

**ENVIRONMENTAL IMPACT ASSESSMENT (EIA) &
ENVIRONMENTAL MANAGEMENT PLAN (EMP)
MYNTDU LESHKA STAGE-II HYDRO ELECTRIC
PROJECT, (210 MW)
MEGHALAYA
(Sector 1(c); Cat “A”)**



Executive Summary

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Prepared for:

Meghalaya Power Generation Corporation Limited

Prepared by:



R S Envirolink Technologies Pvt. Ltd.

402, BESTECH CHAMBERS,

B-BLOCK, SUSHANT LOK-I, GURGAON

Ph: +91-124-4295383: www.rstechnologies.co.in

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EXECUTIVE SUMMARY

1. INTRODUCTION

The Myntdu Leshka Hydro Electric Project (HEP) Stage-II is located near Trangblang village in West Jaintia Hills District of Meghalaya State. It is planned as a Run-of-the-river for hydropower development of the river Myntdu. Location of the project is shown as **Figure 1**.

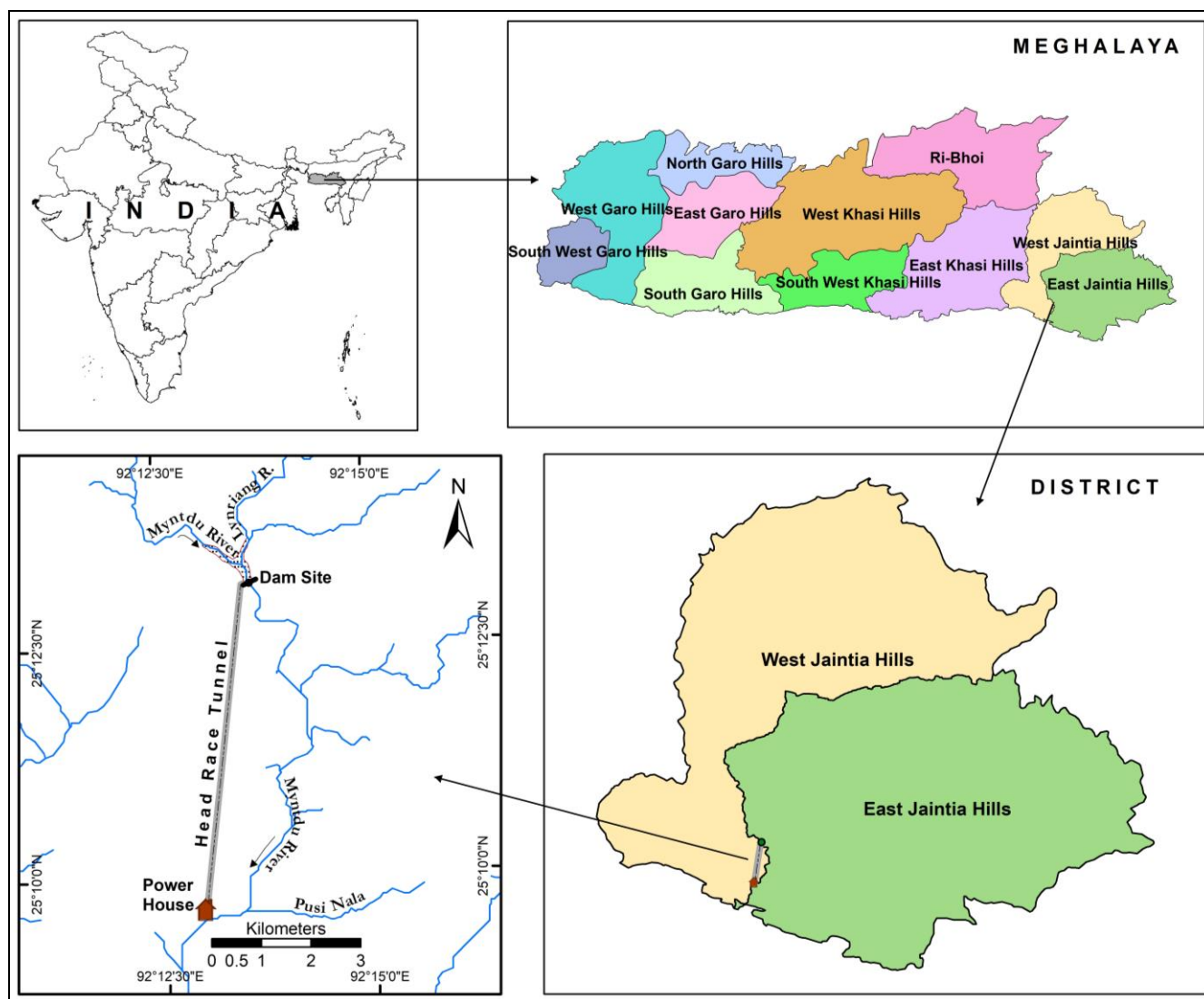


Figure 1: Location Map of Myntdu Leshka HEP Stage-II

2. PROJECT DESCRIPTION

The project scheme comprises a concrete gravity Dam that diverts the water into intake placed on the right bank of the river. The diverted water is planned to be passed through an underground water conductor system comprising the pressure shaft. A surface powerhouse is proposed on the right bank of the river. Tailwater from the powerhouse will be discharged back into the Myntdu river. The project would generate an annual energy generation of 605.64 MU in a 90% dependable year. The project envisages construction of:

- A 46.0 m high concrete gravity dam across the River Myntdu to provide a Live Storage of 2.73 MCum with FRL at El. 270.0 m and MDDL at El. 254.50 m
- A 6.175 km long and 6.0 m dia. headrace tunnel terminating in a surge shaft

- A 69 m high, 21 m dia. surge shaft
- A 835 m long, 4.8 m dia. pressure shaft
- A Surface powerhouse having an installation of 3 Francis Turbine driven generating units of 70 MW each operating under a rated head of 228.38 m; and
- The tail water level at an elevation of 13m to release water back to the river.

The salient features of the project are given in **Table 1**. The layout map of the project is given in **Figure 2**.

Table 1: Salient Features of Myntdu Leshka HEP Stage-II

Table 2: Salient Features of Myntdu Lesma HEP Stage II		
LOCATION		
State	Meghalaya	
District	East Jaintia Hills District and West Jaintia Hills District	
River	Myntdu	
Annual Energy Potential		
	90% DEP. YEAR	50% DEP. YEAR
Energy Generated	605.64 MU	788.27 MU
Design Energy	593.04 MU	770.12 MU
Annual PLF	32.92 %	42.85 %
Lean PLF	3.22 %	8.97 %
DAM SITE		
Location	Right Bank: Near Village Trangblang Left Bank: Near village Bataw	
Latitude	25 ^o 13’17.45” N	
Longitude	92 ^o 13’35.96” E	
Nearest Airport	Shillong, Meghalaya	
Nearest Rail Head	Guwahati (103 km from Shillong)	
HYDROLOGY		
Catchment area at the dam site	480.00 sq km	
Average annual runoff	2290.90 MCM	
90% dependable annual runoff	1668.717 MCM	
50% dependable annual runoff	2304.89 MCM	
Minimum Avg. Annual Discharge (2013-14)	1609.49 Cumec	
Maximum Avg. Annual Discharge (2010-11)	2810.98 Cumec	
RESERVOIR		
Full Reservoir Level (FRL)	El.270.00 m	
Maximum Water Level (MWL)	El. 270.00 m	
Minimum Drawdown Level (MDDL)	El. 254.50 m	
Gross Storage at FRL	5.06 MCum	
Live Storage	2.73 MCum	
Area under submergence at FRL	0.14 Sq Km	
DAM		
Type	Concrete Gravity	
Top elevation of the dam	El. 272.00 m	
Crest Level	El. 253.40 m	
Riverbed level	El. 226.00 m	
Height of dam above riverbed level up to Crest Level	27.40 m	
Height of dam above riverbed level up to FRL	46 m	
Length of the dam at the top	210.76 m	
SPILLWAY		
Design flood (PMF)	10400 Cumec	
Type	Ogee	
Crest Elevation	EL 240.5 m	

Number of bays	7
Length of Spillway	140.00m
Energy dissipation	Ski-Jump Bucket
Gate Size (Radial)	7 Nos. x 8.0 m x 16.6 m
INTAKE	
Invert level	EL 242.5 m
Number	1
Gate Size	6.50 m x 6.30 m
HEAD RACE TUNNEL	
Number	1
Size	6.0 m dia.
Shape	Modified horseshoe
Length	6175 m
Design Discharge	101.89 Cumec (for 210 MW)
Slope	1:231
SURGE SHAFT	
Number	1
Type	Restricted orifice
Size	21.00m dia.
Height	69 m
Latitude	25°10'2.18" N
Longitude	92°13'0.86" E
PRESSURE SHAFT	
Numbers	1 (Trifurcated into 3 of 3.09 m Ø)
Size	4.8 m dia.
Length	835 m
POWERHOUSE	
Type	Surface
Size (Length x Breadth)	
(i) 45.2 m x 19.40 m	Machine hall
(ii) 20.0 m x 19.40 m	Service bay
(iii) 65.2 m x 8.5 m	Control bay
Switch yard	37 m x 30 m
Height of service bay/ generation level	16.20 m
Installed capacity	3 x 70 MW
Number of Units	3 Nos.
Latitude	25°9'36.47" N
Longitude	92°12'55.46" E
Centre Line of Machine	13 m
GIS Hall	69.20 m x 15.20 m
Pot Head Yard (220KV)	81.50 m x 23.00 m
TURBINE	
Type of turbine	Francis turbine
Max head	250.10 m
Min head	229.93 m
Rated Head	228.38 m
Tail Water Level	13 m
Specific speed	130 rpm
Synchronous speed	375 rpm
TAIL RACE	
Type	Open Channel
Length	145 m
Size	5.5 m
Bed Level	El. 20.0 m
GENERATOR	
Rated Output	70000 kW

Capacity Overload	77000 kW
Power Capacity Factor	0.85 lagging
Frequency	50 Hz
Rated Terminal Voltage	11kV

Source: MePGCL

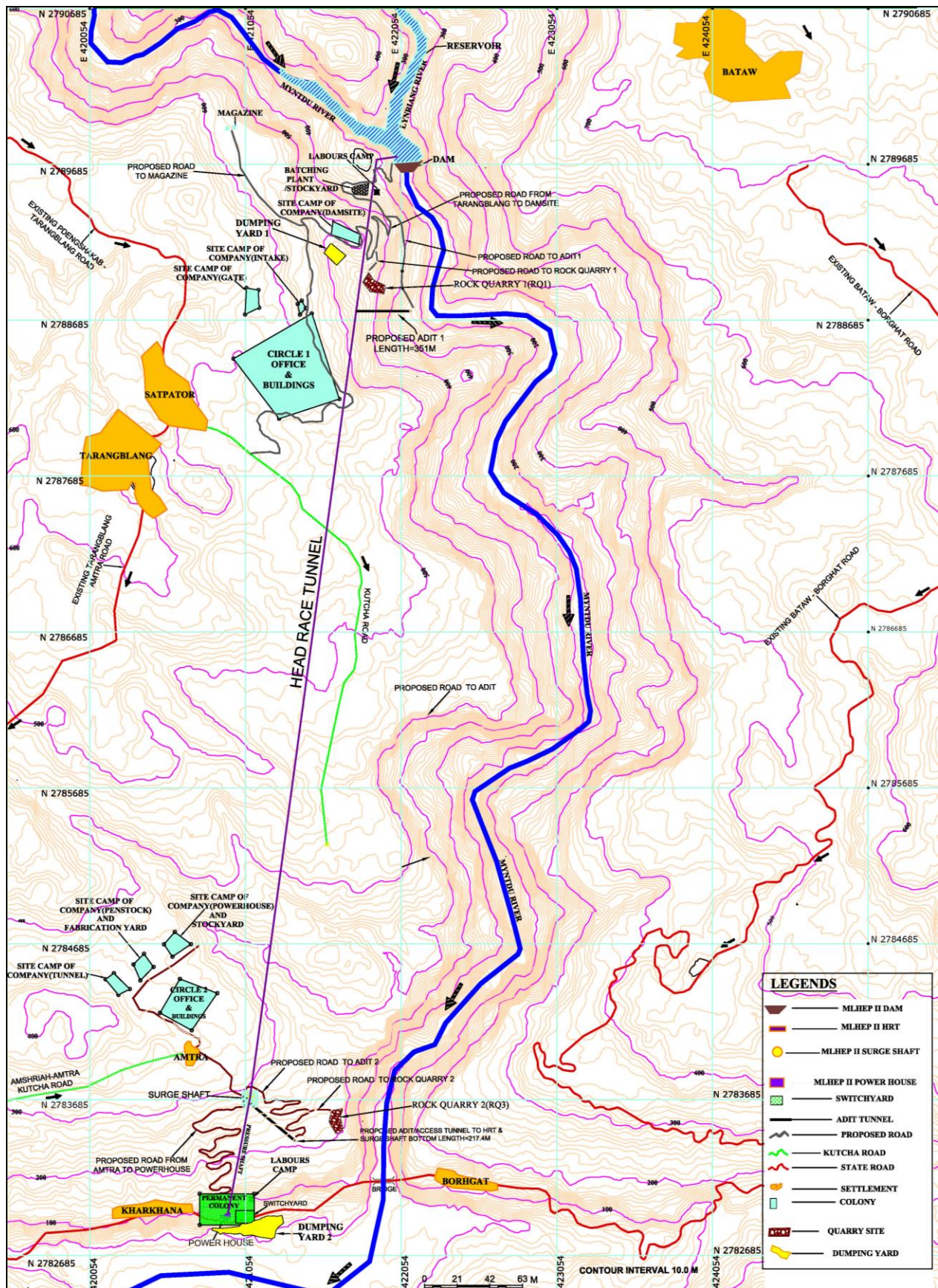


Figure 2: Layout Map of Myntdu Leshka HEP Stage-II

3. LAND REQUIREMENT

The total land requirement for the various project activities is 85.229 ha. The entire land required for the various project activities is private land. Out of this 85.229 ha of land, 11.349 ha is categorized as forest area, 65.880 ha is categorized as non-forest area and the rest 8 ha is categorized as waterbody (river). Proposal for diversion of forest area is yet to be submitted. The Component wise and ownership wise breakup of the total 85.229 ha land required for the development of Myntdu Leshka HEP Stage-II is given in **Table 2**.

Table 2: Land Requirement for the Myntdu Leshka HEP Stage-II

S. No.	Project Component	Forest Area (ha)	Non Forest Area (ha)	Waterbody (ha)	Total Area (ha)
1.	Proposed Road from Trangblang to Damsite (Satpator)	2.550	5.100	-	7.650
2.	Circle 1 Office and Buildings	-	25.730	-	25.730
3.	Site Camp of Company (Gate)	-	1.190	-	1.190
4.	Site Camp of Company (Intake)	-	0.250	-	0.250
5.	Dumping Yard 1	-	1.000	-	1.000
6.	Site Camp of Company (Damsite)	-	1.370	-	1.370
7.	Batching Plant/Stockyard	0.629	-	-	0.629
8.	Rock Quarry	2.000	-	-	2.000
9.	Proposed Road towards Adit 1	-	2.040	-	2.040
10.	Magazine A	0.040	-	-	0.040
11.	Magazine B	0.040	-	-	0.040
12.	Labour Camp at Dam Axis	0.090	-	-	0.090
13.	Reservoir Area	6.000	-	8.000	14.000
14.	Proposed road from Amtra to Site Camp Colony	-	1.755	-	1.755
15.	Circle 2 Office and Buildings	-	6.550	-	6.550
16.	Site Camp of Company (Tunnel)	-	0.990	-	0.990
17.	Site Camp of Company (Penstock) and Fabrication Yard	-	1.120	-	1.120
18.	Site Camp of Company (Powerhouse and Stockyard)	-	1.370	-	1.370
19.	Proposed Road from Amtra to Powerhouse	-	3.975	-	3.975
20.	Surge Shaft	-	1.000	-	1.000
21.	Proposed Road from Surge Shaft to Adit 2	-	2.040	-	2.040
22.	Dumping Yard 2 at Powerhouse	-	3.400	-	3.400
23.	Permanent Colony + Powerhouse Area + Switchyard	-	7.000	-	7.000
	Total Area	11.349	65.880	8.000	85.229

Source: MePGCL and State Forest Department

4. 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, Forests & Climate Change (MoEF&CC), Government of India was collected to understand the present setting of the environment at the project site. A map of the study area prepared based on the above criteria is given in **Figure 3**. The base line status is described briefly in the following sections:

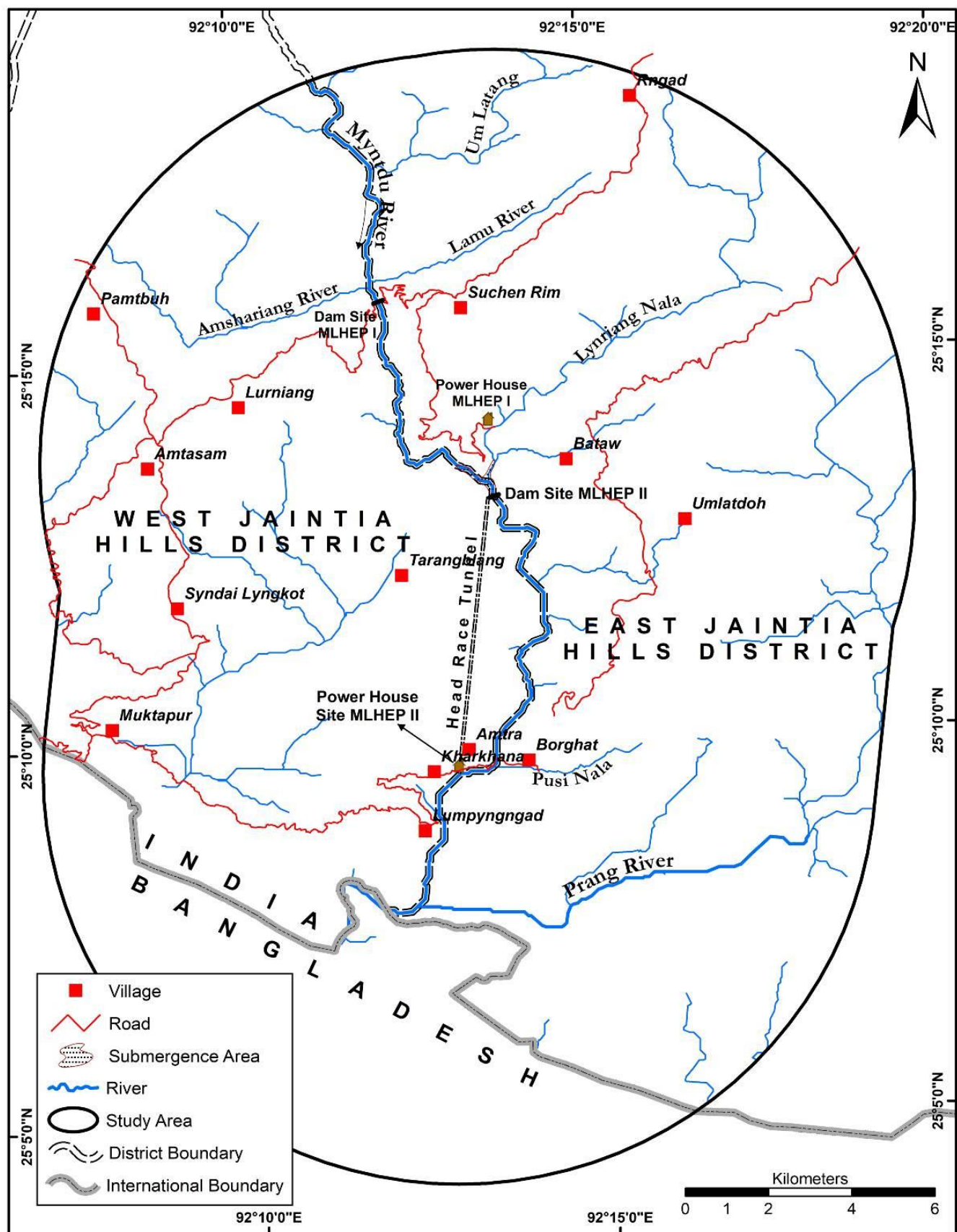


Figure 3: Map showing the Study Area

4.1 Land Use/ Land Cover

The land use/ land cover pattern of the study area was interpreted from the latest satellite data and out of the classified land use/ land cover categories, Forest is the predominant land use in the study area. Nearly 64% of the study area comprises forest of which open forest comprises 48.28%.

4.2 Physiography

About 46% of the study area lies between 500 and 1000 m elevation bands. Only a small percent (7.58%) of the total study area lies above 1000m with the highest elevation of 1190m. Nearly one-third of the study area is characterised by very flat terrain with elevation up to 250m This is mainly the area downstream of the project where the river enters a very gentle slope passing into Bangladesh. Most of the project components are fall in the 200 to 500m elevation band. Most of the area is Moderately Steep to Moderately sloping except some of the areas which have flat terrain.

4.3 Geology

Granite gneiss is the most widely distributed rock type in the project area. At the dam site, migmatites are exposed on the riverbed with granite gneiss exposed on both abutments. The major portion of the traversed length of the water conductor system is covered by overburden with sandstone exposed along the various Nalas encountered along the alignment. The project area falls within the Seismic Zone V of the seismic zoning map of India. A site-specific study of earthquake parameters for Myntdu Leshka HEP Stage-II project has been carried out by Department of Earthquake Engineering, Indian Institute of Technology, Roorkee. The results of the site-specific earthquake design have already been approved by the NCSDP (National Committee of Seismic Design Parameters), Central Water Commission, New Delhi for large dams. The approved horizontal and vertical seismic coefficients are 0.24 and 0.16 respectively.

4.4 Meteorology

The study area falls in the East Jaintia Hills and West Jaintia Hills district, Meghalaya. The climate of Jaintia Hills is uniquely pleasant and bracing. It is neither too warm in summer nor too cold in winter. True to its name, the Meghalaya sky seldom remains free of clouds. The climate of the subbasin is characterized by torrential rains caused by the Southwest monsoon originating in the Bay of Bengal and the Arabian sea. During the monsoon season, rainfall occurs between April to September.

4.5 Soil

The soil in the study area is characterized by dark brown and reddish yellow soil derived from sandstone, and granite and alluvial soil along the riverbank. In general, all the physical soil quality indicators reflect the good quality of the soil. The soil fertility based upon the Nutrient Index in terms of NPK shows that Potassium is in the 'Medium' to 'High' range, but Nitrogen and Phosphorus are in the 'Low' range.

39% of the study area under Soil Unit 20 (Typic Haplumbrepts associated with Umbric Dystrochrepts characterised by Deep, excessively drained, loamy skeletal soils on steeply sloping side slopes of hills having loamy surface prone to severe erosion) followed by Soil unit 21 i.e. Ultic Hapludalfs associated with Typic Kandiodults (Moderately deep, excessively drained, fine loamy soils on steeply sloping side slopes of hills having loamy surface prone to severe erosion).

4.6 Ambient Air and Noise Quality

The Ambient Air Quality monitoring was carried out conforming to the National Ambient Air

Quality Standards for Industrial Residential, Rural & Other Areas and Ecologically Sensitive Areas. The concentrations of PM_{2.5}, PM₁₀, SO₂, and NO₂ at all the sites were 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}, PM₁₀, SO₂, and NO₂ levels in the AQI calculator of CPCB. All the locations fall under the 'Good' category during different seasons in the study area.

4.7 Water Quality

The water quality in the study area, in general, is Poor.

Surface water

- The water of Myntdu river is in the acidic range
- The water of Myntdu river does not fall in any designated Class defined under the Water Quality Criteria of the Central Pollution Control Board.
- According to WQI values obtained for different seasons surface water quality, in general, is in the 'Poor' category
- Based upon the Total Hardness concentration in water samples collected from different locations, the water is under the 'Moderately Hard Water'/'Hard Water' category.

4.8 Floristic Diversity

Forest in the study area was classified under 1B/C3 Cachar Tropical Evergreen Forest, 2B/C1a Assam Alluvial Plains Semi-Evergreen Forest, 2/2S1 Secondary Moist Bamboo Brakes, and 8B/C2 Khasi Sub-Tropical Wet Hill Forest.

Physiographically the project study area is characterized by undulating terrain dominated by Tropical Moist mixed deciduous forest along the hill slopes and on the bank of Myntdu river and its tributary in the study area. There are very sparse patches of agriculture in the area. These forests have mixed vegetation comprised of tree species like *Altingia excelsa*, *Celtis australis*, *Terminalia myriocarpa*, *Alangium chinense*, *Dillenia indica*, *Macaranga denticulata*, *Ostodes paniculata*, *Pandanus dubius*, *Acrocarpus fraxinifolius*, *Albizia chinensis*, *Duabanga grandiflora*, *Ailanthus integrifolia*, *Artocarpus heterophyllus*, etc. *Chimonobambusa callosa*, *Dendrocalamus giganteus*, *Dendrocalamus strictus*, *Yushania hirsuta*, *Calamus erectus*, *Calamus floribundus* and *Calamus tenuis* etc. are the bamboo and cane species observed from the area.

Semi-evergreen bamboos, champa (*Michelia champaca*), chyrngan (*Schima wallichii*), lahit (*Aristolochia saccata*), and soh kyrbait (*Citrus* spp.) are the main crops grown in the study area. Orange and pineapple are another crop grown in these areas.

The shrub layer in the area is mainly represented by *Artemisia capillaris*, *Barleria cristata*, *Phlogacanthus tubiflorus*, *Brassaiopsis hainla*, *Buddleja asiatica*, *Debregeasia longifolia*, *Girardinia diversifolia*, *Justicia adhatoda*, *Lantana camara*, *Trevesia palmata*, *Urena lobata*, etc. Secondary forests are confined to old *jhum* fallows and are mainly comprised of bamboo species like *Dendrocalamus hamiltonii*, *Bambusa tulda* and *Musa* spp. The *Musa* spp. are common along the riverbank downstream of the dam site.

Herbaceous layer in the area was mainly represented by grass species dominated by *Thysanolaena latifolia* and *Saccharum spontaneum*. Other commonly found grass species in the area were *Arundinella nepalensis*, *Arundo donax*, *Chrysopogon aciculatus*, *Cynodon dactylon*, *Digitaria ciliaris*, *Eragrostis amabilis*, *Imperata cylindrica*, *Phragmites karka*, *Poa annua*, *Pogonatherum biaristatum*. *Achyranthes aspera*, *Achyranthes bidentata*, *Ageratum conyzoides*, *Alpinia nigra*, *Arisaema concinnum*, *Chromolaena odorata*, *Commelina benghalensis*, *Justicia mollissima*, *Phyllanthus niruri*, *Senna tora*, *Sida rhombifolia*, *Solanum viarum*, *Urena lobata*, *Urtica dioica* are the species of herbs in the forest, *jhum*, degraded land and near habitation.

The total number of angiosperms plant species recorded during the surveys was 221 and one species of gymnosperm was recorded from the forest area. Among lower plants, 18 species of pteridophytes and 14 species of bryophytes were also reported from the study area. *Nepenthes khasiana* is in the Endangered category and *Dipterocarpus gracilis* is under the 'Vulnerable' category. *Nepenthes khasiana* is endemic to Khasi and Jaintia Hills.

4.9 Faunal Diversity

Mammals:

The sighting of mammals in the project area is quite rare. During the field survey Mongoose (*Herpestes edwardsii*), was the only mammalian species sighted in the study area. Besides these none of the mammals could be sighted during field surveys. Based on field survey and information collected from villagers, a list of 15 species of mammals with their conservation status was compiled.

In addition to the list of mammalian species, the published literature reported the presence of mammals like Leopard (*Panthera pardus*) and Leopard cat (*Felis bengalensis*) even as during the field surveys none of the species could be sighted in the area. The villagers also didn't confirm the probable presence or sighting of these species in the study area.

During field surveys only Rhesus macaque (*Macaca mulatta*), Common mongoose (*Herpestes edwardsii*), and Common langur (*Semnopithecus entellus*) are the species sighted in the study area.

Presence of Common Leopard (*Panthera pardus*), Hanuman Langur (*Semnopithecus entellus*), Himalayan Goral (*Naemorhedus goral*), Indian Muntjac (*Muntiacus muntjac*), and Himalayan black bear (*Ursus thibetanus*) was confirmed by forest officials and villagers in the project area.

Avifauna:

Birds sighting in the forest area was quite rare during the survey. Most of the bird species were recorded along the banks of the river, away from the human settlements. In all, 55 species of birds belonging to 12 Orders were recorded from the study area. Ring dove, Jungle Crow, House Sparrow, Common Myna, Green bee-eater, Black Drongo, Common Hoopoe, Little cormorant were the most frequently sighted bird species in the study area.

Herpetofauna:

A total of 10 species of reptiles and lizards are reported from the study area and these belong

to 8 families. In addition, 5 species of amphibian are also reported from the area

Butterflies:

A total of 19 species of butterflies belonging to 4 families were recorded from the surroundings of the proposed project area. Nymphalidae family was represented by 9 species followed by Papilionidae and Pieridae respectively. Among the butterflies, Indian Cabbage White (*Pieris canidia*), Plain Tiger Pale Grass, and Blue Pansy were most dominant at all sites while others were observed only at two or three sites of the study area.

Fish fauna:

Myntdu river used to harbour good diversity of fish fauna including fish. However, due to inflows from mining in its catchment its water has become extremely acidic destroying its aquatic life. The surveys conducted by MSPCB in 2018 could not find any aquatic life in the river and presently the river is devoid of fish. Even during surveys by the RSET team, no fishes could be seen.

Conservation Status

Different faunal species like mammals, birds, Herpetofauna, and butterflies were assessed for their conservation status according to IUCN Red List categories (Ver. 2021.3) and WPA (1972) Schedules.

As per the IUCN Red List of Threatened Species Version 2021.3, all the species of mammals reported from the study have been listed under Least Concern (LC) category

According to the Wildlife (Protection) Act, 1972, 6 species of mammals reported from the study area are listed as Schedule-II species, two species are listed as Schedule-III species, and five species are listed under Schedule-IV species and one species is under Schedule-V. No schedule I species was sighted in the study area.

All other bird species reported from the study area fall under the 'Least Concern' category of IUCN Red List Ver. 2021.3. As per the Wildlife (Protection) Act, 1972, all the species sighted during field survey are Schedule IV species.

4.10 Proximity to Protected Area

Narpuh Wildlife Sanctuary in East Jaintia Hills is the nearest Protected Areas in the vicinity of the proposed MLHEP Stage-II. The Eco-Sensitive Zone of the sanctuary is approx. 14.5 km from the nearest project component i.e., Powerhouse. The Narpuh Wildlife Sanctuary is the only large tract of pristine forest left in both the East and West Jaintia hills Districts.

4.11 Social Environment

There is a total of 52 villages identified in the study area including five (05) Project Affected villages. Out of these total villages, 21 villages are in East Jaintia Hills district, and the remaining 31 villages are in West Jaintia Hills district.

Out of the five project-affected villages, Bataw village falls in East Jaintia Hills district, while, Amtra, Trangblang, Satpator and Kharkhana falls in West Jaintia Hills district.

a. Demography Profile of the Study Area Villages

Socio-economic profile of the study area villages including project-affected villages is covering aspects like demography, occupational pattern, literacy rate, and other important socio-economic indicators. The baseline socio-economic profile is based on the Census of India 2011.

Total households in the villages are 4060 with a total population of 22,113 out of which 11,111 (50.25%) are males and 11002 (49.75%) are females. The sex ratio in these villages is 990 females per 1000 males.

The population of Scheduled Tribes (ST) is 94.12% whereas only 1.04% of the total population belongs to Scheduled Castes. The average household size in the study area is 5. About 23.52% of the total population is in the 0-6 year age group.

The literacy rate in the study area is 59.11%, among males, it is 57.48% while among females is 60.76% creating a gender gap of (-) 3.28% in favor of women.

As per the Census 2011, about 43.50% of the population is engaged in different kinds of works. Of the total working population, 74.03% are Main Workers and the remaining 25.97% are Marginal Workers.

Among the total working population, 58.54% are male workers and 41.46% are female workers, creating a gender gap of 17.08%. Among the Main Workers, 63.46% are male workers and 36.54% are female workers, creating a gender gap in work participation of 26.92% while out of the total Marginal Workers about 44.52% are males and 55.48% are female, creating a gender gap in the work participation rate of 10.96% in favour of females.

Most of the working population (55.99%) is engaged in agricultural activities, out of which 35.34% are Cultivators and 20.65% are Agricultural Labours. An only a small percentage (0.67%) of the population is engaged as Household Industrial Workers and about 43.35% are in miscellaneous services.

The gender gap in Cultivators is about 24.74% while the gap in population engaged as Agricultural Labours is 8.66%.

b. Demography of Project Affected Villages

The total population of the project affected villages is 3477 belonging to 568 households with an average family size of six. Out of the total affected population, 1680 (48.32%) are males which are 15.12% of the total males of the study area villages and 1797 (51.68%) are females which is 16.33% of the total females of the study area villages. The sex ratio in the affected villages is 1070 females per 1,000 males.

The total Scheduled Tribe population in the affected villages is 3448 which represents 99.17% of the total population of the affected villages and is 16.57% of the total Scheduled Tribe population of the study area villages. Out of these, 48.26% are male and 51.74% are female. The sex ratio among the Scheduled Tribe population is 1072.

There is no Scheduled Castes population in these affected villages.

In the project affected villages, there are 2250 literates which constitute 64.71% of the total population of affected villages and 22.51% of total literates of the study area villages. Out of these literates, 47.07% are male literates and 52.93% are female literates. The literacy rate in the affected villages is 83.77%, among males, it is 81.52% and among females, it is 85.87% which is creating a gender gap of 4.35% in favour of females.

5. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

5.1 Ambient Air Quality

Construction Phase Impacts: The air environment around project site is free from any significant pollution source at present. The sources and activities that might affect air quality in the project area during construction phase are vehicular traffic, material handling and storage, dust arising from unpaved village roads, construction activities including operation of construction plant and machinery and domestic fuel burning.

Additionally, construction activities including operation of crushers, concrete batch plants, construction work and movement of vehicles along unpaved road will generate dust & gaseous emission and impact air quality. The burning of waste will also affect air quality. In absence of proper fuel, construction workers at the project site may use wood for fuel burning and space heating. This will also impact air quality.

Operation Phase Impacts: In hydropower project, air pollution occurs mainly during project construction phase. During operation phase, no impacts are envisaged on air environment.

5.2 Noise Environment

Construction Phase Impacts: Noise in and around the construction site may affect the wildlife and residents in the nearby areas. Sources of noise will be increased vehicular traffic due to project construction on approach roads and at construction sites. Due to construction activity in the area, noise levels will increase during the period of construction, however, they will remain limited to the work area mainly where large-scale construction activity will progress. Other sources of noise and vibration will be the use of explosives for blasting purposes for construction activities.

Operation Phase Impacts: No major impacts are envisaged on noise environment during project operation phase.

5.3 Water Environment

Construction Phase Impacts: Water is used in construction activities leading to wastewater generation with high suspended solids. Similarly, effluents due to washing from truck or equipment etc. would have high concentration of oil and grease. Assessment of quantum of wastewater from such activities is difficult however, they can impact the nearby water bodies if surface run off with high suspended solid is washed into them. Domestic wastewater will be generated from worker's colony to be set up during construction phase, which if finds its way

to river/ground water without any treatment will become significant impact on water environment.

Operation Phase Impacts: Construction of dam to regulate water for power generation will lead to permanent change in flow regime of the river – both upstream as well downstream. During the operation phase, due to the 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 a sewage treatment plant and other infrastructural facilities, the problems of water pollution due to disposal of sewage are not anticipated. The treated sewage will be reused for gardening and green belt around the colony.

5.4 Land Environment

Construction Phase: The following positive impacts are anticipated on Land environment during construction phase

- **Impact due to Land Requirement and change in land-use:** Major impact of land acquisition is permanent change of land use, which is irreversible impact. These impacts cannot be mitigated; however, compensation in terms of implementation of Compensatory Afforestation Plan, Biodiversity Conservation Plan, Green Belt Development Plan will help in managing and reducing the magnitude of such impacts.
- **Impact Due to Muck Generation:** Muck generation, transportation and disposal can significantly impact the land environment, if not managed properly.
- **Impact due to Waste Generation:** The main sources of waste generation can be categorized as:
 - i. Municipal waste (includes commercial and residential wastes generated in either solid or semi-solid form excluding industrial hazardous wastes and bio-medical wastes)
 - ii. Construction and demolition debris (C&D waste)
 - iii. Bio-medical waste
 - iv. Hazardous waste (generated from construction machinery and equipment)
- **Impacts due to Road Construction:** The major impacts likely to accrue because of the construction of the roads are loss of vegetation and geological.
- **Impacts due to Quarrying:** Quarrying is normally done by cutting the face of the hill. The rock from the exposed face of the quarry under the action of wind and other erosion forces gets slowly weathered and they become a potential source of landslide.

5.5 Impacts on Forests and Forest Area

11.349 ha of forest area will be diverted for the construction of the project components. This shall lead to loss of some of the plant species used for various economic purposes. This impact is partially mitigated by implementation of Compensatory Afforestation Plan as well as Biodiversity Conservation and Wildlife Management Plan.

5.6 Flora and Fauna

Construction Phase

Impact on Terrestrial Flora: Increase in human interference could have an impact on terrestrial ecosystem. The workers may also cut trees to meet their requirements for

fuelwood, construction of houses, furniture. Thus, it is necessary to provide training and awareness, maintain cooking fuel supply and implement adequate surveillance to mitigate the adverse impacts on terrestrial flora during project construction phase.

Impact on Terrestrial Fauna: During the construction period, large number of machinery and construction workers shall be mobilized, which may create disturbance to wildlife population in the vicinity of project area. The operation of various equipment will generate significant noise; noise and vibration will also increase during blasting which will have adverse impact on fauna of the area.

Operation Phase

On completion of the construction of the project, the land used for construction activities will be restored. Construction workers who have resided in that area will move to another project site. Operation phase impacts on flora and fauna will be positive due to green belt development, and restoration of construction areas. Increase of greenery in the area and creation of reservoir, will have positive impact on avifauna.

5.7 Socio-Economic Environment

a) Positive Impacts on Socio-Economic Environment

The following positive impacts are anticipated on the socio-economic environment of the local people of villages of project area during the project construction and operation phases:

- i) Several marginal activities and jobs would be available to the locals during construction phase.
- ii) Developer bringing large scale investment to the area will also invest in local area development and benefit will be reaped by locals. Education, medical, transportation, road network and other infrastructure will improve.
- iii) The availability of alternative resources provided by developer in the rural areas will reduce the dependence of the locals on natural resources such as forest.

b) Negative Impacts on Socio-Economic Environment

- i) Loss of agriculture land
- ii) Impact due to influx of outside population may lead to various social and cultural conflicts during the construction stage.
- iii) Increased incidence of Diseases

5.8 Mitigation Measures for Air, Water and Noise Pollution

Proposed project involves construction of dam, powerhouse, reservoir, roads and other associated infrastructure, and construction period is planned for 72 months. Major construction activities have serious potential of pollution generation and impacts all components of environment as discussed above. Impacts arising out of construction activities can be mitigated significantly by taking appropriate mitigation measures, as discussed below.

Control of Air Pollution: For the control of air pollution during construction phase of the project, it is suggested that it should be made mandatory for the contractor/s engaged in the construction works to ensure the implementation of pollution control measures as per CPCB guidelines with regular monitoring of ambient air quality in the project area.

Control of Noise Pollution:

- Diesel Generator sets are to be placed in acoustic enclosures to reduce the noise.
- Proper and regular maintenance/lubrication of machines should be done.
- Noise producing machines (such as crushers, aggregate processing plants, etc.) should be provided with sound barriers.
- Quieter machines and vehicles with high quality silencers should be used.
- Ambient noise should be monitored periodically at different locations.

Control of Water Pollution:

- Provision of septic tank/ soak pit of adequate capacity for labour camp.
- Commission of suitable treatment facilities to treat the sewage generated from the colony
- Oil interceptors shall be provided, and residue of petroleum products will be disposed off in accordance with PCB guidelines.
- Provision of sedimentation cum grease traps to prevent entry of contaminants to the water bodies.

6. 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.

The monitoring will be carried out by an NABL accredited laboratory for a period of 6 years during the project construction phase or extended if the project construction period gets extended. The monitoring program for the proposed project will be undertaken to meet the following objectives:

- To monitor the environmental conditions of the project area and nearby villages.
- To check on whether mitigation and benefit enhancement measures have been adopted and are proving effective in practice.

A total of **Rs. 162.50 lakh** have been allocated to implement various activities envisaged under Environmental Monitoring Programme.

7. ADDITIONAL STUDIES

7.1 Resettlement & Rehabilitation Plan

For the development of Project, land requirement has been worked out as 85.229 ha. The entire land required for the various project activities is private land. Out of this 85.229 ha of land, 11.349 ha is categorized as forest area, 65.880 ha is categorized as non-forest area and the rest 8 ha is categorized as waterbody (river). The entire private land identified for the project falls in five villages – Bataw in East Jaintia District and Amtra, Trangblang, Sapator & Kharkhana in West Jaintia District. The private land proposed for procurement belongs to a total of 122 land owners. All the 122 families will be losing part of their agricultural land and none of the families will be losing any house or any other assets. Private land identified for the project will be acquired as per “The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013 (RFCT_LARR)” and “Meghalaya Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Rules, 2017”. The summary of the financial requirement for implementation of

the Rehabilitation and Resettlement plan and Economic Development Package is **Rs. 18,614.32 lakh** as per the summary given below:

Summary of Budgetary Estimates

S. No.	R&R Components	Cost (Rs in lakh)
1	Rehabilitation Grant	18,584.32.00*
3	Monitoring and Evaluation	30.00
	Total	18,614.32

*** Actual rate for land and asset will be assessed by the respective Districts Deputy Commissioners and District Horticulture officers, during acquiring process**

7.2 Local Area Development Plan

The entire private land identified for the project falls in five villages – Bataw in East Jaintia District and Amtra, Trangblang, Sapator & Kharkhana in West Jaintia District. Therefore, area adjoining these village panchayats will be direct beneficiaries for the Local Area Development schemes.

Based on the local consultations in project affected villages and public hearing consultation process, the focus areas covering many important components of the sustainable development such as social, economic, livelihoods and environment will be identified and set of development activities shall be proposed under each focus area for the benefit of the local people under the Project.

The total budget allocated for implementing the various local area development activities and programs envisaged under LADP in affected area around the project has been kept as **Rs. 15.00 crore**.

8. PROJECT BENEFITS

Myntdu Leshka HEP Stage-II will help in harnessing the potential of river Myntdu for generating electricity to the tune of 605.64 MU annually and bring benefits of renewable energy to state of Meghalaya and country. Apart from power generation benefits, such a large-scale investment in the region will bring about several positive changes in the region and expected to improve the quality of life of local population. The project will help improve local infrastructure and employment generation for local during construction and operation phase. In addition, there will be secondary employment opportunities for locals in terms of catering to the daily need of migratory labour and floating population of transporters and material suppliers to the site. Budget will be proposed towards Local Area Development (LAD) fund, which will be used for the benefits of the locals in project affected villages. In addition, budget will be utilized for skill development aimed at providing employment and for meeting other local needs as required by the locals. On commissioning of projects, a part of profit will go towards CSR fund and such activities can continue bringing benefits to local population for their growth and development.

9. ENVIRONMENT 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.

The project level Environment Monitoring Cell (EMC) would coordinate with necessary stake holder for effective implementation of all environmental safeguard measures prescribed in the EMP.

9.1 Catchment Area Treatment Plan

The Catchment Area Treatment (CAT) plan highlights the management techniques to control erosion in the catchment area of a water resource project. The life span of a reservoir is greatly reduced due to erosion in the catchment area. Adequate preventive measures are thus needed for the treatment of catchment for its stabilization against future erosion.

In the present study, CAT Plan has been formulated for the free draining catchment till the proposed dam site on river. The total area of the free draining catchment is **130 sq km**. The catchment area treatment involves

- Understanding of the erosion characteristics of the terrain and,
- Suggesting remedial measures to reduce the erosion rate.

The estimated cost of implementation of CAT plan including monitoring and evaluation is **Rs. 1312.46 lakh**.

9.2 Compensatory Afforestation Plan

The proposed Myntdu Leshka HEP Stage-II project area is in the jurisdiction of Jowai Forest Division in East and West Jaintia Hills Districts, Meghalaya. The total land requirement for the various project activities is 85.229 ha. The entire land required for the various project activities is private land. Out of this 85.229 ha of land, 11.349 ha is categorized as forest area, 65.880 ha is categorized as non-forest area and the rest 8 ha is categorized as waterbody (river). Since non-forest land for compensatory afforestation has already been identified at Maweit, West Khasi Hills District, therefore, compensatory plantation will be equivalent to the affected or lost forest area i.e. 11.349 ha.

The total budget for diversion of forest land estimated based on Compensatory Afforestation, NPV, Cost of Deforestation and Cost of 11.349 ha of non-forest land identified at Maweit, West Khasi Hills District works out to be **Rs. 457.29 lakh**. Details are as below:

S. No.	Particulars	Amount (Rs. in lakh)
1	Compensatory Afforestation	29.35
2	Net Present Value (NPV)	106.58
3	Cost of deforestation	117.08
4	Cost of 11.349 ha of non-forest land identified at Maweit, West Khasi Hills District for raising compensatory afforestation	204.28
Total		457.29*

* The actual cost will be as determined/assessed under the Forest Diversion proposal.

* Cost of deforestation as per furnished by Divisional Forest Officer (Territorial), West Jaintia Hills District.

* Rate for acquiring land of 11.349 ha is as per Govt. rate 2020

* Actual rate will be assessed by District Deputy Commissioner, West Khasi Hills and Forest Department during acquiring process.

9.3 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 conservation and wildlife management plan and conservation of species are as follows:

- i. Wildlife Habitat Preservation & Improvement
- ii. Establishment of Eco Park
- iii. Biological fencing
- iv. Prevention and Control of Forest Fire
- v. Development of Grazing land/ Pastures
- vi. Awareness promotion
- vii. Strengthening of Infrastructural Facilities of Forest Department
- viii. Biodiversity Management Committee (BMC)

The estimated cost of implementation of various activities envisaged in the Biodiversity Conservation and Management Plan would be **Rs. 132.00 lakh**.

9.4 Green Belt Development Plan including along Reservoir RIM

Green belt development will comprise plantations at various places like alongside roads, around the construction areas, and at different project offices and colonies. During plantation for development of green belt, precaution should be exercised by not planting large size trees around buildings to avoid accidents. Besides this, it is also proposed to develop a green belt around the working areas for trapping the dust and noise, which will rise from the crusher plant, plantation must be done around the crusher plant area. Plantation of avenue, ornamental, and fruit trees are proposed in these areas along with the area around the office complex. The plants of recreational value, horticultural importance shall be planted within the colony area. The ornamental and fruit plants will be procured from the horticulture department and local market while plants for avenue plantation will be procured from the forest department nursery. For the protection of trees from cattle, iron tree guards shall be required. A budgetary provision of **Rs. 47.50 lakh** has been kept for the development of Green Belt in and around the project area.

9.5 Reservoir RIM Treatment Plan

The reservoir rim of Myntdu Leshka HEP Stage-II project in general is expected to be fairly stable in the given geo-environment and would require rim treatment measure at few location. There is no possibility of water leakage into the adjacent valleys as the FRL is sufficiently low and the river valley is defined by narrow gorge cut across this stable basement complex. It is also seen that there is no mineral deposits exist in the reservoir area and accordingly it is concluded that no mineral of economic significance shall get submerged due to impoundment of the reservoir of Myntdu Leshka HEP Stage-II project.

An amount of Rs. 100 lakh has been earmarked for Rim Plantation along the periphery of reservoir. The cost is included in the cost for implementation of catchment Area Treatment Plan. Hence, no separate provision made this head has been made as a part of EMP.

9.6 Muck Management Plan

The construction activities of the project would generate muck from the excavation of various

project structures. Total quantity of muck generated from dam, intake, HRT and Pressure Shaft will be 8,15,668.99 cum, of which around 4,59,156.61 cum (56%) would be reusable, therefore, there would be need to dispose of the balance around 3,56,512.38 cum. The total area of identified 2 dumping yards for dumping of muck is 4.40 ha which can accommodate 4,07,228 cum though the estimated muck to be disposed of is 3,56,512.38 cum.

The estimated cost of the relocation and rehabilitation of excavated material will be **Rs. 199.24 lakh.**

9.7 Landscaping and Restoration of Construction Sites

Landscaping and restoration of construction sites will focus restoration of sites like, Quarry & Borrow sites, job facility area, colony area, and project roads, After the completion of mining activity, these areas will be restored to their normal habitat conditions. These activities will result either in the modification or destruction of the existing landscape of the area. It is therefore imperative that after the project work and related activities are over restoration work should be carried out in these disturbed areas. Various engineering and biological measures will be implemented for the restoration of proposed project affected areas. The landscaping and restoration plan will be implemented with help of landscaping experts and in consultation with Jowai Forest Division and the coordination and funding will be provided by the project proponent. The estimated cost for the landscaping and restoration works of quarry and borrow area, job facility area, colony area, and project roads areas, would be **Rs. 206.52 lakh.**

9.8 Disaster Management Plan

To visualize the worst-case scenario Dam Break Modeling exercise was undertaken and an inundation map was prepared. Based upon the outputs generated from this modeling, a Disaster Management Plan has been formulated. This plan presents warning and notification procedures to be followed in case of failure or potential failure of the dam. The purpose is to provide timely warning to the population likely to be affected and alert key people who must take respective actions in case of an emergency. The estimated total cost of execution of disaster management plan including the equipment would be **Rs. 159.00 lakh.**

9.9 Public Health Delivery System

Project construction and operation will bring about several changes in the socio-economic environment of the area including increased threats to health of the community.

- i. New Diseases due to Migratory Population
- ii. Chances of increase in water borne diseases as malaria, and dengue are high
- iii. Chances of increase in respiratory troubles due to increase in suspended particles during the construction phase.
- iv. Chances of occurrence of gastroenteritis, cholera and typhoid in the labour camps.

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: 1 no. with all the basic Medicare facilities and small DG set, etc. at Power House area
- Budget for running the ambulances including the driver, fuel, and maintenance for 6

years

- Two first-aid posts including sheds, furniture, and basic equipment
- Budget for running the first aid posts @ including the cost of medico, para-medico/Nurses and attendant, consumables, etc. for 6 years
- Budget for strengthening existing medical facilities
- Measures to control COVID19 in the project area
- Budget for Health Awareness/ Vaccination Camps

Budgetary estimates for public health delivery system to be implemented have been worked out as **Rs. 172.00 lakh**.

9.10 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. 89.00 lakh** for labour management have been proposed under EMP.

9.11 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 of in line with the provisions laid down in Solid Waste Management Rules, 2016. The total budget in order to manage the solid waste generated from this population, has been proposed as **Rs. 208.20 lakh**.

9.12 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. 183.00 lakh** have been proposed under Energy Conservation Plan.

10. SUMMARY OF COST

The costs involved for implementation of Environmental Management Plan for Myntdu Leshka HEP Stage-II Project are summarized in the table given below:

Cost for Implementing Environmental Management Plan

S. No.	Component of EMP	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	
1	Catchment Area Treatment Plan	1312.46	0.00	0.00	0.00	0.00	0.00	0.00	1312.46
2	Compensatory Afforestation*	457.29	0.00	0.00	0.00	0.00	0.00	0.00	457.29
3	Biodiversity and Wildlife Conservation & Management Plan	100.00	5.35	5.33	5.33	5.33	5.33	5.33	132.00
4	Green Belt Development Plan	0.00	0.00	0.00	0.00	16.00	16.00	15.50	47.50
5	Muck Dumping and Management Plan	0.00	40.00	40.00	40.00	40.00	39.24	0.00	199.24
6	Landscaping, Restoration of Quarry and Construction Sites	0.00	50.00	50.00	34.26	34.26	38.00	0.00	206.52
7	Disaster Management Plan	135.00	4.00	4.00	4.00	4.00	4.00	4.00	159.00
8	Public Health Delivery System	50.00	20.35	20.33	20.33	20.33	20.33	20.33	172.00
9	Labour Management Plan	40.00	9.00	9.00	9.00	9.00	9.00	4.00	89.00
10	Sanitation and Solid Waste Management Plan	120.00	14.70	14.70	14.70	14.70	14.70	14.70	208.20
11	Energy Conservation Measures	39.00	24.00	24.00	24.00	24.00	24.00	24.00	183.00
12	Control of Air, Noise and Water Pollution	0.00	10.00	10.00	10.00	10.00	10.00	10.00	60.00
12	Environmental Monitoring Program	0.00	27.1	27.08	27.08	27.08	27.08	27.08	162.50
13	Rehabilitation and Resettlement Plan**	18614.32	0.00	0.00	0.00	0.00	0.00	0.00	18614.32
14	Local Area Development Plan	0.00	250.00	250.00	250.00	250.00	250.00	250.00	1500.00
Total		20868.07	454.50	454.44	438.70	454.70	457.68	374.94	23503.03

* The actual cost will be as determined/assessed under the Forest Diversion proposal.

** Actual rate for land and asset will be assessed by the respective Districts Deputy Commissioners and District Horticulture officers, during acquiring process