



Lao people's Democratic Republic
Salavanh Province
Department of Energy and Mines

Nam Sor Hydropower Project



Initial Environmental Examination (IEE)

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CHAPTER V

Potential Impacts during the Construction and Mitigation Measures

5. POTENTIAL ENVIRONMENTAL IMPACT AND MITIGATION MEASURES

5.1 Potential Impacts on Physical Environment during the Construction and Mitigation Measures

5.1.1 Potential Impact on Climate

As per technical design, the Nam Sor PP is a run-of-river plant with ponding and does not require a large area of the reservoir or regulating height. To store a flow of 3.5m³/s over the Sunday off-peak period of 32 hours may require 0.8 m regulation height in the pond and a normal weekday night with 8 hours of off-peak period, only 0.2 m regulating height in the pond is needed.

The major factor of the water temperature in the pond is determined by the inflows from tributaries and the rainfall on the pond. The main influence for the summer season is the temperature of the rainfall accompanying the SW monsoon. While in the winter, there is very little rainfall from NE, and the water flow originates from ground water.

Thus changes of the micro-climate is likely to occur or very small and will not result any changes to the ambient air temperature as well as humidity over the water and surrounding areas. So like with the natural river, in the day the air temperature may be higher than the water temperature and during the night the opposite with a foggy condition developing over the river or pond.

5.1.2 Potential Impact of Sediment Transport and Erosion on Water Quality

High amounts of sediment and soil erosion may occur shortly (for as number of hours) during the construction period such as closing of a cofferdam. Otherwise earthwork exposed like in road works and preparation of canal alignment with soil excavation and stockpiling of earth erosion, during heavy rainfall in the rainy season may occur causing turbidity in the river downstream, if the works have not been properly sealed off before the monsoon. But the magnitude and duration of this will be low compared as example to the washing of the river sediments for extracting gold, which has occurred continuously the last about one year, and will be very temporary and can be mitigated. However, during the raining season the level of soil erosion and sedimentation may increase. It is estimated that about 12,000 m³ of earth rocks and soil need to be excavated and 10,000 m³ will be used for the construction.

❖ **Proposed Mitigation Measure:**

- Diverting runoff from undisturbed or external areas away from the project area
- Providing measures on earthwork to limit erosion and sedimentation like compaction on soil filling, subsurface drains and cross drains, creating vegetation cover on slopes
- Limiting water level variation in the pond upstream of the intake to avoid a wide barren area on the slopes in the elevation interval of annual water level variation
- Providing appropriate road surfaces and sufficient cross drains on roads
- All effluent discharge from the office and workers camps shall be treated to comply with standards
- Use excavated soil for construction as compacted filling instead of dumping it over the edge as normal procedure for earthwork is in Laos
- Regularly monitor suspended matter and sediment rate as well as documenting the performance of sediment control systems at key locations upstream and downstream of project facilities, prior to and during construction and operations, to confirm the extent of impact and implement suitable management responses.
- Where possible avoid to carry out earthwork activities during the monsoon season
- Land clearance activities shall be regularly monitor to ensure that vegetation is cleared only in the approved and planned areas and limited to within pre-defined project boundaries and avoiding the sensitive areas as far as possible
- Planting or seeding local species of trees and grasses to rehabilitate and re-vegetate disturbed land surfaces, especially slopes, at the project site as soon as practicable, to facilitate long-term stabilization.

5.1.3 Potential Impact on Air Quality

Extensive of hard rock and soil excavation are required for the construction of the project facilities. On the other hand, dust emissions will also occur during the construction such as movement of trucks and land clearances. High concentration of dusts will impact not only on the health of workers who works at the project site and have less impact on health of villagers living 8-20km away.

❖ **Proposed mitigation measures for dust suppression and protection:**

- Spraying water on unpaved roads during the dry season to keep the soil moist and free of dust raising every time a vehicle passes
- Cover all transport vehicles carrying dusty materials over more than 300m (will be rare)

- All stockpiles of dusty materials and temporary dumping sites should be regularly sprayed or otherwise kept wet or covered
- Workers must be equipped with masks

5.1.4 Potential Impact on Noise

The main potential impact of high noise levels will be on construction workers. The explosion of rocks, excavation and truck movement within the construction site and during the project operation may create some certain levels of impact on the wildlife. But the problems will be only initial and in the short term, as the wildlife fairly fast gets used to it. Due to the absence of residential areas within 8 km of the Project (Ban Meexay), no major impacts are anticipated on residential Areas.

During construction, noise will be generated from vehicular movements, sand and aggregate processing, concrete mixing, excavation machinery, construction activities, and blasting. While during the operational period, noise will be generated from the pumps, air compressors and generators. During the operation, no significant noise emission will be there. However, appropriate and specific mitigation measures need to consider and develop before the project is started the construction and the operation. Some mitigation measures are discussed as follows:

❖ Proposed mitigation measures:

- Reducing project traffic routing through community areas as well as speed wherever possible, i.e. keeping internal transport on internal roads, so only supplies from outside like with fuel trucks and cement bulk carriers will be passing with Sanasomboun as the last settlement before the project area. This is similar to the large supplies to the mine in Sanasomboun, typically brought to and from Thailand with hundreds of trucks loads per day
- Developing a mechanism to record and respond to complaints
- Adopting an appropriate technique of drilling and blasting and blast with larger arrays of boreholes using delayed ignition to reduce the frequency of blasting and to minimize the noise impact on the wild life and nearby village.
- Establishing complaining and accident records
- Introducing standard and guideline for occupational health and safety practices such as ear protection and enforcement of exposure duration restrictions
- Adopting low noise equipment will be also used as necessary
- Installing absorbing and insulation material at the constructed buildings where the level of noise pressure is high

- Providing ear muffs for the workers who work in the areas of high noise pressure level

5.1.5 Domestic Solid Waste and Wastewater

Due to the large number of workers and project's employees, the utilization of water for cleaning and sanitary will be increased resulting increased the volume of wastewater discharge into the ambient environment. Improper management will result in increasing pressure on the surrounding environment, aquatic life and flora. Proper management and treatment of domestic wastewater is essential.

Large quantities of solids waste from construction as well as office and worker's camps including rubbish and garbage and organic waste from kitchen can cause the impact on human health and environment. Although, office and waste from household or kitchen are not classified as a toxic and hazardous material, but since they consist almost entire of materials such as wrapping materials, the packaging waste, the containers contain of paints, batteries, which may contain mercury, oils and other electrical components.

These problems can be mitigated by establishing a waste management system for recycling, reuse and disposed of waste material. Waste material should be classified and separated by types, recyclable and their toxicities. Biodegradable solid waste material should be collected, segregated and disposed of in a designated land fill site. Domestic wastewater shall be treated by high quality of septic tanks and the effluent must meet the wastewater standard before discharging into the ambient environment.

5.1.6 Toxic and Hazardous Waste

Engine oils or used oil are listed as toxic and hazardous waste material. It is expected that the large amount of the waste oils may generated by changing lubrication oil on construction equipment during the construction period. Used oils may contain various toxic and hazard contaminants depending on the nature and process of their production e.g heavy metals, lead, corrosion inhibitor and PCBs and these contaminants can severely damage the recipient environment.

❖ Proposed mitigation measures to avoid oil spills:

- Develop specific waste management program at the Project area and other specifically areas related to the project
- Store used oils in the safe and secure containers

- Used oils should be properly collected by contractors and resale for the reprocessing or refining purpose. In case the collected engine oil is used as fuel in a furnace or boiler, make sure that the oil is burned under very high temperature to avoid the formation of unintentional persistent organic pollutants.
- Preventive measure must be established to prevent and monitor oils spill
- Establish the emergency response team in case of any accident or oil spill

5.2 Potential Impact on Biological Environment during the Construction and Mitigation Measure

5.2.1 Potential Impact on Forestry and Terrestrial Vegetation

The impact on forestry and terrestrial vegetation will mainly associate the land clearing activities including the construction of a road accesses into the construction site, building office and worker camps, as well as the dam and power substation. The land areas required for clearing are summarized in the following Table 5-1. Small areas of the forest may also require for clearing and replace by projects' building, or project infrastructure. These may also result in the loss of vegetation, forest as well as soil erosions during the clearing of land and truck movements. Soil erosion may also increase during the raining season. Mitigation measures are discussed below.

❖ Proposed Mitigation Measure:

Although the magnitude of the vegetation and land clearing is low but in order to achieve the sound and green hydropower project the proper mitigation measures are proposed as follows:

- Before letting construction equipment loose to build access roads, the alignment has to be set out in the field, so it is confirmed that a road can pass with required maximum slope, which in Laos apparently has no tradition, with the consequence on many projects that not one but 2 or even 3 alignments are cleared before a satisfactory road alignment is established. In this case already one rough unsuccessful alignment was established with the first access made for gold exploration
- Prepare a map for all project works areas including all spoil disposal and quarry areas and temporary land use needed for storage
- Minimizing vegetation and habitat loss by restricted clearing the land, which is required for the project components. Clearance of buffer zones around project infrastructure will be limited and minimized.
- Identified, limit and avoid sensitive habitats areas near the construction areas and designates as "Prohibited" areas.

- Avoiding the impact to forestry resources, cutting down the trees shall be subjected to the discussion and approval of Salvage Logging Committee, while vegetation clearance for biomass purpose will be carried out by project owner under management of Environmental Management Unit in collaboration with the Salvage Logging Committee.
- Avoiding to conduct land clearance during the raining season
- Detail work plan and mitigation measure shall be developed and implemented carefully and under the supervision of the local agriculture and forestry departments

5.2.2 Potential Impact on Wildlife and Mitigation Measures

It is very hard to establish a direct and indirect link or impact on wildlife and their eco system. But surrounding environment of the proposed project is the habitat for many species of wildlife especially migrating birds. Opening up the areas with access roads may typically result in increase in hunting pressure on wild animals by people moving in on motorbike from further away than the closest local villages. However, before opening up the area for vehicles, a heavy hunting pressure was already present with a network of footpaths and temporary huts, especially along the river, used for hunting, fishing and shifting cultivation, both by local villagers and personnel from local army posts.

❖ Proposed mitigation measures for hunting of wildlife and vegetation:

- For the construction period, prohibiting hunting weapons in the camps and participation in hunting by construction workers and employees of the SHPP. Food is provided by the employers
- Introducing forest and wildlife management program for the project area
- Establish an appropriate program to monitor and creating awareness to the workers and employees working for the proposed project
- Cooperating with wildlife and forest management unit of the local government and concern authorities
- Building awareness and minimize hunting of wildlife by workers in surrounding project areas

5.2.3 Potential Impact on Fish and Fishery

Fish are primary source of animal protein in the Lao PDR. A field survey found that residents in two villages in the proposed project area engage in fishing activities. Fish caught in the wet season are larger than those caught in the dry season. However, the total harvested quantity and weight is higher in the dry season and consequently, villagers eat less fish in the wet season. Various techniques are used for fishing including the use of nets, traps and lines. Women are often seen scouring the banks of rivers and streams for aquatic animals, small fish, insects and frogs, which are all used as food sources. Men are responsible for setting nets and traps located in larger rivers and rapids and for fishing by line. As with hunting, villagers state that the variety and quantity of fish are declining due to human population increases, with additional pressure through more people fishing in order to generate income and to capture food sources for family consumption. Fresh fish are normally sold within the villages or else consumed by the residents themselves. Some families process the fish before selling them to consumers. Fishing ranks second in terms of income levels next to non-agricultural activities. Sometimes fish are sold to the Sanasomboun Market or to traders that come directly to the site; fish sold during traditional festivals generate more income for residents than during other seasons.

The construction of the dam will block the fish movement from downstream to upstream. However, with the establishment of the arch dam, a small water body will be established up to the outlet of Nam Sor (5.2km), allowing fish to migrate between the water body and the Nam Sor as the flow of the river changes, where the fish may go up during the monsoon to spawn. The Nam Sor has a number of water falls just before entering into the water body, which for tropical fish will be impassable going up, so it will be unaffected by this.

Fish is seen as a major source of protein in the whole area and the creation of the rather shallow water body is seen as an opportunity to increase the fish production as it has been seen in as example Nam Ngum 1, which also is a rather shallow water body like this, while Nam Sor with a 225m high dam will be quite different. The road access will support the access to fishing and the removal by fishing of the large predator species may result in the increasing production of smaller species.

5.3 Access Road

The project area is located in unpopulated area, with no villages located in the project area. Until 6 months ago it was practically inaccessible, with half a day walk through a very rough terrain from the nearest village. Traditionally slash and burn and no permanent cultivation have been

practiced in the area along the new access road to the arch dam site. With the establishment of the road, initially by the gold exploration team, some temporary settlement by locals is observed, due to the easy access to natural resources through the road.

However, before the construction of the project components is started, an access road connecting to powerhouse site will need to be improved. The access road on the right bank connecting arch dam, canal, and forebay will also need to be constructed, which may disturb some trees on its corridor. But there seems to be no land acquisition involved with the project and no resettlement either.

CHAPTER VI

Environmental Monitoring and Management Plan

6. ENVIRONMENTAL MONITORING AND MANAGEMENT PLAN (EMMP)

There are three separate environmental monitoring and management plan reports which contains a description of environmental and social mitigation measures and the appropriate monitoring program for potential impacts associated with the. The Environmental Monitoring and Management Plan (EMMP) cover all phases of the Nam Sor hydropower plant project development, from construction to operation stages.

6.1 The Scope and Objective of EMMP

The EMMP objective is to provide a technical and institutional framework for:

- undertaking Protection and Mitigation Measures (PMMs) related to direct and indirect project environmental and social impacts; and
- monitoring of those PMMs throughout the life of the project.

The EMMP also provides a basis for evaluating the actual project performance in carrying out the PMMs, including monitoring, with description of the standards that are required as evidence to show that adequate attention has been given to each PMM and its associated monitoring requirement.

The EMMP includes mitigation and monitoring for direct physical and biological impacts from the project, social and cultural values and their mitigation and monitoring.

The recommended PMMs generally can be classified as protection measures, mitigation measures, monitoring programs and studies.

In addition, the EMMP also provides in detail the institutional framework required for the effective implementation of all the PMMs, including setting up of the project EMU and RMU, the necessary staffing skills and technical expertise required to staff these units and the training and other capacity building activities required.

6.2 Institutional and Framework

1. Responsible Institutional and Structure:

The owner of the project will have ultimate responsibility for ensuring the EMP & SAP are implemented. During construction, the implementation of certain management activities will be undertaken by the Contractor in accordance with the requirements of this EMP & SAP. During operation, all management activities will be undertaken by project owner with specialist support as required. The implementation of the EMP & SAP will require staffing and support systems, as outlined below.

2. Project steering committee

The project steering committee shall be set up before the project commencement of the construction. This committee is comprised of representatives from provincial Department of Energy and Mines, Department of Natural Resources and Environment, Department of Agriculture and Forestry, Department of Tourist, Provincial Science, Technology and Environment Department, Lao's Women Union, Youth Union, Lao National Front for Construction, Department of Health and Department of Information and Culture, the committee will chair by provincial governor or vice governor.

The main responsibilities of this committee are to manage overall of the project activities and resolve the problem may rise during project implementation for instance the compensation cost that may not be solve by District Working Committee, consider the tax exceptions of Import materials are required for construction as agreed and specified in project concession agreement.

The Project ESMO will be assigned as the secretary of this committee and they may meet quarterly basic or 6 months period and ad hoc basic as required by the project during course of the project implementation.

3. Project District Working Committee

The project district working committee will be set up during course of the implementation of the project construction, the representatives from government organization almost the same as provincial level, the committee will be closely working with the project ESMO, the specific member of committee will be required and assigned to assist the project, depend on works requirement for instance project public awareness and resettlement issue must be involve by mass organization and Lao National Front for construction and for agriculture extension program will be involved by DAFO.

4. Project Village Working Committee

The village Working Committee will be established to carry out and coordinate with the project in terms of public consultation with villagers and culture compensation issue, this committee will be headed by Chief of the village and consisted of the mass organization and Neo Home Ban (Village Grievance Unit)

5. Environmental and Social Management Office

An Environmental and Social Management Office (ESMO) will be established by the project owner and will have the overall responsibility for implementing and supervising the social and environmental management and monitoring program during detailed design, construction and operation. The unit will be located within the project management structure at a level immediately below the Project Manager. The ESMO will have the following staff.

6. *Environmental and social supervisor*

An experienced and suitably qualified environmental and social supervisor will have the overall responsibility of developing, implementing and coordinating of environmental and social mitigation and monitoring programs. The environmental supervisor would report directly to the project manager. The project manager would channel instructions from the environmental supervisor direct to the contractor. The environmental supervisor will have a graduate or post-graduate qualification relevant to the field of environmental management (e.g. chemistry, hydrology, engineering, biology, natural resource management), at least ten years environmental management experience and familiarity with the design and operation of hydropower projects. Experience with community consultation will be essential.

7. *Technical assistant*

Two technical assistants will be appointed to support the Environmental Supervisor during the construction phase. Both technical assistants will have a graduate or post-graduate qualification relevant to the field of environmental management and at least three years professional experience in the environmental field. It is expected that at least one of the technical assistants will have experience in land rehabilitation and re-vegetation, unless the Environmental Supervisor is experienced in this area. One of the technical assistants will be primarily responsible for supporting the biophysical aspects of the management and monitoring program. The other technical assistant will be primarily responsible for supporting the community aspects of the management and monitoring program. During operations, only one technical assistant, working in a part time capacity will be required primarily to assist with community consultation and routine monitoring.

8. Resources and Management Support

The ESMO will be equipped with a dedicated office, vehicle, computer, email address, phone and digital camera to help undertake their tasks. They will also be provided with suitable monitoring equipment. Full management support will be provided by the Project Manager and other site managers and administrative support will be provided by the site administration. The environmental supervisor will be included in all regular management meetings. He/she will be consulted prior to any operational decision with environmental implications, such as (during construction) changes to the location or routing of project facilities and infrastructure or (during operations) the flushing of head ponds or changing of volumes released downstream from the upper reservoir.

9. Training

The environmental and social supervisor will undertake internal training of the technical assistants. External training of the environmental and social supervisor and the technical assistants will also be provided, where required, to ensure that they are able to effectively carry out the full range of their duties. External training will be undertaken by experienced environmental and social practitioners, and will cover areas such as community liaison, erosion control, re-vegetation practices and water quality monitoring – depending upon need. Environmental and social personnel will also be provided with the opportunity to visit other hydropower projects within Lao PDR, to broaden their experience and exchange knowledge and expertise. Initial, intensive training will be undertaken at the start of the construction period. However, the regular training of environmental personnel will continue throughout the life of the project to ensure that skills are continually being improved and updated. The ESMO will be responsible for establishing environmental training, awareness and induction programs among the broader project and contractor workforce.

Representatives from Provincial Energy and Mine Department and provincial WREA from Vientiane province will be appointed to assist in overseeing the ESMO. This will allow the program to be integrated within the provincial programs and also provide training and assistance to PEMD and WREO staff at the provincial and district level.

10. Reporting

• Monthly reporting

At the end of each month, the project owner will submit a report to DOE/MEM, ESAD/WREA, project steering committees at provincial and district level and other line ministries in Vientiane concerning the implementation of the EMMP & SAP. The monthly report will include: (i) an

account of site management and rehabilitation activities; (ii) the results of environmental and community monitoring, including any significant project impacts detected and an outline of management response; (iii) an account of community consultation, compensation payments and community assistance and community trust fund activities. (iv) Significant environmental or community issues encountered and an outline of management response.

The monthly report will be copied to PEMD and WREA representatives in Vientiane province.

- **Annual reporting**

At the end of each calendar year, the environmental supervisor will submit an annual social and environmental report to DOE/MEM, ESAD/WREA and other line ministries in Vientiane concerning the implementation of the EMP & SAP. The annual social and environmental report will include: (i) progress and success of the site management and rehabilitation program; (ii) the results of environmental and community monitoring, including any significant project impacts detected and an outline of management response; (iii) a summary of community, government and other stakeholder consultation undertaken during the year and the summary of compensation payments and community assistance and community trust fund activities; and (iv) significant environmental or community issues encountered and an outline of management response.

11. Schedule

- **Principle**

A detailed household survey and a first step on the consultations with affected villagers should be the first activities before implementation of SAP takes off. District administrations have been informed in the initial stage but effected household and villages in watershed area that will actually be losing their lands have not officially been informed. Information on the Project was given to soothe villages prior to the household and village surveys. Affected households in downstream village must be given as much notice as early as possible regarding compensation payment; therefore all planning activities will be initiated as soon as possible.

12. Time plan

All the necessary arrangement in respect of facilities and compensation for displacement and relocation must have been adequately taken care of before the actual construction of the dam can be implemented.

The relocation schedule is determined mainly by the construction schedule for the dam and power plant and by the necessity that relocation and all types of in-kind compensation (mainly replacement of land lost due to submersion) must be accomplished before the reservoir is filled.

13. Complaints and Grievance Procedure

There will be three instances for sorting out complaints and grievances. Every affected person has the right to lodge a complaint when dissatisfied with compensation or resettlement process. The first instance will be at the village level, with the Village Committee listening to complaints from the PAPs and trying to resolve these. Should the first instance fail then the second instance, situated at the District level will be the next adjudicator. The district working committee and the ESMO will listen to the complaints. Should the plaintiff still wish to lodge a grievance, having failed to be satisfied at the second instance, the Legal Court at the provincial level will be the last and final instance. The PAP lodging the complaint should not be made to pay for the case. The outcome ruling on the complaint will be respected.

In most cases of disputes, it is expected that the plaintiff will not reach the second instance, which in this case would be the ESMO with Consultant observer/witness to ensure that the PAP is justly heard and the right decision given. Normally disputes are solved at the village level, with moderators ensuring that disputes stay within the village. A body known as Village Front for Construction (Neo Hom Ban) is responsible for resolving disputes at village level.

14. Grievance Processing Mechanism

The grievance/dispute processing and a mechanism is based on a three-tier system, as shown in the following sketch:

- First Instance: Customary ruling under the auspices of Neo Hom Ban, if not successful
- Second Instance: Amicable settlement outside the scope of the customary law under the auspices of VRC and ESMO in the presence of legal counsel, if not successful
- Third Instance: Court of Law

15. First instance process: Within a village

In such compensation operations, many grievances take root in misunderstandings, or result from conflicts between neighbors, which usually can be solved through adequate mediation using customary rules. Most of grievances can be extinguished with additional explanation efforts and limited mediation. A first instance mechanism is aimed at the amicable settlement of disputes. When an aggrieved person presents a grievance or dispute to the Legal Counsel, the

legal advisor will seek settlement using first the customary mechanisms available in the community. These mechanisms use customary rules well known to all and considered binding by all. Community leaders typically and rightfully play an important role in achieving settlements acceptable to all parties. Normally disputes are solved at the village level. With moderators ensuring that disputes stay within the village.

15. Second instance: VRC and ESMO

When a settlement can not be reached at the First Instance level, the second instance mechanism is triggered: Amicable settlement under the auspices of Legal Counsel/Witness GOL and the ESMO.

16. Third instance process: Appeal to court

According to the Lao Constitution, every individual has the right to access a court of law to lodge complaints and petitions as expressed in Article 28 below:

"Article 28. Lao citizens have the right to lodge complaints and petitions and to propose ideas to relevant state organizations in connections with issues pertaining to the rights and interests of collectives or of their individuals.

Complaints, petitions and ideas of citizens must be considered for solutions as prescribed by law". Appeal to the Court will therefore be through the normal jurisdiction. Given the mechanisms described above, it is not expected that many disputes will reach this level.

17. Community Consultation and Awareness Program

A Community Consultation and Awareness Program will be developed to provide a basis for ongoing community consultation. An important focus of the liaison program will be raising awareness amongst the community of hazards introduced into the area as a result of the project (e.g. dangers associated with diversion canal access, increased traffic hazard) and potential, project-related disruptions to the community (such as reduced flows downstream of the head ponds). The program will also communicate to the local community about possible opportunities such as employment and recruitment procedures, business opportunities, and Community Trust Fund program initiatives. The program will provide a forum for the community and (and government where relevant) to raise, discuss and resolve issues associated with the project.

Consultation will occur both formally (e.g. meetings, presentations and workshops) and informally (e.g. visits to the local villages). ESMO staff will consult the community before making any significant decisions relating to: changes to landform or drainage (beyond the proposals

currently contained in the IEE and ISA). Records will be kept of all consultation. Agreements will be written up and signed by relevant parties. For a comprehensive overview of all community consultation to date and proposed ongoing consultation mechanisms, please see the separate report, Public Disclosure and Consultation Plan

18. Disclosure of Information

In accordance with Lao government Safeguard policy policies, disclosure of information to project stakeholders and the general public is necessary. This implies that reliable and up-to-date information on the project as it develops should be available through various media. The main aspects include:

The information disclosure will disseminated through Lao TV and radio to reach the general public - updates about progress on the project and public meeting announcements. Information bulletins will be through national and international newspapers and information to visiting journalists or international NGOs. Information Centres where reports are available.

Translation into Lao language is required for all major summary report of the final IEE, EMP and SAP. This is to facilitate GOL involvement and understanding where necessary.

19. Monitoring Program

Monitoring Requirements

The planning and implementation activities for EMP and SAP will be monitored to ensure that the process is carried out fairly and in accordance with the provisions of the plan. Two separate kinds of monitoring are envisioned:

- Monitoring of physical progress including reaching key benchmarks (acquisition of land, payment of compensation, construction measures)
- Monitoring of non-physical performance - goal/outcome attainment on incomes, health, education, social issues and capacity building.

Monitoring of physical progress will be carried out by the Project's staff under the direction of the Community Development Facilitator, as well as by the VRC. Regular feedback on the SAP process and progress will be provided to the affected residents through formal or informal meetings and discussions. The reporting schedule will be monthly, however, more or less frequent progress updates may be warranted depending on the level of activity and as the relocation date nears.

An independent third party monitoring shall be appointed by the project, will monitor non-physical performance. The third party will perform periodic reviews of the socioeconomic status

of the affected households and watershed management plan, and will solicit feedback and comments from these households regarding the implementing process. A matrix of socio-economic indicators, mainly based on village wide statistics, will be collected as part of the monitoring; however, monitoring of individual households and comparison of their conditions to pre-relocation status will also be carried out. The consultants will provide a report to the Project management presenting their findings including any identified problems, community views and any recommended measures or improvements that could be made.

The monitoring schedule will initially be set as twice a year and will continue for a minimum three years following physical relocation to the new villages. The monitoring period will be extended if necessary until equivalency to pre-relocation conditions can be demonstrated. Specific measurement tools for determining equivalency will be set as part of the monitoring indicators. The methodology used to evaluate equivalency must incorporate a degree of flexibility or be able to adapt to unforeseen or unanticipated events, which are beyond the control of the Developer and which have negative impacts on the populations affected by resettlement. Such events could include drought, floods (or other acts of nature), or sickness.

The monitoring agency must be able to recognize such circumstances, evaluate their effect on resettlement recovery process and develop alternative indicators for determining equivalency if necessary. Indicators based on the relation between the local circumstances and regional or national trends, such as farm plot sizes, production levels, Gross Domestic Product, household and personal incomes, purchasing power, should be considered by the monitoring consultants.

20. Monitoring Indicators

In preparation of this report, the consultant has set up a database of all interviewed PAPs and people in watershed area based on the socio-economic survey. The database will be expanded once the detailed socio-economic survey is carried out at the next stage. The sample survey addressed aspects of living standards of the PAPs through questions on monetary incomes. This makes up a set of indicators that should be defined in agricultural and non-agricultural sources. Additionally, questions on household assets e.g. radio, tractors and other equipment, plus food security and household expenditures were covered during the survey. The quantitative indicators emanating from questions on monetary incomes and welfare indicators should allow for crosschecking of data about living standards.

Monitoring indicators largely come from baseline data defining a measurable characteristic of activities to be monitored. Monitoring then aims at defining its state at the particular time of its observation, and to compare it with a previously defined standard. In this resettlement project, social and economic characteristics form the great majority of indicators. These indicators may include the following: agriculture; food production and marketing; crop production; livestock per

household; incidence of animal disease/type; farmers' groups; involvement of women, etc. For education, the followings are included: (where applicable) primary and basic enrolment levels by gender; secondary (and possibly tertiary) enrolment levels by gender; pupil/teacher ratio; distance to primary school. Health: availability of and distance to safe drinking water and sanitation; incidence of main diseases/gender/age; death rates of main diseases/gender/age; trained health staff; percentage of catchment population; distance to health centre; child nutrition such as height for age (stunting), weight for age (wasting); possibly incidence of HIV/AIDS and other STDs by gender and age. Household economy including: housing, quality of roof, walls, floor, road to next village, tracks, dust/motor road. Other important are: income per household; indebtedness; livelihood skill (i.e. capacity building, skills/vocational training, community infrastructure and improvement in production/income for women/youths).

These indicators may include the following:

- Agriculture: food production and marketing such as crop production (tonnage or bushels per hectare and land use type).
- Education: Where applicable, primary and basic enrolment levels by gender, Secondary (and possibly tertiary) enrolment levels by gender, pupil/teacher ratio and distance to primary school.
- Health including the followings: the availability of and distance to safe drinking water and sanitation, incidence of main diseases/gender/age, death rates of main diseases/gender/age, trained health staff in the catchment population, child nutrition: height for age (stunting), weight for age (wasting), possibly incidence of HIV/AIDS and other STDs by gender and age, household economy and housing, quality of roof, walls, floor.
- Safety regards due to traffic
- Capacity building, skills / vocational training.
- Water Quality
- Water Supply to the downstream village

Organization, responsibilities and schedules for monitoring

Monitoring is part of project management in implementing the resettlement. It is relatively autonomous, serving as a data bank, both for the identification of baseline data (as benchmarks) and for inputs and outputs of the resettlement project. Monitoring therefore should start from the planning stage where the determination is made concerning the frequency of monitoring and of the types of indicators derived from baseline data.

The monitoring system need set up in accordance with monitoring plan will be carried out as following:

- Daily monitoring by SEMU
- Monthly monitoring by Provincial Natural Resources and Environment Office (PNREO)

- Quarterly Monitoring by Water Resource and Environment Administration

Monitoring will be the responsibility of a GOL agency and panel of experts with consultations or other stakeholders to solicit information on the project's progress and impact. Consultation will be sought from technical staff.

2. Environmental Monitoring and Management Unit:

Environmental Monitoring and Management Plan (EMP) based on the identified potential impacts and mitigation measures will be an important guideline for the government and project developer as well as contractors to implement the project according to the rule and regulation and appropriate mitigation measures. All related parties will ensure that all identified problems related to the physical and biological environment as well socio and cultural are properly implemented and included in all contractor bidding documents and operating contracts. The EMU will be responsible for implementing the EMP and soil erosion control plan during project construction and operation. The EMU will ensure that the EMP is updated periodically during construction.

3. Environmental Monitoring Plan:

The Environmental Management Unit shall be established with the function of monitoring project activities and will ensure that:

- (i) The environmental monitoring plan from the IEE is included in all contractor bidding documents and construction contracts,
- (ii) The environmental monitoring plan is updated, as required, during project construction and operation, coordinate all environmental monitoring activities, and
- (iii) Environmental monitoring report is submitted (including physical data) to the concerned government agency during construction and after completion of construction.
- (iv) Environment and Social Monitoring Program are implemented with the coordination of local authorities and the affected persons, if any.
- (v) The dissemination workshops on how the environmental works can be achieved and implemented at the project site. This workshop shall make clear to all parties on the work to be carried out, time schedule and where budget they can be obtained as mitigation and compensation are needed. So, these mean that the ESU will prepare implementing and monitoring plans. For time schedule and parties to be involved in the monitoring and evaluation.

6.3 Potential Negative impact and Mitigation Measures

The magnitude impacts of the proposed project will be minimal due to its scale and capacity and proper mitigation measures are implemented. The general recommendations as follows:

(i) Potential Environmental Impacts Related to Project Location and Design.

No sensitive and protected areas of wildlife have been identified or located by this project. In addition, no any households or any other structures need to remove and resettled. Therefore no compensation is required as well as compensation for rice fields, land and flood plains.

(ii) Potential Environmental Impacts Related to Construction and Mitigation Measures.

Soil erosion, water pollution, short term eutrophication, noise, dust and destruction of vegetation are expected to be an issue during the construction. Proper mitigation measures will be introduced and established including planting of trees and local species of grass to rehabilitate impacted areas, constructing of control devices or infrastructure to limit transportation of erosion, utilizing a bio-septic tanks tank to treat domestic wastewater and sewage, rubbish and other construction materials will be properly collected and disposed of in the land fill. Engine oils or used oil will be sent to the refinery for reused or industry where they can be used as fuel, best technique for blasting and explosions of explosive material will be deployed to minimize the impact on ecosystem and wildlife, water spraying dust, distributing personal protection wear for workers, and carefully planning the laying of transmission lines and trimming the tops of trees if they are unavoidable. All surplus earth and stone will be re-used either into constructing the project structures, or for new road and road renovations. The new road will not have significant impact to vegetation and wildlife. This study presumes that impacts are not significant and small if the recommended mitigation measures are taken.

6.3.1 The Physical Environment

6.3.1.1 Potential Impact on Sediment Transport and Erosion

High amounts of sediment and soil erosions may occur during the project construction such as rock and soil excavation, stockpile of the earths and etc. But the magnitude of the will be low, temporary and can be mitigated.

❖ Proposed Mitigation Measure:

- Diverting runoff from undisturbed or external areas away from the project area
- Providing control device or infrastructure to limit transportation of erosion and sedimentation

- Providing appropriate road surfaces and control on roads
- All effluent discharge from the office and workers camps should comply with standard and guideline
- Established a temporary storage area for soil and waste rock to avoid and limit sedimentation and erosion.
- Regularly monitor suspended matter and sediment rate as well as documenting the performance of sediment control systems at key locations upstream and downstream of project facilities, prior to and during construction and operations, to confirm the extent of impact and implement suitable management responses.
- Where possible to avoid or carry out construction activities during the raining season
- Land clearance activities shall be regularly monitor to ensure that vegetation is cleared only in the approved and planned areas and not clear beyond pre-defined project boundaries and in the sensitive areas
- Planting local species of trees and grasses to rehabilitate and revegetate disturbed land surface at the project site as soon as practicable, to facilitate long term stabilization.

6.3.1.2 Potential Impact on Surface Water and Water Quality

The project design does not include construction of any dam or water impoundment Structure. The Project will not cause significant changes to the downstream discharge hydrograph. Therefore, the Project will not have any impact on downstream water uses.

6.3.1.3 Noise Emission

The main potential impact of high noise levels will be on construction workers. The explosion of rocks, excavation and truck movement within the construction site and during the project operation may create some certain levels of impact on the wildlife. But the problems will be only temporarily and in the short term. Due to the absence of residential areas within 1 km of the Project, no major impacts are anticipated on residential

During construction, noise will be generated from vehicular movements, sand and aggregate processing, concrete mixing, excavation machinery, construction activities, and blasting. While during the operational period, noise will be generated from the pumps, air compressors and generators. During the operation, the noise emission may arise from the power house, but its impact level is minor. However, appropriate and specific mitigation measures need to consider and develop before the project is started the construction and the operation. Some mitigation measures are discussed as follows:

❖ **Proposed mitigation measures:**

- Reducing project traffic routing through community areas as well as speed wherever possible
- Developing a mechanism to record and respond to complaints
- Adopting an appropriate technique of blasting and explosive material such short circuit delay and frequency of blasting to minimize the noise impact on the wild life and nearby village. Blasting rocks or using any explosive material is prohibited.
- Establishing complaining and accident records
- Introducing standard and guideline for occupational health and safety practices such as ear protection and enforcement of exposure duration restrictions
- Adopting low noise equipments will be also used as necessary
- Installing absorbing and insulation material at the constructed buildings where the level of noise pressure is high
- Providing ear muffs for the workers who work in the areas of high noise pressure level
- Avoiding working at night shift which may impact on the ecosystem of wildlife.

6.3.1.4 Air Quality Management

Extensive of hard rock and soil excavation are required for the construction of the project facilities. On the other hand, dust emissions will also occur during the construction such as movement of trucks and land clearances. High concentration of dusts will impact not only on the health of workers who works at the project site but it will also impact on health of villagers living in the surrounding project areas.

❖ **Proposed mitigation measures for Dust Suppression:**

- Employing a watering program to minimize airborne particulate matter emissions from pave and unpaved on-site roadways, storage piles, and other
- Cover all transport vehicles
- All stockpiles and temporary dumping sites should be regularly spray or wetting with water
- Worker must equip with masks and protected equipments

6.3.1.5 Domestic Solid Waste and Wastewater

Due to the large number of workers and project's employees, the utilization of water for cleaning and sanitary will be increased resulting increased the volume of wastewater discharge into the ambient environment. Improper management will result in increasing pressure on the surrounding environment, aquatic life and flora. Proper management and treatment of domestic wastewater is essential.

Large quantities of solids waste from construction as well as office and worker's camps including rubbish and garbage and organic waste from kitchen can cause the impact on human health and environment. Although, office and waste from household or kitchen are not classified as a toxic and hazardous material, but since they consist almost entire of materials such as wrapping materials, the packaging waste, the containers contain of paints, batteries which may contain mercury, oils and other electrical components.

These problems can be mitigated by establishing a waste management system for recycling, reuse and disposed of waste material. Waste material should be classified and separated by types, recyclable and their toxicities. Biodegradable solid waste material should be collected, segregated and disposed of in the engineer landfill site. Domestic wastewater shall be treated by high quality of septic tanks and the effluents must meet the wastewater standard before discharging into the ambient environment.

6.3.1.6 Toxic and Hazardous Waste

Engine oils or used oil are listed as toxic and hazardous waste material. It is expected that the large amount of the waste oils may generate especially during the construction. Used oils may contain various toxic and hazard contaminants depending on the nature and process of their production e.g heavy metals, lead, corrosion inhibitor and PCBs and these contaminants can severely damage the recipient environment.

❖ Proposed mitigation measures for Dust Suppression:

- Develop specific waste management program at the Project area and other specifically areas related to the project
- Store used oils in the safe and secure containers
- Used oils should be properly collected by contractors and resale for the reprocessing or refining purpose. In case the collected engine oil is used as fuel in a furnace or boiler, Make sure that the oil is fired under the high temperature zone to avoid the formation of unintentional persistent organic pollutants.
- Preventive measure must be established to prevent and monitor oils spill
- Establish the emergency response team in case of any accident or oil spill

6.3.2 Environmental Management Plan for Biological Environment during the Construction and Mitigation Measure

6.3.2.1 Hunting wildlife and destruction of vegetation

It is very hard to establish a direct and indirect link or impact on wildlife and their eco system. But surrounding environment of the proposed project is the habitat for many species of wildlife

especially migrating birds. Increasing the number of workers and employees at the project areas will result in damaging of vegetation and hunting for animal and wildlife for foods and commercial. On the other hand, hunting wild animal is also expected to increase. Therefore, human access to these resources must be restricted.

❖ **Proposed mitigation measures for hunting of wildlife and vegetation:**

- Introducing forest and wildlife management program for the project area
- Establish an appropriate program to monitor and creating awareness to the workers and employees working for the proposed project
- Cooperating with wildlife and forest management unit of the local government and concern authorities
- Building awareness and minimize hunting of wildlife by workers in surrounding project areas

6.3.2.2 Land use and loss of land

Some part of land will require of land for construction of campsites, residential and administrative buildings and other construction facilities as well as access road. The power house area will also require land for construction of the campsite, residential and administrative buildings, powerhouse, construction site facilities and access roads to the construction site. However, the land acquisition will not have any affect on the public land. Compensation according to the law and regulation will be made if any public land will be acquired by the project.

6.3.2.3 Impact on nearby Community

The absence of residential areas which are located approximately 9 km away from the project site, therefore no major impacts are anticipated on the residential areas, the main impacts during the construction are anticipated on the workers and employees who work for the project. Impacts on worker from the construction activities like dust, noise, construction of camps etc shall be minimized by introducing specific rules and guidelines as mentioned in the potential impacts and mitigation chapter. On the other hand, all these rule and guidelines should be considered as a compulsory and part of all contracts signed between project developer and contractors and subcontractors. The rules and regulation must include into the contract documents of the Project when agreement is signed. All contractors must fully comply with all these rules and management arrangement programs. It is also recommended that before any payment made to the Contractor(s); Project management will have to make sure that there is no any environment and social issues remaining due to Contractor(s) activities. If there is any issues the Project will immediately order to Contractor(s) to fix those problem(s) before payment

and if the Contractor(s) are neglecting or could not take any measures, Project management will deduct payment amount and implement remedy works by themselves.

6.3.2.4 Fishery

Several species of fish are found in this river. There is no any specific study on the fishery in the Nam Sor river, but according to the Baird and Shoemaker report (2007) indicated that about 300 to 350 species of fish may exist in the Nam Sor River. Some big fish have been recorded in the River. However, based on the villagers' interview conducted during the survey the number of big fish significantly declines.

When the construction of the run-of-river dam is completed, fish movement along the river stream is impossible. But during the operation when water level of the dam is increased, the pond upstream may become a habitat for various types of migrated fishes. A fish management program will be developed and introduced during the operation of the project.

6.3.3 Social Impacts, Monitoring and Management Plant

6.3.3.1 Affected Villages

No village located in surrounding of the project area will be direct impacted. This due to a low dam as of run-of-river scheme, not trans-basin scheme, and the project site is not in the NBCA area. The spillway is over the crest of the dam, which will create a waterfall on the downstream side of the arch dam.

a. Compensation issue:

The arch dam area, construction of campsites, residential and administrative buildings, powerhouse, construction facilities and the dam and its accompanying structures and access road to construction site. In principle, any affected assets that obtaining a livelihood will be compensated according to consultation and discussions with communities and district authority. The pond area is very minor affected by land in the forest.

Any losses of land presently used by the PAP will be fully compensated according to GoL laws and regulations and specific agreements negotiated with the owners during the district, provincial and central level public consultations.

6.3.3.2 Influx and impact on host community:

A labor force of about 150 will be deployed to work during the construction phase, mostly they will be male skilled workers from Lao PDR and neighboring countries like Vietnam and China. The problems of an influx of newcomers are often closely related and have similar effects on

Table 4. Environmental Monitoring and Evaluation Frameworks

Environmental Impact/Issue	Mitigation Measures	Location	Time Frame	Responsibility	
				Implementation	Supervision
A. Construction Phase					
1. Soil:					
- Loss of topsoil	Loss of topsoil will be avoided by stripping and storing topsoil (where present) prior to construction and reusing it for rehabilitation works.	All construction sites	During Construction	Contractor	EMU, Project Developer
- Rehabilitation of borrow areas and temporarily acquired land	Sand and coarse aggregate requirements mine from nearby site and borrow pits shall be undertaken section by section with rehabilitation immediately after excavating to prevent soil erosion. Rehabilitation will include (i) regrading slopes to minimize erosion, (ii) replacing stockpiled soil cover, (iii) replanting grass, shrubs, and trees, (iv) installing sediment runoff control devices, and (v) ensuring ongoing erosion monitoring.	All borrow areas and temporarily acquired land	During Construction	Contractor	EMU, Project Developer
- Soil erosion and siltation	Soil erosion and siltation will be minimized by preventive measures implemented on a case-by-case basis, such as planting trees, shrubs and grass, and appropriately engineered storm-water diversions. Potential soil erosion from the construction of the access road will be minimized by appropriate road engineering including appropriate road compaction and runoff design.	All construction sites and access roads	During Construction	Contractor	EMU, Project Developer
- Soil contamination	Soil contamination will be prevented by installing oil separators at wash-down and refueling areas, and by installing secondary containment at fuel storage sites. Oil leaks and shall be immediately removed and store in the save containers. Used oils will be collected and send to refinery, or reuse as fuel for furnaces.	Hydropower plant and material storage areas	During Construction	Contractor	EMU, Project Developer
- Disposal of excess earthworks	Excavated rock and aggregate will be used in embankment construction to the maximum extent possible. Embankment sites need to be identified and selected for disposed of excess spoil. Sites will be covered with soil and planted with shrubs and grasses.	Waste rock site	During Construction	Contractor	EMU, Project Developer

Environmental Impact/Issue	Mitigation Measures	Location	Time Frame	Responsibility	
				Implementation	Supervision
2. Wastewater and water quality					
Disposal of septic wastewater	- Wastewater discharge during the construction phase will consist of about 12 m ³ /d sanitary wastewater effluent discharge from the work camps. All wastewater will be treated to meet national standards and then recycled on-site. No direct discharge of untreated sanitary waste will be made to surface water bodies. Truck and other vehicle maintenance will be strictly controlled to prevent discharge of waste oil into the river.	Office and Work camps	During Construction	Contractor	EMU, Project Developer
Water Quality	Water quality will be regularly monitored at both up and down stream	Up and down stream	Regularly during the Construction during operation; twice a year	EMU	Project Developer
3. Air Quality					
Generation of dust	- The main impact to air quality during construction will be from increased dust levels from construction machinery, rock blasting, foundation excavation, cement mixing and road construction. Dust generation from construction traffic will be mitigated by using water spray trucks for dust suppression.	All construction sites, all access roads	During Construction	Contractor	EMU, Project Developer
			During Construction	Contractor	EMU, Project Developer
4. Noise					
Noise impacts	- During construction, noise will be generated from vehicular movements, sand and aggregate processing, concrete mixing, excavation machinery, construction noise and blasting. The main potential impact of high noise levels will be on construction workers. Due to the absence of residential areas within 9 kilometers of the Project, no major impacts are anticipated on residential areas. Mitigation measures for noise impacts on construction workers will include standard occupational health and safety practices such as ear protection and enforcement of exposure duration restrictions.	All blasting sites (cuts, rock quarries, etc.).	During blasting And construction activities	Contractor	EMU, Project Developer

Environmental Impact/Issue	Mitigation Measures	Location	Time Frame	Responsibility	
				Implementation	Supervision
5. Solid Waste and Hazardous Materials					
Hazardous and non hazardous Waste	- Disposal of domestic waste and construction waste will occur regularly to approved disposal sites. (ii) No landfills will be developed on-site. (iii) Hazardous waste will be collected and stored on-site in approved facilities according to relevant standards. Hazardous waste will then be removed from the site to approved hazardous waste disposal facilities.	Power plant, accommodation area	During Construction	Contractor	EMU, Project Developer
Hazardous materials	- Potential impacts to the environment are from accidental spillages affecting soil, groundwater, and adjacent water bodies. Mitigation measures to prevent spillage will include installing appropriate hazardous materials storage facilities.	Power plant, accommodation area	During Construction	Contractor	EMU, Project Developer
6. Impact on Flora					
Impact to flora	(i) Some vegetation will be removed at the construction sites (hydropower plant, access roads, and work camps). All works will be carried out to minimize damage or disruption to vegetation. After completion of construction activities, temporarily occupied areas will be replanted. (ii) Construction activities will require removal of a small number of trees. The local forest committee will record all trees in the proposed construction areas, requires compensatory planting for any tree removed during construction. Additionally a fine will be paid to responsible government agency. All vegetation at the project site will not threatened habitats and will be reduced due to construction Activities or sale for commercial by forest committee. (iii) Due to the temporary increase in workers to the construction site, the potential for illegal fuel-wood collection is increased. Mitigation measures will include (a) provision of adequate heating and cooking facilities, and (b) provision of environmental training on environmental management issues including penalties for illegal fuel-wood collection.	Entire project site	During the construction	Contractor	EMU, Project Developer, Provincial Forest Management Department

7. Impact on Fauna					
Impact to fauna	- Construction activities will disturb the habitat of terrestrial animals immediately, especially at the night time. This may result in movement of wildlife from the project vicinity. However, no protected species live in the immediate vicinity of the project site. The impact is anticipated to be temporary during construction and while wildlife adapts to the presence of the HPP.	Entire project site	During the construction	Contractor	EMU, Project Developer
Hunting Wildlife	Hunting for animal and wildlife for foods and commercial is expected to increase due to the influx workers. Appropriate measures shall be implemented including: <ul style="list-style-type: none"> - Introducing forest and wildlife management program for the project area: - Establish an appropriate program to monitor and creating awareness to the workers and employees working for the proposed project - Cooperating with wildlife and forest management unit of the local government and concern authorities - Building awareness and minimize hunting of wildlife by workers in surrounding project areas 	Surrounding project area	During the construction	EMU	Project Developer
B. Operation Phase					
Soil	(i) Soil contamination will be prevented by installing oil separators at wash-down and refueling areas, and by installing secondary containment at fuel storage sites. All hazardous wastes and hazardous materials will be stored in properly designed storage facilities and collected to the disposal facility as approved by the government	Powerhouse site and water outlet	During the operation	EMU	Project Developer
Wastewater disposal	Wastewater will be generated from canteens and sanitation in the hydropower plant and residential areas. The wastewater generation from the residential area will be treated with the septic devices to meet the Discharge Standard of Wastewater to ambient environment and will be recycled on-site.	Hydropower plant and accommodation area	During the operation	EMU	Project Developer
Noise impacts	Residential area is located about xx Km away from the project site and no potential impact is expected. Limiting noise level due to truck movements . Noise generates from the pumps, air, compressors, and generators will be reduced, where required to meet	Hydropower plant	During the operation	EMU	Project Developer

	Environmental Noise and requirements of Noise Standards at Industrial Facility. Mitigation measures during operation for noise impacts on workers will include standard occupational health and safety practices.				
Solid waste Disposal	Domestic and industrial wastes from the hydropower plant and accommodation facilities will be disposed of in existing approved municipal and hazardous waste disposal sites. No landfills will be developed on-site. Storage, collection, and disposal of hazardous wastes will be conducted in conformance with relevant PRC regulations.	Hydropower Plant and resettlement area	During the operation	EMU	Project Developer
Reduced water flow at affected river section	To mitigate adverse impacts, a minimum environmental flow will be maintained in the section downstream of the arch dam similar to the environmental flow released from the Nam Ngum 3 Dam. Maintenance of minimum environmental flows will ensure water supply for flora and fauna habitats along this section. Compensation will be made according to the GOL law and regulation and specific negotiation with affected villages shall be established.	River section with reduced water flow	During the operation	EMU	Project Developer
C. Social Impact					
Impact to livelihoods of Residents: Resettlement, influx workers and health care	<p>(i) The Project does not require any resettlement. All permanent and temporarily acquired land is government owned. No agricultural land is impacted by the project construction.</p> <p>(ii) The construction of the Project will promote local social and economic development, including the improvement of education and health facilities, road improvement and employment opportunities through both direct employment and through development of the service industry. A peak of 150 workers will be required at the project site during construction. Where possible, local labor will be used during construction activities, however due to the low population density of the area, a shortage of skilled personnel is expected. To encourage development of local industries to support the growing hydropower developments of in the local area. Locally based suppliers will be used where possible. The local community will have also opportunity in trading that relates to their local products production and selling</p>	Residents in Project area	During the construction	Contractor	EMU, Project Developer and Provincial Public Health Department

	<p>including all kind of their agriculture plantation and NTFPs</p> <p>(iii) The influx of workers during the construction period may result in an increase in diseases, particularly sexually transmitted diseases such as AIDS. Mitigation measures will include provision of improving health care facility, increasing awareness and education to workers as well as provision of hygienic worker accommodation.</p>				
<p>Impact to livelihoods of Residents:</p> <p><i>Affected Villages</i>- land use</p>	<p>Any affected assets that obtaining a livelihood will be compensated according to consultation and discussions with communities and district authority. The reservoir area is very minor affected by land in the forest. Any losses of land presently used by the PAP will be fully compensated according to GoL laws and regulations and specific agreements negotiated with the owners during the district, provincial and central level public consultations.</p>	Residents in Project area	During the construction	EMU	EMU, Project Developer and government representative and villages