

My Ly - Nam Mo Hydropower JSC



Environmental and Social Impact Assessment


NAM MO 1 HYDROPOWER PROJECT

Volume X
Executive Summary – English
27 October 2017

ENVIRO-DEV
with Input from
PECC1

Volume X

Environmental and Social Impact Assessment Nam Mo 1 Hydropower Project

Date 2017	Revision History	Document No. and Name	Issued by Name and Signature
27 October	First Issue	ENVIRO-DEV Doc 003-2017: Volume X Executive Summary – English	 Shivcharn Dhillion
International Consultant:		Input from National Consultant:	
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LAYOUT OF THE ESIA REPORT

VOLUME I	Environmental and Social Impact Assessment (ESIA)
VOLUME II	Agreements, Approvals and Specialist Reports
ANNEX 1	Agreements and Approvals
ANNEX 2	Appendices, Specialist Reports on (a) Biology, and (b) Water Quality Resources
VOLUME III	Social Baseline
ANNEX 3	Social and Livelihoods Reports
VOLUME IV	Communication
ANNEX 4	Consultations before 2017 (pre-ESIA)
ANNEX 5	ICP Process Reports
VOLUME V	Public Communication and Disclosure Plan (PCDP)
VOLUME VI	Resettlement and Ethnic Minority Livelihoods Restoration Plan (REMLRP)
VOLUME VII	Environmental and Social Management Plan (ESMP)
VOLUME VIII	Executive Summary – Vietnamese
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EXECUTIVE SUMMARY

THE PROJECT

The Vietnam National Power Development Master Plan for 2011-2020 (revised and approved on 18 March 2016) states that, there is an urgent need for more power with higher reliability and competitive electricity prices in all regions of Vietnam. One of the key changes in the revised masterplan is the emphasis on renewable energy development. –It is estimated that there will be approximately 235-245 billion kWh of commercial electricity in 2020 and 265-278 billion kWh of electricity will be produced or imported in the same year. The Ca River basin, where the proposed Project is located, is one of the main ones identified for renewable – hydropower energy sources.

The Nam Mo 1 Hydropower Project ('the Project') is a peaking project designed to have a capacity of 90MW with a storage reservoir of approximately 962ha (874.8ha of land). My Ly-Nam Mo Hydropower Joint Stock Company (JSC), a private Vietnamese enterprise was incorporated by Vietracimex to develop the Project.

The Project is situated in two of the nations in the Indochina region of Asia. Both the governments of Vietnam and Lao PDR have an agreement to develop hydropower projects on the Nam Mo River. Nam Mo River is one of the main tributaries of Ca River. Ca River is located in Nghe An Province of Vietnam and most of the left bank is within the Laos territory in Xiangkhoang Province.

My Ly - Nam Mo Hydropower JSC, the Project Proponent, later engaged Hydropower Engineering Consultancy and Construction Company to prepare the Feasibility Study in June 2012. An agreement between the two Governments was signed in 2016 which stipulates the cooperation of the two countries to develop the Nam Mo 1 HPP including its agreement terms on investment, construction, operation and management of the Project. After which, a more detailed FS has been carried out including procurement of primary permits such as national environmental clearances for both Lao PDR and Vietnam. One of the conditions of the agreement is the preparation of an Environmental Impact Assessment (EIA). Two national EIAs were prepared, one for each country and are subject to each country's respective national procedures and compliance. The approval from the Government of Vietnam was obtained on 20 November 2016, while that from Laos is pending.

My Ly-Nam Mo JSC, intends to acquire a loan to finance the development of the Project. The Proponent plans to apply for a political risk guarantee from the Multilateral Investment Guarantee Agency (MIGA, World Bank Group) to secure the loan. The National EIAs were found not to be compliant with MIGA policy thus requiring upgrading. One of the requirements for a loan agreement is to prepare an international Environmental and Social Impact Assessment (ESIA) based on MIGA Performance Standards.

My Ly-Nam Mo Hydropower JSC engaged ENVIRO-DEV (based in Norway) to develop the ESIA in accordance with the requirements of MIGA Performance Standards (2013). Logistics, input on previous works and field assistance was provided by the Power Engineering Consulting Joint Stock Company (PECC1, EVN).



The salient features of the ESIA of Nam Mo 1 HPP are summarized here.

TECHNICAL CHARACTERISTICS

The main components and auxiliary work areas are all located in the Ta Ca Commune, Ky Son District, Nghe An Province, Vietnam (Table 1). These were proposed through optimization studies including dam structure, installed capacity, number of powerhouse unit, water head, and quantity and dimension of spillway gate, among other technical features (Table 2). The Project’s direct impact area includes 11 villages in Vietnam and five villages in Laos that will be subjected to relocation (Figure 1).

Table 1 Salient features of Nam Mo 1 Hydropower Project

Project Location	Vietnam	Lao PDR
Region	North-Central Vietnam	North – East
Province	Nghe An	Xiangkhoang
District	Ky Son	Nonghed
Communes	Muong Tip, Muong Ai, Ta Ca, Nam Can	No commune unit is used in Lao PDR
Villages	Total of 11 villages to be relocated	Total of five villages to be relocated

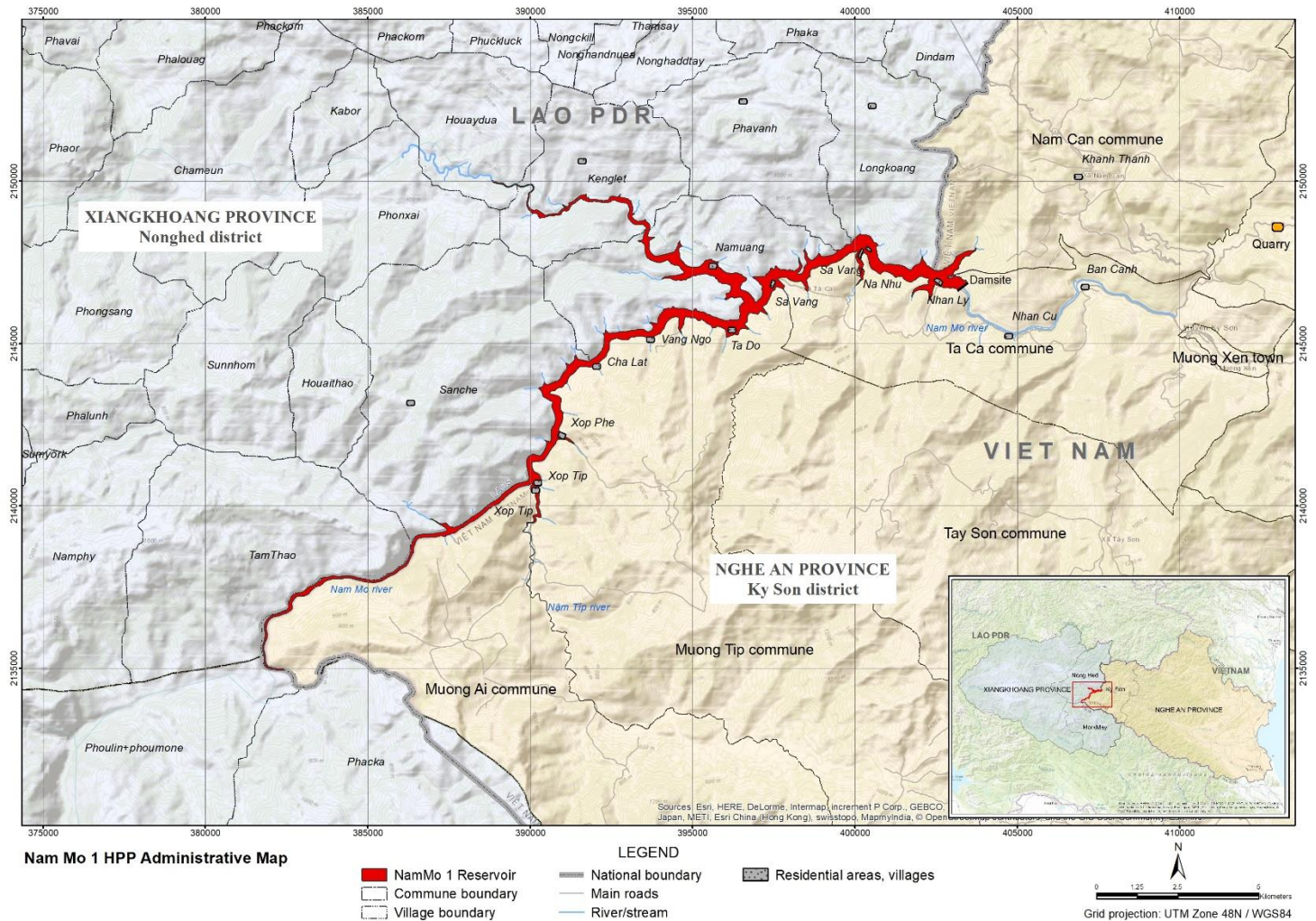


Figure 1. General map showing the Project location and the villages

The main features of the Project head works, reservoir and river are provided in Table 2.

Table 2. Main features of the Project

Project area	
<i>Hydrology at intake</i>	
Annual mean flow	65.5m ³ /s
<i>Other features</i>	
Installed capacity	90MW
Firm capacity	17.5MW
Annual energy production	326.8GWh
a. Headworks	
Location	Ta Ca Commune, in Vietnam
Latitude / Longitude	N : 19°24'44" E: 104°04'46"
Dam type	RCC (gravity rolled compaction concrete)
Dam height	95.52m
Crest length / width	407.15m / 8m
Approximate reservoir length	33km
Calculated head	65m
Reservoir gross storage (total reservoir volume including dead storage)	272.1million m ³
Reservoir active storage	151.3million m ³
Reservoir Full Supply Level (FSL)	235m
Reservoir Minimum Operating Level (MOL)	215m
Reservoir area at FSL (full supply level)	962ha
Maximum powerhouse discharge	156.5m ³ /s
Highest regulated water level	241.46masl
Lowest regulated water level	215masl
Spillway Sill elevation	4 bays (10mx12m each) 225m
Weir total length Stepped spillway – Step height/width	77.5m 12m / 10m
Distance of powerhouse from dam site	108m
Distance of tailrace from dam site	308m
Potential total length of river expected to be affected due to reservoir	33km length of reservoir
b. Headrace Tunnel	
Tunnel inlet elevation	202.25masl

During the construction of the dam, the river will be diverted through a tunnel. In addition to the construction of the dam, the tunnels and the power house, the Project will need new roads/upgraded roads, spoil tip areas, sand quarry areas, rig areas, permanent housing, temporary and labor camps, and transmission lines, among other areas, to complete the development. Some of these planned construction areas and structures will be permanent while others will be temporary. Transmission lines will be the subject of a separate ESIA and thus has not been included in this assessment. The construction areas (auxiliary works) are located clustered next to the dam site concentrating all activities. The only areas not located in the same site is the quarry.

Project site related roads. There are a number of district roads and local roads in the area that are linked to the main national roads. At necessary points in the project area, new project access roads will be built and connected to the existing road system. Most of these will be permanent roads, some will be upgrading of existing roads, and some may be temporary for use during the construction period. Permanent roads remaining will be 4.40km long and temporary construction area roads will be 1.65km long.

Quarry site. The Project will utilize the existing Pah Danh quarry for its source of rock aggregates. It is currently being operated by Phu Cuong Ltd. Company and has a valid extraction permit for 15 years. The Pah Danh quarry is approximately 6.5ha and located downstream of the dam site, approximately 14km in distance. Access to the quarry is through the Tay Nghe An Provincial road. Road surface will be rehabilitated to cater for delivery trucks to the project construction site. There are villages located along the access road to the quarry site: Phieng Pho (in Pha Danh Commune), Khanh Thanh (in Nam Can Commune), Son Thanh, Cau Am, Binh Son, Ban Canh, and Nhân Cù, all are located in Ta Ca Commune.

Spoil disposal areas. The Project proposed two disposal areas with a total area of 13.57ha to accommodate the estimated spoil materials from the various excavation works for construction. Details on amounts needed will be assessed during the detailed design phase. The disposal areas will be a temporary functional area of the Project, until the construction ends or until the area contains spoil at maximum volume capacity. Some of the disposal areas are designed to support structures (e.g., employees' accommodation) once the required height and flatness are achieved. The disposal areas will also be shaped and managed to maintain good and safe conditions such as slope, height and flatness.

Operation of plant. It is envisaged that the Project will store excess water in the reservoir during high flow to be utilized during low flow. The height of the dam will be 95.52m above the existing river bed and the FSL will be 235masl creating a reservoir length of 33km with a total volume of 272.1Mm³. The water will be diverted through a twin tunnel down to a power station located adjacent to the dam. The water will be released back in the river, 200m downstream of the power station and 308m of the dam site. Note though that the release comes within the reservoir of the existing Nam Mo HPP, located downstream of this proposed Project (Nam Mo 1 HPP). In fact, the proposed location of the damsite is still within the tailend of the existing Nam Mo HPP reservoir.

The Plant is optimized for maximum energy generation throughout the year. During the dry season, the Plant will run only as a peaking plant during daytime, while in the wet season, the Project will generate approximately 24-hours at full capacity. Details on planned operation are provided in the next section on salient features.

The dam will create a reservoir that will extend up to 33km upstream and will impact 16 villages, 11 in Vietnam and 5 in Laos (communes of Muong Ai, Muong Tip, Ta Ca and Nam Can in Vietnam and Nonghed districts in Laos). The flow in the river between the dam and the outlet, will be reduced, particularly during the dry season, and the river will be subjected to daily flow fluctuations due to the peaking operation of the power plant. All these operational impacts need to be assessed considerably during the detail design to ensure that the operational criteria for Nam Mo HPP downstream is not compromised.

The proposed Project is planned with installed capacity of 90MW. Based on the planned installed capacity, the total annual energy generation in an average year will be

approximately 326.8GWh. Nam Mo 1 HPP has an active storage volume of 151.3Mm³ and is a long-term regulation reservoir.

Environmental flow. Releasing of water flow for environmental requirements and downstream users is a new concept in Vietnam. A relevant regulation, the national technical regulation on hydraulic structures for design (**QCVN 04-05 – 2012/BNNPTNT**) provides the requirement for minimum flow for HPP's, and the minimum flow (environmental flow) shall be equal to the average flow of the river during dry season, with frequency of 90%.

The case of this Project however is complex because an existing HPP is located downstream and the proposed damsite is located within the tailend of its reservoir, which is not unusual in Vietnam. The minimum environmental flow should also consider the operational criteria of the existing HPP, which is governed by EVN.

At an ecological perspective, a minimum average monthly flow increasing from 1.55 to 2.06 m³/s down the river course of the dam would be required. This discharge considered more than sufficient for the maintenance of adequate wetness conditions to support the ecosystems that may exist in the boulder bed river, riparian vegetation, water resources, and fisheries. Provision shall be made to release such quantum of water which is higher or either at least 15% of the average minimum flow. In the case of Nam Mo 1, human use of the water is low, except for fisheries. The final operation regime will be confirmed during the detail design phase and should include consultation with the downstream HPP (operated by EVN).

Construction manpower. The estimated required manpower for construction is approximately 1750 persons. Ten to fifteen percent of the total estimated work force is expected to be local. In addition, an influx of new settlers and small businesses will normally establish themselves at such large construction sites. Unregistered persons and “camp followers” could come to the area, whose numbers should be held at a minimum. Temporary and permanent camps will be constructed to provide accommodation for the workers and it is envisaged that the design is in-line with MIGA's standards with reference to IFC/EBRD Guidance Note on Worker's Accommodation.

Construction schedule. Start of construction is assumed to be 2018, i.e. preferably at the beginning of the dry season, and last for four years. The construction schedule is based on the construction procedures and corresponding rates of progress described in the Feasibility Report.

The development of the hydropower Project will commence with detailed technical design of the Project works and the elaboration of the environmental and social plans, including all safeguards at the pre-construction phase. The construction will essentially start once the resettlement implementation process is complete. It is possible that a staggered resettlement time-line may be employed with the households closest to the dam relocating before the construction commences, given that the ones further away will be affected when the reservoir is filled. Regardless of timing of physical relocation, all agreements for resettlement must be completed before construction begins.

PHYSICAL ENVIRONMENT

General topography. The Nam Mo River basin within the Project stretch is characterized by a rugged terrain with sharp variation in elevation. The few flat or gentle-sloped lands by the river banks, are either used as settlements and/or cultivation areas. Most of the settlements and agricultural lands are on hill slopes and at small flat highland areas. Areas with gentle slopes are used for agriculture, while the steep areas are common grazing lands, cropland or covered with limited secondary forests. Within the Project Area of Influence (AI), the elevation ranges from minimum of 171masl to maximum of 977masl. The average elevation of the river stretch is 328masl. Slopes range from 20° - 50°.

Land use in the Project Area of Influence. The land use analysis shows that the Project's Direct Impact Area (DIA) and proposed buffer zone (for reducing erosion and safety reasons) is highly influenced by human activities. Approximately 86% of the total area of

the DIA of 1042ha is vegetated (Table 3). Approximately 38% of the vegetation cover in the DIA comprises of a combination of mixed forests (Figure 2).

Table 3. Major land use and cover of Project Direct Impact Area

No	Land cover (land take of Project)	Permanent area (ha) – DIA		Temporary (ha) **	Total (ha)	Buffer area (ha)
		Reservoir	Main works*	In DIA		
I	Vegetation	764.6	21.3	49.69	835.59	544.20
a	Forest	378.7	7.5	11	397.2	295.5
b	Secondary scrub	159.5	1.1	17.9	178.5	108.4
c	Shrub/bamboo/cultivated/uncultivated land	226.4	12.7	20.79	259.89	140.3
II	Other lands	110.2	0.7	3.18	114.6	13.3
III	River/stream	87.2	2.2	2.4	91.8	1.7
	Total	962.0	24.2	55.27		559.20
	Project land take without proposed buffer				1,041.99	

*Main works include dam and associated structures, powerhouse and permanent project facilities

**Temporary area includes disposal sites 1-4, auxiliary area 1-3, and roads

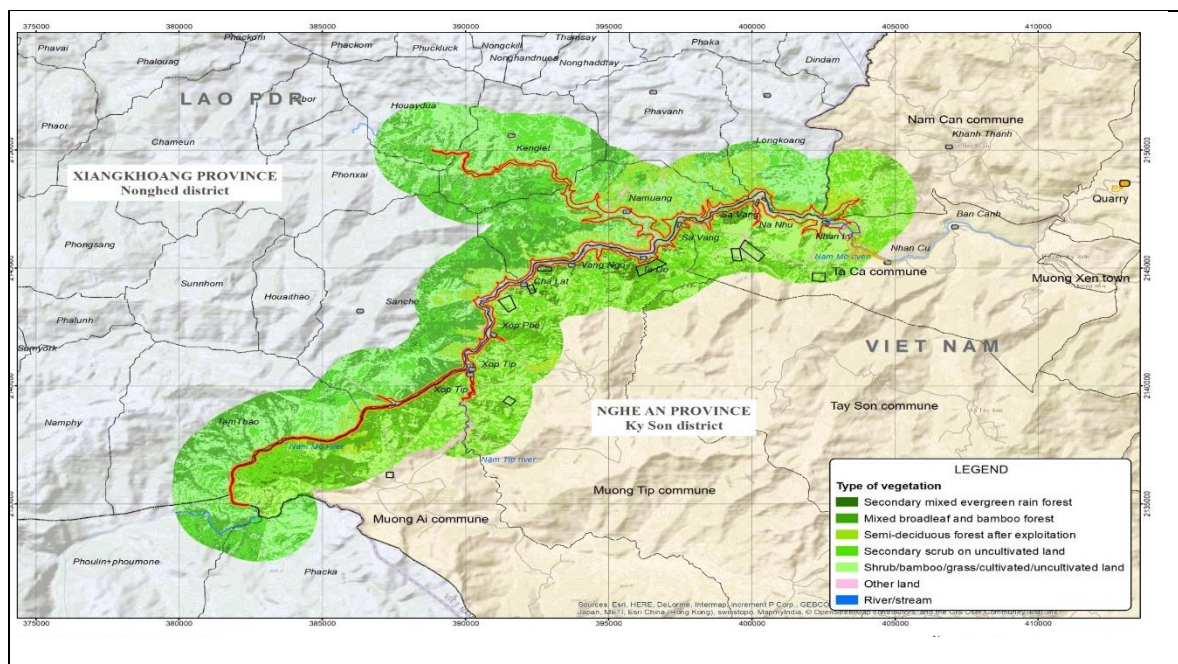


Figure 2. Land use map of Nam Mo 1 HPP Project Area of Influence

Precipitation and seasonality. The mean annual rainfall in the Project area is estimated at 1400mm. History of flooding has been reported in the Ca River basin (e.g., May 1989). Annual rainfall changes along the Ca River basin as indicated in the following records:

- 1100 - 1700mm - Upstream area, where the Project construction will be;
- 1800 - 2500mm - Middle reaches of Ca River; and
- Over 2500mm - Downstream reaches

Vietnam has a remarkably diverse climate conditions because of its location where there is a wide range of latitudes and altitudes. It is divided into three climate zones, north, central and south. The south facing mountain slopes are warmer and attract more precipitation than those facing north. The Project is located in north central Vietnam, and therefore experience a cooler condition. The seasonal climatic pattern (e.g., distinct winter and summer seasons) observed within the Project site is similar throughout the basin, differing only in degree due to the wide variations in elevation and exposure. The rainy season starts in May and ends in October with peak rainfall in July/August contributing to about 80% of the total annual rainfall. The rest of the year is referred to as the dry season, with November to February being the driest.

Lao PDR has less variation in climatic conditions and is characterized by two distinct seasons, the wet and dry. Part of the Project reservoir area in Laos is dominated by both southwest and northeast monsoons forming the two climate regime, the wet and dry seasons similar to that in Vietnam. The annual rainfall distribution is approximately 80% from May to September, 10% from October to December and about 10% from January to April.

Geology. The proposed dam site is considered as the optimum location with favorable condition in terms of engineering geological conditions. The IIA rock zone can support the foundation at a design of 95.52m high concrete dam, where rock zone/layer to be excavated is not more than 10m. The permeability of overburden and bed rock also pass the design requirement.

The geological mapping has also shown that the slope stability in the reservoir area is mainly controlled by the geological structures, as would be expected. Steep areas with slopes in excess of 45 degrees will be at risk of erosion. Such areas can be observed within the Project area. There is however very thin overburden and rock foundation is considered stable.

Earthquake and hazard assessment. The construction site is relatively close to an active grade-2 fault line about 1.65km from the Ca River fault zone. Based on the preliminary seismic investigation, the faultlines within the Project area may generate an intensity 4 or 5 (PGA = 245cm/s²) and trigger a 6.75 magnitude earthquake. The dam therefore has been designed to withstand the predicted earthquake magnitude, and the detail design will need to explicitly address this need.

Hydrology and sediment transport. Nam Mo River is one of the five main tributaries of the Ca River system. It has a total catchment area of about 3,970km², and the Project will cover about 2,492km² of the basin. Water level and discharges from 1969 to present at Muong Xen hydrological gauging station, downstream of the damsite, was used to estimate the annual flow at the Project. Adjusted to the damsite location, annual flow series arriving to Nam Mo 1 HPP was simulated. The annual flow discharge at the planned dam site is 65.5m³/s.

Sedimentation. Annual sediment load at Nam Mo 1 HPP was estimated based on the sediment load and water discharges measured at Cua Rao gauging station for the period 1961 to 2009. Based on this exercise, the average annual bed load at the damsite is 205x10⁶m³. At this rate, sediment deposition at the reservoir over the years once the Project is operational was also estimated and indicated that on the 5th year of operations, the reservoir has been filled up with 25.8Mm³, occupying about 9.48% of the storage area, assuming that no dredging has been done.

Water quality. The water quality of Nam Mo River within the stretch of the Project area has no indication of industrial pollution, except from the tributaries coming from the Laos territory, where elevated turbidity is visual which was attributed to the gold mining activities upstream of the river. Most of physio-chemical properties and heavy metal concentrations conform to the national water standards, except for Total Suspended Solids (TSS), which is higher than the national standard. Traces of coliform, although still within the national water standard were also reported. This is expected when domestic sewage is haphazardly

disposed off along the rivers and stream. In addition, raising of animals along the river banks is also common at the Project site.

Drinking water is sourced from spring. Results showed that all physical and chemical parameters tested for drinking water quality at the Project site fall within the limits set by the GoV, GoL and WHO, except for the levels of coliform bacteria, which should be 'nil' to be considered suitable for drinking water. The presence of coliform in all samples indicated contamination from human excreta. These stations were located downstream of the settlements/villages suggesting that sanitation is lacking in the community.

Air quality. Air quality at the Project area is typical of a rural environment and no indication of air pollution. However, movements of vehicles in the earthen road along the Project area are expected to cause dust pollution. The thick dust layer observed on the tree leaves and vegetation in these areas signifies the dust pollution in the air. There is no mechanized stone crushing plant in the area but the local people along with their children are known to be crushing stones along the rivers and rivulets. Typical of rural areas, burning firewood for cooking meals has been the main source of air pollution at the household level. Exposure to indoor air pollution increases the risk of illnesses such as respiratory tract infections, pneumonia, chronic obstructive pulmonary disorder asthma and lung cancer.

Noise and vibration. Background noise in the Project area is low and inherent to a rural area where population density is low with limited economic activity (e.g., limited traffic noise, absence of industrial and/or commercial activities). Area where potential elevated noise may occur is the quarry site at Pha Danh where blasting and operation of excavator, loading and hauling activities are carried out during operations. However, at the time of measurement, the quarry was at a break so noise level was low at 52.5dBA and below allowable limits (QCVN 26:2010/BTNMT and IFC Guidelines).

BIOLOGICAL ENVIRONMENT

Vegetation. Ta Ca Commune has altogether 3,871ha of forest land of which 1,885ha is classified as Protection Forest and 1,896ha as Production Forest. Production forest area has been allocated to households for planting trees and some fast growing Acacia, teakwood species, *Melia azedarach* (Chinaberry) and *Chukrasia tabularis* (Indian mahogany) are planted. However, most of the Production Forest area has been converted and is farmed with rain-fed upland paddy, maize crop and cassava due to the lack of arable land. Protection Forests have poor quality due to past illegal exploitation and now are covered with secondary forest vegetation and tropical grassland.

Local households collect and depend on a regular supply of wild vegetables, bamboo shoots, mushrooms, *Auricularia auricula-judae* (Jew's Ear, an edible fungus), and herbal medicines such as "củ xa nhân", smilax roots and *Ganoderma lucidum* (nấm Linh Chi) from Protection Forest. They also hunt wild animals such as wild boars, birds, wild chickens, squirrels, *Muntiacus muntjak* (barking deer) and mice for food, although wild boars and barking deer are now very few.

Muong Tip Commune has 3,416.2ha Protection Forest and 2,922ha Production Forest. About 3.3ha Production Forest was allocated to each households for tree plantation, however these are converted to swidden farming. There are very few trees planted, among them are *Melia azedarach* (Chinaberry), *Acacia spp.*, *Erythrophleum fordii* (a legume species), and *Chukrasia tabularis* (Indian mahogany).

Muong Ai Commune has 4,200ha Protection Forest and 625ha Production Forest, averaging 1.5ha of Production Forest allocated per household. Similar to the two villages, Production Forest is allocated to households for planting trees but almost all of the allocations are converted into swidden farmland for growing upland crops such as rice, maize and cassava. In swidden farmland, villagers intercrop *Melia azedarach*, *Acacia spp.*, *Chukrasia tabularis* and *Erythrophleum fordii*. Protection forests on the other hand are mostly covered with bamboos, rattans and bushes. In general, the quality of vegetation is poor due to over exploitation over the years. Similar to the two villages, the forest is source

of food and medicine. The forest also provide wild animals as additional source of protein food.

Xiangkhoang Province in Laos, covers an area of 15,880km² and has a mountainous topography. The proposed reservoir area is source of timber, forest products and is used for agriculture, and the situation is similar to that in Vietnam. It is noted that there are areas with mature trees in Laos mainly in steep and inaccessible sites including cliffs.

Forests are categorized as Protection Forest, Conservation Forest and Production Forest¹. Because of the low population density in Laos, Protection and Conservation Forests are in better condition than in Vietnam. Villagers are not allowed to harvest forest products other than timber for house construction from these forests, but can harvest non-timber forest products like wild vegetables and other edible products from the Production Forest while some areas are used for upland farming such as upland rice and maize. The Vietnamese obtain timber from the Laos side.

Forest vegetation systems in the Project area. Forests close to the settlements and near the Project areas were heavily exploited and farmed without terraces using the swidden agriculture system. Typical for swidden agriculture, once soil fertility diminishes, the villagers abandon the farm and move to a new tract of land and the exploited forest was left to regenerate and restore naturally. Such areas gradually turn into grassland, scrubland and secondary forests.

Type of vegetation in reservoir and construction areas. Forest vegetation in the proposed reservoir area and construction areas is given in Table 5.. The Project will acquire 1,042ha of land and about 80% of this total area is forested or have some forest vegetation. About 52.8% of the 559.1ha proposed buffer zone area has secondary forest vegetation, 25% is grassland and the rest are composed of the stream and other landuses (See Table 3).

Table 4. Vegetation types and land use in direct impact area

No	Vegetation types	Permanent area (ha)		Temporary (ha) **	Total (ha)	Buffer area (ha)
		Reservoir	Main works*			
	Total vegetated area	764.60	21.3	49.1	835	544.10
I	Secondary Mixed Evergreen Rain forest	98.2	0	0.4	98.6	68.2
II	Mixed Broadleaf and Bamboo forest	128.5	4.8	10.6	143.9	126.7
III	Semi-deciduous Forest	152.0	2.7	0	154.7	100.5
IV	Secondary Scrub on Uncultivated land	159.5	1.1	17.9	178.5	108.4
V	Grass/shrub/bamboo/cultivated and uncultivated land	226.4	12.7	20.2	259.3	140.3

Main works include dam and associated structures, powerhouse and permanent project facilities

¹ Temporary area includes disposal sites 1-4, auxiliary area 1-3, and roads

Biodiversity status. There are 420 vascular plant species from 328 genus and 117 families recorded in the 20 sampling sites. Biodiversity in the Project area is low since most of the vegetation has been disturbed. The secondary evergreen mixed rain forest has medium diversity while the secondary forest grown on uncultivated land, mixed broad leaf bamboo forest and predominant bamboo forests are of low biodiversity value. In general, number of tree species in the reservoir area is higher than in the proposed construction areas.

¹ LAO Law of Forestry, 2007

Regeneration, standing volume and total biomass. Regeneration in secondary forests is good, with more than nine species of hardwood species regenerating in the proposed reservoir. Regeneration in the proposed construction areas is lower than in the reservoir area. There is species similarity between these two Project areas with an exception of few species which were not recorded in the reservoir area. Table 5 summarizes the type of forests and its estimated organic biomass at the proposed reservoir and auxiliary areas.

Table 5. Estimated organic biomass above ground in the reservoir area

Type of Forests	Reservoir		Construction sites		Buffer zone	
	Area (ha)	Biomass (mt)	Area (ha)	Biomass (mt)	Area (ha)	Biomass (mt)
Secondary mixed evergreen rain forest	98.2	5,892	0.4	24	68.2	4,092
Mixed broadleaf and bamboo forest	128.5	3,849	15.4	462	126.7	3,801
Semi-deciduous forest	152.0	7,600	2.7	135	100.5	5,025
Secondary scrub on uncultivated land	159.5	1,910	19.0	228	108.4	1,301
Grass/shrub/bamboo/ cultivated and uncultivated land	226.4	1,132	32.9	165	140.3	701
Total	764.6	20,383	70.4	1,014	544.1	14,920

Species of conservation importance. There are two species of concern namely the *Drynaria fortunei* (Gu Sui Bu), an epiphytic herb species native to East Asia and the tree species *Hopea mollissima* (a *Dipterocarp* species) an endemic hardwood to Vietnam and Yunan –China, naturally growing in the evergreen rain forest. The former is listed as endangered species in the Red Data Book of Vietnam, 2007² while the latter is recorded as regionally extinct in the IUCN³. *Drynaria fortunei* is known as traditional Chinese medicine for bone healing. These species are disappearing because of deforestation and habitat degradation.

Wildlife species. Mammals in the Project area include 13 rodent species (*Rodentia*), 6 bat species (*Chiroptera*), six carnivore species, and one insectivores. These animals are mainly distributed in area where forest is in good condition, usually above 500masl. Small mammals, rodents and bats are abundant in the proposed dam site and auxiliary areas.

The reservoir area comprises mainly of secondary forest, bamboo forest, scrub land and grass land. Since wildlife are dependent on their habitats, wildlife population in the Project area did not exhibit a diverse population as compared to where forest is in good condition. There are no large size animals/species or rare species reported in the reservoir area instead, animals of small size such as the civet (*Viverridae*), weasel (*Mustelidae*), tree squirrel (*Sciuridae*), rats (*Muridae*), bamboo rats (*Rhizomyidae*) were reported to occur.

There are also bird species which include wild chicken (*Gallus gallus*), woodpecker (*Piciformes*), rollers (*Coraciidae*), kingfisher (*Alcedinidae*), drongo and *Muscicapidae*. Reptiles and amphibians reported to be present include the agama (*Agamidae*), ground dragon (*Physignathus cocincinus*), gecko (*Gecko gecko*), and some species of frog. Species of conservation interest are given in Table 6.

² Red Data Book of Vietnam (2007)

³ IUCN – International Union for Conservation of Nature – IUCN Red list of Threatened Species

Table 6. List of species of conservation interest

No	Scientific name	Common name	Vietnamese name	Vulnerability status ⁴		
				Vietnam Red Data Book	IUCN	Decree 32/2006
1	Mammals					
	<i>Nycticebus bengalensis</i>	The Bengal Slow Loris	Cu li lớn	VU	VU	IB
	<i>Macaca mulatta</i>	Rhesus monkey	Khỉ vàng	LR		IIB
	<i>Felis bengalensis</i>	Leopard cat				IB
2	Reptiles					
	<i>Gekko gekko</i>	Gecko	Tắc kè	VU		
	<i>Physignatus cocincinus</i>	Chinese water dragon	Rồng đất	VU		
	<i>Varanus nebulosus</i>	Clouded monitor	Kỳ đà vân	EN		IIB
	<i>Varanus salvator</i>	Water monitor	Kỳ đà hoa	EN		IIB
	<i>Ptyas korros</i>	Indochinese ratsnake	Rắn ráo thường	EN		IIB
	<i>Ptyas mucosus</i>	Oriental ratsnake	Rắn ráo trâu	EN		IB
	<i>Bungarus fasciatus</i>	Banded krait	Rắn cạp nong	EN		IIB
	<i>Naja naja</i>	Indian or Asian cobra	Rắn hổ mang	EN		IIB
3	Birds					
	<i>Falco severus</i>	Oriental hobby (a falcon)	Cắt bụng hung			IIB
	<i>Psittacula alexandri</i>	Red breasted parakeet	Vẹt ngực đỏ			IIB
	<i>Copsychus malabaricus</i>	White rumped shama	Chích chòe lửa			IIB

Use of forest plants, animals and forest ecosystem services. Out of the total 420 vascular plant species recorded in the Project area, 149 of them are medicinal plant species, fuelwood and timber species, edible plant species, ornamental plant species, rattan and bamboos species and others, or combination of the uses. There are 60 medicinal plant species of high value naturally growing in the project area while 57 species are used for timber and fuel wood. The villagers have always used and are highly dependent on the forest as source of their fuel-wood, timber, fodder and forage, medicines, religious rituals and food.

The wildlife species in the mixed forest types are all consumed and these include the yellow monkey (*Macaca mulatta*), wild pig (*Sus scrofa*), muntjac (*Muntiacus muntjak*), wild cat and big bamboo rat (*Bandicota indica*). It is also habitat for bird species from the families of

⁴ IUCN. 2016. The IUCN Red List of Threatened Species; VU = Vulnerable; VNRB. 2007. Vietnam Red Data Book; VU=Vulnerable; LR = Lower Risk; Decree 32/2006/ND-CP. Management of Endangered, Precious and Rare Species of Wild Plants and Animals; IB= Prohibiting collection and use for commercial purposes; IIB= Restricting exploitation and use for commercial purposes

drongo, crow, fly eating bird, honey eating bird, Chinese laughing-thrush, cock and turtle bird. Reptile and amphibian species that are found here include *Physignathus cocincinus*, *Varanus nebulosus*, cobra (*Naja naja*), *Trimeresurus albalabris*, species of family tortoise *Emydidae*, and Gecko (*Gekko gekko*). Secondary forest types also have good habitat for small mammals from the orders of rodents and bats; bird species, reptiles and amphibians like *Physignathus cocincinus*, *Ptyas mucosus*, *Bungarus fasciatus*, *Bungarus candidus* and *Naja naja*.

Habitats along Nam Mo River, streams, swidden farming area and the village area.

Areas along Nam Mo River and the adjacent streams, swidden farming areas, settlement areas and along road alignment provide habitat for mammals which are also eaten regularly as a free source of protein: such as the black tail rat (*Crocidura attenuata*), mosquito eating bat (*Java Pipistrellus javanicus*), mice (e.g., *Rattus flavipectus*), rat (*R. norvegicus*) and bird species such as milky stork (*Egretta garzetta*), fly stork (*Bubulcus ibis*), Milky necked stork (*Amaurornis phoenicurus*), big kingfisher (*Megaceryle lugubris*), small kingfisher (*Ceryle rudis*), wolly necked stork (*Halcyon chloris*) and *Alcedo atthis*. Some reptiles, the gecko water snake, amphibians such as family Ranidae, family Rhacophoridae (tree frogs), Microhylidae (small frogs) and some insects (butterfly) were recorded in this habitats.

Fish species and diversity. There were 80 fish species from 18 families and six orders recorded in the Nam Mo River and the streams joining it. Fish living in streams are normally small fish species, preferring rapid water and high oxygen content. Typical stream fish species are those such as *Acheilognathus lamensis*, *Garra poilanei*, *Puntius semifasciolatus* (Gold barb, known for aquarium trade), *Misgurnus anguillicaudatus* (Oriental weatherfish), *Pseudobagrus virgatus*, *Pareuchiloglanis nebulifer*, *Monopterus albus* (Asina swamp eel), *Anabas testudineus* (Climbing perch), *Oreochromis mosambicus* (Mozambique tilapia) and *Oreochromis niloticus* (Nile tilapia).

Eight species have high economic value and most of them except *Onychostoma lepturus* (Thintail Shoveljaw carp) are less common in the river. Two species, *Anguilla marmorata* (Giant mottled eel) and *Bagarius rutilus* (Sisorid catfish) are classified as vulnerable, according to the Red Data Book of Vietnam (Table 7). None of these high valued fish species are found in streams.

Table 7. Fish species of high economic value in Ca River

SN	Fish species	Ca River	Stream
1	<i>Anguilla marmorata</i>	+	-
2	<i>Spinibarbus denticulatus</i>	+	-
3	<i>Cyprinus rubrofuscia</i>	+	-
4	<i>Onychostoma lepturus</i>	++	-
5	<i>Hemibagrus guttatus</i>	+	-
6	<i>Cranoglanis henrici</i>	+	-
7	<i>Bagarius rutilus</i>	+	-
8	<i>Channa striata</i>	+	-

Migratory fish species. *Anguilla mamorata* is a long distance migratory fish species, migrating downstream to sea for feeding. This species is considered to be of high economic value, vulnerable and is now less frequently seen in the river. The existing Nam Mo HPP dam downstream of this proposed Project (Nam Mo 1 HPP) has already obstructed its movement to the sea. Its habitat has been fragmented and a small population is now adapting to this new environment, and is likely to disappear overtime.

Vulnerable species. Of the 80 fish identified, five species are listed as Vulnerable (VU) according to the IUCN Red List (Table 8) while two on the Vietnam Data Red Book (VNRD)⁵.

Table 8. List of vulnerable wildlife species

SN	Scientific name	Common name	Vietnamese name	Vulnerability status	
				VNRB ⁶	IUCN ⁷
1	<i>Bagarius rutilus</i>	catfish	Cá Chiên	VU	VU
2	<i>Acrossocheilus annamensis</i>	carp	Cá tróc		VU
3	<i>Bangana lemassoni</i>	carp	Cá Rằm xanh		VU
4	<i>Hemibagrus guttatus</i>	catfish	Cá Lăng		VU
5	<i>Anguilla marmorata</i>	Marbeled or giant mottled eel	Cá lếch, cá Chình hoa	VU	VU

Fisheries. Fishing is not a main occupation of the people in the Project area. However, most of the households do fishing regularly for their household consumption. Men, women and children go for fishing. Men use boat and cast net, while women and children use baskets for fishing. Families take a day off to go to streams for fishing with basic fishnets and baskets. Sometime they stop the flow on streams, dewater and do fishing. Some villagers also use poisonous leaves in a stream section. Also, although it has been prohibited, the use of electrofishing is still being practiced. Even with the various fishing methods, fish catch is reported to be low, at about 1-3 kg average per day, while on a good day catch could increase to 5-10 kg/day. The species caught are: *Cyprinus rubrofuscua*, *Carassius auratus*, *Hemiculter leucisculus*, *Oreochromis niloticus*, *Oreochromis mosambicus*, *Monopterus albus*, *Spinibarbus denticulatus* and *Glyptothorax quadriocellatus*. Some people also catch crab, shrimp and mussels for household consumption. Fish farming is not a prevalent practice in the Project area although small ponds were noted. These are only for small-scale production and not for large commercial purposes.

⁵ Kottelat, M., 2001. Freshwater fishes of northern Vietnam. A preliminary check-list of the fishes known or expected to occur in northern Vietnam with comments on systematics and nomenclature. Environment and Social Development Unit, East Asia and Pacific Region. The World Bank. 123 p.

⁶ Red Data Book of Vietnam, 2007

⁷ IUCN. 2016. The IUCN Red List of Threatened Species; VU = Vulnerable

SOCIAL ENVIRONMENT AND LIVELIHOODS

Inundation area. The Nam Mo 1 HPP reservoir at FSL will have an elevation of 235m and an inundation area of 962ha. The area is upland forested area with steep slopes, the river is in most parts rocky with high current. Several isolated villages are located along the river close to the river bank and are in the proposed reservoir inundation area.

Nine villages in Vietnam and one village in Laos are expected to be inundated by the Nam Mo 1 HPP reservoir. Added to the villages that will be inundated, are land areas in two villages in Nam Can commune in Vietnam and four villages in Laos. Table 9 summarizes the affected villages.

Table 9. List of villages in the reservoir area expected to be relocated and villages with land that will be potentially loss/inundated.

Commune/Districts	Villages to be relocated	Villages with land loss
Vietnam		
Muong Ai Commune	Zop Tip	-
Muong Tip Commune	Zop Tip	-
	Xop Phe	-
	Cha Lat	-
	Vang Ngo	-
	Ta Do	-
Ta Ca Commune	Sa Vang	-
	Na Nhu	-
	Nhan Ly	-
Nam Can Commune		Tien Tieu Khanh Thanh
Laos		
Nonghed District	Namuang	Sanche
		Kenglet
		Phavanh
		Longkoang

The four villages in the Nonghed District, Laos that will potentially loss their land are located faraway from the Nam Mo River and separated from it by a steep mountainous terrain. However, according to the ASA ESIA Report (Aug 2016), land along the river is associated to these four villages either ownership or management. The riverside in these areas is steep and probably not in an active use by the named villages. The affected areas, their status and utilization have to be investigated during the detail design phase.

The affected villages and administrative areas can be seen in the map in Figure 1.

Project construction areas. Main works and auxiliary work sites are located in Ta Ca Commune and will be in the midst of the planned Project construction areas.

Downstream stretch. Nhan Cu village in Ta Ca Commune is located 2.1km downstream of the Project’s proposed damsite and therefore will be potentially affected by reservoir water regulations and dry season low flow. However, Nhan Cu is also along the stretch of the existing Nam Mo HPP reservoir area, downstream of Nam Mo 1 HPP.

Socio-economic and cultural features of the affected villages

Population ethnicity and poverty. Almost all the people in the Project areas in both countries originate from different ethnic groups/minorities⁸. In the Vietnamese area they are Thai and Kho mu ethnic minority people and in Laos, Kho mu and Thai⁹ with their own identity, language and cultural features. Most villages are inhabited with one ethnic group and people have family ties with each other. The ethnic groups in Vietnam and Laos are related to each other, some people have moved across the national border and settled down on the other side, and villagers have regular social and economic interaction with each other over the border river.

All the households in the affected villages are extremely poor, under or just above the poverty line as defined by the GoV¹⁰ and the GoL¹¹.

Infrastructure and services. The affected villages are located remotely and can be reached either by boat in the Nam Mo River or along soil roads that are hardly vehicle accessible year round. Local people mainly travel either by wooden boats, on foot or by motorcycles. In most villages only a few households if any own a boat, however due to the existing Nam Mo HPP that has disrupted river transportation by cutting off the waterway, boat transportation is not commonly used.

All the villages to be affected by Nam Mo 1 HPP in Muong Ai and Muong Tip communes are connected to the national electricity network, while the households in Ta Ca Commune lack grid electricity and each household has a micro-hydropower (so-called pico) generator. Namuang village in Laos has grid electricity.

Household water is led from tributaries and mountain streams to water tanks in villages that have been constructed through government or donor programs. Household water for cooking, drinking and washing is taken from these water tanks. Additionally, villagers use the Nam Mo River and its tributaries for washing and bathing, as well as for watering animals.

Health and sanitation. Hygienic conditions in the remote villages are in general, very poor. Most villages lack toilets, and the existing ones are very rudimentary. Pigs, poultry and dogs roam freely around in the villages. Villages lack any rubbish disposal system, and litter is found anywhere in and outside the village including the riverside. The general standard of knowledge about health, hygiene and nutrition is very poor and based on tradition. Both ethnic minority men and many elder women smoke, and men often get drunk drinking home-brewed alcohol.

No health services are available in the villages, and the distance to commune or district health center is too long and costly for people to travel. Health problems are treated with medicinal plants, herbs and fungi collected in the forest. Most common health ailments include headache, diarrhea, fever, respiratory infections, itchy eyes, and gynecological

⁸ In Vietnam, the Government recognises a total of 54 ethnic groups, of which the Kinh (Vietnamese) is the majority population with 87% of the national population, and all the other groups are defined as ethnic minorities. In Laos, the national population is divided into three broad categories of 49 ethnic groups, and the term ethnic minority is not used.

⁹ Another spelling "Tai", and also reported as Lao Loum, which is the larger ethnic group. In Laos, people are ethnically divided into three main groups: (1) The Lao Loum, who are also called the Lao Thai or the Lowland Lao, who make up approx. 75% of the population in the country; (2) Lao Theung, the midlands people, consisting of 58 sub-groups, among them the Kho mu; and (3) Lao Soung, the highland people consisting of the Hmong and Yao as the main sub-groups and making about 10% of the national population (sources: <http://minorityrights.org/minorities>; <https://www.luangprabang-laos.com/The-people-tribes-and-ethnic>).

¹⁰ The official poverty line 2016–2020 issued through the GoV Decision No. 59/2015/QD-TTg *Promulgating multidimensional poverty levels applicable during 2016-2020* is for urban areas 900,000VND/capita/month and for rural areas 700,000VND/capita/month. 1USD≈22,700VND (22 Sept 2017).

¹¹ The official poverty line 2010–2015 issued through the Decree No.285/PO *Poverty and development standard 2010-2015* is for country level 192,000 LAK/capita/month, for urban areas 240,000 LAK/capita/month and for rural areas 180,000 LAK/capita/month. 1USD≈8,300LAK (22 Sept 2017).

problems. Most often babies are delivered in the villages, and women seldom attend any birth-controls/health check ups during pregnancy. Most children are vaccinated in the villages through monthly mobile vaccination services provided by the commune health center, and few cases of infant or maternal deaths are reported.

Food and nutrition. Upland rice is the main cultivation crop and the staple food of all the affected people. Forest and river provide the resource base for other daily food. Women collect wild growing vegetables, roots, bamboo shoots and mushrooms in the forest several times every day for household food. Men hunt rats, birds and bamboo rats for food on a daily basis. Another main protein source base is the river: Men fish with nets from boats and shore, while women fish with baskets, and even children are collect snails and shrimps in the shallow waters. Poultry with chicken and ducks is kept not only for selling but also for family food. Pigs are eaten more seldom at special occasions, during annual celebrations and family festivities such as weddings. Food is prepared on open fire, and both men and women collect firewood in the forests.

Education. According to the Vietnamese government standard, there is a kindergarten and a primary school in every village, and in Laos, there are primary schools in villages as well. Secondary boarding school is located in the commune center in Vietnam, and in Laos each village group has a secondary boarding school. Many ethnic minority children drop out of school after primary school or during the secondary school, and very few, if any, continue to high school that is located in the district center.

In the villages, the ethnic minority people use their own ethnic language in everyday communication. Women regularly have lower education level than men, because girls drop out of school early during the secondary school in order to help their families with household work. Many elder ethnic minority women are not able to communicate fluently in the national language, and in some villages up to 90% of the elder women are illiterate.

Livelihoods. All the inhabitants in the Project areas are farmers living on low-productive rain-fed upland rotational swidden agriculture, combined with forest resources utilization, fishery and livestock breeding. Many households do not have sufficient food year round. In some villages 50% of the households lack rice during the period from March to August, prior to the annual harvest. Apart from upland rice, all farmers cultivate maize and cassava for animal fodder. Vegetables and fruit trees are grown on riverbanks, but in many areas the land along the Nam Mo River is too steep and rocky to allow cultivation activities.

Ky Son is a rural district and an overwhelming majority of the inhabitants in its 21 communes are farmers living on upland agriculture and forestry. Cultivable land resources are limited and main part of agriculture takes place in the upland areas. Table 10 below provides an overview of land use in the three communes to be affected by the Nam Mo 1 HPP.

Table 10. Land use in Muong Ai, Muong Tip, Ta Ca and Nam Can communes

SN	Land Use	Commune			
		Muong Ai	Muong Tip	Ta Ca	Nam Can
1	Agriculture land (ha)				
	Wetland paddy	54	3	40	NA
	Other annual crops	13	38	24	NA
	Perennial Crops	0	0	34	NA
	Total	67	41	98	
2	Forest land (ha)				
	Protection Forest	4,200	3,416	1,885	NA
	Production Forest	625	2,922	1,896	NA
	Special use land	0	96.5	0	NA

SN	Land Use	Commune			
		Muong Ai	Muong Tip	Ta Ca	Nam Can
	Total	4,825	6,434.5	3,781	
	Total land area (ha)	9,190	12,470	6,443	NA
	Households	420	517	1,037	812
	Population	2,442	2,998	4,779	4,270

Source: PECI, 2017. Livelihoods Survey Report – Nam Mo 1 HPP ESIA (April 2017), Land use Plan of Village, Keng Du Commune 2015.

Implementation of the Project will require relocation of 10 villages (see Table 10 above) consisting of 502 households. In addition, six villages with 246 households (initial count at this stage) may potentially lose their land. Altogether they cultivate 1505ha of upland farm and 97ha wetland paddy crop annually. Under the rotational farming system, they grow 559ha of maize, 380ha of cassava and 188ha of other crops including peanuts, ginger, pumpkin and taro (Table 11). The estimated livestock population reared in the three communes is 3,374 cattle, 1,819 buffaloes, 6,965 pigs, 1,294 goats, and 12,307 poultry, including ducks.

Table 11. Estimated area under crop cultivation in Project influenced communes

Commune	House holds	Population	Estimated area planted with crops (ha)					Total
			Upland rice	Wetland rice	Maize	Cassava	Others	
Muong Ai	420	2442	805	54	289	110	163	1421
Muong Tip	888	4349	450	3	110	120	15	698
Ta Ca	1037	4779	250	40	160	150	10	610
Total	2,345	11,570	1,505	97	559	380	188	2,729

Source: Areas according to the commune’s statistics; area measured by the CPC

There are 15,040ha of forests in the three communes in Ky Son District (Table 12). In villages, people have encroached on Production Forest for upland cultivation. Agriculture cultivation covers 206ha, based on field data collected in January 2017. It is to be noted that there is encroachment of the different forest types, particularly Production Forest areas, for agriculture, which are not reported. The data from commune usually does not match the actual land under agriculture – largely so in typically swidden agricultural areas.

Table 12. Agricultural and forest land of the Project influenced communes of Ky Son District, Vietnam

Agriculture and forest land	Commune (ha)			
	Muong Ai	Muong Tip	Ta Ca	Total
Agricultural land	67	41	98	206
Production forest	625	2992	1896	5443
Special land use	0	96.5	0	96.5
Protection forest	4200	3416	1885	9501
Households	420	517	1037	2786

Agriculture and forest land	Commune (ha)			
	Muong Ai	Muong Tip	Ta Ca	Total
Population	2442	2998	4779	4270

Source: PECC1, Commune Livelihoods Reports for Nam Mo 1 HPP ESIA, April 2017. Land use data (production is based on commune level statistics (2010).

Upland rice is the major crop grown in the Project AI, production is about 1.2 to 3mt/ha. Wetland rice is more productive at 2.5-3.3mt/ha. The villagers also plant cassava and maize and contributes to the farm production in the community. Table 13 summarizes the productivity of farm products in the different Project villages. In terms of production, cassava has the highest yield among the crops.

Table 13. Productivity of farm crops in Project villages

Commune	House holds	Population	Productivity (mt/ha)					
			Upland rice	Wetland rice	Maize	Cassava	Others	Total
Muong Ai	420	2442	1.1-3.0	2.0-3.0	2.5-3.0	18-20	1.9- 2.0	25.5-31
Muong Tip	888	4349	1.3-3.0	2.5-3.0	4.0-5.5	18-20	9.13-9.15	34.93-40.65
Ta Ca	1037	4779	1.3-3.0	4	2.5-4.0	17-20	0.12-0.16	24.92-31.16
Total	2,345	11,570	1.2-3.0	2.5-3.3	3.0-4.2	17.6-20	3.71-3.77	28.9 - 34.27

Source: Areas according to the commune’s statistics; area measured by the CPC.

Livestock breeding is the most important livelihood after farming for people in the remote villages. All households have chicken and geese for family food, pigs are grown mostly to be sold but also to be eaten at special occasions as festivity food in the village. Animal diseases and deaths are not uncommon, especially among pigs and chicken that are roaming freely in the villages, and epidemics and cold weather kill even cattle. Animal deaths are reported to be more common in the villages in Vietnam, where veterinary services appear to be less available than in Laos, where villagers’ knowledge in animal breeding appears to be somewhat better than in the Vietnamese villages. Most families have a few cows and some households even have buffaloes, which both are kept entirely for selling to generate cash. Together with goats, kept by some farmers, these livestock graze on riverbank grasslands and forests near the upland fields. Animals can roam freely because there are no wildlife predators in the nature.

Forest resources are the crucial base for the daily food and provide approximately 50% or more of the livelihoods of the people in the riverside villages. Non-timber forest products (NTFPs) are important for household food, medicine supply and economy. Women collect bamboo shoots and wild-growing vegetables and mushrooms every day for family food. Some NTFPs like mushrooms, bamboo shoots and medicinal herbal plants are sold to traders. Men collect firewood and do logging of timber that is both used for construction of houses, other structures in the village and sold to traders. Hunting of birds, rats, bamboo rats, squirrels and snakes is done regularly for household food, mainly with crossbows and traps. Wild boars are hunted during the harvest season near the upland fields.

Nam Mo River is another source of livelihoods for the villagers. Most of the households have boats and fish for household food on a daily basis. In addition, they sell fish when the catch is large enough; fish is dried and salted and also made into fish sauce to be sold later. Men fish with nets both from boats and from the shore, women and children use baskets, and also collect shrimps, snails and moss in the shallow river. Fish is an important protein source for the inhabitants along the river. Riverbanks, in some places are also used for home gardening, and these areas serve as pasture for animals as well. However, large

parts of the river and riverbanks are rocky and many areas are steep, where riverbank cultivation is not possible. The river is used for transportation but has been limited by the construction of the Nam Mo HPP, the existing plant downstream of this Project.

Due to the remote location and poor transportation infrastructure **trade and business is very limited**. There are no commune markets, only a district market in the district town. In most villages, there are one or two petty (sundry) shops selling daily consumer goods like rice, salt, fish sauce, drinks, sweets and gasoline. Mobile Vietnamese traders visit villages in both countries for buying and selling goods.

There are very few available non-agricultural labour opportunities. Both permanent and seasonal labour migration of mostly young men and women but even entire families is very common both in Vietnam and in Laos.

Cultural heritage. People in the villages to be affected by the Nam Mo 1 HPP along the Nam Mo River mainly belong to the ethnic minority groups of Kho mu and Hmong. Forest and river provide their needed resources and form the context for their material and spiritual culture. The local worldview contains gods/spirits related to different elements and places in nature. Every family respects its household gods/spirits and ancestors' spirits.

The physical elements of the spiritual culture include spirit forests which are usually located at some distance (about 1km or more) from the village. People are not allowed to utilize forest resources in the spirit forest, however, cattle graze there. Death ceremonies are related to the river, and village graveyard is often located near the river. Each village has a village worship place that is importantly located under the biggest tree in or outside the village. In some villages there is a small wooden spirit house in place, while in some villages only a small wooden platform is used for offerings. Annual ceremonies take place there twice a year, the month of the year depending on the ethnic group residing in the village. Ceremonies are typically connected to the cultivation cycle in the upland fields.

Gender roles and issues. In the Project-area villages, women work in upland fields, in forest and by the river, side by side with men in the livelihoods activities. Women in the ethnic minority villages have in general, lower education level than men. Elder women are often illiterate and cannot fluently use and understand the national language. Especially the Kho mu and Hmong girls drop out of school early, in order to help their families with household work and livelihoods activities. It is common for these girls to get married when 14-15 years. Women are less mobile than men, and they rarely travel outside their village and livelihoods activity areas. Men are decision makers in the village, and women are not customed to speak up or express their opinions in meetings. Due to the low educational level and limited knowledge of ethnic minority women, it is difficult for them to learn new skills for improving their livelihoods and living conditions.

Major reasons for prevailing poverty. There are very few available livelihoods opportunities apart from upland cultivation combined with livestock breeding, fishing and forest resources utilization. The available production land is located in high areas with deep slopes, and in the Vietnamese territory, where the available land is not sufficient for the farming population, pressure on land is therefore high. Erosion and poor soil quality also contribute to very low field yields. Cultivation methods are manual, seeds are local, farmers lack fertilizers and there are no soil improvement methods, which lead to low productivity with hardly enough food for household annual consumption. Every year, many households in the Project-area villages lack rice during the months before the annual harvest.

Cultivation is rain fed and there are no irrigation systems. Agricultural and livestock services are very deficient in Vietnam. In Laos, veterinary services appear to be better available and consequently, animal mortality is lower than in Vietnam. Support and advice from the commune/district is lacking, seeds are not provided at an optimal time, seeds provided are often that of high-fertilizer demanding varieties and farmers lack sufficient skills to take care of the animals that they receive through government development programs.

Villages are remote, far away from the district center both in Laos and in Vietnam, and poor road infrastructure affects people's mobility and market access. Market infrastructure is

undeveloped with the only available markets in the district towns. Most villagers rarely visit the district center, and women do not even go to the commune center or village group center more than 1-2 times per year. Mobile traders buy agriculture and forest products from farmers in the villages for low prices and sell them household goods for high prices.

All the affected people are ethnic minorities who use their own language in everyday communication. Many elder people are illiterate and the general educational level is low, especially in the Vietnamese villages. Many people are not fluent in the national language and lack ability to take opportunities for health, hygiene, livelihoods or other living standards improvements. Still many children in Vietnam drop out of secondary school in order to contribute to the economy of their poor families. Children grow up with deficient education which further hampers their capacity to avail new opportunities to escape poverty.

PROJECT IMPACTS

Land and Households

Land loss. A total of 1600ha of land will be used by the Project (see Table 3). This will include mainly agricultural, different forest assemblages and grassland. The wildlife and plant resources will be lost permanently, while some areas in the auxiliary areas, although used only during construction phase, the change will be permanent.

Villages to be inundated. The reservoir is expected to inundate nine villages in Vietnam and one village in Laos that have to be relocated. The table below summarises the number of households and people count and their ethnicity in each of the villages that will be affected.

All the households in the affected villages are extremely poor, under or just above the poverty line as defined by the GoV and the GoL.

Table 14. Villages in the reservoir inundation and construction areas of Nam Mo HPP to be relocated

Nam Mo 1 HPP Villages to be relocated				
Village	HH	Population	HH poverty %	Ethnicity
Muong Ai Commune - Vietnam				
Xop Tip	16	84	88	Kho mu
Muong Tip Commune - Vietnam				
Xop Tip	29	146	86	Kho mu
Xop Phe	76	360	78	Kho mu
Cha Lat	16/29*	92/166	100	Hmong
Vang Ngo	17/47**	130/356	85	Hmong, Kho mu
Ta Do	99	556	97	Kho mu, Thai***
Subtotal Muong Tip Commune	237/280	1,284/1,584		
Ta Ca Commune – Vietnam				
Sa Vang	97	510	100	Kho mu, 6 HHs Thai
Na Nhu	67	360	100	Kho mu
Nhan Ly	51	275	100	Kho mu
Subtotal Ta Ca Commune	215	1,145		
Total to be relocated - Vietnam	468	2,513		
Nonghed District - Laos				
Namuang	34	224	77	Kho mu
Total to be relocated - Laos	34	224		

Nam Mo 1 HPP Villages to be relocated				
Village	HH	Population	HH poverty %	Ethnicity
Total Nam Mo 1 HPP	502	2,737		

* Village consists of 2 hamlets, one by the river with 16 HHs, and the other higher up with 13 HHs.

** Village consists of 2 hamlets, commune centre is in the lower hamlet and will be inundated.

***5 Thai HHs relocated in 2006 from Ban Ve HPP.

Village land to be inundated. Added to the villages that will be inundated, land in the area of two villages in Nam Can commune in Vietnam are within the proposed reservoir area. In Laos, four villages that are located far from the river have land areas along the river. The villages that will lose land in the reservoir can be seen in Table 15.

Table 15. Villages in Vietnam and Laos with land areas to be inundated by Nam Mo 1 HPP

Nam Mo 1 HPP Villages with Land Losses					
Village	HH	Pop.	HH poverty %	Ethnicity	Impact
Nam Can Commune - Vietnam					
Tien Tieu	170	420	61	Hmong	Production land and Protection forest area by the river
Khanh Thanh	76	386	74	Kho mu	Land to be inundated: 9ha Protection forest and abt 25ha cultivation land, fishponds, fruit trees, grassland belonging mainly to CPC Vice chair, and to three other HHs.
Nonghed District - Laos					
Sanche			These villages are located far away from the Nam Mo River and separated from it by a steep mountainous terrain. However, according to the ASA ESIA Report (Aug 2016), land along the river is associated to these four villages (ownership or management). There is no information in the ASA report about the type of land and its utilization. The riverside in these areas is steep and probably not in an active use by the named villages. The affected areas, their status and utilization have to be investigated during the detail design phase.		
Kenglet					
Phavanh					
Longkoang					



Xop Tip Village in Vietnam subject to relocation

Construction area impacts. Ta Ca Commune with 2,513 Kho Mu and Thai ethnic minority people in 468 households is located approximately 1km downstream of the river from the

planned dam site and in the midst of the project construction areas. This village will be highly impacted of the planned workers' camp with estimated 1,750 workers next to it, and of all the construction transportations in the road along the village border as well as of dust, noise, pollution and material disposal from the dam construction in the vicinity of the village.

Downstream water regime. It is estimated that downstream villages of the planned damsite will be potentially affected by the low flow during dry season and fluctuation from the reservoir water regulation. Nhan Cu village in Ta Ca commune is located 2.1km downstream of the proposed dam and therefore will be potentially affected. However, Nhan Cu is also along the stretch of the existing Nam Mo HPP reservoir area, downstream of the proposed Nam Mo 1 HPP.

Physical losses due to reservoir inundation and dam construction

Loss of private property. Affected households will lose their private houses and attached assets.

The structures include:

- (i) family home;
- (ii) barns for preserving agricultural products;
- (iii) fences around the house;
- (iv) Some villages have connection to the electricity grid, and those who don't, have their own micro-hydro generator; and
- (v) private boats that are used for fishing and river transportation.

Loss of land. The land to be inundated consist of:

- (i) residential land that each household has a land certificate on;
- (ii) land used for production: (a) upland cultivation land; (b) home garden; (c) riverbank cultivation land;
- (iii) forest that is utilized for: (a) timber logging for house construction and for selling; (b) hunting animals for household food and for selling; (c) collecting NTFPs at a daily basis for household food, such as wild growing vegetables, bamboo shoots, mushrooms; (d) collecting firewood; and
- (iv) animal grazing land.

Loss of public infrastructure. The reservoir will inundate public infrastructure in villages and adjoining areas, including:

- (i) village access road;
- (ii) inter-village roads;
- (iii) water supply system with water tanks and water pipes leading water from streams to villages;
- (iv) electricity supply;
- (v) schools;
- (vi) village cultural house;
- (vii) commune centre with government offices and health clinics; and
- (viii) border guard stations.

Loss of cultural heritage. All the villages have areas that are of cultural and spiritual importance. The reservoir will inundate:

- (i) village spirit forest located at some distance from the village in a Protection forest area;
- (ii) graveyard located outside village; and
- (iii) village worship place under a big tree with a small wooden spirit house or altar for offerings.

Non-physical losses due to reservoir inundation and dam construction

Loss of access to livelihoods resources. The Project will inundate land, forest and water areas that are used for household livelihoods. The reservoir and dam construction will also cut accessibility to areas with livelihoods resources such as cultivation and forestry areas across the reservoir lake. Moreover, the HPP will disturb aquatic resources (amount of fish,

shrimps, snails and other crustaceans) and wildlife that are important for households' food security in the Direct and Indirect Impact Areas.

Loss of access to transportation. Due to available road access in all the affected villages and the shallow and rocky structure of the river in many areas, the Nam Mo River is moderately used as a transportation way by the villages to be affected by the reservoir inundation. The existing Nam Mo HPP downstream the planned Nam Mo 1 dam has already affected accessibility, so that villagers can no more travel by boat to the district town as they used to do before the Nam Mo dam construction. River transportation of agricultural products, timber and NTFPs currently takes place in a limited scale in the planned reservoir and downstream area. People also cross the river for visiting relatives and for working in Laos.

Major constraints in agriculture

Farming system. The Project AI has a mountainous terrain and the people living there are ethnic minority people who rely on subsistence farming for their livelihoods. The area for wetland paddy and for perennial crops is limited. Farmers grow rain-fed crops on swidden land on slopes located mostly in production forests. They harvest one crop per year and leave the land to fallow between two to four years. On sloping land without terraces, animals or machines cannot be used for ploughing land and therefore farming operations are done manually. Farmers use local seed materials except maize and farming technology has not improved over the years. Many farmers do not grow vegetable because they prefer to collect wild-growing vegetables for home consumption in the forests. Crops are grown as monoculture, but peanuts, ginger and other crops grown in small areas are also intercropped with cassava and maize. Agriculture extension service is deficient.

Soil fertility. There is no intervention observed in improving swidden cultivation in the Project AI. This agriculture practice is not sustainable: The period of keeping land fallow after cultivation to rejuvenate soil fertility is very short (not sufficient for the soil to recover) due to demand for farming the land again. Fertilizers are not used, except occasionally in maize cultivation, and there is no system of compost making. Legumes are not grown as main crop or as an inter-crop which could gradually build up soil fertility. In upland agriculture, annual cropping without reasonable improvement measures rapidly degrades soil. Farmers indicated poor crop yields due to low soil fertility.

Climate change. Crop yields are highly varying, and farmers reported reduced yields due to unfavorable weather conditions and long periods of droughts. Yield of the hybrid maize is only 40-50% of its potential. Failures of harvest were reported by villagers. Climate change effects will be more profound for crops growing on swidden land because these crops grow under natural conditions and wholly depend on rainfall and temperature regimes, which are gradually changing.

Livestock feeds and fodder. All the livestock reared are of undescribed local breeds adapted to free-ranging system and low level of nutrition and management. Farmers reported shortage of fodder for ruminants during winter months, and in some villages an acute shortage was observed. Some farmers rearing hybrid pigs buy commercial livestock feeds. Nutrition level has to be improved for livestock development and better yields.

Animal health service. Livestock health status is in general, poor and high mortality in pigs and poultry was reported. Animal health service is not easily available, and if available, it is costly and of poor standard. Farmers are not trained and lack knowledge in disease treatment. In some villages, farmers are aware of prevention methods such as vaccination, but the lack of veterinary services makes it very difficult for them to improve their livestock farming.

Livelihoods – linkages and dependence

Currently, livelihoods of the local communities in Laos and Vietnam in the Project AI depend upon forest, water and land resources, the later in the form of swidden (shifting cultivation) agriculture (Figure 3). Forest dependence is high, forests providing protein resources, edible and medicinal plants, vegetables, materials for household energy, construction and other use, and animal protein through small mammals, birds, rodents, lizards and amphibians. Water resources provide free protein through fishes and aquatic insects. Apart from daily food, both these resources are helpful in generating some occasional cash through sale of small mammals and rodents. Livestock is another source of animal protein (mainly poultry) and of cash income through sale of live animals. However, animal health services are poorly available and animals are often lost in disease outbreaks. Swidden agriculture is less productive but provides carbohydrates in the form of rice as a staple food, while maize and cassava are grown for livestock fodder. Rice production is, however, not sufficient for yearly consumption needs for the poor families, and food security is a serious aspect influencing Project Affected Person (PAP) lives and wellbeing. This livelihoods scenario among the ethnic minorities/groups will continue resulting in deterioration of forest and other land in use until changes are brought to the practices used and sustainable processes are put in place. The Nam Mo 1 HHP Project affecting the above resources will have detrimental effects on livelihoods of the people living in the Project DIA. In the context of livelihoods, forest resources are significantly more important than fisheries, livestock and crop farming as these provide a reliable and available source of food and other products.

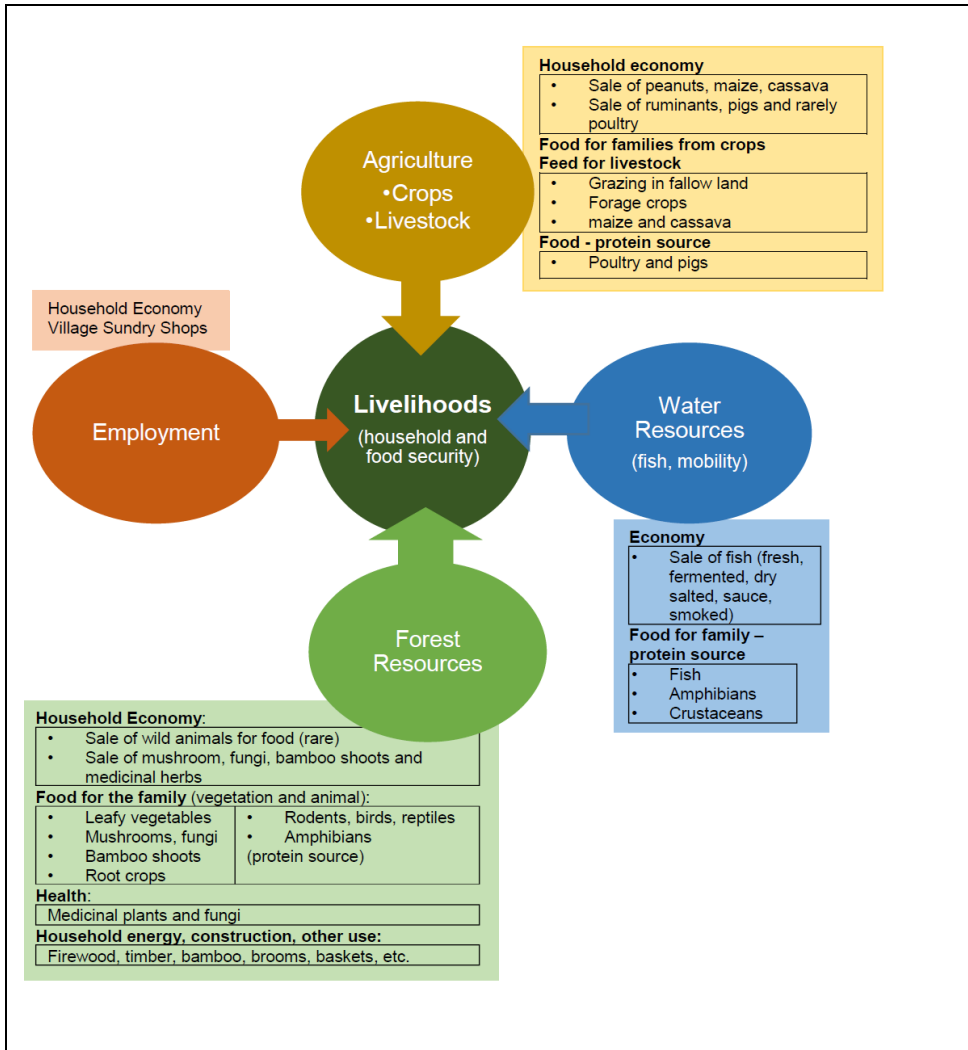


Figure 3. Livelihoods of Project affected households are primarily dependent on forest resources followed by upland agriculture and the water resources of the river.

Biodiversity

The terrestrial ecosystem, mainly forests and grasslands and aquatic ecosystems and their quality in the form of water resources in rivers, as a function of river's catchment, provide a good habitat for wildlife and aquatic life including fish. Biodiversity of forest vegetation and wildlife are inter-related, and serve to provide products for humans, enriched soil (after a few years or regeneration) for agriculture and work to reduce siltation through providing a more stable land cover than, for example, grasslands do. In the Nam Mo 1 HPP area, biodiversity of forest vegetation, a growing secondary forest vegetation after exploitation or developing through a progressive forest succession on uncultivated fallow land is comparatively low but growing. This has resulted in riverine locations of habitats where biodiversity of wildlife is limited to smaller size mammals, e.g., rodents and bats, and reptiles and amphibians. A past long period of exploitation of mature forests has depleted larger wildlife and timber resources. Short - to long - distance migratory fish species and resident species make-up the existing fish biodiversity, however a dam (Nam Mo HPP) operating downstream from the proposed Nam Mo 1 HPP has already impacted upward movement of migratory species, particularly for spawning. Nonetheless, the presence of 80 fish species and several other aquatic species in Nam Mo River indicate that the biodiversity has not deteriorated significantly.

Both the terrestrial and aquatic ecosystems in the Project area provide tangible food products and some cash flow for the ethnic minority communities. The communities in the project area depend more on forest resources including wildlife and aquatic resources, fish and other, for their livelihoods than on crop farming which is restricted mainly to rice. The food resources from the forests are vital, for daily needs and during lean periods when food is insufficient. In general, a hydropower project disturbs the ecosystem, and as in the case of Nam Mo 1 HPP, it will affect significantly the product availability from the forests and rivers to the local people. The mitigation suggested is meant to minimize impacts due to the land-take of the Project through proposing forest conservation, biodiversity restoration, fish monitoring and agriculture enhancement measures linked to community involvement.

Cumulative Impacts

Cumulative impacts are those that result from the incremental impact of the Project when added to existing, planned and reasonably predictable future projects and developments. The cumulative impacts of the proposed Project have been assessed based on the principles outlined in the IFC Guidance Notes (2012). It aims to better understand the impacts of the existing HPP and planned HPPs within the Ca River cascade system, together with this Project.

While there is currently limited quantitative data on some receptors available to make a fully informed cumulative impact assessment, the assessment nevertheless looked at different vital ecosystem and social attributes aspects such as biodiversity, critical habitats, sensitive receptors, livelihood and ecosystem services.

The Nam Mo 1 HPP is planned on the Nam Mo River, one of the major tributaries of the Ca River. During the preparation of this ESIA, there are hydropower projects either existing, underconstruction or planned on the Nam Mo River. Upstream are three HPPs namely Nam Mo 3 (operational), Nam Mo 2 (Under construction) and Nam Mo 1 (same name of this Project, located in Laos). Downstream of the Project are the Nam Can 2 (in operation), Nam Mo (in operation) and Nam Cun (under construction).

The proposed location of the Nam Mo 1 damsite is within the reservoir tail of the existing Nam Mo HPP, and therefore there is an overlap between the two HPPs. The additive impacts are therefore expected to be minimum. The current fishing activities are not expected to be altered due to Nam Mo 1. It would be necessary to monitor the river water levels and river use during the dry season as the regulation of both the planned Nam Mo 1 HPP with respect to Nam Mo HPP will be done at the detail design phase.

The length of the planned Nam Mo 1 HPP reservoir is expected to sustain a range of fish species and serve for fishing needs. This is the case in other reservoirs in the region and elsewhere in Vietnam.

Ecosystem services

Ecosystem Services (environmental services) are the benefits that people derive from the ecosystems and includes four types: provisioning, regulating, cultural and supporting services. In the case of Nam Mo 1 HPP the most relevant types are those provisioning services commonly referred to as natural resources, e.g., water, food and fuel contributing to the human well-being, being central to livelihoods in the DIA and IIA. In order of decreasing relative contribution to livelihoods and importance, the ecosystems services including provisioning, cultural, recreation are from:

- Forest and forest-bamboo (food sources mainly rodents, snakes, birds; medicinal plants; firewood, wood for construction);
- Land (agriculture for rice production, cash crop (peanuts) and feed (maize and cassava) for livestock, some grazing of livestock; vegetation cover that provides for soil and slope stability in Project direct and indirect impact areas); and
- Water (fish, crustaceans; transport; cultural importance linked to rituals related to burials and spirits; bathing).

The dependence on forest and forest-bamboo ecosystems is high and its contribution is directly contributing to provision of food sources, especially protein in the form of rodents and snakes. Many HH make daily collections for food sources from forest ecosystems. The areas that will be inundated will result in a loss of core nutrition and protein source. The water resources of the river are important sources of fish for many villages located in the planned inundation area (direct impact area, reservoir). This ecosystem service will change in composition and will need to be managed if the reservoir is to be used as a source of fish. The river which is currently free flowing and is used to travel across the river and along the river, although moderately. Burial ritual related sacrifice (chickens) is performed with the river serving as pathway for spirits.

There are intimate livelihoods links with forests, the Nam Mo River and uplands which all provide ecosystem services to the local communities. Ecosystem services and their dependence is high and the loss is significant. The conservation and sound management of forest ecosystems and sustainable use of agricultural and grazing land is required in the relocation areas, so that the ecosystem services are available. The river provisioning services may be lost, except for fish in the form of aquaculture or reservoir fishing.

Communication

Previous consultations. The Proponent and hired national consultants in Vietnam and Laos have had several meetings with the local authorities at commune and village levels about the proposed Project during 2012-2016. People in the villages to be affected by the Project have also been informed about the possibility of the HPP in a few instances. These consultations were not arranged in a manner to allow informed consultation and participation of the project affected people and cannot be considered as part of the Informed Communication and Participation (ICP) process.

ICP process initiated. The Free, Prior, and Informed-Consent (FPIC) was initiated in June 2017 when a Vietnamese communication team hired by the Proponent according to advice from and designed by the International Consultant undertook informed consultations in all the villages to be affected by the HPP. Villagers were provided information about the planned Project, its impacts and proposed mitigation measures using communication methods that were understandable for them. Their questions, opinions, views and concerns on the project impacts and proposed mitigation measures were discussed and recorded in a village consent document in each village to be relocated. In those villages that will lose

riverside land but not be relocated, the consultant had similar consultations with the Village leader.

The FPIC consultations showed *broad community support* for the Project and agreements were obtained through the consultations. Main concerns of communities are presented below.

Main concerns from the affected people. People in all the villages to be relocated agreed in principle to the relocation, but some of them expressed concerns and had alternative suggestions for the proposed relocation site. Relocation site and the available land and water resources there were the most important criteria for the affected villagers to agree to the relocation. Other concerns and suggestions that commonly came up in the consultations include:

- Compensation payment should be made in maximum of two larger payments and not in several smaller ones, and the payment should be made in full before relocation;
- Affected households should receive compensation payment directly from the Proponent, not through commune or village government authorities;
- Request that people will screen the proposed relocation site together with the project planning team in order to verify the location, land and water availability, etc.;
- Request that people are involved in the design and relocation of the village, location of graves and spirit forest;
- House placement direction is important and depends on each ethnic clan;
- Forest protection and management and the income it brings to local people is important, and should not be disrupted by the relocation;
- Land use certificates have to be issued on the new location to all households; and
- There has to be a monitoring and compliant (grievance) system, and villagers should be involved in the monitoring.

These and other expressed concerns are to be addressed by the Proponent in follow-up community consultations.

MITIGATION AND ENHANCEMENT MEASURES

Specific and general measures have been proposed to mitigate impacts. Below are flow charts of the key plans for managing social, environmental and resettlement impacts. Elaboration of the key plans spanning all programs are provided in the ESIA and Environment and Social Management Plan (ESMP), Resettlement and Ethnic Minority Livelihoods Restoration Plan (REMLRP) and the Public Communication and Disclosure Plan (PCDP). A resettlement policy and entitlements framework is proposed in the REMLRP.

Physical and biological impacts of hydropower projects can be significant and permanent and if proper mitigation is not conducted at the appropriate time, consequences can be dire. Similarly, the loss of land and properties and the displacement of population from their settlement areas are probably among the major social and cultural impacts of the Nam Mo HPP. As part of the project optimization process a number of measures have been taken to minimize the social and ecological footprint of the Project. The main Programs are:

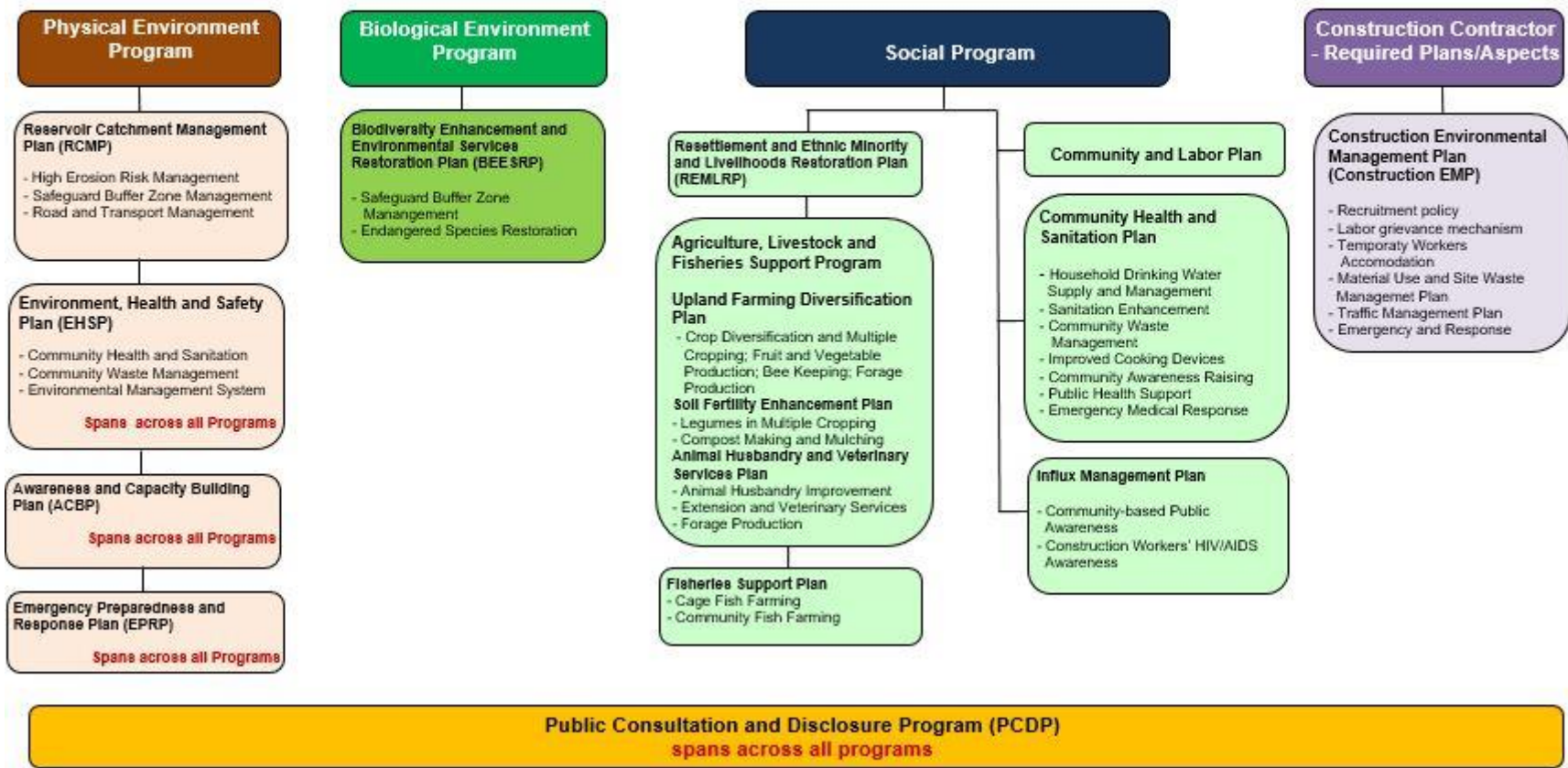
- Physical Environment Program;
- Biological Environment Program; and
- Social Program.

In addition, requirements for the construction contractor are eluded for initial guidance to the Proponent.

Grievance Redress Mechanism. The proponent has to establish in the project planning phase a Grievance Redress Mechanism (GRM) consistent with the MIGA Performance Standard 1. The GRM will provide the PAP clear and practical mechanism to express their complaints and concerns about the project's social and environmental performance. The GRM will allow the Proponent to receive and address any issues on land acquisition, compensation and relocation from the relocated people and host communities. The GRM will also allow the Proponent to address complaints from people in the Indirect Impact and Tertiary Impact Areas who may be affected due to the project activities and activities related to the presence of the Project. The GRM will allow issues to be raised in a timely fashion, and include a mechanism designed to resolve disputes in an impartial manner.

The GRM should be based on the local community organization and be culturally appropriate and understandable for the affected people. It is an integral part of the PCDP. Prior to relocation, the GRM should be adapted to the local community organization structure.

Environment & Social Management Plans



SOCIAL AND ENVIRONMENTAL PLANNING AND MANAGEMENT, MONITORING AND AUDITING

The application of mitigation measures, monitoring, and environmental audit of the proposed Project have been recommended to ensure the validity of impact prediction, effectiveness of mitigation measures and sustainable social, economic and cultural development of the local and adjacent community. The measures proposed are expected to be formulated in detail during the pre-construction (design phase) of Nam Mo 1 HPP. A Social and Environmental Management Division has been proposed to manage and implement the proposed ESMP and the REMLRP under the Proponent's management. The ESMP and REMLRP will be linked to the social mitigation and enhancement measures undertaken under the same division. Similarly, a PCDP and GRM have been proposed for the Proponent's management. An organizational structure and program has been proposed for the ESMP and other safeguard documents. Note that the mitigation measures may change after the public consultations are held during the pre-construction phase.

The proposed PCDP sets the principles and procedures as required according to MIGA PS 1 and PS 7 for an ICP process during the project planning, implementation and operation monitoring to ensure the FPIC of the Project affected ethnic minority/groups communities in Vietnam and in Laos.

CONCLUSION

The Nam Mo 1 HPP is planned along a stretch of the Nam Mo River, one of the main tributaries of the Ca River at the border of Vietnam and Laos. The technical feasibility of the Project has been performed for an installed capacity of 90 MW.

The main anticipated negative impacts of the Project include:

- (i) the loss of land and assets of Project Affected People due to land permanently acquired and used by the Project both in Laos and Vietnam;
- (ii) resettlement and social change;
- (iii) changes related to the loss of Production and Protection forests, agricultural land and associated wildlife habitat;
- (iv) changes related to the change of the river into a reservoir affecting connectivity/transport and fisheries;
- (v) loss of forest-river related ecosystem services affecting livelihoods which are dependent on these systems.

The main anticipated positive impacts of the Project include:

- (i) Increase in mobility and accessibility to the affected villages and Project area in general due to improved roads and provisions of new roads to the villages. This may trigger positive impacts on livelihoods, in making markets accessible, easier access to health care and other services;
- (ii) Restoration of forest-grassland areas so that the vegetated areas improve in quality, such that sediments are reduced, availability of forest products are assured overtime and wildlife habitat is increased. This will ensure that ecosystem services are enhanced, maintained and is sustainable;
- (iii) Improvement in agricultural methods and products whereby food insufficiency does not occur;
- (iv) Improved energy availability and use, better cooking methods and electricity; and
- (v) Increase in well being is expected, provided proposed measures are implemented.

Mitigation and enhancement measures on potential social-cultural, forest, agricultural, biological and physical impacts are proposed to minimize the effects and therefore enhance community well being and forest-agriculture central to livelihoods. Measures include, among others, plans for livelihood restoration, immediate catchment management, ecosystem services enhancement, health and safety measures. The measures proposed in the ESMP will help minimize the ecological footprint of the Project. Safeguard documents include the REMLRP and ESMP guided by the PCDDP. An adaptive management process should be adopted to adjust plans according to findings from monitoring, consultations, and audits. A Social and Environment Division (SEMD) of Nam Mo 1 HPP will administer the ESMP through the establishment of a Social and Environmental Management Unit (SEMU)