THDC INDIA LTD.

ENVIRONMENTAL IMPACT ASSESSMENT & ENVIRONMENTAL MANAGEMENT PLAN BASED ON ONE SEASON STUDY FOR VISHNUGAD PIPALKOTI HEP (444 MW), UTTARAKHAND

EMP REPORT

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CHAPTER-10
ENVIRONMENTAL MANAGEMENT PLAN

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10.1 INTRODUCTION

Environmental Management Plan is a plan that seeks to achieve a required end state and describes how activities that have or could have an adverse impact on the environment, will be mitigated, controlled, and monitored.

Environmental impacts arising due to development activities are the key aspects on EIA study. An equally essential element of this process is to develop measures to eliminate, offset, or reduce adverse impacts to acceptable levels and enhance the beneficial ones during implementation and operation of the projects. The integration of the project planning has been done by clearly defining the environment requirements within an Environment Management Plan (EMP). The Management Action Plan aims at controlling pollution at the source of generation itself to the maximum possible extent with the available and affordable technology followed by treatment measures before they are discharged.

The EMP of VPHEP has been prepared to address the issues such as:

- Institutional and Implementation Arrangement
- Biodiversity Management
- Catchment Area Treatment Plan
- Muck Disposal Management Plan
- Fishery Management Plan
- Greenbelt Development Plan
- Soil Erosion and Sediment Control
- Quarry and Borrow Area Management
- Solid Waste Management
- Management Measures for Road Construction
- Construction Camp & Construction Workers
- Public Health Delivery System
- Environmental Monitoring Plan
- Improving Environmental Management Capacity of THDC
- ISO 14001 Management System
- EMP Budget

Environmental Management Process

For environmental management, the typical management principles of ISO 14001 can be used in setting objectives & targets and providing a framework for review and continual improvement. The environmental management process consists of:

- Defining an environmental policy
- Developing plans for environmental management
- Implementation of the EMP
- Monitoring the EMP & incorporating corrective action
- Review of the policy, EMP and improvement

Institutional & Implementation Arrangement

Different aspects of the EMP of VPHEP are under implementation by Three Agencies such as Forest Department, GoUK, THDCIL, and M/s HCC-the Contractor responsible for construction of VPHEP.

Compensatory Afforestation, Roadside plantation, Catchment Area Treatment Plan and Eco-Restoration Plan (including Wildlife protection) and other aspects of EMP related to Forest area is being undertaken by Forest Department, GoUK.

EMP activities related to construction works such as labor accommodation and their health safety and sanitation etc., management measures during construction works, muck management, sewage treatment, quarry management, crusher and batching plant, controlled blasting etc. are to be executed by M/s HCC.

Other aspects of EMP, not covered with Forest and M/s HCC are to be undertaken by THDCIL such as development of Herbal Garden and Greenbelt, R&R works, community development and CER works etc., as well as regular monitoring of EMP activities.

The Compliance report dated 12-13 October 2020 from the Regional Office of MoEF&CC is attached as an **Annexure XIII.** The meeting to constitute Multidisciplinary Committee to oversee the implementation of suggested measures at VPHEP was approved by competent authority on 10th October 2017. The Minutes of the first and second meeting of the Multidisciplinary Committee of VPHEP that was held on 28th July 2018 and 28th February 2020 is also attached as **Annexure XIII**.

10.2 BIODIVERSITY MANAGEMENT

Government of India, under Ministry of Environment, Forest and Climate Change (MoEF& CC) constituted National Biodiversity Strategy & Action Plan (NBSAP) a, firm step towards addressing the various issues related to the use, status and conservation needs of biodiversity in the country. Under this initiative, it has been envisaged to produce a series of planning documents dealing with various facts related to the conservation of National Biodiversity. Under this initiative, 5% of the country's surface area has been successfully declared as legally protected areas.

In order to conserve the rich biodiversity of the State, the Government of Uttarakhand constituted State Biodiversity Board in 2006. Uttarakhand has also adopted the National Forest Policy (1980) that seeks to integrate biodiversity conservation and sustainable use by local people. A complete ban on hunting (1982) and green felling (1984) has been imposed in the state. A number of legislation having a bearing on biodiversity conservation in the state have been enacted in the state.

10.2.1 Conservation plan of Project Influence Area

Responsibility for implementation of biodiversity management plan in Project Influence Area lies with State Forest Department. Local people are involved by the Forest Department on its discretion, for encouraging community participation. Various mitigation measures are required to be implemented to protect the biodiversity from adverse environmental and social impacts likely to be caused by the VPHEP.

Control Timber and Fuel Wood Demand

Timber/fuelwood demand by labour/villagers may seriously affect forests of the project influence area. The climax species of natural forests are under pressure due to increased timber demand. The timber species of forests such as *Cedrusdeodara* (Deodar); *Pinusroxburghii* (Chir), *Pinuswallichiana* (Kail); *Quercusincana* (Ban oak), *Quercushimalayana* (Moharu oak); *Piceasmithiana* (Rai); *Grewiaoppositifolia* (Biul) etc. are under pressure due to illegal felling of trees.

To reduce dependency on fuel wood by the villages, THDCIL is providing alternative fuel such as LPG to labour, Solar Cookers to villagers, etc. Awareness program are regularly organized against illegal felling of trees.

Control of Agriculture & Horticulture Activities

Horticulture, a cash crop/profit gaining activity i.e. cultivation of fruits, vegetable, flowers is increasing at the cost of forestland leading to loss of forest area year by year. There is also tremendous demand of timber for packing cases for marketing of fruits due to horticulture bloom, leading to increase pressure on forest. Areas under dense forests cover will not be disturbed for agriculture/horticulture activities.

Control of Grazing

Animal husbandry is an important vocation for agriculturist and almost every family rears livestock for rears livestock for their day to day requirement the livestock is mainly dependent upon natural resources i.e. forests for sustenance. Extensive grazing of livestock and severe lopping of trees for fodder had adversity affected the forests of probed-influenced area. Overgrazing will be controlled by punitive as well as awareness building measures, as mentioned below:

- In the permitted grazing areas, the animals will be allowed to enter the forests well after the rains so that grasses would have grown sufficiently to withstand grazing and trampling.
- To reduce the dependency of grazing on forest, stall feeding, balanced animal nutrition, improved cattle varieties application of concentrates etc. will be encouraged
- Fencing or Vegetative Hedge will be planted along plantation area. Thorny species like *Prinsepiautilis, Agave, Zizyphus, Euphorbia royleana*, etc. are planted so that it prevents animals from entering into the forest.

- Plantation of fodder species such *Quercusincana, Quercusdilata, Quercus floribunda, Boehmeriaregulosa, Greviaoppositifolia, Debregeasialongiflolia, Melia azedarach,* and Grass species *Arundinaria falcate, Napier*etc inwasteland / Panchayat land to meet fodder requirement.

Control Forest Fire

Forest fire is commonly recorded throughout the forest area. Most of the fires are due to local incendiaries with the belief that burning forest areas improve the resources by getting fresh grass & tender herbages. Effective fire protection measures like early detection systems, communications systems, equipment and public awareness will be implemented for forest fire control. Gram Panchayats and Van Panchayats will be involved to take care of the forest.

10.2.2 Conservation plan of Project Affected Area

The Biodiversity Management of Project Affected Area is the joint responsibility of THDC, State Forest Department and Local Community. Compensatory Afforestation Plan, Catchment Area Treatment Plan and Wild Life Management Plan being implemented by State Forest Department; GoUK. Whereas, Muck/Quarry Area Redevelopment Plan, Avenue Plantation and Landscaping are being implemented by THDC through M/s HCC (contractor). The local community will ensure protection of the plantation from human and livestock.

Plantation along the approach roads and colony area were carried out by Forest department to maintain slope stabilization, air quality and improvement of aesthetic view of the area.

Development of Herbal Garden:

THDC had planned in their EMP (prepared by M/s CES Limited in 2009 on the recommendation of the World Bank) to undertake development of Herbal garden at suitable place in consultation with Forest Department. The vulnerable species such as *Berginialigulata (Silpara), Hedychium spicatum (Banhaldi) and Thalictrumfoliolosum (Mamiri)*were found in the nearby area and propagation of the species were taken. Besides the three species other species of medicinal value like *Aegle marmelos (Bel), Embelicaofficinalis (Awla), Cinnamomumtamala (Tejpat), Ocimumbasilicum (Tulsi), Adhatodavasica (Vashaka), Centellaasiatica (Brahmi), Thymus serpyllum (Ban ajwain), Asparagus officinails (Satvar), Ocimumkilimandscharicum (Kapoor Tulsi)* may also be grown. Plantation of ornamental plants such as Silver Oak, Bottle Brush, Gulmohar, Baken, Jacaranda etc. were also taken up to increase aesthetic nature of the disposal area and catalyze growth of biodiversity on the land and in surrounding area. In the initial EMP (2007), no provision of Herbal garden was there. however, in 2009 THDCIL has made a provision of Rs. 6 lakhs and against which approximately Rs. 17.4 lakhs have been spent.

Wildlife Protection

- It is to be ensured by the Contractor that no hunting is practiced at the site by any of the worker and that all site personnel are aware of the location, value and sensitivity of the wildlife resources.
- Movement of wildlife is reported in the area therefore check post have been established in the project sites one near Power House and one near TBM platform in consultation with Forest Department looking after the Kedarnath Wildlife Sanctuary (KWLS).
- An amount of Rs. 2.43 crores have been earmarked by under Eco-restoration plan of VPHEP which is to be implemented by Forest Department against the provision of Rs. 50.6 lakhs in the 2007 EMP. In addition to above, THDCIL has also established 02 Nos. Watch tower in order to check the entry of labor into the Forest (KWLS) and 10 Camera traps were also handed over to Forest department to aid anti-poaching system. Furthermore, many awareness camps have been organized by THDCIL to make people aware regarding the importance of wildlife protection and conservation. Approximately Rs. 7.3 lakhs have been incurred on the above works by THDCIL.

Roadside Plantation:

Tree felling for road construction/works is kept bare minimum and strict control has been exercised in consultation with the Forest Department. Equivalent number of new trees were planted as integral part of the project within the available land.

Depending on the availability of land and other resources, afforestation of roadside land was carried out to a sufficient distance on either side of the road were to be carried out by Forest department to maintain slope stabilization, air quality and improvement of aesthetic view of the area with an approximate cost of Rs. 58.81 lakhs stand deposited with Forest department against the EMP (2007) provisions of Rs. 15 lakhs only.

10.2.3 Compensatory Afforestation

In order to compensate diversion of forestland i.e. 100.39 ha (includes 23.13 ha land for underground works) for establishment of various project units, compensatory afforestation was proposed to be carried out on 120.27 ha. as per the Forest(conservation) Act (1980). The compensatory afforestation work is being carried out by the Forest Department. Local species must be preferred for plantation under compensatory afforestation for which a total of Rs. 1.25 Crore has been deposited with Forest Department as per demand raised under forest clearance conditions. The species suggested for plantation is given in Table-10.1 and Present status are given under section 10.2.5.

Table-10.1: Species Suggested for Plantation under Compensatory Afforestation Plan

S. No	Scientific Name	Common Name
1)	*Aesculasindica*	Pangar
2)	*Albizzialebbek*	Siris
3)	*Alnusnepalensis*	Utis
4)	*Bauhinia variegata*	Kachnar
5)	*Cedrelatoona*	Toon
6)	*Celtisaustralis*	Kharak
7)	*Cinnamomumtamala*	Dalchini
8)	*Cupressustorulosa*	Leuri

9)	*Quercusincana*	Banj
10)	*Quercusdilata*	Moru
11)	*Embelicaofficinalis*	Amla
12)	*Grewiaoppositifolia*	Biul
13)	*Meliaazadirach*	Denk
14)	*Pinusroxburghii*	Chil
15)	*Bombaxceiba*	Semul
16)	*Juglansregia*	Walnut
17)	*Pyrusmalus*	Apple
18)	*Prunusarmeniaca*	Apricot
19)	*Prunuscommunis*	Plum
20)	*Prunuspersica*	Peach
21)	*Citrus sp.*	Malta

10.2.4 Budget for Biodiversity Management

Ample Budget provisions under different components have been kept towards the implementation of biodiversity management plan. the details of budget provision is enclosed at table 12.26

Under biodiversity management the following components are considered:

- Herbal Garden
- Wildlife Protection
- Roadside Plantation
- Compensatory Afforestation

An expenditure of Rs. 146.63 lakh has been incurred till April' 2021 as a part of Bio-diversity conservation plan.

PRESENT STATUS

Development of Herbal Garden

- Based on recommendations of Herbal & Research Development Institute (HRDI), Mandal, Gopeshwar, Herbal garden has been developed in the VPHEP colony over an area of 1800 sqm. approx. Also, two nos. dedicated manpower/gardener have been deployed for the maintenance of Herbal Garden.
- Approx. Rs. 17.98 lakhs has been incurred on various works related to the development of the Herbal Garden.
- Medicinal plants like Harad (Terminalia Chebula), Lemon Grass (Cymbogogonfelxuosus), Sarpgandha (Rauvolfia Serpentiina), Aloe Vera etc. planted.

Road Side Plantation/muck management/demarcation

- Requisite funds (i.e. Rs. 59.00 lakhs) has been deposited under CAMPA for implementation.
- Matter is under persuasion with CAMPA and State Forest Deptt. for start of works.

Wildlife Protection (related to NDBR & KWLS)

Wildlife Protection:

- Two (02) nos. Watch Towers have been installed at identified locations at Powerhouse and TBM sites nearby the boundary of KWLS.
- Ten nos. Camera Traps were procured on the recommendation of E&S panel. Out of which,08 nos. Camera Traps were handed over to Forest Department (Nanda Devi

National Park) for installation in NDBR on 20.03.2018 and the same were installed in NDBR by Forest Department at appropriate locations. Balance 02 nos. of Camera Traps have been handed over to Forest officials on 12.06.2019.

- Controlled Blasting techniques are being practiced and the same is being monitored by construction contractor through Central Institute of Mining & Fuel Research (CIMFR), Roorkee. Report up to Nov' 2020 has been received.
- Environment Awareness was spread amongst villagers during Band Vikas Mela being held every year in Pipalkoti during December month.
- Environment Awareness Program has been organized at GIC, Gadora, Chamoli during Feb' 2020 in the presence of noted Environmentalist Sh. Jagat Singh Chaudhary alias "*Jungli Ji*".
- Awareness Programs are being organized from time to time.

Compensatory Afforestation in 120.27 Ha

- Compensatory Afforestation and other works (Roadside Plantation, construction of 4 feet high pillar etc.) to be undertaken by the State Forest Department, GoUK. Requisite fund has already been deposited by THDCIL in CAMPA. However, the fund is yet to be released by the CAMPA to the concerned Forest Deptt.
- THDCIL is continuously pursuing the issue with Senior Forest Officials at Dehradun.
- Issue was also discussed during meeting of Multi-Disciplinary Committee constituted by MoEF&CC, New Delhi under the chairmanship of PCCF-HoFF, GoUK held on 28.02.2020 at Van Bhawan, Dehradun.
- In the said meeting, DFO, Badrinath Forest Division (Nodal Officer) appraised that slow progress is due to non inclusion of activities in the Annual Plan of Operation (APO) by the Forest Department.
- The Chairman - MDC, PCCF-HoFF, has directed the concerned Forest officials to make all-out efforts for early completion of these activities.

10.3 CATCHMENT AREA TREATMENT (CAT) PLAN

10.3.1 Need for CAT Plan

Area draining into dam through different local streams situated within the Catchment area mainly responsible for soil erosion. It disturbs the eco-logical balance by destroying the vegetated cover, dislocating wild life, removing precious topsoil, modification of stream morphology. Consequently, natural vegetation is removed on either side of riverbank. Soil gets disturbed and is easily removed during periods of heavy down pour, leading to accelerated erosion of soil cover. This causes silt/sediment flow into streams below. Siltation of stream beds reduces the capacity of stream channel and reservoir.

The study of erosion and sediment yield from catchments is of utmost importance as the deposition of sediment in reservoir reduces its capacity, thus affecting the water availability for the designated use. The eroded sediment from catchments when deposited on streambeds and banks causes braiding of river beach. The removal of top fertile soil from catchments also adversely affects the agricultural production. Another important factor that adds to the sediment load, and which contributes to soil degradation is grazing pressure. A large number of cattle, sheep's, and goats graze the pastures during summer season continuously for about six months. Due to this pressure, the productivity of these pastures is

also declining further. The lack of proper vegetal cover is a factor to cause degradation and thereby results in severe run off/soil erosion, and subsequently premature siltation of the reservoir. Thus, a well-designed Catchment Area Treatment (CAT) Plan is essential to ameliorate the above-mentioned adverse causes and process of soil erosion. The catchment area treatment involves understanding of the erosion characteristics of the terrain and suggesting remedial measures to reduce the erosion rate. For this reason, the catchments of the directly draining rivers, streams, tributaries, etc. are treated and the treatment plan has been included in the project.

10.3.2 Project area in the CAT Plan

The Catchment Area Treatment Plan for VPHEP has been prepared by the Badrinath Forest Division, Gopeshwar; Garhwal Circle, Pauri, Uttarakhand.

The Plan includes 37 micro watersheds in 5 sub watersheds namely Saraswati, Dhauli ganga, Rishi gang, Budhi ganga & Nagoi gad. But as various CAT plans are already under implementation in this catchment particularly Tapovan Vishnugad CAT plan, only 18 micro watershed in 2 sub watersheds namely Budhiganga and Nagoigad has been selected for treatment.

The total area of selected catchment is 84085.00 ha. Out of which, 12964.00 ha (15.42%) is rocky and snowbound. The remaining area of 71121.00 ha (84.58%) is treatable, of which, agriculture area is 6647.00 ha (7.90%), forest area is 40678.00 ha (48.38%) and blank area is 23.796 ha (28.30%). Therefore, total workable area is 71.121 Sq. Km.

The Land Use Classification in Revised Catchment Area Treatment Plan is given in Table-10.3.

Table-10.2: Land Use Classification in Revised Catchment Area Treatment Plan

Name of the Catchment (Sub-Watershed)	Name of the micro-watershed	Treatable area (ha)			Untreatable area(ha)			Total(ha)
		Agriculture	Forest	Blank	Rocky	River Bed	Snow Bound	
Budhi ganga	Karmansa	537	2293	288	338	0	0	3456
	Senkora	395	3519	137	1562	0	0	5613
	Garur ganga	638	2556	126	592	0	0	3912
	Batula	594	950	31	500	0	0	2075
	Gauna	100	1150	0	1250	0	0	2500
	Pulgadhera	200	3538	175	1187	0	0	5100
	Birahi ganga	144	3337	1569	4000	0	938	9988
	Gadiyal gadhera	37	2763	525	869	0	0	4194
	Taraktal	637	6463	250	0	0	0	7350
	Lasi	1988	1944	80	38	0	0	4050

Name of the Catchment (Sub-Watershed)	Name of the micro-watershed	Treatable area (ha)			Untreatable area(ha)			Total(ha)
		Agriculture	Forest	Blank	Rocky	River Bed	Snow Bound	
	Total Budgi ganga	5270	28513	3181	10336	0	938	48238
Nagoigad	Jaisal	581	875	800	0	0	0	2256
	Menagad	43	6506	8288	0	0	520	15357
	Topon	230	305	1353	0	0	0	1888
	Bangina	486	1857	188	0	0	0	2531
	Kalpagad	0	731	3869	0	0	896	5496
	Barki	19	556	937	0	0	0	1512
	Aroshigad	18	648	1109	0	0	0	1775
	Vishnugad	0	687	4071	0	0	274	5032
	Total Nagoigad:-	1377	12165	20615	0	0	1690	35847
	Grand Total:-	**6647**	**40678**	**23796**	**10336**	**0**	**2628**	**84085**

Source: CAT Plan prepared by Badrinath Forest Division, Gopeshwar

Total area	84085.00ha.
Treatable area	71121.00ha.
Un-treatable Area	12964.00ha.

10.3.3 Objective of the CAT Plan

a) The Primary objective of this plan is to restore the ecosystem and biodiversity of Impact Area affected by the Vishnugad-Pipalkoti Hydroelectric Project.
b) The actual project area is located in forest bound area which is on one hand geologically fragile zone and on the other hand it houses rich in floral and faunal wealth. The wild animals of this area are highly endangered and needs special care & treatment in full movement zone in and around the project area. As such the plan will provide management inputs in the Impact Area for the conservation and management of floral and faunal diversity.
c) Project will give maximum emphasis on catchment treatment through plantation, soil and water conservation works. Treatment of land slide areas, improvement of habitat of wild animals and conserving biodiversity treatment of agricultural field of stake holders, which are sensitive to soil and water erosion to improve the life standard of the local people through Eco development works and ensure people participation. A certain amount of fund has also been earmarked for annual maintenance and upkeep of soil conservation works. The project will be implemented with integrated watershed management approach.
d) The project will be executed by three different agencies i.e. forest department, expert agencies and the local communities depending upon the expertise needed to conduct these works and the stake of the community to own and maintain the intervention. Heavy engineering works pertaining to landslide control in and around the project area will have to be executed with the help of expert agency who has the local expertise for such treatment works. The expert agency will be identified in the annual plan to be made every year by the forest department.

e) The catchment area is strategically located between Nanda Devi National Park, Kedarnath Wildlife Forest Division, Alaknanda Soil Conservation Division and Badrinath forest Division.
f) The CAT plan earmarks the provision for selected inputs in livelihood support activities for the local community, which would facilitate eco-restoration as well as eco-development of the catchment area. Education and awareness of the community for catchment development on watershed approach will be central to all these activities. Apart from this, special care is to be taken on decreasing dependence of the local people on forest areas. For this special effort will be done by raising forest on Civil Soyam and Van Panchayats and doing pastoral development activities.
g) Village communities have been put to the center in the case of all village related eco-development works. Institution and capacity building will be the major intervention areas for conducting any work in the village. Project will focus on the process development in participatory approach with the community in terms of owning the responsibility for maintenance of created assets.
h) Women are the main natural resource managers in the project area and the poorest have the largest stake in the forests. To motivate the women in the project process, women social motivators will be appointed. Special support in the areas of rural technology, gender support, focus group and the public healthcare has been identified for this.
i) The approach to supporting the animal husbandry, agriculture, horticulture and energy conservation sectors will be mostly through technical training inputs and facilitation for forward and backward linkage, long term participatory research programmes and demonstrations for trying out the adaptation and penetration of innovative technologies that lead to lesser dependence on natural resource use will be encouraged in this programme. Income generation activities to provide alternative livelihood opportunities have also been envisaged to reduce pressure on the forests and grazing lands.
j) Dovetailing the awareness training and technical inputs of the project with the ongoing schemes of the line department will be done in order to sustain the initiatives taken up by the project and to prevent misuse of funds through duplicity.
k) A large area of agriculture field of stakeholders lies in the catchment area. This area is also fragile and due to soil erosion land holding is decreasing day by day. So special efforts will be made to check soil erosion and conserving the moisture of agricultural fields of stakeholders by soil and water harvesting measures.

10.3.4 Plantation in the Reserve Forests Areas

Plantations will be carried out in the reserve forest areas in the project area with multi objective of soil conservation, water recharge and Eco restoration of degraded areas. These areas are in addition to the plantations which will be carried out by in nearby Civil and Forest Panchayat areas for meeting their fuel wood and fodder needs that would ultimately reduce the biotic pressure on forests. The participation of the grazer community will be very crucial to make the plantations successful in the reserve forest area in the higher hills. Forest department staff will ensure the participation of the local community in planning the plantation species and in protection of these plantations. Plantations that will be done in the soil conservation areas near the drainages for vegetative treatment will be in addition to the above plantation target. These plantations will be carried out by Nanda Devi National Park, Kedarnath Wildlife Forest Division and Badrinath Forest Division.

10.3.5 Plantation in the Civil Soyam and Van Panchayat Areas

A large area of Civil Soyam and Van Panchayat falls within catchment area. Mostly this area is blank and unable to work as buffer in between community and the reserve forest. Therefore, all the biotic pressure falls on the Reserve Forest. So there is special need to make plantations in these areas so that they could meet the requirement of the local people in and have and restoring the eco systems of the area. These plantations will also increase the livelihood of the people and also the income of the Van Panchayats. These plantation works will be done by Nanda Devi National Park, Kedarnath Wildlife Forest Division, Alaknanda Soil Conservation Division and Badrinath forest Division.

A total of 1000 ha area will be treated for plantation activities. Out of this, 450 ha area will be taken under densification, 50 ha under pasture development and 300 ha under medicinal plants. Apart from this, around 1200 ha area has been selected for assisted natural regeneration.

10.3.6 Drainage Line Treatment and Soil Conservation Work

The Impact Area is very fragile and there is a huge scope of soil and moisture conservation works. These works will be conducted as erosion control works in gullies and eroding stream and river training works. This component concentrates on protection works where lasting benefits will be assured in the lower catchment area. Works will concentrate on construction of site specific physical structures accompanied by tree planting to stabilize banks and planting for short vegetative cover in the landslide prone areas through brushwood and perennial grasses. Project will seek the technical assistance from the institutes identified for deciding the treatment measures and treatment norms. The plan has identified a number of streams which needs treatment from their primary source. The phasing of work in the selected stream has been done depending upon the urgency for treatment needs. The phasing of interventions and type of the structures will be decided based on the treatment needs of each stream on the ground right before the execution of work. Thus, the physical target kept in this plan has to be regarded as nearest possible indicative targets keeping in view the fragile geological condition of the catchment area. Effort will be made to synergies the treatment works with the soil conservation practices of the catchment community. For the works of drainage line treatment to be executed by Forest Department, the village community will be integrally involved in the execution of these works.

10.3.7 Wildlife/ Biodiversity Protection Works

The Impact area of Vishnugad Pipalkoti Hydroelectric Project is strategically located between Kedarnath Wildlife Division, Badrinath Forest Division and Nanda Devi National Park. The area is endowed with variety of flora & fauna, many of which fall under endangered category, e.g. Leopard, Himalayan Black bear and Ghural, Jungal Cat, Barking

deer, Sambhar, Wild boar. The area also houses high-risk pheasant like Monal, Koklas and Chir Pheasants. The civil soyam areas lying in the impact area are also rich in wild Life. The overall objective of wild life and bio-diversity management plan of is:

- Training and capacity building of the forest staff for protection and surveillance
- Protection of floral and faunal resource and conservation of threatened flora and fauna and protection of corridors
- Management of man animal conflict
- Wireless and mobile communication for protection support
- Infrastructure maintenance
- Habitat improvement works
- Biodiversity conservation support to the village communities
- Mobility support for field staff

The usage of the earmarked fund for wild life protection activity will be governed by wild life management plan of each division. The earmarked fund will remain as corpus with the department under a separate account head. This will remain as a corpus fund in fixed deposit in a nationalized bank giving competitive interest rate. Out of this generated interest approximately 90% will be used annually for wild life protection purpose and balance amount will be used to develop the corpus fund further.

10.3.8 Responsibility of Forest Department

The responsibility of implementing the project will lie with the concerned Divisional Forest Officer (DFO). The DFO, Badrinath Forest Division, Gopeshwar shall be the nodal implementing agency who will be the Nodal officer. For effective implementation of this project, the DFO, Badrinath Forest Division/Nodal Officer will need a Project Management Cell (PMC).The project will be closely monitored in terms of physical, financial progress and quality by Conservator of Forests, Pauri Garhwal & Conservator of Forest, Nanda Devi Biosphere Reserve, Gopeshwar. The concerned Assistant Conservator of Forests (ACFs) will closely supervise the project in all respects. One ACF shall be posted at the Nodal Office who will act as the point of overall co-ordination of the staff from the all Implementation Units and specialists from differentdisciplinesincludingProjectCoordinator.TheProjectCoordinator shall be hired/engage or taken on deputation from the linked departments as per the needs.

In PMC the Nodal Asst. Conservator of Forests (ACF) will work in close coordination with Project Coordinators (PC). The technical staff of PMC will comprise of one horticulture specialist, one livestock specialist and other specialists who shall be hired/consulted as per the site specific requirements. The concerned ACFs will be directly responsible for field level planning and monitoring of implementation of work under forestry and soil conservation to be executed by the Forest Department.

Project coordinator (PC) will be directly responsible for overall planning and implementation of all the institution building and capacity building trainings, workshops, exposure visits for

the project which includes project staff of all the ranks from different disciplines and the villagers. For Eco-Development Activities carried out by the V.P., Project Coordinator will make recommendations to the DFOs concerned for execution of all these activities through the ACF.

PCs shall be primarily responsible for planning, coordinating and monitoring the execution of village based eco-development works and livelihood improvement works. PCs shall work in close coordination with horticulture specialist, livestock specialist, engineering specialist and the concerned line agencies for appropriate field level planning and recommending social and technical inputs. PCs will make the joint recommendation in proposals, estimates and vouchers along with ACF for village based livelihood improvement works. Specialist of different components will plan and execute work through PIU office. PCs will also monitor the institutional health of the VPs, assess the adaptive challenges being faced by these institutions and give feedback to the concerned DFOs.

PMC will be handled by assistant accountant and assistant programmer & other staff (as per the based needs) along with the normal ministerial staff of Badrinath Forest Division, Gopeshwar.

It will be the responsibility of DFO, Badrinath Forest Division/ Nodal Officer to coordinate with all the expert /line agencies to seek adequate support partnership for study, research, documentation and information dissemination for planning and execution of work with quality participation of the local communities into the project work. DFO will closely work with concerned ACF and PCs for seeking their assistance for this work.

It will be the responsibility of Conservator of Forests, Garhwal Circle, Pauri and Conservator of forest/Director, Nanda Devi Biosphere Reserve, Gopeshwar, closely monitor the quality of the project regularly through monitoring committee, coordinate with THDC and the Government for regular fund flow and give expert on hand guidance to PMC for effective implementation of the plan.

10.3.9 Responsibility of THDC

- THDC will responsible for overall supervision of the CAT Plan implementation.
- The Environmental Management Cell (EMC) of THDC will supervise the implementation of each activity given in the CAT plan. EMC will also monitor physical & financial progress and prepare a quarterly progress report.
- Year wise fund will be released by THDC for which a Memorandum of Understanding (MoU) may be signed between THDC & Forest Department.

10.3.10 Financial Provision for CAT Plan

The initial provision for the CAT plan that was kept under 2007 EMP of VPHEP was Rs. 271.7 lakhs. However, the provision was revised by the forest department in 2012 and demanded Rs**. 47.00 Crore**. This includes financial provision for the CAT plan of Rs. **234.3**

Lakh and for the Eco-restoration plan the provision is Rs. **4466.6 lakh**. Breakup of the financial provisions under Eco-restoration plan is given in **Table-10.3.**

Table-10.3: Financial Provision for Eco-restoration

S. No.	Particulars	Rs.
1.	Forestry Work	37529900
2.	Engineering Work	191140000
3.	Wild Life Management Work	24325000
4.	Residential and Non Residential Building New Construction and Renovation for Field Staff	25910000
5.	Foot Path Renovation	12060000
6.	Foot Bridge New Construction and Renovation	3700000
7.	Other Developmental and Participatory Activities	152000000
	Total	**4466664900**

Source: CAT Plan for VPHEP, prepared by Badrinath Forest Division, Gopeshwar

10.3.11 Agencies Involved in Implementation of the CAT and Eco-Restoration Plan

Following institutions will provide technical support during implementation of the Catchment Area Treatment Plan:

- Wildlife Institute of India (WII), Dehradun will provide the technical guidance regarding the census, monitoring and evaluation of the faunal diversity in the area.
- Wadia Institute of Himalayan Geology, Dehradun will assist in monitoring the environmental aspects in the project area.
- Herbal Research & Development Institute, Gopeshwar
- UREDA is a premier agency, which is working in the field of non- conventional energy.
- JAL Sansthan/ Jal Nigam: There are various schemes executed by Jal Nigam and Jal Sansthan for providing drinking water facility in the different villages. This facility will be made available in the affected villages by the above agencies under rural development program.
- Bamboo &Fibre Board, Uttarakhand, Dehradun will provided financial & technical support to villagers
- Indian institute of Remote Sensing (IIRS)
- Forest Survey of India (FSI) will give necessary expertise in the Digitization of the maps used for various purposes like reports, and documentation.

10.3.12 Present Status

- Total Implementation value for CAT is Rs. 47.0 Crore., the total amount of Rs. 47.0 Crore stands deposited by THDCIL in CAMPA fund. DFO Badrinath Forest Division is the Nodal Officer for CAT Plan.
- Vide letter dtd. 30.12.2017, final approval has been granted to DPR along with Micro plans for CAT Plan of VPHEP by Forest Deptt., GoUK.
- State Forest Deptt., Uttarakhand is executing activities as per approved DPR. An expenditure of Rs. 23.18 Cr (approx.) has been made by Forest Deptt. till March'21 under CAT Plan of VPHEP.
- Issue of slow progress of CAT Plan was also discussed during meeting of Multi-Disciplinary Committee constituted by MoEF&CC, New Delhi under the chairmanship of PCCF-HoFF, GoUK held on 28.02.2020 at Van Bhawan, Dehradun.

- In the said meeting, DFO, Badrinath Forest Division (Nodal Officer) appraised that slow progress is due to non-inclusion of activities in the Annual Plan of Operation (APO) by the Forest Department.
- The Chairman - MDC, PCCF-HoFF, has directed the concerned Forest officials to make all-out efforts for early completion of these activities.

The copy of approved Catchment Area Treatment Plan is enclosed as **Annexure-XIV.**

10.4 MUCK DISPOSAL MANAGEMENT PLAN

10.4.1 Introduction

The construction of Vishnugad Pipalkoti Hydroelectric Project (444 MW) would involve excavation of earth and rock generating muck in large quantum i.e. in the volume of 1.5 Mm^3. The muck thus generated needs proper disposal. With the objective to protect the disposal areas from further soil erosion and develop the surrounding areas in harmony with the environment the Muck Disposal Plan is formulated.

The Muck Disposal Plan detailed in the following sections gives the quantification of muck, identifies location and activities wherein muck is generated (excavation and blasting operation) and quantifies muck generated from each activities with relevance to disposal options.

The identified locations/sites of muck disposal is in conjunction with various characteristics viz. landscape, cost effectiveness, nearness to source of generation, groundwater/blockage to surface water, relief and scope of afforestation and erosion control/sediment arrest. The plan identifies landscaping measures for disposal of muck, modes of transportation for muck disposal and species selection for use of biofertilizer method for vegetative growth on muck spread, delineates muck disposal options for each site implementation and development of landscape.

10.4.2 Generation of Muck and its Disposal

As per Bill of Quantity (2014), due to the construction of the various components of the project, the total quantity of muck to be generated was estimated to be about 3.4Mm^3 and out of the total muck generated at least 1.0Mm3 (approximately 30%) would be utilized/re-used for construction/filling/infrastructure works of project and/or community development purposes. For dumping of the remaining muck of 2.4Mm^3 four Dump yards areas viz.(i)Gulabkoti(ii) Haat,(iii)Siasain and(iv)Jaisal have been identified adjacent to project components. In these 4 identified sites dumping will be done and further they will be restored and revegetated with proper landscaping.

The details of muck generated from various components is presented in Table 10.4

Table 10.4: Details of Muck Generation

S. No.	Project Activity	Excavation (in cum)	
		Open	Underground
1	Gravity Dam, Spillways & Power Intake Structure	481933	27244
2	Desilting Chamber & D/s Surge Chamber, Butterfly Valve Chamber, Penstock Assembly Chamber, Gate Operation Chamber for Intake gates, Silt Flushing Tunnels	0	592098
3	Adits& Tunnels by DBM	150722	756990
4	12 km of HRT by TBM	0	886777
5	Penstock Tunnel and pressure shaft, various gate shafts	1000	51077
6	U/s surge shafts	16000	52269
7	Machine & Transformer Caverns		201490
8	Potyard	30185	0
9	Miscellaneous Works & Overflow weirs	219000	1300
Total		**898840**	**2569245**
		3468085	

About 30% of muck generated during excavation are proposed to be utilized for various project construction activities/infrastructure and local area development works. After considering 20% as swell factor, approximately 29.13 lac cum muck is to be dumped at various dumping sites. The details of muck to be disposed-off at various muck disposal sites are given in Table-10.5.

Table-10.5: Details of Muck to be disposed off

Quantity proposed to be generated (A)	34,68,085 m^3
Quantity proposed to be utilized in various construction activities (B = 30% of A))	10,40,425.5 m^3
Quantity proposed to be dumped at designated muck disposal sites (C = A-B)	24,27,659.5 m^3
Quantity proposed to be dumped at designated muck disposal sites considering swell factor of 20 % (D = C × 1.2)	29,13,191.4 m^3

Muck Disposal Sites

The description of the muck disposal sites is given below:

i. Disposal Yard 1 (Gulabkoti):

Gulabkoti site (disposal yard 1) has been identified for the disposal of muck to be generated due to the construction of the dam and appurtenance structures. The Gulabkoti area is fairly open with sparse vegetation cover in the form of scrubs with scattered trees. This disposal yard shall accommodate muck generated from diversion tunnel, dam excavation, desilting chamber, Head Race Tunnel (HRT) etc.

ii. Disposal Yard 2 (Haat):

Haat site has been identified for the disposal of muck arising out from construction of HRT by Tunnel Boring Machine (TBM), Surge Shaft, Penstock Assembly Chamber (PAC), Butterfly Valve Chamber (BVC), adits etc.

The terrain of the muck disposal site at Haat has a steep topography in the upper reaches and a gentle sloping topography in the lower reaches in the close proximity of the river bank. The general landscape of the area is more or less open with sparse vegetation cover in the form of scrubs with scattered trees concentrated along the arterial road.

iii. Disposal Yard 4 (Siasain):

Jaisal site near Siyasin has been identified for the disposal of muck to be generated due to the construction of the various Adits of power house, transformer hall, d/s surge shaft, penstock and adits etc. The terrain of the muck disposal site at Jaisal has a steep topography followed by a more or less gentle topography and again steep slope near the river bank. The general landscape is more or less barren with scanty vegetation growth in the form of scrub, grasses and scattered trees which are more prominent in the lower reaches of the river bank and along the streamlets and channels of water.

iv. Disposal Yard 5 (Jaisal):

This site has been identified for the disposal of muck to be generated due to the construction of the tail race tunnel, part of road works etc.

The capacity of Muck disposal sites are given in Table-10.6 and Table-10.7.

Table 10.6: Capacity of Muck Disposal Sites

Dumping Location	Capacity Of Disposal Yard (in cum)
Gulabkoti (Disposal Yard 1)	12,40,000
Haat (Disposal Yard 2)	19,55,678
Siyasain (Disposal Yard 4)	5,33,601
Jaisal(Disposal Yard 5)	2,36,339
Total	**3965618**

Table 10.7: Reassessed Capacity of Muck Disposal Sites

Dumping Location	Capacity Of Disposal Yard (in Lack cum)
Gulabkoti (Disposal Yard 1)	12.3
Haat (Disposal Yard 2)	12.65
Siyasain (Disposal Yard 4)	5.47
Jaisal (Disposal Yard 5)	1.28
Total	**31.7**

10.4.4 Conclusion

From the discussions in the above sections it can be seen that the total volume of muck proposed to be generated is approximately **4.0 Mm^3** and out of which at least **1.4 Mm^3**

(approximately 35%) and remaining **3.12 Mm^3** muck will dumped in the dump yards. Further, the capacity of the muck disposal sites and quantity of muck was re-assessed in 2021 and found that the muck can be easily managed to be disposed-off in the identified muck disposal sites and there is no need for developing another site. It may also be possible that utilizable muck may be much more than the estimated 1.4 Mm^3 which will be known at future execution stage of the project; that will reduce the quantity of muck to be dumped at respective sites.

As discussed above apart from the disposition of the muck through construction of suitable retaining walls such as gabion, masonry gravity walls etc.

10.4.5 Planning and Management of Muck Disposal Yards

a) Re-vegetation

Plantation will be carried out at the muck disposal sites for the stabilization of the slopes, landscaping and improving the aesthetic value of the area.

The waste material dumped at spoil tip would be mechanically compacted and properly leveled with suitable safe slopes. A retaining wall of about 7 m will be constructed at the muck disposal sites. On the uphill side of the slope a 50 cm high and 50 cm thick wall would be provided to protect the uphill side of the terraces from slipping. In order to restore the area, all these dumping sites need to be rejuvenated by means of turfing and vegetation growth. A Schematic Diagram of the turfing of slopes is given in **Figure-10.1**. As the muck would be disposed on an unstable slope, for proper compaction and stabilization 1 m terracing along the contour at 5 m interval along the slope in staggered manner may be done for muck disposal. Muck disposal sites with gentler slopes viz. Gulabkoti, Jaisaal and Haat will be provided with stairway for accessibility and maintenance. For the muck disposal site like Guniyala which has a steeper gradient can't be provided with stairway as rise and tread cannot be designed on a slope of more than 1: 1 m gradient.

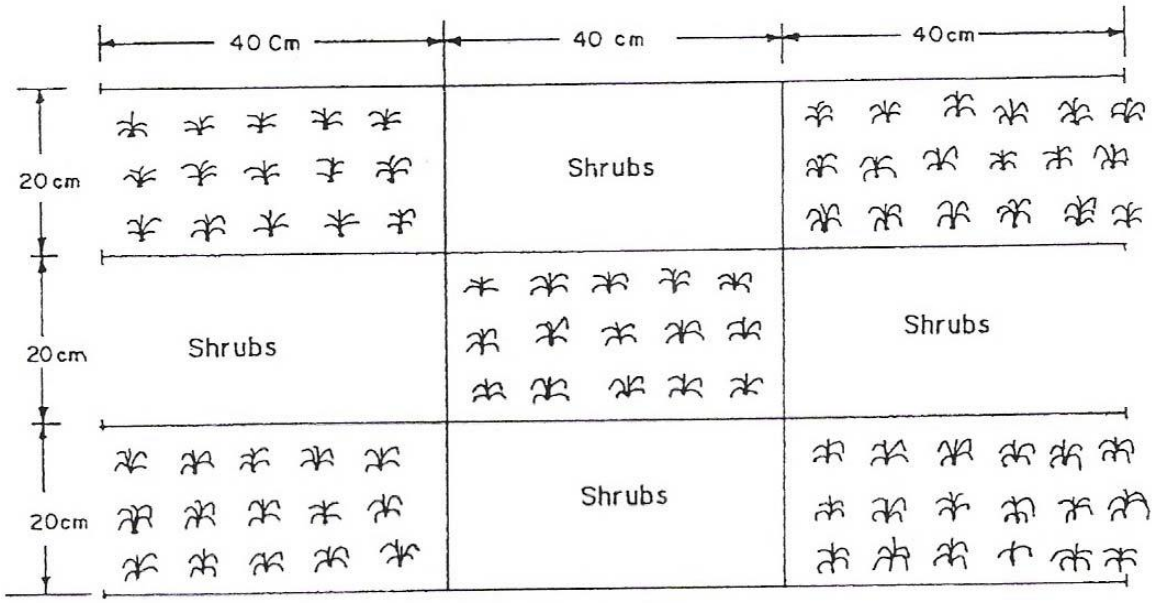

Figure-10.1: Schematic Diagram of Turfing on Slopes

All spoil tip areas will be developed as per specifications and its feasibility. Water treatment will be given for settlement of muck with suitable compaction. Once the dumping is completed these areas will be developed into terraces and restored by laying of the top soil on the top, digging of pits and planting of plant sapling. Once the dumping activities are completed, these dumping areas will be developed into terraces and restored by laying of soil on the top and digging of pits and planting of plant sapling. These areas may be developed into parks, gardens and view point sites for tourists. In between the spoil tips drains or channels, will also be provided for draining of sprinkled water.

The brief work plan formulated for revegetation of these spoil tips is through “Integrated Biotechnological Approach”

- Development of the spoil tips taking into consideration their chemical properties to ensure supportive and nutritive capacity to sustain vegetation growth
- Delineation of appropriate blends of organic waste and soil to develop rhizosphere of good nutritive and supportive capacity
- Mass culture of plant specific bio-fertilizer and mycorrhizal fungi.
- Plantation of 4 spoil tips covering about 14.9462 ha. using identified blend and biofertilizer inoculums

b) Plantation

Plantation will be carried on spoil tips by digging of pits. These pits will be mixed with external soil, organic fertilizer and vermi-compost. Saplings will be planted in these pits. Refilling will be done by covering the entire root system.

Turfing (sodding) and suitable shrubs will be grown at slopes. Thick layer of external soil will be spread on the slope area. Sod patches will be grown in form of patches. Before sowing the area should be properly amended with manure.

Species for Plantation

Afforestation with suitable plant species of high ecological and economic value and adaptable to local conditions will be undertaken in accordance to canopy requirement. The major plant species in the area are:

Non Leguminous including fruit trees

(i) Poplar (*Populu sp.)*
(ii) White willow *(Salix alba)*
(iii) Deodar *(Cedrus deodara)*
(iv) Kail *(Pinus wallichiaia)*
(v) Apricot *(Prunu sp.)*
(vi) Mourning cypress *(Cupressus torulosa)*
(vii) Pangar *(Aesculas indica)*
(viii) Utis *(Alnus nepalensis)*
(ix) Kachnar *(Bauhinia variegata)*
(x) Toon (*Cedrela toona*)
(xi) Shisham (*Dalbergia sissoo*)
(xii) Semul (*Bombax ceiba*)
(xiii) Biul (*Grewia oppositifolia*)
(xiv) Denk (*Melia azedarach*)
(xv) Apricot (*Prunus armeniaca*)
(xvi) Plum (*Prunus communis*)
(xvii) Peach (*Prunus persica*)
(xviii) Pomegranate (*Punica granatum*)
(xix) Malta (*Citrus spp.)*

Leguminous

(i) Locust tree *(Robini psuedoacacia)*
(ii) Maharukh *(Ailanthus excelsa)*
(iii) *Indigiogofera pulchela*
(iv) Siris *(Albizzia lebbeck)*

Shrubs

(i) Rambans *(Agave americana)*
(ii) Basinga *(Eupatorium adenophorum)*
(iii) Shuru *(Euphorbia royleana)*
(iv) Nagphani *(Opuntia dilleni)*
(v) Karonda *(Carissa spinarium)*
(vi) Ber *(Zizyphus mauritiana)*
(vii) Bhilmora *(Rumex hastatus)*
(viii) Kath Neem *(Murraya koengi)*
(ix) Bindu *(Colebrookea oppositifolia)*
(x) Rasaut *(Berberis aristata)*
(xi) Barapilu *(Salvodara sp).*
(xii) Basak *(Adathoda vasica)*
(xiii) Safed musli *(Asparagus sp.)*

Grasses

(i) Gini ghas *(Panicum maximum)*
(ii) Rhodes grass *(Chloris gayana)*
(iii) Doob ghas *(Cynodon dactylon)*
(iv) Vetivar grass (Chrysopogon Zizanioides)

The various species of leguminous and non-leguminous plant species will be grown on the spoil tips. A small portion (approx. 2%) of the vegetation cover will comprise of horticulture plants and one site will be kept for other plantations depending on its suitability.

c) Irrigation Facility

The vegetation in the Vishnugad Pipalkoti area is mostly dependent on rainfall and to some extent on small streamlets. In general the afforestation programme in the vicinity is not supplemented by any irrigation system. However, in order to ascertain quick greenery and growth in the spoil tip areas, irrigation, especially during the drought period is to be provided. To cater to this need portable water pumps along with requisite PVC pipes need to be utilized to draw water from immediate down slope sources. For sites where no immediate source of water is available for this irrigation, the water will be provided by project tankers.

d) Fencing

All the 4 sites will be properly fenced to protect the area from human and animal interference.

e) Watch and Ward

Manpower in the form of watchmen and gardeners would be deployed for protection and maintenance of the sites for three years. The duties will include replacement of casualties, weeding, watering, repair of fence line etc.

10.4.6 Budget

The initial budget provisions of Muck Management plan that was kept under 2007 EMP was Rs. 1.07 Crore which included 97 lakhs for Engineering measures and only Rs.10 lakhs for biological measures. the provision is revised by THDCIL in 2009 to around 1.978 crores for the biological measures and necessary appropriate provisions regarding the complete cost of engineering measures to be ensured at Dump yard sites is included in the Civil contract.

10.4.8 Present Status

- Dumping of muck is being done at designated / identified area & well above the high flood level. Engineering measures such as construction of gabion faced reinforced earth wall with uniaxial geo-grid reinforcement are adopted at dumping site. Benches are being developed to discontinue the slopes in dumpyard.

- Work of plantation of Vetivar (Chrysopogon Zizanioides) grass as slope stabilization measure at Siyasain dumping site (DY-4) was started in September 2018.
- Plantation in approx. 10,000 sqm. area has been completed at DY-4.
- M/s HCC Ltd. has been instructed to ensure necessary reclamation works at all Disposal sites.

10.5 FISH MANAGEMENT PLAN

Snow trout *(Schizothoraichthys progastus* and *Schizothorax richardsonii)* is found in the project stretch. The fish management plan involves various options for management of Mahseer and Snow trout.

10.5.1 Characteristic of Endangered Fish

Snow trout *(Schizothoraichthysprogastus*and *Schizothoraxrichardsonii) is* a freshwater fish. It is mainly herbivorous basically feed on plant material. Breeds in the upper reaches of river and travels down locally after breeding. Maximum size is 50 cm.

The dam on river Alaknanda to be developed as a part of the project will act as a barrier to the local free movement of fish species. Due to its dorso-lateral compressed body, the snow trout is not an active swimmer.

10.5.2 Sustenance of Fisheries

Most of the fish species found in Alaknanda are abundant in nature. However two species of Mahseer (*Tor tor ; Tor putitora*) are endangered as per NBFGR categorization, which are absent at the sampling. Other two species of *Schizothoraichthys progastus* and *Pseudecheneis sulcatus* are vulnerable in nature.

10.5.3 Management Measures

Habitat Restoration: Mahseer is a migratory fish and comes in the Alaknanda and its tributaries in search of feeding and breeding grounds. The Birahi is the most appropriate habitat for Mahseer and able to provide suitable conditions for the survival of its young ones. The catchment of Birahi River can be improved by plantation along the bank. The anthropogenic activity like extraction of sand, pebbles, gravels, stones and fishing activity in the river should be completely banned. Efforts for diversion of route of Mahseer towards Birahi river may be done for effective management of Mahseer and other vulnerable fishes in the region. A capital cost provision of Rs. 10 lakhs were kept in 2009 EMP towards habitat restoration of Mahseer through improvement of the catchment of Birahi River and conservation of fish stock in the study stretch of Alaknanda. The Mahseer hatchery already constructed at the Tehri Dam on the Bhagirathi River is used for propagation of the Mahseer and will be utilized for VPHEP.

Management of Snow trout

For the management of the Snow trout (*Schizothoraichthys progastus*), THDC has been prepared a Fish management plan with consultation of Directorate of Cold Water Fisheries (DCFR), ICAR, Bhimtal. The final report of Fish management plan has been submitted by the DCFR, ICAR, Bhimtal. The Senior Scientist from DCFR, ICAR, Bhimtal have already visited the project site for identification of suitable site for establishment of Snow Trout hatchery for fulfillment of fishery action plan towards restoration of aquatic ecosystem. The MoU for construction of fish hatchery is under implementation

Production and rearing of Fish Seed

Brood stock will be procured and maintained at the fish farm to produce the seed required for stocking. The hatchling will be reared at the farm upto the required stocking size. Health management and feeding of the reared stock should be taken care regularly.

Stocking of fish seed in the Stream

For stocking of fish seed at the site necessary facilities like packaging materials, oxygenation equipment, feeder/ graders etc. will be purchased. A vehicle will also be required for transportation of fish seed reared at the farm to the stocking site. Apart from this, the vehicle will also be used to carry items required for survey and monitoring of water quality and stock assessment fortnight / monthly.

For assessment of fish stock and water / soil quality at the site technical expertise would be required. Manpower will also be required to carry out various activities at the farm ranging from maintenance of brood, stock, rearing of fish seed, health management and transport of the stocking material to the site. For this scientific and manpower, if needed will be arranged on contractual basis.

- Fish passes and ladder are not required as Mahseer is not available at S_0, S_1 and S_2 so it makes no sense in investing in fish ladder and passes. Moreover, seeing the performance of fish passes in other hydropower projects, the performance of these are very poor.
- THDC will also maintain the minimum flow required for the survival of aquatic life and maintain the water quality.
- For management of Snow trout, Gram Panchyats must be involved along with Dept. of Fisheries, GoUK / DCFR, ICAR, Bhimtal. Dept. of Fisheries, GoUK / DCFR, ICAR, Bhimtal will provide the technical assistance and the Gram Panchayats will be involved in intensive culture of fish. This will be an income generating activity for the local inhabitants and also provide nutrition to the malnourished population of the area. Thus, it will contribute in enhancing the living condition of the people in the area.

10.5.4 Proposed Budget for Fish Management

The budget provision kept under 2007 EMP was only Rs. 65 lakhs. The same is proposed to be revised upto to Rs.429.0 lakh, out of that 279 lakhs has already been incurred till date.

10.5.6 Present Status

- The Consultancy Services for preparation & supporting Implementation of Fish Management Plan for VPHEP have been awarded to Directorate of Coldwater Fisheries Research (ICAR-DCFR), Bhimtal an amount of Rs.48.70 lakhs.
- For framing the appropriate fish management plan, ICAR-DCFR has conducted a series of fish surveys and water sampling work along River Alaknanda from Vishnupyarag to Karan Prayag.
- Final Report has been received from ICAR-DCFR. ICAR-DCFR has recommended to construct Snow Trout Fish Hatchery. A MoU has been signed with M/s UPRNN for a total value of 268.26 lakhs for construction of Fish Hatchery nearby Jaisal Nala.
- Construction work of the fish hatchery is in progress.
- Based on recommendation of DCFR report, the EMP cost for fisheries management has been enhanced from Rs. 1.14 Crore to Rs. 4.29 Crore. The DCFR Fisheries Management Plan report is enclosed as **Annexure-XV.**

Environmental Flows:

The Environmental flow (E-flow) at VPHEP shall be governed by the latest Gazette Notification dated 09thOct, 2018 of GoI, regarding maintaining a minimum environmental flow in River Ganga up to Unnao, (UP). As per the notification the environmental is given in Table-10.8.

Table-10.8: Environmental Flows as per Gazette Notification dated 09th Oct 2018

Season	Months	%age of average flow of preceding 10 daily period
Dry	Nov to March	20
Lean	Oct, April and May	25
High flow	June to September	30

The e-flow based on the above will vary based upon the real time inflow data to be observed during the operation stage of the project. Therefore, the values of actual environmental flows cannot be calculated/fixed at the moment. However, based on the inflow data series of 42 years, used for the design of the project, the highest and lowest e-flows works out be 238.7 and 1.7 cumecs (corresponding to highest and minimum recorded inflows) respectively and accordingly the provisions to release the e-flow are being made in the design of the structures. A dual combination operative mechanism of 2 MS pipes of 1.5m dia each with suitable control valves and part opening of lower level sluice gate is being contemplated to allow for the desired riparian flows. The valves will be synchronized with the gate opening (through SCADA etc) so that the dual combination operative mechanism is automated and hassle free. The value of e-flow prior to issue of this Gazette Notification was 15.65 cumec.

10.6 GREENBELT DEVELOPMENT PLAN

Although the forest loss due to various project appurtenances would be compensated as a part of compensatory afforestation, it is proposed to develop greenbelt around the perimeter

of various project appurtenances, selected stretches along the periphery of water spread area, etc. The general consideration involved while developing the greenbelt are:

- Local/native trees growing up to 10 m or above in height with perennial foliage should be planted around various appurtenances of the proposed project.
- Planting of trees should be undertaken in appropriate encircling rows around the project site.
- Generally fast growing trees are planted
- Since, the tree trunk area is normally devoid of foliage up to a height of 3 m, it may be useful to have shrubbery in front of the trees so as to give coverage to this portion.
- The plantation should be at a spacing of 2.5 * 2.5 m. About 1,000 trees per hectare should be planted. The plantation and maintenance of the plantation area should be done by the project proponents.

10.6.1 Species Suggested for Plantation

Local species will be planted under the greenbelt development plan. The list of plant species suggested for plantation is presented in Table-10.91:

Table-10.9 Species Suggested for Plantation under Greenbelt Development Plan

S. No	Scientific Name	Common Name
Trees		
1.	*Aesculasindica*	Pangar
2.	*Albizzialebbek*	Siris
3.	*Alnusnepalensis*	Utis
4.	*Bauhinia variegate*	Kachnar
5.	*Cedrelatoona*	Toon
6.	*Celtisaustralis*	Kharak
7.	*Cinnamomumtamala*	Dalchini
8.	*Cupressustorulosa*	Leuri
9.	*Dalbergiasissoo*	Shisham
10.	*Embelicaofficinalis*	Amla
11.	*Grewiaoppositifolia*	Biul
12.	*Melia azedarach*	Denk
13.	*Pinusroxburghii*	Chil
14.	*Bombaxceiba*	Semul
15.	*Juglansregia*	Walnut
16.	*Pyrusmalus*	Apple
17.	*Prunusarmeniaca*	Apricot
18.	*Prunuscommunis*	Plum
19.	*Prunuspersica*	Peach
20.	*Punicagranatum*	Pomegranate
21.	*Citrus spp.*	Malta
Shrubs		
1.	*Agave americana*	Rambans
2.	*Euphorbia royleana*	Shuru
3.	*Opuntiadilleni*	Nagphani
4.	*Jasminumhumile*	Shunjai
5.	*Rosa brunonii*	JangliGulab
Herbs		
1.	*Ageratum conzoides*	Gunriya

S. No	Scientific Name	Common Name
2.	*Artemisia capillaris*	Pati
3.	*Bergenialigulata*	Silphara
4.	*Centellaasiatica*	Brahmi
5.	*Oxalis corniculata*	Amritsak
6.	*Solanumnigrum*	Makoi
7.	*Tridexprocumbens*	Ground weed

10.6.2 Precautionary Measures

- Plantation activity to be carried out in monsoon months
- The height of the plants should not be less than 1 ft and should be in polythene bags and are not to be removed till the time of planting
- All plants supplied must be planted within three days of removal from the nursery
- The contractor will be required to water the area in case of insufficient rains after planting
- 2 kg of compost /manure are suggested for each pit before plantation.
- To ensure better growth and survival of plants, surface should have sufficient layer of good quality soil (up to 45 cm)

10.6.3 Budget for Greenbelt Development Plan

6,153 Trees are likely to be felled for development of various project sites. Double no. of trees i.e. 12,306 trees may be planted to compensate the loss of trees. A capital cost provision of **Rs. 61.53 lakh** has been kept for development of greenbelt as given in **Table-10.10**. This amount has been taken into the earlier Environmental Clearance. The budget includes cost of digging of pits, fertilizers, saplings and maintenance for 3 years.

Table-10.10: Budget for Greenbelt Development Plan

Issue	I Year	II Year	III Year	IV Year	V Year	Total Rs
Plantation	1500000	1500000	2000000	153000	-	**5153000**
Fencing	250000	250000	250000	250000	-	**1000000**
	1750000	**1750000**	**2250000**	**403000**	**-**	**6153000**

Source: EMP, CES

10.6.4 Present Status

- Green Belt Development is being implemented under the Consultancy of noted Environmentalist Sh. Jagat SinghChaudhary alias “Junglee”
- Cumulatively 9300 (including 1550 high yield variety of fruit bearing trees distributed to villagers) approx. trees have been planted till date.
- Broad leaved, fast growing plant species have also been planted as suggested by “Jungli Ji” and Forest Deptt.

Rs. 61.53 lacs budget has been kept in the EMP which was conducted in the year 2009, out of that Rs. 44.56 expenditure has been occurred up to April 2021. Also, an additional amount of 15 lakhs is being proposed for Green Belt Development related works.

10.7 SOIL EROSION & SEDIMENT CONTROL

There is a possibility of site erosion and sedimentation in the downstream if the site activities are not carefully managed. Erosion and sedimentation will be controlled during the construction phase. Areas of the site not disturbed by the construction activities will be maintained in their existing condition. A principal effort at the construction areas will be the management of erosion of excavated surfaces especially during the wet/monsoon season when the volume of the runoff is expected to be high.

Management plan for control of soil erosion and sedimentation is given below:

- Areas within the construction areas not disturbed by construction activities will be maintained in their existing conditions.
- Soil erosion and sediment control practices will be implemented prior to any major soil disturbance, or in their proper sequence, and maintained until permanent protection is established.
- Prior to wet season, the contractor shall implement appropriate measures to ensure that erosion is minimized from works where the permanent drainage and erosion control measures, if any, are yet complete;
- Materials excavated by the Contractor from open and underground excavation, which are unsuitable for incorporation into the permanent works or are surplus to such requirements, will be disposed of as spoil dumps in spoil disposal areas. Materials suitable for roads, dams, slope protection, channel armoring or riprap and resettlement area fills will be stockpiled separately from spoil disposal areas, at agreed locations for later use by the Contractor or THDC;
- Soil excavated during construction will be stockpiled separately. The soil will be used for landscaping and restoration of work areas. All stockpiles and spoil dumps will be constructed and stabilized, including provision of drainage and erosion control measures in accordance with the Landscaping and Re-vegetation Plan. The height of stockpiles and spoil dumps in spoil disposal areas will be proposed in the Sub-Plan and will be limited to 3m for topsoil and material for future use. Topsoil stockpiles will be deep ripped to provide for moisture retention and re-growth. Drainage and erosion from the stockpiles will be controlled by locating them in areas away from drainage lines. The erosion of the base of the dump will be prevented by providing a silt fence to contain any sediment in any runoff resulting from stockpile or spoil dump;
- Stockpiles and spoil disposal areas shall not be located on drainage lines or in floodway zones or other areas important for the conveyance of floodwaters during major floods. Flooded area behind spoil disposal areas will be allowed to drain to the downstream channel;
- Plans for water management during construction will include development of drainage works, sediment traps, diversion, culverts and other structures designed to treat water before discharge into natural watercourses. All these structures will be constructed progressively prior to commencement of construction work and areas will be directed to the sediment settling areas. They will be inspected regularly for damage caused by scouring, sediment deposition, channel obstruction, and loss of vegetation cover.
- Sedimentation controls will be implemented in the form of silt trap fences and sedimentation ponds where appropriate depending upon the size of the catchment, and other physical and environmental constraints. The silt trap fences shall control flows along minor drainage lines, whereas the sedimentation ponds will be utilized for removing sediment-laden runoff from the construction areas. These will be built prior to the start of the activity and will be maintained until the completion of that activity.

Contractor will be responsible for implementation of the above mentioned plan. Following activities will be undertaken by the Contractor for proper implementation:

- An assessment of the potential for water pollutants to be generated;
- Measures to be taken to collect, store and treat storm water prior to any discharges form the site, (considering options for water re-use on site);
- Management of material storage areas, including raw materials, chemicals, fuels, and oils;
- Measures to prevent litter entering water courses and details of permanent pollutant treatment measures or other water pollution control devices proposed for the operational stage;
- An inspection and maintenance program to maintain the effectiveness of erosion and sediment control measures

Budget: Budget for implementation of the plan will be prepared by the Contractor.

10.8 QUARRY & BORROW AREA MANAGEMENT

The contractor is required to take quarry material only from licensed quarries. In the case of existing quarries the contractor through the Engineer's representative will have to ensure that all actions in these quarries are in accordance with the environmentally sound and acceptable manner.

In case the contractor establishes additional quarries and dedicated crusher plants, the contractor has to ensure that all actions are in accordance with the environmental requirements.

In the case of borrow areas, Contractor need to specify a detailed arrangement including the agreement with the owner of the land. The Contractor must comply with provisions of taxes, levies, royalties etc. of the State.

Management Plan:

The contractor is required to provide following details:

- Name, location and ownership of the borrow or quarry area;
- Existing land use of the area (including the access road to be developed) to be quarried;
- Approximate quantity of the material available;
- The number of trees and the species of the trees to be removed;
- Total area involved;
- Arrangement with the owner;
- Whether purchased or leased;
- A statement from the owner saying the actual arrangement (not in terms of exact monitory compensation) with him is agreeable for him;
- The exact restoration plan indicating the number of trees that will be planted;
- The action plan for leveling and landscaping in order to bring the area in conformity to the neighboring land uses; and
- The access roads rehabilitation.
- Compliance certificate of tax, levy, royalty etc. provisions.

The objective of the rehabilitation programme is to reinstate the quarry /borrow pit sites to a safe and secure area, which the general public should be able to safely enter and enjoy. Securing borrow pits /quarry sites in a stable condition should be a fundamental requirement of the rehabilitation process. This could be achieved by filling the quarry/ borrow pit with suitable materials to approximately the access road level.

Quarries and borrow pits may be backfilled with rejected construction wastes and will be given a vegetative cover. Plantation will be done extensively for slope stabilization. The species suggested for slope stabilization are given in the **Table-10.11**. If this is not possible, then excavation slopes will be smoothed and depression will be filled in such a way that it looks more or less like the original ground surface.

Table-10.11: Species Suggested for Slope Stabilization

S. No.	Scientific Name	Common Name
1	*Agave americana*	Rambans
2	*Eupatorium adenophorum*	Basinga
3	*Euphorbia royleana*	Shuru
4	*Opuntiadilleni*	Nagphani
5	*Carissa spinarium*	Karonda
6	*Zizyphusmauritiana*	Ber
7	*Rumexhastatus*	Bhilmora
8.	*Murrayakoengi*	Kath Neem
9	*Colebrookeaoppositifolia*	Bindu

Source: EMP, CES

During works execution, the contractor shall ensure preservation of trees during piling of materials; spreading of stripping material to facilitate water percolation and allow natural vegetation growth; re-establishment of previous natural drainage flows; improvement of site appearance; digging of ditches to collect runoff; and maintenance of roadways where a pit or quarry is declared useable water source for livestock or people nearby. Once the works are completed, the contractor shall restore the environment his own expense around the work site to its original splits.

A provision of **Rs. 50.0 lakh** shall be earmarked for quarry slope stabilization. This amount has been taken into the earlier Environmental Clearance. The details of cost required for various measures are given in **Table-10.12**.

Table-10.12: Cost Estimate for Restoration of Quarry Sites

Items	I Year	II Year	III Year	IV Year	V Year	Total
Filling up of excavatedsites	-	400000	400000	400000	300000	**1500000**
Purchase green Manure	-	-	250000	200000	50000	**500000**
Digging pits	-	-	30000	30000	20000	**80000**
Plantation of saplings	-	-	15000	15000	10000	**40000**
Purchase Fertilizer	-	-	200000	150000	150000	**500000**

Items	I Year	II Year	III Year	IV Year	V Year	Total
Weeding & maintenance	-	-	50000	50000	50000	**250000**
Fencing	-	-	100000	100000	100000	**300000**
Watch & ward 4 persons	-	-	192000	211200	232320	**1830000**
TOTAL (Rs.)	**-**	**400000**	**1237000**	**1156200**	**912320**	**5000000**

10.8.1 Present Status

- Till May' 2021, no quarry site has been opened for excavation / mining.
- SEIA Uttarakhand vide letter dated: 13.04.2021 accorded the environmental clearance Gadi (Birahi) quarry (approx. 5 km from power house site). The EC letter of Gadi (Birahi) Quary is enclosed in **Annexure-VIII.**
- Quarrying is yet to commence. However, the quarry areas will to be restored after completion of quarrying operations.

10.9 SOLID WASTE MANAGEMENT

A sufficient number of garbage bins and containers will be made available at the worker camps, the areas of planned and spontaneous resettlement and at the main work sites. Garbage and other waste will be regularly collected and be transported to a designated waste disposal site.

Suitable sanitary and solid waste collection and disposal facilities or systems will be provided at all camps, workshops, stores, offices, main work sites and personnel will be provided to operate and maintain the systems. During construction phase, labour, clerical staff and technical personnel are likely to congregate. The increase in population is expected to be of the order of 8,200. The average per capita solid waste generated would be of the order of 425 gm/day/person. The solid waste likely to be generated from labour camps will about 3.5 tonnes/day. For solid waste collection, 30 number of masonry storage vats, each of 2 m^3 capacity will be constructed at appropriate locations in various labour camps. These vats will be emptied at regular intervals and the collected waste can then be transported to disposal site.

Two covered trucks to collect the solid waste from common collection point and transfer it to the disposal site will be put to service. A suitable landfill site should be identified and designed for disposal of municipal waste generated from project township, labour colonies, etc.

The waste disposal site will be located at least 2km from the nearest village. Generally,from sanitary landfill sites, there is little risk from methane, generated due to the decay of organic or degradable component, as it slowly diffuses at low concentration through the covering material. To minimize groundwater pollution from leachates, bed of the disposal site(s)

should be covered with an impervious material, so as to ensure that leachate does not lead to soil and water pollution.

Paper and other material also flies off the landfill area due to wind action. This often creates a nuisance in the immediate vicinity of the landfill site. The landfill site, therefore, needs to be skirted with wire fence of about 3 m high wire fence with paper catchers to avoid fly of papers. Once landfill operation is complete, the entire landfill site will be covered by a depth of 1.5m of soil, and then re-vegetated according to relevant requirements included in the Landscaping & Re-vegetation Plan.

A separate collection and storage procedure will be developed for hazardous or toxic waste, such as batteries, unused paint, thinners and hydrocarbons, disused electronic equipment, etc. These wastes will be stockpiled in accordance with the requirement of the applicable Laws and subsequently transported to special solid waste treatment plant capable of proper disposal of such hazardous or toxic waste as approved by UKPCB.

EMC of THDC is ensuring proper management of solid waste generated by project activities during construction period and will also assure that the solid waste is disposed as described in the solid waste management plan.

A total provision of **Rs.98.0 lakh** needs to be earmarked for this purpose. This amount has been taken into the earlier Environmental Clearance. The details are given in **Table-10.13**.

Table-10.13: Budget for Solid Waste Management

Items	I Year	II Year	III Year	IV Year	V Year	Total
Covered truck	2500000	2500000				**50,00,000**
Employee Persons	878000	878000	878000	878000	878000	**43,90,000**
Miscellaneous	100000	100000	100000	100000	9100	**409100**
	3478000	**3478000**	**978000**	**978000**	**887100**	**97,99,100**

Source: EIA report prepared by WAPCOS / CES

Present Status

VPHEP COLONY

- Organic Waste – An electrical composter has been procured for composting organic waste.
- Inorganic Waste is stored and transported through THDCIL vehicle for handing over to Nagar Panchayat, Chamoli for safe disposal.
- SWM facility constructed nearby the VPHEP colony area
- 300 no. roadside Bins (Separate bins for Organic and Inorganic Waste) etc. have been procured and installed at appropriate locations for proper collection of waste at Project site.
- Additionally, 01 no. dumper has been procured and donated to Nagar Panchayat – Pipalkoti.

M/S HCC LTD. – WORKER/LABOR CAMPS

- Necessary provisions have been kept for Waste Collection, Handling, Segregation, Disposal process under thecontractor's EMP and system is being implemented.
- Separate bins are placed at labor camps and construction sites for biodegradable and non-biodegradable wastes.
- Wastes (Hazardous/E-waste/others) is stored in storage yard for safe disposal and handed over to authorized recycler M/s Shruti Chemical.

Rs. 97.99 lacs budget has been kept in the EMP which was conducted in the year 2009. the same is being implemented by contractor at all its labour camps. apart from above that Rs. 11.38 lacs expenditure has been occurred up to April 2021 THDCIL for infrastructure works.

10.10 MANAGEMENT MEASURES FOR ROAD CONSTRUCTION

The approach roads will have to be constructed as a part of the access to the construction site. In a hilly environment, construction of roads sometime disturbs the scenic beauty of the area. In addition, landslides are often triggered due to road construction because of the loosening of rocks by water trickling from various streams. A total length of 25.6 km of new roads needs to be constructed as a part of the proposed project.

Steeply sloping banks are liable to landslides, which can largely be controlled by provision of suitable drainage. The basic principle is to intercept and divert as much water as possible, before it arrives at a point, where it becomes a nuisance. The other erosion hazard is that of surface erosion of the bank, which is best controlled by vegetation. However, in a steeply sloping terrain, difficulty lies in growing vegetation on steeply sloping banks. Engineering solutions such as surface drainage, sub-surface drainage, toe protection and rock bolting can be used. Landslides can be stabilized by several methods-engineering or bio-engineering measures alone or a combination of these. The cost required for implementation of various measures has already been incorporated in the overall budget earmarked for construction of roads.

In hilly terrain, road construction often generates significant quantity of wastes (muck) due to the stripping of the rocks to make way for the roads. The stripped muck is generally cleared by dumping the material along the slopes. These dumped materials finally flow down to the valleys and ultimately finds its way in to the river. However, it is recommended to adopt a more systematic approach. The stripped material should be collected and dumped in the designated muck disposal area which will have check dams to prevent the muck to flow down into the river. After disposal operation is complete at the dump site, dump yard should be contoured and vegetated. Due to the construction of the roads landslides results due to destabilization of the slopes.

Muck will be generated due to cutting of the slopes and stripping. Various measures to be taken for cutting, stabilization of the slopes and proper disposal of muck, preventing it to go into the river are shown in **Figure-10.2 to Figure-10.7.**

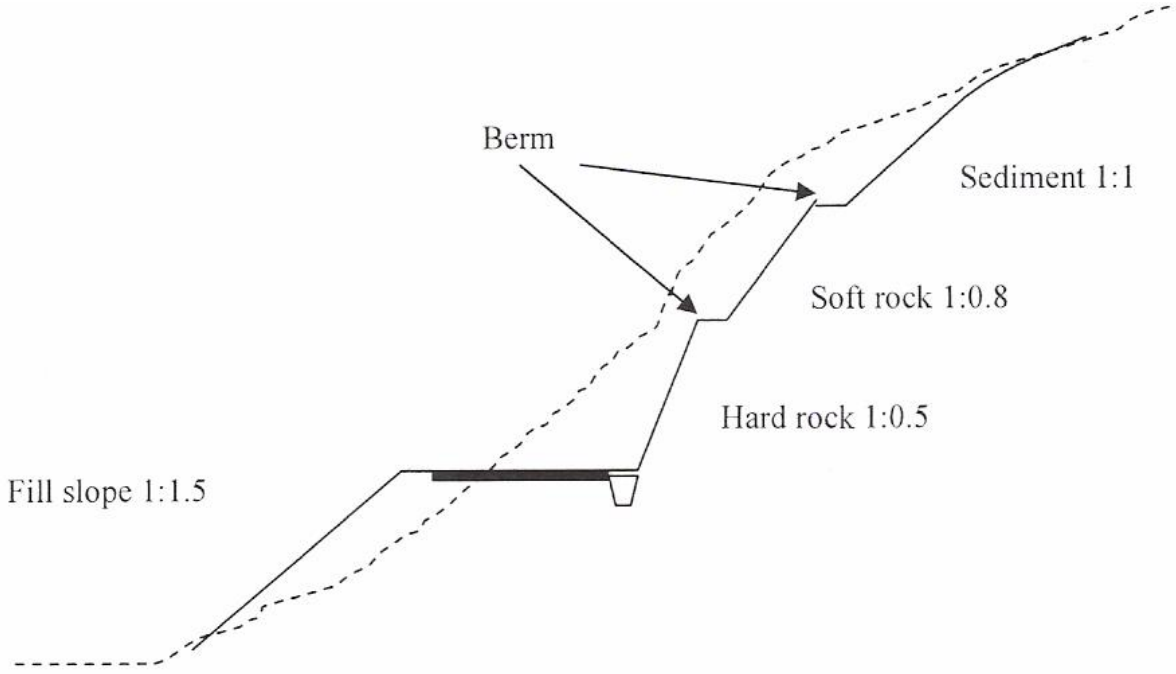

Figure-10.2: Ground Conditions and Shape of Cut Slope

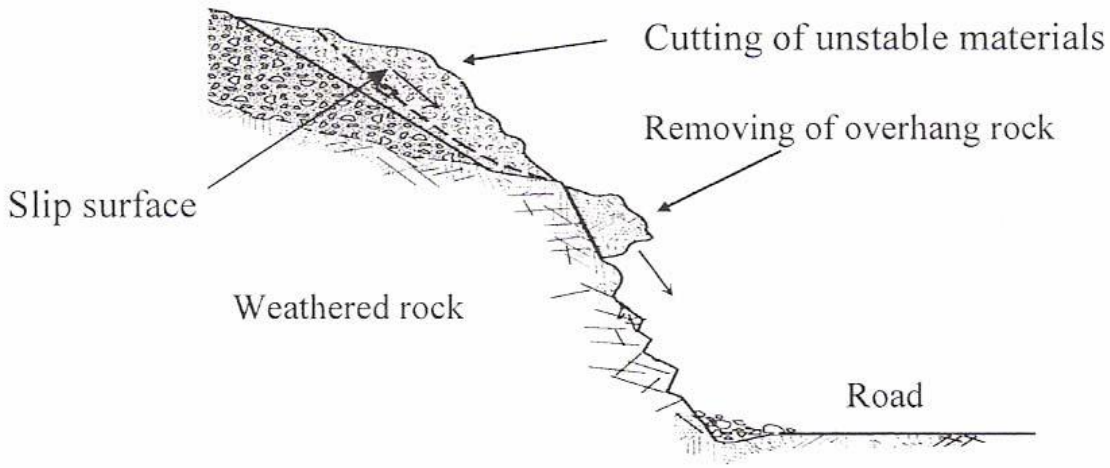

Figure-10.3: Treatment for Cut Slope Failure of Rock Mass

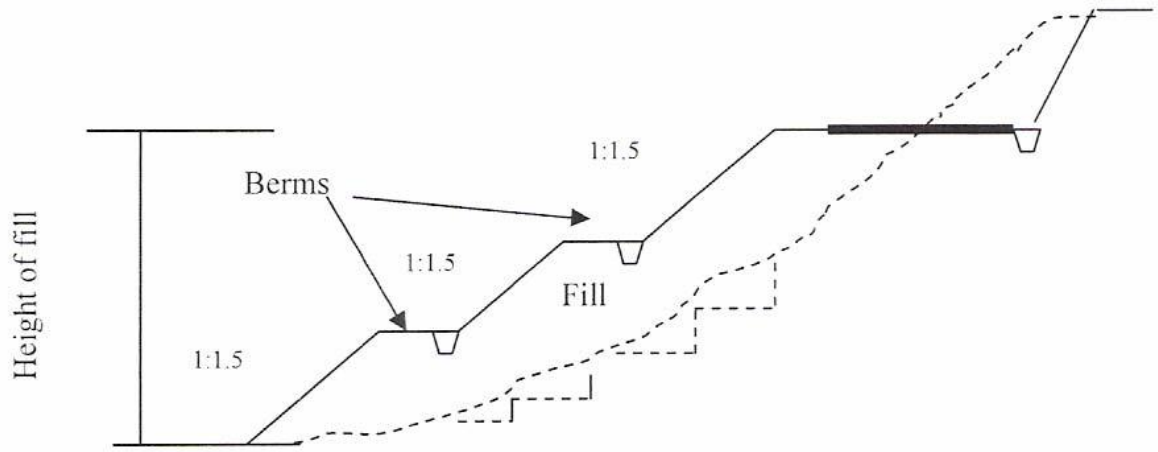

Figure-10.4: Typical Cutting and Filling Works in Landslide Area (Large Sliding Type)

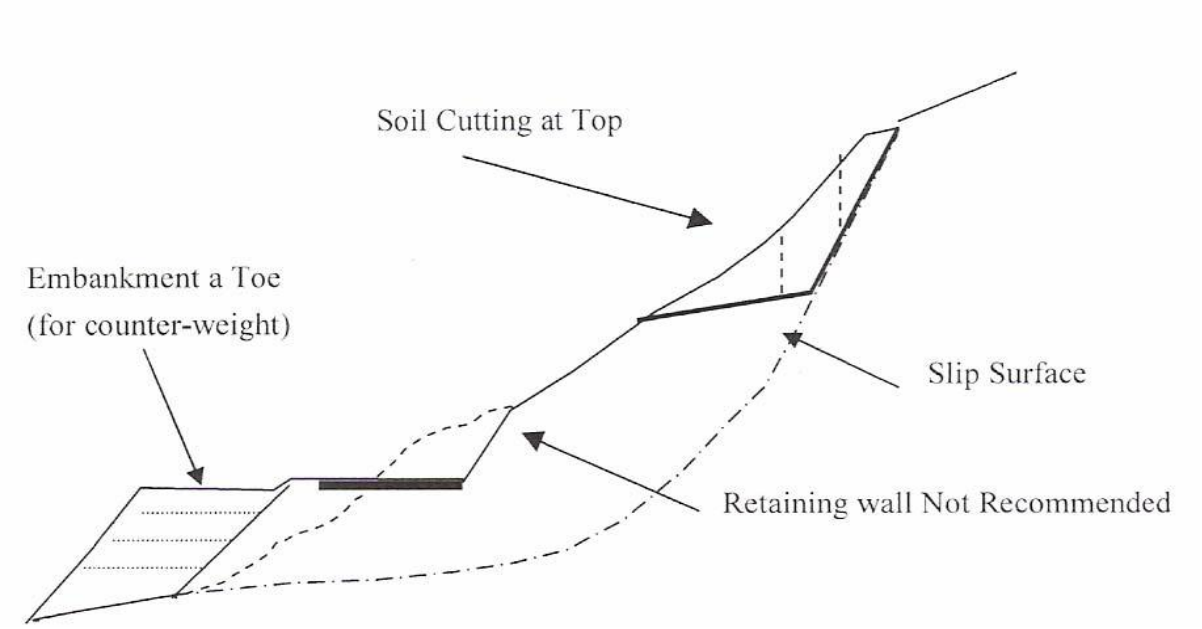

Figure-10.5: Typical Cutting and Filling Works in Landslide Area (Creeping Type)

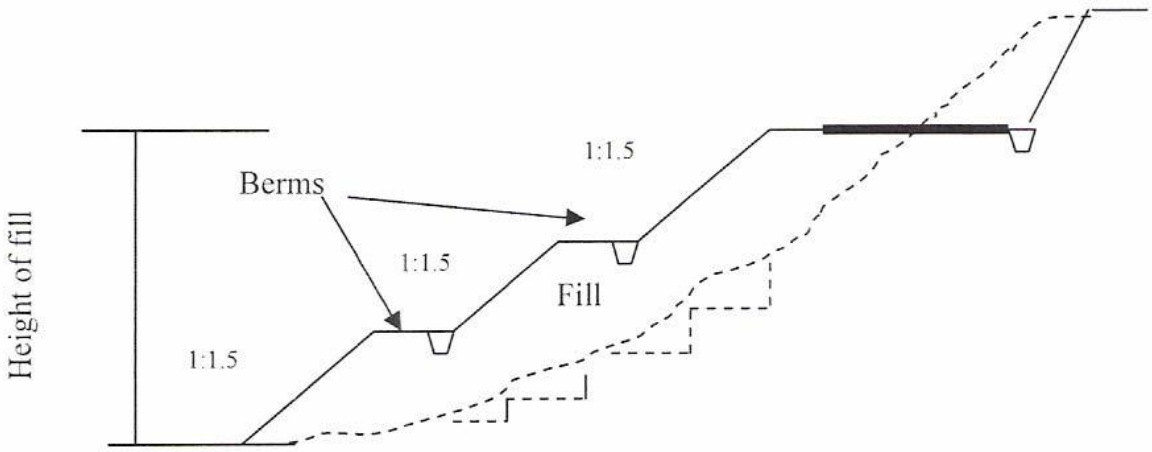

Figure-10.6: Typical Fill Slopes with Berms

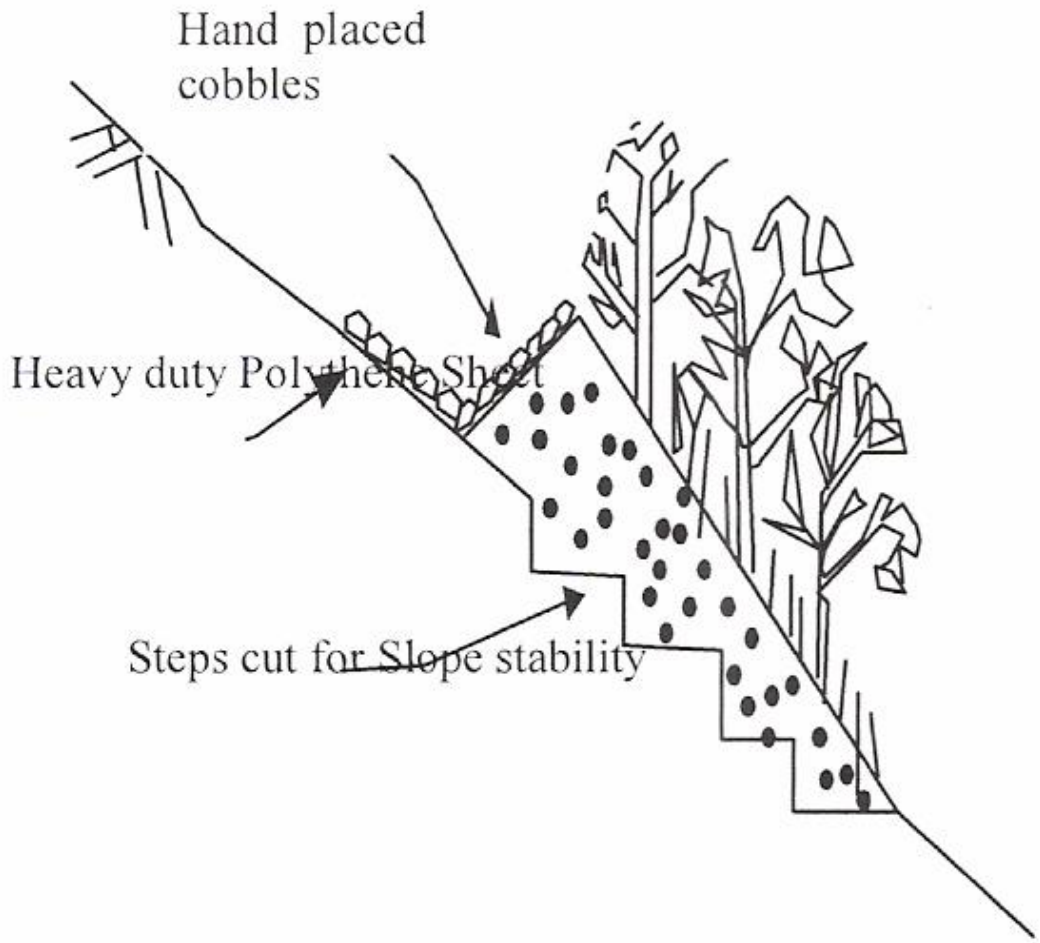

Figure-10.7: Stabilization of Slopes

Construction

- Area for clearing and grubbing shall be kept minimum subject to the technical requirements of the road. The clearing area shall be properly demarcated to save desirable trees and shrubs and to keep tree cutting to the minimum.
- Where erosion is likely to be a problem, clearing and grubbing operations shall be so scheduled and performed that grading operations and permanent erosion control of features can follow immediately thereafter, if the project conditions permit; otherwise temporary erosion control measures shall be provided between successive construction stages. Under no circumstances, however, a very large surface area of erodible earth material be exposed at any one time by clearing and grubbing.
- The method of balanced cut and fill formation shall be adopted to avoid large difference in cut and fill quantities.
- The cut slopes shall be suitably protected by breast walls, provision of flat stable slopes, construction of catch water and intercepting drains, treatment of slopes and unstable areas above and underneath the road, etc.
- Where rock blasting is involved, controlled blasting techniques shall be adopted to avoid over-shattering of hill faces.
- Excavated material should not be thrown haphazardly but dumped duly dressed up in a suitable form at appropriate places where it cannot get easily washed away by rain, and such spoil deposits may be duly turfed or provided with some vegetative cover.

Drainage

- Drainage of the water from hill slopes and road surface is very important. All artificial drains shall be linked with the existing natural drainage system.
- Surface drains shall have gentle slopes. Where falls in levels are to be negotiated, check dams with silting basins shall be constructed and that soil is not eroded and carried away by high velocity flows.
- Location and alignment of culverts should also be so chosen as to avoid severe erosion at outlets and siltation at inlets.

An amount of **Rs. 90.0 lakh** (**Table-10.16**) is earmarked for the purpose of implementing these management measures described above. This amount has been taken into the earlier Environmental Clearance. Contractor will be responsible for implementation of the plan.

Present Status

- During Road Construction, all precautionary measures for soil erosion, slope stability, drainage are duly taken care as per Indian Standards
- Regular Water Sprinkling is being done for dust suppression.

10.11 CONSTRUCTION CAMP & CONSTRUCTION WORKERS

During construction there will be potential for construction work camps and spontaneous settlement areas to be developed without sufficient consideration of planning, health, and environmental requirements.

The contractor shall plan, design and construct construction work camps for the construction workers and the officials of the contractors' organization, which satisfy the following specific requirements. The EMC will be responsible for monitoring activities within the camps to ensure compliance with the plan.

Normally, it has been observed in construction phase of many projects that labour camps are not well planned and are generally haphazard in their layouts, without adequate facilities. The spatial distribution of concentration of construction activities ensures that labour population is likely to be concentrated at two or three major construction sites, i.e. dam, power house and along tunnel alignment. It is recommended that project authorities can compulsorily ask the contractor to make semi- permanent structures for their workers. These structures could be tin sheds. These sheds can have internal compartments allotted to each worker family. The labour camp site should have facilities like electricity, water supply and community latrines. The water for meeting domestic requirements may be collected from the rivers or streams flowing upstream of the labour camps. The water quality of Alaknanda River is good and can be used with/ without chlorination.

10.11.1Sanitation Facilities

One community latrine can be provided per 20 persons. The sewage from the community latrines can be treated in septic tanks. For each 500 persons, one septic tank should be

provided. The effluent from these septic tanks can be disposed-off through soak pits. Drinking water facilities and waste disposal sites will be located away from each other.

The total construction time for the project is about 5 years. At peak construction phase, there will be an increase in population by 8,200. To ensure that the sewage from the labour camps do not pollute the river water, it has been estimated that about 410 community latrines and 17 septic tanks need to be constructed. The total cost required will be **Rs. 125.0 lakh (Table-10.14)**.

Table-10.14: Budget for Sanitary Facilities for Labour Camps

Items	I Year	II Year	III Year	IV Year	V Year	Total
Construction of Community latrines with water supply	4000000	4000000	200000			**8200000**
Construction of Septic tanks	1500000	1750000	1000000			**4250000**
Miscellaneous & Contingencies	10000	10000	10000	10000	10000	**50000**
Total	**200000**	**200000**	**200000**	**200000**	**200000**	**12500000**

Source: EIA Report prepared by WAPCOS / CES

Present Status

- HCC has constructed the camps for its staff / workers and for PRW workers at Helang for the persons engaged at Damsite activities and also at Haat&Batula (Haat-Kauria Road) for the Power House activities. 82 no of water closet (WC) has been constructed in the various Officers/labourcamps at project site.
- Also, HCC has hired various private accommodations / hotels for accommodating their officers and workers at site.
- The total living capacity at HCC constructed camps and hired accommodations is 1288. The total number of persons presently residing in these accommodations is 701.
- All the accommodations are provided with Toilets, Bathrooms and community mess. Septic cum Soak pit tank have also been constructed at camp sites for safe disposal of sewage.

10.11.2 Provision of Fuel

The cost required for LPG and Kerosene distribution was Rs. 97.2 lakh and Rs. 306.0 lakh respectively in EMP 2009. The total proposed cost required for provisions of fuel works out to **Rs.403.2 lakh**.The cost has to be borne by the contractor; hence, the same has not been earmarked in the cost required for implementation of Environmental Management Plan.

Present Status

- Community kitchen for labor / worker at camps being run on LPG, hence no burden for on the forest resources for the fuel wood.
- Usage of approx. 9309 nos. LPG commercial cylinders have been reported by the contractor up to April, 2021.

10.11.3 Other Facilities

- Paved internal roads, storm water drainage systems to prevent stagnant water, adequate day time, night time and security lighting will be provided
- Camp areas will be sited to allow effective natural drainage.
- Camps shall consist of living facilities with housing mess, recreational and sanitary facilities for all workers accommodated within the camps.
- Effective sediment control measures during construction and operation of the construction work camps in accordance with the Environmental Requirements, especially near rivers.
- Firefighting equipment and services and portable fire extinguishers will be provided for all building
- Medical and first aid facilities will be provided at each camp area
- The camp areas shall have an adequate supply of potable water compliant with WHO criteria and Applicable Laws
- Ventilation of buildings within the camp areas will be in accordance withApplicable Laws and Standards
- Adequate provision for medical facility; signage for awareness on health and hygiene; and condom vending machines and other awareness materials to combat HIV/AIDS

Present Status:

Necessary measures are being implemented, maintained and monitored on regular interval at the project sites.

10.12 PUBLIC HEALTH DELIVERY SYSTEM

The increase in water fringe area provides suitable habitats for the growth of vectors of various diseases and they are likely to increase the incidence of water-related diseases. Malaria is one such disease. Malaria control measures which aim at destroying the habitat and interrupting the life cycle of mosquitoes by mechanical or biological or chemical means need to be implemented. The anti-malarial operations can be coordinated by Primary Health Centre (PHC) in the nearby villages and Hospital at District Headquarters in association with the project proponents. The suggested measures are given in following paragraphs:

- Site selected for habitation of workers should not be in the path of natural drainage.
- Adequate drainage system to dispose storm water drainage from the labour colonies should be provided.
- Adequate vaccination and immunization facilities should be provided for workers at the construction site.
- Labour camps and resettlement sites should be at least 2 km away from a main water body or quarry areas.

10.12.1 Development of Medical Facilities

The nearby population is likely to congregate during the construction phase. The labour population will be concentrated at two or three sites. There is no medical facility in the immediate vicinity of the project area during EIA/EMP 2009. It was recommended that necessary medical facilities be developed at the project site. It was also recommended that

the dispensary should be developed during project construction phase itself, so that it can serve the labour population migrating in the area as well as the local population.

10.12.2 Proposed Health Facilities at Construction Sites and Labour Camp during EIA/EMP 2009

It is possible that during the construction period, technical staff operating different equipments is not only exposed to the physical strain of work but also to the physical effects of the environment in which they are working. The workers and other technical staff may come up with common manifestations such as insect bites, fever, diarrhea, work exhaustion and other diseases. In addition they may invariably come up with injuries caused by accidents at work site. Under all circumstances, workers need immediate medical care. A first-aid centre is to be provided at each of the major construction sites, so that workers are immediately attended to in case of an injury or accident. This first-aid centre will have at least the following facilities:

- First aid box with essential medicines including ORS packet
- First aid appliances-splints and dressing materials
- Stretcher, wheel chair, etc.

10.12.3 Health Extension Activities

The health extension activities will have to be carried out in the villages situated in the nearby areas. It is important to inculcate hygienic habits of environmental sanitation especially with respect to water pollution by domestic wastes. There would be possibility of the transmission of communicable diseases due to migration of labour population from other areas at the construction site.

The doctors from the dispensary should make regular visits to these villages and organize health promotional activities with the active participation of the local village Panchayat, NGOs and available local health functionaries. The health functionaries would undertake the following tasks as a part of health promotional activities:

- Collect water samples to ascertain the potability of water from different sources so as to monitor regular disinfection of drinking water sources.
- Maintain close surveillance on incidence of communicable diseases in these villages.
- Maintain close liaison with the community leaders and health functionaries of different departments, so that they can be mobilized in case of an emergency.

10.12.4 Budget for Public Health Delivery System

The cost estimated for implementation of Public Health Delivery System was kept as **Rs. 373.0 lakh** in EIA/EMP 2009. This amount has been taken into the earlier Environmental Clearance.

Infrastructure

Hospital / Dispensary: It is proposed that THDC may establish Hospital / Dispensary at two locations where the influx of labour is maximum. The two locations i.e dam site and colony/powerhouse site are identified for establishment of the Hospital / Dispensary. In addition to this Ambulances equipped with necessary medical aid shall be procured by the project. Assistance as and when required shall be taken from District Hospital functional at Gopeshwar. A total budget of Rs. 160 lakh and Rs. 24 lakh has been earmarked towards establishment of Hospital/ Dispensary and Ambulances respectively.

Present Status

- **VPHEP, THDCIL**
  - At VPHEP Complex, a Dispensary is operational with adequate number of beds.
  - Medical Staff includes Doctors, Nurses, Para Medical Staffs, and Dressers etc. are working in the Dispensary.
  - 01 no of Ambulance deployed at Project site.
  - The Medical Facilities are extended to Project Affected apart from local Population.
- **M/s HCC**
  - 01 no. First Aid Centre is operational at each location i.e. Power House, TBM and Dam site.
  - 01 no. Dispensary is located at Swami Vivekanand Hospital, Mayapur, Pipalkoti.
  - Para Medical Staff & deployed at First Aid Centers along with necessary facilities.
  - 03 Ambulance facilities available at Power House, TBM and Dam.
  - Necessary treatment including required vaccination is being given to labors from time to time.

The total expenditure of Rs 437.5 lakh has already been incurred in Public Health Delivery System.

10.13 GOOD PRACTICES

10.13.1 Landscaping & Re-vegetation

- For Landscaping and Re-Vegetation Plan, Contractor will follow the biodiversity management plan, muck disposal management plan, greenbelt development plan and borrow & quarry area management plan.
- All areas disturbed by construction activity, including temporary access roads, will be landscaped to reflect natural contours, restore suitable drainage paths and encourage the reestablishment of vegetation.
- Spoil heaps and excavated slopes will be re-profiled to stable batters and grassed to prevent erosion. Topsoil stripped from the areas occupied by the spoil heaps will be used for landscaping works. Re-establishment of vegetation will be commenced at the earliest possible opportunity.
- The EMC will be responsible for ensuring the compliance of the construction contractors. The EMC will also inspect the construction areas at the end of the construction phase to ensure that the areas have been re-graded to conform to the natural topography and that appropriate grasses and shrubs have been planted to start the re-vegetation process. The constructor contractor will be responsible for the stabilization of construction areas before they are allowed to vacate the construction areas.

10.13.2 Vegetation Clearing

- During construction there will be a potential for areas to be cleared in excess of real requirements and in sufficient consideration given to retaining vegetation. THDC will minimize vegetation clearing for construction activities and control erosion and sedimentation from the disturbed areas. All such additional clearance will be subject to the approval of the State Forest Department, if the land is designated as forest land, or if the land supports forests.
- All land and forest/vegetation clearing activities will be carried out according to a site plan, which enforces the minimization of vegetation disturbance.
- Areas proposed for clearing will be submitted to and agreed by THDC, and only those proposed areas will be cleared. The design of roads, including temporary and permanent access roads, shall avoid crop areas where reasonable and practical. The application of chemicals for vegetation clearing will be minimized to the greatest extent reasonable and practical. Chemicals, if any, will be selected on the basis of being non-residual and with regard to human health. Herbicides used in the Project shall have negligible adverse human health effects; be shown to be effective against the target vegetation species; have minimal effect on the natural environment; and be demonstrated to be safe for inhabitants and domestic animals in the treated areas, as well as, for personnel applying them. Herbicides will be appropriately packaged, labelled, handled, stored, disposed of and applied according to international standards to be proposed by the Contractor. Persons applying herbicides will be provided with appropriate training, equipment, and facilities to handle, store, and apply these products properly. All herbicides shall have labels in both English and local Languages to allow those handling the herbicides to comprehend the labeling fully.
- Vegetation clearing will be carried out in accordance with the ‘Logging and Removal of Waste Forestry Products’ discussed below.

10.13.3 Logging and Removal of Waste Forestry Products

Prior to commencement of construction, THDC shall have the right, but not obligation, to remove or arrange for the removal of commercial and non- commercial timber as well as other forestry products from the designated construction areas. After commencement of construction the Contractor shall have the right to log and remove forestry products remaining as required to clear areas to carry out the construction works, as necessary. However, in either case, the ownership and any value accruing remains with the State Forest Department.

The contractor shall submit plans for removal of the remaining timber and other forestry products in the areas permitted under this clause to THDC for approval at least three months in advance of any work being executed by the Contractor. The plan will be in accordance with the Contractor’s obligations of the contract Requirements, including in particular, the following items:

- erosion and sedimentation control and mitigation
- vegetation clearing
- air quality
- noise pollution

The contractor’s plan shall provide detailed information regarding the proposed logging and clearing work, including the following:

- Clear identification and justification of the areas to be logged and cleared;
- Name of the company or organization to do the logging and clearing work;
- Schedule for logging and clearing to be undertaken;
- Clear identification of disposal sites for the timber and forestry products;

All works involving the logging and removal of timber and other forestry products after commencement of construction works must be carried out in accordance with the Contractor's non objected Vegetation Clearance Plan.

Other than the contractor's right to use timber obtained from the site for construction/ temporary works, the contractor must not sell, use or obtain any other benefit from the commercial timber/ forestry products.

The contractor, with explicit permission from the State Forest Department, shall dispose of any timber or forestry products resulting from the clearing not used in the construction Works and which are not sold, in a manner selected by the contractor including leaving the timber and forestry products at the perimeter of the cleared construction areas or areas selected by the Contractor. For timber and forestry products discarded by the contractor, the THDC shall have the right to arrange for the removal of such discarded timber and forestry products.

10.13.4 Storage, Handling & Emergency Response for Hazardous Chemical

During construction there will be a potential for the pollution of downstream waterways if site activities are not carefully managed. The contractor will be responsible for preparation of the management plan for storage & handling of hazardous chemical, which will be approved & monitored by the EMC. The plan will incorporate measures and process to handle situations resulting from accidental spills of hazardous materials, including chemicals and hydrocarbons or other similar incidents. General outline of the plan is given below:

Refueling/Maintenance Procedure

- There will be no storage of fuel, oil or fluids within 100m of any surface water body.
- Prior to re-fueling or maintenance, drip pans and containment pans will be placed under the equipment. Absorbent blankets may also be required to be placed under the equipment and hoses where there is a possibility of spillage to occur.
- All used oils or fluids will be properly contained and transported to appropriately licensed (authorized) disposal sites.

Spill Procedure (inside the stream, river or pond /open surface)

In the case of an accidental spill, overflow or release of fluid occurs into the stream, open surface; the following steps will be followed:

a) Stop the follow
    - Shut down the equipment
    - Close valves and pumps
    - Plug hoses

b) Remove Ignition Sources

- Shut down the vehicles and other engines
- Do not allow tiger torches, vehicles, smoking or other sources of ignition near the area. Keep a fire extinguisher on hand but keep it a safe distance away from the potential ignition source (if a fire starts, the extinguisher must be easily accessible)

c) Contact the Concerned Officials and initiate emergency response

- Notify the site supervisor and the Contractor's Environmental Officer as soon as possible
- The Environmental Officer will review the situation and decide if Emergency Services (like Fire Brigade) are required or not.
- Appropriate parties to be informed:
  - The Contractor's Project Manager
  - The Site Engineer of SC through his designated Environmental Officer
  - Environmental Management Cell of THDC
  - Regulatory Agencies like Pollution Control Board, Municipal Authorities, as applicable
  - Site Safety Officer

d) Cleanup and Disposal

- Emergency Services will be engaged for the cleanup and disposal of contaminants released into the environment.

e) Reporting

- The Contractor's Environmental Officer will document the event and submit the reports to THDC and appropriate regulatory agencies like the State Pollution Control Board etc. The report should include reason for the spill, remediation action taken, consequences/ damages from the spill and proposed corrective actions.

f) Procedure Review

- The Site Engineer of Supervision Consultant and THDC will review the report, determine if changes are required to the procedures and will recommend to implement all required changes. The plan will be subsequently updated and submitted to THDC for no objection, every time such an accidental spill happens.

10.13.5 Emission & Dust Control

Fugitive dust from the site disturbances and emissions from the vehicles and plant have the potential to negatively affect air quality in the vicinity of the construction sites and access roads. THDC will minimize emissions from vehicles and equipment used for construction activities and minimizes fugitive dust from construction areas and from unpaved roads within the construction areas.

Responsibility for incorporating specifications for regular maintenance of vehicles and equipment used will be with construction contractor. The EMC of THDC will review the contracts to ensure that these specifications are incorporated. The Contractor will aslo prepare an Emissions and Dust Control Plan. The EMC will develop a monitoring program to ensure that specifications within the construction contracts are respected. The Contractor's Emissions and Dust Control Plan will include the following:

- Proposed methods and action to control dust resulting from construction related activities, including quarry sites, crushing and concrete batching plants, earthworks including road construction, embankments and channel construction, haulage of

materials and construction work camps. Dust will be controlled by water spraying or any other similar measures. These are to be applied as necessary to reduce to a minimum spread of dust from unpaved roads when construction equipment is active, in areas of major earth excavation and any other areas which produces dust;

- The exhaust gases from the construction machinery and vehicles will be inspected and adjusted as required to minimize pollution levels;
- For all underground works/activities, the Contractor shall install mechanical/ forced ventilation systems which shall provide air pollution concentration that comply with the requirements of the National Ambient Air Quality Standard.
- When internal combustion engines are operated in the underground works, only diesel engines will be used. The burning of waste and/or garbage will be done in designated areas at a distance of at least 2km downwind from the nearby villages and in accordance with Applicable Law and the Contractor's Environmental Monitoring and Management Plan. Burning of any material which produces toxic gases will not be allowed.

10.13.6 Environmental Training for Construction Workers

During construction there will be a potential for workers to damage the forests and waterways adjacent to camps and work areas. The contractor shall prepare a training plan for all construction workers. The training will need to ensure that all employees of the contractor are aware about their duties, responsibilities, liabilities and consequences of non-compliance. All employees of the contractor will be required to comply with environmental protection procedures and they will be able to provide evidence that they have attended the training sessions detailed in the plan.

The goal of the "Environmental Training for Construction Workers" program will be to educate all construction workers on the following issue: traffic regulations, illegal logging and collection of non-timber forestry products (particularly in the resettlement areas), hunting and fishing restrictions, sanitation practices, waste management, erosion control, general health issues including the information and education, specific health issues related to HIV/AIDS, safety issues and general information on the environment in which they will be working and living. Training will also include awareness generation that (personal, not related to work) use of explosives and chemicals is not permitted; or hunting and fishing is not permitted. Contractors will establish rules and penalties for violation.

These training sessions will be organized by the contractor, and would include formal training sessions, posters, signage in construction and camp areas, and tool box meeting. These would be in addition to the training program organized by EMC, THDC. However, both training program could be coordinated.

10.13.7 On-Site Traffic & Access Management

During construction there will be a potential for use of large numbers of vehicles of variable size, leading to hazardous conditions on public roads, camps, project roads and work areas.

To address the potentially hazardous conditions, the contractor will prepare and implement an On-Site Traffic and Access Management Plan. The plan shall address the following:

- Details regarding expected road quality, maximum permissible vehicular speed on each section of road, establishment of safe sight distance including within the construction areas and construction camp site;
- Detailed plans for signage around the construction area to facilitate traffic movement;
- Estimated maximum concentrations of traffic and effects on existing traffic patterns for different times of day, and at individual locations within the construction area;
- Provisions to be made by the contractor for adequate off-road parking of all construction related vehicles;
- Plan to be followed while moving special loads, such as hazardous material, or heavy loads. Plan for controlling site access, including both construction areas and construction camp areas;
- Monitoring and methods of enforcing the requirements of the traffic management plan.

Construction traffic, including heavy loads, must not damage public roads. Personnel authorized to the construction areas will be briefed on traffic regulations applicable to the construction area. Parking will be provided for all classes of vehicles traveling to the site. At no time shall construction vehicles be parked in a manner which may restrict movement of traffic on public roads.

Signage should provide directions to various components of the works, provide safety advice and warning. All signs will be in both English and Local Language.

10.13.9 Pandemic Measures

There will be chances of infection by COVID-19 at construction sites/labour camps by concerned contractors and the risks are as follows:

- Contamination from existing or new workmen/laborers, who might be a carrier of COVID-19.
- Contaminations from neighboring communities through inter mingling.
- Contamination from incoming project materials which might have boon contaminated during transportation /handling.
- Malfunctioning of tools due to non- operation for longer period of lockdown.
- Biological hazards, while handling materials at sites / stores which are lying untouched due to long period of lockdown

Mitigation Measures

- Social distancing shall be ensured in labour camps by providing adequate number of rooms for workers / laborers.
- Food items, vegetables and other items of daily requirement for the laborers /staff shall be arranged by the concerned contractor from one or more reliable sources in the camp itself and no one from the camp would be allowed to move out for these requirements.
- Concerned officials of PIU /related departments have to help in arranging permits for contractors, workers and vehicles engaged in arranging essential items and payments.
- Consumption of liquor, smoking, pan, gutka, tobacco etc. and spitting shall be strictly prohibited in labour camps.

- Hospitals / Clinics in the nearby areas, which are authorized to treat COVD-1 9 patients, would be identified and list of the same is needed to be made available in the camp. Concerned contractors would arrange regular visits of doctor/medical staff in the labour camp. Tie up with nearby hospital dealing with COVID-19 testing and treatment is to be ensured. Mobile number of the doctor/medical assistance shall be displayed in the camp at number of locations. Routine medical checkup of each labour /staff by qualified medical staff shall be ensured, at least once in a weak.
- Any person with symptoms of COVID-19 infection shall be immediately placed in designated isolation rooms. In case of positive test results, he would be admitted to designated hospitals or Government Quarantine Center.
- Camp rooms and toilets shall be kept clean with good hygiene.
- Camp area shall be disinfested completely with user friendly disinfectant medicines at prescribed frequency.
- Concerned contractor would provide adequate hand wash facility with soap and sanitizers, preferable with touch free mechanism at the entry & exit points and in common areas of work sites. The workers / laborers would be regularly educated to become habitual of washing their hands with the soap / liquid soap/sanitizers.
- Posters / sign ages with do's and don'ts issued by the Government would be displayed in the camps / construction sites to improve awareness among the people.
- Bathing and washing facilities should be such that fresh water is available for every user. In no case, common tanks would be used for direct wasting and bathing into it. Used water would be draining off immediately.
- It would be mandatory to all the workers/staff members to wear face mask and full sleeve shirt / kurta, trouser /pajama all the time, so that their faces, hands and arms are covered. Concerned contractor would arrange sufficient number of face masks, safety shoes, helmets, etc. for all workers.
- It is to be ensured that workers do not share their belongings like food, water bottles, utensils, mobile phones etc. in the camp/ at the construction sites.
- There would be total ban on non- essential visitors in camps / work sites. No outside worker/staff would be permitted to stay in the labour camps.
- All vehicles and machinery entering the camp should be disinfected by spraying mandatorily.
- For effective implementation of the strategies, a strict M&E system is needed to be developed / implemented having adequate provision of punishment to the culprits in case of its failures.
- The terms and conditions already mentioned in the tender documents for the workers are also to be implemented along with the emergency response plan developed and labor management plan, keeping in view the COVID-19 problem.
- For effective implementation of SOP (Standard Operating Procedure) in the field, awareness generation programs like organizing meetings /discussions etc. are also needed to be organized for all the stakeholders. Besides, adequate numbers of signages / posters in local language are also needed to be developed as part of IEC material.
- Meetings with the concerned contractors are essential to make them aware about the risks envisaged at construction sites, labor camps and towns due to COVID-19 scenario.

THDCIL has organized COVID-19 vaccination camp on dated 09.04.2021 for the THDC employees, HCC and local peoples. THDCIL is also planning to organize COVID-19 vaccination camp in future.

10.14 ADAPTIVE CAPACITY BUILDING

Capacity building is concerned with human resources and the development of institutions, it emphasis on the overall environment within which organizations operate and interact. Unlike capacity building efforts, adaptive capacity is something organizations pursue in an ongoing manner through measures that embed the four attributes of adaptive capacity-external focus, network connectedness, inquisitiveness and innovation.

A capacity development approach requires that, even if the focus of concern is a specific capacity of an organization to perform a particular function, there must nevertheless always be a consideration of the overall policy environment and the coherence of specific actions with macro-level conditions. Capacity development is therefore concerned with the micro and macro factors that determine how institutions translate their capacities into actual performance. Following suggestions are given for strengthening the environmental management of the projects. The components which must be taken care described below

ii. Ecological Monitoring

THDC can undertake comprehensive Ecological Monitoring through Satellite Imagery Studies over project area and vicinity. These studies would reveal significant environmental gains in the vicinity areas as a result of pursuing sound environment management practices. Some of these important noticed may be a change in forest area, agriculture area, waste land etc. Such studies conducted from time to time around and in vicinity of a project would establish the environment status at various post operational stages of the project.

iii. Aquatic monitoring

Aquatic ecology is critical issue in Hydropower projects. Monitoring of aquatic life in the river during construction and operation phase must be carried out. Changes observed in the aquatic life with the change in flow associated impacts must be documented to provide framework for future development policies. Memorandum of Understanding (MoU) must be formed with State Fisheries Department for management of fish.

iv. Monitoring of Environmental Parameters

A broad based Environment Monitoring Programme needs to be formulated Environmental parameters for water quality and sediment quality must be monitored at the stipulated frequency.

v. Environmental Reviews

To maintain constant vigil on environmental compliance, Environmental reviews must be carried out at all sites and remedial measures should be undertaken wherever necessary. Such periodic Environmental reviews and extensive monitoring of the facilities carried out at all locations help in compliance with the environmental norms and timely renewal of different environmental permissions.

vi. On-Line Data Base Management

It is imperative to have an on-line, reliable and efficient environment information system on the operational to achieve effective environment management. In consideration of this, a GIS based computerized programme, which could provide reliable storage, prompt, and accurate flow of information on environmental performance of project locations should be developed and installed in THDC. This software will help and facilitate direct transfer of environment reports and other environment related information from project locations to the Regional and Corporate Centre. This system will help in achieving continuous improvement in THDC's environment performance through improved monitoring and reporting system by using the trend analysis and advanced data management techniques.

vii. GIS Facilities

To facilitate, on-line data base management, environmental management and monitoring requirements related to different proposed and ongoing project developments advanced remote sensing and GIS facilities at corporate level should be set up. This cell will not only serve the in-house project requirements but also proposed to take up the charge of capacity building of other similar institutions.

viii. Photographic Monitoring

Photograph monitoring is simple and reliable method to monitor the changes in environmental features. Plantation can be monitored through photographic analysis of pre selected areas at 6 monthly intervals. Similarly erosion and landslides can be monitored for pre selected areas of rock and land strata at fixed intervals. THDC team will undertake survey of the potential areas, mark and photograph them on visible scale of clarity. Exercise will be repeated every six month and comparative analysis will be made of photograph to identify changes, if any in the vegetation, rock, and strata locations. A record will be maintained of changes occurring in the character of the land strata and /or rock. Evaluation will be used for advance warning of possible erosion and landslide possibility.

ix. Setting up Environmental lab

An environment lab with the following facilities should be setup by THDC for:

- Water quality analysis
- Air quality analysis

- Meteorological Observations

x. Staffing and Training Requirements

THDC has a Social and Environmental Dept at Corporate level however adequate persons with relevant expertise to take care environmental issues linked with various ongoing and proposed projects are required. In view of existing organizational structure at THDC Corporate office, following is suggested:

- The Social and Environmental Dept should be able to handle all issues related to different environmental attributes. Deploy professionals from relevant environmental discipline such as EIA, Terrestrial Biodiversity, Aquatic Ecology, Chemist, GIS and Socio economics. Emphasis may be given on specialized areas to be filled up at THDC.
- Establish an Environmental Management Cell (EMC) at project level. The EMC will handle all issues related to different environmental attributes, it will be responsible for overall environmental management in project being undertaken by THDC from investigation level to execution at project level
- Training on EIA procedure, Legal status, EMP, Monitoring, Disaster Management Plan, ISO-14001 EMS, Sound construction practices may be given to Corporate and Project Staff.
- Undertake to national /international exposure visit.

In the first five years, adaptive management targets and related monitoring requirements will be reviewed and amended. Thus, the adaptive management process will accommodate any changes based on new information.

A budget of **Rs.640.8 lakh** has been proposed for Adaptive Capacity Development.

Present Status:

THDCIL has its dedicated HRD department for conducting various domain specific National/International training programme as required for capacity building.

10.15 LOCAL AREA DEVELOPMENT/ CORPORATE ENVIRONMENT RESPONSIBILITY (CER)

The objective of the Local Area Development Plan (LADP) for VPHEP is to empower the families of the study area villages. Contrarily, it is the project affected families residing in affected who are not likely to benefit from the proposed project except for compensation of their acquired properties, which would be mostly part of their lands. Thus, LADP is being framed to extend benefits to not only the residents of the affected villages, but also to residents of the villages adjoining to project area which are also within the study area villages.

The following aspects have been covered under the Local Area Development Plan/CER as per the demand of public during the public hearing and subsequent requests obtained from Affected villages (Table-10.15):

- Educational Facilities
- Health Care and Medical Facilities
- Infrastructure Development
- Economic Development
- Social and Cultural Development

Table: 10.15 Issues/ Demands raised during Public Hearing as a part of Local Area Development

S. No.	Issues/demand raised during public hearing	Status as on june, 2021	Remarks
1	During all stages of Project, Local people shall be given job opportunities on priority basis.	Based on the requirement, direct & indirect job opportunities are being extended among local people on priority basis at THDCIL & Contractors Level. Employment opportunities includes: Direct/Indirect job opportunities in THDCIL & with Contractor Award of petty Contracts, Hiring of Vehicles, Allocation of Shops. As on date around 1118 persons have been provided direct / indirect employment opportunities in Project HCC / THDCIL/ Contractors/ Hiring of vehicles/Lease land for various purposes etc.	Proper plan has been prepared for providing Various facilities under Community Development programme/ Corporate Environment Responsibility. All the activities requested by project affected peoples regarding public good are considered for execution. The details of

S. No.	Issues/demand raised during public hearing	Status as on june, 2021	Remarks
2	Arrangements as per standards/policy shall be ensured for Project Affected Persons and Complete compensation of the acquired land shall be released to the concerned in time.	Land Compensation as assessed & decided by Land Acquisition Officer is being disbursed through Special Land Acquisition Officer (SLAO) in accordance to the provisions of LA Act. About 94% PAF's have received payment from SLAO. Besides SLAO Payment, Project is extending various other benefits to the Project Affected Families in accordance to the R&R Policy of Project, framed based on NRRP-2007 & considering the World Bank Operational Policy. The Affected Families are getting cash benefits in the form of various Grants. An Amount of 47.73 Cr has been incurred till date.	expenditure incurred on the activities considered under community development /CER is presented in the table below.
3	Various facilities developed for the project shall be available for the people of the area and community development works shall be carried out in nearby villages.	Various facilities, awareness programmes etc. under Community Development have been made available for the Project Affected Villages including surrounding villages that comprise of : Construction of Pathways, Waiting shelters, Community buildings, Road widening, Hill side slope protection works, Solar street lights for villages, furniture & sports kits for community, water supply schemes, Teaching aids & furniture to schools, Construction of additional classrooms & toilets, promotion of sports & cultural activities, awareness camps on social & environmental aspects, health camps & awareness camps on HIV AIDS, Pulse Polio etc.	
4	The proper development of religious places and Shamshan Ghats nearby the river bank shall be ensured.	The aspect has been covered under Community Development activities at Point No. 3 above.	
5	In order to provide all necessary Project related information to local people, a Public Information Centre shall be established and completed information shall be provided to the people.	Project has established Public Information Centres (PIC`s) at two locations under Project area. Necessary information related to Technical, Social & Environmental aspects are displayed and are available in PIC`s.	

S. No.	Issues/demand raised during public hearing	Status as on june, 2021	Remarks
6	Complete details related to the project shall be published through Press and the views /opinions of the people shall properly solve.	Project related information is being published in the local newspapers from time to time. Grievance Redress Mechanism resolves the issues of affected population in accordance to R&R Policy of VPHEP.	

The activities under CER/local area development are considered by the project on the basis of demands raised by representatives of the local villages.

An expenditure of approximately 12.42 crores has already been incurred on various developmental and supporting activities under CER as mentioned below in **Table 10.19**:

Table 10.16: Details of Expenditure incurred under Local area development / CER

S. No.	Item description	Expenditure incurred (in Rs. Lakhs)
1	Construction of pathways and routes in villages	273.35
2	Drinking Water facilities in villages	172.49
3	Education School support	45.02
4	Electrification/solar lighting	45.32
5	Water Supply	0.83
6	Vermi Compost	0.26
7	Support in cultural activities	7.50
8	Infrastructure development(public) in affected villages	268.65
9	Logistic Support	51.25
10	Procurement (Chair, Desktop and items for Community Development Works)	28.33
11	other activities/ works as per demand by villagers	174.84
12	Scholarships to affected students	74.31
13	Monthly assitance scheme to displaced widows	23.12
14	Income genration activities(training etc.)	77.20
	Total (in Rs. Lakhs)	**1242.47**

Further provisions

Upgradation of Educational Facilities

It is proposed to upgrade the primary schools in 12 villages in the periphery of the affected villages. The following activities are proposed under Local Area Development activities:

- Up-gradation of school fixtures, equipment
- Improvement of drinking water facilities

- School bus service

It is suggested to Up-gradation of school fixtures, equipment, etc., and to improve drinking water facilities in one primary school in 12 study area villages. A lump-sum amount of Rs. 5.0 lakh per primary school is being made for this purpose. The details are given in Table-10.20. Since 12 primary schools are to be upgraded, an amount of Rs.60.0 lakh needs to be earmarked for this purpose. In addition, an amount of Rs.60.0 lakh has been earmarked for purchase of 4 school vans/mini-buses. Thus, total lump-sum amount of Rs.280.0 lakh needs to be earmarked for this purpose.

Table 10.17: Break up of cost required for up-gradation of existing primary schools

S. No.	Particular	Amount (Rs. lakh) /school	Amount (Rs. lakh) for 12 schools
1	Furniture & fixtures and equipment	5.0	60.0
2	Improvement of drinking water facilities	5.0	60.0
3.	Toilets with biodigester to be constructed in each school	5.0	60.0
	Sub-Total (A)	**15.0**	**180.0**
4	Purchase of school vans/mini-buses x 4 Nos.	25.0	100.0
	'Sub-Total (B)		**100.0**
	Total (A + B)		**280.0**

Scholarships for Students

It is suggested to provide scholarships for local students. On the one hand school going students who are presently studying between Class–I to Class-XII, scholarships are suggested for an amount of Rs.2000 per year for a period of 12 years may be extended as scholarship to about 100 students in the Villages.

On the other hand, scholarships are also suggested for students going in for higher studies. Meritorious students from the above mentioned category or students who are presently pursuing higher studies will then be supported for their college/ higher education. A scholarship provision of Rs.5000 per year for meeting their fee and study material requirement along with Rs.3000 per year for meeting their hostel expenses for a period of 4 years is being made for meritorious students for higher studies. About 25 students are proposed to be covered under this scheme.

A total amount of Rs.32.6 lakh may be earmarked for providing scholarships, details of which are given in Table-10.18.

Table-10.18: Details of scholarships

S. No.	Activities	Amount (Rs. lakh)
1	Scholarship for School going students (100 students x 2000 per year for 12 years)	24.0
2	Scholarship for meritorious students–College/ higher education a) Fees/course material (@ Rs. 5000/year x25 students x	

	4 years) b) Hostel expenses (@ Rs. 36,000/year x 25 students x 4 years)	5.0 3.6
	Total	**32.6**

Improvement of Public Health Facilities

It is proposed up-grade 2 existing Primary Health Centers to be identified by the Local Administration. Up-gradation of this health care facility would involve renovation of existing structure/ construction of new wing, if required. Provision of new and/or latest gadgets and instruments, such as furniture, beds, laboratory equipment/instruments, computers wherever possible, installation of new floorings and ceilings, up-gradation/ construction of new of lavatories, electrification and adequate and proper lighting in rooms, facilities for cold storage of essential medicines, provision of drinking water facilities, etc.

In addition, it is suggested to purchase 1 van fitted with lifesaving equipment and stocked with medicines, which will function as a mobile clinic. It is further suggested to attach these mobile clinics to any of the above mentioned PHCs from where these mobile units will operate. A lump-sum amount of Rs.30.0 lakh is being earmarked for this purpose.

A total amount of Rs.100.0 lakh is being earmarked for extending health facilities under Local Area Development Plan. The details are given in Table 100.19.

Table-10.19: Budget for up-gradation of PHSCs

S. No.	Items	Cost (Rs. lakh)	Cost for 2 PHCs (Rs.lakh)
1	Furniture, Beds and other items	10.0	20.0
2	Up-gradation of Pathological laboratory	10.0	20.0
3	Up-gradation of operation theater (labor room)	15.0	30.0
	Sub-Total (A)	**35.0**	**70.0**
4	Purchase of 1 mobile clinic vans	30.0	30.0
	Sub-Total (B)		**30.0**
	Total (A+B)		**100.0**

Budget for CERP

An amount of Rs. 412.6 lakh is being made for implementation of the Local Area Development Plan. The details are shown in Table-10.20.

Table-10.20: Budget for implementation of Corporate Environment Responsibility

Plan (CERP)* S. No.	Items	Budget (Rs. lakh)
1	Construction/Up-gradation schools (refer Table–10.22)	280.0
2	Scholarships to students (refer Table–10.23)	32.6
3	Improvement of Public Health Facility (refer Table-10.24)	100.0
	Total	**412.6lakh say 4.13 crore**

Other activities under CER shall be taken up as per the demands raised by the public during the construction and operation phase. Appropriate provisions shall be made as and when requirement arises.

10.16 BUDGET FOR CAPACITY BUILDING

The Corporate HRD group will prepare the detailed training calendar in consultation with EMC and allocate an annual budget for it. The sum invested on Training shall be monitored quarterly. Tentative budget proposed for capacity building of VPHEP is **Rs. 213.8 lakh**

10.17 BUDGET FOR IMPLEMENTATION OF ENVIRONMENTAL MANAGEMENT PLAN

An additional capital cost provision of about **Rs.1291.03 lakh** has been kept towards the environmental protection measures in the EMP. The summary is presented in **Table-10.21.**

Table-10.21: Summary of EMP Budget

Cost provisions under EMP (in Lakhs)								
SN		**Item**		**Provision under EMP 2007**	**Provision under EMP 2009**	**Expenditure till Date**	**Additional provisions Proposed (2021)**	**Final EMP Cost**
		2		**3**	**4**	**5**	**6**	**8=4-5+6 /8=5+6 (for over expenditure cases)**
1	**Biodiversity Management Plan**		Development Herbal Garden	0	6	17.98	15	32.98
			Compensatory Afforestation (120 ha)	279.9	640	125	0	125
			Deforestation/NPV	1200	#	825	0	825
			Road Side Plantation (plantation/afforestation)	15	15	59	0	59
			Green Belt Development	0	61.53	44.56	15	76.53
			Sustenance of riverine fisheries / Fish Management Plan	65	114	279	150	429
		Wildlife	Monitoring (THDCIL)	50.6	20	7.28	0	20
			Conservation & Monitoring (Forest Under ERP)		243	243		4700
		CAT Plan	Eco-restoration Plan (excl. Wild Life Conservation 240)	0	4223.6	4457		
			Treatment of directly draining catchment area/CAT Plan	271.7	234.3			
Total (A)				**1882.2**	**5557.43**	**6057.82**	**180**	**6267.51**
2	Under contractors Scope		Landscaping and restoration of construction sites	20		534.19	0	1498.09

Cost provisions under EMP (in Lakhs)							
SN		**Item**	**Provision under EMP 2007**	**Provision under EMP 2009**	**Expenditure till Date**	**Additional provisions Proposed (2021)**	**Final EMP Cost**
		Stabilization of muck disposal sites (Biological Measures)	10	197.8			
		Management of impacts due to construction of roads	105	90			
		Stabilization of quarry sites	50	50			
		Public Health Delivery and Safety System	200	437.5		0	
		Sanitary facilities in labour camps and STP	125	125		372	
		Solid waste collection and disposal system	94	97.79		0	
		Provision for free fuelwood distribution	10	10		20	30
	Total (B)		**614**	**1008.09**	**534.19**	**392**	**1528.09**
3	Monitoring	Monitoring programme during construction phase	91	223.1	296.46	31.5	327.96
		Monitoring programme during operational phase	11.6				
4	Archaeological	Archaeological Management Plan	Nil	25	0	0	25
5	Capacity Building	Adaptive Capacity Building	Nil	854.6	0	0	854.6
6	ISO	ISO 14001 and OHSAS	NIL	20	10.5	0	20

Cost provisions under EMP (in Lakhs)							
SN	**Item**		**Provision under EMP 2007**	**Provision under EMP 2009**	**Expenditure till Date**	**Additional provisions Proposed (2021)**	**Final EMP Cost**
7	R&R	Resettlement and Rehabilitation Plan	1543.3	6144	3530.13	0	
8	CER / LAD	**CER activities**	**vide notification dated 01.05.2018**		**1242.27**	**687.73**	1930
Total (C) - CER - R&R			**102.6**	**1122.7**	**306.96**	**31.5**	**1227.56**
EMP (A+B+C)			**2598.8**	**7688.22**	**6898.97**	**603.5**	**9023.16**
EMP (A+B+C) + CER			**4528.8**	**9618.22**	**8141.24**	**1291.03**	**10953.16**

Items	EMP Cost (A+B+C)	Capital (lakh)	Total Recurring Cost (Lakh)
Biodiversity Management Plan (A)	6267.51	6087.51	180
Under contractors Scope (B)	1528.09	1508.09	20
Other (C)	1227.56	331.46	896.1
Total	9023.16	7927.06	1096.1
Total Recurring Cost per Month			**219.22**

10.18 RESPONSIBILITY MATRIX

Environmental Management Plan (EMP) is the key to ensure a safe and clean environment. The desired results from the environmental mitigation measures proposed in the project may not be obtained without a management plan to assure its proper implementation & function. The EMP envisages the plans for the proper implementation of mitigation measures to reduce the adverse impacts arising out of the project activities during construction and operation stage.

- **Construction Stage:** Construction stage is the most crucial and active stage of the EMP. The construction activities shall increase pollution load in the atmosphere as well as there shall be some other impacts. Therefore, in addition to the monitoring of construction activity to ensure that the environment is not impacted beyond permissible limits, safety of the workers, labour camp management, disposal of construction waste and risks associated with construction activities such as accidental spillages and consequent damage to the surrounding environment in terms of loss of flora, fauna, agricultural crops or loss of fertile land shall be monitored simultaneously.
- **Operation Stage:** The operation stage shall essentially entail monitoring activity within the project area. The monitoring for pollutants specified in the monitoring plan will serve two purposes. In addition to checking the efficacy of the protection/mitigation/enhancement measures implemented, this will help to verify or refute the predictions made as a part of impact assessment. Thus, it will complete a very important feedback loop for THDC.

Table-10.22: Environmental Management Measures & Responsibilities - Construction Stage

S. No.	Environmental Issues	Impacts (Direct/ Indirect)	Management Measures	Responsibility	
				Execution/ Civil Work	Supervision/ Monitoring
C.1	Preservation of top soil	Loss of top soil	The topsoil from all areas of cutting and all areas to be permanently covered shall be stripped to a specified depth of 15 cm and stored in stockpiles. A portion of the temporarily acquired area shall be earmarked for storing topsoil. The locations for stock piling shall be pre-identified in consultation and with approval of Environmental Expert of Supervision Consultant (SC) & EMC. The following precautionary measures shall be taken to preserve them till they are used: (a) Stockpile shall be designed such that the slope does not exceed 1:2 (vertical to horizontal), and height of the pile is restricted to 2 m. To retain soil and to allow percolation of water, the edges of the pile shall be protected by silt fencing (b) Stockpiles shall not be surcharged or otherwise loaded and multiple handling shall be kept to a minimum to ensure that no compaction shall occur. Such stockpiled topsoil shall be utilized for - • covering all disturbed areas including borrow areas • top dressing of the muck disposal areas • in the agricultural fields of farmers, acquired temporarily. Residual topsoil, if there is any shall be utilized for the plantation.	The Contractor	Environmental Expert of SC and EMC
C.2	Earth from Borrow Areas for Construction	• Disfiguration of topography due to indiscriminate digging of borrow pits • Uncontrolled digging of borrow pits resulting in water accumulation & breeding of vector disease.	No borrow area shall be opened without permission of the Environmental Expert of EMC & SC. The Contractor shall rehabilitate the borrow areas as soon as borrowing is over from a particular borrow area in accordance with the Borrow Area Rehabilitation/ Redevelopment Guidelines or as instructed by the Environmental Expert.	The Contractor	Environmental Expert of SC and EMC
C.3	Quarry operation	• Loss of vegetation • Deterioration of surface water quality • Dust generation • Slope instability	The Contractor shall develop a Comprehensive Quarry Redevelopment Plan as per the Mining Rules of Uttarakhand and submit a copy to EMC and SC prior to opening of the quarry site. The quarry operations shall be undertaken within the rules and regulations in force. Sediment traps will be installed Dust suppression measures will be implemented Landscaping will be carried out by the Contractor to rehabilitate the quarry areas as soon as quarrying is over from a particular area In borrow pits, the depth shall be so regulated that the sides of the excavation shall have a slope not steeper than 1 vertical to 2 horizontal, from the edge of the final section of the bank.	The Contractor	Environmental Expert of SC and EMC
C.4	Construction water	Impact on the local water sources due to use of construction water.	The Contractor shall arrange adequate supply and storage of water for the whole construction period at his own costs. The Contractor shall submit a list of source/s from where water shall be used for the project to SC and EMC.	The Contractor	Environmental Expert of SC
C.5	Construction of approach roads	Soil erosion Dust Generation Slope instability	The Contractor shall provide necessary drainage measures to control soil erosion & fly of dust etc., and shall take necessary slope protection measures for making the slopes stable, as directed by Environmental Expert of SC & EMC.	The Contractor	Environmental Expert of SC and EMC
C.6	Muck disposal	• Loss of vegetation • Loss of top soil • Heavy siltation of river specially during monsoon season due to muck falling in surface water/ river • Loss of aesthetic value of the area	• Top soil will be reused for landscaping activities • Suitable retaining walls shall be constructed at muck disposal sites to develop terraces so as to support the muck on vertical slope and for optimum space utilization. Loose muck would be compacted layer wise. The muck disposal area will be developed in a series of terraces of boulder crate wall and masonry wall to protect the muck from flood water during monsoons. In-between the terraces, catch water drain will be provided. The terraces of the muck disposal area will be ultimately covered with fertile soil and suitable tree species will be planted.	The Contractor	Environmental Expert of SC and EMC
C.7	Water pollution	• Increase of sediment load in the run off	• The Contractor shall take all precautionary measures to prevent the wastewater generated	The Contractor	Environmental Expert of SC

S. No.	Environmental Issues	Impacts (Direct/ Indirect)	Management Measures	Responsibility	
				Execution/ Civil Work	Supervision/ Monitoring
	from - construction wastes and fuel and lubricants	from construction sites and increase in turbidity in receiving water bodies. • Water pollution due to sewage from construction camps. • Deterioration of surface water quality.	during construction from entering into Alaknanda River & its tributaries, • All waste arising from the project is to be disposed off in the manner that is acceptable to the State Pollution Control Board or as directed by Environmental Expert. • Construction activities shall be prohibited during the rainy season. • The Contractor shall ensure that all construction vehicle parking location, fuel/lubricants storage sites, vehicle, machinery and equipment maintenance sites are located at least 100 m away from water body. • The Contractor shall also ensure that spillage of fuels and lubricants do not contaminate the ground. • All location and lay-out plans of such sites shall be submitted by the Contractor prior to their establishment and shall be approved by the Environmental Expert of SC and EMC. The Contractor shall arrange for collection, storing and disposal of oily wastes to the pre-identified disposal sites		and EMC
C.8	Air pollution	• Deterioration of air quality due to fugitive dusts emission from construction activities like excavation backfilling & concreting, and hauling & dumping of earth materials & construction spoils, and vehicular movement along unpaved roads. • Deterioration of air quality due to gaseous emissions from construction equipment & vehicular traffic.,	• The Contractor shall take every precaution (water sprinkling etc.) to reduce the level of dust generating from construction site. • The Contractor shall provide necessary certificates to confirm that all crushers used in construction conform to relevant dust emission control legislation. • The Contractor shall ensure that all vehicles, equipments and machineries used for construction are regularly maintained and confirm that pollution emission levels comply with the relevant requirements of State Pollution Control Board (SPCB). • The Contractor shall submit PUC certificates for all vehicles/ equipment/ machinery used for the project and maintains a record of the same during the contract period. Monitoring results shall also be submitted to SC and EMC as per the monitoring plan. • Appropriate Ventilation in Underground works.	The Contractor	Environmental Expert of SC and EMC
C.9	Noise pollution	Increase in noise level due to construction activities like operation of construction equipment, blasting & vehicular traffic.	The Contractor shall confirm the following: • All plants and equipments used in construction shall strictly conform to the CPCB noise standards. • All vehicles and equipment used in construction shall be fitted with exhaust silencers. • Servicing of all construction vehicles and machinery shall be done regularly and during routine servicing operations, the effectiveness of exhaust silencers shall be checked and if found defective shall be replaced. • At the Construction sites noise be restricted as per the norms under Environment Protection Act 1986. A noise meter be installed for time to time measurements.	The Contractor	Environmental Expert of SC and EMC
C.10	Safety	• Personal safety measures for labour • Risk from electrical equipments	The Contractor shall provide: • Protective footwear and protective goggles to all workers employed on mixing asphalt materials, cement, concrete etc. • Protective goggles and clothing to workers engaged in stone breaking activities, welding activities etc. • Earplugs to workers exposed to loud noise, and workers working in crushing, compaction, or concrete mixing operation. • Adequate safety measures for workers during handling of materials at site. • Helmets & Boots for workers working underground and in open excavation areas. • Safety Belts etc. The Contractor shall comply with all the precautions as required for ensuring the safety of the workmen as per the International Labour	The Contractor	Environmental Expert of SC and EMC

S. No.	Environmental Issues	Impacts (Direct/ Indirect)	Management Measures	Responsibility	
				Execution/ Civil Work	Supervision/ Monitoring
			Organization (ILO) Convention No. 62 as far as those are applicable to this contract. The Contractor shall make sure that during the construction work all relevant provisions of the Factories Act, 1948 and the Building and other Construction Workers (regulation of Employment and Conditions of Services) Act, 1996 are adhered to. The Contractor shall not employ any person below the age of 14 years for any work and no woman shall be employed on the work of painting with products containing lead in any form. The Contractor shall also ensure that no paint containing lead or lead products is used except in the form of paste or readymade paint. He shall provide facemasks for use to the workers when paint is applied in the form of spray or a surface having lead paint is rubbed and scraped. The Contractor shall mark 'no smoking' in high risk areas and enforce non-compliance of use of PPE with zero tolerance. These shall be reflected in the Construction Safety Plan to be prepared by the Contractor during mobilization and shall be approved by SC and EMC. All machines to be used in the construction shall conform to the relevant Indian Standards (IS) codes, are free from patent defect, are kept in good working order, regularly inspected and properly maintained as per IS provision and to the satisfaction of the Environmental Expert.		
C.11	First aid	Health related problems to construction workers due to inadequate health & safety measures.	The Contractor shall arrange for – • A readily available first aid unit including adequate supply of sterilized dressing materials and appliances as per the Factories Rules in every work zone • Availability of suitable transport at all times to take injured or sick person(s) to the nearest hospital • Equipment and trained nursing staff at construction camp.	The Contractor	Environmental Expert of SC and EMC
C.12	Labour Camp Management	Likely sanitation & health hazards & other impacts on the surrounding environment due to inflow of construction labourers.	**Accommodation:** The Contractor shall follow all relevant provisions of the Factories Act, 1948 and the Building and the other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 for construction and maintenance of labour camp. **Potable water:** The Contractor shall: • Supply of sufficient quantity of potable water in every workplace/labour camp at suitable and easily accessible places and regular maintenance of such facilities. • If any water storage tank is provided, the bottom of the tank shall be kept at least 1mt. above the surrounding ground level. • Testing of water shall be done every month as per parameters prescribed in IS 10500:1991. **Sanitation and sewage system:** The Contractor shall ensure that: • The sewage system for the camp shall be designed, built and operated in such a fashion that it should not pollute the ground water or nearby surface water. • Separate toilets/bathrooms, shall be arranged for men and women • Adequate water supply is to be provided in all toilets and urinals • All toilets in workplaces are with dry-earth system (receptacles) which are to be cleaned and kept in a strict sanitary condition • Night soil (human excreta) is to be disposed off by putting layer of it at the bottom of a permanent tank prepared for the purpose and covered with 15 cm. layer of waste or refuse and	The Contractor	Environmental Expert of SC and EMC

S. No.	Environmental Issues	Impacts (Direct/ Indirect)	Management Measures	Responsibility	
				Execution/ Civil Work	Supervision/ Monitoring
			then covered with a layer of earth for a fortnight. Waste **disposal:** The Contractor shall provide segregated garbage bins (biodegradable and non-biodegradable) in the camps and ensure that these are regularly emptied and disposed off in a hygienic manner as per the Comprehensive Solid Waste Management Plan approved by the Environmental Expert of SC. Environmental Expert of SC shall be required to inspect the labour camp once in a week to ensure the compliance of the EMP.		
C.13	Contractor's Demobilization	Clean-up operations, restoration and rehabilitation	The Contractor shall prepare site restoration plans, which shall be approved by the Environmental Expert of SC and EMC. The clean-up and restoration operations are to be implemented by the Contractor prior to demobilization. The Contractor shall clear all temporary structures; dispose all garbage, night soils, POL waste and all construction zones as per Comprehensive Waste Management Plan and as approved by SC. All disposal pits or trenches shall be filled in and effectively sealed off. Residual topsoil, if any shall be distributed on adjoining/ proximate barren land or areas identified by Environmental Expert	The Contractor	Environmental Expert of SC and EMC
C.14	Cultural Property	Chance find during construction, if any.	• Whenever chance finds of cultural or historical artifacts (moveable and immovable) are made the Department of Archaeology of the state Government, the Archaeological Survey of India will be informed. Should the continuation of work endanger the historical and cultural artifacts, the project work will be suspended until a solution is found for the preservation of these artifacts, or advice from the Archaeological Survey of India is obtained. • Contractors, employees of the contractors and all project employees will be responsible for informing the Project Director immediately after discovery of the chance find, without any judgment on their own on the value of the chance find. The Project head will be responsible to inform the Department of Archaeology of the State Government, and the Archaeological Survey of India, local Office, within 48 hours of such discovery. • The Project Head will request for a representative of the State Department of Archaeology, Government of Uttarakhand, and/or the Archaeological Survey of India, local Office in Uttarakhand to make a site inspection. • Project Head will order cessation of work in the vicinity of the chance find until the visit of a representative (usually required within 48-72 hours of notification); and follow the advice by the State Department of Archaeology, and / or the Archaeological Survey of India on possible salvage or excavation (usually required within 48-72 hours of notification). • Failure to report a chance find within the 48 hours of discovery, is a punishable offence under the relevant Indian legislation. Similarly, (intentional) damage to a historical or cultural artifact is a punishable offence.	Construction Contractor / THDC	Archaeological Survey of India
C.15	Social Management	The Social Impact of Work force of this size will be significant especially in small communities near the camp. Although the impact will be short term (Construction period). There are also a number of specific impacts arising from the interaction between the social & physical environment which requires immediate	• Understanding existing conditions & trends related to demography and employment. • Identifying potential impacts of camps and related construction activities, including the work force requirements and potential impacts on services and communities in the project areas, impact on natural resources such as forest produce and developing procedure to minimise the impacts. • Identification of Mitigation measures. • Direct work force local labour recruitment policy. • Social management of potential risks associated with spontaneous camp followers. • Management & Monitoring of health issues in		

S. No.	Environmental Issues	Impacts (Direct/ Indirect)	Management Measures	Responsibility	
				Execution/ Civil Work	Supervision/ Monitoring
		mitigation such as the risk of exposure to Dust, the increase risk of traffic accidents etc.	the Contractor's camp area / work areas which shall necessarily include test for HIV. • Provision of free fuel wood, kerosene oil, or LPG to workers. • Community outreach & communication programme including resolution mechanism to deal with issues and concerns that they may arise during the construction period. • Code of Conduct – Work Force behaviour. • Detailed procedures for receiving and addressing complaints including a complaint register. • Educating the work force on traditional village life. • Communicating risks to villagers and river user etc.		

Table-10.26: Environmental Management Measures & Responsibilities – Operation Stage

S. No	Environmental Issues	Impacts (Direct/ Indirect)/ Implications	Management Measures	Responsibility	
				Execution/ Civil Work	Supervision/ Monitoring
O.1	Monitoring Operation Performance	Enhancement of surrounding environment of the project area	• The EMC shall monitor the operational performance of the various mitigation/ enhancement measures carried out as a part of the project. • The indicators selected for monitoring include the survival rate of trees; utility of enhancement provision for relocated utilities and structures; status of rehabilitation of borrow areas; quarry areas; muck disposal sites etc.	EMC	THDC
O.2	Pollution Monitoring	• To evaluate the performance of mitigation measures proposed in the EMP • To suggest improvements in management plan, if required • To enhance environmental quality • To satisfy the legal and community obligations	• The periodic monitoring of the ambient air quality, noise level, water quality, soil pollution/contamination in the selected locations as suggested in Environmental Monitoring Plan shall be the responsibility of EMC. • EMC shall appoint SPCB approved Pollution Monitoring Agency for this purpose.	Pollution Monitoring Agency, EMC	THDC
O.3	Terrestrial Biodiversity	• 100.39 ha (includes 23.13 ha land for underground works)forest land and associated vegetation will be affected by the project • Improved accessibility of the area and increased human population in the area will increase pressure on natural resources and wildlife • Increased land erosion in the catchment area	• Compensatory Afforestation plan towards loss of forest • Effective Catchment Treatment Plan • Control measures for grazing • Control measures for forest fire	State Forest Department/ EMC	THDC