

Proposed Terms of Reference for EIA Studies

INTRODUCTION

River Periyar, the longest of all the rivers in the State of Kerala, and also the largest in potential, having a length of 244 km. This river basin is the second largest basin of Kerala State

From its origin, Periyar traverses through an immense cliff of rocks in a northerly direction receiving several streamlets in its course. About 48 km downstream, the Mullayar joins the main river at an elevation of +854 m above MSL. Afterwards, the river flows westwards and at about 11 km downstream of the confluence of Mullayar and Periyar, the river passes through a narrow gorge, where the present Mullaperiyar Dam is constructed in 1895. The name Mullaperiyar is derived from a portmanteau of Mullayar and Periyar.

The entire length of the Periyar River flows through the territory of the State of Kerala before it empties into the Arabian Sea.

Majority of the hydro power projects of Kerala including the giant Idukki Hydro Electric Project (780 MW) are located in this river basin. The Central Kerala and Metropolitan City of Kochi heavily depend on this river for its irrigation, industrial and drinking water requirements. River Periyar is rightly considered as the life line of Kerala.

The Old Mullaperiyar Dam constructed by the British Engineers is the oldest dam in the State of Kerala. The archaic design and primitive construction methods coupled with the natural deterioration due to ageing have rendered the old structure unsafe and has become a constant threat to the lives and properties of thousands of people residing in its downstream. As the State of Kerala is duty bound to protect the lives and properties of its citizens, a decision was taken by the State of Kerala to build a new dam at downstream to replace the old Mullaperiyar Dam.

M/s Pragathi Labs Ltd is entrusted to carry EIA studies for new Mullaperiyar dam located at Kerala state. Model Terms of Reference for the Preparation of Environmental Impact Assessment (EIA) Report and EMP on above project, is summarized as follows

Major heads discussed in the project

1. Introduction
2. Project description
 - 2.1 Project Description
 - 2.2 Project details
 - 2.3 Additional details

- 2.4 Details of irrigation project
3. Baseline status
 - 3.1 Air Environment
 - 3.2 Noise Environment
 - 3.3 Water Environment
 - 3.4 Land Environment
 - 3.5 Biological Environment
 - 3.6 Socio-economic Environment
4. Anticipated Environmental Impacts & Mitigation Measures
5. Analysis of Alternatives (Site)
6. Environmental Monitoring Program
7. Additional Studies
8. Project Benefits
9. Environmental Cost Benefit Analysis
10. EMP Summary & Conclusion
11. Disclosure of Consultants engaged

The EIA study includes determination of baseline conditions, assessment of the Impacts on the Environment due to the proposed Irrigation project and making recommendations on the preventive measures to be taken, to minimize the impact on the environment to the acceptable levels. A suitable post-study monitoring program will be outlined. The baseline studies will consist of 3 seasonal studies (Pre-monsoon, monsoon and winter seasons) and will be conducted in the following study area.

Study Area:

The study area should include the following areas:

- Catchment Area
- Submergence Area
- Project Area to be acquired for various appurtenant works area within 10 km from main project Components (i.e. Dam/Barrage/Diversion structure, Power house etc).
- To examine the cascading effect, a clear map showing the approved/under Construction/completed Irrigation project on the both U/S and D/S to this project. Connect such Information to establish the total length of interference of natural river flow, the total length of Tunnelling of the river and the committed unrestricted release from the site of diversion into the main river.
- Adverse impact on land stability, catchment soil erosion, reservoir sedimentation and spring flow (if any) due to (a) considerable road construction/ widening activity (b) interfere of reservoir with the in-flowing streams (c) blasting for commissioning some other structures should be studied
- Various maps providing salient features of the project need to be depicted in proper scale map of at least 1:15,000 like
 - The location map of the proposed project.

1. The project layout shall be superimposed on a contour map of ground elevation showing

Main project features (viz. location of dam, head works, main canal, branch canals, quarrying etc.) shall be depicted in a scaled map.

2. Drainage map of the catchment up to the project site.

3. Soil map of the study area.

4. Map showing the Tiger reserve forest with its boundaries and distance for the dam site

5. Geological and seism tectonic maps of the study area showing main project features.

5. Remote sensing studies, interpretation of satellite imagery, topographic sheets along with Ground verification shall be used to develop the land use/land cover pattern of study area Using overlay mapping techniques viz. Geographic Information Systems (GISs). False colour Composite (FCC) generated from satellite data of study area should be presented.

Air Environment

Meteorology

Meteorological observations at a suitable location at the project site will be carried out during The study period. The monitoring will be carried out on regular basis for the following

Parameters on hourly basis:

- Wind speed and direction;
- Temperature;
- Relative humidity and
- Rainfall

Apart from this wind roses will be given 0-8, 8-16, 16-24 and 0-24 hours separately. The monitored data will be used as an input for mathematical modeling.

Ambient Air Quality Monitoring (AAQ)

The baseline data generation on Ambient Air Quality will be carried out for 8 locations covering all sensitive locations surrounding the Project site.

The frequency of AAQ monitoring is twice a week for the study period during the EIA study period. Samples will be collected for SPM, RPM, NO_x, and SO₂ for 24 hours, twice a week during 3 month study period in each season and the results will be compared with NAAQS.

Anticipated Impacts

Predictions will be made for fugitive dust emissions due to constructional activities and the Anticipated impacts of pollutants on human population, flora and fauna will be assessed.

Mitigation Measures

If the predicted concentrations are more than the limits or near to the limits, potential mitigation Measures will be discussed.

Noise Levels

Noise Level Monitoring will be conducted at about 8 locations of project area covering various categories such as industrial, residential, commercial and sensitive areas and the recorded results will be given in L_{day} and L_{night} values (dBA) separately in the 24 hourly measurements at each location.

Anticipated Impacts

Sources of noise and its impact on the environment will be addressed. The noise level at varying distances for multi-sources were predicted using Noise model. A comparison of measured noise (Leq) at monitoring locations to that of predicted noise levels (Leq) will be made and mitigatory measures will be recommended to conform to regulatory ambient air noise standards. However the most anticipated impacts are temporary.

Mitigation Measures

The potential mitigation measures will be identified and addressed to reduction in noise levels by control at source, provision of greenery to absorb noise during its propagation, isolation of high noise generating sources.

Water Quality

For assessing the water quality in the study area, the water samples (surface and ground) will be collected from about 35 locations covering both surface and ground water sources once during the study period for analysis of physicochemical and biological parameters.

<u>Physical parameters</u>	: pH, EC, TSS
<u>Chemical parameters</u>	: Alkalinity, Hardness, BOD, COD, NO ₃ , PO ₄ , Cl, SO ₄ , Na, K, Mg, Silica, O&G, Phenolic compounds, Residual sodium carbonate
<u>Bacteria</u>	: E.Coli, Total Coliforms
<u>Heavy Metals</u>	: Pb, As, Hg, Cd, Cr ⁺⁶ , total chromium, Cu, Zn and Fe

The Locations will be selected based on the reconnaissance survey of the area. Selection of parameters for sampling will be carried out as per the following procedures:

The water analysis will be carried to understand changes in water quality, impact of sewage disposal if any and its suitability for fish and fauna

2. Analysis of Water Quality will be carried out as per "Standard Methods for Examination of Water and Wastewater" published by American Public Health Association (APHA) were adopted.

Anticipated Impacts

The assessment of potential impacts of the project will be carried out with respect to:

- i. Ground water quality degradation if any
- ii. Surface and river water quality degradation if any
- iii Available water resources and their utilization in the study area; and
- iv Potential for and extent of contamination of surface and ground water resources.
- V. Impact on water sources due to shifting of water courses if any

Mitigation Measures

Some examples of potential mitigation measures applicable to reduce adverse impact on surface water and sources at the site if any, control measures will be suggested. Potential

alterations of ground water will be identified during impact assessment. Scientific management methods will be deployed for stabilization waste dumps.

Land Environment

Soil samples will be collected both in Project site and its surroundings for physicochemical testing such as

Physical : Texture, Porosity, water holding capacity, Bulk Density

Chemical : pH, EC, Total alkalinity, Mg, Ca, K, OC, Available Potassium and Phosphorus SAR, Nitrogen and Salinity etc., One sample per hectare in the command area

Soil infiltration status will be identified to know the possibility of soil contamination if at all any due to accidental leakage / spillage of oils of chemicals..

Land use pattern / cropping / vegetation cover will be given.

Anticipated Impacts

The land used for the irrigation project, and dumping areas will be assessed. The total loss of vegetation cover will be assessed to know loss of biomass due to the proposed project . Impact on soil due to erosion, Change in landscape, impact of irrigation project on the topsoil will be assessed.

Mitigation Measures

Selection suitable plant species to compensate the loss of biomass. Increase in species diversity for sustainable ecosystem development. The plant site will be surveyed and if loss any important species will be identified and proper conservation methods will be adopted.

Biological Environment

i. Flora

Forests and forest types will given (Forest classification will be carried out based on Champion and Seth (1968)).

General vegetation pattern and floral diversity viz. trees, shrubs, grasses, herbs, significant microflora etc. Quadrat study will be carried out after finalizing the quadrat size after making species area curve. IVI, Shannon weaver index. Similarity index studies will be carried at selected in the study area like Water body inundating land.

Enumeration of plant species will be carried by direct observation and available literature. Economic plants, medicinal plants will be separately tabulated. Endemic, endangered and threatened species if any separately listed at impoundment and construction area.

List crops and their avg. yield, cropping details will be given.

ii. Fauna

Faunal investigation will be carried and will be listed as per the respective schedule.

- Inventorisation of terrestrial wildlife and present status
- Zoogeographic distribution/affinities, Endemic, threatened and endangered species

Status of avifauna like Status Resident/Migratory/Passage migrants will be recorded.

Zoogeographic distribution/affinities, endemic, threatened and endangered species & animal fossils Impact of project on threatened/endangered taxa, if any Inventorisation of terrestrial wildlife and present status along with schedule of the species

Aqua- fauna like macro-invertebrates, zooplankton, phytoplanktons, benthos etc. will be listed.

Similarly Fish migrations, if any and their Breeding grounds will be given and Impact of dam building on fish migration and habitat degradation will be studied.

v. Conservation areas and status of threatened/endangered taxa

Biotic Pressures

Management plan for conservation areas and threatened/endangered taxa

Anticipated Impacts

Impacts of irrigation project on flora – fauna, dependant people on forest product (if any) will be assessed. Loss of top soil, thereby loss of biomass will be assessed. Impacts on agriculture production will be assessed.

Mitigation Measures

Any loss of important species will be highlighted and conservation methods will be given. Development of green belt for sustainable ecosystem will be given. List of plant species will be given to arrest soil erosion, stabilization of waste dumps will be projected based on the size and nature of over dumps.

Socio-economic environment

The existing status of demography and socio-economic factors will be established for the zone covered in the site based on the Secondary source information available (Census Data, 2001). The demographic details, Occupational status, Literacy and basic amenities will be collected based on Census Data. List of historical, cultural and ecological important places will be given within the study area.

Anticipated Impacts

Impacts on livelihood of the people living within the vicinity of core zone will be assessed. Similarly impact on crop pattern, forest produce, grazing due to project activities will be assessed.

Mitigation Measures

Mitigation measures will be taken into account based on the need of the people, affected population based on primary and secondary data. While suggesting mitigation measures all the points given Model TOR for preparation of EIA and EMP for irrigation projects.

Hydrology of the basin

Hydro-meteorology, drainage systems

Catastrophic events like cloud bursts and flash floods, for estimation of Sedimentation rate direct sampling of river flow is to be done during EIA to get actual silt flow rate (to be expressed in ha-m km⁻² year⁻¹). The one year of EIA study will provide an opportunity to do this for ascertaining the actual silt flow rate. Water availability for the project and the aquatic fauna

Design discharge and its recurrence interval.

Environmental Management Plan

Delineation of micro-watersheds in the river catchment and mapping of critically degraded areas requiring various biological and engineering treatment measures. Identification of area for treatment based upon Remote Sensing & GIS methodology and Silt Yield Index (SYI) method of AISLUS coupled with ground survey. The prioritization of watershed for treatment based upon SYI.

Spatial Information in each micro watershed should be earmarked on maps in the scale of 1:50,000. The Cat plan would be prepared with year-wise Physical and financial details.

Creation of Green Belt Plan around the Periphery of the Reservoir and Compensatory Afforestation Scheme in consultation with the State Forest department. Biodiversity Conservation and Wild life Management Plan for conservation and preservation of endemic, rare and endangered species of flora and fauna (in consultation with the State Wildlife Department)

Muck Disposal Plan (Suitable sites for dumping of excavated material would be identified in consultation with the State Pollution Control Board and Forest Department)

Energy Conservation Measures

- Dam Break Analysis & Disaster Management Plan.
- Restoration and landscaping of working Areas: reclamation of borrow pits (quarry sites) and construction areas. Public Health Delivery System including the provisions for drinking water facility for the local community.
- Management during the Road Construction
- Sanitation & Solid Waste Management Plan for domestic waste from colonies and labour camps, etc. Water and Air Quality & Noise Environment Management during construction and post construction periods.
- Forest Protection Plan
- Reservoir RIM Treatment Plan

Environmental Monitoring Programme (With physical & financial details covering all the aspect form EMP). For such a large and high budget project, neglecting drinking water component may not be justified. Therefore, if supplying safe drinking water to the population surrounding the project area is not to be considered, a clear justification for this may be given Option assessment study to show that are the option available for fulfilling the needs of the people that the project hopes to fulfil. This section should also show if and

how the proposed project is the least cost option and also include reducing the transmission and distribution losses to the minimum.

Post Study Monitoring Plan

The Post Project Monitoring (PPM) plan shall be prepared as per the CPCB guidelines. The report will be prepared as per the methodology for testing of environmental attributes, EIA /EMP will be based on the Revised (September 2006) Model Terms of Reference for the Preparation of Environmental Impact Assessment (EIA) Report and Environmental Management Plan (EMP) for Consideration by Expert Appraisal Committee.

