESCRIPTION

Subansiri Upper HEP envisages the construction of a 237m high dam from the deepest foundation level with top width of 15m.

Subansiri Upper HEP is proposed to be a storage project with objective of power generation and flood moderation considering exclusive storage of 10m above FRL. The proposed project utilize the gross head of about 195.46m between the Full Reservoir Level (FRL) EL460m and Max Tail Water Level (TWL) at EL 264.54m at TRT outlet. Flood storage of 10m above FRL i.e., MWL EL 470m has been kept as per integrated flood moderation study of Subansiri basin. The main components of the project are proposed as below:

- Three 11.0 m diameter, horseshoe-shaped diversion tunnels, located at the right bank, are proposed along with upstream and downstream cofferdams for diverting the Subansiri River. The lengths of three diversion tunnels are 703.0m, 791.0m and 1031.0m. The diversion tunnels are provided for a design flood of 3813 Cumec. The inlet structures are located about 400.0m upstream of the dam axis with invert level at the riverbed level El 256.00m. The outlet structures are located about 450.0m downstream of the dam axis at El 253.00m.
- To facilitate the construction of the concrete dam, two cofferdams located upstream and downstream of the dam axis located at about 200.0m u/s and 350.0m d/s of dam axis respectively. The height of coffer dam at upstream and downstream is 39.0 m and 20.0 m, respectively.
- A concrete Gravity dam 237m high from its deepest foundation level and 518m long at dam top level EL 472m. Reservoir levels are FRL- EL 460m, MWL -EL 470m and MDDL - EL 420m.
- Spillway consisting of 6 bays of 6.0m (width) x 10.0m (height) main spillway, 2 nos. auxiliary spillway of opening 6.0m (Width)X 10.0 m(Height) and 6 No. construction sluices of size 4.0m(width) x 4.5m (height).
- Power intake four numbers located in right bank. Three Power Intake (for HRT-1, 2 & 3) has opening size 2Nos x 5.0m(Width) X 11.0m(Height) and fourth one (HRT-4) has opening size 2Nos x 3.5m(Width) X 8.0 m(Height) at invert level EL 398.0m.
- Four nos. HRT in which, HRT-1 HRT-2& HRT-3 are of size 11.0m and HRT-4 are of size 8.0m of Horse shoe shape and length 462m to 650m located in right bank.
- Four nos. of Pressure shafts (PS), circular steel lined, PS-1 size is 8.0 m, PS-2 & PS-3 size are 7.7 m and PS-4 size are 6.6 m which further bifurcates into 5.1m for all main unit and 3.5m for auxiliary unit at lower bottom portion near power house.
- Underground power house cavern of size 283m (L) x 24m (W) x 58 m (H) housing 7nos. main units of 215 MW each and an auxiliary unit of 100 MW.
- Transformer, GIS cum draft tube gate operation cavern of size 285m (L) x 20m (W) x 31.70 m (H) located d/s of power house cavern.
- Eight nos. Unit TRT, in which Unit TRT -1 to 6 are of size 9m, Unit TRT- 7 is of size 7.75m and Unit TRT -8 of Auxiliary unit is of size 5.5m Horse shoe shape and 133m to 145m long.
- Four nos. of main TRT, TRT-1 to TRT-3, each of size 11 m and TRT-4 of size 8.0 m Horse shoe shape of length varying from 90m to 130m.

- A pothead yard of size 160.0m x 50.0m is proposed at El 320.0m towards south of Power House on the right bank of river.
- To facilitate the construction and operation of the project components, suitable Adits and Access tunnels have been proposed.

The salient features of the Project are as shown in **Table 1**. Layout map of the project is shown as **Figure 2**.

Table 1: Salient Features of the Project

LOCATION	
State	Arunachal Pradesh
District	Upper Subansiri
River	Subansiri
Dam Site	28°6'34.05"N, 94°9'20.45"E 1.5 km U/S of Menga Village and about 25 km from Daporijo
HYDROLOGY	
Catchment Area	14665 km^2
Average Annual Rainfall	2027 mm
Water Availability	18937 MCM
Maximum Temperature	39.5°C
Minimum Temperature	11.5°C
Maximum Observed Discharge at Dam Site	6178 cumec
Minimum Observed Discharge at Dam Site	41 cumec
Probable Maximum Flood (PMF)	13097 cumec
River Diversion Flood (1 in 25 non-monsoon)	3813 cumec
Glacier lake outburst flood (GLOF)	1817 cumec
Ecological Release during Lean period	21.77 cumec
RESERVOIR	
Maximum Water Level (MWL)	El. 470.00m
Full Reservoir Level (FRL)	El. 460.00m
Minimum Draw Don Level (MDDL)	El. 420.00m
Gross Storage at MWL	1988 MCM
Gross Storage at FRL	1755 MCM
Gross Storage at MDDL	1010 MCM
Surcharge Storage	233 MCM
Live Storage	745 MCM
Surface Area at FRL	22.20 sq km
Reservoir Length	49.5 km
DIVERSION TUNNELS	
Number	3 nos.
Diameter	11.0m, Horse shoe shaped
Length	700m to 1030m
Diversion Capacity	3813 cumec
Height of upstream cofferdam	39m
Height of downstream cofferdam	20m
CONSTRUCTION SLUICE	
Number	6 nos.
Size (W x H)	4 m x 4.5 m
Crest Level	El. ± 272 m
DAM	
Type	Concrete Gravity
Top Elevation of Dam	El. 472.00 m
Height of dam above deepest foundation level	237 m
Length of dam at top	518 m
SPILLWAY	
Design Flood	11000 cumec
Type	Orifice Type

CREST ELEVATION	
Lower Level	El. 358 m
Upper Level	El. 430 m
NUMBER & SIZE OF SPILLWAY OPENING	
LOWER LEVEL	
Number	6 nos.
Size (W x H)	6.0 m x 10.0 m
UPPER LEVEL	
Number	2 nos.
Size (W x H)	6.0 m x 10.0 m
Energy Dissipation	SKI Jump
Length of Spillway	112 m
ARRANGEMENT FOR E-FLOW	
During monsoon	Through Main and Auxiliary Power house units
During Pre & Post monsoon	Through Auxiliary Power house units
During Lean period	Through Main or Auxiliary Power house units
E-Flow Outlet	Auxiliary TRT outlet at plunge pool
INTAKE	
Number	4nos
Invert elevation	El. 398.00m
Size of Gate opening in each Intake	
HRT 1 to 3	6 nos. 5.0 m (W) x 11.0 m (H)
HRT 4	2 nos. 3.5 m(W) x 8.0m (H)
Trash Rack	Inclined Type
HEADRACE TUNNEL	
Number	4 nos.
Size	
HRT 1 to 3	11.0 m
HRT 4	8.0 m
Shape	Horseshoe
Length	Varying from 462 m to 650 m
Design Discharge	
HRT 1 to 3	281.80 cumec
HRT 4	206.43 cumec
Discharge with 10% overload	
HRT 1 to 3	309.98 cumec
HRT 4	227.07 cumec
PRESSURE SHAFT	
Number	4 nos.
Shape	Circular
Diameter	
Pressure Shaft 1	8.0 m
Pressure Shaft 2 & 3	7.7 m
Pressure Shaft 4	6.6 m
Height	150.10m
Length	69.5 m
PENSTOCK	
Number	8 nos.
Shape	Circular
Diameter	
Penstock 1 to 7	5.1 m
Penstock 8 (Auxiliary)	3.5 m
Length	
Penstock 1, 3, 5 & 7	50 m
Penstock 2, 4, 6 & 8	35 m
Design Discharge	
Penstock 1 to 7	140.9 cumec
Penstock 8 (Auxiliary)	65.53 cumec
Discharge with 10% Overload	
Penstock 1 to 7	154.99 cumec

Penstock 8 (Auxiliary)	72.08 cumec
POWERHOUSE	
Type	Underground
Installed Capacity	Total - 1605 MW
	7 X 215 MW (Main Unit)
	1 x 100 MW (Auxiliary Unit)
Number of Units	8
Cavern Size	283 m (L) x 24 m (W) x 58 m (H)
Type of Turbine	Francis
Design discharge per unit for Main Units	140.9 cumec
Design discharge for Auxiliary Units	65.53 cumec
Discharge with 10% overload per unit for Main Units	154.99 cumec
Discharge with 10% overload for Auxiliary Units	72.08 cumec
Turbine centre line elevation Main unit & Auxiliary unit	EL 246.40 m/ 246.40 m
Bottom of Runner Removal Gallery Main unit & Auxiliary unit	EL 238.70 m / 241.10 m
Pump Floor level Main unit	EL 241.70 m
Turbine Floor Level Main Unit & Auxiliary Unit	EL 250.60 m
Generator Floor level Main unit & Auxiliary unit	EL 255.10 m
Operating Floor & Service Bay level Main unit & Auxiliary unit	EL 261.50 m
Design Head	168.0 m
TRANSFORMER, CUM DRAFT TUBE GATE CAVERN	
Cavern Size	285 m(L) x 20 m (W) x 31.70 m (H)
Draft Tube Gate Size	
Draft Tube 1 to 6	7.4 m (W) x 9 m (H)
Draft Tube 7	6.5 m (W) x 7.75 m (H)
Draft Tube 8	4.6 m (W) x 5.5 m (H)
Transformer floor level	El. 282.30m
GIS floor level	El. 296.30m
Unit TAIL RACE TUNNEL	
Number	8 nos.
Size	
Unit TRT 1 to 6	9 m
Unit TRT 7	7.75 m
Unit TRT 8 (With Auxiliary Unit)	5.5 m
Shape	Horseshoe
Length	133 m to 145 m
Design Discharge	
Unit TRT 1 to 7	140.9 cumec
Unit TRT 8 (With Auxiliary Unit)	65.53 cumec
Discharge with 10% Overload	
Unit TRT 1 to 7	154.99 cumec
Unit TRT 8 (With Auxiliary Unit)	72.08 cumec
TAILRACE TUNNELS	
Number	4
SIZE	
TRT 1 to 3	11 m
TRT 4	8.0 m
Shape	Horseshoe
Length	90 m to 130 m
Design Discharge	
Unit TRT 1 to 3	281.80 cumec
Unit TRT 4	206.43 cumec
Discharge with 10% Overload	
Unit TRT 1 to 3	309.98 cumec

Unit TRT 4	227.07cumec
Minimum Tail Water Level	El. 258.32 m
Maximum Tail Water Level	El. 264.54 m
Maximum Tail Water Level for Flood (PMF + GLOF) (14914 cumec)	EL (280.30m)
Main Unit Gate Numbers and Size	2 nos., 6.0 m (W) x 11 m(H) each
Auxiliary Unit Gate Numbers and Size	2 nos., 5.0 m (W) x 8.0 m(H)
Gate Operating Deck Level	EL 282.30 m
CONSTRUCTION ADIT/ ACCESS TUNNEL	
Main Access Tunnel (MAT) to Power House	8 m (W) x 10 m (H) D-shape, 545 m Length 8 m Dia. D Shape, 115 m Length
Main Access Tunnel to Transformer cum Draft Tube Gate Operation Cavern	8 m Dia. D Shape, 105 m Length
Adit to Pressure Shaft Top Erection Gallery	7 m (W) x 10 m (H) D-shape, 830 m Length
Adit to Pressure Shaft Bottom	7 m (W) x 10 m (H) D-shape, 470 m Length
Adit to HRT	7 m dia. D-shape, 460 m Length
Adit to Powerhouse cavern top	7 m dia. D -shape, 262 m Length
Adit to Transformer cavern top	7 m dia. D- shape, 223 m Length
Adit to unit TRT/ TRT	7 m dia. D- shape, 625 m Length
Pressure Shaft Erection Gallery	4 nos., 11.5 m (W) x 10 m (H) D Shape, 26 m Length each
POTHEAD YARD	
Size	160 m (L) x 50 m (W)
Elevation	EI. 320.00 m
POWER GENERATED	
Installed Capacity	1605 MW
Annual Energy Generation in 90% Dependable Year	6131.55 MU

Source: DPR of Subansiri Upper HEP

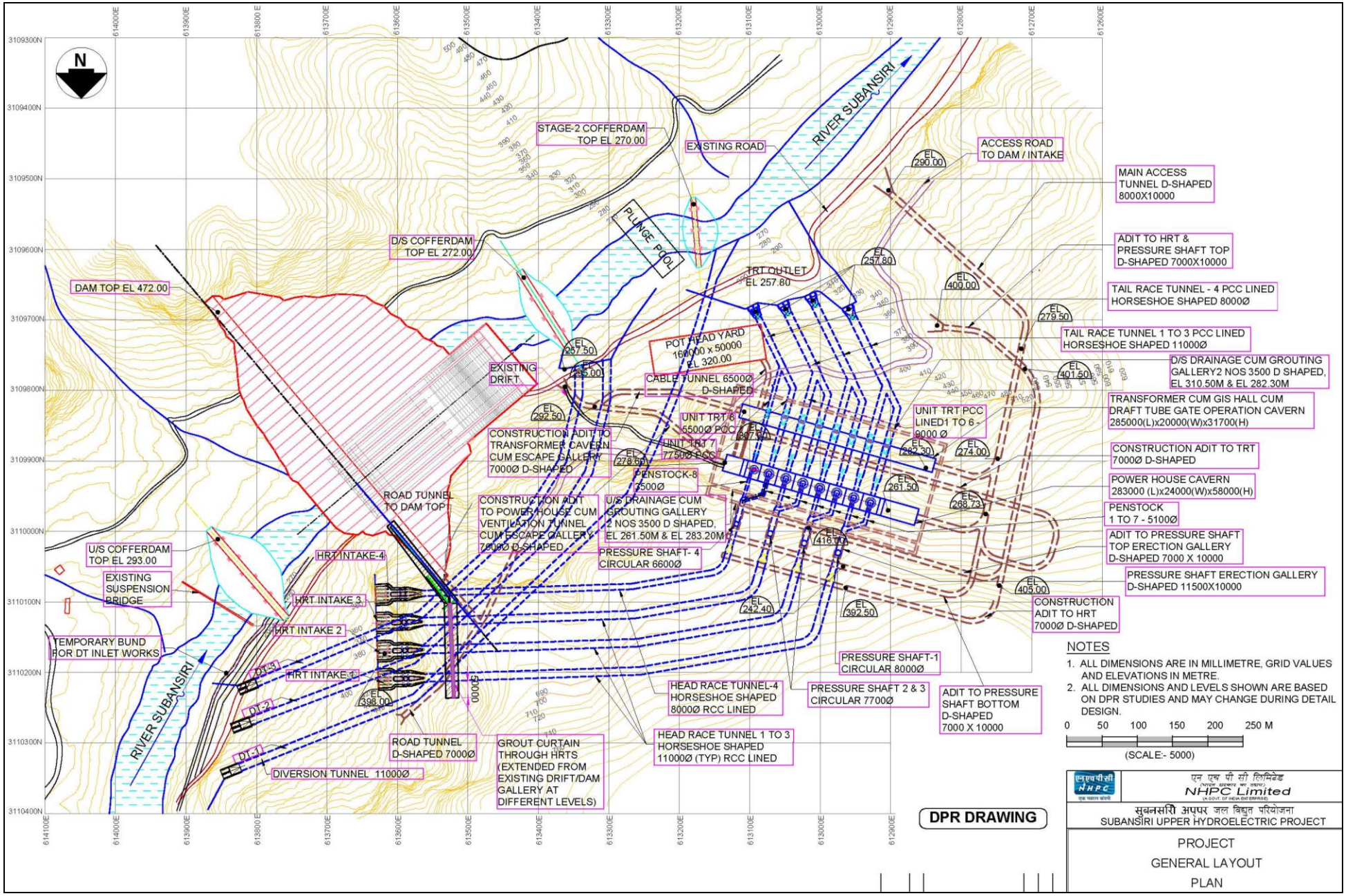

Figure 2: Project Layout of Subansiri Upper HEP *(Source: DPR of Subansiri Upper HEP)*

3.1 Land Requirement

The total land requirement for the proposed Subansiri Upper HEP is estimated as 2733 ha, all of which consists of forest (Unclassed State Forest) land. The submergence area at MWL i.e. EL 470 m will cover 2417.47 ha. The details are given in **Table 2**.

Table 2: Permanent Land Requirement for the Project

PURPOSE	AREA (in ha)			LOACATION
	Right Bank	Left Bank	Water bodies	
Submergence area at EL 470 m	932.66	1047.3	437.51	Along the Subansiri River on U/s of Dam site at Menga
Project Component	145.48	21.74	7.76	
Project Infrastructures	35.00	0.00	0.00	Pisa colony
Quarry Area				
Mara River shoal Deposit	10.83	0.00	0.00	
Menga Rock quarry	11.67	0.00	0.00	1.5 km on Right Bank of River Menga on Menga to Giba Road
Sippi River Shoal Deposit	5.46	0.00	0.00	Near Sippi
Sippi Downstream River Shoal Deposit	1.55	0.00	0.00	Near Sippi
Daporijo River Shoal Deposit	5.3	0.00	0.00	Near confluence of Sigin river with Subansiri river
Subansiri Island Shoal Deposit	7.39	0.00	0.00	Near Daporijo
Dumporijo River Shoal Deposit	4.46	0.00	0.00	Dumporijo
Dumporijo Left Bank River shoal deposit	0.00	2.39	0.00	Dumporijo
Total Quarry Area	**46.66**	**2.39**	**0.00**	
Muck Disposal Area	35	0.00	0.00	On the banks of Menga river and on the banks of Subansiri river
Magazine area/Store	4	0.00	0.00	Location 11.2 km from Daporijo
Project Store	16	0.00	0.00	Location 16 km from Daporijo
Contractor facility/colony	0.00	1.5 ha	0.00	Opposite Menga Village on left bank of River
Total	**1214.8**	**1072.93**	**445.27**	
Total Land Requirement	**2733.00**			

Source: DPR of Subansiri Upper HEP

3.2 Proximity to Protected Area

No project component falls in any notified protected area. Nearest Protected Area to the Project Components is Nidak Danyi Wildlife Sanctuary (WLS) which is at a distance of around 10.6 km from proposed reservoir tail-end on Selin Nala.

4.0 DESCRIPTION OF THE ENVIRONMENT

Data on the existing environmental parameters in the study area delineated as per the approved Terms of Reference (ToR) for EIA studies by Ministry of Environment, Forest & Climate Change (MoEF&CC) were collected to understand the present setting of the environment at the project site. The field surveys for the collection of primary data were conducted between December 2024 and July 2025 covering winter, pre-monsoon/summer, and Monsoon seasons to collect data/ information on various environmental and social

parameters. A map of the study area prepared as per the approved ToR is given in **Figure 3**. The base line status is described briefly in the following sections.

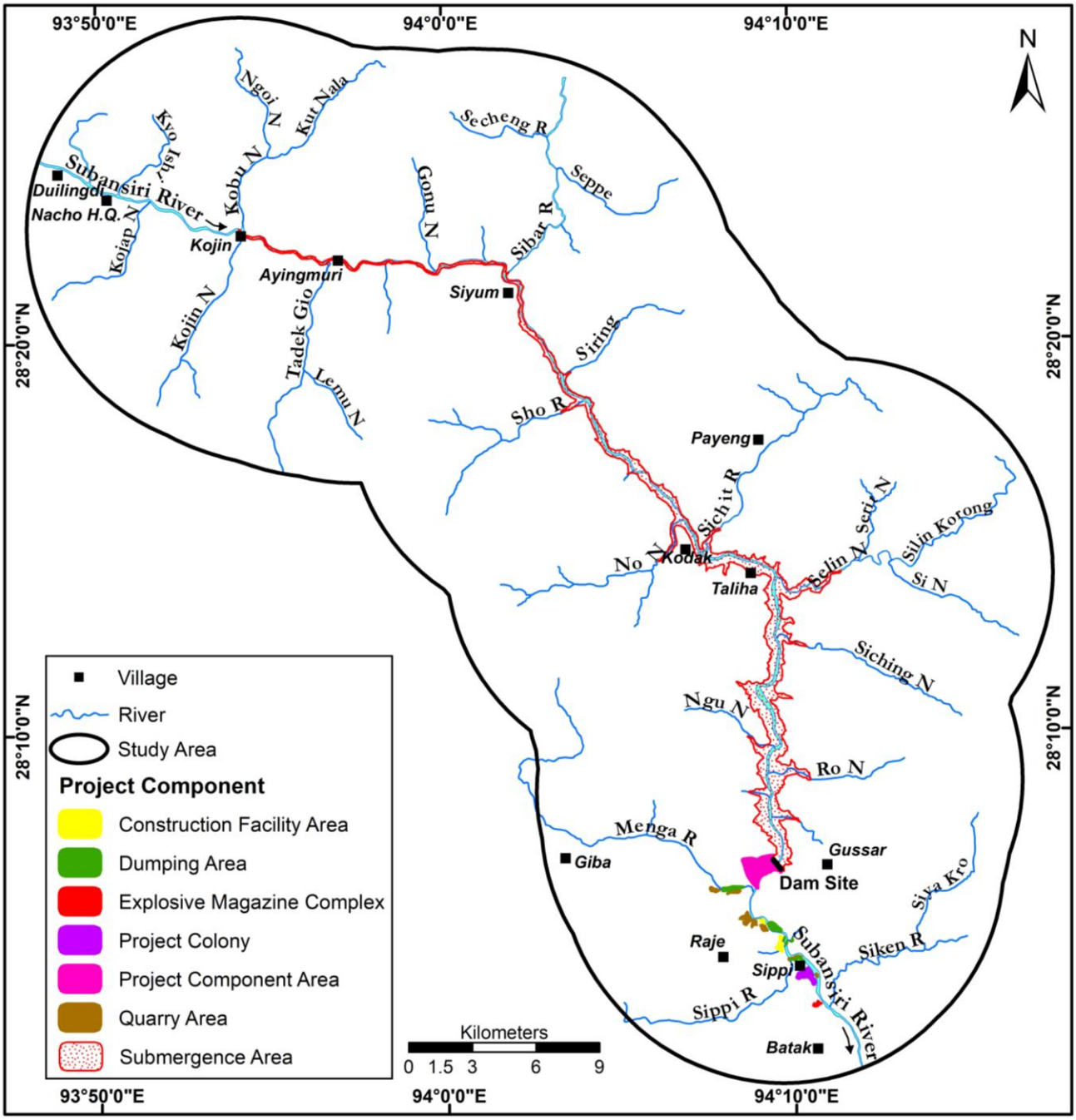

Figure 3: Map showing Study Area of the Project

4.1 Physiography

The study area exhibits a rugged physiography with elevations ranging from 244 m to 3674 m. A significant portion of the area (48%) lies between 500 and 1500 m, indicating a predominance of mid-altitude terrain. The slope analysis shows that the terrain is largely steep, with about 41% of the area falling in the steep slope category (30°–45°) and another 39% under moderately steep slopes (15°–30°).

4.2 Land Use/ Land Cover

The land use/landcover classes were followed as per the NRSC classification. The land use and land cover of the study area have been classified into nine categories. The

predominant land cover is forest, with Evergreen Forest and Scrub Forest together accounting for about 94% of the total area. Area under Shifting cultivation is comprised of 1.41 % of the total area.

4.3 Geology

The project area is occupied by siliceous dolomite & dolomitic limestone of Menga Formation (equivalent to Chilliepam Formation) of Bomdila Group. In general, the rock mass is exposed on escarpment slopes with a cover of slope wash material on uphill ground. Deep weathering and thick vegetation / forest growth is normally observed. At places rock mass is characterized by elephant skin weathering and milky precipitate of calcite. Presence of small-scale stalactite & stalagmite on rock slopes are also seen.

4.4 Seismicity

Project area falls under Seismic Zone-V as per India's seismic zoning map of India prepared by the Bureau of Indian Standard.

4.5 Hydrology

The project envisages construction of 237 m high storage dam from deepest foundation level on River Subansiri with a gross storage reservoir capacity of 1755 MCM at FRL i.e. EL 460 m. The reservoir surface area is 22.2 sq.km at FRL whereas the reservoir length is around 49.5 km at FRL.

CWC approved average 10-daily water availability series at project site for the period 1973-74 to 2007-08 which is extended up to the year 2022-23 on the same philosophy as adopted for monsoon & non-monsoon period based on the observed discharge data of Gerukamukh G&D site on River Subansiri.

The water availability series from 1973-74 to 2022-23 (48 years) has been approved by CWC Hydrology (NE) Directorate vide their file no. T-11013/2/2024-HYD(NE) dte, dated 26-03-2024. The average annual yield (i.e. 1973-74 to 2022-23, 48 years) of approved & extended flow series is computed as 18937 MCM (i.e. 1291 mm).

A design flood value (PMF) of 13097 m^3/sec based on 2-day PMP and 24 hour temporal distribution has been approved by CWC vide their letter No. CWC U.O.No.4/375/2011-Hyd(NEW) 118 dated 18.01.2012

Environment Flow to be released through running the generating units appropriately, to maintain the required e-flow (i.e. 21.77 cumec for lean months, 193.25 cumec for monsoon months and 64.40 cumec for the remaining months).

Regarding sedimentation, as advised by CWC vide letter no. 4/372/2011-hyd (NE)/69, dated 14/3/12 & 4/372/2011-hyd(NE)/182, dated 06/7/12 during the clearance of KHPCEL DPR, sediment studies of the projects in North-East region are carried out with sediment rate of 1 mm/km^2/ year (including bed load) and the same has been adopted for Subansiri Upper HEP.

4.6 Meteorology

The study area of the project lies Upper Subansiri District of Arunachal Pradesh. The south-west monsoon rainfall occurs from May to September in the study area with maximum rainfall occurring between these months. In the study area, the average maximum temperature of 30.9°C was recorded during August. The average minimum temperature of 11.1°C was recorded during January. The average humidity in the study area is close to 88% in July, August (85.80%) and September (85.00%). The lowest humidity is generally in January (58.80%) month. The wind speed is higher during the month of April at 2.67 m/s, whereas the lowest average wind speed of 1.77 m/s was recorded during November.

4.7 Soil

The study area features diverse soils, with the most common types being characterized as Loamy-skeletal, Typic Udorthents which is Very deep, somewhat excessively drained, fine soils on moderately steeply sloping side slope of hills having loamy surface with moderate erosion hazard associated with Fine-Loamy, Typic Eutrochrepts which is Moderately deep, somewhat excessively drained, fine-loamy soils with moderate erosion hazard. The components (Dam, Powerhouse, Submergence area, etc.) of the proposed project are also falling under this soil unit. Physico-chemical properties reveal Sandy Loam to Loamy Sand textures, with bulk density between from 1.81 to 1.94 g/cc, porosity from 34.6% to 41.6%, and water holding capacity between 36.8% and 41.6%.

The electrical conductivity (EC) ranged from 145 to 232 µS/cm, indicating low salinity levels. Since these values are well within the acceptable limit up to 2000 µS/cm. The soil fertility in the study area, in general, is based upon Nutrient Index in terms of NPK, the concentration of Nitrogen and Phosphorus is in 'Medium' range in all three seasons, whereas Potassium is found to be in 'Low' range in all the sites.

4.8 Ambient Air Quality

The air quality baseline of the project area, a predominantly rural zone with limited vehicular traffic and no industrial presence, indicates generally clean ambient air. Air quality was monitored over three seasons—winter, pre-monsoon, and monsoon—across six locations. Key pollutants assessed were $PM_{2.5}$, PM_{10}, SO_2, and NO_2.

The results of monitoring show that $PM_{2.5}$, PM_{10}, SO_2, and NO_2 levels at all the sites are well within the Residential & Rural area permissible limits prescribed by National Ambient Air Quality Standard 2009 notified by CPCB. Air quality was also assessed using 24h averages of $PM_{2.5}$, PM_{10}, SO_2, and NO_2 levels in the AQI calculator of CPCB. This shows that Ambient Air quality at all the monitored locations in the study area fall under 'Good' category.

4.9 Noise Quality

Noise levels were monitored across 08 sites in the study area, and results were compared with the Central Pollution Control Board (CPCB) norms under the Noise Pollution Rules, 2000. The daytime noise level was recorded near to the permissible limit of residential area (55 dBA) at most of the sites due to movement of vehicles and operation of machineries for sand mining and transportation. However, the noise level at night time remains below the permissible limit (45 dBA) as per Ambient Air Quality Standards in Respect of Noise is notified

under Noise Pollution (Regulation and Control) Rules, 2000.

4.10 Traffic Density

Traffic volume was assessed through field surveys conducted in different seasons, with data recorded for heavy, light, and two-wheeled vehicles. The traffic movement was relatively higher in the pre-monsoon season as compared to the monsoon and winter seasons. Density of light motor vehicles like car, jeep & taxi and two-wheeler vehicle are higher in the area.

4.11 Water Quality

The data on water quality has been collected to evaluate surface and ground water quality in study area. The water quality in the study area, in general, is good. This is primarily due to the absence of any industrial establishment and low population density in the project area.

A. Surface Water Quality

Surface water quality was assessed at eight locations across three seasons—winter, pre-monsoon, and monsoon. The highest pH was recorded at Site located on Subansiri River (near Siyum Village) during winter season, and lowest at site located on stream near Taliha Village during pre-monsoon season. Dissolved Oxygen (DO) concentrations were observed from minimum 8.4 mg/l in pre-monsoon season to maximum 10.8 mg/l in monsoon season. Biological Oxygen Demand (BOD) levels were found <2 mg/l, while Chemical Oxygen Demand (COD) values were recorded <6 mg/l across all the sampling sites. All the heavy metals were below detectable limits. The total coliform levels observed at all sampling locations were recorded as less than 2 MPN/100 ml, indicating excellent microbiological quality of surface water within the study area.

According to the Central Pollution Control Board's criteria, the water qualified as Class 'A', meaning it is suitable as a drinking water source without conventional treatment but requires disinfection. Based upon CPCB guidelines as well the calculated WQI, the water quality in the study area falls under 'Good' to 'Medium' category.

B. Ground Water Quality

Groundwater quality was analyzed from six sites. According to BIS standards for Drinking Water (2012), all the Groundwater samples collected from the study area fall within permissible limits of the same. Also, the Drinking Water Quality Index calculated for ground water DWQI, shows that all the samples of groundwater quality fall in 'Excellent' water quality class.

4.12 Floristic Diversity

Forest Types

According to Champion and Seth's classification, forest in the study area falls under tropical semi-evergreen forest, tropical moist deciduous forest, and Himalayan dry temperate forest.

Taxonomic Diversity

A total number of 148 plant species, belonging to 66 family, were sighted and recorded during the study period from the study area.

However, the detail inventory of plant species reported from the study area has been done based on primary survey and same has also been supplemented with available secondary data. Based on this, a list of 394 species of flowering plants (angiosperms), 11 species of gymnosperms, 29 species of pteridophytes, 11 species of bryophytes and 14 species of lichens were compiled.

As per the Red Data Book of Indian Plants published by BSI, six RET plant species were reported from the study area. These species are *Livistona jenkinsiana* & *Paphiopedilum fairrieanum* which are listed under 'Endangered' category, *Cymbidium eburneum* & *Coptis teeta* are listed under 'Vulnerable' category, *Rhynchoglossum lazulinum* is listed under the 'Rare' category, and *Gleditsia assamica* is listed under the 'Indeterminate' category. No plant species endemic to the project study area has been reported.

As per the IUCN Red List criteria. Among these species, *Saurauia punduana* & *Paphiopedilum fairrieanum* are listed under Critically Endangered (CR) category, *Taxus wallichiana, Amentotaxus assamica, Canarium strictum, Lagerstroemia minuticarpa* & *Coptis teeta* are listed under Endangered (EN) category, *Cephalotaxus manni, Dipterocarpus gracilis, Piper pedicellatum, Mesua ferrea, Pinus merkusii* & *Gleditsia assamica* are listed under Vulnerable (VU) and *Quercus lamellose* & *Abies spectabilis* is listed under Near Threatened (NT) category of IUCN ver. 2025-1.

Based on Wildlife (Protection) Amendment Act, 2022 (WPAA), *Coptis teeta* and *Taxus wallichiana* are listed as 'Schedule III' species.

The important agricultural crops grown by villagers are Jhum Paddy, Maize, Soybean, Linseed, Mustard, etc. A variety of horticultural crops such as Mandarin Orange, Pineapple, Banana, Lemon, etc. Other than this, Colocasia, Chilli, Potato, Brinjal, Cabbage, Tomato, Leafy vegetables, etc. are grown as the vegetable crop by villagers.

4.13 Faunal Diversity

The study area was surveyed for mammals, birds, butterflies, and herpetofauna across various habitat types and altitudes, despite difficult terrain restricting systematic transects.

Mammals: No direct sightings were recorded, but 35 species are reported from literature. During the faunal survey, no mammalian species were spotted. However, the local people have confirmed the presence of the species like Common Leopard, Black Bear, Sambar, Wild Dog, Wild Boar, Barking Deer, Rhesus macaque, Marten Goral, etc. near forest area, agriculture fields and settlements.

Birds: Only 6 bird species were sighted during survey. On the basis of field survey and forest working plan, an inventory of 44 bird species has been prepared.

Butterflies: During the field surveys, 7 species of butterflies were recorded from the study area. While based on secondary literature and finding of filed studies a list of 23 species has been prepared.

Herpetofauna: 14 reptile and 4 amphibian species were reported from the study area.

Conservation Status:

- Based on WPAA 2022, 25 mammalians, 1 bird species, 2 species of herpetofauna species are listed under schedule I.
- As per the IUCN Red List of Threatened Species (version 2025-1), in case of mammals, Dhole (*Cuon alpinus*) is listed under Endangered (EN) category, Leopard (*Panthera pardus*), Clouded Leopard (*Neofelis nebulosa*), Black Bear (*Ursus thibetanus*), Sambar (*Rusa unicolor*), Fishing Cat (*Prionailurus viverrinus*), Hog Badger (*Arctonyx collaris*), Bear Cat (*Arctictis binturong*) and Stump-tailed Macaque (*Macaca arctoides*) are listed under Vulnerable (VU) category and Common Otter (*Lutra lutra*), Himalayan Goral (*Naemorhedus goral*), Marbled Cat (*Pardofelis marmorata*), Black Giant Squirrel (*Ratufa bicolor*) & Assamese Macaque (*Macaca assamensis*) are listed under Near Threatened (NT) category.

Fish fauna: During field surveys, *Tor tor, Tor putitora, Bangana dero, Pseudecheneis sulcata, Cirrhinus reba, Psilorhynchus balitora, Garra gotyla, Garra sp.* and *Schizothorax richardsonii* were captured from Subansiri River and its tributaries. The information on fish species reported from the study area was also collected from the local fishermen, which was confirmed with the various secondary sources. A total of 15 species could be confirmed from the area.

4.14 Social Environment

Socio-Economic Profile of the Study Area

The proposed Project is located in Upper Subansiri District of the state of Arunachal Pradesh. The project area is located in a remote and hilly terrain inhabited mainly by Scheduled Tribe (ST) communities. The major tribes inhabiting the district are the Tagin, Nyishi and Galo, with the Tagin being the largest group. These communities follow indigenous belief systems alongside growing Christian influences. Traditional customs, language and festivals such as Si-Donyi remain an integral part of cultural life.

Study Area of the proposed project falls under Nacho, Siyum, Paying, Taliha, Gibba, Chetam (Peer Yapu), Daporijo and Gussar Circle of the Upper Subansiri District. The study area comprises a total of 276 villages, all located within the Upper Subansiri District.

The total population of the affected villages is 5567, among which 2848 are males (51.15%) and 2719 are females (48.84%). There are 1085 households, with an average of 5-6 people living in each house. The sex ratio in the study area is 954 females per 1,000 males.

The average literacy rate in the project area is estimated to be between 45% and 55%, which is lower than the national average. The majority of households depend on agriculture and allied activities as their primary occupation. Forest-based activities also

support the local economy. Villagers collect firewood, wild fruits, cane, bamboo, and medicinal plants from the surrounding forests. These resources are either used domestically or sold in nearby markets, depending on accessibility. Handicrafts, especially bamboo and cane work, are practiced in some villages—mostly by women. The cropping system is mainly rain-fed, as there is adequate rainfall during the monsoon months. Pig farming, Poultry farming and Mithun rearing are particularly prevalent in the area.

The education and medical facilities in the area are limited. For drinking water villages depend on natural water sources. Road connectivity is gradually improving under various government schemes such as PMGSY and other border area development projects. Electricity is available in all the villages surveyed, although power outages are frequent due to poor infrastructure and maintenance issues.

These areas have rich cultural traditions and beautiful natural surroundings, although they are not much developed for tourism or historical studies.

Among the economic resources, graphite is the minerals with economic value found in the area. Around the proposed reservoir area of Subansiri Upper HEP, 496 hectares of the Taliha Graphite Deposit have been allocated for graphite mining. At present, mining activities have not yet begun.

Other than Graphite, Department of Geology and Mining, Govt. of Arunachal Pradesh also proposed Geo-Chemical and Geological Mapping of Limestone and Dolomite in and Around Menga Area.

5.0 ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

5.1 Ambient Air Quality

Construction Phase Impacts:

During the construction phase of the project, potential sources of air pollution include increased vehicular traffic, dust from unpaved roads, and combustion of fuelwood by workers. Currently, the ambient air quality in the area is good, as there are no major pollution sources. However, construction activities such as operation of equipment, crushers, concrete batching plants, and material handling are expected to generate dust and gaseous emissions, which may temporarily affect air quality.

Diesel combustion in construction machinery primarily emits SO_2, and although particulate emissions are minimal due to low ash content, appropriate stack heights are needed to disperse emissions effectively. Crushers and other plants may emit fugitive dust, especially under windy conditions, potentially affecting nearby areas. Additionally, handling and storage of construction materials like sand and aggregates may release dust, particularly in dry weather. While such emissions are difficult to eliminate entirely, their impact can be minimized through proper mitigation and dust control measures.

Operation Phase Impacts:

In hydroelectric power projects, air pollution occurs mainly during the project construction phase. During the operation phase, no major impacts are envisaged on the air environment.

5.2 Noise Environment

During the construction phase of the project, noise will be generated primarily from construction equipment, vehicles, blasting activities, and stationary equipment such as concrete batch plants. Equipment like excavators, loaders, and trucks are expected to produce noise levels ranging from 70-90 dB(A), which will decrease with distance. Blasting, limited to small sections of the tunnel and shaft, will create short-term noise levels of 75-85 dB(A) but will be mitigated by attenuation factors. Noise from increased vehicular traffic and equipment may affect nearby workers but is unlikely to impact villages, as there are no settlements near the work areas. Blasting may also cause ground vibrations, but measures like blast hole design and muffling mats will reduce these effects. Noise impacts on workers will be managed by limiting exposure times and providing protective equipment.

No major impacts are envisaged on the noise environment during the project operation phase.

5.3 Water Environment

Construction Phase Impacts:

During the construction phase of the project, water pollution can arise from various sources such as effluents with high turbidity from crushers, sewage from labor camps, and the discharge of oil and grease from machinery. Wastewater from the labor camps, if untreated, could deteriorate water quality in nearby surface and groundwater sources, leading to waterborne diseases. The wastewater from construction plants and workshops, as well as the effluent from crushers, may contain suspended solids and pollutants like oil, which can affect water bodies if not treated. Muck disposal near water bodies can also increase turbidity, harming aquatic life, though efforts will be made to use muck for construction purposes to minimize this impact. Sewage treatment facilities will be set up in labor camps, and effluent from crushers will be treated before discharge to ensure compliance with environmental standards. Overall, the project will implement measures to control water pollution and mitigate any adverse effects.

Operation Phase Impacts:

During operation phase the obstruction created by the dam would hinder the migration of fish species especially *Schizothorax* sp., and other migratory fish species. To mitigate and minimize the impact on aquatic life, provision of E-flow has been made. Environment flow requirements during monsoon, pre & post monsoon and lean seasons shall be met by operating units (main and auxiliary unit) 24 hours in full/part load throughout the seasons, which will provide the sufficient discharge downstream side.

As per Cumulative Impact and Carrying Capacity Study (CI&CC) of Subansiri Basin including downstream impacts carried out by CWC in 2015, minimum environmental flow has been considered as 20% of the average flow in monsoon, pre & post monsoon and lean period of

90% dependable year respectively. Accordingly, minimum environmental flow of 21.77 cumec for lean months, 193.25 cumec for monsoon months and 64.40 cumec for the remaining months have been considered in the studies.

5.4 Land Environment

Construction Phase Impacts:

The total land requirement for the Subansiri Upper HEP is estimated to be 2733.0 ha. The land use change for construction of various project components of Subansiri Upper HEP will result in permanent land-use changes, including loss of agricultural land and vegetation. These effects will be addressed through compensation to landowners and ecological restoration measures like greenbelt development and biodiversity conservation.

Construction activities will generate significant muck; some of which will be reused, while the rest will be disposed of in designated areas to avoid environmental issues such as water pollution and soil erosion.

Different categories of manpower like labour, technical, other officials, and service providers required during peak construction time will generate various types of waste, including municipal, biomedical, hazardous, and e-waste. Waste management systems and sewage treatment will be implemented according to regulatory standards. Quarrying in hilly areas may cause long-term visual and geological impacts, mitigated by slope stabilization.

Operation Phase Impacts:

During the operation phase, no impacts are envisaged on land as this phase will entail only operation and maintenance of turbines, powerhouse, etc.

5.5 Flora and Fauna

Construction Phase Impacts:

Impact on Terrestrial Flora:

About 2733.0 ha forest land will be diverted for the construction of the project components. As per the forest diversion proposal, a total of 135733 individuals representing 18 tree species need to be removed for the construction of various project components.

Another major impacts on the flora in and around the project area may be due to increased level of human interference as during peak construction phase population of 3000 including technical staff and workers, are likely to congregate in the area.

Workers residing in the area may tend to use fuelwood, if no alternate fuel is provided. The workers may also tend to cut trees to meet their requirements for the construction of houses and space heating. Thus, it is necessary to provide alternative fuel, training and awareness; and implement adequate surveillance to mitigate the adverse impacts on terrestrial flora during the project construction phase.

Impact on Terrestrial Fauna:

Forest in the area provide habitat for various wild animals, birds and other faunal species. On the basis of field survey and secondary literature, forest in the area provide habitat to 35 species of mammals, 44 species of birds and many other faunal species in wild as well as surrounding area. Increased human activity could also impact the terrestrial ecosystem. To mitigate these effects, controlled blasting and strict surveillance are proposed. Measures will also be taken during construction to minimize disturbance to both terrestrial and avian species, ensuring protection of the surrounding habitat.

Operation Phase Impacts:

During the operation phase of Subansiri Upper HEP, environmental impacts are expected to be largely positive. Restoration of construction and muck disposal areas, greenbelt development, and implementation of biodiversity and wildlife conservation plans will enhance local flora and fauna. Increased greenery and moisture from the reservoir may benefit bird populations.

5.6 Fish Fauna

Project may impact aquatic life, particularly the migratory *Schizothorax* species found upstream and downstream of the dam. To mitigate these effects, a Fisheries Management Plan and provisions for maintaining environmental flow have been included in the Environmental Management Plan.

5.7 Socio-Economic Environment

a) Positive Impacts on Socio-Economic Environment

The Subansiri Upper HEP is expected to generate several socio-economic benefits for local communities during both construction and operation phases. These include increased employment opportunities through marginal jobs and petty contracts, enhanced local infrastructure such as education, healthcare, and transportation, and reduced reliance on natural resources due to alternative provisions by the developer. Additionally, large-scale investment and NHPC's local area development initiatives will contribute to overall regional upliftment.

b) Negative Impacts on Socio-Economic Environment

- Such projects, besides positive socio-economic impacts, may cause social and cultural conflicts due to influx of outside population during construction (about 8 years). Developers should work with local leaders, Panchayat, and NGOs to minimize these conflicts.
- Agriculture is the main source of livelihood; acquisition of agricultural land will impact social environment and may change occupational profiles.
- Land use changes will reduce grazing land, negatively affecting livestock and cattle rearing.
- Loss of wildlife habitat may lead to human-wildlife conflicts such as crop raiding and livestock loss.

  These impacts can be mitigated by implementing biodiversity conservation, wildlife management, and green belt development plans.

- Increased disease incidence risk exists due to large-scale labor influx, temporary camps, increased mobility, and local population participation/resettlement.
  However, these health impacts are expected to be short-term, limited only during construction phase.

6.0 MITIGATION MEASURES FOR AIR, WATER AND NOISE POLLUTION

Impacts of pollutants arising out of construction activities can be mitigated significantly by taking appropriate mitigation measures, as discussed below.

Control of Air Pollution:
To control air pollution, measures such as installing wet scrubbers on crushers, maintaining DG sets with standard chimney heights, water spraying on work sites, providing masks, ensuring proper ventilation, conducting regular air quality monitoring, and using controlled blasting are essential.

Control of Noise Pollution:
Control strategies for increase in Noise level include using acoustic enclosures for DG sets, providing hearing protection to workers, maintaining equipment regularly, using noise barriers, opting for quieter machinery, planting vegetation around residential areas, and monitoring ambient noise at regular intervals.

Control of Water Pollution:
To mitigate the impact of construction activities on water quality, septic tanks, soak pits, settling tanks, and grease traps should be installed. Oil interceptors must be used at fueling and washing zones, and wastewater should be treated per environmental guidelines to prevent contamination.

A lump sum budget **Rs. 120.00 lakh** (**@Rs. 15.00 lakh/year for 8 years**) has been proposed for the mitigation measures for control of air, noise and water pollution during project construction phase.

7.0 ENVIRONMENTAL MONITORING PROGRAMME

Environmental Monitoring shall be performed during all stages of the project (namely: construction and operation) to ensure that the impacts are no greater than predicted, and to verify the impact predictions.

Environment monitoring is proposed for a period of 8 years commensurate with the construction period of the project. If the construction period is extended, the monitoring period will also be extended accordingly and additional budget provided. The monitoring program for the proposed project will be undertaken to meet the following objectives:

- To monitor the environmental conditions of nearby area;
- To check on whether mitigation and management measures have been adopted, and are proving effective in practice.

A total of **Rs. 414.0 lakh** have been allocated to implement various activities envisaged under Environmental Monitoring Programme.

8.0 ADDITIONAL STUDIES

8.1 Resettlement & Rehabilitation Plan

The total land to be acquired/diverted for the project is 2733.00 ha. Land required for the project is spread over 27 villages of 4 circle viz. Taliha (23 villages), Gusar (2 villages), Siyum (1 village) and Payeng (1 village) of Upper Subansiri District. A total of 567 households with 2274 nuclear families are likely to be affected/submerged in the Subansiri Upper HEP.

The present R&R plan has been prepared for the purpose of EIA study only. The plan addresses the compensation package as per the provisions of RFCTLARR Act, 2013.

The financial requirement for implementation of the Rehabilitation and Resettlement plan and Economic Development Package works out to be **Rs. 181.00 crore**. This is budgetary estimate and actual estimate as prepared by the district administration.

8.2 Corporate Environment Responsibility

A provisional budget of **Rs 20.00 Crore** has been allocated for local area development activities in the project-affected region under CER. The specific activities will be finalized based on feedback from public consultations and in coordination with local authorities.

8.3 Public Consultation

On completion of draft EIA report and its executive summary in English and vernacular language, report will be submitted to Arunachal Pradesh State Pollution Control Board to initiate the process of Public Consultation. On completion of Public Consultation process, major issues raised during Public Consultation process and response will be covered in this section.

9.0 PROJECT BENEFITS

Hydropower is a clean, renewable energy source that provides reliable peaking power, enhancing grid stability. It helps meet the country's growing energy demand sustainably and offers additional benefits like tourism and recreation. Also, the proposed project drive socio-economic development by improving healthcare, education, communication, and infrastructure, benefiting local communities. They create job opportunities and promote new markets, overall improving the quality of life in the project area.

10.0 ENVIRONMENTAL MANAGEMENT PLAN (EMP)

Pollution generation mainly during construction phase will be in the form of air, water and noise pollution, which will be mitigated by adopting various mitigation measures and implementation of environment management plans.

NHPC Limited is the project proponent/implementing agency for the entire scheme. The overall responsibility for implementation of the EMP measures rests with NHPC Limited through implementing agency and their contractors. Environment Manager of NHPC Limited reporting directly to the project head shall ensure coordination and implementation of the EMP measures.

10.1 Catchment Area Treatment Plan

The Catchment Area Treatment (CAT) plan focuses on controlling erosion in the catchment area of a water resource project to prolong the reservoir's lifespan. Erosion can significantly reduce reservoir life, so preventive measures are essential for stabilizing the catchment.

For the CAT Plan of Subansiri Upper HEP, free draining catchment area has been delineated as intercepting catchment area between the dam site of upstream Dengser HEP and dam site of proposed Subansiri Upper HEP. The total free draining catchment area thus calculated comes out to be 1753.23 sq km (175323.09 ha). The plan involves analysing erosion characteristics of the terrain and recommending measures to reduce erosion.

The CAT plan has already been approved by State Forest Department vide letter No. FOR.12-06/Cons/2023/Vol-I/1748-51 dated 03.05.2025. The estimated cost of implementation of Catchment Area Treatment Plan for the free draining catchment area as defined above is **Rs. 2869.20 lakh**.

10.2 Compensatory Afforestation Plan

The total land requirement for proposed Subansiri Upper HEP is estimated as 2733.0 ha, all of which consists of forest land coming under the jurisdiction of Daporijo Forest Division. Application for forest clearance vide proposal number: FP/AR/HYD/IRRIG/493475/2024 dated 25.02.2025 has been submitted.

As per the Part II of the application for forest clearance submitted by the Divisional Forest Officer (DFO), Daporijo Forest Division, compensatory afforestation is proposed to be undertaken on 5466.0 ha of (twice of affected forest area) degraded forest land identified in Madhya Pradesh state. As per the detailed estimate submitted in Part II, the total cost estimated for compensatory afforestation is **Rs. 264,44,57,763/- (Say Rs. 264.45 Crore)**.

The total cost of NPV for the diversion of 2733.0 ha of forest land as stipulated in Part II thus comes out be Rs. 392,64,19,110 (Say **Rs. 392.64 Crore**).

The total cost of the compensatory afforestation plan, and NPV, is **Rs. 657.09 Crore**.

10.3 Biodiversity Conservation & Wildlife Management Plan

Keeping in view of the anticipated impacts of proposed project on the biodiversity of area, the mitigation measures suggested for biodiversity and wildlife conservation and management plan are as follows:

Habitat conservation measures

- Afforestation and Enrichment plantation.
- Farm Forestry
- Development and Management of Grasslands
- Biological fence (Bamboo species, *Agave americana*, etc.) around the habitation and around the agriculture fields adjoining to forest area to control human wildlife conflict
- Awareness Programme

Management measures

- Prevention of Forest Fire: Training and Infrastructure facilities
- Rejuvenation and Maintenance of Natural Water Springs in Wildlife Habitat
- Support/Provision of veterinary care, cages, recuse centers, etc.
- Support to Monkey Sterilization Programme
- Training and capacity building
- Strengthening of infrastructural facilities of forest department
- Monitoring & evaluation

The proposed plan has already been approved by State Forest Department vide letter No. CWL/D/21(469)/2025/4256-57 dated 12.03.2025. The total budget allocated focusing on Biodiversity and Wildlife Conservation and Management Plan including conservation and management measures for Schedule-I species is **Rs. 30,33,11,300/- (say Rs. 3033.11 lakh)**. State Forest Department shall be the executing agency for implementation of the proposed mitigation measure under Biodiversity Conservation and Wildlife Management Plan in the surrounding of proposed project site.

10.4 Fisheries Development Plan

The Fisheries Development Plan focuses on conserving and enhancing local fish resources while supporting community livelihoods.

Key objectives are enriching riverine fish fauna, stocking reservoirs, upgrading government fish farms, supporting private aquaculture, and enhancing local fishing skills. Major actions include:

- Continuing stocking of river stretches to boost biodiversity and fish populations.
- Regular reservoir stocking.
- Establishment of hatchery to supply quality fingerlings and support private farms.
- Promoting freshwater aquaculture with financial aid, training, and subsidized seed to generate employment and reduce wild stock pressure.
- Providing skill development and training to fishermen and women's groups.
- Maintaining mandatory environmental flow in the downstream to sustain aquatic ecosystems.

The Arunachal Pradesh State Fisheries Department will lead implementation, monitoring, regulation enforcement, and management. The total budget allocated for the various interventions to sustain fisheries resources and enhance socio-economic benefits in the project area is **Rs. 382.43 lakh**.

10.5 Muck Management Plan

The total muck generation from the Subansiri Upper HEP is estimated at approximately 88,14,700.0 Cum, out of which 3,525,880 cum (40% of the total excavated muck) shall be utilized as construction material. Considering the swelling factor of 40% for net excavated material, the total quantity of muck to be disposed is worked out as 74,04,348.0 Cum. A total of 35.00 ha of land has been allocated for muck disposal. The total storage capacity of muck disposal sites is 79.28 lakh m^3.

The plan has been prepared in consultation with Forest department. The estimated cost for implementing the proposed slope stabilization and muck disposal measures (engineering and biological) has been estimated as **Rs. 3966.22 lakh.**

10.6 Landscaping and Restoration of Construction Sites

The Landscaping and Restoration Plan for the proposed project focuses on mitigating impacts caused during construction, which includes extensive excavation, underground tunnelling, and setting up temporary job sites and colonies. Key activities like quarrying, construction of infrastructure, and road development will disrupt natural habitats, necessitating systematic restoration measures post-construction.

Overall, **Rs. 1519.00 lakh** is budgeted for the comprehensive restoration plan, to be implemented with the support of forest departments.

10.7 Reservoir RIM Treatment

Subansiri Upper HEP is proposed as a storage project with objective of power generation and flood moderation considering exclusive storage of 10m above FRL. At full reservoir level, the total surface area of submergence is 22.20 sq. km. within the submergence area, the left bank of the river is found to be degraded and the lower stretches are predominated with shrubs, whereas good vegetation cover is recorded in the right bank of the river. Erosion at certain degraded slopes are anticipated in the reservoir area.

From the study of the reservoir area, it is observed that most of the banks of reservoir comprise of alluvial and colluvial deposits with dense vegetation. The reservoir area was exposed with rocks consisting of different varieties of gneisses, carbonates and quartzite-phyllite sequence. it appears that no major reservoir rim instability is expected.

While for stabilization of active slides various engineering and bio-engineering measures have been made under Reservoir RIM Treatment Plan. The afforestation and enrichment plantation along the rim is proposed under CAT Plan approved by State Forest Department The cost of various activities involved in reservoir rim treatment plan is **Rs. 217.88 lakh**.

10.8 Green Belt Development

The Green Belt Development Plan for proposed project focuses on environmental enhancement through plantations along roadsides, dam and powerhouse sites, crusher areas, colonies, office complexes and restored muck disposal sites.

To ensure the supply of plant material proposed under green belt development plan financial provision has been kept for strengthening and upgradation of forest nurseries in the area. The total cost for the plan, including nursery development and maintenance, is estimated at **Rs. 155.00 lakh**.

10.9 Sanitation and Solid Waste Management

Solid waste generated from temporary and permanent colonies in construction as well as operation phase requires special management for disposal. The project authorities will

ensure sewage generated from labour colonies and site office is treated and disposed as per the SPCB guidelines. Various aspects of solid waste management include:

- Reuse/Recycling
- Storage/Segregation
- Collection and Transportation
- Disposal

The waste generated from the project area will be collected, segregated and disposed off in line with the provisions laid down in Solid Waste Management Rules, 2016. Additionally, provision is kept for reclamation of the landfill, for a Sewage Treatment Plant (15 KLD) and two covered mini trucks for transportation of waste material and their operational costs. Further provisions are kept for awareness and training programs and for tools and implements.

A total budget of **Rs. 380.80 lakh** has been proposed for the Solid Waste Management Plan

10.10 Public Health Delivery System

Medical services at secondary level play a vital and complimentary role to the tertiary and primary health care systems and together form a comprehensive district-based health care system. Following activities are proposed:

- Ambulance: 2 no. with all the basic Medicare facilities and small DG set, etc. to cater for villages in the project area.
- Budget for running the ambulance including driver, fuel and maintenance for 8 years.
- Two first-aid post including sheds, furniture and basic equipment.
- Budget for running the first aid posts including cost of medico, para-medico/Nurses and attendant, consumables, etc. for 8 years.
- Budget for strengthening existing medical facilities.
- Budget for Health Awareness/ Vaccination Camps for 8 years.

Budgetary estimates for public health delivery system to be implemented have been worked out as **Rs. 428.00 lakh.**

10.11 Energy Conservation Measures

The existing facilities will become insufficient for supply of kitchen fuel for the migrant population during the construction of the project. Therefore, the project authorities would make adequate arrangements such as Community kitchen, Supply of Kitchen fuel, efficient cooking facilities and solar lantern either directly by developer or through contractor to reduce the pressure on natural resources in the project area and minimize impacts on this count. A total budget of **Rs. 464.00 lakh** have been proposed under Energy Conservation Plan.

10.12 Labour Management Plan for their Health and Safety

Construction work has many associated risks and health impacts for the workers who are directly exposed to such health and safety risks. Therefore, there is a need to prepare complete health and safety documents for workers either by project proponent/contractor and proponent shall ensure its implementation. A detailed plan will be prepared covering

the above activities before start of construction work. A tentative budget of **Rs. 131.00 lakh** for labour management have been proposed under EMP.

10.13 Disaster Management Plan

Dam break analysis for Subansiri Upper HEP has been carried out for following hydrodynamic simulations due to occurrence of:

- Design flood with Dam break with initial reservoir level at FRL of the dam
- Design flood without dam in place (virgin condition)

From the result of Dam Break Modeling, it is evident that in worst-case scenarios of FRL, up to about 42.5 km d/s of the Dam (upto MDDL level of 181 m of Subansiri Lower Project), flood wave elevation to the maximum reaches in about three hour from start of breach thus having little time for rescue, hence Disaster Management Plan should concentrate on preventive actions and emergency preparedness, rescue action planning and implementation of same. Also, as evident from the inundation maps, in case of Dam break scenario, 23 villages are likely to be partially affected.

The estimated total cost of execution of disaster management plan including the equipment would be **Rs. 750.00 lakh**.

11.0 SUMMARY OF COST

The capital and recurring costs involved for implementation of Environmental Management Plan for the Project is **Rs. 34930.64 lakh** as summarized in **Table 3**. Cost of Compensatory Afforestation and Net Present Value (**Rs. 65708.77 lakh**) estimated as a part of forest diversion is summarized in **Table 4**.

Table 3: Cost for Implementing Environmental Management Plan

S. No.	EMP COMPONENTS	Capital Cost (Rs. in lakh)	Recurring Cost (Rs. in lakh)								Total Cost (Rs. in lakh)
			Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	
1	Catchment Area Treatment Plan	2869.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**2869.20**
2	Biodiversity Conservation & Wildlife Conservation Plan	3033.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**3033.11**
3	Fisheries Development Plan	382.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**382.43**
4	Muck Dumping and Management Plan	83.00	1697.25	1194.25	387.25	218.25	185.03	77.33	82.33	41.53	**3966.22**
5	Landscaping, Restoration of Construction Sites	25.00	50.00	50.00	65.00	110.00	330.00	395.00	277.00	217.00	**1519.00**
6	Reservoir Rim Treatment Plan	15.38	0.00	0.00	50.50	25.00	40.00	33.00	27.00	27.00	**217.88**
7	Green Belt Development Plan	35.00	3.00	4.50	4.50	13.00	20.00	27.00	21.00	27.00	**155.00**
8	Sanitation and Solid Waste Management Plan	156.00	28.10	28.10	28.10	28.10	28.10	28.10	28.10	28.10	**380.80**
9	Public Health Delivery System	100.00	41.00	41.00	41.00	41.00	41.00	41.00	41.00	41.00	**428.00**
10	Energy Conservation Measures	92.00	46.50	46.50	46.50	46.50	46.50	46.50	46.50	46.50	**464.00**
11	Labour Management Plan	40.00	7.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	**131.00**
12	Disaster Management Plan	550.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	**750.00**
13	Pollution Control and Mitigation Measures	0.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	**120.00**
14	Environmental Monitoring Program	0.00	51.75	51.75	51.75	51.75	51.75	51.75	51.75	51.75	**414.00**
15	Rehabilitation and Resettlement Plan	18100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**18100.00**
16	Corporate Environment Responsibility (CER)	2000.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**2000.00**
	Total	**27481.12**	**1964.60**	**1468.10**	**726.60**	**585.60**	**794.38**	**751.68**	**626.68**	**531.88**	**34930.64**

Table 4: Cost Estimate for Compensatory Afforestation and NPV (as per Part-II of forest diversion proposal)

S. No	Other Components	Capital Cost (Rs. in lakh)
1	Compensatory Afforestation	26444.58
2	Net Present Value (NPV)	39264.19
	Total	**65708.77**