

**DRAFT**

# *Environmental & Social Impact Assessment (ESIA) Report*

**100 MW TIDONG HYDROELECTRIC POWER PROJECT**

(INITIALLY PREPARED BY: RITES)

**September 2011**

**FOR:**



**NSL RENEWABLE POWER PRIVATE LIMITED**

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## List of Abbreviations

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µg/m <sup>3</sup>	: Micro Gram per Cubic Meter
ADB	: Asian Development Bank
ADM	: Additional District Magistrate
APHA	: American Public Health Association
BDO	: Block Development Officer
BIS	: Bureau of Indian Standards
BOCW	: Building and Other Construction Workers
BOD	: Biological Oxygen Demand
CAP	: Corrective Action Plans
CAT	: Catchment Area Treatment
CDM	: Clean Development Mechanism
CEA	: Central Electricity Authority, Gol
CEO	: Chief Executive Officer
CLO	: Community Liaison Officer
CO	: Community Officer
COD	: Chemical Oxygen Demand
CPCB	: Central Pollution Control Board
CPI	: Consumer Price Index
CRC	: Grievance Redressal Cell
CWC	: Community Welfare Committee
dB(A)	: Decibels on scale A
DEM	: Digital Elevation Data
DFO	: Divisional Forest Officer
DG	: Diesel Generator
DO	: Dissolved Oxygen
DPR	: Detailed Project Report
EC	: Environmental Clearance
EHS	: Environment, Health and Safety
EHS&S	: Environment, Health, Safety and Social
EHS&S	: Environmental, Health, Safety & Social
EIA	: Environmental Impact Assessment
EMMP	: Environmental Management and Monitoring Plan
EPA	: Environment Protection Act, 1986.
EPFIs	: Equator Principle Financial Institutions
EPP	: Emergency Preparedness Plan
ESIA	: Environmental and Social Impact Assessment
FCA	: The Forest Conservation Act
FI	: Financial Intermediary
GI	: Galvanized Iron
GIP	: Good International Industry Practice
GoHP	: Government of Himachal Pradesh
Gol	: Government of India

HEP	: Hydro Electric Project
HP	: Himachal Pradesh
HPPTCL	: Himachal Pradesh Power Transmission Corporation Limited
HPSEB	: Himachal Pradesh State Electricity Board
HPSPCB	: Himachal Pradesh State Pollution Control Board
HRT	: Head Race Tunnel
IA	: Impact Assessment
IBRD	: International Bank for Reconstruction and Development
IFC	: International Finance Corporation
ILO	: International Labour Organization
INR	: Indian National Rupees
IPH	: Public Health Department
LAA	: The Land Acquisition Act, 1894
LADA	: Local Area Development Authority
Leq	: time weighted average of the level of sound in dB(A)
MoEF	: Ministry of Environment and Forest
MPP	: Multi Purpose Projects
MSW	: Municipal Solid Waste
MW	: Mega Watt
NAAQS	: National Ambient Air Quality Standards
NBWL	: National Board for Wildlife
NDVI	: Normalized Difference Vegetation Index
NEAA	: National Environment Appellate Authority
NGO	: Non Governmental Organization
NH	: National Highway
NOC	: No Objection Certificate
NOx	: Nitrogen Oxide
NPV	: Net Present Value
NRPPPL	: NSL Renewable Power Private Limited
NRRP	: National Resettlement & Rehabilitation Policy, 2007
NSL	: Nuziveedu Seeds Limited
NTFP	: Non Timber Forest Produce
NTPGL	: NSL Tidong Power Generation Limited
OSHA	: Occupational Safety and Health Administration, USA
PAF	: Project Affected Families
PAP	: Project Affected Population
PESA	: Panchayats Extension to Schedule Areas Act, 1996
PHC	: Primary Health Centre
PHSC	: Primary Health Sub Centre
PLIA	: Public Liability Insurance Act, 1991
POL	: Petroleum, Oil & Lubricant
PPE	: Personal Protective Equipment
PS	: Performance Standards
PUC	: Pollution under Control
PWD	: H.P. Public Works Department Road
R&R	: Rehabilitation and Resettlement
ROR	: Run of the River
RRC	: Random Rubble Concrete

RSPM	: Respirable Suspended Particulate Matter
SMP	: Social Management Plan
SMP	: Socio-Economic Management Plan
SO <sub>2</sub>	: Sulphur Dioxide
SPCB	: Pollution Control
SPM	: Suspended Particulate Matter
SPM	: Suspended Particulate Matter
SRTM	: Shuttle Radar Topography Mission
SS	: Suspended Solids
ST & SC	: Schedule Tribes and Schedule Castes
TDS	: Total Dissolved Solid
TEC	: Techno-economic Clearance
THEP	: Tidong Hydro Electric Project
TMP	: Traffic Management Plan
TRC	: Tail Race Channel
UN	: United Nations
UTPCC	: Union Territory Pollution Control Committee

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# 1. INTRODUCTION

## 1.1 Background

India is blessed with immense amount of hydro-electric potential and ranks 5<sup>th</sup> in terms of exploitable hydro-potential on global scenario<sup>1</sup>. As per assessment made by Central Electricity Authority (CEA), India is endowed with economically exploitable hydro-power potential to the tune of 148,700 MW of installed capacity due to its great river systems and favorable geographical features. While State and Central Government agencies are largely concentrating on mega-hydel projects, the private sector is being involved to execute the mini and micro-hydel segment projects. Funding for these projects has come in from the various multilateral financing institutes like the World Bank, IFC, private banks like ICICI, nationalized banks like Central Bank of India, various State Banks. The basin wise assessed potential is as under:

**Table 1-1 Basin wise hydropower potential in India**

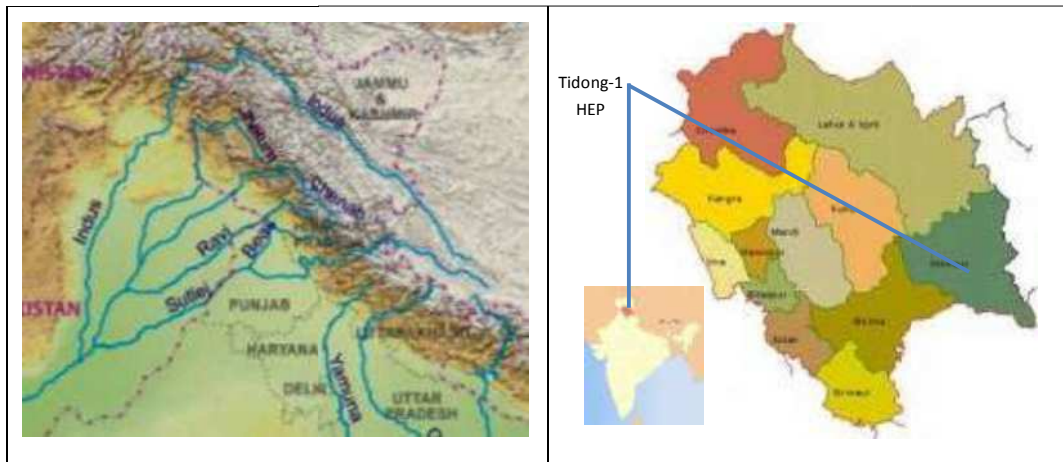
Basin/Rivers	Probable Installed Capacity (MW)
Indus Basin	33,832
Ganga Basin	20,711
Central Indian River system	4,152
Western Flowing Rivers of southern India	9,430
Eastern Flowing Rivers of southern India	14,511
Brahmaputra Basin	66,065
<b>Total</b>	<b>148,701</b>

Source: NHPC Limited

In addition, 56 number of pumped storage projects have also been identified with probable installed capacity of 94,000 MW. In addition to this, hydro-potential from small, mini & micro schemes has been estimated as 6,782 MW from 1,512 sites. Thus, in totality India is endowed with hydro-potential of about 250,000 MW. However, exploitation of hydro-potential has not been up to the desired level due to various constraints confronting the sector.

<sup>1</sup> As per NHPC Study ([http://www.nhpcindia.com/English/Scripts/Hydro\\_Scenario.aspx](http://www.nhpcindia.com/English/Scripts/Hydro_Scenario.aspx))

Figure 1-1: a) Main Rivers of Northern India; b) District Map of State of Himachal Pradesh



**1.1.1 Hydropower Potential in Himachal Pradesh**

Himachal Pradesh has vast hydroelectric potential of about 12,249.37 MW at 60% load factor, with an installed capacity of 20,415.62 MW. The Satluj basin in Himachal Pradesh has a hydropower potential of 9,866.55 MW, which represents approximately 50% of its likely installed capacity. In addition to the Satluj, other rivers, which are part of the great Indus Basin and pass through Himachal Pradesh, also contribute to the power potential of the state. The total identified hydropower potential of Himachal Pradesh in its various stages of development is indicated in Table 1-2 and 1-3.

Table 1-2: Status of Hydropower Potential in Himachal Pradesh

Project Status	Potential (MW)
Projects under Operation (including Himurja Projects)	6,370.12
Projects which are under execution/allotted and planned for 11 <sup>th</sup> Plan Period	5,744.10
Projects which have been allotted/under process of allotment and expected to yield benefit during the 12 <sup>th</sup> Plan period	5,615.50
Projects which would have to be re advertised	1,481.00

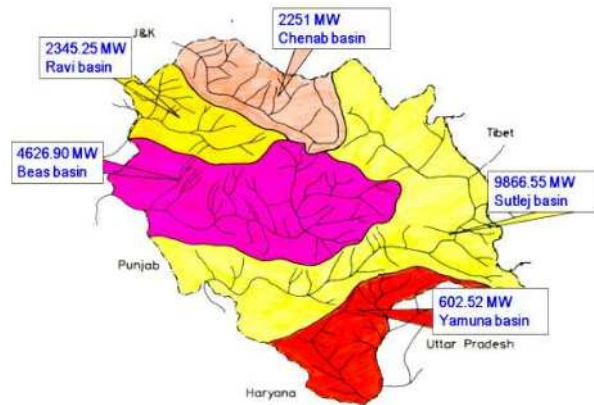
Projects which have been abandoned due to environmental considerations	435.00
Projects under investigation for preparation of DPR	46.50
Himurja Projects proposed/under execution) {750-26.60} [Under Operation - 26.60 MW]	723.40
<b>TOTAL POTENTIAL</b>	<b>20,415.00</b>

Source: HP State Electricity Board ([www.hpseb.com](http://www.hpseb.com))

Total exploitable hydropower in Himachal Pradesh is 12,249.37 MW which is 14.56% of India’s total hydropower. Basin wise hydropower potential in Himachal Pradesh is depicted in Table 1-4. Figure 1-1a depicts important river basins of Northern India.

**Table 1-3: Basin wise Hydropower potential of Himachal Pradesh**

Basin	Hydropower MW
Beas Basin	4626.90
Ravi Basin	2345.25
Satluj Basin	9866.55
Yamuna Basin	602.52
Chenab Basin	2251.00
Mini Micro Projects	723.40
<b>TOTAL</b>	<b>20415.62</b>



Source: Himachal Pradesh State Electricity Board

The Tidong-1 HEP (Hydro Electric Project) is a part of Satluj Basin and total 11 numbers of projects with a cumulative capacity of about 3277 MW are currently operation and about 12 projects with cumulative capacity of 3080 MW are under execution, however, other projects are in different stages before execution such as investigation, allotment, etc.

The Tidong-1 HEP under execution has a capacity of 100 MW and is located on the Tidong Khad (Stream), a tributary of river Satluj in Kinnaur district. It is a run of the river scheme proposed to harness the hydro potential of Tidong Khad in its lower reach between Lambar and Rispa villages. The project site is situated 270 km from Shimla on National Highway 22 upto a place near Moorang and thereafter 21 km on state road upto village Lumber. Diversion weir would come at Lumber village and powerhouse at Rispa village. Index map of the project site is given as Figure 1-1b.

## 1.2 Objective and Scope of Work

The Environmental Impact Assessment (EIA) report for the project was initially prepared by M/S RITES Ltd. in Nov-2005. The main purpose of this present study is to update the existing EIA report to meet the requirements of International Finance Corporation (IFC). The objectives are described as follows:

- NSLRRPL has sought partial financing arrangement for their Projects from the International Finance Corporation (IFC). To fulfill IFC's Environmental and Social requirements, the Project required revision and updating of Environmental and Social Impact Assessment (ESIA) study along with broad overview of execution work of Transmission Line to be carried out by Himachal Pradesh Power Transmission Corporation Limited (HPPTCL). Execution of this associated facility will be done in accordance with HPPTCL's Environmental, Health, Safety and Social guidelines. These guidelines have been reviewed by AECOM and found broadly to be in line with IFC requirement in this respect.
- Ensure potential adverse environmental and social impacts arising from the project that are identified, evaluated w.r.t. IFCs' performance standards and minimised through implementation of appropriate mitigation measures; and
- Developing environmental and social management plan for effective implementation of mitigation measures to minimise identified environmental and social impacts due to the Project during its entire life cycle.

The scope of work for AECOM includes to revise and update the existing EIA report with respect to the Performance Standards on Social & Environmental Sustainability issued by IFC, which are adopted by Equator Principle Financial Institutions (EPFIs) to ensure that the project they finance are developed in a manner that is socially responsible, reflect sound environmental management practices. The study will not undertake any primary monitoring data for environmental baseline data generation.

The detailed scope of the services was as outlined below:

- Compliance Assessment of the Project vis-à-vis the Equator Principles including IFC's Performance Standards for development of the ESIA study;
- Review the regulatory and institutional framework that applies to the Project including those on labour and working conditions and workers' Health and Safety;
- Verification and updation of Project information;



- Reconnaissance visits and collection of available additional secondary environmental, social and demographic information;
- Consultation with stakeholders on issues related with project impacts on environment, social and economic impact on community, etc.;
- Collection of information on forestry, flora and fauna, natural habitats and species of special conservation/scientific interest through secondary data of the study area;
- Review of land acquisition and compensation process;
- Identification and review of the applicable standards and identification of key issues;
- Assessment of potential environment and social impacts of the Project and developing mitigation measures and plans to maximize project benefits in consultation with affected communities; and
- Preparation of Environmental and Management & Monitoring Plan (EMMP) and Social Management Plan (SMP) based on the review and develop procedures for monitoring environment and social impacts on an ongoing basis and to identify any impacts/mitigation requirements that may occur subsequent to the completion of the ESIA.

This “Revised and Updated ESIA Report” of the Project covers requirements of Performance Standards and Environmental, Health, Safety & Social (EHS&S) guidelines of IFC.

### 1.3 Report Layout

The report has been structured as follows:

- Executive Summary
- **Chapter-1** of the report is on introduction. It gives an overview of the project rationale and context as far as Tidong HEP is concerned.
- **Chapter-2** The policy, legal and administrative frameworks including IFC and Equator Principles Financial Institutions (EPFIs) guidelines for social and environmental performances.
- **Chapter-3** describes the proposed project components and activities including project features, construction schedule and methodology etc.
- **Chapter-4** summarizes environmental baseline on physical and biological parameters as obtained prior to the commencement of the project.
- **Chapter-5** explains about socio-economic status of the project affected population, project affected area and the villages in the vicinity. Social Impact of project has also been assessed in this chapter in addition to the suggested Social Management Plan.

- **Chapter-6** highlights anticipated environmental and few associated social impacts of the project.
- **Chapter-7** proposes Environmental & Social Management Plans in which all sectoral plans are discussed separately along with their cost estimates wherever necessary.



## 2. LEGAL AND ADMINISTRATIVE FRAMEWORK

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The 1972 United Nations (UN) Conference on Human Development at Stockholm emphasized the need for a well-developed legal mechanism to conserve resources, protect the environment and ensure the health and well being of the people in India. Over the years, the Government of India has formulated several policies and circulated a number of Acts, Rules and Notifications with an objective to manage and protect the environment. As a result, India now has a comprehensive set of environmental legislation intended to ensure that the development process meets the overall objective of promoting sustainability in the long run.

The nodal environmental regulatory agency in India is the Ministry of Environment and Forest (MoEF), New Delhi. MoEF formulates environmental policies and accords environmental clearances for different projects. The project conforms to the requirements of the Environment Protection Act (EPA), 1986. The Environmental Clearance has been undertaken in accordance with the Environmental Impact Assessment (EIA) Notification 2006.

The current project will be guided by various National Acts, Rules and Policies and also IFC's Policies and Performance Standards which have been discussed in brief in following sections:

### 2.1 Relevant Environmental, Health & Safety, Worker Welfare Legislations

#### 2.1.1 The Environmental Impact Assessment (EIA) Notification, 2006 and its amendments

Hydroelectric Projects can cause broad range of impacts including alteration in the habitats and species, diversity of area, changes in land use pattern, aesthetics, natural and artificial resources and also affect upstream and downstream biology, hydrology and sociology. Although, water used in such projects may be free, inexhaustible and reusable natural resource but the same is not true for the environmental aspects. Environmental aspects need to be scrutinized for the sustainable development to mitigate the negative impact caused by hydroelectric projects. Hence, EIA Notification, 2006 requires preparation of an EIA Report and Environmental Clearance (EC) for hydroelectric power projects. Hydroelectric Power generation projects have been classified under Category 1 (c) "River Valley projects" of the EIA Notification, 2006.

Whenever a project is accorded an Environmental Clearance, a set of recommendations and conditions are stipulated by the Appraisal Committee for compliance by the investor while the project is under implementation and later under operation.

Also, Public Hearing is required for hydroelectric projects as a part of EC process. The applicant is required to make a request through a simple letter to the Member Secretary of the SPCB or Union Territory Pollution Control Committee, in whose jurisdiction the project is located, to arrange the public hearing within the prescribed statutory period. In case the project site is covering more than one District or State or Union Territory, the public hearing is mandated in each District, State or Union Territory in which the project is located and the applicant shall make separate requests to each concerned SPCB or UTPCC for holding the public hearing as per this procedure.

The applicant has to enclose with the letter of request, at least 10 hard copies and an equivalent number of soft (electronic) copies of the draft EIA Report with the generic structure given in Appendix III including the Summary Environment Impact Assessment report in English and in the official language of the state/local language, prepared strictly in accordance with the Terms of Reference communicated after Scoping (Stage-2). Simultaneously the applicant has to arrange to forward copies, one hard and one soft, of the above draft EIA Report along with the Summary EIA report to the following authorities or offices, within whose jurisdiction the project will be located:

- a) District Magistrate/District collector/Deputy commissioner /s
- b) Zila Parishad or Municipal Corporation or Panchayats Union
- c) District Industries Office
- d) Urban Local Bodies (ULBs) / PRIs Concerned/Development authorities
- e) Concerned Regional Office of the Ministry of Environment and Forests

Following panel constitution, SPCB releases notice for the public hearing in one major National Daily and one Regional vernacular Daily, inviting objections from the people likely to be affected by a project covered under the EIA notification. Its proceedings are then issued by SPCB to MoEF with a copy to the project proponent.

### **2.1.2 National Environment Appellate Authority Act, 1997**

This Act was established to hear grievances arising out Environmental Clearance cases under the Environmental (Protection) Act by the establishment of a National Environment Appellate Authority (NEAA). A person aggrieved by an order granting environmental clearance in a given area for establishing an industry may, within 30 days from the date of such an order, appeal to the NEAA. The appellant can be a person, who owns or controls the project, an association of persons, Central or State Government or any local authority. The Authority shall dispose of the appeal within 90days from the date of filing the appeal.

### **2.1.3 National Environment Tribunal Act, 1995**

The National Environment Tribunal Act prescribes the procedure and substantive law relating to compensation for the death of, or injury to, a person and damage to property and environment, by any industry wherein a hazardous substance is used or is a byproduct. It also provides for the establishment of a National Environment Tribunal for effective and expeditious disposal of such. The tribunal would have jurisdiction over matters specified in the Public Liability Insurance Act. The tribunal would receive claims of compensation by the person who has sustained the injury or by his or her legal representative.

### **2.1.4 National Green Tribunal Act, 2010**

This act provides for the establishment of National Green Tribunal for the effective and expeditious disposal of cases relating to environment protection and conservation of forests and other natural resources and giving relief and compensation for damages to persons and property. The tribunal has jurisdiction over all civil cases relating to environment. It would deal with all environmental laws on air and water pollution, the Environment Protection Act, the Forest Conservation Act and the Biodiversity Act. Also the relief and compensation under this act is in severance to the relief paid under Public Liability Insurance Act, 1991.

### **2.1.5 The Forest (Conservation) Act, 1980 as amended in 1988**

The Forest Conservation Act was adopted in 1980 to protect and conserve forests. It strictly restricts and regulates the de-reservation of forests or use of forest land for non-forest purposes without the prior approval of Central Government. To this end the Act lays down the pre-requisites for the diversion of forest land for non-forest purposes. The FCA is relevant for the power sector for the siting guidelines for hydroelectric power plants, and for passage of transmission through forest areas, since it would involve use of forestland for "non-forest" purposes.

### **2.1.6 The Forest (Conservation) Rules 2003**

The Forest (Conservation) Rules, 2003 empower the Central Government to constitute a seven - member committee to advise the Central Government on proposal made by a State Government for conversion of a forestland. The MoEF circulated guidelines for submission of proposal for diversion of forest area to non-forest activity under the Forest (Conservation) Act, 1980 through letter no. 2-1/2003-FC dated October 20, 2003. The parameters for evaluation of loss of forests include loss of animal husbandry productivity, value of timber, fuel wood, forest produce, wages from the harvest, loss of public facilities and administrative infrastructure and Environmental loss.

The Indian Forest Act, 1927 consolidates the law relating to forests, the transit of forest-produce and the duty leviable on timber and other forest-produce.

### **2.1.7 The Wild Life (Protection) Act, 1972, as amended in 1993 and Rules 1995**

The Wildlife (Protection) Act, 1972 provides for protection to listed endangered species of flora and fauna and establishes a network of ecologically important protected areas. The objective is also to control poaching, smuggling and illegal trade in wildlife and its derivatives. The Act empowers the Central and State Governments to declare any area to be a Wildlife Sanctuary, National Park or a closed area. There is a blanket ban on carrying out any industrial process or activity inside any of these protected areas. In case forestland within the protected areas network is to be diverted for any non-wildlife use, a no objection has to be obtained from the Indian Board of Wildlife and the State Legislature, before the final consideration by MoEF. The Act was amended in January 2003 and punishment and penalty for offences under the Act have been made more stringent. The Ministry has proposed further amendments in the law by introducing more rigid measures to strengthen the Act.

In accordance with Wildlife (Protection) Amendment Act, 2002 “no alternation of boundaries /National Park/Sanctuary shall be made by the State Govt. except on recommendation of the National Board for Wildlife (NBWL)”. The study area does not involve any notified National Park or Wild life Sanctuary or biosphere reserve located within 10 Km radius; hence this Act is not applicable.

### **2.1.8 The Environment (Protection) Act, 1986, amended in 1991 and Rules 1986**

This Act was introduced in 1986 as an umbrella legislation that provides a holistic framework for the protection and improvement to the environment. In terms of responsibilities, the Act and the associated Rules requires for obtaining environmental clearances for specific types of new / expansion projects (addressed under Environmental Impact Assessment Notification, 1994) and for submission of an environmental statement to the State Pollution Control Board annually. It empowers the Central Government to establish authorities charged with the mandate of preventing environmental pollution in all its forms and to tackle specific environmental problems that are peculiar to different parts of the country. It also empowers Central government to take measures necessary to protect and improve the quality of the environment by setting standards for emissions and discharges; regulating the location of industries; management of hazardous wastes, and protection of public health and welfare. The Act was than amended in 1991. The EIA report has been prepared in accordance with the guidelines of this act. The proposed project will fully abide to The Environment (Protection) Act.



### **2.1.9 Air (Prevention and Control of Pollution) Act, 1981, amended 1987 and Rules 1982, 1983**

The Act prohibits the construction and operation of any industrial plant without the consent of SPCBs. The Act assigns powers and functions to the CPCB and the SPCBs for prevention and control of air pollution and all other related matters. For the prevention and control of air pollution, the State Government, in consultation with the SPCB has the powers to set standards for emissions from automobiles, impose restrictions on use of certain industrial plants and prohibit emissions of air pollutants in excess of the standards laid down by the SPCB. It can also make an application to the court for restraining persons from causing air pollution. In addition, it also has the power of entry and inspection, power to obtain information and power to take samples of air emissions and conduct the appropriate follow up. The Act also allows for appropriate penalties and procedures for non-compliance.

This Act empowers Central and State Pollution Control Boards prosecuting offenders and issuing licenses for construction and operation of any facility. National ambient air quality standard for different regions e.g. industrial, residential and sensitive is notified under this Act. Air quality monitoring during construction and operation phases, particularly for obtaining consent for establishment & operation will be done under this Act.

To empower the central and state pollution boards to meet grave emergencies, the Air (Prevention and Control of Pollution) Amendment Act, 1987, was enacted. The boards were authorized to take immediate measures to tackle such emergencies and recover the expenses incurred from the offenders. The power to cancel consent for non-fulfillment of the conditions prescribed has also been emphasized in the Air Act Amendment.

The Air (Prevention and Control of Pollution) Rules formulated in 1982, defined the procedures for conducting meetings of the boards, the powers of the presiding officers, decision-making, the quorum; manner in which the records of the meeting were to be set etc. They also prescribed the manner and the purpose of seeking assistance from specialists and the fee to be paid to them.

Complementing the above Acts is the Atomic Energy Act of 1982, which was introduced to deal with radioactive waste. In 1988, the Motor Vehicles Act, was enacted to regulate vehicular traffic, besides ensuring proper packaging, labeling and transportation of the hazardous wastes. Mass emission standards were notified in 1990, which were made more stringent in 1996. In 2000 these standards were revised yet again and for the first time separate obligations for vehicle owners, manufacturers and enforcing agencies were stipulated.

### **2.1.10 Water (Prevention and Control of Pollution) Act, 1974 and Rules 1975 as amended up to 1988**

This Act makes provision for the establishment of the Central and State level Pollution Control Boards, whose responsibility includes managing of water quality and effluent standards, as well as monitoring water quality, prosecuting offenders and issuing licenses for construction and operation of any facility. Subject to the provisions of the Act, the functions and powers of CPCB as well as the SPCBs have been delineated individually and with respect to each other.

### **2.1.11 Water (Prevention and Control of Pollution) Cess Act, 1977**

This Act provides for a levy and collection of a cess on water consumed by industries and local authorities. It aims at augmenting the resources of the central and state boards for prevention and control of water pollution. Following this Act, the Water (Prevention and Control of Pollution) Cess Rules were formulated in 1978 for defining standards and indications for the kind of and location of meters that every consumer of water is required to install.

### **2.1.12 Legislations on Waste Management**

Under the EPA 1986, the MoEF has issued several notifications to tackle the problem of hazardous waste management. These include:

- Hazardous Wastes (Management, Handling and Transboundary Movement) Rules 2008 including amendment Rules 2009, which brought out a guide for manufacturing, storage and import of hazardous chemicals and for management of hazardous wastes. The Rules require industries to classify wastes into categories and manage them as per the prescribed guidelines and obtain prior authorization for handling, treatment, storage and disposal of Hazardous Wastes. They also provide guidelines for the import and export of hazardous waste in the country.
- Para 25 of the Hazardous Wastes (Management, Handling and Transboundary Movement) Rules 2008 mentions about Liability of Occupier, Transporter, Operator of any waste facility and Importer. It suggests that the occupier and the operator of the facility shall be liable to pay financial penalties as levied for any violation of the provision under these rules by the SPCB with the prior approval of the SPCB.
- Biomedical Waste (Management and Handling) Rules, 1998 and amended in 2003, were formulated along parallel lines, for proper disposal, segregation, transport etc. of infectious wastes.
- Municipal Wastes (Management and Handling) Rules, 2000, whose aim was to enable municipalities to dispose municipal solid waste in a scientific manner.

### 2.1.13 The Land Acquisition Act, 1894

The Land Acquisition Act of 1894 is summarized below:

- Land identified for the purpose of a project is placed under Section 4 of the LAA. This constitutes notification. Objections must be made within 50 days to the Collector (highest administrative officer) of the concerned District. The CBA requires 30 days for objections;
- The land is then placed under Section 6 of the LAA (or Section 7 of the CBA). This is a declaration that the Government intends to acquire the land. The Collector is directed to take steps for the acquisition, and the land is placed under Section 9. Interested parties are then invited to state their interest in the land and the price. Under Section 11, the Collector shall make an award within two years of the date of publication of the declarations. Otherwise, the acquisition proceedings shall lapse;
- In case of disagreement on the price awarded, within 6 weeks of the award the parties (under Section 18) can request the Collector to refer the matter to the Courts to make a final ruling on the amount of compensation;
- Once the land has been placed under Section 4, no further sales or transfers are allowed. However, since the time lag between Sections 4 and the others following it is about three years, land transfers are not uncommon;
- Compensation for land and improvements (such as houses, wells, trees, etc.) is paid in cash by the project authorities to the State government, which in turn compensates landowners. In the case of acquisition for coal projects, the coal companies make direct payments to landowners;
- The price to be paid for the acquisition of agricultural land is based on sale prices recorded in the District registrar's office averaged over the three years preceding notification under Section 4. The compensation is paid after the area is acquired, actual payment by the State taking about two or three years. An additional 30 percent is added to the award as well as an escalation of 12 percent per year from the date of notification to the final placement under Section 9. For delayed payments, after placement under Section 9, an additional 9 percent per annum is paid for the first year and 15 percent for subsequent years.

#### **2.1.14 Panchayats Extension to Schedule Areas Act, (PESA) 1996**

The PESA Act is one of the most potent legislative measures of the recent times, which recognizes the tribal people's mode of living, aspirations, their culture and traditions. The PESA Act provides special provision for function of Panchayats so as to protect and promote the tribal interests in accordance with the spirit of the scheduled areas as enshrined in the constitution. In addition this State has also formulated The Himachal Pradesh Panchayati Raj (Extension to the Scheduled Areas) Rules, 2011 also.

As per PESA, the Gram Sabha will be involved in approval of development plans, and programmes, land availability and rehabilitation of affected persons, and has given control of land, forest and water in the hands of tribal through the Gram Sabha. The Act entrusts the Gram Sabha with the following:

- Gram Sabha shall safeguard and preserve the traditions and customs of the people, their cultural identity, community resources and the customary mode of dispute resolution.
- Gram Sabha shall be responsible for approval of plans, programmes and projects for social and economic development.
- Responsible for the identification or selection of persons as beneficiaries under the development programmes.
- Consultation with Panchayat prior to land acquisition and Rehabilitation & Resettlement activities in the scheduled areas.
- Endows ownership of minor forest produce to Panchayats.
- Endows power to prevent alienation of land in Scheduled areas and to take appropriate action to restore any unlawfully alienated land of STs.

#### **2.1.15 Rules for the regulation of Rights in the Demarcated and Un-demarcated Forest of the Sutlej Valley under the Schedule of Bashahr Lease, 1920**

The rule prohibits certain activities in all the forests of the Bashahr State (now Kinnaur District), except with the permission of the Forest Officer or in the exercise of recorded rights. The prohibited activities include selling timber, shooting without license, removing dead leaves, setting trees or grass tracts to fire, breaking up of land for cultivation etc. However in case of demarcated forests, the proprietors of cultivated land and their agricultural tenants are allowed to exercise activities, like grazing of cattle; collection of dry and fallen wood for firewood;

collection of fruits, edible seeds and other useful flowers, medicinal roots; collection of slates for sale or personal use from existing quarries; maintenance and repair of existing mills and water channels in demarcated forests; lopping of silver fir, kail, spruce and neoza (Chilgoza) for charcoal and for manufacturing of agricultural implements; cutting and collection for personal use and sale to agriculturalists within the state and extraction of resin from trees other deodar, blue pine, neoza trees etc, only when they have been specified in the record of rights. These activities may also be carried out without permission, provided the recognised customs and usages of the villages concerned are respected. As per the rules, the land in un-demarcated forest for new cultivation will be granted by the Forest Officer and the application for the same will have to be submitted through the Manager of the Bashahr State (now Kinnaur District) in accordance with such orders as may be prescribed by the Superintendent, Hill States, Shimla.

#### **2.1.16 Himachal Pradesh Panchayati Raj Act, 1994**

The aim of this act is to consolidate, amend and replace the law relating to Panchayats with a view to ensure effective involvement of the Panchayati Raj Institutions in the local administration and the developmental activities.

The act has specific provisions for the formulation, composition, specific functions and powers, various sub committees, election procedures, judicial functions, finance, taxation and accounts of the local bodies such as Gram Panchayat, Gram Sabha, Panchayat Samiti and Zila Parishad. The act also specifies dispute solving mechanisms within these institutions.

#### **2.1.17 Public Liability Insurance Act (PLIA), 1991, amended in 1992 and associated Rules**

The Act covers accidents involving hazardous substances and insurance coverage for these. Where death or injury results from an accident, this Act makes the owner liable to provide relief as is specified in the Schedule of the Act. The PLIA was amended in 1992, and the Central Government was authorized to establish the Environmental Relief Fund, for making relief payments.

#### **2.1.18 Factories Act, 1948 and its Amendment in 1987**

The Factories Act, 1948 was a post-independence statute that explicitly showed concern for the environment. The primary aim of the 1948 Act has been to ensure the welfare of workers not only in their working conditions in the factories but also their employment benefits. While ensuring the safety and health of the workers, the Act contributes to environmental protection. The Act contains a comprehensive list of 29 categories of industries involving hazardous

processes, which are defined as a process or activity where unless special care is taken, raw materials used therein or the intermediate or the finished products, by-products, wastes or effluents would:

- Cause material impairment to health of the persons engaged
- Result in the pollution of the general environment

#### **2.1.19 Child Labour (Prohibition and Regulation) Act, 2000**

The Act addresses the issue of Child Labour which is social concern. This Act prohibits the engagement of children below the age of 14 years in certain employments and regulates the conditions of work of children in certain other employments. The Act prohibits employment of child in about 13 occupations and about 51 processes. The Act provides no child shall be permitted or required to work between 7p.m. and 8 a.m., for more than 3hrs before he has an interval for rest at least one hour. Every child employed in an establishment shall be allowed in each week a holiday for one whole day. The Act also levies the penalty on those who employs or permits any child to work in the occupations and processes in which employment of children is prohibited.

#### **2.1.20 The Indian Fisheries Act, 1897**

The Indian Fisheries Act, 1897 contains seven sections. Section 5 of the Act prohibits destruction of fish by poisoning waters.

#### **2.1.21 Biological Diversity Act 2002 and Rules 2004**

The Ministry of Environment and Forests has enacted the Biological Diversity Act, 2002 under the United Nations Convention on Biological Diversity signed at Rio de Janeiro on the 5th day of June, 1992 of which India is also a party. This Act is to “provide for the conservation of biological diversity, sustainable use of its components, and fair and equitable sharing of the benefits arising out of the use of biological resources, knowledge and for matters connected therewith or incidental thereto.” As per the provision of act certain areas, which are rich in biodiversity and encompasses unique and representative ecosystems are identified and designated as biosphere reserve to facilitate its conservation. All restrictions applicable to protected areas like National Park & Sanctuaries are also applicable to these reserves.

#### **2.1.22 Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996**

This law was enacted in 1996 with an objective to provide a comprehensive Central Legislation for workers and laborers. It provides for regulation of employment and conditions of service of the building and other construction workers with respect to their safety, health and welfare measures in every establishment which employs 10 or more than 10 workers. The exception made is only in respect of residential houses for own purpose constructed with a cost not exceeding Rs. 1.0 Million and such other activities to which the provisions of Factories Act, 1948 and Mines Act, 1952 apply. The Act also has provision for immediate assistance in case of accidents, old age pension, loans for construction of house, premium for group insurance, financial assistance for education, to meet medical expenses, maternity benefits etc. The Act also requires constitution of Advisory Committee at the Central and the State levels and safety committees in every establishment employing 500 or more workers.

### **2.1.23 The Building and other Construction Workers' Welfare Cess Act, 1996**

The aim of this Act is to provide for the levy and collection of a cess on the cost of construction incurred by employers with a view to augmenting the resources of the Building and Other Construction Workers' Welfare Boards constituted under the Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996. The Act provides for regulating the employment and conditions of service of building and other construction workers and also provides for their safety, health and welfare measures and other matters connected therewith or incidental thereto.

### **2.1.24 Employer's Liability Act, 1938 (as Amended)**

The Act provides scenarios in which the employer may or may not have to take liability for certain accidents and damages faced by employees. It applies to a wide range of industries. Compensation benefits for injured party in case of liability taken up by employers have also been mentioned in the Act.

### **2.1.25 The Contract Labour (Regulation & Abolition) Act, 1970 and Rules**

The Government of India has been deeply concerned about the exploitation of workers under the contract labour system. With a view to removing the difficulties of contract labour and bearing in mind the recommendations of various commissions and committees and the decisions of the Supreme Court, the Contract Labour (Regulation and Abolition) Act was enacted in 1970. This Act seeks to regulate the employment of contract labour in certain establishments and to provide for its abolition under certain circumstances.



### **2.1.26 Himachal Pradesh Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Rules, 2008**

Himachal Pradesh Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Rules, 2008 apply to the building or other construction work relating to any establishment in relation to which appropriate Government in the State Government of Himachal Pradesh under the Act. These Rules suggests the responsibilities and duties of employers, architects, project engineers and designers, building workers, undertaking any of the operation or works. The Rules intend to ensure safety of workers, promote following of the accepted principles of standard safe operating practices connected with building and other related to or incidental to building or other construction, sanitation and hygiene of workers, timely payment of wages, testing, examination and inspection of machinery and equipment etc.

### **2.1.27 Payment of Wages Act, 1936 (Amended)**

The Payment of Wages Act, 1936 is a central legislation which applies to the persons employed in the factories and to persons employed in industrial or other establishments specified in sub-clauses (a) to (g) of clause (ii) of section 2 of this Act. This Act does not apply on workers whose wages payable in respect of a wage period average Rs. 1,600/- a month or more. This Act has been enacted with the intention of ensuring timely payment of wages to the workers and for payment of wages without unauthorized deductions. The salary in factories/establishments employing less than 1000 workers is required to be paid by 7<sup>th</sup> of every month and in other cases by 10<sup>th</sup> day of every month. A worker, who either has not been paid wages in time or an unauthorized deductions have been made from his/her wages, can file a Claim either directly or through a Trade Union or through an Inspector under this Act, before with the Authority appointed under the Payment of Wages Act. The power for hearing and deciding Claims under this Act has been vested at present with the Presiding Officer of a Labour Court.

### **2.1.28 Minimum Wages Act, 1948 (Amended)**

The Minimum Wages Act, 1948 provides for fixing minimum rates of wages in scheduled industries. The Act purports to achieve to prevent exploitation of labour and that purpose the authorities under Act have been empowered to take steps to prescribe minimum rates of wages in certain employments where labour is ignorant or less organized.

### **2.1.29 Workmen Compensation Act, 1923 as amended by Amendment Act No.6 of 1976**

Workmen's Compensation Act 1923 is central legislation which provides for payment of compensation for injuries suffered by a workman in the course of and arising out of his employment according to the nature of injuries suffered and disability incurred, where death results from the injury, the amount of compensation is payable to the dependants of the workmen. All the Deputy Labour Commissioner has been appointed as Commissioner under Workmen's Compensation Act. Where an employer is in default in paying the compensation due under this Act, within one month from the date it fell due, the Commissioner shall direct that the employer in addition to the amount of arrears, pay simple interest there on at the rate of 12% per annum or on such higher rates.

### **2.1.30 Maternity Benefit Act, 1961 (Amended)**

This Act provides for maternity benefits and is applicable to factories covered under the Factories Act, 1948. It also applies to Shops and Establishments in which ten or more workers are employed or were employed on any day of the preceding twelve months. The provisions of this Act do not apply to any factory or establishment to which the provisions of Employee state Insurance Act, 1948 apply. The Rules have been framed under this Act, according to which Inspector of Factories is ex-officio Chief Inspector under this Act in respect of factories registered under the Factories Act, 1948.

### **2.1.31 The Industrial Employment (Standing Orders) Act, 1946 (Amended)**

The act requires employers in industrial establishments to define with sufficient precision the conditions of employment under them and to make the said conditions known to workmen employed by them. It applies to every industrial establishment wherein one hundred or more workmen are employed, or were employed on any day of the preceding twelve months

### **2.1.32 The Industrial Disputes Act, 1947 (Amended)**

The Industrial Disputes Act came into existence in April 1947. It was enacted to make provisions for investigation and settlement of industrial disputes and for providing certain safeguards to the workers. The Act contains 40 sections divided into 7 chapters. The act contains description of various authorities such as Conciliation Officers, Labour Courts and Tribunals. The act also lays down the procedure, power and duties of the authorities constituted there under.

### **2.1.33 Payment of Bonus Act, 1965 and Amendment Act No.43 of 1977 and No.48 of 1978 and amendments**

The Payment of Bonus Act imposes statutory liability upon the employers of every establishment covered under the Act to pay bonus to their employees. It further provides for payment of minimum and maximum bonus and linking the payment of bonus with the production and productivity. The Act applies to every factory where 10 or more workers are working and every other establishment in which 20 or more persons are employed, on any day during an accounting year. The Payment of Bonus Act, 1965, gives to the employees a statutory right to a share in the profits of his employer. The Act enables the employees to get a minimum bonus equivalent to one month's salary or wages (8.33% of annual earnings) whether the employer makes any profit or not. But the Act also puts a ceiling on the bonus and the maximum bonus payable under the Act is equivalent to about 2.5 months' salary or wage (20% of annual earnings).

### **2.1.34 The Personal Injuries (Compensation Insurance) Act, 1963 (as amended)**

This Act provides for imposing liability on employers to pay compensation to workmen sustaining personal injuries and to provide for the insurance of employers against such liability. The act defines the cases under which the employer is liable to pay compensation to the affected employee. It also guides on the compensation policy to be followed in case of such events.

The Contractor will take into account all the above said financial liabilities in his quoted rates and nothing extra, whatsoever, will be payable to his on this account.

### **2.1.35 Employees Provident Fund Act**

The Act is a piece of social security enactment designed to provide for a scheme to make provisions for the future of industrial workers and their dependents in case of their retirement and in the event of their premature death. The benefits are applicable to a wide range of employees working in factories, mines, plantations, construction industries, educational institutions and other classes of establishments in a short period.

The Contractor will provide and produce necessary proof and declaration to NRPPL regarding compliance of all the provisions, making of timely deposits etc. otherwise a sum of 5% of the gross bill amount will be deducted against EPF deposit from the bill.

### **2.1.36 Ambient Air Quality Standards**

Revised National Ambient Air Quality Standards (NAAQS) for major pollutants were notified by the CPCB in November 2009. The NAAQS prescribe specific standards for industrial, residential, rural and other ecologically sensitive areas. Table 2-1 presents the Revised National Ambient Air Quality Standards. Since Tidong-1 HEP is located in rural and residential area therefore levels prescribed for “Industrial, Residential, Rural and Other area” is applicable to this project.

**Table 2-1: Revised National Ambient Air Quality Standards**

S. No.	Pollutant	Time Weighted Average	Concentration in Ambient Air		
			Industrial, Residential, Rural and Other area	Ecologically Sensitive Area (notified by Central Govt.)	Methods of Measurements
1	Sulphur Dioxide(SO <sub>2</sub> ) µg/m <sup>3</sup>	Annual *	50	20	Improved West Gaeke Ultraviolet fluorescence
		24 hours**	80	80	
2	Nitrogen Dioxide (NO <sub>2</sub> )µg/m <sup>3</sup>	Annual *	40	30	Modified Jacob & Hochheiser (Na-Arsenite) Chemiluminescence
		24 hours**	80	80	
3	Particulate Matter (size less than 10 µg)or PM 10 µg/m <sup>3</sup>	Annual *	60	60	Gravimetric TOEM Beta attenuation
		24 hours**	100	100	
4	Particulate Matter (size less than 2.5 µg)or PM 2.5 µg/m <sup>3</sup>	Annual *	40	40	Gravimetric TOEM Beta attenuation
		24 hours**	40	60	
5	Ozone(O <sub>3</sub> ) µg/m <sup>3</sup>	8 hours**	100	100	UV photometric Chemiluminescence Chemical method
		1 hours**	180	180	
6	Lead (Pb) µg/m <sup>3</sup>	Annual *	0.50	0.50	AAS/ICP method after sampling on EPM 2000 or equivalent filter paper ED-XRF using Teflon filter
		24 hours**	1.00	1.00	
7	Carbon Monoxide (CO)mg/m <sup>3</sup>	8 hours**	02	02	Non Dispersive Infrared Spectroscopy
		1 hours**	04	04	
8	Ammonia (NH <sub>3</sub> ) µg/m <sup>3</sup>	Annual *	100	100	Chemiluminescence Indophenol blue method
		24 hours**	400	400	
9	Benzene(c <sub>4</sub> H <sub>4</sub> ) µg/m <sup>3</sup>	Annual*	05	05	Gas chromatography based continuous

					analyzer Adsorption followed by GC analysis
10	Benzo pyrene (BaP)- particulate phase only ng/m3	Annual*	01	01	Solvent extraction followed by HPLC/GC analysis
11	Arsenic(As) ng/m3	Annual*	06	06	AAS/ICP method after sampling on EPM 2000 or equivalent filter paper
12	Nickel(Ni) ng/m3	Annual*	20	20	AAS/ICP method after sampling on EPM 2000 or equivalent filter paper

*\*Annual arithmetic mean of minimum 104 measurements in a year at a particular site taken twice a week 24 hourly at uniform intervals  
 \*\*24 hourly or 08 hourly monitored values as applicable shall be compiled with 98% of the time in a year. 2% of the time they may exceed the limits but not on two consecutive days of monitoring.  
 Source: Ministry of Environment and Forests, GOI 2009*

### 2.1.37 Ambient Noise Standards

Ambient noise level standards have been notified by the MoEF under Noise (Regulation & Control) Rules 2000 and also in the Schedule III of the Environmental (Protection) Rules 1986. Noise levels are measured in dB(A) Leq which denotes the time weighted average of the level of sound in decibels on scale A which is relatable to human hearing. These are presented in Table 2-2.

**Table 2-2: Ambient Noise Level Standards**

Area Code	Category of Area / Zone	Limits in dB(A) Leq	
		Day Time*	Night Time*
A	Industrial area	75	70
B	Commercial area	65	55
C	Residential area	55	45
D	Silence Zone**	50	40

Source: Central Pollution Control Board

\*Day time means from 6.00 a.m. to 10.00 p.m. Night time means from 10.00 p.m. to 6.00 a.m.

\*\*Silence zone is an area comprising not less than 100 meters around hospitals, educational institutions, courts, religious places or any other area which is declared as such by the competent authority

Mixed categories of areas may be declared as one of the four above mentioned categories by the competent authority.

Noise standards in the work environment are specified by Occupational Safety and Health Administration (OSHA-USA) which in turn are being enforced by Government of India through model rules framed under the Factories Act. These are given in Table 2-3 as follows.

**Table 2-3: Occupational Safety and Health Administration (OSHA) Noise Standards**

Total Time of Exposure per Day in Hours (continuous or short term exposure)	Sound pressure level dB(A)
8	90
6	92
4	95
3	97
2	100
3/2	102
1	105
¾	107

½	110
¼	115
Never	>115

Note: No exposure in excess of 115 dB(A) is to be permitted

### 2.1.38 Water Quality Standards

To ascertain and categorize the existing water quality, the results of the analysis of water quality will be compared with the water quality standards as prescribed by Central Pollution Control Board (CPCB) given in Table 2-4.

**Table 2-4: Water Quality Criteria**

Designated-Best-Use	Class of water	Criteria
Drinking Water Source without conventional treatment but after disinfection	A	<ul style="list-style-type: none"> <li>– Total Coliforms Organism MPN/100ml shall be 50 or less</li> <li>– pH between 6.5 and 8.5</li> <li>– Dissolved Oxygen 6mg/l or more</li> <li>– Biochemical Oxygen Demand 5 days 20°C 2mg/l or less</li> </ul>
Outdoor bathing (Organized)	B	<ul style="list-style-type: none"> <li>– Total Coliforms Organism MPN/100ml shall be 500 or less</li> <li>– pH between 6.5 and 8.5</li> <li>– Dissolved Oxygen 5mg/l or more</li> <li>– Biochemical Oxygen Demand 5 days 20°C 3mg/l or less</li> </ul>
Drinking water source after conventional treatment and disinfection	C	<ul style="list-style-type: none"> <li>– Total Coliforms Organism MPN/100ml shall be 5000 or less</li> <li>– pH between 6 to 9</li> <li>– Dissolved Oxygen 4mg/l or more</li> <li>– Biochemical Oxygen Demand 5 days 20°C 3mg/l or less</li> </ul>
Propagation of Wild life and Fisheries	D	<ul style="list-style-type: none"> <li>– pH between 6.5 to 8.5</li> <li>– Dissolved Oxygen 4mg/l or more</li> <li>– Free Ammonia (as N) 1.2 mg/l or less</li> </ul>
Irrigation, Industrial Cooling, Controlled Waste disposal	E	<ul style="list-style-type: none"> <li>– pH between 6.0 to 8.5</li> <li>– Electrical Conductivity at 25°C micro mhos/cm Max.2250</li> <li>– Sodium absorption Ratio Max. 26</li> <li>– Boron Max. 2mg/l</li> </ul>
	Below-E	– Not Meeting A, B, C, D & E Criteria



## 2.2 Environmental Permits Required for the Project

As per the policies and legal framework, following approvals/clearances are required for a hydroelectric project:

Clearance Required	Status
Implementation Agreement	Executed on 28-Jul-06 between Government of Himachal Pradesh and Nuzividu Seeds Limited
Techno-economic Clearance of Detailed Project Report from HP State Electricity Board	HPSEB (Sectt) 401-TEC/Tidong-I/50-42034-47 dated 23-Jul-07
Environmental Public Hearing by Himachal Pradesh State Pollution Control Board (HPSPCB)	Conducted on 21-Jul-06 in Villages Lambar and Village Rispa, Tehsil Moorang
No Objection Certificate/Consent to Establish by the Himachal Pradesh State Pollution Control Board	Received vide letter no. HPSPCB/Tidong HEP-Kinnaur/ 10140-47 dated 8-Aug-2008.
Environmental Clearance by the MoEF, as per EIA notification, 2006 under Environment (Protection) Act, 1986;	Received vide letter no. J-12011/35/2007-IA-I dated 7-Sep-2007.
Forest Clearance for diversion of 39.0546 ha. of forest land by the MoEF.	Received vide letter dated 18-Jun-2008 diverting 39.0546 ha. of forest land and 1261 trees standing on that land in favour of project.
Private Land acquisition - 3.2011 ha under Land Acquisition Act, 1894	Awarded vide letter number SDP -III - 71(Peshi)2009-3631 dated 31-Jul-09
Clearance under Wildlife Protection Act, in case, any part of National Park / Wildlife Sanctuary is involved in the project influence zone, approval of Hon'ble Supreme Court is to be obtained after recommendation of Standing Committee of National Board for Wild Life (NBWL).	Not applicable, as no protected area is falling under the influence zone of the project.
No Objection from Irrigation and Public Health Department (IPH), Government of Himachal Pradesh.	Received vide letter dated 8-Feb-2006
No Objection from Department of Fisheries, Government of Himachal Pradesh.	Received vide letter no. FSH-F(2)39/2010-ARC-5996 dated 10-Jun-2010 after receiving an amount of Rs. 11.1 Millions towards their proposal on "Fisheries Development Plan" sent to NSL vide their letter dated 11-Apr-2007.
No Objection from Public Works	Received vide letter number PW.KNR –

Department, Government of Himachal Pradesh	WA – N.O.C./2005 -6406 dated 06-Dec-05
Labour License	Received vide letter number LO(KIN)PE/REC/2008 7 Dated 04-Dec-08
Registration under Building and Other Construction workers Act, 1996	Applied for registration in March-2011

## 2.3 Relevant Policies of Government of India

### 2.3.1 Policy on Hydropower Development

Government of India formulated Hydropower Development Policy in August 1998. The objective of the Policy is to prevent a decline in hydro share and to undertake measures for maximising vast hydroelectric potential in the country especially in the North and North-eastern Regions. Hydro stations presently account for only 25% of the total installed capacity as against the ideal hydro - thermal mix of 40:60. The total hydro potential assessed by CEA at 60% load factor is 84,044 MW. With the completion of the hydel projects under construction, the hydro potential utilised would increase to 22%. The objectives of the policy include the following:

- Ensuring targeted capacity addition during 9th Plan (and the subsequent plans – the 11th Plan aims capacity addition of 18,781 MW in the hydropower sector);
- Exploitation of vast hydroelectric potential at a faster pace;
- Promoting small and mini hydel projects;
- Strengthening the role of PSUs/SEBs for taking up new hydro projects;
- Increasing private investment in development of hydropower; and
- Supporting public sector by greater private investment through IPPs and joint ventures. Private sector participation is considered vital for large scale development of hydropower.

### 2.3.2 National Environmental Policy of India, 2006

Government of India released the National Environment Policy in 2006. The present national policies for environmental management are contained in the National Forest Policy, 1988, the National Conservation Strategy and Policy Statement on Environment and Development, 1992; and the Policy Statement on Abatement of Pollution, 1992. Some sector policies such as the National Agriculture Policy, 2000; National Population Policy, 2000; and National Water Policy, 2002; have also contributed towards environmental management. All of these policies have

recognized the need for sustainable development in their specific contexts and formulated necessary strategies to give effect to such recognition.

The dominant theme of this policy is that while conservation of environmental resources is necessary to secure livelihoods and well-being of all, the most secure basis for conservation is to ensure that people dependent on particular resources obtain better livelihoods from the fact of conservation, than from degradation of the resource.

### **2.3.3 Water Policy of India**

National Water Policy of India with respect to hydropower generation states that “water resource development projects should, to the extent possible, be planned and developed as multipurpose projects. Provision of drinking water should be a primary consideration. The projects should provide for irrigation, flood mitigation, hydroelectric power generation, navigation, pisciculture and recreation wherever possible”.

India has water treaties with neighbouring countries like Pakistan, Nepal and Bangladesh. As an example the present project is proposed on Tidong River, which is a tributary of River Sutlej. The Sutlej is a tributary of River Indus, which flows into Pakistan along with some other rivers from India. India signed the Indus Water Treaty in 1960 with Pakistan under the aegis of International Bank for Reconstruction and Development (IBRD, part of the World Bank group). The Project will not alter the water flow downstream the Indus River, therefore, does not attract the provisions of Indus Water Treaty with Pakistan. All projects undertaken by NSLRPL shall consider the National Water Policy if it attracts any of its provisions.

### **2.3.4 Indus Water Treaty**

The Indus Waters Treaty is a water-sharing treaty between the Republic of India and Islamic Republic Of Pakistan, brokered by the World Bank (then the International Bank for Reconstruction and Development). The treaty was a result of Pakistani fear, that since, the sources of the Indus basin were in India, it could potentially create droughts and famines in Pakistan, especially at times of war.

The Indus System of Rivers comprises three Western Rivers the Indus, the Jhelum and Chenab and three Eastern Rivers - the Sutlej, the Beas and the Ravi; and with minor exceptions, the treaty gives India exclusive use of all of the waters of the Eastern Rivers and their tributaries before the point where the rivers enter Pakistan. Similarly, Pakistan has exclusive use of the Western Rivers. Pakistan also received one-time financial compensation for the loss of water from the Eastern rivers.

The countries agree to exchange data and co-operate in matters related to the treaty. For this purpose, treaty creates the Permanent Indus Commission, with a commissioner appointed by each country.

### **2.3.5 Wildlife Conservation Strategy 2002**

Conservation of wildlife, involves the protection of entire ecosystems. No diversion of forest land for non-forest purposes from critical and ecologically fragile wildlife habitat shall be allowed. Lands falling within 10 km of the boundaries of National Parks and Sanctuaries are notified as eco-fragile zones under the Environment (Protection) Act.

### **2.3.6 National Forest policy 1988**

1988 National Forest Policy emphasizes the role of forests in the national economy and in ecology. The basic objectives of National Forest Policy are given below:

- Maintenance of environmental stability through preservation and, where necessary, restoration of the ecological balance that has been adversely disturbed by serious depletion of the forests of the country;
- Conserving the natural heritage of the country by preserving the remaining natural forests with the vast variety of flora and fauna, which represent the remarkable biological diversity and genetic resources of the country;
- Checking soil erosion and denudation in the catchment areas of rivers, lakes, and reservoirs in the interest of soil and water conservation, for mitigating floods and droughts and for the retardation of siltation of reservoirs.
- Checking the extension of sand dunes in the desert areas of Rajasthan and along the coastal tracts;
- Increasing the sustainability of the forest/tree cover in the country through massive afforestation and social forestry programmes, especially on all denuded degraded and unproductive lands;
- Meeting the requirements of fuel wood, fodder, minor forest produce and small timber of the rural and tribal populations;
- Increasing the productivity of forests to meet essential national needs;
- Encouraging efficient utilization of forest produce and maximising substitution of wood; and

- Creating a massive people's movement with the involvement of women for achieving these objectives and to minimise pressure on existing forests.

### **2.3.7 National Resettlement & Rehabilitation Policy (NRRP), 2007**

The National Resettlement and Rehabilitation Policy (NRRP) 2007 aim at striking a balance between the need for land for developmental activities and protecting the interests of the land owners, and others, such as the tenants, the landless, the agricultural and non-agricultural laborers, artisans, and others whose livelihood depends on the land involved. This policy has been referred and relied upon while preparing the “Resettlement & Rehabilitation Entitlement Framework” for the project. However it has not been considered applicable to the project because project does not envisage involuntary displacement of 200 or more families en masse as applied to tribal or hilly areas.

The NRRP, 2007 also requires to carry out a Social Impact Assessment Study and an SIA Clearance for all new projects or expansion of existing projects involving involuntary displacement of 400 or more families en masse in plain areas, or 200 or more families en masse in tribal or hilly areas. Several section of the policy deals with the public hearing and information sharing with the affected stakeholders.

The benefits under the Policy are available to all affected persons and families whose land, property or livelihood is adversely affected by land acquisition or by involuntary displacement of a permanent nature due to any other reason, such as natural calamities, etc.

The objectives of NRRP, 2007 are:

- to minimise displacement and to promote, as far as possible, non-displacing or least-displacing alternatives;
- to ensure adequate rehabilitation package and expeditious' implementation of the rehabilitation process with the active participation of the affected families;
- to ensure that special care is. taken for protecting the rights of the weaker sections of society, especially members of the Scheduled Castes and Scheduled Tribes, and to create obligations on the State for their treatment with concern and sensitivity;
- to provide a better standard of living, making concerted efforts for providing sustainable income to the affected families;
- to integrate rehabilitation concerns into the development planning and implementation process; and

- vi. where displacement is on account of land acquisition, to facilitate harmonious relationship between the requiring body and affected families through mutual cooperation.

A strong Grievance Redressal Mechanism has been prescribed, which includes standing R&R Committees at the district level, R&R Committees at the project level, and an Ombudsman duly empowered in this regard.

### **Specific provisions for Indigenous People in the NRRP, 2007**

Kinnaur is also known as the tribal district of Himachal Pradesh. Out of the limited sample social survey conducted in the project affected villages, hundred percent respondents confirmed to be belonging to SC/ ST Class. However, no displacement of any kind has been involved in the current project.

Special provisions have been made in the NRRP, 2007 for the members of Schedule Tribes and Schedule Castes (STs and SCs) include preference in land-for-land for STs followed by SCs. The policy also suggests that a Tribal Development Plan must be put in place, where involuntary displacement of two hundred or more Scheduled Tribes families is involved. The Plan also contains a programme for development of alternate fuel, fodder and non-timber Forest produce (NTFP) resources on non-forest lands within a period of five years sufficient to meet requirements of tribal communities who are denied access to forests. The concerned Gram Sabha or the Panchayats at the appropriate level in the Scheduled Areas under Schedule V of the Constitution or as the case may be, Councils in the Schedule VI Areas shall be consulted in all Cases of land acquisition in such areas including land acquisition in cases of urgency, before issue of a notification under the Land Acquisition Act, 1894 or any other Act of the Union or a State for the time being in force under which land acquisition is undertaken, and the consultation shall be in accordance with the provisions of the Provisions of the Panchayats (Extension to the Scheduled Areas) Act, 1996 and other relevant laws.

## **2.4 International Finance Corporation's (IFC) Policies and Performance Standards**

### **2.4.1 Policies and Procedures**

International Finance Corporation (IFC) applies the Performance Standards to manage social and environmental risks and impacts and to enhance development opportunities in its private sector financing in its member countries eligible for financing. The Performance Standards may also be applied by other financial institutions choosing to support them in the proposed project.

In addition, IFC applies World Bank Group environmental, health and safety guidelines to all projects. In sectors where no appropriate IFC policies or guidelines exist, IFC applies relevant internationally recognized standards. Furthermore, the project sponsor must ensure compliance with host country requirements.

The Policy on Social and Environmental Sustainability defines IFC's responsibility for supporting project performance in partnership with clients. As part of review of a project's expected social and environmental impacts, IFC uses a system of social and environmental categorization. This categorization is used to reflect the size of impacts understood as a result of the client's social and environmental assessment and to specify IFC's institutional requirements. The categories used by the IFC are:

**Category A** - Projects expected to have significant adverse social and/or environmental impacts that are diverse, irreversible or unprecedented.

**Category B** - Projects expected to have limited adverse social and/or environmental impacts that can be readily addressed through mitigation measures.

**Category C** - Projects expected to have minimal or no adverse social and/or environmental impacts, including certain financial intermediary projects (FI) with minimal or no adverse risks.

**Category FI** – All FI projects excluding those that are Category C projects.

IFC defines the projects area of influence as the primary project site(s) and related facilities that the client (including its contractors) develops or controls; associated facilities that are not funded as part of the project (funding may be provided separately by a client or a third party including the government), and whose viability and existence depend exclusively on the project and whose goods or services are essential for the successful operation of the project; areas potentially impacted by cumulative impacts from further planned development of the project; and areas potentially affected by impacts from unplanned but predictable developments caused by the project that may occur later or at a different location. The area of influence does not include potential impacts that would occur without the project or independently of the project.

#### **2.4.2 IFC's Performance Standards on Social and Environmental Sustainability**

International Finance Corporation (IFC) applies the Performance Standards to manage social and environmental risks and impacts and to enhance development opportunities in its private sector financing in its member countries eligible for financing. Together, the eight Performance Standards establish standards that the client is required to meet throughout the life by IFC or other relevant financial institution.



- **PS 1 Social and Environmental Assessment and Management System-** It establishes the importance of integrated assessment to identify the social and environmental impacts, risks, and opportunities in the project's area of influence. PS 1 requires Social and Environmental Assessment and Management Systems for managing social and environmental performance throughout the life cycle of this Project and runs through all subsequent PSs. The main elements of PS.- 1 includes following elements: (i) Social and Environmental Assessment; (ii) Management program; (iii) organizational capacity; (iv) training; (v) community engagement; (vi) monitoring; and (vii) reporting.
- **PS 2 Labor and working conditions-** requires that worker-management relationship is established and maintained, compliance with national labor and employment laws and safe and healthy working conditions are ensured for the workers.
- **PS 3 Pollution prevention and Abatement-** outlines approach to pollution prevention and abatement in line with Internationally disseminated technologies and practices with objectives to a) avoid or minimize adverse impacts on human health and the environment by avoiding or minimizing pollution from activities; and b) promote the reduction of emissions that contribute to climate change. It requires a project to avoid, minimize, or reduce adverse impacts on human health and the environment by avoiding or minimizing pollution from project activities.
- **PS 4 Community health, safety and security-** concentrates on the responsibility that must be undertaken by the client to avoid or minimize the risks and impacts to the community's health, safety and security that may arise from project activities.
- **PS 5 Land Acquisition and Involuntary Resettlement-** This standard requires that project does not result in involuntary resettlement or at least if unavoidable it is minimized by exploring alternative project designs. Also the project will ensure that social and economic impacts from land acquisition or restrictions on affected persons' use of land are mitigated.
- **PS 6 Biodiversity Conservation and Sustainable Natural Resource Management-** aims at protecting and conserving biodiversity, the variety of life in all its forms, including genetic, species and ecosystem diversity and its ability to change and evolve, is fundamental to sustainable development. This PS addresses how clients can avoid or mitigate threats to biodiversity arising from their operations as well as incorporate sustainable management of renewable natural resources.
- **PS 7 Indigenous Peoples-** acknowledges the possibility of vulnerability of indigenous people owing to their culture, beliefs, institutions and living standards and that it may further get compromised by one or other project activity throughout the life cycle of

the project. The PS underlines the requirement of minimizing adverse impacts on indigenous people in the project area, respecting the local culture and customs, fostering good relationships and ensuring that development benefits are provided to improve their standard of living and livelihoods.

- **PS 8 Cultural Heritage-** aims to protect the irreplaceable cultural heritage and to guide clients on protecting cultural heritage in the course of their business operations.

The applicability of these Performance Standards is established during the Social and Environmental Impact Assessment process, while implementation of the actions is necessary to meet the requirements of IFC, the Performance Standards are managed through the owner's Social and Environmental Management System.

NRPPL will have to follow all the Performance Standards of IFC for this project and should also ensure that the contractors / subcontracts (subcontractors of the contracts) appointed by NSL all follow the IFC performance standards on Environmental and Social Sustainability.

### 2.4.3 IFC EHS Guidelines

The EHS Guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice (GIP), as defined in IFC's Performance Standard 3 on Pollution Prevention and Abatement. Reference to the EHS Guidelines by IFC Clients is required under Performance Standard 3. IFC uses the EHS Guidelines as a technical source of information during project appraisal activities, as described in IFC's Environmental and Social Review Procedure. The EHS Guidelines contain the performance levels and measures that are normally acceptable to IFC and are generally considered to be achievable in new facilities at reasonable costs by existing technology. For IFC-financed projects, application of the EHS Guidelines to existing facilities may involve the establishment of site-specific targets with an appropriate timetable for achieving them. The environmental assessment process may recommend alternative (higher or lower) levels or measures, which, if acceptable to IFC, become project- or site-specific requirements.

When host country regulations differ from the levels and measures presented in the EHS Guidelines, projects are expected to achieve whichever is more stringent. If NSL chooses less stringent levels or measures are appropriate in view of specific project circumstances, a full and detailed justification for any proposed alternatives is needed as part of the site-specific environmental assessment. This justification should demonstrate that the choice for any alternate performance levels is protective of human health and the environment. NRPPL should also ensure that their sub-contractors also follow the same guidelines and it should for a part of contract between them.



## 3. PROJECT DESCRIPTION

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### 3.1 Project Location

NSL Renewable Power Private Limited (NRPPL), a private limited company incorporated in India, proposes to set up 100 MW Tidong-1 Hydroelectric Project in Tehsil -Moorng, District Kinnaur, Himachal Pradesh in India. The project is being set up by NTPGL's wholly held subsidiary Company NSL Tidong Power Generation Limited (NTPGL). The Tidong-1 HEP is located on the Tidong Khad, a tributary of river Satluj in Kinnaur district of Indian state of Himachal Pradesh. It is a run-of-the-river scheme proposed to harness the hydro potential of Tidong Khad in its lower reach between Lambar and Rispa villages. The project site is situated 270-km from Shimla on National Highway 22 upto a place near Morang and thereafter, 21-km on State Road upto Diversion barrage would come at Lambar village and Powerhouse at Rispa village. The location map of the project is give as Figure 3-1 and Layout Plan is given at Figure 3-3. Access to the Project Components

The access to the following Project components is through H.P. Public Works Department Road (PWD Road) from National Highway -22; Morang to Chharang Road on the right bank of the Tidong Stream;

- Immediately after Morang, the project road starts which connects Associated infrastructure (for temporary and permanent residential and non-residential buildings, stores, sheds etc);
- Powerhouse complex and its associated works including pressure shaft, surge shaft, tail race tunnel and switchyard on the left bank are further connected with about 6-km proposed project road from residential colony after crossing the river with steel bridge;
- About 10-kms ahead of Morang on the PWD Road, another project road starting on the right bank, extends for about 2-km upto Adit-1 via intake on left bank and diversion structures on the right bank of Tidong stream.

### 3.2 Project Rationale

Installed power generation capacity in India increased from 1362 MW in 1947 to 64,729 MW in 1990. During that period, energy production jumped from 4 to 264 TWh. However, despite that appreciable growth, power demand has almost throughout outstripped the supply. At the



end of the 7th Plan, the shortfall in energy availability on an all India basis was 6.8% and the shortage with regard to peak availability was 19%.

Figure 3-1: Location map of 100 MW Tidong Hydro Electric Project







The hydropower potential of Himachal Pradesh is surplus to its own requirement. However, the surplus power is usefully made available to meet the power and energy requirements in other parts of the country. Therefore, it is necessary to look into energy and power requirements of the India while planning of hydropower development. Power demand and supply for India is given in Table 3.1 whereas energy and peak demand / met for the Northern Region during 1995-2010 is given in Table 3.2.

**Table 3-1: Power Demand and Supply (2002-10)**

Period	Peak Demand (MW)	Peak Met (MW)	Peak Deficit / surplus (MW)	Peak Deficit / surplus (%)	Energy requirement (MU)	Energy Availability (MU)	Energy Deficit / Surplus (MU)	Energy Deficit / Surplus (%)
2002-03	81,492	71,547	-9,945	-12.2	545983	497890	-48093	-8.8
2003-04	84,574	75,066	-9,508	-11.2	559264	519398	-39866	-7.1
2004-05	87,906	77,652	-10,254	-11.7	591373	548115	-43258	-7.3
2005-06	93,255	81,792	-11,463	-12.3	631554	578819	-52735	-8.4
2006-07	100,715	86,818	-13,897	-13.8	690587	624495	-66092	-9.6
2007-08	108,866	90,793	-18,073	-16.6	739343	666007	-73336	-9.9
2008-09	109,809	96,785	-13,024	-11.9	777039	691038	-86001	-11.1
2009-2010	119,166	104,009	-15,157	-12.7	830,594	746,644	-83,950	-10.1
Apr-Dec 2010	119,437	107,286	-12,151	-10.2	638,181	582,225	-55,956	-8.8
Dec 2010	117,409	105,060	-12,349	-10.5	71,363	65,529	-5,834	-8.2

**Table 3-2: Energy and Peak Load Demand (1995-2010)**

PERIOD	ENERGY (GWH)	PEAK LOAD (MW)
1995-1996	119,887	22,466
1996-1997	129,587	24,234
1997-1998	139,976	26,124
1998-1999	151,086	28,143
1999-2000	162,954	30,295
2005-2006	248,332	45,634
2009-2010	318,715	58,117

From Table 3.2, it can be seen that peak demand over a period of 15 years is more than doubled from 22466 MW in 1995-96 to as much as 58117 MW in 2009-2010

From the growth of peak demand and anticipated installed generating capacity on the basis of schemes proposed for benefits under construction/consideration during eighth and ninth five

year plan, it is observed that there is dire need to provide additional capacity to the Northern Grid to meet the increasing demand of the grid. Thus new schemes are required to be taken up immediately for their implementation to get the timely benefits.

The most important source of power development in the Northern region is Hydro resources located in Himachal Pradesh, Uttaranchal and Jammu and Kashmir. Tidong Hydroelectric Project is very good and attractive scheme from the view of deriving benefits by feeding power to the Northern grid.

### 3.3 Project Categorization

The Project falls under environmental Category A<sup>1</sup> as per criteria described in IFC's Performance Standards. Environmental Assessment (EA) for a Category A project examines the Project's potential positive and negative impacts, compares them with those of feasible alternatives (including the "Without Project" scenario), and recommends any measures needed to prevent, minimize, mitigate, or compensate for adverse impacts and improve performance. Projects categorised as A or B requires the borrower to assess all possible environmental and social impacts and risks.

### 3.4 Project Appurtenances

This run-of-the-river project will have a 10 m high concrete barrage at about 9.8 km upstream from the confluence of Tidong and Satluj River. The barrage will submerge an area of about 0.5 hectares and divert the water into a 4 hours peaking reservoir of 237000m<sup>3</sup> storage capacity. The water will be transmitted through 8461 m long D-shaped Head Race Tunnel (HRT) to a 1200 m long pressure shaft. The over ground power house will have 2 x 50 MW Vertical Shaft Pelton turbines.

The project will use existing PWD road starting from NH-22 near Morang upto Barrage site located near villager Lambar. However, addition roads of about 11 km are being constructed to access various appurtenances like diversion structure, HRT, Intake, powerhouse, pressure shaft and surge shaft. Water from the project will be discharged into the Tidong stream after generation of power through 50 m long open Tail Race Channel. The project will have a 120 m high surge shaft with 8 m diameter. Project will use a sand quarry in 2 ha. of diverted forest land on the left bank of Satluj river near Morang Bridge. This land is a part of 39.0546 ha. diverted forest land. However, requirement of aggregate will be met with excavated material from project for which quality test were found suitable for the requirement. However, in case

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<sup>1</sup>Category-A projects are the projects with potential significant adverse social or environmental impacts that are diverse, irreversible or unprecedented.

of additional aggregate, it may be sourced from external quarry that is approved and having valid consent from pollution control board. Different project appurtenances are given in the Figure 3-3.

The project will also have a colony which will be constructed towards the closing phase of the construction period. Two labour colonies, one at head works and the other near power house is in advanced stage of construction. There are 4 muck disposal areas for the project and all are operational. The water supply for the labour camps and the permanent colony will be drawn from the Tidong river. The project area will have a proper municipal waste disposal system and the collected waste will be incinerated through an incinerator. The salient features are as detailed in Table 3-3 and main components are described under subsequent Para.

**Table 3-3: Salient Features**

<b>1. LOCATION</b>	
State	Himachal Pradesh
District	Kinnaur
Stream	Tidong, a tributary of Sutlej river
Vicinity	Near Reckong Peo town.
Longitude	78° 22' 10"E to 78° 47' 50"E
Latitude	31° 20' 30" N to 31° 33' 30" N
<b>2. HYDROLOGY</b>	
Catchment area at diversion	497.86 km <sup>2</sup>
Design Flood (50 year Return period)	405 cumec.
<b>3. RIVER DIVERSION (During Construction)</b>	
Type	Diversion Channel
Length	210.00m
Size & shape	9m (W)x 2 (D), Rectangular
<b>4. DIVERSION BARRAGE</b>	
Diversion reservoir Submergence area	0.4844 hectares (diverted forest land) and no standing trees on this land
<b>A. Spillway</b>	
Type	Non Gated
Maximum Water level	2888.00 m
Average river bed level at barrage	2880.00m
axis Crest level of Spillway bays	2881.75 m
Bridge deck level	2890.00 m
No. of Spillway	1
bays Width of bay	20.0 m
Energy Dissipation System	Stilling Basin

<b>B. Undersluice</b>	
Type	2 Nos, Vertical Lift Gate(5m x 3 m size)
Maximum Water level	2888.00 m
Average river bed level	2880.00 m
Crest level of undersluice	2875.50 m
Bridge deck level	2890.00 m
Width of undersluice portion	12.00 m
No. of undersluice bays	2
Width of each bay	5.0 m
Energy Dissipation System	Stilling Basin
<b>C. Head regulator</b>	
Type	2Nos.Vertical lift gates, 2.5 m x 2.65m
Maximum Water level	2888.00 m
Average river bed level	2880.00 m
Crest level of undersluice	2875.50 m
Regulator Bridge deck level	2890.00 m
Width of undersluice portion	2
Width of each bay	2.5 m
Energy Dissipation System	Stilling Basin
<b>D. Tunnel Intake Structure</b>	
Type	Rectangular bell mouth entrance, Non gated
Sill level	2853.00m
Trash rack	Vertical (2 panels)
Design Discharge	19.2 Cumecs
<b>5. DESILTING BASINS</b>	
Type	Surface desilting basins with dome cover
No. & Size of desilting trough	2 Nos., 80.0 m x 8.50 m x 8.50 m
Particle size to be excluded	0.20 mm and above
Design discharge	25 cumec
Flow through velocity	0.2 m/s
Flushing velocity	6 m/sec
Gates opening for flushing conduit	2 Nos. Vertical lift gates, 2.0 m x 1.6 m
<b>6. RESERVOIR</b>	
Capacity	4 Hours peaking (237000m3)
FRL	2873.75 m
MDDL	2860.75m
Reservoir bed level	2860.00m
Type of desilting arrangement	Dragging by Siphon action
<b>7. HEAD RACE TUNNEL</b>	

Type and Size	Concrete Lined, D – Shaped, 3.5m Finished Dia
Velocity	1.75 m/s
Length	8461 m
Design discharge Slope	19.2 cumec 1 in 160
<b>8. ADITS</b>	
Type and Size	D – Shaped, 3.5m Finished Dia.
To HRT (RD-2404)	Adit-1: 247 m long
To HRT (RD-195)	Adit-5: 116 m Long
To HRT, Surge Shaft & Valve house (At junction of Surge shaft & Valve house)	Adit-2: 114 m long
To Pressure Shaft (Intermediate Adit at El 2531)	Adit-3: 124 m long
To Pressure shaft (At 'Y' junction of pressure shaft)	Adit-4: 93 m long
<b>9. SURGE SHAFT</b>	
Type	Underground, Restricted orifice type. Concrete lined upto 2900 m.
Size:	8.0m Dia., 120 m high.
Maximum Upsurge Level	2910.40 m
Minimum Downsurge Level	2830.30 m
Bottom Level	2800.00 m
Top Level	2900.00 m
<b>10. PRESSURE SHAFT</b>	
Type	Underground
Size Main	1 No., 2.5 m dia, 1200m long.
Branches	2 nos., 1.75 m dia, 15 m each
Velocity	3.91 m/s
Type & thickness of steel liner	ASTM A-516 Grade -70 grade, 12 mm to 66 mm thk.
Valve gallery	10.0 m (H) x 8.0 m (W) x 10.0 m (L)
<b>11. POWER HOUSE</b>	
Type	Surface
Installed Capacity	100 MW (2 x 50 MW)
Size	63.00 m x 25.0 m
Maximum gross head	609.42 m
Max Net head	603.67 m
Min Net Head	590.67 m
Rated Net head	595.00 m
C/L of Turbine	2260.0 m

Erection bay floor level	2268.30 m
Crane beam level	2277.80 m
Maximum TWL	2252.00 m
HFL	2250.00 m
Capacity of E.O.T crane	150 tones
<b>12. TAIL RACE CHANNEL</b>	
Type	Surface
Size	4 m wide open channel, 50 m long
Velocity	1.90m/s
<b>13. TURBINES</b>	
No. & Type	2, Vertical Shaft Pelton.
Rated Power (at generator terminal)	50 MW
Rated net Head	595m
Max/Min net Head	603.67 /590.67 m
Rated discharge	9.60 cumec.
Speed	500 RPM
Specific Speed	14.75 (m. kw)
<b>14. MAIN INLET VALVE</b>	
Type	Spherical valve
Diameter	1.2m
Location	In the power house
<b>15. GENERATOR</b>	
Type	Vertical shaft synchronous generator
Number	2
Rated Capacity	55.55 MVA
Nominal Active Power	50 MW
<b>16. MAIN GENERATOR STEP UP TRANSFORMER</b>	
Location	Side wall of Powerhouse
No. of Single Phase Transformer	7
Rated Output of Each Transformer	23.5 MVA
Rated Voltage	11 KV/220V
Frequency	50Hz
Type of cooling	OFWF
<b>17. SWITCHYARD</b>	
Area	120 m x 60 m
Type	Surface at EL 2268.30m
<b>18. TRANSMISSION SYSTEM</b>	
It has now been finalized that the 220 kV DC Line from Tidong to Kashang will be done by HPPTCL at	

its cost. The metering will be at Tidong. Beyond Kashang HPPTCL has finalized to transmit the Power to 400 kV Sherpa Colony Pooling Station with step up arrangement at PGCIL's Station at Sherpa Colony instead of the 220kV system from Kashang to Kunihar via Kotla and Kunihar to Nalagarh where PGCIL has the 400 kV station to save use of additional corridor. We will only pay open access charges for the power evacuation transmission system.

**19. ESTIMATED COST**

Pre Operative and Civil Works	Rs. 3919.80 million
Electrical /Mechanical Works	Rs. 1362.80 million
Transmission works	Rs. 177.80 million

**20. ESTIMATED COST- FOR TARIFF CALCULATIONS**

Pre-operative Expenses	Rs. 305.60 million
Civil works	Rs. 3614.20 million
Elect./Mech. Works	Rs. 1362.80 million
Transmission line Cost	Rs. 177.50 million
Total Basic cost	Rs. 5459.0 million
Escalations	Rs. 237.0 million
Interest During Construction	Rs. 667.20 million
Fund Management Expenses	Rs. 22.60 million
Total (Generation Works)	Rs. 6482.50 million
Cost per MW installed	Rs. 64.83 million

**21. POWER BENEFITS**

Energy generation at 95% availability in 90% dependable year.	414.15 MU
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**22. FINANCIAL ASPECTS**

Cost of generation in first year	3.42
Average DSCR	1.05

**23. CONSTRUCTION PERIOD** 5 ½ year

**24. Other Project Facilities**

Access Roads	
a. Road to Adit-1	2500 mtrs.
b. Road to power house	2460 mtrs.
c. Road to surge shaft	6220 mtrs.
Labor Camps	Separately for upstream and downstream works to accommodate peak strength of 500 workers.
Employee Colony	A residential colony will be constructed to accommodate about 50 families.
Water (Construction and Drinking)	Water will be sourced from Tidong stream to meet the requirement for construction and drinking purposes.
Wastewater	Wastewater is being generated from labour camps during construction phase, which is being directed

Solid Waste	into the septic tanks. However, the domestic wastewater from employee colony will be treated in the Sewage Treatment Plant.
a. Domestic solid waste	All the domestic solid waste generated from the labour camps, project offices and employee colony will be collected and disposed by Incineration.
b. Muck	The muck generated from excavation activities will be dumped in designated muck disposal sites within the project area. These areas will be provided with retaining wall to protect muck from flowing along with the storm water.
Hazardous Wastes	All the hazardous waste generated from the project will be kept in the designated storage area.

### 3.5 Analysis of Alternatives

One of the alternatives exercised for the project were left and right bank of Tidong Stream for Head Race Tunnel. Though all the facilities are available on the right bank including road upto Intake, the project alternatively on right bank could not be selected as the tunnel has to negotiate the weak geological terrain and about five tributaries to Tidong. On the left bank the geology is good and it has to negotiate only two tributaries. Additionally, HRT on the right bank would have caused more impact more impact on the community.

Another alternative analyzed by the project is the access road to power house. The road to power house originally designed was passing through Village Rispa. However, respecting the concerns shared by Rispa Gram Panchayat, NTPGL has analyzed another option to construct the road on the left bank of the Tidong stream i.e. passing through Morang Panchayat and constructed 2.46 km of Approach Road and a steel bridge on Tidong Khad to reach the Power House.

### 3.6 Land Required for Project

The total land required by the project is 42.2557 hectares which includes 39.0546 ha. of forest land and 3.2011 hectares of private land. The said forest land (including 1261 numbers of trees) was diverted in favour of NSL by Regional Office of Ministry of Environment and Forests, Government of India vide their letter no. 9-HPC602/2007-CHA/5228 dated 18-Jun-2008 after receiving the required amount towards Compensatory Afforestation and Net Present Value from the project proponent. In addition the forest land, felling of 1261 trees standing on the diverted land, were also approved for felling vide this letter.



The private land, involved in the project, falls in three villages of three different Panchayats as mentioned below:

**Table 3-4: Details of Private land required**

S. No.	Project Component	Village	Panchayat	No. of families affected by the acquisition of land (shareholders of the compensation)	Private Land acquired (Hectares)
1	Upstream structures and part of access road to Adit-1	Lambar	Thangi	5 (9)	0.8156
2	Power House area	Lizang	Rispa	3 (3)	0.1353
3	Staff Colony and part of access road to Power house	Ruwang	Morang	21 (29)	2.2502
TOTAL					3.2011

Entire private land has been acquired by the project under Land Acquisition Act, 1894 through Land Acquisition Collector-Cum-Additional District Magistrate (ADM), Pooh, District Kinnaur, H.P. vide their office letter no. SDP-III-71(Peshi)/2009-1163 dated 14-Jul-2009. The compensation amounting to Rs 25.8 million (including trees and structures existing on the private land being acquired) was deposited by the project proponent vide letter dated 16-Jul-09. There were 4 nos. of kutcha/semi-pucca structures in addition to 39 nos. fruit bearing and 134 no fruit trees on the acquired land.

The compensation amount toward acquisition of private land was disbursed to the beneficiaries. All the beneficiaries have reportedly accepted the compensation from ADM under protest, to enhance the land rates.

It was further discovered during personal interviews with land owners that they have entered into litigation against the Govt. of Himachal Pradesh and the company on the Issue of the rates of land at which the compensation has been disbursed by ADM. There are 29 Project Affected Families (PAF) involved in acquisition of private land but none of them have been displaced or rendered homeless. Currently the company has obtained the possession of above mentioned private land.

### 3.7 Transmission Line

A Transmission line of 220kV DC capacity is envisaged for evacuation of power from Tidong-1 and the stretch from Kashang to Tidong-1 HEP is considered as an 'associated facility' as per IFC guidelines. Himachal Pradesh Power Transmission Corporation Limited (HPPTCL), a State Transmission Utility, will be managing its execution. The land acquisition for the same will also be carried out by HPPTCL. Execution of this associated facility will be done in accordance with HPPTCL's Environmental, Health, Safety and Social guidelines.

As per the present arrangement, HPPTCL will be laying 220KV DC Line from Tidong-1 Power House to Kashang of about 24Km length. NTPGL will have to pay open access charges (Transmission losses + wheeling charges) to HPPTCL for transmitting the power from Tidong to PGCIL's 400KV station at Sherpa Colony through Tidong-1 – Kashang – Sherpa Colony Line. A separate metering system will be provided at Tidong-1 Power House by HPPTCL. The 220KV DC line will be constructed with twin Zebra Conductor (ACSR) and this can transmit 400MW on both the circuits and at least 200MW in case of outage on the other circuit. Tidong-2 HEP (60MW) an immediate upstream project of Tidong-1 HEP (100MW) has also to evacuate its power through the Tidong – Kashang line.

HPPTCL has planned the construction of 24Km of 220KV DC Line from Tidong to Kashang at their cost. This is as per the master plan finalized by CEA (Central Electricity Authority). A schematic diagram showing the master plan of evacuation of power from power stations of Satluj River basin is shown as Figure 3-2. As seen from this the 220KV DC line is to be constructed from Tidong to Kashang and also Kashang to Sherpa colony with 220/400KV transformer station at Sherpa colony. Thus the Tidong, Kashang line will be an important link in the grid in addition to serving for evacuation of power from Tidong-1 and Tidong-2 Power Stations.

Though the transmission line will be constructed and operated by HPPTCL and the NSL has no environmental and social liability for the transmission line, as per the IFC, it can be considered as an associated facility and therefore has been included in the EIA report.

### 3.8 Construction Schedule

The project has been scheduled to complete in 5 ½ years starting from mid of 2008 and completing at the end of 2013. Since the construction activities have already started, the balance period of about 2 ½ years is left as per schedule, for completion of the project.

The project activities already completed include the following major works;

- Approach road to Adit-1 to HRT in the upstream and power house in the downstream, both of the roads include steel bridges.
- Excavation of Undersluice in the upstream and for the surface power house in the downstream.

The detailed schedule for construction activities can be referred as Figure 3-4.

Figure 3-2: Schematic Diagram showing the Master Plan of Evacuation of Power from the Power Stations of Satluj Basin

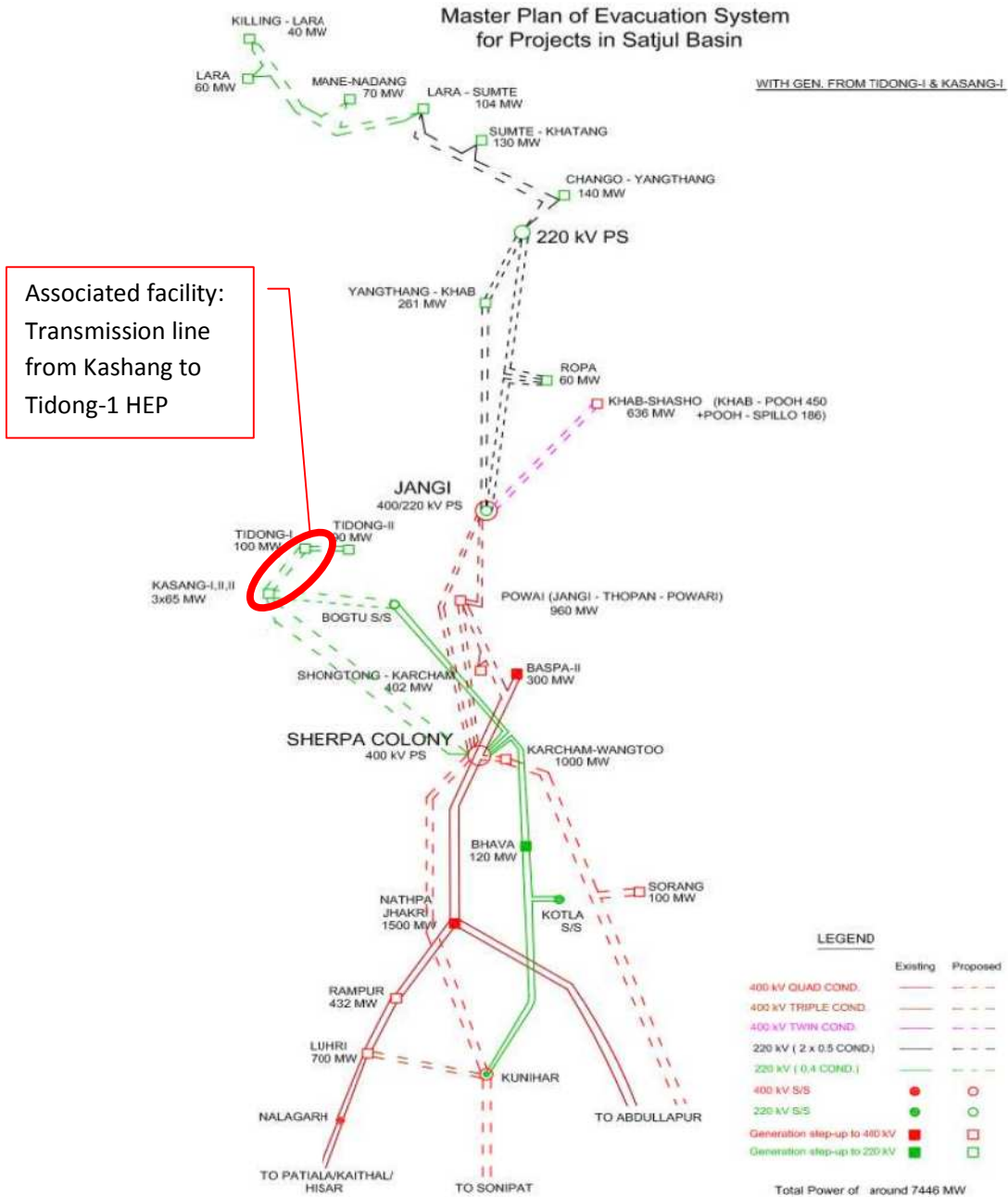
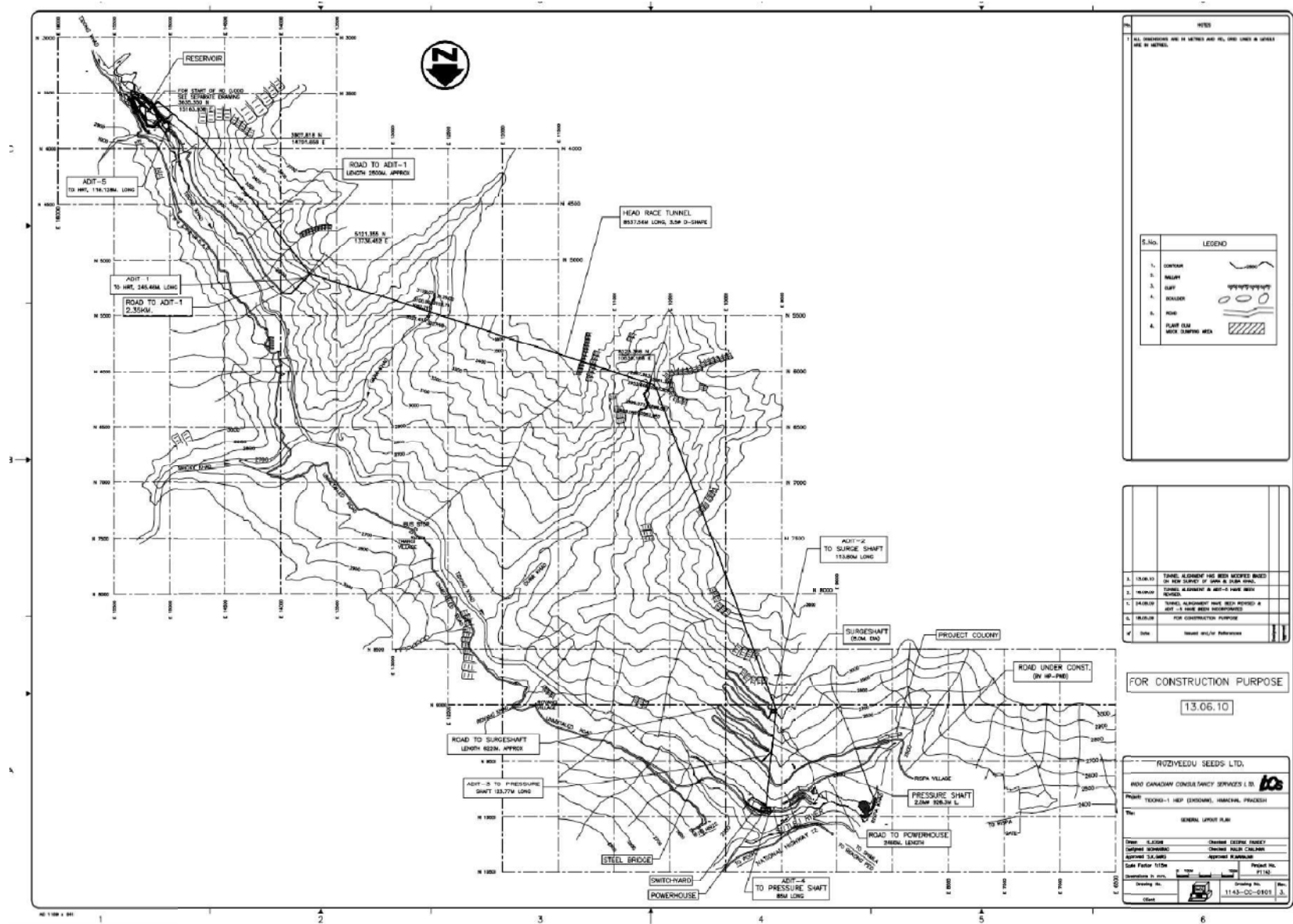


Figure 3-3: Tidong-1 HEP Project Layout



**NOTES**

- ALL DIMENSIONS ARE IN METRES AND ALL GRID LINES IN METRES ARE IN METRES.

**LEGEND**

S.No.	LEGEND
1.	CONTOUR
2.	SALP
3.	CLIFF
4.	DAM
5.	ROAD
6.	PLANT AREA

1. TUNNEL ALIGNMENT HAS BEEN RECEIVED BASED ON THE SURVEY OF 2010 & 2011 DATA.

2. TUNNEL ALIGNMENT IN ADIT-1 HAS BEEN RECEIVED.

3. TUNNEL ALIGNMENT HAS BEEN RECEIVED A ADIT-2 HAS BEEN RECEIVED.

4. TUNNEL ALIGNMENT HAS BEEN RECEIVED A ADIT-3 HAS BEEN RECEIVED.

5. TUNNEL ALIGNMENT HAS BEEN RECEIVED A ADIT-4 HAS BEEN RECEIVED.

6. TUNNEL ALIGNMENT HAS BEEN RECEIVED A ADIT-5 HAS BEEN RECEIVED.

7. FOR CONSTRUCTION PURPOSE

8. Date: Issued and/or Reference

**FOR CONSTRUCTION PURPOSE**

13.06.10

**RIZVIEDU SEEDS LTD.**

INDO CANADIAN CONSULTANCY SERVICES (P) LTD.

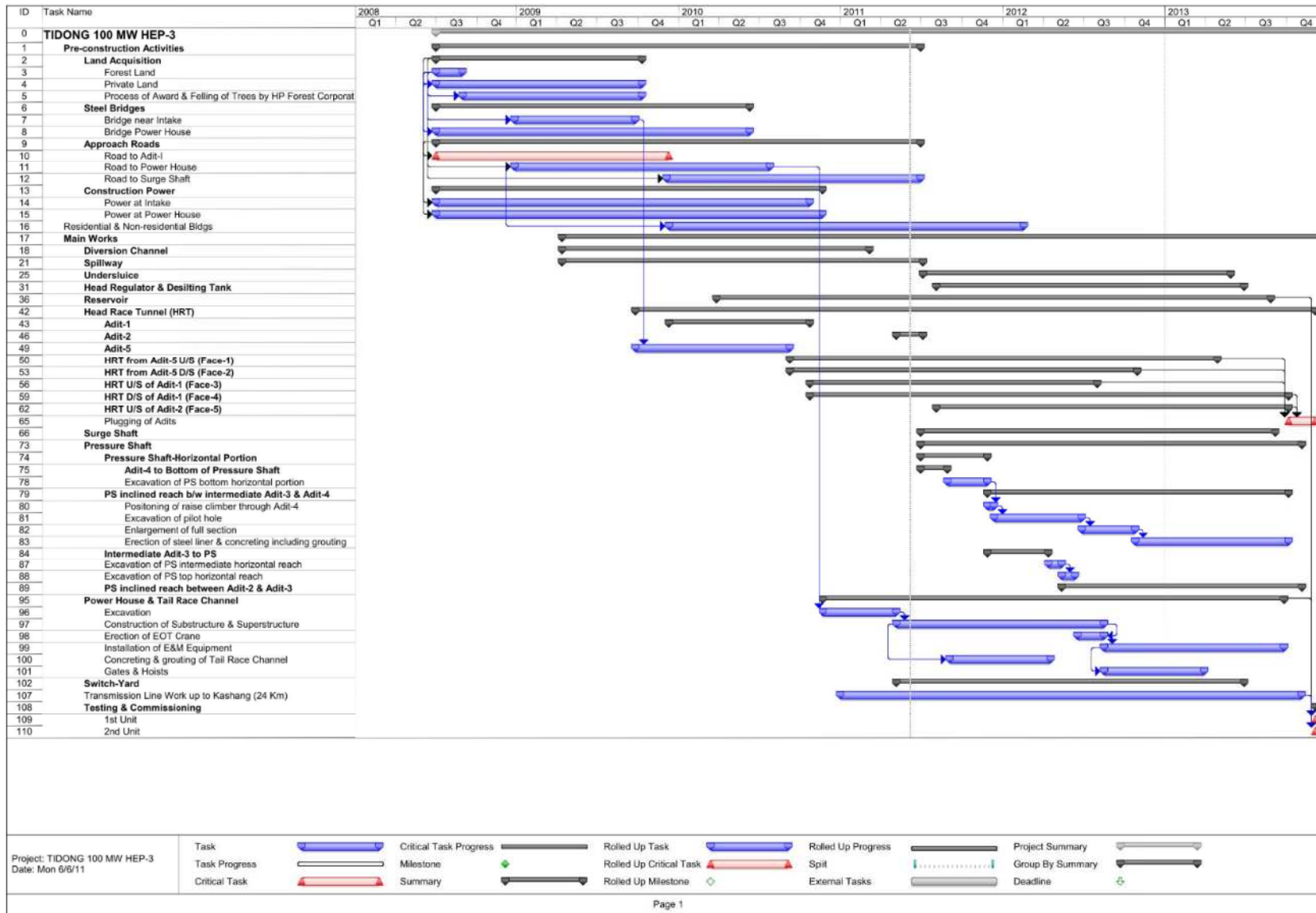
Project: TIDONG-1 HEP (200MW), HIMACHAL PRADESH

Scale: GENERAL LAYOUT PLAN

Drawn: S. SINGH  
Checked: DEEPAK SINGH  
Designed: S. SINGH  
Scale Factor: 1:1000  
Date: 13.06.10  
Project No.: P1102

Sheet: 1143-02-0103

Figure 3-4: Project Construction Schedule





## 4. ENVIRONMENTAL BASELINE SETUP

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### 4.1 General

This chapter deals with the description of baseline environmental settings of the project area. The identification of physical and biological characteristics of the region and assessing their existing conditions is imperative to predict the possible environmental impacts of the proposed hydropower project. The baseline information of the proposed project and surrounding area as presented, were collected through primary surveys during EIA-2005, however, validation of this information was conducted by AECOM, through the data from secondary sources, satellite imagery study and the reconnaissance visit.

The baseline environmental data has been compiled to cover the following disciplines:

- Land;
- Water (water resources, water quality, source of pollution and hydrology);
- Meteorology and Air quality (rainfall, temperature, humidity, air quality, wind speed and wind direction);
- Noise (noise levels);
- Ecological (terrestrial and aquatic ecology) and
- Demography and Socio-Economics

### 4.2 Areas of Study

#### 4.2.1 Project area

The proposed 100 MW Tidong-1 Hydroelectric Project is located on the Tidong river (Khad), a left bank tributary of Satluj river in Kinnaur district of Himachal Pradesh. The location map of proposed project is given in Figure 3-1. The project area consists of following zones on the tidong stream.

- Submergence zone in the upstream of 10 metre high barrage near Lambar village
- Diversion works including, barrage, desilting chambers, Intake and HRT near Lambar village
- Affected river stretch of about 9.8-km between diversion and tailrace passing from the underground stretch on the left bank of the Tidong stream.
- Power House area including Power house, surge shaft, pressure shaft, tailrace channel, staff colony and other facilities between Rispa village on left bank and Moorang on right bank of Tidong stream.



### 4.2.1 Study area (Influence zone)

As per the norms of Ministry of Environment and Forests, Government of India, the study area considered for this project include 10 km radius around the dam site, HRT and powerhouse site. The study area cover all the village settlements and other eco-sensitive areas where the project is likely to have impact due to the construction and operation of the project and has been referred as “Influence zone” in this EIA report.

## 4.3 Physiography

The different physiographic features of the project were analyzed using GIS tools and interpretation of the spatial databases were completed through secondary data like Survey of India toposheets on the 1:50,000 scale, satellite imagery IRS-P6 LISS-III scene of October, 2008 (Table 4-1) and Shuttle Radar Topography Mission (SRTM) data procured from the Global Land Cover Facility maintained by Department of Geography, University of Maryland, NASA. Digital image processing of the satellite data and the analysis of interpreted maps were carried out using ERDAS Imagine and ArcGIS software.

**Table 4-1 Details of the Satellite Imagery**

Satellite	Sensor	Path/Row	Date	Data type & Bands
IRS-P6	LISS-III	96/48	05-10-2008	Digital (1,2,3,4)
IRS-P6	LISS-III	96/49	05-10-2008	Digital (1,2,3,4)

### 4.3.1 Drainage

The catchment of the Tidong basin is oval shaped with many snow fed and rain fed streams with dendritic drainage pattern. The Tidong Khad originates at an elevation of more than 6000 m and traverses about 36 km from east to northwest up to the proposed weir site and fed by many big and small streams on both the banks. Most of the snows fed tributaries join the Tidong khad on its left bank (Figure 4-1).

**Lambar khad :** Snow fed tributary Joins the Tidong stream after about 260 meters

**Shankvi Khad:** Shankvi Khad is a perennial tributary joins Tidong after 3640 meters at its right bank near Thangi village after travelling 7.74 km from its origin.

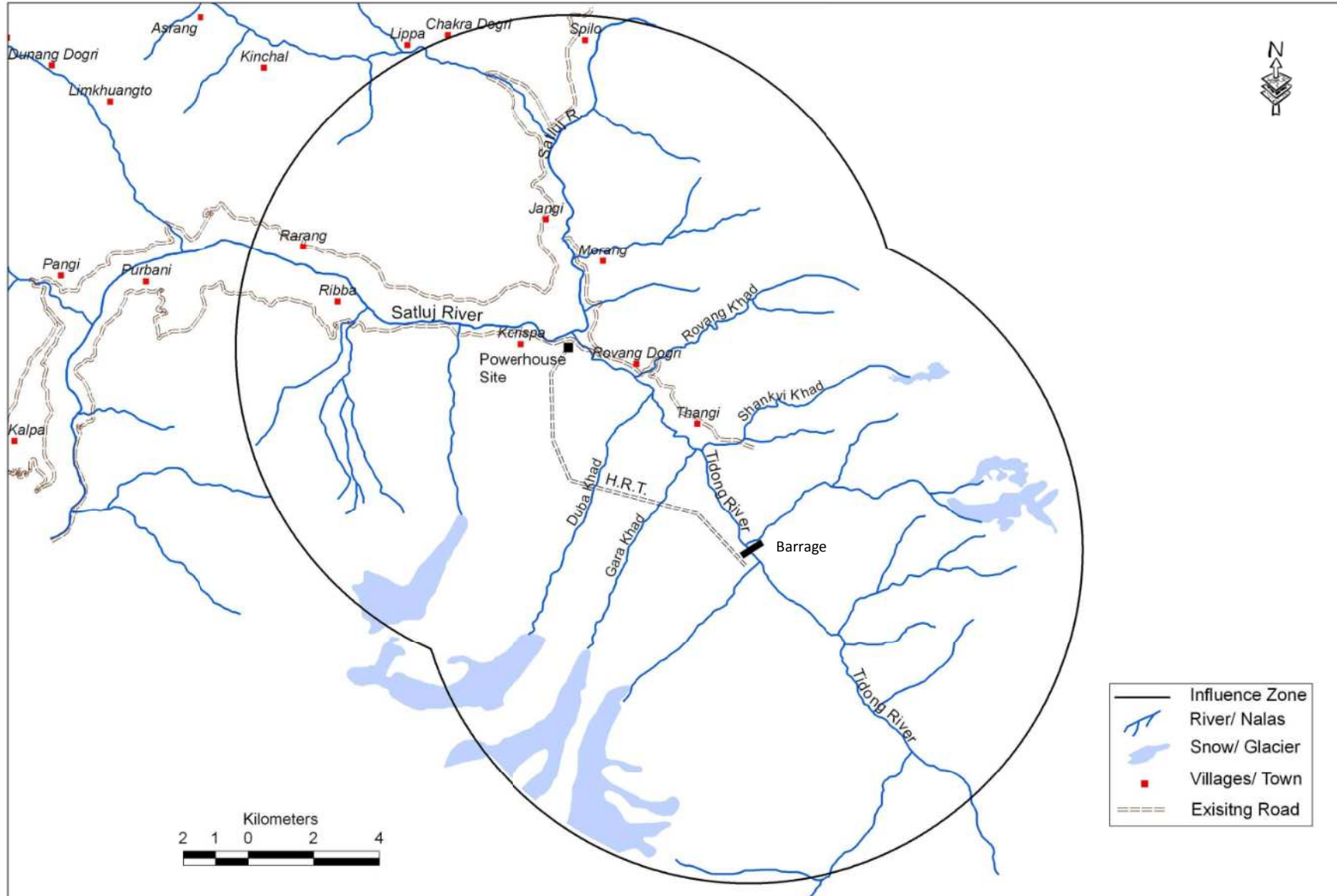
**Gara Khad:** It is a snow fed perennial tributary of Tidong and originates from Gara glacier. Gara Khad travels about 7.25 km from its origin before joining Tidong after 3875 meters near Thangi village.

**Duba Khad:** It is also a snow fed perennial tributary and joins Tidong after 6505 meters after traversing 8.7 km from its origin. It is also fed by many small nallas.

**Rovang Khad:** Rovang Khad is a perennial tributary joins Tidong after 7395 meters at its right bank near Rovang Dogri village at an elevation of about 2400 m.



Figure 4-1: Drainage Map of influence zone of the proposed Tidong HEP project



### 4.3.2 Slope

The slope map of the catchment area and area of influence zone for the proposed Tidong hydropower project was generated from Digital Elevation Data (DEM) prepared from SRTM data. The slope of mountains in the Tidong basin has been categorized into seven slope categories;

- 1 Gently sloping (0-2%)
- 2 Moderately sloping (2-8%)
- 3 Strongly sloping (8-15%)
- 4 Moderately steep (15-30%)
- 5 Steep (30-50%)
- 6 Very steep (50-70%)
- 7 Escarpments (above 70%)

The slope profile for the proposed Tidong hydropower project catchment area and respective area breakup for each type of slope category is given in Table 4-2 and the same is depicted in Figure 4-2 and Figure 4-3. These figures show that most of the catchment area is either strongly sloping or moderately steep. The area of the catchment with very steep slope and escarpment is significantly less i.e. 0.30% and 0.10% respectively.

**Table 4-2 Area (in ha) under different slope categories for the catchment area of proposed project**

S. No.	Slope categories	Area (ha)	Percentage (%)
1.	Gently sloping (0-2%)	2813.23	4.92
2.	Moderately sloping (2-8%)	8227.37	14.39
3.	Strongly sloping (8-15%)	24411.97	42.69
4.	Moderately steep (15-30%)	18633.62	32.59
5.	Steep (30-50%)	2864.11	5.01
6.	Very steep (50-70%)	172.50	0.30
7.	Escarpments (above 70%)	55.08	0.10

Figure 4-2 Slope Profile for catchment area of Tidong

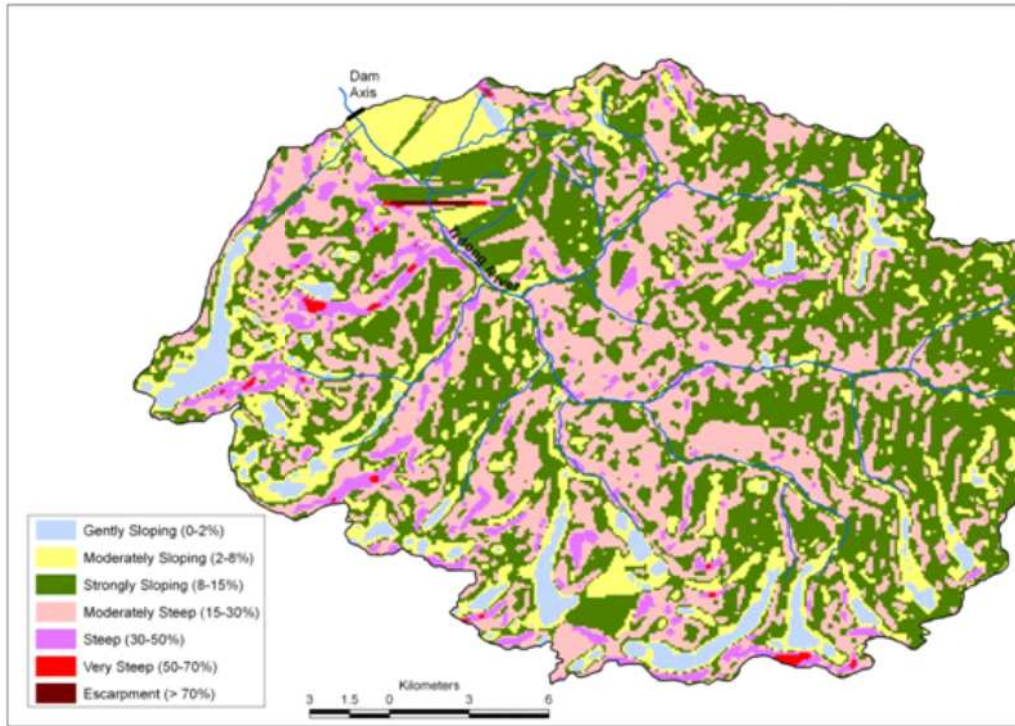
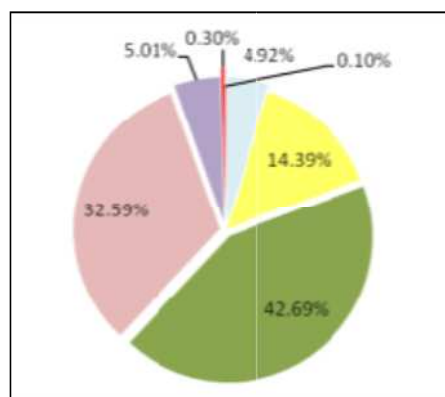


Figure 4-3 Percentage of area under each slope category for Catchment area of Tidong



Slope profile for the influence zone of proposed Tidong hydropower project and respective area breakup for each type of slope category is given in

Table 4-3 and the same are depicted in Figure 4-4 and Figure 4-5. In the project influence zone, strongly and moderately steep category of slope together cover more than 71% area while moderately slope covers about 17.5% around Tidong



and Satluj rivers and some patches of this category are found at higher elevations. Steep and gently sloping categories cover only 10.65% area in the influence zone while 0.21% of the area is under very steep mountain slope.

**Table 4-3 Area (ha) under different slope categories for the influence zone of proposed project**

S. No.	Slope categories	Area (ha)	Percentage (%)
5.	Gently sloping (0-2%)	2833.32	3.86
6.	Moderately sloping (2-8%)	12855.79	17.52
7.	Strongly sloping (8-15%)	26897.42	36.66
8.	Moderately steep (15-30%)	25593.69	34.88
9.	Steep (30-50%)	4984.01	6.79
10.	Very steep (50-70%)	155.82	0.21
11.	Escarments (above 70%)	55.08	0.08

**Figure 4-4 Slope Profile for project influence zone**

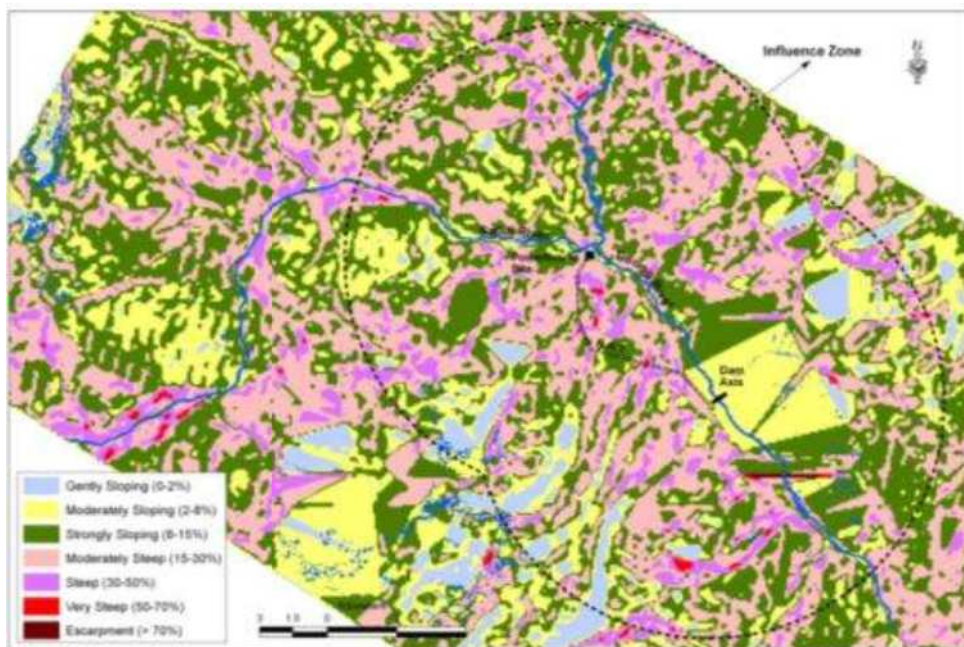
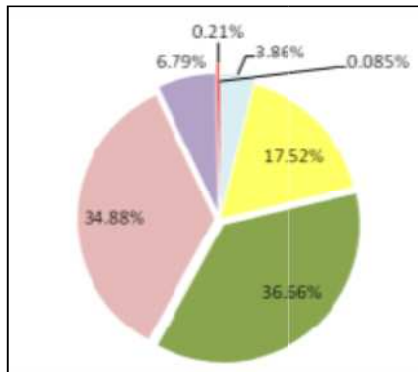


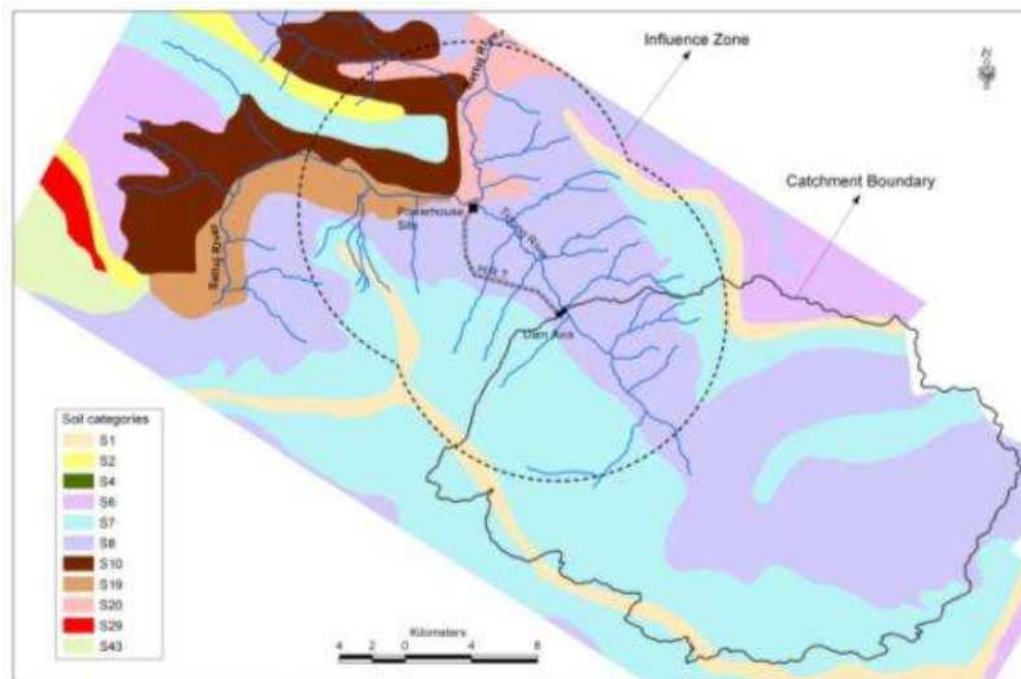
Figure 4-5 Percentage of area under each slope category for project influence zone



### 4.3.3 Soil

Soil mapping of the proposed area for Tidong hydropower project was prepared from the National Bureau of Soil Survey and Land Use Planning, 2000. The soil map for the catchment area and influence zone of proposed project is shown in Figure 4-6 and legend to this soil map is given in Table 4-4.

Figure 4-6 Soil Map of catchment area and influence zone of proposed project



**Table 4-4 Soil series and its description in the project area**

<b>Soil Unit</b>	<b>Soil Taxonomy</b>	<b>Description</b>
S1	Lithic Cryorthents	Rocky outcrops covered with glaciers; <i>associated with :</i> Shallow, excessively drained, sandy skeletal soil with sandy surface, severe erosion and strong stoniness.
S2	Lithic Cryorthents	Rocky outcrops. <i>associated with:</i> Shallow, excessively drained, sandy skeletal soil on very steep slopes with sandy surface, severe erosion and moderate stoniness;
S4	Lithic Cryorthents	Rocky outcrops covered with glaciers; <i>associated with :</i> Shallow, excessively drained, sandy skeletal soil on very steep slopes with sandy surface, severe erosion and moderate stoniness
S6	Typic Cryorthents	Rock outcrops; <i>associated with:</i> Medium deep, excessively drained, loamy skeletal calcareous soils on steep slopes with loamy surface, severe erosion and moderate stoniness
S7	Typic Cryorthents	Rock outcrops; <i>associated with :</i> Shallow, excessively drained, loamy-skeletal soils on very steep slopes with loamy surface, severe erosion and moderate stoniness.
S8	Typic Cryorthents	Rock outcrops; <i>associated with :</i> Medium deep, excessively drained, loamy skeletal calcareous soils on steep slopes with loamy surface, severe erosion and strong stoniness.
S10	Lithic Cryorthents	Rock outcrops; <i>associated with :</i> Shallow, somewhat excessively drained, coarse-loamy, calcareous soils on steep slopes with loamy surface, severe erosion and strong stoniness.
S19	Dystric Eutrochrepts	Deep, well drained, mesic, fine-loamy soils on moderately steep slopes with loamy surface, moderate erosion and slight stoniness; <i>associated with :</i> Medium deep, somewhat excessively drained, sandy soils with loamy surface, severe erosion



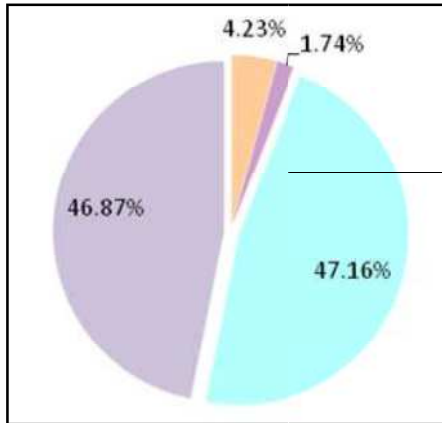
		and moderate stoniness
S20	Typic Cryorthents	Rock outcrops; <i>associated with</i> : Medium deep, somewhat excessively drained, loamy skeletal on moderately steep slopes with loamy surface, severe erosion and moderate stoniness.
S29	Typic Udorthents	Rock outcrops; <i>associated with</i> : Medium deep, excessively drained, mesic, loamy-skeletal soils on very steep slopes with loamy surface, severe erosion and moderate stoniness.
S43	Typic Udorthents	Shallow, well drained, thermic, loamy-skeletal soils on moderate slopes with loamy surface, moderate erosion and moderate stoniness; <i>associated with</i> : Shallow, somewhat excessively drained, coarse-loamy soils with loamy surface, severe erosion and slight stoniness.

The catchment area and influence zone of the proposed Tidong hydropower project mainly comprises of four soil families Lithic Cryorthents, Typic Cryorthents, Typic Udorthents and Dystric Eutrochrepts having 8 soils units. The catchment area of Tidong has a rocky outcrop with soil which is primarily shallow or moderately deep with loamy skeletal calcareous soils (S7 and S8). It is also characterized by severe erosion, stoniness and loamy surface. The details of area under different soil unit categories of catchment area and influence zone of the project is presented in Table 4-5, Figure 4-7 and Figure 4-8.

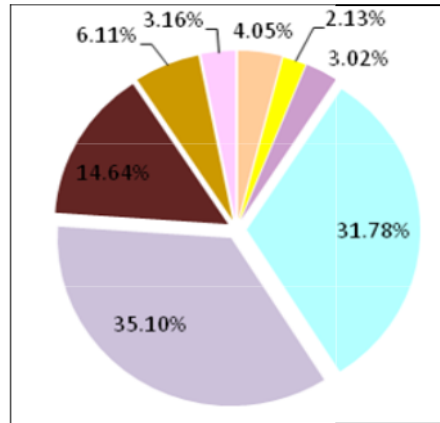
**Table 4-5 Area (ha) of different soil unit categories of catchment area and influence zone**

Soil Units	Catchment Area		Influence Zone	
	Area (ha)	Percentage (%)	Area (ha)	Percentage (%)
S1	2400.38	4.23	2971.85	4.05
S2	-	-	1565.28	2.13
S6	988.98	1.74	2214.59	3.02
S7	26777.37	47.16	23320.5	31.78
S8	26617.68	46.87	25758.18	35.1
S10	-	-	10741.13	14.64
S19	-	-	4484.15	6.11
S20	-	-	2319.44	3.16

**Figure 4-7 Area profile of different soil units in the catchment area**



**Figure 4-8 Area profile of different soil units in the influence zone**

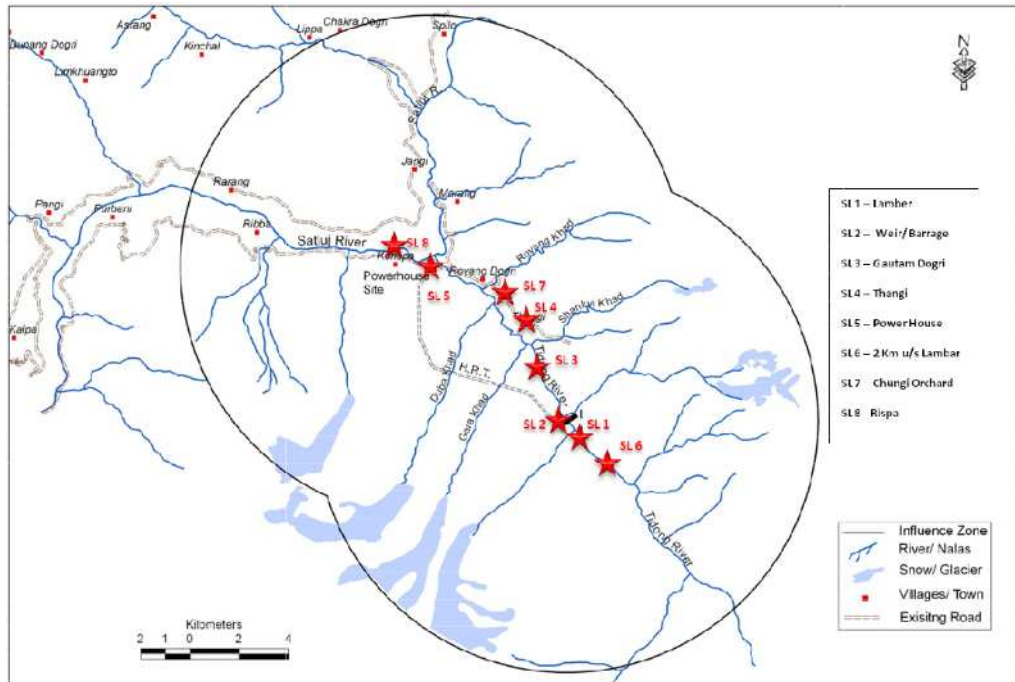


During site visit conducted in September 2005 by RITES, Soil samples were collected from the following 8 locations:

1. Lambar village;
2. Weir site;
3. Gautam Dogri;
4. Thangi village;
5. Powerhouse site;
6. Two km upstream of Lambar village;
7. Chungi Orchard; and
8. Rispa village.

The sample locations were well distributed to represent the project area and can be referred as Figure 4-9. Test results of these samples have been presented in Table 4-6. The soil sample analysis reveal that pH value of seven samples except the sample collected from Chungi Orchard varies from 6.98 to 7.95, which shows that the soil is slightly alkaline. Sand content of the samples varies between 48% and 84% indicating that the soil is predominantly sandy. NPK (Nitrogen, Phosphorus, and Potassium) contents of the samples indicate good fertility of soil; Conductivity of soil is less than 2, which indicates poor salinity; Calcium and Magnesium content of the samples is very less indicating the poor cation exchange capacity of soil. The Soil Texture Classification of all the samples is also represented in Figure 4-10.

Figure 4-9: Soil Sampling Locations

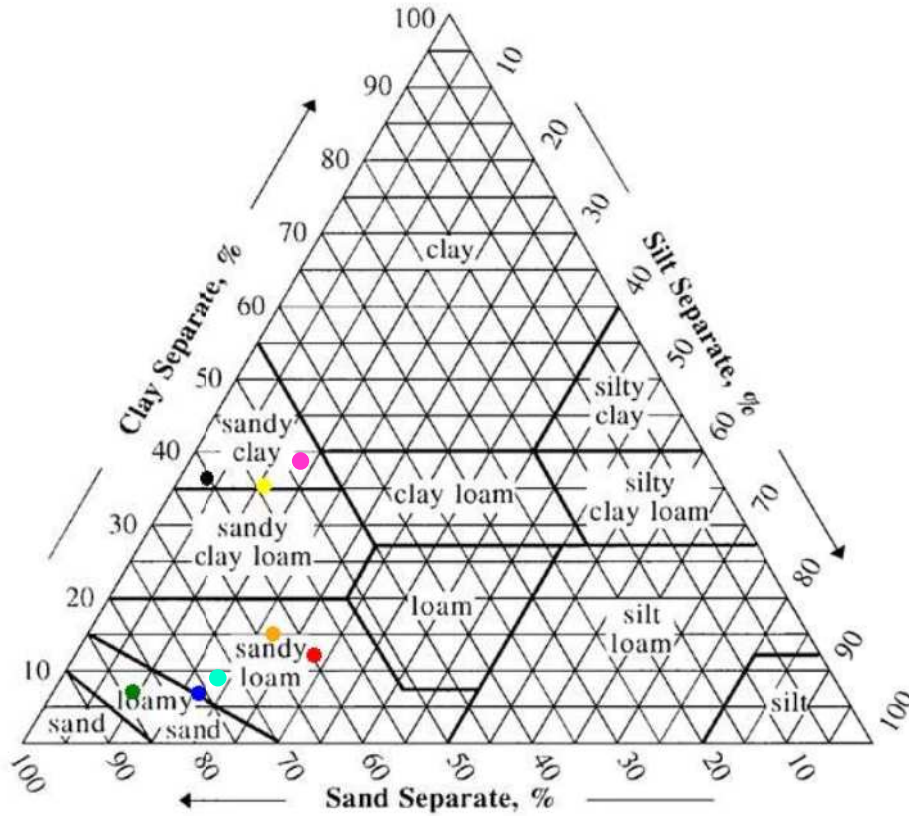


**Table 4-6: Physio-Chemical Characteristics of Soil Samples**

S. No.	Parameter	Unit	Results							
			1	2	3	4	5	6	7	8
	<b>Location*</b>									
1	Texture									
i.	Clay Content	%	12.37	7.17	7.43	36.84	35.77	15.34	9.35	38.84
ii.	Sand Content	%	59.81	76.26	83.78	60.46	54.03	63.2	72.26	48.35
iii.	Silt Content	%	27.82	16.57	8.79	3.2	10.2	21.46	18.29	12.81
2	Bicarbonate (HCO <sub>3</sub> )	mg/kg	214	268.26	376.94	276.18	302.11	162	76	94
3	Calcium Content	meq/100 gm	11.37	16.26	24.33	8.72	3.39	85	165	255
4	Chloride Content	mg/kg	203.52	99.35	128.79	236.27	78.77	14	36	12
5	Conductance (1:2)	millimho/cm	0.21	0.38	0.263	0.122	0.13	0.19	0.51	0.22
6	Magnesium Content	meq/100gm	3.03	5.23	3.84	4.21	3.23	117	18.3	161
7	Moisture Content	%	18.45	31.61	18.75	13.56	0.27	13.95	10	10.82
8	Available Nitrogen content	kg/ hectare	6648.81	9394.08	11816	2905.42	813.94	5601.9	2913	3137
9	Total Organic Carbon	%	2.62	7.19	9.75	1.41	0.15	3.2	1.2	1.5
10	pH Value at 25 <sup>o</sup> C(1:2)	-	7.37	6.98	7.15	7.54	7.95	7.2	5.2	7.9
11	Ortho Phosphate content (as P2O5)	kg/ hectare	1997.11	1125.04	2810.88	1768	2167.44	873.6	851.49	1254.8
12	Total Phosphorous (P2O5)	kg/ hectare	4600	4377.32	4304.67	4398.82	4596.41	291.3	291.3	403.3
13	Potassium Content	meq/100gm	0.98	22.88	0.57	0.57	0.64	5.6	6.7	4.6
14	Sodium Content	meq/100gm	0.61	6.91	0.89	0.78	0.87	7.4	5.7	7

**\*Location Code:** 1 Lambar village; 2 Weir site; 3 Gautam Dogri; 4 Thangi village; 5 Powerhouse site; 6 Two km upstream of Lambar village; 7 Chungi Orchard; 8 Rispa village

Figure 4-10 Soil Texture Classification



● Lumber village	● Weir site	● Gautam Dogri	● Thangi village	● Powerhouse site
● Two km upstream of Lumber village	● Chungi Orchard	● Rispa village		

**4.3.4 Elevation Bands (Relief)**

The relief in the catchment area and influence zone of Tidong hydropower project varies from 2000 m to 6400 m. This elevation range was divided into 12 elevation bands with 400 m interval (Figure 4-11). The area of catchment area and influence zone (in terms of hectares and percentage) which comes under these 12 elevation bands is given in Table 4-7 and depicted in Figure 4-12 and Figure 4-13. It is clear from the graph that most of the catchment area of proposed project (approximately 74.1%) has an elevation in the range of 4400-5600m. The proposed location of power house and dam site has an elevation of about 2000-2400m and 3200-3600m respectively. Three dimensional (3D) perspective view of the catchment and influence zone of the proposed Tidong hydropower project is shown in Figure 4-14.

Figure 4-11 Elevation Band Map of catchment area and influence zone of proposed project

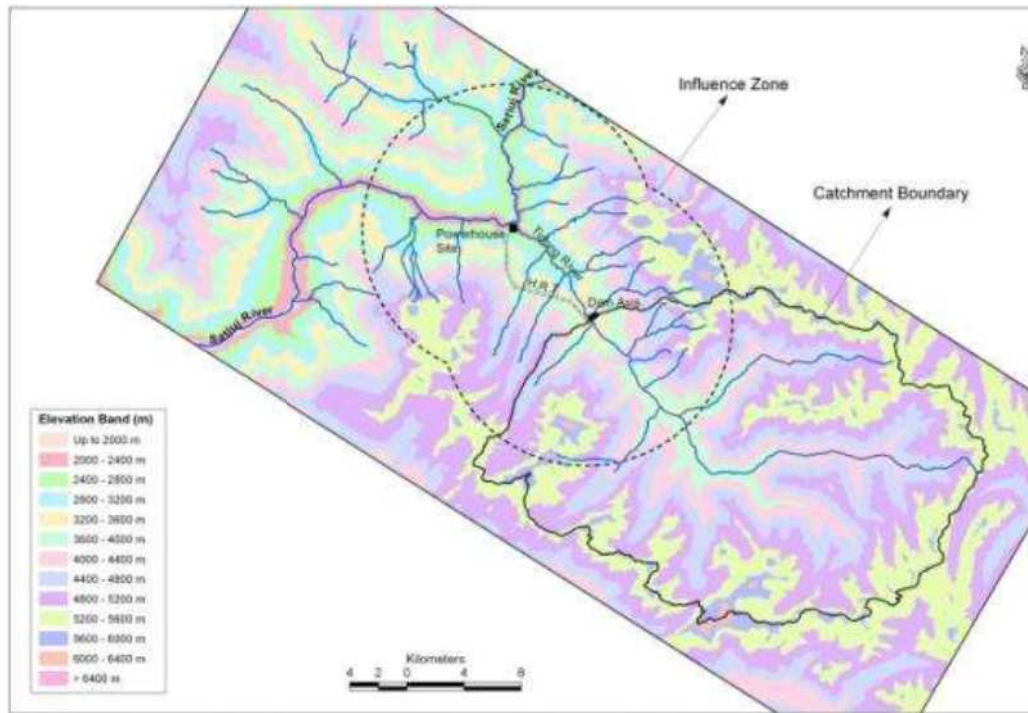


Table 4-7 Area (ha) of different elevation bands of catchment area and influence zone

Elevation Bands	Catchment Area		Influence Zone	
	Area (ha)	Percentage (%)	Area (ha)	Percentage (%)
Up to 2000	-	-	171.77	0.23
2000-2400	-	-	2939.43	4.01
2400-2800	-	-	6245.37	8.51
2800-3200	-	-	7910.18	10.78
3200-3600	931.29	1.63	10353.73	14.11
3600-4000	4021.62	7.03	11400.26	15.54
4000-4400	7751.47	13.56	9388.25	12.78
4400-4800	12153.77	21.26	7730.71	10.54
4800-5200	16638.14	29.1	8733.35	11.9
5200-5600	13573.55	23.74	6856.97	9.35
5600-6000	1965.11	3.44	1549.38	2.11
6000-6400	142.91	0.25	95.72	0.13

Figure 4-12 Area profile under different elevation bands (m) in the catchment area

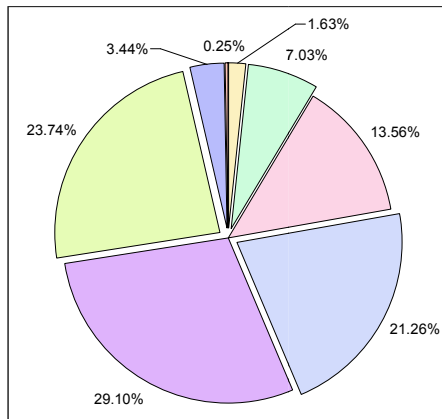


Figure 4-13 Area profile under different elevation bands (m) in the influence zone

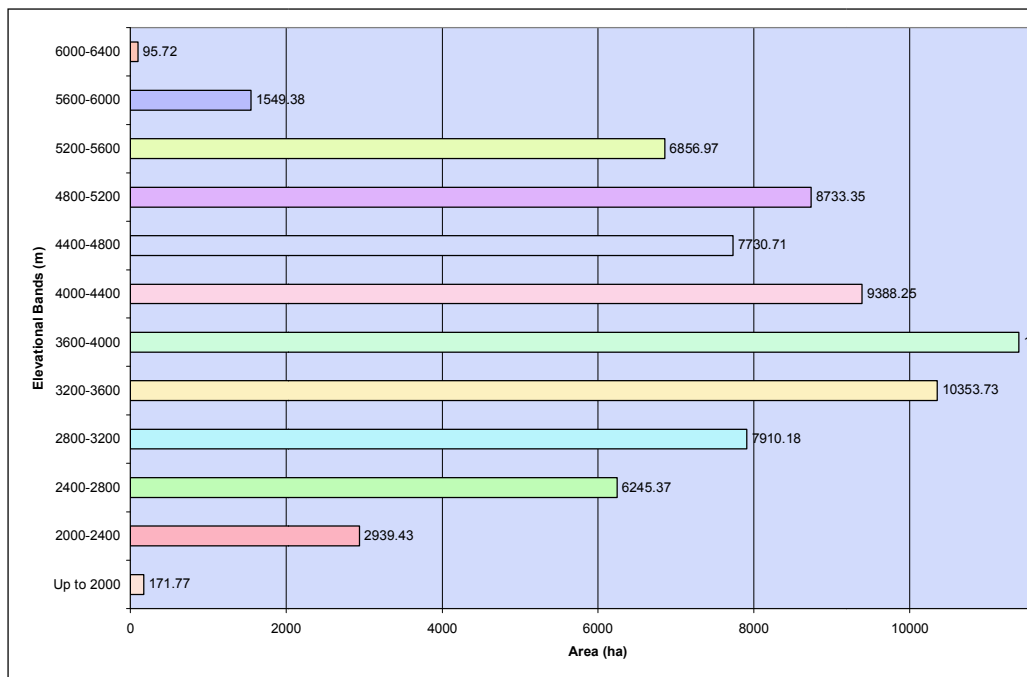
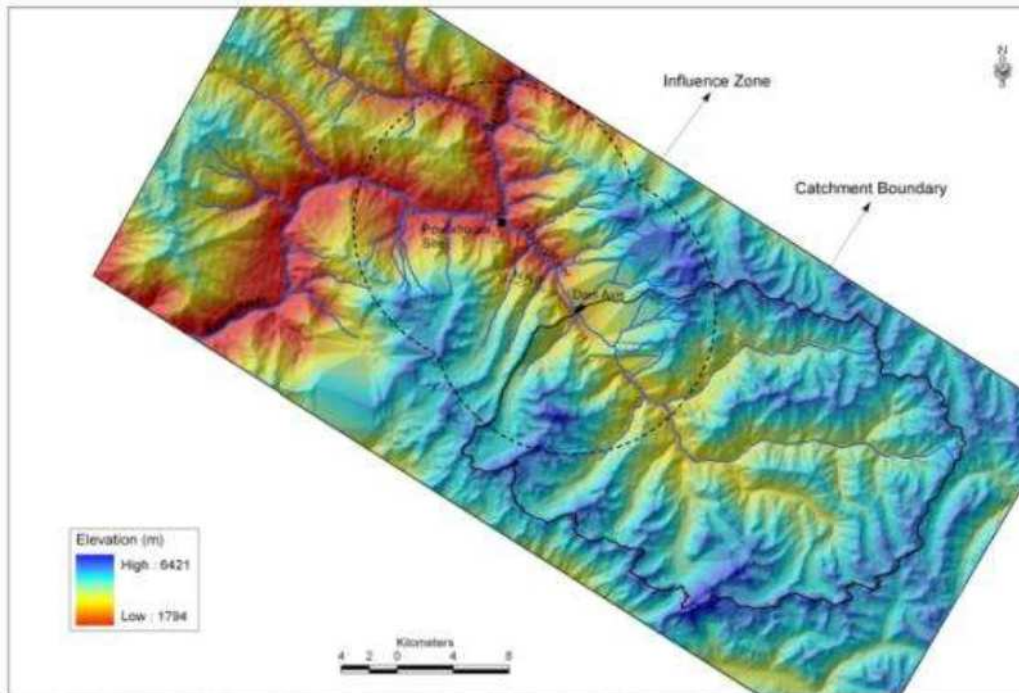




Figure 4-14 Three dimensional (3D) perspective view of the catchment and influence zone of the proposed Tidong H.E. project

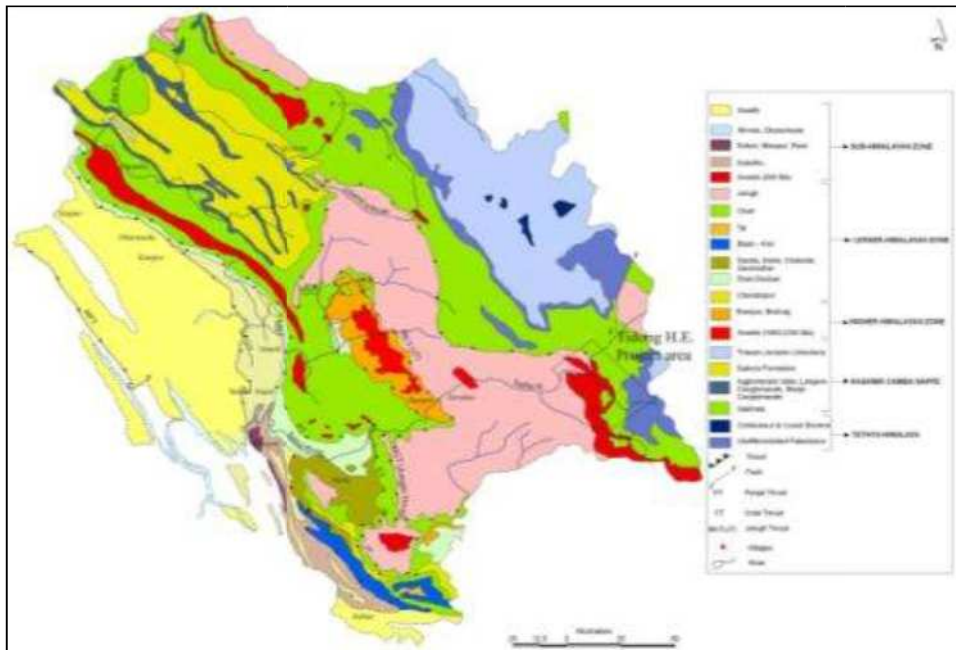


#### 4.3.5 Geology and Seismicity

The regional geology of the Satluj valley in Himachal Pradesh is shown in Figure 4-15. The regional stratigraphic framework for the Lesser Himalaya has been established from various published works (Srikantia and Bhargava, 1998; Srikantia and Sharma, 1976; Sharma, 1977, Kumar, 1999). The rocks exposed along the Lesser Himalaya region of the Satluj basin are of Archaean, Proterozoic, Palaeocene, Pleistocene, Holocene age. The dominant rock types include granite gneisses, quartzites, schists, mafic volcanics, limestones, dolomites, shales, laterites and older and newer alluvium.

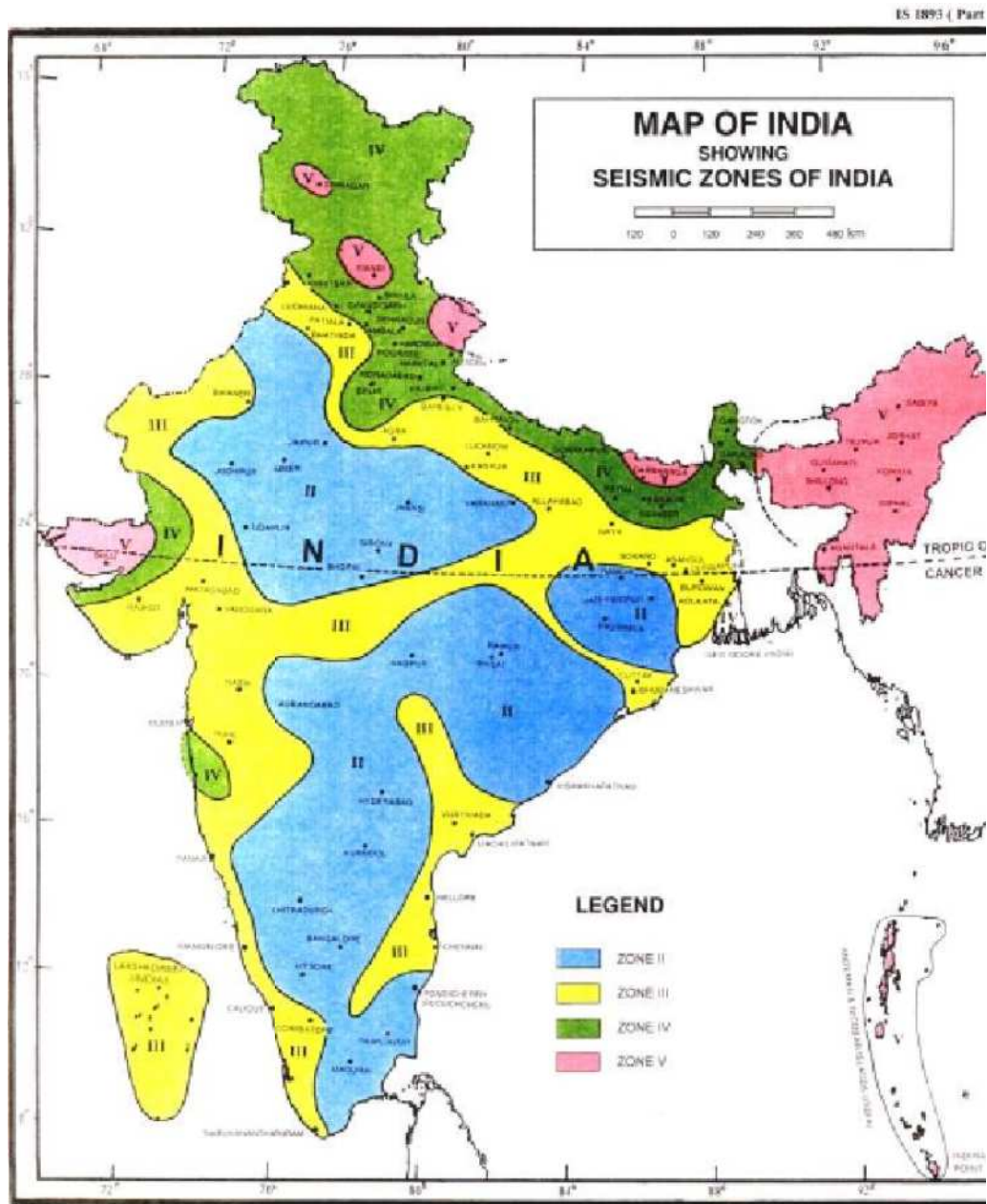
The project area lies in Mehbar and Maldi gneisses comprised of kyanite and psamatic gneisses with bands of schist and quartzite. These are intruded by basic and acidic rocks. Some of the rocks are well foliated. The general trends are North-South with moderate dips towards East. These are transacted by a number of joints of which the foliation and strike joints are the most predominant followed in frequency by steeply dipping transverse joints. The rock formations within the project area going upstream from the tailrace consist of Wangtoo, Rampur and Jutogh gneisses and granites. The Wangtoo rocks are overlaid by the Rampur followed by Jutogh, the three series having thrust contacts.



**Figure 4-15 Regional Geology of Himachal Pradesh**

The seismic zoning map of India published by Bureau of Indian standards is shown in Figure 4-16. According to which India is divided into four zones namely zone II, III, IV and V where zone II is least active and zone V is most active. On the seismic zoning map of India, Himachal Pradesh lies within the ambit of seismic zone – IV & V. The proposed Tidong hydropower project area lies in the seismic zone-IV. Available data on seismicity within a radius of 150 km of the project shows that earthquakes of magnitude greater than 5 on the Richter scale occur at frequent intervals.

Figure 4-16 Seismic Zoning Map of India



#### 4.3.6 Land Use and Land Cover

Land use and land cover mapping of the catchment area and influence zone falling within 10 km radius of the Tidong river basin was carried out by standard methods of remotely sensed data and digital image processing of satellite data.

The satellite imagery of catchment area and influence zone was generated from the two satellite imageries as mentioned in Table 4-1. The extracted satellite imagery of catchment area and influence zone is shown in Figure 4-17, and Figure 4-18 respectively.

Figure 4-17: False Colour Composite (FCC) map of catchment area generated from P6 LISS-III

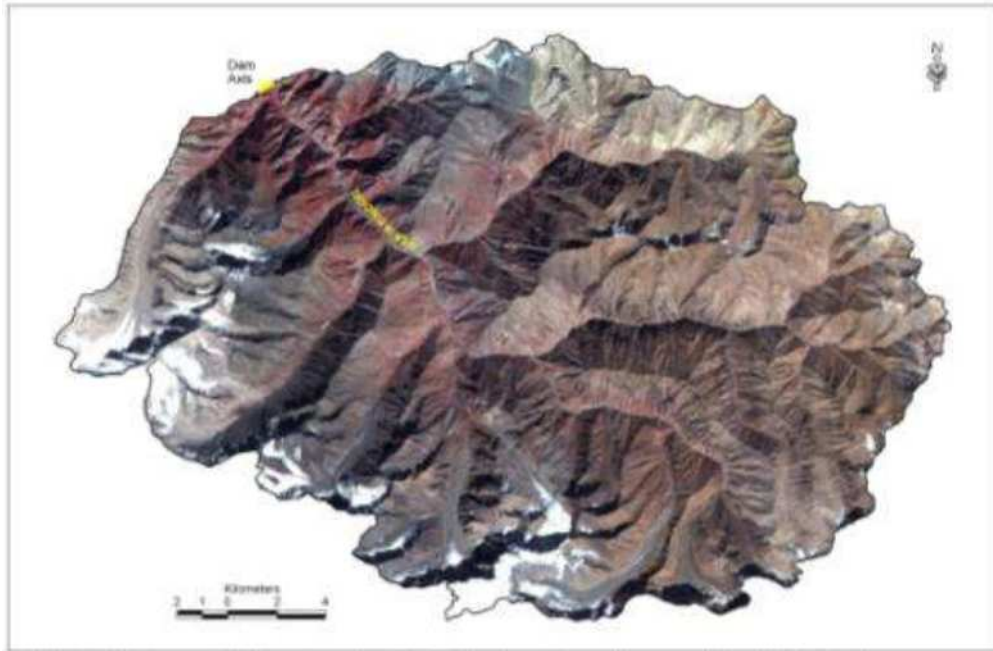
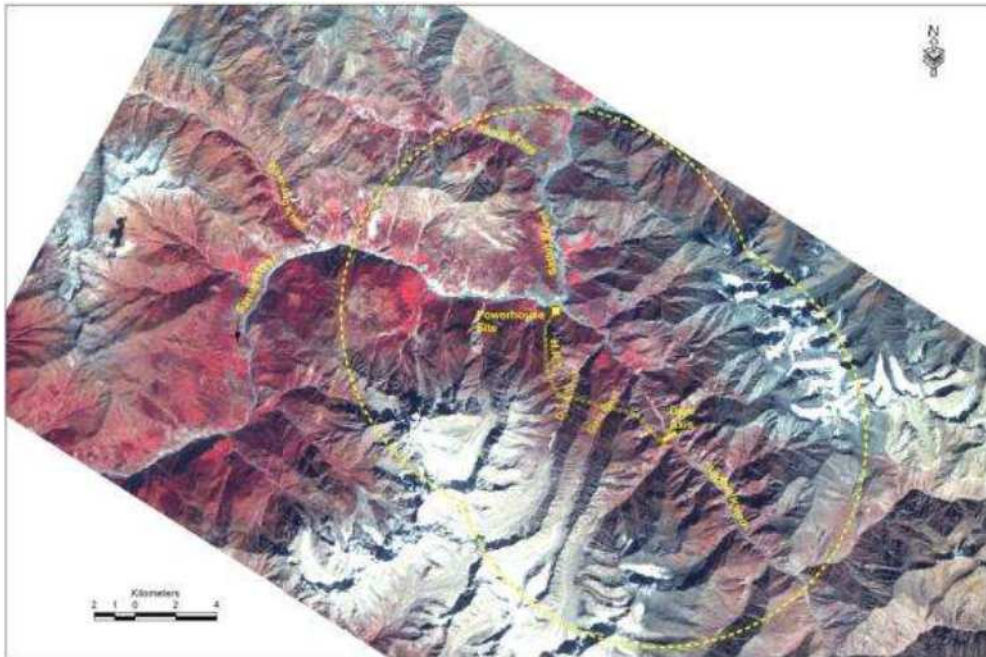


Figure 4-18: False Colour Composite (FCC) map of influence zone generated from P6 LISS-III



For the preparation of land use and land cover mapping, density classification was done by supervised, unsupervised and Normalized Difference Vegetation Index (NDVI) techniques. The land use of catchment area and influence zone is categorized into following categories:

- Dense forest - forest with canopy density more than 70%
- Moderately dense forest - forest with canopy density in the range of 40-70%
- Open forest - forest with canopy density between 10-40%
- Crop land
- Other non-forest land cover in the form of barren/ rocks, snow/ glaciers, lakes, etc.

The land use area for catchment area and influence zone is presented in Table 4-8.

**Table 4-8 Area of influence zone and catchment area under different land use categories**

Land Use/ land cover categories	Catchment Area		Influence Zone	
	Area (ha)	Percentage (%)	Area (ha)	Percentage (%)
Dense Forest	1537.77	2.69	17568.41	23.94
Open Forest	1493.64	2.61	14255.14	19.43
Scrub/ Alpine scrub	437.98	0.77	6510.42	8.87
Settlement & Cultivable area	162.95	0.28	2038.17	2.78
Barren/ Rocks	34032.49	59.52	16340.18	22.27
Moraines	12083.18	21.13	8612.24	11.74
River/ Waterbodies	65.16	0.11	603	0.82
Snow/ Glaciers	7364.7	12.88	7447.57	10.15
<b>Total</b>	<b>57177.87</b>	<b>100</b>	<b>73375.13</b>	<b>100</b>

**Catchment Area**

Tidong catchment area up to the proposed weir site of Tidong hydroelectric project is approximately 57177.87 ha. Most of the catchment region is characterized by barren land and rocks which amounts to more than 59% of total area. On the higher ridges of the catchment, about 12.88% of area is covered by snow and glaciers. The vegetation including dense and open forests together constitutes an area of 5.30% (2.69% and 2.61% respectively). While moraines at higher elevations are spread over the catchment with area coverage of 21.13%, a few patches of settlement and cultivable area are found along the Tidong River (Figure 4-19 and Figure 4-20).



Figure 4-19 Land use of catchment area of proposed project

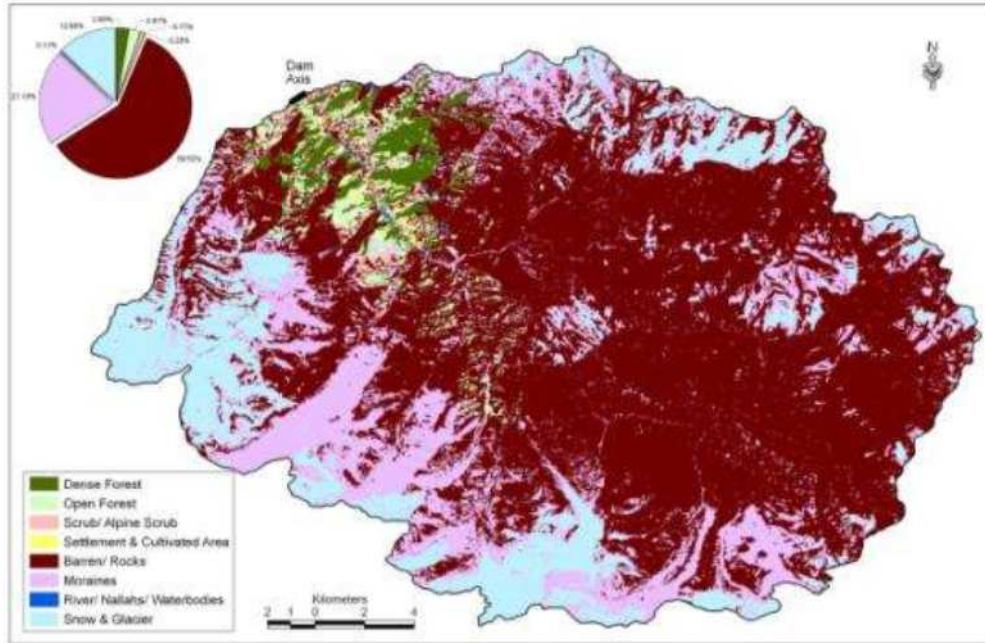
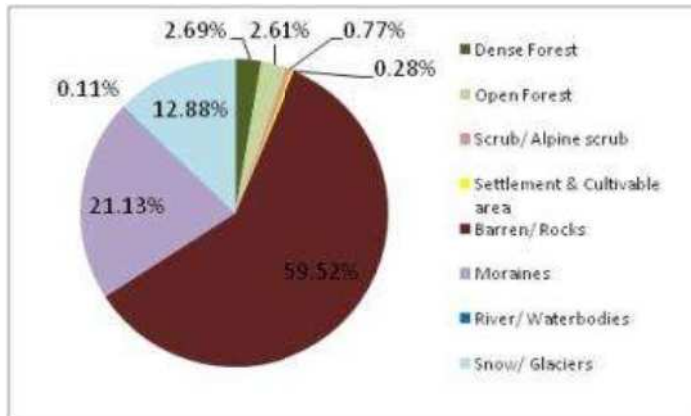


Figure 4-20 Area profile of different land use/ land cover classification for catchment area



**Influence Zone**

As per the norms of Ministry of Environment and Forests, Government of India, the study area considered for this project include 10 km radius around the dam site, HRT and powerhouse site. The study area cover all the village settlements and other eco-sensitive

areas where the project is likely to have impact due to the construction and operation of the project and has been referred as “Influence zone” in this EIA report. The total area of influence zone is about 73375.13 ha. In this zone, total vegetation (Scrub/ Alpine scrub, dense and open forests) predominantly covers the land with an area of 54.24%. 22.27% of influence zone area is either barren or rocky land. The settlement and cultivable area covers 2.78% of influence zone (Figure 4-21 and Figure 4-22).

**Figure 4-21 Land use of influence zone of proposed project**

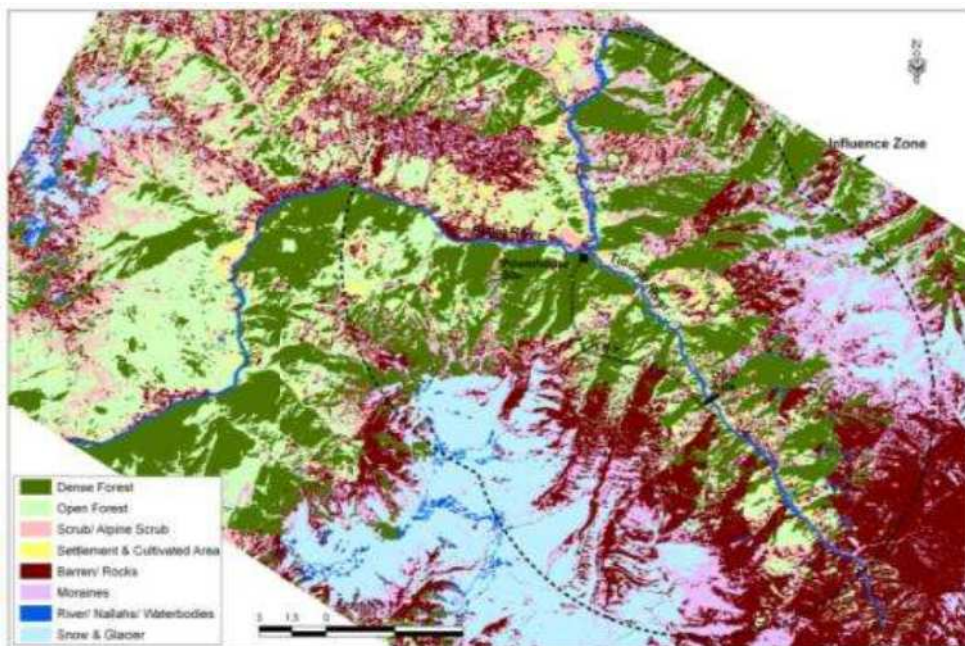
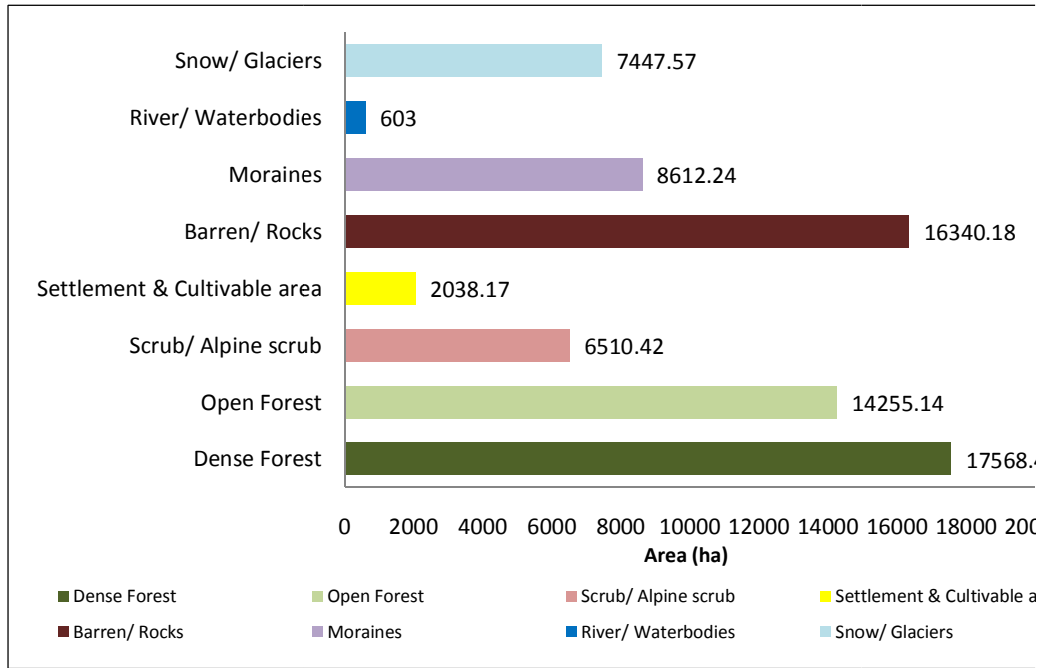




Figure 4-22 Area profile of different land use/ land cover classification for influence zone



## **4.4 Water Environment**

One of the main premises of water environment consists of water availability in the form of surface and ground resources, its quality and use (both present and intended). Study of the water environment is essential in preparation of EIA for identification of critical issues including planning the mitigation measures with a view to have optimum use of the water resources.

The total catchment area of Tidong at proposed barrage site is about 571 sq km, out of which about 95% is above permanent snowline (EL 4200m), which is either stony or snowbound area. No vegetation grows at such heights and in the snowbound and stony area. Tidong is primarily a snow fed stream. It also receives inflow from rainfall. A minimum release 15% of lean season minimum flow will be discharged from Tidong-1 barrage throughout the year in the Tidong stream. NTPGL will install online electronic flow meter to ensure this release and report to HP State Pollution Control Board.

### **4.4.1 Surface Water**

Surface water in the form of streams, rivers and springs is the main source of water in the area. Most of them are semi-perennial in nature being fed by the glaciers. Quality of the surface water is excellent, the reasons being that there are no sources of pollution, cascading effect in the streams/rivers and no scope for stagnation. The project area comprising of hilly terrain does not have any natural storages. Surface water in the area caters to the domestic, irrigation and other needs of the people.

### **4.4.2 Ground Water**

Most of the water needs in the project area are met from surface water, which has minimized the scope for ground water exploration/development. Development of ground water is also limited due to uncertainty of the aquifer as a characteristic of hilly and steep terrain. Ground water comes out at certain places on surface in the form of springs, most of which are perennial in nature as observed at site. During field visits a hand pump at village Thangi was also noted, which draws water from a depth of 40m. For drinking purpose use of spring water is preferred as it is rich in minerals.

### **4.4.3 Water Quality**

Water quality parameters of the surface water, which is the main source of water in the project area, have been studied to evaluate its suitability for drinking purpose along with anticipated impacts of the proposed project on water environment. The sampling and analysis was conducted for EIA 2005. Water quality can be expressed in terms of physical, chemical and biological characteristics. Essential characteristics like pH, colour, odour and

total suspended solid are covered under physical analysis; dissolved solids, total hardness, Calcium, Magnesium, Sulphates, Nitrates, Chloride, Fluoride and heavy metals under chemical analysis and Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Coliforms under biological/ bacteriological analysis.

To generate baseline data for existing quality of water in the project area, eleven (11 nos.) water samples (composite) were collected and analyzed as per the procedure specified in standard methods for examination of water and wastewater published by American Public Health Association and the Bureau of Indian Standards (APHA/BIS). Representative samples from river Satluj were also taken at its confluence with Tidong at upstream and downstream points, considering its importance during project activities. To establish the ground water quality, one sample each from Hand pump at Thangi village and a natural spring near Gautam Dogri was also collected. Almost all the important physico-chemical attributes as well as microbiological parameters were analyzed for all the eleven samples collected. The sampling locations can be referred from Figure 4-23. The results of the analysis carried out for the sampling undertaken are summarized in Table 4-9. Some of the important results are also represented in Figure 4-24 and Figure 4-25.

**Figure 4-23: Water Sampling Locations**

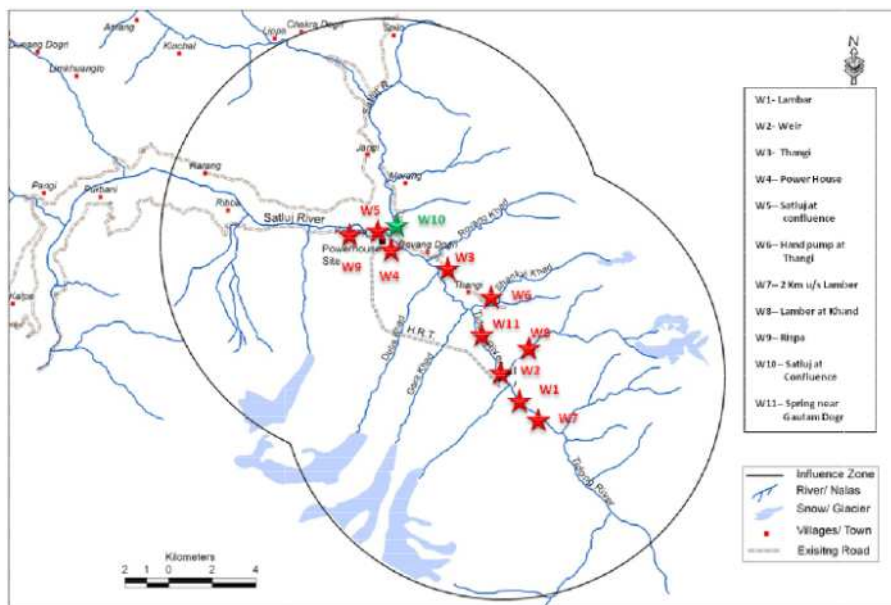


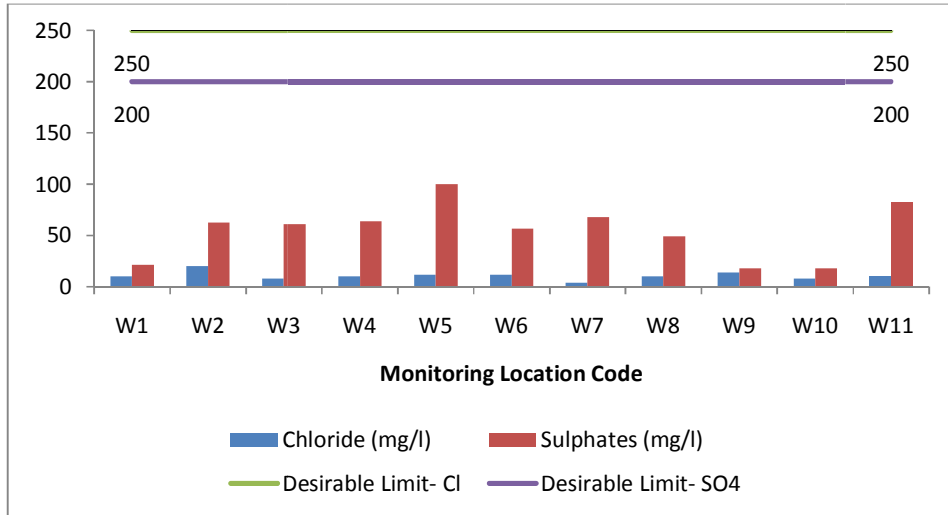
Table 4-9 Water Analysis Results

S.No.	Parameter	Unit	Results											Desirable Limit BIS 10500-1991	WHO Drinking Water Guidelines, 1993
			1	2	3	4	5	6	7	8	9	10	11		
1	pH		7.0	7.2	7.0	7.0	7.0	7.0	7.3	7.2	7.4	7.2	7.1	6.5-8.5	-
2	Colour	Hazen Unit	<5	<5	<5	<5	<5	<5s	<5	<5	<5	<5	<5	5	-
3	Odour		Odourless	Odourless	Odourless	Odourless	Odourless	Odourless	Odourless	Odourless	Odourless	Odourless	Odourless	Unobjectionable	Unobjectionable
4	Dissolved Oxygen	mg/l	7.5	7.5	7.8	7.8	8.2	8.2	7.4	7.6	7.6	7.9	8	-	-
5	Total Harness as CaCO3	mg/l	144	296	320	280	400	272	197	163	111	146	128	300	-
6	Calcium Hardness	mg/l	88	192	192	208	208	192	68	67	48	83	98	75	-
7	Magnesium Hardness	mg/l	56	104	128	72	192	80	129	96	63	63	29	30	-
8	Chloride as Cl	mg/l	10	20	8	10	12	12	4	10	14	8	10	250	250
9	Fluoride as F	mg/l	0.5	0.5	0.75	0.75	1	0.75	0.75	0.75	0.75	1	0.75	1	1.5
10	Nitrate as NO <sub>3</sub>	mg/l	10	10	10	10	10	10	ND	0.1	1	3	1.9	45	50
11	Phosphate as PO <sub>4</sub>	mg/l	0.15	0.15	0.15	0.15	0.15	0.15	0.08	0.04	0.06	0.07	0.06	-	-
12	Arsenic (as As)	mg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ssND	0.01	0.01
13	BOD (5 days at 20°C)	mg/l	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	-	-
14	Cadmium (ad Cd)	mg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.01	0.003
15	Chromium (as Cr)	mg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.05	0.05
16	COD	mg/l	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	-	-
17	Coliforms	MPN/100ml	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	-
18	Copper (as Cu)	mg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.05	2
19	Cyanide (as Cn)	mg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.05	0.07
20	Lead (as Pb)	mg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.05	0.01
21	Manganese (as Mn)	mg/l	0.004	0.03	0.046	0.048	0.043	0.014	0.01	0.03	0.041	0.028	0.014	0.10	0.5
22	Mercury (as Hg)	mg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.001	0.001
23	Selenium (as Se)	mg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.01	0.01
24	Sulphates (as SO <sub>4</sub> )	mg/l	21.32	62.47	60.97	63.67	100	56.76	68	49	18	18	82	200	500
25	Total Dissolved Solids	mg/l	89.19	210.57	219.42	208.36	317.1	205	212	192	154	224	232	500	-
26	Total Iron (as Fe)	mg/l	0.223	0.327	0.203	0.215	0.286	0.225	0.45	0.13	ND	ND	ND	0.3	-
27	Total Suspended Solids	mg/l	0.5	3.7	2.6	3.8	93.5	0.29	1.5	5.2	3.5	56.5	1.3	-	-
28	Zinc (as Zn)	mg/l	0.036	0.098	0.115	0.102	0.106	0.085	0.036	0.045	0.102	0.102	0.085	5	3

\*Location Code: 1 Lambar village; 2 Weir site; 3 Thangi village; 4 Powerhouse site; 5 Satluj at Confluence d/s; 6 Hand pump at Thangi; 7 Two km u/s Lambar; 8 Lambar khad; 9 Rispa Village; 10 Satluj at Confluence u/s; 11 Spring near Gautam Dogri;

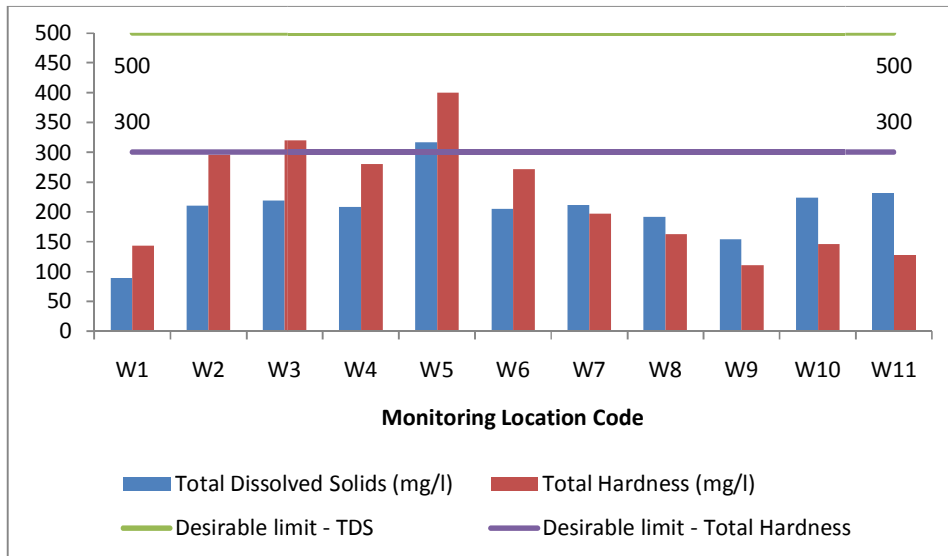
Source: Field Study by RITES for EIA-2005

**Figure 4-24 Chloride and Sulphate Concentration in 11 water samples**



The analysis shows that the concentration of Chloride (Cl) in water taken from all the eleven locations ranged from 4 to 20 mg/l. The maximum concentration was of Chloride recorded at location near Weir. However, the recorded values of Chloride are quite low and do not exceed the desirable limits of 250 mg/l. Similarly the concentration of Sulphate (SO<sub>4</sub>) in the water samples varied from 18 to 100 mg/l with maximum value found in the sample taken from Satluj at the downstream of confluence with Tidong. None of the concentration recorded for SO<sub>4</sub> exceeded the desirable limit of 200 mg/l.

**Figure 4-25 Total Dissolved Solids and Total Hardness Concentration in 11 water samples**



As evident from the table and graphs, the water is almost neutral with pH varying from 7.0 to 7.4 through the study area. DO ranges from 7.4 to 8.2 mg/l indicating it to be rich in dissolved oxygen. Test results of most of the parameters are within desirable limits of drinking water except for total hardness and Iron content. The total hardness exceeds the BIS 10500-1991 drinking water standards at two locations namely the Satluj confluence at u/s and d/s. Iron content in 2 results exceeded the standards. On the basis of CPCB Water Quality Criteria, it can be concluded that quality of all the samples fall under 'A' category of water with respect to pH, DO and BOD and total Coliform.

#### 4.4.4 Source of Pollution

As per the interaction with the local people and information gathered during field visits, no significant sources of pollution (industrial), other than the domestic one, exists in the project area. The sewage from domestic sources is let out either on land or to nearby water bodies without any treatment. Since, the population density is low the quantity of wastewater generated from domestic waste water is less, and no significant adverse impact on water quality is observed.

### 4.5 Meteorology and Air Environment

Meteorological factors decide the dispersion of air pollutants and are an important aspect in any environmental impact assessment study. Movement of air pollutant is dependent on the wind speed and wind direction, the temperature and humidity also affects the dispersion of pollution. Meteorological parameters i.e. wind, temperature, humidity and rainfall are discussed in the subsequent sections.

#### 4.5.1 Meteorology

The project area falls in temperate climate zone with winters from November to April and summers from May to October. The winter season is a little extended by virtue of elevation of the area. The summer season in itself includes the rainy season from July to September. The transition period from April to May and from September to October correspond to the spring and autumn seasons of the area. Broadly speaking three seasons viz. winter, summer and rainy are discernible.

**Winter Season:** Though the duration of winter season depends on altitude, it generally lasts from November to April in most parts of the tract. It is characterized by heavy frost in the lower areas and fairly heavy snowfall at higher elevation. Rain and snow during winter season come from north-western air currents, and snowfall starts at higher elevations towards the end of November or early in December. It does not contribute directly to the stream discharge significantly and mostly feeds the snow/glacier bound area of the catchment. The snow comes down to 1300 m elevation, but it seldom lies long below 2000

m. Snow generally disappears before the middle of May, all the areas are clear of snow except the shady localities on northern faces and the nallahs. Snow lies almost permanently above 4500 m.

**Summer Season:** This is characterized by frequent showers in the moist or wet zone while in the dry zone, snowfall as late as May has taken place at Kalpa in 1957. This period is of intense phonological activity at the higher elevations and can be termed as spring. At this time of the year the lower valleys are hot. Hot winds blowing up the Satluj and hot sun in arid and semi-arid parts allow only a short spring.

**Rainy Season:** It starts with the advent of monsoons either towards the end of June or early in July and lasts till middle or sometimes up to the end of September. The bulk of rainfall is received during this period in the wet zone. In the inner valley beyond Wangtu, the rainfall shows a progressive decline followed by an enhanced snowfall so much so that at pooh, there is higher snowfall and absolutely no rains. The distribution of rainfall is, however, not regular. Sometimes it rains exceptionally heavy for a few days and rest of the rainy season may go dry. Such exceptionally heavy cloud bursts cause havoc to tree growth and result in heavy erosion, massive landslides and floods. The scars of landslides caused by such unusual cloudbursts take several years to heal.

After the rainy season, the sky becomes clear and there is very little rain, if any, during October to November. In these months the diurnal range of temperature is quite marked. The soil loses moisture very rapidly. There is thus another dry period during the months of October and November. All the areas above about 1200 m elevation experience severe frost especially in the depressions.

**Rainfall:** The climate of the Satluj Valley shows a gradual alteration from the heavy monsoon of the outer Himalayas to the arid Tibetan type with a winter snowfall and practically no summer rain. The monsoon clouds advancing from the plains of India are combed out by the outer ranges of the hills, where most of the monsoon rain falls, so that the inner valleys get a good deal of cloud but no steady precipitation. The snow fall is also heavier in the Himalayas than it is on the Tibetan plateau, but the zone of heavy snowfall includes the whole of Kinnaur and it is only beyond the Tibetan border and up in Spiti Valley that the snowfall shows any marked decline. Table 4-10 is given with rainfall recorded at Moorang Tehsil (2001-2004) and at Kalpa Meteorological observatory (2004).

**Table 4-10 Rainfall in Project Area**

Months	Rainfall in mm				
	Moorang				Kalpa
	2001	2002	2003	2004	2004
January	3.6	35.2	33.3	149.7	117.5
February	34.1	149.1	209.9	16.3	53.9

March	69.4	22.6	38.2	0	5.7
April	7.1	108.6	126.7	46.9	46
May	10.1	24.34	33.7	18.3	40.1
June	12.5	0	13.7	1.4	4.8
July	6.5	0	25.3	14.2	25.9
August	33.5	23.6	11.2	28.4	53
September	2.4	34.4	0	0	5.9
October	0	2.4	0	32.3	185.5
November	8.8	0	0	0	0
December	34.6	0	60.1	7.8	31.8
<b>TOTAL</b>	<b>222.6</b>	<b>400.24</b>	<b>552.1</b>	<b>315.3</b>	<b>570.1</b>

Source: Rites EIA-2005

Observations from the above table show an increase in annual rainfall from 2001-through 2003 but shows decline in the year 2004. Overall figures of the annual rainfall in the project area (Moorang) indicate that the area in general receives quite less rains. The monthly rainfall and snowfall data of Kalpa (2003) as given in Table 4-11 represent the rainfall and snowfall trend of the project area.

**Table 4-11 Snowfall Trends in Project Area (Kalpa) in 2003 and 2008**

Month	Rainfall, mm		Snowfall, cm	
	2003	2008	2003	2008
January	0	0	45.5	100
February	0	1	139.9	68
March	23.9	20	85.6	201
April	83.5	61	16	8
May	59.6	41	0	0
June	28.2	41	0	0
July	78.2	31	0	0
August	32.5	53	0	0
September	26.8	36	0	0
October	4.9	32	0	0
November	0	2	6.4	17
December	0	2	75.1	43
<b>Total</b>	<b>337.6</b>	<b>320</b>	<b>368.5</b>	<b>437</b>

**Water Availability:** Discharged data as 10 days average flow of Tidong River at the proposed barrage site between Dec-2004 and Jul-2010 as provided by the NTPGL is given in Table 4-12. The data suggests that the winter months have lesser discharge and the monsoon months (July-Aug) have higher discharge. The minimum flow observed was on January 2005 and is 4.53 cumec and the maximum flow of 75.149 cumec in July 2006.



Highest flood level at Barrage is calculated at 2889.40 msl and at Tail Race it has been calculated as 2250 msl.

**Table 4-12: Discharge Data of Tidong River at Lambar**

Period	Discharge (Cumeecs)						
	2004	2005	2006	2007	2008	2009	2010
<b>Jan I</b>	-	4.53	6.929	6.692	7.197	7.09	6.834
<b>II</b>	-	5.41	6.434	6.233	6.654	6.97	6.155
<b>III</b>	-	4.61	6.354	6.252	6.302	6.78	6.308
<b>Feb I</b>	-	4.79	6.382	6.729	6.691	5.78	6.152
<b>II</b>	-	4.93	6.507	6.730	6.872	6.01	6.307
<b>III</b>	-	4.75	6.941	6.473	6.898	6.15	7.166
<b>Mar I</b>	-	4.82	6.568	6.566	6.487	6.96	7.498
<b>II</b>	-	5.67	7.063	7.013	6.953	7.09	8.509
<b>III</b>	-	5.29	6.741	8.039	6.710	7.43	8.878
<b>Apr. I</b>	-	5.21	7.460	7.324	6.340	6.24	8.166
<b>II</b>	-	5.95	7.856	7.621	7.342	7.07	10.337
<b>III</b>	-	7.94	8.733	8.971	9.272	8.39	13.689
<b>May I</b>	-	10.73	9.424	11.611	10.578	9.93	17.274
<b>II</b>	-	10.88	11.09	11.588	10.966	12.95	22.796
<b>III</b>	-	10.71	14.648	10.028	12.551	17.62	29.781
<b>Jun. I</b>	-	12.15	17.168	12.872	14.584	18.23	24.942
<b>II</b>	-	23.93	19.954	25.813	25.733	15.65	26.345
<b>III</b>	-	43.22	37.04	36.398	41.410	35.050	49.363
<b>July. I</b>	-	58.08	75.149	46.867	59.949	43.33	52.253
<b>II</b>	-	62.2	73.187	51.531	71.434	47.69	53.609
<b>III</b>	-	60.97	67.617	56.872	69.454	51.36	54.673
<b>Aug. I</b>	-	58.1	67.258	54.733	65.827	52.09	
<b>II</b>	-	52.49	54.446	49.772	57.168	49.43	
<b>III</b>	-	46.73	48.366	46.959	50.578	43.76	
<b>Sep. I</b>	-	31.45	36.531	35.762	36.01	30.93	
<b>II</b>	-	20.54	27.079	28.176	26.51	22.554	
<b>III</b>	-	18.37	21.445	21.928	20.02	19.358	
<b>Oct. I</b>	-	12.912	14.150	14.540	12.61	17.916	
<b>II</b>	-	8.610	9.096	9.132	11.03	13.644	
<b>III</b>	-	7.527	7.449	7.730	8.34	8.695	
<b>Nov. I</b>	-	6.878	7.195	7.336	7.35	8.785	
<b>II</b>	-	7.022	6.552	6.953	6.93	9.806	
<b>III</b>	-	5.955	5.795	5.949	6.12	8.75	
<b>Dec. I</b>	5.33	5.841	5.888	6.148	6.05	8.21	
<b>II</b>	5.48	6.309	6.397	6.383	6.41	7.24	
<b>III</b>	5.49	7.1366	6.796	6.903	6.76	7.22	

**Temperature and Humidity:** Temperature in different parts of the tract varies according to the elevation. Temperature begins to rise rapidly from the end of February, till June, which is the warmest month. The temperature remains high during July and August in the arid zone because it lies beyond the reach of the monsoons. The weather is cool and pleasant in the summer season except in the deep valleys. With the onset of southwest monsoon by the end of June, the temperature begins to decrease gradually; however, the drop is rapid only after October. January is the coolest month. In association with the passage of western disturbances in the cold season, the tract experiences spells of cold weather when temperature often goes down several degrees below the freezing point. Frost occurs from October to May.

Temperature and Humidity were monitored from 27-Apr-05 to 1-May-05 between 0600 hours to 2200 hours at five locations in the project area. The results of the same are tabulated in Table 4-13.

**Table 4-13 Temperature and Humidity Observations (APRIL/MAY 2005)**

TIME hrs	AKPA A1		THANGI A2		LAMBAR A3		BARRAGE SITE A4		POWER HOUSE A4	
	Temp °C	Hum %	Temp °C	Hum %	Temp °C	Hum %	Temp °C	Hum %	Temp °C	Hum %
600	10	62	10	74	9	73	5	84	12	54
800	15	48	15	68	12	65	6	70	14	47
1000	20	36	12	54	16	50	15	48	16	43
1200	22	33	11	52	17	34	18	21	20	32
1400	23	28	13	55	18	36	16	24	21	27
1600	21	20	12	76	13	35	13	25	13	25
1800	18	32	10	74	11	41	11	38	12	35
2000	15	39	9	73	9	48	10	50	10	54
2200	12	54	8	72	8	59	10	54	8	79

Source: Field Study by RITES for EIA-2005

Monthly mean temperature (maximum and minimum) and monthly mean relative humidity (0830 and 1730 hours) for Kalpa meteorological centre have been given at Table 4-14. The data has been collected from Regional Meteorological Centre, New Delhi, for Kalpa meteorological centre which is the nearest observatory to the project site. The monthly mean of maximum daily air temperatures at Kalpa meteorological centre varies from 24.5 to 6.1 °C. The monthly mean of minimum daily air temperatures varies from -2.9 to 12.1 °C.

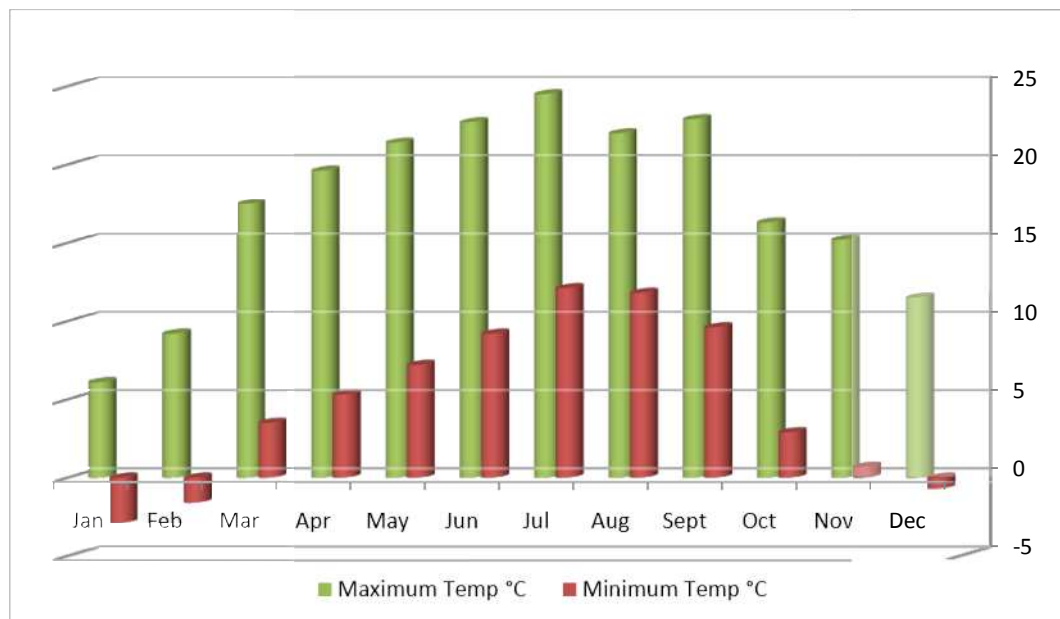
**Table 4-14 Temperature and Relative Humidity for Kalpa**

Months	Monthly Mean Temperature °C		Monthly Mean Relative Humidity %	
	Maximum	Minimum	0830 hrs	1730 hrs

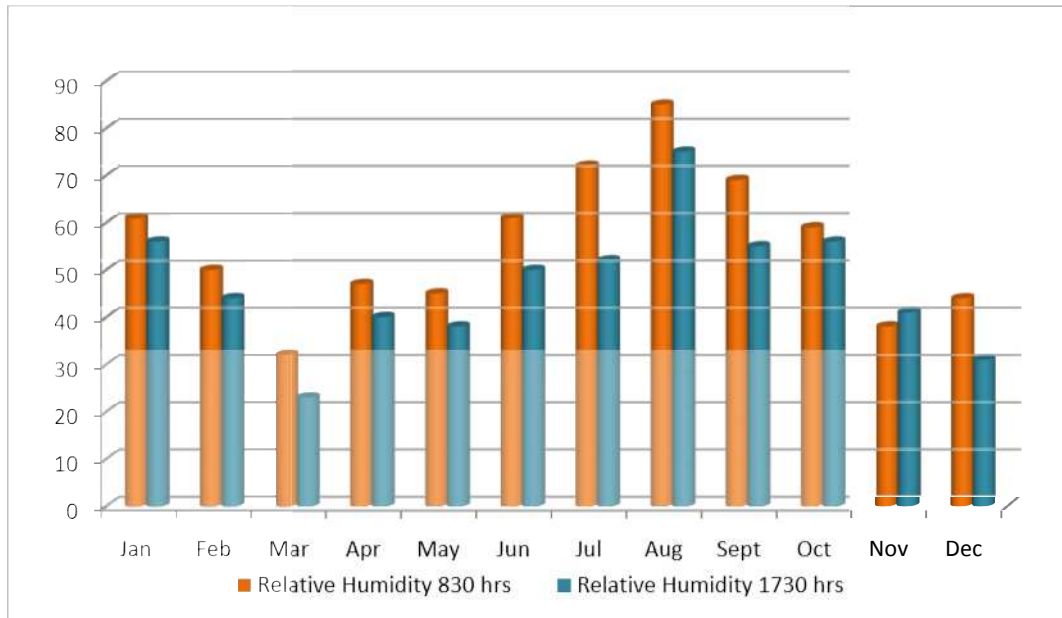
<b>January</b>	6.1	-2.9	61	56
<b>February</b>	9.2	-1.6	50	44
<b>March</b>	17.5	3.5	32	23
<b>April</b>	19.6	5.3	47	40
<b>May</b>	21.4	7.2	45	38
<b>June</b>	22.7	9.2	61	50
<b>July</b>	24.5	12.1	72	52
<b>August</b>	22	11.8	85	75
<b>September</b>	22.9	9.6	69	55
<b>October</b>	16.3	2.9	59	56
<b>November</b>	15.2	0.7	38	41
<b>December</b>	11.5	-0.7	44	31

*Source: Regional Meteorological Centre, New Delhi*

**Figure 4-26 Monthly Mean Temperature (°C) for Kalpa**



**Figure 4-27 Monthly Mean Relative Humidity (%) for Kalpa**



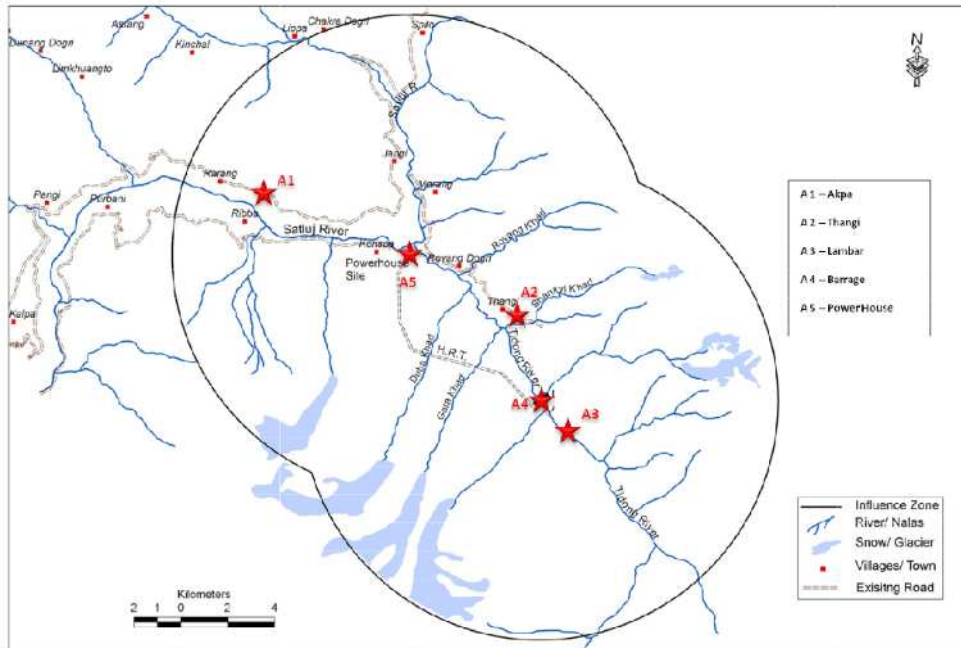
**4.5.2 Air Quality**

The ambient air quality monitoring within the study area of 10 km radius with reference to barrage axis was accomplished. The monitoring stations were selected to get the representative samples of the ambient air quality in the project area, which would also help in assessing the conformity to standards of the ambient air quality during the construction and operation of the project. The existing ambient air quality of the study area serves as an index for assessing the pollution load and the assimilative capacity of any region and forms an important tool for planning further development in the area. The sampling locations have been shown in the Figure 4-28.

Air quality monitoring was carried out from 27th April, 2005 to 1st May, 2005 for the following five parameters:

- Suspended Particulate Matter (SPM),
- Respirable Suspended Particulate Matter (RSPM),
- Sulphur Dioxide (SO<sub>2</sub>),
- Nitrogen Oxide (NO<sub>x</sub>) and
- Carbon Monoxide (CO)

**Figure 4-28: Air Sampling Locations**



**Sampling schedule:** Monitoring at all the selected five locations was conducted in two shifts of 8 hourly monitoring (06-1400 hrs and 1400-2200 hrs). The average results of the air quality monitoring are given in Table 4-15. Average concentration of SPM and RSPM at 5 sampling locations (shift wise) is shown in Figure 4-29

The results were compared with the national ambient air quality standards prescribed by Central Pollution Control Board (CPCB) for residential, rural and other areas. A summary of ambient air quality monitoring results is as follows:

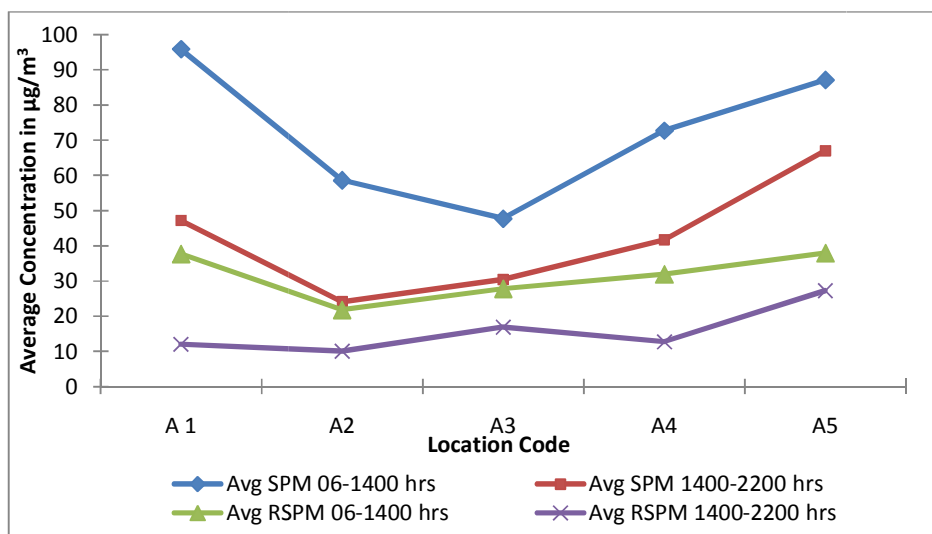
**Table 4-15 Air Quality Monitoring Results**

Location	Code	Shift	AVERAGE CONCENTRATIONS in $\mu\text{g}/\text{m}^3$				
			SPM	RSPM	SO2	NOX	CO*
Akpa	A1	1	<i>95.81</i>	37.66	7.78	12.39	<i>1.7</i>
		2	47.2	12.07	<5	5.78	1
Thangi	A2	1	58.6	21.8	6.67	14.3	1
		2	<i>24.1</i>	<i>10.1</i>	<5	7.16	0.7
Lambar	A3	1	47.7	27.8	<i>8.89</i>	11.56	1.3
		2	30.4	16.9	<5	6.06	1
Barrage	A4	1	72.7	31.9	<5	4.95	0.33
		2	41.7	12.8	<5	<i>3.3</i>	<i>ND</i>
Power House	A5	1	87.1	<i>37.9</i>	10	<i>24.2</i>	0.7
		2	67	27.2	<i>8.89</i>	23.67	0.7

Source: Field Study by RITES for EIA-2005

\* indicates concentration in ppm; Results in Italics red are min-max for the parameter

**Figure 4-29: Average concentration of SPM and RSPM at 5 sampling locations (shift wise)**



**SPM:** The concentration of SPM in the ambient air recorded at the five locations ranged from 24.1 to 95.81  $\mu\text{g}/\text{m}^3$ . The maximum concentration was found at Akpa.

**RSPM:** The concentration of RPM ranged from 10.1 to 37.9  $\mu\text{g}/\text{m}^3$  at the five monitoring locations. The maximum concentration of RPM was recorded at Power house site.

**SO<sub>2</sub>:** The SO<sub>2</sub> concentration ranged from 8.89 to less than 5  $\mu\text{g}/\text{m}^3$  in the ambient air recorded at the five locations. The maximum concentration was recorded at the Power house site and Lambar village location.

**NO<sub>x</sub>:** The NO<sub>x</sub> concentration ranged from 3.3 to 24.2  $\mu\text{g}/\text{m}^3$  at all the five locations. The maximum concentration was found at Power house site.

**CO:** The concentration of CO recorded in the ambient air ranged from 0.33 to 1.7 ppm. However, the CO concentration could not be detected at Barrage site during second shift, indicating its values to be less than 0.1 ppm.

However the results of ambient air quality monitoring which was undertaken in the previous EIA (by RITES) cannot be compared either with the WHO Ambient Air Quality Guidelines or with National Ambient Air Quality Standards. 8 hourly monitoring in two shifts is not acceptable as per these guidelines. Hence, fresh monitoring data needs to be generated for ambient air quality. The details of suggested monitoring plan are given in Section 7.11 of this report.

#### 4.5.3 Wind Speed and Wind Direction

Data for wind speed and direction were collected to prepare wind rose diagram of winter, summer and rainy season. Annual wind rose diagram has also been drawn to get the annual average result of wind speed and wind direction. The wind rose diagram has been drawn for 830 hours and 1730 hours time. These diagrams are depicted in **Figure 4-30** to **Figure 4-37**. Wind direction during morning and evening hours have been found out from these diagrams and given in Table 4-16, which indicates that wind direction prevailing in the morning hours is northeast and that in the evening time is southwest.

**Table 4-16 Prevailing Wind Direction**

Season	Prevailing Wind Direction	
	0830 hrs	1730 hrs
Annual	NE	SW
Summer	NE	SW
Winter	NE	SW
Rainy	NE	SW

*Source: Field Study by RITES for EIA-2005*

Figure 4-30 Wind Rose Diagram: Winter - 8.30 hrs

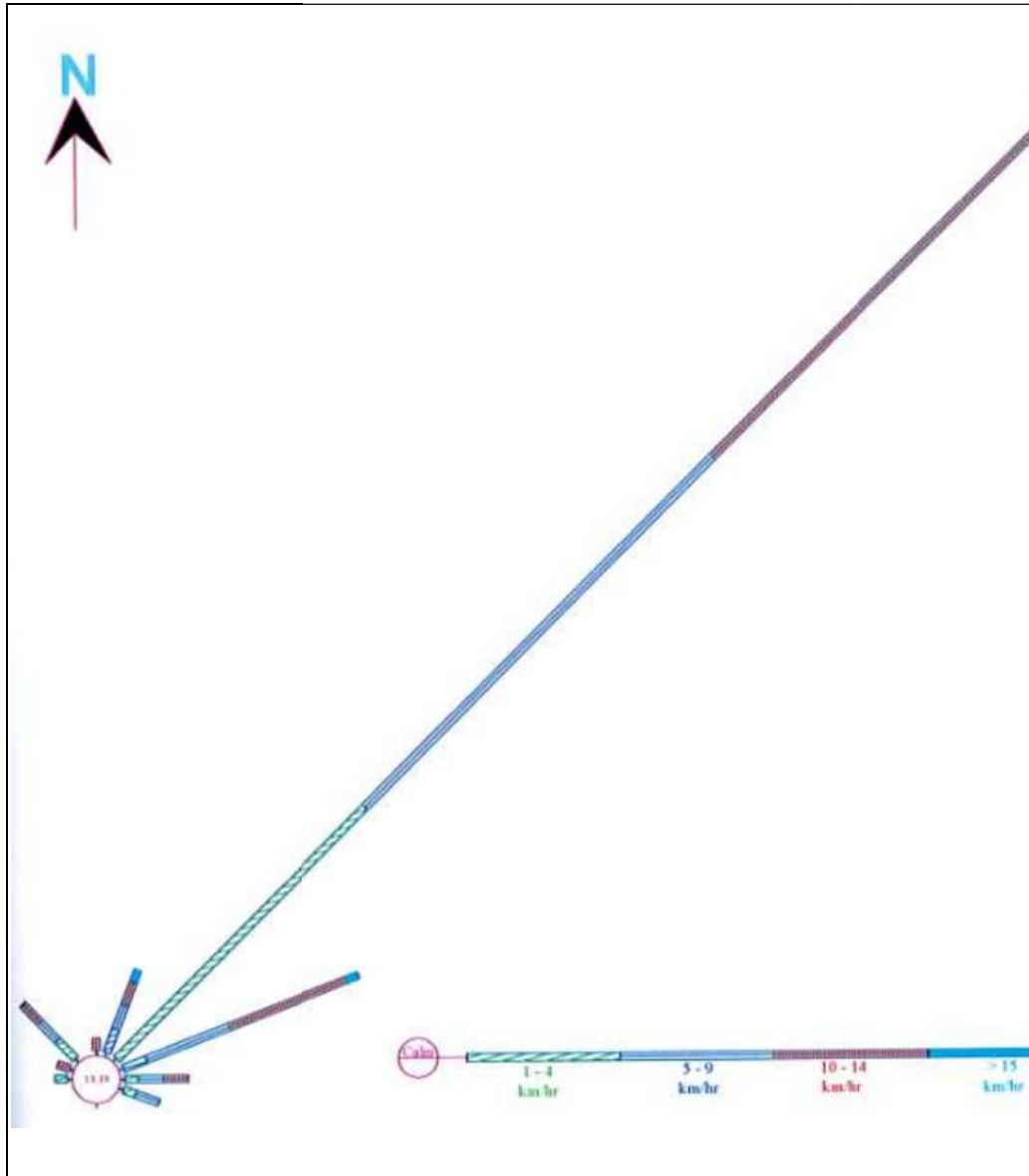




Figure 4-31 Wind Rose Diagram: Winter - 17.30 hrs

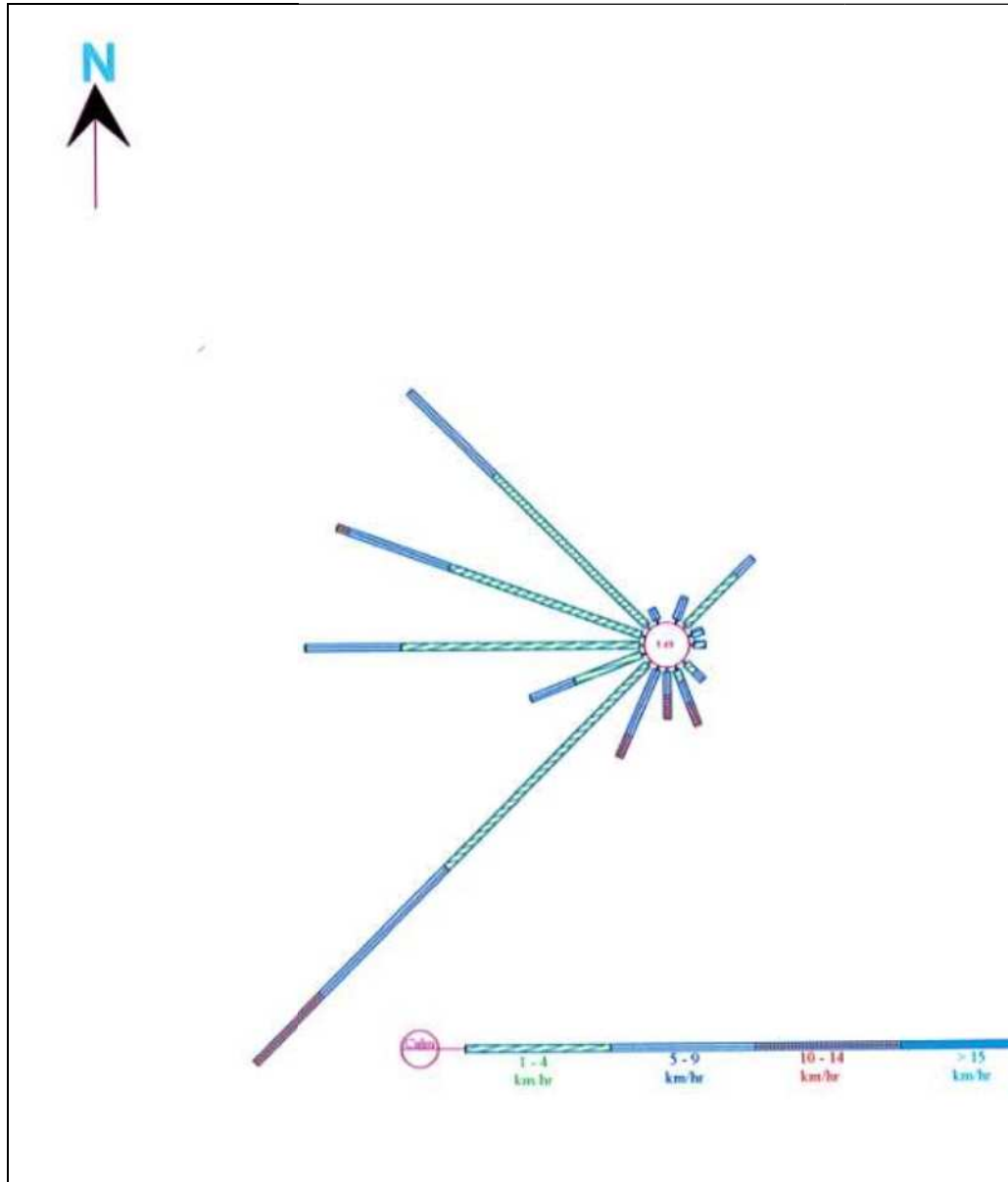


Figure 4-32 Wind Rose Diagram: Summer - 8.30 hrs

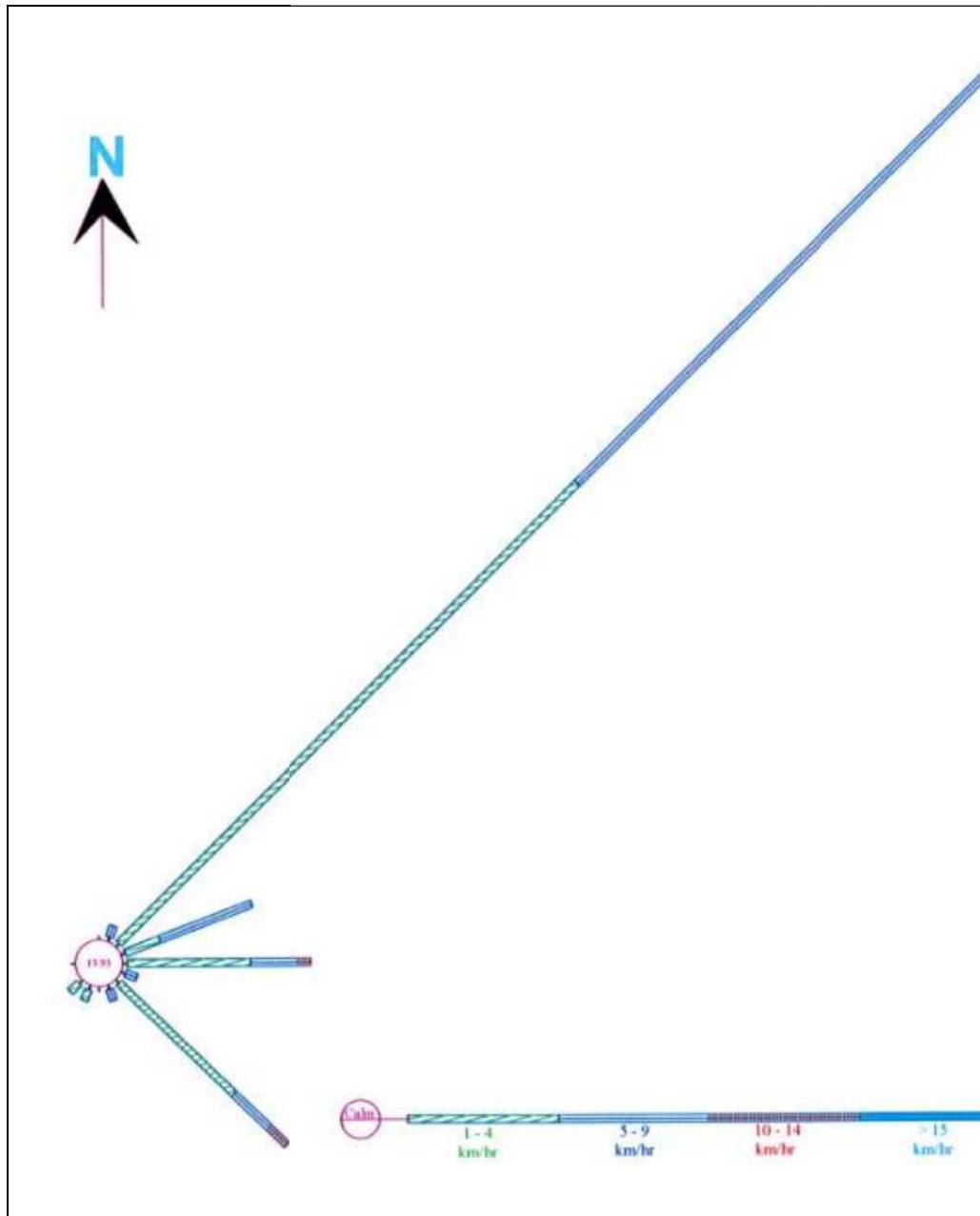


Figure 4-33 Wind Rose Diagram: Summer - 17.30 hrs

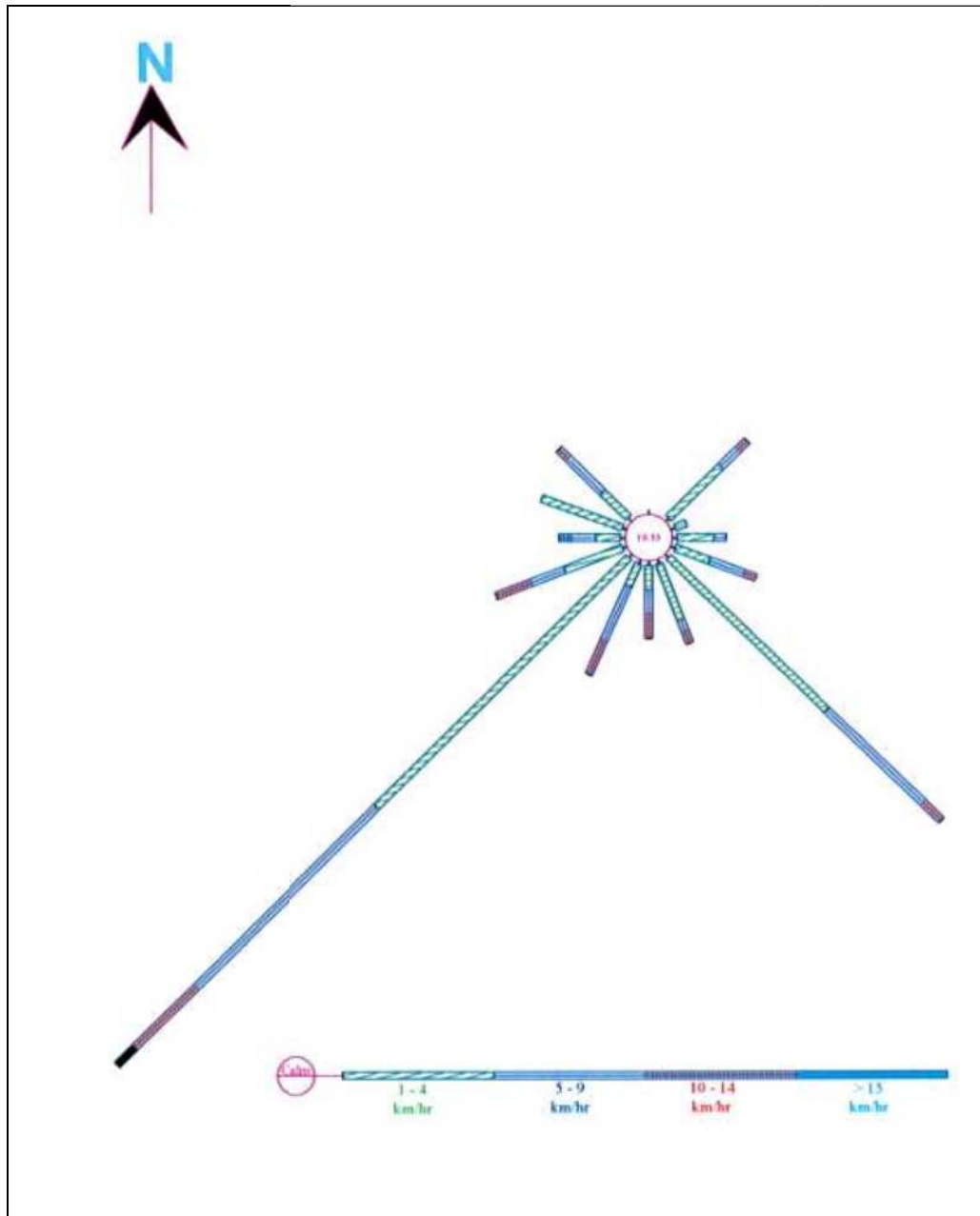


Figure 4-34 Wind Rose Diagram: Rainy – 8.30 hrs

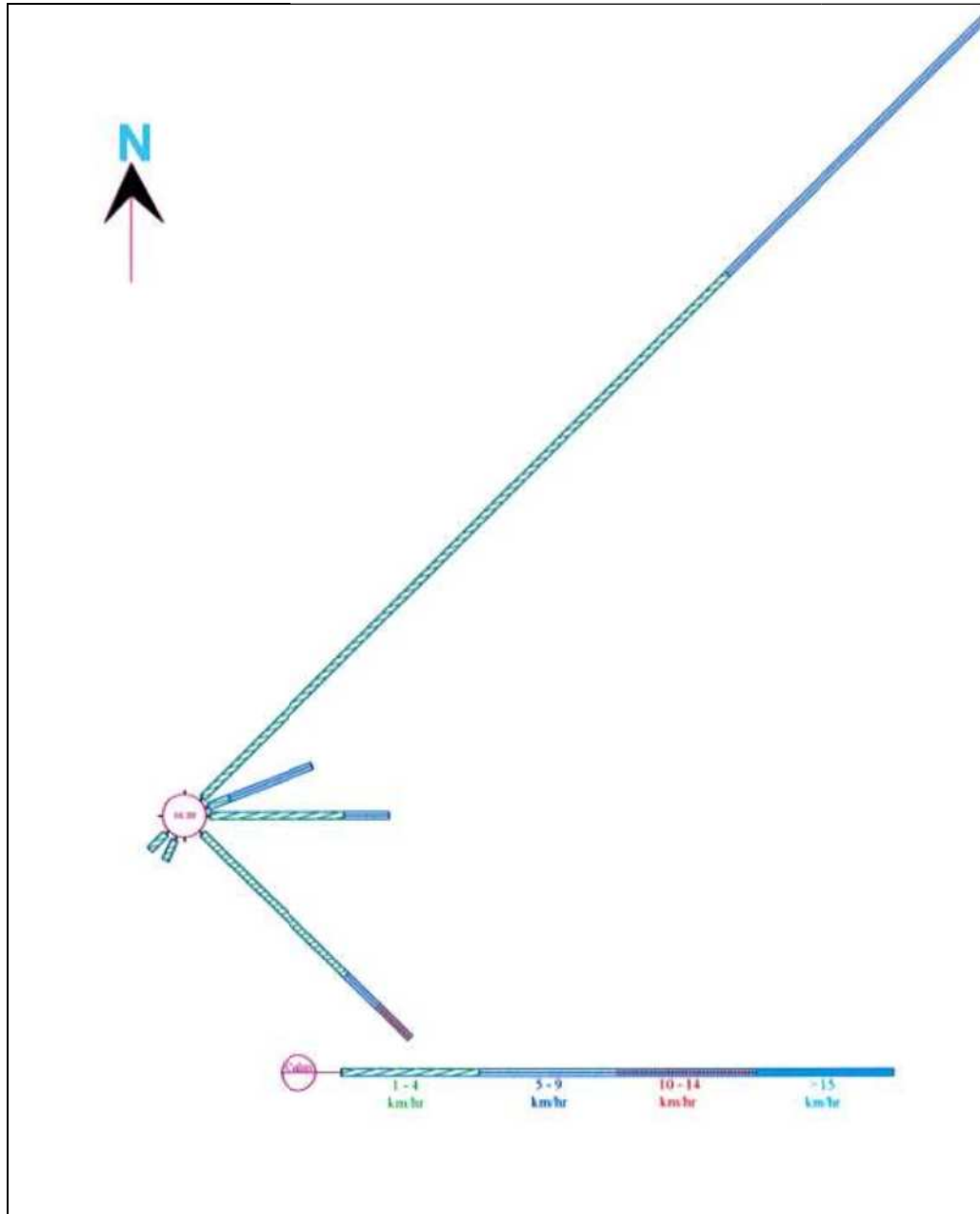


Figure 4-35 Wind Rose Diagram: Rainy– 17.30 hrs

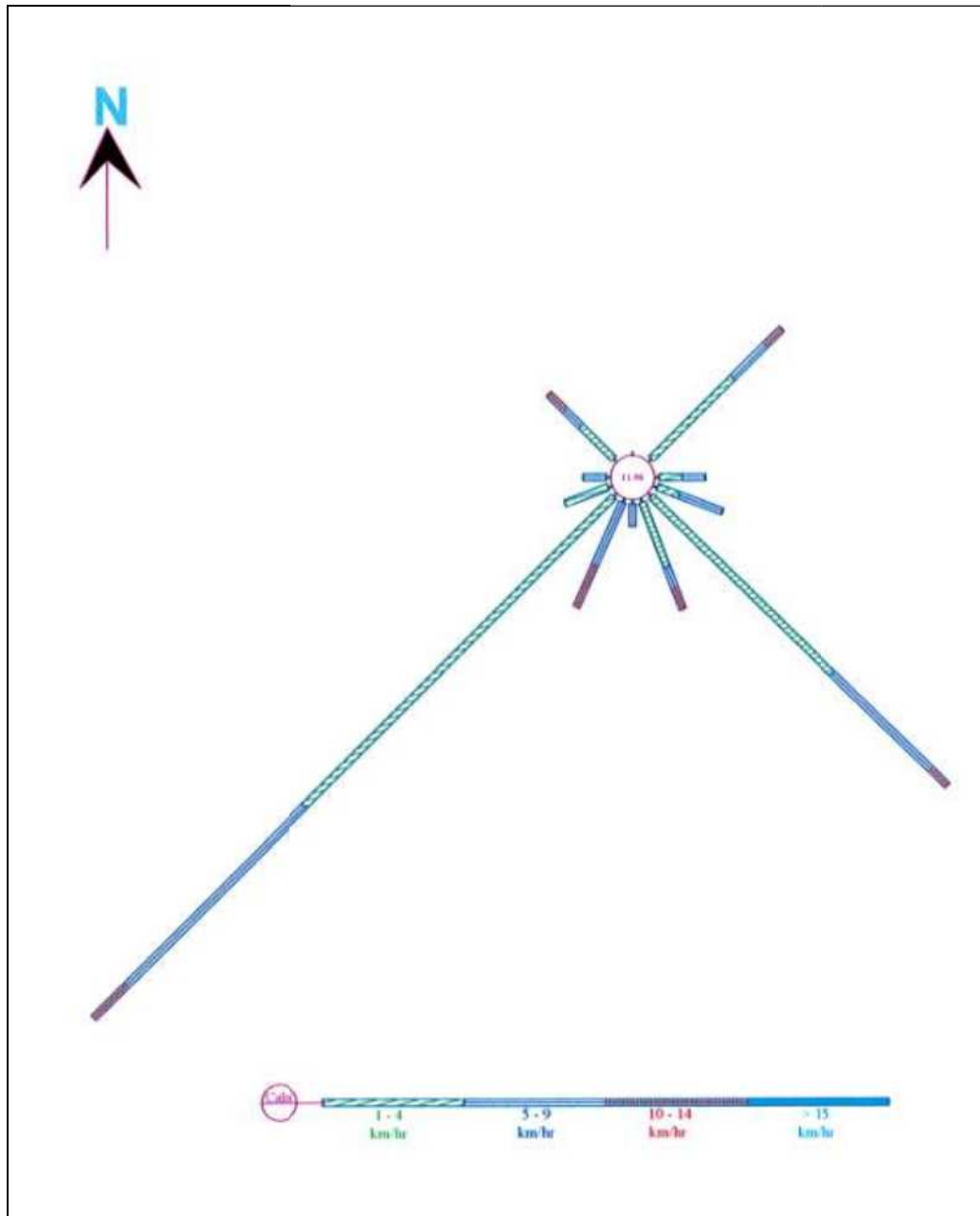


Figure 4-36 Wind Rose Diagram: Annual – 8.30 hrs

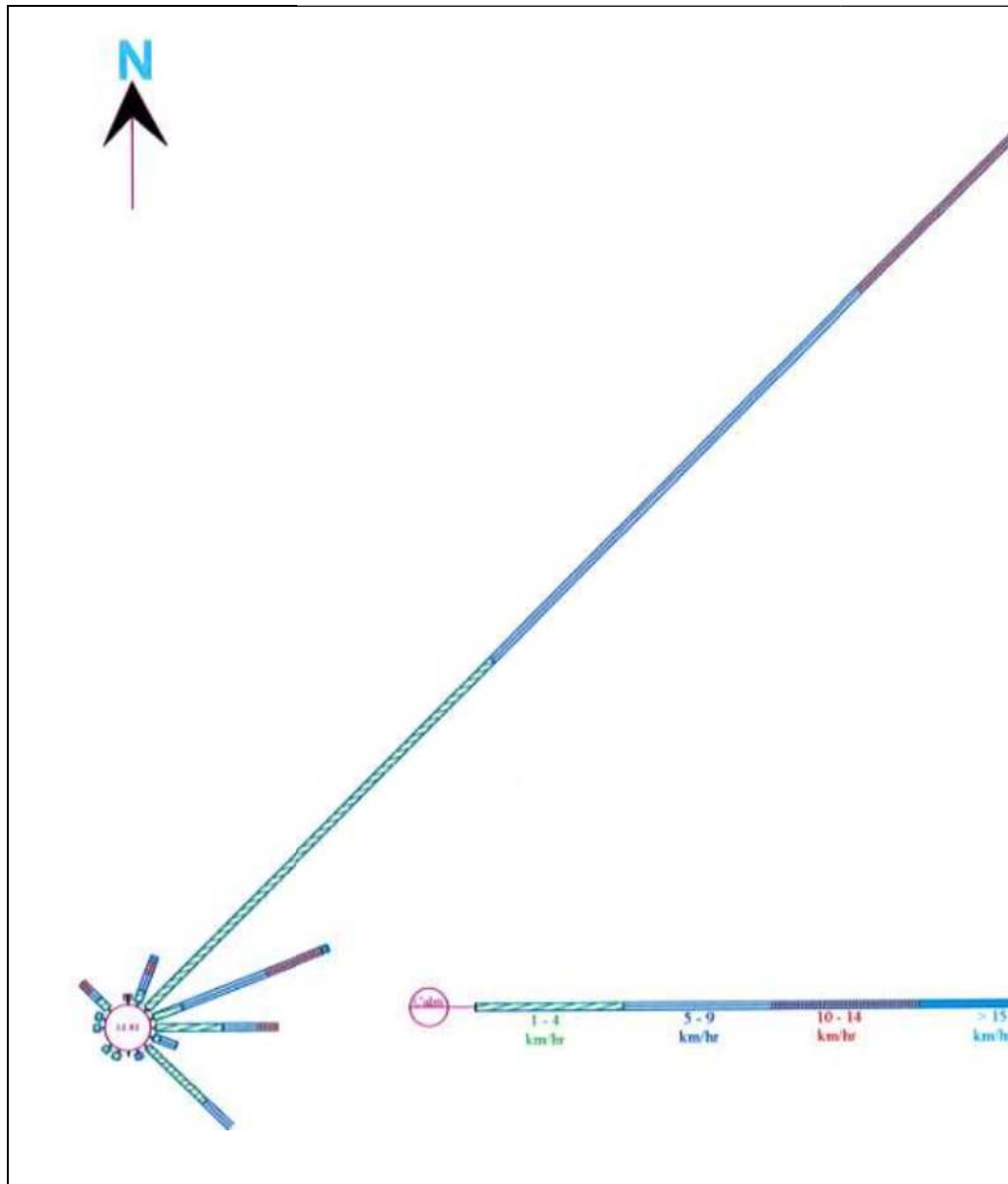
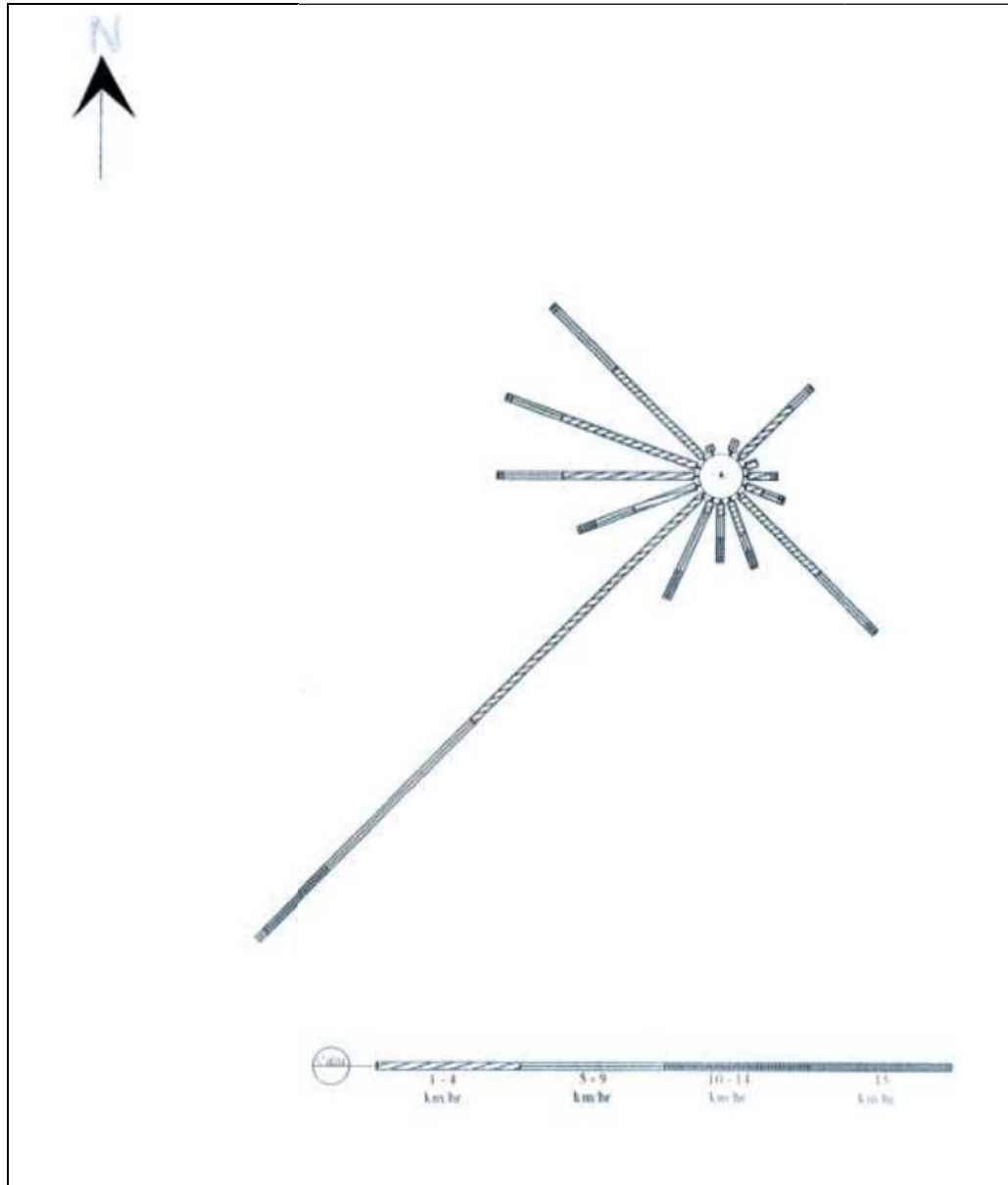


Figure 4-37 Wind Rose Diagram: Annual – 17.30 hrs



### 4.6 Noise Environment

The ambient noise monitoring was conducted in the study area to assess the background noise levels. Five noise monitoring locations vis-a-vis Akpa, Thangi, Lambar, proposed barrage and powerhouse sites were chosen to spatially cover the project area. Ambient noise levels were monitored during daytime (08-10 hrs, 12-14 hrs and 16-18 hrs) and night time (20-22 hrs). Noise was measured in dB (A) at all the locations. The results of monitoring have been presented as Table 4-17 in terms of Leq, L90, L50, L10, Lmax, Lmin, Lday, Lnight and Ldn and graphically presented in Figure 4-38.

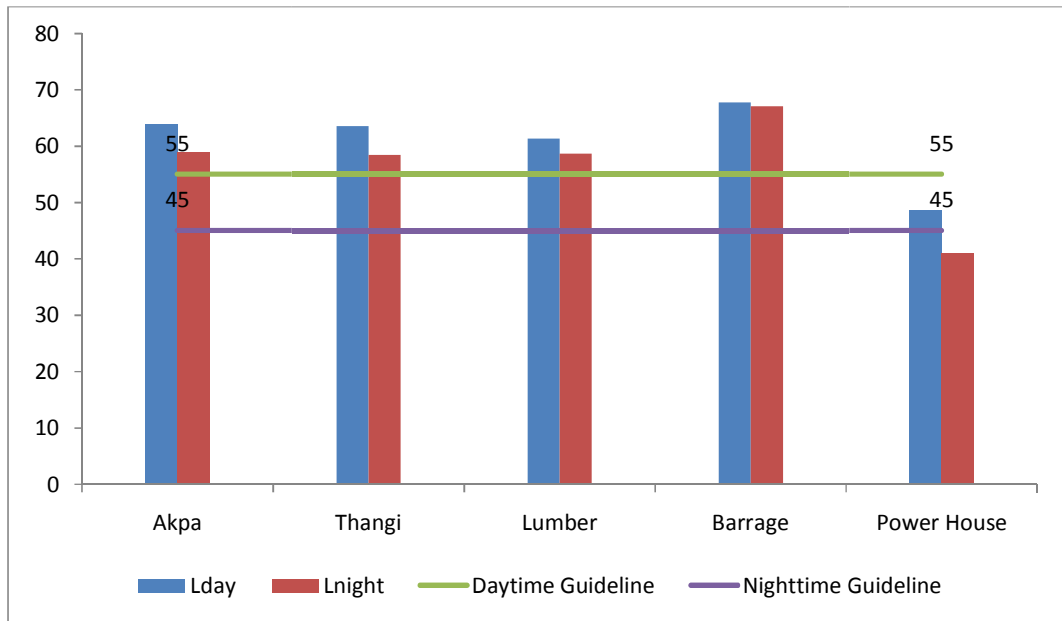
**Table 4-17 Noise Measurements in project area in dB (A)**

TIME PERIOD	NOISE LEVEL IN dB (A)							
	Leq	L90	L50	L10	Lmax	Lmin	Lday/ Lnight	Ldn
<b>AKPA</b>								
8-10	62.79	61.81	62.7	63.56	63.67	61.5	63.87	65.1
12-14	63.88	62.95	63.63	64.73	65.03	62.7		
16-18	64.96	64.28	64.93	65.55	65.8	64		
20-22	58.79	57.89	58.63	59.57	59.87	57.73	58.79	
<b>THANGI</b>								
8-10	69.38	61.33	61.6	68.01	72.03	61.23	63.57	64.78
12-14	61.67	61.53	61.67	61.81	61.87	61.5		
16-18	59.66	59.05	59.67	60.16	60.33	58.77		
20-22	58.42	57.74	58.4	58.97	59.07	57.5	58.42	
<b>LAMBAR</b>								
8-10	61.17	60.65	61.27	61.53	61.6	60.37	61.29	63.12
12-14	61.36	61.04	61.33	61.65	61.73	60.93		
16-18	61.34	60.77	61.4	61.76	61.8	60.57		
20-22	58.63	57.76	58.43	59.45	59.83	57.6	58.63	
<b>BARRAGE</b>								
8-10	67.78	67.41	67.67	68.19	68.5	67.37	67.78	70.1
12-14	67.54	67.31	67.57	67.73	67.77	67.2		
16-18	68.02	67.62	68.03	68.38	68.43	67.57		
20-22	67.07	66.71	67	67.45	67.6	66.67	67.07	
<b>POWER HOUSE (RISPA)</b>								
8-10	48	42.53	44.93	50.18	52.7	42.1	48.51	49.11
12-14	51.76	46.75	49.1	54.09	55.07	46.23		
16-18	45.77	42.83	45.93	47.43	48.2	42.47		
20-22	40.92	38.69	40.37	42.41	43.2	38.1	40.92	

Source: Field Study by RITES for EIA-2005



**Figure 4-38 Lday/ Lnight Noise Levels in project area (dB)**



The above table indicates that the average of day and night noise level L<sub>dn</sub> for the study area ranges from 49.11 to 70.10 dB (A). The day time L<sub>day</sub> noise levels ranged from 48.51 to 67.78 dB (A) and night time L<sub>night</sub> noise levels ranged from 40.92 to 67.07 dB (A). The comparison of these results with the ambient noise standards shows that the day-time values are exceeding prescribed standard of 55 dB (A) at all locations except at Powerhouse location near Rispa village. Similarly night time noise levels are also exceeding the prescribed standard of 45 dB (A) except at Powerhouse location near Rispa village. The main source of noise in the project area is the sound caused by river water flow. Occasionally, there are vehicular movements at Akpa, Thangi and Powerhouse site, which could also contribute to the generation of noise.

**4.7 Ecological Environment**

An ecological study of the ecosystem is essential to understand the impact on the existing flora and fauna of the area due to project development activities.. The present study was undertaken to predict changes as a result of project activities and to suggest measures for maintaining the conditions. This section describes the ecology of the area based on information compiled from field ecological study conducted by RITES in September, 2005.

**4.7.1 Sampling Sites and Methodology**

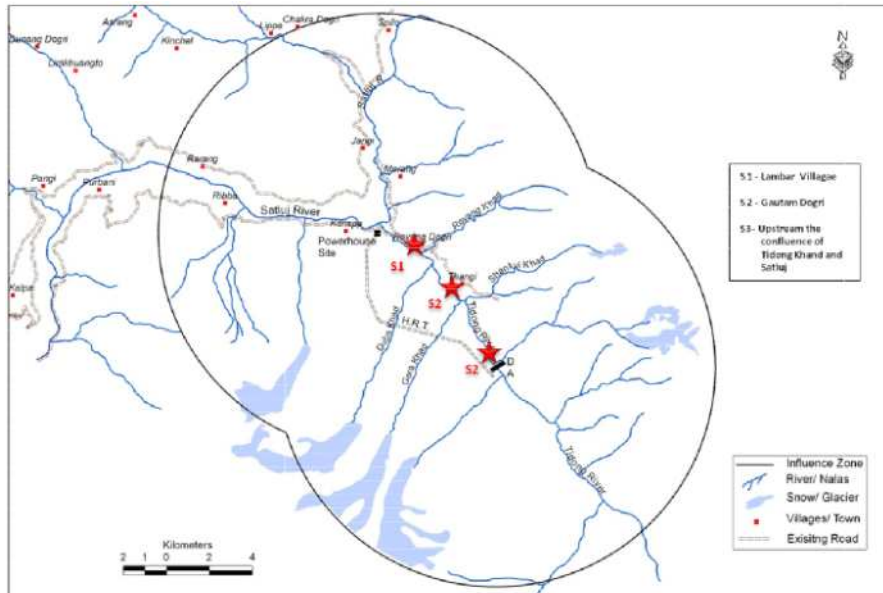
Three sampling sites i.e. S<sub>1</sub>, S<sub>2</sub> and S<sub>3</sub> (Figure 4-39) were identified to provide reasonable spatial coverage of the project affected area. Primarily following areas were considered to ensure representative samples of ecological environment were collected:

- area likely to be adversely affected and submerged due to project activities;
- area within 10 km distance of the reservoir periphery;
- land to be acquired for power house; and
- the site proposed for dumping of excavated tunnel material.

The sampling site S<sub>1</sub> was identified near Lambar village on Tidong Khad (2,860 m above m.s.l.) just above the barrage site in the submergence area, while the S<sub>2</sub> site was identified near Gautam Dogri (2,600 m above m.s.l.), 2 km downstream of S<sub>1</sub>. The sampling site S<sub>3</sub> was identified near Rispa village, 200 m upstream of confluence of Tidong Khad and Satluj (2,260 m above m.s.l.) and closes the site of powerhouse and dumping grounds of the excavated material. Photographs of these sampling sites taken during field study conducted by RITES in September 2005 are given as Figure 4-41 to Figure 4-48.

For the updation of EIA report the area was revisited in the month of March-2011 and the data collected on various parameters of ecology has been included in the report.

**Figure 4-39: Ecological Sampling Locations**



### Terrestrial Ecology

The objective of the terrestrial ecosystem study was to prepare an inventory of flora, listing of rare, endangered, economically important and medicinal plant species and to determine frequency, abundance and density of different vegetation components. Considering the difficult terrain of study area, quadrat method was used for sampling of the vegetation. Twenty five (25) random quadrats of 10m x 10m size were laid to study the trees and shrubs, and twenty five (25) random quadrats of 1m x 1m size were laid to study the herbaceous component at each sampling site. During the survey, numbers of plants of different species in each were counted and identified. The height of individual tree was estimated using Abney level/ Binocular and the DBH of all trees having height more than 8m was measured. Based on the quadrat data, frequency, density and cover (basal area) of each species were calculated. The importance value index (IVI) for different species of trees were determined based on the relative density, relative frequency and relative cover value. The relative density and relative frequency values were used to calculate the IVI of shrubs and herbs. The volume of wood for trees was estimated using the data on DBH (measured at 1.5 m above the ground level) and height. The volume was estimated using the formula:  $\pi r^2 h$ , where r is the radius and h is the estimated height of the bole of the tree.

Species diversity indices (Shannon Weiner Index) of general diversity ( $\overline{H}$ ) was computed using the following formula:

$$\text{Shannon Weiner Diversity Index } (\overline{H}) = - \sum_{i=1}^s \left( \frac{n_i}{N} \right) \log_2 \left( \frac{n_i}{N} \right)$$

Where,  $\overline{H}$  = Shannon Wiener index of diversity;

$n_i$  = total number of individuals of a species; and

$N$  = total number of individuals of all species.

During the vegetation survey, herbarium was prepared for those plants, which had flowers. The Red Data Book of India and other available literature, floral herbaria pertaining to the rare/ endangered species were considered to identify the endemic, rare and other threatened categories of plants.

### Aquatic Ecology

Aquatic ecological analysis of Tidong Khad was made following the methods outlined in Wetzel and Likens (1991) and APHA (1998). Periphytons were collected using a timed scraping technique following Ward (1974) with the help of a sharp knife for each replicate sample. The upper surfaces of atleast cobble sized rocks were scrapped using a five-minute period. For enumeration of plankton population, bulk water samples were collected in polythene jars. For obtaining, net plankton from the water sample, 150 ml of bulk water was filtered through a 50  $\mu\text{m}$  net and was centrifuged at 1500 rpm for 10-minute period.

The sediment of the centrifuge tubes was made to concentrate and was used for enumeration of zooplankton population. A plankton chamber of 0.5 ml capacity was used for counting of plankton under the Inverted Compound Microscope. The total number of plankters present in a litre of water sample was calculated using the following formula:

$$\text{Number of plankton (units l}^{-1}\text{)} = \frac{\text{Number of plankters in 0.5 ml aliquot} \times 0.5 \times 1000}{\text{Volume of sediment concentrate} \times \text{Volume of water centrifuged}}$$

Primary productivity of periphyton-phytoplankton of Tidong Khad was determined by the 1.93 litre molded Polystyrene Chamber Method in situ measurement of the rate of primary production. Three replicates were maintained for each sampling site. The experimental chamber was kept for 4 hrs under incubation in the Tidong Khad. The modified Winkler's method was used for determination of oxygen in the light and dark chambers. The calculation of primary production of phytoplankton-periphyton was made following the methods outlined in Strickland and Parsons (1960) and Benton and Werner Jr. (1972).

$$\text{Respiration (R)} = O_2 \text{ consumed} = O_2 \text{ at start (-) } O_2 \text{ at end in dark chamber}$$

$$\text{Gross Primary Productivity (Pg)} = O_2 \text{ contents of light chamber (-) } O_2 \text{ contents of dark chamber}$$

$$\text{Net Primary Productivity (Pn)} = Pg \text{ (-) } R$$

Macrozoobenthos colonizing the substrate were collected with the help of the Surber Sampler (0.50 mm mesh net) and by hand picking from stones. Quantitative estimation of macrozoobenthos was based on numerical counting (ind. m<sup>-2</sup>). The surface area of the stones of the sampled area was estimated by using following formula:

$$S = n/3(LW+LH+WH)$$

Where, L = length; W = width; H = height of each stone to the nearest of 0.5 cm.

**4.7.2 Results and Analysis**

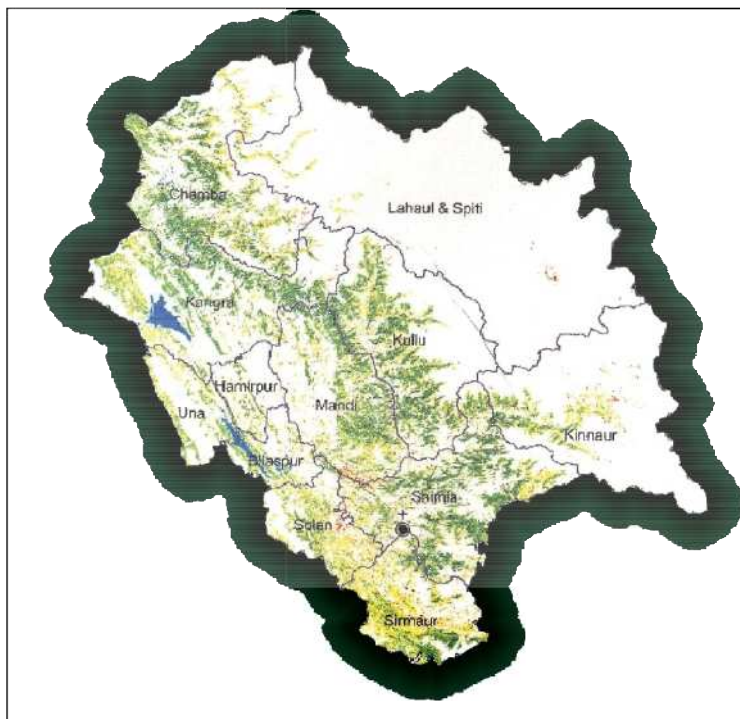
*Terrestrial Ecology (Flora)*

The terrestrial ecological survey for various aspects of the project area was conducted.

**Forests**

The Forests of Himachal Pradesh are known for their grandeur and majesty. According to National Forest Policy, 1988, at least two third i.e. 66% of the geographical area should be under forest in the hilly states like Himachal Pradesh. However, keeping in view that about 20% of the area is inaccessible and beyond the tree limit, the State Government aims to bring 50% Figure 4-40 of the geographical area under forest cover. The Forest Department of Himachal Pradesh has classified the forests of the State on an ecological basis as laid down by Champion and Seth, and can be broadly classified into Coniferous Forests and broad-leaved Forests.

**Figure 4-40: Forest Cover map of Himachal Pradesh**



Distribution of various species follows fairly regular altitudinal stratification. The vegetation varies from Dry Scrub Forests at lower altitudes to Alpine Pastures at higher altitudes. In between these two extremes, distinct vegetational zones of Mixed Deciduous Forests, Bamboo, Chil, Oaks, Deodar, Kail, Fir and Spruce, are found. The various forest types reported in Satluj basin is as below.

**Table 4-18 Major Forest Types of Satluj Basin**

S. No.	Major Forest Type	Classification Code
1	Northern Dry Mixed Deciduous Forests	5B/C-2
2	Himalayan Subtropical Pine Forests	9 C-1
3	Dry Bamboo Breks	5 B/E9
4	Himalayan Sub Alpine Fir Forests	14/ C1b
5	Himalayan Kharsoo – Oak Forests	12/C2 a
6	Himalayan Dry Temperate Forests	13/ C1
7	Himalayan Kharsoo – Oak Forests	12/C1a
8	Mixed Broad leaved Coniferous Forests	12/C1b
9	Coniferous Pine Forests	13/C2a
10	Western Mixed Coniferous Forests	12/C1d

Source: Forest Department, Rampur Division

**Table 4-19: Classified description of Forest Cover in District Kinnaur**

District	Geographical Area	Forest Area	Tree covered area				% of Geog. Area
			Very dense forest	Moderate dense forest	Open forest	Total forest cover	
Kinnaur	6401	5093	82	263	257	602	9.40

Source: Forest Department, Himachal Pradesh; As per Forest Survey of India Report - 2009

The altitude in the project area of Tidong hydropower project ranges from 2,260 m to 2,860 m above m.s.l. The major forest type of the project area is a temperate mixed evergreen forest. A total number of 94 plant species were recorded during the floristic survey in the project area. Plant diversity of the project area encompasses 20 species of trees, 30 species of shrubs and 30 species of herbs including 6 species of climbers and 8 species of grasses. An inventory of plant species, their local names, ecological status and economic values have been presented in Table 4-20.

**a. Sampling Site S<sub>1</sub> (Barrage/Submergence Area)**

The sampling site S<sub>1</sub> is near the barrage site (2,860m above msl). The right bank of the Tidong Khad is dominated by the tree species of *Cedrus deodara*, *Prunus armeniaca* and *Pinus wallichiana*. A deforestation of the magnitude of 10-15% was also noticed in this area. The possible reason seems to be easy accessibility of the site. The higher reaches of the right bank is having steep slopes and do not support any vegetation. The left bank side of the Tidong Khad is not easily accessible and has an undisturbed mixed forest. The floral composition of the left bank side includes the trees of *Cedrus deodara*, *Betula utilis*, *Pinus gerardiana*, *Pinus wallachiana* and *Prunus armeniaca*. The submergence area at the left bank side of Tidong Khad has mostly young trees. However, the higher reaches of left bank side have old trees of *Cedrus deodara* and *Pinus gerardiana*.

**Figure 4-41 Laying of Quadrate at Sampling Site S1**

**Figure 4-42 Collection of Plants from the area of Tidong HEP**



The frequency, density, abundance, basal area and importance value index (IVI) of the trees, herbs and shrubs at S1 have been presented in Table 4-21. A perusal of the data on the ecological analysis revealed that the most dominant tree species were *Cedrus deodara* (IVI: 95.66), *Prunus armeniaca* (IVI 71.02) and *Pinus gerardiana* (IVI: 63.91). The shrubs were dominantly represented by the species of *Artemisia* (IVI: 34.80, 42.28 and 46.67) followed by *Rosa sericea* (IVI 45.89). The dominant herbs were the species of *Anaphalis* (IVI: 43.40 and 51.37) and *Anisomeles indica* (IVI: 34.28).



**b. Sampling Site S2 (close to Gautam Dogri)**

The sampling site S<sub>2</sub> is 2 Km downstream to S<sub>1</sub> and close to a place named Gautam Dogri. The left bank of the site has a good forest cover of *Pinus gerardiana* and *Cedrus deodara*. However, the right bank side has no forest cover except some scattered trees, shrub and herb species.

**Figure 4-43 Ecological survey of terrestrial ecosystem at S2**



The frequency, density, abundance, basal area and importance value index (IVI) of the trees, herbs and shrubs at S<sub>2</sub> have been presented in Table 4-22. A perusal of data revealed that the sampling site S<sub>2</sub> is dominated by the tree species of *Pinus gerardiana* (IVI: 125.98) and *Cedrus deodara* (IVI: 117.81). However, the shrubs were dominated by three species of *Artemisia* (IVI: 38.19, 39.39 and 45.88), *Rubus biflorus* (IVI 58.34) and *Persicaria polystachya* (IVI: 45.88). The herbs were dominantly represented by the species of *Nepeta* (IVI: 33.08, 35.50 and 39.09) and the species of *Anaphalis* (IVI: 36.25 and 37.56).

**c. Sampling Site S3 (near the proposed site of Power House)**

The sampling site S<sub>3</sub> is located near the proposed site of Power House, which is represented by three types of habitats. The one habitat was dominated by a dense and old forest of *Pinus gerardiana* and *Cedrus deodara*. This forest is located on a high slope of the left bank side of Tidong Khad, which is above the HRT. Most of the tree species are very old and their girth ranged from 3-7m. This area is very close to Rispa village, which is famous for Chilgoza (*Pinus gerardiana*) forest and the cultivation of apple. Another habitat is the dumping ground in riparian zone of Tidong Khad, which is represented by few shrubs and herbs species. The third type of habitat is the site where plantation of *Alnus nitida* has been done in the riparian zone of Left Bank of the river. The entire plantation is not more than 4-5 years old.

The frequency, density, abundance, basal area and importance value index (IVI) of the trees, herbs and shrubs at S<sub>3</sub> have been presented in Table 4-23. A perusal of data revealed that the sampling site is dominated by the tree species of *Pinus gerardiana* (IVI: 139.82) and *Cedrus deodara* (IVI: 108.09). The shrubs at the sampling site S<sub>3</sub> were dominated by the four species of *Artemisia* (IVI: 38.74, 40.30, 41.02 and 41.22) and three species of *Nepeta* (IVI: 27.99, 28.54 and 30.00).

Figure 4-44 View of valley of Tidong Khad at S<sub>3</sub>



Figure 4-45 Confluence of Tidong with Satluj near S<sub>3</sub>



Figure 4-46 Power House Site of Tidong HEP at S<sub>3</sub>



Figure 4-47 Aquatic Survey of Tidong at S<sub>3</sub>



Figure 4-48 Measurement of DBH at S<sub>3</sub>



**d. Diversity Indices**

Species diversity indices can be considered as a measure of environmental quality and indicates the well being of any ecosystem. The species diversity indices (Shannon-Weiner) of plants at sampling site S<sub>1</sub> have been presented in Table 4-21.

Diversity indices of sampling site S<sub>1</sub> were computed to be 2.121 for trees, 2.979 for shrubs and 3.17 for herbs. The values for all the three components of plants indicate a good environmental quality of the ecosystem at dam site.

The species diversity indices (Shannon-Weiner) of plants at sampling site S<sub>2</sub> have been presented in Table 4-22. Diversity index of sampling site S<sub>2</sub> was found to be 1.458 for trees. This indicates that the S<sub>2</sub> is not very rich in terms of biodiversity.

The species diversity indices (Shannon-Weiner) of plants at sampling site S<sub>3</sub> have been presented in Table 4-23. Diversity indices of sampling site S<sub>3</sub> were found to be 1.449 for trees, 2.988 for shrubs and 3.05 for herbs. The values for all the three components of plants indicate good environmental quality of the site S<sub>3</sub>. However, it does not show rich tree diversity.

Table 4-20: Plant Diversity

S. NO	BOTANICAL NAME	VERNACULAR NAME	STATUS	ECONOMIC IMPORTANCE
<b>Trees</b>				
1.	<i>Alnus nitida</i> D. Don	Kosh, Kunish, Nyun	Common	Nitrogen fixing, soil binder
2.	<i>Betula utilis</i> D. Don	Bhojpatra, Pad	Common	Bark used as paper for writing religious texts, regarded as sacred
3.	<i>Cedrus deodara</i> Roxb.	Diar, Kialmang, Kelo	Common	Timber
4.	<i>Celtis australis</i>		Common	Fodder
5.	<i>Cupressus sempervirens</i>	Saru	Common	Timber
6.	<i>Ficus benjamina</i> Linn.	Dhudhi, Beduli	Common	Fodder
7.	<i>Juglans regia</i> Linn.	Khor, Akhrot	Common	Timber, dye and medicine
8.	<i>Juniperus indica</i> Linn.		Common	
9.	<i>Juniperus macropod</i> Linn.	Guggal, Dhup, Shur	Common	
10.	<i>Juniperus squamata</i> Linn.		Common	
11.	<i>Pinus gerardiana</i>	Chilgoza, Rai	Rare	Timber, fruits edible, medicine
12.	<i>Pinus wallichiana</i> A.B. Jackson	Kail	Common	Timber, fruits edible, medicine
13.	<i>Prunus armeniaca</i>	Chuli, Chul	Common	Edible and medicine
14.	<i>Prunus cornuta</i>	Jamnol	Common	Timber, leaves for fodder, fruits edible
15.	<i>Prunus persica</i>	Aaru	Common	Fruits edible, seed yield edible oil, leaves and bark used to relieve cough and cold
16.	<i>Pyrus malus</i>	Seb, Seo	Common	Fruits edible
17.	<i>Salix tetrasperma</i>	Bena, Shon	Common	Timber, agricultural implements, cabinet making, Cricket bat
18.	<i>Swida macrophylla</i>	Khagsi/Khagsa	Common	Fodder
19.	<i>Trema politoria</i>	Jivan	Common	Fodder, fiber, fuel and charcoal
20.	<i>Trewia spp</i>	Tumri	Common	Soft whitish wood used for making drums
<b>Shrubs</b>				
1.	<i>Artemisia girelinii</i>	Kunja	Common	Essential oil and medicinal
2.	<i>Artemisia maritima</i>	Seski, Buer	Common	Essential oil and medicinal
3.	<i>Artemisia strata</i>	Seski, Buer	Common	Essential oil and medicinal
4.	<i>Artemisia vestita</i>	Seski, Buer	Common	Essential oil and medicinal
5.	<i>Artemisia vulgaris</i>	Seski, Buer	Rare	Essential oil and medicinal
6.	<i>Astragalus chlorostachys</i>		Rare	Pods edible, fodder, medicinal
7.	<i>Astragalus amherstianus</i>		Common	
8.	<i>Berberis aristata</i>	Kashmal Khepacho	Rare	Medicinal
9.	<i>Berberis lyceum</i>	Kashmol, Chutrum	Rare	Medicinal
10	<i>Coriaria nepalensis</i>	Masroi, Lit Zaklo	Common	
11.	<i>Cotoneaster acuminata</i>	Chum Raonsh, Banang	Common	
12.	<i>Desmodium dichotomum</i>	Safed Kathi	Rare	
13.	<i>Gaultheria nummularioides</i>	Bhwimla	Common	Fruits edible
14.	<i>Hypericum choisianum</i>	Phulya	Rare	Fodder and medicinal
15.	<i>Hypericum lysimachioides</i> syn. <i>H. dyeri</i>		Rare	
16.	<i>Indigofera hochstetteri</i>	Kathi, Kanthi	Common	
17.	<i>Inula cappa</i>	Athhu	Common	Medicinal
18.	<i>Inula grandiflora</i>	-	Common	
19.	<i>Olea ferruginea</i>	Bair Bainj	Rare	Medicinal, agricultural implements, fodder
20.	<i>Persicaria polystachya</i>	Ama-haldu	Common	Occasionally used as vegetable, leaves used in laceration
21.	<i>Prinsepia utilis</i>	Bhekal	Common	Edible oil, medicinal
22.	<i>Reinwardtia indica</i>	Phiunli, Basanti	Common	Petals chewed as tongue cleaner, considered sacred
23.	<i>Rhamnus purpureus</i>	Gaunta, Luish	Common	Wood for agricultural implements
24.	<i>Rhamnus virgatus</i>	Chentuli, Choundalu	Common	Medicinal and fuel
25.	<i>Rosa sericea</i>	Dharkunja	Rare	Fruits edible, medicinal
26.	<i>Rubus biflorus</i>	Anchu	Common	Fruits edible and roots medicinal
27.	<i>Salix hastate</i>	Buins	Rare	
28.	<i>Smilax vaginata</i>	Peepal satta	Common	
29.	<i>Sorbaria tomentosa</i>	Bhiloka	Common	Medicinal
30.	<i>Zanthoxylum alatum</i>	Timira, Timri	Threatened	Medicinal

S. NO	BOTANICAL NAME	VERNACULAR NAME	STATUS	ECONOMIC IMPORTANCE
<b>Herbs</b>				
1.	<i>Aconitum spp</i>	Patish, Dhoop	Rare	Medicinal
2.	<i>Anaphalis adnata</i>	Bugla	Common	Paste of leaves applied on cuts, wounds and boils
3.	<i>Anaphalis busua</i>	Bugla	Common	Leaves juice applied on bruises, cuts and wounds
4.	<i>Angelica glauca</i>	Chora	Rare	Roots yield an essential oil
5.	<i>Anisomeles indica</i>	Gobara	Common	Medicinal
6.	<i>Bidens spp.</i>		Common	
7.	<i>Blumia hieracifolia</i>	Kakranda	Common	
8.	<i>Carpesium nepitense</i>		Common	
9.	<i>Chenopodium opulifolium</i>		Common	Medicinal
10.	<i>Circium verutum</i>	Kardra	Common	Root juice taken in constipation and dyspepsia
11.	<i>Gentiana kuroo</i>	Karu, Kore	Common	
12.	<i>Gnaphalium hypoleucum</i>	Buglu, Bugla	Common	Plant extract used in cuts and wounds
13.	<i>Heracleum canescens</i>	Kakrya, Arva	Common	Root paste applied on eczema and ring worm
14.	<i>Holiotropium strigosum</i>	Phulya, Basanti	Rare	Leaf powder used in tertiary fever
15.	<i>Imapatiens thomsoni</i>	Ghad-chaul	Common	
16.	<i>Melilotus indica</i>	Ban Mathi	Common	Fodder, roasted seeds given in diarrhea and dysentery
17.	<i>Mentha longifolia</i>	Paudina	Common	Leaves used as flavoring and refrigerant, medicinally used in vomiting and indigestion
18.	<i>Nepeta gracilliflora</i>	Uprya ghas	Common	Medicinal
19.	<i>Nepeta laevigata</i>	Uprya ghas	Common	Medicinal
20.	<i>Nepeta leucophylla</i>	Karda	Common	Leaves given in malarial fever
21.	<i>Plantago depressa</i>	Luhrya	Rare	Paste from leaves and seeds applied on cuts, wounds and piles
22.	<i>Pluchea lanceolata</i>		Common	
23.	<i>Podochyllum emodi syn P. hexandrum</i>	Ban kakri	Rare	Medicinal
24.	<i>Polygonatum multiflorum</i>	Khaul	Common	Medicinal
25.	<i>Potentilla atrosanguinea</i>		Common	
26.	<i>Ranunculus sceleratus</i>		Common	
27.	<i>Thalictrum javanicum</i>	Mamiri	Threatened	Medicinal
28.	<i>Urtica dioica</i>	Kandali	Common	Stem yields fibre, fodder, vegetable, medicinal in sciatica, rheumatism etc.
29.	<i>Vicoa indica syn Pentanema indicum</i>		Common	
30.	<i>Viola biflora</i>	Vanafsa	Common	Medicinal
<b>Climbers</b>				
1.	<i>Clematis barbellata</i> , Edgew	Belkangu, Chabru, Wantah	Common	Stem used for coarse ropes, decoction of leaves used in scabies
2.	<i>Clematis connata</i> , DC. Prodr.	Garol	Common	Leaves as fodder
3.	<i>Clematis grata</i> Wallich.	Garol, Wantah	Common	Fodder
4.	<i>Cuscuta reflexa</i>		Common	Medicinal
5.	<i>Dioscorea deltoides</i>	Kunj Calendi, Singlimingli, Baniatakari, Galthi	Common	Tubers edible and medicinal
6.	<i>Rosa macrophylla</i>	Pahari gulab, Kunja, Benyal	Common	Fruits edible, flowers paste applied on skin
<b>Grasses</b>				
1.	<i>Andropogon ischaemum</i>			Fodder
2.	<i>Arundinaria falcata</i>	Ringal, Nirgal, Poo	Common	Widely used for mats and baskets, leaves as fodder
3.	<i>Arundinella setosa</i>	Ringal	Common	Used for brooms
4.	<i>Cymbopogon spp</i>		Common	Medicinal
5.	<i>Festuca gigantea</i>		Common	Ropes made from the leaves, also fodder
6.	<i>Poa pratensis</i>	-	Common	Fodder
7.	<i>Pogonatherum saccharoideum</i>	-	Common	Fodder
8.	<i>Trypogon filiformis</i>	-	Common	Fodder



Table 4-21: Ecological Field Study Results for Site S1

PLANTS	FREQUENCY (%)	DENSITY (IND.HA <sup>-1</sup> )	ABUNDANCE	BASAL AREA (HA)	IVI	DIVERSITY INDEX (SHANNON WEINER)
<b>TREES</b>						
<i>Prunus armeniaca</i>	68	132	1.94	1.527	71.02	0.53
<i>Pinus girardiana</i>	64	116	1.81	1.295	63.91	0.52
<i>Pinus wallichiana</i>	20	40	2.00	1.790	29.83	0.33
<i>Cedrus deodara</i>	64	92	1.44	7.127	95.66	0.48
<i>Betula utilis</i>	20	28	1.40	3.758	39.59	0.27
<b>Total</b>		<b>408</b>				<b>2.121</b>
<b>SHRUBS</b>						
<i>Artemisia grrelinii</i>	60	256	1.07	0.157	42.28	0.32
<i>Artemisia maritima</i>	68	400	1.47	0.135	46.67	0.41
<i>Artemisia vulgaris</i>	68	320	1.18	0.065	34.80	0.37
<i>Inula cappa</i>	48	256	1.33	0.100	32.58	0.32
<i>Inula grandiflora</i>	56	368	1.64	0.039	30.78	0.39
<i>Persicaria polystachya</i>	56	352	1.57	0.038	30.05	0.39
<i>Rosa sericea</i>	52	304	1.46	0.185	45.89	0.36
<i>Rubus biflorus</i>	56	416	1.86	0.074	36.94	0.42
<b>Total</b>		<b>2672</b>				<b>2.979</b>
<b>Herbs</b>						
<i>Anaphalis adnata</i>	68	9600	1.41	0.196	43.40	0.37
<i>Anaphalis busua</i>	56	8000	1.43	0.332	51.37	0.34
<i>Anisomeles indica</i>	68	9600	1.41	0.096	34.28	0.37
<i>Bidens spp</i>	64	8000	1.25	0.049	27.14	0.34
<i>Blumia hieraciifolia</i>	56	8800	1.57	0.107	31.96	0.36
<i>Imapatiens thomsoni</i>	64	8000	1.25	0.091	30.94	0.34
<i>Nepeta graciliflora</i>	44	8800	2.00	0.096	28.63	0.36
<i>Nepeta laevigata</i>	48	8000	1.67	0.080	26.92	0.34
<i>Nepeta leucophylla</i>	52	8400	1.62	0.049	25.35	0.35
<b>Total</b>		<b>77200</b>				<b>3.172</b>

Table 4-22: Ecological Field Study Results for Site S2

Plants	Frequency (%)	Density (ind.ha <sup>-1</sup> )	Abundance	Basal area (ha)	IVI	Diversity Index (Shannon Wiener)
<b>Trees</b>						
<i>Pinus girardiana</i>	72	108	1.5	8.627	125.98	0.52
<i>Pinus wallichiana</i>	32	36	1.125	5.012	56.19	0.41
<i>Cedrus deodara</i>	64	96	1.5	8.989	117.81	0.53
<b>Total</b>		<b>240</b>				<b>1.458</b>
<b>Shrubs</b>						
<i>Artemisia grrelinii</i>	48	304	1.58	0.100	45.88	0.41
<i>Artemisia maritima</i>	44	208	1.18	0.097	39.39	0.33
<i>Artemisia vulgaris</i>	52	320	1.54	0.039	38.19	0.42
<i>Inula cappa</i>	40	272	1.70	0.071	37.08	0.39
<i>Inula grandiflora</i>	44	304	1.73	0.041	35.25	0.41
<i>Persicaria polystachya</i>	48	304	1.58	0.100	45.88	0.41
<i>Rubus biflorus</i>	40	352	2.20	0.180	58.34	0.44
<b>Total</b>		<b>2064</b>				<b>2.792</b>
<b>Herbs</b>						
<i>Anaphalis adnata</i>	56	9200	1.64	0.264	37.26	0.37
<i>Anaphalis busua</i>	48	6400	1.33	0.352	36.25	0.30
<i>Bidens spp</i>	36	7200	2.00	0.159	25.09	0.32
<i>Blumia hieraciifolia</i>	68	11200	1.65	0.246	41.58	0.41
<i>Imapatiens thomsoni</i>	48	6800	1.42	0.181	28.26	0.31
<i>Nepeta graciliflora</i>	52	9200	1.77	0.246	35.50	0.37
<i>Nepeta laevigata</i>	56	8800	1.57	0.312	39.09	0.36
<i>Nepeta leucophylla</i>	56	10000	1.79	0.159	33.08	0.38
<i>Ranunculus sceleratus</i>	40	8000	2.00	0.096	23.88	0.34
<b>Total</b>		<b>76800</b>				<b>3.152</b>

**Table 4-23: Ecological Field Study Results for Site S3**

PLANTS	FREQUENCY (%)	DENSITY (IND.HA <sup>-1</sup> )	ABUNDANCE	BASAL AREA (HA)	IVI	DIVERSITY INDEX (SHANNON WIENER)
<b>Trees</b>						
<i>Alnus spp.</i>	30	105	3.50	8.089	52.10	0.50
<i>Pinus girardiana</i>	60	225	3.75	72.800	139.82	0.48
<i>Cedrus deodara</i>	45	85	1.89	96.000	108.09	0.47
		<b>415</b>				<b>1.449</b>
<b>Shrubs</b>						
<i>Artemisiamaritima</i>	56	368	1.64	1.200	40.30	0.39
<i>Artemisia strata</i>	64	304	1.19	1.320	41.22	0.35
<i>Artemisia vestita</i>	52	400	1.92	1.240	41.02	0.40
<i>Artemisia vulgaris</i>	60	416	1.73	0.840	38.74	0.41
<i>Berberis aristata</i>	52	336	1.62	1.480	41.51	0.37
<i>Hypericum choisianum</i>	48	272	1.42	0.840	30.75	0.33
<i>Pericaria polystachya</i>	48	336	1.75	0.840	33.08	0.37
<i>Rhamnus purpureus</i>	56	320	1.43	0.760	33.39	0.36
		<b>2752</b>				<b>2.988</b>
<b>Herbs</b>						
<i>Anaphalis adnata</i>	48	8000	1.67	0.332	36.44	0.35
<i>Anaphalis busua</i>	60	9200	1.53	0.159	32.62	0.37
<i>Bidens spp.</i>	44	6400	1.45	0.332	33.42	0.31
<i>Blumia hieracifolia</i>	56	8000	1.43	0.173	30.81	0.35
<i>Chenopodium opulifolium</i>	44	6800	1.55	0.246	30.00	0.32
<i>Nepeta gracilliflora</i>	52	8800	1.69	0.119	28.54	0.37
<i>Nepeta laevigata</i>	44	6800	1.55	0.246	30.00	0.32
<i>Nepeta leucophylla</i>	40	8000	2.00	0.186	27.99	0.35
<i>Polygonatum multiflorum</i>	44	6400	1.46	0.314	32.58	0.31
<i>Tripgon filiformis</i>	36	5600	14.32	0.051	17.61	0.28
<b>Total</b>		<b>74000</b>				<b>3.306</b>

**e. Economically Important Plant**

- Medicinal Plants**

The state of Himachal Pradesh is bestowed with a diverse array of natural vegetation ranging from tropical deciduous forests to herbaceous meadows in the alpine region. The temperate zone offers diverse habitat for a number of plants of great medicinal value. Some of the medicinal plants along with their medicinal uses in the area are given in Table 4-24. Most of these plants were observed during the survey conducted by RITES in September 2005 in the project area.

**Table 4-24: Economically Important Plant Species in the Project Area**

S. No.	Plant species	Local name	Family	Altitude	Part used
1.	<i>Angelica glauca</i>	Choru	Apiaceae	2600-3600	Roots
2.	<i>Artemisia gmelinii</i>	Kala- parcha	Asteraceae	1600-3000	Leaves
3.	<i>Astragalus chlorostachys</i>	-	Papilionaceae	2600-3000	Whole plant
4.	<i>Berberis aristata</i>	Kashmal	Berberidaceae	Up to 2800	Stem, roots
5.	<i>Cuscuta reflexa</i>	Akas- bel	Cuscutaceae	Up to 2200	Stem
6.	<i>Heracleum canescens</i>	Kakrya	Apiaceae	1800-2800	Root
7.	<i>Hypericum choisianum</i>	-	Hypericaceae	1800-2800	Roots
8.	<i>Juglans regia</i>	Akharot	Juglandiaceae	Up to 2800	Bark
9.	<i>Mintha longifolia</i>	Pudina	Lamiaceae	Up to 2500	Leaves



10.	<i>Nepeta leucophylla</i>	-	Lamiaceae	1700-3000	Leaves
11.	<i>Olea ferruginea</i>	Bair Bainj	Oleaceae	1800-3000	Stem
12.	<i>Prinsepia utilis</i>	Bhenkla	Rosaceae	1500-2800	Fruit
13.	<i>Prunus armeniaca</i>	Khumani	Rosaceae	1500-2800	Seed
14.	<i>Podophyllum hexandrum</i>	VanKakri	Podophyllaceae	3000-4000	Fruit
15.	<i>Polygonatum multiflorum</i>	MahaMeda	Liliaceae	2800-3600	Root

- **Food Plants**

Parts of many wild plants are used by local people as vegetables or eaten raw. These include fruits of *Juglans regia*, *Pyrus malus*, *Prunus armeniaca* and *Rosa macrophylla* which are eaten raw. In addition to these, leaves of certain wild plant species provide good source of minerals in the diet of the local people. *Amaranthus viridis*, *Chenopodium album*, *Rumex nepalensis*, and *Urtica dioica* are important plant source of minerals.

- **Timber Trees and Fuel wood**

The good quality timber is transported from higher to lower altitudes for various construction purposes. *Cedrus deodara* is an excellent quality of durable wood which is used in construction. Other gymnosperm trees which yield wood are *Cupressus sempervirens*, *Juniperus macropoda*, *Pinus gerardiana* and *P. wallichiana*. Among angiosperms, *Alnus nitida*, *Celtis australis*, *Juglans regia*, *Prunus cornuta*, etc. are widely valued as timber trees.

None of the species found the area are not classified as threatened in the IUCN Red List of Threatened Species.

### **Terrestrial Ecology (Fauna)**

#### **a. Mammals**

Catchment area of Tidong Hydropower project is inhabited by more than 13 species of mammals which together constitute around 8 families. Most of the species are restricted to the high altitudes of Himalayas. The region is an important ecological niche because it harbours some of the threatened and rare mammalian species. As per the IUCN criterion (2010.3), it harbours two endangered and one vulnerable species while as per the National Red Data Book (NDB) the region is inhabited by 4 vulnerable and 3 endangered species. A total of 8 species are categorized as Scheduled I of Wildlife (Protection) Act (1972) in the catchment and influence zone. The list of mammalian fauna recorded in the catchment area and influence zone of Tidong hydropower project along with their conservation status is given in Table 4-25.

**Table 4-25 Mammalian Fauna and their Conservation Status in the Influence Zone and Catchment Area of Project**

S.No.	Zoological Name	English name	Conservation Status		
			IUCN	NRD	WPA
			2010	1994	1972
<b>Felidae</b>					
1	<i>Panthera unica</i>	Snow leopard	EN	VU	I
2	<i>Panthera pardus</i>	Common leopard	NT	VU	I
<b>Canidae</b>					
3	<i>Canis aureus</i>	Jackal	LC	-	II
4	<i>Vulpes vulpes</i>	Red Fox	LC	-	II
<b>Ursidae</b>					
5	<i>Ursus thibetanus</i>	Himalayan black bear	VU	-	I
6	<i>Ursus arctos</i>	Brown Bear	LC	EN	I
<b>Herpistidae</b>					
7	<i>Herpestes edwardsii</i>	Mongoose	LC	-	IV
<b>Mustellidae</b>					
8	<i>Mustela sibirica</i>	Himalayan Weasal	LC	-	II
<b>Bovidae</b>					
9	<i>Pseudois nayaur nayaur</i>	Blue sheep	LC	VU	I
10	<i>Naemorhedus goral</i>	Goral	NT	-	III
11	<i>Capricornis sumatraensis</i>	Serow	LC	VU	I
12	<i>Hemitragus jemhicus</i>	Himalayan tahr	NT	EN	I
<b>Moschidae</b>					
13	<i>Moschus chrysogaster</i>	Musk deer	EN	EN	I
<b>Ochotonidae</b>					
14	<i>Ochotona roylei</i>	Royal's Pika	LC	-	IV

LC: Least Concern, VU: Vulnerable,; NT: Near Threatened; EN: Endangered;

The Tidong Hydroelectric project does not fall in any notified wildlife conservation area. The list of reported wild life around the project area has been presented in

A Himalayan pit viper (*Ancistrodon himalayanus*), a highly poisonous snake was spotted between the boulders during the site visit conducted in September 2005. Other fauna observed in the project site were common lizard, mongoose etc.

During the EIA study conducted in 2005, pugmarks of Snow leopard (*Panthera uncia*) were noticed in the area and photographed during the ecological survey. The Snow Leopard is listed as endangered on the IUCN-World Conservation Union's Red List of the Threatened Species. In addition, the Snow Leopard, like all big cats, is listed on Appendix I of the Convention on International Trade of Endangered Species (CITES), which makes trading of

animal body parts (i.e., fur, bones and meat) illegal in signatory countries. The snow leopard remains one of the most mysterious cats in the world. This roving, high altitude cat is rarely sighted by local people. Because it is so elusive, accurate population numbers are hard to come by, although estimates range from 100 to 200 individuals. As humans continue to push further into the mountainous areas with their livestock, the Snow Leopards' habitat is getting boxed-in by increasing human intrusion. As humans push further into the mountainous areas with their livestock, the snow leopard's habitat is getting degraded and fragmented. Overgrazing has damaged the fragile grasslands, leaving less food for the wild sheep and goats that are the Snow Leopard's main prey. Snow Leopards prefer steep, rugged terrains with rocky outcrops and ravines. They are found at high elevations in Himachal Pradesh. The higher altitudes of Tidong area is likely habitat of Snow Leopards. In view of the nature of the Snow Leopard, which prefers higher altitude (Above 3000 m) and do not frequent the valley areas. However, the barrage area may be one of the peripheral habitats for the Snow Leopard. The lower reached of the project area is not a typical habitat of the Snow Leopards and one is unlikely to encounter a Snow Leopard during the construction Phase It appears that the one whose pugmark was noticed during the EIA study, may be a stray cat and not a regular resident of the area. . However, as per the information from the forest department of Himachal Pradesh, snow leopards generally follow the snow line for pray. When there is heavy snow fall in the upper mountains and the ungulates move down for greener areas, the snow leopards follow the pray and comes down to the valleys. During the interactions with the villagers, few mentioned that they have seen the pug marks of snow leopards in the valley but have never seen the animal.

Tidong area is also reported to be the habitat of two other endangered species namely Musk Deer and Himalayan Brown Bear.

Musk deer is the most endangered of all the species of deer. One of the main reasons for this is that they are highly poached for their musk. Musk deer of India resemble medium-high dogs in size. They weigh just about 9 to 11 kg and are very different from the other types of Indian deer. Indian musk deer tend to be very secretive. They can be found either living alone or in groups, consisting of not more than three members. The sighting of the musk deer is poor. The most preferred habitat of the musk deer in India comprises of pockets with rock outcrops, which serve as a shelter from their predators. As winter season approaches, musk deer moves down to the area of coniferous trees. In summers, they like to stay in the upper reaches of the valley with good grassy vegetation. The region where the project is located is known to be a habitat for musk deer. However, during the EIA study period, no musk deer was sighted. Since musk deer prefers higher altitude, it is unlikely that the work areas would be a habitat of musk deer. During the interaction with the villagers, they mentioned that they have never seen a musk deer in the area. However they mentioned that musk deer was found in earlier times but now are not reported in the Tidong valley.

The mountains, around Tidong HEP also, are the habitat of Himalayan Black and Brown Bear as per the information obtained from the forest department. . The Brown Bears occurs in very low density in higher mountains in the Kinnaur area. Himalayan Brown Bears are omnivores and eat grasses, roots and other plants as well as insects and small mammals. They also like fruits and berries. They sometimes prey on mammals, including sheep and goats. No Brawn Bear was sighted during the study. During the interaction with the villagers, they mentioned that both Brown and Back Bear are not available in the Tidong valley but are common in Sangla area. None of the villagers have ever seen an Brown or a Black Bear in the Tidong valley.

**Figure 4-49: Himalayan Pit Viper Camouflaged between the Boulders**



**Figure 4-50: Common Lizard in the Project area**



**Figure 4-51: Pug Mark of Snow Leopard Preserved in Moist Soil**



**Table 4-26: Wildlife Fauna**

S.No.	Zoological Name	English Name	Local Name
<b>Mammals</b>			
1.	<i>Panthera unica</i>	Snow leopard	Safed bagh
2.	<i>Ursus thibetanus</i>	Himalayan black bear	Bhalu
3.	<i>Pseudois nayaur nayaur</i>	Blue sheep	Bharal
4.	<i>Moschus chrysogaster</i>	Musk deer	Kastura
5.	<i>Herpestes edwardsi</i>	Mongoose	Neola
6.	<i>Ochotona royalei</i>	Himalayan mouse hare	Rungata
<b>Birds</b>			
1.	<i>Lophophorus impejanus</i>	Himalayan pheasant	Monal
2.	<i>Alectoris chukar</i>	Chukar Partridge	Chakor
3.	<i>Tetraogallus himalayensis</i>	Snow cock	Ram Chakor
4.	<i>Gyps bengalensis</i>	White backed vulture	Gidh
5.	<i>Glaucidium cuculoides</i>	Himalayan spotted owl	Uloo
<b>Reptiles</b>			
1.	<i>Ancistrodon himalaynus</i>	Himalayan pit viper	Saap;
2.	<i>Agama tuberculata</i>	Common lizard	Chhipkali

**a. Avifauna**

The catchment area of Tidong H.E. project is poor in avifaunal species richness. Including influence zone it harbours nearly 40 species of birds comprising of Kite, Vulture, Chukor partridge, Tragopan, Monal, Pigeons, Parakeet, Owl, Hoopoe, Woodpeckers, Martin, Swallow, Shrike, Magpie, cough, Crow, Bulbuls, Flycatcher, Redstart, Chat, Thrushes, Tits, Wagtails, Sparrows, Finches, buntings, etc.

During the field survey a total of 17 species of birds were recorded from the influence zone and catchment area (Table 4-27). Majority of the species were widespread resident, followed by summer visitors. Red-billed Cough, Rock Pigeon, White-cheeked Bulbul, Blue Whistling Thrush and House Sparrow were most common and abundant species. None of the species was migratory, endemic, threatened and Scheduled I. All species are commonly distributed in Himalaya.

**Table 4-27: List of Avifauna**

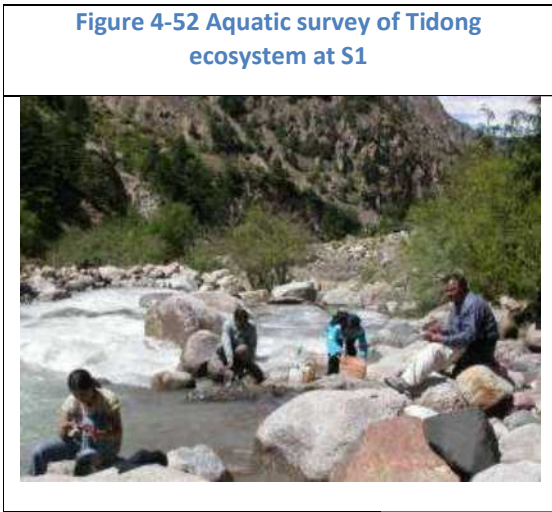
S.No.	Scientific Name	Common name	Habit
1.	<i>Alectoris chukar</i>	Chukar Partridge	R
2.	<i>Columba leuconota</i>	Himalayan Snow Pigeon	R
3.	<i>Columba livia</i>	Rock Pigeon	R/SM
4.	<i>Upupa epops</i>	Hoopoe	SV

5.	<i>Hirundo smithii</i>	Swallow	SV
6.	<i>Lanius schah</i>	Rufous back shrike	SV
7.	<i>Pica pica</i>	Black-billed Magpie	R
8.	<i>Pyrrhocorax Pyrrhocorax</i>	Red-billed Cough	R
9.	<i>Corvus macrorhynchus</i>	Jungle Crow	R
10.	<i>Pycnonotus leucogenys</i>	White-cheeked Bulbul	R
11.	<i>Pycnonotus cafer</i>	Redvented Bulbul	R
12.	<i>Rhyacornis fuliginosus</i>	Plumbeous Redstart	R/SM
13.	<i>Myiophonus caeruleus</i>	Blue Whistling Thrush	R
14.	<i>Parus monticolus</i>	Green-backed Tit	R
15.	<i>Motacilla cinerea</i>	Grey Wagtail	R
16.	<i>Passer domesticus</i>	House Sparrow	R
17.	<i>Emberiza schoeniclus</i>	Rock Bunting	R

R = Resident, SV = Seasonal Visitor, SM Seasonal Migrant

*Aquatic Ecology*

The aquatic analysis of Tidong Khad was conducted by RITES for one season only at all the three sampling sites (S1, S2 and S3) during the month of September 2005. The biological analysis of aquatic organisms revealed that the periphyton, phytoplankton and macrophytes represented as primary producers. However, zooplankton and benthos represented as the secondary producers.



**a. Periphyton and Phytoplankton**

The Tidong Khad, a rithronic stretch of the river, is dominated by the rapids, only a few pools were present in the stretch of the project area. Dominance of periphyton was present in the rapids, while, stray numbers of phytoplankton were present in the pools. Periphytons were represented by 23 members of the family of Bacillariophyceae, Chlorophyceae and Myxophyceae. However, only 14 members of phytoplankton were represented by the



family of Bacillariophyceae, Chlorophyceae and Myxophyceae. The data on frequency, density, abundance and diversity indices of periphyton dwelling in Tidong Khad have been presented in Table 4-28, Table 4-29 and Table 4-30 for  $S_1$ ,  $S_2$  and  $S_3$  respectively. The total density of periphyton ranged from 3,124 ind.  $m^{-2}$  to 4,916 ind.  $m^{-2}$ , which was dominated by the members of Bacillariophyceae. Diversity indices (Shannon-Weiner) of periphyton ranged from 3.8489 to 3.9894, which show that the diversity and quality of aquatic ecosystem was good at  $S_3$  of Tidong Khad.

The data on frequency, density, abundance and diversity index (Shannon Weiner) of phytoplankton of Tidong Khad have been presented in Table 4-31, Table 4-32 and Table 4-33 for sampling sites  $S_1$ ,  $S_2$  and  $S_3$  respectively. The population of phytoplankton were sparse (301.6 - 393.6 ind./lit) at the sampling sites. The diversity index was in the range of 2.1470 – 2.4432.

#### **b. Zooplankton**

Zooplankton population in the torrential water current of Tidong Khad was very low as depicted in Table 4-34, Table 4-35 and Table 4-36 for  $S_1$ ,  $S_2$  and  $S_3$  respectively. Zooplanktons were represented by the taxa cladocerans (01) and rotifers (03). Density of zooplankton was present in the range of 88.8 - 138.4 ind./lit. The diversity index was in the range of 1.0865 - 1.2711 at all the sites. It indicates the poor diversity of zooplankton in the Tidong Khad.

#### **c. Primary Production**

Primary production of Tidong Khad was mainly contributed by periphyton-phytoplankton assemblage. The data on gross primary productivity ( $P_g$ ), net primary productivity ( $P_n$ ) and P/R ratio have been presented in Table 4-40 and Table 4-41. The data on  $P_g$ ,  $P_n$  and P/R have been presented on terms of biomass (dry),  $g\ m^{-3}$ , carbon value ( $g\ C\ m^{-3}$ ) and calories of energy ( $K\ cal\ m^{-3}$ ) per hour (hr) and per month. The photoperiod (sunshine value) during the month of September 2005 was 12 hours.

The gross primary productivity ( $P_g$ ) was in the range from 0.498 to 0.557  $g\ C\ m^{-3}\ hr^{-1}$ . The net primary productivity ( $P_n$ ) of Tidong Khad was estimated to be in the range from 0.026 to 0.075  $g\ C\ m^{-3}\ hr^{-1}$ . The monthly (September 2005) gross primary productivity ( $P_g$ ) ranged from 179.385 to 200.667  $g\ C\ m^{-3}\ month^{-1}$ . However, the net primary productivity ( $P_n$ ) was recorded in range from 9.459 to 27.026  $g\ C\ m^{-3}\ month^{-1}$ .

#### **d. Trophic Status of Tidong Khad**

The P/R ratio of Tidong Khad was estimated to be in the range from 1.056 to 1.156. It shows that the primary productivity ( $P_g$ ) is somewhat higher to community respiration, which is the indicator of autotrophic nature of the aquatic ecosystem. The higher P/R ratio (1.156) is the clear indication of better trophic status present at the sampling site  $S_3$ .



**e. Aquatic Macrophytes**

Some of the aquatic macrophytes were recorded along the bank of the Tidong Khad. These macrophytes were identified as Equisetum spp., Adiantum and Selaginella spp. Aquatic macrophytes were present in the wet area of riparian zone of Tidong khad

**f. Macrozoobenthos**

Macrozoobenthos of Tidong Khad were represented by the members of Ephemeropterans (11), Trichopterans (04) and Dipterans (01). Ephemeropterans contribution was maximum to the total macrozoobenthos. The densities of macrozoobenthos were present in the range of 1,604 – 3,556 ind. m<sup>-2</sup>. A maximum density was observed at S3. It was also noticed that the health of aquatic Ephemeropterans was very good at S3. The diversity index of macrozoobenthos ranged from 3.9856 to 3.9939 in Tidong Khad project area as given in Table 4-37, Table 4-38 and Table 4-39 for S1, S2 and S3 respectively which confirms the rich diversity of aquatic insects and good environmental quality of aquatic ecosystem.

**g. Fish**

No fish species was encountered at sampling site S1 and S2. However, the species of Snow trout (*Schizothorax richardsonii*) and Rainbow trout (*Salmo trutta fario*) were present at the sampling site S3. This site is very close to the confluence of Tidong Khad and Satluj River and at the lowest altitude (2,260 m above m.s.l.) of the Project area. Snow trout (*Schizothorax richardsonii*) has been included in the IUCN Red List of threatened species. However, the conservation status of *Salmo trutta fario* has not been evaluated by IUCN.

As per EIA report of Rampur HEP and their further updated versions and related studies, fish catch surveys conducted in the area revealed that the tributaries and small rivulets joining the main Satluj river show presence of fishes population in small number but the main Satluj river has very less fish population. The fish species found is mainly Trout. The fish generally reach the main Satluj river when they travel down from the tributaries/khads.

The snow trout or mountain barbel (*Schizothorax richardsonii*) is an inhabitant of snow-melt and glacier-fed streams in the Greater and Lesser Himalayas. They undertake migration during winter months when the temperature in the Greater Himalayan waters reaches the near-freezing point. This induces them to migrate downstream and frequent the warmer spring-fed streams in search of suitable spawning grounds. The optimum temperature for spawning is 18-21.5°C.

The probable reasons fish being scanty in river Satluj are as follows:

- a. Satluj is very unstable in terms of flow regime. The river experiences frequent floods which make the conditions extremely difficult for fish breeding and their thriving.

- b. According to the report on “Ecology and Fisheries of Mountain Streams of the North-Western Himalayas”, KL Sehgal, ICAR, Nainital, 1988, most of the energy of cold-water fishes is utilised in maintaining their position in fast-flowing waters and hence they live under continuous physiological stress and exhibit poor biological productivity.
- c. The river Satluj carries the significant amount of silt . Silt, in sufficient volume, threatens trout by clogging gill membranes, by burying trout eggs to depths that they die of oxygen deficiency and by killing their nymphs. If the organic component of silt is high enough, this may raise the BOD (biological oxygen demand) of the water through the utilization of oxygen by bacteria and fungi which feed off the organic materials. Given high enough BOD levels, trout will either abandon the section of the stream so affected or will simply suffocate for lack of an adequate supply of oxygen.
- d. The hydrological factors also change the structure and consistency of the substratum of the river channel thus making less favorable for well-being and propagation of cold water fish.

**Table 4-28 Field Analysis Result for Periphyton at S1**

PERIPHYTON	FREQUENCY (%)	DENSITY (IND.M <sup>-2</sup> )	ABUNDANCE	DIVERSITY INDEX (SHANNON WEINER)
<b>Bacillariophyceae</b>				
<i>Tabellaria fenestrata</i>	80	292	3.650	0.2545
<i>Diatoma vulgare</i>	84	296	3.524	0.2567
<i>Meridion circulare</i>	68	152	2.235	0.1640
<i>Fragilaria inflata</i>	88	416	4.727	0.3158
<i>Synedra ulna</i>	80	196	2.450	0.1956
<i>Nitzschia</i>	80	248	3.100	0.2290
<i>Navicula radiosa</i>	92	312	3.391	0.2653
<i>Cocconeis placentula</i>	48	84	1.750	0.1064
<i>Cymbella cistula</i>	96	400	4.167	0.3086
<i>Gomphonema</i>	76	164	2.158	0.1730
<i>Cyclotella</i>	60	100	1.667	0.1212
<i>Stauroneis</i>	72	156	2.167	0.1670
<i>Denticula</i>	72	148	2.056	0.1609
<i>Gomphoneis</i>	72	156	2.167	0.1670
<i>Astrionella</i>	72	128	1.778	0.1451
<b>Chlorophyceae</b>				
<i>Closterium leibleinii</i>	64	116	1.813	0.1351
<i>Zygnema</i>	80	148	1.850	0.1609
<i>Ulothrix zonata</i>	76	152	2.000	0.1640
<i>Spirogyra</i>	76	152	2.000	0.1640
<b>Myxophyceae</b>				
<i>Phormidium</i>	36	52	1.444	0.0738
<i>Oscillatoria tenuis</i>	56	100	1.786	0.1212
<b>Total</b>		<b>3,968</b>		<b>3.8489</b>

Field Analysis Conducted by RITES in September 2005

**Table 4-29 Field Analysis Result for Periphyton at S2**

PERIPHYTON	FREQUENCY (%)	DENSITY (IND.M <sup>2</sup> )	ABUNDANCE	DIVERSITY INDEX (SHANNON WEINER)
<b>Bacillariophyceae</b>				
<i>Tabellaria fenestrata</i>	96	296	3.083	0.3077
<i>Diatoma vulgare</i>	76	160	2.105	0.2083
<i>Meridion circulare</i>	60	104	1.733	0.1545
<i>Fragilaria inflata</i>	100	336	3.360	0.3311
<i>Synedra ulna</i>	68	92	1.353	0.1415
<i>Nitzschia</i>	100	408	4.080	0.3682
<i>Navicula radiosa</i>	88	160	1.818	0.2083
<i>Cocconeis placentula</i>	52	60	1.154	0.1032
<i>Cymbella cistula</i>	100	320	3.200	0.3220
<i>Gomphonema</i>	60	80	1.333	0.1278
<i>Cyclotella</i>	60	80	1.333	0.1278
<i>Stauroneis</i>	72	100	1.389	0.1503
<i>Ceratoneis arcus</i>	40	48	1.200	0.0872
<i>Denticula</i>	64	108	1.688	0.1587
<i>Gomphoneis</i>	24	52	2.167	0.0927
<b>Chlorophyceae</b>				
<i>Closterium leibleinii</i>	16	20	1.250	0.0438
<i>Zygnema</i>	52	84	1.615	0.1325
<i>Ulothrix zonata</i>	92	192	2.087	0.2350
<i>Spirogyra</i>	52	68	1.308	0.1134
<i>Oedogonium</i>	92	160	1.739	0.2083
<b>Myxophyceae</b>				
<i>Phormidium</i>	64	88	1.375	0.1370
<i>Oscillatoria tenuis</i>	60	108	1.800	0.1587
<b>Total</b>		<b>3,124</b>		<b>3.9182</b>

Field Analysis Conducted by RITES in September 2005

**Table 4-30 Field Analysis Result for Periphyton at S3**

PERIPHYTON	FREQUENCY (%)	DENSITY (IND.M <sup>2</sup> )	ABUNDANCE	DIVERSITY INDEX (SHANNON WEINER)
<b>Bacillariophyceae</b>				
<i>Tabellaria fenestrata</i>	96	408	4.250	0.2889
<i>Diatoma vulgare</i>	96	412	4.292	0.2905
<i>Meridion circulare</i>	92	196	2.130	0.1812
<i>Fragilaria inflata</i>	100	672	6.720	0.3768
<i>Synedra ulna</i>	72	128	1.778	0.1345
<i>Nitzschia</i>	100	500	5.000	0.3240
<i>Navicula radiosa</i>	96	404	4.208	0.2872
<i>Cocconeis placentula</i>	68	116	1.706	0.1252
<i>Cymbella cistula</i>	100	560	5.600	0.3441
<i>Gomphonema</i>	92	176	1.913	0.1683
<i>Cyclotella</i>	80	132	1.650	0.1375
<i>Stauroneis</i>	32	44	1.375	0.0601
<i>Ceratoneis arcus</i>	40	68	1.700	0.0841
<i>Denticula</i>	72	132	1.833	0.1375
<i>Gomphoneis</i>	64	108	1.688	0.1189
<i>Astrionella</i>	76	148	1.947	0.1491
<b>Chlorophyceae</b>				
<i>Closterium leibleinii</i>	64	96	1.500	0.1090
<i>Zygnema</i>	24	36	1.500	0.0513
<i>Ulothrix zonata</i>	68	108	1.588	0.1189
<i>Spirogyra</i>	44	80	1.818	0.0951
<i>Oedogonium</i>	72	168	2.333	0.1630
<b>Myxophyceae</b>				
<i>Phormidium</i>	72	112	1.556	0.1221
<i>Oscillatoria tenuis</i>	60	112	1.867	0.1221
<b>Total</b>		<b>4,916</b>		<b>3.9894</b>

Field Analysis Conducted by RITES in September 2005

**Table 4-31 Field Analysis Result for Phytoplankton at S1**

PHYTOPLANKTON	FREQUENCY (%)	DENSITY (IND.L <sup>-1</sup> )	ABUNDANCE	DIVERSITY INDEX (SHANNON WEINER)
<b>Bacillariophyceae</b>				
<i>Tabellaria fenestrata</i>	40	28.8	3 600	0.1940
<i>Diatoma vulgare</i>	32	20.8	3 250	0.1545
<i>D. elongata</i>	36	21.6	3 000	0.1587
<i>Fragilaria inflata</i>	36	25.6	3 556	0.1789
<i>Nitzschia</i>	28	22.4	4 000	0.1629
<i>Navicula radiosa</i>	44	32.8	3 727	0.2118
<i>Cymbella cistula</i>	28	31.2	5 571	0.2048
<i>Ceratoneis arcus</i>	40	19.2	2 400	0.1459
<i>Astrionella</i>	24	11.2	2 333	0.0980
<i>Denticula</i>	28	15.2	2 714	0.1231
<b>Chlorophyceae</b>				
<i>Ulothrix zonata</i>	32	25.6	4 000	0.1789
<i>Spirogyra</i>	32	18.4	2 875	0.1415
<b>Myxophyceae</b>				
<i>Oscillatoria tenuis</i>	44	28.8	3 273	0.1940
<b>Total</b>		<b>301.6</b>		<b>2.1470</b>

Field Analysis Conducted by RITES in September 2005

**Table 4-32 Field Analysis Result for Phytoplankton at S2**

PHYTOPLANKTON	FREQUENCY (%)	DENSITY (IND.L <sup>-1</sup> )	ABUNDANCE	DIVERSITY INDEX (SHANNON WEINER)
<b>Bacillariophyceae</b>				
<i>Tabellaria fenestrata</i>	36	29.6	4 111	0.1968
<i>Diatoma vulgare</i>	36	27.2	3 778	0.1858
<i>D. elongata</i>	40	19.2	2 400	0.1453
<i>Fragilaria inflata</i>	52	40.8	3 923	0.2435
<i>Nitzschia</i>	72	38.4	2 667	0.2341
<i>Navicula radiosa</i>	36	28.0	3 889	0.1895
<i>Cymbella cistula</i>	36	29.6	4 111	0.1968
<i>Cocconeis</i>	36	12.8	1 778	0.1079
<i>Ceratoneis arcus</i>	4	1.6	2 000	0.0205
<i>Astrionella</i>	36	16.0	2 222	0.1273
<i>Denticula</i>	20	11.2	2 800	0.0976
<b>Chlorophyceae</b>				
<i>Ulothrix zonata</i>	36	22.4	3 111	0.1622
<i>Spirogyra</i>	32	17.6	2 750	0.1364
<b>Myxophyceae</b>				
<i>Oscillatoria tenuis</i>	60	28.8	2 400	0.1932
<b>TOTAL</b>	<b>323.2</b>		<b>2.2370</b>	

Field Analysis Conducted by RITES in September 2005

**Table 4-33 Field Analysis Result for Phytoplankton at S3**

PHYTOPLANKTON	FREQUENCY (%)	DENSITY (IND.L <sup>-1</sup> )	ABUNDANCE	DIVERSITY INDEX (SHANNON WEINER)
<b>Bacillariophyceae</b>				
<i>Tabellaria fenestrata</i>	60	40.0	3.333	0.2317
<i>Diatoma vulgare</i>	60	40.8	3.400	0.2347
<i>D. elongata</i>	56	33.6	3.000	0.2063
<i>Fragilaria inflata</i>	64	54.4	4.250	0.2815
<i>Nitzschia</i>	52	39.2	3.769	0.2286
<i>Navicula radiosa</i>	68	42.4	3.118	0.2406
<i>Cymbella cistula</i>	72	39.2	2.722	0.2286
<i>Cocconeis</i>	32	12.0	1.875	0.0984
<i>Ceratoneis arcus</i>	24	6.4	1.333	0.0606
<i>Astrionella</i>	20	8.0	2.000	0.0721
<i>Denticula</i>	28	14.4	2.571	0.1129
<b>Chlorophyceae</b>				
<i>Ulothrix zonata</i>	24	20.0	4.167	0.1436
<i>Spirogyra</i>	36	22.4	3.111	0.1558
<b>Myxophyceae</b>				
<i>Oscillatoria tenuis</i>	32	20.8	3.250	0.1477
<b>Total</b>		<b>393.6</b>		<b>2.4432</b>

Field Analysis Conducted by RITES in September 2005

**Table 4-34 Field Analysis Result for Zooplankton at S1**

ZOOPLANKTON	FREQUENCY (%)	DENSITY (IND.L <sup>-1</sup> )	ABUNDANCE	DIVERSITY INDEX (SHANNON WEINER)
<b>Cladocerans</b>				
<i>Daphnia</i>	44	19.2	2.182	0.2496
<b>Rotifers</b>				
<i>Trichocera</i>	48	29.6	3.083	0.3248
<i>Keratella</i>	40	20.8	2.600	0.2626
<i>Asplanchna</i>	40	19.2	2.400	0.2496
<b>Total</b>		<b>88.8</b>		<b>1.0865</b>

Field Analysis Conducted by RITES in September 2005

**Table 4-35 Field Analysis Result for Zooplankton at S2**

ZOOPLANKTON	FREQUENCY (%)	DENSITY (IND.L <sup>-1</sup> )	ABUNDANCE	DIVERSITY INDEX (SHANNON WEINER)
<b>Cladocerans</b>				
<i>Daphnia</i>	52	25.6	2.462	0.3209
<b>Rotifers</b>				
<i>Trichocera</i>	56	30.4	2.714	0.3533
<i>Keratella</i>	76	37.6	2.474	0.3946
<i>Asplanchna</i>	16	10.4	3.250	0.1800
<b>Total</b>		<b>104.0</b>		<b>1.2489</b>

Field Analysis Conducted by RITES in September 2005

**Table 4-36 Field Analysis Result for Zooplankton at S3**

ZOOPLANKTON	FREQUENCY (%)	DENSITY (IND.L <sup>-1</sup> )	ABUNDANCE	DIVERSITY INDEX (SHANNON WEINER)
<b>Cladocerans</b>				
<i>Daphnia</i>	48	29.6	3.083	0.2906
<b>Rotifers</b>				
<i>Trichocera</i>	72	40.0	2.778	0.3459
<i>Keratella</i>	56	32.0	2.857	0.3044
<i>Asplanchna</i>	68	36.8	2.706	0.3302
<b>Total</b>		<b>138.4</b>		<b>1.2711</b>

Field Analysis Conducted by RITES in September 2005

**Table 4-37 Field Analysis Result for Benthos at S1**

BENTHOS	FREQUENCY (%)	DENSITY (IND.M <sup>-2</sup> )	ABUNDANCE	DIVERSITY INDEX (SHANNON WEINER)
<b>Ephemeropterans</b>				
<i>Heptagenia</i>	72	156	2.167	0.3386
<i>Baetis niger</i>	56	108	1.929	0.2724
<i>B. muticus</i>	80	148	1.850	0.3287
<i>B. rhodani</i>	56	76	1.357	0.2172
<i>Ecdynurus</i>	60	84	1.400	0.2321
<i>Ameletus</i>	56	136	2.429	0.3130
<i>Siphonurus</i>	68	132	1.941	0.3076
<i>Centroptilum</i>	68	112	1.647	0.2786
<i>Ephemerella ignita</i>	64	104	1.625	0.2661
<i>Rithrogena</i>	48	100	2.083	0.2596
<b>Trichopterans</b>				
<i>Rhyacophila</i>	40	76	1.900	0.2172
<i>Hydropsyche</i>	64	108	1.688	0.2724
<i>Perla</i>	76	40	0.526	0.1389
<i>Isoperla</i>	44	72	1.636	0.2095
<b>Dipterans</b>				
<i>Tendipes</i>	84	152	1.810	0.3337
<b>Total</b>		<b>1,604</b>		<b>3.9856</b>

Field Analysis Conducted by RITES in September 2005

**Table 4-38 Field Analysis Result for Benthos at S2**

BENTHOS	FREQUENCY (%)	DENSITY (IND.M <sup>-2</sup> )	ABUNDANCE	DIVERSITY INDEX (SHANNON WEINER)
<b>Ephemeropterans</b>				
<i>Heptagenia</i>	80	280	3.500	0.3868
<i>Baetis niger</i>	76	256	3.368	0.3694
<i>B. muticus</i>	72	124	1.722	0.2404
<i>B. rhodani</i>	72	148	2.056	0.2691
<i>Ecdynurus</i>	56	88	1.571	0.1913
<i>Siphonurus</i>	72	120	1.667	0.2354
<i>Centroptilum</i>	88	200	2.273	0.3224
<i>Ephemerella ignita</i>	80	152	1.900	0.2736
<i>Ephemerella notata</i>	56	116	2.071	0.2302
<i>Rithrogena</i>	76	132	1.737	0.2503
<b>Trichopterans</b>				
<i>Rhyacophila</i>	76	148	1.947	0.2691
<i>Hydropsyche</i>	68	120	1.765	0.2354
<i>Perla</i>	60	104	1.733	0.2142
<i>Isoperla</i>	56	120	2.143	0.2354
<b>Dipterans</b>				
<i>Tendipes</i>	68	144	2.118	0.2645
<b>Total</b>		<b>2,252</b>		<b>3.9873</b>

Field Analysis Conducted by RITES in September 2005

**Table 4-39 Field Analysis Result for Benthos at S3**

BENTHOS	FREQUENCY (%)	DENSITY (IND.M <sup>-2</sup> )	ABUNDANCE	DIVERSITY INDEX (SHANNON WEINER)
<b>Ephemeropterans</b>				
<i>Heptagenia</i>	100	872	8.720	0.5204
<i>Baetis niger</i>	100	392	3.920	0.3884
<i>B. muticus</i>	84	192	2.286	0.2578
<i>B. rhodani</i>	96	284	2.958	0.3265
<i>Ecdynurus</i>	60	120	2.000	0.1889
<i>Siphonurus</i>	84	164	1.952	0.2329
<i>Centroptilum</i>	64	132	2.063	0.2016
<i>Ephemerella ignita</i>	48	88	1.833	0.1520
<i>Ephemerella notata</i>	64	116	1.813	0.1845
<i>Rithrogena</i>	60	104	1.733	0.1710
<b>Trichopterans</b>				
<i>Rhyacophila</i>	84	196	2.333	0.2611
<i>Hydropsyche</i>	96	300	3.125	0.3368
<i>Perla</i>	72	152	2.111	0.2216
<i>Isoperla</i>	72	144	2.000	0.2137
<b>Dipterans</b>				
<i>Tendipes</i>	84	300	3.571	0.3368
<b>Total</b>		<b>3,556</b>		<b>3.9939</b>

Field Analysis Conducted by RITES in September 2005

**Table 4-40: Gross Primary Productivity (P<sub>g</sub>), Respiration (R), Net Primary Productivity (P<sub>n</sub>) per hour and P/R Ratio of Aquatic Periphyton And Phytoplankton**

Sites	Gross primary productivity (P <sub>g</sub> )			Respiration (R)			Net Primary Productivity (P <sub>n</sub> )			P/R ratio
	Biomass (dry) g m <sup>-3</sup> hr <sup>-1</sup>	Carbon value g C m <sup>-3</sup> hr <sup>-1</sup>	Calories of energy K Cal m <sup>-3</sup> hr <sup>-1</sup>	Biomass (dry) g m <sup>-3</sup> hr <sup>-1</sup>	Carbon value g C m <sup>-3</sup> hr <sup>-1</sup>	Calories of energy K Cal m <sup>-3</sup> hr <sup>-1</sup>	Biomass (dry) g m <sup>-3</sup> hr <sup>-1</sup>	Carbon value g C m <sup>-3</sup> hr <sup>-1</sup>	Calories of energy K Cal m <sup>-3</sup> hr <sup>-1</sup>	
S <sub>1</sub>	0.997	0.498	5.481	0.944	0.472	5.192	0.053	0.026	0.289	1.056
S <sub>2</sub>	1.002	0.501	5.512	0.925	0.463	5.089	0.077	0.038	0.423	1.083
S <sub>3</sub>	1.115	0.557	6.132	0.965	0.482	5.306	0.150	0.075	0.826	1.156

Field Analysis Conducted by RITES in September 2005

**Table 4-41: Gross Primary Productivity (P<sub>g</sub>), Respiration (R), Net Primary Productivity (P<sub>n</sub>) per hour and P/R Ratio of Aquatic Periphyton And Phytoplankton**

Sites	Gross primary productivity (P <sub>g</sub> )			Respiration (R)			Net Primary Productivity (P <sub>n</sub> )			P/R ratio
	Biomass (dry) g m <sup>-3</sup> hr <sup>-1</sup>	Carbon value g C m <sup>-3</sup> hr <sup>-1</sup>	Calories of energy K Cal m <sup>-3</sup> hr <sup>-1</sup>	Biomass (dry) g m <sup>-3</sup> hr <sup>-1</sup>	Carbon value g C m <sup>-3</sup> hr <sup>-1</sup>	Calories of energy K Cal m <sup>-3</sup> hr <sup>-1</sup>	Biomass (dry) g m <sup>-3</sup> hr <sup>-1</sup>	Carbon value g C m <sup>-3</sup> hr <sup>-1</sup>	Calories of energy K Cal m <sup>-3</sup> hr <sup>-1</sup>	
S <sub>1</sub>	358.769	179.385	1973.230	339.851	169.925	1869.180	18.918	9.459	104.050	1.056
S <sub>2</sub>	360.796	180.398	1984.378	333.094	166.547	1832.020	27.702	13.851	152.359	1.083
S <sub>3</sub>	401.335	200.667	2207.342	347.283	173.642	1910.057	54.052	27.026	297.285	1.156

Field Analysis Conducted by RITES in September 2005





## 5. SOCIO-ECONOMIC ASSESSMENT & MANAGEMENT PLAN

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### 5.1 General

The proposed project will involve construction of the diversion barrage, headrace tunnel, powerhouse etc. Construction of the project facilities would require 42.2557 ha of land, out of which 39.0546 ha is the Government/Forest Land and the remaining 3.2011 ha is Private land owned by the individuals. Compulsory acquisition of private lands may cause social disruption and economic loss for the project affected families/ population. As the project is located in area with low population density, the workers, which will be migrating in the project area during construction, would also cause demographic and social changes. While implementing the project, there is a need to take into account these disturbances and losses due to project, their impact on socio-economic condition of the population and plan for their mitigation measures to minimize any negative impacts. The social aspects including issues relating to Resettlement and Rehabilitation of Project Affected Families in this particular case needs be handled with utmost care and fore thought since the project area is remote, where majority of community comprises of marginal farmers, workers and artisans. For successful implementation of the project it is necessary to cultivate a productive relationship between the project offices and the affected families.

Governed by this consideration, the study assesses and evaluates the broad economic resource base and socio-economic profile of the immediate region (i.e. villages) with an implicit purpose of assessing the social absorption capacity of the region. This has been mainly carried out through the published census data of 1991, 2001 and 2011 and field social survey of the sample<sup>1</sup> of affected families.

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<sup>1</sup> Sample size of 82% of project affected population comprising of 23 families out of 28 affected families.

## 5.2 Socio-Economic Profile of Kinnaur District

### 5.2.1 Geographical and Demographic Features

Kinnaur is one of the most scenic but less known districts of Himachal Pradesh. Located on the Indo-Tibetan border, it is surrounded by Tibet to the East, Garhwal Himalaya to the South, Spiti Valley to the North and Kullu to the West. Kinnaur is about 235 kms from Shimla; the capital of Himachal Pradesh, having the three high mountains ranges i.e. Zaskar, Greater Himalayas and Dhauladhar, enclosing valleys of Sutluj, Spiti, Baspa and their tributaries. The district covered an area of 6401 sq. kms, which forms about 11.5 per cent of total geographical area of the state. Most of the land consists of rugged barren mountains, it receives little rainfall and the desolate countryside can be compared to that of the Ladakh region.

Demographic data used for this review is primarily based on 2001 Census data. However, the provisional district level data from 2011 Census is available and has been considered while reviewing this chapter. At limited places, few figures have extrapolated accordingly wherever required.

Total population of the District according to 2011 census is 84,298 persons (approximately 21136 households), comprising of 46,364 males and 37,934 females. Sex ratio (females per 1000 males) is 818. The density of population is 13 per sq. km. The scheduled castes and scheduled tribes population<sup>2</sup> of the district is 8,205 (About 9.7%) persons and 6,056 (about 7.2%) persons respectively (Table 5-1 is entirely based on 2001 census data). As per A Presidential Notification in 1956 (under Article 341 of the Indian Constitution), the tribal population of Kinnaur have been accorded the status of Scheduled Tribe.

On the basis of the Central Government norm of treating a region with 50 percent or above concentration of tribal population as a Scheduled Area, the district of Kinnaur qualifies to be the Scheduled Area. This district is, therefore, covered by Integrated Tribal Development Project of Government of India.

### 5.2.2 Administrative Set up

Administratively, district Kinnaur is divided into 3 administrative divisions i.e. Pooh, Kalpa and Nichar, which are further divided into five tehsils i.e., Pooh, Moorang, Kalpa, Sangla and

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<sup>2</sup> Figures extrapolated from Census of India 2001 and 2011

Nichar. Further, the smaller constituents of administrative system of the district are 660 villages under 64 Panchayats.

### 5.2.3 Socio-Cultural Background

Due to the proximity of Kinnaur to Tibet, the life style and religion of its inhabitants have been influenced by Buddhism, though the majority of the people practice Hinduism. They practice a complex form of religious admixture between Hinduism and Buddhism. Though all the respondents who have been displaced due to project claims to be Hindu they also practice Buddhism. In face one of the family members of the displaced family is a Lama (Buddhist Priest) and claims to be a Hindu.

The Kinnaur society is divided into two broad occupational groups viz. peasants and the artisans, possibly of diverse ethnic origin. Their clothing is well suited to the climate. They mostly wear woolen clothes in their own distinctive way. Men wear woolen shirts called *Chamn Kurti* which are tailored in the village itself. Women wrap up a woolen shawl like garment called *Dohru*. The staple food is wheat, *ogla*, *phafra* and barley, which are local produce. Besides these *kankani*, *cheena*, maize, *chollair* and *bhatu* are also taken. A number of dialects are spoken by the inhabitants of Kinnaur district that come under 'Kinnauri' or 'Kanauri'. The villagers on the Tibetan Border speak Tibetan dialects of western Tibet.

**Table 5-1: Demographic and Socio-Economic Characteristics of Kinnaur District and Himachal Pradesh**

Sl. No.	Characteristics	Kinnaur	Himachal Pradesh
1.	Total Area Covered (in Sq.Kms.)	6401	55,673
2.	Number of Households	18,641	1,221,589
3.	Household size	4	5
4.	Total Population	78,334	6,077,900
4.1	Male	42,173	3,087,940
4.2	Female	36,161	29,989,960
5.	SC Population	7625	1,502,170
5.1	Male	3,972	763,333
5.2	Female	3,653	738,837
6	ST Population	56,268	244,587
6.1	Male	27,583	122,549
6.2	Female	28,685	122,038
7.	Sex Ratio (no. of females per 1000 males)	857	968
8.	Population Density (per sq.km.)	12	109

Source: Census of India, 2001

#### 5.2.4 Agriculture

Kinnaur district has about 9,400 ha cultivable land and about 614,000 ha non-cultivable land. Agriculture and Horticulture are the mainstay of the district. In 2002-2003, about 5,500 ha of area came under irrigation. About 76% of the total working population is engaged in these occupations. Fruits and cash crops, like seed potatoes, ginger, vegetable seeds, apples, stone fruits, etc. are grown in the district. Wheat, maize and rice are the major food crops. In 2001-02, total area under food production was 5,430 ha and the total food grain production was 3.5 lakh tones, 31,268 tone fruits were produced over 8507 ha of area. According to 2001 census report, there are 30,977 cultivators and 1,101 agricultural labourers in the district. Daily wages for unskilled labour in agricultural sector has been increased from Rs.40/- in 1994-95 to Rs. 90/- in 2002-03 and Rs. 110 in May 2010. The information about agriculture in Kinnaur district is given at Table 5-2.

**Table 5-2: Agriculture in Kinnaur District**

Sl.No.	Items	Unit	No.
1.	Total Cultivated Land	Hectare	9355
2.	Non-Cultivated Land	Hectare	614387
3.	Total irrigated land	Hectare	5478
4.	Area under food production	Hectare	5430
5.	Food grain production	Tonnes	3561.02
6	Area under fruit production	Hectare	8507
7	Fruit production	Metric Tonnes	31268
8	Cultivators	No.	30977
9	Agricultural labourers	No.	1101

Source: Handbook of Statistics, 2003, District Kinnaur, Himachal Pradesh.

#### 5.2.5 Livestock

Geographical condition of the district is better suited to development of animal husbandry as compared to agriculture. The livestock in the district play an important role in agricultural operations and it is customary to rear different and certain types of animals in each family. But the livestock combinations depend on the climatic conditions, availability of fodder, need and economic status of the population. The livestock in the district included 73208 (Ovine), 35919 (Caprine), 24685 (Bovine), 5964 (Poultry), 4133 (Equine), 3447 (Canine) and 30 (Swine).

### 5.2.6 Tourism

Kinnaur is a coveted tourist destination. However the distance and the remoteness of the area prevents beautiful district to visit. Great natural scenes, rivers valleys, high mountains, lakes and green pastures create a mesmerizing scene for tourists. The best time to visit the district is from April to October. However, no tourist spot has been identified in the project area during the reconnaissance visit, therefore, no impact on tourism is sought by the project.

### 5.2.7 Industrial Status

The Kinnaur district is extremely industrially backward. The main reasons behind this is lack of enterprise among local population, paucity of finance, lack of raw material, lack of markets and traditional outlook of the people. There are no large industries, but only 59 handloom units and 3 handicraft units in the district. Tourism industry has yet to get momentum in the district. However, in recent years, the potential of hydropower has been identified and projects are being developed in the district. Major project under execution in the district are 1000 MW Karchham Wangto, 243MW Kashang 3-stage, 402 MW Shongtong Karcham, and 100 MW Tidong-1 HEP.

### 5.2.8 Literacy

Himachal Pradesh is among the leading States in the country in terms of literacy and therefore, all the districts except Chamba have a higher literacy percentage as compared to the all-India average. The literacy level of the Kinnaur district increased from 58.36 % in 1991 to 75.2 % in 2001 and 80.77% in 2011. As per 2011 census data 88.37 % males and 71.34% females are literate. While Kinnaur district may have lesser number of literates, “the current status of this critical sector of human development constitutes a remarkable achievement. Advances in the field of education comprise one of Himachal Pradesh’s greatest success stories.

Table 5-3: Literacy and Human Development Index

District / State	Literacy						Human Development Index	Rank amongst other districts of Himachal
	2001			2011				
	P	M	F	P	M	F		

Kinnaur	75.2	84.3	64.4	80.77	88.37	71.34	0.51	3
Himachal Pradesh	77.13	86.02	68.08	83.78	90.83	76.6	0.433	

P=Person, M=Male, F=Female

Source: Census of India, 2011 and Himachal Pradesh Human Development Report, 2002

There are 189 Primary Schools, 37 Middle Schools, 22 High Schools, 22-Senoir Secondary School and one Government College in Kinnaur district as per available data<sup>3</sup>.

### 5.2.9 Public Health

Difficult terrain, poor infrastructure and overall shortage of specialist medical personnel and centers have created serious delays in achieving the goal of “Health for All” in District Kinnaur. Nonetheless, infant mortality rate has declined and the district has experienced a decline in crude death and birth rate during the last decade. There are one regional hospital, 4 block hospitals, 50 primary health centers/ sub-centres, 1 ayurvedic hospital and 41 ayurvedic health centers. These health facilities are not distributed evenly over the whole district and most of them are confined to market center and easily accessible areas. The major diseases in the district are pneumonia, acute diarrhoea, measles, and enteric fever.

#### 5.2.10 Other Services

There are 72 post offices, 9 telegraph offices, 1 Doordarshan kendra, 4 police station, 18 Nationalized Banks, 11 government banks and 10 co-operative bank branches in the district. Veterinary services are quite inadequate as there are only 18 veterinary hospitals, 39 dispensaries, 2 poultry farms, 1 sheep-breeding farm and 1 mobile veterinary dispensary. The available mode of transportation in the district is road transports. The total length of mettalled roads is 962 Kms. Travel in some high altitude areas can be slow and dangerous, especially during monsoon season due to the poor condition of roads and frequent landslides. Most areas have telephone services.

## 5.3 Socio-Economic Profile of Project Affected Area

Socio economic study in the project affected area was conducted in the selected study area which comprises of seven selected villages namely Rispa Khas, Lijing, Roowang, Lambar,

<sup>3</sup> Official website of District Kinnaur – [www.hpkinnaur.nic.in](http://www.hpkinnaur.nic.in)



Thangi Khas, Piwar and Charang Khas are situated within affected area and in the close vicinity. Though few of them are not affected directly, however, the project activities would have substantial indirect impact on the socio-economics of these villages and with this view, a socio-economic analysis of these villages has been carried out as given in the following paragraphs. The project acquired land from Rispa, Roowang and Lambar villages.

### 5.3.1 Population Characteristics

Parameters covered under demographic study are number of households, total population with sex wise distinction, average. Family size and sex ratio in the selected villages and is briefed in Table 5-4. Marked variations in the distribution of population and sex ratio in the villages have been observed, which are related to their environmental conditions and geographical locations. Thangi Khas village has the highest population (614 persons) followed by Rispa Khas (498), Charang Khas (204). The lowest populated villages are Piwar (16), Lijing (29) and Lamber (30 persons). Sex ratio i.e. number of females per 1000 males, of some of these villages are extremely skewed.

Table 5-4: Population of Project Area Villages

VILLAGES	No. of H.H	POPULATION			Family Size	Sex Ratio
		P	M	F		
Rispa Khas	105	498	273	225	4.7	824
Lijing	6	29	21	8	4.8	381
Roowang	29	139	79	60	4.8	759
Lambar	8	30	6	24	3.8	4000
Thangi Khas	136	614	310	304	4.5	981
Piwar	7	16	8	8	2.3	1000
Charang Khas	48	204	82	122	4.3	1488

HH=House Holds, P=Person, M=Male, F=Female  
Source: Census of India, 2001

Most of the Villages have skewed sex ratio and varies from 381 in Lijing to 4000 in Lambar. Outward migration of males from the villages could be a possible reason for such abnormal sex ratio.

### 5.3.2 Literacy

Rate of literacy in the study area is 64% which is below the overall literacy rate of the district and the state. The rate varies from a high of 84.3% in Thangi Khas to the lowest of 45.5% in

Roowang village in the study area. All other villages show a literacy rate between 63-77% as mentioned in Table 5-5. In all the villages of the area, more number of males were found to be literate than females.

### 5.3.3 Employment

The economic classification of workers as per the 2001 Census is given in Table 5-6 and Table 5-7. Out of the total population in project villages, the highest percentage of workers is from Lizing (90%) followed by Rispa (75%) and Charang (60%) and lowest is Lambar (47%). There are no small or medium scale industries in affected villages.

A few household industries exist in Charang khas, Thangi khas and Rispa Khas employing less than 1% of total workers population from the villages. In the Project Affected villages, the male population dominates in the category of “Main Workers” except for cultivators, while female population dominates the “Non-Workers”.

**Table 5-5: Literacy rate of villages in the Project vicinity**

Village	Literacy rate (Percentage)		
	Persons	Males	Females
Rispa Khas	69.4	76.3	60.4
Lijing	63.0	75.0	28.6
Roowang	45.5	54.7	34.8
Lambar	69.2	100.0	60.0
Thangi Khas	84.3	93.6	74.3
Piwar	66.7	87.5	42.9
Charang Khas	77.2	84.7	72.2

Source: Census of India, 2001

**Table 5-6: Workers Classification in the Project area Villages**

Village	Total Population	% of Population		% of Workers	
		Workers	Non Workers	Main Workers	Marginal Workers
Rispa Khas	498	75%	25%	88%	12%
Lijing	29	90%	10%	88%	12%
Roowang	139	59%	41%	100%	0%
Lambar	30	47%	53%	100%	0%

Thangi Khas	614	67%	33%	80%	20%
Piwar	16	56%	44%	100%	0%
Charang Khas	204	60%	40%	81%	19%

Source: Census of India, 2001

**Table 5-7: Main Workers Classification from the Project Area villages**

Village	Cultivators (%)	Agricultural labourers (%)	Workers in household industries (%)	Other Workers (%)
Rispa Khas	73.6	23.7	0.3	2.4
Lijing	34.8	65.2	0.0	0.0
Roowang	25.6	0.0	0.0	74.4
Lambar	92.9	0.0	0.0	7.1
Thangi Khas	83.6	5.5	0.3	10.6
Piwar	88.9	0.0	0.0	11.1
Charang Khas	80.8	0.0	2.0	17.2

Source: Census of India, 2001

Notes on Table 5-6 and Table 5-7:

- i. Main workers: Those who have worked for at least 183 days in a year.
- ii. Marginal workers: Those who work for less than 183 days in a year.
- iii. Cultivators: A person engaged either as employer, single worker or family worker in cultivation of land- cultivation includes supervision or direction of cultivation.
- iv. Agricultural labour: A person who works in another person’s land for wages in money, kind or share.
- v. Household industry worker: Industry conducted by the household at home.
- vi. Other workers; includes factory workers, plantation workers, those engaged in trade, commerce, business, transport, mining and construction etc.
- vii. Non-workers: include students, dependents, retired persons, beggars etc.

## 5.4 Socio-Economic Survey of Project Affected Population (PAP)

28 households and 1 *Mandir Devta Kuldev* (Temple of Local God) from Ruwang, Lizang & Lambar village have been affected due to partial acquisition of their land for the project in execution. The project, however, did not acquire any house. The details of the land

acquisition and the amount of compensation received by the individual land holders are given in Table 5-8. It is important to mention here that Mrs. Suraj Devi who had only 0.0036 ha. of total holding had lost 0.0074 ha. to the project and left with an unviable parcel of land. Being women headed family as well, it has been categorized as vulnerable family.

**Table 5-8: Details of Project Affected Families, Land Acquired and Compensation**

Sl. No.	Name	Village	Land Acquired (Ha.)	Land Remaining (Ha.)	Compensation (Rs.)	Names of Shareholders
1	Mr. Kalyan Singh	Roowang	0.1736	0.70020	1,947,505	Ms. Geeta Devi
2	Mr. Arjun Singh	Roowang	0.0443	0.83450	414,452	Mr. Chander Kumar
3	Mr. Hans Bhadhur	Roowang	0.0877	3.98540	1,208,148	
4	Mr. Atam Dev	Roowang	0.2666	0.67980	2,371,222	Mr. Karam Bhagat
5	Mr. Rangsal Giachho	Roowang	0.1458	1.28330	1,252,105	
6	Mr. Govind Singh	Roowang	0.1433	1.42520	1,199,563	
7	Mr. Thakur Bhagat	Roowang	0.2621	2.91260	2,155,779	
8	Ms. Suraj Devi	Roowang	0.0036	0.00740	9,040	
9	Mr. Videsh Kumar	Roowang	0.0565	0.52800	517,745	
10	Mr. Ganga Ratan	Roowang	0.0565	0.23580	517,745	Mr. Dhyan Singh
11	Mr. Amar Singh	Roowang	0.1384	0.76230	1,215,948	
12	Mr. Devi Dayal	Roowang	0.1072	0.99710	1,088,396	Mr. Satya Sagar, Mr. Ranvir Singh
13	Mr. Tanjin Nargu	Roowang	0.1167	0.22930	1,205,788	
14	Mr. Jai Singh	Roowang	0.2906	2.02160	2,786,647	
15	Mr. Thakur Sain	Roowang	0.0747	1.19820	709,793	
16	Mr. Pratap Singh	Roowang	0.0373	0.41530	354,896	
17	Mr. Marshal Avinesh	Roowang	0.0665	1.54250	621,676	
18	Mr. Rajeev Kumar	Roowang	0.0798	0.10540	673,118	Mr. Daleep Kumar
19	Mr. Jamna Dass	Roowang	0.0096	0.62670	24,027	
20	Mr. Gawang Chetan	Roowang	0.0096	0.10460	24,027	
21	Mr. Ram Sain	Roowang	0.0798	0.18150	673,118	
22	Mr. Sunder Lal	Rispa	0.0088	0.62950	22,099	
23	Mr. Prahlad Bhagat	Rispa	0.056	4.12160	721,463	Mr. Gyan Keerti

24	Mandir Devta Kuldev	Rispa	0.0705		306,691	
25	Mr. Amar Singh	Lambar	0.1143	0.21120	769,408	Mr. Inder Bhagat, Mr. Vidhya Rajan
26	Mr. Prithvi Pal singh	Lambar	0.2285	0.42250	1,538,816	Mr. Uday Singh
27	Mr. Sujan bhagat	Lambar	0.2468	0.63480	806,460	Mr. Surender Singh
28	Mr. Chander Singh	Lambar	0.1234	0.09280	403,230	
29	Mr. Prem Lal	Lambar	0.1026	1.45330	180,079	Mr. Padam lal, Mr. Santosh Raj

A survey was undertaken to study and understand the socio economic conditions of these project-affected households and to examine the impact of the proposed project thereupon. Though several meetings have been conducted between the affected villagers and the land losers in past, to understand the current status of the land losers, additional survey was undertaken. A structured questionnaire was framed by AECOM and interviews were held by the project authority with the land losers. Out of 29 land losers, 23 were contacted and data as per the structured questionnaire was collected. Important aspects covered in the questionnaire are the identification particulars of PAP, his/her family details, , assets and acquisition, drinking water facilities, details of structures, land utilization, cropping pattern, commercial / self employment activities etc. A brief questionnaire used for the survey is attached as Annexure – 5.1. Based on the social survey, socio-economic analysis of the project affected households has been documented in this section. In addition, AECOM interviewed about 12 of the 23 land loser to appreciate their present socio-economic status and aspirations from the project.

#### 5.4.1 Population Composition Project Affected Population (PAP)

The sex and age particulars of the PAP have been presented in Table 5-9. Out of the total sample population of 113, largest group is about 34% from the age group of 26-40 years, followed by 27% from 41-60 years, and 22% in 16-25 years. Relatively lower percentage i.e. 1% and 7% has been observed in the age group of 0-5 and 60+ years respectively of the survey population. The males outnumber females in all age groups except 6-15 and 16-25 years.

### 5.4.2 Literacy

Literacy (education) is the one of the indicators of socio-economic development of a society. From Table 5-10 it is observed that 38% of the project affected population have their education up to primary level, 7% and 15% of them have their education up to Intermediate and high school level respectively. The literacy rate amongst the land losers is lower than the literacy rate of the Kinnaur district. About 5% and 6% of them have studied up to Post Graduate and Graduate level respectively. Overall about 28% of the population was found to be illiterate.

**Table 5-9: Age and Sex Wise Distribution of Project Affected Population**

Sl No.	Age	Population			Percentage
		Male	Female	Total	
1	0-5	1	0	1	1%
2	6-15	6	12	18	16%
3	16-25	9	13	22	19%
4	26-40	20	18	38	34%
5	41-60	16	11	27	24%
6	60 & above	5	2	7	6%
	<b>TOTAL</b>	<b>57</b>	<b>56</b>	<b>113</b>	

**Table 5-10: Literacy of Project Affected Population**

Sl.No.	Education	Numbers	Percentage
1	Post Graduate	6	5%
2	Graduate	7	6%
3	Intermediate (10+2)	8	7%
4	High School (10)	17	15%
5	Primary	43	38%
6	Illiterate	32	28%
	<b>TOTAL</b>	<b>113</b>	<b>100%</b>

### 5.4.3 Religion and Caste

The religious believes appear to be more complicated in the area. Though majority of the households surveyed from the PAP mentioned that they follow Hinduism and one family follows Buddhism, during the interviews with the land losers all mentioned that they also practice Buddhism. From the discussion with the locals it is evident that they are significantly influenced by Buddhism or might have converted themselves to Buddhism but wants to retain Hinduism to avail the benefits of Scheduled Tribe. All the PAP surveyed responded of being under the scheduled tribe category as mentioned in Table 5-11.

**Table 5-11: Caste Wise Distribution of Sample Project Affected Families**

SL NO.	CASTE	NO. OF HOUSEHOLDS	PERCENTAGE
1	SC	---	---
2	ST	23	100%
3	OBC	---	---
4	General	---	---
	TOTAL	23	100%

### 5.4.4 Occupation

100 percent respondents covered under the sample survey informed agriculture and agriculture-allied occupations as their primary occupation and primary source of income as well. However, among other secondary occupations/source of income include civil contractor, government service, and pensioners.

The project has provided 38 jobs to local depending on their one job to 10 of the land loser’s families. The candidates for the job were chosen by the head of the land loser family. The land loser generally, chose the younger member of the family who can work for longer duration. Though most of the selected candidates have been absorbed by NTPGL, few works for the contractor engaged by NTPGL. However, most of the land losers want all the shareholders of the land and other eligible family members to be provided with a job by the company. Detailed discussions were held by AECOM with 10 persons who has been awarded job at NTPGL. None of the land loser employees have been provided with an appointment letter or job contract. However, it was revealed that all have been issued an Identity Card and Provident Fund as per the act is being deducted. None gets a salary slip.

NTPGL sponsored 4 land losers, who are also employed by them, for ITI training. All the expenses are being paid by the company.

#### 5.4.5 Family Income

Analysis results of surveyed population from Table 5-12 suggest that most of the project-affected households fall in income groups of Rs. 50,001 – Rs. 1,00,000/- and Rs. 20,001 – Rs. 50,000/-, each group comprising of 78% and 17% of the households. However, rest of 4% households have their family income between Rs. 100,000 to Rs. 200,000/-

The average income of a project-affected household is above Rs 75,000 per annum and agriculture is the main sources of income of the PAP.

**Table 5-12: Family Income of PAP (Rs. Per Annum)**

SL NO.	FAMILY INCOME	NO. OF HOUSEHOLDS	PERCENTAGE
1.	Below 20,000/-	0	---
2.	20,001-50,000/-	4	17%
3.	50,001-100,000/-	18	78%
4.	100,001-2,00,000/-	1	4%
5.	Above 2,00,000/-	0	---
<b>TOTAL</b>		<b>23</b>	<b>100%</b>

#### 5.4.6 Marital Status

Analysis shown in Table 5-13, it is evident that out of 113 persons, 65% are married and remaining 35% are unmarried.

**Table 5-13: Marital Status of PAP**

Sl No.	Marital Status	No. of Persons	Percentage
1.	Married	62	55%
2.	Unmarried	51	45%
<b>TOTAL</b>		<b>113</b>	<b>100%</b>

#### 5.4.7 Family Pattern and Size

Fraternal polyandry prevails in the affected villages but is rapidly losing ground to monogamy. However, they have patriarchal system of inheritance. All the brothers of the bridegroom are considered automatically the husbands of the bride. Polyandry helps the



people of Kinnaur to limit the population to sustainable levels and safeguard the family property from fragmentation.

Most of the land losers in one village belongs to the same patriarchal family, it is observed from the analysis in Table 5-14 that project affected households are dominated by Nuclear families with separate kitchen, which contribute almost 65% of the survey households and joint families contribute to 30%, however there is one individual is also reported in the survey. The size of family varies from is 1 to 10 with an average of 5.2 (see Table 5-15).

**Table 5-14: Family Pattern of PAP**

Sl. No.	Family Pattern	No. of Households	Percentage
1	Joint	7	30%
2	Nuclear	15	65%
3	Individual	1	4%
<b>TOTAL</b>		<b>23</b>	<b>100%</b>

**Table 5-15: Family Size of PAP**

Sl. No.	No. of Family Members	No. Of Households	Percentage
1	2-4	11	48%
2	5-7	11	48%
3	8 & Above	1	4%
<b>TOTAL</b>		<b>23</b>	<b>100%</b>

#### 5.4.8 Family Assets

**Land:** The main asset of all 28 project-affected households is land. The 29<sup>th</sup> share of land was acquired from *Mandir Devta Kuldev* (Temple of Local God). Size of the landholding as indicated in Table 5-16 shows that majority of households i.e 18 are marginal farmers who had less than 1 hectare of land. 6 households (21%) are small farmers having 1 to 2 hectare and rest 4 households (4%) were large farmers having more than 2 hectares of land. The extent of land acquired for the project given in the Table 5-17. This interprets that only 1 household has lost above 50% of land holding, 8 households have lost 25 to 50% of their total landholding. Majority of the households have lost less than 25% of their landholding i.e. 19 households and out of them 15 households have lost less than 10% of total landholding.

**Houses:** All the 23 surveyed affected households have their own houses, constructed of wood and other building material.

**Livestock:** About 75% of the surveyed household showed the ownership of livestock in terms of Cows and Sheeps.

**Crops:** All the respondent households have apple tree except four who owns Apple as well as Potato, *Rajmah* (Kidney Beans), Vegetables crops and *Badam* (Almond).

**Table 5-16: Land Holdings of PAP before and after acquisition**

SL NO.	LAND DETAILS (Acres)	Before Acquisition		After Acquisition	
		NO. OF HOUSEHOLDS	PERCENTAGE	NO. OF HOUSEHOLDS	PERCENTAGE
1	Large Farmers	4	14%	4	14%
2	Small Farmers	6	21%	5	18%
3	Marginal Farmers	18	64%	19	68%
	<b>TOTAL</b>	<b>28</b>	<b>100%</b>	<b>28</b>	<b>100%</b>

Note:

Large Farmers: >2 ha. of land holding

Small Farmers : 1-2 ha. of land holding

Marginal Farmers: <1 ha. of land holding

As seen in Table 5-16, land acquisition has shifted only one family from Small farmer category to marginal farmer. Mr. Devi Dayal who reportedly had 1.1043 ha. of land before acquisition of 10% of his total holding i.e. 0.1072 ha. After this acquisition he was left with 0.99710 ha. of land therefore moved into the category of marginal farmer.

**Table 5-17: Land Acquisition pattern of PAP**

SL NO.	Acquired LAND DETAILS (Acres)	NO. OF HOUSEHOLDS	PERCENTAGE
1	Above 50%	1	4%
2	25 to 50 %	8	29%
3	0 to 25%	19	68%
	<b>TOTAL</b>	<b>28</b>	<b>100%</b>

## 5.5 Socio-economic Impact Assessment and Mitigation Measures

Taking into consideration the findings of socio-economic analysis and field observations, positive and negative impact of proposed hydroelectric project on socio-economic condition of project-affected population (this would include all the seven villages of project area and in the vicinity, though the maximum impact will be on Roowang village) has been examined in this section.

### 5.5.1 Impacts due to Acquisition of Land

One of the major social and economic impact results from the acquisition of the land and property. In the Tidong project the land was acquired by the state government through the Land Acquisition act of 1894. Majority of the households (19 families) have lost less than 25% of the land holding followed by 8 families who lost between 25%-50% of the land holding. Only one family lost more than 50% of their land holding. The land acquisition pattern indicates that all the land losers have some land left for sustenance and none have been rendered landless.

To assess the current financial status of the land losing families, questions were asked to sample population on the utilization of the compensation amount received by them. In rural areas, it has been seen that many spend a part of the compensation amount to meet their immediate requirements.

In this area, during the interview of the sample population it was evident that none of the land losers have spent the compensation amount to meet their immediate requirements and all have invested a part of the compensation to improve their apple orchards and in Fixed Deposits in Banks. This precisely means that the land losing families have reasonable economical status. Provision of job by NTPGL has helped them to tide over the initial financial hardships, if any.

As mentioned earlier, the land was acquired through the land acquisition act by the government of Himachal Pradesh and the land was handed to NCL after acquisition. As per the land acquisition act, the Collector was to assess the current land value based on recent transactions in the area. The area being remote, no land transaction had taken place in immediate past before the acquisition and therefore the collector decided the market value of land based on adjoining area, namely Rispa and Pibbar. However, during the

enquiry under section 9 of the LAA, villagers claimed that in the same Tahsil and adjoining village, land is being acquired at much higher cost. As per the Land Acquisition Collector, this claim was unsubstantiated. Based on the land acquired for the transmission lines between Karcham and Jhakri of Bhawanagar project, the Additional Chief Secretary of Government of HP through his letter dated 11.10.2007 decided that amount of compensation for the acquisition of private land should not be less than Rs. 469,995 per Bigha (1 Bigha = 20 Biswa = 735.294 Centiare; 1 Centiare = 1 Sq m) and Rs. 104,416 per Bigha for Irrigated/orchard and un-irrigated/other land respectively. In view of the fact that the area is hilly and tribal land and in view of the tourism and horticultural potential, the Land Acquisition Collector considered a cost enhancement 10% per year is fair and equitable. Since the notice of the Additional Chief Secretary was dated 2007 and the Tidong land was acquired in 2009, 20% enhancement of the land cost as compensation was provided.

It needs to be mentioned that Karcham and Jhakri, against which the land cost was derived, is about 50 km and 80 km south respectively from the site and near to Rampur town. Because of easier accessibility and nearness to Rampur town, the land cost in Jhakri and Karcham is higher as compared to the Lizang and Lambar area where the Tidong project is located. In view of this it appears that the land compensation that was provided seems to be fair. In addition, if there was any structure on the acquired land, the value was evaluated by the HPPWD, B&R division and the compensation was paid. The valuation of the fruiting and non-fruiting trees was undertaken by the Forest and the Horticulture department and the amount was paid as compensation. Solatium @ 30% (as per the LAA) was also paid to the land losers.

The land losers are, however, not happy with the compensation amount. All the land losers accepted the compensation amount with protest. The land losers do not have copy of the document indicating their protest, but during the interaction with AECOM, mentioned that they indicated their protest in the check acknowledgement register. All the land losers with whom AECOM interacted mentioned that though they have minor grievances, they have no specific significant objection to the project but are unhappy with the amount of compensation. The land losers have filed petitions in August 2009 to the District Judge Kinnaur under section 18 of the LAA seeking enhanced compensation against the Himachal State, Land Acquisition Collector and Tidong Power Generation Pvt. Ltd. The petition indicates that the Land Acquisition Collector wrongly assessed the land cost and failed to assess the actual value of the land in the locality. The petitioner claims that the actual land cost should be Rs. 2 million / Bigha. The petitioners also mentioned that the land compensation is much lower than that has been granted by HPSEB in the same Tahsil and

adjoining village and for the construction of Kasang Hydro-electric project. The petition, however, do not mention any rate of the land that has been paid by HPSEB. The petition do not contest the compensation paid for the trees and the structures and appears that they were satisfied with the compensation.

Section 18 of the LAA under which the above petition was filed mentions that any person who has not accepted the compensation can file objections for the compensation rate for the acquired land. Since the land losers have already accepted the compensation (though under protest), the validity of the petition will be decided by the court. NTPGL provided the compensation amount as decided by the Government who acquired the land under the LAA. If the compensation amount is enhanced by the court and government directs NTPGL to deposit the additional amount, the project appears to be willing to abide by the court and government's directives.

The forest products of Neoza (Chilgoza) trees in the region are considered as the common property of the Village Panchayat. The income from the yield is shared amongst the households. It is not the main source of income for the villagers. The diversion of forestland and loss of Chilgoza trees for the project has resulted in loss of income for the Panchayats and ultimately the villagers.

The Project proponent has paid the compensation for the diverted land which includes the net present value (NPV) and includes the monetary value of Non Timber Forest Products (NTFP) which in this case is includes Chilgoza also. As per the calculation by AECOM the loss of revenue per households due to the loss of Chilgoza trees will not amount to more than Rs. 5,500 per household/ Year (considering that 1500 Chilgoza trees were diverted and damaged due to project activities). The amount of loss to the villagers has not been compensated and needs to be resolved amicably.

Regarding the infrastructural requirements; most of the villagers do not seem to require any significant facilities from the project. Most of the persons interviewed indicated that the project should construct a temple as the blessings of God will benefit both the villagers and the project.

### ***Mitigation***

A detailed Rehabilitation and Resettlement (R&R) Plan will be prepared after a detailed survey of the affected community, based on R&R Framework provided as a part of Socio-economic Management Plan.

Though the Project proponent has paid the compensation for the diverted forest land which includes the net present value (NPV) and includes the monetary value of the NTFP which in this case includes Chilgoza also. As per the calculation by AECOM the loss of revenue per households due to the loss of Chilgoza trees will not amount to more than Rs. 5,500 per household/ Year (considering that 1500 Chilgoza trees were diverted and damaged due to project activities). The amount of loss to the villagers has not been compensated and needs to be resolved as per the R&R Framework.

### **5.5.2 Pressure on Existing Infrastructure/Resources**

The construction of hydroelectric project started in mid of 2008 and requires 5½ years to complete. During the construction period, manpower will be required for various construction activities. It has been estimated that an effective population of about 825 people will reside in the area during the peak construction period and a floating population of about 100 comprising of engineers, staff, suppliers, visitor, etc. will visit project area every day.

Keeping in view the local demography, it can be anticipated that almost 75% of the workforce will be migrating from outside the project area. Necessary infrastructure, though, would be developed in the worker's camp area; however, the migrated workforce would certainly put pressure on the existing poor infrastructure. They would also encroach into the natural resources being used by the locals. During the interaction between the land losers and AECOM, few mentioned that the immigrant workers will share the scarce resources like forest wood and they are unhappy over it. They also mentioned that during the harvest, the labour is not available to the villagers as most of the labour prefers to work for the project as it offers long term employment opportunities.

#### **Mitigation**

1. Provision for labour camps to the migratory workforce with a common kitchen facility within the project area: Though the provisions impose upon the freedom to choose own lodging facility, this could ensure avoidance of firewood for cooking by the outside workforce. The role of the developer and contractor is very crucial on this matter. To abide by the provision, the developer/contractor needs to make this provision as one of the criteria for project employment to the outside workforce.
2. Provision of free fuel to the workforce for cooking and common kitchen facility: To minimize the use of firewood a provisions for common kitchen, room heating facility and common geysers to be made in labour camps. Additionally fuel wood depots will be

- open to provide free fuel to labours if required. Contractor should be made responsible for the above arrangements contractually.
3. Motivate workers to stay in labour camps within project area. However, labours will be living in close vicinity of the village, or in rented accommodations within the village, therefore it is suggested that the contractors will have a Community Officer (CO) in their teams. The CO will be responsible for all community interaction on behalf of the contractor. The COs will be trained together on managing community relations keeping the commitments of NTPGL by the Social Team of Project proponent.

### 5.5.3 Incidence of Water and Solid Waste Related Diseases

Due to implementation of the proposed project, possibility of stagnant/ impounded water would provide favorable breeding places for vector life such as mosquito and snails. The aggregation of labour, discharge of uncontrolled solid waste and wastewater and its accumulation may result in occurrence/spread of diseases like cholera, gastroenteritis, etc. Labour population along with their families would be more vulnerable to the increased incidence of water borne diseases caused by vectors and pathogens. Provision of safe drinking water, sanitation, garbage management and healthcare facilities would control and prevent the occurrence of diseases in the project area. Provision of these facilities in labour camps has been discussed in Section-7.2 and 7.4 i.e. Construction Labour Management Plan and Waste Management Plan. Improvement of these facilities in the project-affected villages would make part of the Social Management Program of the project.

#### *Mitigation*

Provision of safe drinking water, sanitation, garbage management and healthcare facilities would control and prevent the occurrence of diseases in the project area. Provision of these facilities in labour camps has been discussed in Management Plans. Improvement of these facilities in the project-affected villages would make part of the Social Management Program of the project.

Provision of primary health centre operated and maintained by NTPGL

### 5.5.4 Cultural Conflicts

Kinnaur district has its unique culture and the population of this area has a distinct habit of food and clothing. They have deep religious faiths and celebrate their festivals with great enthusiasm. During construction phase of the project, migratory population is expected from other parts of the country having different cultural habits. Nepali work force is

common all over Himachal Pradesh and in the Tidong area. The local people do not like to work in the apple orchards and agricultural field and prefers to engage Nepali labour. Since majority of the migratory workforce is expected to be Nepali, no significant cultural conflicts are expected. However, many of the skilled workers will be from other parts of India and therefore some minor cultural conflicts could not be ruled out.

### *Mitigation*

1. The contractors should be made aware of the environmental and social obligations of NTPGL through an orientation of the contractors prior to award of contract. This would also enable them to incorporate adequate budget and manpower resources to manage these issues in the field;
2. The contract agreement with the contractors to include specific commitments on social obligations including community relations, handling complaints and grievances, adherence to labour laws and international commitments, protection of forests, provision of accommodation, food and free fuel wood, etc. These commitments to be monitored by the EHS team of NTPGL;
3. The contractor will provide adequate training on social behaviour and community interaction to the workers engaged by them;
4. The contractor will undertake medical test of the workers engaged for the project to identify any communicable disease prior to engagement and will monitor it on annual basis;
5. Motivate workers to stay in labour camps within project area. However, labours will be living in close vicinity of the village, or in rented accommodations within the village, therefore it is suggested that the contractors will have a Community Officer (CO) in their teams. The CO will be responsible for all community interaction on behalf of the contractor. The COs will be trained together on managing community relations keeping the commitments of NTPGL by the Social Team of Project proponent;
6. Contractor will have to manage the labour camps as per the requirement of NTPGL
7. NTPGL will also appoint a Social Officer for the project who will interact with the CO of all the contractors and ensure consistency in approach to communicating with the Community, and in resolving grievances. The contractor COs will report on a weekly/monthly basis to the NTPGL Social Officer throughout the construction and operation phase of the project;



### 5.5.5 Cost of Living and Inflation

Minor increase in cost of living and inflation would be experienced in the project area as a result of increased commercial activities.

#### *Mitigation*

The increase in the per capita income of the population due to the project activities such as contracts, increased trading for daily needs items, grocery, vegetables, etc. will be able to meet the increase the minor increase in the cost of living.

### 5.5.6 Grievance and Redressal

During the interaction between AECOM and the villagers, the preference of the villagers towards grievance and Redressal mechanism was discussed. Though the Grievance & Redressal mechanism has been put in place and same has been communicated to the affected *Gram Panchayats* also, but currently the villagers address their grievances to the project manager often verbally and sometimes in writing.

#### *Mitigation*

Detailed mechanism for the Redressal of grievances to be developed and made functional in the project.

### 5.5.7 Impacts on structures from blasting and movement of heavy equipment

Vibrations caused due to blasting and movement of heavy equipment may damage the structures in the villages.

#### *Mitigation*

Pibbar village on the left bank of Tidong stream is the only place near HRT. Blasting is unlikely to cause any damage to the structures in Pibbar, as there is a rock cover of about 100 m horizontally and about 150 m vertically.

## 5.6 Socio-Economic Management Plan (SMP) of the Project

Ministry of Rural Development, Government of India has published the National Rehabilitation and Resettlement Policy (NRRP-2007) in October 2007. The Policy addresses the Resettlement and Rehabilitation (R&R) issues of the Project Affected Families in case of compulsory acquisition of land for public purpose including infrastructure projects. Para 6.1

of the Policy says that it will be applicable to projects displacing 400 families or more en masse in plain areas and 200 families or more en masse in hilly areas mentioned in Schedule V and Schedule VI of the constitution of India. States where R&R packages are higher than proposed in the Policy are free to adopt their own package.

As mentioned earlier in this chapter, no family has been displaced due to the project. However, partial land has been acquired from twenty nine families of Roowang (Panchayat Morang), Lizang (Panchayat Rispa) and Lambar (Panchayat Thangi) villages. The number of affected families is much less than 200, hence the NPRR-2007 is not compulsorily applicable in this case. The State Government of Himachal Pradesh does not have any R&R policy.

### 5.6.1 Objectives of the SMP

The basic objective of the program is to protect the cultural heritage of the local area in compliance with IFC's Performance Standard-8. This is in line with one of the IFC's philosophy that collaborating with the public makes good business sense, which reduces the financial risk, (from delays, legal disputes, and negative publicity), direct cost savings, increased market share (through good public image), and enhanced social benefits to local communities. Other objectives of Social Management Plan includes following components:

- Generate a sense of affinity, familiarity and confidence, not alienation, in the population living in the project area.
- Focus on upliftment of weaker section of the society and women.
- Take care of Project-Affected Families and compensate their economical and social impact according to the suitable norms in terms of skill enhancement, strengthening of as well as creation of employment opportunities for them towards their socio-economic development.
- Acknowledge constructive role of the local population through technical training inputs, participatory research programs, demonstration of trying out the adaptation and penetration of innovative technologies that lead to lesser dependence on natural resource in support of animal husbandry, agriculture and horticulture.
- Educate local population on micro watersheds, medicinal plantation in forest and private land, plantation with specific requirement to fulfill fodder and fuel needs etc.
- Build capacity for wildlife as well as forest resource protection.
- Develop a participation mechanism in which village level committees are formed in implementation of the SMP. In such committees 4-6 members representing all sections of the society from each village will be taken through Gram Panchayat. At least 50% of

such members will be female; who being lesser-privileged and yet most active class needs to be involved as the focus group.

- Involve the society in the programme so as to ensure acceptability of the project and make them feel as their own program.
- Provide livelihood support activities for the local community which will gather economic benefits for the project affected population and restore/improve their economic condition.
- Detail out the awareness training a program and combine it with the ongoing scheme to sustain the initiative taken up by the project.
- Ensure the participation of the project affected population at every stage from planning through implementation and to keep them abreast, educated and informed about the project through PCDP as well as the SMP on a regular basis.

### **5.6.2 Approach to SMP**

The SMP will aim to have a specific Community Development Program for the Project-Affected Area, in which the following steps will be involved;

#### ***Identification and interaction with the Project Affected Population***

For the purpose of extending benefit of SMP, the target population has been classified in following order.

- Families whose land holding has been acquired.
- Women headed family whose land has been acquired.
- Families who are residing in the “affected villages”, but their land are not acquired.

#### ***Conducting Demographic and Socio-economic Survey***

The EIA conducted by RITES include a socio-economic survey of the population that was envisaged to be affected during the course of the study. However, the project appurtenants have been altered and therefore it is suggested to appoint an independent agency for carrying out the Census survey (100%) of Project Affected Population, as per the current status of the project. The agency will study the baseline socio-economic status of the affected villages, impact of the project and opportunities for them depending upon their qualification and aptitude. On the basis of these surveys and continuous interaction with the population from affected area, an action plan will be prepared in coordination with the Social Cell. A budgetary provision of Rs. 0.5 million is kept for this purpose.

### ***Establishment of “Participative Mechanisms”***

It is suggested that initially, each affected villages will be made aware of SMP, thereafter motivated and facilitated to constitute a community based organization, termed as Village Community Welfare Committee (CWC) or any other name based on the preference of committee members. Preferably Gram Pradhan should be the Patron of this committee. The committee should have equal representation from all sections of the community with at least 50% of members being the female, with the total number of members being 4 to 6. It could have two nominated members, one each by the local administration and the project authorities. The committee will focus its activities for socio-economic development as well as eco-restoration (based on micro-watershed level works) in the village. It will be responsible for preparation of plans, their execution and fund management, including fund shared by NTPGL in order to obtain NOC from these villages. The social cell of the project will co-ordinate and supervise the progress of works by the village committee. A budgetary provision of Rs. 0.18 million has been kept for the operation and facilitation of the activities suggested herewith.

### **5.6.3 Works to be carried out under SMP**

***Eco Restoration:*** During the interaction between AECOM and some of the land losers, it was reported that because of the acquisition and diversion of land, some of the pasture land has been lost. The affected group also mentioned that though there are other pasture lands available in the area, it would be difficult to take their cattle for pasture because of terrain constraints. In view of this silvipasture development is being suggested. The silvipasture development and plantation of Medicinal Plants e.g. trees, shrubs and herbs plantation needs to be taken up in degraded patches of Van Panchayats and Civil Forest lands. A budgetary provision of Rs. 0.6 million will be made for this purpose.

***Water Conservation and Harnessing:*** These works would include recharging of ground water through plantation program, soil conservation measures, improvisation of traditional water conservation practices, emphasis for construction of water harvesting tanks, protection of existing sources of water etc. A Budgetary provision of Rs. 1.2 million to be made for this purpose.

***Vulnerable Project Affected Person Support:*** One of the project affected families is headed by an illiterate 56 years old woman Ms. Suraj Devi. Her family comprises of another women, i.e. 26 years old daughter, who is qualified as post graduate. Annual income of this family is reported to be about Rs. 30,000 per annum, which is much below the average

income of the project affected families. NTPGL is required to concentrate attention on such families and explore possibilities for proper rehabilitation to ensure economic up-liftment. A budget of Rs. 5 million to be allocated for annuity Policy of vulnerable persons identified in the demographic survey. This policy should ensure a monthly pension of minimum Rs. 750/- to the beneficiary.

**Livelihood Enhancement Works:** Depending upon the needs identified during the census survey of the project affected villages, following well-defined programmes will be undertaken in collaboration with the concerned department.

- **Animal Husbandry:** Animal husbandry is one of the most important aspects of the rural community in Tidong area. Inputs will be given on various topics such as introduction of nutritious grass cultivation, better stall feeding practices, awareness of animal health program, breed improvement and installation of mini community thresher if required. Budgetary provision of Rs. 0.2 million to be made for this purpose.
- **Horticulture and Medicinal Plants:** The works under this subhead will include awareness programmes for growing fruit trees, nuts, oil seeds and medicinal plants. This would also include value addition, processing units, market research etc. Budgetary provision of Rs. 0.5 million to be made for this purpose.
- **Public Health Support:** The mitigative measures towards Public health concerns have been discussed in section 7.4. However, other major concern areas of health at local level as well as site specific will be identified and addressed during census survey of the affected area. Priority will be given in organizing health camps and emphasis will be given on reproductive health, family welfare and HIV/AIDS awareness programmes. A budgetary provision of Rs. 0.5 million to be made for this purpose.
- **Gender Support:** Women folk will be kept in the center stage in program implementation so that they can play an active role in socio-economic development of the area. A budgetary provision of Rs. 0.2 million to be made for this purpose.
- **Infrastructure Development Support:** Works like approach road to the village, drinking water facility, community building etc. will come under this head and a budgetary provision of Rs. 0.5 million to be made for this head.
- **Education Assistance:** A provision of Rs 0.3 million to be made for education assistance program, which will include scholarships, support to facilities in schools in the affected villages.

- ***Direct and Indirect Employment Opportunities in Project:*** At project management level the project-affected population could be involved towards employment generation in various ways like:
  - Educating them to establish support facilities like eco-village, hotel/inn for promoting tourist, construction agencies, repair shops etc.
  - Educating them to develop support supply systems for the construction workers.
  - Creating contractual opportunities for suitable local agencies.
  - Providing direct employment to suitable candidates at subordinate levels. Engagement in support activities like hiring of vehicles/drivers, security guards, casual workers etc.
  - Facilitating loans from banks, for establishing businesses.

#### **5.6.4 Rehabilitation & Resettlement: Entitlement Framework**

Total private land acquired for Tidong-1 HEP is 3.2011 hectares in addition to the diversion of about 39.0546 hectares forest land where 1261 green standing trees were also diverted in favour of project. With the acquisition of private land, 28 families have been affected and 1 Mandir Devta Kuldeo have been affected. However, none of these have been rendered landless, houseless or have lost their homestead. Maximum extent of individual land loss has not exceeded 57% of total land holding of particular person and 26 families have lost less than 35% of their total land holdings.

This framework has drawn upon the spirit of National Rehabilitation & Resettlement Policy, 2007 and National Rehabilitation & Resettlement Policy, 2003, whichever is applicable, and in compliance to the performance standard 5 of IFC, to mitigate adverse social and economic impacts of Tidong-1 HEP, from land acquisition or restrictions on affected persons. The framework will also improve the living standard of affected zone and to facilitate the harmonious relationship between requiring body and inhabitants of affected zone.

#### ***Definitions for R&R Entitlement Framework***

Various terms which are relevant to the proposed project are described in following paragraphs.

- (a) *"Project Affected family" (PAF)* means:

- (i) a family whose land is acquired for the project or primary place of residence or other property or source of livelihood is affected by the acquisition of land for a project or involuntary displacement for any other reason or
  - (ii) any tenure holder, tenant, lessee or owner of other property, who on account of acquisition of land (including plot in the *abadi* or other property) in the affected area or otherwise, has been involuntarily displaced from such land or other property; or
  - (iii) any agricultural or non-agricultural labourer, landless person (not having homestead land, agricultural land, or either homestead or agricultural land), rural artisan, small trader or self-employed person; who has been residing or engaged in any trade, business, occupation or vocation continuously for a period of not less than three years preceding the date of declaration of the affected area, and who has been deprived of earning his livelihood or alienated wholly or substantially from the main source of his trade, business, occupation or vocation because of the acquisition of land in the affected area or being involuntarily displaced for any other reason.
- (b) "*Project Affected area*" means area as notified by the Deputy Commissioner, Kinnaur, where land is acquired for construction for any component of project, infrastructure, township, offices, construction facilities, welfare facilities, etc. for the project. Unit for declaring Project Affected Area would be Revenue Village.
- (c) "*Agricultural labourer*" means a person primarily resident in the affected area for a period of not less than three years immediately before the declaration of the affected area who does not hold any land in the affected area but who earns his livelihood principally by manual labour on agricultural land therein immediately before such declaration and who has been deprived of his livelihood.
- (d) "*Agricultural land*" includes lands being used for the purpose of
- (i) agriculture or horticulture;
  - (ii) dairy farming, poultry farming, pisciculture, breeding of livestock or nursery growing medicinal herbs;
  - (iii) raising of crops, grass or garden produce; and

- (iv) land used by an agriculturist for the grazing of cattle, but does not include land used for cutting of wood only;
- (e) "minimum agricultural wages" is current rate at the time of grant of compensation as notified for Scheduled Tribal Areas in H.P. notified by Dept. of Labour and Employment, Govt. of Himachal Pradesh.
- (f) "*family*" includes a person, his or her spouse, minor sons, unmarried daughters, minor brothers, unmarried sisters, father, mother and other relatives residing with him or her and dependent on him or her for their livelihood; and includes "*nuclear family*" consisting of a person, his or her spouse and minor children.
- (g) "*Holding*" means the total land held by a person as an occupant or tenant or as both.
- (h) "*Land acquisition*" or "*acquisition of land*" means acquisition of land under the Land Acquisition Act, 1894 (1 of 1894), as amended from time to time, or any other law of the Union or a State for the time being in force.
- (i) "*marginal farmer*" means a cultivator with an un-irrigated land holding up to one hectare or irrigated land holding up to half hectare.
- (j) "*non-agricultural labourer*" means a person who is not an agricultural labourer but is primarily residing in the affected area for a period of not less than three years immediately before the declaration of the affected area and who does not hold any land under the affected area but who earns his livelihood principally by manual labour or as a rural artisan immediately before such declaration and who has been deprived of earning his livelihood principally by manual labour or as such artisan in the affected area.
- (k) "*small farmer*" means a cultivator with an un-irrigated land holding up to two hectares or with an irrigated land holding up to one hectare, but more than the holding of a marginal farmer.
- (l) "community" means the residents of a Panchayat as a whole, from where land has been acquired.
- (m) "vulnerable person" such as the disabled, destitute, orphans, widows, abandoned women, or persons above fifty years of age; who are not provided or cannot immediately be provided with alternative livelihood, and who are not otherwise



covered as part of a family.

### ***Entitlement Framework***

Government of Himachal Pradesh (GoHP) is also preparing a R&R scheme for the Project. Where provisions of the GoHP R&R scheme are identical to one or more provisions of this entitlement framework, NTGPL will implement either the GoHP scheme or this entitlement framework. In cases where GoHP R&R scheme and this entitlement framework address the same impact but entitlements under both are different, the Company will implement the higher of the two entitlements. Further, in case GoHP R&R scheme includes provisions for impacts not covered in this entitlement framework, those will be implemented in addition to this entitlements detailed herein. In any case, the benefits under this entitlement framework will be paid and made available to eligible affected families within one year of release of this report.

The entitlement has been divided in two categories each for affected families and community as described below;

#### **A. Entitlement for Project Affected Families**

The rehabilitation benefits to be paid by NTPGL Tidong Power Generation Private Limited (NTGPL) apart from other actions implemented / money already paid by the Company or government in lieu of cost of land acquired (including cost of structure and / or trees) as defined below shall be extended to all the affected families based on the entitlement of the following requirements.

##### **a. Resettlement Grant**

The project affected family whose land has been acquired shall be eligible for resettlement grant in the following manner:

- Each affected person who is a rural artisan, small trader or self-employed person and is a financially or physically displaced person shall get a one-time financial assistance of not less than Rs. 37,000/- considering to the Consumer Price Index (CPI) till 2011, for construction of working shed or shop.
- Each affected family if has lost cattle shed / structure and owns cattle, will get financial assistance of not less than Rs. 22,000/- considering to the Consumer Price Index (CPI) till 2011, for construction of cattle shed.

- Each affected family if displaced will get one-time financial assistance of not less than fifteen thousand Rs. 15,000/- considering to the Consumer Price Index (CPI) till 2011, for shifting of the family, building materials, belongings and cattle.

b. Employment & Skill Development

- NTGPL will give preference to the affected families whose land has been acquired for the Project or whose livelihood was dependent on the private land acquired for the project, at least one person per nuclear family, in providing employment in the project, subject to the availability of vacancies and suitability of the affected person for the employment. Subsequently, this preference in providing employment will be extended also to other project affected families subject to the availability of vacancies and suitability of the affected person for the employment;
- Wherever necessary, the project proponent will arrange for training of the affected persons, so as to enable such persons to take on suitable jobs.
- NTGPL will offer scholarships and other skill development opportunities to the eligible persons from the affected families as per the criteria as may be fixed in consultation of respective Gram Panchayat;
- The affected families whose land has been acquired for the Project or whose livelihood was dependent on the private land acquired for the project, will be entitled for a rehabilitation grant equivalent to five hundred (500) days current minimum agricultural wages as notified for Scheduled Tribal Areas in H.P. notified by Dept. of Labour and Employment, Govt. of Himachal Pradesh.
- Each affected family whose land has been acquired for the Project or whose livelihood was dependent on the private land acquired for the project, shall get a monthly subsistence allowance equivalent to 25 days minimum agricultural wages per month for a period of one (1) year from the date of displacement.
- NTGPL will, at their cost, arrange for annuity policies that will pay a pension for life to the vulnerable affected persons, subject to a minimum of Rs. 750/- i.e. Rupees Seven Hundred Fifty per month.
- In case of linear acquisitions, in project relating to transmission lines in the project area wherein only a narrow stretch of land is acquired for the purpose of the project or is utilised for right of way, each affected family shall be offered by the requiring body an ex-gratia payment of such amount as the appropriate Government may

decide but not less than thirty thousand rupees (Rs. 30,000/-), in addition to the compensation or any other benefits due under the Land Acquisition Act, 1894 or programme or scheme under which the land, house or other property is acquired. Provided that, if as a result of such land acquisition, the land-holder becomes landless or is reduced to the status of a "small" or "marginal" farmer, other rehabilitation and resettlement benefits available under this policy shall also be extended to such affected family.

- The affected families may be given the option to take a lump-sum amount in lieu of one or more of the benefits as entitled and specified in the framework.
- All the affected Scheduled Tribes, other, traditional forest dwellers and the Scheduled Castes families having fishing rights in a river or pond , or dam in the affected area shall be given fishing rights in the reservoir area of the irrigation or hydel projects. As a part of the fisheries development plan, the Directorate of Fisheries, Government of Himachal Pradesh proposes to develop reservoir fisheries in the barrage and stocking of the Tidong reservoir. NTGPL needs to discuss the issue of giving the fishing rights to the affected families to augment their income with the state government.

c. Secondary Employment

- NTGPL will give preference to the affected persons or their groups or cooperatives in the allotment of outsourced contracts, shops or other economic opportunities coming up in or around the project site;
- NTGPL will give preference to willing landless labourers and unemployed affected persons while engaging labourers in the project during the construction phase; and
- The affected persons will be offered the necessary training facilities for development of entrepreneurship, technical and professional skills for self employment.

**B. Entitlement for Community**

- Community people who harness chilgoza and other forest produce as per the Himachal Pradesh Government rules such as Forest Settlement of Bushahr State, 1921, etc. from the diverted forest land of the project needs to be compensated.
- Other than this it was reported by a land loser that some community grazing land is also lost on the river side, by the land acquired for the project, in the upstream

works near barrage area. However, as per satellite imagery of 2005, no significant grazing land was observed in the area along the river near barrage area.

- NTGPL has already paid the amount towards the loss of these NTFP (Non Timber Forest Produce) to government as Net Present Value (NPV) of the diverted forest land, therefore company will resolve the issues with the respective government department so as to ensure that all the project affected families receive fair and just compensation for loss of access to the forests.
- Further, Government of Himachal Pradesh is also formulating a R&R scheme for the Project. However, in any case if the matter pertaining to community rights on forest produce is not resolved, NTGPL will pay the compensation amount for loss of access to forest produce/loss of customary rights within one year after the release of this report. This compensation amount will be formally fixed by a committee comprising of company representative, village Panchayat members, forest officials and local opinion leaders. The committee will evaluate the compensation to be paid in lieu of the loss of customary rights of the people with respect to aforesaid NTFP including chilgoza, fuelwood, fodder lost from grazing land along the river in the upstream work of the project, and other forest produces including on account of the involuntary nature of loss of access to the forests/customary rights. The committee will evaluate the compensation amount to be paid to the community, based on the available government and village records.

### *Census Survey*

Since the individual details of the affected area is lacking, therefore, an extensive survey will be carried out by NTGPL. Outcome of the survey and the entitlement framework will help to draw an actionable Rehabilitation & Resettlement Plan.

The third party survey and preparation of the plan will include the following procedure to be followed for carrying out survey and census of affected area, affected persons, assessment of government land available and land to be arranged for rehabilitation, preparation of the draft rehabilitation scheme or plan and its finalization.

Every such survey shall contain the following village-wise information of the affected families;

- (i) members of the family who are permanently residing, engaged in any trade, business, occupation or vocation in the affected area;
- (ii) families who have lost their house, agricultural land, employment or are alienated wholly or substantially from the main source of their trade, business,

- occupation or vocation;
- (iii) agricultural labourers and non-agricultural labourers;
- (iv) families belonging to the Scheduled Caste or Scheduled Tribe categories;
- (v) vulnerable persons such as the disabled, destitute, orphans, widows, unmarried girls, abandoned women, or persons above fifty years of age; who are not provided or cannot immediately be provided with alternative livelihood, and who are not otherwise covered as part of a family;
- (vi) families that are landless (not having homestead land, agricultural land, or either homestead or agricultural land) and below poverty line, but residing continuously for a period of not less than three years in the affected area preceding the date of declaration of the affected area; and
- (vii) Scheduled Tribes families who are or were having possession of forest lands in the affected area prior to the 13th day of December, 2005.

The survey shall be completed expeditiously and within a period of one hundred twenty (120) days from the date release of this report. Based on the findings of the survey a draft Rehabilitation and Resettlement Action Plan will be drawn. The draft plan shall contain the following particulars;

- (a) the extent of land acquired for the project and the name(s) of the affected village(s);
- (b) a village-wise list of the affected persons, family-wise, and the extent and nature of land and immovable property owned or held in their possession in the affected area, and the extent and nature of such land and immovable property which they are likely to lose or have lost, indicating the survey numbers thereof;
- (c) a list of agricultural labourers in such area and the names of such persons whose livelihood depends on agricultural activities;
- (d) a list of persons who have lost or are likely to lose their employment or livelihood or who have been or likely to be alienated wholly or substantially from their main sources of trade, business, occupation or vocation consequent to the acquisition of land for the project or involuntary displacement due to any other cause;
- (e) a list of non-agricultural labourers, including artisans;
- (f) a list of affected landless families, including those, without homestead land and below poverty line families;
- (g) a list of vulnerable affected persons,
- (h) a list of occupiers, if any;
- (i) a list of public utilities and government buildings which are affected or likely to be affected;

- (j) details of public and community properties, assets and infrastructure;
- (k) a list of benefits and packages which are to be provided to the affected families;

The draft rehabilitation and resettlement scheme or plan shall also be discussed in *gram sabhas* of the affected areas within 120 days of the release of the report. The consultation will be conducted with the gram sabha or the panchayats at the appropriate level in the Scheduled Areas under Schedule V of the Constitution shall be in accordance with the provisions of the Provisions of the Panchayats (Extension to the Scheduled Areas) Act, 1996 (40 of 1996). Thereafter finalized Rehabilitation and Resettlement Plan will be implemented by NTGPL.

#### ***Community Development Plan***

The Company will as part of the census survey also carry out a community need assessment and based on the findings of this survey, develop a phased community development plan and the activities undertaken as part of LADA scheme will also be covered under the plan. The draft community development plan will be discussed with the affected community in gram sabha and/or panchayat, community recommendations incorporated and finalized. The Company will finalize the Community development plan within 6 months of this report.

#### **5.6.5 Monitoring and Evaluation**

A system will be evolved to have a continuous feedback of implementation of program. A separate body comprising of representatives from project management & public representatives will be formed for monitoring and concerted evaluation of the SMP.

#### **5.6.6 Public Information System**

It is one of the most important tools to keep a continuous interaction with the affected areas and to keep them informed with the actions, achievement and program underway. It will have to be ensured that there is no communication gap between project authorities and the affected persons. The composition, powers functions of the grievance cell will be as per prevailing norms, however, it must include one male and one female from the Project Affected Population. The Project Affected Population could elect these representatives among themselves. Any aggrieved persons from the affected area could move his/her application to the Grievance Redressal Cell (GRC) and the Cell will ensure that it is finally resolved amicably. GRC, including its constitution, functions and methodology of redressal, has been discussed below. An amount of Rs. 200,000/- should be allocated for this purpose.

### 5.6.7 Grievance Redressal Plan

In order to appreciate the primary needs of the stakeholders including project affected families, villagers, etc and for everybody, a Grievance Redressal Mechanism will be established along with the constitution of Grievance Redressal Cell (GRC). The purpose of the cell is to record the grievances and find mutually acceptable solutions for problems like employment, disputes with project activities, damages to private property, community development needs, socio-economic development of villages etc.

The cell will comprise of a Grievance Redressal Committee which will convene meetings periodically and take steps to redress the grievance. The cell will three level Redressal system functional at Site, Divisional and Corporate levels by NTPGL on following guidelines;

#### Site Grievance Redressal Committee

- Direct contact at work site where responsible persons will be nominated for upstream works and downstream works of Tidong-1 HEP separately as direct contact persons for registering the grievance. Any concern from stakeholders directly related onsite work such as pollution abatement, transportation, traffic, occupational health, etc. may be directly registered verbally or in writing to the nominated person. The issues registered at this level will be resolved within 1 week of the date of receipt of complaint.
- Person in charge of project office or Head – EHS any other responsible officer in Reckong Peo office of Tidong-1 HEP may be nominated to head the committee at this level. In later cases matter will be consulted with Project in-charge before its redressal. A member from the respective Panchayat may be included in the committee. Any concern from stakeholders related to job opportunities, compensation, small contracts, etc. may be directly received verbally or in writing to the nominated person. The issues registered at this level will be resolved within 1 weeks of the date of receipt of complaint (if necessary).

#### Divisional Grievance Redressal Committee

- The person in charge or any other responsible officer will head this committee at Shimla office of NTPGL. Any concern from stakeholders which are not resolved at site and Reckong Peo office can be registered at this level either verbally or in writing. The issues registered at this level will be resolved within 1 weeks of the date of receipt of complaint.

The Divisional GRC should include a Panchayat member and / or district administration representatives (if possible the Additional District Magistrate and the local patwari). The cell may also have representation from the Project Affected Families. While the representation of these members from district officials is not mandatory, it is definitely a preferred situation as they would be able to swiftly handle grievances related to land acquisition and legal claims. The GRC will also look into complaints and concerns about ownership disputes, inheritance of assets, distribution of compensation among heirs, missing affected assets and persons in the census etc. The procedure will not replace existing legal processes but, based on consensus, will seek to resolve the issues quickly in order to expedite the receipt of compensation, without resorting to expensive and time- consuming legal actions.

#### Corporate Grievance Redressal Committee

The top most layer will be the head of the company i.e. Chief Executive Officer (CEO) of the project or any equivalent person in the Head office of NTPGL. A member from the respective Panchayat may be included in the committee. Any concern from stakeholders which are not resolved at any layers below can be registered at this level either verbally or in writing. If required involvement of district administration will be requested for resolving the grievance. The issues registered at this level will be resolved within 2 weeks of the date of registration.

#### **Current Status of GRC**

The GRC for this project has been partially constituted at the project site, Project head office at Reckong Peo, Project Head Quarter at Shimla and Corporate Headquarter at Hyderabad. However, Social expert of the Company, government and village representatives in the GRC are to be incorporated. The current cell structure of GRC as communicated to Gram Panchayat of Morang, Thangi and Rispa is as given below.

Site level GRC: Sr. DGM and AGM

Project Head office Level GRC: Sr. DGM, AGM, Finance Representative and HR Representative.

Project Head Quarter Level GRC: Divisional Head and HR Head.

Corporate Level GRC: CEO and HR head of the company.

GRC formation at all levels has to be completed and made operation within next 15 days after the release of this report.



### ***Method of Registering the Grievance***

Any person / group of persons having grievance with Tidong HEP can register their concerns with project at suitable level by suitable means of registering i.e. verbal or written. Drop boxes and registered will be provided at various locations for the ease of stakeholders.

Complaint drop boxes for lodging the complaint will be placed at strategic location including *Gram Panchayat Bhawans* (Village Council Hall) at Morang, Rispa and Thangi; Project site office in the upstream and downstream; Project office at Reckong Peo and other strategic locations as the need arises. These locations will notified by the project to all the *Gram Panchayats* and key members of affected villages. More places may be identified to keep these boxes if required. These boxes will be cleared twice a week and gist of the complaints will be noted down along with date and name of the complainant with an allotment of unique number to the complaint in a permanent register i.e. "Grievance Register".

Any grievance communicated verbally, will be written on "Grievance Register" with allotment of unique number, by the nominated person who has received the verbal grievance.

The project authority will issue an acknowledgement of the complaint immediately (in case of hand delivery) or by post to the complainant through registered post within next two days. Complainant can also lodge their grievances, directly in the permanent "Grievance Register" kept at the reception of the Reckong Peo project office or through post or submit by hand.

### ***Communication of Mechanism to the stakeholders***

Formal information of Grievance Redressal Committees constituted, as suggested above, will be communicated to the respective stakeholders and nominated members of the committee. This communication can be made through personal letter, letter to *Gram Panchayat*, pamphlets, poster, public announcement at strategic locations such as during respective *Gram Sabha* Meetings. The stakeholders will be encouraged to approach this cell with their concerns and suggestions.

### ***Meeting of Grievance Redressal Committees***

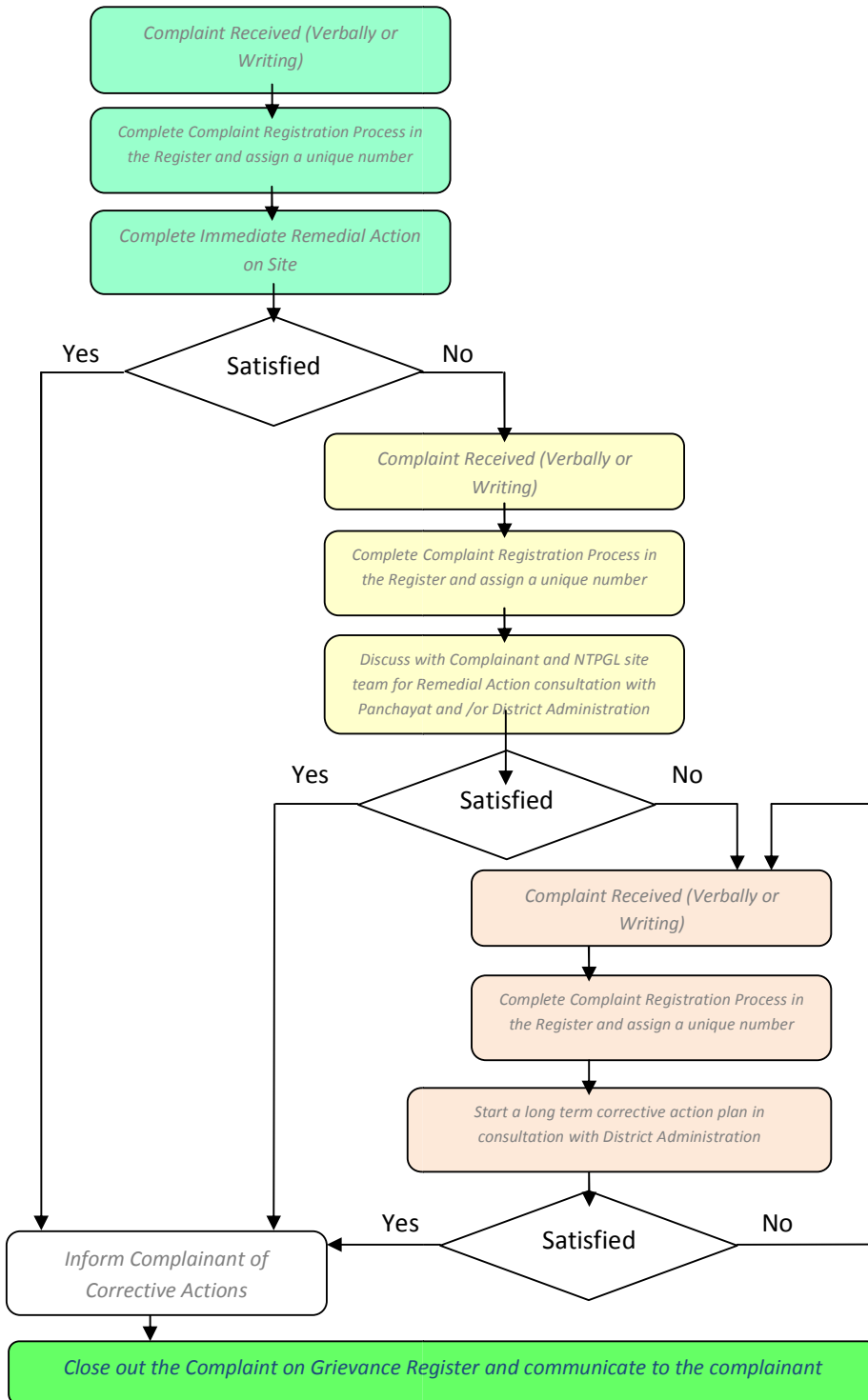
The site committee will meet at least once every fortnight in the first 6 months of implementation, and thereafter once, every month. At every Grievance Redressal Committee meeting, the issues raised in the last meeting and report on action taken, will be summarized. Issues that cannot be resolved at the GRC would be referred / directed to next

designated levels. Divisional and Corporate Committees will convene their meetings as and when required.

#### *Closing of Grievance*

The complaints lodged in the GRC Register will be resolved amicably by the above mechanism and closed by informing to the complainant directly with closing signatures on the GRC Register or by sending registered post to the complainant, in case he is not approachable. The resolution shall be informed to respective *Gram Panchayat* also in writing for display at a common place for information to interested parties.

**Figure 5-1: Grievance Redressal Mechanism – Flow Diagram**



**Site Level**

Grievance Redressal Committee

Time to close the action - 2 wks

Approach for: onsite work such as pollution abatement, transportation, traffic, occupational health, etc.

**Divisional Level**

Grievance Redressal Committee

Time to close the action - 1 weeks

Approach for: job opportunity, unresolved land matter or any unresolved matter from Site level

**Corporate Level**

Grievance Redressal Committee

Time to close the action - 2 wks.

Approach for: Any unresolved matter from Site and Divisional levels

### 5.6.8 Organizational Arrangement for implementation of SMP

The Social Cell of NTPGL, headed by GM-EHS&S and a specialist Community Liaison Officer (CLO) will be leading the team of support staff. The cell will remain under administrative control of the General Manager-EHS&S of the project site. It will be responsible to identify the areas of thrust, methodology and implementation of ‘Social Management Plan’. The cell will also look into the local demands as they arise from time to time and will respond to the needs of the project as well as project affected population i.e. during various stages of PCDP.

Figure 5-2: Organization structure for Social Cell



Qualification and other details of these positions have been discussed in section 7.9 of this report.

### 5.6.9 Cost Estimate for SMP

The estimated cost of SMP works to keep a budgetary provision will be as given in Table 5-18 below.

Table 5-18: Cost Estimate of Social Management Program

Sl.No.	Description	Budget (Rs. Million)
1	Demography survey	0.50
2	Establishment expenses of 3 no. CWC for 30 months @ Rs. 2,000 per month	0.18
3	Eco Restoration Works	0.60

4	Water Conservation and Harnessing	1.20
5	Animal Husbandry	0.20
6	Horticulture and Medicinal Plants	0.50
7	Public Health Support	0.50
8	Gender Support	0.20
9	Infrastructure Development Support	0.50
10	Education Assistance	0.30
11	Public Information System	0.20
	<b>TOTAL</b>	<b>4.88</b>

#### 5.6.10 Action plan for the management of Socio-economic Impacts

Key features of the plan are mentioned in following table as actionable activities with the defined responsibilities;

**Table 5-19: Action plan for management of socio-economic impacts**

Sl. No.	Activities	Project Phase for implementation	Responsibilities
1	Detailed demographic and socio economic survey will be conducted	Construction	NTPGL
2	A participative mechanism in the form of Community Welfare Committee (CWC), to be established for effective implementation of Socio-economic Management plan.	Construction	NTPGL and representatives of Morang, Rispa and Thangi Panchayat.
3	Ecorestoration of degraded common land and Silvipasture land development	Construction	NTPGL and representatives of Morang, Rispa and Thangi Panchayat and other interested villagers
4	Water conservation practices will be adopted	Construction	NTPGL and representatives of Morang, Rispa and Thangi Panchayat and other interested

			villagers
5	Vulnerable Project Affected Family Support – efforts for economic up-liftment	Construction	NTPGL
6	Livelihood improvement works to be implemented such as Animal Husbandry, Horticulture and Medicinal Plants, Public Health Support, Gender Support, Infrastructure Development Support, Education Assistance, Direct and Indirect Employment Opportunities in Project,	Construction	NTPGL and representatives of Morang, Rispa and Thangi Panchayat and other interested villagers
7	Establish a public Information System and implement Grievance Redressal Plan	Construction	NTPGL
8	Monitoring and Evaluation	Construction	NTPGL



## 6. POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATIONS MEASURES

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### 6.1 General

The primary function of an Environmental Impact Assessment study is to predict and quantify potential impacts, assess /evaluate the magnitude and identify the mitigation measures. Thereafter impact assessment and mitigation measures constitutes the basis for the development of Environmental Management Plan which provides procedural requirements to ensure that all the mitigation measures and monitoring requirements specified in the approved ESIA report will actually be carried out in subsequent stages of project development. Environmental impacts could be positive or negative, direct or indirect, local or regional and also reversible or irreversible. These impacts for Tidong-1 HEP have been identified, predicted and evaluated, keeping in view the baseline of environmental and social status of the project area and activities envisaged for the development of project. This chapter discusses anticipated positive as well as negative impacts during various phases of the project under execution. Wherever possible, the impacts have been quantified and otherwise, qualitative assessment has been made. The impacts are discussed broadly into three categories, viz. impacts due to project location, impacts during project construction and impacts during project operation. The mitigation measures have also been discussed corresponding to the identified impacts. These mitigation measures have been explained as actionable items in management plans described separately in Chapter-7.

### 6.2 Impact Identification

The Environmental Impact Assessment process began with the scoping process to identify the significant environmental impacts due to the proposed hydroelectric project in its different phases. The type and magnitude of the impacts, however, depend on the specific attributes of the given environment. As far as possible, attempts have been made to quantitatively predict the impacts due to the project. However, for non-quantitative impacts, qualitative assessment has been done. Potential impacts on environment due to the proposed hydroelectric project activities have been summarized in Table 6-1. The impacts due to the project location are generally irreversible and cannot be mitigated through environmental enhancement measures. However, impacts related to construction are normally short term, which can be set-off by observing a set of precautionary measures.



**Table 6-1: Potential Environmental Impacts**

	Identification of Potential Impacts					
	PRE CONSTRUCTION	CONSTRUCTION PHASE				OPERATION PHASE
Major activities ↓ Environmental elements	Land Acquisition	Site Clearance	Contractor camps	Construction of Diversion Weir / HRT / PH	E& M Plant	Operation
Land/Soil	Change in land use	Loss of trees/vegetative cover, Increase in soil erosion	Land pollution due to solid waste and Increased soil erosion	Increased erosion/land Slides	Pollution due to spills	Soil erosion & Siltation
Ground Water	-	-	-	Depletion of aquifers due to tunnelling	-	Rise in water table
Surface water	-	Change in water quality and siltation	Water Pollution from Sanitary and other wastes	Increase in turbidity	Water pollution due to split into water bodies	Water pollution
Ecology	Loss of Terrestrial Flora	-	-	Deterioration of fish habitate	-	Loss of fish habitat
Drainage	-	Change in Natural drainage pattern		Change in Natural drainage pattern		Cleaning & Maintenance
Air quality	-	Increase In air pollution	Atmospheric Pollution due to fuel burning	Increased SPM	SPM, NOR, SO2 Emission	
Noise Quality	-	Reduced buffering of noise	-	Vibrators, concrete batching plants noise, blasting, etc	Increase in noise	increase in noise levels due to increased traffic
Forest	Diversion of Forest Land	Loss of Forest	Increased pressure on forest resources	Loss of Forest	-	Improvement in forest

## 6.3 Environmental Impacts

The following paragraphs identify and appraise various negative impacts likely to result from the proposed development on land, water, air, noise, ecology and socio-economic environment, which have been listed under the following headings:

- Impacts due to Construction Works
- Impacts due to Project Operation

### 6.3.1 Impacts Due to Project Construction

Although environmental impacts related to construction works are temporary in nature its intensity could be severe unless due care is taken. The likely impacts have been considered on all the environmental components as indicated above. Some of the impacts which are irreversible in nature may extend well after the cessation of construction activities. Thus, it is imperative to address such issues appropriately well in advance to ameliorate the severity of such impacts to the extent possible.

The construction works of Tidong-1 H.E. project have been scheduled for the 5 ½ Years. Main construction activities like diversion structure, power house complex, workshop, office complex, labour camps, fabrication yard, colonies, magazine, HRT, TRC, etc. will be located within 6-7 km area around the Tidong Stream. Since the project work has already started and now about 2 ½ years are left as per schedule for the completion of the project i.e. by the end of year 2013. The project works already completed include Adit-1 to HRT in upstream works, roads to powerhouse including steel bridges on both these roads and excavation of undersluice and surface powerhouse.

The diversion site location across stream Tidong is suitable with sound abutment conditions. The HRT along its route will encounter hard rock formations of the geology and is suitably aligned with respect to the discontinuity planes and the intermediate tributaries to Tidong. The HRT is not expected to encounter any major problem, however, seepage at places can be a possibility. In most parts of the tunnel, there is sound rock coverage of minimum 157 meters with thick vegetation cover which anchors the slopewash material to the hills.

The surge shaft will be constructed in the hard, compact and jointed gneisses and vertical as well lateral rock cover around the structure is adequate. No major geological problem will be encountered during the construction as the rockmass is of good to fair quality in general. The powerhouse area exposes hard, compact and moderately jointed gneisses. The rock base below the power house structure has been assessed in previous studies to be adequate and of good to fair quality. The geology for open channel tailrace tunnel would be fair to good quality. Except one old slide zone on the left bank of Tidong, no major slopes near Adit -1 was observed around the project structures.

Construction of such projects involves various activities like site clearance, excavation, filling, blasting, tunneling, RRC works, etc. Environmental impacts related to construction works are mostly temporary in nature, however, needs to be addressed adequately. Appropriate measures needs be included in the work plan and budgeted for. The likely impacts related to the construction works of the project are:

### **Impacts on Vegetation Due to the Project Structures and Site clearance**

As mentioned earlier project requires 39.0546 ha. of forest land. The trees approved for felling on diverted forest land and damaged trees on adjacent non diverted forest land, were estimated by forest department for the purpose of compensation to be paid by NTPGL. As per estimate approximate number of trees that will be removed is 1261. Considering average height of the affected trees as 10m with an average diameter of 0.2m, the total wood loss has been estimated as 5786 cum. The wood loss is not high and it means that the forest land that was taken for the project do not have high density of trees. Due to various project activities additional 580 trees on non diverted land were damaged till date. Forest department regularly assess the damage of trees and if any further damage is evident, the same till be intimated to NTPGL and further compensation amount will be fixed.

Improved access to the presently virgin area during and after construction of the project would put pressure on the forest adjoining to the project site and may lead to degradation of nearby forests, if not managed properly.

Out of 30 species of trees present in the project area of Tidong-1 HEP, Chilgoza (*Pinus gerardiana*) is the rare tree species, which is economically very important. Therefore, an effort should be made for the minimum damage to the Chilgoza trees. After a careful scanning the status of shrubs present in the project area, it has been found that one shrub species (*Zanthoxylum alatum*) is of threatened category and the 8 species (*Berberis aristata*, *B. lyceum*, *Desmodium dichotomum*, *Hypericum choisianum*, *H. lysimachioides syn H. dyeri*, *Olea ferruginea*, *Rosa sericea* and *Salix hastate*) of shrubs are rare. Four species of rare categories and one species of threatened category of herbs are present in the project area. Therefore, an environmental management plan (EMP) for the protection and rehabilitation of these rare and threatened species is envisaged.

During the construction period, the area will have large number of labour and there could be a tendency to collect wood from nearby forest for various purposes legally or illegally, which can affect the health of the forest.

### **Mitigation Measure**

Efforts have been made to minimize the forest area and vegetation loss while planning the project structures and facilities. However, complete avoidance of the forested areas and vegetation is not possible due to the project key structural locations determined by geology and other design parameters. The loss of the forested area and vegetation by the project structures and facilities is unavoidable.

However, to minimize the loss of forest area and vegetation following mitigation measures will be implemented.

1. Compensatory afforestation will be carried out by HP Forest Department, in unreserved forest block C-194 of Chharang, and unreserved forest block C-186 of Thangi, over 79.00 hectares of degraded forest land as per proposed scheme by HP Forest Department, at a cost of INR 26,676,610/- (Rupees Twenty Six Million, six hundred seventy six thousand, six hundred and ten only) and the amount of NPV at the tune of INR 24,488,773/-(Rupees twenty four million four hundred eighty eight thousand seven hundred and seventy three only) which is reported to have already been deposited by NTPGL.
2. Clearing of the forest vegetation as to the requirement of project structures and facilities only. The project sites requiring forest clearance will be demarcated and each of the trees have been marked and documented through joint inspection of the Forest officials and project representative. The contractor will be given order to make a clear felling of the only designated sites and tree under strict supervision of the project environmental officer. Such actions are envisaged to minimize the loss of unwanted trees in the project structure and facility sites.
3. Technical and financial assistance to the Affected Community Forests User Groups: The affected community will be provided technical assistance for the management of the community forests. A forester will be hired to prepare a plan to maximize the benefit from the existing forest areas without impinging upon the existing ecological status. Disbursement of compensation to the beneficiaries for the loss of NTFP (Non timber forest produce) will be ensured, and plantation of local species in the degraded forest area will be provided to upgrade the economic conditions of the community.

### **Impacts on Vegetation Due to the offsite activities of construction works and associated workforce**

The project development site in upstream and downstream works will employ about 500 migratory construction workforce. Traditionally for cooking and other heating purposes, firewood is used in Himachal Pradesh. There could be a possibility that the construction workers may use the firewood from the adjacent forests for cooking. To meet the additional demand, from the construction work force and their families, the local merchants/villagers or workers themselves may cut the trees from the local forest. This may have a long term impact on the ecology.

#### **Mitigation**

1. *Preference to the local population for project employment:* One of the options to minimize the impacts related to outside workforce is to provide maximum job opportunity to the local communities to the extent possible.

2. *Provision of free fuel to the workforce for cooking and common kitchen facility:* To avoid the illegal extraction of firewood, a provisions for common kitchen, room heating facility and common geysers to be made in labour camps. Additionally fuel wood depots will be open to provide free fuel to labours if required. Contractor should be made responsible for the above arrangements contractually.
3. *Prohibition on the sale and purchase of the local NTFP in the camps:* The project staff and workers could be the buyers of high value high value forest products such as Chilgoza. A prohibition should be implemented by the project management and contractor, on the purchase, sale and storage of the local high value NTFP within the camps.
4. *Prohibition on roaming of project workers in the forest area:* Project proponent and contractor should inform their migrant workers at the time of induction, on the prohibition of roaming in the forest areas without the permission of the management. Notice on this regard will be posted in the camp notice boards on permanent basis. Anyone found roaming or exploiting forest resources without the knowledge of the management should be penalized.
5. *Vigilance:* Vigilance to be kept on the adjoining forest areas and forest entry points in the project area, by deploying security guards and patrolling nearby areas. Vigilance may be enhanced by engaging local communities/ gram panchayat through constitution of joint committees.

### **Impact on Terrestrial Fauna**

The influence area of the project (10 km radius area) does not encroach into any Wildlife Sanctuary or any National Park. The possibility of existence of a wildlife corridor was discussed with the forest department and the local communities. After discussion it was concluded that this area does not constitute a corridor for movement of wildlife.

During the EIA study, the pugmarks of Snow Leopard were noticed. The region is also a habitat of Black and Brown Bear and Musk Deer. Snow Leopard and Musk Deer generally stay at higher altitudes and unlikely to visit the work area which is at a lower height. The pugmark of the Snow Leopard which was witnessed during the survey could probably a stray cat and is not likely a resident of the valley where the work will be undertaken. The valleys are, however, visited by Black and Brown Bears and could be encountered during the construction stage. During the cold winters, the bear could take shelter in the adits or tunnels. If a bear is ever encountered in the work area, the same should be immediately reported to the forest department.

During the blasting, ground vibrations are generated. These vibrations are not perceived by humans but could sometime scare wild animals. The wild animals tend to locate themselves in far away areas where the ground vibrations are not felt. This often brings a re-distribution of wild animals in the area. The re-distribution could cause territorial conflict within the same species or could alter the pray-predator

ratio. To a lesser extent atmospheric noise generated by the project machinery could also scare animals. This also could bring direct conflict with human and could cause retribution killings. However these are grey areas. It is difficult to predict which animal will relocate themselves (if at all they do) in which area and what is the current wildlife set up of that area.

The Snow Leopard and Must Deer is a high value kill and there could be a possibility that the workers may get tempted to hunt. Many of the migrant labours often use trap to catch the animal for its skin, musk or the other animal parts.

### *Mitigation*

During the construction phase, various adverse impacts on the wildlife are anticipated in the surrounding areas of the proposed project in terms of increased noise levels, land vibrations during tunneling and blasting, release of air and water pollutants, etc. Mammals are the most vulnerable group affected by these negative impacts, which affect their movement, behavior and breeding habit. To avoid and minimize the negative impacts from these activities following safeguard measures will be adopted:

- Strict restrictions and joint surveillance with villagers as suggested in flora section will be imposed on the workers at project sites to ensure that they would not harvest any species/produce from the natural forests and cause any danger or harm to the animals and birds.
- All mitigations measures suggested in ambient noise level section to be adopted.
- Anti-poaching measures like intensive patrolling will be undertaken with the help of the forest department.
- All the mitigation measures suggested for impact on ambient noise level should ensured to be adopted.
- Provisions will be made for the supply of free fuel for worker's camp to avoid forest degradation and destruction of animal habitats.
- Workers will be accommodated in labor camps/ colonies within the project area so that they don't set up temporary sheds in the vicinity of the forest and wilderness areas. During the discussion with the Forest Department, it was evident that the opportunity for poaching might increase because of the accessibility of the site due to the construction of better roads. Forest department is also worried of migrant workers whom they consider expert trappers of wild life. Additional surveillance and restricting the workers only to work site is very important and should be strictly adhered.
- Representative of Forest Department mentioned that the predators like panthers and snow leopards follow smaller prey like dogs especially during the winters when the snow fall is heavy. They often follow and prey on feral dogs. The feral dogs are generally around the work sites and survive on the municipal wastes. The municipal waste management practices should therefore strictly follow as suggested in this report to avoid feral dogs which attracts leopards and

panthers. However, if the feral dog population is noticed, it should be immediately reported to the forest department for sterilization.

- Before providing employment (both NTPGL and contractors workforce), a mandatory training needs to be provided to impress the rules that they have to follow with respect to environmental issues. The EHS team should also frequently visit the adjoining work areas and if any worker is found loitering around for no valid reason, strict action should be taken against the individuals and the contractors.
- An awareness programme is suggested for local villagers on the wildlife indicators such as increase in animal density at a particular place etc. the same should be immediately conveyed to the forest department.

### **Impact on Aquatic Fauna**

As mentioned in the Chapter 4, no fishes were found in the Tidong stream near the barrage site and immediate downstream during the sample survey conducted for EIA-2005. However, the species of Snow trout (*Schizothorax richardsonii*) and Brown trout (*Salmo trutta fario*) were present at sampling site S3 near the confluence of Tidong and Satluj river i.e. near power house site. The native *Schizothorax richardsonii* has been classified as vulnerable mainly because of sharp decline of its population in recent times. Moreover Snow Trouts often lose out in the competition for survival with the exotic salmonoids.

During the construction, the adits and other excavation works generally intercepts the ground water and the runoff of the muddy water is discharged in the river. During the winter months when the flow is minimum, even a small discharge of dirty water makes the river water high in Suspended Solids (SS). The higher SS renders the water unfit for fishes as it chokes the gills.

### **Mitigation**

Strict measures should be taken to ensure that high TSS water is not directly discharged into the river. The details of treatment of the tunnel water are given in chapter 7. If the suggested measure is taken, the fishes will have no significant deleterious impacts during the construction stage. All other mitigation measures suggested for water resource and water quality will be followed strictly.

### **Impact on Land use Pattern**

The total land required by the project is 42.2557 hectares which includes 39.0546 ha. of forest land and 3.2011 hectares of private land. Land use will be changed will be two types i.e. permanent and temporary. Permanent change will be caused due to construction of various project components like reservoir, diversion structure, powerhouse, staff colony, office, access roads and other ancillary structures. However, temporary change in land use pattern is caused by some of the project activities

such as batching plant, labour camps, etc. These temporary areas will be unused after the construction activities are completed.

### *Mitigation*

The land use pattern changed permanently, by project components and staff colony, offices and access roads will remain unchanged. A systematic land development plan to be prepared by NTPGL within 6 months after the release of this report, for eco-restoration of temporarily changed land areas such as muck disposal area, batching plant, labour camp, quarry sites, etc. after the closure of respective site by seeding grass and planting saplings of native species. The species for plantation will be selected to restore the biodiversity of the area in consultation with forest department.

### **Impact on Erosion and Siltation**

There is scanty rainfall in the project area as may be seen from the rainfall data recorded at Morang Tehsil (refer table 4-10). This reduces the erosion risk due to rainfall. However, snow slides in such area carries along with them a huge silt load, which ultimately comes to river when the snow melts.

Silt load in river water in general is more in summer season than that in the winters. The project is a run-of-the-river reduces risk of reservoir siltation. The silt (up to 0.20 mm) arrested in the silt chambers is required to be flushed back in to the river flow at periodic intervals.

Any excavation work during the construction activities, whether permanent or temporary, would require removal of vegetation cover from ground, runoff from unprotected excavated areas, muck disposal sites, quarry sites etc. would result in increased soil erosion, excavations on slopes would also decrease its stability. Given with the topography of the area, unprotected excavations on sloping grounds will make landslide prone sites, especially during the rainy season, excessive soil erosion and mass movement of soil is likely to disrupt the natural drainage, which can lead to impounding of runoff in dangerous preposition.

### *Mitigation*

- Storm water drainages and underground drainage of seepage water from the construction area to be provided retention tanks to hold water for at least 2hours and silt collected will be periodically cleaned to ensure the retention time in not decreased. All the silt collected from the retention tanks will be used for leveling of land or dumped into the designated muck dumping areas.
- Slopes in the excavated areas should be protected against sliding and any excavation should follow benching if the height of the excavation increases beyond 3 meters.
- All trace cutting works for road construction, adequate retaining wall or breast wall to be provided in case the geology is not self supporting.



- Slope stabilization measures will be adopted such as adequate vertical and horizontal drains, drainage along road sides, cross drainage etc.
- Controlled blasting practices to be adopted to avoid breach in retaining wall, slides etc.
- Mapping of structures likely to be impacted by vibration such as retaining walls, erosion and land stability/slides.

### **Impact due to Earthquake**

The project area falls in Zone IV as per the Indian Standard Seismic Map. The available data suggests that there were only three low intensity earthquake (less 4.0 Richter scale) in past 5 years. For safety of the structures, necessary factors and appropriate co-efficient have to be incorporated in designing the structures under worst combination of forces. Provided with the appropriate design of the dam, tunnel and other structures of the scheme, the risk due to earthquake can be restricted. However, in young mountains like Himalayas, high intense seismic activity is always a possibility. With the available experience, it has been scientifically established that dams, using modern methods of construction can safely withstand high intensity earthquakes.

### **Mitigation**

1. Necessary design parameters for earthquake resistance, to be ensured in the design of project components.
2. Since it is a run-of-the-river project and envisages a 10-meter high barrage for diversion of stream water into the project, therefore dam break analysis is not required. The project is designed to store about 25,000 cum of water in the barrage and intermediate reservoir, surge of this water during dam break is unlikely to cause any human fatality or damage community structures mainly because along the Tidong khad no human resides and no village structure exist. Nearest village Nearest human habitation from the Tidong stream is about 200 meters away in Thangi and its relative elevation is more than 100 meters, other habitation is Morang village which is more than 300 m away from the left bank and at an elevation of more than 150 meters from the Tidong Khad. Surge of such a small quantity of water in no way will have no impact on the villages.
3. However, an Emergency Preparedness Plan (EPP) has been prepared and is being modified by NTPGL by incorporating Names and contact numbers of the emergency response team, training to stakeholders as suggested in corresponding action plan in chapter – 7, considering other emergencies like fire, cloud burst, land slide, tunnel collapse, etc. constituting a committee with defined roles and responsibilities along with important contact numbers. The EPP should also define the procedure and frequency of mock drills.

### **Impact on streams and spring along the tunnel alignment;**

The Gara and Duba Khad (Stream) lie in the alignment of Head Race Tunnel (HRT) on the left bank of Tidong stream and water from these khads is used for irrigating about 800 bighas of land, which lies in the landslide prone zone. It was anticipated that these streams might dry due to the construction of HRT.

#### **Mitigation**

1. Inventory of water sources, falling in the project area has been prepared by ADM-Pooh and a videographic survey has been conducted for all those sources.
2. Tunnel has been aligned deeper to obtain a minimum rock cover of about 157 m over the tunnel at the point of crossing.
3. In case damages are observed due to project activities, it will be adequately compensated by the project proponent by providing piped water on the desired places of usage.

### **Impact on air quality due to Construction Activities**

Fugitive emissions from various construction machinery added with the dust generated by movement of construction vehicles would be the main source of air pollution during construction. Electric power supply from Himachal Pradesh Electricity Board is proposed to be used for electrically operated construction machinery/equipment, which would reduce the consumption of diesel. The use of DG set would be limited during power failure as a backup. Running of dumpers and heavy machineries around the project area will result in the increase in SPM, NO<sub>x</sub> and SO<sub>2</sub> levels in the air. Comparing the present status of air quality and its source with the expected source of pollutants during the construction, it can be predicted that the SPM, NO<sub>x</sub> and SO<sub>2</sub> will increase. However, this increase would be of temporary nature and restricted to construction phase only. The project proponent will be taking necessary actions to protect the fugitive dust generation from various project activities.

Since the construction activities have already started and dust generation from the project activities has been a major concern of the villagers which was identified during various informal and formal interactions held during March and April 2011. Construction period impacts on air quality is mainly due to the activities like site preparation, approach roads, excavation, drilling, blasting, foundation, tunneling, deployment of machinery, transportation, sand quarrying, storage of muck, etc. The nature and extent of impact on air environment will vary from time to time and through different stages of development of project.

Suspended Particulate Matter (SPM) is the main air pollutant during construction. Large quantity of dust is being generated from traffic movement. The fugitive dust released during the construction activities may cause immediate effect on the construction workers who are directly exposed to the fugitive dust

in addition to the effect on neighbouring community. The other likely source of air pollution is due to the emission from various construction equipments. The various equipments require combustion of fuel, normally diesel oil. The major pollutants, which get emitted from diesel vehicles, are hydrocarbons, and oxides of sulphur & nitrogen.

### **Impact on Air Quality due to Transportation of Material and Operation of Construction Equipment**

The project construction would require about 63 thousand cu.m of fine aggregate, 0.13 million cu.m of coarse aggregate 49 thousand tons of cement and 3,577 tons of steel and about 0.71 million cu.m of muck to different muck disposal sites within the project area. These would have to be transported from source to the construction site/batching plant. The coarse and fine aggregate would be transported from the quarry site, but steel and cement would come all the way from their source via nearest railway station at Kalka. In addition, the operation and construction machinery, about 1.5 million liters of POL (Construction Petroleum, Oil & Lubricant) would also be transported to the project site. Transportation of aggregate, sand, muck in and around the construction site would add SPM and other pollutants from vehicular emissions to the local air shed.

Transportation of the construction material from Kalka to the project site would put considerable pressure on the Kalka-Peo road and reduce its service life. The increased traffic on this road would also increase air pollutions though the same would disperse in the vast volumes of available clean background air not having any noticeable impact on the air quality along this route.

### **Mitigation**

Most of the measures are precautionary while a few are included in the construction methodology and no specific budgeting is required.

- As the vehicular movement generates fugitive dust in the area, hence provisions will be made for sprinkling of water on the project roads and PWD roads, with a suitable frequency to ensure that there is no fugitive dust emission from the roads due to movement of vehicles. Special attention will be provided for the roads stretches passing through villages.
- Idling of delivery trucks / tractors and other construction equipment's should not be permitted during the periods when they are unloaded or are not in active use. Effective traffic management to be undertaken to avoid significant delays in and around the project area.
- Road damage caused by sub-project activities will be promptly attended to with proper road repair and maintenance work
- Grading operation to be suspended when the wind speed exceeds 20 km /hr.
- All storage piles shall be adequately wetted or covered with plastic to ensure to protection of ambient air from fugitive emission wind storm
- The wind barriers of 50% porosity will be installed three sides of all storage piles

- The project roads and PWD road from NH-22 will be inspected and the debris left by the tractor - trolleys will be removed as early as possible.
- All the stone crushers, if installed for project activities, will install suitable pollution control arrangement and obtain consent from the state pollution control board.
- Concrete batching plant will be located at closes possible location to the point of use, so that the requirement of transit mixers/ delivery trucks is minimized.
- Operation time of construction equipment will be optimized through modifications in the work schedule.
- As soon as the construction activity is over the surplus earth will be utilized to fill up the low-lying areas, or adequately managed.
- All stationary machines/ DG sets / construction equipment emitting the pollutants will be inspected weekly for maintenance and should be fitted with exhaust pollution control devices.

### Impact on ambient Noise in the surrounding areas

The primary noise generating activities at during construction could arise from:

- Blasting & Drilling,
- Concreting & Mixing,
- Casting and Material movement.

For the tunneling, drill and blast method will be used. The drilling operation and the subsequent blasting generate noise. The noise is most prominent at the work phase but is not significantly audible on the surface. However, the blasting activity generates ground vibrations and travels a long distance from the blast site. These vibrations are not felt by human but may scare the wild life in the area.

Several construction equipments will be operated at the construction site and will generate noise at various levels. Expected noise levels due to operation of various construction machineries at site are indicated in Table 6-2.

**Table 6-2: Typical Noise Level of construction equipment**

SI No.	Equipment	dB(A)
1	Drilling Machine	120-130
2	Motor Scraper	85-95
3	Face Shovel	80-90
4	Dump Truck	80-90
5	Compactor	80-85
6	Dozer	80-90
7	DG Set	80-110
8	Pumps	80-100

9	Grouting m/c	80-100
10	Jack Hammer	130-140
11	Vibrators	70-82
12	Compressors	90-95

As seen from the above table, construction activities are expected to produce noise levels at source in the range of 80-140 dB(A), which will decrease with increase in distance. The construction works will be carried out during the day time. The impact of noise produced during the construction will, however, be limited to a distance of about 50 to 200 meters at which the noise level of various equipment will come down below 55 dB(A). It could, therefore, be concluded that the construction activities would not have a significant impact on existing ambient noise levels

Due to high noise levels of construction machinery, the personnel operating the machines and workers stationed near to the machines are prone to exposure of high levels of noise for extended periods. Use of Personal Protective Equipment (PPEs) will reduce noise impact on personnel. During excavation of earth, cutting of rock, crushing, loading and transportation activities the cumulative noise generated can be computed using the where difference between two or more noise levels is known. Careful planning of machinery operation and scheduling of operations can however, reduce the noise levels.

There are no sensitive receptors around the project site to have direct noise impact due to construction activity. Therefore, noise produced during the construction will not have significant impact.

### *Mitigation*

Noise would be generated at the time of construction of powerhouse, tunneling, machine operations, running of pumps, drilling machines, blasting, plying of dumpers etc. Continuous exposure of workers to high level of noise may result in annoyance, fatigue, and may cause temporary shift of threshold limit of hearing and even permanent loss of hearing.

- The work hours should be limited depending on convenience of the local people.
- The construction equipment generating high noise must be designed to have an adequate muffler system.
- Over ground blasting time should be established during day time only. The established time will be notified and displayed in project area at strategic places such as main gate, project office, project roads, near blasting site etc.
- Controlled blasting techniques such as Noiseless Trunk Delay (NTD) technique etc. to be adopted to reduce vibrations.
- Proper guideline should be issued so that noisy equipments are not operated during the night time. Additionally To ensure that noise is not generated during night, the project should petrol by security guards and by the project authorities on a daily basis.

- All stationary noise generating equipments such as air compressors, power generators should be used away from the residential area.
- Movement of vehicles should be restricted to office hours only.
- The total sound power level,  $L_w$ , of a DG set should be less than,  $94+10 \log_{10} (KVA)$ , dB(A).
- Noise from the DG set should be controlled by providing an acoustic enclosure or by treating the enclosure acoustically.
- The Acoustic Enclosure should be provided to all noise generating equipment e.g. compressor and the walls of the enclosure should be insulated with fire retardant foam so as to comply with the 75 dBA at 1m sound levels specified by CPCB, Ministry of Environment & Forests.
- The DG set should also be provided with proper exhaust muffler with insertion loss of minimum 25 dB(A).
- A proper routine and preventive maintenance procedure for the DG set, compressors, and vehicles should be set and followed in consultation with the respective manufacturer which would help prevent noise levels from deteriorating with use.
- Restriction on pressure horns.
- Provision of ear plugs to the construction workers

### **Impacts on drainage pattern**

Natural drainage of the hill slope will be affected due to construction of road and other project components.

#### **Mitigation:**

- Cross drainage will be provided in addition to the side drains along the access roads, to maintain the natural drainage of the construction area.
- Inventory of all surface natural channels/drainages to be prepared to ensure no alteration in the drainage pattern.
- Temporary surface drainages to be provided in labour camps, offices and key construction areas.
- If any area is found likely to be unstable, in due course of time due to drainage, drainage diversion etc. because of the project activities, adequate measures should be taken to stabilize the same.

### **Impact on water quality**

Physical and biological characteristics of Tidong stream indicate that its water is of good quality and free from coliforms. There are no significant point sources of pollutants and diffused sources (agriculture & settlements) are also very sparse. During construction, the likely impacts arise from inappropriate disposal of muck, effluents from crushers and other sources and sewage from labour camps and colonies. The muck will come essentially from road building activities, tunneling and other activities. The

unsorted waste going into the river channel could contribute to the deterioration of water quality at least during the construction period. The high turbidity is known to reduce the photosynthetic efficiency of primary producers in the river and as a result the biological productivity will be greatly reduced. Thus prolonged turbid conditions, if exists, would have negative impacts on the aquatic life.

Unless adequate care is taken, one of the major sources of water pollution could be due to discharge of sewage from labour camps/colonies. The remaining duration of construction will be about 2.5 years. In all, about 825 people will be staying at site during peak period of construction. The water supply will be about 135 liters per capita per day. The total sewage production will be about  $0.80 \times 135 \times 825 = 89.1 \text{m}^3/\text{day}$  and affect the water quality adversely, if not treated properly. The BOD load contributed by the domestic sewage will be about 14 kg/ day. The sewage from workers camp and other establishments need be treated before its final disposal. If the human waste and refuse is directly drained into the river channel, the coliforms and other disease causing organisms may increase leading to water borne diseases. Therefore, in order to avoid any deterioration in water quality and subsequent changes in the aquatic biota, a proper waste management plan has been proposed.

The present DO concentration at barrage site is about 9 mg/l. The DO level below 4-mg/l impedes aquatic life. Careful planning of excavation and disposal reuse of excavated material can prevent the silt transport downstream.

Seepage discharge from underground works, aggregate washing discharge, and batching plant wastewater contain significant amount of silt which, if discharged directly into the Tidong Stream, will add to the slit content and increase pollution.

The construction of barrage and associated structures will be carried out on the river bed. Therefore, any construction on the river bed is expected to affect the river water quality and habitat of aquatic life. Construction of barrage foundation requires diverting river in a stretch of about 200 meters during the construction phase. The river diversion works can have serious effect on the existing water quality during the diversion period and can affect the existing aquatic ecology permanently. The envisaged impacts on water quality is short term, while on the aquatic ecology is long term and of high magnitude.

The wash water from equipment and workshop yards may cause water pollution downstream. Since the plants and yards are proposed to be located away from the vicinity of riverbank, there will not be any water pollution from the wash waters.

### **Mitigation**

Construction work require large quantities of water to be used in various processing plants for material preparation; curing purposes, cooling water in equipments, domestic usages in colonies, etc. wastewater will be generated in various from labour colonies. This can deteriorate the water quality in the project area. The following mitigation measures are suggested to be followed during the construction phase of the project:

- Segregation of storm water with different types of wastes i.e. solid wastes and sewage, so as to avoid its mixing and contamination of Tidong stream is avoided. .
- To avoid the deterioration of water quality and release of pollutants into the Tidong stream, project proponent would provide proper sanitation facilities and garbage disposal bins to the workers/ colony areas. The garbage collected in the bins will be collected, transported and disposed in a manner to ensure the proper disposal and treatment.
- Seepage water from underground works contain significant amount of silt which, if discharged directly into the Tidong Stream, will add to the silt content and increase pollution. Such seepage water from all the underground works should be treated to ensure its quality before final discharge into the natural stream. Desilting tanks should be provided for seepage water at each opening of underground works from where such water is discharged. These tanks should be designed in accordance to the silt load in the tunnel discharge to ensure the retention time of 2 hours. Cleaning schedule will be prepared for these tanks with a frequency so that they are cleaned before their effectiveness is reduced. Silt removed from the tanks will be used for leveling of land or dumped into the designated muck dumping sites.
- All the excavated areas should be protected through garland drains to avoid siltation of adjacent area from surface runoff.
- The project proponent will establish a procedure for water quality surveillance and ensure safe water for the consumers. A detailed epidemiological study related to water borne diseases will be carried out and the data will be compiled for every year in the project area. This data would help the authority in finding out the trends for incidence of water related diseases prevalent in the area, which would help them to take suitable remedial measures for reducing or eradicating the occurrence of these diseases in future.
- Water quality parameters will be monitored as per the prescribed schedule in environmental monitoring plan to cover seasonal variations for five years. Water quality monitoring at two distinct locations i.e. barrage and power house site would be ensured, through the environmental division of the project.
- Adequate river water quantity shall be secured after diversion of water into HRT, to meet the requirements of riparian rights, livestock, and wild animals and to sustain the aquatic ecosystem.
- Controlled blasting will be practiced at all times while excavating the surface or underground area to have a minimum vibration impact in the surrounding areas.
- The excavated surface will be protected against the water erosion by adequate vertical and horizontal drainages and the water collected from the excavation area will be discharged into safe area.
- Since the project has to construct the barrage structure, the perceived impacts could not be avoided and will remain as the residual impact. However to minimise the impact on water quality during barrage foundation construction, discharge of construction waste such as cement,



and concrete slurry will not be discharged to the river water. Arrangement will be made to collect the unused waste materials for disposal in the designated muck/spoil disposal sites.

- Leakage of oil wastes from oil storage, vehicles, should be avoided in order to prevent potential contamination of the ground water system.
- Surface runoff from oil handling areas/devices should be treated for oil separation before being discharged into the river. If oil wastes are combined with sanitary sewage, oil separation will be necessary at the wastewater treatment facility.
- For labour colonies, septic tanks followed by soak pit of not less than 25m<sup>3</sup> each would be constructed at appropriate sites for each set toilet and bathroom. Cleaning schedule of these tanks will be prepared and followed. The organic waste generated would be decomposed and used as manure while landscaping the project area or transported to nearest disposal facility. One to two tanks or soak pits are proposed for each set of toilet. It will be ensured that there will be no discharge from the septic tanks.
- Camp kitchen waste water will be disposed in septic tanks.
- Once the septic tank is full, it should be cleaned and collected sludge to be disposed to composting facility at Shimla. Alternatively, another septic tank to be provided for sewage and abandon the old septic tank after complete utilization. No discharge from the septic tanks should be allowed.
- Monitored the protection walls to identify the breach in the initial stage. The breached found to be repaired immediately Muck disposal sites to be restored with vegetation after leveling and dressing once the dumping is completed.
- Waste Oil/ grease/ lubricants are categorized by MoEF as Hazardous wastes. All such waste will be collected and stored at a protected place and sold to a vendor, authorized by Pollution control boards or MoEF for treatment of hazardous wastes.

### **Impact due to solid waste generated in camps its disposal**

The expected migrant population for a period of 2.5 years of balance construction period as per schedule, although transitory, would generate large quantities of waste that needs to be disposed off without polluting the land, air and water resources of the region. In India, the average dry weight per capita solid waste generated per day is around 300 g. For the migrant population of 1075 persons in the THEP, the solid waste generated would be approximately 325 kg ( $0.3 \times 1075 = 322.5$  kg). The project authorities would ensure proper collection and disposal of this waste besides providing proper sanitary facilities to the residential colony and labour camps in the project area.

#### **Mitigation**

Organic and inorganic garbage will also be generated in the colony area. Dustbins of good and long-lasting quality should be installed at different places to collect organic, plastic, glass and other garbage separately. All the waste from labour camps, office and staff colony will be collected by NTPGL and

transported to disposal site. Metals, plastics and glasses in the garbage will be sold to vendors. The organic garbage will not decompose into manure due to predominantly low temperature in the region therefore will be mixed with other combustible garbage and will be incinerated. The incinerator will be double chambered, with air pollution control equipment to meet all the air quality standards as prescribed by the Central Pollution Control Board.

### Impact due to Muck generated from project

Approximately 1,062,889 cum (1.063Mm<sup>3</sup>) of muck is estimated to be generated from the project activities. Muck is the major solid waste generated from any hydro electric project, along with other solid wastes generated such as domestic solid wastes. Table 6-3 gives the quantity of muck expected to be generated per project component/ civil structure. Based on the geological nature of the rocks and engineering properties of the soil, a part of the muck can be used as construction material. Best management of waste is to make it a resource for some other activity and to fulfill the requirement of IFC's Performance Standard - PS 3 Pollution Prevention and Abatement. Out of total muck generation, about 32% will be reused within the project as backfilling material and construction material. Thus it will conserve the resources required for these activities.

The muck will be partly reused in backfill and partly as building / construction works. Details of muck generation and reuse are explained in the following table:

**Table 6-3: Muck generation and their reuse from Respective Project Components**

S.No	Components	Quantity of Muck/ Debris (m3)	Vol. to be used Backfill (m3)	Vol. to be used for construction / protection works (m3)	Total reuse (m3)	% Reuse
1	Diversion Works					
(a)	River Diversion Works	19880	2850	3976	6826	34%
(b)	Barrage	252560	53250	37884	91134	36%
(c)	Desilting Chamber	33600	3550	6720	10270	31%
(d)	Reservoir	90817	14200	15439	29639	33%
(e)	Tunnel Intake	3500	0	1050	1050	30%
	Total of (1)	<b>400357</b>	<b>73850</b>	<b>65069</b>	138919	35%
2	Head Race Tunnel	148396	0	44519	44519	30%
3	Adits (Inlet and intermediate)	13547	0	4064	4064	30%
4	Surge Shaft & Value house	14871	0	4461	4461	30%
5	Pressure shaft	19482	0	4175	4175	21%
6	Power House & Switch yard	116200	16600	8300	24900	21%
7	Road	344436	86110	36910	123020	36%

8	Tail Race Channel	5600	500	400	900	16%
	<b>Total Excavation</b>	<b>1062889</b>	<b>177060</b>	<b>167898</b>	<b>344958</b>	<b>32%</b>

Source: Addendum-1, Volume-V of Environmental Impact Assessment, May 2006 for 100 MW Tidong-1 HEP

The remaining quantity of about 717931 cu.m muck will be transported and disposed at pre-identified, designated and adequately developed dumping locations.. Normally, muck is disposed in low-lying areas or depressions. Trees, if any, are cut before muck disposal, however, shrubs, grass or other types of undergrowth in the muck disposal at sites perish.will However, in the project area, availability of flat area having suitable approach for muck disposal is very limited due to the topography. Muck disposal sites will have to be located on slopping grounds.

**Table 6-4: Summary of Muck generation, reuse and dumping**

Project Activity	Quantity of Muck (M <sup>3</sup> )
Generation	1,062,889
Reuse	344,958
Dumped	717,931

Being loose in nature, it often flow with water, slides with snow, flies with wind when dry and pollutes water and air. Management of muck with adequate slope stabilization is required along with suitable retaining walls. Mitigation measures to be followed are as mentioned below;

**Mitigation**

1. Designated dumping sites will be developed in such a way that no spillage of excavated material takes place and cause no damage to Tidong stream water quality. Layer by layer filling of muck will be done and compacted mechanically. Dumping sites on sloping ground will be protected adequately against any possible slide/slope failure through engineering measures i.e. retaining wall.
2. Muck Dumping sites to be provided with gabion walls (with 100 mm thick RCC cladding on outer site) against any possible slide/slope failure.
3. All the muck disposal sites will be covered with vegetation after leveling and dressing the top surface once the dumping is completed.

**Impact on Traffic at Common Roads**

The traffic for material transportation to project as explained above in Impact on Air Quality section will affect the traffic on the national highway. Further, a 17-km long PWD road being maintained by Public Works Department (PWD), Government of Himachal Pradesh, taking off from NH-22 at Morang Bridge

up to Village Lumber, is used by the vehicles from villages and employed for the project. Presently, the above mentioned PWD road has a load of around 40 to 45 light and heavy vehicles every day. This load is expected to raise to around 80 to 90 vehicles per day during peak construction activities of the Project. In addition to this, 2.46-km long road for power house is already constructed, 6.22-km long road to surge shaft from power house is under construction within the project and another 2.35 km long road to access Adit-1 is already constructed from PWD road near mooring at the upstream works. These roads can be referred from project layout attached as Figure 3-2. Both of these roads also include the construction of Belly Bridge for crossing the Tidong stream. Major portion of the road near Powerhouse is constructed in the sinking zone of the hill slope. Since the roads are still under construction, the safety signs are not yet installed. A Traffic Management Plan is suggested for the project for the construction period.

Route maps showing proposed routes that should be followed to gain access to the site during the delivery of construction materials and also while leaving the site to avoid site vehicle trafficking through adjacent residential/ community roads.

The potential impacts likely to be associated with the road traffic movement during the construction phase of the proposed project include the following:

- Temporary increase in traffic flows on the road network linked to the project leading to potential for delays and congestion on already narrow roads;
- Short term closures of existing transport routes during proposed widening of PWD road up to upstream works, resulting in disruption and delays to local transport users;
- Increased traffic related noise and emissions;
- Impact on natural resources where new access roads to Power house, surge shaft and Adit 1 are being constructed;
- Potential modifications to natural drainage patterns brought by the construction of new access roads;
- Increased traffic movements will increase the risk of traffic accidents which may result in injury, fatalities or environmental damage.

### **Mitigation**

Key mitigation measures identified are as below,

- Appropriate speed limits for various motor vehicles and construction equipments will be determined as part of the traffic management based on type of roads available en-route the location to and fro of the project component where construction material is to be transported project;
- Establishment of safe sight distances including within construction areas;

- As far as possible the movement of heavy, wide or slow-moving loads will be planned at times when traffic volume on the roads concerned is least;
- Prepare detailed plan for signage around the construction areas to facilitate traffic movement;
- If required, widening will be done for existing roads being used by the project activities;
- Regular inspection of access roads conditions and whenever, necessary, repair of construction traffic related damages will be done;
- Plan will be prepared for movement of special loads such as hazardous materials, heavy loads etc;
- Appropriate supervision will be provided to control flow of traffic when machinery needs to cross roads;
- Training and testing of heavy equipment operators and drivers, including vision tests, with records kept of all trainings;
- Create traffic awareness among the local people and inform parents to keep children from exposing themselves to the traffic in the construction area. Vehicle traffic will be minimised during the periods when children are travelling to and from schools located on traffic routes;
- Maintaining records of all accidents involving project vehicles and implementing a traffic complaint and corrective action procedure;
- Liaison with the police and other authorities prior to the movement of any abnormal loads or any over dimensioned consignment;
- If road closures are required, diversions will be planned and communicated to the authorities and affected communities in advance. All diversion will be constructed to the specifications of the applicable road authority and will be maintained in good drivable conditions until the completion of the re-instatement work;
- The project traffic or any project activity will not obstruct the access to neighbouring properties;
- Ambulance and fire services will be consulted regarding road diversions. Road diversions will not increase the response time of these services to local communities; and
- In the case of open excavation works, all road diversions will employ traffic control devices to warn and protect the public and construction personnel;
- Delivery hours should be limited to working hours
- Security/ gatemen may be positioned half an hour before start of work and before the earliest delivery time.

## Impact on Human Health and Safety

A population of about 1000 persons (825 workers population + 100 officers /staff) is expected to be work during peak construction period at various sites. Health risk during the project construction includes disease risk due to lack of sanitation (water supply and waste disposal).

Labourers come from different part of India with varied environmental and social conditions. A significant number of migrant labourers are expected in this area. Labourers may carry vector borne disease and may finally get transmitted to the local population. hazards due to local carriers. A Health Management System must include proper facilities sanitation, water supply, solid waste management and health care. The project should also organize health awareness campaigns though street theaters and issue of pamphlets in local language.

Due to implementation of this project, possibility of stagnant/ impounded water would provide favorable breeding places for vector life such as mosquito and snails. The aggregation of labour, discharge of uncontrolled solid waste and wastewater and its accumulation may result in occurrence/spread of diseases like cholera, gastroenteritis, etc. Labour population along with their families would be more vulnerable to the increased incidence of water borne diseases caused by vectors and pathogens.

Workers occupational safety may be impacted will be exposed to several occupational hazards while working in the project at different components such as electrical hazard, fall of a person hazard while working at height, hazard of falling object from overhead / in underground work, hazard of flying rock due to explosion, hazard of unwanted explosion while handling explosive, fire hazard, hazard of tunnel collapse, hazard of drowning into river, fire hazard, etc.

### Mitigation

- Pre-employment health checkup for all the workers and employees, provision of safe drinking water, sanitation, garbage management and healthcare facilities would control and prevent the occurrence of diseases in the project area. Provision of these facilities in labour camps has been discussed in Management Plans. Improvement of these facilities in the project-affected villages would make part of the Socio-economic Management Program of the project.
- Proper leveling of the site and provision of drainage to avoid water stagnation.
- Safety audit by an expert agency to be conducted for the project, within 4 months after the release of this report.
- Adequate personal protective equipments (PPEs) to be made mandatory to all the persons entering work sites.
- Training and awareness programmes to be conducted for all the workers to mitigate the hazards in their respective work areas and use of PPEs.
- Handling of explosive to be ensured in the strict supervision of licensed person only

- Explosive to be strictly stored in licensed magazine only and if found any other place, strict action should be initiated against the responsible person. Accurate inventory of the explosive received, issued and person in-charge for issued explosive should be maintained.
- Explosive to be transported in licensed explosive van only under the strict supervision of licensed person. Left over explosive from work sites should be sent back to magazine immediately.

### **Impact due to Transmission line**

A Transmission line of 220kV DC capacity is envisaged for evacuation of power from Tidong-1 and the stretch from Kashang to Tidong-1 HEP is considered as an 'associated facility' as per IFC guidelines. Himachal Pradesh Power Transmission Corporation Limited (HPPTCL), a State Transmission Utility, will be managing its execution. The land acquisition for the same will also be carried out by HPPTCL. Execution of this associated facility may have impact due to diversion of forest land, due to acquisition of private land, involuntary displacement, health impacts, community conflict, labour involvement, tree felling, etc. However, the impact will be decentralized as the towers for transmission line will be erected at different places.

### **Mitigation**

The Tidong-1 to Kashang line is under planning stage and the routing will be decided after the study is complete. As per the norms of Himachal Pradesh, initially three routes will be tentatively proposed and the route with the least environmental and social impact will be chosen for construction and operation. The final decision on the line routing is yet to be taken.

HPPTCL has received loan from ADB under the Clean Energy Transmission Investment Programme and have formulated an Environmental and Social Safeguard Policy. The salient principles of the policy are given below:

- a. Make all efforts to minimize adverse impacts on the natural environment by consciously economizing on the requirement of resources including land for civil structures,
- b. Avoid, as far as practicable, operations in environmentally Sensitive Areas, Eco-Sensitive Zones, Wetlands, Ramsar Sites, Wildlife Sanctuaries, National Parks and Biosphere Reserves. If it is inevitable, HPPTCL shall obtain approvals as required under the relevant laws.
- c. Consider environmental implications of location, terrain and sensitive areas in impact identification and mitigate these with innovative, practical engineering solutions.
- d. Apply efficient and safe technological practices and standards and it shall strive to keep itself updated on the same.
- e. Abate pollution in all its activities and operations. It shall adopt the good practices of the sector and shall promote reuse, recycling and safe disposal of resources.
- f. Minimize energy losses and promote energy efficiency.

- g. Take suitable and adequate mitigation measures whenever, avoidance to impacting the environment is not possible.
- h. Ensure total transparency in dealing with all the stakeholders i.e. the concerned government agencies, local communities, individual landowners and employees with their involvement through a well-defined public disclosure and public consultation process as well as dissemination of relevant information about the project at every stage of implementation.
- i. Maintain high standards of corporate responsibility not only towards communities but also towards the consumers and the civil society.

### Social Safeguards Policy Principles

Harmonizing its operations with the Environment and Social Policy Statement and its commitment thereto, the HPPTCL shall:

- a. Take due precautions to avoid disturbance to human habitations, tribal areas and places of cultural significance and minimize the same wherever inevitable.
- b. Inform and consult the affected people from planning, inception stage to operation and maintenance stage.
- c. Encourage consultation with communities in identifying environmental and social implications of projects. For this purpose it shall share information with local communities about environmental and social implications.
- d. Pay special attention to marginalized and vulnerable groups and secure their inclusion in overall public participation.
- e. Take due and adequate care of Project Affected Families.
- f. Guarantee adequate entitlements and compensation to affected persons.
- g. Always maintain highest standards of health and safety and adequately compensate affected persons in case of any eventuality.
- h. Maintaining high standards of human resource development of staff, contractors and others associated with HPPTCL.
- i. Constantly review the policy and procedures consistent with its guiding principles of prevention, minimum disturbance and innovative remedial measures.

HPPTCL have also formulated a Resettlement, Relief, Rehabilitation and Compensation Policy. The basic aim of the policy is:

- a. To avoid/minimize the adverse impact on persons affected by the project
- b. To sustain the quality of life of the people of the area through suitable infrastructure, sustainable income and better skills generally contribute to and be a part of the development of the area and the people.
- c. To create goodwill for the organization and have a good long term relationship.



- d. To ensure that rights of individual and society particularly those belonging to the weaker section/vulnerable groups of the society are safeguarded
- e. To assist the affected persons to regain or improve the standard of living if and where negative impacts are unavoidable
- f. To raise the quality of life and infrastructure in the area
- g. To ensure that people of the area are well informed and involved.

The strategies for implementation of the Relief and Rehabilitation Policy are given below:

- a. Each Project Affected Family will be suitably and adequately compensated to ensure replacement of the assets lost or acquired.
- b. The local population of the Project Affected Area will be provided guidance and counseling for better living conditions and better livelihood including training in the area of common occupations like Agriculture, Horticulture etc.
- c. Contribution towards General Development of the project area in-terms of improving local infrastructure through public participation.
- d. Creating opportunities of income generation and/or employment for local people.
- e. Maintaining a friendly contact with the public through regular meetings, Public consultations, sponsoring of events, printed material, Public Disclosure of provisions of this Policy as also HPPTCL's overall programme, Project Specific RR Plans, PAF identity card, organizing functions etc.
- f. Providing direct help to the people in extreme hardship.

Apart from the adequate compensation HPPTCL policy has provision for additional benefits like provision of houses, grant of petty contracts, shifting allowance, annuity policy for vulnerable groups etc depending on the type of projects (transmission line, Sub-station) and the project cost. The complete Resettlement, Relief, Rehabilitation and Compensation Policy and the Environment and Social Safeguards Policy are given in the HPPTCL website <http://www.hpptcl.gov.in/page/Policies.aspx>.

The EHS framework in HPPTCL is driven by ADB loan. Though the Tidong 1-Khasang line are not covered under the ADB Grant, HPPTCL is committed to follow the R&R and Environmental and Social frame work policy for all the projects. Since the policy was formulated recently, the administrative framework to implement the policy is in a nascent stage. Currently, a retired DFO has been employed by HPPTCL to overlook the implementation, and they have a plan to augment the manpower immediately by deputing Tahsildar/BDO from the state government. HPPTCL have a plan to form a comprehensive EHS Cell by 2014.

## 6.3.2 Impacts due to Project Operation

### Downstream Impact

Generally the project operation is the phase of environmental restoration. Many of the appropriate environmental measures adopted during the construction shows its benefit during the project operation phase

The impacts due to project operation could be of longer duration and can be both positive and negative in nature. The negative impacts could be:

#### Impact on fishes in reduced flow zone;

The diversion of water through HRT would lead to reduction of water along about 9.8 km of the river stretch between the Head Works and the TRC. The TRC is about 40m upstream of the confluence of Tiding and Satluj River. As per the Government of Himachal Pradesh Notification no. MPP-F(2)-16/2008 of Department of MPP and Power, projects shall ensure a minimum flow of 15% of the lean season discharge of the stream, immediately downstream of the diversion structure of the project throughout the year.

As per the mentioned notification, and based on the water availability mentioned in Chapter-4, the project needs to discharge a minimum of 0.678 cumec of water downstream of the diversion structure. For 260 m the Tidong will have only 0.678 cumec of water. Beyond 260 m downstream, a perennial stream, lambar Khad meets Tidong on the right Bank. Further downstream, Shicky and two more streams, Gara Khad and Duba Khad meets Tidong on the left bank. The discharge data for Shicky, Gara and Duba khad is not available and therefore it is difficult to predict the Tidong flow beyond 260m from the diversion structure.

Since there are no fishes near the head works, no impact due to the reduced release of water is anticipated on the riverine ecology. The reduction of water is also not going to affect wild life or domesticated animals that use the river water for drinking purposes. River water at this stretch is not used by any villager for irrigation or any other purpose. However the reduction of the flow in the river will affect the downstream fishes, near the confluence of Tiding with Satluj.

Species of Snow trout (*Schizothorax richardsonii*) and Brawn trout (*Salmo trutta fario*) were found at sampling site S3 near the confluence of Tidong and Satluj river i.e. near power house site. The area where fish was found will be upstream of the TRC thereby meaning that the area will be under the reduced flow stretches of the river.

Slope of Tidong near the confluence is low and the river mouth is wide (about 300m). The river braids into several small rivulets at the mouth causing shallower depth of the river. Shallow water. Gravelly river bed with low water velocity provides suitable habitat for Trout. The depth of the river will further reduce when the flow is diverted and only 15% of the lean season flow is allowed to flow in the river.

As mentioned in Chapter-4, the spawning season of Trouts vary widely and depends on the water temperature, DO, water speed and depth of the column. Several studies suggest that in Himachal Rivers the Trout generally spawn between March and May. The flow of the Tidong in March to June is low and the water depth is shallow. Further reduction of the water depth due to the diversion of water may affect the spawning adversely. The fry will fall prey to birds who can hunt in shallow waters. Moreover the temperature of shallow stream will be high which may increase the mortality of the fry.

It needs to be pointed that the government notification indicating the mandatory release of 15% of the minimum flow is rather arbitrary. Moreover discharge data for Shicky, Gara and Duba khad has never been measured. Therefore, the flow of the Tidong near the confluence, where the fishes were reported cannot be predicted. The survival of Trout in Himalayan Rivers depends on several parameters like discharge, velocity, temperature, DO, river profile etc. Since data on none of the mentioned parameters is available, it is recommended that a study on the impact of reduced flow on the Trout could be undertaken by NTPGL.

### **Mitigation**

Stocking of Salmonid fishes is common in Himachal Rivers. It needs to be mentioned here that *Salmo trutta fario* is an exotic species where as *Schizothorax richardsonii* is native. Stocking of the trout will not affect the basic riverine ecology. NTPGL has deposited money to Directorate of Fisheries, Government of Himachal Pradesh for Fisheries Development Plan. The plan includes:

- a) Development of sustainable fisheries in Tiding Reservoir
- b) Adequate replacement of Riverine fish fauna through stocking

Directorate of Fisheries proposes to stock an exotic species, *Salmo gairdnerii gairdnerii* (Steelhead Trout), in addition to the snow and brown Trout. The Directorate of Fisheries may reconsider the introduction of a new exotic species in the Tidong River in view of the fact the cause of decline of snow trout in Himachal Rivers is mainly because of the introduction of new exotic species.

NTPGL needs to follow up with the Directorate of Fisheries to ensure that the above plan for which they have deposited money is implemented to maintain the riverine ecology of the Tidong River. The details of the Fisheries development plan have been elaborated in Chapter 7.

Further In light of the data deficiency on fishes, NTPGL will conduct, an year long study covering all seasons, by engaging a fisheries expert, so as to generate data for the entire year at the S1, S2 and S3

sampling locations. This study will determine if there is any deviation from the data and assessment presented in this ESIA, and in the event a deviation is identified, develop appropriate mitigation plans.

### **Impact on Air quality**

Waste generated in the staff colony will be incinerated in the incinerator meant for this purpose.

#### *Mitigation*

The incinerator will be double chambered, with air pollution control equipment to meet all the air quality standards as prescribed by the Central Pollution Control Board.

### **Impact on Water quality**

The wastewater will be generated from staff colony

#### *Mitigation*

Domestic wastewater from the residential staff colony will be treated in Sewage Treatment Plant. Properly treated water conforming to the desired standards<sup>1</sup> should either be reused for greenery development or released into the natural water channels.

### **Upstream Impacts due to impoundment created by the Tidong-1 HEP barrage**

#### **- due to river bed level rise**

The water impoundment in the reservoir by the barrage structure will be in 0.4844 ha. and this will not cause a significant impact to the upstream. Due to change in the profile of the river bed, sedimentation will increase immediately upstream of the reservoir. The river might migrate laterally and could erode the river bank for about 100 to 200 m upstream of the reservoir which in long term might affect the orchards or agricultural lands located close to the river. The envisaged impact is direct, localized, long term and of low in magnitude.

#### *Mitigation*

There will be no submergence of orchard / agricultural fields. However due to fluctuation in water level there could be some slide or erosion till FRL. Therefore there could be some possibility of damage due to scouring to the agriculture land located on the hill slope above. It is suggested to provide protection to the river banks in the identified critical areas successively as the erosion potentials are noted or

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<sup>1</sup> General Standards for Discharge of Environmental Pollutants Part –A: Effluents as referred in Schedule-VI under Rule 3A of The Environment (Protection) Rules, 1986.

reported by the villagers from lambar. The rise in bed level due to change in the river profile of the river by the barrage is a residual impact of the project and will not be mitigated

**- due to reservoir bank failure**

Being run-of-the-river project, the impoundment of water in the reservoir and fluctuation of the water level daily in the months from November through April might trigger small scale slumps from the reservoir banks into the reservoir. Large debris slide due to water level fluctuations in the reservoir rim is not expected. Since the immediate land use around the reservoir rim is mostly forest land, the envisaged impact is of very low magnitude only.

**Mitigation**

Small scale slumps in the reservoir rim by the water fluctuation will remain as the residual impact of the project and will not be totally avoided nor mitigated.

**Impact on Forests**

The improved access to the project sites will open an avenue to villagers and other interested parties as encroachers for illegally entering into the forests, which are currently pristine. It is anticipated that increased human activity in the area might increase the pressure on the forest. On the other hand, the requirements of fuel wood for heating and cooking will be replaced by electricity generated by hydropower projects, ultimately reducing deforestation.

**Mitigation**

HP Forest department is required to tighten the forest access and improve the surveillance to control on illegal entrants into the forest areas adjoining to the project. NTPGL will depute security personnel to check the forest entrants from the project areas.

**Impact on wildlife**

Most of the human population as well as its activities in the Himalayan terrain in which the project is located are concentrated in the river valleys due to availability of some agricultural land perennial source of water. The human activities have already pushed the wild life away from these places. The operation of project would increase the human activities in the area, which is expected to push further the wildlife away from the area.

**Mitigation**

It has been mentioned in the construction impacts section that some of the animals could be redistributed due to blasting operations. Since during the operation phase, there will be no blasting, the scared animals will return to their original habitat and things will return to normalcy.

### Impact on Water Quality and Risk of Eutrophication

Running water has a self purifying capacity, which is directly related to its flow regime. Run-of-the-river project practically does not hold the water for a period to allow biological growth in it therefore self induced degradation of biological quality of water is very less and potential risk of eutrophication is not envisaged.

#### Mitigation

No mitigation required, as risk of eutrophication is not envisaged.

### Impact on human Health

The factor enhancing the proliferation of water related diseases are vectors and pathogens. The stagnant water and vegetation provide favorable breeding place for vector life such as mosquito and snails. The project being a run-of-the-river scheme does not have any significant impoundment of water, except for a balancing reservoir of about 2 ha area. As water will be flowing, the chances of mosquitoes to thrive are less, hence implementation of project would not lead to malarial fever. The field survey showed that the typical vector borne diseases like malaria are not common in the project area, probably due to less habitation, no stagnation of water or pile up of waste. Low temperature is also a reason for absence of malaria incidents. Increased health facilities due to the project would also improve the situation. However, suitable drainage and sanitation facilities are required in the project establishments.

## 6.4 Checklist of Impacts

Based on negative and positive impacts of the project, a checklist of impacts has been prepared and classified as short term and long term impacts as presented in Table 6-5. It is evident from the table that most of the negative impacts are of short term in nature.

Table 6-5: Checklist of Impacts due to the project

S. No	Project Phase / Environmental Impact	Impact				
		Positive '+'	Negative '-'	No Change (NC)	Short Term (ST)	Long Term (LT)
A. Impact due to project Location						
1	Displacement of people			NC		
2	Loss of Land /Change in Land Use		-			LT
3	Encroachment into forest Land/ Loss of		-		ST	

	Forest Produce					
4	Encroachment into Nature Reserves & Wildlife			NC		
5	Loss of Historical / Cultural Monuments			NC		
6	Loss of infrastructure			NC		
7	Erosion and Slit Risks		-		ST	
8	Disruption of hydrological Balance			NC		
<b>B.Impacts due to Project Construction</b>						
9	Soil Erosion at Construction Sites		-		ST	
10	Muck Generation		-		ST	
11	Transportation of muck and construction material		-		ST	
12	Deforestation		-		ST	
13	Human Health		-		ST	
14	Water Quality		-		ST	
15	Culture Hazards		-		ST	
16	Air and Noise Pollution		-		ST	
<b>C.Impacts due to Project Operation</b>						
17	Reservoir Evaporation Losses			NC		
18	Deforestation		-			LT
19	Effect on Wildlife			NC		
20	Change in Water Quality & Risk of Eutrophication			NC		
21	Increased incidence of Water Borne Diseases			NC		
22	Impact on Fish and Aquatic Life			NC		
23	Public Health	+				LT
24	Drainage			NC		
<b>D. Positive Impacts</b>						
25	Clean and renewable source of energy	+				LT
26	Employment	+			ST	LT

	Opportunities					
27	Catchment Area Treatment	+				LT
28	Recreation and Tourism Potential	+				LT
29	Additional Habitat for Aquatic wildlife/ Wetland Species	+				LT
30	Fisheries & Aquaculture Potential	+				LT
31	Benefits to Economy	+				LT
32	Reduction in Air Pollution	+				LT
33	Reduction in Greenhouse gas Emission	+				LT
34	Increased Infrastructure	+				LT

## 6.5 Cumulative Impacts

### Impact on Satluj Basin

Tidong is one of 14 well known tributaries to river Satluj. Satluj enters Himachal at Shipki (at 6608 msl) and flows in the South-Westerly direction through Kinnaur, Shimla, Kullu, Solan, Mandi and Bilaspur districts. Its course in Himachal Pradesh is 320 km. Famous tributaries of Satluj are Spiti, Ropa, Taiti, Kashang, Mulgaon, Yula, Wanger, Throng and Rupi on the right bank, whereas Tidong, Gayathing, Baspa, Duling and Soldang are left bank tributaries. It leaves Himachal Pradesh to enter the plains of Punjab at Bhakhra, where the world's highest gravity dam has been constructed on this river.

The total catchment area of Satluj, in Himachal Pradesh is 20,000 sq. km. which includes 571.78 sq. km. as a catchment area of Tidong stream. Visually Satluj water is very turbid however Tidong stream remains clear most of the time during the year.

Major loading of silt in river Satluj come from human settlements and their activities, including crushers installed along the rivers and hydropower projects under execution. River Satluj along with its tributaries has a potential of 9,657 MW hydro power generation. List of these projects are as below;

**Table 6-6: Project on Satluj in various stages**

Category	Capacity (MW)
Projects Under Operation	3,277
Projects under Execution	3,080



Projects allotted / under process of allotment	3,157
Projects to be re-advertised	144
<b>TOTAL</b>	<b>9,657</b>

Source: HP State Electricity Board

Out of the total potential of the basin, 11 projects with a cumulative capacity of about 3277 MW are already in operation and 12 projects of cumulative capacity of about 3080 MW are under execution stage. Further to this, about 14 hydro electric projects, with a cumulative capacity of 3157 MW, are under allotment stage and will be executed soon. Few projects abandoned by the government due to various reasons have not been listed here.

**Table 6-7: Projects under Operation**

Sl.No.	Name of project	MW
1	Rukti	1.5
2	Chaba	1.75
3	Rongtong	2
4	Nogli	2.5
5	Bhaba	120
6	Ganvi	22.5
7	Bhakra	1325
8	Nathpa Jhakri	1500
9	Baspa-II	300
10	Titang	0.9
11	Lingti	0.4
	<b>TOTAL</b>	<b>3276.55</b>

Source: HP State Electricity Board

**Table 6-8: Projects under Execution in Satluj Basin**

Sl.No.	Name of project	Capacity (MW)
1	Bhaba Aug.PH	4.5
2	Kashang-I	130

3	Kashang-II	65
4	Kashang-III	48
5	Ganvi-II	10
6	Shongtong Karcham	402
7	Kol-Dam	800
8	Rampur	412
9	Tidong-1	100
10	Sorang	100
11	Karcham Wangtoo	1000
12	Raura	8
	<b>TOTAL</b>	<b>3079.5</b>

Source: HP State Electricity Board

**Table 6-9: Projects allotted / under process of allotment**

Sl.No.	Name of project	MW
1	Khab-I	450
2	Khab-II	186
3	Luhri	750
4	Ropa	60
5	Mane Nadang	70
6	Lara	60
7	Bahairari	5.5
8	Chango Yangthang	140
9	Yangthang Khab	261
10	Sumta Kathang	130
11	Kut	24
12	Tidong-2	60
13	Jangi thopan	480
14	Thopan Porari	480
	<b>TOTAL</b>	<b>3156.5</b>

Source: HP State Electricity Board

Contribution of Tidong-1 HEP on entire Satluj basin will be negligible as 100 MW represents only about 3% of cumulative capacity of projects under execution on Satluj basin and only 1% of overall hydropower potential on the basin.

## Cumulative Impact of 100 MW Tidong-1 and 60 MW Tidong-2

Tidong-2 HEP (60 MW) is planned in the upstream of this project. The execution of Tidong-2 is not yet started as the matter is under litigation. No information is available on the Detailed Project Report (DPR) of Tidong-2 and a general layout has been provided. This layout may change as more detailed studies are undertaken. General layout of the Tidong-2 HEP can be referred from Figure 6-1 and schematic diagram of Tidong-1 & 2 HEPs on the stream is shown in Figure 6-2. Relative features of both the project are as below

**Table 6-10: Relative Features of Tidong-1 and 2 starting from upstream**

Sl.No.	Component-1	Component-2	Distance (in Meters)
A	Intake of Tidong-2	Tail Race of Tidong-2	5961m
B	Tail Race Tidong-2	Intake of Tidong-1	330m
C	Intake of Tidong-1	Tail Race Tidong-1	9840m
D	Tail Race of Tidong-1	confluence of Tidong and River Satluj	40m

It is evident that Tidong-2 will have environmental impacts and that may add up the environmental impacts of Tidong-1. The impact will be more pronounced if the construction of these two projects overlaps. The basic issue of concern include; i) Private land acquisition; ii) Forest Land diversion; iii) Loss of Non Timber Forest Produce (NTFP); iv) Influx of additional labourers; v) Decrease in economic base of affected population; vi) Damage local culture; vii) Negative health impacts; viii) Increased traffic volume; ix) Increase in dry stretch of Tidong stream; x) Silt enhancement in river basin; xi) Shrinkage of wildlife habitat; etc. The cumulative impacts identified for proposed Tidong-1 & 2 projects are discussed in social and environmental categories as below:

### **Social Impacts**

If the proposed Tidong-2 HEP is constructed simultaneously with Tidong-1, it will result in additional labour force in the area, increased movement of traffic and pressure on existing resources like accommodation, water resources, transportation, other infrastructure like health facilities, etc. at village level. There is a possibility that same families from village Lambar may get affected from both the projects as downstream works of Tidong -2 and Upstream works of Tidong -1 are nearby i.e. only 330 meters away from each other. These are as discussed below;

#### **Private land Acquisition**

In case the private land is acquired for Tidong -2 then there is a possibility that same families may lose their land from villager Lambar who have lost their land to Tidong-1. However, preliminary information collected reveals that Tidong -2 may not acquire any private/village land but may require forest land

only. This may affect the utilization of the forest resource that villagers harness to augment their economic base.

#### Loss of Non Timber Forest Produce (NTFP)

Diversion of forest for Tidong-2 would lead to loss of trees including NTFP i.e. Chilgoza, fuel wood, etc. extracted by the villagers as per the existing law. Additional work force for Tidong-2 HEP may create an extra pressure on Fuel wood resources from remaining forest. In extreme case villagers may be forced to buy fuel wood, to fulfill their needs causing further loss in income.

#### Additional Labour

Additional labour requirement by project in close proximity can lead to increased migration with more pressure on the local infrastructure. The villages in the vicinity will be increasingly exposed to outside communities and customs for longer duration. There could be an acute shortage of rented accommodations, vehicle and food joints leading to new in migration of more entrepreneurs and increase in cost of living.

Guest-host relationship may deteriorate and Conflict in culture may lead to disputes within the society leading to law and order problems, increase in crime and disruption of work.

#### Increased Movement of Traffic

Increase movement of vehicles on the same roads will increase the wear and tear of existing roads. It will also increase the possibility accidents and inconvenience from break down and stop over. There is potential for traffic blockades and long queues of trucks and other vehicles causing inconvenience to villagers.

#### Demand for additional infrastructure

Increased demand for water supply, fuel, vegetables etc will raise issue regarding lack of facilities result in increase in the cost of commodities in local market.

### ***Environmental Impacts***

The cumulative environmental impacts of Tidong-1 and Tidong-2 may include;

#### Increase in dry stretch of Tidong stream

Tidong 1 and 2 after commissioning, will cumulatively affect a stretch of about 16-km of Tidong stream except 330 meters between the two projects. The amount of water flowing through this stretch will be least during the lean season and will affect the river ecology. Since, no fishes were reported in the upstream works from baseline survey of Tidong-1, therefore it can be inferred that there will be no fishes in the entire stretch of Tidong-2 as well.

#### Silt enhancement in river basin

Cumulative amount of silt from both the projects will be higher and can cause effect to the fishes as reported near confluence of Tidong with Satluj, if the construction simultaneously. However, overall silt contribution to Satluj will not be significant, as cumulative capacity of 160 MW of both of these projects is only 5% of all the projects under construction on Satluj basin.

#### Shrinkage of Wildlife habitat

Forest area for Tidong-1 has been considered as peripheral zone of wildlife habitat. However the forest area concerned Tidong-2 may fall in higher altitudes i.e. above 3000 msl and at the inward side of the peripheral habitat zone for wildlife of the region. This will shrink the movement zone of the animal, especially the snow leopard.

#### Dust Pollution due to increased Traffic

The traffic load on PWD road along Tidong stream will increase significantly if vehicles from both the projects are included on this road.

#### Common Catchment Area

Catchment area of Tidong-2 will be common for Tidong-1. Implementation of catchment area treatment measures for both the project cumulatively will improve the overall silt load from the area.

#### ***Mitigation Measures***

The proposed project on the upstream has been delayed due to legal issues between the government and the initial project proponent. After the resolving the matter, detailed investigations to be conducted and clearances will be obtained before starting the work on site. Therefore, it is very unlikely that the timeframe of both the site construction works overlap with each other. Therefore it is understood that the any activity on ground for Tidong-2 may take 1-2 year's time. This would effectively mean that the peak labour force of the Tidong-1 would have moved out or will be in the stage of moving out when the Tidong-2 commences hence there will limited overlap of labour influx.

Some of the labour engaged with Tidong-1 will effectively move into Tidong-2 which will also reduce any further migration from outside.



Regarding ecological flows and traffic load on PWD road, a detailed study needs to be conducted to ascertain the exact amount of water to be released to fulfill the environmental requirements of the affected stretch of the stream and a detailed traffic movement and safety study for the common PWD road.

Figure 6-1: Tidong-2 General Layout of the Project

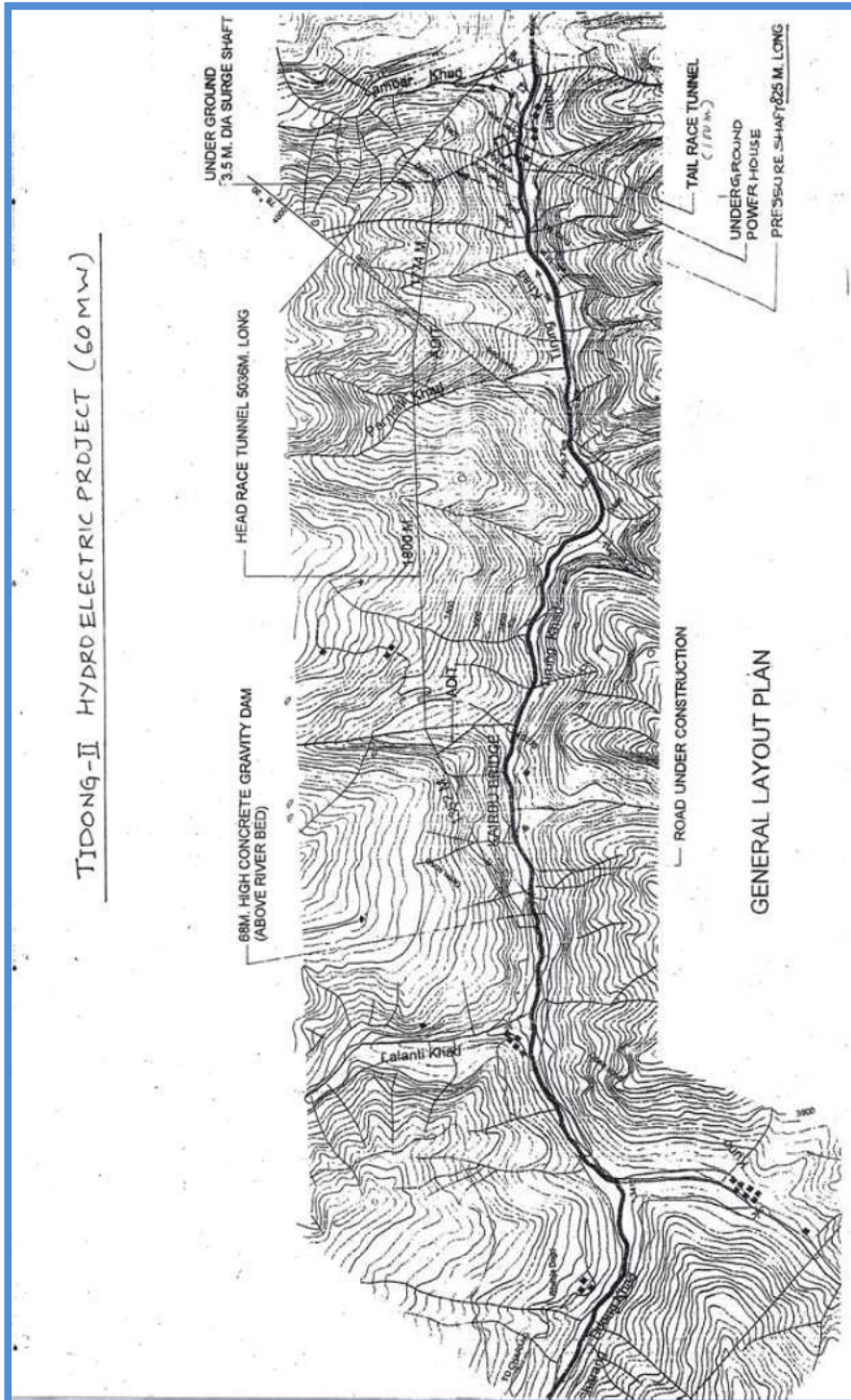
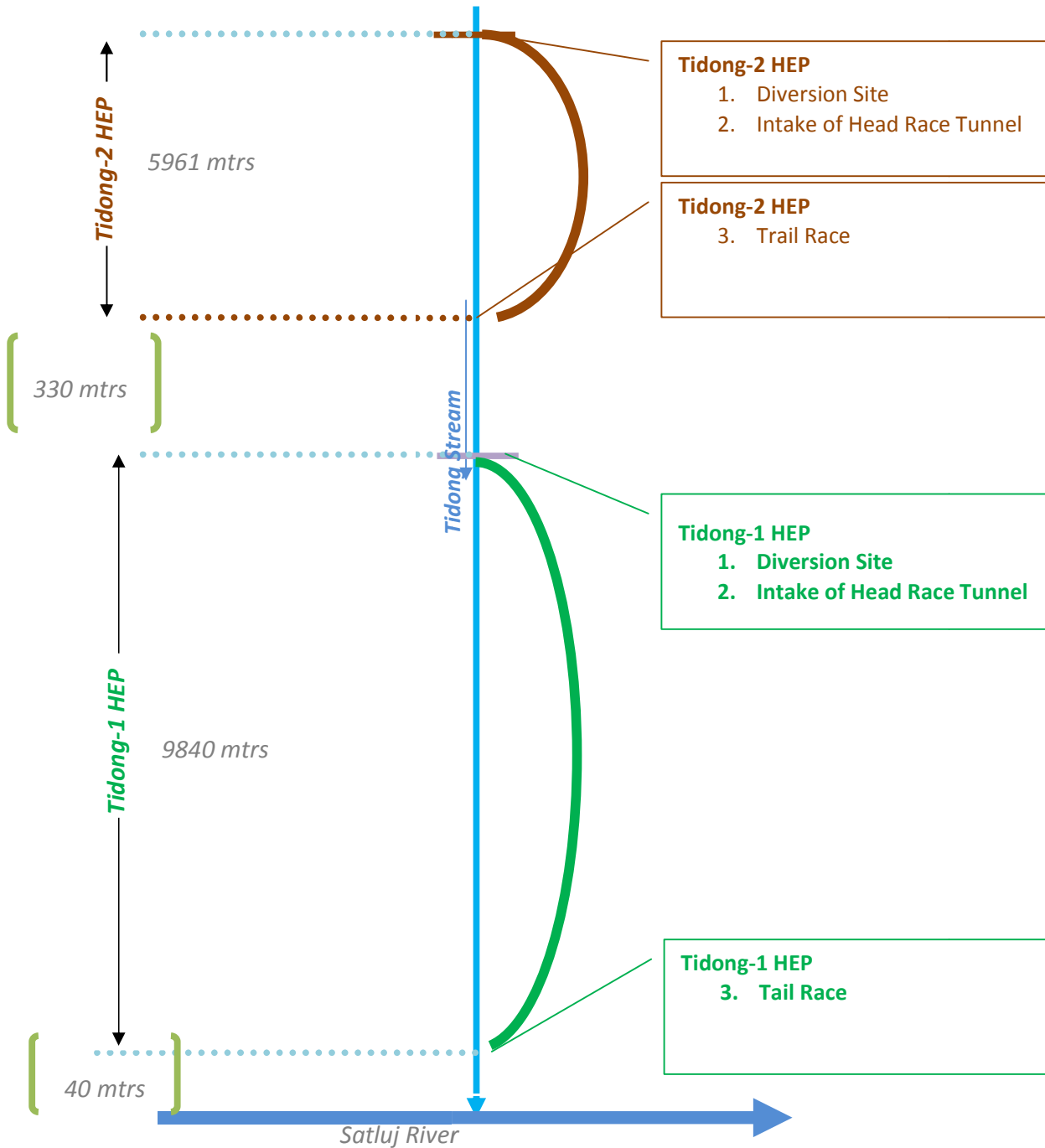


Figure 6-2: Schematic Diagram for Tidong-1 HEP and Tidong-2 HEP







## 7. ENVIRONMENTAL MANAGEMENT AND MONITORING PLAN

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### 7.1 Introduction

Environmental Management and Monitoring Plan (EMMP) is the mitigation of the possible adverse impact of a project and to ensure in maintaining the quality of the environment and monitoring the effectiveness of mitigation measures. The EMMP procedure converses all aspects of planning, construction and operation of the project, which are relevant to environment. Therefore, it is essential to implement this plan right from the planning stage and then continuing it throughout the construction and operation stage. Hence the main objective of the EMMP is to identify the project specific activities that would have to be considered for investigation and their significant adverse environmental impacts and subsequently mitigation measures required. Since, construction activities have already been started in Tidong-1 HEP, therefore measure, which can be adopted now onwards during Construction and Operation phases are being suggested in this chapter.

Adverse environmental impacts perceived from different projects differ from each other. Therefore, the mitigation measures also differ from project to project. EMMP for hydro-electric project includes several actions and measures. These mitigation measures relates to both abiotic as well as biotic components of the environment. The mitigation measures for reversible impacts from 100 MW Tidong-1 HEP, identified in Chapter-6 of this report, are as explained herewith. This part proposes 11 different plans, along with their implementation procedure, time frame and suggested organizational arrangement has been explained in following plans.

### 7.2 Clearance and Approval Plan

This plan provides a framework to ensure the regulatory compliance from obtaining clearances and approvals required for the project at the different stages. A legal register will be maintained by NTPGL and contractors for respective clearances and approvals. A mechanism will be established to update the legal register with the new regulations introduced time to time. As per the policies and legal framework, the statutory clearances and approvals obtained by NTPGL for execution of Tidong Hydro Electric Project are listed as below,

**Table 7-1: Clearance and Approvals required**

Sl. No.	Clearance / approval Required	Competent Agency	Project stage for implementation	Responsibility	Status
1	Implementation Agreement	Government of Himachal Pradesh	Pre-construction	NTPGL	Completed
2	Techno-economic Clearance of Detailed Project Report	HP State Electricity Board, Govt. of HP	Pre-construction	NTPGL	Completed
3	Environmental Public Hearing	Himachal Pradesh State Pollution Control Board (HPSPCB)	Pre-construction	HPSPCB and NTPGL	Completed
4	No Objection Certificate/Consent to Establish from pollution angle and authorization for handling hazardous wastes	HPSPCB	Pre-construction	NTPGL	Completed
5	Consent to Operate from pollution angle and authorization for handling hazardous wastes	HPSPCB	Pre-construction	Major package contractors in the project	Not completed
6	Environmental Clearance as per EIA notification, 2006 under Environment (Protection) Act, 1986;	Ministry of Environment and Forests, Government of India	Pre-construction	NTPGL	Completed
7	Forest Clearance for diversion of 39.0546 ha. of forest land by the	Ministry of Environment and Forests, Government of	Pre-construction	NTPGL	Completed

	MoEF	India			
8	Private Land acquisition - 3.2011 ha under Land Acquisition Act, 1894	Government of HP	Pre-construction	NTPGL	Completed
9	No Objection Certification for using stream water for generating hydro power	Irrigation and Public Health Department (IPH), Government of HP	Pre-construction	NTPGL	Completed
10	No Objection certificate towards from fisheries perspective	Department of Fisheries, Government of HP	Pre-construction	NTPGL	Completed
11	No Objection Certificate for using Public utilities	Public Works Department (PWD), Government of HP	Pre-construction	NTPGL	Completed
12	Registration under Building and Other Construction Workers Act, 1996	Department of Labour, Government of HP	Construction	NTPGL	Applied for
13	Labour License	Department of Labour, Government of HP	Construction	NTPGL	Completed
14	Consent to Operate from pollution angle and Authorization for handling Hazardous wastes	HPSPCB	Operation	NTPGL	To be obtained before commissioning
15	Factories License	Directorate of Factories, Government of HP	Operation	NTPGL	To be obtained before commissioning

### 7.3 Environmental Training Plan

This plan is prepared to ensure the project management team, engineers, supervisors, contractors and the workforce are made aware and educated regarding the related environmental issues of the project and their responsibilities towards environmental protection of the project area and vicinity so that he is able to take environmental related decision making on implementation, monitoring, reporting and corrective actions.

Environmental management is a continuous process, apart from the general training to the managers and engineers of project management and contractors, a trainers training will be provided to the section heads responsible for the environmental and social management units of the project management and contractor management. The objective is to roll the training needs in day in day out cycle during the project construction period for the old and new comer construction workers and engineers. The environmental Training Plan is presented in Table 7-2.

**Table 7-2: Environmental Training Plan**

Sl. No.	Actions	Target Group	Project stage for Implementation	Responsibility
1	Induction training regarding environment protection at Tidong-1 HEP	All employees, contractors and workers	Construction	NTPGL and Contractors
2	Orientation and Environmental Trainers Training related to Tidong-1 HEP with focus on mitigation and monitoring actions (EMP Implementation)	Sectional heads of NTPGL and major contractors	Construction	NTPGL and Contractors
3	Organizing seminars and training to the school teachers in the project area for introduction of environmental education among the school children. Observance of environment, ecology and wildlife weeks to creating	Employees, workers, contractors villages and schools children in Moorang, Thangi and Rispa Panchayats	Construction	NTPGL and Contractors

	awareness. Publication and dissemination of posters, brochures, signboards on dos and don'ts on Environment Health and safety matters			
4	Involving an NGO, active in the project area to disseminate the knowledge about the benefits of the proposed project and ensuring greater participation of local people in conservation efforts	Employees, workers, contractors and villagers of Morang, Thangi and Rispa panchayats	Construction	NTPGL and Contractors

### 7.3 Traffic Management Plan

The Traffic Management Plan for the project is one of the tools to minimize the interface, between Public and Construction Site Traffic wherever possible, managing the staging of deliveries such that the volume of traffic kept as even as possible avoiding peaks and controlling vehicle movements.

It is expected that there will be increase of traffic for construction related activities of the Project. This would disturb local people in the area and also increase chances of road accidents requiring a Traffic Management Plan (TMP) to minimise adverse impacts.

The key elements addressed by the Traffic Management Plan in terms of mitigation measures include:

- Traffic Management Planning
- Access Route Selection and Management
- Road-Related Accidents
- Parking Facilities
- Drivers' Training
- Vehicle Management and Maintenance
- Community Liaison and Safety
- Roles and Responsibilities

The essential features of each element are outlined as follows.

#### *Traffic Management Planning*

Many of the impacts that are associated with the project related road traffic can be mitigated through efficient transport planning and management. Wherever possible, the use of community road transport network and undue associated adverse environmental impacts will be minimised by the project proponent and the contractor by efficient traffic planning. The efficient management and planning of transport will require the implementation of following measures to:

- Impose and enforce speed limits on all haulage vehicles operating on haul routes;
- Appropriate speed limits for various motor vehicles and construction equipments will be determined as part of the traffic management based on type of roads available en-route the location to and fro of the project component;

- Minimum safe distance of 10-meters of Safe distances between the vehicles to be ensured;
- As far as possible the movement of heavy, wide or slow-moving loads will be planned at times when traffic volume on the roads concerned is least;
- Prepare detailed plan for signage around the construction areas to facilitate traffic movement;
- If required, widening will be undertaken for existing roads being used by the project activities;
- Regular inspection of access roads conditions and whenever, necessary, repair of construction traffic related damages will be undertaken;
- Plan will be prepared for movement of special loads such as hazardous materials, heavy loads etc;
- Appropriate supervision will be provided to control flow of traffic when machinery needs to cross roads;
- Training and testing of heavy equipment operators and drivers, including vision tests, with records kept of all trainings;
- Create traffic awareness among the local people and inform parents to keep children away from road. Vehicle traffic will be minimised during the periods when children are travelling to and from schools located on traffic routes;
- Maintaining records of all accidents involving project vehicles and implementing a traffic complaint and corrective action procedure;
- Liaison with the police and other authorities prior to the movement of any excessively heavy loads or any over dimensioned consignments;
- If road closures are required, diversions will be planned and communicated to the authorities and affected communities in advance. All diversion will be constructed to the specifications of the applicable road authority and will be maintained in good drivable conditions until the completion of the re-instatement work;
- The project traffic or any project activity will not obstruct the access to neighbouring properties;
- Ambulance and fire services will be consulted regarding road diversions. Road diversions should not increase the emergency response time of these services;
- In the case of open excavation works, all road diversions will employ traffic control devices to warn and protect the public and construction personnel;
- Movement of vehicles should be limited to working hours;
- Security/ gatemen should be deployed for round the clock;



Where there is the potential for cumulative impacts from congestion and related impacts from construction traffic to settlements near or en route to the project component locations, transport movement will be carefully considered in order to minimise disturbance impacts.

#### *Access Route Selection and Management*

The construction equipment and other materials are transported to the upstream works through a 17 km long PWD road taking off from NH-22 at Morang Bridge up to Lumber village. The road is a one lane road and at present the traffic movement is very slow. This is further expected to increase due proposed project activity. Presently around 40 to 45 light and heavy vehicles are moving on above PWD road per day and the vehicular movement intensity is expected to raise to around 80 to 90 vehicles per day during peak construction activities of the Project. In addition to this, a 2.8 km long road is under construction by the project proponent for Powerhouse and Surge shaft access and another 2.7 km long road to access Adit 1 from PWD road at the upstream works. Both of these roads also include the construction of Belly Bridge for crossing the Tidong stream.

All the new access roads will be designed and built in accordance with the project design specifications. Adequate slope and cross-fall drainage to channel storm water safely will be provided for the construction of new access roads, thereby preventing erosion or siltation.

The traffic management is to be monitored on daily basis to evenly spread traffic flow during a day so as to avoid congestion and minimise chances of road accidents. In addition, the contractor will comply with all statutory vehicle limits with respect to width, height, weight, loading, etc.

Throughout the project construction period, NTPGL will be responsible for monitoring the condition of access roads used by project traffic and for ensuring that they are maintained in a condition that is at least as good as the condition they were in before the start of construction, to the satisfaction of the road maintenance authorities and landowners. The project proponent is expected to adopt appropriate measures to keep access roads free from mud, dust and debris, such as:

- The use of hard core surfaces on access roads;
- The provision of easily cleaned paved area within the project components;
- The provision of wheel washing facilities for vehicles leaving the marshy or slushy construction base/working width;
- Appointment of personnel/sweepers to clean hard standing area and to remove any mud/debris deposited on the access roads and public highways; and

- Sheeting of all project vehicles carrying potentially dusty material or likely to deposit loose materials on the access roads.

### *Road-Related Accidents*

Hazards to personnel associated with vehicle transportation, both on road and off-road, will present one of the most significant risk exposures of the project. Accordingly, contractor will develop and implement management systems and procedures that will provide control over these hazards. This will cover arrangement for the following aspects:

- Source and number of qualified drivers needed,
- Drivers' training and certification by trainer,
- Hours of driving and rest periods,
- Driver, vehicle and load security arrangements,
- Driver's communication with control point and vehicle equipment,
- Language/communication,
- Source and number of suitable vehicles required,
- Vehicle quality and specification,
- Vehicle preventative maintenance programme,
- Vehicle routes, route planning and alternative routes,
- Overall vehicle movements,
- Emergency recovery of vehicle;
- Strategic vehicle parking locations,
- Impact of vehicles on local community, villages, roads, and
- Inspection and audit of the project transport system.

### *Parking facilities*

A detailed plan for signage around the construction areas to facilitate traffic movement, parking facilities, provide directions to various components of the works, provide safety advice and warnings will be prepared. All signs will be posted in both English and Hindi language.

The parking of construction vehicles along footpaths, single lane roads will be prohibited on community roads and public highways in the vicinity of the project site. Provision for dedicated parking area will be made near the project office, intake site and other suitable location for the private vehicles of construction personnel.

Temporary concrete paved areas will be provided for parking of vehicles and overhaul provisions will be made for any accidental spill of oil or fuel during parking or whenever the vehicle is idling.

### *Driver Training*

The project EHS requirements and Indian regulatory requirements specify the requirements for driver training. The project proponent and contractor are required to ensure that all drivers and driver trainers are suitably trained in accordance with driver training requirements. All drivers will be trained and evaluated in defensive and off-road vehicle operation.

The following issues and documents are to be addressed during driver training in a language (Hindi language) mostly understood by drivers:

- Trip Management Plan;
- Daily pre-use vehicle inspection by the driver;
- Safety kit in vehicle and
- Health and Safety Standards and Practices;
- National and local legal requirements to drive a vehicle.

Unauthorised passengers in project related vehicles will be strictly prohibited. All the personnel who drive vehicles as a part of contract will have to be in possession of a valid Driving License and will adhere to the Driver's Safety code and Passenger's Safety code as supplied in the Journey Management Plan.

### *Vehicle Management and Maintenance*

In order to ensure that accident rates and the overall transport fuel consumption are minimised, NTPGL will ensure that the vehicle fleet working on the project (whether directly for the contractor or for the contractor's subcontractors) is maintained according to the manufacturers' specifications. This will include the compliance of all vehicles with all safety related specifications (such as the fitting of the correct tyre, with adequate reserves of tread, safe for movement in snow areas, inflated to manufacturer recommended levels).

The project proponent will ensure the following in respect of vehicle maintenance, noise and emission standards:

- All vehicles will be maintained so that their noise and emissions do not cause nuisance to workers or local people;
- An upto-date database of all vehicles and construction equipments deployed across various project component locations will be maintained. The database will contain details about the periodical maintenance, schedule of maintenance, vehicular emission and noise emission testing carried out as per Indian regulatory requirements, copy of PUC certificates etc.

- All the vehicles/ equipment will comply with emission standards in force on the purchase date and during operation;
- Oil and fuel leaks must be addressed within 24 hrs of observation or reporting on any vehicle or construction equipment;
- Vehicle maintenance and management parameters will form a critical component of key performance indicator for the contractor; and
- All heavy vehicles like cranes, battery operated trolleys etc. will be provided with reversing siren.

### *Community Liaison and Safety*

Traffic safety in local communities must be a high priority for NTPGL and their contractors. NTPGL as well as the contractor must seek to minimise the amount of traffic through communities, the distance travelled by employees to undertake work and the distances over which equipment will be transported by precise and optimal planning.

It will be ensured that communities are advised in advance of project progress and near term activities where transport issues have the potential to impact local communities. The communications to the community will include the timing of road closures, if any (start, duration and finish of project activities in their vicinity) and diversions, and information about any other alternative routes.

Other aspects of project transportation that will be the subject of community liaison will include the upgrading of existing roads to facilitate their use for project purposes. These issues will be taken up with the communities through NTPGL's Social Officer and Contractor's Community Liaison Officer, who in turn will also seek support of local administration for management of heavy traffic and closure of community roads.

Efforts will be made to brief women particularly on safety measures. As the primary caretakers, women are well positioned to pass on safety information to their children. The Social Officer and the Community Liaison Officer will carry out traffic safety awareness programme as part of road safety awareness programme on behalf of NTPGL power and contractor.

### *Action Plan for traffic management*

Responsibilities specific to the traffic management are listed below and will be reflected in job descriptions as appropriate.

**Table 7-3: Action plan for management of traffic with Responsibilities**

S.No.	Activities	Project phase for implementation	Responsibilities
1.	Implementation of Traffic Management Plan (TMP) by relevant commitments and contractual requirements;	Construction	NTPGL
2.	Communicating the contents and requirements of TMP to all NTPGL personnel and contractors managing transport operations and fleet.	Construction	NTPGL
3.	Coordinating the preparation of management plans at micro-level, if required and, reviewing and approving the Contractor plans before allowing the commencement of work	Construction	NTPGL
4.	Securing a periodical updated listing of all transport vehicle fleet details and their corresponding environmental regulatory compliance details with regards emission and noise from the project contractors	Construction	NTPGL
5.	Workforce training and ensuring that all personnel are aware of their responsibilities	Construction	NTPGL
6.	Working internally, and with contractors, to minimise traffic generation	Construction	NTPGL
7.	Implementation of appropriate inspection and monitoring programme	Construction	NTPGL
8.	Determining corrective action for non-compliance, and identifying opportunities for continuous improvement	Construction	NTPGL
9.	Comply with the requirement as delineated in the TMP and all its components such as verification and monitoring aspects, reporting, maintaining records etc	Construction	Contractor
10.	Communicating to the workforce the contents and requirements of TMP	Construction	Contractor
11.	Identify appropriate personnel responsible for coordinating and managing traffic related issues	Construction	Contractor

	across their respective location of the project component		
12.	Performance of all subcontractors with respect to the requirements of management plan and compliance with all relevant statutory requirements, permits and licence conditions	Construction	Contractor
13.	Securing and updating the necessary permits for on-road and off-road vehicles from concerned regulatory authorities.	Construction	Contractor
14.	Workforce training and ensuring that all personnel are aware of their responsibilities	Construction	Contractor
15.	Ensuring that all fleet vehicles comply with environmental regulations with regards emission and noise	Construction	Contractor
16.	Record keeping and reporting	Construction	Contractor
17.	Records to be maintained: PUC certificate, vehicle insurance, driver's license, daily / weekly / monthly inspection checklist & driver's training register.	Construction	Contractor NTPGL for respectively owned vehicles

## 7.4 Construction Labour Management Plan

Migrant labourers are generally from poorer regions that come to the construction area in search of work. At Tidong site, the migrant labours can be categorized into organized and unorganized labour force. The organized labor is generally skilled or semi-skilled and they travel from one construction site to the other. These organized labourers such as drillers, equipment operators, electricians, fitters are generally engaged by a construction company acting as package contractors in the project. The organized labour tends to reside in a labour colony for a longer duration and therefore it is easy to deliver services like drinking water, sanitation, common kitchen, etc. The unorganized labour, on the other hand, are those who has no skill set as such and engage themselves in any kind of labour on payment basis such as local petty contracts for road construction, site cleaning and enabling work, material shifting, restaurant helper, delivery boy. The unorganized labour generally resides in temporary shanties/tents and in the villages under unhygienic conditions without sanitation, drinking water and other facilities. Unless the labour camps (organized and unorganized) are managed properly, it could create significant environment, health and safety issues.

Considering worker housing, it is important to be aware of the international, national and local regulatory framework and guidelines. At a general level, several international instruments recognize a right to an adequate standard of housing for everyone or for specific categories of the population as part of respecting human rights. To ensure the full realization of this right, binding instruments generally require the State to take appropriate steps and measures. For workers, the recognition of such a right has been included in ILO Conventions and Recommendations and these conventions have further been incorporated into the Indian laws. The regulatory frameworks and IFC requirements applicable to this project are as follows;

- i. The Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 (BOCW Act).
- ii. The H.P. Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Rules, 2008 (BOCW Rules).
- iii. IFC's Performance Standard 2, 2006 and other interrelated standards.
- iv. Payment of Wages Act, 1936 (Amended).
- v. Minimum Wages Act, 1948 (Amended).

- vi. The Contract Labour (Regulation & Abolition) Act, 1970 with Rules framed there under as amended.
- vii. Workmen Compensation Act, 1923 as amended by Amendment Act No.6 of 1976.
- viii. Employer's Liability Act, 1938 (Amended).
- ix. Maternity Benefit Act, 1961 (Amended).
- x. Payment of Bonus Act, 1965 and Amendment Act No.43 of 1977 and No.48 of 1978 and any amendments thereof.
- xi. The Personal Injuries (Compensation Insurance) Act, 1963 and any modifications thereof and rules made there under from time to time. The Contractor will take into account all the above said financial liabilities in his quoted rates and nothing extra, whatsoever, will be payable to his on this account.
- xii. Employees Provident Fund Act - The Contractor will provide and produce necessary proof and declaration to NTPGL regarding compliance of all the provisions, making of timely deposits etc. otherwise a sum of 5% of the gross bill amount will be deducted against EPF deposit from the bill.

All the employers / contractors in Tidong-1 HEP have to comply with the provisions of all the acts, laws and regulations or bye laws of any local or other statutory authority applicable in relation and IFC guidelines, to the execution of the works, as listed above.

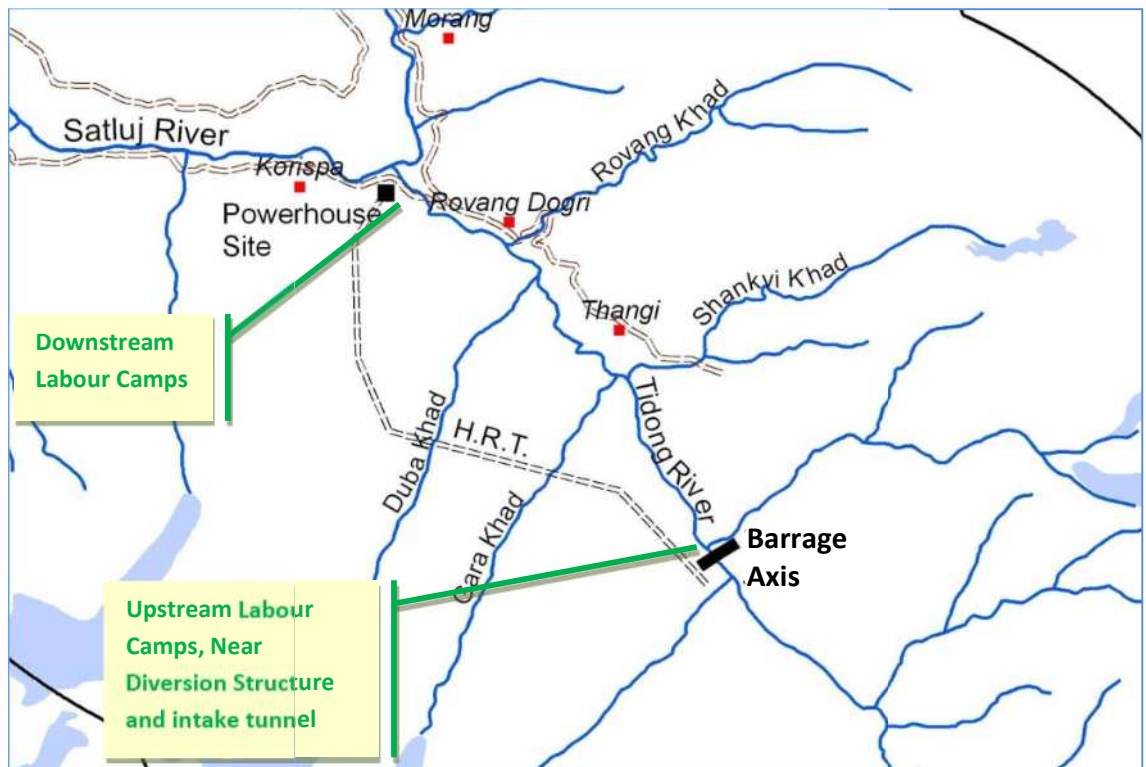
#### **7.4.1 Current Status**

A site visit was carried out during Mar-Apr 2011 by AECOM during which the status of labour camps, their living and working conditions were observed Major findings of the visit are as follows;

The labour camps have been set up in the project area based on the geographical distribution of construction works near Villager Lumber and Village Morang as shown Figure 7-1. The labourers who are engaged in upstream works such as diversion structure, intake and part of HRT, have been accommodated in Upstream labour camps and those engaged in the works of power house, surge shaft, colony, pressure shaft and road cutting works in the downstream, will be accommodated in Downstream labour camps.



Figure 7-1: Locations of Labour Camps



### *Upstream Labour Camps:*

These camps are located in project area near village Lumber, comprise of dwelling units which consist of 2 rows of 4 to 5 rooms each facing opposite to each other and size of each room is about was 3x3x3 mtrs. (LxWxH). Existing camps can accommodate about 100 workers engaged in the construction of diversion and intake structures.

The rooms have been constructed of GI Sheets and not insulated to protect from prevailing cold climate of the region. The rooms have been developed to accommodate 3 workers on separate beds. These camps have been common kitchen, toilet and bathing facilities. However, water heating and room heating facilities were not observed in the camps. However, kerosene heaters are being reportedly provided in the camps whenever required especially during the winter season. Drinking water is sourced directly from the Tidong stream and supplied without any additional treatment. Fuel wood extracted from neighbouring forest is being used for heating purposes.

**Figure 7-2: Upstream Labour Camps**



### *Downstream Labour Camps:*

These camps are located in project area near village Morang, where about 50 migratory workers, engaged in trace cutting work for road, were accommodated in temporary arrangements near power house location. Average space available per person was about 2 cum. No beds are available and sleeping arrangements are made on the ground.

Since there is no common kitchen facility available for downstream workers, all the workers have their own arrangements for cooking food. Stocked fuel wood was observed around the camp, which was informed to be extracted from the forest. Common toilets and bathrooms

have been constructed with underground septic tanks and soak pits. It was informed that workers are less motivated to use them and prefer open defecation and bathing.

Drinking water was sourced directly from the Tidong stream and used without any treatment. Fuel wood extracted from neighbouring forest was being used for heating and cooking purposes.

**Figure 7-3: Downstream Labour Camps**



It was observed that children have an easy access into the construction working area and hence are prone to accidents and other occupational hazards. There were no suitable rooms or barricaded playing areas or crèche facilities available for these children to accommodate them during the working hours.

**7.4.2 Issue Related to Migrant Labours**

The negative environmental, social, and economic impacts associated with labour immigration often lead to deterioration in the social context in which the project’s host communities reside and the project is operating. Kinnaur district has its unique culture, people of this area have distinct habits of food and clothing. They have deep religious faiths and celebrate their festivals with great enthusiasm. Migrants may cause an overall decline in the well-being and welfare of the resident population by threatening their way of life and the basis of existing livelihoods and placing additional pressure on what often already may be inadequate public infrastructure, services, and utilities.

Problems such as disease epidemics, increased occurrence and practice of social vices, increased intra- and inter-group disputes, rising crime and violence, ethnic tensions and the

increased probability of public security force intervention may affect the local population (and the project workforce).

Pressure on existing Infrastructure: Introduction of migrant population to project area will affect the demand on the existing infrastructure. It is observed that all labourers are not accommodated in the campsite and some of them live in rented accommodation in the nearby villages. The villages around the project area are small with limited population, a peak time workforce of 500 would lead to severe pressure on the available rented accommodations. This may benefit the local community with increased income but will put pressure on utilities such as water supply, power, transport, health facility etc.

Sanitation and Health Concerns: Increase in migrant population can lead to indiscrete disposal of sewage, garbage and other wastes in and around the project area, which can lead to unhygienic conditions both for the workers and for the villagers in the vicinity. There is a significant possibility of increase in outbreaks of diseases and related vectors with inappropriate arrangements for waste disposal and management.

Conflict of culture: People from different culture may arrive with different mannerism, way of interaction, faith, beliefs, dressing, superstitions etc. They may also find the existing customs and culture difficult to accommodate and lead to significant conflict of culture. The outcome of such conflicts can be quarrels, bickering, sabotage, leading to law and order problems. The overall impact on the project will be negative as one such incident can lead to a prolong period of mistrust between the community and project including the workers.

Loss of Opportunity: Small entrepreneurs who migrate along with projects to set up small business such as tea shop, grocery, canteens etc. result in reducing the potential for sales by local shop owners. This can result in direct conflicts or indirect competition leading to an atmosphere of animosity and non cooperation.

Communicable diseases: Introduction of workers who have worked in different part of communities and acquired communicable disease such as AIDS, Tuberculosis, etc may bring them with to the community. Similarly migrant labourers not exposed to local disease vectors previously may find themselves vulnerable in a new location.

### **7.4.3 Labour Management Plan**

The issues concerned with migratory labours involved in construction, are well known for this part of the world. Few of the focus areas identified by IFC are as follows,

- i. Living standards,
- ii. Working conditions,
- iii. Relations with neighbouring communities and environment including forest,
- iv. Enforcement of standards and monitoring difficulties.

In order to ensure that these issues are addressed in a systematic manner, a detailed management plan for migratory construction workers is drawn, based on of current status observed during reconnaissance visit conducted by AECOM during Mar-Apr 2011.

### *Estimation of Influx of Labour*

The proposed project will attract significant number of migrant labour. Most of the labour engaged in similar projects in Himachal Pradesh comes from Nepal and Uttaranchal, although a significant migration within the states is also envisaged.

Migrant groups will vary according to origin, language, cultural group, ethnic or tribal group (including migrant indigenous people), religious or profession, among others. The groups that are anticipated at Tidong, Kinnaur may include:

Labourers and their families: These include people who migrate in search of livelihood, usually appointed through sub contractors. The project related migration and settlement of labourers and their families can potentially introduce a wide range of concerns into the project area of operations, related to the adequacy of public infrastructure, services, utilities, housing, and sustainable resource management. A large part of labour that will move in for Tidong project will comprise of skilled, experienced and mobile workers who travel from project to project with major contractors.

Entrepreneurs: Migrant entrepreneurs arrive to capture business opportunities associated with the project as well as increased demand for goods and services associated with the local population's higher levels of disposable income. This may include small tea shop owner, travel agents, material suppliers, fleet owners, etc.

Potential providers of goods and services to the local population: Traders, entrepreneurs, small and medium enterprise owners, commercial sex workers, etc., from the formal and informal sectors, aiming to capture substantial increases in disposable income through provision of goods and services.

The labour strength is expected to peak during the 4<sup>th</sup> to 5<sup>th</sup> year of construction while the strength will be around 500 persons and is not likely to exceed 300 persons during the 3<sup>rd</sup>

however, in the past the strength has not reached beyond 200 during 1<sup>st</sup> and 2<sup>nd</sup> years of construction. Detailed calculation of peak population load due to migrant labours for this project is as described in Table 7-4;

**Table 7-4: Calculation for total migrant laboureres population (peak time) expected for the Tidong-1 HEP**

Sl.No.	Particulars	Numbers	Total
A.	Migrant workers (Considering peak workers as 500)		
	i) Single	400	
	ii) Married	100	
	iii) Members of families where only husband is working	300	
	Total Population of A		800
B.	Service Providers (Considering peak strength as 10)		
	i) Single persons	5	
	ii) Married service providers	5	
	iii) Members of families where husband is only working	15	
	Total population of C		25
<b>Grand Total of A+B</b>			<b>825</b>

### *Labour Camps/ Accommodations*

Rooms in the labour camps should be follow the requirements as below,

- The migrant labour will be provided accommodations, on twin sharing basis, made of Galvanised steel sheets and other locally available building material. These accommodations will be duly insulated to protect from prevailing cold climate of the region.
- Accommodating labourers within the villages should be discouraged in order to avoid social conflicts among villagers and labourers.
- These camps will be established above highest flood level of the river to protect from the possibility of hazards of flood.
- These camps will be supported by common latrines and bathing facilities duly segregated for male and female labour. Piped water supply will be made available to these facilities and sufficient arrangements will be provided to keep the common places need and clean.

Provisions for hot water during the cold seasons will have to be made in the labour colonies.

- Number of facilities to be considered – 1 toilet, 1 urinal and 1 bathroom per 15 male workers and 1 each for 10 female workers. Labourers will be motivated to use these facilities as decentralised defecation in the open areas may lead to contaminate the natural water stream and may cause of outbreak of diseases.
- The accommodation provided will ensure a minimum space of 4-4.5 m<sup>2</sup> per allocated per person and minimum ceiling height will be ensured as 2.10 metres.
- All doors and windows should be lockable, and provided with mosquito screens where conditions warrant.
- There will be adequate arrangement of water with provisions of about 135 litre per capita per day.
- Disposal of sewage will be made through a septic tank –soakpit arrangement.
- Arrangements for collection of garbage in dustbins and regular disposal will be made.
- Food will be provided by the employer at common canteen for each location i.e. upstream and downstream, which will be of an appropriate level of nutritional value and will take into account the different religious/cultural backgrounds;
- Adequate ventilation will be provided in the labour accommodations.
- The presence of stagnant water is a factor of proliferation of potential disease vectors such as mosquitoes, flies and others, and must be avoided.

Worker camps and housing facilities will have a written management plan, including management policies or plans on health and safety, security, living conditions, workers' rights and representation, relationships with the communities and grievance processes. A code of conduct will be provided to the workers in advance through their contractors. It will be communicated to them in local language and it will instruct workers to respect the local customs and community in general.

In order to have an effective management for unorganized, short-term labourers who are mostly engaged by petty contractors, it is recommended that the contractor will make arrangement for their accommodations in the existing labour camps to the extent possible. NTPGL will be responsible to ensure that the labour camps are properly maintained. . There could different mechanisms for providing this facility including toilets, bathrooms, kitchen, hot water, etc. from the existing labour camps. These could be managed via main contractors or directly by NTPGL and the cost towards the same may be payable within the contract or via any other suitable means. With this mechanism, NTPGL will ensure that no migratory labourer is staying outside the project area.



### *Drinking Water*

Provisions of safe drinking water for all the labourers will be made by the respective employer/ contractor. The drinking water quality should conform the Indian standard suggested by Bureau of Indian Standards (i.e. IS:10500). Direct usage of river water, without treatment, for drinking purpose needs to be discontinued immediately. Environment team of NTPGL will monitor the quality of drinking water available in labour camps. Water samples will be collected from the camps at a regular interval and analysis to be conducted. Status of compliance will be submitted to GM – EHS&S. In case of non-compliance, suitable corrective action will be taken immediately.

### *Water Supply*

Access to adequate and convenient supply of free potable water should always be available to workers. Quantity of water to be provided should be about 135 litres per capita per day (lpcd), which works out to about 111 KL of water every day during the peak load. This is based on the assumption that, out of peak population of 825 will be staying within the project area, and they will have moderate consumption based on the climatic condition i.e. 135 lpcd.

### *Canteen*

Common kitchen and canteen, facilities should be built in adequate and easy to clean materials and kept in a clean conditions. If workers can cook their own meals, kitchen space is provided separate from their sleeping areas and free fuel should be provided for cater the need of cooking. Canteens should have a reasonable amount of space per worker. Standards range from 1 square metre to 1.5 square metres per person present at any point of time.

### *Waste Generation*

#### *Solid Wastes*

The peak migrant population expected to be engaged is about 500 and out of those, 100 will be having a non-working family. Therefore, an effective population of about 825 including 25 service providers to these camps will be present. Although the population will be transitory in nature, large quantities of waste would be generated which will need appropriate disposal without polluting the land, air and water resources of the region. In India, the average dry weight per capita solid waste generated per day is around 300 g. For the migrant population of 825 persons in the THEP, the solid waste generated daily would be approximately  $(0.3 \times 825 = 247.5 \text{ kg})$  250 kg. NTPGL management would ensure proper collection and disposal of this waste besides providing proper sanitary facilities to the labour colonies in the project area.



The waste will be collected on daily basis from labour camps. It is expected that about 10% of the waste generated will be glass and metal in nature which will be segregated at source and could be sold in the market. The rest of the waste will be sent for incineration. An incinerator of 30 kg / hr. may be installed for this purpose. The same incinerator will be used for garbage disposal from staff colony during operational stage of the project. The emission from the incinerator should meet the CPCB emission standards.

#### *Wastewater*

Source of waste water from labour camps will be kitchen, bathroom, washing and toilets. Wastewater generated from these camps will be treated before disposal. Considering an average sewage generation of 50 litres per person per day and one seat per 15 persons, the project will construct toilets for each of the camp site. Total sewage generation for peak 825 (including their families) will be 41 KL /day. The project will accordingly construct toilets for the construction labour camps and near workplaces. The toilets will be attached to septic tanks attached with soak pits as per the design suggested by Bureau of Indian Standards (i.e.IS:2470).

#### *Protection of Work Force*

##### *Child Labour:*

Any employer including contractors will not employ children in a manner that is economically exploitative, or is likely to be hazardous or to interfere with the child's education, or to be harmful to the child's health or physical, mental, spiritual, moral, or social development. Children below the age of 18 years will not be employed for the project work.

##### *Forced labour:*

The client will not employ forced labour, which consists of any work or service not voluntarily performed that is exacted from an individual under threat of force or penalty. This covers any kind of involuntary or compulsory labour, such as indentured labour, bonded labour or similar labour-contracting arrangements.

#### *Fuel Arrangement for Construction Labour*

Though the common kitchens will be provided to the labour camps, the demand of additional fuel cannot be ignored. The additional fuel will be required for water heating, warming of living area, etc. by the decentralized workers. This demand is likely to impose a pressure on adjacent forest by the way of illegal extraction of fuel wood. For the purpose of protecting the forests from this threat, free fuel wood will be made available to the labours.

In compliance with Performance Standard-6 of IFC, fuel wood depots will be made operational, in co-ordination with H.P. Forest Corporation, within the project area near labour camps in upstream and downstream works. This will provide free fuel to the labours working in the project.

Small contractors will separately procure the fuel wood from the government sales outlets and provide to their labours for free of cost.

These activities will be monitored by Environment Officer as a part of weekly checklist and status of compliance will be submitted to GM – EHS&S.

#### *Health Management for Construction Labour*

Primary Health Centre (PHC) facility would be provided for the labourers working during construction period as per the requirements of Ministry of Health and World Health Organisation. The Primary Health Centre will have one doctor and minimum of five health personnel, (nurses, pharmacist, etc.). Under the health plan, several provisions like infrastructure, medical laboratory, medicines and necessary staff will be provided. This health centre would satisfactorily serve the personnel employed on the project and affected villages including affected families.

Up-gradation of existing Government operated PHC at Morang as desired by the villagers and agreed by project proponent would further add to the health delivery system in the project area, since all the facilities would be available for the workers and the project affected villages as well.

#### *Crèche*

Project is required to arrange a crèche near to the labour establishment where children of workers can be looked after. This will ensure that the children do not enter into the work area or roads and protected from occupational hazards.

#### *Occupational Health and Safety*

In compliance with Performance Standard-2 of IFC, all the employers including contractor who engage migratory labour to work in the project, will follow the applicable laws, especially BOCW Act, BOCW Rules and related IFC guidelines. All the provisions towards occupational health, safety & hygiene will be adhered. These requirements broadly include the protection against following,

- i. Excessive noise, vibration, etc.
- ii. Fire
- iii. Fencing of motors
- iv. Lifting and carrying of excessive weight
- v. Dangerous and harmful environment
- vi. Overhead Protection
- vii. Slipping, tripping, cutting, drowning and falling hazards
- viii. Dust, gases, fumes etc.
- ix. Electrical hazards
- x. Vehicular Traffic
- xi. Stability of Structures
- xii. Illumination of passageways, etc
- xiii. Stacking of materials
- xiv. Disposal of debris
- xv. Excavating and tunneling works
- xvi. All other applicable requirements in the acts and rules.

Employer / contractor will safeguard their labours for safe and efficient discharge of work at their respective work sites by providing;

- i. Eye Protection gears;
- ii. Ear plugs
- iii. Head protection and other protective apparel;
- iv. Use of safety helmets and shoes;
- v. Any other job specific personal protective equipment

The employer / contractor will ensure the test and periodical examination of all lifting appliances at a suitable frequency.

Every establishment employing fifty or more workers will prepare a written statement of policy in respect of safety and health of building workers and submit the same for the approval of the Chief Inspector of Inspection of Building & Construction.

NTPGL's Site in-charge will enforce implement the above requirements and it will be contractor's prime responsibility for implementing this requirement on the work site and thereby ensuring safety of the labours. Every site will have daily, weekly and monthly HSE checklist for their site specific equipment and work environment.

Safety officer of NTPGL and his team will monitor the implementation of these requirements.

### *Consultation and Grievance Mechanisms*

Mechanisms for workers' consultation should be designed and implemented. A review committee should be constituted which includes representatives elected by workers and management representatives. Labours should be made aware about the processes and mechanisms to articulate their grievances. Workers subjected to disciplinary proceedings arising from behavior in the accommodation should have access to a fair and transparent hearing with the possibility to contest decisions and refer the dispute to independent arbitration or relevant public authorities. In case conflicts between workers themselves or between workers and staff break out, in such cases workers should have an easy access to the review committee for a fair conflict resolution mechanism.

### *Contractor Management*

The proposed Project will involve several contractors to execute different works in its construction and operations phase. Hence, there would be more than one contractor working simultaneously in the field. At present, there are 42 local contractors engaged for the construction activities. Issues pertaining to cultural conflicts and matter of faith will remain a concern, although large part of contracts has been given to local community but the labour engaged are migrant. Some essential management measures suggested for management of labour are:

- The contractors should be made aware of the environmental and social obligations of NTPGL through an orientation of the contractors prior to award of contract. This would also enable them to incorporate adequate budget and manpower resources to manage these issues in the field;
- The contract agreement with the contractors to include specific commitments on social obligations including community relations, handling complaints and grievances, adherence to labour laws and international commitments, protection of forests, provision of accommodation, food and free fuel wood, etc. These commitments to be monitored by the EHS team of NTPGL;
- The contractor will provide adequate training on social behaviour and community interaction to the workers engaged by them;
- The contractor will undertake medical test of the workers engaged for the project to identify any communicable disease prior to engagement and will monitor it on annual basis;
- Labours will be living in close vicinity of the village, or in rented accommodations within the village, therefore it is suggested that the contractors will have a Community

Officer (CO) in their teams. The CO will be responsible for all community interaction on behalf of the contractor. The COs will be trained together on managing community relations keeping the commitments of NTPGL by the Social Team of Project proponent;

- Contractor will have to manage the labour camps as per the requirement of NTPGL
- NTPGL will also appoint a Social Officer for the project who will interact with the CO of all the contractors and ensure consistency in approach to communicating with the Community, and in resolving grievances. The contractor COs will report on a weekly/monthly basis to the NTPGL Social Officer throughout the construction and operation phase of the project;

The project proponent will ensure that adequate contractual obligation are added to contract awarded to ensure that the migrant labour is adequately, trained, briefed and facilitated during the course of the project.

### *Community Interaction*

The proposed project will ensure that there is a process of engagement of Site Management with the community throughout project regarding labour issues. The Grievance Redressal Mechanism should ensure that all complaints and feedbacks obtained from the community are addressed and resolved to the satisfaction of the complainant.

The project will ensure that engagement of workers in community functions and festivals are well monitored and necessary action taken in case of any report of untoward incident

### *Labour Camp Inspection*

All the labour camps will be directly managed by the contractor incharge of Labour camps and will be inspected by the Environment Officer of NTPGL and his team on weekly basis. This inspection will focus on the following parameters of the camps:

- i. General observations on cleanliness;
- ii. Canteen hygienic conditions;
- iii. Drinking water availability with respect to source, cleanliness of storage tanks and water quality;
- iv. Provisions of sanitation facilities, water availability in toilets, their cleanliness and drainage;
- v. Provisions of garbage segregation and disposal;
- vi. Status of children and conditions of crèches

- vii. Fuel used for cooking
- viii. Ventilation in rooms and living place temperature

Non Compliances observed during the inspections will be taken up with contractor by NTPGL site in-charge for suitable redressal.

It is envisaged that several contractors will be working in the project and is likely that they will bring workforce for the execution of the project. While signing the contract the project should ensure that all the provisions of the labour management plan as given in this report is to be included as a part of the contract condition.

Therefore the contractor will implement the labour management plan in accordance to the contract. However, implementation of the labour management plan by the contractor will be the sole responsibility of the project proponent.

Entire action plan and responsibilities has been explained in following table.

**Table 7-5: Action Plan for Construction Labour Management**

Sl. No.	Activities	Project phase for implementation	Responsibilities
1	Information to villagers from Morang, Rispa and Lamber about influx of migratory labour	Pre-construction	NTPGL
2	Site clearance and leveling for establishment of camps	Pre-construction	NTPGL and Contractors
3	Construction of labour establishments as per the guidelines in the management plan	Construction phase	-Major Contractors -Location to be finalized by NTPGL
4	Desired numbers of toilets and bathroom separately designated and demarcated for male and female workers with regular supply of hot water in bathrooms.	Construction phase	Contractor
5	Common kitchen for all	Construction phase	Contractor

	the workers on no profit basis.		
6	Provision of safe drinking water conforming the Indian standard suggested by Bureau of Indian Standards (i.e. IS:10500)	Construction phase	Contractor
7	Provision of garbage bins for waste collection	Construction phase	Contractor
8	Waste Collection and transportation to disposal facility	Construction phase	NTPGL
9	Free fuel arrangement for construction workers	Construction phase	NTPGL
10	Checking and inspection of labour camps, and associated facilities e.g. hygienic condition, availability of water, drainage, disposal of wastewater, hot water facility, etc.	Construction phase	NTPGL
11	Crèche facility near labour camp in case kids are present in the camps	Construction phase	NTPGL
12	Grievance register	Construction phase	Contractors
13	Training register for workers	Construction phase	Contractors
14	Contractual conditions regarding Environment, Health & Safety requirements in the contract agreements	Construction phase	NTPGL
15	Records to be maintained: Pre-employment Health checkup register and records, Induction training records and	Construction Operation	Contractor NTPGL

	register, refresher training records and register.		
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## 7.5 Pollution Abatement Plan

### 7.5.1 Water Pollution Control

Construction work require large quantities of water to be used in various processing plants for material preparation, curing purposes, cooling water in equipments, domestic usages in colonies, etc. This can deteriorate the water quality in of the Tidong stream if released untreated. The mitigation measures are suggested in the following action plan.

### 7.5.2 Air Pollution Control

Since the construction activities have already started and dust generation from the project activities has been a major concern of the villagers which was identified during various informal and formal interactions held with AECOM and villagers of Morang, Rispa and Lambar during March and April 2011. Construction period impacts on air quality is mainly due to the activities like site preparation, approach roads, excavation, drilling, blasting, foundation, tunneling, deployment of machinery, transportation, storage of muck, etc. The nature and extent of impact on air environment will vary from time to time and through different stages of development of project.

Suspended Particulate Matter (SPM) is the main air pollutant during construction. Large quantity of dust is being generated from traffic movement. The fugitive dust released during the construction activities may cause immediate effect on the construction workers who are directly exposed to the fugitive dust in addition to the effect on neighbouring community. The other likely source of air pollution is due to the emission from various construction equipments. The various equipments require combustion of fuel, normally diesel oil. The major pollutants, which get emitted from diesel vehicles, are hydrocarbons, and oxides of sulphur & nitrogen.

Most of the measures suggested in following action plan are precautionary while a few are included in the construction methodology and no specific budgeting is required for the same.



### 7.5.3 Noise control

Noise would be generated at the time of construction of powerhouse, tunneling, machine operations, running of pumps, drilling machines, blasting, plying of dumpers etc. Continuous exposure of workers to high level of noise may result in annoyance, fatigue, and may cause temporary shift of threshold limit of hearing and even permanent loss of hearing.

#### Action plan for pollution abatement

**Table 7-6: Action plan for pollution abatement**

Sl. No.	Actions	Project phase for implementation	Responsibilities
A	<b>Water Pollution Control</b>		
1	Storm water and wastewater drains to be separated	Construction	Major contractor
2	Treatment of tunnel discharge to conform CPCB Standard before discharging into Tidong stream. Water should be treated by providing retention time of 2 hours in a tank to enable the settlement of slit. The silt will be cleaned periodically to ensure that retention time is maintained. Silt to be used for leveling of land or dumped into designated muck dumping areas.	Construction	Major contractor
3	Protect storm water quality by proper collection & disposal of municipal solid waste and wastewater from labor camps.	Construction	NTPGL
4	Water quality parameters monitoring as per prescribed schedule at Barrage and power house	Construction	NTPGL
5	Leakage of oil wastes from oil storage, vehicles, should be avoided in order to prevent potential contamination of the	Construction	Contractors

	natural water system		
6	Surface runoff from oil handling areas/devices should be treated for oil separation before being discharged into the river.	Operation	Contractors
5	Adequate quantity of river water to be maintained after the diversion of water into the HRT. The remaining water in the Tidong stream should be minimum 15% of the lean season discharge of the river and suitable enough to fulfill the environmental need of the stream.	Operation	NTPGL
<b>B</b>	<b>Air Pollution Control</b>		
1	Sprinkling of water on the project roads and PWD roads, with a suitable frequency to ensure that there is no fugitive dust emission from the roads due to movement of vehicles. Special attention will be provided for the roads stretches passing through villages.	Construction	NTPGL
2	Idling of delivery trucks / tractors and other construction equipment's should not be permitted. Effective traffic management to be undertaken to avoid significant delays in and around the project area.	Construction	NTPGL
3	Road damage will be promptly attended to with proper road repair and maintenance work	Construction	NTPGL
4	Land grading operation shall be suspended when the speed of wind is very high	Construction	NTPGL

5	All storage piles shall be adequately sprinkled with water or covered with plastic to ensure to protection of ambient air from fugitive emission wind storm	Construction	Contractors
6	The wind barriers of 50% porosity will be installed three sides of all storage piles	Construction	NTPGL
7	The project roads and PWD road from NH-22 will be inspected and the debris left by the tractor - trolleys will be removed as early as possible.	Construction	NTPGL
8	All the stone crushers, if installed for project activities, will install suitable pollution control arrangement and obtain consent from the state pollution control board.	Construction	Contractors
9	Concrete batching plant will be located at closes possible location to the point of use, so that the requirement of transit mixers/ delivery trucks is minimized.	Construction	Contractors
10	As soon as the construction activity is over the surplus earth will be utilized to fill up the low-lying areas, or adequately managed.	Construction	NTPGL
11	All stationary machines/ DG sets / construction equipment emitting the pollutants will be inspected weekly for maintenance and should be fitted with exhaust pollution control devices.	Construction	Contractors
<b>C</b>	<b>Noise control</b>		
1	The construction work occurring within 100-150 meter of a residential area, the	Construction	Contractor

	work hours should be limited depending on convenience of the local people.		
2	The construction equipment generating high noise must be designed to have a high quality muffler system	Construction	Contractor
3	All stationary noise generating equipments such as air compressors, power generators should be used away from the residential area	Construction	Contractor
4	Regular monitoring of equipments and vehicles shall be carried out	Construction	Contractor
5	The total sound power level, $L_w$ , of a DG set should be less than, $94+10 \log_{10} (KVA)$ , dB(A)	Construction	Contractor
6	Noise from the DG set should be controlled by providing an acoustic enclosure or by treating the enclosure acoustically.	Construction	Contractor
7	The Acoustic Enclosure should be provided to all noise generating equipment e.g. compressor and the walls of the enclosure should be insulated with fire retardant foam so as to comply with the 75 dBA at 1m sound levels specified by CPCB, Ministry of Environment & Forests.	Construction	Contractor
8	The DG set should also be provided with proper exhaust muffler with insertion loss of minimum 25 dB(A).	Construction	Contractor
9	Routine and preventive maintenance procedure for the DG set as prescribed by the manufacturer should be set and followed which would	Construction	Contractor

	help prevent noise levels of the DG set from deteriorating with use.		
<b>D</b>	<b>Records to be maintained</b>		
1	Ambient air quality monitoring register and reports	Construction	NTPGL
2	Surface water quality monitoring register and reports	Construction	NTPGL
3	Noise level monitoring register and reports	Construction	NTPGL
4	Daily / weekly / monthly inspection checklists	Construction	Contractors

### 7.6.1 Wildlife Conservation

There is no conservation area or protected area in the form of any wildlife sanctuary, national parks etc in and around the proposed project area. However, wildlife already discussed in baseline report section includes few endangered species e.g. Brown Bear, Musk Deer, Snow leopard, etc and other common wildlife may be exposed to human interference besides stray cases of poaching. The cattle population, illegal felling trees, traditional rights of local people, etc resulted in depletion of forests and thereby causing disturbance of wildlife. Keeping in view the concern for wildlife enhancement and conservation in the project area, the project envisages a contribution of Rs 0.5 million towards wildlife conservation program apart from the provision in CAT Plan. During the construction phase, various adverse impacts on the wildlife are anticipated in the surrounding areas of the proposed project in terms of increased noise levels, land vibrations during tunneling and blasting, release of air and water pollutants, etc. Mammals are the most vulnerable group affected by these negative impacts, which affect their movement, behavior and breeding habit. To avoid and minimize the negative impacts from these activities following safeguard measures will be adopted:

- Strict restrictions and surveillance will be imposed on the workers at project sites to ensure that they would not harvest any species/produce from the natural forests and cause any danger or harm to the animals and birds.

- Minimum level of noise during construction activities will be ensured by providing acoustic enclosures on high noise generating equipments like DG-sets, Compressors, etc. and minimum activities will be carried out at night where the project site.
- Anti-poaching measures like intensive patrolling will be undertaken with the help of the forest department.
- Provisions will be made for the supply of free fuel for worker's camp to avoid forest degradation and destruction of animal habitats.
- Workers will be accommodated in labor camps/ colonies so that they don't set up labour colonies in the vicinity of the forest and wilderness areas. During the discussion with the Forest Department, it was evident that the opportunity for poaching might increase because of the accessibility of the site due to the construction of better roads. Forest department is also worried of migrant workers whom they consider expert trappers of wild life. Additional surveillance and restricting the workers only to work site is very important and should be strictly adhered.
- Forest Department also mentioned that the predators like panthers and snow leopards follow smaller prey like dogs especially during the winters when the snow fall is heavy. They often follow and prey on feral dogs. The feral dogs are generally around the work sites and survive on the municipal wastes. The municipal waste management practices should therefore strictly follow as suggested in this report to avoid feral dogs which attracts leopards and panthers. However, if the feral dog population is noticed, it should be immediately reported to the forest department for sterilization.
- The project will be bound by the rules and regulations of the Wildlife (Protection) Act (1972) and Rules (1995), Biological Diversity Act (2002) and Rules (2004), Forest Conservation Act (1980), Forest Conservation Rules (2003), Environment Protection Act (1986) and Rules (1986), for the preservation of habitats and protection of wild animals.

### **7.6.2 Compensatory Afforestation**

The compensatory afforestation will be carried out by the HP Forest Department, Government of Himachal Pradesh (Divisional Forest Officer, Kinnaur) over 79.00 hectares of degraded forest land. The Forest Conservation Act of 1980 stipulates strict forest protection measures and outlines procedures (Guideline 1/08-1 (ii)) for compensatory afforestation if the Department accepts conversion of forestlands for other purposes:

- If non-forest land is not available, compensatory forest plantation is to be raised on degraded forest land to the extent of twice the affected or lost forest area;

- If non-forest land is available, compensatory afforestation is to be raised over an area equivalent to the affected/lost area of the forest.

The objectives of the afforestation programme should be to develop natural areas in which ecological functions could be maintained on sustainable basis.

An amount of Rs 26.676 millions has already been deposited by NTPGL to the HP Forest Department towards compensatory afforestation. However no information on the progress of afforestation plan is available.

### **7.6.3 Control of Deforestation**

Efforts will be made to minimize the cutting of trees for various construction activities. Construction of the proposed project is likely to increase human activities during construction and operation of the project, which would increase pressure on local natural resources if no adequate measures are taken. Encroachment on nearby forest reserves and subsequent forest degradation can be avoided by arranging adequate supply of alternative fuels. The requirement of fuel for worker's camp is provided in the Construction Labour Management Plan.

### **7.6.4 Preservation of Endangered & Medicinally Important Species of Terrestrial Flora**

Some of the species of terrestrial flora which have medicinal value are likely to be affected due to the project activities as reported in Chapter-4, environmental baseline status of the project area. Efforts will be made to preserve these species by including them in the plantation programs under reforestation and CAT plan. It is also proposed to establish and maintain nursery especially for these species. The work will have to be carried out through the local forest department under the provision of CAT Plan.

### **7.6.5 Catchment Area Treatment Plan (CAT Plan)**

The total catchment area of river Tidong at proposed barrage site is 570.55 sq km, out of which about 95% is above permanent snowline (EL 4200m), which is either stony or snowbound area. No vegetation grows in the snowbound and stony area. Any kind of treatment is neither possible nor warranted in such area. The remaining 5% area where any kind of vegetation can grow is substantially denuded and deforested due to indiscriminate felling, repeated lopping of trees for fodder, uncontrolled excessive grazing and annual

burning of forest. Reduction of vegetative cover in the recent times has worsened the ecosystem of Tidong valley, which is otherwise fragile due to its geomorphologic features.

#### Catchment Area Treatment and its Need

Soil erosion may be defined as detachment and transportation of soil. Various factors affecting erosion are soil characteristics, meteorological conditions such as total annual precipitation, snow fall, intensity of precipitation, wind velocity, exposure conditions such as extent and type of vegetation cover and the topography of the catchment. Controlling one or more factors responsible for erosion as mentioned above can control the process of soil erosion. The catchment of river Tidong has very steep ground slopes where rainfall/snowfall is the prime factor responsible for erosion, which is severe to the extent that mass movement of soil (land slide) is a very common phenomenon. Providing vegetation cover will have two fold effects in erosion control, the first is that it improves the soil matrix through reinforcing and second it reduces the intensity of run-off. Breaking of slopes through engineering measures like, check dams, contour bunds and retaining walls discontinue the slopes and prevent mass movement of soil.

Sedimentation of the reservoir is a function of soil erosion rate of the river catchment area. It reduces the water storage capacity of reservoir and availability of water for its designated use. It could, therefore, be concluded that useful life of a hydroelectric project is directly related to the soil erosion rates of the catchment area. The past experience of hydropower projects shows that sedimentation of reservoir has determined the useful life span of such projects. Remedial measure like dredging and disposal of sediment has not proved practically useful since it is cost exorbitant. Erosion of topsoil from the catchment also reduces its fertility and the vegetation growth as well.

Tidong-1 HEP is a run of the river scheme; hence storage of water is not anticipated. A small balancing reservoir has been provided leading to desilting chamber. Silt load coming with the flowing water is removed by passing the water through desilting chamber to prevent the wear and tear of the turbine. Catchment area treatment results into less sediment load of water to be removed by desilting chamber and less amount of silt discharge downstream of barrage back into the river. It, therefore, becomes imperative to take adequate preventive measures towards soil erosions at the planning stage itself.

The catchment area treatment (CAT) plan pertains to preparation of a management plan for treatment of erosion prone area of the catchment through biological and engineering measures; however, a comprehensive CAT plan should also include the social dimensions associated directly or indirectly with the catchment. A well-designed CAT plan should not only



control the sedimentation of reservoir but should also provide a life support system to the local population through their active involvement. An effective CAT plan of a hydropower project is a key factor to make the project eco-friendly and sustainable.

Integrated watershed management aimed at minimizing the sedimentation of reservoir and ecosystem conservation of the catchment area is the prime objective of the catchment area treatment, which can be further elaborated as listed below:

- Soil conservation through biological and engineering solutions to reduce sediment load in the reservoir.
- Ecosystem conservation through improvement in water retaining properties of soil and increase in vegetative cover.
- To fulfill fuel and fodder requirements of the local people.
- Integration of the CAT plan with social and economic activities of the local population through employment generation.
- To promote community participation by motivation/ awareness and training in adopting environmentally sustainable practices and to upgrade their skills in natural resources management.
- To improve rural infrastructure in the project area.
- To promote in-situ moisture conservation, ground water resources, increase productivity of all types of land and sustained use of natural resources.
- To strengthen wildlife management in the tract and take initiatives for mitigating the impacts of project on wildlife.

#### Catchment Area Treatment Measures

The Catchment Area Treatment Plan will be for the period of 10 years. However most of the activities will be completed during the initial 5 years and later half of the plan period will be mainly for the maintenance of plantation area.

The Catchment Area Treatment Plan (CAT) aims to develop the catchment area in an integrated manner by improving vegetative cover over the degraded and blank areas through afforestation and bio-engineering measures. It also envisages an active participation of the local community and to treat the flood prone nallas, stabilization of Tidong River bank, road side slopes by providing suitable bio-engineering structures and soil conservation measures include Nurseries, Forest Conservation & Improvement of Tree Cover, Pasture Improvement, Silvicultural Operation, Soil & Moisture Conservation Works, Road side avenue Planting and Landscaping, forest infrastructure development, Rural Infrastructure Development, Treatment of Private Lands , Fuel Saving Devices, Rain/ Snow Harvesting Structure, Wildlife Management,

Training and Studies, Awareness and Publicity , Operational Supports, Agricultural Support, Horticultural Support, Animal Husbandry Support, Development of ECO Tourism, Provision of Eco Task Force, Provision for Allied Activities, etc.

Detailed CAT Plan prepared in October 2007 has been approved by HP Forest Department can be referred separately. An amount of Rs. 72.484 millions has been deposited by NTPGL with HP Forest for implementation. However, status of implementation is not known.

### Action plan for the management of terrestrial ecology

Key features of the plan are mentioned in following table as actionable activities with the defined responsibilities;

**Table 7-7: Action plan for the terrestrial ecology management**

Sl. No.	Activities	Project Phase for implementation	Responsibilities
1	Preference to the locals for project employment, contract and labours.	Construction	Contractor NTPGL
2	Provision of Labour camps and motivates contractors to accommodate their labourers in the camps	Construction	Contractor
3	Regular monitoring of Landslides and erosions on the hill slopes, discharge and usage springs and waterholes, status of Forest and wildlife, ecological conditions and aquatic ecology	Construction Operation	NTPGL
4	Common kitchen facilities in the labour camps at no profit basis	Construction	Contractor
5	Provision of room and water heating arrangements	Construction	Contractor
6	Provision of free fuel by opening free fuel depots near the labour camps.	Construction	Contractor
7	Prohibition on the sale and purchase of the local NTFP and	Construction	Contractor NTPGL

	fishes in the camps		
8	Strict restrictions and surveillance on the workers from entering forest area	Construction	Contractor
9	Strict restrictions and surveillance on the workers against poaching and extraction of NTFP	Construction	Contractor
10	Noise reduction measures to be adopted during construction activities	Construction	Contractor
11	Report to the forest department if the feral dog population is noticed nearby	Construction	NTPGL
12	Compensatory Afforestation against the amount deposited by NTPGL	Construction	HP Forest department
13	Implementation of CAT Plan against the amount deposited by NTPGL	Construction	HP Forest department
14	Daily / weekly / monthly inspection checklist for labour camps	Construction	NTPGL
15	Correspondences with HP Forest Department and MoEF regarding status of CAT plan and Compensatory afforestation.	Construction Operation	NTPGL
16	Records to be maintained: Correspondences with Government regarding status of implementation CAT Plan and Compensatory afforestation	Construction Operation	NTPGL

## 7.7 Aquatic Ecology Management Plan

### 7.7.1 Minimum Ecological Flow

The most effective mitigation measure during project operation, towards the impact on aquatic ecology, is discharge in the affected stretch of river i.e. length of about 9.8-km between diversion structure and tailrace channel. This is due to change in water levels, currents and water quality will be changed after the water is diverted through the project. NTPGL is required to ensure the discharge of minimum ecological flows downstream of the diversion and maintain the river water quality. This ecological flow may be designed based on the habitats of the most valued aquatic species in the river.

As discussed in impact assessment chapter no. 6, it is mandatory to release the minimal flow in the stream which has been defined by the Government vide its Notification no. MPP-F(2)-16/2008 of Department of MPP and Power, government of Himachal Pradesh, that the ROR projects shall ensure a minimum flow of 15% of the lean season discharge of the stream, immediately downstream of the diversion structure of the project throughout the year.

Discharged data as 10 days average flow of Tidong River at the proposed barrage site between Dec-2004 and Jul-2010 was provided by the NTPGL (Data provided in Chapter-4). The data suggests that the winter months have lesser discharge and the monsoon months (July-Aug) have higher discharge. The minimum flow observed was on Jan-2005 and is 4.53 cumec and the maximum flow of 75.149 cumec in July 2006. As per the mentioned notification, the project needs to discharge a minimum of 0.678 cumec of water downstream of the diversion structure. For about 260 m the Tidong will have only 0.678 cumec of water. Beyond about 260 m downstream, a perennial stream, Shicky Khad meets Tidong on the right Bank. Further downstream, two more streams, Gara Khad and Duba Khad meets Tidong on the left bank. The discharge data for Shicky, Gara and Duba khad is not available and therefore it is difficult to predict the Tidong flow beyond 260m from the diversion structure. NTPGL will install online electronic flow meter to ensure this release and report to HP State Pollution Control Board.

However, 15% discharge is often not sufficient to sustain the aquatic life and any other downstream use of the river water. It is related to a number of factors such as hydrologic and biotic character of critical reaches, perceived sensitivity, desired state of the river and other utilizations of river flow. Hence, it is recommended that detailed study be carried out to determine the minimum ecological flow for the Tidong stream.

### 7.7.2 Other mitigation measures

In order to protect the aquatic ecology other mitigation measures include the water pollution abatement measures as discussed earlier.

### 7.7.3 Fisheries development activities

As per the EIA baseline data on fishes in the Tidong stream, it is apparent that fish are not found on the upper reaches of the stream. However, near the confluence with Satluj, Snow and Rainbow trout were encountered. Some of the fish habitats will have severe problem mainly because it falls within the dry stretch in the upstream of Tailrace channel.

To sustain biodiversity and fisheries in Tidong stream, sustainable management of habitats and systems of exploitation of available resources is required. In order to mitigate the effect of construction and operation of the project, a Fisheries Development Plan has been proposed by Directorate of Fisheries, Himachal Pradesh. Following measures have been suggested in the proposal:

- Develop sustainable fisheries in Tidong reservoir,
- Adequate replenishment of fish by producing and stocking their seed to offset the loss of auto breeding/ auto stocking besides losses due to degradation of aquatic ecosystem,
- Creation and strengthening of infrastructure for the production of fish seed at the fish farm located at Sangla, Himachal Pradesh,
- Procurement of fish seed of improved phenotypes and genotypes of the existing/ residential fish species,

Supplementary stocking programme for Trout fish will be carried out for the project area under this proposal and the spawn of trout fish so generated will be released in the waters of Tidong and Satluj river. The rate of stocking for Tidong reservoir and stream below the reservoir is proposed as 10,000 fry of about 30mm size per year. This will be achieved by strengthening of infrastructural facilities at fish farm, Sangla. The seeds will then be transported from this fish farm. The supply of seeds can also be augmented by collecting them from natural sources.

NTPGL has already made payment of Rs 11.1 million to the Department of Fisheries towards Fisheries Development Plan. The construction work for strengthening and expansion of fish farm at Sangla will be carried out by HP Housing and Urban Development Authority or any

other agency authorized by HP Government. The monitoring of fisheries development plan will undertaken by the steering committee constituting of the following members:

- |   |                  |
|---|------------------|
| 1. Secretary (Fisheries) to the HP Government | Chairman         |
| 2. Representative of Proposed Project         | Member           |
| 3. Director-cum-warden of Fisheries           | Member           |
| 4. Representative of construction agency      | Member           |
| 5. Assistant Director of Fisheries            | Member Secretary |

The responsibilities of steering committee will be;

- Review and monitor the progress of construction works
- Consideration of the need for any mid course change in the requirements under fisheries development plan

Though the requisite amount has been deposited by NTPGL, however, status of the implementation of this plan is not known.

Further In light of the data deficiency on fishes, NTPGL will conduct, an year long study covering all seasons, by engaging a fisheries expert, so as to generate data for the entire year at the S1, S2 and S3 sampling locations. This study will determine if there is any deviation from the data and assessment presented in this ESIA, and in the event a deviation is identified, develop appropriate mitigation plans. A budget of Rs. 3.0 Million will be allocated for this study.

#### 7.7.4 Action plan for the management of aquatic ecology

Key features of the plan are mentioned in following table as actionable activities with the defined responsibilities;

**Table 7-8: Action plan for aquatic ecology management**

Sl. No.	Activities	Project Phase for implementation	Responsibilities
1	All the action plan to be followed for water pollution abatement plan	Construction	NTPGL Contractor
2	Prohibition on aggregate mining on the river bed	Construction	Contractor

3	Ensure that designs have the provision of releasing 15% of the minimum lean season discharge as a inbuilt structure of the barrage and ensure that the structure is constructed as per design.	Construction	NTPGL
4	Ensure the release of 15% of the lean season minimum discharge to fulfill the environmental need of the stream.	Operation	NTPGL
5	Strengthening of government fish farm at Sangla as per plan	Construction	Department of Fisheries, Government of HP
6	One year baseline study for fishes Tidong stream at S1, S2 and S3 sampling locations and develop an appropriate mitigation plan	Construction	NTPGL
7	Records to be maintained: Correspondences with Department of Fisheries, regarding status of implementation fisheries development plan, Discharge data in the downstream of diversion structure, river water quality records as suggested in monitoring plan.	Construction Operation	NTPGL

## 7.8 Erosion Abatement and Muck /spoil Management Plan

### 7.8.1 Soil Erosion Control

Careful planning for excavation, filling and dumping along with re-vegetation are required to mitigate the soil erosion. A general guideline to control soil erosion will be to stop all the earthwork activities during rainy season so that surfaces having loose earth are not exposed to rains. The cutting and filling area, on completion of the work will be dressed well, compacted and covered with plantation.

Soil erosion may be defined as detachment and transportation of soil. Various factors affecting erosion are soil characteristics, meteorological conditions such as total annual precipitation, snow fall, intensity of precipitation, wind velocity, exposure conditions such as extent and type of vegetation cover and the topography of the catchment. Controlling one or more factors responsible for erosion as mentioned above can control the process of soil erosion. The catchment of river Tidong has very steep ground slopes where rainfall/snowfall is the prime factor responsible for erosion, which is severe to the extent that mass movement of soil (land slide) is a very common phenomenon. Providing vegetation cover will have two fold effects in erosion control, the first is that it improves the soil matrix through reinforcing and second it reduces the intensity of run-off. Breaking of slopes through engineering measures like, check dams, contour bunds and retaining walls discontinue the slopes and prevent mass movement of soil.

The catchment area treatment (CAT) plan pertains to preparation of a management plan for treatment of erosion prone area of the catchment through biological and engineering measures; however, a comprehensive CAT plan should also include the social dimensions associated directly or indirectly with the catchment. A well-designed CAT plan should not only control the sedimentation of reservoir but should also provide a life support system to the local population through their active involvement. An effective CAT plan of a hydropower project is a key factor to make the project eco-friendly and sustainable.

Integrated watershed management aimed at minimizing the sedimentation of reservoir and ecosystem conservation of the catchment area is the prime objective of the catchment area treatment, which can be further elaborated as listed below:

- Soil conservation through biological and engineering solutions to reduce sediment load in the reservoir.



- Ecosystem conservation through improvement in water retaining properties of soil and increase in vegetative cover.
- To promote in-situ moisture conservation, ground water resources, increase productivity of all types of land and sustained use of natural resources.

### 7.8.2 Muck Disposal

Muck generated from excavation of any project component is required to be disposed in an appropriately planned and environmentally responsible manner so that it takes a least possible space and is not unsafe to the environment. Sedimentation in rivers is greatly increased due presence of improperly managed muck disposal sites. These also blemish the visual aesthetics of the area. The disposal sites, if not designed and managed properly may cause mass movement of soil, blocking the natural drainage and causing other sequential problems.

#### *Identification of Muck Disposal Sites*

After careful consideration of various locations, project proponents have identified four sites on the basis of their merits for safe disposal of the surplus muck (left after reuse), generated from underground excavations. All these sites are located along the Tidong stream barrage sites and power house. These muck disposal sites will be covered with vegetation after leveling and dressing the top surface after filling up and closure. Location of the muck disposal sites have been shown on a plan as **Error! Reference source not found.**. The total area required for the purpose is 14.64 ha. and details of these dumping sites mentioned in **Error! Reference source not found.** are as below:

**Table 7-9: Dumping Site Details**

Name of Dumping site	Location	Capacity (m <sup>3</sup> )	Muck dumping (m <sup>3</sup> )	Left over Capacity (m <sup>3</sup> )
PA-1	Left bank of Tidong near Lambar	308358	297742	10616
PA-2	Left bank of Tidong near Lambar village and Adit-1	107652	102379	5273
PA-3	Left bank of Tidong between Rispa and Lambar villages	77180	73653	3527
PA-4		249400	244157	5243
<b>TOTAL</b>		<b>742590</b>	<b>717931</b>	<b>24659</b>

### *Methodology for Disposal*

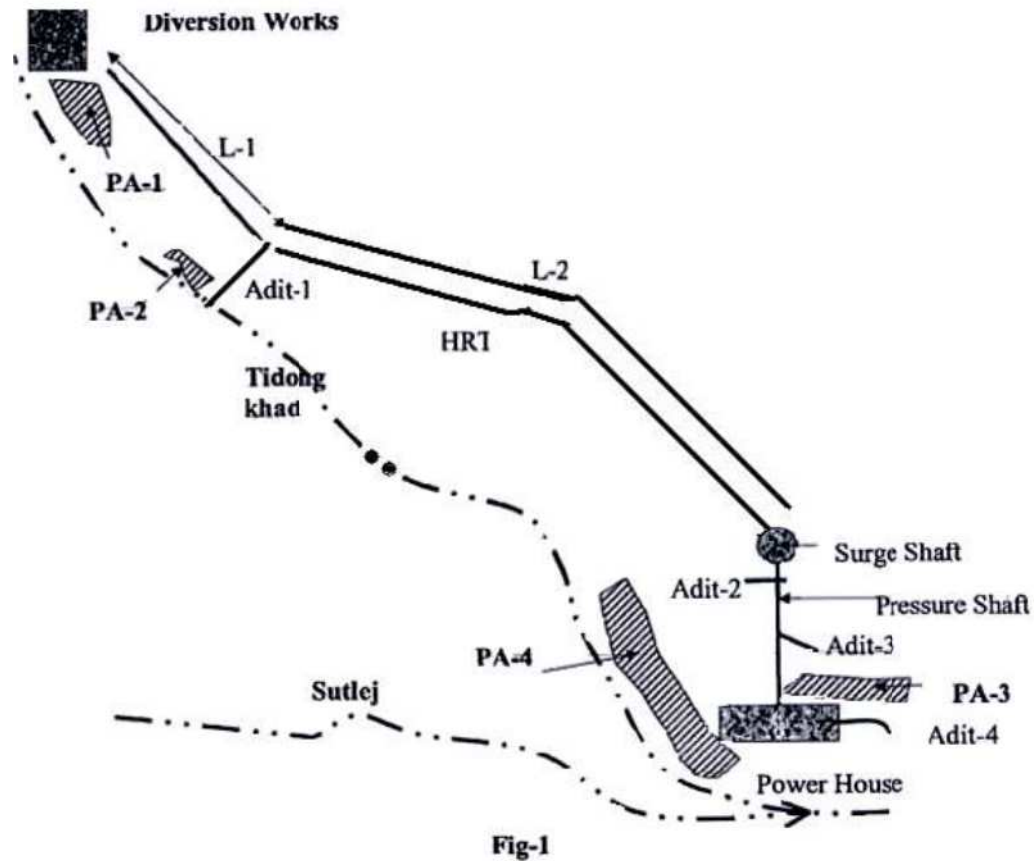
The dumping of muck will be done in the scientific manner by providing appropriate protection walls with deep foundations so that muck will not flow and washed away in the river. The muck will be filled in these areas in layers and compacted mechanically. Dumping sites on sloping ground will be protected adequately against any possible slide/slope failure through engineering measures i.e. retaining wall. Typical cross sectional a detail of such wall has been given in detailed muck disposal plan can be referred from “Addendum-1 of Volume-V of Environmental Impact Assessment, May 2006 for 100 MW Tidong-1 HEP”. The entire muck disposal area on completion of the filling operation will be provided with a layer of good earth on the top, dressed neatly and covered with vegetation after closure. Muck generally lacks nutrients and therefore, is difficult to re-vegetate. Since, top soils are not available in large quantities in hills; it may not be possible to apply a thin layer of soil over the muck along with additional nutrients. Techniques such as use of biofertilizers will be attempted to achieve the desired results.

A provision of Rs 1.97 millions towards development of muck disposal site as green patches has been made as estimated in Table 7-10.

**Table 7-10: Cost of Development and Restoration of Muck Disposal Sites**

Sl. No.	Item	Cost (Rs. In Millions)
1.	Engineering measures:	
	Leveling of sites before dumping	Part of Engineering Estimate
	Boulder crate as per requirement	Part of Engineering Estimate
	Catch water drain as per requirement	Part of Engineering Estimate
	Masonry Retaining wall as per requirement	Part of Engineering Estimate
	Fencing in selected patches for 2.5 km @ Rs. 200,000/km	0.50
	Provision of top soil for plantation (25% of total area) including leveling/dressing, 10980 cum@ Rs.60/cum	0.67
2.	Biological measures:	
	Plantation for 3.66 Ha @Rs. 27,310/- per ha including of 5 yrs maintenance	0.20
	Beautification works LS	0.60
	<b>TOTAL</b>	<b>1.97</b>

Figure 7-4: Designated Muck Dumping Sites



### 7.8.3 Municipal Solid Waste (MSW) Management

MSW management is one of the most warranted operational activities at any hydro-electric project sites. MSW from the project will be generated labour camps, office and staff colony. Surrounding areas of proposed Tidong-1 project are sparsely populated. Total human population in affected villages in the Tidong valley is more about 4000. The influx of migrant labourers with their families and other technical staff would exert additional pressure on the existing ecosystem. This will also help in maintaining the aesthetic beauty and keeping the

environment clean and healthy. This plan suggests for the disposal of all types of wastes, including solid waste and sewage, generated in the labour camps, project colonies and other sites of the project. Appropriate sewage and solid waste treatment as well as disposal system would be developed by the project authorities to avoid indiscriminate dumping of waste in and around the project area. The objective of this plan is to ensure collection, transportation and disposal of all the wastes from the project, in an environmentally and socially satisfactory manner using the most feasible in the local climatic conditions and economical means available.

The total migrant population load has been calculated taking into consideration the periodic labour requirement, based on the following assumptions:

It is assumed that 20% of the labour and 50% technical staff are likely to have families,

- i. 20% of the labour population will have family
- ii. 2% of the total migrating population is assumed as service providers,
- iii. 50% of service providers will have families.
- iv. The average family size for labourers and for technical staff is assumed to be of 4 persons respectively.

Following table gives the details of migrant population for the project. Based on the above mentioned assumptions, the peak time migrant population on calculation comes out to be 1075 persons. This total population would probably reside in the project area at any given time.

**Table 7-11: Total Migrant Population (Labourer & Technical Staff) in the Project**

Sl.No.	Particulars	Numbers	Total
1.	<b>Total Migrant Labourers Population</b> (from Table 7-4)		825
2.	<b>Technical Staff</b> Considering peak strength of 100		
	i) Single person	50	
	ii) Married	50	
	iii) Members of families where husband is only working	150	
	Sub Total		250
	Grand Total of 1+2		<b>1075</b>

Organic and inorganic garbage will also be generated in the colony area. Dustbins of good and long-lasting quality should be installed at different places to collect organic, plastic, glass and other garbage separately. Metal and glass garbage should be sent for recycling. The organic garbage will not decompose into manure due to predominantly low temperature in the region therefore will be mixed with other combustible garbage and will be incinerated. **Rs. 6.00 millions** has been allocated for the installation and maintenance of electrical incinerator.

#### **7.8.4 Domestic Wastewater Management**

Septic tanks are used for treating domestic sewage from individual households both in suburban and rural areas, where a piped sewage system (i.e., a public sewer) is not available. It is a horizontal continuous flow sedimentation tank in which sewage moves very slowly. Septic tank serves two purposes: deposition of settling solids in sewage by sedimentation, and partial or complete digestion of the sludge prior to its disposal. A septic tank produces septic action by anaerobic bacteria, wherein proteins, carbohydrates, cellulose and fatty matter present in sewage are broken to simpler compounds. The nitrogen is converted to ammonia, while the colloidal matter is flocculated, then liquefied and finally digested. The sanitary facilities provided in the colonies would be of standard municipal design for the hill areas.

For labour colonies, septic tanks followed by soak pit of not less than 25m<sup>3</sup> each would be constructed at appropriate sites for each set toilet and bathroom. Cleaning schedule of these tanks will be prepared and followed. The organic waste generated would be decomposed and used as manure while landscaping the project area or transported to nearest disposal facility. One to two tanks or soak pits are proposed for each set of toilet. The total budget allocated for the purpose is around **Rs. 1.00 million**.

Domestic wastewater from the residential staff colony will be treated in Sewage Treatment Plant. Properly treated water conforming to the desired standards<sup>1</sup> should either be reused for greenery development or released into the natural water channels. Total allocated budget for the sewage treatment plant is around **Rs. 4.00 millions**.

Open toilets should strictly be prohibited in the project area and in the vicinity. Provisions will be made for common toilets and bathrooms facilities in the labour colony for males and females. Number of these facilities to be considered as 1 toilet, 1 urinal and 1 bathroom per 15 male workers and 1 each for 10 female workers. Proper facilities for bathing and washing

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<sup>1</sup> General Standards for Discharge of Environmental Pollutants Part –A: Effluents as referred in Schedule-VI under Rule 3A of The Environment (Protection) Rules, 1986.

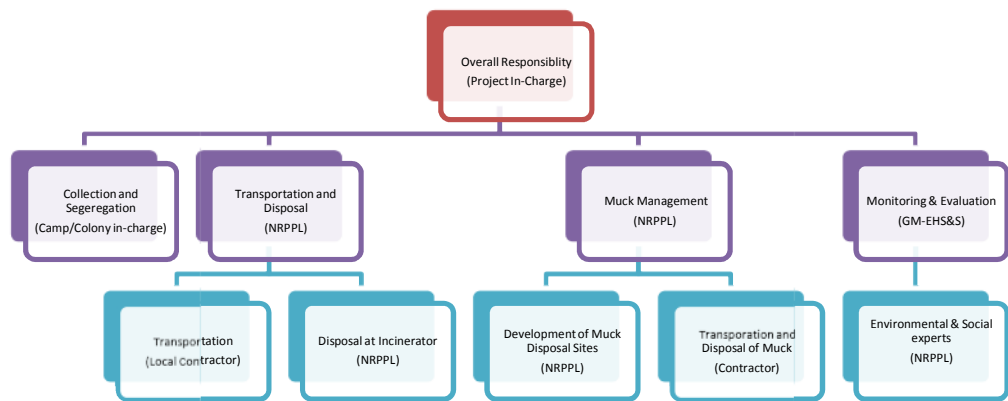
clothes with hot water arrangements would be provided in the colony areas. Labourers will be motivated to use these facilities as decentralised defecation in the open areas may lead to contaminate the natural water stream and has the possibility of outbreak of diseases.

Each set will have 8 to 10 seats and at least 4 bathrooms. Toilet facilities (temporary) will also be provided at the working sites at upstream and downstream sites with proper water facilities. Total budget allocated for this purpose is around Rs. 1.00 million.

**7.8.5 Organizational Arrangement**

Staff for the various facilities required for Erosion Abatement and Muck / Spoil management at various places like colony areas, construction sites, etc. will be provided by respective area owners. For example for labour camp, the respective contractor will provide all the resources and for staff residential colony, NTPGL will provide necessary resources. Operating staff for garbage collection, dumping and incinerator operation will be provided by NTPGL as a centralized treatment facility. Installation and operation of the Incinerator will be the responsibility of NTPGL. Organizational arrangement and responsibility for effective implementation of waste management is as suggested below in Figure 7-5.

Figure 7-5: Organizational Arrangement



### 7.8.6 Cost Estimate

In order to manage the waste generated from the population of more than 1000 expected population, a number of mechanisms for handling and disposing solid waste are proposed. A total budget of **Rs. 11.47 millions** is proposed in the plan which includes Rs. 1.00 million for septic tank and toilets/ bathrooms each, Rs. 4.00 millions for Sewage treatment plant, Rs.3.5 millions for Incinerator and Rs. 1.97 millions for Muck disposal.

### 7.8.7 Action plan for Erosion Abatement and Muck / Spoil management

Key features of the plan are mentioned in following table as actionable activities with the defined responsibilities;

**Table 7-12: Action Plan for erosion abatement and muck / spoil management**

Sl. No.	Activities	Project Phase for implementation	Responsibilities
1	Soil conservation through biological and engineering solutions to reduce sediment load in the reservoir as a part of CAT Plan	Construction	HP Forest Department
2	Ecosystem conservation through improvement in water retaining properties of soil and increase in vegetative cover as a part of CAT Plan	Construction	HP Forest Department
3	To promote in-situ moisture conservation, ground water resources, increase productivity of all types of land and sustained use of natural resources as a part of CAT Plan	Construction	HP Forest Department
4	Identification and development of Muck disposal sites by providing adequate protection wall with RCC cladding	Pre construction	NTPGL
5	No overloading of muck in the	Construction	Contractor

	tippers to avoid spillage on the project road		
6	Layered compaction of muck in the muck dumping sites	Construction	Contractor
7	Provision of garbage bins in the labour camps	Construction	Contractor
8	Collection and transportation of garbage from entire project area to disposal site	Construction	NTPGL
9	Provision of Incinerator for disposal	Construction	NTPGL
10	Provision of Septic tanks for bathroom and toilets in labor camps, offices and work areas for disposal of wastewater	Construction	Contractor
11	Sewage treatment plant for staff colony	Construction	NTPGL
12	Records to be maintained: Correspondence with govt. regarding implementation of CAT Plan and Compensatory afforestation, Register of solid waste collected from labour camps, offices and colony, register of waste receipt at disposal point, Muck register at every excavation site showing reutilization and dumping, Register of every muck disposal site showing daily receipt of muck and capacity of the site remaining.	Construction	Contractor NTPGL



## 7.9 Public Health and Occupational Safety Management Plan

The proposed project is located in the remote area of Himachal Pradesh, where existing medical facilities are inadequate. The diseases, which are predominant in the area, are gastroenteritis/ diarrheal diseases, typhoid, acute respiratory infection and other air & water born diseases. The main objective of the proposed in this plan is to deliver effective health care to those involved in the project and also to the general population affected by the project or staying in the immediate vicinity of the project site.

An influx, of about 925 (825 effective population due to work force and 100 officers and staff are) working population, is expected during peak construction phase at various sites. Health risk due to this influx, during the project construction, includes disease caused due to lack of proper sanitation (water supply and municipal waste disposal) and vector borne disease and hazards due to local carriers. Therefore, apart from availability of various infrastructures like sanitation, drinking water supply, solid waste management etc. provision of adequate health care services should also be in place.

As mentioned earlier, the surrounding area of Tidong-I HEP, has no adequate health care facility. The nearest facility is a Primary Health Sub Centre which is located in Morang. The District hospital is in Reckong Peo, is about 40 km away. To access better health care facilities, people have to travel to Reckong Peo. Therefore it is suggested a PHC to be established with reasonably good health care facility to be provided by the project for the construction workforce and residents of affected area.

### 7.9.1 Primary Health Centre

A Primary Health Centre is suggested in the colony area of proposed project. In addition to the project staff and labourers, the services of this Centre could be extended the project affected families and other residents of affected area. Project can issue Identity cards to the affected population to avail the medical facility. The project authorities would operate and maintain this PHC throughout the life cycle of the project. Total budget that could be allocated for the PHC is about Rs. 3.6 million as per the details given in Table 7-13.

**Table 7-13: Estimated cost for the setting up of a Health Centre at Colony area of Project**

S.No.	Particulars	Amount (Rs. In million )
1	Building 200 sq.mt.	1.00
2	Ambulances (1 Nos.)	0.60

3	Equipments for laboratory facility, furniture (Lump sum)	0.50
4	Maintenance and running cost of ambulances for 2.5 Years	0.50
5	Lump sum cost for Medicines	1.00
	<b>Total</b>	<b>3.60</b>

This PHC will serve entire project affected area as the road connectivity is good and a dedicated ambulance will be available. From the PHC, medicines of general nature (for fever, cough and cold, stomach ailments etc) could be distributed free of cost to the project affected families. A cost of Rs 25,000 per month can be allocated for this purpose. Pathological facility can also be extended to the affected families at a nominal charge on no profit basis. The salary of the Doctor and paramedical staff is to be included in the staff cost of the project and therefore is not included here.

### 7.9.2 Immunization Programme

A door-to-door immunization and vaccination programme is under way by Health Department of Himachal Pradesh. However, the project authorities will ensure that the same is extended to the labour camps and residential colony of the project. Existing manpower from Health Department of Tidong HEP will be deployed for this purpose.

### 7.9.3 Distribution of First Aid Boxes

Training programmes with respect to First Aid in the affected villages of Morang, Rispa and Lumber will be organized by Health Department of the project. This capacity building process will help improving the basic health knowledge base of the villagers. After completion of training, first aid box would be distributed in these villages. At least two persons for each village will be trained and at least 1 first aid box will be distributed to each village. The trained persons in the villages will take responsibility of these boxes placed in Panchayat buildings. The trained persons could receive medicines from Primary Health Centre of the project after submitting utilization records of medicine used. The trained persons will be paid by a nominal amount as incentive.

Total budget for the training and distribution of first aid boxes and related expenses including immunization program during construction period would be Rs. 0.50 million only.

#### 7.9.4 Occupational Safety of Workforce

Project execution involves diverse types of construction activities with inherent hazards. The workers involved in the construction works are exposed to these hazards and occupational risks which can cause sickness, injuries, and even fatal accidents. The increased traffic of construction vehicles and associated fugitive dust and noise is the other activity which could have a direct health effects, even fatal to both the project area people and occupational workers. Consideration these probabilities, following safeguards have been suggested to minimize the risk on occupation health and safety of the construction workers.

##### *Safeguard Measures*

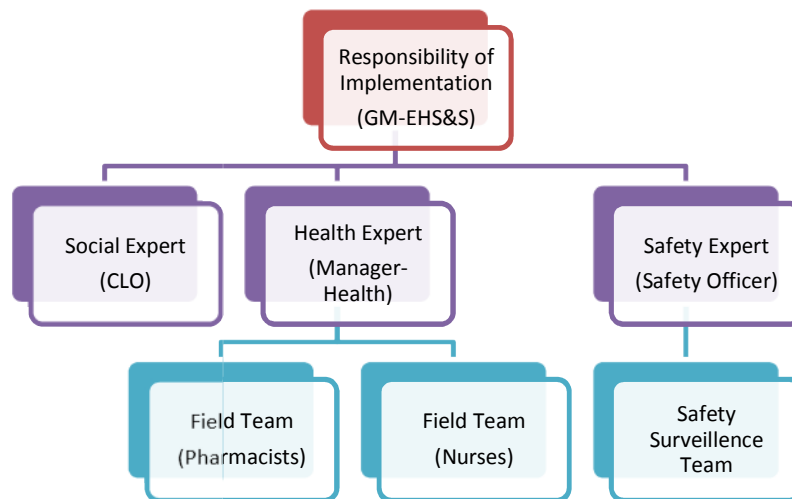
The following measures are suggested to minimize the incidence of vector born diseases.

- Before joining the project, the migrant labourers and technical staff will have to undergo a complete medical check up, which would be arranged and financed by the project authorities.
- The site selected for labour camps should not be located along any natural drainage and water bodies as a safety measure to avoid flooding.
- Adequate drainage arrangements should be in place to direct storm water away from the labour colonies.
- Adequate vaccination and immunization facilities to be provided for workers in the project.
- Deployment of sanitary inspectors and teams to disinfect an area of concern.
- Preparation of occupational health and safety plan and submission to environmental and social unit of Tidong-1 HEP for approval
- Approval of the occupational health and safety plan by environmental and social unit of Tidong-1 HEP for implementation
- Hoarding boards and traffic signs placed at critical locations on the traffic movement, speed, use of horns etc
- Appropriate danger signs in all active construction sites work areas as to the degree of risk in the site
- Provision of Personal Protective Equipments (such as boots, gloves, masks, ear plugs, helmets, safety goggles etc) to the construction workers as to the requirement and risk of the working area and implement the use effectively
- Induction training and refresher training (at least once in three months) to the construction workers and health and safety issues of the construction works
- Insurance of workers

**7.9.5 Organizational Arrangements**

Project-in-charge, NTPGL will be solely responsible for the implementation of this program and facilitate all required resources from top management to the operating team headed by the health expert i.e. Manager-Health. Health Expert will take all necessary measures and actions to ensure safe and healthy environment in and around the project area including affected area including safeguard measures suggested above. For approaching to community, he would always seek the support from Social Expert of the project i.e. CLO, who in turn will be have a consultation and dissemination of information regarding the health activities with concerned villages including respective Panchayats.

**Figure 7-6: Organizational Arrangement**



Organizational arrangement for the same as shown above will be applicable for the implementation of the plan.

**7.9.6 Cost Estimates**

Total cost estimate for the health delivery system for proposed THEP would be Rs. 4.10 Millions only. It includes:

**Table 7-14: Cost Estimates for Health Infrastructures**

S. No.	Health Infrastructure	Budget (Rs. Millions)
1.	Establishment of a PHC in Project Colony area	3.60

2.	Immunization and vaccination programmes and distribution of first boxes in the surrounding villages	0.50
<b>TOTAL</b>		<b>4.10</b>

### 7.9.7 Action plan for Public Health and Occupational Safety

Key features of the plan are mentioned in following table as actionable activities with the defined responsibilities;

**Table 7-15: Action plan for Public Health and Occupational Safety**

Sl. No.	Activity	Project Phase for implementation	Responsibilities
1	Construction and commissioning of Primary Health Centre in the project colony	Construction	NTPGL
2	Immunization programme within the project and in Morang, Thangi and Rispa Panchayats	Construction and Operation	NTPGL
3	Distribution of First Aid Boxes in the labour camps, villages, project components and project offices	Construction and Operation	NTPGL Contractors
4	Pre joining medical check up	Construction	Contractors
5	No labour camp establishment along any natural drainage and water bodies to avoid risks during flooding	Construction	Contractors NTPGL
6	Storm water drains away from the labour colonies	Construction	Contractors NTPGL
7	Vaccination and immunization facilities for workers	Construction	Contractor
8	Cleaning and disinfect of office and labour camps	Construction	Contractor
9	Preparation of occupational health and safety plan and submission to environmental and social unit of Tidong-1 HEP for approval	Construction	Contractor
10	Approval of the occupational health and safety plan by environmental and social unit of Tidong-1 HEP for implementation	Construction	Contractor

11	Hoarding boards and traffic signs placed at critical locations on the traffic movement, speed, use of horns etc	Construction	Contractor
12	Appropriate danger signs in all active construction sites work areas as to the degree of risk in the site	Construction	Contractor
13	Provision of Personal Protective Equipments (such as boots, gloves, masks, ear plugs, helmets, safety goggles etc) to the construction workers as to the requirement and risk of the working area and implement the use effectively	Construction	Contractor NTPGL
14	Monitoring of potable water quality in the camps and offices and health of public in three affected panchayats i.e. Moorang, Thangi and Rispa	Construction	NTPGL
15	Induction training and refresher training (at least once in three months) to the construction workers and health and safety issues of the construction works	Construction	Contractor NTPGL
16	Structural conditions of built structures in the vicinity of areas with damage potential; Tunnel Air Quality; Law and order and Security	Construction Operation	Contractor NTPGL
17	Insurance of workers	Construction	Contractor NTPGL
18	Records to be maintained: Health register, immunization register, first aid training register, occupation Health & safety training register, list of PPEs distributed and available, Group insurance policy	Construction	Contractor NTPGL

## 7.10 Emergency Preparedness Plan

Emergency is an unexpected event due to sudden failure of the system, external threats, internal disturbances, earthquakes, fire & accidents. The first step is to identify the causes, which pose unexpected danger to the structural integrity of structures thereby likely to cause danger to life & property downstream. The potential causes are excessive load, cracks, failure and malfunctioning of sensing instruments, accident, etc caused either by deficiency in design or quality control or by natural occurrence of earthquake or excessive flood etc. These need to be looked into with care. All the structures (underground and above ground) need be designed by adopting suitable factors of safety and standard internationally accepted parameters.

Disaster on Tidong Project can be anticipated due to failure of the Barrage either by manmade or natural causes, fire, cloud burst, tunnel collapse, land slide etc. It is proposed to draw guidelines for reporting procedures, communication system and emergency action committee as follows.

The level at which a situation will be termed a disaster shall be specified. This shall include the stage at which the surveillance requirements should be increased both in frequency and detail. The engineer-in-charge should notify the safety or emergency officer for the following information:

- Exit points for the people.
- Safety areas in underground structures, and
- Nearest medical facility.

An efficient communication system is absolutely essential for the success of any disaster management plan. This has to be worked out in consultation with local authorities. More often, the entire communication system gets disrupted when a disaster occurs. The likely damage areas need to be clearly identified and provided with regular and foolproof communication system.

To ensure co-ordinated action, an Emergency Action Committee should be constituted. The civic administrator may be the Chairman of this committee. The committee may comprise of:

- Deputy Commissioner as Chairman

- V.P of Tidong Power Gen. (P) Ltd. as Co-Chairman
- DGM-Civil
- Safety Engineer on the Project
- Police Officer of the area (preferably DSP level)
- Fire Brigade Representative
- Health Department Representative
- Department of Information & Publicity
- Non-Governmental Organisation / Panchayat member of respective area

Emergency Action Committee will prepare the evacuation plan and procedures for implementation based on local needs and facilities available. The plan should include:

- Demarcation of the areas to be evacuated with priorities.
- Safe route to be used, adequacy of transport for evacuation, and traffic control.
- Safe areas
- Security of property left behind in the evacuated areas, and
- Functions and responsibilities of various members of evacuation teams

All personnel involved in the Emergency Action Plan should be thoroughly familiar with all the elements of the plan and their responsibilities. They should be trained through drills for the Emergency Action Plan. The staff at the site should be trained for problem detection, evaluation and emergency remedial measures. Individual responsibility to handle the segments in emergency plan must be allotted.

Success of an emergency plan depends on public participation, their response to warning notification and timely action. The Public has to be educated on the hazards and key role in disaster mitigation by helping in the planned evacuation and rescue operations

The Company has a designated safety Engineer on the Project who, in co-ordination with the Project In-charge, will carry out all measures necessary for disaster management.

### *Emergency Measures*

The emergency measures are adopted to avoid failure in the system such as lights, fire, means of escape, ventilation shafts etc. The aim of Emergency Action Plan is to identify areas, population and structures likely to be affected due to a catastrophic event of an accident. The action plan should include prevention action notification, warning procedures and co-ordination among various relief authorities.



### **Emergency Lighting**

The emergency lights operated on battery power would be provided at barrage site. The battery system would supply power to at least 25% of the lights at barrage site, intake structure and spillway area for a period of 2 hours. Similar arrangement will also be made at the Power House area.

### **Fire Protection**

The building materials would be of appropriate fire resistance standard. The fire resistance period would be at least 4 hours. Wood shall not be used for any purpose, excluding artificial wood products, which are flame resistant. The materials, which have zero surface burning characteristics, shall be used. Accumulations of refuse of any inflammable material like paper and plastic cartons constitute a major fire hazard and shall not be permitted.

All aspects of fire prevention and control will be dealt in close collaboration with the local fire fighting authority. In fire of electrical origin, water cannot be used until the electric system has been made dead and earthed. For electrical fires, non-aqueous agents like ABC powder, Chloro-Bromo-Methane or CO<sub>2</sub> gas, shall be utilized for fire fighting. Fire extinguishers with these agents shall be provided at static installations.

### **Action plan for Emergency Preparedness**

Key features of emergency management plans are mentioned in following table as actionable activities with the defined responsibilities;

**Table 7-16: Action plan for Emergency Preparedness**

<b>Sl.No.</b>	<b>Activities</b>	<b>Project Phase for implementation</b>	<b>Location / Persons</b>	<b>Responsibilities</b>
1	Identification of exhaustive list of emergencies	Pre-construction	-	NTPGL
2	Constitution and notification of Emergency action committee and their contact numbers	Construction Operation	Notification at Lambar, Morang & Rispa villages in respective panchayats and Project offices on site and at	NTPGL Contractor

			Reckong Peo	
3	Training and awareness on emergency preparedness and mock drill every 6 months	Construction Operation	All project workers, employees, contractors, villagers residing along the Tidong stream and respective Panchayat members	NTPGL Contractor
4	Provision of standby ambulance to evacuate the injured at the earliest to project site hospital	Construction Operation	Upstream works near Lambar village and Downstream works near Morang and Rispa village	NTPGL & Contractor
5	Provision of stabilizing equipments and facilities to the injured before he could be moved to the nearest hospital with good facilities.	Construction Operation	Upstream works near Lambar village and Downstream works near Morang and Rispa village	NTPGL Contractor
6	Provision of firefighting equipment and trained personnel to fight fire	Construction Operation	All project components	NTPGL Contractor
7	Provision of battery operated emergency lights	Construction Operation	All project components	NTPGL Contractor
8	Provision of sirens to inform the people of the emergencies	Construction Operation	All project components	NTPGL Contractor
9	Monitoring of the above activities	Construction Operation	-	NTPGL Contractor
10	Records to be maintained: Emergency response team with contact numbers,	Construction Operation	Office	NTPGL Contractor

	Emergency register, list of emergency numbers display.			
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## 7.11 Environment, Health, Safety & Social Monitoring Plan

The impacts envisaged due to the construction of the Tidong-1 HEP would result from the exploration activities, construction of tunnels and approach roads, etc. and may continue up to generation of electricity. During the construction phase, the activities like site preparation, approach roads, traffic movement, excavation, drilling, blasting, foundation, tunneling, deployment of machinery, erection, transportation, dumping will be taken up. All these activities would affect the environment by increased noise levels and deteriorated water and air qualities.

The purpose of Environmental, Health, Safety and Social (EHS&S) Monitoring is to evaluate the effectiveness of implementation of EHS&S Management Plan by periodically monitoring the important environmental and social parameters within the impact area, so that any adverse affects are detected and timely action can be taken.

Monitoring of various plans suggested in report is most important step in the success of Environment and Social Management Plan and its implementation process. The project proponents will monitor the social management plans including PCDP and environmental management plans including ambient air quality, noise levels, groundwater quality and quantity, soil quality and solid wastes in accordance with an approved monitoring schedule in consultation with the Regional Office of Himachal Pradesh State Pollution Control Board (HPSPCB).

### 7.11.1 Monitoring of Air, Water Quality & Noise Level

Monitoring the environmental parameters is required to evaluate the effectiveness of implementation of various mitigation measures. A suggested monitoring protocol, based on the predicted impacts, is given in Table 7-17 below;

Table 7-17: Environmental Indicators Monitoring Program for NTPGL

Sl. No.	Type	Locations	Parameters	Frequency	Duration of Monitoring
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1	Ambient Air Quality	<ul style="list-style-type: none"> <li>Lambar village</li> <li>Ruwang village</li> <li>Rispa Village</li> </ul>	SO <sub>2</sub> , NO <sub>x</sub> , CO, PM <sub>10</sub> , PM <sub>2.5</sub>	24 hourly 1 sample / week / location	Construction phase
2	Stack emission	<ul style="list-style-type: none"> <li>DG Sets</li> <li>Incinerator</li> </ul>	SO <sub>2</sub> , NO <sub>x</sub> , CO, SPM	1 sample / month / location	Construction and operation phase
2	River Water	<ul style="list-style-type: none"> <li>500 metres Upstream &amp; 1000 meters Downstream of diversion structure</li> <li>500 meters Upstream &amp; Downstream of Tidong stream at powerhouse area before confluence with Satluj</li> </ul>	BOD, DO, TSS, Conductivity & Turbidity Coliform	1 sample / month / location	Construction and operation phase
3	Waste water	<ul style="list-style-type: none"> <li>Seepage water from underground works</li> <li>Labour camp discharge</li> <li>STP outlet</li> </ul>	TDS  BOD, COD, TSS, TDS, Conductivity	2 samples /month / location	Construction phase  STP outlet to be monitored during operation phase
4	Drinking water	<ul style="list-style-type: none"> <li>Work area,</li> <li>labour camps and</li> <li>colony</li> </ul>	Drinking water parameters as per IS:10500	2 samples /month / location	Construction phase
5	Noise Levels	<ul style="list-style-type: none"> <li>Barrage</li> <li>PWD Road Nr Barrage</li> <li>Power House</li> <li>PWD Road Nr Barrage</li> <li>Lambar village</li> <li>Ruwang village</li> <li>Rispa Village</li> </ul>	Equivalent noise levels	1 sample 24 hourly day and night /month / location	Construction phase
6	Ecology	Study on impact and mitigation on fishes	Progress of study	Quarterly	till the completion of study
7	Eco Restoration	Preparation of Land development plan and its implantation	Progress of development and implementation of plan	Once a month	Till the completion of study restoration of all identified sites
8	Afforestation and CAT activities	Follow up with forest department		Quarterly	till the completion of CAT and afforestation
9	Emergency	Preparation and	Progress of	Fortnightly	till the work is

	Preparedness	implementation of plan	work		completed
10	Social Parameters	• Preparation and Implementation of R&R	Preparation and Implementation	Once a month	till completion
		• Compensations in lieu of forest produce	Progress of compensation	Once a month	Till the matter is settled
		• Community facilities (Sanitation, Water Supply, Sewerage etc.)	Progress of work	Once a month	Construction and operation
		• Community development work	Progress of work	Once a month	Operation phase
		• Functioning of Grievance Redressal cell	Effectiveness of functioning and number of received and redressed	Quarterly	Construction and operation
		• Functioning of Public Consultation and disclosure plan	Effectiveness and number of meetings	Quarterly	Construction and operation

### 7.11.2 Monitoring of Management Plans

Monitoring of management plans is as follows,

#### *Clearance and Approval Plan*

Status of all the clearance will be assessed every quarter by Environment Manager and reported to GM-EHS&S

#### *Environmental Training Plan*

Status of all training plan will be evaluated every quarter by Environment Manager and reported to GM-EHS&S

#### *Traffic Management Plan*

Progress of Traffic management plan will be evaluated by NTPGL. The safety team of the project would monitor the progress of the plan and provide the report to GM-EHS&S.

#### *Construction Labour Management Plan*

The project authorities would ensure that the project workers are getting the facilities as per plan. Identity card to all workers would be provided with identity card for their identification and will be provided free fuel wood. The project boundary must be demarcated clearly so that workers could not enter in the villages and forests without any valid reason. These issues

would be monitored by Environment Manager and reported to GM-EHS&S of NTPGL every fortnight.

#### ***Pollution Abatement Plan***

The measures which are required to monitor are proper treatment of wastewater, maintenance of air emissions from equipment, proper dumping of garbage, sanitation system in the labour colony, its transportation and disposal etc. The project authorities would provide the monthly progress report to Manager-Environment and would monitor the progress and provide the report to GM-EHS&S.

#### ***Terrestrial Ecology Management Plan***

Progress of this plan will be monitored by NTPGL. The environment team of the project would monitor the progress every quarter and provide the report to GM-EHS&S.

#### ***Aquatic Ecology Management Plan***

Progress of this plan will be monitored by NTPGL. The environment team of the project would monitor the progress every quarter and provide the report to GM-EHS&S.

#### ***Erosion Abatement and Muck /spoil Management Plan***

Progress of this plan will be monitored by NTPGL and HPSPCB. Inspection of existing check dams for cracks and structural stress will be monitored every six month. The environment team of the project would monitor the progress and provide the report to GM-EHS&S.

#### ***Public Health and Occupational Safety Management Plan***

This plan would be implemented by the project authorities in consultation with State Labour Department and State Health Department. All the medical inspection reports and other records will be monitored over any abnormal activity over the year. The medical cell of the project would monitor the progress and provide the report to GM-EHS&S.

#### ***Emergency Preparedness Plan***

An Emergency preparedness plan has been prepared by the project and a framework is suggested in this report. However, the plan is insufficient to the expected emergencies and required training and communication. It is recommended that new plan to evaluated and monitoring will be conducted by Safety officer of NRRPL every six month and reported to GM-EHS&S to assess the awareness & training adequacy level imparted as par the required plan.

### ***Social Management Plan***

Progress of implementation of Social Management Plan, R&R Plan and PCDP would be evaluated by NTPGL every six month. The Social cell of the project would monitor the progress and provide the report to GM-EHS&S.

### ***Catchment Area Treatment Plan***

The work carried out by State Forest Department as per approved CAT plan Environment Cell of the project and conduct regular communication to follow up with the state forest department. Project should get in touch with HP Forest Dept. on a routing basis to appreciate the progress of CAT, however, it has often been experienced that HPFD do not provide the necessary details for monitoring of CAT to the project authority. In such case project should get the information related to the area that the CAT is being implemented and carry out a high resolution satellite study in the catchment area to study to understand the interventions of the forest department (Check dams, afforestation, river training, etc.)

### ***Fishery Development Plan***

Though the State department will be executing the fisheries development plan however, the environment cell of the project would also monitor the progress of Plan through regular communication with concerned department. The final evaluation of fishery development plan would be carried out by GM EHS&S, NTPGL every six month.

### ***Public Consultation & Disclosure Plan***

CLO of NTPGL will follow the plan every month for implantations and keep on monitoring the development of activities and would monitor the progress and provide the report to GM-EHS.

## **7.11.3 Organizational Arrangement for Effective Monitoring Plan**

For the effective and consistent functioning of any project, an Environment, Health, Safety and Social Management Plan should be established at the site. The EHS&S Plan should include the following:

- Environment, Health, Safety and Social (EHS&S) Management Cell
- Awareness and Training
- Record Keeping and Reporting
- Environmental Audits and Corrective Action Plans
- Grievance Redressal Mechanism

### *Environment, Health, Safety and Social (EHS&S) Management Cell*

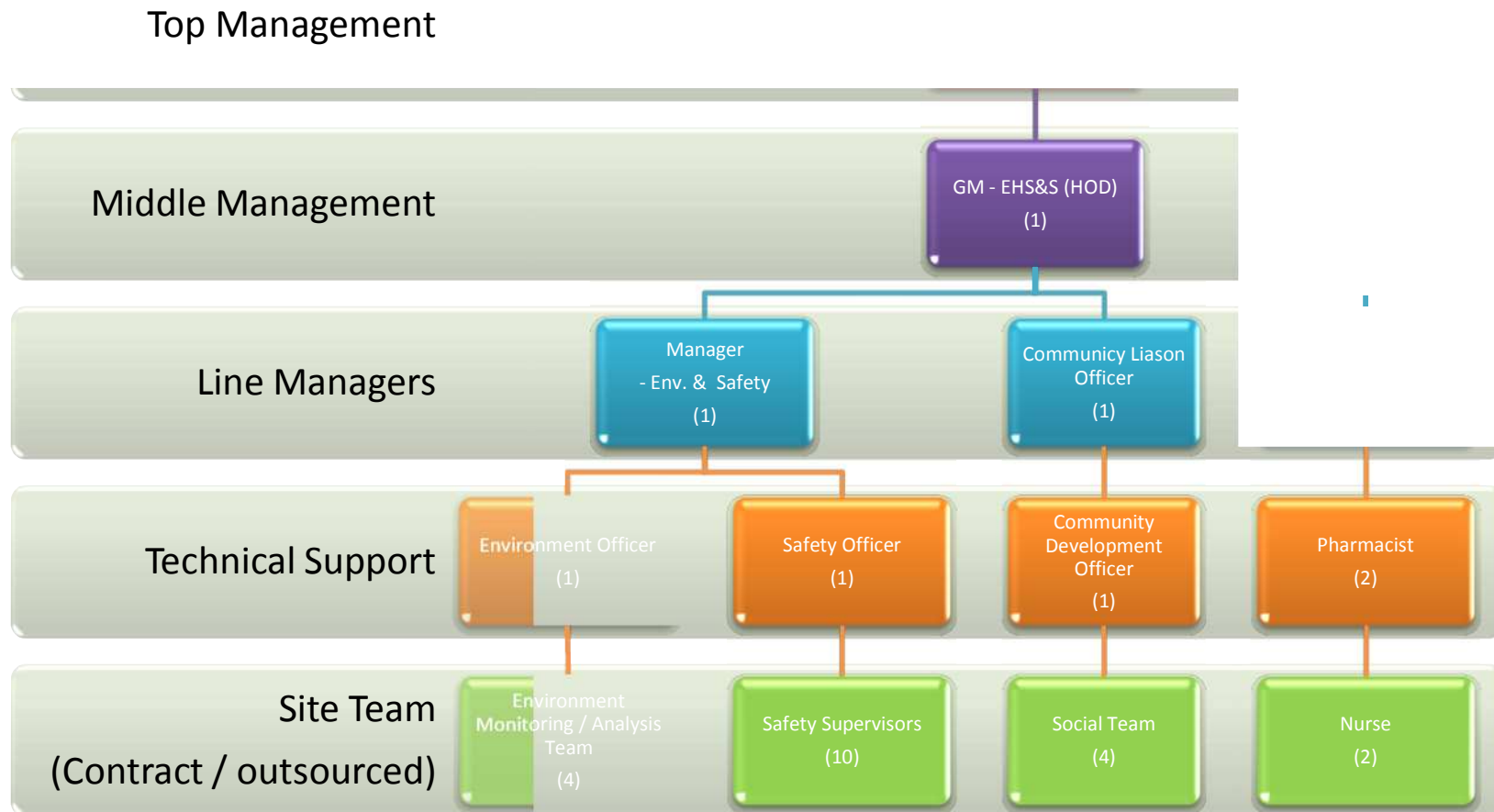
Besides having an Environmental Management Plan, it is also imperative to have a permanent organizational set up which is responsible of ensuring its effective implementation and conduct regular monitoring of social, health and safety parameters along with environmental aspects. The major duties and responsibilities of Environmental Management Cell shall be as given below:

- To implement the environmental, health, safety and social management plan by setting and maintaining appropriate institutional arrangements at the project site.
- To assure regulatory compliance with all relevant rules and regulations by way of independent Monitoring and Evaluation agency for a third party assessment
- To ensure regular operation and maintenance of pollution control devices,
- Helping the utilization of village development funds in each of the villages and implementation of Community development plan.
- Monitoring the management plan and implementation activities as per approved schedule. Review and interpretation of monitored results and corrective measures in case monitored results are above the specified limit.
- Maintain documentation of good environmental practices and applicable environmental laws as ready reference.
- Maintain environmental related records.
- Address grievances received from the project stakeholders.
- Ensure that the Management plans are implemented in accordance to the guiding policies of NTPGL and IFC.
- Arrange training programs for officers to be involved in the management plans.
- Develop corporate linkages with financial institutions and banks to facilitate financing of income generating schemes for the project affected families.
- Compliance of stipulated conditions by the regulatory agencies and reporting of the same as per the specified period.

To achieve above objectives, the suggested EHS&S Management Cell hierarchical structure is as below,



Figure 7-7: Organization Structure for Environment, Health, Safety and Social Department of NTPGL at Tidong-1 HEP



## *Roles, Responsibilities and Qualifications*

### *At top Management*

Overall responsibility of implementation for the protection of Environment, Occupational Health, Safety of workman & employees and maintaining social harmony lies with the top management of the project.

### *At Middle Management*

#### *General Manager – Environment, Health, Safety & Social (EHS&S)*

The General Manager will Head the Environmental, Health, Safety and Social Management Cell and will be responsible for overall implementation of the EHS & S Management plans. He will be functionally reporting to the Project In-Charge so that commitment and focus on EHS&S matters is maintained throughout the organization. He shall also be responsible for risk analysis, vulnerability assessment, response action plans, mitigation & implementation strategies and disaster preparedness, disaster impact, relief and rehabilitation with respect to floods, droughts, earthquakes, industrial and chemical hazards, road accidents and fires.

He will have to review on a daily basis with the team members, their allocation of responsibilities and functioning of all EHS&S plans. He will have to co-ordinate with the outside agencies including contractors for monitoring and controlling the related tasks. He shall also interact with the health officer to collect & synthesize the workers' sickness record and analyze the possible occurrences of occupational diseases and implement the remedial measures to eradicate the root cause.

#### *Qualifications:*

A competent person should have a Post Graduate Degree in Environment (M.Tech/ MSc) or above. An additional degree /diploma in Industrial Safety will be favourable. He should also have an overall experience about 15 years of managing EHS&S in the same sector.

### *Line Managers*

#### *Manager – Environment and Safety*

He will be responsible for on-site implementation of Environmental Management Plans, maintaining the schedule, duration and parameters to be monitored. He will also be continuously assessing the risks / hazards from the project activities, thereafter suggesting the remedial measures to mitigate / minimize the potential impacts of hazards identified in the project. He will be supported by an Environment Officer and a Safety Officer for executing the site activities. He will also supervise the implementation of environmental protection measures viz. water sprinkling/ spraying, proper drainage system including culverts and other protective measures/ arrangements.

He will ensure that a suitable emergency preparedness plan has been prepared and implemented on site with required training to the concerned person.

*Qualifications:*

He/ She should have a Post Graduate Degree in Environment ((M.tech/ M.Sc.) or above. An additional degree / diploma in Industrial Safety will be favorable. He should also have an overall experience about 5 years of managing EHS&S in the same sector.

**Community Liaison Officer (CLO)**

The CLO will directly interact with the neighboring community for effectively implementing community development plan. CLO will also be facilitating the community for their training needs assessment and capacity building which helps improving income generation capacity of the individuals. CLO will co-ordinate with the functioning of Land Acquisition and Rehabilitation and Community development and regularly interacts with different stakeholders, specially the PAFs to get the feedback on implementation process. CLO will report to General Manager – EHS&S for all functional matters.

In addition to CLO's functionality, there will be a Grievance Redressal Cell (GRC) the details of which are provided later. As a whole CLO will be leading the Rehabilitation and Community Development cell which will have a Community Development Officer (CDO) and a team of 4 supporting staff, who would oversee the entire individual and community rehabilitation and development. The CDO that will also execute the income restoration and skill upgradation programmes for the affected villagers.

Other responsibilities of the Rehabilitation and Community Development cell will be:

- Establish rapport with the community and hold public consultation and disclosure sessions as required by the Public Consultation Disclosure Plan (PCDP);
- Act as a contact point for grievance redressal and dispute settlement at the village level;
- Ensure adequate implementation of rehabilitation process, payment of compensation, training and income generation programme;
- Facilitating the villagers and Gram Panchayats in the preparation of village micro plans and its implementation,
- Establish linkages with labour co-operatives and local employment exchanges to identify potential employment opportunities for project affected families,
- Develop linkages with ongoing Government programmes at the district, block and village levels.

*Qualifications:*

CLO should have a degree in social works or equivalent and relevant experience for about 3 years.

**Health Manager – (Doctor)**

Health manager of the project will be working on occupational health and hygiene related issues such as work related injuries, review hygienic condition of labour camps, possibilities of

outbreak of diseases, HIV / AIDS related matter for migratory community and their interaction with the local community. He will also be responsible for addressing the health related matter of the neighboring community. He will be supported by 2 pharmacists and 2 nurses to cater health related requirements in project and in adjacent villages. The area being remote, it is often difficult to find a post qualified doctor. Under such circumstances project can make arrangements with an institution / individual who can visit the Project occupational health center at least once a week.

*Qualifications:*

An MBBS degree will be mandatory.

**Technical Support**

**Environment Officer and Monitoring / Analysis team**

Roles and responsibilities of this Environment Officer will involve following;

- Sampling of Air, Water and Noise for the prescribed parameters as per Environmental Management Plan.
- Ambient air quality, workplace air quality and noise will be sampled in underground and above ground areas including roads and villages in the vicinity. DG Stack monitoring will also be conducted by the team
- Water samples will be collected from selected upstream and downstream locations of Tidong stream and discharge from labour camps and colony.
- Analysis of desired parameters in all the collected samples.

*Qualifications:*

Environment officer should have a Masters qualification in Environmental Science or equivalent, with about 3 years of experience in the sampling and analysis of Air, Water and Noise parameters. He will be supported by a team of 4 personnel for conducting these activities. Each member of this team needs to have Bachelors degree in Chemistry or Environmental science.

**Safety Officer**

The Safety officer will be responsible for safety functions of the project both during construction and operation phases. He will be leading the Hazard Identification and Risk Assessment (HIRA) for all the activities in the project. Formulation of risk mitigation measures based on HIRA and their effective implementation will be one of his core responsibilities. He will be supported by 10 numbers of Safety Supervisors who will supervise and issue daily work permits to construction works at all construction sites, roads, underground works, etc.

He will ensure that a safety induction system is developed and implemented at site and all the officers and workers are adhering to this system. Development of training calendar, based on need assessment will be prepared by safety officer for the implementation in co-ordination with HR department. Safety officer will complete the injury investigation after their reporting, initiated by line manager from the spot of accident. He will also ensure that all the concerned persons are imparted with effective training as a measure of successful implementation of the emergency preparedness plan.

The area being remote, It's often may be difficult to a post qualified safety officer on site. Under such circumstances project can made arrangements with an institution / individual who can visit the Project at a frequency such as every alternate week or every week in a month. In such case he will be working offsite and communicating to site to ensure all the required systems are in place and his responsibilities are fulfilled.

*Qualifications:*

Minimum qualification for Safety officer is “Diploma in Industrial Safety” from a government recognized institution or an internally recognized similar qualification. He should have at least 3 years of experience in construction safety including minimum 1 year safety experience of underground works.

**Community Development Officer (CDO)**

The Community Development Officer will help the stakeholder villagers to formulate development plans for the community. He will help in capacity building, training sessions, interactions with related government departments to help villagers in implementations of various development plans. He will also assist the CLO in establishing rapport with the community and hold public consultation and disclosure sessions as required by the Public Consultation Disclosure Plan (PCDP). He will help villagers and *Gram Panchayats* in the preparation of village micro plans and its implementation, ensure adequate implementation of rehabilitation process, payment of compensation, training and income generation programme.

*Qualifications:*

A degree on social studies/ social work and should have worked in the area of community development in rural sector.

**Pharmacist**

The pharmacist will be responsible for following;

- Drug distribution and dispensing,
- Patient Safety,
- Clinical program development,
- Communications with patients and doctor,
- Visiting the project sites on a fixed schedule to extend the facilities.

*Qualifications:*

A pharmacist will have a minimum qualification of Diploma in Pharmacy or equivalent.

Site Team

The above Managers and Supervisors will be assisted by a team of Site Executives comprising of Environment Site Executive/ Green belt development, Environmental Analysis Team/ Sr. Chemist, Safety Supervisor/ Executive, Social Work Executive and Nurse reporting to their respective Managers/ Line managers.

#### **7.11.4 Awareness and Training**

Training and human resource development is an important link to achieve sustainable operation of the facility and environmental management.

For successful functioning of the project, relevant EHS &S Plans should be communicated to the following groups of people:

Residents and Contractors

Residents must be made aware of the importance of waste segregation and disposal, water and energy conservation. This awareness can be provided through leaflets and periodic meetings. They should be informed of their responsibilities for successful operation of various environmental management schemes inside the premises.

Site Staff

Relevant personnel at site must be trained for the following:

- Collection, transport, treatment and disposal solid and hazardous waste.
- Operation and maintenance of Treatment systems and reclamation system.
- Techniques for waste minimization, water conservation & energy conservation.
- Applicable environmental, health and safety regulations and compliance requirements for the same.
- Functioning of the Environmental Management System including environmental monitoring, reporting & documentation needs.

#### **7.11.5 Record Keeping and Reporting**

Record keeping and reporting of performance is an important management tool for ensuring sustainable operation of the township. Records should be maintained for regulatory, monitoring, operational issues and as mentioned in action plans of every management plan. Typical record keeping requirements for the proposed housing complex is summarized below:

**Table 7-18: Record Keeping Requirement**

Parameter	Particulars
Solid Waste Handling and Disposal	<ul style="list-style-type: none"> <li>➤ Daily quantity of waste received</li> <li>➤ Daily quantity treated and recycled</li> <li>➤ Daily quantity sent for landfill</li> </ul>
Sewage Treatment	<ul style="list-style-type: none"> <li>➤ Daily quantity of raw and treated sewage</li> <li>➤ Quantity and point of usage of treated wastewater</li> <li>➤ Treated wastewater quality</li> </ul>
Regulatory Licenses (Environmental)	<ul style="list-style-type: none"> <li>➤ Environmental Permits / Consents from HPSPCB/ MOEF</li> <li>➤ Copy of Waste manifests as per requirement, labour license, BOCW Registration, etc.</li> </ul>
Monitoring and Survey	<ul style="list-style-type: none"> <li>➤ Records of all monitoring carried out as per the finalized monitoring protocol.</li> </ul>
Accident reporting	<ul style="list-style-type: none"> <li>➤ Date and time of the accident</li> <li>➤ Sequence of events leading to accident</li> <li>➤ Name of hazardous waste involved in the accident</li> <li>➤ Chemical datasheet assessing effect of accident on health and environment</li> <li>➤ Emergency measure taken</li> <li>➤ Step to prevent recurrence of such events</li> </ul>
Other	<ul style="list-style-type: none"> <li>➤ Log book of compliance</li> <li>➤ Employee environmental, health and safety records</li> <li>➤ Equipment inspection and calibration records, where applicable</li> <li>➤ Vehicle maintenance and inspection records</li> <li>➤ Communications with government on EHS&amp;S issues</li> </ul>

### **7.11.6 Monitoring of Environmental parameters & Third Party EHS&S Audits and Corrective Action Plans and Cost**

NTPGL will establish an Environment, Health, Safety and Social organization structure to implement and monitor the suggested mitigation measures. Regular monitoring of all mitigation measures will be conducted as suggested in the ESIA report by the EHS&S team. Key aspects to be monitored during Construction period and operation period are mentioned in Table 7-17. In addition to internal monitoring, a third party EHS&S Audit will be carried out every quarter during the entire construction period. Project will prepare a time bound Corrective Action Plan to close the findings of the third party audit. A budget of Rs. 3.00 million to allocated for Equipment cost of environmental monitoring and Rs. 3.00 million to allocated for third party auditing for two years i.e. till commissioning in 2013.

Total cost of mitigation measures in ESIA has been estimated to Rs. 226.35 Millions. Out of which an amount of Rs. 188.5 millions have already been deposited towards the cost of CAT



Plan, Compensatory Afforestation, Cost of Trees, Net Present Value of the diverted forest, Fisheries Management, LADA Works, and environmental monitoring by HPSPCB. Rest of the i.e. Rs. 37.85 million is to be allocated by project on various mitigations measures including 1 year fisheries study, installation of incinerator, sewage treatment plant, monitoring of environmental parameters, third party EHS&S quarterly audit for 2 years, primary Health centre, demographic survey, annuity policy of vulnerable families, etc.





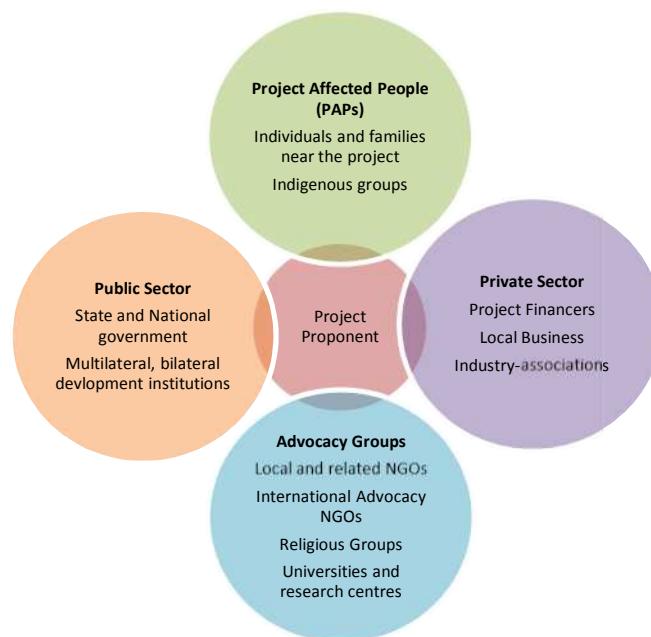
## 8. PUBLIC CONSULTATION & DISCLOSURE PLAN

Public Consultation and Disclosure Plan (PCDP) are important tools applied throughout the development phase of the project to ensure transparency, accountability and two-way communication between the project proponent and the stakeholders.

Public Consultation plays a critical role in raising awareness of a project’s impacts and gaining agreement on management and technical approaches in order to maximize benefits and reduce negative consequences. Furthermore, consulting and collaborating with the public makes good business sense. Public Consultation can lead to reduced financial risk (from delays, legal disputes, and negative publicity), direct cost savings, increased market share (through good public image), and enhanced social benefits to local communities.

Public Disclosure is vital as information is very critical to the effective participation of affected citizens near the project. An informed public will better understand the trade-offs between project benefits and disadvantages; be able to contribute meaningfully to project design; and have greater trust in its new corporate neighbors.

**Figure 8-1: Relationship of Stakeholder with Project Proponent**



Given that the Tidong HEP has been identified by the International Finance Corporation (IFC) as a “Category A” project, the project proponent is required to develop and implement a PCDP. This document provides the Public Consultation and Disclosure Plan (PCDP) for the Tidong HEP as proposed by NSL Renewable Power Pvt. Limited (NTPGL), hereinafter referred to as the “Project Proponent” or “NSL”. This PCDP outlines community engagement activities that were undertaken during the preconstruction activities and execution of the project. This PCDP also provides an outline of planned community engagement activities that are to be undertaken leading up to and during the construction of this HEP.

PCDP seeks to define a technically and culturally appropriate approach to Consultation and Disclosure. The goals are to ensure that adequate and timely information is provided to Project Affected People and other stakeholders and that these groups are given sufficient opportunity to raise their concerns and provide cooperation through their involvement as and when required.

Objective of Public Consultation and Disclosure Plan, summarized below, are to ensure that:

- all stakeholders are identified and included in the consultation and disclosure process;
- initial information disclosure about the project is accurate and comprehensible to the non-technical stakeholders and the local population;
- adequate and timely information is provided to the project affected people and other stakeholders;
- all stakeholders are given sufficient opportunity to voice their opinions, concerns and suggestions;
- these opinions, concerns and suggestions of the stakeholders influence project decisions;
- regular feedback is provided to the stake holders on the project activities future plans; and
- effective communication continue during the construction and operational phases of the proposed project.

## 8.1 National Regulations, Policies and IFC Requirements with respect to PCDP

Various acts, policies and regulations have provisions for public consultation / hearing / disclosure to make public and the stakeholder aware of the developments of the project, especially during the land acquisition and environmental clearance stage. Regulations and requirements related to Public Consultation and Disclosure Plan, applicable to the project, are listed as below. Salient features of these regulations can be referred in Chapter-2 i.e. Legal and Administrative Framework;

- Environment Impact Assessment Notification, 2006
- The Land Acquisition Act, 1894
- National Rehabilitation and Resettlement Policy (NRRP) 2007
- Panchayats Extension to Schedule Areas Act, (PESA) 1996
- Himachal Pradesh Panchayati Raj Act, 1994
- IFC's Requirement on Environmental and Social Safeguards

Detailed provisions under these

## 8.2 Benefits of Public Consultation

Public Consultation, according to the International Finance Corporation (IFC), *"...is a tool for managing two-way communication between the project sponsor and the public. Its goal is to improve decision-making and build understanding by actively involving individuals, groups and organizations with a stake in the project. This involvement will increase a project's long-term viability and enhance its benefits to locally affected people and other stakeholders"* (IFC, 1998). In accordance with IFC and World Bank guidelines the project, has placed consultation at the centre of its activities that affect the local community. The project's philosophy is to regard consultation as an organic and dynamic process rather than a single event. A fundamental requirement in World Bank/IFC policies on resettlement, land acquisition and compensation is a framework for Public Consultation, participation, and the establishment of a process to redress the grievances of affected people. Consultation with the affected population and with officials of local government, civil society and other representatives of the affected population is essential for gaining a comprehensive understanding of the types and degrees of adverse effects.

Stakeholder involvement in both the project development and environmental decision-making provides valuable information on its social, economic and environmental implications. Through early, proactive and continual engagement of stakeholders, negative impacts can be minimised or eradicated and positive impacts can be maximised.

Ensuring that all stakeholders and affected groups have been identified and consulted has therefore been the emphasis of the consultation process for the Tidong Hydro Electric Project, with opportunities to obtain a wide range of views and to ensure a widespread understanding of the project.

Also, for effective participation of affected citizens near the project, disclosure of project information and project progress update is very important. An informed public will better understand the trade-offs between project benefits and disadvantages; be able to contribute meaningfully to project design; and have greater trust in its new corporate neighbors.

### **8.3 Process adopted for Public Consultation**

As discussed above, public consultation and disclosure in environmental decision-making is an important element of the Environmental and Social Impact Assessment (ESIA) process. In line with this, consultation has been an integral and on-going part of the ESIA process for the Tidong Hydro Electric Project.

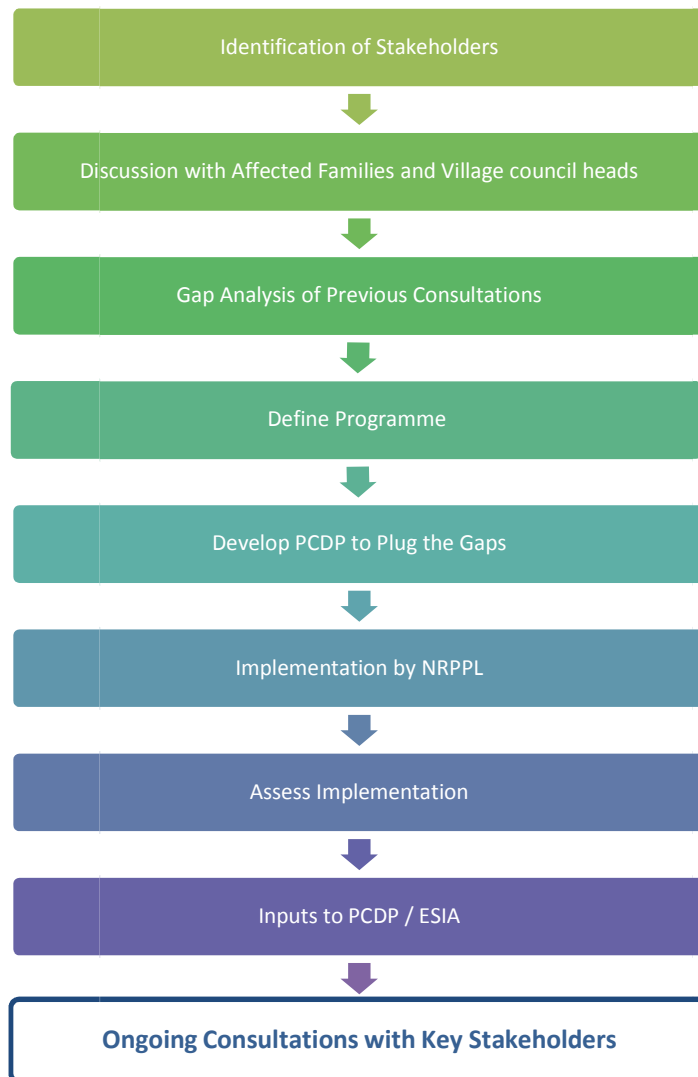
Stakeholder Engagement is a process where the concerns of various stakeholders are understood and adequately and appropriately addressed. It should be noted that stakeholder identification and involvement are often context-specific, i.e. what works with one project may not be appropriate for another (IFC, Doing Better Business Through Effective Public Consultation and Disclosure: A Good Practice Manual, 1998). With these principles in mind the project used the following methods for stakeholder identification:

- Formal and informal Public Consultation meetings;
- Document and literature review;
- Household surveys;
- Informal unscheduled discussions;

This entire process commenced in April 2005, with informal consultation taking place during the initial scoping visit by the NTPGL team and continued during subsequent visits till the construction activities started on site. Ongoing consultation has continued throughout the pre-construction activities and shall continue throughout the project life from initial construction, through operation to decommissioning. Consultation with a range of

stakeholders has been conducted both formally and informally. Entire process of developing PCDP has been shown in Figure 7-2 below.

**Figure 8-2: Consultation Process at NTPGL**



## 8.4 Identification of Stakeholders

Involving the right stakeholders during appropriate stages of the consultation process has been a key concern of the project ESIA process. This has been best achieved using appropriate stakeholder identification techniques. Stakeholder identification is undertaken to determine who will be directly or indirectly affected, positively or negatively, by a project (commonly called project affected people or project-affected groups), and who can contribute to or hinder its success (commonly called other relevant stakeholders). It is important for the project sponsor to be comprehensive in identifying and prioritizing all project stakeholders, including the disadvantaged and voiceless. Those identified will then need to be consulted to varying degrees, depending on level of impact, at strategic points during the life of the project.

A stakeholder is any group or individual who may affect or be affected by a specific project. They should be prioritized by identifying direct (those who have a direct interest or influence on the project) and indirect stakeholders whose interest is indirect. Stakeholders may also be internal within the Project or external to the Project. Stakeholder identification is useful to prioritize, analyze and assess stakeholder issues while creating management systems and strategies to address specific concerns. The stakeholders identified for the Project are presented in Table 1.2.

**Table 8-1: Stakeholder Mapping**

Stakeholder Group	Profile of the Stakeholder
<b>Direct Internal Stakeholders</b>	
NSL Renewable Power (P) Limited (NTPGL) and the Project Management Team	NTPGL, the wholly-owned subsidiary of Hyderabad-based Nuziveedu Seeds Limited, and has been formulated to develop renewable energy projects. NSL Renewable Power Private Limited (NTPGL) is already engaged with three more hydel projects in Himachal besides Tidong. A total capacity of about 155MW is under various stages of construction in Himachal Pradesh.
Employees of NTPGL	During construction, the total number of employees for the hydro power project will be around 65 to 75 people. They are likely to be mainly from the local area. It has been made incumbent upon industrial units being set up in the State to employ a minimum of 70% of its manpower whether on regular basis or daily basis or contractual/sub contractual basis or by any other mode from amongst the bonafide Himachalis.
<b>Direct External Stakeholders</b>	

Ministry of Environment and Forests, Government of India	The project obtained its Environmental Clearance in 1997 in accordance with the EIA notification 1994 and 2006 (As mentioned in the EC letter). The project has also obtained Forest clearance for diversion of forestland, the projects will also abide by the conditions of forest clearance.
Government of Himachal Pradesh	The state government holds the stake via Department of Multipurpose Projects and Power as “First Party” in Implementation agreement, and for the overall supervision of the project in the state.
State Pollution Control Board	The project requires Consent To Establish from State Pollution Control Board under the Air and Water Act. The project will abide by the conditions of the consent.
HP State Forest Department	State forest department directly responsible for the forest area in the project area and adjacent forest directly exposed to the project work and the migrant workforce.
Financial Intermediaries	They represent financial institutions like the IFC and other lenders who are undertaking project financing. These stakeholder groups tend to be the influential in term of their set of guidelines which NTPGL would need to comply.
Project Affected Families	They represent the families whose land has been acquired by the project for installation of various project components. They are key stakeholders as their primary occupation is agriculture and loss of land would directly affect their source of income. However, for this project no relocation of the household is required for the project as no houses will be acquired.
Local Community	They represent the villagers of Thangi, Rispa and Morang wherein the project location will fall. They will be affected by movement of men and machinery to project site, noise from construction, blasting, migrant population etc. There will be sharing of community resource, road, hospitals etc with the project activities and migrant workers.
Tata Power Limited	NTPGL has entered into a Power Purchase Agreement with Tata Power Limited. The power generated will be procured by Tata Power Limited to fulfil their objectives.
HP Power Transmission Corporation Limited (HPPTCL)	HPPTCL will be constructing the 220kV DC Line from Tidong HEP (100 MW) upto Kashang HEP at their cost. Further the Power will be transmitted to Sherpa Colony through their existing and proposed transmission system upto interfacing with central transmission utility PGCIL's (Power Grid



	Corporation India Limited, Government of India) 400 kV Line. Tidong Project has to pay Open Access charges for the Intra State Transmission System to HPPTCL (State Transmission Utility) and for Inter State transmission System to PGCIL.
Contractors	Contractors and suppliers whom NTPGL is likely to engage/ or have already engaged in the construction phase for procuring labour, material etc. will be bound by the requirements and commitments made by NTPGL to the community and other stakeholders.
Migrant Workers	These represent workers within and outside the district who have settled down in the vicinity of the project in the hope of getting gainful employment in the project. They would tend to be semi-skilled as well as skilled.
<b>Indirect Stakeholders</b>	
Panchayat: Thangi	The local Panchayat from whom NTPGL has obtained a No-Objection Certificate (NOC) dated 13-Jan-2009. Lumber village where the upstream construction is proposed falls under the Thangi Panchayat. Lumber village however is located at about 8-km upstream of Thangi Village. This NOC has been issued by the Panchayat after entering into an agreement with the project on 13-Jan-2009 with certain conditions by the Panchayat for issuing the NOC for project.
Panchayat: Rispa	NTPGL has obtained a no-objection certificate (NOC) from Rispa Panchayat dated 5-Apr-2009. The proposed power house for the project falls in village Lizang of Rispa Panchayat. This NOC has been issued by the Panchayat after entering into an agreement with the project on 30-Mar-2009 with certain conditions by the Panchayat for issuing the NOC for project.
Panchayat: Morang	NTPGL has obtained a no-objection certificate (NOC) dated 1-Apr-2009. The access road to proposed power house and proposed staff colony for the project falls in village Ruwang of Morang Panchayat. This NOC has been issued by the Panchayat after entering into an agreement with the project on 31-Mar-2009 with certain conditions by the Panchayat for issuing the NOC for project.
Block and District Administration	The Block Development Office as well as Land Acquisition Collector Cum – Additional District Magistrate (ADM), Pooh,

	District Kinnaur, H.P. who have approved and provided their consent for the project.
Local Area Development Authority (LADA)	A Local Area Development Authority (LADA) has been formed by the Himachal Pradesh Government to oversee the Environmental Management of the project and the implementation of the Environmental Management and Local Area Development (EMLAD) Plan. The activities of the LADA will be financed by setting aside 1.5% of the total capital cost of the Project.
Local media and NGOs	Media groups who have covered the proposed project as well as NGOs that are locally active and involved with community activities.

### 8.5 Stakeholder Engagement Process – Review of Past Consultations

To a certain extent, the formal Public Consultations and stakeholder engagement process is directed by the regulatory authorities as part of statutory requirement like the various notices served under the Land Acquisition Act, the Public Consultation event for obtaining Environmental Clearance from Ministry of Environment and Forests, Government of India, etc. However, other formal consultations with stakeholders were also conducted by the proponent and consultants e.g. consultation for project land requirement, for seeking ‘No Objection Certificate’ from affected villages.

Informal consultation and meetings with various stakeholders have been an ongoing process in the project. Members of the ESIA team also had informal discussions with local affected communities and local government officials between March and May 2011. The household survey, which was carried out during 2006 to 2010, provided a further opportunity for discussions with villagers about their issues of concern.

The formal stakeholder consultations organized for Tidong HEP are as below:

- a. Public Consultation as per Environmental Impact Assessment Notification, 1994 in association with Himachal Pradesh State Pollution Control Board (HPSPCB);
- b. Consultation with Gram Panchayat, Rispa and Tidong Valley Paryavaran Samrakshan Vikas Samiti by project representatives;
- c. Involvement of villagers of Rispa in joint enumeration of affected trees on adjacent forest land by State Forest Department along with project representatives;

- d. Series of project specific consultations during 2006 to 2011 with three affected Gram Panchayats, for seeking support for the execution of project. About 20 consultations with the members of village and Gram Panchayat Rispa, 18 consultations with Gram Panchayat Thangi and about 10 consultations with the members of village and Gram Panchayat Morang were conducted;
- e. Clean Development Mechanism (CDM) Stakeholder Consultation collectively with members of villages, gram panchayats of all three affected villages, district administration and other concerned government departments;

The proceedings, apprehensions and responses from these consultations are summarized in the subsequent paragraphs:

#### **Public Consultation as per EIA Notification 1994 (and 2006) in Jul-07**

NTPGL had submitted EIA report and Environment Management Plan to Himachal Pradesh State Pollution Control Board (HPSPCB) with a request to conduct the Public Consultation. Based on the request and guidelines from Notification Number SO-318(E) dated 10-Apr-1997 by the Ministry of Environment and Forests, Government of India, as a requirement for the Environmental Clearance, HPSPCB had scheduled the Public Hearing at two places, i.e. near proposed diversion structure in Village Lumber, Panchayat Thangi, Tehsil Morang and in Village & Panchayat Rispa, Tehsil Morang, near proposed power house.

Information regarding the Public Consultation was published in the Newspapers including the local language Hindi Newspapers on 20-Jun-2006 with details of time and dates. The Public Consultation was conducted to integrate the public suggestions, views, comments and objections from interested persons/ groups/ organizations on the proposal with a view to have maximum participation.

Public Consultation was organized by HPSPCB on 21-July-2007 at village Lumber. This consultation was attended by representatives from HP State Pollution Control Board (PCB), three representatives from NTPGL, other concerned departments and nearly 150 villagers. However, the event scheduled at Village Rispa was not attended by the residents. Morang village was not a part of the project when the EIA was undertaken and therefore was not included in the public consultation process as required under the EIA notification. However, several informal public consultations were undertaken by the project proponent at later dates in order to obtain No Objection Certificate from the village Panchyat.

Detailed minutes of the public consultation area attached as **Annexure -8.1**. However, a brief of public concerns and respective responses by the NTPGL, recorded by the HP State Environment Protection & Pollution Control Board are given below.

1. Damage due to construction of road from Lumber village to Adit-1:

The villagers were worried that construction of the proposed 2.7 km long approach road from village Lumber to Adit-1 would cause destruction of large number of Chilgoza, Deodar, Kail and Bhojpatra trees. The other project construction activities they felt would also affect the nearby forest area. They felt that cutting of these trees would not only affect the ecology and environment of the area but also the economy as some of the species are rare and found only in Kinnaur district.

The project proponent informed the villagers that about 39.05 ha of forest land (including 1261 trees) would be diverted for the project. To compensate the loss of standing trees on the diverted forest area, an amount of Rs 26.676 million had been paid to the Forest Department for compensatory afforestation over an area of 78.10 ha. NTPGL updated the villagers that a total of 590 trees were damaged during the construction works, out of which 209 trees were damaged during the construction of the above mentioned approach road. The NTPGL had already made the payment of Rs 8.3 million to Forest Department against this damage of 373 trees.

2. Damage due to Muck from Adit-1:

The villagers expressed their concern that the construction activities at Adit-1 are likely to generate large quantities of muck and improper disposal of this muck can cause damage to adjoining areas which included orchards and house.

During Public Consultation, NTPGL informed the villagers that muck disposal was planned only at designated dumping sites in such a way that no spillage of excavated material takes place and cause no damage to houses and orchards. It was informed that the State Board will be conducting continuous monitoring for ensuring compliance to norms. All the muck disposal sites will be covered with vegetation after leveling and dressing the top surface. Layer by layer filling of muck will be done and compacted mechanically. Dumping sites on sloping ground will be protected adequately against any possible slide/slope failure through engineering measures i.e. retaining wall.

During the site visit, it was observed that three Muck Dumping sites have been developed, reportedly designated as PA1, PA2 & PA4. These sites are provided with Gabion Walls (with 100 mm thick RCC cladding on outer site) against any possible slide/slope failure as per the approval of the Pollution Control Board

3. *Drying of water from Gara and Duba Khad (water channels/ rivulets) and water sources in the area:*

The Gara and Duba Khad lies in the alignment of Head Race Tunnel (HRT) and water from these khads is used for irrigating about 800 bighas of land, which lies in the landslide prone zone. The villagers were concerned that these khads might dry due to the construction of HRT.

In response, the project informed, that inventory of water sources, falling in the project area has been prepared by ADM-Pooh and a videographic survey has been conducted for all those sources. NTPGL further informed that the tunnel has been aligned deeper to obtain a minimum rock cover of about 157 m over the tunnel at the point of crossing. However, in case damages are observed due to project activities, it will be adequately compensated by the project proponent.

4. *Affect on Piber village:*

The Head Race tunnel (HRT) is proposed to pass from below the Piber village which makes it most vulnerable village in the project area. The project construction can cause destruction of forest in the Piber area which is one of the major sources of wood, manure and natural herbs for the villagers. The villagers raised their concern that issue of Piber village has not been addressed in the Detailed Project Report (DPR).

The project envisages that almost all the works will be underground and there will be no major emissions (point or fugitive) from the project that will damage the vegetations in the area. The project proponent had ensured that fugitive dust emissions from the roads will be suppressed by keeping road wet by sprinkling water regularly through water tankers.

During site visit, it was informed by NTPGL that as per the final alignment, the tunnel is over 1000 m horizontally away from village Piber causing no concern about the tunnel. Also, the minimum rock cover over the HRT has been estimated to be more than 150 m, hence no impact on the village due to vibrations will be present.

It was observed that one tanker has been deployed for sprinkling water on road for suppression of fugitive dust from roads. However, the dust from project was still a general concern of the villagers; therefore, project needs to assess the effectiveness of water sprinkling and increase the numbers of tankers if required to effectively suppress the fugitive dust.

5. *Damage to general environment of the area due to project construction:*

The villagers expressed concern that the main source of income in the project affected area is cultivation of apple, almond, apricot, chilgoza etc. The project construction activities might affect the cultivation of these crops. Also, the pollution associated with project activities will have negative impact on the cash crops. Increased human activity in the area is also likely to increase the pressure on the forest.

In response to this, the Project clarified that almost all the works will be underground and there will be no such emissions from the project that will damage apple or any other crop in the area.

6. Impact on Flora and Fauna:

The villagers expressed their apprehension about the impact of project activities on the existence of species of animals and plants.

In response to this apprehension, it was apprised by NTPGL that the project site area does not harbor any wildlife at or near the site of powerhouse or barrage. The wild animals like snow leopard, bear etc live at high altitude and are quite away from the proposed site. The project will undertake Silviculture development and plantation of the medicinal plants (trees, shrubs and herbs) plantation in degraded patches of forest lands. A budgetary provision of Rs 0.6 million had been made for this purpose.

7. Damage to local culture:

The proposed project will attract labour from outside the local area. Laborers from different culture may arrive with different mannerism, way of interaction, faith, beliefs, dressing, superstitions etc. The villagers feared that this difference can cause conflicts, quarrels leading to law and order problems.

The project assured the villagers that interaction of migrant labour with the local community will be avoided to the extent possible. NTPGL also assured the villagers that there will be proper trainings and awareness programme for the migrant labour with an emphasis to respect the local culture and practices.

The local employment details shared by NTPGL with AECOM also indicate that more than 70% staff working on site and office is local, however, all the labourers engaged in for the project are migratory in nature because local people do not prefer to be engaged as labourers.

Other issues like Cold desert, danger to National Security, melting of glaciers were also discussed during the process of Public Consultation.

### **Consultation with Gram Panchayat, Rispa and Tidong Valley Paryavaran Sanrakshan Vikas Samiti in Jul-06**

The Environmental Public Consultation at village Rispa was boycotted by the villagers as they did not want the project staff colony and approach road to power house, pass through their village i.e. from the left bank of the Tidong stream. Therefore later, the Tidong Valley Paryavaran Samrakshan Vikas Samiti and Gram Panchayat of Rispa invited NTPGL for a meeting to raise their concerns. The meeting was held on 22-July-2006 and attended by 19 participants. The main issues discussed in the meeting were the proposed alignment of access road through village Rispa, associated environmental concerns due to such alignment and threat to existential, cultural and water security of village Rispa. The responses of NTPGL to the concerns of villagers of Rispa are given below:

- The alignment of proposed access road to Power house and Surge shaft has been shifted to the right bank of Tidong Khad such that it does not pass through the middle of Rispa village.
- Since no project road passes through the middle of Rispa village, there will be no threat to the cultural and existential security of village.
- It was clarified that no source of water exists near the proposed location of Power house, surge shaft and switch yard.

A surge shaft road, approximately 1.5 km falling in the Rispa Panchayat, would however require uprooting of trees lying in the Rispa Panchayat. Involvement of villagers of Rispa in enumeration of affected trees in Sep-2006

NTPGL had invited the people of Rispa Panchayat to be involved in the exercise of enumeration of the trees coming in alignment of surge shaft road by the Forest Department through a letter dated 13-September-2006. List of participants was not available, however, it was reported by the project proponent that representative of Rispa village was present on all the days during the enumeration and had signed the enumeration details.

### **Consultations with all three affected Gram Panchayats (Thangi, Rispa and Morang) during 2006 to 2011**

The project area falls in three Gram Panchayats namely Thangi, Rispa and Morang. NTPGL consulted all the three affected gram panchayats before the acquisition of private land and for obtaining “No Objection Certificate” (NOC) from these affected panchayats. Reportedly project proponent has already held about 10 to 20 numbers of consultations with Thangi, Rispa and Morang each. Gists of these consultations are attached as **Annexure-8.2**. In the process NOC was obtained from respective panchayats, though these NOC’s were not

statutorily required by any of the Rules or Acts in force as is evident from the Letter dated June 2007 from DC Kinnaur to the Principal Secretary (Power) to the Govt. of H.P, appended as **Annexure-8.3.**

The NOC's from Thangi, Rispa and Morang panchayats dated 13-Jan-2009, 5-Apr-2009 and 1-Apr-2009 respectively were obtained after entering into the agreements with the panchayats. The agreements and NOCs received from the affected panchayats are attached as **Annexure-8.4.** These agreements with the panchayats include the following major commitments from the project proponent.

- The Project proponent to grant the compensation towards direct and indirect impacts of the project. The amounts stipulated for Thangi and Rispa is Rs. 20 million each and for Morang the amount is Rs. 10 million. This amount is apart from the provisions committed under LADA (Local Area Development Authority), R&R Plan (Resettlement and Rehabilitation Plan) & EMP (Environmental Management Plan) by the proponent. *Currently, entire amount has been released by the project, except the last instalment of Rs. 5 million for Panchayat Rispa, which is being released shortly.*
- Provision of employment to project affected people in the project, based on their qualifications and related available vacancies. *A total of 38 persons from the three project affected panchayats have been employed by NTPGL in the project. Out of this, 10 persons are from project affected families.*
- Priority to be given to villagers in the contract works based on their ability and competitive bidding. *Already 42 no. of contracts have been given to villagers of project affected area.*
- Provision of water if any such source in the project area dries up due to project activities, installation of street lights, compensation for loss of crops, if any, due to project activities, pollution and dust abatement, limited blasting, etc.

#### **Clean Development Mechanism (CDM) Stakeholder Consultation in Feb-2011**

CDM Stakeholder's meeting was conducted by Tidong Power Generation Pvt. Ltd. at Up-Mohal Ruwang, Tehsil Morang in which local villagers, government officials and district administration were invited. The total of 132 people participated in the meeting held on 24-Feb-2011. The consultation started with a presentation on salient features of the Tidong HEP by the proponent.

All participants were apprised of details the components of Tidong-I HEP (100MW) along with brief activities of NSL Renewable Power Pvt. Ltd. (NTPGL) under which Tidong Power Generation Pvt. Ltd. is operating as one of the group companies. The Project Proponent also informed the participants about the payments made them to the Forest Department, Fisheries



Department, HP State Pollution Control Board and LADA against Environment Management Plan.

### **Consultation of Project Affected Families and affected Gram Panchayat members by IFC and NTPGL Apr-2011**

A focus group discussion was undertaken by a team of IFC experts on 19-Apr-11 at project site to consult the group and about land acquisition, project activities, related issues and overall support.

During the event villagers widely confirmed that they will be continuing their support to the project execution as long as their grievances are addressed as and when required. They strongly encouraged IFC to lend to NTPGL and stated that more such projects were needed, including the proposed Tidong-II upstream of Tidong-I which they are fully aware.

Further the issues of dust generation from project activities, impact of blasting for surge shaft road construction, trapped private land in the powerhouse access road were discussed and requests were made for increasing employment opportunities, strengthening grievance redressal mechanism, additional street Lights and development of Shamshan Ghat (Cremation Grounds). Detailed minutes of the discussion can be referred in **Annexure-8.5**.

## 8.6 Community Welfare Works undertaken by NTPGL

As per the information received from proponent, following payments have already been made to Forest Department, Fisheries Department, HP State Pollution Control Board and LADA against Environment Management Plan. However, the status of progress of the works with Government Departments for which the finance was provided is not known. Table 8-2 provides the amount of money provided by NTPGL under various heads.

**Table 8-2: Payments already made by NTPGL against EMP**

S. No.	Description	Amount paid (Rs in millions)
<b>Forest Department</b>		
	Compensatory Afforestation	26.676
	Net present Value	24.488
	Cost of Trees	16.800
	CAT Plan	72.484
	Damage of 373 trees during construction activities	8.393
	Reclamation Plan (for sand quarry, dumping areas etc.)	4.558
<b>Fisheries Department</b>		
	Fishery Development	11.1
<b>HP State Pollution Control Board</b>		
	Monitoring of EMP	1.3238
<b>Local Area Development Authority (LADA)</b>		
	Implementation of works through LADA	32.12
<b>Development of Muck Disposal Sites</b>		
	Development of Muck Disposal Sites	18.426

Community development programs are good practices to build trust and maintain local support. Consultation during this process ensures that potential investments in community development are effective in generating benefits and community support. Direct consultation with the local population is essential to identify the community's most pressing needs. Not only urgent physical and infrastructure needs of the community, but also improving the economic livelihoods of the poorest or most vulnerable members of the community are very vital aspects. Along with the payments mentioned above M/S NTPGL took up various

community development and welfare works in the project affected areas, some of which have been mentioned below:

1. A sum of Rupees 0.30 million was paid to Pradhan Gram Panchayat, Rispa on 29-Apr-10 for repair of temple.
2. About 20 numbers of street lights have been provided to Village Rispa.
3. Preference has been given to the eligible contractors of Project affected three Gram Panchayats in the award of works.
4. Preference has also been extended for Employment to the persons of above Project Affected Panchayats in accordance with their qualifications/ fulfillment of requisite criteria. About 39 persons from three affected Gram Panchayats have been employed.
5. Hiring of vehicles including tippers required for construction of the Project from the villagers of Project Affected Panchayats.
6. Two annual installments totaling to Rs. 32.12 millions out of total provision of Rs. 80.3 millions against LADA has been given to Local Area Development Committee for the development activities of three Project Affected Panchayats.
7. NTPGL has committed to provide one percent free power after commissioning of the Project to the Govt. of H.P. for the development activities of three Project Affected Panchayats.
8. A contribution of Rs. 0.5 million towards the Annual Kinnaur Sanskritik Mahotsav in the year 2009 and 2010 each was made by NTPGL to preserve and protect the culture of the people of Kinnaur.
9. The infrastructure added to the area such as approach road to power house of 2.80 kms will provide convenient access to villagers of Rispa and Morang after the project commissioning.
10. Resettlement grants and other payments/ facilities as covered in the Resettlement and Rehabilitation Plan of the Project, which is under finalization with Govt. of H.P., shall also be provided to the Project Affected Families.

Additionally NTPGL will provide free power @12% of deliverable energy for the period of 12 years from date of commissioning of 1<sup>st</sup> Generating unit and for the balance agreement period of 28 years, it will be provided @18% of deliverable energy of the Project. This is as per Implementation Agreement signed on 28-Jul-06 between NTPGL with Govt. of Himachal Pradesh.

## 8.7 Ongoing and Proposed Consultation and Community Relations

For the directly affected people, those who lost land or livelihood or income, a regular and continuous process of consultation will be held throughout the rehabilitation process. However, for the public in general, the frequency of the consultations and their focus will vary with the changing project phases.

With other stakeholders such as the government officials and district administration, the project proponents should maintain a regular dialogue and information sharing at least every quarter.

Public consultation with affected families and other stakeholders is an ongoing activity. Therefore regular consultations will be continued with the concerned stakeholders throughout the life of the project. A list of proposed activities and the schedule to be followed with different stakeholders i.e. Gram Panchayats, Affected Families, Community, Contractors, Employees, Construction workers, Government and Local Media & NGO is provided in following Table 8-3 to Table 8-10.

**Table 8-3: Consultation and Disclosure with affected Gram Panchayat Members**

Event / Tasks	Mode of Communication	Target group	Status / Action Plan	Schedule / frequency
<b>Pre Construction stage</b>				
Consultation with key stakeholders and preliminary information dissemination	General meeting of Gram Sabha and / or other meetings	Affected villagers and Gram Panchayat members from Morang, Rispa and Lambar villages	<b>Completed</b> the activity during 2006 - 07	During primary survey
Consultation and information dissemination on loss of land to stakeholders	-do-	Project Affected families	<b>Completed</b> for the pre construction stage	Before Land acquisition
Providing information about land acquisition process	-do-	Generally to Project affected families	<b>Completed</b>	Before land acquisition
Disclosure of environmental impacts	General meeting	Affected villages	<b>Completed Partially</b> NTPGL provided the	<i>NTPGL shall immediately</i>

of the project through the non-technical executive summary of the EIA report in local language	of Gram Sabha and / or other meetings		complete EIA report to the Panchayats along with the Detailed Project Report in English language. The village community has express concerns that they are not fully aware of the project activities and their impacts.	<i>arrange for sharing of project information and related impacts in local language through print and visual media. Also a non technical summary to be made available at prominent places including Panchayat and site office.</i>
Consultation and dissemination of information on the employment opportunities and income generation programs	-do-	Project affected families and other members of affected villages	Partially Completed	<i>Continuous process, to be undertaken prior to commencement of all new activities requiring new workers</i>
<b>Construction Phase</b>				
Prepare hand outs on project information and impacts, in Hindi and set up an arrangement for dissemination of project related information/planning to the stakeholders prior to commencement of all	-do-	Gram sabha, key members of affected panchayats and Project affected families, affected villagers	Villagers have expressed lack of information dissemination about the project.  NTPGL shall involve in greater information sharing	Continuous process to be undertaken on three monthly basis

major project activities			about the status of project.	
Develop and Use alternate media e.g. street plays and video films etc to disseminate about project features using the local dialect to ensure that all members of the affected community gain understanding of project design, its layout, the likely social and environmental impacts and the proposed mitigation measures	General meeting of Gram Sabha and / or other meetings	All members of the affected community	To be undertaken by NTPGL as part of information dissemination to address concerns regarding lack of project information	To commence by the end of Sep-2011. It will be an ongoing process and shall be repeated every 6 months
Dissemination of information on health and hygiene requirements and benefits of the same by conducting focus group meetings and distributing leaflets in Hindi and display of information boards with do's and don'ts at all the labour establishments.  An audio visual presentation pertaining to the site specific activities including environment, health and safety concerns, to be prepared and	-do-	All the contractors, labours and service provider related with project	To be undertaken by NTPGL on regular basis.	By the end of Jun-2011  This will be an ongoing activity to be repeated whenever new contractor / labourer are inducted into the project.

presented to the contractors and labours force as a part of their induction as a good practice.				
Consult about dust generation due to project activities and mitigation measures adopted by the project.	General meeting of Gram Sabha and / or other meetings	Gram sabha, key members of affected panchayats and Project affected families	To be undertaken as a structured process	Quarterly starting from July 2011
Consult on Traffic Movement during Various stage of Construction	-do-	Gram sabha, key members of affected Panchayats and affected villagers	To be undertaken as a structured process	To be undertaken prior to movement of heavy components or machinery related to construction
Health Safety and Environmental concerns to be consulted prior to starting any new activity in the project such as new place of blasting, opening of new tunnel / excavation, new material storage areas, etc and inform villagers about the related impacts and mitigation measures required of those activities.	-do-	Gram sabha, key members of affected Panchayats and affected villagers	To be undertaken as a structured process	To be undertaken prior to commencement of all major activities as explained in corresponding task column.
Information and consultation on	-do-	All the project labourers,	Grievance Redressal Mechanism is yet to	Grievance Redressal

grievance redressal and dispute settlement mechanism set up by the project		contractors, employees, and affected villagers including Gram Sabhas	be established. The villagers are not aware of any structured process.	mechanism to be established and communicated to the stakeholder by the end of Aug-11
<b>Pre Commissioning Stage</b>				
Consultations for addressing environmental and social aspects of the plant operation	General meeting of Gram Sabha and / or other meetings	Gram sabhas, key members of affected Panchayats and Project affected families	Proposed	Before the commissioning of project
Dissemination of information on Emergency preparedness and Disaster Management Plan	-do-	Gram sabhas, key members of affected Panchayats and Project affected families	Proposed	Before commissioning of project
Consultation before commissioning of project regarding reduced flow of water in the affected stretch of Tidong stream.	-do-	Gram sabhas key members of affected Panchayats and Project affected families	To be completed	Before the commissioning of project
Consultation for opening of project road for public use.  Evaluation will be conducted with respective increase in traffic movement due to project vehicles and mitigation measures.	-do-	Villagers and gram sabhas from Rispa and Morang	Proposed	Before opening the project road for general public



Operation Phase				
General Consultation about project status and current matter of concern w.r.t. the project execution or operation.	-do-	Gram sabhas, key members of affected panchayats and Project affected families	Proposed	Every six month

**Table 8-4: Consultation and Disclosure with Affected Families**

Event / Tasks	Mode of Communication	Target group	Status / Action Plan	Schedule / frequency
<b>Pre Construction stage</b>				
Diversion of Forest land, enumeration of trees, private land acquisition, preliminary information dissemination.	Face to face meeting, group meeting	Affected families i.e. whose land has been acquired for Tidong-1 HEP.	<b>Completed</b> the activity before land acquisition	Once before private land acquisition
Consultation and information dissemination on loss of land to stakeholders	Face to face meeting, group meeting	Project Affected families	<b>Completed</b> for the pre construction stage	Before Land acquisition
Providing information about land acquisition process	Face to face meeting, group meeting	Project Affected families	<b>Completed</b>	Before land acquisition
Consultation and dissemination of information on the employment opportunities and income generation programs	Face to face meeting, group meeting	Project affected families	<b>Partially Completed</b>	Continuous process, to be undertaken prior to commencement of all new activities requiring new

				workers
Provide advice on availability of alternate land for purchase and utilization of compensation money in the best possible way.	Face to face meeting, group meeting	Project affected families	<b>To be undertaken</b>	By the end of Jul-11
<b>Construction Phase</b>				
Information and consultation on grievance redressal and dispute settlement mechanism set up by the project	Face to face meeting, group meeting	Project affected families	<b>Completed Partially</b> Grievance Redressal Mechanism has been established. Mechanism to be shared with the focus group.	Once on establishing the mechanism
<b>Pre Commissioning Stage</b>				
Consultations for addressing environmental and social aspects of the plant operation	Face to face meeting, group meeting	Project affected families	<b>To be completed</b>	Before the commissioning of project
<b>Operation Phase</b>				
General Consultation about project status and current matter of concern w.r.t. the project execution or operation.	Face to face meeting, group meeting	Project affected families	<b>To be completed</b>	Every six month

**Table 8-5: Consultation and Disclosure with Community**

Event / Tasks	Mode of Communication	Target group	Status / Action Plan	Schedule / frequency
<b>Pre Construction stage</b>				

Diversion of Forest land, enumeration of trees, private land acquisition, preliminary information dissemination.	Public meetings, printed leaflets, posters and banners	Community of Gram Panchayats of Morang, Rispa and Lambar villages	<b>Partially Completed</b> During various meetings with community 2006 -07  Prepare hand outs on project information and impacts, in Hindi and set up an arrangement for dissemination of project related information/planning to the stakeholders prior to commencement of all major project activities	Once for all community during primary survey
Consultation and information dissemination on loss of land to stakeholders	Public meetings	Community of Gram Panchayats of Morang, Rispa and Lambar villages	<b>Completed</b> During various meetings with community 2006 -07	Before Land acquisition
Providing information about land acquisition process	Public meetings	-do-	<b>Completed</b>	Before land acquisition
Disclosure of environmental impacts of the project through the non-technical executive summary of the EIA report in local language	Public meetings, Sharing of documents on demand	-do-	<b>Completed Partially</b> NTPGL provided the complete EIA report to the Panchayats along with the Detailed Project Report in English language. The village community has express concerns that they are not fully aware of the	NTPGL shall immediately arrange for sharing of project information and related impacts in local language through print and visual media. Also a non technical

			project activities and their impacts.	summary to be made available at prominent places including Panchayat and site office.
Consultation and dissemination of information on the employment opportunities and income generation programs	Public meetings, Sharing of documents on demand.	Community of Gram Panchayats of Morang, Rispa and Lambar villages	Partially Completed	Continuous process, to be undertaken prior to commencement of all new activities requiring new workers
<b>Construction Phase</b>				
General working practices within the project, influx of work force, women safety, traffic on public road, movement of vehicles, noise, dust emission, cultural issues due to migratory labours, etc.	Public meetings	Community of Gram Panchayats of Morang, Rispa and Lambar villages	<p><b>Completed Partially</b></p> <p>Villagers have expressed lack of information dissemination about the project.</p> <p>NTPGL shall involve local NGO and people for information sharing about the status of project.</p> <p>Develop and Use alternate media e.g. street plays and video films etc to disseminate about project features using the local dialect to ensure</p>	Continuous process to be undertaken on 6 monthly basis. Activity to be commenced by the end of Sep-2011. It will be an ongoing process and shall be repeated every 6 months

			<p>that all members of the affected community gain understanding of project design, its layout, the likely social and environmental impacts and the proposed mitigation measures.</p> <p>Dissemination of information on health and hygiene requirements and benefits of the same by conducting focus group meetings and distributing leaflets in Hindi and display of information boards with do's and don'ts at all the labour establishments.</p> <p>An audio visual presentation pertaining to the site specific activities including environment, health and safety concerns, to be prepared and presented to the contractors and labours force as a part of their induction as a good practice.</p>	
Consultation and	Public meetings,	Community of Gram	<b>To be completed</b>	Quarterly

disclosure about Environment, Health, Safety and Social Concerns due to project activities and mitigation measures adopted by the project and prior to starting any new activity in the project such as new place of blasting, opening of new tunnel / excavation, new material storage areas, etc and inform villagers about the related impacts and mitigation measures required of those activities.	printed leaflets, posters and banners	Panchayats of Morang, Rispa and Lambar villages	To be undertaken as a structured process as discussed above	starting from September 2011
Disclose on Traffic Movement during Various stage of Construction	Public meetings	-do-	<b>To be completed</b> To be undertaken as a structured process as discussed above	To be undertaken prior to movement of heavy components or machinery related to construction
Information and consultation on grievance redressal and dispute settlement mechanism set up by the project	Public meetings, printed leaflets, posters and banners	-do-	<b>Completed Partially</b> Grievance Redressal Mechanism has been established. Mechanism to be shared with the focus group.	Once on establishing the mechanism
Revised Environment and Social Impact Assessment Report – 2011	Public meetings, Sharing of documents on demand.	-do-	<b>To be completed</b> Immediately the ESIA – 2011 Report is finalized. Process to be completed within 1 month.	NTPGL shall immediately arrange for sharing of Updated ESIA-2011 in local language

				<p>through print and visual media to be made available at prominent places including Panchayat and site office.</p> <p>This activity to be completed within 30 days after finalization of ESIA 2011.</p>
<b>Pre Commissioning Stage</b>				
Consultations for addressing environmental and social aspects of the plant operation	Public Meeting	-do-	<b>To be completed</b>	Before the commissioning of project
Dissemination of information on Emergency preparedness and Disaster Management Plan	Public Meeting	Villagers residing along the Tidong stream and along the road in the downstream of diversion structure.	<b>To be completed</b>	Before commissioning of project
Consultation before commissioning of project regarding reduced flow of water in the affected stretch of Tidong stream.	Public Meeting	Community of Gram Panchayats of Morang, Rispa and Lambar villages	<b>To be completed</b>	Before the commissioning of project
Consultation for opening of project road for public use. Evaluation will be conducted with respective increase in	Public Meeting	Community of Gram Panchayats of Morang, Rispa and Lambar villages	<b>To be completed</b>	Before opening the project road for general public

traffic movement due to project vehicles and mitigation measures.				
<b>Operation Phase</b>				
General Consultation about project status and current matter of concern w.r.t. the project operation.	Public Meeting	Community of Gram Panchayats of Morang, Rispa and Lambar villages	<b>To be completed</b>	Every six month

**Table 8-6: Consultation and Disclosure with Contractors**

<b>Event / Tasks</b>	<b>Mode of Communication</b>	<b>Target group</b>	<b>Status / Action Plan</b>	<b>Schedule / frequency</b>
<p>Consultation on general employment conditions, company's code of conduct, Health Safety &amp; Environmental concerns and other contract, regulatory and IFC requirements.</p> <p>Such as accommodation to be provided to workers, drinking water, food, fuel, heating arrangement, etc.</p>	Letter and face to face meeting	Head person of the contracting agency	<p><b>Completed Partially</b> M/s SCL infratech ltd. has been informed formally in Jun-2011</p> <p>All petty contractors to be informed and the requirements to be incorporated about requirements.</p>	During hiring of contractor
Information and awareness about requirements of labor laws and minimum wages, working hours etc. is a key input	Display in Reckong Peo office and site offices, the abstracts of applicable labour laws including minimum wages, working hours, provisions of overtime, etc.	All Contractors	To be completed	Continuous activity



Information and consultation on grievance redressal and dispute settlement mechanism established by the company.		All the project contractors	<b>Completed Partially</b> Grievance Redressal Mechanism has been established. Mechanism to be shared with contractors.	On induction of every contractor
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**Table 8-7: Consultation and Disclosure with Employees**

Event / Tasks	Mode of Communication	Target group	Status / Action Plan	Schedule / frequency
Consultation on general employment conditions, company's code of conduct and Health Safety & Environmental concerns.	Letter and face to face discussion	All employees	<b>Completed</b> On commencement of employment	On every new recruitment
Disclosure of employers HR Policies and procedures in practice	Display of abstract	All employees	To be completed for newly developed HR Policies and Procedures as per IFC PSs within 3 months of release of same.	Once on release of policies and procedure and once on induction of every new employee thereafter
Information and consultation on grievance redressal and dispute settlement mechanism	Face to face discussion and display of general notice in the office	All employees	<b>Completed Partially</b> Grievance Redressal Mechanism has been established. Mechanism to be shared with employees.	On induction of every employee
Consultation before retrenchment (if required)	Letter & Face to face discussion	Affected, employees	Scheduled to be completed before any retrenchment	30 days before retrenchment if required
Dissemination of information on Emergency preparedness and	General Meeting, e-mails, training in group and display boards in staff colony.	All employees Entire team working in the project including managers,	Scheduled to be completed before any commissioning of project	Before commissioning of project

Disaster Management Plan		staff and their families accommodated in the colony.		
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**Table 8-8: Consultation and Disclosure with Construction Workers**

Event / Tasks	Mode of Communication	Target group	Status / Action Plan	Schedule / frequency
<b>Pre Construction stage</b>				
Induction to project activities and various requirement of project such as code of conduct for work site, labour camps and Health Safety & Environmental concerns.	Meeting with Group of workers	Batch of Construction workers to be inducted for the project construction works	<b>Completed Partially</b> All the workers should formally be informed about expectation from them other than construction work.	During induction of every workers
<b>Construction Phase</b>				
Induction to project activities and various requirement of project such as code of conduct for work site, labour camps and Health Safety & Environmental concerns.	Meeting with Group of workers	Batch of Construction workers to be inducted for the project construction works	<b>Completed Partially</b> All the workers should formally be informed about expectation from them other than construction work.	During induction of every workers
Information and awareness about requirements of labor laws and minimum wages, working hours etc. is a key input	Display in Reckong Peo office and site offices, the abstracts of applicable labour laws including minimum wages, working hours,	All workers	To be completed	Continuous activity

	provisions of overtime, etc.			
Information and consultation on grievance redressal and dispute settlement mechanism	Meeting with Group of workers	All the project labourers	<b>Completed Partially</b> Grievance Redressal Mechanism has been established. Mechanism to be shared with workers.	On induction of every worker
<b>Pre Commissioning Stage</b>				
Consultation before retrenchment (if applicable)		All the project labourers	Scheduled to be completed before any retrenchment	30 days before retrenchment when particular construction activity is about to complete

**Table 8-9: Consultation and Disclosure with Government**

Event / Tasks	Mode of Communication	Target group	Status / Action Plan	Schedule / frequency
<b>Pre Construction stage</b>				
Regulatory Clearance for the project such as Implementation Agreement, Consent to Establish, Environmental Clearance, Forest Clearance, DPR clearance, Electrical Clearance, MoU with State Government, District Administration, etc	Meeting with the concerned government official and record the minutes of meeting.  Letters by post or delivery by hand	Department of Power- Government of Himachal Pradesh (GoHP), Himachal Pradesh State Pollution Control Board, Ministry of Environment and Forests, Govt. of India, Central Electricity Authority Govt. of India.	<b>Completed</b> the pre construction regulatory clearances with respective departments. Such as consent to establish, environmental clearance, DPR clearance, Forest Clearance, MoU and Implementation Agreement with HP Government obtained for Tidong-1 HEP.	Before starting the construction activities on site.

<b>Construction Phase</b>				
Compliance reports towards the conditions stipulated in the regulatory clearances obtained from government departments, such as compliance status of conditions in Environmental Clearance, forest clearance, Consent to establish, etc.	Letters by post or delivery by hand	Department of Power- Government of Himachal Pradesh (GoHP), Himachal Pradesh State Pollution Control Board, Ministry of Environment and Forests, Govt. of India, Central Electricity Authority Govt. of India.	<b>Ongoing</b> activity as periodic submission on the compliance status is required to be submitted to respective government department.	As defined in the particular clearance letter.  Such as 6-monthly compliance status to be submitted for environmental clearance.
Consult the movement of large project components Various stage of Construction such as Gates, Main Inlet Valve, etc	Personal meeting	Public Works department, Government of HP.	<b>Ongoing</b> whenever the transportation of such components is scheduled.	As and when required.
<b>Pre Commissioning Stage</b>				
Obtain Consent to Operate	Letter along with required application form	Himachal Pradesh State Pollution Control Board	Before commissioning of project	Once before commissioning of project
Compliance to the consent condition 15% discharge by installation of online measuring device	Letters by post or delivery by hand	Himachal Pradesh State Pollution Control Board	Before diversion of Tidong stream into Head Race Tunnel	Once
<b>Operation Phase</b>				
Compliance report towards the consent condition 15% discharge by submitting the discharge data.	Letters by post or delivery by hand	Himachal Pradesh State Pollution Control Board	<b>Ongoing</b> after the project is commissioned and water of Tidong stream is diverted into Head race tunnel of the project.	Monthly

**Table 8-10: Consultation and Disclosure with Local Media and NGOs**

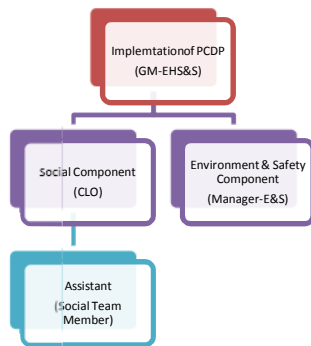
Event / Tasks	Mode of Communication	Target group	Status / Action Plan	Schedule / frequency
<b>Pre Construction stage</b>				
Diversion of Forest land, enumeration of trees, private land acquisition, preliminary information dissemination. Disclosure of environmental impacts of the project through the non-technical executive summary of the EIA report in local language	Letters, face to face Meeting, e-mail, Communication of references to web content	Local media and Non Governmental Organizations	<b>Partially Completed</b> Tidong Valley Paryavaran Sanrakshan Vikas Samiti in Jul-06 regarding Environmental Public Hearing Loss of	-
<b>Construction Phase</b>				
Prepare hand outs on project information and impacts, in Hindi and set up an arrangement for dissemination of project related information/planning to the stakeholders prior to commencement of all major project activities  Develop and Use alternate media e.g. street plays and video films etc to disseminate about project features using the local dialect to ensure that all members of the affected community gain understanding of project design, its layout, the likely social and environmental impacts and the proposed	Letters, face to face meetings.	-do-	<b>To be Completed - Ongoing</b> Engage local media and NGOs in preparing and distribution of the information material.  To be undertaken by NTPGL as part of information dissemination to address concerns regarding lack of project information	Continuous process to be undertaken on quarterly basis  To commence by the end of Sep-2011.

mitigation measures				
<b>Pre Commissioning Stage</b>				
Consultations for addressing environmental and social aspects of the plant operation	E-mail, reference to company's web content.		Proposed	Before the commissioning of project
Consultation before commissioning of project regarding reduced flow of water in the affected stretch of Tidong stream.	-do-	-do-	To be completed	Before the commissioning of project
<b>Operation Phase</b>				
General Consultation about project status and current matter of concern w.r.t. the project execution or operation.	-do-	-do-	Proposed	Every six month

**8.8 Resources and Responsibilities**

NTPGL will establish dedicated Cell as shown below in Figure 8-3 for environment and social issues at site to address all social and environmental impacts of the project, as well as ensure proper implementation of the Public Consultation and Disclosure and the Rehabilitation Action Plan/ Community Development Plan

**Figure 8-3: Organization arrangement for implementation of PCDP**



GM-EHS&S will have the overall responsibility of managing and implementation of the entire plan and CLO and Manager-E&S will provide the support in implementation. During various stages of consultations these experts will have the discussions with the target groups in their respective matters. They will ensure that right focus group is identified for each consultation and informed well in advance to the consultation or desired milestone. Experts will also ensure that correct information is being shared in the local language.

