TRUNG SON HYDROPOWER PROJECT MANAGEMENT BOARD

VIETNAM TRUNG SON HYDROELECTRIC PROJECT

ENVIRONMENTAL ASSESSMENT

EXECUTIVE SUMMARY

JANUARY 15, 2011

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ABBREVIATIONS

CLIP	Community Livelihood Improvement Plan
CRO	Community Relations Officer
CTA	Chief Technical Assistant
DoNRE	Department of Natural Resources and Environment (province level)
DPC	District People's Committee
EA	Environmental Assessment
EMDP	Ethnic Minority Development Plan
EMP	Environmental Management Plan
EIA	Environment Impact Assessment (carried out by EVN)
EVN	Vietnam Electricity
FSL	Full Supply Level
GHG	Greenhouse Gas
HWL	High Water Level
IMC	Independent Monitoring Consultant
IGP	Independent Grievance Panel
IUCN	International Union for the Conservation of Nature
MONRE	Ministry of Natural Resources and Environment
NPT	National Power Transmission Company
NR	Nature Reserve
NTFP	Non-timber Forest Product
PoE	Environmental and Social Panel of Experts
PPC	Provincial People's Committee
RLDP	Resettlement Livelihood and Ethnic Minorities Development Program
RP	Resettlement Plan
SEI	Stockholm Environment Institute
SESIA	Supplemental Environmental and Social Impact Assessment Report
STD	Sexually Transmitted Diseases
TB	Tuberculosis
TSHPMB	Trung Son Hydropower Project Management Board
TSHPP	Trung Son Hydropower Project
VDIC	Vietnam Development Information Center
WWF	Worldwide Fund for Nature

INTRODUCTION

The 260 MW Trung Son Hydroelectric Plant (TSHPP) in Vietnam will be built on the upper Ma River, about 170 km from Hanoi and 48 km from the Lao border and about 200 km from the river mouth. TSHPP is a multipurpose project, including both power generation and flood control benefits. At completion, the project is expected to produce an average of 1,019 GWh of electricity a year and help control annual flooding on the river valley downstream, and supplement water supplies during the dry season.

The total project cost is estimated at $412 million U.S. dollars, of which $35.1 million has been allocated for compensation and resettlement purposes, $2 million for livelihood development, approximately $2.9 million for implementation of the Environmental Management Plan which including $0.6 million for public health actions. Vietnam Electricity (EVN) has requested financing from the World Bank, currently estimated to be $330 million. Construction will take place over five years and the dam is expected to be fully operational by 2017.

Environmental impact studies were first undertaken in 2003. This EIA was updated in 2007 as required by Vietnamese regulations and approved by the Ministry of Natural Resources and Environment (MoNRE) in 2008. At the request of the Bank, additional studies were undertaken in 2008 in aspects such as water quality modeling, fish and fisheries, biodiversity, physical cultural resources, workers' camp and construction management, and health. Social impact studies and additional consultations with affected communities, were also undertaken. Environmental and social studies completed to date are listed in the Annex.

Based on these additional studies and efforts, two environmental and one social report have been prepared. The Supplementary Environmental and Social Impact Assessment Report (SESIA) the Environmental Management Plan (EMP) and the Resettlement Livelihood and Ethnic Minorities Development Program (RLDP), all dated January 2011, bring together, summarize and update the findings of all prior studies, and propose mitigation and compensation plans and actions that aim to address the environmental and social impacts of the project.

The draft SESIA, EMP and RLDP were the subject of formal and intense community and public consultations, meetings and briefings with interested provincial and local governmental institutions as well as non-governmental organizations conducted by TSHPMB from 2008 to 2010. The comments and suggestions from communities and organizations were incorporated into the final SESIA, EMP, and RLDP and summarized in an Annex to the SESIA.

Project Overview

The TSHPP is located on the Ma River, approximately 700 m downstream of its confluence with Quanh brook, in the Trung Son commune, Quan Hoa district in the province of Thanh Hoa, Vietnam. (See Box 1). The project site is located near three protected areas, the Xuan Nha, Pu Hu and Hang Kia-Pa Co Nature Reserves. When completed the project components will be as follows:

- An 84.5 m high dam with a crest length of 513 m.
- A total reservoir area of 13.13 km^2, with a volume of 348.5 million m^3, a full supply level (FSL) at an elevation of 160 m and a minimum operating level (MOL) at 150 m.
- A 20.4 km access road from Co Luong (Mai Chau, Hoa Binh province) to Co Me (Trung Son, Thanh Hoa province); the access road will include two major bridges, one at its junction with National Road 15 and the other over the Ma River to access the workers' camp on the right hand side of the river.
- A construction work camp for a peak work-force of approximately 4,000 workers.
- 65 km of 220 kV double-circuit transmission line to connect the project to the Hoa Binh – Nho Quan 220kV line, in Tan Lac District.

About 2,327 households or 10,591 people will be resettled from reservoir area, access road, dam construction sites, borrow pits and workers' camps. This includes is a preliminary estimate of 325 households or 1,625 people affected by the transmission line, construction of which is to be started in about two years' time. A framework to address environmental resettlement and ethnic minorities impacts of the transmission line has been agreed with the government.

EVN is the project owner. It has delegated day to day responsibility for the project to the Trung Son Hydropower Project Management Board (TSHPMB), covering preparation, planning and execution of the main dam and ancillary works including construction of the power lines and substations up to 110kV, and the access road and bridges. Construction and operation of the 220kV transmission lines is to be undertaken by the National Power Transmission Company (NPT), a wholly-owned subsidiary of EVN.

Major Environmental and Social Impacts of Project Components

The major environmental consequences of the project stem from the dam and the reservoir it will create. A considerable resettlement program and livelihood restoration program is required, particularly in the seven communes and one town which bound the reservoir and site for the main construction work. About 98 percent of all people so far identified as affected by the project are from four ethnic minority groups: the Thai, the Muong, the H'mong and the Kho Mu. Thus the project has the potential to disrupt cultural and social structures in the area, create additional pressure on community infrastructure and services, and increase the risk of spreading sexually transmitted diseases.

Direct impacts on biodiversity are considered minimal. The project will not flood any critical natural habitat. Fish migration in the Ma River occurs mainly in the lower and middle segments of the river basin up to 100 km from the river mouth while the distance from the dam site to the river mouth is approximately 200 km. Movement of fish upstream Trung Son is not prevalent. Therefore impacts on fish and fisheries are also considered of low magnitude. Although some paleontological sites were identified in the flooded area, which will be excavated before flooding, the area of the reservoir does not have a rich cultural heritage value.

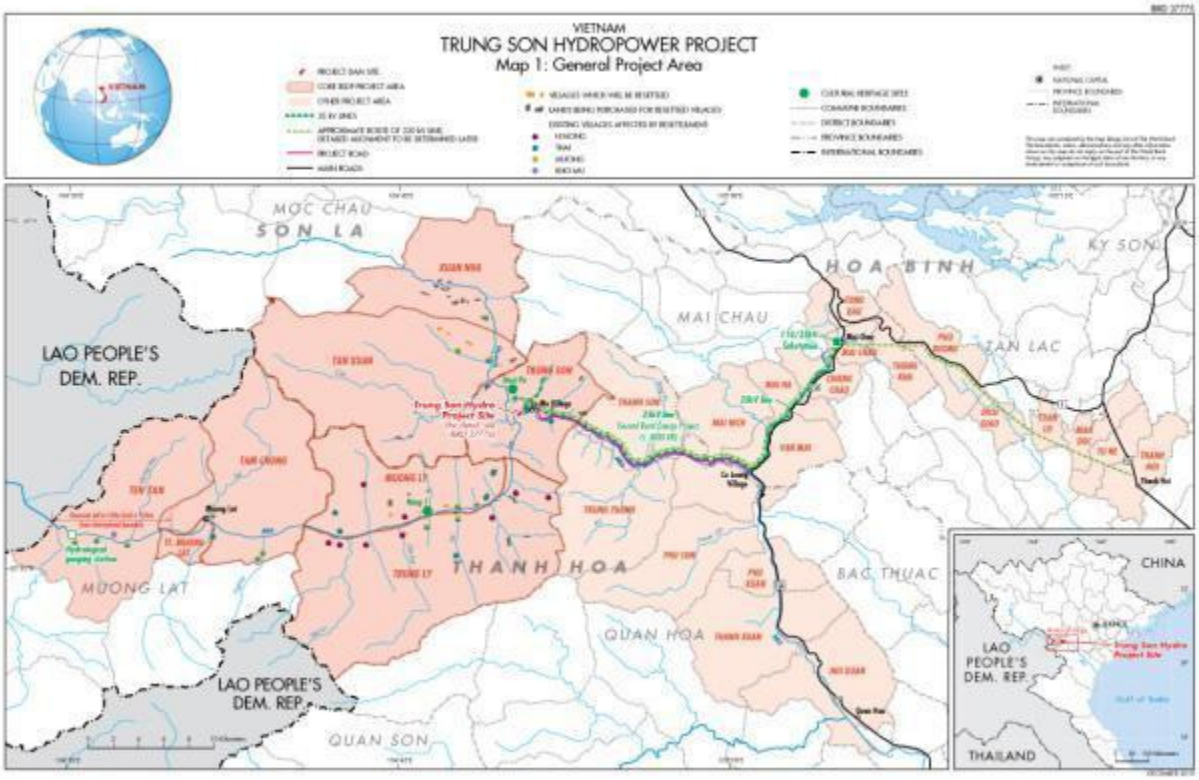
Beyond these impacts which could normally be expected from the change in use of the land, the construction of the dam itself poses perhaps the highest environmental and social risk. At its peak, a labor force of around 4,000 workers will be housed in camps for dam construction. Indirect impacts stemming from the inflow of workers and additional immigration of between 400-1,000 people into the zone prompted by the construction of the dam and the enhanced access provided by the roads, and the resettlement of the population to new areas in the river basin will exert additional pressures on natural resources (forest, bamboo, wildlife) especially in the Xuan Nha Nature Reserve in the Son La Province, the Pu Hu Nature Reserve in the Thanh Hoa Province, and the Pa Co-Hang Kia Nature reserve in the Hoa Binh Province.

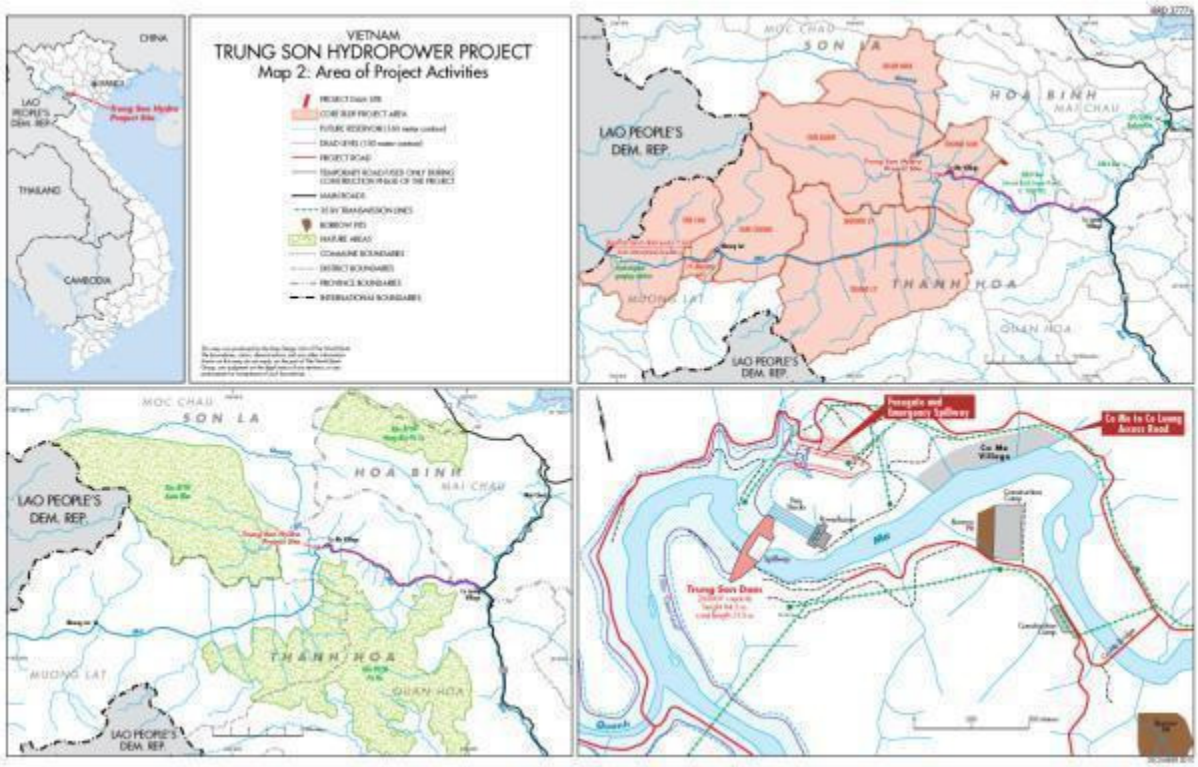
Appropriate mitigation measures have been identified to address direct and indirect impacts from the project which are organized in two plans: the Environmental Management Plan (EMP), and the RLDP which includes a Resettlement Plan (RP), a Community Livelihood Improvement Plan (CLIP), and an Ethnic Minorities Development Plan (EMDP).

PROJECT REGULATORY AND LEGAL FRAMEWORK

The New Environmental protection Law of Vietnam was in effect in July 2006. The Law provides an umbrella framework for environmental management and protection in Vietnam, and the prime authority is the Ministry of Natural Resources and Environment (MoNRE). At the provincial level, the Provincial Department of Natural Resources and Environment (DONRE) is the operating unit for overall environmental management in the province. In addition, other national laws are also important for environmental protection and natural resources management. Vietnam has a State Plan on Environmental and Sustainable Development, 1991-2000 (1991), National Biodiversity Action Plan up to 2010 and Orientations towards 2020 (2007) as well as the Tropical Forest Action Program, Cleaner Production Action Plan, Forest Protection and Development Law (1991); the People's Health Protection Law (1989); Land Use Law (1993); Law of Oil and Petrol; Mineral Resources Law (1996), Water Resources Law (1998); Criminal Affair Law (reform, 1999); Dykes Protection Ordinance (1989); Ordinance of Resources Taxes (1989); Ordinance of Aquatic Resource Protection (1989), Ordinance of Radiation Safety and Control (1996), Ordinance of Vegetation Protection and Quarantine (1993). Most recently, a Biodiversity Law came into effect in 2009 and a revised Cultural Heritage Law came into effect in 2010.

Box 1. Project Location and Main Features





Because of some incompatibilities between the requirements of Vietnamese law and regulations and the requirements of OP 4.12, Policy Frameworks for Compensation, Resettlement and Rehabilitation of Project Affected Persons (RPF) have been prepared and approved by the Prime Minister for the man project and the power lines. They establish the principles, objectives, and definitions to be used in resettlement planning and implementation. They define affected persons and establish eligibility criteria for compensation or other forms of assistance, describe the legal and institutional framework,

establishes modes of asset valuation and compensation payment, arrangements for consultation and participation, and procedures for pursuing grievances.

In addition to the requirements of national legislation, TSHPP must also comply with applicable environmental policy and standards of the World Bank Group. A full Environmental Assessment (EA) was carried out following terms of reference agreed with the World Bank. The terms of reference were discussed in public meetings. The project triggered the following World Bank policies: Environmental Assessment; Natural Habitats; Pest Management; Indigenous Peoples; Involuntary Resettlement; Physical Cultural Resources; Safety of Dams; and International Waterways. Compliance with these policies is summarized in Table 1. The World Bank policy on Forests was not triggered in this project. The natural forests in TSHPP area have been significantly exploited for household and commercial purposes. Vegetation in the reservoir and dam construction area and the access road consists mainly of plantations of bamboo and other trees with low biodiversity value. Natural vegetation in the reservoir area has been severely exploited, converting the land into scrubland and grassland.

Table 1: Compliance World Bank Safeguards Policies

Safeguard Policies	Actions
Environmental Assessment (OP/BP 4.01)	• Category A project. Full EIA and EMP have been prepared for the project • Full, stand alone EMP and Resettlement Plan were prepared for the access road, to be built ahead of the main works. • A Panel of Experts on Environmental and Social issues has actively participated in project preparation.
Natural Habitats (OP/BP 4.04)	• The project does not have direct impacts on critical natural habitats • Adequate assessment of induced impacts on natural habitats (illegal hunting and logging) stemming from additional pressures from workers' camps on protected areas was carried out • Adequate mitigation and compensation measures (strengthening management of protected areas) were incorporated in EMP
Pest Management (OP 4.09)	• Mosquito control programs will be implemented in workers' camps and resettlement sites. In addition, the project will provide garden plots for resettled families. • Specifications for safe handling of pesticides and all hazardous wastes have been included in bidding documents for main contractors. • The Resettlement Plan and CLIP includes technical assistance to resettlement families on management of pesticides and chemicals in their garden plots.
Physical Cultural Resources (OP/BP 4.11)	• Archeological survey conducted along on reservoir areas and all ancillary sites • Three paleontological sites were recommended to further study and excavation • Chance finding procedures during construction have been prepared and will be included in bidding documents and contracts.
Involuntary Resettlement (OP/BP 4.12) Indigenous Peoples (OP/BP 4.10)	• Social Assessment has been conducted • Since the total majority of people to be resettled belong to ethnic minorities, the Resettlement Livelihood and Ethnic Minorities Development Plan (RLDP) which includes a Resettlement Plan (RP), a Community Livelihood Improvement Plan (CLIP), and an Ethnic Minorities Development Plan (EMDP).
Safety of Dams OP 4.37	• A Dam Safety Review Panel has been established • The Panel has reviewed all designs and emergency plans • A dam safety report has been issued by the Panel confirming the design and plans meet international standards.
International Waterways OP7.50	• Formal notification to Laos was carried out by the Government of Vietnam • A formal response from the Government of Laos, acknowledging and accepting the Trung Son Project was issued
Consultation and Disclosure	• Intensive, culturally sensitive consultation efforts were carried out in all communities in the area of influence of the project on the EIA and RLDP. Governmental and Non-Governmental organizations were also consulted in public meetings. • All supporting studies have been disclosed in Vietnamese and English on the Bank and the TSHPMB websites

ENVIRONMENTAL AND SOCIAL SETTING

The area of the project presents unique ecological and cultural characteristics which make this project particularly challenging: a shared watershed with Lao PDR, vulnerable ethnic communities, and sensitive protected areas.

The Ma River Basin

The Ma-Chu River system rises in Dien Bien province in Northern Vietnam, it flows through Lai Chau province and enters Lao territory in Houaphan Province, before re-entering Vietnam in Thanh Hoa province, finally discharging into the East Sea. The Ma River has two main tributaries; the Chu and the Buoi Rivers. The Ma River basin is an important international river, with the 5th largest catchments area in Vietnam after Mekong, Red and Thai Binh, Dong Nai and Ca Rivers. The total area of the basin is 28,400 km^2 of which 62% (17,600 km^2) is in Vietnamese territory and 38% (10,800 km^2) in Laos. The main stem of Ma River has a length of 512 km of which 410 km is in Vietnam.

Natural Habitats and Biodiversity

In 1992, the World Conservation Monitoring Centre ranked Vietnam as one of the 16 most biologically diverse countries in the world. Its biodiversity is characterized by 295 species of mammals, 828 species of birds, 296 species of reptiles, 162 species of amphibians, and more than 700 species of fresh water fish and 15,000 species of fauna have been identified. New species are discovered every year. Forests in Vietnam have a diverse and abundant endemic flora and fauna, consisting of 100 species and subspecies of birds, 88 species and subspecies of mammals and about 20% of plant species.

The TSHPP is located in the transition zone between the Greater Annamites Eco-region and the Northern Highlands. The Greater Annamites Eco-region is one of the Worldwide Fund for Nature (WWF)'s global 200 eco-regions, characterized by the world's most outstanding biodiversity values and hot spot for biodiversity conservation. The Northern Highlands also contain biodiversity centers with a large number of species of high conservation significance.

Terrestrial Ecology

There are 1,873 species of plants that belong to 152 families in the TSHPP area. Vegetation cover within the TSHPP area contains mixed forest stands, which include broad leaf trees, bamboo, pine and grasslands.

Surveys indicate still an abundance of fauna in the project area. The TSHPP area provides habitat for a large number of animals. And the tropical and subtropical forests remaining in the project area are rich in species diversity.

The natural forests in the TSHPP area have been significantly exploited for domestic and commercial activities. Vegetation in the reservoir and dam construction site and the Co Luong – Co Me road consists mainly of plantations of luong bamboo (*Dendrocalamus membranaceus*), other bamboo (*Melia azedarach*) and other planted trees with very low biodiversity value. At its normal water supply level, the reservoir will submerge 1313 ha of land, and from which 1.069 ha is planted forest land, including 1.001 ha of luong bamboo plantations and 68 ha of natural forest. Natural vegetation in the reservoir area has been severely exploited, converting the land into scrubland and grasslands with low biodiversity value.

Aquatic Ecology

Vietnam as a whole has an extensive diversity of aquatic species. In the vicinity of the Trung Son project, 198 fish species of 141 genera, 57 families and 13 orders have been identified. This represents 19% of the total number of fish species in the country. Ninety-six percent of these species are native to Vietnam while the remaining four percent are classified as exotics. In total, there are 95 freshwater (48%) and 103 brackish (52%) water species. The Ma River generally has lower biodiversity levels when compared with other rivers in Vietnam due to heavy flooding. Nine of the 198 fish species are listed in the Vietnam Red Data Book. However, none of the species recorded in the Vietnam Red

Book appear in Red List of the International Union for the Conservation of Nature (IUCN) 2006 because they are all widely distributed in rivers of North and North-Central Vietnam.

There is a conspicuous migration of brackish fish species into the upper catchments of the Ma River. Out of the 60 species which migrate upstream, only 44 reach the lower catchment, which is 30 km from the river's mouth. Twelve species reach the middle catchment, which is over 30 km from the river's mouth and the remaining species migrate 100 km upstream to the upper catchment. The dam is approximately 200 km from the river's mouth.

There are several economic fish species within the project area. Among these, only four species (*Cyprinus carpio, Hemiculter leucisculus, Cranoglanis sinensis* and *Mastacembelus armatus*) currently inhabit the entire area; 12 species are confined to the upper catchment; 17 species inhabit primarily the middle catchment area and 29 species occupy the lower catchment area.

Protein from fish plays an important role for local people; it represents 50 to 59% of total daily protein consumed. There are 41 harvestable fish species within the Ma River and approximately 100% of the fish caught are used for food. Because the lower catchment enjoys the highest productivity it also enjoys the highest rates of protein consumption. Within the mountainous districts such as Trung Son, there is little surface water and therefore, the aquaculture sector has not developed as extensively as the agricultural and forestry sectors. Fish ponds are not frequent and are mostly located in the wider valleys of Tam Chung and Tan Xuan communes in the middle and lower reaches of the river.

Fishing in the Ma River is an important source of income for communes far downstream of the dam site, especially since the majority of fish have a high market value. Aquaculture is common in coastal communities and freshwater fish breeding has just begun to develop in recent years. Raising fish is common in some households in Tam Chung commune downstream of the dam.

Though the Ma River is rich in fish species, aquaculture productivity is low. Aquatic resources from the Ma River are rapidly declining due to overexploitation and use of illegal destructive catching methods (explosives, poison), destruction of habitats especially of riparian forests, lack of enforcement of breeding seasons, fishing tools, and catch sizes, and river pollution and degradation by sand and gravel mining activities. It is anticipated that biodiversity levels of freshwater, estuarine and coastal marine fish species will continue to decline even in the absence of the project.

Protected Areas

There are three Natural Reserves (NR) located in the area of influence of the project: Pu Hu Natural Reserve (Thanh Hoa Province), Xuan Nha Natural Reserve (Son La Province) and Hang Kia – Pa Co Natural Reserve (Hoa Binh Province). The second map in Box 1 shows the location of the three NR in the TSHPP area. All of the natural reserves are characterized by tropical and sub-tropical evergreen forests with high biodiversity values. The characteristics of these natural reserves are summarized in Table 2.

The biodiversity in the protected areas includes 936 species of vascular plants, 79 species of mammals, 258 species of birds and 30 species of amphibians. A total of 216 species are considered as species at risk by NICS; 41 species of plants and 33 species of animals are considered as internationally endangered; 93 species of plants and five species of animals identified in the natural reserves are endemic to Vietnam.

Table 2: Characteristic Features of Three Natural Reserves in TSHPP Basin

Data	Xuan Nha	Pu Hu	Hang Kia-Pa Co
Location	Moc Chau District, Son La Province	Quan Hoa and Muong Lat Districts, Thanh Hoa Province	Mai Chau District, Hoa Binh Province
Year of establishment /Management Board establishment	1986 2002	1999 1999	1986 2000
Ownership agency	Management Board of Xuan Nha Natural Reserve	Management Board of Pu Hu Natural Reserve	Management Board Hang Kia - Pa Co Natural Reserve
Management Authority	FPD of Son La Province	FPD of Thanh Hoa Province	FPD of Hoa Binh Province

Data	Xuan Nha	Pu Hu	Hang Kia-Pa Co
IUCN category	Category Ib (Wilderness Area)	Category Ib (Wilderness Area)	Category Ib (Wilderness Area)
Core Zone Area (ha)	16,316.8 ha	23,149 ha	7,091 ha
Area of buffer zone	87,336 ha.	27,306 ha	8,135 ha
Objectives	• Conservation of Tropical and Sub-tropical forest ecosystems of Northwest Vietnam • Conservation of precious and endangered species Protection of Watershed area of Ma and Da rivers; environmental protection, and supporting socio-economic development of local communities	• Conservation of typical forests and biodiversity of North Central Vietnam • Conservation of precious and endangered species • Protection of watershed areas of Ma and Luong Rivers; environment protection and socio-economic development of local communities	• Conservation of limestone forest ecosystems of Northwest Vietnam • Conservation of precious and endangered species • Protection of natural environment and Supporting socio-economic development of local communities

Source: Protected Areas and Terrestrial Biodiversity (PATB), 2008

Threats to Biodiversity

Terrestrial biodiversity has been declining dramatically in the TSHPP area for several decades. This is common over all forested areas of Vietnam. In part, the loss is due to habitat destruction through economic development, but the larger part of the loss is caused by the rapidly increasing wildlife trade, which is driven by a growing urban market for wildlife for consumption and for export. These threats will continue even without the presence of the project. However, the project could exacerbate these threats mainly because of the need for a large workforce. At the same time, the project might well become a vehicle for protecting the valuable resources of the project area. Threatened species in the three reserves include:

Xuan Nha Reserve: 43 nationally threatened species (24 species of mammals, one species of birds, 17 species of reptiles and one species of amphibians) and 32 globally threatened species (19 species of mammals, one species of birds, eight species of reptiles and four species of amphibians). Two endemic species of herpetofauna, Sapa Skink (*Mabuya chapaensis*) and Granular Spiny Frog (*Paa verrucospinosa*), were also recorded. In addition, species of national and global conservation importance (primates and testudinates) have been observed. Filed investigations also identified seven primate species, including Bengal Slow Loris (*Nycticebus bengalensis)*, Pygmy Slow Loris (*Nycticebus pygmaeus),* Stump-tailed Macaque (*Macaca arctoides)*, Assam Macaque (*Macaca assamensis)*, Rhesus Monkey (*Macaca mulatta),* Grey Langur (*Trachypithecus crepusculus),* Delacour's Langur (*Trachypithecus francoisi),*and Western Black-crested Gibbon (*Nomascus concolor*). Six testudinates (turtle and tortoise) species were recorded in the Xuan Nha natural reserve, five of which are globally threatened, including Big-headed Turtle (*Platysternon megacephatum)*, Indochinese Box Turtle (*Cuora galbinifrons*), Keeled Box Turtle (*Pyxidea mouhoti*), Impressed Tortoise (*Manouria impressa*) and Wattle-necked Softshell Turtle (*Palea steindachneri*).

Pu Hu Reserve: 42 nationally threatened species (25 species of mammals, two species of birds, 13 species of reptiles and two species of amphibians), and 33 globally threatened species (23 species of mammals, nine species of reptiles and one species of amphibians) . Out of 42 species, 26 species are considered as highly threatened. One endemic species known as Granular Spiny Frog (*Paa verrucospinosa*), is classified as nationally and globally threatened.

Hang Kia-Pa Co: 34 nationally threatened species (14 species of mammals, three species of birds, 14 species of reptiles and four species of amphibians) and 21 globally threatened species (12 species of mammals, one species of birds, seven species of reptiles and one species of amphibians). Out of 55 species identified, 17 species are considered highly threatened.

Forests and important biodiversity values of the Pu Hu, Xuan Nha and Hang Kia – Pa Co Nature Reserves face various threats. Studies show that there are six main threats which can lead to a reduction of forest areas, forest quality, and animal and plant species. These threats are summarized in Box 2.

These threats are exacerbated by weak management capacity in all three reserves: limited budget, limited staff and training, unclear demarcation, and weak enforcement. Management boards of the Nature Reserves and other Forest Protection Departments' staff in the area are unable to address the drivers of the fauna trade or deal with trade outlets, which tend to be protected through a network of political connections. Forest protection capacity of local authorities is likely not to be increased significantly in near future while demands for agricultural land, forest products and wildlife continue to increase because of increase of local people population and improvement of transport roads in the area. So it is very likely that the loss and quality degradation of Watershed protection and Production forests in TSHPP area will continue even in the absence of TSHPP development.

Box 2: Existing Threats to Biodiversity in the Protected Areas near TSHPP

Hunting and trapping wildlife: Mainly by local residents, following ancient traditions. Wild animals are hunted by bows and many kinds of traps, but also by guns and dogs. Guns are widespread among the buffer zone communes, representing the most dangerous method of hunting, even though the Management Board of the NRs -in collaboration with local authorities- have made great effort to reduce the number by confiscating them. Hunting occurs all year round, but mainly from October to March. In the past, animals were used as a supplementary food; nowadays large animals are sold to city restaurants.

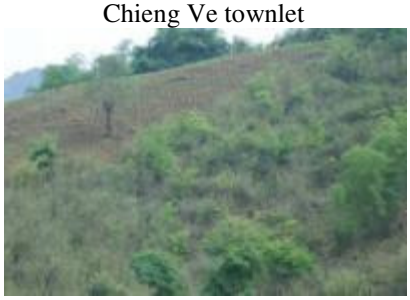
Forest clearance for agriculture: Some ethnic minorities (H'mong) have a long tradition of shifting cultivation, practice which is still commonly used in the three NRs. Steeply sloped land, limited cultivable land, lack of irrigation systems, and poor agriculture technologies, lead to rapid soil erosion and fertility loss. Shifting cultivation is carried out in old fields, scrublands, grasslands, and regenerating young forest areas outside the NRs. Tall-tree forests are also cleared next the NRs and villages for shifting cultivation..

Illegal timber extraction: Occurring all year round but on a small scale, nearby the villages and/or the NRs boundaries; mainly for valuable timber species, such as *Parashorea chinensis, Manglietia fordiana, Michelia spp., Chukrasia tabularis*, and *Fokenia spp*. Local communities use timber for house construction, which has experienced a high demand over the years. Local people are too poor to make brick houses; in addition, some ethnic groups (Thai and Muong) still keep their tradition of wooden houses on stilts. Illegal timber extraction leads to degradation of forest quality, modification of forest structure and species composition, and destruction of forest canopy.

Over-harvesting Non Traditional Forest Products (NTFP): Local people have a long tradition to harvest and use of many NTFP: medicine plants, rattans, bamboos, young bamboo shoots, fuel wood, honey, orchids, palm leaves, and weed plants. Except for palm leaves, which are used locally for house roofs and for fuel, the remaining products are mainly for sale. Overharvesting of the NTFPs has affected some species (such as scent wood *Aquilaria* sp., rattans, medicine plants *Elettaria cardamomum*) which have become rare or exhausted. Depending on the product, harvesting may occur seasonally or all year round.

Free-range cattle grazing: The lack of specifically devoted cattle areas is the reason of the widespread grazing in the three NRs. Buffaloes, cows and goats are left free in the NRs, and only taken back to the villages to work or to be sold. Domestic livestock can cause disturbance to forest restoration, compete for food, and transfer diseases to wild animals.

Leopard cat *Prionailurus bengalensis* in Chieng Ve townlet



Upland grazing fields in buffer zone

Palm civet *Pradoxurus hermaphrodites*

Hunted stump-tailed macaque *Macaca arctoides* village

Box 2: Existing Threats to Biodiversity in the Protected Areas near TSHPP	
Infrastructure development inside NRs: Villages, communes and districts sharing territory within the NRs and the buffer zones have always high demand for infrastructure development (roads, irrigation, hydropower works, etc.). Road development provides easier access to forests for illegal hunting, timber logging and NTFPs collection.	 Illegal timber exploitation

Archaeological, Cultural and Historical Resources

Archaeological investigations were undertaken to identify and study potential areas containing relics and artifacts. All areas where artifacts and cultural spots were discovered were at a medium altitude and had some form of water supply year-round. Investigations found 11 sites, seven of which are within the reservoir area. Twenty six Metal Age artifacts (five bronze, 20 stone and one bone-horn object) and several historical artifacts (one bronze bar and a collection of zinc coins) were also collected from several villages. Artifacts impacted by the TSHPP will be donated to government institutes according to the Law on Cultural Heritage in order to preserve and display national cultural heritage artifacts. Two sites of importance were identified which merit further research**:**

The Paleolithic site of Nang 1 Village

This site plays a special important role in the study of the pre- and proto-historic period in the Western Thanh Hoa. This is a unique Paleolithic site found in the region of Quan Hoa, Muong Lat so far. The site belongs to the type of hill and mound sites of mountainous Sơn Vi culture, bearing the common features of Paleolithic site groups discovered in Son La, Lai Chau, and Dien Bien. The finding of this site significantly clarifies the spatial distribution of the prehistoric resident groups in the Northwest area of Vietnam. However, there is a need for further research and excavations in order to come to more exactly scientific conclusions.

The burial area of Huoi Pa

The burial area plays a significant role in the study of history and ethnic races in the Western Thanh Hoa. The site is dated to the 16th – 17th century, lying within the cultural space and activities of Thai people but bearing a few elements of Muong burial areas. The primary working area is in the cultural space of Thai people alternating with small groups of Muong ones. At present, the process of living together has strongly been occurring between two groups.

The Huoi Pa burial and the Nang 1 paleolithic sites will be excavated prior to flooding the reservoir to preserve the artifacts and cultural remains.

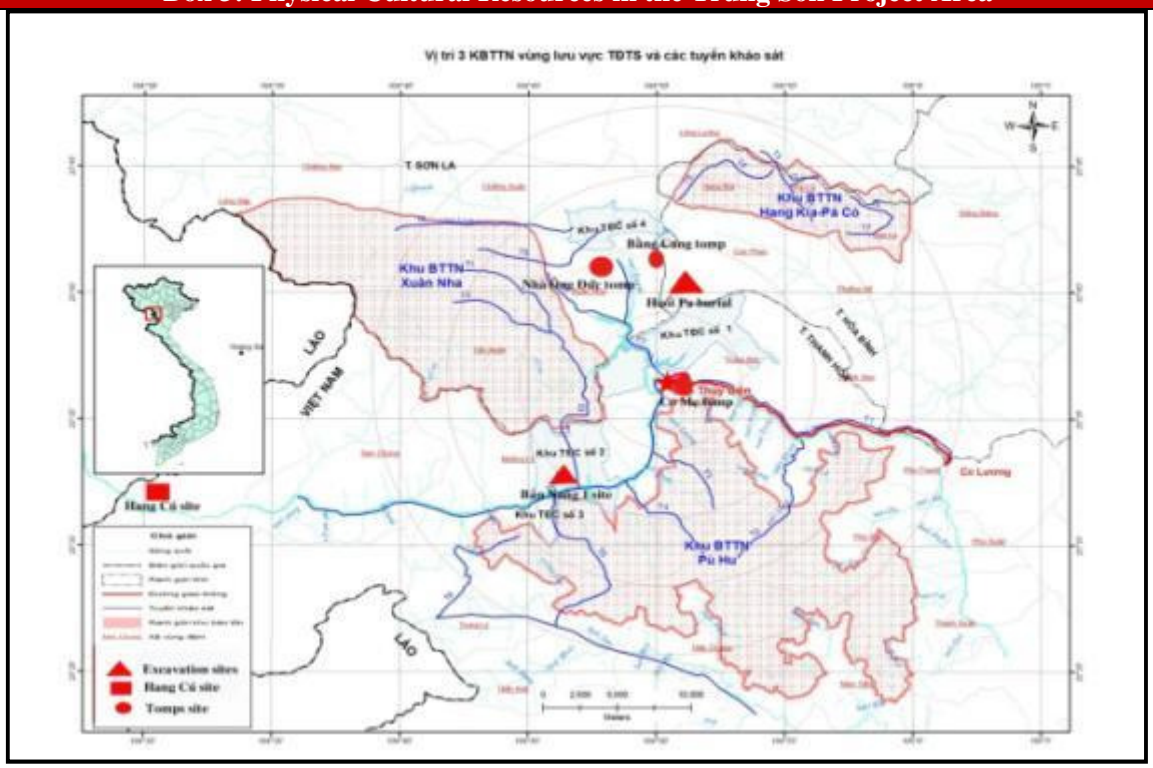
The area also has some places of significance for the local populations**:** A *Khieng San* is a village's sacred place where rituals are performed. Khieng San means the village's votive places in Thai language. It denotes an important holy place from a cultural and religious point of view, where praying practice takes place, particularly for rain and peace. Prayers are done once a year, around the fourth or fifth lunar month, with offerings of buffalos, cows, pigs, chickens and *ruou Can* (local wine drunk through a bamboo pipe). The official prayer must be led by the head of the village or a prestigious man. Three of these shrines are within the proposed future flooded area of the reservoir. Khieng sans in Ta Ban and Tai Chanh villages have also been identified as cultural sites within the region. Upon leaving the village, the Khieng san will have no functional value and will lose its spiritual value.

The current cemeteries have similar structure and keep close alignment with long traditional burial custom. One or two stones mark the graves. Although some concrete markers are used (as in the case of the cemetery of Ta Ban hamlet), most tombs are marked the traditional way by stones of the

prevalent rock formations in the area. The main difference between modern and ancient sites can be seen in the size of the stone markers, with smaller stones being used nowadays rather than the large stone markers in ancient tombs.

The location of identified sites in the project area and some samples of artifacts collected are presented in Box 3.

Box 3: Physical Cultural Resources in the Trung Son Project Area



Archeological Sites in Trung Son Area

Huoi Pa Burial Site

"Khieng san" of Nàng 1 village

Tu Duc-dated coins

Socio-Economic Setting

Population

The TSHPP reservoir and main facilities are located in two provinces and three districts. Quan Hoa and Muong Lat Districts have small populations, with respectively around 42,000 and 29,000 people, while Moc Chau has a larger population of 138,000 people. The project area is sparsely populated with population densities ranging from 36 inhabitants per square kilometer in Muong Lat, 42 in Quan Hoa, to 68 in Moc Chau. A total of 28 communes in five districts are affected by one or more of the reservoir, construction sites, downstream, access road and power lines impacts.

Poverty

Poverty is extremely high. Muong Lat District is recognized as one of the poorest districts of Vietnam. The other two districts are also considered poor districts within the provinces. Infrastructure and services are underdeveloped and income sources other than from agriculture and forestry are limited.

Health

Son La, Thanh Hoa and Hoa Binh Provinces have the highest infant mortality rates in Northwest Vietnam (24-32 per thousand). Common health issues in Northwest provinces include tuberculosis (TB), malaria, HIV/AIDS, traffic accidents and mental disorder (schizophrenia and epilepsy). There is high prevalence of malaria in the three provinces. In the affected districts, the most common health problems are flu, food poisoning and diarrhea, and traffic accident consequences. TB, malaria and goiter are frequent. HIV/AIDS is a concern although the reported numbers of affected persons is very limited at present, only six in Muong Lat district town for example. HIV/AIDS incidence in Son La Province is overall 2 per 1000 people, 40 percent more than the national average. It is 0.5 per 1000 in Thanh Hoa Province. There is high under nutrition among children below five years of age and comparatively low uptake of contraceptive methods for family planning.

Housing

Approximately 90% of inhabitants live in good condition homes, Those of the Thai Muong and Kho Mu are usually built on stilts, those of the H'Mong on the ground. Solid and semi-solid homes are mainly built adjacent to roads or village centers.

Education

Presently, all of the communes within the Thanh Hoa province are equipped with both primary and secondary schools. Though schools are well maintained, attendance rates are rather low. Illiteracy is very prominent, particularly within the villages with a high percentage of H'Mong people and females tend to have even higher rates of illiteracy.

Communications

Although word of mouth is the most common medium for spreading information within villages, every commune, with the exception of Muong Ly and Tan Xuan, has a loudspeaker system that broadcasts twice a day. In 2005, the number of telephones in Quan Hoa and Mai Chau districts was 820 and 1,460, respectively. Communication amongst villages is restricted as telephone services are unavailable in several communes, such as Tan Xuan. Commune to village roads are in very poor condition, sometimes being only paths along the Ma River.

Markets

None of the project area communes have a community market. In each village, there are some families that sell the necessary goods for subsistence. Since transportation is inconvenient between villages, prices tend to be higher for local goods. There is one market in Muong Lat district, while the majority of shops are a minimum of 45 km (in Moc Chau and Quan Hoa districts) away from the project site.

Family Income

The majority of households have adjacent hill-side plots for harvesting timber and forest production is usually devoted to growing bamboo or bead-trees. Many households in the Trung Ly, Muong Ly and Trung Son communes have developed bamboo farms, which have provided a stable source of income. Currently, planted trees cover a large part of the potential flooded area of the reservoir. Luong bamboo is by far the main forestry income source. It is generally planted along the banks of the Ma River and Quanh River, mainly in Trung Son and Tan Xuan Communes. Bamboo is inter-planted with cassava during the first three years of cultivation.

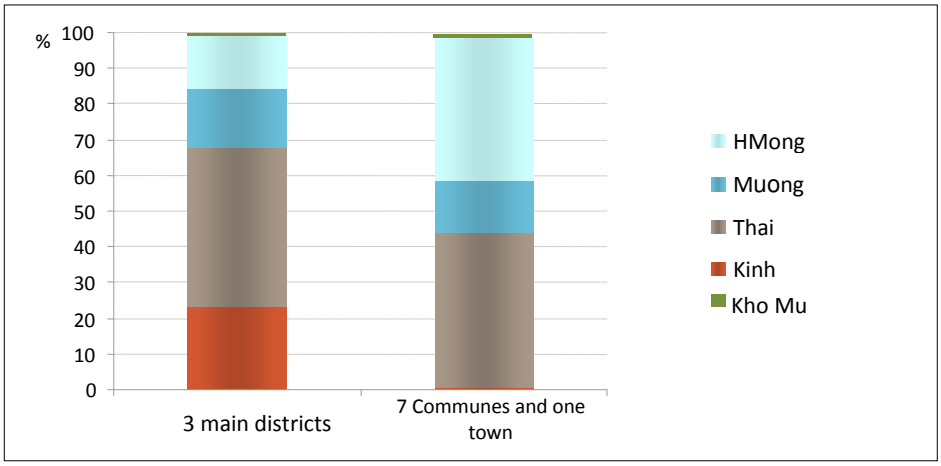
Ethnic Groups

Distribution

Fifty percent of people in Son La and Thanh Hoa provinces are from ethnic minority groups. This is considerably higher than the national proportion of 14 percent. The project takes place in districts with a population that is almost fully (for Muong Lat District) or mostly (in other districts) from four ethnic minority groups: the Thai, from the Tay-Thai ethno-linguistic family, the Muong, from the Viet-Muong ethno-linguistic family, the H'Mong, from the Hmong-Dao ethno-linguistic family and the Kho Mu from the Mon-Khmer ethno-linguistic family. The distribution of the population within the project area among these three ethnic groups is: Thai (85%), Muong (13%), and H'Mong (2%) There are about 810 Kho Mu in the project area (less than 0.04%). The Kinh majority accounts for less than 1% percent of population in the direct area of influence of the project, with a higher percentage in downstream communes. Only five of the villages affected by reservoir flooding have some Kinh households, with a maximum of six households in Ta Ban village, one of the two villages that would be fully resettled. The distribution of ethnic minorities in the project area is presented in Figure 2.

The H'Mong account for close to two thirds of the population in two communes, and more than one third in two other main communes in the direct area of influence (Muong Lat District). However there is only around five percent of H'Mong among the relocated households (28 households out of 509) since most of the households currently living close to the future reservoir are Thai or Muong. The proportion of H'Mong people with land affected by the reservoir is conversely significant, around 14 percent of those affected on land (41 households out of 292). All of them are in Muong Ly Commune in Muong Lat District.

Figure 1: Ethnic Minority Peoples in the Project Area



Sources: GSO population census (district population); social assessment (commune population).

Extremely high poverty incidence in the project area is correlated to the very high proportion of ethnic minority people. Within the minority ethnic groups, the H'Mong have significantly higher poverty levels than the other two groups as documented in the social assessment. There is a historically settled H'Mong population in the project area. However, a H'Mong population has recently migrated from the Northern provinces, mostly in the 1990s, and is considered as not fully settled yet. The government

has initiated a large-scale program specifically for the development of the H'Mong in Muong Lat District.

Community Structure and Culture

The cultural customs of Thai and Muong are very similar; most of the minor cultural differences are centered on traditional ceremonies. These groups coexist with the ethnic majority, the Kinh, and have similar agricultural production activities. At present, communes of Thai and Muong groups either live separately or share the same village, resulting in numerous multi-ethnic couples. There appears to be no discrimination between families of two ethnic groups; however, each group has their own customs and traditions. The Kho Mu moved from living at high altitude to river valleys in about 1984, and settled among Thai villages in Ten Tan commune of Muong Lat District. They intermarry with Thai people and use Thai as a common language and appear to be well acculturated and can be considered alongside the Thai for most practical purposes.

Traditional family structures have changed dramatically amongst all four groups as extended households, consisting of three to four generations, no longer exist due to state control over land. This has had a large impact on maintaining family connections. The practice of extended families has declined so that most houses now comprise a single household. The Thai and the Muong display a relatively small cultural gap with the mainstream Vietnamese society. They generally live in mixed villages and have a good understanding of the Viet language except for elder people. They maintain strong traditions in terms of social organization, roles of traditional leaders, housing preferences, and their animist religion. The H'Mong retain a significant cultural gap both with mainstream Vietnamese society and with the other groups. They live in fully or mostly H'Mong villages and no intermarriages are reported. Most H'Mong women have very limited understanding of the Viet language. The H'Mong maintain strong social networks within their own kin groups.

ANALYSIS OF ALTERNATIVES

The main purpose of the project is to help satisfy Vietnam's growing electricity demands. Peak load is forecasted to grow by approximately 15,000 MW between 2015 and 2020. In order to help meet this demand, Vietnam is planning to increase its hydropower generation capacity.

Economically, when social mitigation costs, the value of forest lost in the reservoir, and GHG emissions from reservoirs are taken into account, its strategy for hydropower generation is justified and TSHPP is one of the best projects in terms of its cost of electricity and capital cost. The current site for TSHPP was chosen because it was likely to cause the least social and environmental impact while meeting the objectives of this project with a potential for high investment revenue.

The Master Plan for the Development of the Ma River has considered a range of sites and development options. The subsequent evaluation of alternative Trung Son project configurations was based on a trade-off analysis between optimal hydro production on the one hand, and environmental and risk considerations on the other – including minimization of geotechnical risks, minimizing the number of project affected persons, and avoiding reservoir impacts in Laos (which constrained the full reservoir elevation to 164 meters above sea level). Thus, the analysis of alternatives included several dimensions: alternatives to supply side expansion, hydroelectricity in the optimum capacity expansion strategy, alternative hydro projects to Trung Son, and alternative dam sites at the Trung Son project level; and finally, alternative reservoir operating level for the selected site.

Alternatives to Supply Side Expansion

Given Vietnam's need for economic development, the increasing demand for electricity in general, and peaking supply in particular, simply cannot be accommodated by demand side options alone. EVN has embarked on an ambitious Demand Side Management program (including a Compact Fluorescent Lamp (CFL) program, and a major initiative to improve commercial energy efficiency). The same is true of small renewable energy projects: several recent reforms (such as the introduction of a standardized power purchase agreement, and a published avoided tariff), and the World Bank supported Renewable Energy Development Project, Cr. 4564-VN) are expected to enable the ambitious 6th Power Development Plan for around 1500 MW of small hydro and other renewable

energy by 2015. In short, while all of these alternatives to supply side expansion are unquestionably desirable, they are already under implementation, and simply do not represent an alternative to Trung Son: *both* are needed.

Hydroelectricity in the Optimum Capacity Expansion Strategy

All power systems require peaking projects, and if hydro projects were not built, the likely alternative is natural gas based combined cycle projects. Not only does this imply additional greenhouse gas emissions, it incurs significantly higher costs, particularly were gas priced at international levels (which means a gas price equivalent to about 90% of the Singapore fuel oil price). Even when gas is priced at the Ca Mau pricing formula, at 45% of the fuel oil price, developing Vietnam's remaining hydro projects bring significant economic benefits. In short, at capital costs of below $2000/kW, hydro projects are win-win, bringing significant avoided GHG emission and economic benefits. In addition, reducing the dependence of imported fossil fuel by developing indigenous renewable energy resources improves energy security through greater supply diversity.

A study of the national hydropower development plan by the Stockholm Environmental Institute (SEI) confirms these arguments. Based on a series of capacity expansion scenarios with progressively less hydro it finds the costs of *not* developing the hydro projects presently identified in Vietnam's 6th Power Development Plan as prohibitively expensive. This is true even when all indirect costs are quantified, such as the economic loss of forest products from the inundated area (The economic analysis of Trung Son follows all of the SEI recommendations on internalizing environmental and indirect costs in the benefit-cost assessment).

Alternative Hydro Projects to Trung Son

A Hydropower Development Master Plan for the Ma River was first prepared in the 1960s, and updated in 1988, 1998 and 2003. Subsequent minor revisions were made to include several small hydropower projects downstream of the then-named Ban Uon project, which is now known as Trung Son.

Based on the 1998 analysis, five hydropower projects were studied in 2003 in eight hydropower cascade alternatives as presented in Table 3. The Trung Son project was included in all alternatives as it was considered to have the best potential.

Table 3: Hydropower cascade options for the Ma River (2003)

Project	Option I	Option II	Option III	Option IV	Option V	Option VI	Option VII	Option VIII
Pa Ma	455							
Huoi Tao	380							
Trung Son	150	150	150	160	150	160	160	160
Hoi Xuan	80	80			70	80	70	80
Cam Ngoc	50	50	40	40				

The selection of the best hydropower cascade was based on (i) reduction of downstream flood water levels; (ii) reduction of downstream salinity; (iii) environmental and social impacts; and (iv) power generation. All of these considerations were monetized and included in the economic and financial indicators. Of the eight considered alternatives, Option I, comprising five projects: Pac Ma, Huoi Tao, Trung Son, Hoi Xuan and Cam Ngoc, was selected for the following reasons: (i) having the best economic indicators; (ii) providing a flood control volume of 700 million m^3 meeting the requirement for reducing floodwater levels, maintaining water levels at the level of the 50year flood at Ly Nhan not to exceed 12.7 m; (iii) ability to supplement 71.3 - 80.5 m^3/s to the downstream requirement for water supply and reduction of salinity; and (iv) providing the maximum exploitation of hydropower potential of the river with total installed capacity of 772 MW and annual output of 2.2 billion kWh.

Among the hydropower projects in Option I, Trung Son was considered the best project. It features good technical conditions, and has a reservoir of sufficient size to provide downstream flow

augmentation. It is economically and financially viable and has smaller environmental and social impacts compared with the other projects in the Option. The other projects had higher numbers of affected persons and hence higher compensation and resettlement costs. Trung Son was recommended as the first project for development on the Ma River. The main benefits of the project were identified as follows:

- Providing a flood control of 200 million m^3.
- Maintaining a salinity level at Ham Rong of less than 2.48‰.
- Providing 260 MW of power with annual output of 1.015 billion kWh.

Alternatives for Trung Son dam site

Three alternative sites along a 19.2 km stretch of the Ma river were considered for the Trung Son project, all in Quan Hoa district: at Phu Thanh and Thanh Son; further upstream of alternative I at Trung Thanh and Thanh Son; and the most upstream alternative, alternative III, at Trung Son. These alternative sites are summarized in Table 4.

Table 4: Site alternatives in the Pre-feasibility Study

Parameter	Unit	Alternative I	Alternative II	Alternative III
Catchment area	Km^2	13430	13296	13175
Annual flow	m/s	244	242	239
High water level	Meters	150	155	165
Reservoir area	Km^2	135	140	157.5
Active volume	Mil. m^3	281.1	253.1	97.9
Total volume	Mil. m^3	714.0	638.6	399.3
Flood control volume	Mil. m^3			
Installed capacity	MW	297	295	290
Annual output	GWh	1168.2	1150.9	1166.0
HH/People to be relocated	HH/people	1372/6998	1148/5656	416/2114
Land flooded	Ha	2286.1	2287	1552
Investment cost	VND billion	4587	4471	2876
NPV	VND billion	418	405	1011
IRR	%	11.2	11.2	13.5
B/C	[ ]	1.11	1.11	1.32

Various combinations of high and low reservoir levels and installed capacity were studied at this stage, and the resulting economic evaluations compared against potential project risks, and environmental and social considerations. The study concluded that

- Alternative I has the most unfavorable geo-technical conditions, given its close proximity (3km) to an active fault. Alternative II has similar geological conditions, but the third Alternative is the most distant from the fault (15km away).
- Alternatives I and II have significantly larger reservoir storage volumes, but a lower generation head, and therefore provide almost the same energy output as Alternative III.
- Because there is no large tributary along this stretch of river, the inflows do not differ greatly at the three sites.
- Alternatives I and II require higher investment costs due to the need for larger dam structures.

Alternatives I and II also have a higher number of project affected persons, and higher costs for relocation and resettlement.

Consequently, Alternative III, the site at Trung Son, was selected as the preferred option.

Alternatives for reservoir operating level

To avoid affecting Lao territory, the high water level (HWL) should not exceed 164m. Two lower HWLs were also examined (162m and 160m). There is relatively little difference between the economic indicators among the three options, and therefore the lowest of these three levels was selected, thereby minimizing the reservoir area at HWL, the related environmental impacts, and the possibility of disturbance to Lao territory.

In conclusion, when one compares Trung Son against all of the other potential hydro projects on the basis of the main environmental attributes (loss of forest, persons displaced, power density, cost of energy), the high ranking of Trung Son is confirmed. In short, given that the overall strategy requires the development of Vietnam's remaining economic hydropower resource endowment, Trung Son is one of the most attractive.

Climate Change

The impact of climate change on the economic feasibility of the project was carried out. In June 2009 the Ministry of Natural Resources and Environment published an assessment of the impact of climate change on Vietnam, which included scenarios for changes in rainfall (as well as temperature and sea level rise). The report notes a number of observed trends that may have potential significance for the Trung Son hydrology:

- A higher frequency and intensification of typhoons affecting Vietnam
- Annual rainfall has decreased in the northern areas, and increased in the southern areas. On average in the period 1958-2007, rainfall decreased by 2%
- Fewer cold fronts, but more intense (such as the prolonged 2008 cold surge in Northern Vietnam)

However, over the first 25 years of Trung Son operation (i.e. by 2040) there is little difference across the scenarios: dry season rainfall decreases by between 2.1 and 2.3%. Moreover, given the normal range of hydrological variation, with annual generation varying from 800 to 1,200 GWh, a long term decrease of average dry season inflows of a few percent will have very little impact on the economics In short, even under MoNRE's worst case, it is extremely unlikely that climate change induced rainfall pattern changes will have any significant impact on Trung Son.

The net GHG emissions from the Trung Son reservoir itself can be ignored. The power density of Trung Son is high, and calculations suggest that this emission source is less than 1% of the avoided emissions from thermal generation.

ANTICIPATED ENVIRONMENTAL AND SOCIAL IMPACTS AND THEIR MITIGATION

Physical Environment

Key impacts on the physical environment are associated with changes in hydrology and its effect on downstream areas and water quality. Impacts during project construction are discussed separately below.

Downstream Impacts

Changes in the river flows downstream from the dam could have negative impacts on fish biodiversity, erosion and sedimentation patterns. The diminished flows downstream will create unsuitable conditions for fish in the immediate downstream segments of the Ma River. Increased erosion is expected to be significant downstream as a result of flow variations and the lower sedimentation loads of project waters released from the dam. However, no significant river infrastructures exist in the downstream area close to the dam. Sedimentation and erosion phenomena are expected to stabilize once the confluence of major tributaries of Ma River downstream of the dam.

Mitigation. Maintain an environmental flow of 15 m^3/s at all times. This will guarantee a minimum of aquatic conditions for fish during the dry season. Monitoring programs for embankment erosion will be implemented. Based on the results of this monitoring appropriate measures will be implemented (see adaptive management approach below). The technical and legal feasibility of establishing an intact river policy in one of the branches of the Ma River is included in the Environmental Management Plan.

Water Quality

Water quality in the reservoir can be deteriorated by the flooded vegetation and the formation of stratification in the reservoir. Reservoir quality modeling have demonstrated that the low density of flooded biomass (less than 24 ton/ha) and the low retention time of the reservoir (water renewal rate of 16 days) will ensure proper levels of water quality albeit there might be some deterioration in the earliest stages of flooding. The models have also shown a moderate tendency for thermal stratification.

Mitigation. A vegetation clearance plan will be implemented. Intensive water quality programs in the reservoir and downstream of the dam will be implemented.

Impacts on the Biological Environment

The project's main impacts on the biological environment are on aquatic and terrestrial habitats, species biodiversity, protected areas and endangered species.

Aquatic Habitats, Fish and Fisheries

Aquatic habitats are also likely to be affected by project construction and operation. Erosion and sediment loads will be increased by construction activities and clearing of reservoir area. There is also a potential for pollution from camps and by oils and fuels and other chemicals used during construction. Once construction is completed, the long term impacts on aquatic habitats and fish biodiversity will occur. Impoundment of 39 km of the Ma River and the formation of the reservoir, plus changes in thermal characteristics of the reservoir, will displace many species not able to adapt to the new conditions. The reduced flows immediately downstream from the dam and the variation in water levels will reduce fish populations in the immediate downstream segments of the river. Fish migration in the Ma River is limited up to the lower and middle sections of the watershed up to 100 km from the river's mouth. Few species go all the way up to upper watershed. Therefore the dam is not expected to alter significantly migration patterns in the Ma River. Fish monitoring in similar watersheds in Vietnam have demonstrated the existence of healthy fish populations downstream and upstream of hydroelectric projects located in the middle segments of the river.

Mitigation. Strict management and regulation of all contractors' activities during construction will be implemented during construction. These measures will include run-off control programs, management and prevention of oils and fuels and spills, and control of worker's behavior to restrict illegal fishing practices. Support to community fisheries and aquaculture programs will be provided as part of the Livelihood restoration Plan. A minimum environmental flow of 15 m^3/s will be maintained at all times downstream of the reservoir. Feasibility study on intact river for the Buoi tributary on the Ma-Chu river system will be carried our during construction phase of the proposed project. It is expected that hydrological conditions will stabilize once the discharge from major tributaries come into the Ma River.

Terrestrial Biodiversity and Threatened Species

Direct impacts on terrestrial biodiversity are expected to be insignificant. The area to be flooded, the construction and camp sites, borrow pit and other infrastructures will affect long intervened areas, grasslands, disturbed habitats, and degraded forests. However, significant indirect impacts on terrestrial biodiversity are expected to occur as a result of increased population (workers and camp followers) and increased access to the area. The new access road to the dam and the reservoir itself will make the nature reserves more easily accessible particularly for hunting thus increasing the vulnerability of wildlife. The demand for fuel for cooking will increase illegal timbering and logging. Demand for wild meat will increase. Perhaps the most sensitive impact from the project, the presence of a large population will exacerbate current practices of poaching and illegal logging in the nature

reserves. This is further exacerbated by the current weak management and protection capacity in the reserves.

Threatened species may be negatively impacted as a result of increased human populations and increased access to the natural reserves areas where these species occur. The increased population during construction will engender additional hunting pressures on wildlife. The value of wildlife for communities has been traditionally high. However, in addition to food intake, current hunting takes place to meet demand from restaurants in the area especially in Mai Chau. The reservoir and the new access road will improve accessibility to the nature reserves and with it, the potential for increased hunting pressure and trade of endangered species.

Mitigation. A Biodiversity and Protected Areas Management Plan will provide support to Reserves Management to strengthen their in suit protection and control. Furthermore, the workers camp will be required to provide alternate fuels sources for cooking to minimize the demand for firewood. Canteens and restaurants under the control of Contractors will be prohibited to serve wild meat. Strict workers behavior rules regarding poaching, hunting, and illegal logging will be enforced.

Impacts on Social Environment

Social impacts will be exerted by two factors: (i). the need to acquire land and relocate population for the reservoir, the dam sites, borrow pits, access and construction roads, transmission lines, and disposal sites.; and (ii) the presence of a large workforce in an area with vulnerable ethnic populations.

Resettlement Impacts

The key impacts will be the resettlement of approximately 2,327 households, of which 1,516 households will be affected by main project. 599 out of 2,327 are impacted on residential land, houses, infrastructure, assets and agricultural land such that they have to be relocated. The remainder have productive land or assets in the project affected area, but do not have to relocate. There are 40 who have no residential land or house in the flooded area but are eligible because their land and house are isolated by the formation of the reservoir. The 357 households affected by the planned resettlement sites in host communities are only losing agricultural land for this purpose.

Table 5 presents a summary of the resettlement impacts from the TSHPP.

Table 5: Households Affected and Included In the Project Area

Source of Impact	No. Households	No. People
Reservoir flooded areas	**1,059**	**5,038**
• Relocated	533	2,445
• Agricultural land lost (but not relocated)	519	2,570
• Productive assets other than land impacted (e.g. shops) but not relocated	7	23
Within the construction area (borrow pits, roads, construction site and construction camp)	**100**	**439**
Households losing land to incoming resettlers	**357**	1,535
Affected by access road[1]	**486**	**1,954**
• Relocated	66	274
• Agricultural land lost (but not relocated)	420	1,680
• Productive assets other than land impacted (e.g. shops) but not relocated	20	75
Affected by transmission line (estimates)	**325**	**1,625**
Total	**2,327**	**10,591**

[1] All those losing productive assets also lose agricultural land and therefore total affected is not the sum of the three sub-categories noted

The project affects three types of land: (a) land used for crop production (paddy fields, upland fields on slopes), (b) residential land and (c) forest land, and two types of assets other than land: (a) houses and (b) shops or other business assets. No project-affected land currently under community land use right certificates previously allocated to a church, pagoda, temple or ethnic minority community has been identified during the inventory of losses.

76% of the land flooded by the reservoir is on steep slopes under bamboo cultivation. Among income sources, Luong bamboo is the most significantly affected because it is mostly planted along river banks. At the reservoir supporting sites such as dam site, borrow pits, disposal sites, all land affected (198 ha) is forestry land with Luong bamboo.

Mitigation. The proposed RLDP has been designed to ensure that all affected peoples are significantly better off after relocation. Twelve resettlement sites are planned for five communes: four villages in Trung Son Commune, three in Tan Xuan, two in Trung Ly, two in Muong Ly and one in Tam Chung. The resettlement sites were identified in 2004 and modified in 2008 on the basis of feedback received through local consultation. All planned resettlement sites are within the affected communes so that relocated households will be able to continue to manage their remaining land and other properties outside the project affected areas, and maintain social relationships. Average distance from affected sites to resettlement sites is 2 km (actual distance by village). The current area of agricultural land and forestry land in resettlement sites is preserved. Overall, other land (unused land) decreases to allow the creation of residential land and new paddy fields. A detailed assessment of water resources was completed as part of the master plan. The planned relocation sites can provide water through gravity systems to a total of 540 households.

Households requiring resettlement were provided with three options: (i) relocation to resettlement sites as planned; (ii) relocation to a site within the project area instead of resettlement sites as planned; or (iii) Relocation out of the district/province area with little assistance. Resettlement strategies were based on four principles: a) Minimize environmental and social impacts during land acquisition, b) If resettlement is unavoidable, affected people shall receive financial compensation to sustain their livelihood. Compensation shall be provided before or after the acquisition of land from DPs, c) the project provides employment opportunities to the local people and d) participation of local people and communes in planning and implementation.

Provisions for livelihood restoration will include:

- Enhancement and improvement of existing farming systems for most households. The majority of households have a preference for land-based livelihoods. The plan will provide options for households to adjust their farming systems to land and water resources in their new locations;
- Diversification into non-agricultural occupations through vocational training for some young people, and support to local microenterprises that will create local jobs. The plan also pays attention to retain human resources, i.e. to avoid that the majority of relocated households with higher formal education levels move out of the area. It provides to these households opportunities to stay in the project area.

Other Social Impacts

The presence of a large workforce in close contact will vulnerable ethnic minorities poses a significant threat to their cultural values and community structures. The spread of alcoholism and STDs is likely to occur if mitigation measures are not implemented. The social assessment, the livelihoods assessment and the supplementary social and environmental impact assessment have identified through consultation with affected people a range of impacts, or risks of impact, within the project area. They are summarized in Table 6. Impact factors in italics are addressed through elements of the environment management plan other than the RLDP.

Table 6: Summary of Social Impacts

Project Element	Negative Impact
Dam	*Noise, dust, road safety* *Waste* *Safety at flooding*

Project Element	Negative Impact
	Downstream impact: fish resources for livelihoods, sand extraction Disruption of boat transportation
Reservoir flooded areas	Relocation Loss of agricultural land, especially land for bamboo plantation, need for livelihood restoration Loss of ethnic/cultural identities in resettlement sites
Construction worker camp	*Increased drug use and trade among workers* *Increased demand for local health services from camp followers* *Safety and reproductive health, especially among women*
Access road **Power lines**	Resettlement of affected households

A comprehensive strategy to address work force and camp followers issues has been designed for the project. In addition to the provisions included in the RP and CLIP, other actions have been included in the EMP such as:

- The construction and workers camps include codes of behavior for and restrictions for camp management.
- The *Community Relations and Safety Plan* that wil*l* inform local communities on progress of the project and ensure community safety; this plan will include feedback, complaint and grievance and conflict resolution mechanisms for non-resettlement and/or land acquisition matters.
- The *Public Health Action Plan.* This plan puts in place measures to manage health risks in local communities, workforce and camp flowers.
- The EMP outlines the criteria for addressing camp followers issues by TSHPMB and the commitment to implement additional actions if warranted.

Environmental and Social Impacts during Construction

Construction and Workers Camp Impacts

The construction of the dam and its ancillary infrastructure will entail potentially significant negative impacts on communities and surrounding aquatic habitats. The proper management of excavation materials, river and drainage crossings, and the reduction of nuisances such as dust, noise, increased traffic, pedestrian safety concerns, and the presence of a large work force in or near small rural communities, will require careful engineering planning, closed supervision, and a continuous and intense community information program. During the construction period, construction and material carrier vehicles will use existing roads and village roads and partial congestion may occur with some negative impacts upon local traffic. The presence of communities and some schools along some of these roads pose a significant risk for pedestrian and student safety. Traffic management during construction will require strict controls. Unexploded ordnance may present a hazard to construction workers and the public.

A workforce that will peak at 4,000 workers is expected during the construction period. Based on experiences for hydropower projects elsewhere in Vietnam, additional people in the area – "camp followers" could be expected to be between 400 and 1,000. Potential impacts arising from the workforce and spontaneous development include pressure on land and natural resources (logging, hunting), generation of solid and liquid wastes and increased public health risks, especially of sexually transmitted disease such as HIV/AIDS. The interaction of the workforce with the local population will pose a threat to their family structure and traditional customs.

Mitigation. A Construction Impact Management Plan has been designed and will be strictly enforced, primarily as an obligation placed on the main civil works construction contractor. Appropriate management of construction activities include sediment and erosion control, quarry and disposal sites management, traffic management, nuisances (dust, noise) reduction measures, and waste and wastewater management plans. Environmental specifications will be included in all bidding documents and contracts. Worker behavior rules (a workers' code of conduct) will prevent hunting and illegal trade and reduce disturbance to traditional customs. Wastewater and solid waste management

systems will be implemented in all work sites. The contractors will be required to provide alternative fuels to minimize the need for firewood. The support to the nature reserves (see above) will increase patrolling and control measures. A Health Management Plan has been designed to address health issues at the workers camps and resettlement sites, and health issues at the regional level. Environmental and social awareness programs for workers will be implemented. A community relations and information program will be required of the main contractor. Environmental supervision of all construction activities will be part of the compliance framework. Sites will not be handed over to contractors until it has been cleared of unexploded ordnance.

An EMDP will (i) minimize and mitigate project impact on the livelihoods of ethnic minority people in the area affected by the Trung Son hydropower project; and (ii) ensure that the development process fosters full respect for the dignity, human rights and cultural uniqueness of ethnic minorities in the project affected area, and takes into account their development needs and aspirations.

Construction/upgrading of Access Roads and Transmission Line

20.4 km of a new access road will be built. In addition, access roads and tracks (some temporary) will be needed for construction. Potential impacts include resettlement, erosion, slope instability, dust, traffic safety risks, increased access to nature reserves. The construction of the transmission line can also exert impacts along the route.

Mitigation. Standalone Environmental Management and Resettlement Plans for the access road have been prepared. Environmental specifications for contractors include measures for erosion, dust and traffic control, slope stabilization, road signage and enforcement of maximum speeds. Frameworks for the preparation of resettlement, ethnic minorities and environmental management plans for the transmission line have been prepared.

Impacts on Physical Cultural Resources

The area for the reservoir and ancillary facilities has been surveyed and all physical cultural resources present have been identified.

Mitigation**.** Procedures and measures for their mitigation and management of physical cultural resources have been prepared. Two sites have been proposed for further study and excavation before impoundment. Chance finding procedures during construction have been prepared and will be included in all bidding documents and contracts. Special procedures, according to traditions and existing laws, and in agreement with local communities, will be followed for all *Khieng San* (worshipping place) and cemeteries.

Cumulative Impacts

Cumulative Impact in the Project Area

The analysis of cumulative impacts for the TSHPP considered the interaction of the following four project components:

- Construction and operation of the dam;
- Construction and operation of the construction camp;
- Construction and operation of the access road; and

Resettlement of over project affected people.

The immediate cumulative impacts from project activities will be the increased pressure on harvesting of wildlife for food and other consumptive usage in protected areas.

Mitigation***:*** Workers' code of conduct prohibiting hunting and fishing; prohibition of consumption of wildlife or bush meat products in camps; control ingress and egress on access roads to minimize poaching; implement park management plans; implement park patrols and wardens; education campaign to workers and local communities; and control of ingress and egress to the TSHPP site

Cumulative Impacts in River Basin

Hydroelectric development in the Ma river catchment will be intensive in the next decades. At least four hydroelectric projects are planned for the basin, with one (Cua Dat on the Chu river branch) already under construction. This development will have significant impacts on water quantity (flows), water quality, fisheries, and sediment transport. These hydroelectric projects are described in Table 3 above.

A set of issues at the watershed level have been identified in the EIA of the Trung Son project and other strategic reports carried out in Vietnam during the last few years (see Annex) has been developed based on preliminary identification of the potential key direct and indirect impacts caused by the proposed project and medium and long term development in the region: hydrology; vulnerability to flooding; fisheries; water quality; navigation; water supply and irrigation; institutional issues; and aquatic biodiversity. Of special concern are the cumulative impacts on aquatic biodiversity.

Mitigation. One means of mitigating the effects of the Trung Son dam is to ensure that selected branches of the Ma River system remain unaltered and unaffected. This would need to consist of a complete unaltered sub-basin with no dams or barriers and a high level of protection from other impacts such as mining-related pollution, forestry, wastewater pollution from urban areas, and destructive fishing practices. Having a completely unaltered system would preserve the ecological connectivity within one branch of the system and provide species with inter-habitat migration from one part of the basin to another.

Fish biodiversity studies carried out for Trung Son recommended that two complete river sub-basins of the Ma River should be considered to be kept free from barriers and activities that impact fish biodiversity. Keeping these two sub-basins "intact" will ensure that a full sequence of fish habitats and migratory routes is protected in the Ma River. Potential candidate sub- basins are for such an intact rivers scheme are the Buoi River and the Luong River. The EMP includes provisions, budget and terms of reference for a study to review the feasibility of such a an approach.

In addition, the EMP also includes the budget and terms of reference for a comprehensive cumulative impacts assessment at the regional level from development programs in all development sectors.

Environmental Impacts of Resettlement

Each resettlement site will be provided with adequate infrastructure which will be designed and implemented during the resettlement process. The proposed infrastructure includes:

- Rural roads, ferry stages and bridges: approximately 43.2 km of Class B rural roads, five ferry stages and two small bridges;
- Water Supply: 14 water retaining walls which are about 1 m – 1.2 m high, 41.5 km of distribution pipes to convey water from source to households for domestic use, and 26.5 km of channels for irrigation serving 27 ha of rice field, two crops/year;
- Power supply: build 13 substations of 31.5 kVA, 75 kVA or 100 kVA. Install 10.7 km of 0.4 kV power line and 30.18 km of 35 kV power lines;
- Commune buildings including 8 kindergartens, 5 classrooms and 4 accommodations for teachers, 5 cultural houses. All are grade 4 (one storey);

Housing: Affected households may have the choice of building their new houses on their own, or having the project to build houses for them based on the model that affected households has chosen among those introduced by the project.

In order to address the minor environmental impacts of this resettlement infrastructure, an Environmental Management Framework (EMF) has been designed and is included as an appendix to the EMP. The framework includes the actions, responsibilities and measures to guarantee that the impacts from all infrastructures built in resettlement sites are minimized. The EMF provides screening criteria, potential impacts and typical mitigation measures, and reporting and monitoring requirements for all project types to be built.

Climate Change

Hydropower, as a renewable energy source, displaces thermal generation, and thereby avoids emissions of global pollutants resulting from burning coal, gas, and oil. Nonetheless, it can also result in emissions of local pollutants and GHG from the reservoir. During the wet season Trung Son will displace the least efficient coal plant that would otherwise have to run; this is estimated to avoid emissions of 1.36kgCO_2/kWh. During the dry season, peaking plant are avoided, which tend to be more efficient gas-fired machines and will avoid emissions of 0.45kgCO_2/kWh. Although not an explicit objective of the project, it is expected that net greenhouse gas emission reductions of the project will be in the order of 1 million tones CO_2/year. At 19.8 Watts installed at the dam per square meter of reservoir area (W/m^2), the power density of TSHPP is high and calculations of the expected GHG emissions from the reservoir based on data from Brazil suggests that these will be less than one percent of the avoided emissions from thermal generation.

Climate change could have two undesirable impacts on hydro projects: lower dry season inflows, accompanied by an intensification of storms in the wet season (which may mean greater spill given reservoir storage limitations, and hence lower wet season generation). Even the most unfavorable reduction in generation from a rapid decline in inflows resulting in a 26 percent reduction by 2035 leave the Trung Son economic returns above the hurdle rate.

Other Safeguard Issues

Pest Management (OP 4.09)

Mosquito control programs will be implemented in all workers camps and resettlement sites. Resettled families will be provided with garden plots for planting fruits and vegetables. The management of pesticides and other hazardous wastes is included in the environmental specifications for contractors. Mosquito control in resettlement sites will follow government procedures. The CLIP includes training for resettlers on management of the pesticides including Integrated Pest Management.

Safety of Dams (OP 4.37)

The Trung Son hydropower project is the first to be constructed on the Ma River although plans exist for development along the length of the main stem, including in Dien Bien province upstream of the Lao section of the river, and downstream of Trung Son. Vietnamese dam safety requirements have been reviewed and compared with the requirements of OP 4.37. TSHPMB has established a Dam Safety Review Panel (DSRP) which has undertaken two missions at the feasibility stage and detailed design stage of the project. It has reviewed the quality assurance, O&M, instrumentation and emergency preparedness plans prepared by TSHPMB and found them satisfactory. All the other recommendations of the DSRP have been met.

IMPLEMENTATION ARRANGEMENTS

Environmental and Social Management Plans

The management of environmental and social impacts and measures to mitigate them are encompassed in a comprehensive set of plans prepared under the project. The two key plans are the EMP (as a separate chapter of the ESIA) and the RLDP. Their scope and objectives are summarized in Table 7.

Table 7: Scope and Content of EMP and RLDP

Plan	Objectives	Content
Environmental Management Plan EMP	The Environmental Management Plan (EMP) for the Trung Son Hydropower Project (TSHPP) identifies the principles, approach, procedures and methods that will be used to control and minimize the environmental and social impacts of all construction and operational activities associated	• Construction Impact Management Plan – measures to minimize negative impacts of construction activities on local communities and the natural environment, to reduce the induced impacts of camp followers, to prevent pollution; • Biodiversity and Protected Areas Management Plan – measures to ensure protection of local and regional biodiversity and minimize project

Plan	Objectives	Content
	with project development The EMP contains guiding environmental principles and procedures for communication, reporting, training, monitoring and plan review to which all EVN and TSHPMB staff, contractors and subcontractors are required to comply with throughout the preconstruction, construction and operation phases of the TSHPP	impacts on three adjacent protected areas; • Vegetation Clearing and Salvage Plan – measures to minimize biomass loss as a result of reservoir clearing and to coordinate timing to allow salvage benefits to local communities; • Environmental Monitoring Plan – measures to ensure project compliance, and the success of proposed mitigation, continue baseline monitoring and review environmental and social performance; • Community Relations Plan – measures to inform local communities on progress of the project and ensure community safety; • Regional Health Management Plan – PMB shall prepare a regional health plan to mitigate project impacts on the health of local populations; • Physical Cultural Resources Management Plan – measures to prevent any inadvertent loss of physical and cultural resources during construction and operation; • Environmental Management of Infrastructure in Resettlement Sites - address environmental issues that may arise during the construction and operation of the infrastructure that will be provided to resettlement sites • Additional Studies – additional studies are planned to improve information for the project
Resettlement Livelihoods and Ethnic Minorities Development Program (RLDP)	Vietnam Electricity (EVN), through the RLDP, commits to fully compensate resettlement impacts, to improve or at least restore livelihoods of local residents and to minimize or mitigate other negative social impacts. RLDP identifies the principles, measures and procedures that to fulfill this commitment. The RLDP starts during planning, continues during construction and operation	The RLDP comprises three inter-related plans: • The Resettlement Plan relates to losses of houses, land and other livelihood assets. The plan makes provisions for full compensation and relocation of all affected residents. • The Community Livelihoods Improvement Plan is a development plan for all villages affected by resettlement under the main project. Details are available for each participating village. • The Ethnic Minorities Development Plan addresses impacts on ethnic minority communities not covered by other plans.

The EMP is complemented by three additional instruments:

- A stand-alone Environmental Management Plan and Resettlement Plan for the 20.4 km access road to the dam from Co Luong (Mai Chau, Hoa Binh province) to Co Me (Trung Son, Thanh Hoa province) and two major and five minor bridges along the route.
- An Environmental Management Framework to address environmental issues during the construction and operation of resettlement sites; and
- A Policy Framework for Resettlement, Compensation and Rehabilitation of Project Affected Persons, an Environmental Planning Framework and an Ethnic Minorities Planning Framework to be applied to the 65 km , 220 kV double-circuit transmission line to connect the project to the Hoa Binh – Nho Quan 220kV line in Tan Lac District.

The EMP also includes specific studies to improve the baseline of the project area and support decision making through adaptive management. These studies include:

- A Cumulative Impact assessment at the basin level to analyze the broad impacts of Trung Son and all future hydroelectric projects and other development activities in the Ma River basin;
- A study to analyze the technical and legal feasibility of establishing an intact river policy in one of the Ma river branches;
- Additional water quality modeling in the reservoir and downstream.

Roles and Responsibilities for EMP Implementation

TSHPMB will be responsible for the management, implementation, monitoring and compliance of the EMP, SESIA and any approval conditions, including supervision of all TSHPMB staff, contractors and all subcontractors. The organizational structure and responsibilities for implementation of the EMP is presented in Table 8.

Table 8: Responsibility for EMP Implementation

Organization	Responsibility
EVN: Vietnam Electricity	▪ Overall responsibility for environmental performance of TSHPP
	▪ Decision-maker on applicable policies to the TSHPP
	▪ Oversight supervisory role during the construction and operational phase
	▪ Review reports of the Independent Environmental Monitoring Consultant (IEMC)
	▪ Approves changes to the EMP, as necessary, as part of an adaptive approach to environmental and social management of the TSHPP
	▪ Working with stakeholders in developing an approach to Intact Rivers management
TSHPMB	▪ Establish an environmental unit, headed by the Project Environmental Officer to implement EMP responsibilities
	▪ Management, implementation, monitoring and compliance of the EMP, SESIA and any approval conditions, including supervision of all TSHPMB staff, contractors and all subcontractors
	▪ Review of EMP performance and implementation of correction actions, or stop work procedures, in the event of breaches of EMP conditions, that may lead to serious impacts on local communities, or affect the reputation of the project
	▪ Ensure effective communication and dissemination of the content and requirements of the EMP to contractors and subcontractors
	▪ Assisting the contractor with implementation of EMP sub-plans
	▪ Monitoring of EMP and SESIA performance
	▪ Ensuring compliance to all project social commitments, including RLDP
	▪ Report environmental performance of the TSHPP directly to EVN
	▪ Report on environmental performance also to MONRE, World Bank, independent environmental monitoring consultants and other government regulators as required
	▪ Prepare environmental reports summarizing project activities, as required
	▪ Representing the project at community meetings
	▪ Ensuring effective community liaison and fulfilling commitments to facilitate public consultation
	▪ Monitoring of downstream impacts and any reports downstream of decreased fish yields
Supervising Engineer	▪ Preparation and implementation of the Environmental Supervision Plan during construction
	▪ Preparation and implementation of the Environmental Monitoring Plan during construction
	▪ Supervision of contractor performance on the Construction and Work Camp Management Plan
	▪ Reporting any incidents or non-compliance with the EMP to the TSHPMB
	▪ Ensuring adequate training and education of all staff involved in environmental supervision
	▪ Making recommendations to the TSHPMB regarding EMP performance as part of an overall commitment to continuous improvement
Construction Contractor	▪ Preparation and implementation of the Construction and Worker Camp Management Plan
	▪ Prepare and maintain records and all required reporting data as stipulated by the EMP, for submission to the Supervising Engineer
	▪ Ensure that all construction personnel are informed of the intent of the EMP and are made aware of the required measures for environmental and social compliance and performance
	▪ During construction, maintain traffic safety along access roads, with special emphasis on high trafficked areas

Organization	Responsibility
Independent Monitoring Consultants (IMCs)	▪ Report to TSHPMB, EVN and the World Bank on project compliance with environmental and social commitments in the EMP, EIA and other applicable standards
Local Authorities	▪ Local authorities, communities and individuals shall be involved in supervision of both the SESIA and EMP, where applicable

EVN is the project owner. It takes responsibility to ensure to entire project is implemented according to both government and World Bank requirements. Included within this is the responsibility to ensure the RLDP is implemented in compliance with the commitments set out in it. EVN approves the RLDP and will ensure that sufficient resources are allocated to implement it. EVN will oversee implementation by TSHPMB of the RLDP and coordinate with provinces and the World Bank on issues related to the RLDP. EVN has entrusted TSHPMB with all aspects in relation to implementation of the project.

The PPCs are each responsible for reviewing and endorsing the RLDP in so far as it applies within the territory of the province. They will approve the Resettlement Plan or assign District People's Committees (DPCs) under them to approve it. The PPCs direct the DPCs and other related departments or organizations to coordinate with TSHPMB and provide resources for implementation of the RLDP. The PPCs also monitor the implementation of the RLDP.

The District People's Committees (DPC) coordinate with the TSHPMB in design, implementation, monitoring and evaluation of the RLDP. They will review and endorse the RLDP before it is submitted to the PPC for its review. If authorized by the PPC, DPCs will review and approve the Resettlement Plan. DPCs will direct commune and village authorities and directly assign their own staff to work with TSHPMB and affected communities.

Commune People's Committees: villages, ethnic minority representatives and households. a commune workgroup is established to assist implementation and for participatory monitoring of the three plans. Each commune nominates an ethnic minority representative to District Compensation Committee and to its EMDP team. These representatives are village elders or prestigious people among the ethnic minority community. Each village sets up a monitoring group.

TSHPMB manages the project in such a way that it complies with RLDP principles. It implements and monitors RLDP, and assists in the resolution of complaints and grievances.

Within TSHPMB, a safeguard team is in charge of all social aspects, including but not limited to resettlement (as well as environmental management aspects: refer to environmental management plan). The safeguard team reports directly to the Director of TSHPMB. The safeguard team (a) implements the RP including the inventory of losses, preparation of compensation and allowance plans, contracts for construction of the resettlement sites and associated infrastructure, delivery of compensation and allowances, in particular by preparing detailed schedules and plans, and monitors progress; (b) takes part in the CLIP team under the coordination of the Chief Technical Assistant (CTA), particularly to manage activities in the service center, and (c) is a facilitator for the district ethnic minority development teams which oversee EMDP. It implements communication activities jointly with the TA team.

Consultants and contractors, hired by TSHPMB: (a) support the preparation and implementation of the individual plans within the RLDP, (b) carry out construction of resettlement sites and associated infrastructure; (c) conduct independent monitoring of each of the plans within the RLDP.

Institutional responsibilities for RLDP implementation are summarized in Table 9.

Table 9: Primary Agency Responsible for Each Element of RLDP

Area of respons-ibility	PPC	TSH PMB	Contr-actor (1)	Safeg-uard team	DPC	DCC	CPC	Villages
Overall RLDP								
Compliance		√						

Area of respons-ibility	PPC	TSH PMB	Contr-actor (1)	Safeg-uard team	DPC	DCC	CPC	Villages
Management		√						
Coordination	√	√			√			
Communication			√	√				
Monitoring		√		√				
1. Resettlement Plan								
DCC coordination				√		√	√	
Compensation						√	√	
Participation								√
Resettlement sites			√			√	√	
2. Community Livelihoods Improvement Plan								
Participation in CLIP team			√	√	√			
Technical assistance			√					
Technical advisory board	√							
Service center			√	√				
Participation in activities							√	√
3. Ethnic Minorities Development Plan								
Coordination				√		√		
Participation in activities							√	√
Specific measures				√		√		

Panel of Experts

An environmental and social Panel of Experts (PoE) has been established to provide independent review and guidance on the treatment of environmental and social issues associated with the Trung Son project. Among other duties, the PoE will provide reports to EVN and PMB on the status and compliance with EMP and RLDP requirements. The PoE has already produced two reports on the preparation of the environmental and social documentation for the project. The recommendations from the panel have been incorporated in the final version of these documents.

Adaptive Management

PMB recognizes that the proposed plans may need future adjustments. An adaptive management approach will therefore be adopted for environmental and social management components. Based on monitoring and evaluation of actual performance, proper adjustments will be made to management plans.

Safeguards will be managed in a flexible manner in order to fully reach the objective of meeting the requirements for management of: fish and fisheries in the reservoir and downstream; water releases and environmental flows; increased erosion downstream; water quality in the reservoir and downstream; health impacts; and resettlement and livelihood development. Adaptive management is expected to be important in at least four areas:

- Response to updates in the legal framework.
- Actual circumstances on the ground. If monitoring of any part of the environment or social management indicates that circumstances have been changed, or there have been oversights in preparation (for example if a household not included in the census is eligible for compensation) the application of the principles set out in the SESIA, EMP and RLDP will apply.

- Budget. The Environment and Social Mitigation component budget of the project is a cost estimate which will be adjusted as needed during implementation. Contingencies have been included to allow budget increases.
- Schedule. The schedule reflects the sequence of planned operations as of October 2010. It will be revised as frequently as needed during implementation. The mitigation plans are programmed for a five-year period from end-2010 until end-2016 (2015 for the RLDP). The programs will close at the end of 2016 if and only if the objective had been reached.

Adaptation will only take place if the outcome of this adaptation is conducive to better achievement of the project objectives and principles. Adaptive management cannot be used to justify actions that would conflict with legal principles or Bank policies. Prohibited changes would include, among others:

- Altering or reducing environment standards that result in not restoring the project area to its pre-project condition to the greatest extent possible, or failing to mitigate known environment impacts.
- Ignoring or avoiding dealing with emerging environment or social issues.
- Restriction or elimination of entitlements and eligibility criteria, or reduction of compensation rates below the replacement cost standard.
- Lowering the resettlement objective to below the requirement to at least restore incomes or living standards to below pre-project levels (or accepting a substandard outcome as satisfactory).
- Imposing, activities on ethnic minority communities without free, prior and informed consultation resulting in expression of broad community support.

PUBLIC CONSULTATION AND DISCLOSURE

Public consultation is a key component of the TSHPP. So far it has been pivotal in:

- Finalizing the report on Supplementary Environmental and Social Impact Assessment (SESIA) and Environmental Management Plan (EMP) for the Trung Son Hydropower Project.
- Creating the Resettlement Livelihood and Ethnic Minorities Development Program (RLDP) with three main components: the Resettlement Action Plan (RP), Community Livelihood Improvement Development Plan (CLIP), Ethnic Minority Development Plan (EMDP) and the communication and management component.
- Designing an open dialogue between TSHPP authorities, village leaders and affected households. The goal was to ease the transition into resettlement areas, while improving living conditions and quality of life of affected households.

The objectives of consultation are:

- Inform the affected households and communities, local authorities and civil society organizations about potential Project impacts and proposed mitigation measures. Information provided in the RLDP and EIA/EMP was disclosed at the project affected area, Vietnam Development Information Center (VDIC) and the Public Information Center (Infoshop) of World Bank located in Washington, D.C. at least three weeks in advance of the consultation;
- Collect opinions/feedback to complete the RLDP and EIA/EMP; and
- Have initial agreement/commitment to co-operate with the local authorities during the implementation process.

Three consultation rounds with local communities and communes were carried out in 2008-2010 as to:

- Inform affected households and communities about project impacts; and
- Collect information and initial feedback be used as input data to prepare for the project, particularly the RLDP and SESIA/EMP.

The first consultation round was carried out from July 12 to 26, 2008 in 15 villages and one hamlet that are to be relocated in the reservoir area. The second round was carried out from December 20, 2008 to January 12, 2009 in 34 other villages affected by the project including the villages along the

access road, and those that could be affected but not necessarily resettled. The total number of villages affected by the project and consulted is 47.

In 2009 and 2010, the third round of consultation at the village, district, provincial and central levels was carried out. At village level, community consultation concluded in all 56 villages of 17 communes affected by the TSHPP, including downstream affected communes. Representatives from Vietnam River Network participated in all village-level consultation meetings as observers. At the district level, consultation was carried out in Muong Lat and Quan Hoa districts of Thanh Hoa Province, Mai Chau District of Hoa Binh Province and Moc Chau District of Son La Province. Participants were from relevant district/communes authorities, at least one representative from each affected village in the respective district and representatives from provincial authorities as appropriate. At provincial level, consultation has been implemented in three provinces including Thanh Hoa, Son La and Hoa Binh with participation of relevant departments such as provincial electricity department, Ethnic Minority Department, Agricultural and Rural Development department, Natural and Environmental Department, Department of Labor, War Invalid and Social Affairs etc). At central level, consultation with civil society was held in Hanoi in March 2010 with participation of representatives from civil society organizations, NGOs, international agencies or any individuals.

Consultation Methods

Consultation with Affected Communities

Consultation was conducted in every affected village/community. Information of appropriate form and in local languages was provided at village and household level at least three weeks before the consultation meeting. A meeting was held in each consulted village with participation of as many villagers as possible and any other interested individual/organizations. Extra efforts were needed to encourage women and others who might otherwise be excluded to attend; consideration was given to having separate meetings with any groups that was reluctant to attend the village meetings. A short oral summary on the project, its impacts and proposed mitigation measures was presented in the meeting. All questions/ feedback and requests were properly recorded and responded as appropriate. Group discussions were held if needed. In addition to Vietnamese, translation of the discussions into local languages was provided as necessary. Photograph and video recording were taken but only if they did not inhibit the consultation process. Minutes were prepared for each consultation and agreed to with participants. A summary report to describe the consultation process and main findings was prepared no later than one week after completion of the consultation.

Consultation with Villages and Communes Potentially Affected by Downstream Impact

Downstream impacts to those villages/ communes can only be fully assessed when the dam enters operation thus an adaptive approach has been proposed. The consultation materials will be disclosed at each affected villages and a consultation meeting will be held in each commune center with participation of the villages' representatives. Consultation content shall be adjusted as appropriate.

Consultation with Civil Society

The consultation was organized by the World Bank in collaboration with the PMB. A facilitator was hired to chair this meeting. Box 4 shows some elements and materials of the community consultation.

Public Consultation Results

Trung Son HPMB has received many responses from local authorities and households in the project area, and particularly from households affected by the project. The following were general comments from Project-affected households: (i) welcome and support the construction of TSHPP; (ii) believe that quality of life should improve with additional community services and infrastructure; (iii) concerns of local people on compensation rates for land areas required and agricultural production and bamboo affected by the project; (iv) state policies should financially assist impacted villages, especially after construction and resettlement; (v) environmental policies minimize the extent of environmental pollution; (vi) implementation of mitigation measures specified in EMP and programs in RLDP; and (vii) village security and environment shall be sustained.

Agricultural land and its productivity are the main concerns of local villagers. Resettlement land and its productivity need to be of equal or greater value to the lost land. Bamboo takes approximately six to seven years before it can be harvested; therefore, adequate financial or "land-for-land" compensation will be vital in supporting villages during and more importantly, after construction. Resettled and affected areas will also receive financial support and health, education and community services and programs.

Village security and maintenance of social order were also common concerns. The rapid population increase, particularly the number of males in the Co Me and Chieng Po communes, could dramatically increase the amount of gambling, prostitution, theft, drugs and disease. Several villages have requested state guards during construction.

One of the most significant outcomes of consultation with communities during preparation has been the revision, in two out of four communes, of the resettlement sites that had been initially planned. New, smaller sites have been selected with more fertile soils and higher water resources. Through consultation, all Hmong communities have expressed a preference for relocation within their village, so that the resettlement sites are currently planned for a wholly Thai/Muong population, with a few Kinh households. Consultation with local social organizations has led, among other elements, to include prevention of HIV/AIDS and women and child trafficking in impact mitigation measures. Resettlement can only proceed after the affected community has indicated its broad support for resettlement arrangements. Together these assessments have elicited local feedback on the project, the draft compensation and resettlement policy, relocation plans and relocation assistance, livelihood restoration and improvement, and questions relating to ethnic minority cultures and other project impact.

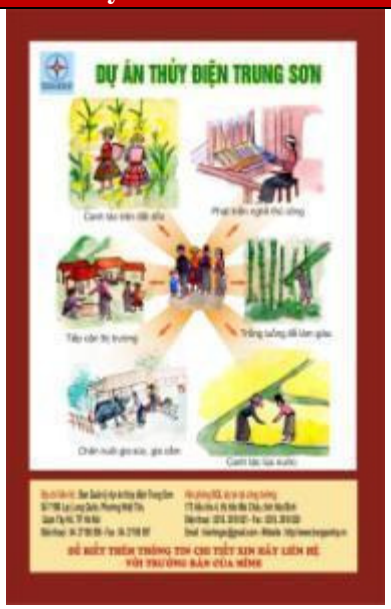
Box 4: Community Consultations in Trung Son

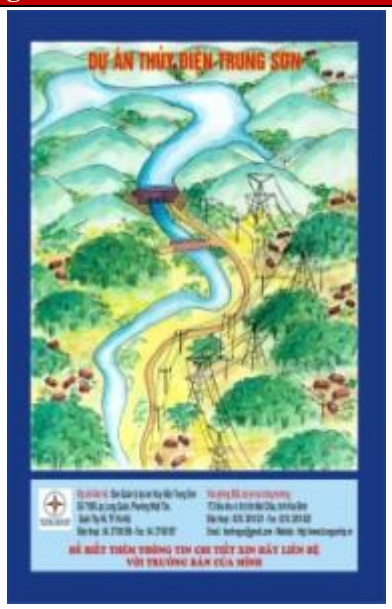
Three Rounds of consultations were conducted for affected communities from December 2008 to March 2010.

- Round 1: 14 villages which will be inundated by the reservoir
- Round 2: 34 villages affected by the construction of the access road
- Third round of consultation has been conducted in January/ February 2010 from village to central level (53 villages, four Districts and three provinces.
- At central level, consultation with Civil society and the Provinces was conducted early March 2010

Materials

- Cassette recorder, batteries and tapes recording project information, key socio-environmental issues, and mitigation programs in 4 languages (in 3 ethnic languages) distributed to village leaders.
- Documents and materials for consultation sent to villages/ districts and provinces at least three weeks before consultation takes place
- **Website for Trung Son project** was created to provide information to interested parties.
- **Posters and wall calendars** (a very common fixture in the area) with information on Trung Son were distributed among local households.





Consultation details and feedback from local authorities, project affected households, non-government organizations, and individuals were synthesized and presented in a Consultation report included in project documents.

Free, Prior and Informed Consultation Has Led to Broad Community Support

The principle of free, prior and informed consultation in ethnic minority villages has been pursued during project design and will be continued during implementation. In practice this has meant provision of written, visual and audio materials in form, substance and language appropriate for the audiences well in advance of consultations. The consultations have been held at hamlet or village level, and led by respected members of the community. Minority or under-represented groups, including women and young people have had opportunities to express their opinions in all meetings. Communities will continue to have opportunities to voice concerns.

Reports of consultations provided by consultants indicate support for the project. This is supported by firsthand experience of the staff of TSHPMB through numerous field visits, and now a continuing field presence throughout the project area over the period from 2007. Communities continue to express support for the project, and requested acceleration of project implementation. In the opinion of TSHPMB, there is broad community support for the project.

Complaints and Grievances

Complaints and grievances relate to issues that cannot be solved immediately and may not be solved locally. In environment matters, it can relate to the impacts of the construction works or the way in which they are carried on, behavior of construction workers, and safety matters In resettlement, the scope of the grievance includes all land issues directly related to project impact including, if appropriate, clarification of boundaries between villages and communes. For ethnic minorities affected by the project, these issues may relate to (a) conflict between communities on access and management of natural resources, (b) any other matter for grievance in relation to ethnic minority cultures.

Complaints and grievances will be handled through two channels. First, a legal mediation channel formed by Peoples' committees from commune up to province level, is in place in Vietnam. This channel is distinct from the technical project implementation formed by the DCC and commune workgroup. Second, the project itself sets up an alternative channel, the independent grievance panel

Legal Mediation Channel

The formal national procedure of the Land law is based on four stages of mediation:

First step: if any person is aggrieved by any aspect of the resettlement and rehabilitation program, he/she can lodge an oral or written grievance with commune authorities. The CPC will resolve the issue within fifteen days from the date it receives the complaint.

Second step**:** if any aggrieved person is not satisfied with the decision in the first step, he/she can bring the complaint to the DPC within fifteen days from the date of the receipt of the first step decision. The DPC will reach a decision on the complaint within fifteen days.

Third step: if the aggrieved person is still not satisfied with the decision at district level, he/she can appeal to the Provincial People's Committee within 45 days of receiving the decision of the DPC. The Provincial People's Committee will reach a decision on the complaint within the timing regulated by Vietnamese law.

Fourth step: If the DP is not satisfied with the decision of the Provincial level, the case may be submitted for consideration by the District Court within 45 days of receiving the decision of the PPC. The District Court will reach a decision on the complaint within the timing regulated by the Vietnam's law.

Independent Grievance Panel

TSHPMB will establish a grievance panel independent of the legally-established grievance mechanism. The safeguard team in TSHPMB will provide a monthly monitoring report to the panel to allow it to monitor all complaints and grievances.

Complaints or grievances are received through a variety of sources, including, for example direct from either the individual or a group, or through a representative, such as the village head, a representative of a mass organization or an NGO. (in the Vietnamese language or a local ethnic language) or in written form. They may also be reported through the Commune People's Committee, which informs the safeguard team; or directly to the safeguard team during monthly compliance monitoring. The complainant may be assisted by others throughout the process. Key principles in the informal process are: (a) to deal with the matter at the lowest possible level; and (b) to address complaints as quickly as practicable to avoid minor issues becoming major ones.

The first point of contact for a complainant is the project Community Relations Officer (CRO), a member of the Trung Son Safeguards Team. The CRO will take up the matter with relevant members of the Trung Son Safeguards Team to try to reach a solution. If no solution satisfactory to the complainant can be achieved, the complainant meets the head of the Trung Son Safeguards Team, who addresses the issue in conjunction with heads of other departments in TSHPMB, contractors and, as necessary, local authorities. Records of meetings between complainants will be maintained and reviewed by the project IEMCs. Meetings are conducted in a language acceptable to the complainant and in a setting appropriate to the needs of the meeting (which may include the site of the complaint, or the offices of TSHPP).

If the complainant is not satisfied with the solutions on offer from the head of the Trung Son Safeguards Team, the Independent Grievance Panel (IGP) will hear the case. The IGP is composed of the head of the Trung Son Safeguards Team, and at least one member of the independent PoE. It is chaired by the Director of TSHPMB. It may co-opt additional members as required including, for example, independent social and environment monitoring consultants, a technical expert or an NGO. It may also take independent advice from consultants or other experts at its discretion.

Complaints received by the IGP will be publicly disclosed when they are received. The IGP will hear the complaint in a face-to-face meeting, at which the complainant and any advisor or representative may be present. The IGP will publish its findings promptly after it has completed its deliberations and one member of the IGP will be delegated to communicate the findings to the complainant in a suitable form and language.

The IGP will convene quarterly to review all complaints dealt with by either the CRO or the head of the Trung Son Safeguards team, and to discuss any ongoing complaints. The IGP can be convened by any individual member to deal with urgent matters which cannot wait until the next scheduled meeting.

Project information leaflets provide practical information about grievances to local residents such as contacts and addresses. They mention both the legal mechanism and the IGP, and provide information about how to get in touch with both.

BUDGETS

Estimated costs for the implementation of the EMP and RLDP are presented in Tables 10 and 11.

Table 10: EMP Component Costs	Estimated Cost (US $)
Contractor – built into contract	8-12% of total construction costs
Supervision – environment – to be built into the contract for Engineering Supervision (includes sampling for environmental quality); built into contract	10-25% of engineering supervision cost plus $250,000 (separate estimate for environmental quality monitoring)
Independent Environmental Monitoring	$250,000 (3-5 years)
Institutional Strengthening, Training and Capacity Building[1] ▪ Formation of TSHPMB environmental unit ▪ Local authorities, communities and other stakeholders ▪ On-site training ▪ Offsite training ▪ Local capacity building ▪ Equipment and logistics	$250,000
Technical Assistance to TSHPMB environmental unit ▪ Provision of outside consultants ▪ Manual of functions and procedures ▪ Assist in development of environmental database ▪ Special issues – e.g. water quality ▪ EMP protocols and procedures ▪ Assist in development of TSHPMB Environmental Unit ▪ Assist in implementation of updated management plans ▪ Contractor liaison ▪ TORs	$300,000 (2 years)
Chance Finds Procedures and Cultural Property Salvage (including downstream erosion assessment)	$200,000
Biodiversity and Protected Areas ▪ Support to Protected Areas Management Plans ▪ Provision of wardens	$700,000

[1] Costs of salaries, administration and function of the environmental unit paid by TSHPMB

Table 10: EMP Component Costs	Estimated Cost (US $)
▪ Infrastructure and equipment ▪ Education ▪ Tiger Action Plan	
Public health action plan	$600,000
Additional Studies	
Intact Rivers Management	$150,000
Water Quality Modeling	$100,000
Cumulative Effects Assessment	$100,000
Total (excluding costs built into other contracts)	$2,900,000

Table 11 RLDP Component CostsTable 11	Estimated Cost (US$)
1. Base cost	
Main project RP	25,958,206
CLIP	2,000,000
EMDP	137,436
Total base cost	28,095,642
2. Management	
Main project RP (management and design)	2,336,239
CLIP	40,000
EMDP	2,749
Communication	95,175
Capacity-building	51,282
M&E	264,262
Total management	2,789,706
Depreciation	1,404,782
Contingency	2,809,564
Total RLDP	**35,099,694**

ANNEX: LIST OF ENVIRONMENT AND SOCIAL STUDIES AND REPORTS

Document	Disclosed
A. Related to Identification Phase	
Environment Impact Assessment Report at Investment Project Phase (May 2008)	May 11, 2010
Master Plan for Use and Protection of Water Resources of the Ma River in Vietnamese	November 16, 2010
Strategic Environment Assessment of the Hydropower Master Plan in the Context of the Power Development Plan VI, Main Report and Appendices (January 2009)	November 16, 2010
Environment Impacts Assessment for Trung Son Hydropower Project as Approved by MoNRE in English and Vietnamese (June 2009)	November 16, 2010
B. Related to Preparation Phase	
Resettlement Livelihood Development Plan & Annexes (Draft)	December 23, 2009
Resettlement Policy Framework – Power Line Component	May 19, 2010
Environmental Management Plan draft report	December 23, 2009
Supplemental Environmental Impacts Assessment (SESIA, Draft)	December 23, 2009
Draft Resettlement Plan for Access Road and Bridges	September 15, 2009
Summary of Planning on Environment Management for Access Road and Bridges	November 16, 2010
Environmental Impacts Assessment (EIA) and Annexes for Access Road and Bridges	February 17, 2009
Environmental Management Plan (EMP) for Access Road and Bridges	December 23, 2009
C. Documents supporting preparation of SESIA	
Reservoir Vegetation Cover Clearance Plan (December 4, 2009)	November 16, 2010
Impact Assessment Of Trung Son Hydropower Project To Fish-Biodiversity And Fisheries - Mitigation Measures Suggest (December 2008)	November 16, 2010
Assessment Of Impacts Caused By Trung Son Hydropower Project To Protected Areas And Terrestrial Biodiversity (2008)	November 16, 2010
Trung Son Reservoir Hydrodynamic And Water Quality Modeling (May 4, 2009)	November 16, 2010
Operation Model Of Reservoir - Technical Design (July 2010)	November 16, 2010
Environmental Guidelines For Power Lines (May 18, 2010)	May 19, 2010
Environmental Management Plan (August 3, 2010)	November 16, 2010
Planning On Environment Management Access Road And Bridges Trung Son Dam By IESE (2008)	November 16, 2010
Report Of Construction And Camp Management Of Trung Son Hydropower Project (March 23, 2010]	November 16, 2010
Health Impact Assessment And Public Health Action Plan (July 10, 2010)	November 16, 2010
D. Livelihoods	
Research report of livelihoods opportunities and challenges of the communities living in region affected by hydroelectricity power dam Trung Son - Thanh Hoa by Research team of GRET (March 31, 2008)	November 16, 2010
Social and economic survey and assessment report by DRCC. (June 20, 2008)	November 16, 2010
E. Physical Cultural Resources	
Investigating Tangible Cultural Resources In The Area Of Trung Son Hydro-Electric Project, Thanh Hoa Province (November 2008)	November 16, 2010

F.	**Economic and Financial Analysis of Project and Alternatives**	
	Alternatives The Trung Son Hydro Project (December 2009)	November 16, 2010
G.	**Independent Assessments - Panel of Experts and Independent Monitoring**	
	Panel of Experts Report #1 (August 2008)	November 16, 2010
	Panel of Experts Report #2 (June 2010)	November 16, 2010
	Inception report on Independent Resettlement Monitoring for the Road (September 2009)	November 16, 2010
	Independent Resettlement Monitoring for the Road Mission I report (August 2009)	November 16, 2010
	Independent Resettlement Monitoring for the Road Mission II report (July 2010)	November 16, 2010