

F. No. IA3-22/33/2022-IA.III [E 188159]  
Government of India  
Ministry of Environment, Forest and Climate Change  
(IA Division)


Indira Paryavaran Bhawan  
Jor Bagh Road, Aliganj,  
New Delhi - 110003  
Dated: 14<sup>th</sup> August, 2023

**OFFICE MEMORANDUM**

**Subject: Specific Terms of Reference (ToRs) for Pump Storage Projects - regarding.**

The Ministry vide Notification no. S.O. 2226 (E) dated 18<sup>th</sup> May, 2023 amended the EIA Notification 2006 to bring Pump Storage Projects (PSP) into the ambit of the Environmental Clearance (EC) regime.

2. The above amendment also states that PSPs including off-stream closed loop shall be appraised based on specific Terms of Reference (ToRs) issued by the Central Government.
3. The Ministry has formulated specific ToRs to be followed while conducting Environmental Impact Assessment (EIA) study for PSPs in consultation with the sectoral EAC.
4. Accordingly, it is hereby directed that for preparation of EIA/EMP report, respective specific ToRs enclosed as Annexure to this OM shall be prescribed for the proposals involving closed loop or open loop PSPs. However, PSPs which are planned as part of Hydro power projects (new/expansion) shall be covered under the ToRs issued for the Hydro power projects.
5. This is issued with the approval of the Competent Authority.

  
(Sundar Ramanathan)  
Scientist 'E'

Encl: as above.

To

1. Chairman, Central Pollution Control Board (CPCB).
2. Chairman of all the Expert Appraisal Committees
3. Chairperson/Member Secretaries of all the SEIAAs/SEACs
4. Chairpersons/Member Secretaries of all SPCBs/UTPCCs
5. All the Officers of I.A. Division

Copy for information to:

1. PS to Hon'ble Minister for Environment, Forest and Climate Change
2. PS to Hon'ble MoS (EF&CC)
3. PPS to Secretary (EF&CC)
4. PPS to DGF&SS (EF&CC)
5. PPS to AS(TK)/PPS to JS (SKB)
6. Website, MoEF&CC/Guard file

**SPECIFIC TERMS OF REFERENCE FOR CONDUCTING RAPID ENVIRONMENT IMPACT ASSESSMENT STUDY FOR CLOSED LOOP PUMP STORAGE PROJECT(PSP) AND INFORMATION TO BE INCLUDED IN EIA/EMP REPORT.**

**1) Scope of EIA Studies**

The EIA Report should identify the relevant environmental concerns and focus on potential impacts that may change due to the construction of proposed project. Based on the baseline data collected for one season (other than monsoon), the status of the existing environment in the area and capacity to bear the impact on this should be analyzed. Based on this analysis, the mitigation measures for minimizing the impact shall be suggested in the EIA/EMP study.

**2) Details of the Project and Site**

- i. General introduction about the proposed project.
- ii. Details of project and site giving L-sections of Upper and Lower Reservoir with all relevant maps and figures. The total length of tunneling/TRC/TRT/ Pipelines alignment /channeling of proposed lower reservoir to upper reservoir. Total length of /tunneling for filling upper reservoir from source of water.
- iii. A map of boundary of the project site giving details of protected areas in the vicinity of project location.
- iv. Location details on a map of the project area with contours indicating main project features. The project layout shall be superimposed on a contour map of ground elevation showing main project features (viz. location of upper and Lower reservoir dam, Head works, main canal/length of pipelines alignment, branch canals, quarrying, dumping site etc.) shall be depicted in a scaled map.
- v. Layout details and map of the project along with contours with project components clearly marked with proper scale maps of at least a 1:50,000 scale and printed at least on A3 scale for clarity.
- vi. Distance of both the proposed reservoirs (upper and Lower) from all existing streams/natural reservoir.



- vii. Existence of National Park, Sanctuary, Biosphere Reserve etc. in the study area, if any, should be detailed and presented on a map with distinct distances from the project components (Reservoir/power house dam etc.).
- viii. Drainage pattern and map of the sources of water (river/streams/natural reservoir) catchment up to the proposed project site.
- ix. Delineation of critically degraded areas in the directly draining catchment on the basis of Silt Yield Index as per the methodology of All India Soil and Land Use Survey of India. Soil characteristics and map of the project area.
- x. Geological and seismo-tectonic details and maps of the area surrounding the proposed project site showing location of dam site and powerhouse site.
- xi. 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 the study using overlaying mapping techniques viz. Geographic Information System (GIS), False Color composite (FCC) generated from satellite data of project area.
- xii. Land details including forests, private and other land.
- xiii. Demarcation of snow fed desert/rain fed areas for a realistic estimate of the water availability. Different riverine/streams/natural reservoir/natural depression area habitats like rapids, pools, side pools and variations in the natural reservoir. A substratum, bedrocks, rocks, boulders, sand/silt or clay etc. need to be covered under the study.

### 3) Description of Environment and Baseline Data

To know the present status of environment in the area, baseline data with respect to environmental components air, water, noise, soil, land and biology & biodiversity (flora & fauna), wildlife, socio-economic status etc. should be collected with 10 km radius of the main components of the project/site i.e. Upper and Lower Reservoir / source of water (streams/natural reservoir) / dam site and power house site. The air quality and noise are to be monitored at such locations which are environmentally & ecologically more sensitive in the study area. The baseline studies should be collected for one season (other than monsoon seasons). The study area should comprise of the following:

- a. Catchment area up-to the upper reservoir dam site /lower reservoir.



- b. Impoundment area/ source of water for upper reservoir.
- c. Project area or the direct impact area should comprise of area falling within 10 km radius from the periphery of dam/reservoir, project components (Reservoir/TRT/TRC/power house dam etc.).
- d. Land coming under transporting water from natural reservoir/streams to upper reservoir and area /length of canal / Pipelines alignment, lifting water from lower reservoir to upper reservoir.
- e. 10 km from downstream of lower reservoir and up stream of upper reservoir and sources of water for filling upper reservoir.

#### 4) Details of the Methodology

The methodology followed for collection of base line data along with details of number of samples and their locations in the map should be included. Study area should be demarcated properly on the appropriate scale map. Sampling sites should be depicted on map for each parameter with proper legends. For forest classification, Champion and Seth (1968) classification should be followed.

#### 5) Methodology for collection of Biodiversity Data

The number of sampling locations should be adequate to get a reasonable idea of the diversity and other attributes of flora and fauna. The guiding principles should be the size of the study area (larger area should have larger number of sampling locations) and inherent diversity at the location, as known from secondary sources (e.g. eastern Himalayan and low altitude sites should have a larger number of sampling locations owing to higher diversity).

The entire area should be divided in grids of 5km X 5 km preferably on a GIS domain. There after 25% of the grids should be randomly selected for sampling of which half should be in the directly affected area (grids including project components such as upper and lower reservoir / source of water (streams/natural reservoir) / dam, powerhouse, tunnel, canal etc.) and the remaining in the rest of the area (areas of influence in 10 km radius form project components). At such chosen location, the size and number of sampling units (e.g. quadrats in case of flora/transects in case of fauna) must be decided by species area curves and the details of the same (graphs and



cumulative number of species in a tabulated form) should be provided in the EIA report. Some of the grids on the edges may not be completely overlapping with the study area boundaries. However, these should be counted and considered for selecting 25% of the grids. The number of grids to be surveyed may come out as a decimal number (i.e. it has an integral and a fractional part) which should be rounded to the next whole number.

The conventional sampling is likely to miss the presence of rare, endangered and threatened (R.E.T.) species since they often occur in low densities and in case of faunal species are usually secretive in behavior. Reaching the conclusion about the absence of such species in the study area based on such methodology is misleading. It is very important to document the status of such species owing to their high conservation value. Hence likely presence of such species should be ascertained from secondary sources by a proper literature survey for the said area including referring to field guides which are now available for many taxonomic groups in India. Even literature from studies/surveys in the larger landscapes which include the study area for the concerned project must be referred to since most species from adjoining catchments is likely to be present in the catchments in question. In fact, such literature from the entire state can be referred to. Once a listing of possible R.E.T. species from the said area is developed, species specific methodologies should be adopted to ascertain their presence in the study area which would be far more conclusive as compared to the conventional sampling. If the need be, modern methods like camera trapping can be resorted to, particularly for areas in the eastern Himalayas and for secretive/nocturnal species. A detailed listing of the literature referred to, for developing lists of R.E. T. species should be provided in the EIA reports.

The R.E.T. species referred to in this point should include species listed in Schedule I and II of Wildlife (Protection) Act, 1972 and those listed in the red data books (BSI, ZSI and IUCN).

#### **6) Components of the EIA Study**

Various aspects to be studied and provided in the EIA/EMP report are as follows:

##### **a) Physical and Chemical Environment**

**i. Geological & Geophysical Aspects and Seismo- Tectonics:**

1. Physical geography, Topography, Regional Geological aspects and structure of the Catchment.
2. Tectonics, seismicity and history of past earthquakes in the area. A site specific study of the earthquake parameters will be done. The results of the site specific earthquake design shall be sent for approval of the National committee of Seismic Design Parameters, Central water commission (NCSDP), New Delhi for large dams.
3. Landslide zone or area prone to landslide existing in the study area should be examined.
4. Presence of important economic mineral deposit, if any.
5. Justification for location & execution of the project in relation to structural components (Power house, upper and lower reservoir dam height).
6. Impact of project on geological environment.

**ii. Meteorology, Air and Noise:**

Meteorology (viz. Temperature, Relative humidity, wind speed/direction etc.) to be collected from nearest IMO station. Ambient Air Quality with parameters viz. Suspended Particulate Matter (SPM), Respirable Suspended Particulate Matter (RSPM) i.e. suspended particulate materials <10 microns, Sulphur Dioxide (SO<sub>2</sub>) and Oxides of Nitrogen (NO<sub>x</sub>) in the study area at 10 locations. Existing noise levels and traffic density in the study area at 10 locations.

**iii. Soil Characteristics**

Soil classification, physical parameters (viz., texture, porosity, bulk density and water holding capacity) and chemical parameters (viz. pH, electrical conductivity, magnesium, calcium, total alkalinity, chlorides, sodium, potassium, organic carbon, available potassium, available phosphorus, SAR, nitrogen and salinity, etc.) (10 locations).



**iv. Remote sensing and GIS Studies**

Generation of thematic maps viz., slope map, drainage map, soil map, land use and land cover map, etc. Based on these, thematic maps, an erosion intensity map should be prepared.

**v. Water Quality**

History of the ground water table fluctuation in the study area. Water quality for both surface water and ground water for (i) Physical parameters (pH, temperature, electrical conductivity, TSS); (ii) Chemical parameters (Alkalinity, Hardness, BOD, COD, NO<sub>2</sub>, PO<sub>4</sub>, Cl, SO<sub>4</sub>, Na, K, Ca, Mg, Silica, Oil & Grease, phenolic compounds, residual sodium carbonate); (iii) Bacteriological parameter (MPN, Total coliform) and (iv) Heavy Metals (Pb, As, Hg, Cd, Cr-6, total Cr, Cu, Zn, Fe) (10 locations).

Delineation of sub and micro-watersheds, their locations and extent based on the All India Soil and Land Use Survey of India (AISLUS), Department of Agriculture, Government of India. Erosion levels in each micro-watershed and prioritization of micro-watershed through silt yield index (SYI) method of AISLUS.

**b) Water Environment & Hydrology**

1. Hydro-Meteorology of the project viz. precipitation (snowfall, rainfall), temperature, relative humidity, etc. Hydro-meteorological studies in the catchment area of reservoirs should be established along-with real time telemetry and data acquisition system for inflows monitoring. Run off, discharge, water availability for the project, sedimentation rate of upper and lower reservoir etc.
2. A plan for Periodic monitoring of underground water within 10km radius of the project cover area shall be prepared in consultation with CWC.
3. Hydrological studies/data as approved by CWC shall be utilized in the preparation of EIA/ EMP report. Actual hydrological annual yield may also be given in the report. Sedimentation data available with CWC may be used to find out the loss in storage over the years.

c) **Biological Environment**

Besides primary studies, review of secondary data/literature published for project area on flora & fauna including RET species shall be reported in EIA/EMP report. Identify private land for use of project facilities (such as muck disposal land, batching and crushing plant etc.) for reduction of forest area. Endemic plant and animal species found in the study area (project surrounding area) given in the EIA report. Ground water depth in project vicinity area to be collected and to be incorporated in EIA report.

A detailed study shall be carried out about the fulfilling the entire power requirement to pump the water from the lower reservoir to the upper reservoir from renewable sources and shall be incorporated in EIA

i. **Flora**

1. Characterization of forest types (as per Champion and Seth method) in the study area and extent of each forest type as per the Forest Working Plan.
2. Documentation of all plant species i.e. Angiosperm, Gymnosperm, Pteridophytes, Bryophytes (all groups).
3. General vegetation profile and floral diversity covering all groups of flora including lichens and orchids. A species wise list may be provided.
4. Assessment of plant species with respect to dominance, density, frequency, abundance, diversity index, similarity index, importance value index (IVI), Shannon Weiner index etc. of the species to be provided. Methodology used for calculating various diversity indices along with details of locations of quadrates, size of quadrates etc. to be reported within the study area in different ecosystems.
5. Existence of National park, Sanctuary, Biosphere Reserve etc in the study area, if any, should be detailed.
6. Economically important species like medicinal plants, timber, fuel wood etc.
7. Details of endemic species found in the project area.
8. Flora under RET categories should be documented using International Union for the Conservation of Nature and Natural Resources (IUCN) criteria and Botanical Survey of India's Red Data list along-with economic significance. Species diversity curve for RET species should be given.



9. Cropping pattern and Horticultural Practices in the study area.

**ii. Fauna**

1. Fauna study and Inventorisation should be carried out for all groups of animals in the study area. Their present status along with Schedule of the species.
2. Documentation of fauna plankton (phyto and zooplankton), periphyton, benthos and fish should be done and analyzed.
3. Information (authenticated) on Avi-fauna and wildlife in the study area.
4. Status of avifauna their resident/ migratory/ passage migrants etc.
5. Documentation of butterflies, if any, found in the area.
6. Details of endemic species found in the project area.
7. RET species-voucher specimens should be collected along-with GPS readings to facilitate rehabilitation. RET faunal species to be classified as per IUCN Red Data list and as per different schedule of Indian Wildlife (Protection) Act, 1972.
8. Existence of barriers and corridors, if any, for wild animals.
9. Compensatory afforestation to compensate the green belt area that will be removed, if any, as part of the proposed project development and loss of biodiversity.
10. Collection of primary data on agricultural activity, crop and their productivity and irrigation facilities components.
11. For categorization of sub-catchment into various erosion classes and for the consequent CAT plan, the entire catchment (Indian Portion) is to be considered and not only the directly the draining catchment.
12. Details of Flora and Fauna reported in the proposed reservoir area, number of trees along with their density and nomenclature required to be cut for reservoir creation (upper and lower reservoir) and other project component.

**d) Aquatic Ecology**

- i. Documentation of aquatic fauna like macro-invertebrates, zooplankton, phytoplanktons, benthos etc.
- ii. Fish and fisheries, their migration and breeding grounds.
- iii. Fish diversity composition and maximum length & weight of the measured populations to be studied.
- iv. Conservation status of aquatic fauna.
- v. Sampling for aquatic ecology and fisheries and fisheries must be conducted during one season (other than monsoon). Impact on important fish species at water source need to be collected and breeding and feeding grounds should also be identified along the project site or in vicinity.

**e) Socio-Economic**

- i. Collection of baseline data on human settlements, health status of the community and existing infrastructure facilities for social welfare including sources of livelihood, job opportunities and safety and security of workers and surroundings population.
- ii. Collection of information with respect to social awareness about the developmental activity in the area and social welfare measures existing and proposed by project proponent.
- iii. Collection of information on sensitive habitat of historical, cultural and religious and ecological importance.
- iv. The socio-economic survey/ profile within 10 km (from project component including sources of water, natural reservoir) of the study area for demographic profile; Economic Structure; Developmental Profile; Agricultural Practices; Infrastructure, education facilities; health and sanitation facilities; available communication network etc.
- v. Documentation of demographic, Ethnographic, Economic Structure and development profile of the area.
- vi. Information on Agricultural Practices, Cultural and aesthetic sites, Infrastructure facilities etc.
- vii. Information on the dependence of the local people on minor forest produce and their cattle grazing rights in the forest land.



- viii. List of all the Project Affected Families with their name, age, educational qualification, family size, sex, religion, caste, sources of income, land & house holdings, other properties, occupation, source of income, house/land to be acquired for the project and house/land left with the family, any other property, possession of cattle, type of house etc.
- ix. Special attention has to be given to vulnerable groups like women, aged persons etc. and to any ethnic/indigenous groups that are getting affected by the project.

## 7) Impact Prediction and Mitigation Measures

The adverse impact due to the proposed project should be assessed and effective mitigation steps to abate these impacts should be described.

### a) Air Environment

- i. Changes in ambient and ground level concentrations due to total emissions from point, line and area sources.
- ii. Effect on soil, material, vegetation and human health.
- iii. Impact of emissions from DG set used for power during the construction, if any, on air environment.
- iv. Pollution due to fuel combustion in equipment and vehicles.
- v. Fugitive emissions from various sources.

### b) Water Environment

- i. Changes in surface and ground water quality.
- ii. Water pollution due to disposal of sewage.
- iii. Water pollution from labour colonies/ camps and washing equipment.
- iv. Impact due to Impoundment, damming, realignment and other changes to the hydrology of watercourses or aquifers. Impact on aquatic ecosystem due to project construction and quantity of water to be lifted for power generation and thermal stratification.

### c) Land Environment

- i. Adverse impact on land stability, catchment of soil erosion, reservoir sedimentation and spring flow (if any)

1. due to considerable road construction/ widening activity.
  2. interference of reservoir with the inflowing stream.
  3. blasting for commissioning of HRT, pi and some other structures.
- ii. Changes in land use / land cover and drainage pattern.
  - iii. Immigration of labour population.
  - iv. Quarrying operation and muck disposal.
  - v. Changes in land quality including effects of waste disposal.
  - vi. Impacts due to increase in terrestrial and aquatic ecology due to increased human interferences during project construction and operation phases.
  - vii. Deforestation and shrinkage of animal habitat.
  - viii. Impact of project activity on the terrestrial ecosystem, within project area classifying the impact zones (highly impact/low impact zone) based on seasonal variations and covering the aspects related to project activity during construction and operation period. Impacts on productivity of the ecosystem due to disposal/transportation of muck.

**d) Biological Environment**

- i. Impact on forests, flora, fauna including wildlife, migratory avi-fauna, rare and endangered species, medicinal plants etc.
- ii. Pressure on existing natural resources.
- iii. Deforestation and disturbance to wildlife, habitat fragmentation and wild animal's migratory corridors. The impacts on native species be assessed.
- iv. Compensatory afforestation-identification of suitable native tree species for compensatory afforestation and green belt.
- v. Impact on fish migration and habitat degradation due to decreased flow of water, Impact on breeding and nesting grounds of animals and fish in the source of water.
- vi. Impacts on productivity of the ecosystem, water availability, water uses for generation of hydro power and Ecological flows in the source of water.

**e) Environmental Cost Benefit Analysis:**



Prepare Environmental Cost Benefit Analysis in terms of loss of Forest ecosystem due to diversion of Forest land/loss of biodiversity and its impacts on ecosystem, water availability, water uses for generation of hydro power in study area 10 km from periphery of Project components including transportation of water from water sources.

**f) Socio-economic aspects**

- i. Impact on local community including demographic profile.
- ii. Impact on socio-economic status & Impact on economic status.
- iii. Impact on human health due to water / vector borne disease.
- iv. Impact on increase traffic Impact on Holy Places and Tourism.
- v. Impacts of blasting activity during project construction which generally destabilize the land mass and leads to landslides, damage to properties and drying up of natural springs and cause noise pollution, will be studied. Proper record shall be maintained of the baseline information in the post project period.
- vi. Positive and negative impacts likely to be accrued due to the project listed.

**8) Environmental Management Plans**

- i. Catchment Area Treatment (CAT) Plan should be prepared micro-watershed wise. Identification of free draining/ directly draining catchment based upon Remote Sensing and Geographical Information System (GIS) methodology and Sediment Yield Index (SYI) method of AISLUS, Deptt. of Agriculture, Govt. of India coupled with ground survey. Areas or watersheds falling under 'very severe' and 'severe' erosion categories should be provided and required to be treated. Both biological as well as engineering measures should be proposed in consultation with State Forest Department for areas requiring treatment. Year-wise schedule of work and monetary allocation should be provided. Mitigation measures to check shifting cultivation in the catchment area with provision for alternative and better agricultural practices should be included.
- ii. Compensatory Afforestation shall be prepared by the State Forest Department in lieu of the forest land proposed to be diverted for construction of the project as per the Forest (Conservation) Act, 1980. Choice of plants for afforestation

should include native and RET species, if any. This will be a part of the forest clearance proposal.

- iii. Biodiversity and Wildlife Conservation and Management Plan for the conservation and preservation of rare, endangered or endemic floral/faunal species or some National Park/Sanctuary/ Biosphere Reserve or other protected area is going to get affected directly or indirectly by construction of the project, then suitable conservation measures should be prepared in consultation with the State Forest Department and with the physical and financial details. Suitable conservation techniques (in-situ/ ex-situ) will be proposed under the plan and the areas where such conservation is proposed will be marked on a project layout map. Appropriate Biodiversity Conservation and Management Plan for the native, Rare & endangered floral and faunal species affected due to construction of Project.
- iv. Fisheries Conservation and Management Plan a specific fisheries management measures should be prepared for water source. The plan will detail out the number of hatcheries, nurseries, rearing ponds etc. proposed under the plan with proper drawings.
- v. Resettlement and Rehabilitation Plan needed to be prepared on the basis of findings of the socio economic survey coupled with the outcome of public consultation held. The R&R package shall be prepared after consultation with the representatives of the project affected families and the State Government. Detailed budgetary estimates are to be provided. Resettlements site should be identified. The plan will also incorporate community development strategies. Tentative no. of project affected families identified and accordingly appropriate Rehabilitation & Resettlement plan to be prepared.
- vi. Green Belt Development Plan along the periphery of the upper and lower reservoir, dumping area, power house, approach roads around the colonies and other project components, local plant species must be suggested with physical and financial details. A layout map showing the proposed sites for developing the green belt should be prepared.
- vii. Protection plan for stabilization of land slide / land slip zones, of Upper and Lower reservoir bank area if any, around the reservoir periphery is to be



prepared based on detailed survey of geology of the reservoir rim area. Suitable engineering and biological measures for treatment of identified slip zones to be suggested with physical and financial schedule. Layout map showing the landslide/landslip zones shall be prepared and appended in the chapter.

- viii. Muck Disposal Plan suitable sites for dumping of excavated materials should be identified in consultation with State Pollution Control Board and State Forest Department. All muck disposal sites should be at safe distance (minimum 1 Km) from the HFL of natural reservoir/streams. The quantity of muck to be generated and the quantity of muck proposed to be utilized shall be calculated in consultation with the project authorities. Details of each dumping site viz. area, capacity, total quantity of muck that can be dumped etc. should be worked out and discussed in the plan. Distance of muck disposal area(location), from muck generation sources (project area). Management plan for stabilization /landscaping of muck disposal area. Plan for rehabilitation of muck disposal sites should also be given. The L-section I cross section of muck disposal sites and approach roads should be given. The plan shall have physical and financial details of the measures proposed. Layout map showing the dumping sites vis-a-vis other project components will be prepared and appended in the chapter. Adequate protection measures taken up to avoid any spillage of muck to the adjoining agricultural fields/ forest areas/natural reservoir, streams.
- ix. Restoration Plan for Quarry Sites and landscaping of colony areas, construction area working areas, roads etc. Details of the coarse/fine aggregate/clay etc. required for construction of the project and the rock/clay quarries/river shoal sites identified for the project should be discussed along with the Engineering and Biological measures proposed for their restoration with physical and financial details. Layout map showing quarry sites vis-a-vis other project components, should be prepared.
- x. Study of Design Earthquake Parameters: A site specific study of earthquake parameters should be done. Results of the site specific earthquake design



parameters should be approved by National Committee of Seismic Design Parameters, Central Water Commission (NCSDP), New Delhi.

- xi. Dam Break Analysis and Disaster Management Plan: The outputs of dam break model should be illustrated with appropriate graphs and maps clearly bringing out the impact of Dam Break scenario. To identify inundation areas, population and structures likely to be affected due to catastrophic floods in the event of dam failure. DMP will be prepared with the help of Dam Break Analysis. The action plan will include Emergency Action and Management plan including measures like preventive action notification, warning procedure and action plan for co-ordination with various authorities.
- xii. Water, Air and Noise Management Plans to be implemented during construction and post-construction periods.
- xiii. Public Health Delivery Plan including the provisions of drinking water supply for local population shall be in the EIA/EMP Report. Status of the existing medical facilities in the project area shall be discussed. Possibilities of strengthening of existing medical facilities, construction of new medical infrastructure etc. will be explored after assessing the need of the labour force and local populace.
- xiv. Labour Management Plan for their Health and Safety.
- xv. Sanitation and Solid waste management plan for domestic waste from colonies and labour camps etc.
- xvi. Local Area Development Plan to be formulated in consultation with the Revenue Officials and Village Panchayats. Appropriate schemes shall be prepared under EMP for the Local Area Development Plan with sufficient financial provisions.
- xvii. Environmental safeguards during construction activities including Road Construction.
- xviii. Energy Conservation Measures for the work force during construction with physical and financial details. Alternatives will be proposed for the labour force so that the exploitation of the natural resource (wood) for the domestic and commercial use is curbed.



- xix. Environmental Monitoring Programme to monitor the mitigative measures implemented at the project site is required will be prepared. Provision for Environment Management Cell should be made. The plan will spell out the aspects required to be monitored, monitoring indicators/parameters with respect to each aspect and the agency responsible for the monitoring of that particular aspect throughout the project implementation.
- xx. A summary of Cost Estimates for all the plans, cost for implementing all the Environmental Management Plans.
- xxi. Scope of watershed development in the 10 km radius of the project shall be studied in consultation with reputed government institution having expertise in water shed development and accordingly a detailed Water Shed Development Plan shall be prepared and incorporated in EIA/EMP report.
- xxii. All the tasks including conducting public hearing shall be done as per the provisions of EIA Notification, 2006 and as amended from time to time.
- xxiii. Public hearing issues raised and compliance of the same shall be incorporated in the EIA/EMP report in the relevant chapter. Statement on the commitments (activity-wise) made during public hearing to facilitate the discussion on the CER in compliance of the Ministry's OM F.No.22-65/2017-IA.III dated 30th September, 2020 shall be submitted.
- xxiv. Take the photograph of monitoring stations & sampling locations. The photograph should bear the date, time, latitude & longitude of the monitoring station/sampling location and provided in EIA/EMP report.
- xxv. Matrix formulated on the basis of detailed study and field survey of flora and Fauna methodology used shall be mentioned in the EIA report.
- xxvi. Scientific based Integrated Fisheries Management Plan for conservation and livelihood improvement prepared along with other Environmental Safety Measures for natural Reservoir and shall be incorporated in the EIA/EMP report.
- xxvii. Carbon sequestration ratio shall be identified.
- xxviii. Techniques/activities shall be explored for reducing water losses due to evaporation. Possibility of installation of solar panel on both reservoirs shall be studied.



**SPECIFIC TERMS OF REFERENCE FOR CONDUCTING ENVIRONMENT IMPACT ASSESSMENT STUDY FOR OPEN LOOP PUMP STORAGE PROJECT(PSP)/ON RIVER/STREAMS AND INFORMATION TO BE INCLUDED IN EIA/EMP REPORT.**

**1) Scope of EIA Studies**

The EIA Report should identify the relevant environmental concerns and focus on potential impacts that may change due to the construction of proposed project. Based on the baseline data collected for two (02) seasons (Pre-monsoon, Post Monsoon seasons), the status of the existing environment in the area and capacity to bear the impact on this should be analyzed. Based on this analysis, the mitigation measures for minimizing the impact shall be suggested in the EIA/EMP study.

**2) Details of the Project and Site**

- i. General introduction about the proposed project.
- ii. Details of project and site giving L-sections of all U/S and D/S projects of River (Upper and Lower Reservoir) with all relevant maps and figures. Connect such information as to establish the total length of interference of Natural River/streams, the total length of tunneling/TRC/TRT/ Pipelines alignment /channeling of proposed lower reservoir to upper reservoir. Total length of /tunneling for filling upper reservoir from source of water (streams/river)
- iii. A map of boundary of the project site giving details of protected areas in the vicinity of project location.
- iv. Location details on a map of the project area with contours indicating main project features. The project layout shall be superimposed on a contour map of ground elevation showing main project features (viz. location of upper and Lower reservoir dam, Head works, main canal/piping alignment, branch canals, quarrying, dumping site etc.) shall be depicted in a scaled map.
- v. Layout details and map of the project along with contours with project components clearly marked with proper scale maps of at least a 1:50,000 scale and printed at least on A3 scale for clarity. Distance of both the proposed reservoirs (upper and Lower) from all existing river systems and area of catchment area.



- vi. Existence of National Park, Sanctuary, Biosphere Reserve etc. in the study area, if any, should be detailed and presented on a map with distinct distances from the project components (Reservoir/power house dam etc.).
- vii. Drainage pattern and map of the sources of water (river/streams/natural reservoir) catchment up to the proposed project site.
- viii. Delineation of critically degraded areas in the directly draining catchment on the basis of Silt Yield Index as per the methodology of All India Soil and Land Use Survey of India. Soil characteristics and map of the project area.
- ix. Geological and seismo-tectonic details and maps of the area surrounding the proposed project site showing location of dam site and powerhouse site.
- x. 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 the study using overlaying mapping techniques viz. Geographic Information System (GIS), False Color Composite (FCC) generated from satellite data of project area.
- xi. Land details including forests, private and other land.
- xii. Demarcation of snow fed desert/rain fed areas for a realistic estimate of the water availability. Different riverine/streams/natural reservoir/natural depression area habitats like rapids, pools, side pools and variations in the river substratum, bedrocks, rocks, boulders, sand/silt or clay etc. need to be covered under the study.

### 3) Description of Environment and Baseline Data

To know the present status of environment in the area, baseline data with respect to environmental components air, water, noise, soil, land and biology & biodiversity (flora & fauna), wildlife, socio-economic status etc. should be collected with 10 km radius of the main components of the project/site i.e. Upper and Lower Reservoir / source of water (streams/river) / dam site and power house site. The air quality and noise are to be monitored at such locations which are environmentally & ecologically more sensitive in the study area. The baseline studies should be collected for 2 seasons (Pre-Monsoon and Post Monsoon seasons). The study area should comprise of the following:

- a. Catchment area up-to the upper reservoir dam site /lower reservoir.



- b. Source of water for upper reservoir (streams/ natural depression/ reservoir/tributaries/river).
- c. Project area or the direct impact area should comprise of area falling within 10 km radius from the periphery of dam/reservoir, project components (Reservoir/TRT/TRC/power house dam etc.).
- d. Land coming under transporting water from natural reservoir/rivers/streams to upper reservoir and area /length of canal / pipelines alignment, lifting water from lower reservoir to upper reservoir.
- e. 10 km from downstream of lower reservoir and up stream of upper reservoir and sources of water for filling upper reservoir.

#### 4) Details of the Methodology

The methodology followed for collection of base line data along with details of number of samples and their locations in the map should be included. Study area should be demarcated properly on the appropriate scale map. Sampling sites should be depicted on map for each parameter with proper legends. For forest classification, Champion and Seth (1968) classification should be followed.

#### 5) Methodology for collection of Biodiversity Data

The number of sampling locations should be adequate to get a reasonable idea of the diversity and other attributes of flora and fauna. The guiding principles should be the size of the study area (larger area should have larger number of sampling locations) and inherent diversity at the location, as known from secondary sources (e.g. eastern Himalayan and low altitude sites should have a larger number of sampling locations owing to higher diversity).

The entire area should be divided in grids of 5km X 5 km preferably on a GIS domain. There after 25% of the grids should be randomly selected for sampling of which half should be in the directly affected area (grids including project components such as upper and lower reservoir/ source of water (streams/river) / dam, powerhouse, tunnel, canal etc.) and the remaining in the rest of the area (areas of influence in 10 km radius form project components). At such chosen location, the size and number of sampling units (e.g. quadrats in case of flora/transects in case of



fauna) must be decided by species area curves and the details of the same (graphs and cumulative number of species in a tabulated form) should be provided in the EIA report. Some of the grids on the edges may not be completely overlapping with the study area boundaries. However, these should be counted and considered for selecting 25% of the grids. The number of grids to be surveyed may come out as a decimal number (i.e. it has an integral and a fractional part) which should be rounded to the next whole number.

The conventional sampling is likely to miss the presence of rare, endangered and threatened (R.E.T.) species since they often occur in low densities and in case of faunal species are usually secretive in behavior. Reaching the conclusion about the absence of such species in the study area based on such methodology is misleading. It is very important to document the status of such species owing to their high conservation value. Hence likely presence of such species should be ascertained from secondary sources by a proper literature survey for the said area including referring to field guides which are now available for many taxonomic groups in India. Even literature from studies/surveys in the larger landscapes which include the study area for the concerned project must be referred to since most species from adjoining catchments is likely to be present in the catchments in question. In fact such literature from the entire state can be referred to. Once a listing of possible R.E.T. species from the said area is developed, species specific methodologies should be adopted to ascertain their presence in the study area which would be far more conclusive as compared to the conventional sampling. If the need be, modern methods like camera trapping can be resorted to, particularly for areas in the eastern Himalayas and for secretive/nocturnal species. A detailed listing of the literature referred to, for developing lists of R.E. T. species should be provided in the EIA reports.

The R.E.T. species referred to in this point should include species listed in Schedule I and II of Wildlife (Protection) Act, 1972 and those listed in the red data books (BSI, ZSI and IUCN).



## 6) Components of the EIA Study

Various aspects to be studied and provided in the EIA/EMP report are as follows:

### a) Physical and Chemical Environment

#### i. Geological & Geophysical Aspects and Seismo- Tectonics:

1. Physical geography, Topography, Regional Geological aspects and structure of the Catchment.
2. Tectonics, seismicity and history of past earthquakes in the area. A site specific study of the earthquake parameters will be done. The results of the site specific earthquake design shall be sent for approval of the National committee of Seismic Design Parameters, Central water commission (NCSDP), New Delhi for large dams.
3. Landslide zone or area prone to landslide existing in the study area should be examined.
4. Presence of important economic mineral deposit, if any.
5. Justification for location & execution of the project in relation to structural components (Power house, Upper and lower reservoir dam height).
6. Impact of project on geological environment.

#### ii. Meteorology, Air and Noise:

Meteorology (viz. Temperature, Relative humidity, wind speed/direction etc.) to be collected from nearest IMO station. Ambient Air Quality with parameters viz. Suspended Particulate Matter (SPM), Respirable Suspended Particulate Matter (RSPM) i.e. suspended particulate materials <10 microns, Sulphur Dioxide (SO<sub>2</sub>) and Oxides of Nitrogen (NO<sub>x</sub>) in the study area at 10 locations.

Existing noise levels and traffic density in the study area at 10 locations.

#### iii. Soil Characteristics

Soil classification, physical parameters (viz., texture, porosity, bulk density and water holding capacity) and chemical parameters (viz. pH, electrical

conductivity, magnesium, calcium, total alkalinity, chlorides, sodium, potassium, organic carbon, available potassium, available phosphorus, SAR, nitrogen and salinity, etc.) (10 locations).

**iv. Remote sensing and GIS Studies**

Generation of thematic maps viz., slope map, drainage map, soil map, land use and land cover map, etc. Based on these, thematic maps, an erosion intensity map should be prepared.

**v. Water Quality:**

History of the ground water table fluctuation in the study area. Water quality for both surface water and ground water for (i) Physical parameters (pH, temperature, electrical conductivity, TSS); (ii) Chemical parameters (Alkalinity, Hardness, BOD, COD, N<sub>2</sub>, P<sub>4</sub>, Cl, S<sub>4</sub>, Na, K, Ca, Mg, Silica, Oil & Grease, phenolic compounds, residual sodium carbonate); (iii) Bacteriological parameter (MPN, Total coliform) and (iv) Heavy Metals (Pb, As, Hg, Cd, Cr-6, total Cr, Cu, Zn, Fe) (10 locations).

Delineation of sub and micro-watersheds, their locations and extent based on the All India Soil and Land Use Survey of India (AISLUS), Department of Agriculture, Government of India. Erosion levels in each micro-watershed and prioritization of micro- watershed through silt yield index (SYI) method of AISLUS.

**b) Water Environment & Hydrology**

1. Hydro-Meteorology of the project viz. precipitation (snowfall, rainfall), temperature, relative humidity, etc. Hydro-meteorological studies in the catchment area should be established along-with real time telemetry and data acquisition system for inflows monitoring. Run off, discharge, water availability for the project, sedimentation rate of streams/upper and lower reservoir, etc.

**Basin characteristics**

2. Catastrophic events like cloud bursts and flash floods, if any, should be documented.



3. For estimation of Sedimentation Rate, direct sampling of river flow is to be done during the EIA study. Actual silt flow rate to be expressed in ha-m km<sup>2</sup> year<sup>-1</sup>.
4. Set up a G&D monitoring station and a few rain gauge stations in the catchment area for collecting data during the investigation.
5. Flow series, 10 daily with 90%, 75% and 50% dependable years discharges. Information on the 10-daily flow basis for the 90 per cent dependable year the flow intercepted at the dam, the flow diverted to the power house and the spill comprising the environmental flow and additional flow towards downstream of the dam for the project may be given.
6. The minimum environmental flow shall be 20% of the flow of four consecutive lean months of 90% dependable year, 30% of the average monsoon flow. The flow for remaining months shall be in between 20-30%, depending on the site specific requirements. A site specific study shall be carried out by an expert organization.
7. Hydrological studies/data as approved by CWC shall be utilized in the preparation of EIA/ EMP report. Actual hydrological annual yield may also be given in the report. Sedimentation data available with CWC may be used to find out the loss in storage over the years

**c) Biological Environment**

Besides primary studies, review of secondary data/literature published for project area on flora & fauna including RET species shall be reported in EIA/EMP report. Identify private land for use of project facilities (such as muck disposal land, batching and crushing plant etc.) for reduction of forest area. Endemic plant and animal species found in the study area (project surrounding area) given in the EIA report. Ground water depth in project vicinity area to be collected and to be incorporated in EIA report.

A detailed study shall be carried out about the fulfilling the entire power requirement to pump the water from the lower reservoir to the proposed upper reservoir from renewable sources and shall be incorporated in EIA

**i. Flora**

1. Characterization of forest types (as per Champion and Seth method) in the study area and extent of each forest type as per the Forest Working Plan



2. Documentation of all plant species i.e. Angiosperm, Gymnosperm, Pteridophytes, Bryophytes (all groups).
3. General vegetation profile and floral diversity covering all groups of flora including lichens and orchids. A species wise list may be provided.
4. Assessment of plant species with respect to dominance, density, frequency, abundance, diversity index, similarity index, importance value index (IVI), Shannon Weiner index etc. of the species to be provided. Methodology used for calculating various diversity indices along with details of locations of quadrates, size of quadrates etc. to be reported within the study area in different ecosystems.
5. Existence of National park, Sanctuary, Biosphere Reserve etc. in the study area, if any, should be detailed.
6. Economically important species like medicinal plants, timber, fuel wood etc.
7. Details of endemic species found in the project area.
8. Flora under RET categories should be documented using International Union for the Conservation of Nature and Natural Resources (IUCN) criteria and Botanical Survey of India's Red Data list along-with economic significance. Species diversity curve for RET species should be given.
9. Cropping pattern and Horticultural Practices in the study area.

ii. **Fauna**

1. Fauna study and Inventorisation too should be carried out for all groups of animals in the study area. Their present status along with Schedule of the species.
2. Documentation of fauna plankton (phyto and zooplankton), periphyton, benthos and fish should be done and analyzed.
3. Information (authenticated) on Avi-fauna and wildlife in the study area.
4. Status of avifauna their resident/ migratory/ passage migrants etc.
5. Documentation of butterflies, if any, found in the area.
6. Details of endemic species found in the project area.
7. RET species-voucher specimens should be collected along-with GPS readings to facilitate rehabilitation. RET faunal species to be classified as per IUCN Red Data list and as per different schedule of Indian Wildlife (Protection) Act, 1972.
8. Existence of barriers and corridors, if any, for wild animals.

9. Compensatory afforestation to compensate the green belt area that will be removed, if any, as part of the proposed project development and loss of biodiversity.
10. Collection of primary data on agricultural activity, crop and their productivity and irrigation facilities components.
11. For categorization of sub-catchment into various erosion classes and for the consequent CAT plan, the entire catchment (Indian Portion) is to be considered and not only the directly the draining catchment.
12. Details of Flora and Fauna reported in reservoir area, number of trees, along with their density and nomenclature, required to be cut for reservoir creation (upper and lower reservoir) and other project component.

**d) Aquatic Ecology**

- i. Documentation of aquatic fauna like macro-invertebrates, zooplankton, phytoplanktons, benthos etc.
- ii. Fish and fisheries, their migration and breeding grounds.
- iii. Fish diversity composition and maximum length & weight of the measured populations to be studied for estimation of environmental flow in the river/streams.
- iv. Conservation status of aquatic fauna.
- v. Sampling for aquatic ecology and fisheries and fisheries must be conducted during two seasons i.e., Pre-monsoon (summer) and post monsoon in natural reservoir/streams/nalahs/River. Sizes (length & weight) of important fish species need to be collected and breeding and feeding grounds should also be identified along the project site or in vicinity.

**e) Socio-Economic**

- i. Collection of baseline data on human settlements, health status of the community and existing infrastructure facilities for social welfare including sources of livelihood, job opportunities and safety and security of workers and surroundings population.

- ii. Collection of information with respect to social awareness about the developmental activity in the area and social welfare measures existing and proposed by project proponent.
- iii. Collection of information on sensitive habitat of historical, cultural and religious and ecological importance.
- iv. The socio-economic survey/ profile within 10 km (from project component including sources of water, streams/natural reservoir/ponds/river) of the study area for demographic profile; Economic Structure; Developmental Profile; Agricultural Practices; Infrastructure, education facilities; health and sanitation facilities; available communication network etc.
- v. Documentation of demographic, Ethnographic, Economic Structure and development profile of the area.
- vi. Information on Agricultural Practices, Cultural and aesthetic sites, Infrastructure facilities etc.
- vii. Information on the dependence of the local people on minor forest produce and their cattle grazing rights in the forest land.
- viii. List of all the Project Affected Families with their name, age, educational qualification, family size, sex, religion, caste, sources of income, land & house holdings, other properties, occupation, source of income, house/land to be acquired for the project and house/land left with the family, any other property, possession of cattle, type of house etc.
- ix. Special attention has to be given to vulnerable groups like women, aged persons etc. and to any ethnic/indigenous groups that are getting affected by the project.

## 7) Impact Prediction and Mitigation Measures

The adverse impact due to the proposed project should be assessed and effective mitigation steps to abate these impacts should be described.

### a) Air Environment

- i. Changes in ambient and ground level concentrations due to total emissions from point, line and area sources.
- ii. Effect on soil, material, vegetation and human health.



- iii. Impact of emissions from DG set used for power during the construction, if any, on air environment.
- iv. Pollution due to fuel combustion in equipment and vehicles.
- v. Fugitive emissions from various sources.

**b) Water Environment**

- i. Changes in surface and ground water quality.
- ii. Steps to develop pisci-culture and recreational facilities.
- iii. Changes in hydraulic regime and downstream flow of natural streams.
- iv. Water pollution due to disposal of sewage.
- v. Water pollution from labour colonies/ camps and washing equipment.
- vi. Impact due to Impoundment, damming, realignment and other changes to the hydrology of watercourses or aquifers. Impact on aquatic ecosystem due to project construction and quantity of water to be lifted for power generation and thermal stratification.

**c) Land Environment**

- i. Adverse impact on land stability, catchment of soil erosion, reservoir sedimentation and spring flow (if any)
  - 1. due to considerable road construction/ widening activity.
  - 2. interference of reservoir with the inflowing stream.
  - 3. blasting for commissioning of HRT, TRT and some other structures.
- ii. Changes in land use / land cover and drainage pattern.
- iii. Immigration of labour population.
- iv. Quarrying operation and muck disposal.
- v. Changes in land quality including effects of waste disposal.
- vi. Impacts due to increase in terrestrial and aquatic ecology due to increased human interferences during project construction and operation phases.
- vii. Deforestation and shrinkage of animal habitat.
- viii. Impact of project activity on the terrestrial ecosystem, within project area classifying the impact zones (highly impact/low impact zone) based on



seasonal variations and covering the aspects related to project activity during construction and operation period. Impacts on productivity of the ecosystem due to disposal/transportation of muck.

**d) Biological Environment**

- i. Impact on forests, flora, fauna including wildlife, migratory avi-fauna, rare and endangered species, medicinal plants etc.
- ii. Pressure on existing natural resources.
- iii. Deforestation and disturbance to wildlife, habitat fragmentation and wild animal's migratory corridors. The impacts on native species be assessed.
- iv. Compensatory afforestation-identification of suitable native tree species for compensatory afforestation and green belt.
- v. Impact on fish migration and habitat degradation due to decreased flow of water, Impact on breeding and nesting grounds of animals and fish.
- vi. Impacts on productivity of the ecosystem, water availability, water uses for generation of hydro power and Ecological flows in the stream/natural reservoir/ponds/Nallah and River.

**e) Environmental Cost Benefit Analysis**

Prepare Environmental Cost Benefit Analysis in terms of loss of Forest ecosystem due to diversion of Forest land/loss of biodiversity and its impacts on ecosystem, water availability, water uses for generation of hydro power and Ecological flows in the stream/Nallah/ponds/natural reservoir and rivers in study area 10 km from periphery of Project components including transportation of water from water sources (river/streams).

**f) Socio-economic aspects**

- i. Impact on local community including demographic profile.
- ii. Impact on socio-economic status & Impact on economic status.
- iii. Impact on human health due to water / vector borne disease.
- iv. Impact on increase traffic Impact on Holy Places and Tourism.
- v. Impacts of blasting activity during project construction which generally destabilize the land mass and leads to landslides, damage to properties and



drying up of natural springs and cause noise pollution, will be studied. Proper record shall be maintained of the baseline information in the post project period.

- vi. Positive and negative impacts likely to be accrued due to the project listed.

## 8) Environmental Management Plans

- i. Catchment Area Treatment (CAT) Plan should be prepared micro-watershed wise. Identification of free draining/ directly draining catchment based upon Remote Sensing and Geographical Information System (GIS) methodology and Sediment Yield Index (SYI) method of AISLUS, Deptt. of Agriculture, Govt. of India coupled with ground survey. Areas or watersheds falling under 'very severe' and 'severe' erosion categories should be provided and required to be treated. Both biological as well as engineering measures should be proposed in consultation with State Forest Department for areas requiring treatment. Year-wise schedule of work and monetary allocation should be provided. Mitigation measures to check shifting cultivation in the catchment area with provision for alternative and better agricultural practices should be included.
- ii. Compensatory Afforestation shall be prepared by the State Forest Department in lieu of the forest land proposed to be diverted for construction of the project as per the Forest (Conservation) Act, 1980. Choice of plants for afforestation should include native and RET species, if any. This will be a part of the forest clearance proposal.
- iii. Biodiversity and Wildlife Conservation and Management Plan for the conservation and preservation of rare, endangered or endemic floral/faunal species or some National Park/Sanctuary/ Biosphere Reserve or other protected area is going to get affected directly or indirectly by construction of the project, then suitable conservation measures should be prepared in consultation with the State Forest Department and with the physical and financial details. Suitable conservation techniques (in-situ/ ex-situ) will be proposed under the plan and the areas where such conservation is proposed will be marked on a project layout map. Appropriate Biodiversity Conservation and Management Plan for the



- native, Rare & endangered floral and faunal species affected due to construction of Project.
- iv. Fisheries Conservation and Management Plan a specific fisheries management measures should be prepared for river and natural reservoir/streams/ponds. If the construction of fish ladder/ fish-way etc. is not feasible then measures for reservoir fisheries will be proposed. The plan will detail out the number of hatcheries, nurseries, rearing ponds etc. proposed under the plan with proper drawings. If any migratory fish species is getting affected then the migratory routes, time/season of upstream and downstream migration, spawning grounds etc. will be discussed in details.
  - v. Resettlement and Rehabilitation Plan needed to be prepared on the basis of findings of the socio- economic survey coupled with the outcome of public consultation held. The R&R package shall be prepared after consultation with the representatives of the project affected families and the State Government. Detailed budgetary estimates are to be provided. Resettlements site should be identified. The plan will also incorporate community development strategies. Tentative number of project affected families identified and accordingly appropriate Rehabilitation & Resettlement plan to be prepared.
  - vi. Green Belt Development Plan along the periphery of the Upper and Lower reservoir, dumping area, power house, approach roads around the colonies and other project components, local plant species must be suggested with physical and financial details. A layout map showing the proposed sites for developing the green belt should be prepared.
  - vii. Reservoir Rim Treatment Plan Protection plan for stabilization of land slide / land slip zones, of Upper and Lower reservoir bank area/ streams/natural reservoir/ponds if any, around the reservoir periphery is to be prepared based on detailed survey of geology of the reservoir rim area. Suitable engineering and biological measures for treatment of identified slip zones to be suggested with physical and financial schedule. Layout map showing the landslide/landslip zones shall be prepared and appended in the chapter.
  - viii. Muck Disposal Plan suitable sites for dumping of excavated materials should be identified in consultation with State Pollution Control Board and State Forest



Department. All muck disposal sites should be minimum 30 m away from the HFL of river/natural reservoir/streams. The quantity of muck to be generated and the quantity of muck proposed to be utilized shall be calculated in consultation with the project authorities. Details of each dumping site viz. area, capacity, total quantity of muck that can be dumped etc. should be worked out and discussed in the plan. Distance of muck disposal area(location) from muck generation sources (project area)/River, Management plan for stabilization /landscaping of muck disposal area and Plan for rehabilitation of muck disposal sites should also be given. The L-section I cross section of muck disposal sites and approach roads should be given. The plan shall have physical and financial details of the measures proposed. Layout map showing the dumping sites vis-a-vis other project components will be prepared and appended in the chapter. Adequate protection measures taken up to avoid any spillage of muck to the adjoining agricultural fields/ forest areas/river streams.

- ix. Restoration Plan for Quarry Sites and landscaping of colony areas, construction area working areas, roads etc. Details of the coarse/fine aggregate/clay etc. required for construction of the project and the rock/clay quarries/river shoal sites identified for the project should be discussed along-with the Engineering and Biological measures proposed for their restoration with physical and financial details. Layout map showing quarry sites vis-a-vis other project components, should be prepared.
- x. Study of Design Earthquake Parameters: A site specific study of earthquake parameters should be done. Results of the site specific earthquake design parameters should be approved by National Committee of Seismic Design Parameters, Central Water Commission (NCSDP), New Delhi.
- xi. Dam Break Analysis and Disaster Management Plan: The outputs of dam break model should be illustrated with appropriate graphs and maps clearly bringing out the impact of Dam Break scenario. To identify inundation areas, population and structures likely to be affected due to catastrophic floods in the event of dam failure. Identify inundation areas/affected area (periphery of Upper Reservoir), population and structures likely to be affected due to event of dam failure. DMP will be prepared with the help of Dam Break Analysis. Maximum water level that

- would be attained at various points on the downstream in case of dam break will be marked on a detailed contour map of the downstream area, to show the extent of inundation. The action plan will include Emergency Action and Management plan including measures like preventive action notification, warning procedure and action plan for co-ordination with various authorities.
- xii. Water, Air and Noise Management Plans to be implemented during construction and post- construction periods.
  - xiii. Public Health Delivery Plan including the provisions of drinking water supply for local population shall be in the EIA/EMP Report. Status of the existing medical facilities in the project area shall be discussed. Possibilities of strengthening of existing medical facilities, construction of new medical infrastructure etc. will be explored after assessing the need of the labour force and local populace.
  - xiv. Labour Management Plan for their Health and Safety.
  - xv. Sanitation and Solid waste management plan for domestic waste from colonies and labour camps etc.
  - xvi. Local Area Development Plan to be formulated in consultation with the Revenue Officials and Village Panchayats. Appropriate schemes shall be prepared under EMP for the Local Area Development Plan with sufficient financial provisions.
  - xvii. Environmental safeguards during construction activities including Road Construction.
  - xviii. Energy Conservation Measures for the work force during construction with physical and financial details. Alternatives will be proposed for the labour force so that the exploitation of the natural resource (wood) for the domestic and commercial use is curbed.
  - xix. Environmental Monitoring Programme to monitor the mitigatory measures implemented at the project site will be prepared. Provision for Environment Management Cell should be made. The plan will spell out the aspects required to be monitored, monitoring indicators/parameters with respect to each aspect and the agency responsible for the monitoring of that particular aspect throughout the project implementation.



- xx. A summary of Cost Estimates for all the plans, cost for implementing all the Environmental Management Plans.
- xxi. Scope of watershed development in the 10 km radius of the project shall be studied in consultation with reputed Government institution having expertise in water shed development and accordingly a detailed Water Shed Development Plan shall be prepared and incorporated in EIA/EMP report.
- xxii. All the tasks including conducting public hearing shall be done as per the provisions of EIA Notification, 2006 and as amended from time to time.
- xxiii. Public hearing issues raised and compliance of the same shall be incorporated in the EIA/EMP report in the relevant chapter. Statement on the commitments (activity-wise) made during public hearing to facilitate the discussion on the CER in compliance of the Ministry's OM F.No.22-65/2017- IA.III dated 30th September, 2020 shall be submitted.
- xxiv. Take the photograph of monitoring stations & sampling locations. The photograph should bear the date, time, latitude & longitude of the monitoring station/sampling location and provided in EIA/EMP report.
- xxv. Matrix formulated on the basis of detailed study and field survey of flora and Fauna methodology used shall be mentioned in the EIA report.
- xxvi. Scientific based Integrated Fisheries Management Plan for conservation and livelihood improvement prepared along with other Environmental Safety Measures for natural Reservoir/streams/rivers and shall be incorporated in the EIA/EMP report.
- xxvii. Carbon sequestration ratio shall be identified.
- xxviii. Techniques/activities shall be explored for reducing water losses due to evaporation. Possibility of installation of solar panel on both reservoirs shall be studied.

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