Initial Environmental Examination for Nam Pua Representative Subproject

Project Number: 50236-002
April 2019

Lao PDR: Sustainable Rural Infrastructure and Watershed Management Sector Project

CURRENCY EQUIVALENTS

(as 5 April 2019)

Currency Unit	–	Kip (KN)
KN1.00	=	$0.000116
$1.00	=	KN8,600

ABBREVIATIONS

ADB	:	Asian Development Bank
CCA	:	climate change adaptation
CIFOR	:	Center for International Forestry Research
COL	:	Concessional OCR lending
DAFO	:	District Agriculture and Forestry Office
DALAM	:	Department of Agricultural Land Management
DDMCC	:	Department of Disaster Management and Climate Change
DMF	:	Design and Monitoring Framework
DRR	:	disaster risk reduction
EIA	:	Environment Impact Assessment
ERP	:	Emissions Reduction Program
FAO	:	Food and Agriculture Organization (of the United Nations)
GCF	:	Green Climate Fund
GDP	-	Gross Domestic Product
GIZ	:	Deutsche Gesellschaft für Internationale Zusammenarbeit (German International Cooperation Agency)
GMS	:	Greater Mekong Subregion
IEE	:	Initial Environment Examination
IMT	:	irrigation management transfer
IPM	:	Integrated pest management
ISF	:	irrigation service fee
IUCN	:	International Union for the Conservation of Nature
IWMI	:	International Water Management Institute
LDC	:	least developed country
MAF	:	Ministry of Agriculture and Forestry
MONRE	:	Ministry of Natural Resources and Environment
NGO	:	Non-governmental Organisation
NRI	:	Northern Rural Infrastructure Development Project
NSEDP	:	National Socio-Economic Development Plan
NTFP	:	non-timber forest product
O&M	:	Operations & Maintenance
OCR	:	Ordinary Capital Resources
ODA	:	Overseas Development Assistance
PAFO	:	Provincial Agriculture and Forestry Office
PAM	:	Project Administration Manual
PDR	:	People’s Democratic Republic (of Lao)
PGT	:	Project Governance Team
PLUP	:	participatory land use planning
PPIT	:	Provincial Project Implementation Team
PONRE	:	Provincial Office of Natural Resources and Environment
PRAP	:	Provincial REDD+ Action Plans
PRC	:	People’s Republic of China
PRI	:	productive rural infrastructure

PRT	:	pesticide reduction training
RRP	:	Report & Recommendations to the President
RSP	:	representative subproject
SME	:	Small-Medium Enterprises
SRIWSM	:	Sustainable Rural Infrastructure and Watershed Management
TRTA	:	Transaction Technical Assistance
VDF	:	village development fund
WUA	:	water users association
WUG	:	water user group

GLOSSARY

Catchment	In its totality a catchment is equivalent to a watershed, however a watershed may comprise of micro-catchments and sub-catchments. In this document a catchment refers to a subset of the larger watershed.
Watershed	A topographically delineated area from which rainwater drains as surface run-off via a river or stream to a common outlet point (e.g. a large river, lake or the sea).
Watershed management	Securing watershed functions in a sustainable manner. Broadly these functions include: ➢ Ecological function: availability of sufficient good quality water over time, space; erosion control, soil fertility, biodiversity, clean air, carbon sequestration; ➢ Economic function: sufficient natural resource products like food, fuel wood, timber, water, fish, energy required for basic needs of the local population; income generating opportunities; ➢ Social function: maintenance of social structures; protection and development of knowledge and lifestyle arrangements; maintenance and revitalisation of cultural identity and values, recreational facilities.

NOTE(S)

(i) In this report, "$" refers to US dollars unless otherwise stated.

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I. INTRODUCTION

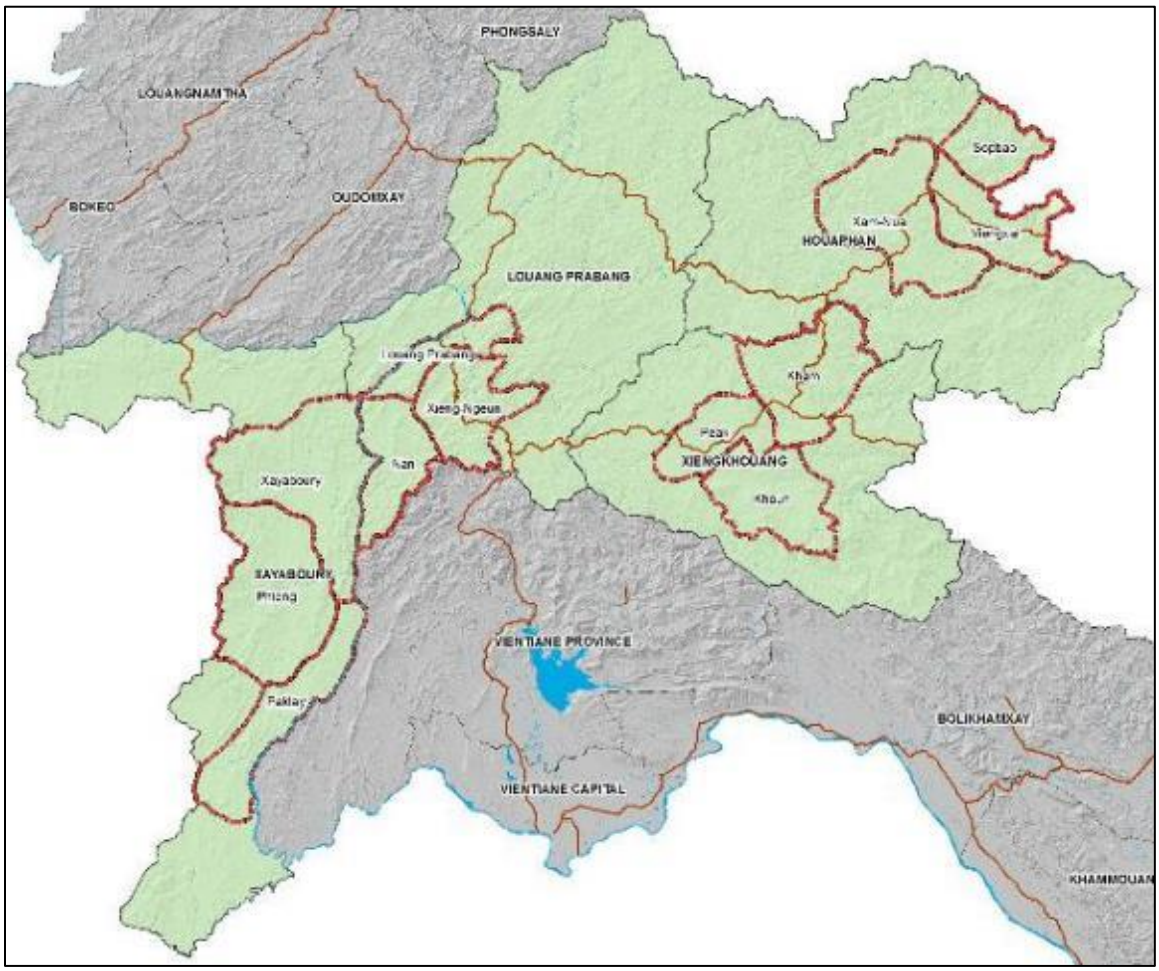
A. Overall Project Area and Scope

1. The geographic scope of the Sustainable Rural Infrastructure and Watershed Management - Sector Project (SRIWSM) extends to the four provinces of Houaphan, Xieng Khouang, Louang Prabang and Xayaboury. The project will finance subprojects in three agreed districts in each province, see Table 1 and Figure 1.

Table 1: Project Area

Province	District
Houaphan	1. Nam Xeua 2. Vengxiay 3. Sop Bao
Xieng Khouang	1. Peak 2. Khoan 3. Kham
Louang Prabang	1. Nan 2. Nguen 3. Louang Prabang
Xayaboury	1. Xayaboury 2. Phieng 3. Paklai

Figure 1: Agreed Project Provinces and Districts



2. The ADB SRIWSM project is part of a wider investment by Government into more sustainable intensification and diversification of the agriculture sector. The investment is being supported by parallel cofinancing from IFAD (for output 1 and output 3 - WUG support) and GIZ for output 2 (with the exception of Xieng Khuoang province). ADB will invest in the establishment of irrigation headworks, conveyance systems to the command areas, and water control structures within the command areas along with the provision of improved access. IFAD will support WUGs to intensify and diversify land use during the dry season. GIZ will invest in more sustainable land uses in the upper catchments with the SRIWSM catchments prioritized. For safeguards IFAD have committed to apply ADB safeguard policy whilst GIZ is applying the required WB safeguards from the emission reduction program into which GIZ is investing.

3. Within the IEE the parallel financed activities are considered as part of associated facilities (see ADB (2012) Environmental Safeguards – A Good Practice Sourcebook. Associated facilities are those “that are not funded as part of a project but whose viability and existence depend exclusively on the Project, or where goods and services are essential for successful operation of the Project.” The guidance for these facilities or linkages (see Para 68 bullet 2) states “Even though the impacts and mitigation measures from the development of associated facilities do not have to be analysed in detail in the EIA/IEE of the project financed by ADB, basic information about the main design features, their location, the significance of potential impacts, the required

approval process and institutional arrangements need to be outlined in the IEE. ADBs due diligence on the levels of impacts and risks to the environment will recognize the borrower/client's control and influence over the associated investments.

4. The implication of this on the environment of the subproject catchments is intended to have a net positive impact. This is mainly because it will reduce the risk from dry season cropping of the irrigation command areas and the potential increased income leading to both intensification and diversification. This will reduce the pressure on land conversion for upland cropping. Such land conversion is identified as a major driver of forest loss as crops are grown on steep, bare ground subject to high rates of soil erosion in the wet season.

5. The risks associated with intensification relate to (i) increased use of agrichemicals and fertilizer, and (ii) increased demand for irrigation water during the dry season.

6. For this IEE the risks linked to the "associated facilities" are the risk of intensification of agricultural inputs for the production of high value crops. The IEE incorporates the requirements to address, where necessary, risks arising from inappropriate pesticide and herbicide use through the Government Pesticide Management Training programs and where warranted IPM training within the IFAD support program. Nutrient management will be incorporated into the IFAD WUG training, farm to farm extension and on-farm demonstrations. In the situation that the timing of IFAD cofinancing is delayed the Subproject costing includes ADB financing to ensure the provisions of the EMP are covered as well as the costs of the intensification of irrigated dry season cropping.

7. Further to the impacts of the intensification that fall under the associated facilities the IEE requires that the borrower/client will not use products that fall in World Health Organization Recommended Classification of Pesticides by Hazard Classes 1a (extremely hazardous) and 1b (highly hazardous) or Class II (moderately hazardous), if the project host country lacks restrictions on distribution and use of these chemicals, or if they are likely to be accessible to personnel without proper training, equipment, and facilities to handle, store, apply and dispose of these products properly. The good practice requirement will include training in the handling, storage, application and disposal of pesticides in accordance with international good practice such as the Food and Agricultural Organization's International Code of Conduct on the Distribution and Use of Pesticides.

8. Risks to environmental flows are considered within the context of ADB supported facilities and are addressed through the requirements for water source gauging stations and information, flow modelling and estimation, the use of crop water demand planning using CROPWAT software upon which crop planning i.e. sowing dates, crop choice are scheduled within the available water resources. For most cropping options in Nam Poua the irrigation demand occurs prior to the timing of minimum flow with the final irrigation in mid to late February due to the short growth period for green vegetables, gherkhin, and cucumber.

B. Location of the Nam Poua Subproject

9. The Nam Poua subproject involves an existing irrigation scheme constructed under the ADB funded Community Managed Irrigation (CMI) project in 2000. The scheme is relatively simple with a single weir headworks and one main canal with gravity fed field to field flow that supports a wet season rice crop. During the dry season there is an area of high value irrigated dry season crop grown, that for the past 5 seasons have been grown under plastic mulch with furrow based flood irrigation using field to field flow but on a 30 day return period. The resultant dry season

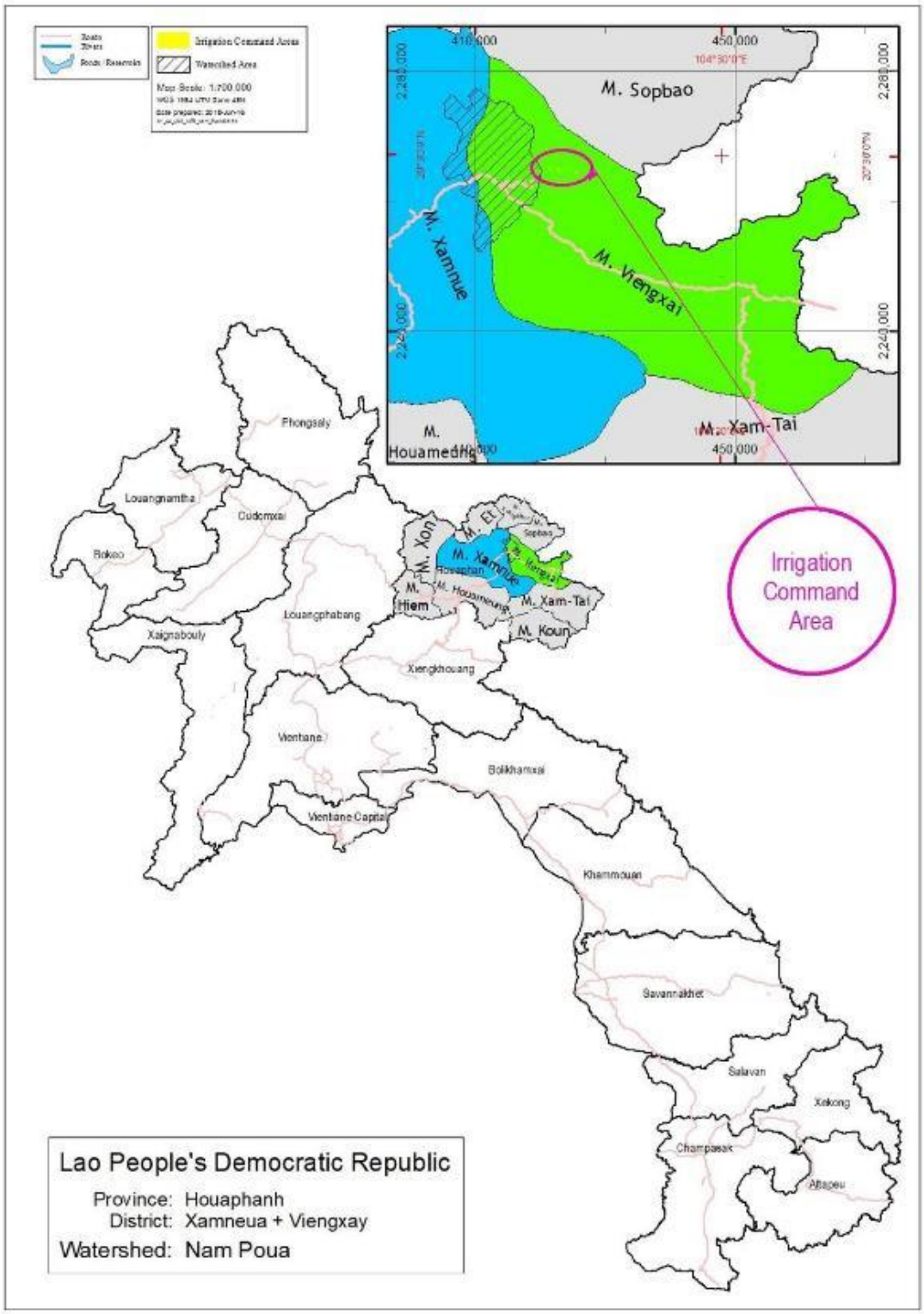
productivity is significant but constrained due to the inability to control and manage water delivery in terms of frequency and amount. As a consequence water is over delivered on a 30 day watering cycle that is too long such that crops experience moisture stress prior to the next watering cycle. The watering cycle is due to the CMI scheme being designed for wet season rice with a field to field distribution system. The lower command area (western end of the main canal) experiences water shortages during the wet and dry season due to conveyance inefficiencies and the uncontrolled water use at the head of the command area.

10. The Nam Poua subproject is located on the recently upgraded National Road No. 6A and extends from km 15 to km 24 where Km 0 is Hanglong village, Viengxay district. From the subproject area road 6A extends Et District including the branch to the recently established border crossing into Son La Province Viet Nam – See Figure 2.

11. Subproject villages are located about 20 – 25 km north of Viengxay town and around 25 km north-east of Xamneua, Huaphan provincial capital. Dry Season produce has previously been marketed via roadside sales to buyers from to Houaphan and Xiang Khouang. Other vegetable production in Viengxay is marketed into VietNam via Road 6b where it is sold mostly into Hanoi as a safe vegetable product. The opening of Road 6A and the border crossing provides a more direct route to Hanoi compared to the Thanh Hoa route via road 6b currently being used east from the east of Viengxay District. Within the north-eastern province Houaphan the subproject straddles the boundary between Xamneua and Viengxay districts of Houaphan, with the majority of the subproject catchment and all the command area located in Viengxay district.

12. This north-eastern corner of Lao PDR, including Houaphan is outside the Mekong basin, with the Nam Poua draining via the Nam Ma, across the border into Son La Province of Viet Nam, where it joins the Da River discharging into the South China Sea.

Figure 2: Subproject Location Map



C. Catchment description

13. The catchment of Nam Poua irrigation scheme includes a drainage area of 215km^2. The catchment extends about 25 km north-south and 15 km east-west – see Figure 2. The upstream topography is relatively complex with a mean slope of 23% and a mean elevation level of 938 metres above sea level, although the command area is at an elevation of approximately 650 metres. Details are given in Table 2.

Table 2: Catchment Descriptors

Mean annual areal rainfall (mm/year)	Perimeter (km)	Mean elevation (masl)	Drainage area (km^2)	Cumulated stream length (km)	Mean drainage density (km^{-1})	Mean slope (%)	Lat (dd)	Long (dd)
1352	109.7	938	214.9	20.038	0.09	23.4	20.5	104.2

Source: IWMI pers comm.

14. The geology of Houaphan Province is a mixture of ancient igneous and metamorphic rocks with bands of Triassic-Jurassic shallow marine sedimentary rocks. It is a complex structure, and although there are no major regional faults, major folding indicates that surface-outcropping geology is very variable. Tectonically it is stable. Geotechnically, slopes formed in the older igneous rocks should be strong, but there may be weaknesses – leading to them being prone to land sliding in areas of weaker sedimentary rocks. Major slopes might have superficial layers of colluvium that could give rise to shallow slope failures.

15. The topography of the Nam Poua catchment includes an area of high hills, rising to about 1500 metres on the western side of the catchment, with a series of streams coalescing to form the Nam Poua, flowing generally eastwards. At the point where it leaves the subproject area, the river is about 650 metres above sea level.

D. Rationale for the Overall Project

16. The project rationale is economic growth through the sustainable use of natural resources by maximising the value of irrigation water to smallholder irrigators and the wider rural communities of which they are part. Historically, investment in wet season irrigation improvements involved replacing traditional weirs and structures with engineered concrete structures to provide supplemental wet season irrigation. The headworks and distribution canals generally fed water to the highest point of the command area, from where field to field flow was used for distribution. This improved household food security and often provided surplus rice which is sold. As food security based on rice productivity has been achieved the surplus of rice has resulted in declining world and local prices limiting the sustainability of these irrigation systems. Food security investment overlooked dry season cultivation and crop diversification which requires a substantially higher level of investment in the command areas.

17. The government operates a policy of transferring to the users the management of irrigation systems that have been supported by donor investment. However, low returns from rice do not currently provide sufficient margin to finance more efficient water management and maintenance of assets through the irrigation service fees that users contribute. As a result, most schemes do not maintain assets or use operational systems that support their command areas, leading to a decline in size and efficiency over time.

18. Dry season crop and livestock systems have vastly higher income opportunities than are feasible from irrigated rice. These opportunities require dry season irrigation, when water is less abundant and requires active management in the command area. But without effective control, farmers face insecure or uncertain irrigation outcomes and will not invest in new opportunities. Ensuring control requires more in-command area investment for delivering the right amount of water, at the right time and in sufficient quantity through more active regulation and management of irrigation water. There is a need to move away from systems of field to field flow with abundant wet season water, to approaches which increase the precision of use of potentially scarce water.

19. Equally important is the recognition that labour is increasingly scarce and valuable, with most irrigators earning less than 50 percent of their income from agriculture. The relative return to irrigated crops per day of labor input determines the household allocation of labor. Once a household is food secure, labor is allocated to the highest return which for the dry season, and increasingly for the wet season, if often casual or contract labor markets in the construction sector, tourism sector and or upland cropping. High value dry season crops are shown to increase returns to labor substantially. In Nam Poua these effects are well proven with the adoption of high value crops creating paid employment opportunities for other community households resulting in less pressure on upper watersheds.

20. The efficient and precise use of water is critical because of the impact of climate change and resultant instability within both ecosystems and production cycles. Hence water management is no longer a choice, but has become a necessity. New technologies that increase efficiencies in both water use and labour must be the priority to maximise the value of irrigation water. The control of water requires capacity in the Water User Groups to plan and operate their schemes. These operational inputs require financing, which wet season rice is unable to provide – resulting in rice-only irrigation schemes being unsustainable.

21. Dry season irrigation is exposed to upper catchment degradation and loss of watershed environmental services that reduce in-catchment storage and lead to longer periods of low flows during the extended dry season. Managing catchment-based risks to the watershed is a critical success factor for the sustainability of dry season irrigation. Uncertainty of water access or unreliable water quantities make smallholder investment far too risky, so that during the wet season farming households move their labour into off-farm opportunities.

22. To date, Participatory Land Use Planning has too often been seen as an output to address these risks, when in fact it is an input. The output requires a stronger focus on changing land use behaviours. Planning systems need to identify far more clearly what behaviours need to change, who in these communities are responsible for these behaviours and how can they be supported for change.

23. The efficient allocation of labour and farmer investment into dry season agriculture requires high value cropping and livestock to generate higher incomes. The increased incomes increase the affordability of the operation of schemes while providing sufficient incentive to retain labour on the farm. These options however carry substantially more market and business risk than irrigated rice. To manage these risks requires strong and reliable market linkages. Smallholders, and the sector as a whole, need to move from selling outputs to producing for markets through better market connections and strengthened value chains. Agribusiness skills that support Provincial Agriculture and Forestry Office (PAFO) staff and build connections from markets to producers are non-existent and need to receive additional capacity building.

24. Business risks are a significant hurdle for most smallholders, as they arise from the need for new technologies, different management skills and more complex sets of inputs and outputs. Extension services in Lao have proven difficult to establish, access, and even more difficult to sustain outside of a project. Options for linking farmers to other farmers, and to access the pool of knowledge and experience that exists in recent past or ongoing development or private sector projects is considered a high priority.

II. DESCRIPTION OF THE SUBPROJECT COVERED BY THIS INITIAL ENVIRONMENTAL EVALUATION

A. Purpose of the Initial Environmental Evaluation

25. This Initial Environmental Evaluation (IEE) has been undertaken in compliance with the specified safeguard requirements of the borrower, the Government of Lao PDR (the government), and the main financing organisation, the Asian Development Bank (ADB). The IEE will also provide guidance for the activities that may be invested in under the cofinanced IFAD project that targets the water users in SRIWSM command areas for building linkages to markets, and the agricultural inputs and capability for the diversification and intensification of irrigated agriculture during the dry season. The IEE covers the ADB financing of infrastructure and provides clear guidance for the associated facilities to be financed by IFAD related to agricultural diversification and intensification. The watershed management cofinanced by GIZ/GCF is addressed through its own safeguard provisions.

B. Subproject Rationale and Design

26. The subproject rationale is to provide the infrastructure and scheme operational input to provide reliable, controllable water throughout the entire command area for the dry season. The subproject will operate within the existing irrigation infrastructure and command area and involves very limited changes to the physical footprint of the scheme infrastructure. The change will involve providing additional water control through buried secondary distribution pipes and offtake points for piped, hand held hoses or sprinkler applications. The improved water use efficiency along with increased water control will enable dry season water to be delivered for a 12-hour irrigation day on a 5-day rotation. Limited upgrading will be provided to the main canal to reduce the losses and damaged sections to increase water delivery through the lower reaches of the command area adjacent to the canal end. This will increase the reliability of wet season irrigation and remove the yield losses to the wet season rice crop in dry years. In addition, the area will be serviced during the dry season for high value crop use.

27. In summary the subproject is expected to:

- Reduce the yield losses of wet season rice due to limited conveyance of wet season water;
- Increase the dry season command area that receives reliable water;
- Deliver dry season water using pipes throughout the command area; from these, individual farmers can connect using hose pipes, leaky pipes or sprinkler systems;
- Intensify dry season production through reduced inter-row spacing as a result of moving from furrow to hose- or pipe-based irrigation systems;

- Controlled dry season water through scheduling a 12-hour irrigation window, delivering water every 5 days to match crop water needs more efficiently; and

- Increase the cropping intensity from by at least 30 percent.

28. The subproject seeks to increase farmer returns by at least threefold through increased high value crop production, thereby enabling producer-based Water User Groups to operate and maintain the irrigation scheme through significantly increased but affordable irrigation service fees. It is envisaged that crops similar to those grown in the past five years will be expanded. Whilst the market has been limited by the distance to traditional markets within as far afield as Vientiane, the future is increasingly likely to supply into Viet Nam because of the upgrading of Road 6A and the connection across the border into Son La Province. Furthermore, the recently opened expressway from Son La to Hanoi will provide a five hour freight time to Hanoi. Currently Houaphan vegetables supply Viet Nam Border Province the Hanoi market via Nghe Ahn - Thanh Hoa province on a freight time of more than 12 hours. The competitive advantage of Northern Viengxay for the supply of the Viet Nam safe vegetable market has improved significantly and may provide an alternative market opportunity.

29. The output of the subproject will include a total of 69 ha of cultivated land with reliable wet and dry season irrigation, and with sufficient infrastructure for the control and management of water during the dry season on a 5-day watering rotation throughout the total command area. The 2018 baseline is of 52 ha of command area irrigated in the wet season and 32 ha in the dry season, so the subproject will provide an expected incremental gain of 17 ha and 37 ha respectively. Crop productivity gains are expected for 17 ha of irrigated wet season rice production, and for the entire dry season command area due to more accurate watering, increased intensity of crop sowing (i.e. reduced inter-row spacing) over 37 ha and a total gain for the 32 ha of additionally cropped command area.

30. The subproject will also construct two bridges to create access into and out of the command area from Road 6A for people and goods via small trucks. The removal of the need to swim the river increases the participation of women in the economic activities of the irrigation command area and the adjacent upland orchard areas. It will also reduce crop losses and spoilage during periods of high river flow.

31. The layout of the catchment and irrigation scheme are shown in Figure 3. The physical modernisation of the Nam Poua scheme involves:

- Securing the canal from damage during large floods;

- Installing a gate at the start of the canal and channels to stop logs being washed into the canal, facilitating water management;

- Increasing the masonry lining for 5.1 km in selected sections along the 9.1 km canal to reduce leakage losses within the existing canal;

- Covering the canal in unstable bank sections to prevent blockages by landslide debris;

- Installing improved canal crossings or super passages for watercourses, to prevent water ingression and secure the even flow of the canal;

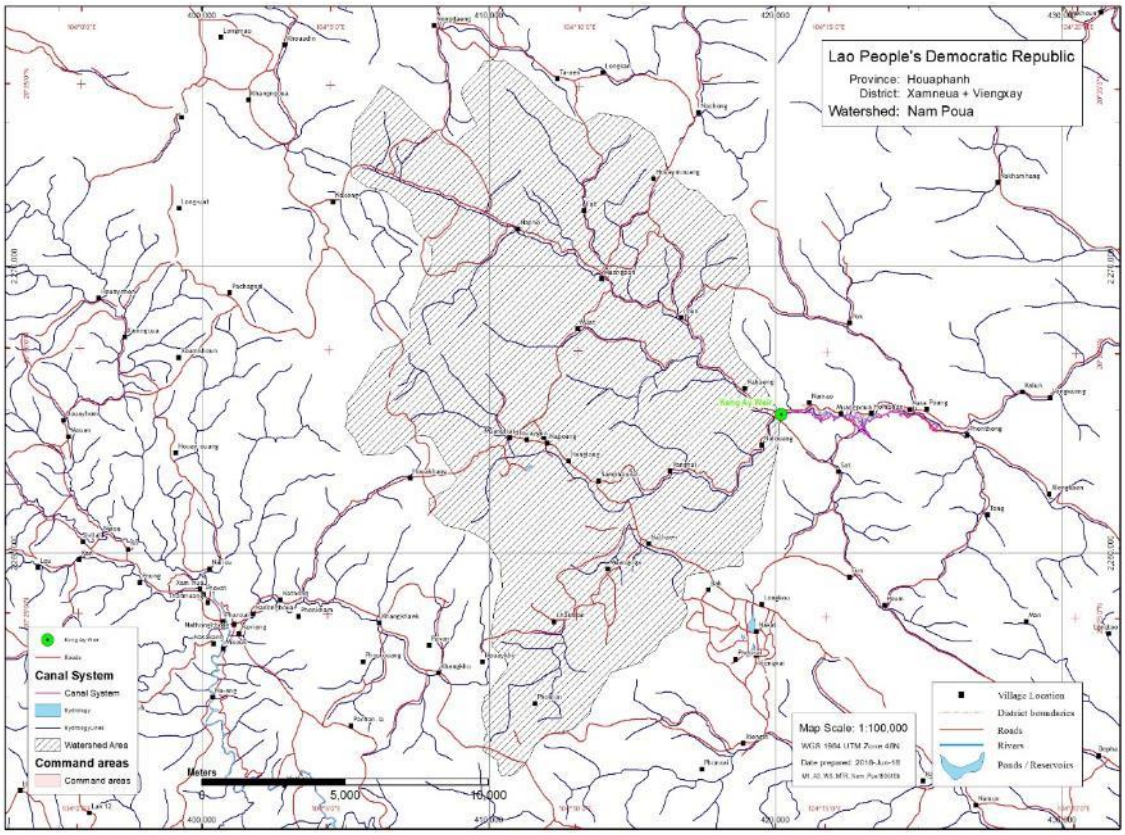
- Reducing the number of existing canal offtakes and installing 16 pipelines and hydrants to serve the command area, thereby utilising the available elevation difference between the canal and the fields;

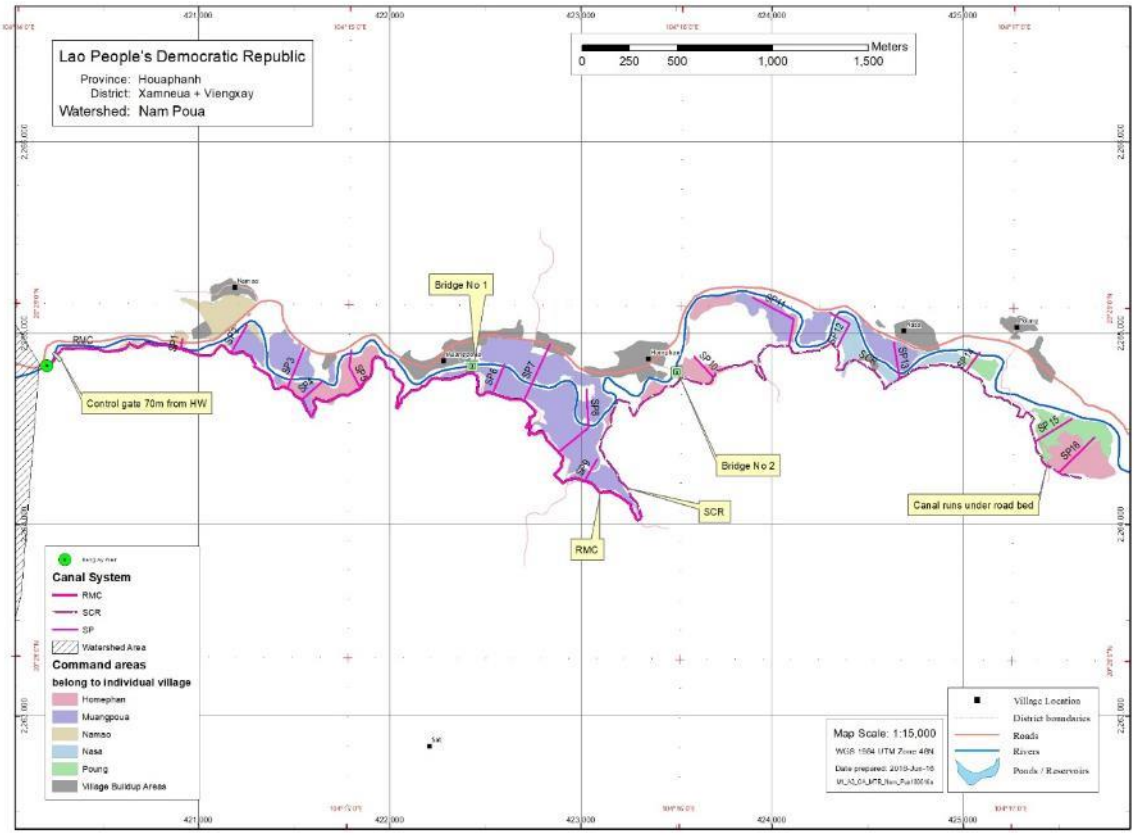
- Improving water use efficiency through facilitating use of controlled flows, hoses or low pressure sprinklers for in-field distribution;

- Improving access along the canal to facilitate operation and maintenance; and

- Constructing two concrete road access bridges across the Nam Poua.

Figure 3: Subproject Layout. Top: General Area and Catchment (above headworks). Bottom, Subproject Command Area.




Lao People's Democratic Republic
Province: Houaphanh
District: Xamneua + Viengxay
Watershed: Nam Poua
Meters
0 250 500 1,000 1,500
Bridge No 1
Bridge No 2
Control gate 70m from HW
Canal runs under road bed
SCR
RMC
Canal System
RMC
SCR
SP
Watershed Area
Command areas
belong to individual village
Homeghan
Muangpoua
Namso
Nasa
Poung
Village Buildup Areas
Village Location
District boundaries
Roads
Rivers
Ponds / Reservoirs
Map Scale: 1:15,000

32. The Nam Poua Subproject is spread over six villages as shown in Table 3.

Table 3: Beneficiaries of the Existing Nam Poua Irrigation Scheme

Village	No. of Households	No. of Individuals
Namao	35 households	164 persons/78 women
MeuangPoua	83 households	396 persons/193 women
Homphan	55 households	365 persons/191 women
Nasa	35 households	148 persons/71 women
Poung	31 households	179 persons/92 women
Nangeun	65 households	366 persons/171 women

33. The subproject fulfils the eligibility criteria defined by the project's EARF, as listed in Table 4. This table also provides further implementation on the scale and context within which it is to be implemented.

34. The catchment above the headworks, where watershed management improvements is expected to be financed by a proposed GIZ / GCF programme that is still to be designed. The two areas are shown in Figure 2.

35. The subproject rationale is linked to the current use of dry season cropping and how this is linked to the movement of labour away from upland cropping high in the catchment, and into the irrigated lowland areas. Further, the project seeks to increase dry season production up the productivity curve, to expand the dry season cropping and to use the site as a farmer-to-farmer extension site.

Table 4: Eligibility Check for Nam Poua Subproject

No.	Eligibility Criteria	Nam Poua Subproject
1	**National Strategy.** Be consistent with government strategies and policies.	The subproject supports government agriculture policy.
2	**Socio-economic Relevance.** Be consistent with medium and long-term socio-economic development plans at the provincial and district levels.	The subproject aims to help improve the livelihoods opportunities for the catchment beneficiaries.
3	**Effectiveness.** Have relatively simple and logical designs within one contiguous command area.	It is based on a single distribution system to a command area along one valley.
4	**Safeguards Compliance.** Comply with government and ADB safeguard guidelines and involve a minimum of negative environmental and resettlement impacts, i.e. only MONRE category 1 and ADB safeguard category B or C will be considered. Preference where works are maintained within existing footprint or right of way to minimise land acquisition costs to government.	This IEE confirms that it complies with MONRE category 1 and ADB safeguard category B, and that the anticipated environmental impacts can be satisfactorily mitigated.
5	**Location 1.** Subprojects must be located in rural areas where the majority of beneficiaries are likely to be dependent upon agriculture for their livelihoods.	The villages of the Nam Poua catchment fit into this category.
6	**Location 2.** Subprojects must not be located in any area where a major development, such as a new hydropower scheme, a mine, major land concession, or a Special Economic Zone, is planned.	No such scheme is known, despite exhaustive enquiries among the government agencies and development partners. A scheme nearby will not affect the subproject (see Appendix 1).
7	**Commitment.** There must be demonstrated local commitment to the subproject with confirmation by beneficiaries (inclusive of women and ethnic groups), participating kumbans[1], and district authorities to that effect, including a confirmed willingness of beneficiaries to contribute land voluntarily for tertiary canals.	This has been expressed verbally and minuted at a number of stakeholder meetings. It will be formalised in signed agreements before the subproject is implemented.
8	**Financial Scale.** The estimated cost of the subprojects must be in the range of $0.7 to $2.0 million (with any exceptions specifically justified).	Detailed costing is not yet available, but the subproject cost is expected to be around the middle of this range.
9	**Productivity.** All proposed subprojects will include more than one type of PRI infrastructure.	Canal improvements and piped distribution are key elements.
10	**Social Conflict.** No significant social conflict in the watershed that will delay investment.	This has not been identified as a constraint during investigations.
10	**No Pumped Schemes.**	No pumping will be involved.

[1] Kumans refer to a grouping of smaller villages into a single administrative unit

No.	Eligibility Criteria	Nam Poua Subproject
11	**Improved Resource Utilisation.** Prioritise the sustainability of assets through WUG or provincial Government to commit to support periodic maintenance through written assurance. Where an existing WUG is operating, the PAFO/DAFO is to obtain written agreement of each stakeholder prior to the field visits.	Options for a sustainable management system have been discussed at a number of stakeholder meetings. The agreed mechanism will be formalised in a signed agreement before the subproject is implemented.

C. Subproject Design

36. The layout of the subproject is shown in Figure 3, which demonstrates the relative locations of the upstream catchment and the downstream command area. It involves the upgrading of an existing irrigation system, to make it more resilient and to ensure better dry season availability of irrigation water. At present the canal contains no flood control measures, so that floods in the river can be transmitted along the canal and cause damage to both the canal structure itself, and the land on to which they sweep. In addition, the distribution system from the primary canal into the field is rudimentary and partly ineffectual, since there are 37 existing outlets and no water control structures. Some of the water is transferred to the other side of the river by means of plastic pipes suspended from bamboo structures. Since the existing primary canal is located 5 to 13 metres above the lowland command area fields, it provides adequate head for piped distribution. The total command area amounts to 70 hectares.

37. The proposed subproject engineering works will consist of the following elements.

(i) Improvement of headwork canal offtake
(ii) Installation of water control measures to stop floods from the river washing down the canal.
(iii) Repairs to 5.1 km of the 9 km primary canal along the valley side.
(iv) Installation of feeder pipes from the primary canal, to hydrants strategically located in the command area fields.
(v) Construction of two new bridges to join different parts of the command area on either side of the river, since crossing the river during the wet season is difficult at best and dangerous at times.

38. Engineering works to be supported by the subproject are therefore improvements to the main canal over 5.1 km, construction of two bridges, and installation of pipes, hydrants, and culverts.

D. Implementation Arrangements

39. The executing agency of the SRIWSM is MAF, with support from the IA - Department of Irrigation (DOI). Implementation is decentralised to the Provincial Agriculture and Forestry Offices (PAFO) where implementation activities will be assigned to the respective sections of PAFO, co-ordinated into a Provincial Project Implementation Team (PPIT) for the management of the SRIWSM Project.

40. The executing agency (i.e. MAF) and IA (i.e. DOI) will establish a Program Governance Team (PGT) that would be responsible for: (i) establishing the operational procedures to be used by the PPIT, including planning, budgeting, financial management, procurement, disbursement,

contract management, safeguard monitoring and compliance monitoring; (ii) ensuring both government and donor audit requirements are met; (iii) providing capacity building at the provincial level for both PPIT staff and potential contractors; and (iv) providing technical support for advanced engineering designs and project management teams, including the provision of skill mentoring and technical assistance input to procurement and contract management.

41. Government staff are therefore involved in environmental management and monitoring at a number of levels and in two main ministries: MAF for both management and monitoring; and MONRE as delegated to PONRE for monitoring. The capabilities required of staff varies depending on the phase of the subproject, and their level and remit, but the common thread required by all is a sound understanding of the environment and society in the rural hill catchments of the northern provinces, and a particular understanding of current issues in both upland and irrigated agriculture. PONRE staff have the underlying environmental knowledge but often lack the technical expertise to address specific issues. DONRE staff are far less experienced and qualified. The Loan Implementation Consultants – both international and National will provide (i) Project awareness training, (ii) technical training with respect to environmental monitoring systems and techniques that will apply to their specific subproject (most PONRE have only 3 subprojects to monitor), (iii) PONRE staff receive budgetary support for their additional costs on an output basis ie PAFO will pay for monitoring reports received. In addition, PONRE and DONRE monitoring staff will be supported for regular site visits by the construction supervision staff of PAFO.

42. During the project implementation period, which effectively involves subproject design and construction phases, safeguards are the responsibility of the Vice Governor Office represented by PAFO with support from the PGT within the Department of Irrigation. Environmental safeguards will be assigned through a Memorandum of Understanding (MoU) between the Vice Governor Office, Director of PAFO and Director of PONRE. Additional support is provided by the environmental safeguard consultants in the LIC. The LIC consultants will generate the IEE/EMP or Code of Conduct documentation for approval. PAFO Project management staff, will work with the construction supervision staff, PONRE and DONRE staff to provide the monthly, quarterly safeguard reports that will be submitted to the Vice Governor, and the EA via the PGT in DOI.

43. At the provincial level, a PAFO will assign overall project management to an existing PAFO Deputy Director General and will implement subprojects. Within each PAFO, the technical staff will be assigned to the PPIT must be able to monitor the implementation of works programs with the supervision role also maintaining both social and environmental checklists for site visits. The submission of safeguard reports to the Vice Governor and to the PGT will trigger a consolidation report from the PGT that will be submitted to ADB twice yearly for review and approval.

44. The division of the responsibilities for environmental safeguards is listed in Table 6.

Table 5: Responsibilities Regarding the Environment and Related Safeguards

Project organization	Management Roles and Responsibilities
Ministry of Agriculture and Forestry (Executing Agency)	• The EA will constitute a national steering committee with representatives of MAF, Vice-governors of Participating Provinces (4), MOF, MPI and MONRE.
National Steering Committee	• Provide guidance to the IAs and EAs in terms of project scope of work, expected performance standards, remedial action. • Confirm annual performance.

Project organization	Management Roles and Responsibilities
Department of Irrigation (Implementing Agency)	• Support and operate the Program Governance Team. • Provide technical support on irrigation technical and institutional issues. • Consolidation of reports
Department of Planning and Finance (within the MAF)	• Define and validate the project management systems to be applied across the programme to ensure that government and ADB requirements are met. • Verify all subproject draft procurement (including safeguard) documentation prior to be submitted to ADB or publicly advertised. • Undertake a quality control and verification of the quarterly and annual reports that will have document quality control procedures and a sign-off page
Program Governance Team (within the DOI)	• Overall programme management and coordination of separate project investment within the programme. • Define the programme code of conduct including accountability of individuals, authority and levels of delegated authority, jurisdiction and mandate limits. • Produce a project management procedure manual, and the supporting templates, guidelines for planning, budgeting, financial accounts, disbursement, procurement, contract management, reporting, safeguards and audit. • Technical support for setting up project management systems and templates in the Provincial project management units and the required capability to operate these systems • Ensure safeguard frameworks are being applied in the design of subprojects with each safeguard plan (i.e. the Resettlement and Ethnic Minority Development Plan or REMDP and IEE / EMP) at the subproject level, to be reviewed and commented on within 30 working days. • Monitor the safeguard implementation of the REMDP and IEE / EMP during subproject implementation. • Facilitate the development of provincial contractor awareness and capability. • Will ensure that all subproject detailed engineering designs include a first step that confirms dry season water availability for a minimum of 50 percent of the wet season command area and that the social environmental safeguard screening is confirmed as category B under ADB safeguard provisions.
Provincial Steering Committee	• Each Participating Province will establish a Provincial Steering Committee chaired by the Vice-governor, Participating District Governors, Directors General of PAFO, Finance, Planning and Investment, and PONRE. • Review annual work plans and provide guidance on project scope and performance standards.

Project organization	Management Roles and Responsibilities
Provincial Project Implementation Team (within the PAFO / PIS)	• Each provincial government will form a Project Implementation Team under the Provincial Agriculture and Forestry Office (PAFO), aligned to the Provincial Irrigation Section (PIS) within the PAFO. The PAFO will identify implementation focal points in DALAM and DOF to be seconded into the project management structure of the PIT to support activities relating to land use planning, catchment management and land registration administration. • Establish operational systems with staff assigned and with the capacity to maintain the project administration and management systems • Establish and maintain subproject monitoring and impact assessment using the RSP irrigation modernization as a wider learning site • Coordinate the ADB-financed activities and integrate these with the activities of other donor-financed programmes working on watershed management. • Provide quarterly and annual reports according to the templates specified by the Program Governance Team • For the Representative Subproject • Obtain final approval from the Director General of the PAFO in accordance with the Irrigation Law 2014 - (Article 38). • With support of the Program Governance Team identify local contractors and conduct awareness and capacity building programmes to increase the inclusiveness of local contracting companies. • Complete land acquisition and compensation programme as per the REGDP. • Contract management during implementation • Ensure implementation of the Environmental Management and Monitoring Plan. • Ensure implementation of the REGDP action plan. • Safeguard monitoring as per the LARP and REGDP subproject documents. • On project completion as confirmed by the construction supervision consultant (Program Governance Team) the Project Director (PAFO) shall conduct a site inspection in accordance with the Public Work and Irrigation Law. On confirmation of contract completion the PAFO will transfer the operation and maintenance of the asset to the water user group. • For Water User Groups: • Provide awareness and capacity building on project activities, water user group implementation roles and procurement modalities. • Monitor and mentor water user group contracting of in-command area works.

Project organization	Management Roles and Responsibilities
PONRE Land Registration Department	• Conduct land registration. • Issue land title and demarcation.
PONRE Environmental Management Department	• Conduct regular environmental monitoring of subprojects. • Undertake a general programme of monitoring environmental parameters (e.g. water quality) at strategic sample locations throughout the province. • Provide Quarterly monitoring reports to PAFO
MAF – DALAM	• Agricultural land use planning guidelines and verification.
PAFO – DALAM	• Agricultural land registration survey. • Consultation of land users in command areas • Land registration proposal for agricultural land
MAF - Department of Forestry	• Forest Land Use Guidelines and quality verification.
PAFO - Department of Forestry	• Forest Land use zonation and survey demarcation. • Supervision of forestry activities funded by ADB.

45. During the infrastructure operation period, following construction and commissioning, the subproject infrastructure is operated by the Water User Groups. The subproject infrastructure will be handed over to the Water Users' Group at the time of commissioning with government agency only responsible for supporting a general overview role.

46. The environmental monitoring portfolio of the PONRE means that its staff are responsible for ensuring compliance with environmental safeguards under all activities of the subprojects supported by the SRIWSM, and during the subsequent infrastructure operational period, which is indefinite. This role includes review of submitted reports, analysis of the information provided and occasional field visits to verify findings. These staff are responsible for ensuring that the project's environmental impacts really are effectively mitigated, and for flagging up shortcomings in its strategy if this does not appear to be the case. This takes place both through the PONRE, and at national level, through the ministry itself.

47. Reforms of government to separate the environmental portfolio from agriculture and forestry started in 2017 and are not yet complete. Capacity in this respect is therefore still being developed, particularly at the provincial and district levels. Early in the subproject, the loan implementation consultants will therefore be expected to help improve capacity and assist the government to improve its staff skills and knowledge in this respect. This should include support to PONRE and DONRE staff in their capabilities for environmental monitoring.

a. Water User Groups

48. The subproject WUG becomes the owner of the infrastructure at the time it is commissioned. It then has the responsibility for managing and maintaining it, and ensuring environmental mitigation during the operational period of the infrastructure – which in effect means throughout the lifetime of the engineering works created under the subproject. During the design period, the WUG must be given the support required by its members to understand and commit to implementing operational mitigation measures during their use of the subproject

facilities.[2] Further support is required during the later construction period, in the run-up to the handover of the infrastructure. It is likely that the WUG members' capacity will need to be enhanced in order to be able to undertake some aspects of these obligations.

b. Loan Implementation Consultant

49. The project implementation consultant will assist the executing agency (i.e. the PGT within DOI), the implementing agency (i.e. PAFO) and the other project stakeholders in the design and construction of the subproject. For this reason, the Program Governance Team will contract a Loan Implementation Consultant with two environmental specialists- See PAM for detailed ToRs to support subproject designs and the preparation of IEE and for the supporting and monitoring of the EMP during subproject implementation.

50. The LIC environmental specialists work with the WUG, PAFO and DAFO and the contractors for the subproject, to ensure the IEE and EMP are properly implemented, with the required environmental mitigation measures incorporated into the final engineering designs and administrative arrangements in every case. During the construction period, they must work with the subproject implementation partners to ensure that all of the environmental management and mitigation measures are fully complied with, as agreed in each IEE and as outlined in every EMP.

c. Contractors and Subcontractors

51. All contract documents must include an environment section in the terms of reference for bidders, and environmental contract clauses for contractors that include special conditions for the protection of the physical, biological and socio-economic environments. These will underpin the obligations towards the environment that must be upheld by all contractors. There is a need to ensure that contractors, as the stakeholders with the shortest-term involvement in the subproject, do not give rise to long term liabilities for the subproject owners and other stakeholders through reckless practices.

52. While the contractors themselves must fulfil their environmental responsibilities, in most cases success in this respect requires strict management and supervision of the contractor during site works: this is the responsibility of PAFO. Because of the competitive bidding process and the emphasis on engineering works, there is often a tendency for environmental safeguards to be delayed by contractors in the hope that costs can be saved, and overlooked by management staff as being of lower importance than the primary functional infrastructure. This must not be allowed to happen, or it will mean that the subproject and therefore the overall SRIWSM is non-compliant with respect to both government and ADB safeguards.

53. Additional attention must be paid to subcontractors. It must be made clear to the main contractor at all times that they are fully responsible for the actions of his subcontractors, and that retention money is at risk if there is not full compliance with this plan. The contractor should be encouraged to start this process with an orientation for each subcontractor before they start work, and sub-contractual conditions to ensure that the subcontractor complies. The project implementation consultant should be able to assist the contractor in this process.

[2] The proposed IFAD project will support WUG capacity strengthening

d. Summary of Institutional Arrangements

54. The PGT will appoint a qualified environmental safeguards officer to supervise and co-ordinate implementation of environmental safeguard requirements with support of the LIC International and National Environment Specialists. The PGT Project Director will be responsible for submitting environmental safeguard reports to ADB for clearance and disclosure. They will also carry out regular monitoring during implementation and prepare a summary of progress of EMP and GRM implementation for the quarterly project progress reports. They will participate in ADB loan review missions, ensure that semi-annual environmental safeguards monitoring reports are submitted to ADB on time and follow-up on agreed actions.

55. Each PPIT will nominate an environmental safeguards focal point to support LIC Environment Specialists and PGT with co-ordination at the province level. The PPIT environmental safeguards focal point will undertake joint site visits with subproject Supervision Staff and Contractors to review implementation of EMP and GRM and report issues to PGT and LIC. PPIT will co-ordinate environmental quality monitoring with PONRE and invite PONRE to join site visits and ADB loan review missions.

56. The LIC Environmental Specialists (LIC ES) will provide safeguards capacity development training for PGT, PPIT, LIC, Contractors and GRM focal points on EMP mitigation and monitoring measures, Contractor EMP preparation, templates for environmental monitoring and report. LIC ES will screen and assess additional subprojects proposed under Output 3 and any other infrastructure requiring civil works under other outputs and prepare the environmental safeguards reports and ensure that RSP environmental safeguard reports are updated based on detailed engineering design.

57. The Contractor will be required to develop a site-specific Construction Environmental Management Plan (CEMP) in accordance with the IEE/EMP and designate an environmental health and safety (EHS) Officer to supervise and train workers on occupational and community health and safety practices and to monitor and report on implementation of EMP/CEMP and corrective actions. A GRM focal point/community liaison officer should also be designated to ensure public disclosure of planned construction to affected persons and monitoring and reporting on GRM. Each works Contractor EHS Officer will prepare a monthly report on EMP/CEMP and GRM implementation for submission to PPIT, PGT and LIC.

58. The construction supervision staff (CSC) will ensure a CEMP is prepared for each Category B subproject and an Environmental Code of Conduct for each Category C subproject. The CSC will be responsible for day to day monitoring of implementation of health and safety and EMP/Code of Conduct requirements and issuing instructions for corrective actions, as needed.

59. ADB will visit project sites and review project performance against the EMPs and legal agreements and as documented in periodic environment monitoring reports submitted by the PGT. If any of the safeguard requirements that are covenanted in the legal agreements are found not to be satisfactorily met, ADB will require the PGT to develop and implement an appropriate corrective action plan (CAP) agreed upon with ADB. If unanticipated environmental impacts become apparent during project implementation, ADB will require the PGT with support of LIC ES to (i) assess the significance of such unanticipated impacts; (ii) evaluate the options available to address them; and (iii) prepare or update the IEE and EMPs.

E. Analysis of Alternatives

60. During the technical assistance inception period, a large number of possible subprojects were assessed for suitability. In Houaphan Province, as elsewhere, subprojects were proposed by the PAFO for consideration. The consultants used an agreed screening process, which was defined in the technical assistance Inception Report. This led to six subprojects being selected for a short list: these are shown in Table 6. Although these may be funded later as SRIWSM subprojects, at this stage they remain alternatives compared with the subproject that is the subject of this IEE.

Table 6: Subproject Short List – Houaphan Province.

District	Subproject	Command Area (ha)		Catchment Area	Villages	House-holds
		Wet Season	Dry Season	(km^2)	(no.)	(no.)
Viengxay	Nam Poua	256	180	218	6	275
Viengxay	Nam Soy (1,2,3)	184	127	254	8	1,031
Xam Neua	Nam Harm (Gnai, Noi)	130	45	290	3	183
Sopbao	Nam Hom (1,2)	168	86	110	6	355
Sopbao	Nam Bong	85	20	325	2	94
Viengxay	Nam Sim	69	35	86	2	128
Total		**892**	**493**	**1,283**	**27**	**2,066**

61. From the short list, one representative subproject was selected for each province. This secondary selection process focused on several parameters. Overall the types of subproject selected were considered in terms of how they reflect those in the wider programme. In addition they were selected on their ability to demonstrate and pilot aspects of modernised irrigation, irrigation management, and overall development impact. As such, the Nam Poua subproject will be used in project implementation strategies as a demonstration or pilot site. To enable this strategy a structured knowledge management supported by an information and monitoring programme is proposed along with the addition of an expert to establish this and prepare the baseline on which the project builds.

62. In terms of alternatives to the proposed subproject works, an initial concept was to install 16 more outlets in the primary canal, coming to a total of 57 outlets. This would have permitted only flood or furrow irrigation, which would be too water intensive during the dry season. Hence the subproject rejected that concept and instead adopted the design for the pipe and hydrant arrangement. This exploits the good vertical head between the canal and the field, and ensures that water control at the fields is excellent. It allows for precise sprinkler or other irrigation of vegetable crops, but also ensures that enough water is delivered for dry season rice if that is desired. Further to this it reduces the capacity required on the main canal where the design capacity is defined for dry season rice establishment – land preparation needs. The reduced capacity enables a smaller cross section required for canal upgrading and lining.

III. LEGAL AND POLICY FRAMEWORK OF THE IEE

A. Lao PDR Environmental Law and Policy

63. Government policy on environmental protection is expressed in the eighth National Socio-economic Development Plan (SEDP), for the period 2016 to 2020. This builds on the achievements in previous planning periods, including the regularisation of environmental assessment procedures through the widespread use of IEE and ESIA, greater use of environmental monitoring and the establishment of five environmental laboratories, including a national laboratory certified to ISO standards. In the eighth SEDP, environmental protection, climate risk and disaster preparedness are effectively mainstreamed by placing them as the third of three major outcomes, albeit behind overall economic growth and the development of human capital. This raising of the profile of environmental issues means that all forms of natural resources development should be sustainable during the plan period, with greater emphasis given to management plans and monitoring, and reinforcing of the "polluter pays" principle through increased taxes of largescale resource users and fines against abusers.

64. Specific policy for environmental management of investment projects is provided in the objectives for the Decree on Environmental Impact Assessment, April 2010, which states that all investment projects may create adverse environmental and social impacts, are to be designed with the correct and appropriate environmental and social impact prevention and mitigation measures or environmental management and monitoring plans (EMP) and social management and monitoring plans (SMMP).

65. The law governing the protection of the environment, including the assessment and management of projects, is the Environmental Protection Law (EPL) 1999, which is further elaborated on by the Decree on the Implementation of the EPL of 2002. Responsibilities and procedures for environmental assessment, together with requirements for environmental monitoring of projects, were revised and are set out in a new Decree on Environmental Impact Assessment (EIA Decree), dated April 2010.

66. The EIA Decree sets out the principal institutional arrangements, assigning primary responsibility for undertaking environmental assessment of projects to the project developer, which may be an individual or private sector entity as well as a Government Department. In the case of development projects, the relevant line Ministry is responsible to review and assess draft environmental assessments and issue its own approval before submission to the MONRE – formerly the Water Resource and Environment Administration (WREA) – and local administrations, as appropriate. The MONRE is responsible for the review and approval of environmental assessment reports, co-ordination of monitoring and evaluation, and issuance of compliance certificates, acting through the head office in Vientiane or through its provincial departments. Public participation and discussion with local administrations is required throughout the environmental assessment process.

67. The MONRE was created in 2011 by merging the WREA with departments of the National Land Management Authority (NLMA) and portfolios of other ministries including the Geology Department, and the Forest Conservation and Divisions within the Ministry of Agriculture and Forestry (MAF). The MONRE houses the Department of Environment, which hosts the Climate Change Office that acts as the Designated National Authority or national focal point for the UNFCCC. The Department of Forest Resource Management (DFRM) was formed within the MONRE in 2012.

68. Investment projects are categorised according to a schedule to the EIA Decree into

(i) Category 1: small scale investment projects with minor environmental and social impacts, for which initial environmental examination is required;
(ii) Category 2: Large scale investment projects which are complicated or create significant environmental and social impacts, for which environmental impact assessment is required.

69. For irrigation projects, those with a command area of between 100 and 2,000 hectares are in category 1, and those with a command area greater than 2,000 hectares are in category 2. The implication is that an irrigation project with a command area less than 100 hectares and with negligible environmental impacts would not qualify as either. In the EIA Decree, where a project is of a type that is not in either category, an investment application is submitted to MONRE for screening. However, because of the nature of the subproject, involving changes in water use and agriculture for the command area where there are identified potential environmental impacts, a discretionary approach has been used in this case, placing it into category 1. The corresponding category in the ADB's classification system is B, which, similarly, requires an IEE (see below).

70. Lao PDR is signatory to the following international environmental agreements.

(i) ASEAN Agreement on the Conservation of Nature and Natural Resources.
(ii) Convention for the Protection of the World Cultural and Natural Heritage.
(iii) Agreement on the Cooperation for Sustainable Development of Mekong River Basin.
(iv) United Nations Convention to Combat Desertification.
(v) United Nations Framework Convention for Climate Change.
(vi) Convention on Biological Diversity.
(vii) Montreal Protocol on Substances that Deplete the Ozone Layer.
(viii) Vienna Convention for the Protection of the Ozone Layer and the Montreal Protocol on Substances that Deplete the Ozone Layer.
(ix) Millennium Declaration.
(x) Convention on International Trade in Endangered Species of Wild Fauna and Flora.
(xi) Stockholm Convention on Persistent Organic Pollutants.
(xii) Wetlands of International Importance Especially as Waterfowl Habitat (Ramsar Convention).
(xiii) Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade.

71. Several laws and regulatory decrees and directives underpin the national adherence to these international conventions. Examples of these include the following, although this is not an exhaustive list.

(i) Decree on Compensation and Resettlement Management in Development Projects, No. 84, dated 5 April 2016
(ii) Directive on the Prohibition of Hunting and Trading Wildlife and Aquatic Animals, Nationally and Internationally, and of Providing Passage to 3rd Countries, No. 76/MAF, dated 2 June 2002
(iii) Law on Chemical Management No. 07/NA, dated 10 November 2016
(iv) Decree on Pesticide Management, No. 258 /GOV, dated 24 August 2017

(v) Regulation on Control of Pesticides in Lao PDR, No. 2860/MAF, dated 11 June 2010

72. The EIA Decree sets out in detail the procedures, rights and responsibilities for the preparation and approval of IEE, and the preparation, approval, implementation and verification of EMP.

73. For Environmental safeguards the IEE is guided by the ADB policy as represented in the current Safeguard Policy Statement (2009). Within the SPS document with Annex 1 details the specific coverage of ADB environmental safeguards. At all times it is the ADB SPS (2009) – unless updated that the SRIWSM must confirm with. Within the SPS (2009) some of the policy requirements are linked to wider documents and international agreements such that ADB's SPS is aligned with these documents.

74. The ADB SPS states as part of its pollution prevention and abatement requirement that ADB projects shall "During the design, construction, and operation of the project the borrower/client will apply pollution prevention and control technologies and practices consistent with international good practice, as reflected in internationally recognized standards such as the World Bank Group's Environment, Health and Safety Guidelines 2009. These standards contain performance levels and measures that are normally acceptable and applicable to projects. The requirements of both the ADB SPS (2009) policy and the linked references are legally required to apply to the SRIWSM. The World Bank 2007 Environmental Health and Safety Guidelines with the additional guidelines for annual crops WB, 2016 that were prepared after ADB SPS and as such are not referred to by ADB policy.

75. ADB's environmental policy is described in its Environment Safeguards: a Good Practice Sourcebook – Draft Working Document, dated December 2012. This provides guidance for implementation of the Environmental Assessment Guidelines (2003). In turn, these go into considerable detail on a number of issues which must be incorporated into the EARF and IEE documents. Key among them is the initial screening of projects, which leads to the following three categories.

Category A: A proposed project is classified as Category A if it is likely to have significant adverse environmental impacts that are irreversible, diverse, or unprecedented. These impacts may affect an area larger than the sites or facilities subject to physical works.

Category B: A proposed project is classified as Category B if its potential adverse environmental impacts are less adverse than those of Category A projects. These impacts are site-specific, few if any of them are irreversible, and in most cases mitigation measures can be designed more readily than for Category A projects.

Category C: A proposed project is classified as Category C if it is likely to have minimal or no adverse environmental impacts. An EIA or IEE is not required, although environmental implications need to be reviewed.

B. Categorization of the Nam Poua Subproject

76. The Nam Poua Subproject was screened using the criteria summarised in Table 6a, with the results shown in Table 6b, which forms part of the review process described in the EARF. The screening resulted in an allocation of the subproject to MONRE category 1 and ADB category B. The irrigated command area is less than 2000 hectares. There will be limited environmental impacts that are expected to be reversible and can be mitigated. This means that an IEE is required for the subproject, and this document has been duly prepared confirming the categorisation as B

C. Environmental Standards

77. The government published its National Environmental Standards in 2017 superceding the 2010 standards. These cover air quality, water quality, noise and vibration in considerable detail. The project uses these standards as appropriate as part of its safeguarding programme, and they are incorporated into this subproject IEE.

78. Standards are not yet defined by government for a number of practical environmental management measures. To ensure that each subproject maintains best environmental practices, a number of additional guidelines have been defined. These are listed in the accompanying EMP. They cover a wide range of construction site management issues to help ensure compliance by contractors, and are to be used throughout the subproject to underpin the environmental mitigation measures adopted in the EMP.

79. The World Bank Group Environment, Health and Safety General Guidelines (2007) provide indicative standards designed for use in an international setting where national standards are not fully developed. Subsequent to the general guidelines, a set of sector specific guidelines for large scale annual cropping have been prepared (WB, 2016) Elements of these have been adopted in the project-specific guidelines listed in the EMP.

Table 6a: Environmental Appraisal Categorisation Checklist

Issue	Outcome
1. Will the subproject involve an irrigation command area of more than 2000 hectares?	• If "yes", then it qualifies as MONRE category 2 (ADB category A) and cannot be supported. • If no, then address all of the questions below.
2. Will the subproject involve an irrigation command area of more than 100 hectares? 3. Might the siting of the subproject cause the removal of native trees and shrubs? 4. Might the site of the subproject be affected by climate conditions including extreme weather-related events such as floods, droughts, storms or landslides? 5. Will the subproject cause alteration of surface water hydrology that might result in increased sediment in streams? 6. Will there be bare surface at the construction site that might give rise to soil erosion? 7. Might silt and waste runoff from construction lead to a deterioration of surface water quality?	• If the answer to any one of these questions is "yes" **and** the potential adverse impacts are likely to be significant, irreversible, diverse or unprecedented, then it qualifies as MONRE category 2 (ADB category A) and cannot be supported.
8. Might there be increased air pollution due to subproject construction and operation? 9. Might there be increased noise and vibration due to subproject construction and operation? 10. Might the subproject or its construction generate solid waste or hazardous waste? 11. Might chemicals or fuels be stored and used for the subproject or its construction? 12. Might wastewater be produced during subproject construction or operation? 13. Might there be construction dust and erosion from earthworks?	• If the answer to any one of these questions is "yes", but the likely impacts are reversible and can be mitigated, then it qualifies as MONRE category 1 (ADB category B) and requires an IEE (see Environmental Assessment and Review Framework).
14. Might there be any loss of habitat or micro-habitat for local biodiversity? 15. Might there be changes to local drainage? 16. Might the subproject involve an excessive use of local water resources? 17. Might the subproject lead to water use conflicts? 18. Might the subproject cause cumulative impacts on limited water resources? 19. Might the construction and use of access roads be close to and affect residences, waterways or other facilities due to dust, noise or runoff? 20. For agricultural components, might there be transport, storage, handling and use of materials, and inputs of seeds, seedlings, fertilisers and pesticides? 21. Might there be increased residues of plastics, including mulch materials, in soil and water?	• If the answer to all of these questions is "no", then it does not fall into a MONRE category (but fits ADB category C), it requires an investment application that must be covered by the Environmental Code of Conduct (see Environmental Assessment and Review Framework).

Issue	Outcome
22. Will soil conservation and management risks be increased or important for the sustainability of the infrastructure 23. Will the subproject increase the use of pesticides? 24. Will fertiliser use increase with the diversification and intensification of irrigated cropping? 25. Will there be a change greenhouse gas emissions? 26. Will there be increased risks to occupational safety and health from physical, chemical hazards including UXO? 27. Will there be changes to the Community Safety and Health	

Table 6b: Environmental Appraisal Categorisation Checklist Completed for Nam Poua

Screening issue	Finding
1. Will the subproject involve an irrigation command area of more than 2000 hectares?	• No.
2. Will the subproject involve an irrigation command area of more than 100 hectares?	• No.
3. Might the siting of the subproject cause the removal of native trees and shrubs?	• Not anticipated.
4. Might the site of the subproject be affected by climate conditions including extreme weather-related events such as floods, droughts, storms or landslides?	• Yes. This aspect is covered in detail in the project's CRVA, with appropriate climate resilience measures put in place.
5. Will the subproject cause alteration of surface water hydrology that might result in increased sediment in streams?	• No.
6. Will there be bare surface at the construction site that might give rise to soil erosion?	• Yes, but this will be carefully controlled through the EMP.
7. Might silt and waste runoff from construction lead to a deterioration of surface water quality?	• Yes, but this will be carefully controlled through the EMP.
8. Might there be increased air pollution due to subproject construction and operation?	• Yes, but this will be carefully controlled through the EMP.
9. Might there be increased noise and vibration due to subproject construction and operation?	• Yes, but this will be carefully controlled through the EMP.
10. Might the subproject or its construction generate solid waste or hazardous waste?	• Yes, but this will be carefully controlled through the EMP.
11. Might chemicals or fuels be stored and used for the subproject or its construction?	• Yes, but this will be carefully controlled through the EMP.
12. Might wastewater be produced during subproject construction or operation?	• Yes, but this will be carefully controlled through the EMP.
13. Might there be construction dust and erosion from earthworks?	• Yes, but this will be carefully controlled through the EMP.
14. Might there be any loss of habitat or micro-habitat for local biodiversity?	• No biodiversity habitat of significance will be affected.
15. Might there be changes to local drainage?	• Only on the irrigated land, which will be managed carefully.
16. Might the subproject involve an excessive use of local water resources?	• Unlikely, as there is currently adequate water for all known uses.
17. Might the subproject lead to water use conflicts?	• Unlikely, as there is currently adequate water for all known uses.
18. Might the subproject cause cumulative impacts on limited water resources?	• Unlikely, as there is currently adequate water for all known uses.
19. Might the construction and use of access roads be close to and affect residences, waterways or other facilities due to dust, noise or runoff?	• No. There will be no access roads.
20. For agricultural components, might there be transport, storage, handling and use of	• Yes, but it is expected that this will be better controlled through

Screening issue	Finding
materials, and inputs of seeds, seedlings, fertilisers and pesticides?	additional capacity building of PAFO staff.
21. Might there be increased residues of plastics, including mulch materials, in soil and water?	• Not expected.
22. Will Soil Conservation and Management risks be increased	• No – to the contrary substantial gains are likely through the use of piped distribution, spray and trickle irrigation, improved canal structures and canal protection from high flow ingress
23. Will the subproject increase the use of pesticides	• Command area pesticide use is likely to increase depending on the crop being grown, most pesticide use is expected with cucumber and melon which are currently sprayed under the project the area of such crops will increase
24. Will fertiliser use increase	• FErtilsier use will increase marginally, but will remain at low levels internationally. (see Section D subsection 5 for details.)
25. Will there be a change in greenhouse gases	• Yes with the slight increase in nitrogenous fertiliser and the increase in total output requiring additional transport • Increased cultivation during the dry season will lead to increased fuel use however the benefits to soil structures reduces cultivation energy demand for the wet season
26. Will there be increased risk to occupational safety and health from physical and chemical hazards including UXO	• Occupation risks will decline with safer access into and out of the command area, reduced drudgery as irrigation transitions into piped and trickle distribution systems • UXO exposure is however possible and will Provincial certification of UXO clearance which given the works will be within an existing command are the risk of a new UXO clearing is expected to be low
27. Will there be changes to the Community Safety and Health Risks from Traffic and vehicle movement, in-migration and chemical use	• Construction vehicle risks will increase but be relatively trivial along the main canal road, the extent of construction works is very limited. Community safety especially for children and women to gain access is markedly improved • Main canal lining and covering at the off take will reduce risk of injury • Chemical use will increase due to

Screening issue	Finding
	increased area of cropping and as cropping during the dry season is adopted while the intensity of plastic mulch may increase in the short run however the piped distribution may result in movement away from plastic mulch • Handling, mixing and application of agrichemical will increase with increased numbers of users

IV. DESCRIPTION OF THE SUBPROJECT ENVIRONMENT

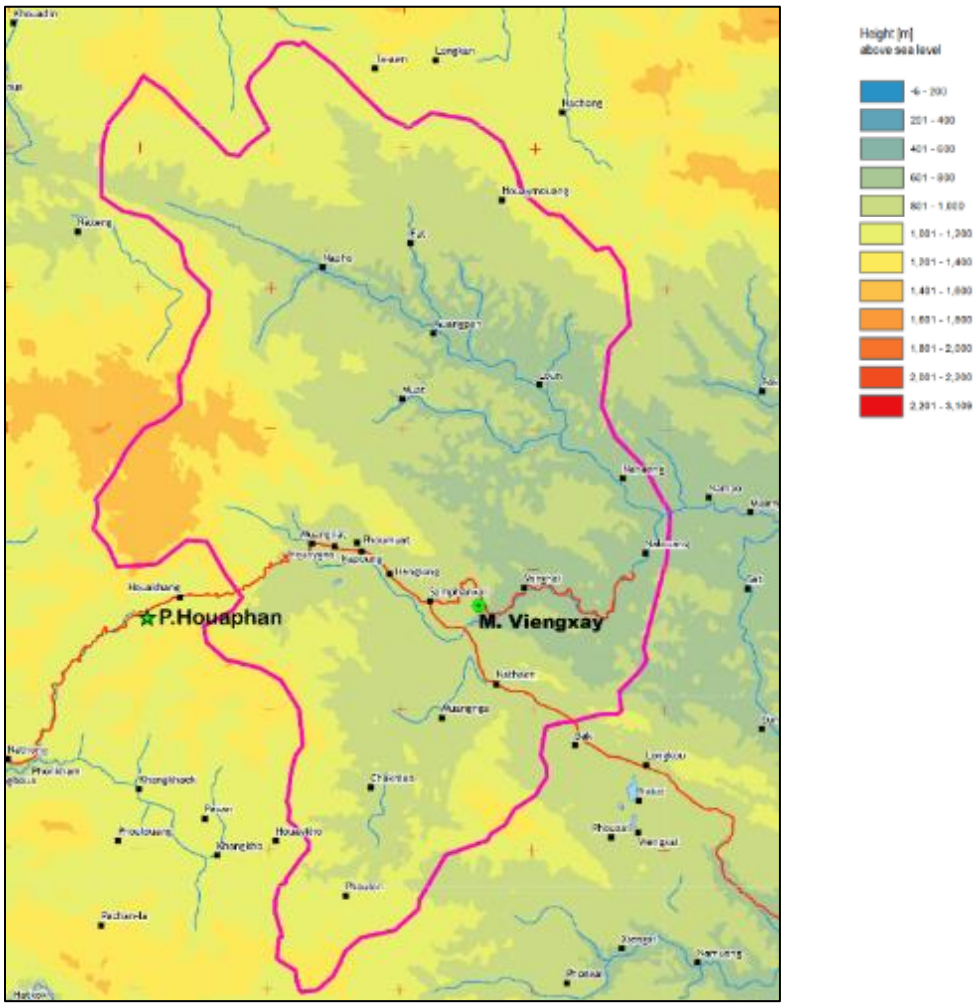
A. Topography and Geology

80. The underlying geology of Houaphan Province is mainly a mixture of ancient igneous and metamorphic rocks with some bands of Triassic-Jurassic shallow marine sedimentary rocks. It is a complex structure, and although there are no major regional faults, there has been major folding which means that surface-outcropping geology is very variable. Tectonically it is stable. Geotechnically, slopes formed in the older igneous rocks should be strong, but there may be weaknesses – and a potential to landsliding – in the limited areas of weaker sedimentary rocks. Major slopes, even in the stronger rock types, might have superficial layers of colluvium that could give rise to shallow slope failures.

81. Occurrences of gold, copper, lead, zinc and cobalt are known from parts of Houaphan. However, no exploitable resources have been found so far that would affect the Nam Poua catchment. The Houaphan Mining and Thermal Project in Xamneua District is becoming established, but will not affect the subproject.

82. The topography of the Nam Poua catchment is shown in Figure 4. An area of high hills, rising to about 1500 metres, is situated on the western side of the catchment, with a series of streams coalescing to form the Nam Poua, flowing generally eastwards. At the point where it leaves the subproject area, the river is about 650 metres above sea level. The subproject area of the catchment extends about 25 km north-south and 15 km east-west.

Figure 4: Outline Topographic Map of the Nam Poua Catchment



1. Soils, Vegetation Cover and Land Utilisation

83. Soils in the area are mostly Acrisols. These are heavily weathered, clay-rich tropical soils that are usually moderately acidic and can have high contents of iron and aluminium, and relatively low fertility. In the lower-lying locations, where soil drainage is limited, soils are subject to waterlogging and therefore have the characteristics of Gleysols (i.e. soils subject to seasonal changes in saturation, and consequently the aeration and oxidising or reducing conditions that strongly dictate the growing conditions for plants. Luvisols also occur in some parts of the landscape, showing heavy leaching and the displacement of clay.

84. A comparison was made of 2010 and 2018 satellite imagery to assess the general land utilisation and the trends over the last eight years. Extensive cloud coverage and shadow in the 2010 satellite image make it difficult to be precise about the trends. Based on this interpretation, the areas of different land cover were calculated as shown in Table 7, as mapped in Figure 5.

Table 7: Defined Land Use Areas based on Satellite Imagery Interpretation

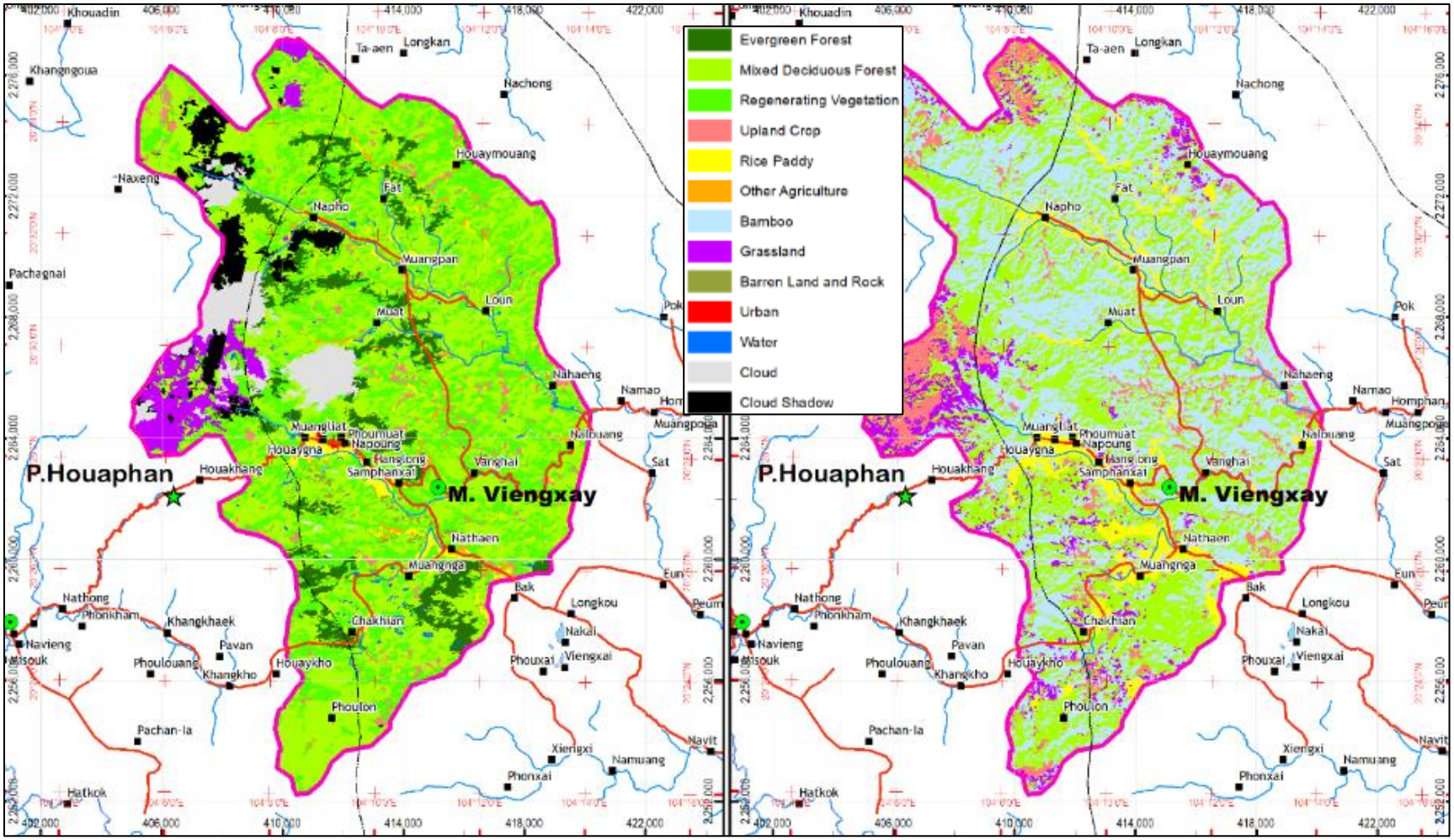
Land Use	Area 2010 (ha)	Area 2018 (ha)	Variation (ha)
Evergreen forest	1,575		-1,575
Mixed deciduous forest	9,638	7,902	-1,736
Bamboo	4	9,288	9,283
Regenerating vegetation	6,471		-6,471
Grassland	747	1,224	476
Upland agricultural cropping	424	1,698	1,273
Rice paddy	613	1,774	1,161
Other agriculture	341		-341
Urban	38		-38
Bare land and rock	76		-76
Water	144		-144
Cloud	1,022		-1,022
Cloud shadow	791		-791
Total catchment area	21,885		

85. Based on interpretation of Table 6 and Figure 5, the following changes appear to have occurred in the Nam Poua catchment between 2010 and 2018.

- The catchment had been subject to heavy use before 2010, with at least a third of the forest already cleared on the upland slopes and replaced by regenerating vegetation and other cover.
- Nevertheless, the forest has declined since then, from more than half in 2010 to only 36 percent in 2018. It is now very fragmented and mostly interspersed with bamboo.
- Bamboo and grassland dominate the disturbed and abandoned land, and now occupy 48 percent of the entire catchment. Bamboo appears to have become dominant in the regenerating forest over a large proportion of the catchment: bamboo alone now occupies 42 percent of the total.

- Upland agriculture has increased from 765 to 1698 hectares. This includes nearly all the high ground on the western side of the catchment. The main agricultural crops are upland rice, lemons and other fruit trees.
- Rice paddy has increased significantly, from 613 to 1774 hectares, so that it now occupies 8 percent of the catchment.

Figure 5: Interpretation of Land Utilisation in the Nam Poua Catchment: left, 2010; right, 2018



B. Climatic Conditions

86. There are no weather data specifically for the Nam Poua catchment, so climate must be considered at the provincial scale. Houaphan as a whole has a humid tropical climate, being situated between 19.5 and 21.0 degrees north of the equator. Average temperatures are generally in the range of 15 to 30 degrees centigrade throughout the year in the valleys. Temperature declines with elevation, to the extent that the high land at the heads of the mountain catchments have temperature regimes about five degrees cooler than the valley bottoms. To this extent the higher areas might be considered to have subtropical climates, while the valley bottoms are tropical.

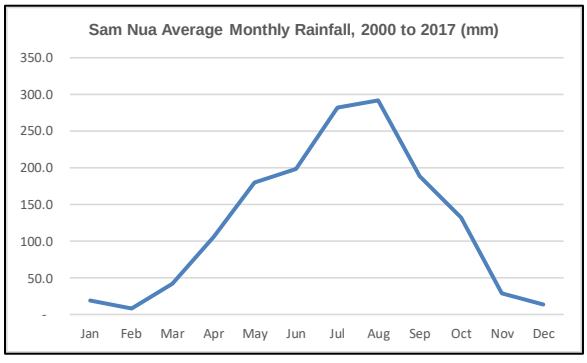
87. Moisture is dominated by seasonal air movements, with most rainfall coming with the south-west monsoon during the northern hemisphere summer. Simply put, the northward migration of the sun draws warm, moist maritime air from the Indian Ocean across the land masses of south and south-east Asia. Rainfall varies across Lao, but Houaphan is in a relatively low rainfall belt. The two weather stations in the Province, Sam Nua and Vieng Say, show generally similar average annual rainfall, at 1500 and 1550 mm respectively. The range of annual totals recorded over the last 18 years has been greatest at Sam Nua, with variations between 1000 and 2000 mm. This is a significant variation – 33 percent either side of the mean – and so much variability over a short period suggests that a longer timeframe is likely to see even wider extremes. Monthly and annual rainfall figures for both stations are given in Figure 6.

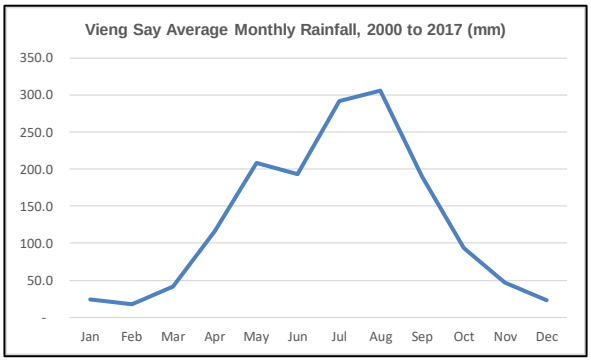
88. The pattern is for increasing rain as pre-monsoon warming gives rise to convective cells that produce thundery downpours through March, April and May. The monsoon arrives in June, with rainfall highest – typically around 300 mm per month – in July and August. The monsoon weakens and dissipates in September, with the last substantial rain clearing usually in the first half of October. This leads into the pronounced dry season from November to February. However, this pattern can be altered in any year by the passage of tropical cyclones, usually affecting Lao from the South China Sea: these are discussed below.

Figure 6: Monthly Rainfall (mm) at Sam Nua (top) and Vieng Say (bottom)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2000	-	6.3	2.1	75.4	209.8	164.8	180.2	187.4	151.3	75.9	0.5	-	1,053.7
2001	11.3	-	91.6	41.8	307.3	116.1	253.8	187.8	130.7	238.0	14.8	-	1,393.2
2002	24.5	-	49.0	141.6	363.9	154.8	331.0	271.2	124.7	64.1	71.0	60.8	1,656.6
2003	14.3	36.9	32.4	97.9	199.1	247.8	229.3	245.0	204.6	38.5	0.2	-	1,346.0
2004	2.1	11.0	67.0	224.5	330.4	155.7	287.9	340.7	179.3	0.5	56.2	2.8	1,658.1
2005	2.5	2.0	24.4	71.9	90.6	171.9	462.7	389.9	286.2	3.7	45.3	15.3	1,566.4
2006	1.1	4.9	28.4	113.9	142.9	127.1	169.8	389.0	81.4	64.6	-	-	1,123.1
2007	1.4	49.2	40.2	121.1	200.4	247.5	300.4	178.4	292.6	323.1	7.3	3.7	1,765.3
2008	27.9	22.8	102.3	137.1	185.9	238.1	185.8	158.7	297.4	246.8	33.9	14.0	1,650.7
2009	4.4	6.1	18.6	89.8	207.2	143.3	270.2	273.8	193.7	50.3	0.5	1.3	1,259.2
2010	67.9	8.0	36.2	82.2	183.6	140.1	124.1	254.6	78.9	102.2	0.4	3.4	1,081.6
2011	4.3	2.7	152.5	67.6	121.1	264.7	440.8	236.9	461.4	48.3	7.0	3.9	1,811.2
2012	9.1	0.5	6.5	83.2	170.0	303.9	342.1	394.6	353.0	101.9	88.6	2.5	1,855.9
2013	21.1	-	29.1	108.4	117.8	169.4	393.5	284.0	78.0	41.2	11.0	31.8	1,285.3
2014	1.1	0.4	39.4	94.4	124.3	331.3	363.4	327.2	19.1	60.1	51.4	2.1	1,414.2
2015	45.9	1.1	5.1	92.5	27.0	157.2	251.1	451.2	145.7	68.5	94.9	53.6	1,393.8
2016	83.6	6.3	7.4	206.6	79.2	122.5	141.5	569.4	121.5	638.0	31.1	8.3	2,015.4
2017	33.9	0.3	29.8	61.9	171.3	320.6	348.3	117.8	189.3	217.6	2.2	47.4	1,540.4
Average	19.8	8.8	42.3	106.2	179.5	198.7	282.0	292.1	188.3	132.4	28.7	13.9	1,492.8
Minimum	-	-	2.1	41.8	27.0	116.1	124.1	117.8	19.1	0.5	-	-	1,053.7
Maximum	83.6	49.2	152.5	224.5	363.9	331.3	462.7	569.4	461.4	638.0	94.9	60.8	2,015.4

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2000	5.8	46.2	1.5	85.9	406.7	169.4	305.5	386.3	220.3	43.3	1.6	4.0	1,676.5
2001	16.0	7.2	139.7	71.4	350.3	179.9	332.0	230.4	174.4	201.8	92.3	6.4	1,801.8
2002	51.2	5.6	49.0	102.6	336.5	320.1	289.3	234.7	129.4	72.2	86.5	49.4	1,726.5
2003	20.9	41.2	18.0	98.0	196.0	148.7	317.5	290.9	193.1	22.3	0.7	2.9	1,350.2
2004	4.9	20.2	11.8	304.6	301.0	149.4	190.2	151.9	204.9	1.1	40.3	1.6	1,381.9
2005	6.8	3.3	23.9	72.3	132.8	228.6	303.3	400.0	279.3	16.2	90.1	30.1	1,586.7
2006	5.9	3.8	23.3	157.8	177.9	120.1	226.4	358.2	118.3	66.0	0.6	-	1,258.3
2007	1.3	70.3	27.4	137.2	163.6	187.7	278.5	222.9	341.6	315.1	16.0	5.2	1,766.8
2008	21.5	37.7	80.4	184.6	181.0	196.9	323.0	160.4	186.2	270.7	155.4	19.6	1,817.4
2009	12.2	7.8	22.2	111.6	292.0	98.8	234.3	218.9	224.3	35.2	4.9	2.6	1,264.8
2010	58.8	8.7	39.6	94.3	251.5	92.3	124.3	396.8	163.7	99.7	1.2	12.8	1,343.7
2011	22.6	5.9	163.3	85.6	109.5	296.7	269.6	270.7	219.2	55.6	27.2	11.8	1,537.7
2012	18.8	11.1	3.8	63.7	200.2	182.6	315.2	326.2	281.1	89.0	78.1	10.3	1,580.1
2013	10.2	2.8	26.8	74.4	162.6	213.7	332.6	328.7	130.0	50.1	19.4	29.2	1,380.5
2014	1.6	3.1	31.4	96.4	115.4	427.3	461.6	396.1	132.1	25.9	48.5	14.5	1,753.9
2015	41.1	9.4	28.3	132.3	10.5	236.1	256.1	285.9	138.6	53.6	149.2	75.7	1,416.8
2016	85.0	29.7	10.2	133.7	153.3	-	220.3	485.9	124.5	29.9	32.3	98.0	1,402.8
2017	53.7	1.9	46.6	80.7	205.4	229.1	478.4	360.3	155.7	224.4	2.2	33.4	1,871.8
Mean	24.4	17.6	41.5	116.0	208.1	193.2	292.1	305.8	189.8	92.9	47.0	22.6	1,551.0
Minimum	1.3	1.9	1.5	63.7	10.5	-	124.3	151.9	118.3	1.1	0.6	-	1,258.3
Maximum	85.0	70.3	163.3	304.6	406.7	427.3	478.4	485.9	341.6	315.1	155.4	98.0	1,871.8





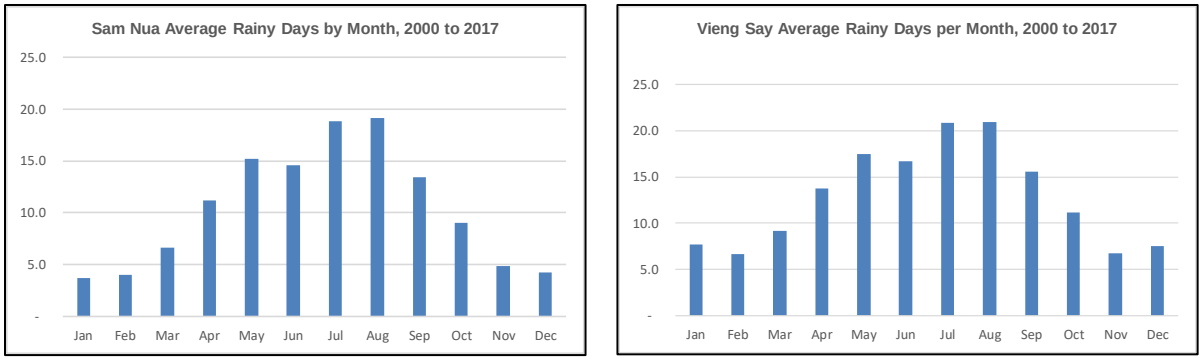
89. The annual spread of rainfall can be seen by the data on the number of rainy days per month, given for the same two weather stations in Figure 7. Although it is rare for there to be no

rain in a month, periods can be seen where there is very little: for example, there was a total of 11.8 mm of rain in four days in the period of November 2000 to February 2001, presumably giving a significant drought. By contrast, it is rare for there to be rain on less than half the days in July and August.

Figure 7: No. of Days with Rain by Month at Sam Nua (top) and Vieng Say (bottom).

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2000		10	3	13	22	16	19	18	15	10	1		127
2001	3		9	5	23	15	13	12	9	10	1		100
2002	1		4	10	16	16	18	18	11	9	11	6	120
2003	3	3	6	7	15	12	20	20	16	3	1		106
2004	2	4	9	19	23	14	23	20	10	1	9	2	136
2005	3	1	8	12	12	16	25	25	16	3	7	6	134
2006	4	6	7	12	14	14	14	25	10	9	1	1	117
2007	3	4	7	14	17	18	18	20	16	12	4	3	136
2008	3	3	13	11	14	21	22	14	16	17	7	5	146
2009	5	2	5	10	15	11	20	16	1	9	2	3	99
2010	5	2	6	13	8	7	12	24	14	12	1	7	111
2011	4	2	9	6	13	14	23	19	23	13	4	4	134
2012	5	1	4	13	20	15	22	21	15	12	5	4	137
2013	4	-	5	15	15	14	21	21	15	10	8	4	132
2014	2	19	4	12	14	17	21	20	17	9	7	2	144
2015	2	1	8	10	7	16	17	21	11	6	10	8	117
2016	6	5	4	11	11	12	12	18	14	7	7	4	111
2017	8	1	9	9	15	15	20	13	13	11	2	4	120
Average	3.7	4.0	6.7	11.2	15.2	14.6	18.9	19.2	13.4	9.1	4.9	4.2	123.7
Minimum	1	0	3	5	7	7	12	12	1	1	1	1	99
Maximum	8	19	13	19	23	21	25	25	23	17	11	8	146

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2000	11	10	4	20	24	21	20	24	15	17	3	5	174
2001	5	5	16	9	23	17	23	18	16	10	5	5	152
2002	8	4	7	14	24	22	17	21	12	10	12	9	160
2003	10	5	6	9	17	12	24	22	17	5	1	3	131
2004	5	5	9	18	21	17	20	20	10	1	11	2	139
2005	3	4	13	9	15	16	27	26	18	7	8	9	155
2006	6	7	12	12	18	16	22	27	10	8	2	14	154
2007	3	4	7	17	18	21	19	18	20	11	4	3	145
2008	5	16	14	13	17	23	24	15	15	17	10	7	176
2009	12	4	5	11	20	13	21	18	13	10	3	4	134
2010	6	3	7	18	15	12	15	25	19	14	3	10	147
2011	13	8	20	15	17	19	21	20	22	16	7	7	185
2012	17	9	6	13	19	18	19	24	15	11	12	9	172
2013	13	7	7	20	20	18	26	21	19	11	9	5	176
2014	2	5	6	13	15	19	22	24	17	24	8	12	167
2015	6	10	9	13	4	20	17	20	15	8	12	14	148
2016	7	10	5	13	12	-	16	21	10	7	9	6	116
2017	7	3	12	11	16	16	23	13	17	13	2	11	144
Mean	7.7	6.6	9.2	13.8	17.5	16.7	20.9	20.9	15.6	11.1	6.7	7.5	154.2
Minimum	2	3	4	9	4	0	15	13	10	1	1	2	116
Maximum	17	16	20	20	24	23	27	27	22	24	12	14	185

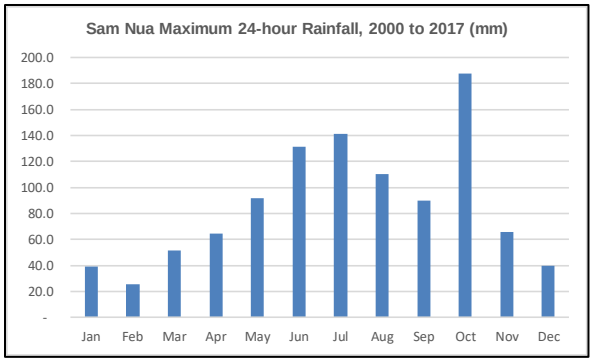


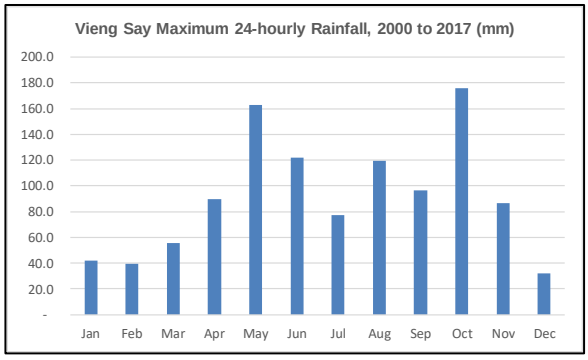
90. Rainfall intensity data are scarce, but the maximum 24-hour rainfall totals are available for both stations: see Figure 8. In general, these show the same pattern of greater amounts during the summer monsoon, although there appears to have been a particularly heavy localised storm at Sam Nua in May 2013. The prominent outlier in October is discussed below. The general pattern is that up to half a month's rain can fall in a single 24-hour period.

Figure 8: Maximum Daily Rainfall (mm) at Sam Nua (top) and Vieng Say (bottom).

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2000	-	14.4	16.0	17.5	45.3	30.8	30.9	36.0	26.2	16.5	0.5	-
2001	7.5	-	25.7	26.4	23.6	20.8	82.5	42.0	55.5	70.0	14.8	-
2002	24.5	-	37.0	50.5	91.5	37.1	67.6	51.5	45.1	23.8	31.5	33.9
2003	5.8	19.2	23.2	26.6	42.0	76.6	49.7	47.7	47.8	29.2	0.2	-
2004	1.6	9.3	37.9	40.2	76.9	47.9	40.9	110.4	78.9	0.5	15.4	1.7
2005	1.2	2.0	10.0	22.8	19.8	39.3	120.9	40.3	69.0	1.9	27.7	6.6
2006	0.6	1.6	12.8	27.5	37.5	46.9	50.7	65.9	27.8	18.9	-	-
2007	0.8	25.8	25.4	23.4	38.6	54.7	42.4	54.9	81.3	187.6	5.0	2.0
2008	12.9	18.6	22.6	52.0	58.1	53.3	24.2	68.6	74.8	128.6	11.9	8.4
2009	1.7	3.9	7.6	31.0	38.5	51.8	39.6	64.7	86.1	27.8	0.3	0.4
2010	38.6	7.6	15.5	16.7	55.9	33.2	34.4	54.7	18.2	41.7	0.4	1.2
2011	3.0	2.3	51.8	27.3	44.5	71.8	53.8	37.8	89.9	13.4	2.9	2.2
2012	4.3	0.5	3.5	32.4	46.2	70.4	58.3	78.2	80.5	43.5	66.0	2.0
2013	14.9	-	17.6	22.1	50.2	38.0	61.6	57.0	15.7	11.8	4.1	21.7
2014	0.9	0.4	16.0	28.6	47.4	70.9	72.3	78.2	42.3	15.9	33.2	1.4
2015	22.1	1.1	31.6	16.5	10.6	58.0	77.0	60.2	68.4	34.7	42.4	21.6
2016	39.1	2.6	5.9	64.2	32.3	30.9	141.5	22.4	44.4	21.9	13.5	5.2
2017	24.3	0.3	7.5	33.1	31.2	131.3	63.5	28.3	80.0	95.6	1.5	39.5
Maximum	39.1	25.8	51.8	64.2	91.5	131.3	141.5	110.4	89.9	187.6	66.0	39.5

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2000	1.3	18.0	1.0	24.3	85.5	31.2	46.5	97.7	40.5	10.3	0.9	2.3
2001	8.7	2.4	39.0	18.1	84.7	31.0	73.3	57.2	40.6	90.6	69.3	11.5
2002	41.8	2.5	31.0	21.0	73.1	108.2	59.1	36.7	28.8	47.9	86.6	29.3
2003	5.0	21.5	10.5	25.7	49.7	43.0	52.2	69.6	48.7	16.9	0.7	1.7
2004	2.3	16.0	4.7	49.8	74.7	38.0	24.0	90.8	96.5	1.1	14.0	1.4
2005	3.4	1.7	6.3	44.7	32.7	37.6	32.5	50.1	65.3	6.1	43.4	13.3
2006	2.2	2.2	10.0	89.8	36.1	28.0	67.4	55.4	32.2	17.7	0.6	-
2007	1.3	39.5	9.5	32.5	38.2	29.6	70.6	37.1	89.3	176.0	12.0	4.0
2008	16.9	15.8	13.4	66.2	49.3	28.0	57.5	54.6	60.3	71.5	80.3	8.5
2009	1.7	3.2	8.7	20.4	45.0	37.0	55.7	83.9	83.9	18.0	2.1	1.2
2010	27.3	6.5	21.4	15.9	57.5	23.5	28.1	71.0	31.6	17.0	4.0	2.4
2011	5.7	1.5	55.3	30.3	23.3	110.5	37.1	68.7	46.5	22.9	17.1	5.3
2012	4.8	3.4	1.5	20.0	70.1	55.6	57.6	46.9	83.6	27.0	55.8	3.6
2013	2.7	0.9	9.6	19.6	162.6	35.9	47.5	69.2	22.9	13.4	9.9	20.3
2014	1.1	1.4	19.8	22.9	25.1	122.0	26.9	110.8	44.7	8.8	35.0	3.6
2015	16.4	2.6	16.0	47.0	7.9	87.0	40.3	81.0	65.8	25.1	32.2	25.2
2016	29.4	3.0	8.9	45.0	33.0	-	27.9	119.2	38.0	10.5	10.6	32.0
2017	35.3	0.5	18.0	26.0	70.8	5.4	77.0	73.8	82.8	100.4	1.5	30.3
Maximum	41.8	39.5	55.3	89.8	162.6	122.0	77.0	119.2	96.5	176.0	86.6	32.0





91. The Climate Risk and Vulnerability Assessment gives a more thorough analysis of the risk and impacts of tropical cyclones, but it is important to consider the key factors in an IEE. The tracks and effects of typhoons across south-east Asia have been well documented over recent decades. There is variability between years, and in some years cyclones can develop into typhoons in every month of the year. However, the most common time for this to happen is in the spring or autumn. In terms of impacts on the Nam Poua catchment, the event that stands out from Figure 8 is that of October 2007, when in one day 188 and 176 mm of rain was recorded at the two weather stations. This presumably came from Severe Tropical Storm Lekima, which hit Lao PDR on 4 October 2007, and was a Category 1 Hurricane (i.e. Typhoon) at the time it made landfall in central Viet Nam but downgraded by the time it penetrated inland as far as Lao. Typhoon Mekkhala hit Lao PDR from 30 September 2008, which could account for the high daily figure at Sam Nua in October 2008.

92. During subproject consultations, farmers at Ban Muang Poua indicated a typical high flood level in Nam Poua at the proposed road bridge site number one which equated with a calculated flow rate of about 200 m^3/s. No date could be recalled for a particularly high historic flood. They reported that Typhoon Haima of June 2011, which caused extensive flooding in Xiang Khouang and Xayaboury did not produce a particularly large flood in Nam Poua (the maximum 24-hour rainfall recorded during June 2011 in Vieng Say was 110 mm).

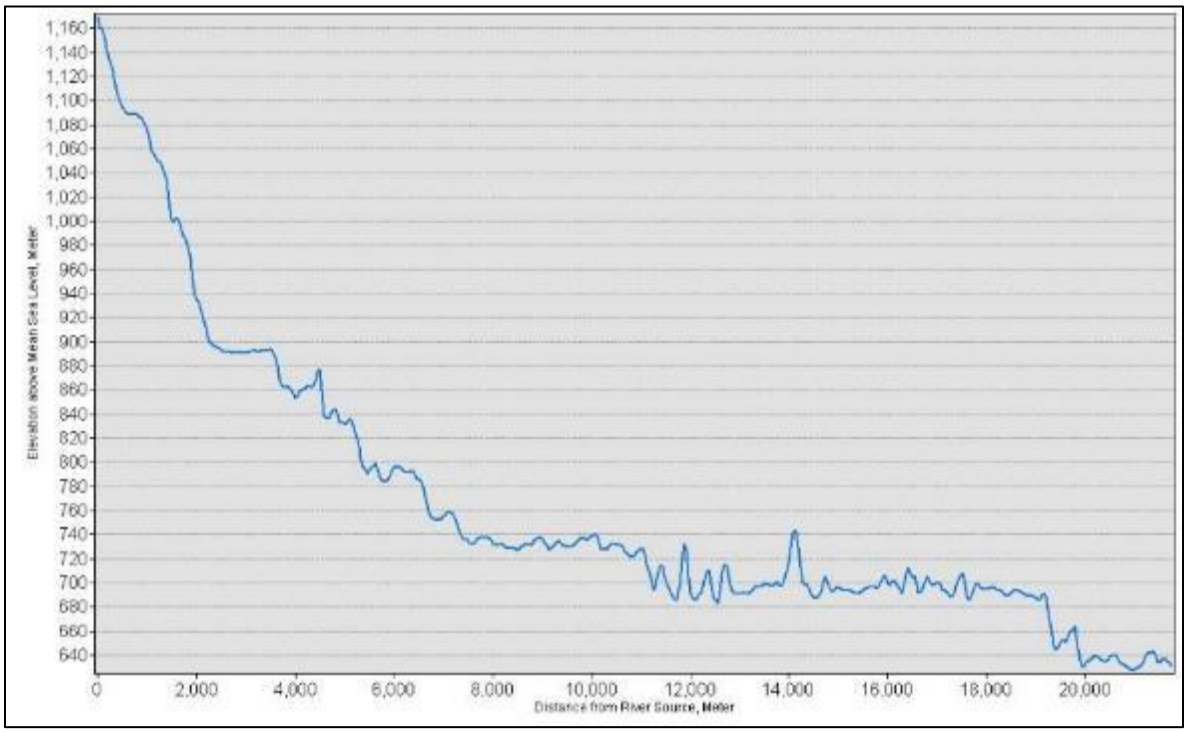
93. Very intense rainfall is not only due to typhoons, however. In May 2013, a 24-hour rainfall total of 163 mm was recorded at Vieng Say, yet there were no severe tropical storms or typhoons

anywhere in the western Pacific in that month. Either it is an aberration in the data, or it was a particularly intense thunderstorm. But the implication is that, if in 18 years of data there was one incidence of almost 200 mm in a 24-hour period, there is a strong possibility that such a figure could be exceeded over a similar or longer time period. This is also only for rainfall collection periods, and obscures possibly greater amounts of rain within 24 hours but split between two recording periods. Data are also not sufficient to ascertain cumulative heavy rainfall prolonged over a 48- or 72-hour period, and the effects of this on flood or landslide events. There are no parallel river level data to link with rainfall.

C. Water Resources

94. The Nam Poua forms a steeply falling hill catchment with a classic profile that gradually flattens down the valley (see Figure 9). The catchment area above the existing headworks that will be upgraded by the proposed GIZ / GCF project[3] covers approximately covers 210 km^2.

Figure 9: Longitudinal Profile of the Nam Poua above the Headworks



95. The flows in the Nam Poua naturally follow the rainfall pattern with the mean highest flows being in July and August, and lowest flows in late March. There is no flow recording station on the river. River flow estimates at the headworks were made by the project technical assistance and PIS staff on 14 February 2018 (2.2 m^3/s), 4 April 2018 (1.0 m^3/s) and 27 April 2018 (0.895 m^3/s). Information provided by the PIS and from discussions with farmers suggests that 2018 was a typical rainfall year and that observed flows are typical of expected low flows in the period from February to April. A gauge plate was installed at the headworks in April to be read by the WUG to record water levels regularly in the future, but data were not forthcoming for inclusion in

[3] (ii) GIZ and FAO propose to cofinance catchment management works in three of the four SRIWSM provinces under the emission reduction program to be financed from the Green Climate Fund.

project design calculations. On the assumption that the observed flows are representative of low flows, the estimated water availability is sufficient to meet the wet season peak irrigation demand of 0.28 m^3/s and the dry season irrigation demand of 0.19 m^3/s. The expected dry season water demand represents 12 percent of the minimum flow in March and 15 percent of estimated April flow rates in a "typical rainfall year". Further details of the irrigation water requirements are given in the subproject's Feasibility Study. However, until more data are available on the hydrology of the river, the year-to-year variations and the flow levels in a particularly dry year, the assumption must remain that the impact of abstraction from the river should not be significant on the basis of the investigations made to date.

96. Water quality information is not available. Although the upper catchment is in relatively good condition, water quality is less good lower down the river. This is largely because of sand extraction from the river, often involving pumping. This means that parts of the river are frequently turbid, with considerable amounts of suspended sediment. These may cause damage to aquatic flora downstream. However, no evidence was found of chemical pollution although it is possible that runoff from fields where there has been use of fertilisers, herbicides and pesticides may have raised levels of potentially toxic substances in the river.

D. Command Area Land Resources

97. The command area is located on the western side of road 6b and as such has very little direct linkages to the residential areas – see Figure 10. As such the Social Resettlement categorisation of the subproject is category C.

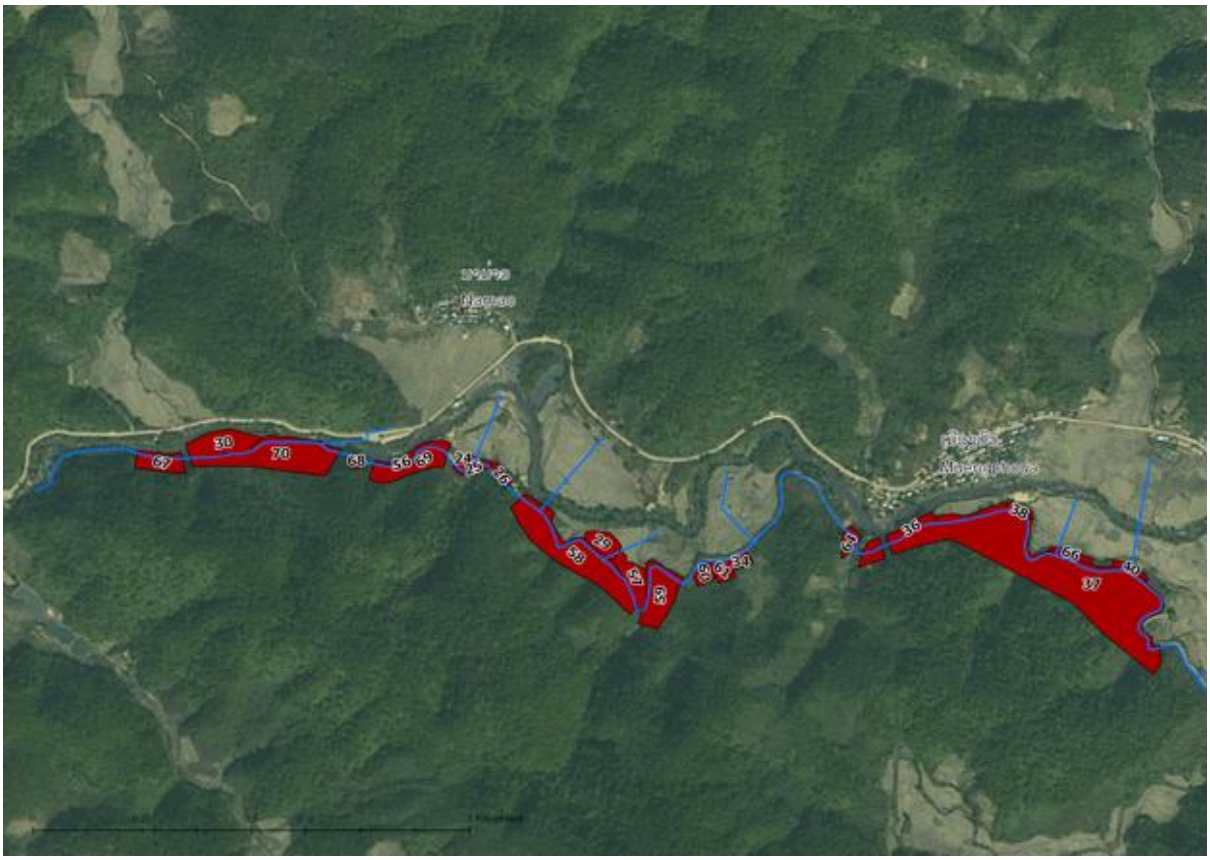


Figure 10: Affected Land Plots

98. The land is currently growing wet season paddy rice and about 75% of the command area is cropped during the dry season using plastic mulch, furrow based irrigation systems that deliver water monthly through the paddy rice distribution system. As such water delivery is poorly linked to water demand with overwatering during each irrigation and then water deficits before water can be delivered back to the same area one month later.

99. Crop production in the wet season is pesticide free although limited amounts of 13-5-7 phosphate based fertiliser is applied. It is expected that this may increase under the with project scenario as water delivery is more assured and reliable, however current experience is that growers involved with dry season cropping report significant crop yield increase in paddy rice from the improvement to soil structure from aeration of paddy soils and the use of crop residues that are incorporated into the soil after cropping.

100. Dry season cropping currently applies low levels of Urea (40 kg/ha) and depending on the crop selection it is probable that these levels will increase to 80 kg/ha and will be applied to a large proportion of the command area. Similarly, phosphatic fertilizers are expected to increase

on average by about 25% from 160 kg/ha to 200 kg/ha for the dry season vegetable crops. The increase is considered conservative for the intensity of production and would be considered low by international standards.

Figure 11: Command Area – Dry Season 2017-2018

101. Pesticide use is currently limited to cucumber and melon crops and are applied as a last resort for crop protection. This strategy is likely to continue with disincentives to increase pesticide use coming from Provincial Regulation that seeks to protect the Viet Nam market for safe vegetable that has significant demand, price benefit and is linked to a number of SRIWSM command area sites. Under the associated facility provisions of the EARF and this IEE the pesticide reduction training (PRT) and integrated pest management (IPM) programs will be considered and included in the IFAD project where warranted. The same provisions are required as an integral part of the Lao-Good Agricultural Practice (GAP) certification program that will be rolled out in the command areas.

Table 8: Agrichemical inputs by Crop Model for Wet Season Rice and Dry Season Crops

Crop			Rice (WSIR)		Garlic/ Shallots		Cucumber		Melon		Vegetables	
Details	WP/WOP		wop	wp	wop	wp	wop	wp	wop	wp	wop	wp
	Season		wet	wet	dry	dry	dry	dry	dry	dry	dry	dry
	Irrigated/rainfed		rainfed	irrigated	irrigated	irrigated	irrigated	irrigated	irrigated	irrigated	irrigated	irrigated
Fertiliser	Urea (46-20-0)	kg	-	-	40	40	40	80	40	80	-	40
	Compound (15-15-15)	kg	-	-	-	-	15	15	15	15	-	-
	Compound (13-5-7)	kg	40.0	80.0	-	-	120	120	120	120	-	-
	KCl	kg	-	-	-	-	-	-	-	-	-	-
	FYM compost	kg	-	-	-	-	-	-	-	-	-	-
	Bio extract	lt	-	-	-	-	-	-	-	-	-	-
Agro chemicles	Glyphospate 48	lt	-	-	-	-	-	-	-	-	-	-
	Herbicide 24D	lt	-	-	-	-	-	-	-	-	-	-
	Pesticide	lt	-	-	-	-	3	3	3	3	-	-
	Fungicide	lt	-	-	-	-	-	-	-	-	-	-

E. Habitat, Ecology and Wildlife

102. There are two protected areas in Houaphan Province. The Nam Xam National Biodiversity Conservation Area lies in the eastern part of the province and covers 580 km^2. The much larger Nam Et National Biodiversity Conservation Area occupies 1915 km^2 of the north-western part of the province and adjoins a contiguous protected area across the border in Viet Nam. Both are located 20km and 50 km from the subproject area respectively. While these are not close to the Nam Poua catchment, they contain a wide range of animal and plant species, including a number that are classified as Critically Endangered, Endangered or Vulnerable on the IUCN Red List.

103. Aquatic ecology was not studied scientifically, but local communities were asked for information about fish and other fauna known to be present in the Nam Poua (Appendix 1). This generated the list given in Table 9. All of these species are caught for domestic consumption and were considered to be quite common, but no trading of fish was reported.

Table 9: List of fishes and other fauna known in the Nam Poua

Scientific name	Lao name	English name
Poropuntius laocnsis	ປາຈາດ	
Puntius aurotaeniatus	ປາຂາວ	
Not known	Pa Kham ປາຂາມ	
Not known	Pa Phep ປາແພດ	
Homaloptera leonardi	ປາຕິດຫີນ	
Not known	Pa Phanh ປາພ້ນ	
Not known	Pa Bou ປາປູ່	
Not known	Pa Khing ປາຂີ້ງ	
Not known	Pa Mon ປາມົ້ນ	
Cyprinus carpio	Pa Nai ປາໄນ	
Oreochromis niloticus	ປານິນ	
Devario salmonatus	Pa Siew ປາຊິ້ວ	
Channa striata	Pa Kor ປາຄໍ່	
Claias batrachus	PaDouk ປາດຸກ	
Anabas testudineus	ປາແຂ້ງ	
Not known	Kouing	Small river shrimp
Not known	Kob	Frog

Not known	Pa Pee ປາຜີ	
Not known	Pa Fek ປາເຜກ	

104. A biodiversity proximity report was generated for the Nam Poua catchment by ADB using the Integrated Biodiversity Assessment Tool (IBAT). This is available as a separate document that accompanies this IEE. It lists approximately 980 species on the IUCN Red List that could be found in the Nam Poua catchment given adequate habitat. The number of those that are threatened – that is, quite likely to face extinction – are listed by order in Table 10. The Critically Endangered Mammal is the Chinese Pangolin; the three Critically Endangered and most of the Endangered reptiles are freshwater turtles.

Table 10: Threatened Species in the Proximity of the Nam Poua Catchment

Order	Critically Endangered	Endangered	Vulnerable
Amphibians	0	0	0
Birds	0	2	5
Fishes	0	0	1
Invertebrates	0	0	1
Mammals	1	3	11
Plants	0	0	1
Reptiles	3	7	4

105. In the subproject area, the local consultations included discussions on the biodiversity found in the forest. Certain tree species are used for small timber in house construction and other local uses. A significant proportion of households appear to be involved in the gathering of non-timber forest products, and there is also a certain amount of hunting in the forests. The response tables in Appendix 1 give details of the species involved. Identifications are difficult to verify, but as far as possible the species have been checked against the IBAT listing. The Sunda pangolin described in the catchment is *Manis javanica*, which is also Critically Endangered but distinct from the Chinese pangolin (*Manis pentadactyla*). The hunters stated that it is now rarely seen, and that they do not kill it. The IBAT listing includes two Vulnerable cobra species, but it is impossible to determine whether either of these is among those described as “always see” by the Nam Poua hunters.

106. Not enough detailed information exists to determine whether any threatened species are present in the Nam Poua catchment or not. It is unlikely that many could be, since even the best remaining forest in the upper parts of the watershed have been altered. In preparing the IEE, consultations were held with local people, including hunters, who confirmed that the very rare species were formerly found in the area, but have not been seen for many years. Over the period between 2010 and 2018, all of the remaining evergreen forest (the MAF classification for primary or little-disturbed forest) has gone; although there still remains nearly 8,000 hectares of moist

deciduous forest (MAF's classification for disturbed, partially logged forest that has not been cleared wholesale), it is very fragmented. This combination of degradation and fragmentation usually means a significant decline in habitat quality. As a general rule, the more rare a species is, the less able it usually is to adapt to disturbance and habitat change. Hence it seems unlikely that there is a critical remaining population of any threatened species remaining in the catchment.

107. Despite the fragmented and highly disturbed nature of the habitat residual populations of common species may be present. Even disturbed and fragmented, 8,000 hectares of forest can harbour a wide range of species, and other species may re-colonise the area if the forest and habitat qualities improve. In addition, over 9,000 hectares of additional land is regenerating from former clearances. These extensive areas are currently dominated by bamboo, and it is not clear how much will recover a full forest canopy rather than remain largely sterilised because the natural diversity of plants cannot re-establish itself through the suppression of the aggressive bamboo plants.

F. Air Quality

108. There are no records of air quality measurements in the Nam Poua catchment, and being a rural area with no significant industries other than agriculture, the air quality is generally good. There are the usual short-duration impacts from road traffic in the vicinity of the existing roads, in the form of dust and vehicle emissions, but traffic levels are usually low.

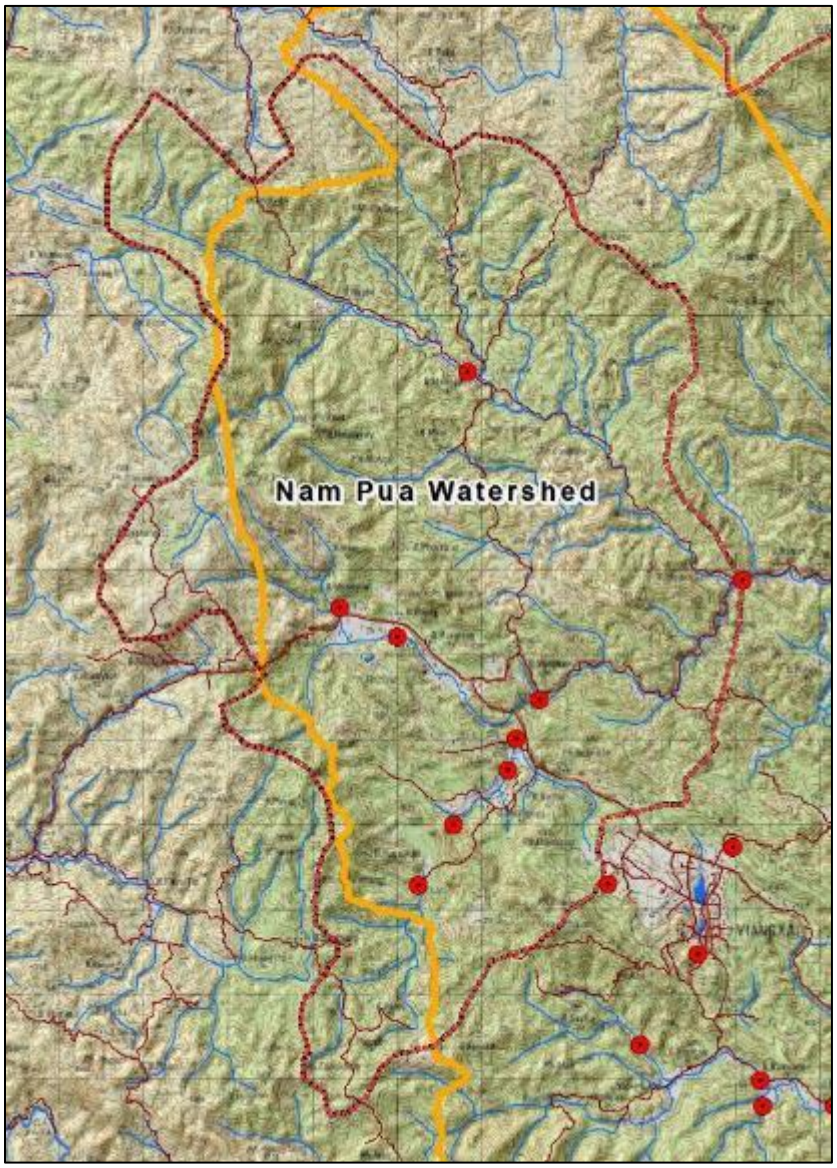
G. Ambient Noise

109. As with air quality, there are no records of ambient noise measurements in the Nam Poua catchment, and being a rural area with no significant industries other than agriculture, ambient noise levels are generally very low. Again, there is the usual short-duration impact from vehicle noise in the vicinity of the existing roads, but traffic levels are usually very low.

H. Infrastructure

110. An infrastructure map of the catchment is given in Figure 10. Most of the catchment is served by existing roads, though excluding the higher ground on the western side. There are ten small irrigation headworks in the subproject area, though these all need some degree of maintenance or rehabilitation.

**Figure 12: Infrastructure Map of the Nam Poua Subproject Area.
This shows: roads (thin dark red lines); existing irrigation headworks (red circles); district boundaries (thick amber lines; and the subproject boundary (thick red and black line).**



111. An irrigation scheme was installed in 2000 under government funds. Until that time there was no irrigation in the catchment, but the scheme installed 180 hectares of dry season irrigation and 256 hectares of wet season irrigation. This project benefited 1,618 people in 304 households, between six villages, as shown in Table 2.

112. Sand extraction is a small industry in some locations along the Nam Poua in the subproject area. In a few locations it is quarried from the lower hillslope on a small commercial basis. More frequently it is pumped out of the river bed, or pits beside the river, as a household livelihood activity. There are no environmental controls over these activities. During discussions, the local authorities agreed that it was an area where there was inadequate control because it fell between the remits of several agencies. The Vice Governor has since banned sand mining in the Nam

Poua. Village level discussions revealed how it is commonly seen as a damaging source of pollution in the river, affecting downstream water quality badly. Figure 11 illustrates two examples of this activity. Subsequent action to control it has reportedly been taken by the authorities.

Figure 13: Examples of Sand Extraction in the Nam Poua. Left: a Small Commercial Quarry. Right: a Household Sand Pumping Pit in the River

1. Pollutants

113. There are no records of significant pollutants of the soil, water or air currently in the Nam Poua catchment, other than the very visible suspended sediment in the river from the sand extraction described above. Other evidence of pollution was not observed during field visits, but no water tests were conducted.

114. Despite the use of plastic mulch for over 5 years there are no signs of plastic mulch pollution either through soil incorporation or within drainage systems or the Nam Poua river.

115. Agrichemical use is extremely limited however the intensive dry season cropping is linked to increased fertiliser and some limited pesticide usage. Application rates for both nutrient and agrichemical are very low however with increased intensification increases in the short to medium term are likely.

116. The EARF gives details of the approach to a risk based approach to water quality monitoring within the support program for irrigated agriculture including pesticide reduction and management training and integrated pest management to be financed and implemented under the IFAD PICSA program. Where necessary, water quality testing will respond to anticipated or identified threats based on likely chemical use and will require customized sampling and testing programs to be developed as part of the irrigated agriculture support program. Obtaining reliable water tests requires a concerted programme of sampling over a considerable period of time. If there are significant changes to the use of agricultural inputs that the monitoring should be undertaken during project implementation to ensure that the quality of water remains satisfactory.

2. Unexploded Ordnance

117. Although Houaphan Province as a whole has a considerable amount of unexploded ordnance, none is known of in the Nam Poua catchment. As a past CMI project site it is presumably cleared however this needs to be confirmed by Provincial Authorities. The Government will be required to certify to ADB that all Project areas are clear of UXO, with any UXO clearance activities being the responsibility of the Government of Lao PDR. No Contract may be awarded without this certification.

3. Community Health and Safety

a. Population and Ethnicity

118. Full details of the socio-economic characteristics of the subproject communities are given in the report on village and household surveys undertaken for the Nam Poua Subproject in parallel with the preparation of this IEE. A summary is provided in the paragraphs below and the following sections.

119. In the six subproject villages there reside 291 households (389 families) with 1,816 inhabitants (842 females) and composed of four ethnic groups. Among them, 37 percent (108 households) are ethnic Lao (following Buddhism) and 33 percent (97 households) are ethnic Tai-Daeng (following Animism), both belonging to the Lao-Tai Ethno-linguistic Group and speaking the Lao-Tai Language. Some 12 percent (34 households) are Hmong and speak the Hmong Language, and 18 percent (52 households) are Iu Mien and speak the Iu Mien language; these two belong to the broader Hmong-Mien Ethno-linguistic Group and follow Animism. There is no significant vulnerable ethnic minority within the subproject villages, according to both the WUG Committee and all of the village authorities. The demographic characteristics of all subproject villages are presented in Table 11.

120. Households generally comprise of one family, although 34 percent (98 households) have two families. The average size of household is 6.2 (4.6-5.3 for ethnic Lao; 5.3-6.1 for ethnic Tai-Daeng; 7.4 for ethnic Hmong and 6.8 for ethnic Iu Mien). It is confirmed that there are no landless households. One Lao female-headed household is present in Namao village and two Hmong female-headed households live in Homphan village. Both village authorities confirmed that they regularly organise help for them in rice transplanting and harvesting.

121. The number of poor households is only one (3 percent) in Namao, none in Meuang Poua, 11 percent (7 households) in Homphan, 11 percent (3 households) in Nasa, 6 percent (2 households) in Poung (Poua) and 13 percent (8 households) in Phonthong.

b. Social Resources

122. The six subproject villages are scattered along National Road No. 6A and on the Nam Poua River. All villages are connected with the power gridline and covered by mobile cellphone networks. It is confirmed by the village authorities that all school-age children have access to the schools. There is one elementary school (class 1-3) in each subproject village. There is also a lower secondary school in Homphan village for all appropriately aged children of the Kumban, with distances of one to five kilometres from each subproject village. An upper secondary school and a technical and vocational college are in Viengxay Urban (22 to 27 km); and universities are located in Luang Prabang City (520 km) and Vientiane Capital (650 km) away.

123. There is one Kumban dispensary located in Meuang Poua village, providing a basic primary health care for less serious cases, For severe health problems or birth attendance, villagers have to go to the District Hospital in Viengxay District, between 22 and 28 km from home, or to the Provincial Hospital in Samneua Urban (the provincial capital of Houaphan), 25 to 30 km away. The primary means of getting to health (and other public service) facilities is by motorbike or pickup. The condition of the road is very good and travelable all season since the National Roads 6 and 6A were upgraded in 2015 by the ADB12 Project. The distances to the public facilities are shown in Table 11.

Table 11: Access to Public Facilities in District and Provincial Centres

Subproject Village	Distance to Primary School (km)	Distance to high School (km)	% School aged at school	Distance to Health Post (km)	Distance to nearest regular market (km)	All year road access (Y/N)
Namao	2	22	100%	2	2	Yes
Meuang Poua	0.5	1	100%	0.5	0.2	Yes
Homphan	0.02	0.01	93%	0.6	0.6	Yes
Nasa	1	25	100%	2	3	Yes
Poung (Poua)	0.01	2	100%	2.5	2.5	Yes
Phonthong	0.02	0.01	100%	5	5	Yes

Table 12: Demographic Characteristics of the Subproject Villages

Subproject Village	Population				Religion/ Belief (HH)		Ethnic Group												Average HH size	Average family size	No. of female headed	Poor HHs	HH
							Lao-Tai Ethno-Linguistic Group						Hmong-Mien Ethno-Linguistic Group										
							Lao ethnic			Tai Daeng ethnic			Hmong ethnic			Iu Mien ethnic							
	No. of household	No. of Family	Total population	No. of female	Buddhism	Animism	No. of HH	No. of Pop.	No. of female	No. of HH	No. of Pop.	No. of female	No. of HH	No. of Pop.	No. of female	No. of HH	No. of Pop	No. of female					No. of vulnerable HH
	(HH)	(Fam)	(Pers.)	(Pers.)	(HH)	(HH)	(HH)	(Pers.)	(Pers.)	(HH)	(Pers.)	(Pers.)	(HH)	(Pers.)	(Pers.)	(HH)	(Pers.)	(Pers.)	(Pers./ HH)	(Pers./ Fam.)	(HH)	(HH)	(HH)
1. Namao	30	32	160	75	30		30	160	75										5.3	5.0	1	1	1
2. MeuangPoua	78	83	362	168	78		78	362	168										4.6	4.4			
3. Homphan	64	93	468	230		64							34	252	120	30	216	106	7.3	5.0	2	7	
4. Nasa	27	36	143	63		27				27	143	63							5.3	4.0		3	
5. Poung (Poua)	32	38	194	102		32				32	194	102							6.1	5.1		2	
6. Phonthong	60	107	489	204		60				38	354	156				22	135	48	8.2	4.6		8	
Total	**291**	**389**	**1,816**	**842**	**108**	**183**	**108**	**522**	**243**	**97**	**691**	**321**	**34**	**252**	**120**	**52**	**351**	**154**	**6.2**	**4.7**	**3**	**21**	-
% of female population (%)			**100%**	**46%**				**100%**	**47%**		**100%**	**46%**		**100%**	**48%**		**100%**	**44%**					
% of Population by Ethnic Group (%)	100%						37%			33%			12%			18%							
% of HHs by religion/ Belief (%)	100%				37%	63%																	

124. It was reported that some villagers drink bottled water produced and delivered by factories located in Viengxay Urban. However, the majority of inhabitants drink boiled water (hot tea or traditional medicinal herbs) and use water from the gravity feed systems for boiling. In terms of domestic use water, all inhabitants share water from the village gravity feed systems supported by non-government rural development organisations. All households in four villages (Meuang Poua, Nasa, Poung (Poua) and Phonthong) have and use their own household toilets, but some 10 percent of households in Namao and 20 percent in Homphan still do not have toilets.

4. Livelihoods, Agriculture, Development and Economic Conditions

125. Agriculture dominates the livelihoods of the subproject villages. The total low-lying land areas are around 327 ha, of which 188 ha are irrigated and used for wet season rice and 139 ha are used for the cultivation of different consumable crops (cassava, sweet corn, chilli, lemon grass, ginger, galangal, eggplant, bean, pumpkin, soy bean, groundnut, etc.).

126. Little Chicken Rice (Khao Kai Noy) is a main consumable crop planted during the wet season for both household consumption and sale. Sales are restricted to surplus quantities from time to time, both within the local market and to buyers from Viengxay and Samneua Districts and elsewhere. The area planted to wet season rice is around 188 ha by 291 households. Water melon, cucumber and mixed vegetables have been planted for cash sales in the dry season in irrigated areas of Nam Poua and other irrigation schemes within the subproject villages. The total area planted to cash crops is around 64 ha by 107 households (37 ha used the Nam Poua scheme).

127. Since the Land Use Planning and Land Allocation (LUPLA) campaign[4] was applied in these villages, the slash and burn use of upland area has been reduced. Only a limited number of people in Homphan, Poung (Poua) and Phonthong villages now practice some form of upland cultivation. There are 28 households in Homphan that still practice non-fixed upland rice mixed with consumable crops over 30 ha of land, and 22 households utilise a fixed area swidden system on a 5 to 6-year rotation on 50 hectares. Two households in Poung (Poua) village have 0.8 ha of permanent upland rice, and five households in Phonthong practice upland field planting of consumable vegetables (lemon grass, pumpkin, galangal, ginger, etc.) on two hectares of land.

128. Cash crops planted in the dry season are mainly water melon, cucumber and vegetables such as garlic, lettuce, tomato and onion. Fruit trees planted in the area are orange, longan and banana (46 ha) and tung oil (*Vernicia*) and *Spondias* trees (28 ha), and are for cash sales from the subproject villages. Tung oil has local potential for organic fuel production in northern Lao PDR.

129. Household incomes aggregated from the sample household survey (30 households in different well-being ranking levels) demonstrate that major incomes are from off-farm activities including government and private sector salaries, labour for construction work, provision of transportation services, small businesses, marketing, sale of handicraft products (mainly weaving) and remittances from family members working out of the villages and particularly in Vientiane. Incomes from farming are mainly from wet season rice production, from dry season cash crops (water melon, cucumber and vegetables), fruits and tung oil nuts, and the sale of large

[4] The LUPLA is one of a series of approaches and policies used since the early 1990s by the Government of Lao PDR and its donor partners in many parts of the country to reduce shifting cultivation, stem forest decline, and stabilise and develop agriculture.

livestock. Among non-timber forest product, there is very limited collection and sale of bamboo shoots and wild vegetables among the villages.

130. The average household income is at 43.6 million Kip per year for relatively well-off households, 16.0 million Kip for middle-income and 6.1 million Kip for poor households. The average income per capita per month is 595,464 Kip, which is 3.3 times higher than the poverty line of 180,000 Kip per person per month) for the better-off group, 247,160 Kip (1.3 times higher than the poverty line) for the middle group and only 81,389 Kip (less than half the poverty line) for the least well-off.

5. Cultural and Scenic Matters

131. None of the communities or authorities consulted reported any areas of cultural value that would be affected by the proposed subproject.

132. The only site of scenic value in the area affected is the Nam Nua waterfall. This is in a tributary of the Nam Poua, close to the confluence of the two rivers, and has the classic beauty of a Laotian forest waterfall in a clear-flowing mountain catchment (Figure 12). It is located about 12 km upstream of the subproject's intake, and the subproject is not expected to have any impact.

133. There is a district-level plan, endorsed by the Provincial Information, Culture and Tourism Office, to develop the area around the waterfall and improve access to it. The total site area proposed is 39 hectares. It is expected to be particularly popular at festival periods such as Pi Mai Lao. The waterfall is close to an existing irrigation headworks (not part of this subproject), and as Figure 12 also shows, the distant view on approach is already spoilt by this infrastructure. The development of the site has been started, but then halted due to lack of funding. An area of access road has been constructed, which in itself is casting sediment into the Nam Poua. If this is not managed wisely in the future, it could continue to contribute sediment into the river, and eventually into the subproject's scheme.

Figure 14: Two Views of the Nam Nua Waterfall.
[The weir shown is not connected with this subproject]

6. Data Gaps

134. With respect to rainfall and hydrology data, the complete absence of detailed information for the subproject catchment is the single biggest concern regarding the evaluation of the environment within which the proposed works and development will be undertaken. Even for the province as a whole, although there are two weather stations showing generally similar patterns, there is still considerable variability between them, and the entire data set lasts for only 18 years. This is nowhere near long enough to provide a robust view of extremes.

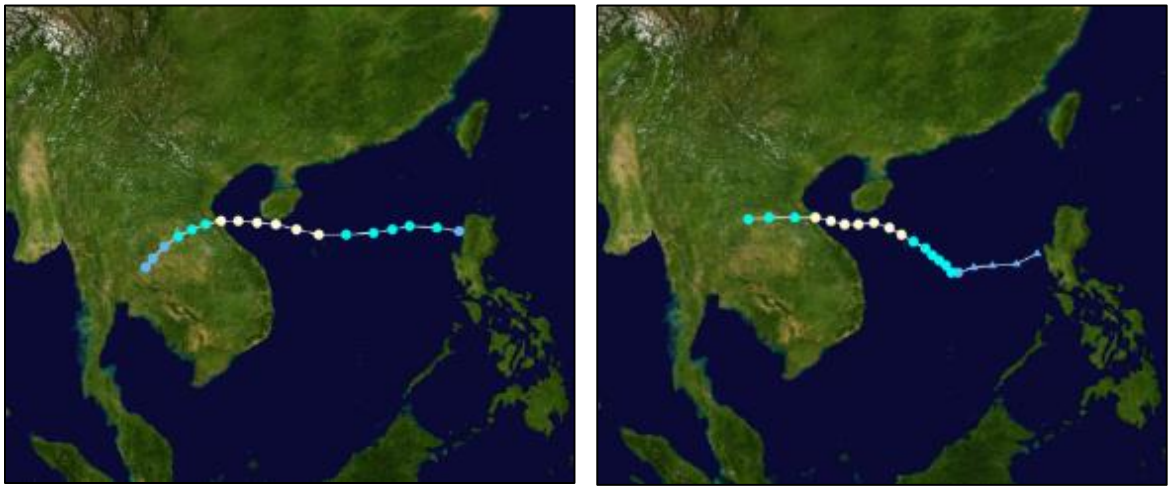
135. For biodiversity, the obvious data gap is the absence of catchment-specific biological studies. For the general area, the Integrated Biodiversity Assessment Tool highlights the large proportion of fishes which are listed as Data Deficient by the IUCN. A considerable number of invertebrates are also listed as Data Deficient.

I. Climate Change Considerations

1. Current Understanding of Climate in Houaphan

136. The current understanding of climate in Houaphan is limited by the restricted data for the province, and the consequent need to extrapolate from other areas. Figures 7 to 9 give the available precipitation data from the meteorological stations at Sam Nua and Vieng Say. The analysis given in the baseline statement on climatic conditions earlier in this IEE also discusses the evidence for extreme rainfall events, which are mostly linked either to tropical storms, particularly when developed into cyclones or full typhoons, or localised thunderstorms. Figure 15 shows the tracks of two severe tropical storms (typhoons at the point of landfall in Viet Nam) which both led to unusually heavy rainfall in the province. Lekima in 2007 appears to have given rise to 188 and 176 mm of rain in one day, recorded at Sam Nua and Vieng Say respectively.

Figure 15: Tracks of two Tropical Storms affecting Northern Lao PDR: Left, Lorna in September-October 1972; Right, Lekima in September-October 2007.



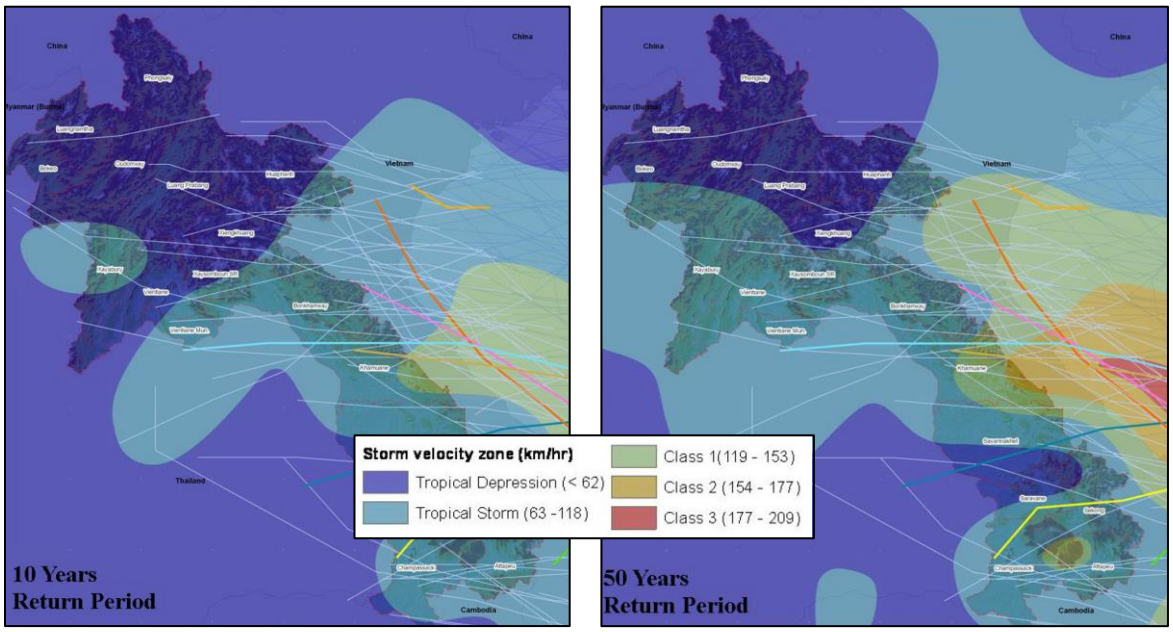
Sources: NASA.

137. While Figure 15 shows the effects of two storms many years apart, a wider range of data have been analysed to determine the overall storm risk: these are shown in Figure 16 for two possible return periods. Even so, these data so far cover only a 30-year period, and so also give

only what can best be described as an approximation. While these show that the whole of Lao is susceptible to the impacts of tropical depressions, even on a projected 50-year return period, storms of typhoon force barely appear to touch the eastern side of Houaphan Province: the risk is much less than in Khammouane Province, far towards the south. Sometimes the proximity of storms does not actually translate into extreme rainfall: for example, storm Kai-tak in 2005, which moved north-westwards through Viet Nam after making landfall at Hué and came close to Houaphan (the red track shown on the maps in Figure 16), cannot be distinguished in the rainfall records in Figures 7 to 9.

138. At the other end of the climate moisture scale, droughts can also be a feature in Houaphan. These can occur as relative effects at any time of year, since in meteorological terms they are defined as a drier deviation from "normal" rainfall. Drought hazard maps and frequency charts for a range of depths of drought are shown in Figure 17. These demonstrate that droughts can occur in Houaphan at any time of year, but more so in the wet season. Nevertheless, Houaphan is not a badly affected province at any time of year, and the risks are relatively low.

Figure 16: Storm Risk Maps of Lao PDR. Left, 10 Years Return Period; Right, 50 Years return Period. Based on Data from 1979 to 2009.



Source: United Nations Development Programme. 2010. Developing a National Risk Profile of Lao PDR. Part 1: Hazard Assessment.

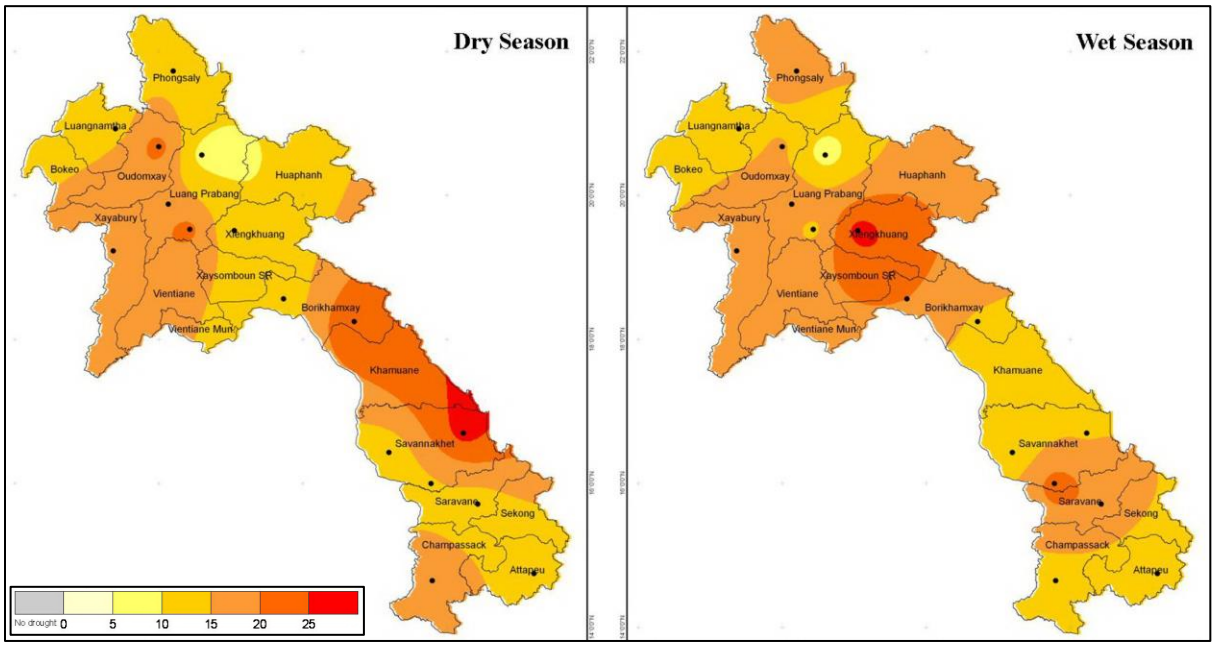
2. Climate Change Risk Assessment

139. The Nam Poua subproject has been screened using the regional-level AWARE^{TM} climate risk assessment tool. The overall climate risk level determined is "high risk". This is on the basis of identified high risks of floods, landslides, onshore category 1 storms and wild fires; and risks of changes in precipitation (either increase or decrease), changes in solar radiation and temperature increases. A radar chart presenting these risks is given in Figure 16. Any project falling into the overall high risk rating requires further analysis, and this is provided in the subproject's Climate Risk and Vulnerability Assessment.

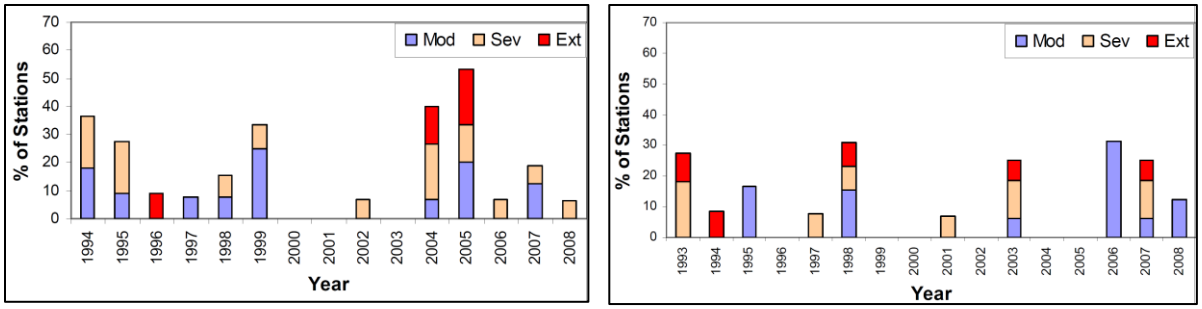
140. The radar chart provides only an overview of individual risks that are likely to be significant. Wild fires are not considered to be a local threat for the Nam Poua area, but the high exposure recorded in the AWARE™ tool means that between 1997 and 2010 there have been on average more than 20 fires per year observed in the region. Floods and, in susceptible terrain, landslides, are related to extreme precipitation events. As described above, these are already a serious threat to infrastructure, and certainly require careful consideration. Category 1 typhoons storms certainly occur in the region, but it seems that by the time they penetrate to Houaphan, they have moderated into severe tropical storms or less by the time they reach this far inland (as shown in Figure 14). Nevertheless, these are certainly a high risk, and at present tend to be the causes of the most severe rainfall events.

141. Drought risk is not considered by the AWARE™ tool, although the decrease in precipitation is a possible risk[5]. However, as this could be a potentially serious issue in relation to irrigation, it is considered in the subproject CRVA.

Figure 17: Moderate to Extreme Drought Susceptibility Maps: Numbers of Droughts between 1980 and 2009, based on Standardised Precipitation Indices. Below: Drought Occurrence by Year, Severity and Proportion of Recording Stations: Left, Dry Season; Right, Wet Season.

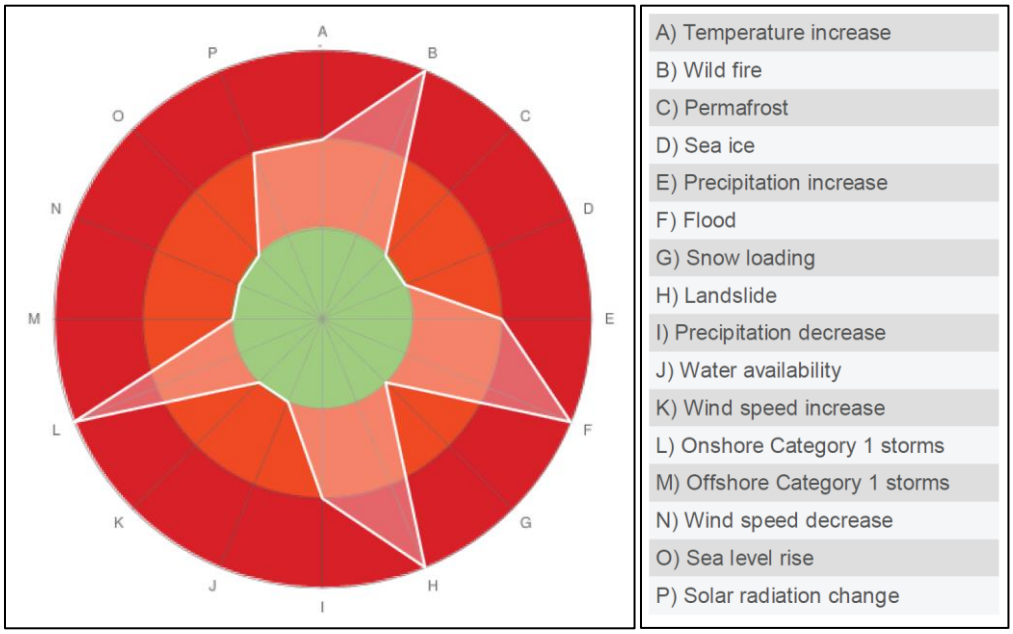


[5] AWARE report on declining precipitation is caveated by (i) a projected small magnitude of change and with high levels of uncertainty such that the output notes that increases are only slightly less probable than the project reductions. The uncertainty, along with a lack of frequency duration of no or below average rainfall linked to projected ET changes would indicate limited drought risk information being generated by AWARE.



Source: United Nations Development Programme. 2010. Developing a National Risk Profile of Lao PDR. Part 1: Hazard Assessment.

Figure 18: Climate Risk Radar Depiction from the AWARE™ Tool
The Red Outer Band Denotes High Risk Parameters.



J. Environmental Impacts and their Mitigation

1. Environmental Justification

142. The main justification for the Nam Poua Subproject is that it will provide both improved irrigation facilities for 275 households in six villages. The upgraded irrigation systems will allow for better dry season cropping options through more reliable water supplies outside the rainy season. This will allow each participating household to increase its incomes from the more intensively used irrigated land, thereby improving livelihoods. While this will free up money to pay for agricultural inputs and improvements to generate a virtuous circle of wealth creation from farming, it will also ensure that the households are better off overall and therefore more able to tap into social capital opportunities such as health care and education. Hence there should be significant benefits to socio-economic environmental conditions.

143. Improved lowland irrigation generally also results in reduced pressures on the less productive uplands. This in turn helps to move the farming system away from its dependence on the remaining upland forests, because they are no longer reliant on the traditional systems of shifting cultivation and the growing of the less productive dryland rice and other crops. Forests will still retain a place in the livelihoods system, but more for the collection of non-timber forest products than for land conversion and subsequent cropping. This is still disturbing for biodiversity, but far less damaging than the wholesale slash and burn clearance that is part of shifting cultivation. Hence there is expected to be a greater degree of forest conservation in the revised upland land use management plan that will accompany the subproject, with better soil protection and safeguarding of biodiversity. Therefore the subproject is also expected to generate benefits for the bio-physical environment.

2. Environmental Safeguards – Overview

144. Under the SRIWSM, ensuring environmental safeguards is a requirement of ADB financing. For this reason, adherence with the findings of this IEE and the EMP that accompanies it, forms a loan covenant.

3. Potential Adverse Environmental Impacts – Overview

145. The largest environmental impacts from the subproject are likely to relate to the volumes of water taken off the Nam Poua, and the effects of downstream users and ecology. Niether of these are not expected to change as a result of the subproject, it is not clear that the existing scheme is leaving appropriate volumes in the river for the environmental compensatory flow downstream of the headworks. At the design stage it is difficult to know exactly how much water is available due to the lack of year-round data on the flows of small rivers in northern Lao, and the large amount of study that would be required to understand the exact requirements of other water uses. To overcome these potential impacts, the following pragmatic process must be followed to address potential negative impacts.

(i) All available rainfall and flow data for the river catchment will be collected and assessed to provide a working model of average monthly flows throughout the year. Limitations in the data must be acknowledged to make clear both the requirements for further knowledge and the extent to which the design is based on approximations.
(ii) A river staff gauge will be placed on the river close upstream from the main headworks. Responsibilities must be assigned for managing these instruments and collating the data.
(iii) The proximity and flows of tributary streams close downstream from the proposed headworks must also be assessed. These might help to resolve downstream requirements while allowing a greater offtake.
(iv) A survey must be undertaken which establishes the cumulative minimum water needs of other existing users, plus ecological requirements.
(v) A calculation must then be made as to the offtake that can be allowed. The rationale and assumptions used must be recorded as part of the scheme design, since these will need to be revisited when more information is available.
(vi) During the TRTA the options for improving water use efficiency has been integrated into the engineering design e.g. pipe and spray or drip systems rather than flood irrigation.
(vii) Once scheme operation commences, the gauged river flows and water offtake volumes must be reassessed. These, along with a follow-up ecological survey plus

any complaints from downstream users, must be used to recalculate the allowable offtake. The scheme must then be revised accordingly.

146. It may not be possible to establish a fully quantified calculation of the minimum acceptable downstream flows, particularly because of the difficulty of determining ecological needs without long term studies.

147. As part of the design phase a precautionary approach will be adopted with respect to water flow and environmental flows that are not defined in the environmental institutional framework for GOL.

148. Reduced flows in rivers and streams can have consequences on both biodiversity and downstream water uses. Aquatic biodiversity is directly affected for the following main reasons: (i) water flow levels are a major determinant of physical habitat in streams, which in turn is a major determinant of biotic composition; (ii) aquatic species have evolved life history strategies primarily in direct response to their natural flow regimes; (iii) maintenance of natural patterns of longitudinal and lateral connectivity is essential to the viability of populations of many riverine species; and (iv) the invasion and success of exotic and introduced species in rivers is facilitated by the alteration of flow regimes (Bunn and Arthington, 2002). Mitigation is by setting minimum environmental or compensatory flows, which must be maintained throughout the year. These might typically be based on a proportion of dry season flow; but as flow regimes are not well understood in most small catchments, they may need to be based on approximations.

149. Excessive water flows are also damaging, but mainly to infrastructure. Floods can damage irrigation headworks but more often cause damage along canals. Flood overflow structures are needed, either to reduce flood water entry into canals, or to divert the water back into the river from an overflow weir on the side of the canal.

150. The use of agrichemicals, both fertilisers and pesticides, are likely to be increased as a result of the subproject. Without adequate training and extension support, farmers are apt to misuse these substances unintentionally, but often with very damaging consequences. Excessive phosphates and nitrates can alter the biochemistry of waterways significantly, particularly affecting algal growth and its use of dissolved oxygen. Many pesticides are very damaging to aquatic biota, and some can persist in the soil or at different levels in the food chain. Two legal provisions are in place to control pesticides: Regulation on the Control of Pesticides in Lao PDR (Regulation No 2860/MAF, 11 June 2010); and Decree on Pesticide Management: (Decree No. 258/GOV, 24 August 2017). Nevertheless, there is evidence that enforcement of these provisions is limited, especially in remote areas where banned substances are easily brought across national borders and sold with labels only in Thai and Chinese scripts. The Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade, to which Lao PDR acceded on 9 October 2010 and entered into force on 20 December 2010, gives an international dimension to potential control measures.

4. Evaluation of Potential Adverse Environmental Impacts

151. The identified environmental impacts have been listed according to the various subproject periods: (i) planning and design phase; (ii) construction phase; and (iii) the subsequent indefinite operation period. They have then been rated according to the judged level of significance. The significance is further elaborated by the ease and extent to which these impacts can be mitigated. Many of the criteria have required an essentially qualitative judgement, which has been undertaken by environmental specialists not involved in the design proposals, and in consultation

with local authorities and farmers. The anticipated potential adverse environmental impacts and the rating of their significance is given in Table 13. Brief comments are also provided on the rationale behind the significance evaluation.

Table 13: Anticipated Environmental Impacts and their Level of Significance

No.	Environmental Impact	Anticipated Significance
Subproject Planning Phase		
1.01	Loss of land or other property to infrastructure.	Low. Very little land affected and land values will increase (a project benefit).
1.02	Loss of land of importance for biodiversity.	Low. Infrastructure is in areas of very low biodiversity value according to IEE consultation and fieldwork findings.
1.03	(a) Incomplete hydrological data and as yet poorly developed climate change models lead to inaccurate designs for infrastructure. (b) Infrastructure is damaged by high flood levels, reducing the scheme's lifespan or effectiveness and causing damage to the nearby environment. (c) Downstream riverine quality is affected in very dry years due to abstraction of water for irrigation.	High. Mitigation measures for both high and low flow levels are required to resolve data gaps.
1.04	Disruption of hydrological flows by increased offtake from rivers.	Low. Designs are to be fine-tuned and managed on the basis of environmentally allowable offtake.
1.05	Water supplies polluted by upstream land management practices do not comply with national standards for surface water.	Medium. Water quality monitoring is required to ensure that it meets national standards.
1.06	Upstream land uses cause a decline in the quality and quantity of water available for the irrigation scheme.	Medium. Pro-soil conservation watershed management schemes are required as part of the GIZ cofinanced project.
Subproject Construction Phase		
2.01	(a) Release of silt into water courses from excavations and earthworks during construction. (b) Release of silt into water courses from poorly finished earthworks following construction.	Medium. This is a common problem on many projects, but it can be managed by the contractor and monitored by the project implementing agency. Appropriate bio-engineering measures are recommended.

No.	Environmental Impact	Anticipated Significance
2.02	Environmental damage of any form results from the poor understanding of subproject requirements by the contractor and subcontractors.	Medium. This is a common problem, but the PPIT must manage the contractor to ensure that it does not happen here. Clear mitigation measures are to be included in all works contracts.
2.03	Clearance of vegetation leads to the unnecessary removal of trees and other plants.	Low. This can be managed by the contractor and monitored by the project implementing agency.
2.04	Temporary closure of irrigation systems during construction.	Low. This can be agreed between the water users and contractor.
2.05	Disposal of soil from excavations such as irrigation canals.	Low. This can be managed by the contractor and monitored by the project implementing agency.
2.06	Release of dust into the atmosphere from excavations and other construction activities.	Low. This can be managed by the contractor and monitored by the project implementing agency.
2.07	Release of noxious gases into the atmosphere.	Low. This can be managed by the contractor and monitored by the project implementing agency.
2.08	Noise nuisance from construction activities.	Low. This can be managed by the contractor and monitored by the project implementing agency.
2.09	Temporary use of land for construction affects livelihoods or leaves it damaged. This may include borrow pits.	Low. This must be agreed between landowners and the contractor, and monitored by the project implementing agency.
2.10	Influx of temporary labour disrupts local communities.	Low. This can be managed by the contractor and monitored by the project implementing agency.
2.11	Operation of construction machines affects both workers and local society.	Low. This can be managed by the contractor and monitored by the project implementing agency.
2.12	Pollution by hydrocarbons from construction plant.	Low. This can be managed by the contractor and monitored by the project implementing agency.

No.	Environmental Impact	Anticipated Significance
2.13	Pollution from construction site wastewater, from camps and other work sites.	Low. This can be managed by the contractor and monitored by the project implementing agency.
2.14	Pollution from solid waste materials.	Low. This can be managed by the contractor and monitored by the project implementing agency.
2.15	Injuries to workers and others.	Low. This can be managed by the contractor and monitored by the project implementing agency.
2.16	Disruption of cultural sites.	Low – no site have been identified during design. This can be managed by the contractor and monitored by the project implementing agency. All chance finds of such assets or sites will trigger a stop work and a reporting to the PPIT. The PPIT shall assess the need for mitigation or additional management requirement for the contractor
2.17	Subsequent users may not fully understand how to manage the subproject works.	Medium. This is a common problem, the design process has incorporated Water users in the design options and operational requirement, The IFAD cofinanced project will support water use management capacity development.
Subproject Operation Period		
3.01	Disruption of downstream hydrological flows due to offtake from river.	Low unlikely to change from without project scenario. Water offtake is to be fine-tuned and managed on the basis of environmentally allowable volumes.
3.02	Upstream land uses cause a decline in the quality and quantity of water available for the irrigation scheme.	Medium. Catchment investment will be undertaken under a separate project agreement with GIZ .

No.	Environmental Impact	Anticipated Significance
3.03	(a) Extraction of water from river causes a decline or loss of aquatic biodiversity. (b) Extraction of water from river leaves downstream users short. (c) Subproject irrigation scheme requires more water than is available.	Low. The river is already a highly altered environment, the changes to the flow regime are expected to be modest and have been the subject of detailed assessment. In addition, long term monitoring and refinement is a required mitigation measure.
3.04	(a) Flood damage to headworks. (b) Erosion of canal banks, either from flood surges or normal flows.	Low. The subproject design specifically aims to make these resilient.
3.05	Increased agrichemical use	Medium With the increased area under dry season cropping and the likely increase in intensification of dry season cropping Higher risk to farmer workers and handlers of agrichemicals relates to the EHS risks of agrichemical handling, mixing and application in the short term. Risk from agrichemical over use is unlikely in the medium term, Lao GAP certification requires safe production principles including IPM and PRT.
3.06	Increased nutrient use	Medium to High
3.07	Water Quality Impact	Low significance. Water quality will be improved through upper watershed management and within the command area the ability to control water movement will limit contamination risk and the proposed cropping agrichemical use is low.
3.08	Water Quality Impact	Low significance. Water quality will be improved through upper watershed management and within the command area the ability to control water movement will limit contamination risk and the proposed cropping agrichemical use is low.

5. Environmental Mitigation Measures – General

152. The subproject is classified as Category B for environmental impact. Under the classification of the proposed subproject into MONRE category 1 and ADB category B, all adverse environmental impacts must be mitigated; if they cannot be mitigated, then the category of the subproject would need to be changed and a full EIA undertaken, making it ineligible for SRIWSM financing. Hence ways must be found to avoid, minimise or restore all potential impacts found in the course of designing and implementing the Nam Poua Subproject. The detailed mitigation measures depend on individual site conditions. However, in most cases there are only a limited number of options for the mitigation of certain issues. The proposed mitigation measures are

therefore listed in the EMP, covering all of the main impacts that are likely to occur. Most of them represent simple, practical, common sense measures to ensure that disruption is limited to the minimum as a result of all subproject activities.

153. In some cases, mitigation measures cannot be defined precisely because there is inadequate information on which to base precise actions. Water flows are particularly little understood because to date there have been very few gauging stations maintained in smaller catchments. Defining compensatory flows throughout the year is therefore difficult, and initially must be based on estimates. The mitigation strategy in this case is to use as much information as possible to ensure that the initial estimates are as accurate as they can be, while starting to collect continuous series monitoring data. Because of natural variations from year to year, this process needs to be continued every year for at least ten years, and ideally throughout the life of the infrastructure, so that the compensatory flows can be updated as the running averages, minima and maxima for flow in each month become more statistically robust.

154. Both to realise the environmental benefits of the project and to safeguard the infrastructure investments, catchment land use needs to be improved in the Nam Poua watershed. Part of the rationale for the SRIWSM (though in Houaphan it is proposed to be implemented under a separate project with its own safeguards agreements and requirement) is to assist the rural population to reduce its dependence on upland agriculture, since other land pressures mean that shifting cultivation is no longer just used by a limited population for subsistence, but is being used to produce cash crops for export and as a result is giving rise to an unsustainable rate of forest conversion. Loss and fragmentation of the forests has had a major impact on biodiversity. It has also affected the hydrology of many hill catchments, so that there is likely to be less retention of moisture from rainfall in the catchment, with increased runoff and shorter duration flood hydrographs with higher peak levels. Periodic disturbances to vegetation cover have also increased sediment fluxes in the rivers. In the long term, the effectiveness of the subproject irrigation facilities depends on the stabilisation of the forest cover in the upper catchment. This in turn requires the communities within the catchment to adopt improved land use planning, which will focus on intensified agriculture in the irrigated land and leave a greater proportion of the watershed under a longer term cycle of forest use. Better land use management is therefore critical to the subproject achieving its purpose and to the mitigation of the impacts of increased infrastructure.

155. In a steep hilly catchment and with the intense rainfall that occurs in the Nam Poua watershed, the protection of soil surfaces is essential around all of the infrastructure that will be installed. This includes irrigation headworks, canals and access roads. There are two main purposes for this. The first is to avoid erosion from rainfall, with bare surfaces highly prone to the entrainment of soil particles as a result of raindrop impact and runoff, leading to the loss of topsoil and increased amounts of sediment in water courses. The second is to protect earthworks from flood scour, when river or canal flows overtop the structures during high floods. Simple bio-engineering measures are the only effective way of protecting large surface areas from rainfall-induced erosion, and so this is a straightforward but critical mitigation measure for targeted areas.

6. Potential Adverse Environmental Impacts – Design Phase

156. Design phase environmental impacts are expected to be minimal but should still be recorded and plans made for their mitigation. Potential impacts might come particularly from geotechnical site investigations for structure foundations, or as a result of vegetation clearance for surveying.

157. Identified impacts and the proposed mitigation measures for the subproject design phase are listed in Table 14: these are an extract from the impact, mitigation, responsibility and monitoring tables provided in the EMP.

158. A key part of the design period is to set the scene and conditions for the successful implementation of the project and the subsequent operation of the infrastructure it will provide. To ensure that this happens effectively, there are non-negotiable key environmental elements that must be incorporated into all subproject agreements and which, like all environmental compliance, are a condition of financing.

(i) A river staff gauge plate will be installed on the Nam Poua above the headworks. PAFO must show an annual review of calculations for minimum base compensatory flows within each river course, during each calendar month. Records of the data (both primary and interpreted) and reviews must be lodged with the Department of Irrigation (MAF) and the Department of Water Resources (MONRE) in Vientiane, to help build up the national databases.

(ii) A catchment land use plan is recommended and will be developed under the PLUP provisions of the GIZ cofinanced project. The plans primary objective is upstream catchment protection to ensure that the subproject irrigation scheme is safeguarded in terms of water supply and limited sediment supply. It is proposed to be implemented by the proposed GIZ / GCF project.

(iii) Protection measures must be designed and implemented as part of all elements of infrastructure. Engineering designs must not be approved without adequate provision of protection against high flood conditions. Construction must not be approved as complete before all protection works have been finished as per the design. The purpose of the protection measures is to ensure that the subproject infrastructure and surrounding land can sustain climate-induced events – mostly high flood levels – both under current climate conditions and potentially more extreme over the period between 2020 and 2050. These measures would typically be a combination of bio-engineering and hard engineering works.

(iv) Water used for irrigation and fish ponds are expected to comply with the National Environmental Standards (2017)[6]. This is to ensure that it does not cause downstream pollution as a result of contaminants entering the rivers from land uses in the catchment above the headworks. This may alter as a result of different activities that are introduced in response to changing circumstances. Contaminants can be transported either in direct solution in water that has leached through the soil, or in soil colloids carried in suspension. Fertiliser residues such as nitrates and phosphates can be harmful to aquatic life. Some chemicals from pesticides can enter the food chain or remain persistently in soil and plants.

[6] The implementation arrangements for the standards are yet to be defined and regulated. This is currently work in process and is expected to be completed during the implementation period of the project at which point the arrangements for water quality may need to be re specified through a PAM update.

Table 14: Anticipated Environmental Impacts and Mitigation Measures during the Subproject Planning Phase

No.	Anticipated Impact	Proposed Mitigation Measures
1.01	Loss of land or other property to infrastructure.	1. Full consent to the subproject must be sought through standard consultative processes. 2. Full and fair compensation based on the provision of the Land Acquisition and Resettlement Framework to be applied.
1.02	Loss of land of importance for biodiversity.	1. Subproject landtake is to be minimised. 2. Landtake is to use land that is already degraded, to the greatest extent possible. 3. Subprojects in forest or protected areas, would not be eligible for SRIWSM financing.
1.03	(a) Incomplete hydrological data and as yet poorly developed climate change models lead to inaccurate designs for infrastructure. (b) Infrastructure is damaged by high flood levels, reducing the scheme's lifespan or effectiveness and causing damage to the nearby environment. (c) Downstream riverine quality is affected in very dry years due to abstraction of water for irrigation.	1. Care is to be used to interpret as well as possible the best available data for the subproject catchment. 2. A significant margin is to be allowed to ensure that infrastructure is likely to be resilient under current climatic conditions. 3. An additional margin is to be allowed to ensure that infrastructure remains resilient under possible future more intense or prolonged rainfall events. 4. Specially designed protection measures such as bio-engineering must be incorporated into designs as a matter of course. 5. Engineering designs must not be approved without adequate provision of protection against high flood conditions. 6. In very dry periods, released flows from the intake must be monitored to ensure that the minimum agreed environmental base flow is always provided downstream of the intake.

No.	Anticipated Impact	Proposed Mitigation Measures
1.04	Disruption of hydrological flows by offtake from rivers.	1. All available rainfall and flow data for the river catchment must be collected and assessed to provide a working model of average monthly flows throughout the year. 2. A hydrological gauging station must be established on the subproject catchment, upstream of the headworks, to help define acceptable dry season minimum flows. The proximity and flows of tributary streams close downstream from the proposed headworks must also be assessed. 3. A survey must be undertaken which establishes the cumulative minimum water needs of other existing users, plus ecological requirements. 4. A calculation must then be made as to the offtake that can be allowed. 5. Where no flow data exist, initial minimum flows of at least 30 percent of the estimated monthly average flow must be used as the abstraction criterion. 6. Offtake regimes must be refined as more data become available.
1.05	Water supplies polluted by upstream land management practices do not comply with national standards for surface water.	1. An assessment must be made of the quality of water at the headworks and its likely suitability for use in irrigation. 2. PONRE and Department Agriculture Land Management (DALAM) will, if necessary, monitor the use of chemicals during the life of the project.
1.06	Upstream land uses cause a decline in the quality and quantity of water available for the irrigation scheme.	GIZ support is proposed for developing a catchment land use plan. The plan should be both socio-economically beneficial and environmentally sound, in that its primary objective would be upstream catchment protection to ensure that the subproject irrigation scheme is safeguarded in terms of water supply and limited sediment supply.

7. Potential Adverse Environmental Impacts – Construction Phase

159. Although the subproject construction phase will be relatively short, the impacts from it can be very significant. Access routes can be particularly destructive, and so should be subject to environmental management in as much detail as the main infrastructure works, with appropriate mitigation measures. Contractors' construction sites can be very damaging to the environment. Physical construction may be only in limited areas, but may require borrow pits or quarries elsewhere, fuel transport and storage, and temporary site camps for materials, plant, offices and labour. Poor scheduling during construction can result in activities taking place at inappropriate times, for example with earthworks being kept open through the wet season.

160. Impacts during construction may be short-lived, but they can be intense. Dust and noise pollution can be highly disturbing to local residents. A single season of sediment flows into rivers can devastate the aquatic biota, requiring perhaps years or even decades for the river to recover. One large spillage of fuel can take many years to clean up. Mitigation is therefore through the provision of preventative measures, such as through using noise abatement measures, dust suppression, sediment control and sound fuel management measures.

161. Identified impacts and the proposed mitigation measures for the construction phase are listed in Table 15: these are an extract from the impact, mitigation, responsibility and monitoring tables provided in the EMP.

Table 15: Anticipated Environmental Impacts and Mitigation Measures during the Subproject Construction Phase

No.	Anticipated Impact	Proposed Mitigation Measures
2.01	(a) Release of silt into water courses from excavations and earthworks during construction. (b) Release of silt into water courses from poorly finished earthworks following construction.	1. The removal of vegetation and creation of bare surfaces must be minimised to essential areas only. 2. Vegetation clearance and earthworks may only be undertaken during the months of October to April. 3. Temporary sediment settling ponds built using strong stone or timber check dams (not bamboo or fabric silt fences) must be constructed to trap sediment from all earthworks that have unprotected surfaces at any time during the months of April to October inclusive. 4. Borrow areas, camp sites, temporary access tracks etc. must be fully rehabilitated back to a condition that is fully protected against soil erosion. 5. Bio-engineering surface protection must be planted on all bare earthworks during the months of May to July.
2.02	Environmental damage of any form results from the poor understanding of subproject requirements by the contractor and subcontractors.	1. At a pre-mobilisation site meeting, the contractor must demonstrate a full understanding of the requirements of the EMP. 2. All of the sub-plans listed below must be created, reviewed, improved if necessary and accepted for approval. 3. The contractor must demonstrate that he is fully responsible for all subcontractors' adherence to the provisions of the EMP, and that he has formally ensured this.

No.	Anticipated Impact	Proposed Mitigation Measures
2.03	Clearance of vegetation leads to the unnecessary removal of trees and other plants.	1. No tree over 200 mm diameter at breast height (1.5 metres above the ground) may be cleared unless the design drawings specifically require it. 2. The contractor's site clearance plan must be limited to the agreed work site boundaries and must be approved by the PPIT's environmental representative before any clearance may be commenced.
2.04	Temporary closure of irrigation systems during construction.	1. Contractors must provide a plan in advance to provide irrigation water into existing supply channels, which must be approved by the project implementing agency and the Water User Group. 2. If it is not possible to avoid temporary closure, then full and fair compensation is to be paid for loss of crops as a consequence.
2.05	Disposal of soil from excavations such as irrigation canals.	1. Soil from excavations should be re-used in designs wherever possible. 2. Where soil is excess to engineering requirements and is treated as spoil, it must be disposed of in the nearest available approved location, and stabilised and protected from rainfall using bio-engineering measures.
2.06	Release of dust into the atmosphere from excavations and other construction activities.	1. Earthworks must be halted during periods of strong winds. 2. Heavily used access tracks must be sprayed with water during dry periods. 3. On all unmetalled surfaces, construction traffic must be limited to 30 kmh within 250 metres of habitation and 80 kmh elsewhere. 4. Loads of dust-making materials must be covered. 5. Crushers must be fitted with water sprays to prevent dust emissions.
2.07	Release of noxious gases into the atmosphere.	1. Vehicles and machines must be in a good condition and serviced regularly, to ensure minimal emissions. 2. All vehicles and machines must comply with the Lao PDR emissions standards.
2.08	Noise nuisance from construction activities.	1. Contractors must not exceed statutory noise levels at any time. 2. Work sites within 500 metres of habitation: (a) must not operate during the hours of darkness or on holidays; and (b) must have noise-abatement measures installed for other periods.

No.	Anticipated Impact	Proposed Mitigation Measures
2.09	Temporary use of land for construction affects livelihoods or leaves it damaged.	1. Land for use by any contractor or subcontractor must be agreed by both the PPIT and the local community authority before the contractor may have access. 2. Full and fair compensation is to be paid for loss of crops or other assets before the contractor may have access to the land. 3. The contractor must have a land restoration plan, which must have been implemented to the satisfaction of both the PPIT and the landowner before the contractor's final bill may be paid.
2.10	Influx of temporary labour disrupts local communities.	1. Contractors and subcontractors are required to use the maximum local labour possible. 2. If a significant number of staff and workers (i.e. more than 20) are to be brought into the subproject site, then the contractor must provide a management plan and code of conduct for the staff and workers, that is approved by the local community authority.
2.11	Operation of construction machines affects both workers and local society.	1. The noise and dust reduction measures listed above must be adhered to. 2. Safety measures for machine operation must be defined and approved by the project implementing agency. 3. Machine operators and workers must be trained and certificated in the safe use of machines.

No.	Anticipated Impact	Proposed Mitigation Measures
2.12	Pollution by hydrocarbons from construction plant.	1. The contractor must prepare a plan for the management of hydrocarbons, which must be approved by the PPIT before the contractor is permitted to mobilise to site. 2. Fuel and oil must be transported in properly designed vehicles meeting national standards. 3. Fuel and oil must be stored at least 50 metres from a water body, in covered and bunded locations, and dispensed under strict controls. 4. Vehicle and machine parking and service areas must have impermeable surfaces and the outlet drains must be fitted with oil traps. 5. Contractors must have spill clean-up equipment on site, and persons always present who know when and how to use it. 6. The contractor must have a land restoration plan that includes hydrocarbon facilities, which must have been implemented to the satisfaction of both the project implementing agency and the landowner before the contractor's final bill may be paid. 7. Any subcontractor must comply with the same rules, at the contractor's liability.
2.13	Pollution from construction site wastewater, from camps and other work sites.	1. The contractor must prepare a plan for the management of wastewater, which must be approved by the PPIT before the contractor is permitted to mobilise to site. 2. "Black" wastewater from sanitation facilities must be led to a properly constructed septic tank and soakaway. 3. "Grey" wastewater from washing and cooking facilities must be led to a septic tank or to a specially built reed bed filtration system. 4. Oil-contaminated water from workshops and fuel stores must be collected and taken to an approved municipal waste management facility. 5. The contractor must have a land restoration plan that includes wastewater facilities, which must have been implemented to the satisfaction of both the PPIT and the landowner before the contractor's final bill may be paid. 6. Any subcontractor must comply with the same rules, at the contractor's liability.

No.	Anticipated Impact	Proposed Mitigation Measures
2.14	Pollution from solid waste materials.	1. Solid waste must be recycled wherever possible. 2. Non-recyclable solid waste must be sent to an official landfill site. 3. Open burning of solid waste is prohibited 4. The contractor must have a land restoration plan that includes solid waste, which must have been completed to the satisfaction of both the PPIT and the landowner before the contractor's final bill may be paid.
2.15	Injuries to workers and others.	1. Work sites must be clearly demarcated using barrier tape and all non-project personnel excluded. 2. All staff, workers and visitors to construction sites must be issued with appropriate personal protective equipment. 3. All staff, workers and visitors to construction sites must be briefed on safe working procedures for that site. 5. Every construction site must have a first aid kit and at least two persons always present who are trained and competent to use it.
2.16	Disruption of cultural sites.	1. All small cultural sites (such as small shrines and graves) must be protected by the contractor during works periods. 2. A plan for the protection of cultural sites must be approved by the PPIT. 3. Once construction is complete the surrounding of such sites must be restored to their pre-construction condition.
2.17	Subsequent users may not fully understand how to manage the subproject works.	1. Instructions on managing the infrastructure must be provided to the end users before handover. 2. The operating instructions must be explained to the Water User Group. 3. Before handover, the operating instructions must be finalised and the EMP requirements included.

8. Potential Adverse Environmental Impacts – Operation Period

162. Impacts during the operation phase can be overlooked during environmental appraisal, when the tendency is to focus on the design and construction phases, since those are the periods of maximum investment. Yet the operation phase is the much longer period of time and means that environmental impacts can become progressively more significant if they are not adequately mitigated.

163. Identified impacts and the proposed mitigation measures for the operation period are listed in Table 16: these are an extract from the impact, mitigation, responsibility and monitoring tables provided in the EMP.

Table 16: Anticipated Environmental Impacts and Mitigation Measures during the Subproject Operation Period

No.	Anticipated Impact	Proposed Mitigation Measures
3.01	Disruption of downstream hydrological flows due to offtake from river.	1. Once scheme operation commences, the gauged river flows and water offtake volumes must be reassessed. These, plus any complaints from downstream users, must be used to recalculate the allowable offtake.
3.02	Upstream land uses cause a decline in the quality and quantity of water available for the irrigation scheme.	1. The catchment land use plans are recommended. The plan's primary objective is upstream catchment protection to ensure that the subproject irrigation scheme is safeguarded in terms of water supply and limited sediment supply. 2. Arrangements for implementation of the plan must be maintained.
3.03	(a) Extraction of water from a river causes a decline or loss of aquatic biodiversity. (b) Extraction of water from a river leaves downstream users short. (c) Subproject irrigation scheme requires more water than is available.	1. If these impacts occur, then it shows that the assumptions of water flow made during subproject design were wrong. This is likely to be due to a lack of flow data at design stage. 2. The minimum flow release must be recalculated, based on user needs and the latest data on river flow. 3. Water use by the subproject scheme must be reviewed against what is actually available. 4. A revised scheme management plan must be introduced, implemented, monitored and adjusted until it resolves the problem. 5.
3.04	(a) Flood damage to headworks. (b) Erosion of canal banks, either from flood surges or normal flows.	1. All flood protection works must be maintained as per the design of the subproject, or any subsequent engineering works. 2. Any flood damage must be reviewed and appropriate measures designed for resolution. 3. Occasional minor flood damage should normally be resolved by using appropriate measures. 4. The use of civil engineering structures (i.e. concrete or gabion works) may be required in the event of serious damage from exceptional floods.
3.05	Increased Use of Pesticide	5. The implementation of Lao-GAP certification will include Pesticide Reduction Training, Integrated Pest Management systems will be provided under the IFAD financed project

No.	Anticipated Impact	Proposed Mitigation Measures
3.06	Increased Nutrient input	6. Nutrient management is currently lower than international practices, however the ability to control and use nutrient inputs wisely is a key component of crop management support and crop demonstration by the IFAD financed program
3.07	Increased Greenhouse Gas Emissions	1. Likely to be low due to the gravity based irrigation system, low levels of mechanisation and limited use of Urea fertilizer
3.07	Community Safety	1. Safe access to the command area will reduce the risk to children, women that currently are required to swim during river high flows 2. Increased exposure to agrichemicals from handling, mixing and application by an increased number of users to be addressed through the PRT and IPM training programs that must include ESH risk management as part of the wider pesticide management programs 3. Reduced drudgery and time demanded for in command area water management

9. Cumulative and Transboundary Impacts

164. Cumulative environmental impacts would occur if other significant developments were to be proposed in the subproject area or close to it. At the time of planning, no such major proposals were known about. This was one of the subjects of enquiry at both provincial and district levels during the preparation of this IEE.

165. At the local level, the main cumulative impacts that might arise are restricted to the area around the irrigation headworks and the Nam Nua waterfall. Development of the waterfall site could interfere with the headworks but the risk is considered low given the distance between the water fall and the subproject headworks.

166. Engineering of the headworks improvements needs to be done sensitively to ensure that they do not detract from the appearance of the waterfall. Since the waterfall development project is short of funding, the irrigation works should include provision for bio-engineering to stabilise the spoil from the waterfall access road, which is being washed into the Nam Poua, partly upstream of the intake.

167. Sand quarrying is the other local activity with environmental impacts that can have cumulative effects along with the proposed subproject. This is giving rise to raised sediment levels in the Nam Poua and, if allowed to expand, could begin to affect bed levels, riverbank stability and flood velocities. It is important that it be addressed through the appropriate official channels to ensure that it does not adversely affect the irrigation scheme or the riverine environment in general. IT is understood that sand Mining is now banned from the Nam Poua

river and that this scenario should be retained until an acceptable sand extraction program can be agreed.

168. Transboundary impacts are theoretically possible because the subproject catchment flows ultimately into Viet Nam. However, the likely impacts were judged to be negligible on account of the nature of the subproject proposals, and the very small scale of the Nam Poua watershed in relation to the overall watershed flowing towards the Son La in Viet Nam.

K. Consultation

1. Consultation Process

169. During planning, construction and operation, the subproject developer – in this case the PAFO supported by the SRIWSM – is obliged under the EIA Decree to inform project-affected people and other stakeholders of project activities which are likely to create environmental and social impacts, and to provide access to general information about the subproject.

170. The process for public consultation and information disclosure is described in the EIA Decree. The project developer is required to make people in the affected area aware of the project and what it will involve, and to collect their views, early in the IEE process. These initial disclosure and consultation meetings must then be followed up later on, to release a draft of the IEE for comment over a period of at least 30 days. Potentially damaging impacts must be made clear to all stakeholders. Associated with this consultation process is a grievance redress mechanism that allows complaints to be heard by the authorities responsible for the project, and recorded at the district administration. The mechanism must allow concerns to be raised from village to district level and if still not resolved, to national level.

171. During IEE preparation, a series of meetings was held in the provincial, district and village centres, at which the following activities were undertaken: (i) a summary of the works proposed under the subproject was presented; (ii) discussion was held on the subproject objectives, and likely positive and negative environmental impacts, covering the construction phase and longer term operational period; and feedback was gathered in the form of any comments that the various stakeholders made, along with their suggestions on mitigation. Table 17 provides a list of the groups consulted and the dates of the meetings. Full information on the dates, attendees, topics covered and conclusions of consultations are recorded and included in Appendix 1. In some cases, comments, corrections or further information have been provided alongside the records.

Table 17: Consultative Meetings Held Regarding the Nam Poua Subproject

Group consulted	Date of meeting
Provincial Agriculture and Forest Office	19 March 2018
District Agriculture and Forest Office	20 March 2018
Provincial Agriculture Office	19March 2018
Provincial Public Works and Transport Office	19 March 2018
District Public Works and Transport Office	20 March 2018

Provincial Energy and Mine Office	19 March 2018
District Energy and Mine Office	20 March 2018
Provincial Environment Office	19 March 2018
Provincial Information, Culture and Tourism Office	19 March 2018
Village group in Namwa	20 March 2018
Village group in Meaung Poua	20 March 2018
Village group in Hom Phan	20 March 2018
Village group in Pong	20 March 2018
Village group in Nasa	20 March 2018
Village group in Na Ngern	20 March 2018
PCM Consultation in Houaphan, Nam Poua Meeting Hall	14-16th December 2018

172. Following completion of a draft IEE, the EIA Decree requires consultation meetings at provincial, district and again at village level. Once the IEE is completed, it should be summarised and made available to the public for a period of at least 30 days. For this purpose, the IEE must be prepared in both English and Lao, and distributed to district administrations, where they will be made available for public review.

173. The Public Consultation Meeting (PCM) on the draft IEE included participation from PAFO _Irrigation Section, Energy and Mine Section, Viengxay district; DONRE, Viengxay district, Water users that are affected by the work program, villagers and village head along the irrigation channel. The (PCM) with the villagers and water users on the finalize on the result of the environmental assessment. The PCM meeting confirmed:

i. Participants support the project including both villagers and district authorities,
ii. All participants agreed and understood on the potential environmental impact during the construction phase that need to be responded by all related parties including local authorities, contractors and the PPIT- PONRE/DONRE EMP roles,
iii. A prioiritisaiton to continue to stop and prohibit the sand mining particularly upstream of the irrigation channel, with regular reporting of sand pumping by the villagers and other investor with and without official permission
iv. The local authorities at district/provincial and villager level will have more cooperation in order to find (1) the proper sand collection/pumping, (2) pumping duration, and (3) potential mitigation measure for treating the sedimentation before discharge water to the natural water course.

174. The specific issues and concerns raised by villagers and water users were:

i. Enable village participation in construction monitoring within the monitoring visits, and as observers of work. Ensure environmental authorities pay more attention for monitoring the infrastructure development project, the village level should be involved/participated in the project's monitoring process.
ii. Provide employment opportunity to village laborers,
iii. To decrease the sedimentation discharge from the upstream for allowing the fish passage along the stream. This includes ensuring both district and provincial authorities take action on upstream sand mining to decrease the silt sedimentation.
iv. The report that sand pumping along the Nam Poua canal by villager has being conducted based on the natural and seasonal condition which it does not create the sedimentation.
v. The project is good purpose for the farmers and villager in order to increasing the income and improving livelihoods to support the next generation for agriculture occupation.
vi. If sufficient water is available or water savings can be found to extend the irrigation command area

175. The specific propose and concern from the district and Provincial officers propose:

i. To request the village authorities, participate for official registration of the sand mine activities particularly for the villager along the canal Nam Poua stream. They request villagers understanding on the current market need for the sand and to provide the regular information of the sand volume,
ii. Agree to have joint monitoring among village/district and provincial authorities during the project construction and operation phase,
iii. The provincial and district authorities had been official noticed and disseminated the prohibit notice for all upstream sand mining,
iv. Other cause of the sedimentation along the stream and Nam Poua canal is the road construction and soil erosion particularly during the rainy season,
v. Irrigation Division/Office will closely cooperate with the village and district authorities on the detail design of the irrigation improvement, on the construction and environmental monitoring during the construction period.

176. Irrigation Division/Office will regular share/disseminate the related plan and project design to all related Divisions/Offices in order to allow the join monitoring and better understanding about the project action plan.

2. Information Disseminated

177. The preliminary engineering designs, along with estimates of potential impacts on land, the acquisition needed and compensation and resettlement for the subproject implementation, were used as the basis for discussions in meetings with the community. 177.

Additional specific meetings were then conducted with households whose land would be affected by the proposed rehabilitation or construction. Safeguard specialists assisted project engineers to disseminate and discuss the preliminary engineering designs with the community, and particularly with the affected households.

178. The meetings provided the information required to clarify: (i) the justification of the proposed subproject rehabilitation or construction works considering the anticipated resettlement impacts; (ii) mitigation measures to restore the affected households' livelihoods and standard of living; and (iii) assistance from the community or the district administration to plan, agree and implement the mitigation and support measures for the affected households. The consultations also covered the villagers' views on measures to mitigate the anticipated impacts including compensation and design alternatives to reduce impacts.

179. More details on information dissemination and consultation are provided in the SRIWSM's Resettlement Land Acquisition and Ethnic Group Development Framework, which forms a parallel safeguard document to this IEE.

3. Results from Consultation

180. Few environmental concerns were raised during the consultations in the subproject area. Those that emerged are listed in Table 18. While most of the discussions focussed on accounts of development and environmental conditions in the general area, some participants at the consultative meetings were concerned that sand pumping and quarrying had increased the sediment load in the river, affecting agricultural activities, reducing the amount of water available for village use, disturbing fish movements, causing fish deaths and decreasing the river weed grown. Clearly these other uses of the Nam Poua will need to be reconciled with the changes proposed by the subproject as part of the implementation of the subproject.

Table 18: Matrix of Concerns Raised by Participants during Consultations

Consulted groups	Concerns raised
Provincial Agriculture and Forest Office	Soil and water. During the construction and operation phases, greater understanding needs to be developed of catchment water retention among the project and local authorities. Response: The GIZ GCF catchment program will address these concerns
District Agriculture and Forest Office Provincial Energy and Mine Office District Energy and Mine Office Village consultation groups	Sand pumping from the main stream may affect the water quality for agriculture, but due to the small amount and short-term pumping which the villagers conduct themselves under agreement with the village and district authorities. Response: The Provincial government has instigated sand mining bans and is undertaking a public awareness and compliance program
District Agriculture and Forest Office	There is still some uncontrolled use of chemical fertiliser and pesticides by villagers (sometimes to get rid of insects, and sometimes to collect insects). Response: IFAD (or ADB if IFAD is delayed) will include PRT, IPM as part of the LAO GAP certification program training and support

181. The results of all the consultations regarding environmental issues are given in Appendix 1. In general, the stakeholders were all in favour of the subproject, since it involves rehabilitating and improving an existing irrigation scheme, and it will lead to better cropping options and improved incomes. At both district and provincial levels it is supported as a positive intervention that fits with their strategies for environmentally sound agricultural development.

4. Grievance Redress Mechanism

182. The process for public consultation and information disclosure is described in the EIA Decree and the ADB SPS. The project developer is required to make people in the affected area aware of the project and what it will involve, and to collect their views, early in the IEE process. Likewise, the SPS, requires 'meaningful consultation' with affected persons to enable their informed participation in the project development process. The design process outlined in the PAM defines clearly the consultation steps required at the district, community, and water user group level. The initial disclosure and consultation meetings must then be followed up later on, to release a draft of the IEE for comment over a period of at least 30 days through DONRE, Subproject village leadership and through consultations with villages and water users. Then consultation will be undertaken by PAFO with input from the national LIC consultant. Potentially damaging impacts must be made clear to all stakeholders.

183. Affected persons should also be consulted on project entry points and effective media and entry points for the project GRM. The project GRM is established to receive and facilitate

resolution of affected peoples' concerns and grievances about the borrower's social and environmental performance at project level using an understandable and transparent process that is gender responsive, culturally appropriate, and readily accessible to all segments of the affected people. Key GRM focal points should be identified within Contractor, PPIT (being the Social Safeguards Staff member), PGT (being the safeguard focal point) and affected villages. GRM focal points will be trained on GRM implementation, including recording, monitoring and reporting requirements.

184. During the preparation of this IEE, the SPS and EIA Decree requires dissemination meetings to inform the affected villagers of the proposed project and the possible environmental and social impacts. The meetings must also be used to collect opinions from people who may be affected by the project and feedback provided on how the project will respond to issues raised. Assistance is to be provided by the local administrations. The following agenda should be used to ensure that there is an adequate exchange of information and opinions.

(i) A summary of the works proposed under the subproject.
(ii) A summary of subproject objectives, and likely positive and negative environmental impacts, covering the construction phase and operational impacts.
(iii) Invitation for feedback in respect of any areas of concern that the public may have, and suggested means of mitigation.
(iv) Acceptability of the proposed works to the public.
(v) A request for information on the known occurrence of unexploded ordnance in the area where the scheme components will be built.

185. The dates, attendance records (names/gender/age/occupation), topics covered, summary of consultations and photos, are recorded and included in the IEE report. The consultation record should document how the project will respond to the issues raised. Comments may be added as to the ways in which corrections or further information have been provided subsequently.

186. Following completion of the draft IEE, the EIA Decree requires consultation meetings at provincial, district and again at village level. These were completed as part of the social and environmental consultations. Key issues raised were the need for community participation in monitoring of the Project, a desire to end the role of the banana concession, to ensure canal leakage and the impact on the access road were included in the project. Discussions with the community using drainage water informed these stakeholders about the continued access to drainage water after the SC1 command area is fully developed.

187. Once the IEE is completed, it should be summarised and made available to the public for a period of at least 30 days. For this purpose, the IEE must be prepared in both English and Lao, and distributed to district administrations, where they will be made available for public review.

188. During construction and operation, the project developer is obliged under the EIA Decree and SPS to inform project-affected people and other stakeholders of project activities which are likely to create environmental and social impacts, and to provide regular access to general information about the subproject.

189. In addition, should people affected by the subproject have any grievances, they have the right to lodge complaints through a GRM established for the subproject. The GRM provides a process for affected persons to lodge complaints regarding any aspect of the subproject, including implementation of environmental, social and resettlement safeguards. This process does not affect their right to file complaints with a court of law at any point in the process. Costs are borne

by the project developer. Where complainants do not have sufficient literacy skills to express themselves in writing, they are to be encouraged to seek assistance from the subproject and nominated local non-governmental organisations, or other family members or village heads to have their grievances recorded in writing. All complaints and resolutions must be properly documented by the receiving entry point, whether through the project GRM entry points or through the country system. The GRM involves a series of procedural steps which provide recourse to district, provincial and national level authorities as may become necessary. These are described in Table 19.

Table 19: Procedural Steps in the Grievance Redress Mechanism

Step	Action
1	At the village level, an affected person (AP) files a complaint or grievance verbally or in writing to the Village Committee (VC) to seek resolution at village level. If unwritten the VC will record details of the complaint and provide consideration based on their traditional method of conciliation and mediation. Resolution is to be within five days after the complaint or grievance was received.
2	If no solution or understanding is reached within 5 days, the AP can bring the complaint at the district level. The GRU at the district level will meet the AP, and resolve within 10 days after receiving the complaint. If the AP is part of an ethnic group and requires assistance, representatives from the District LNF shall be appointed to assist by the DRC.
3	If the AP is still unsatisfied or has not received any decision from the GRU at the district level, he or she can seek redress at provincial GRU (within the PRC) that should decide the issue in 10 days. If the AP is part of an ethnic group and requests assistance, a representative from the provincial LNF will be appointed by the PRC.
4	If still unsatisfied with the decision of GRU at the provincial level, the AP may lodge an appeal with MONRE and the NPMO will monitor to ensure each complaint is resolved within 10 days after receiving the appeal.
5	As a last resort, the AP may request the case be heard by either the National Assembly or the local Court of Law.

L. Environmental Management and Monitoring

190. PONRE staff numbers and capability is limited with most staff having graduate status but little experience. The ability to translate these skills into systematic inputs for monitoring and reporting the implementation of the attached EMP is the most important constraint.

1. Environmental Management and Monitoring Plan

191. The EMP is the key document that underpins this IEE and ensures that the required environmental safeguards will be adequately implemented. The EMP for the Nam Tong subproject is an essential document that must be read in combination with this IEE.

192. Although environmental management and environmental monitoring plans are often issued as separate documents, for SRIWSM they are combined. The purpose of the monitoring plan is to ensure that the management plan is being implemented. Combining the two helps to ensure that this happens, and also clarifies the institutional responsibilities.

2. Institutional Responsibilities

193. **Institutional arrangements for implementation of environmental safeguards.** The **PGT** will appoint a qualified environmental safeguards officer to supervise and co-ordinate implementation of environmental safeguard requirements with support of the LIC International and National Environment Specialists. The PGT Project Director will be responsible for submitting environmental safeguard reports to ADB for clearance and disclosure. They will also carry out regular monitoring during implementation and prepare a summary of progress of EMP and GRM implementation for the quarterly project progress reports. They will participate in ADB loan review missions, ensure that semi-annual environmental safeguards monitoring reports are submitted to ADB on time and follow-up on agreed actions.

194. Each **PPIT** will nominate an environmental safeguards focal point to support LIC Environment Specialists and PGT with co-ordination at the province and district level. The PPIT environmental safeguards focal point will undertake joint site visits with subproject Supervision Consultants and Contractors to review implementation of EMP and GRM and report issues to PGT and LIC. PPIT will co-ordinate environmental quality monitoring with PONRE and invite PONRE to join site visits and ADB loan review missions.

195. The **LIC Environmental Specialists** (LIC ES) will provide safeguards capacity development training for PGT, PPIT, LIC, Contractors and GRM focal points on EMP mitigation and monitoring measures, Contractor EMP preparation, templates for environmental monitoring and report. LIC ES will screen and assess additional subprojects proposed under Output 3 and any other infrastructure requiring civil works under other outputs and prepare the environmental safeguards reports and ensure that RSP environmental safeguard reports are updated based on detailed engineering design.

196. The **Contractor** will be required to develop a site-specific Construction Environmental Management Plan (CEMP) in accordance with the IEE/EMP and designate an environmental health and safety (EHS) Officer to supervise and train workers on occupational and community health and safety practices and to monitor and report on implementation of EMP/CEMP and corrective actions. A GRM focal point/community liaison officer should also be designated to ensure public disclosure of planned construction to affected persons and monitoring and reporting on GRM. Each works Contractor EHS Officer will prepare a monthly report on EMP/CEMP and GRM implementation for submission to PPIT, PGT and LIC.

197. The **construction supervision staff member of each PPIT** (CS) will ensure a CEMP is prepared for each Category B subproject and an Environmental Code of Conduct for each Category C subproject. The CS will be responsible for day to day monitoring of implementation of health and safety and EMP/Code of Conduct requirements and issuing instructions for corrective actions, as needed.

3. Capacity Building

198. Training and capacity building of environmental capabilities will be part of the remit of the project implementation consultant (see Table 20). At provincial, district and subproject levels, it will use formal seminars and training courses focussed on the needs of the individuals working with each of the stakeholder organisations, as well as guided on-the-ground action learning-through-doing.

Table 20: Environmental Safeguard Capacity Strengthening Plan

Topic	Trainee	When	Training Responsibility
Project Awareness	WUG Official DONRE PONRE assigned staff and Section Head PAFO Safeguard Focal Point PAFO Construction Supervision	Q1-2 Project year 1	PGT Project Management Advisor
ADB and Govt Environment Safeguard Requirements	DONRE PONRE assigned staff and Section Head PAFO Safeguard Focal Point PAFO Construction Supervision PPIT DIrector	Q2 Py 1	LIC National Environemtnal Consultant and National Project Management Advisor
Environmental Documentation – Additional Subproject Processing	WUG, Assigned staff PONRE and DONRE PAFO – construction supervision	Q2-3 PY 1	LIC Project Management Advisor –PGT LIC International and National Consultant
Environmental Monitoring – RSP	WUG Assigned staff PONRE and DONRE	Q3 PY 1	LIC International and National Environmental Consultant

Topic	Trainee	When	Training Responsibility
	PAFO – construction supervision		Lt National Construction Supervision Consultant
Environmental Reporting	Assigned staff PONRE and DONRE PAFO – construction supervision PPIT Project Management Advisor	Q4 PY1 and Q1 Py2	LIC International and National Consultant
Environmental Sampling and water Flow data analysis	Assigned staff PONRE and DONRE PAFO – construction supervision PPIT Project Management Advisor	Q1 Py 2Q2 PY 2	LIC International and National Consultant

4. EMP Budget

199. The budget for the implementation of the IEE and EMP[7] include the items in the following table – however training of PONRE and DONRE staff is included in the LIC terms of reference and are not included in the table below as they are not budgeted inputs by individual subproject.

Item	Amount (USD)
Monitoring Equipment	600
Sample Testing	5,800
Allowances	11,000
LaoGap- IPM implementation	17,800
Subtotal	35,200

[7] The monitoring of irrigated agriculture – intensification and diversification dry season including water quality testing will, if required, be financed as part of the PICSA (IFAD funded) support program.

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Appendix 1. Records of Consultations

Schedule of Meetings

No	Date	Item
1	19 March 2018	Meeting at the Division of Forestry and Agriculture (related offices: Irrigation, Forestry, Livestock, plantation), at HP province
2		Meeting at the Public Work and Transport sector, the Energy and Mine sector (related offices: public work and transport, energy and mine office), at HP province.
3		Meeting at the Environmental Office, Meeting at the Information, Culture and Tour Office, at HP province.
4	20 March 2018	Meeting with the related officers of the Agriculture and Forestry office, Irrigation Office, Energy and Mine office, environmental office, Information Culture and Tour Office, at Viengxay district.
5		Meeting with the local authorities at the village level, including the related officers from the Provincial and district level.

Provincial Agriculture and Forest Office

General comments

- The potential of the agriculture production has a high possibility which it need the facilities support such as specific experiences in the agriculture major, market in the province, other province and neighbour country.
- There is a few mine prospecting area in the same district but it was far from the representative subproject.
- The forest type in the catchment area along the irrigation channel is the mixed deciduous forest.
- The planting and livestock activities which bases on the water from the earth irrigation particularly during the dry season.
- While the rainy season would do the rice planting and half of the district changing to do the shifting cultivation to be the planting fruit plant and another handicraft work particularly for the women activities.
- The planting and rice field in upland or lowland would rely on the natural base (rainfall, natural fertilizer and compost) and not much apply for the chemical fertilizer.
- There is not any reforestation plan in the Nam Poua catchment area, and no data of the water level in the Nam Poua stream.
- Overall strategy development plan may have the potential activities for increasing the forest area particularly in the 5 year economic plan but no specific outline and activity cause of no budget support yet.
- There is some of the concession for the bamboo tubes, which the district and village authorities has supported and operated this concession by collecting the bamboo tubes from the villagers under the contract among the villagers and private company/factory. The private company/factory shall pay based on amount of the selected bamboo tubes.
- Some households make the family economic income by making the charcoal, explore and pumping the sand along the stream by using the local technical base.
- During March, most of the villagers shall begin the cycle shifting cultivation in the selected area and some area was extended.

- Currently, there is no other development activity beside the irrigation programs.
- Last 2004, villagers was intended planting a lot of the teak and Yom trees but since present there is not potential market to supply those trees confirmatively.
- In general concern on the soil and water quality: due to the soil quality(soil mix sand) in the subproject area seems not well store/block the water for use; therefore the catchment management plan may increase the capacity to storage the water in the long term, but during the construction and operation phase, the water level may still be concerned and may require the more consider for well understanding among the project and local authorities.

Existing proposed development plan inside the Nam Poua Catchment are:

1. Irrigation KengAi project, located in Ban MeuagPoua, Nam Poua river, GPS(420206/2264829)
2. Irrigation FaiKeng project, located in Ban VangNua, Nam Nua river, GPS(414966/2261922)
3. Waterfall development project, located Tad Nam Nua, Nam Nua river, GPS(414981/2261874)
4. Irrigation HouyLiength project, located in Ban Hanglong, HouyLiength, GPS(412420/2263363)
5. Irrigation Reservior HouyLiength project, located in Ban Meuag liength, HouyLiength, GPS(410530/2264295)
6. Irrigation ThamNamNga project, located in Ban MeuagNga, Nam Nga, GPS(413351/2259237)

The potential forest development plans are to : (1) conduct the activities for preventing the forest burning and/or fire, and to extend the forest-agriculture land for the 22 villages in Viengxai district; (2) rehabilitate the degraded forest based on the actual condition and budget, (3) provide the young plant and seed to plant yearly in the degraded forest, (4) continuous planning the forest area management in the local authorities level, and (5) implement the workplan for protecting the catchment area in order to protect the biodiversity and forest and water flow which this activities shall base on the actual condition and budget and (6) pursue the handicraft activities through the district and village level.

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ວັນທີ: 19/3/2018

ລ/ດ No.	ຊື່ ແລະ ນາມສະກຸນ (Name and surname)	ຕາແໜ່ງ (Position)	ມາຈາກພາກສ່ວນ (Organizational)	ເບີໂທ (Phone No.)	ທີ່ຢູ່ອີເມວ (Email address)	ລາຍເຊັນ (Signature)
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District Agriculture and Forest Office

General comments

- The general implementation for the agriculture development and forest management are follow the 3 main pillars of the GoL socio-economic development plan.
- Most of the agriculture type are planting the orange, lemon, cucmber, fish pond, livestock.
- The livestock medicine could be provided as fund in the village and district level, and the health center could be provide as well.
- The existing infrastructure such as the irrigation and Nam Lin are normal improve/fix requirement yearly and occasion depend on the case of the broken condition.
- The water users provided the group fund and payment for supporting the irrigation improvement yearly.
- There is a chopstick and toothpick factory has made the contract with the village level under the district authority, in order to buy the bamboo tube from the village. The contract have included all related cost such as forest rehabilitation and management, bamboo tubes and local worker cost, which of those cost shall be response by investor. The cutting of the bamboo tubes shall be the 3 year cycling in the proposed area and be permitted by village and district authorities. The investor shall collect the bamboo and transport to the factory by themselves.
- The bamboo forest is mostly place in the production forest where response by village forest authority, and those area shall be natural conserve for 3 years after cutting the bamboo.
- The rice field, planting vegetation and fish pond during the dry season had faced with the insufficient water use particularly for the area where is far from the irrigation channel, which of them would mostly rely on the season water(rainfall).
- The strategic socio-economic development plan 2020 has focused on the development of the dry season planting, livestock and rice planting.
- The local sand pumping from the main stream may issue the water quality for agriculture, but due to the small amount and short term pumping which the village level had been conducted itself under the agreement among the village and district authorities.
- Sometimes, village level is still use of the pesticide and chemical fertilizer to get rid of insect, and sometime to collect the insects by villagers.
- The official regulation for agriculture and forest management in Viengxai district had been distributed to the village authorities

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Provincial Agriculture Office

Strategy for agriculture development, March 2018

- Study and research for management method and land use development for agriculture field under the potential ability and actual condition where could approach on the clean agriculture, modern industry and environmentally friendly and sustainable.
- Improve and gathering the lesson learn with the suitable technology into the agriculture development based on the provincial capacity.
- Analysing and researching the proper fertilizer and soil and production factor for land use planning and soil quality improvement.
- Increasing the local authorities capacity on the agriculture term by provide more training, establish the agriculture development group, produce the guideline for agriculture development and soil improvement, conserve the protected area and prevent the shifting cultivation activities and limit of the burning forest for agriculture activities.
- Cooperate with the related sectors for searching on the technical support and funding support for implementing of the work-plan in order to achieve the provincial framework target.
- Provide the technical supervision from the provincial level through the village authorities in order to close monitoring on the potential possibility and ability of each management level.

The PAFO summarised the weak points from implementation in 2016-2017 to improve in 2018 as follows.

- No specific regulation for implementing of the agriculture land use and development.
- Insufficient capacity and facilities in the provincial, district and local authorities.
- Insufficient budget and fund providing to implement all the workplan and monitoring..

Current solutions are: (1) searching fund for conducting the survey work, analyse the agriculture land and soil for better improvement (2) to find the fund for improving the staff capacity, (3) to find the fund to improve the infrastructure and laboratory and (4) to pursue the investor to invest in the agriculture activities such as fertilizer factory.

Provincial Public Works and Transport Office

There is no existing plan inside the catchment area and villages because the villages located near by the main road and they were provided the basic infrastructure such as water supply, gravity water line, sanitation, electricity and village roads. So, during this stage, there is no plan on this area.

Only sometime of the rainy season which it cause of the erosion along the road, the requirement of the road improvement may request.

District Public Works and Transport Office

There is no potential development plan in the subproject area.

There is no information on the potential sand exploration in the district or/and provincial level.

Provincial Energy and Mine Office

There is the small scale concrete gravity dam project (to generate an estimated 15 MW of electricity) about 10 KM far from Nam Poua subproject, belong to the private company (Duangchalern Group Development Construction Co.,Ltd). Proposed plan on March 2013 and contracted on October 2014. Dam width 5m, 70m Length, 19m Height. Project preparation 42%. No reservoir, Average inflow 6,48 m3/sec; Design flood 2745 m3/sec; Diversion Tunnel 6,668m (3m diameter).

The sand exploitation along the stream and mountain had conducted by the village and district authorities.

- The sand exploitation along the stream belong to the PWT responsibility.
- The sand exploitation at the mountain is belong to the PEM responsibility.

There is no other infrastructure program inside the catchment, only the main 6 A which it has sometime requirement to improve due to the erosion impact.

The mineral exploitation in the Viengxay district, mostly sand, is small and medium scale which the district authority is the main responsibility. There is no plan for any mineral exploration in the proposed catchment area of this subproject.
The basic infrastructure requirement such as road, water supply, sanitation, electricity in the villages had been provided since 1996.

District Energy and Mine Office

The overfall dam located far from the subproject about 12 km, which there is no impact to the Nam Poua catchment area and irrigation channel because it is the overfall dam which shall return the water flow naturally to the Nam Poau channel. The overfall dam had been studied since 2013 and now is on the preparing stage.

There is a few private sector conduct the sand exploitation at the mountain along the Nam Poau channel which those of them had been prohibited and required to have the official documentation, the local authorities had being monitored and instructed the private sector but somehow a few non-compliance matter still issue, and the erosion matter is still come along the stream.

For the village sand pumping is a small activity for the small supply to the village use and sale, the activities happen along the stream channel by using the generator machine to pump the sand. The villagers could pump the sand not higher than 30m3 per year per household, and the related environment matter would be monitoring by the local authorities.

Overall, the procedure of the sand exploration permission is still insufficient measurement and lack of the cooperation to the Public Work and Transport Office and Environmental Office because some of the private sector had conducted without official environmental documentation.

The sand exploration along the stream shall be a responsibility of the Public Work and Transport Office, while the sand exploration on the mountain area shall be a responsibility of the Energy and Mine Office. The current proposed plan is to focus on the enforce the private sector

to follow the permission procedure of any mineral exploration. And also to improve the cooperation channel among Energy and Mine Office to the Public Work and Transport Office and Environment Office.

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Provincial Environment Office

The current proposed development are Nam Nua waterfall, and Nam Hoa (15 MW) electricity plant.

Nam Nua waterfall development is still no official informing and reporting to the PNREO on the proposed development, only the clearing the existing local access road which it has no any environment concern.

Nam Hoa electricity plant (15MW) had been proposed to have the potential study since 2013-2014, but until the present has no official informing and reporting to the PNREO on the potential Feasibility Study and environmental assessment.

The potential water use from the natural water channel course along the Nam Poua stream would be for the agriculture, tourism, sand pumping and small dam.

Provincial Information, Culture and Tourism Office

There is one proposed waterfall development, where it is fall into the irrigation channel, it was called Nam Nua waterfall. Total required area is 39ha (02 Zones).

The detail proposed Nam Nua waterfall development is belong to the district authority responsibility, which the private sector has proposed to develop this waterfall, the current activity is on the access road improvement and sometime propose for traditional festival organization (Lao New Year and other local festivals).

For the relate to the environment and other activities of Nam Nua waterfall activity, the local authorities has monitoring and regular internal reporting, which only the access road improvement and sometime propose for traditional festival such as Pi Mai Lao.

District Information, Culture and Tourism Office

The current proposed activity in the subproject area has only the Nam Nua waterfall development, but somehow due to the lack of funding for development, the proposed development plan for Nam Nua waterfall has no much progress, only the clearing existing access road for sometime occasion such traditional festival on Pi Mai Lao and other.

The proposed plan is to develop the Nam Nua waterfall to be one of the income source for local people and expecting to have sufficient funding for this proposed development plan.

Village Consultations

Village names: Namwa, Meaung Poua, Hom Phan, Pong, Nasa, Na Ngern

Villagers views on the current condition
Sand pumping and sand exploitation had affected to:
(1) the sediment issue for the agriculture activities, (2) less water quantity for village use, (3) disturbance of fish flow or passage, and fish deaths, and (4) decreasing the river seed grown.

The data and information on the following pages derive from interviews with representative village heads and villagers regarding the condition of the Nam Poua catchment area.

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ວັນທີ: 20/03/2018.

ລ/ດ No.	ຊື່ ແລະ ນາມສະກຸນ (Name and surname)	ຕໍາແໜ່ງ (Position)	ມາຈາກພາກສ່ວນ (Organizational)	ເບີໂທ (Phone No.)	ທີ່ຢູ່ອີເມວ (Email address)	ລາຍເຊັນ (Signature)
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Wildlife

No	Name	Always see	Rarely seen	Hunting number (-Unit)	Hunting time (-Time/Month)	Remark
1	Wild boar, Mupa , ໝູປ່າ		√	3ໂຕ /year	Occasion	In case of the tracked occassionly
2	Common palm civet, Ngen ເຫງັນ		√	No	No	
3	Striped back Weaset, Jonfone, ຈອນຟອນ		√	No	No	
4	Sunda Pangolin, Linຫລິ່ນ		√	No	No	
5	Muntiacus feai, Fan ຟານ		√	No	No	
6	Porcupine, Men ເຫັ້ນ		√	No	No	
7	Begal monitor , Lenແລນ		√	No	No	
8	Otter , Naknam ນາກນ້ຳ		√	No	No	
9	Sciuridae. Kahok ກະຮອກ	√		50/year	12 time a year	To hunt during the dry season
10	Tupaiidae, Katea ກະແຕ	√		45/year	12 time a year	
11	Common tree shrew, Kanai ກະໄນ	√		45/year	12 time a year	
12	Euroscaptor klossi, On ອີ້ນ	√		20/year	6 times a year	
13	Red-necked keelback, Ngoou Dangheaງູດາງແຫ	√		No	No	
14	Cobra species, Ngoouhao ງູ ຕ່ຳ	√		No	No	
15	Green snake spices, Ngooukhiew ງູຂຽວ	√		No	No	

Birds

No.	Bird name	Always see	Rarely see	Hunted bird per time (bird number)	Hunting freqency(time per season)	Remark
1	Riparia paludicola ນົກແອ່ນ	√		20ໂຕ/year	6 time per dry season	
2	Bubo nipalensis ນົກເຄົ້າ		√	No hunt	No	
3	Cisticola exilis ນົກກະຈິບ	√		50ໂຕ/year	6 time per dry season	
4	Greater coucal ນົກກົດ		√	No hunt	No	
5	Flycatcher ນົກຈິກ	√		10ໂຕ/year	6 time per dry season	
6	Cuckoo drove ນົກເຂົ້າ		√	No hunt	No	rarely seen and no hunt, in case of tracked for once occasion which it is for family only
7	Changeable Hawk Engleນົກແຫລວ		√	No hunt	No	
8	Drongo ນົກແຊວ		√	No hunt	No	
9	Eurasian Jay ນົກທົ່ວທົ່ງ		√	No hunt	No	
10	Red Junglefowl ໄກ່ປ່າ		√	No hunt	No	
11	Barbet ນົກຕ້ອງລໍ		√	No hunt	No	

Fish

No	Fish name	which stream had seen (name of stream)	distance from village (ຮວມ)	How many kg per time fishing(average per week)	Domestic Consumption	Sale, how many kg	Where to sale (village or market)
1	Poropuntius laocnsis ປາຈາດ	Nam Poua and nearby natural canal	200	0.5	Yes	No	Only to share with the neigbourhood
2	Puntiusaurotaeniatus ປາຂາວ			0.5	Yes	No	
3	Pa Khamປາຂາມ		200 m	0.5	Yes	No	
4	PaPhep ປາຫຼຜດ			0.5	Yes	No	
5	Homaloptera leonardi ປາຕິດຫີນ			0.5	Yes	No	
6	Pa Phanh ປາພ້ນ			0.5	Yes	No	
7	Pa Bou ປາປູ່			0.5	Yes	No	
8	Pa Khing ປາຂິ້ງ			0.5	Yes	No	Only to share with the neigbourhood
9	Pa Mon ປາມົ້ນ			0.5	Yes	No	
10	Cyprinus carpio , Pa Nai ປາໄນ	Nam Poua and nearby natural canal		0.5	Yes	No	
11	Oreochromis niloticus ປານິນ			0.5	Yes	No	
12	Devario salmonatus, Pa Siew ປາຊີ໐			0.5	Yes	No	
13	Channa striata, Pa Kor ປາຄໍ່			0.5	Yes	No	
14	Claias batrachus, PaDouk ປາດຸກ			0.5	Yes	No	
15	Anabas testudineus ປາຂ້ຽ			0.5	Yes	No	
16	Small river shrimp, Ko			0.5	Yes	No	
17	Frog, Kob			0.5	Yes	No	
18	Pa Pee ປາພີ			0.5	Yes		
19	Pa Fek ປາຫຼຝກ			0.5			

Forest Products Using Trees

No	Timber type	Last seen	Use or not	Use for what	Still have in the project area (many, not so many)	Remark
1	Bamboo tubes, Mai Pong	current	use	Tooth strict, shofstrict	Many	
2	Mai Jing					Mai Jing is the small timber which its diameter is less than 10mm. This Mai Jing shall be regular used for household activity and some of the agriculture work such as being the fence, chacol, build the small hut, shall house, rice storage, field hut, and other temporary structure in the village.
	Xylia xylocarpa var; kerrii. Mai Deng					
	Vatica cinerea, Mai xee		use	regular used for household activity and some of the agriculture work such as being the fence, chacol, build the small hut, shall house, rice storage, field hut, and other temporary structure in the village.	Many	
	Peltophorum dasyrachis, Mai Safang	current	use		Many	
			use		Many	
	archidendron clypearia ไม้สะท้อน	current	use		Many	
			use		Many	
			use		Many	
3	Shoft timber					
			use		Many	
	Lagerstroemia, Mai Peuy		use		Many	
	Anisoptera costata, Mai Bak		use		Many	
			use		Many	

Non-timber Forest Products

No	NTFP type	Collect month	Whom collect(male or female)	Eat or sale	How many Kg per year	Price per kg (kip)	Where to sale	Remark
					Kg		(village or market)	
1	Mushroom	Dry season(Nov-April)	Female	Eating	No	No	No	
	Bamboo shot	October - June	Female	Eating	No	No	No	
2	Wild Vegetable	All year	Female	Eating	No	No	No	There is a few type of vegatable which could find all year in diffferent type of vegetable.
3	Wild Fruit (Pompeng)	Dry season(Nov-April)	Female	Eating	No	No	No	
4	Tiger grass ແຂມ	October - April	Female	Household Use	No	No	No	
5	Calamus acanthophyllus Beccari ເຄືອບາງເມືອກ, ເຄືອຕີບຕີ, Boehmerial malabarica,	All year	Female	Sale	50	3000kip	Trader collects at village	
6	ໝາກມ່ານ, ໝາກຄ່າ	Dry season(Nov-April)	Female	Eating and Sale	15	5000kip	Trader collects at village, and villager go to sale at market	
7	River weed, Kaihin	Dry season(Nov-April)		Eating and sale	NA	NA	Trader collects at village, and villager go to sale at market	
8	Polygonum Multiflorum, Mun On Ling	A few month per time	Female	Eating	No	No	No	

Appendix 2. Photographs from Consultation and Field Visits

PCM Consultation Records

Annex 1: Photos

Meeting at the related village and district authorities along the Nam Poua channel, 14 December 2018

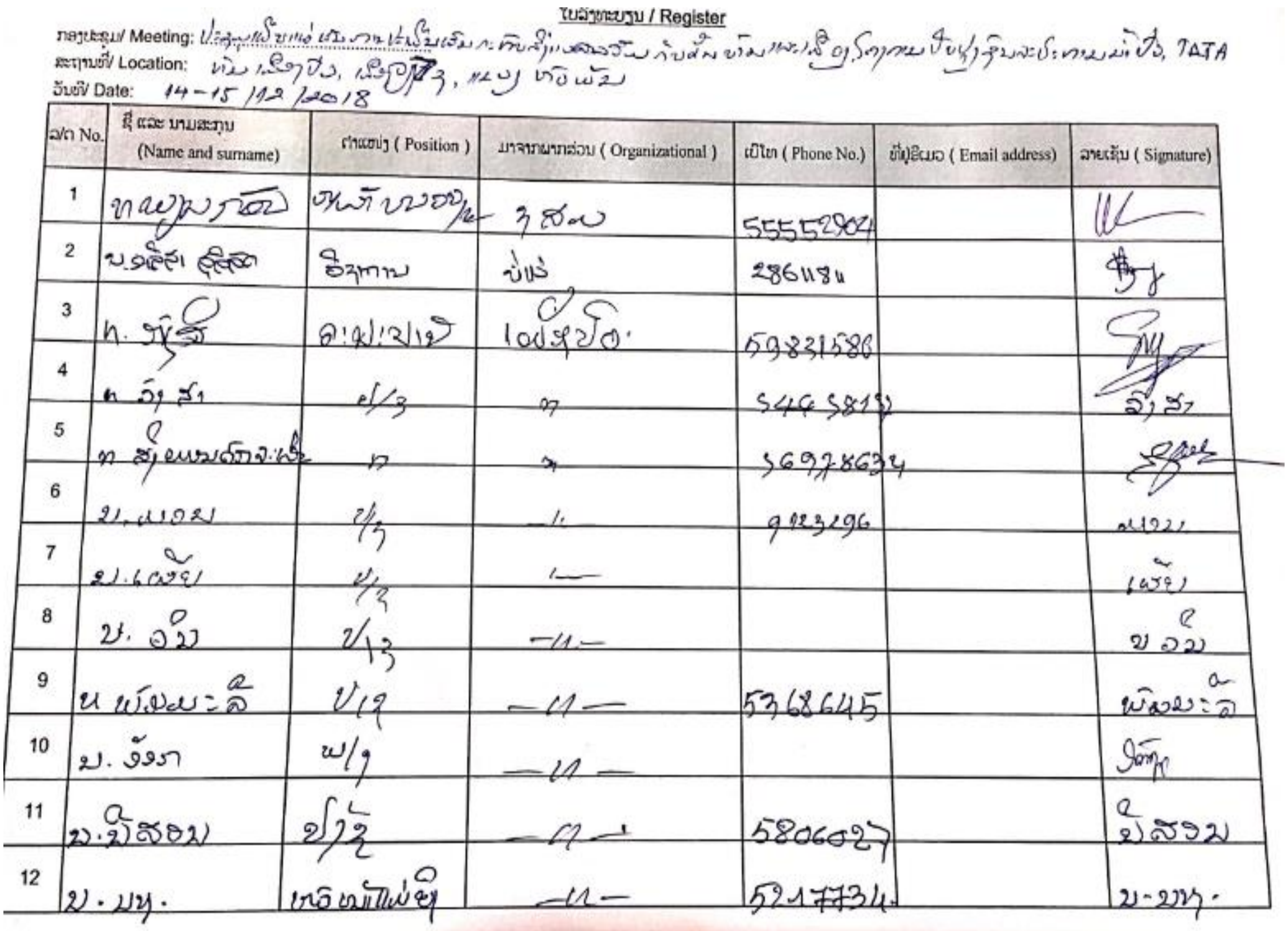
Meeting at the related village and district authorities along the Nam Poua channel, 14 December 2018

Annex 2: Participant List

No	Name and surname	Position	Organization	Phone #
1	Mr. Samlan Thavyxay Latsavong	Village officer	Meuapoua village	56233873
2	Mr. Thongsy	Villager	Meuapoua village	59442426
3	Mr. Xu Phimphaun	Villager	Na Nguen village	030 9140074
4	Ms. Oiy Syphundong	Vice village chief	Meuapoua village	030 9862501
5	Mr. Bounthone	Water user	Nasa village	030 9150779
6	Mr. Nouanthong	Water user	Nasa village	030 5162407
7	Mr. Xorva	Village chief	Homphun village	020 55148418
8	Mr.Khunya	Villager	Meuapoua village	020 56155144
9	Mr. Sonekham	Village officer	Meuapoua village	020 28262068
10	Mr. Aiewsy	Villager	Meuapoua village	
11	Mr. Maiphouan	Villager	Meuapoua village	
12	Mr. Meena	Villager officer	Meuapoua village	020 55050830
13	Mr. Somphiang	Villager	Nasa village	
14	Mr. Lenkham	Villager	Meuapoua village	
15	Mr. Saykhoon	Villager	Meuapoua village	
16	Mr.Sysouvath	Villager	Meuapoua village	
17	Mr. Keomanyvong	Officer	Nasa village	
18	Mr. Sysomphong	Villager chief	Meuapoua village	
19	Mr. Thanongsak	Technician	Irrigation division	020 52504666
20	Mr. Sysouk Thepphavong	Technician	Irrigation division	020 97999594
21	Mr. Noonlieng Khamthongxay	Village chief	Meuapoua village	
22	Mr. Phiangkone	Head unit	DoNRE, Viangxay district	5555 2904
	Ms. Alisa Soulilad	Technician	DEM, Viangxay district	28611811
	Mr. Kongsy	Village chief	Meuapoua village	59831586
	Mr.Vongsa	Villager	Meuapoua village	54458157
	Mr. Singphone Dokchaleun	Villager	Meuapoua village	56978634
	Ms. Mon	Villager	Meuapoua village	9123296
	Ms. Meuy	Villager	Meuapoua village	
	Ms. Vin	Villager	Meuapoua village	
	Mr. Phommaly	Villager	Meuapoua village	5368645
	Ms. Oath	Villager	Meuapoua village	
	Ms. Nysone	Villager	Meuapoua village	5806027
	Ms. Nang	Women union officer	Meuapoua village	5217734
	Ms. Pern	Villager	Meuapoua village	
	Mr. Pheng	Villager	Meuapoua village	
	Mr. Aivone	Villager	Meuapoua village	030 5033922
	Mr. Phonechanh	Village officer	Meuapoua village	
	Ms. Viengseng	Villager	Meuapoua village	
	Mr. Phonethong	Villager	Homphun village	030 490256
	Mr. Loanxieng Xeatern	Villager	Homphun village	020 99423481

	Mr. Paoteng	Villager	Meuapoua village	
	Ms. Onsy	Villager	Meuapoua village	

Scanned participant List:



ໃບລົງທະບຽນ / Register

ກອງປະຊຸມ/ Meeting: [illegible] TAJA

ສະຖານທີ່/ Location: [illegible]

ວັນທີ/ Date: 14-15/12/2018

ລ/ດ No.	ຊື່ ແລະ ນາມສະກຸນ (Name and surname)	ຕຳແໜ່ງ (Position)	ພາກສ່ວນ (Organizational)	ເບີໂທ (Phone No.)	ທີ່ຢູ່ອີເມວ (Email address)	ລາຍເຊັນ (Signature)
1	[illegible]	[illegible]	[illegible]	55552904		[illegible]
2	[illegible]	[illegible]	[illegible]	2861184		[illegible]
3	[illegible]	[illegible]	[illegible]	59831586		[illegible]
4	[illegible]	[illegible]	[illegible]	5465819		[illegible]
5	[illegible]	[illegible]	[illegible]	56978634		[illegible]
6	[illegible]	[illegible]	-//-	9123296		[illegible]
7	[illegible]	[illegible]	-//-			[illegible]
8	[illegible]	[illegible]	-//-			[illegible]
9	[illegible]	[illegible]	-//-	5368645		[illegible]
10	[illegible]	[illegible]	-//-			[illegible]
11	[illegible]	[illegible]	-//-	5806027		[illegible]
12	[illegible]	[illegible]	-//-	5217734		[illegible]

ລ/ດ No.	ຊື່ ແລະ ນາມສະກຸນ (Name and surname)	ຕຳແໜ່ງ (Position)	ມາຈາກພາກສ່ວນ (Organizational)	ເບີໂທ (Phone No.)	ທີ່ຢູ່ອີເມວ (Email address)	ລາຍເຊັນ (Signature)
13	ນ. ເບັນ	ປ/2	ເມືອງປົວ			[illegible]
14	ທ. ເພັງ	ປ/2	—//—			[illegible]
15	ທ. ໂຮວອນ	ປ/2	—//—	0305033922		[illegible]
16	ທ. ພອນວັນ	ພ/2	—//—			[illegible]
17	ນ. [illegible]	ປ/2	—//—			[illegible]
18	[illegible]	ປ/2	[illegible]	030490256		[illegible]
19	ທ [illegible]	ປ/2	[illegible]	02099423481		[illegible]
20	ທ. [illegible]	ປ/2	—//—			[illegible]
21	ນ ອອນສີ	ປ/2	ເມືອງປົວ			[illegible]
22						
23						
24						

ໃບລົງທະບຽນ / Register

ກອງປະຊຸມ/ Meeting: [illegible] ADB TA8[illegible]

ສະຖານທີ່/ Location: [illegible]

ວັນທີ/ Date: 14-15/12/2018

ລ/ດ No.	ຊື່ ແລະ ນາມສະກຸນ (Name and surname)	ຕຳແໜ່ງ (Position)	ມາຈາກພາກສ່ວນ (Organizational)	ເບີໂທ (Phone No.)	ທີ່ຢູ່ອີເມວ (Email address)	ລາຍເຊັນ (Signature)
1	[illegible]	[illegible]	[illegible]	56233873		[illegible]
2	[illegible]	[illegible]	[illegible]	59442426		[illegible]
3	[illegible]	[illegible]	[illegible]	0309180074		[illegible]
4	[illegible]	[illegible]	[illegible]	0308862501		[illegible]
5	[illegible]	[illegible]	[illegible]	0309150770		[illegible]
6	[illegible]	[illegible]	[illegible]	0305162407		[illegible]
7	[illegible]	[illegible]	[illegible]	02055114848		[illegible]
8	[illegible]	[illegible]	[illegible]	56155121		[illegible]
9	[illegible]	[illegible]	—//—	98269068		[illegible]
10	[illegible]	ປ/2	[illegible]			[illegible]
11	[illegible]	[illegible]	[illegible]			[illegible]
12	[illegible]	[illegible]	[illegible]	33050830		[illegible]

ລ/ດ No.	ຊື່ ແລະ ນາມສະກຸນ (Name and surname)	ຕຳແໜ່ງ (Position)	ພາຈານາພາກ່ວນ (Organizational)	ເບີໂທ (Phone No.)	ທີ່ຢູ່ອີເມວ (Email address)	ລາຍເຊັນ (Signature)
13						
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20				52504666		
21				97999594		
22						
23						
24						

Environmental Management Plan

Project Number: 50236-002
April 2019

Lao PDR: Sustainable Rural Infrastructure and Watershed Management Sector Project

Nam Poua Catchment
Xamneua and Viengxay Districts
Houaphan Province

Prepared by the Ministry of Agriculture and Forestry for the Asian Development Bank

CURRENCY EQUIVALENTS

(as of 5 April 2019)

Currency Unit	–	Lao Kip (LAK)
KN1.00	=	$ 0.000116
$1.00	=	LAK 8,600

ABBREVIATIONS

ACIAR	:	Australian Center for International Agricultural Research
ADB	:	Asian Development Bank
AF	:	Additional Financing
CCA	:	climate change adaptation
CIFOR	:	Center for International Forestry Research
COL	:	Concessional OCR lending
DAFO	:	District Agriculture and Forestry Office
DALAM	:	Department of Agricultural Land Management
DDMCC	:	Department of Disaster Management and Climate Change
DMF	:	Design and Monitoring Framework
DOI	:	Department of Irrigation
DRR	:	disaster risk reduction
EIA	:	Environment Impact Assessment
EMP	:	Environmental Management Plan
ERP	:	Emissions Reduction Program
FAO	:	Food and Agriculture Organization (of the United Nations)
GCF	:	Green Climate Fund
GDP	-	Gross Domestic Product
GIZ	:	Deutsche Gesellschaft für Internationale Zusammenarbeit (German International Cooperation Agency)
GMS	:	Greater Mekong Subregion
IEE	:	Initial Environment Examination
IMT	:	irrigation management transfer
ISF	:	irrigation service fee
IUCN	:	International Union for the Conservation of Nature
IWMI	:	International Water Management Institute
LDC	:	least developed country
LIC	:	Loan Implementation Consultant
MAF	:	Ministry of Agriculture and Forestry
MAF	:	Ministry of Agriculture and Forestry
NGO	:	Non-Governmental Organizations
NRI	:	Northern Rural Infrastructure Development Project
NSEDP	:	National Socio-Economic Development Plan
NTFP	:	non timber forest product
O&M	:	Operations & Maintenance
OCR	:	Ordinary Capital Resources
ODA	:	Overseas Development Assistance
PAFO	:	Provincial Agriculture and Forestry Office
PAM	:	Project Administration Manual
PDR	:	People’s Democratic Republic (of Laos)
PGT	:	Program Governance Team
PLUP	:	participatory land use planning
PONRE	:	Provincial Office of Natural Resources and Environment
	:	

PRAP		Provincial REDD+ Action Plans
PPIT	:	Provincial Project Implementation Team
PRC	:	People's Republic of China
PRI	:	productive rural infrastructure
PRT	:	pesticide reduction training
RRP	:	Report & Recommendations to the President
RSP	:	representative subproject
SME	:	Small-Medium Enterprises
SRIWSM	:	Sustainable Rural Infrastructure and Watershed Management
TRTA	:	Transaction Technical Assistance
VDF	:	village development fund
WUA	:	water users association
WUG	:	water user group

GLOSSARY

Catchment	In its totality a catchment is equivalent to a watershed, however a watershed may comprise of micro-catchments and sub-catchments. In this document a catchment refers to a subset of the larger watershed.
Watershed	A topographically delineated area from which rainwater drains as surface run-off via a river or stream to a common outlet point (e.g. a large river, lake or the sea).
Watershed management	Securing watershed functions in a sustainable manner. Broadly these functions include: ➢ Ecological function: availability of sufficient good quality water over time, space; erosion control, soil fertility, biodiversity, clean air, carbon sequestration; ➢ Economic function: sufficient natural resource products like food, fuel wood, timber, water, fish, energy required for basic needs of the local population; income generating opportunities; ➢ Social function: maintenance of social structures; protection and development of knowledge and lifestyle arrangements; maintenance and revitalisation of cultural identity and values, recreational facilities.

NOTE(S)

(i) In this report, "$" refers to US dollars unless otherwise stated.

CONTENTS

Reference Documents

List of Appendixes

I. INTRODUCTION

A. Nam Poua Subproject

1. The Nam Poua Subproject is to support the upgrading of an irrigation distribution system constructed during 2004. The scheme is designed to support an irrigated area of 70 hectares during the wet season and currently supports 55 hectares during the dry season, allocated to households in six villages. The productive rural infrastructure (PRI) will support the existing intake headworks, the distribution canal and the overall command area. The scheme has a high-level canal running mostly along the toe of a slope that then irrigates down to a valley floor stream.

B. Purpose of the Environmental Management and Monitoring Plan

2. This Environmental Management Plan (EMP) has been prepared in compliance with the specified safeguard requirements of the borrower, the Government of Lao PDR (the government), and the Asian Development Bank (ADB). It accompanies an Initial Environmental Examination (IEE) that: (i) provided an overview of the proposed subproject and its purposes; (ii) provided a description of existing environmental conditions; (iii) made an evaluation of the likely impacts that will occur to the environment as a result of the proposed subproject activities; and (iv) outlined the mitigation measures that will be required to ensure that no part of the project causes significant damage to the environment.

3. The EMP has been prepared on the basis of the design for the subproject, and its likely effects on the environment, as evaluated in the IEE. It defines the anticipated environmental impacts, the measures required to mitigate them, the responsibilities for doing so and the responsibility for monitoring that they have been undertaken effectively at the right time. Following the approval of the IEE, this EMP forms the guiding document to ensure that all necessary environmental safeguards are put in place.

4. Adherence to this EMP is a condition of the use of ADB financing for the Nam Poua Subproject. Acceptance of and a commitment to implement the EMP must also form part of the contractual conditions for any physical engineering works under the subproject.

C. Use and Review of the EMP

5. Compliance with this EMP is an ADB loan covenant. The subproject works will construct infrastructure that will give rise to changes to the environment. Consequently, the management and monitoring of the resulting environmental impacts should be continued for the lifetime of the infrastructure, not just the construction period of the project. The EMP covers the design, construction and operation periods of the subproject as well as associated facilities provided under the cofinancing of IFAD[1]. Each stakeholder requires to use different parts of the document at different times. It is recommended that the tables of responsibilities given in the appendices are extracted and used by the appropriate entities as the basis of their working practices on the project. The environmental monitoring team will need to use the monitoring table relevant to each phase. Once construction has been completed, it is recommended that the EMP be updated to form a simplified document for the operational period following handover of the infrastructure to

[1] Should IFAD financing be delayed ADB will finance these activities until IFAD financing becomes effective.

its users. This should be done by the PAFO, supported by the Loan Implementation Consultant and in consultation with the PONRE.

II. RESPONSIBILITIES AND CAPACITY FOR ENVIRONMENTAL MANAGEMENT AND MONITORING

A. Summary of Institutional Arrangements

6. The executing agency of the SRIWSM is MAF, with support from the IA - Department of Irrigation (DOI). Implementation is decentralised to the Provincial Agriculture and Forestry Offices (PAFO) where implementation activities will be assigned to the respective sections of PAFO, co-ordinated by a Provincial Project Implementation Team (PPIT) for the management of the SRIWSM Project.

7. The executing agency (i.e. MAF) and IA (i.e. DOI) will establish a Program Governance Team (PGT) that would be responsible for: (i) establishing the operational procedures to be used by the PPIT, including planning, budgeting, financial management, procurement, disbursement, contract management, safeguard monitoring and compliance monitoring; (ii) ensuring both government and donor audit requirements are met; (iii) providing capacity building at the provincial level for both PPIT staff and potential contractors; and (iv) providing technical support for advanced engineering designs and project management teams, including the provision of skill mentoring and technical assistance input to procurement and contract management.

8. Government staff are involved in environmental management and monitoring at a number of levels and in two main ministries: MAF for both management and monitoring; and MONRE as delegated to PONRE for monitoring. Reforms of government to separate the environmental portfolio from agriculture and forestry started in 2017 and is not yet complete. Capacity in this respect is therefore still being developed, particularly at the provincial and district levels.

9. The capabilities required of staff varies depends on the phase of the subproject, and their level and remit, a sound understanding of the environment and society in the rural hill catchments of the northern provinces, and a particular understanding of current issues in both upland and irrigated agriculture is needed. PONRE staff have the underlying environmental knowledge but often lack the technical expertise to address specific issues. DONRE staff are far less experienced and qualified. The Loan Implementation Consultant will be expected to help improve capacity and assist the government to improve its staff skills and knowledge in this respect. This should include support to PONRE and DONRE staff in their capabilities for environmental monitoring. The Loan Implementation Consultant (LIC) – both international and National will provide (i) Project awareness training, (ii) technical training with respect to environmental monitoring systems and techniques that will apply to their specific subproject, (iii) PONRE staff receive budgetary support for their additional costs on an output basis ie PAFO will pay for monitoring reports received. In addition, PONRE and DONRE monitoring staff will be supported for regular site visits by the construction supervision staff of PAFO.

10. During the project implementation period, which effectively involves subproject design and construction phases, safeguards are the responsibility of the Vice Governor Office represented by PAFO with support from the PGT within the Department of Irrigation. Environmental safeguard monitoring responsibility will be assigned to PONRE through a Memorandum of Understanding (MoU) between the Vice Governor Office, Director of PAFO and Director of PONRE.

11. At the provincial level, PAFO will assign overall project management to an existing PAFO Deputy Director General to implement subprojects. Within each PAFO, the technical staff will be assigned to the PPIT must be able to monitor the implementation of works programs.

12. Following construction and commissioning, the subproject infrastructure will be handed over to and operated by the Water User Groups. The relevant PONRE will be responsible for environmental monitoring during operation.

13. The project implementation responsibilities as set out in the PAM are provided in Table 1.

Table 1: Project Implementation Responsibilities

Project organisation	Management Roles and Responsibilities
Ministry of Finance (MOF)	• Establish the Project's Advance Account, • Manage direct payments to contractors, • Provide replenishment reports to ADB, • Provide advances to Implementing Agencies Subaccounts, • Overarching financial control.
Ministry of Agriculture and Forestry (MAF) - Executing Agency (EA)	• The EA will constitute a national steering committee with representatives of MAF, Office of Governor (Implementing Agency – IA) of four northern provinces (FNP), MOF, Ministry of Planning and Investment (MPI) and Ministry of Natural Resources and Environment (MONRE). • Responsible for ensuring loan agreements and covenants and assurances are achieved. • Responsible for internal monitoring of the States' interests.
National Steering Committee (NSC)	• Provide guidance to the IAs and EAs in terms of project scope of work, expected performance standards, remedial action. • Ensure cross sector coordination and integration of work plans • Confirm annual performance. • Membership will include MAF – Minister, Governors of the FNP, Provincial Agriculture and Forestry Offices (PAFO) Director Generals (DG) from each province, and Deputy Director Generals (DDG) of Department of Irrigation (DOI).
DOI - IA	• Support and operate the Program Governance Team and represent the EA in the day to day implementation of the project. • Provide technical support on irrigation and institutional issues. • Consolidate financial and progress reports for the MAF ADB. • Consolidate and quality check all withdrawal applications and replenishment requests to be forwarded to MAF's Department of Planning and Finance (DOPF) for clearance and onward forwarding to MoF.
MAF's DOPF	• Define and validate the project management systems to be applied across the programme to ensure that government and ADB requirements are met. • Verify all subproject draft procurement (including safeguards) documentation prior to be submitted to ADB or publicly advertised. • Undertake a quality control and verification of the quarterly and annual reports that will have document quality control procedures and an endorsement page. • Ensure financial management systems (FMS) are consistent with MAF's requirements.

Project organisation	Management Roles and Responsibilities
	• Ensure that project reporting systems support both Government and ADB requirements. • Provide quality assurance for the replenishment and disbursement documentation to be provided to ADB and MOF.
Program Governance Team (PGT) within the DOI	• Overall program management and coordination of the project • Prepare a code of conduct including accountability of individuals, authority and levels of delegated authority, jurisdiction and mandate limits. • Produce a project management manual, and the supporting templates, guidelines for planning, budgeting, financial accounts, disbursement, procurement, contract management, reporting, safeguards and audit. • Provide the consolidation and quality assurance function with the project for all work planning, budgeting and financial management records, replenishment requests, withdrawal applications that are then forwarded to DOPF. • Conduct assigned procurement of (i) vehicles, (ii) equipment, (iii) LIC, and (iv) other consultants and service providers. • Facilitate the development of provincial contractor awareness and capability. • Provide technical support for setting up project management systems and templates in the Provincial project implementation team (PPIT) and the required capability to operate these systems • Appoint a Gender focal point from MAF' Women Advancement Unit (WAU) to oversee and support the implementation of the gender action plan (GAP). • Undertake safeguard screening of additional subprojects in line with Resettlement and Ethnic Group Development Framework (REGDF) and Environmental Assessment and Review Framework (EARF) to confirm classifications, and that subprojects that would be classified as Category A to be excluded. • Ensure safeguard frameworks (REGDF and EARF) are applied in the screening, selection and assessment of subprojects and preparation of safeguard plans, Resettlement and Ethnic Group Development Plans (REGDPs) and Initial Environmental Examination / Environment Management Plans (IEEs / EMP) at the subproject level, to be reviewed and commented on within 30 working days by ADB. • Monitor implementation of safeguard requirements as set out in the REGDF/REGDPs and IEEs / EMPs/Environmental Code of Conduct (ECC) during subproject implementation. • Ensure that all subproject design reports (SDR) clearly demonstrate dry season water availability for the reliable irrigation whilst ensuring environmental minimum flow is sustained. • Assign two staff to act as safeguards focal points – one for resettlement and social safeguards and one for environmental safeguards, to provide safeguard oversight and input to semi-annual safeguards reports for submission to ADB.
Provincial Steering Committee (PSC)	• Each of the FNPs will establish a PSC chaired by the Governor, participating District Governors, Directors General of PAFO, Finance, Planning and Investment, Public Works and Transport Office (PWTO), Plant Protection Center, and Provincial office of Natural Resources and Environment (PONRE).

Project organisation	Management Roles and Responsibilities
	• Review annual work plans and provide guidance on project scope and performance standards. • Approve annual work plans and receive regular progress reports • Establish operational memorandums of understanding (MOUs) between PAFO, PONRE, and PWTO.
Provincial Procurement Committee (PPC)	• Each of the FNPs will establish a PSC chaired by the Governor and including Provincial representatives. • Manage evaluation bidding documents, conduct scoring and ranking of bids. • Provide recommended procurement actions to PSC and PAFO.
Provincial Project Implementation Team (within the PAFO)	• Each provincial government will form within PAFO a Project Implementation Team (PPIT), aligned to the Provincial Irrigation Section (PIS). The PAFOs will identify implementation focal points in Department of Agriculture and Land Management (DALAM) and DOF to be seconded into the project management structure of the PPIT to support activities relating to land use planning, catchment management and land registration administration. • PAFO will establish a gender focal point from the WAU that will be responsible for ensuring the GAP is implemented and that all stakeholders are fully aware of the GAP and the associated responsibilities • Each PAFO will appoint a safeguards focal point to supervise implementation of safeguard requirements and to co-ordinate project specific grievance redress mechanism and support provincial program safeguards focal point on periodic safeguards monitoring and reporting. • Establish operational systems with staff assigned who have the capacity to maintain the project administration and management systems. • Establish and maintain subproject monitoring and impact assessment using the productive rural infrastructure (PRI) representative subprojects (RSP) as learning sites. • Coordinate the ADB-financed activities and integrate these with the activities of other donor-financed programmes working on watershed management. • Provide quarterly and annual reports and semi-annual safeguards reports according to the templates specified by the PGT. • Ensure subproject REGDPs if any and IEE/EMPs are updated based on detailed engineering design, approved by ADB and disclosed on ADB website prior to contract awards. • Obtain final approval from the PAFO DG in accordance with the Irrigation Law 2014 - (Article 38). • Obtain environmental compliance certificates from the relevant PONREs prior to award of civil works contracts. • With support from the PGT, identify local contractors and conduct awareness and capacity building programmes to increase the inclusiveness of local contracting companies. • Complete land acquisition and compensation as per the REGDF prior to award of civil works contracts. • Contract management during implementation.

Project organisation	Management Roles and Responsibilities
	• Ensure implementation of the mitigation and monitoring measures as set out in the EMPs and any required safeguards corrective actions. • Ensure implementation of the REGDF action plan. • Safeguards monitoring as per the land acquisition and resettlement plans (LARP) and REGDF subproject documents. • On project completion as confirmed by the construction supervision consultant (PG the Project Director (PAFO) conduct a site inspection in accordance with the Public Work and Irrigation Law. On confirmation of contract completion, PAFO will transfer the operation and maintenance (O&M) of the asset to the water user group (WUG). **For WUGs** • Provide awareness and capacity building on project activities, WUG implementation roles and procurement modalities. • Monitor and mentor water WUG contracting of in-command area works.
PONRE Land Registration Department	• Conduct land registration. • Issue land title and demarcation.
PONRE Environmental Management Department	• Conduct regular environmental monitoring of subprojects. • Undertake a general programme of monitoring environmental parameters (e.g. water quality) at strategic sample locations throughout the province. • A budget provision has been made for (i) training, (ii) travel and (iii) field allowances. Training is in the terms of reference (ToR) for the LIC consultants.
MAF _ Plant Protection Centers	• Identify the need for Pesticide Reduction Training (PRT), Crop Surveillance and integrated pest management as part of the Lao GAP quality assurance support
MAF – DALAM	• Agricultural land use planning guidelines and verification.
PAFO – DALAM	• Agricultural land registration survey. • Consultation of land users in command areas. • Land registration proposal for agricultural land. • Participatory land use planning (PLUP) responsibilities
MAF - Department of Forestry	• Provide training and leadership in the issues surrounding ecological service protection for the land use change programs • Forest Land Use Guidelines and quality verification
PAFO - Department of Forestry	• Forest Land use zonation and survey demarcation. • Participate in PLUP when requested. • Supervision of forestry activities funded by ADB.
Provincial Nutrition Committees	• Facilitate multi-sectoral coordination for nutrition, including coordinating joint baseline and end line surveys to be developed by the National Nutrition Committee (NNC) Secretariat; ensuring alignment with any National Nutrition Advocacy and Communication Strategy and Plan of Action, or similar; supporting Joint Government of Lao PDR – Development Partners Monitoring Missions, etc. • Coordinate implementation and monitoring. • Undertake field monitoring activities. • Receive monitoring reports from districts and projects and provide annual and biannual reports to the NNC.

Project organisation	Management Roles and Responsibilities
	• Provide leadership and support for District Nutrition Committees (DNC)
DNC	• Facilitate multi-sectoral coordination for nutrition, including identifying priority villages • Coordinate implementation and monitoring • Undertake field monitoring activities and provides annual and bi-annual reports to Provincial Nutrition Committee (PNC).
District Agriculture and Forestry Office (DAFO)	• Assign a focal point who should be at least a Deputy Head of the DAFO and should be the representative on the DNC. This officer will be responsible for planning and oversight of project Nutrition Support Advisor (NSA) activities in the district, including agreeing monthly and weekly workplans with the assigned technical staff • Assign one staff member to be responsible for the financial management related to project NSA activities • Assign up to 3 full-time equivalent technical staff as members of District Nutrition Teams, with preference for female staff and staff belonging to local ethnic groups • Permit these assigned staff to participate in basic nutrition training and ensure that trained staff remain assigned for the duration of the project • Select priority villages in coordination with the DNC. The primary criterion will be nutrition needs as identified by the DNC, taking account of any other completed, ongoing or anticipated NSA interventions. The secondary criterion will be to give preference to nutrition priority villages in the watersheds and command areas of the PRI subprojects. • Collaborate with the Lao Womens Union (LWU) to form nutrition clubs in the selected villages, and provide them with NSA activities using a farmers' nutrition school approach, resulting in group and / or individual NSA development plans • Provide technical support to facilitate implementation of the development plans

B. Institutional arrangements for implementation of environmental safeguards

14. **PGT.** The PGT will appoint a qualified environmental safeguards officer to supervise and co-ordinate implementation of environmental safeguard requirements with support of the LIC International and National Environment Specialists. The PGT Project Director will be responsible for submitting semi-annual environmental safeguard reports to ADB for clearance and disclosure. They will also carry out regular monitoring during implementation and prepare a summary of progress of EMP and GRM implementation for the quarterly project progress reports. They will participate in ADB loan review missions, ensure that semi-annual environmental safeguards monitoring reports are submitted to ADB on time and follow-up on agreed actions.

15. **PPIT.** Each PPIT will nominate an environmental safeguards focal point to support LIC Environment Specialists and PGT with coordination at the province level. The environmental safeguard focal point shall have a background in environmental and social safeguards and will receive training in project environment and social safeguards requirements by the LIC. The PPIT environmental safeguards focal point will undertake joint site visits with subproject Supervision Staff and Contractors to review implementation of EMP and GRM and report issues to PGT and LIC. PPIT will co-ordinate environmental quality monitoring with PONRE and invite PONRE to

join site visits and ADB loan review missions. The environmental safeguard focal point shall have a background in environmental and social safeguards and will receive training in project environment and social safeguards requirements by the LIC. The PPIT environmental safeguards focal point will undertake joint site visits with subproject Supervision Staff and Contractors to review implementation of EMP and GRM and report issues to PGT and LIC. The environmental safeguard provisions of all contracts will be monitored and supervised by PPIT construction supervision staff and PoNRE.

16. **Loan Implementation Consultants.** The LIC will assist the executing agency (i.e. the PGT within DOI), the implementing agency (i.e. PAFO) and the other project stakeholders in the design and construction of the subproject. For this reason, the Program Governance Team will contract a LIC with two environmental specialists (9 months International Environment Specialist and 17 months National Environmental Specialist)- See PAM for detailed ToRs for LIC Environmental Specialists (LIC-ES) to support subproject designs and the preparation of IEE and for the supporting and monitoring of the EMP during subproject implementation.

17. The environmental safeguard consultants in the LIC will undertake screening, classification and assessment of future subprojects and will train and support PONRE and DONRE staff with monitoring visits and preparation of monthly and quarterly safeguard reports that will be submitted to the Vice Governor, and the EA via the PGT in DOI. The LIC will support the PGT to prepare a summary of safeguards and GRM implementation to be included in the quarterly project progress reports to be submitted to ADB. The LIC will support PGT to prepare semi-annual integrated safeguard reports to be submitted to ADB. These reports will include details of issues raised and resolved through the GRM during the reporting period. The semi-annual integrated safeguards monitoring report will be disclosed on ADB website once approved.

18. During the design and preparation phase the LIC environmental specialists work with the WUG, PAFO and DAFO and the contractors for the subproject, to ensure the required environmental mitigation measures are incorporated into the final engineering designs and bid documents. During the construction period, they must work with the subproject implementation partners to ensure that all of the environmental management and mitigation measures are fully complied with, as agreed in each IEE and as outlined in every EMP. The LIC Environment Specialists will provide safeguards and GRM capacity development training for PGT, PPIT, LIC, Contractors and GRM focal points on EMP mitigation and monitoring measures, Contractor EMP preparation, templates for environmental monitoring and report.

19. **Contractors and Subcontractors.** All contract documents must include the EMP (category B) or Environmental Code of Conduct (category C) and an environment section in the terms of reference for bidders, and environmental contract clauses for contractors that include special conditions for the protection of the physical, biological and socio-economic environments. These will underpin the obligations towards the environment that must be upheld by all contractors. There is a need to ensure that contractors, as the stakeholders with the shortest-term involvement in the subproject, do not give rise to long term liabilities for the subproject owners and other stakeholders through reckless practices.

20. While the contractors themselves must fulfil their environmental responsibilities, in most cases success in this respect requires strict management and supervision of the contractor during site works: this is the responsibility of PAFO. Because of the competitive bidding process and the emphasis on engineering works, there is often a tendency for environmental safeguards to be delayed by contractors in the hope that costs can be saved and overlooked by management staff as being of lower importance than the primary functional infrastructure.

21. Additional attention must be paid to subcontractors. It must be made clear to the main contractor at all times that they are fully responsible for the actions of subcontractors, and that retention money is at risk if there is not full compliance with this plan. The contractor should be encouraged to start this process with an orientation for each subcontractor before they start work, and sub-contractual conditions to ensure that the subcontractor complies. The project implementation consultant should be able to assist the contractor in this process.

22. The Contractor will be required to develop a site-specific Construction Environmental Management Plan (CEMP) in accordance with the IEE/EMP and designate an environmental health and safety (EHS) Officer to supervise and train workers on occupational and community health and safety practices and to monitor and report on implementation of EMP/CEMP and corrective actions. A GRM focal point/community liaison officer should also be designated to ensure public disclosure of planned construction to affected persons and monitoring and reporting on GRM. Each works Contractor EHS Officer will prepare a monthly report on EMP/CEMP and GRM implementation for submission to PPIT, PGT and LIC.

23. The construction supervision consultants (CSC) will review and approve the CEMP and ensure it covers all the required provisions of the subproject IEE and EMP. The CSC will be responsible for day to day monitoring of implementation of health and safety and EMP requirements and issuing instructions for corrective actions, as needed.

24. ADB will visit project sites and review project performance against the EMPs and legal agreements and as documented in periodic environment monitoring reports submitted by the PGT. If any of the safeguard requirements that are covenanted in the legal agreements are found not to be satisfactorily met, ADB will require the PGT to develop and implement an appropriate corrective action plan (CAP) agreed upon with ADB. If unanticipated environmental impacts become apparent during project implementation, ADB will require the PGT with support of LIC ES to (i) assess the significance of such unanticipated impacts; (ii) evaluate the options available to address them; and (iii) prepare or update the IEE and EMPs.

III. SUMMARY OF THE POTENTIAL ENVIRONMENTAL IMPACTS

A. Potential Impacts on the Environment

25. The IEE identified a number of potential environmental impacts. Some of these are beneficial, mainly directly to the socio-economic environment but also indirectly to the bio-physical environment. Although on balance these are judged to outweigh the negative impacts, as with most projects there are long lists of potential adverse impacts. As described below, and given in tables in this plan, there are means of mitigating these impacts so that the effects do not cause significant damage.

B. Enhancement Measures

26. Community organisation and development is the basis of the subproject. This will be enabled through assistance to the WUG to establish improved capacity and management systems, so that their members can best gain from the rehabilitated and enhanced infrastructure that the subproject will fund. Improved livelihoods are the intended outcomes for the beneficiaries, giving households dependent on agriculture a wider range of choices and access to more productive farming systems.

27. The infrastructure rehabilitated and upgraded by the subproject is designed to be resilient. This means that it should withstand both current and likely future extreme climatic effects while remaining functional. This is achieved by careful design on the basis of analysis of climate variables and change possibilities, to ensure that the structures are robust but not over-engineered at too high a cost.

C. Mitigation Measures for Adverse Environmental Impacts

28. Under the classification of subprojects into MONRE category 1 and ADB category B, all adverse environmental impacts must be mitigated; if they cannot be mitigated, then the category of the subproject would need to be changed and a full EIA undertaken; this would make it ineligible for SRIWSM funding. Hence ways must be found to avoid, minimise or restore all potential impacts found in the course of designing and implementing an SRIWSM subproject. The detailed mitigation measures depend on individual site conditions. However, in most cases there are only a limited number of options for the mitigation of certain issues.

29. The mitigation measures are listed in the Environmental Management and Monitoring Matrix forms the operational core of this EMP. They cover all of the main impacts that are likely to occur. Most of them represent simple, practical, common sense measures to ensure that disturbance to the environment is limited to the minimum as a result of all subproject activities.

D. Specific Key Priority Concerns

30. The quality of water used in irrigation is defined by the government in the National Environmental Standards (2017), where it should meet class 3 quality criteria (see Appendix 5). The reason for this is to ensure that soil, plants and aquatic organisms are not poisoned by a build-up of toxic chemicals brought in by river water from polluting activities carried on in the upper catchment. In the Nam Poua, the irrigation scheme has operated for more than one decade and the proposed SRIWSM support simply modifies the manner in which water is managed within the existing irrigation command area. As considered in detail in the project's Environmental Assessment and Review Framework (EARF), the responsibilities of an entity using polluted water are not as clear as those causing the pollution in the first place. As also discussed in the EARF, the process of undertaking a reliable and definitive water testing programme is also problematic for a number of technical reasons. The mitigation measures recommended in this EMP address this issue in a pragmatic way.

31. In some cases, mitigation measures cannot be defined precisely because there is inadequate information on which to base precise actions. Water flows are little understood because to date there have been very few gauging stations maintained in smaller catchments. Defining compensatory flows throughout the year is therefore difficult, and initially must be based on estimates, however the SRIWSM will not increase the water take that has been the usual scenario for the last decade. The mitigation strategy in this case is to use as much information as possible to ensure that the initial estimates are as accurate as they can be, while starting to collect continuous series monitoring data. Because of natural variations from year to year, this process needs to be continued every year for at least ten years, and ideally throughout the life of the infrastructure, so that the compensatory flows can be updated as the running averages, minima and maxima for flow in each month become more statistically robust. The implementation of water quality testing that is robust in both sampling and testing protocols is proposed if a significant risk to water quality is determined during the catchment planning project to be financed by GIZ.

32. Both to realise the environmental benefits of the project and to safeguard the infrastructure investments, catchment land use needs to be improved in the water supply catchment of the subproject. Part of the rationale for the SRIWSM is to assist the rural population to reduce its dependence on upland agriculture, since other land pressures mean that shifting cultivation is no longer just used by a limited population for subsistence, but is being used to produce cash crops for export and as a result is giving rise to an unsustainable rate of forest conversion. Loss and fragmentation of the forests has had a major impact on biodiversity. It has almost certainly also affected the hydrology of the steep hilly watershed of the Nam Poua. Periodic disturbances to vegetation cover have also increased sediment fluxes in the river. In the long term, the effectiveness of the subproject irrigation facilities depends on the stabilisation of vegetative cover in the catchment. This in turn is dependent on the communities within the catchment adopting improved land use planning, which would focus on intensified agriculture in the irrigated lowland and leave more of the upper catchment under a longer-term cycle of forest use. Better land use management is beneficial for the subproject in achieving its purpose and is to be implemented by GIZ as part of the WB Emissions Reduction Program and applying the Agreed WB safeguard frameworks.

33. In a steep hilly catchment like that of the Nam Poua, and with the intense rainfall that occurs throughout northern Laos, the protection of soil surfaces is essential around all of the infrastructure that will be installed through the subproject. This includes irrigation headworks, canals and access roads. There are two main purposes for this. The first is to avoid erosion from rainfall, with bare surfaces highly prone to the entrainment of soil particles as a result of raindrop impact and runoff, leading to the loss of topsoil and increased amounts of sediment in water courses. The second is to protect earthworks from flood scour, when river or canal flows overtop the structures during high floods. Simple bio-engineering measures are the only effective way of protecting large surface areas from rainfall-induced erosion, and so this is a straightforward but critical mitigation measure in targeted key locations.

IV. ENVIRONMENTAL MONITORING

A. Environmental Management Plan

34. The EMP is the key document underpinning each IEE and ensuring that the required environmental safeguards are adequately implemented. This EMP follows the format provided in the EARF for the SRIWSM.

35. Although environmental management and environmental monitoring plans are often issued as separate documents, for SRIWSM they are combined. The purpose of the monitoring plan is to ensure that the management plan is being implemented. Combining the two helps to ensure that this happens, and also clarifies the institutional responsibilities.

B. Institutional Responsibilities for Environmental Monitoring

36. The institutional responsibilities for both the implementation and monitoring of environmental management measures is provided in detail above. Implementation of environmental management actions follows the same responsibilities as the overall construction and implementation of the subproject itself. The PAFO PPIT is responsible for subproject implementation and the participation of the WUG. During the project construction period, the PPIT and PONRE will be supported by LIC for monitoring.

37. The operational responsibilities for the subproject infrastructure will lie with the Water User Groups who will continue to be assisted by IFAD under the PICSA project. The combination of ADB and IFAD support seeks to institutionalize the operational management of irrigation infrastructure based on the increased incentives from dry season irrigated cropping. The application of irrigation service fees are sufficient to finance the operation and maintenance of infrastructure.

V. ENVIRONMENTAL MANAGEMENT AND MONITORING MATRIX

A. Introduction

38. The matrix below forms the practical management tool of the EMP. It lists the environmental impacts expected to be experienced on the Nam Poua Subproject, and the typical mitigation measures that can be used to avoid, minimise or restore the effects of these impacts.

39. The division of responsibilities between different agencies during the planning, construction and subsequent operation phases are given in simplified tables for the various sections of the PAFO (Appendix 2), the contractor (Appendix 3) and the Water User Group (Appendix 4).

40. Additional environmental monitoring by appropriate units of both the Ministry of Agriculture and Forests and the Ministry of Natural Resources and Environment is not always referred to in the matrix, but represent further safeguards on the project's activities.

41. The standards against which compliance is to be monitored are: (i) the Lao PDR National Environmental Standards (2017), including the surface water quality standards given in Appendix 5 of this EMP[2]; (ii) the World Bank's Environment, Health and Safety General Guidelines (2007); and (iii) the SRIWSM environmental guidelines given in Appendix 6.

B. Subproject Planning Phase during Project Implementation

42. Environmental mitigation in the design phase is principally the responsibility of the provincial representative of the project implementing agency (i.e. the Programme Governance Team in the Department of Irrigation), supported by the Provincial Project Implementation Team in the PAFO and the Loan Implementation Consultant company.

[2] Under Government of Lao, Environmental Assessments and Environmental Management and Monitoring Plan (EMMP) is required, ADB requires a broader assessment within an Environmental Management Plan (EMP). EMP is used to cover both of these documents.

Table 2: Planning Phase Environmental Management and Monitoring

No.	Potential Impact	Safeguards or Mitigation	Responsibility to Implement and Timing	Monitoring, Checking and Timing
1.01	Loss of land or other property to infrastructure.	1. Full consent to the subproject must be sought through standard consultative processes. 2. Full and fair compensation is to be paid for loss of land, crops or other assets before the subproject commences. 3. Land Acquisition and Resettlement Framework to be followed diligently.	PIS - PAFO, supported by PAFO representative and project preparation consultant. 1. Before application to the project implementing agency for subproject funding. 2. Before signing a contract for the commencement of physical works.	DALAM - PAFO. 1. Before approval of project funding for the subproject. 2. Before approving any contract for physical works.
1.02	Loss of land of importance for biodiversity.	1. Subproject landtake is to be minimised. 2. Landtake is to use land that is already degraded, to the greatest extent possible.No projects to go ahead in forest or protected areas.	PIS - PAFO and engineering team of the project preparation consultant, supported by environment team of preparation consultant. 1. At the start of subproject design. 2. At each design review.	PONRE. Before approval of project funding for the subproject.

No.	Potential Impact	Safeguards or Mitigation	Responsibility to Implement and Timing	Monitoring, Checking and Timing
1.03	(a) Incomplete hydrological data and as yet poorly developed climate change models lead to inaccurate designs for infrastructure. (b) Infrastructure is damaged by high flood levels, reducing the scheme's lifespan or effectiveness and causing damage to the nearby environment. (c) Downstream riverine quality is affected in very dry years due to abstraction of water for irrigation.	1. Care is to be used to interpret as well as possible the best available data for the subproject catchment. 2. A significant margin is to be allowed to ensure that infrastructure is likely to be resilient under current climatic conditions. 3. An additional margin is to be allowed to ensure that infrastructure remains resilient under possible future more intense or prolonged rainfall events. 4. Specially designed protection measures such as bio-engineering must be incorporated into designs as a matter of course. 5. Engineering designs must not be approved without adequate provision of protection against high flood conditions. 6. In very dry periods, released flows from the intake must be monitored to ensure that the minimum agreed environmental base flow is always provided downstream of the intake.	PIS - PAFO and engineering team of the project preparation consultant, supported by environment team of preparation consultant. 1. At the start of subproject design.	DG PAFO, DG PONRE. During subproject design.

1.04	Disruption of hydrological flows by offtake from rivers.	1. All available rainfall and flow data for the river catchment must be collected and assessed to provide a working model of average monthly flows throughout the year. 2. A Staff gauging plate will be established upstream of the headworks, to help define acceptable dry season minimum flows. The proximity and flows of tributary streams close downstream from the proposed headworks must also be assessed. 3. If necessary a survey will be undertaken which establishes the cumulative minimum water needs of other existing users, plus ecological requirements. 4. A calculation must then be made as to the offtake that can be allowed. 5. Where no flow data exist, initial minimum flows of at least 30 percent of the estimated monthly average flow are planned however if levels fall between 10 and 30% PONRE will provide PAFO guidance to the Provincial Steering Committee through PAFO. Flows falling under 10% are not permitted. 6. Offtake regimes must	PIS - PAFO and engineering team of the project preparation consultant, supported by environment team of Loan Implementation Consultant. 1. Gauging station to be installed at the start of subproject design. 2. Data to be re-assessed at each design review. 3. Data and offtake regime to be reviewed annually from the date of starting subproject implementation.	PONRE. Review the emerging data in the light of observations and comments from water users, and discuss with the PIS whether adjustments to water flows are desirable.

No.	Potential Impact	Safeguards or Mitigation	Responsibility to Implement and Timing	Monitoring, Checking and Timing
		be refined as more data become available.		
1.05	Water supplies polluted by upstream land management practices do not comply with national standards for surface water.	1. An assessment must be made of the quality of water at the headworks and its likely suitability for use in irrigation. 2. Under the PICSA IPM and Pesticide management programs a water quality risk assessment will be undertaken to, if required, customize a water quality testing program of surface water discharged from the command area	LIC. During subproject design. PAFO, supported by Loan Implementation Consultant. IFAD PICSA Implementation Team	PONRE. During subproject design. Cropping planning and monitoring for each season
1.06	Upstream land uses cause a decline in the quality and quantity of water available for the irrigation scheme.	GIZ will prepare and implement a catchment land use plan should be initiated before construction starts on physical works. The plan should be both socio-economically beneficial and environmentally sound, in that its primary objective would be upstream catchment protection to ensure that the subproject irrigation scheme is safeguarded in terms of water supply and limited sediment supply.	Watershed management, agriculture and forestry teams in DALAM AND DOF, PAFO. .	DALAM Before approval of project funding for the subproject.

C. Subproject Construction Phase during Project implementation

43. Environmental mitigation in the construction phase is principally the responsibility of the contractor, managed by the Provincial Project Implementation Team as the provincial project implementing agency, supported by the DAFO and the Loan Implementation Consultant.

Table 3: Construction Phase Environmental Management and Monitoring

No.	Potential Impact	Safeguards or Mitigation	Responsibility to Implement and Timing	Monitoring, Checking and Timing
2.01	(a) Release of silt into water courses from excavations and earthworks during construction. (b) Release of silt into water courses from poorly finished earthworks following construction.	1. The removal of vegetation and creation of bare surfaces must be minimised to essential areas only. 2. Vegetation clearance and earthworks may only be undertaken during the months of October to April. 3. Temporary sediment settling ponds built using strong stone or timber check dams (not bamboo or fabric silt fences) must be constructed to trap sediment from all earthworks that have unprotected surfaces at any time during the months of April to October inclusive. 4. Borrow areas, camp sites, temporary access tracks etc. must be fully rehabilitated back to a condition that is fully protected against soil erosion. 5. Bio-engineering surface protection must be planted on all bare earthworks during the months of May to July.	Contractor, managed by the PPIT and Loan Implementation Consultant. 1. Throughout the subproject construction period. 2. Before issuing the contractor's certificate of substantial completion. 3. Before returning retention monies.	PPIT environmental section. Quarterly or as required. PONRE. At quarterly inspections throughout subproject construction period.

No.	Potential Impact	Safeguards or Mitigation	Responsibility to Implement and Timing	Monitoring, Checking and Timing
2.02	Environmental damage of any form results from the poor understanding of subproject requirements by the contractor and subcontractors.	1. The Contractor EHS officer will prepare a CEMP to be approved by supervision consultant prior to starting works. 2. EHS Officer/GRM focal point to ensure details of subproject GRM entry point contacts are disclosed at camp, sites and affected villages. 3. EHS Officer to induct/ train workers on occupational and community health and safety practices 4. GRM focal points/community liaison officers to carry out regular consultation with affected persons.	Contractor, PPIT Before mobilisation and as required eg. whenever the contractor mobilises a new subcontractor.	Programme Governance Unit in DOI. As per the timings given for implementation.
2.03	Clearance of vegetation leads to the unnecessary removal of trees and other plants.	1. No tree over 200 mm diameter at breast height (1.5 metres above the ground) may be cleared unless the design drawings specifically require it. 2. The contractor's site clearance plan must be limited to the agreed work site boundaries and must be approved by the PPIT 's environmental representative before any clearance may be commenced.	Contractor, managed by the PPIT and Loan Implementation Consultant. 1. Throughout the subproject construction period. 2. Before issuing the contractor's certificate of substantial completion. 3. Before returning retention monies.	PPIT environmental section. Quarterly or as required. PONRE. At quarterly inspections throughout subproject construction period.

No.	Potential Impact	Safeguards or Mitigation	Responsibility to Implement and Timing	Monitoring, Checking and Timing
2.04	Temporary closure of irrigation systems during construction.	1. Contractors must provide a plan in advance to provide irrigation water into existing supply channels, which must be approved by the project implementing agency and the Water User Group. 2. If it is not possible to avoid temporary closure, then full and fair compensation is to be paid for loss of crops as a consequence.	Contractor, managed by the PPIT and Loan Implementation Consultant. 1. Before allowing the contractor to commence work. 2. Throughout the subproject construction period.	PPIT environmental section. Quarterly or as required. PONRE. At quarterly inspections throughout subproject construction period.
2.05	Disposal of soil from excavations such as irrigation canals.	1. Soil from excavations should be re-used in designs wherever possible. 2. Where soil is excess to engineering requirements and is treated as spoil, it must be disposed of in the nearest available approved location, and stabilised and protected from rainfall using bio-engineering measures.	Contractor, managed by the PPIT and Loan Implementation Consultant. 1. Throughout the subproject construction period. 2. Before issuing the contractor's certificate of substantial completion. 3. Before returning retention monies.	PPIT environmental section. Quarterly or as required. PONRE. At quarterly inspections throughout subproject construction period.

No.	Potential Impact	Safeguards or Mitigation	Responsibility to Implement and Timing	Monitoring, Checking and Timing
2.06	Release of dust into the atmosphere from excavations and other construction activities.	1. Earthworks must be halted during periods of strong winds. 2. Heavily used access tracks must be sprayed with water during dry periods. 3. On all unmetalled surfaces, construction traffic must be limited to 30 kmh within 250 metres of habitation and 80 kmh elsewhere. 4. Loads of dust-making materials must be covered. 5. Crushers must be fitted with water sprays to prevent dust emissions.	Contractor, managed by the PPIT and Loan Implementation Consultant. Throughout the subproject construction period.	PPIT environmental section. Quarterly or as required. PONRE. At quarterly inspections throughout subproject construction period.
2.07	Release of noxious gases into the atmosphere.	1. Vehicles and machines must be in a good condition and serviced regularly, to ensure minimal emissions. 2. All vehicles and machines must comply with the Lao PDR emissions standards.	Contractor, managed by the PPIT and Loan Implementation Consultant. Throughout the subproject construction period.	PPIT environmental section. Quarterly or as required. PONRE. At quarterly inspections throughout subproject construction period.
2.08	Noise nuisance from construction activities.	1. Contractors must not exceed statutory noise levels at any time. 2. Work sites within 500 metres of habitation: (a) must not operate during the hours of darkness or on holidays; and (b) must have noise-abatement measures installed for other periods.	Contractor, managed by the PPIT and Loan Implementation Consultant. Throughout the subproject construction period.	PPIT environmental section. Quarterly or as required. PONRE. At quarterly inspections throughout subproject construction period.

No.	Potential Impact	Safeguards or Mitigation	Responsibility to Implement and Timing	Monitoring, Checking and Timing
2.09	Temporary use of land for construction affects livelihoods or leaves it damaged.	1. Land for use by any contractor or subcontractor must be agreed by both the PPIT and the local community authority before the contractor may have access. 2. Full and fair compensation is to be paid for loss of crops or other assets before the contractor may have access to the land. 3. The contractor must have a land restoration plan, which must have been implemented to the satisfaction of both the PPIT and the landowner before the contractor's final bill may be paid.	Contractor, managed by the PPIT and Loan Implementation Consultant. 1. Before work is permitted to start. 2. Throughout the subproject construction period. 3. Before returning retention monies.	PPIT environmental section. Quarterly or as required. PONRE. At quarterly inspections throughout subproject construction period.
2.10	Influx of temporary labour disrupts local communities.	1. Contractors and subcontractors are required to use the maximum local labour possible. 2. If a significant number of staff and workers (i.e. more than 20) are to be brought into the subproject site, then the contractor must provide a management plan and code of conduct for the staff and workers, that is approved by the local community authority.	Contractor, managed by the PPIT and Loan Implementation Consultant. 1. Before work is permitted to start. 2. Throughout the subproject construction period.	PPIT environmental section. Quarterly or as required. PONRE. At quarterly inspections throughout subproject construction period.

No.	Potential Impact	Safeguards or Mitigation	Responsibility to Implement and Timing	Monitoring, Checking and Timing
2.11	Operation of construction machines affects both workers and local society.	1. The noise and dust reduction measures listed above must be adhered to. 2. Safety measures for machine operation must be defined and approved by the project implementing agency. 3. Machine operators and workers must be trained and certificated in the safe use of machines.	Contractor, managed by the PPIT and Loan Implementation Consultant. 1. Before work is permitted to start. 2. Throughout the subproject construction period.	PPIT environmental section. Quarterly or as required. PONRE. At quarterly inspections throughout subproject construction period.
2.12	Pollution by hydrocarbons from construction plant.	1. The contractor must prepare a plan for the management of hydrocarbons, which must be approved by the PPIT before the contractor is permitted to mobilise to site. 2. Fuel and oil must be transported in properly designed vehicles meeting national standards. 3. Fuel and oil must be stored at least 50 metres from a water body, in covered and bunded locations, and dispensed under strict controls		
2.12	Pollution by hydrocarbons from construction plant.	4. The contractor must prepare a plan for the management of hydrocarbons, which must be approved by the PPIT before the contractor is permitted to mobilise to site.		

No.	Potential Impact	Safeguards or Mitigation	Responsibility to Implement and Timing	Monitoring, Checking and Timing
		5. Fuel and oil must be transported in properly designed vehicles meeting national standards. 6. Fuel and oil must be stored at least 50 metres from a water body, in covered and bunded locations, and dispensed under strict controls. 7. Vehicle and machine parking and service areas must have impermeable surfaces and the outlet drains must be fitted with oil traps. 8. Contractors must have spill clean-up equipment on site, and persons always present who know when and how to use it. 9. The contractor must have a land restoration plan that includes hydrocarbon facilities, which must have been implemented to the satisfaction of both the project implementing agency and the landowner before the contractor's final bill may be paid. 10. Any subcontractor must comply with the same rules, at the contractor's liability.	Contractor, managed by the PPIT and Loan Implementation Consultant. 1. Before the contractor is permitted to mobilise to site. 2. Throughout the subproject construction period. 3. Before returning retention monies.	PPIT environmental section. Quarterly or as required. PONRE. At quarterly inspections throughout subproject construction period.

No.	Potential Impact	Safeguards or Mitigation	Responsibility to Implement and Timing	Monitoring, Checking and Timing
2.13	Pollution from construction site wastewater, from camps and other work sites.	1. The contractor must prepare a plan for the management of wastewater, which must be approved by the PPIT before the contractor is permitted to mobilise to site. 2. “Black” wastewater from sanitation facilities must be led to a properly constructed septic tank and soakaway. 3. “Grey” wastewater from washing and cooking facilities must be led to a septic tank or to a specially built reed bed filtration system. 4. Oil-contaminated water from workshops and fuel stores must be collected and taken to an approved municipal waste management facility. 5. The contractor must have a land restoration plan that includes wastewater facilities, which must have been implemented to the satisfaction of both the PPIT and the landowner before the contractor’s final bill may be paid. 6. Any subcontractor must comply with the same rules, at the contractor’s liability.	Contractor, managed by the PPIT and Loan Implementation Consultant. 1. Before the contractor is permitted to mobilise to site. 2. Throughout the subproject construction period. 3. Before returning retention monies.	PPIT environmental section. Quarterly or as required. PONRE. At quarterly inspections throughout subproject construction period.

No.	Potential Impact	Safeguards or Mitigation	Responsibility to Implement and Timing	Monitoring, Checking and Timing
2.14	Pollution from solid waste materials.	1. Solid waste must be recycled wherever possible. 2. Non-recyclable solid waste must be sent to an official landfill site. 3. Open burning of solid waste is prohibited 4. The contractor must have a land restoration plan that includes solid waste, which must have been completed to the satisfaction of both the PPIT and the landowner before the contractor's final bill may be paid.	Contractor, managed by the PPIT and Loan Implementation Consultant. 1. Throughout the subproject construction period. 2. Before returning retention monies.	PPIT environmental section. Quarterly or as required. PONRE. At quarterly inspections throughout subproject construction period.
2.15	Injuries to workers and others.	1. Work sites must be clearly demarcated using barrier tape and all non-project personnel excluded. 2. All staff, workers and visitors to construction sites must be issued with appropriate personal protective equipment. 3. All staff, workers and visitors to construction sites must be briefed on safe working procedures for that site. 4. Every construction site must have a first aid kit and at least two persons always present who are trained and competent to use it.	Contractor, managed by the PPIT and Loan Implementation Consultant. 1. Before the contractor is permitted to commence work. 2. Throughout the subproject construction period.	PPIT environmental section. Quarterly or as required. PONRE. At quarterly inspections throughout subproject construction period.

No.	Potential Impact	Safeguards or Mitigation	Responsibility to Implement and Timing	Monitoring, Checking and Timing
2.16	Disruption of cultural sites.	1. All small cultural sites (such as small shrines and graves) must be protected by the contractor during works periods. 2. A plan for the protection of cultural sites must be approved by the PPIT . 3. Once construction is complete the surrounding of such sites must be restored to their pre-construction condition.	Contractor, managed by the PPIT and Loan Implementation Consultant. 1. Before the contractor is permitted to commence work. 2. Throughout the subproject construction period. 3. Before returning retention monies.	PPIT environmental section. Quarterly or as required. PONRE. At quarterly inspections throughout subproject construction period.
2.17	Subsequent users may not fully understand how to manage the subproject works.	1. Instructions on managing the infrastructure must be provided to the end users before handover. 2. The operating instructions must be explained to the Water User Group. 3. Before handover, the operating instructions must be finalised and the EMP requirements included.	Contractor, supported by the PPIT and Loan Implementation Consultant. 1. By 6 months before scheduled handover of infrastructure. PPIT and Loan Implementation Consultant. 2. 6 months and 3 months before handover, and at handover. 3. At infrastructure handover.	Director of PAFO and PONRE. 1. 3 months before handover. 2. At infrastructure handover.

D. Subproject Operation Period following Project implementation

44. Environmental mitigation in the operation period is principally the responsibility of the Water User Group and the Provincial Irrigation Section in the PAFO, supported by other sections of the PAFO and the DAFO.

Table 4: Operation Period Environmental Management and Monitoring

No.	Potential Impact	Safeguards or Mitigation	Responsibility to Implement and Timing	Monitoring, Checking and Timing
3.01	Disruption of downstream hydrological flows due to offtake from river.	1. Once scheme operation commences, the gauged low rates and water offtake volumes must be reassessed. These, plus any complaints from downstream users, must be used to recalculate the allowable offtake. 2. The scheme must then be revised accordingly.	PIS - PAFO. Annually.	PONRE. Annually.
3.02	(a) Extraction of water from a river causes a decline or loss of aquatic biodiversity. (b) Extraction of water from a river leaves downstream users short. (c) Subproject irrigation scheme requires more water than is available.	1. If these impacts occur, then it shows that the assumptions of water flow made during subproject design were wrong. This is likely to be due to a lack of flow data at design stage. 2. The minimum flow release must be recalculated, based on user needs and the latest data on river flow. 3. Water use by the subproject scheme must be reviewed against what is actually available. 4. A revised scheme management plan must be introduced, implemented, monitored and adjusted until it resolves the problem.	PIS - PAFO. If necessary, specialist expertise should be requested from the central Department of Water Resources and the central Department of Irrigation. Annually.	PONRE. Annually.

No.	Potential Impact	Safeguards or Mitigation	Responsibility to Implement and Timing	Monitoring, Checking and Timing
3.04	(a) Flood damage to headworks. (b) Erosion of canal banks, either from flood surges or normal flows.	1. All flood protection works must be maintained as per the design of the subproject, or any subsequent engineering works. 2. Any flood damage must be reviewed and appropriate measures designed for resolution. 3. Occasional minor flood damage should normally be resolved by using appropriate measures. 4. The use of civil engineering structures (i.e. concrete or gabion works) may be required in the event of serious damage from exceptional floods.	Water User Group, calling on the PIS – PAFO for advice if damage is severe. Annually.	PAFO and PONRE. Annually.
3.05	Increased use of agrichemicals and nutrient	1. Identification of crops, cropping and farming systems 2. Support for Lao Gap training and awareness 3. Where warranted PRT 4.Where required IPM training for specific crops that require pesticide use 5. Nutrient management regimes built into farm technology demonstrations	1. PAFO with Input from IFAD financed support services 2. PAFO Plant Protection Centre staff	1. Cropping season monitoring to capture detail of agrichemical use – PPIT, PAFO monitoring program implemented by WUG through mobile phone systems at sowing and harvest of each cropping season

VI. ENVIRONMENTAL MONITORING FORMAT

A. Recommended Format

45. Environmental monitoring in both the subproject construction phase and the subsequent operation period is principally the responsibility of the Environmental Section of the PONRE. During the construction phase, monitoring must be undertaken quarterly, or more frequently if deviations are observed or complaints received. During the subsequent and indefinite operation period, monitoring must be undertaken annually, or more frequently if deviations are observed or complaints received.

46. It is recommended that a simple table and traffic light system is used to indicate the level of seriousness of any lapses. A key and format for this is given below. The intention is to give a quick and clear indication of anything that is going wrong, who needs to take action to resolve it, and what they must do.

Category 3	Serious issue causing widespread pollution or other environmental damage.
Category 2	Significant issue causing localised pollution or other environmental damage.
Category 1	Minor lapses causing short term environmental damage that can be easily rectified.
Category 0	No environmental problems or previous problem resolved.
Category D	Issues requiring action but deferred due to plans for future activities that will affect them, or for other reasons.

Table 5: Monitoring Action Report

No.	Mitigation	Assessment of Condition	Corrective Actions Required	Timing	Cat.

B. Example of the Monitoring Format Used

47. The version of the monitoring table below shows a hypothetical worked example for some of the mitigation measures during the construction phase of the subproject.

Table 6: Monitoring Action Report – Nam Poua Subproject
[*Hypothetical Example, 1 September 2020*]

No.	Mitigation	Assessment of Condition	Corrective Actions Required	Timing	Cat.
2.01(1)	The removal of vegetation and creation of bare surfaces must be minimised to essential areas only.	Contractor is complying well and there are no areas cleared unnecessarily.	DAFO to continue encouraging contractor to go on complying.		**0**
2.01(2)	Vegetation clearance and earthworks may only be undertaken during the months of October to April.	Contractor commenced vegetation clearance on feeder canal in August to try to improve his schedule. Erosion has started and some neighbouring land has been inundated with sediment.	DAFO engineer must hold a site meeting with the contractor. The contractor must install emergency erosion control measures within one week. The contractor must also rehabilitate the damaged land in consultation with the engineer and the landowner, within one month.		**2**
2.01(3)	Temporary sediment settling ponds built using strong stone or timber check dams must be constructed to trap sediment from all earthworks that have unprotected surfaces at any time during the months of April to October inclusive.	These were installed successfully in March. However, the heavy rains in early August caused some damage near the headworks construction site, leading to some erosion and soil washing into the irrigation canal.	The contractor must repair the damaged sediment traps within two weeks. The DAFO engineer is to ensure this is done.		**1**
2.01(4)	Bio-engineering surface protection must be planted on all bare earthworks during the months of May to July.	Bio-engineering works were implemented on schedule in June. The grass has established well and is already providing a good protection from erosion on the main canal embankment.	The contractor is to continue to protect the site and ensure that livestock do not graze it during the forthcoming dry season. The DAFO engineer is to monitor.		**0**

No.	Mitigation	Assessment of Condition	Corrective Actions Required	Timing	Cat.
2.03(1)	No tree over 200 mm diameter at breast height (1.5 metres above the ground) may be cleared unless the design drawings specifically require it.	No trees had to be cut in the process of these works.	Not applicable.		**0**
2.03(2)	The contractor's site clearance plan must be limited to the agreed work site boundaries and must be approved by the PPIT 's environmental representative.	The contractor is keeping to the agreed site boundaries in most cases. However, there are lapses in that the contractor's trucks are frequently parked overnight on the river bank and not taken back to the camp. Engine oil is dripping on to the soil surface and could be leached into the river.	The contractor must ensure that the trucks are parked in the correct location overnight, with immediate effect. The contractor must clean up the oil contamination within two days. The DAFO engineer is to ensure this is done.		**1**

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Appendix 1. Subproject Terms of Reference for Technical PONRE Staff

Category	Description
A: Position /Title	**Provincial Environmental Officer**
B: Position / Type	Staff member of the PONRE
C: Source	National
D: Qualifications	Degree in an environmental subject (e.g. soil science, botany, zoology, physical geography, ecology, forestry, agronomy or environmental science).
E: Experience	At least five years of field experience in the operation of rural infrastructure development projects (i.e. in project implementation).
F: Posting	Provincial Centre
G: Reporting To	DG-PONRE and National Environmental Safeguards Consultant
H: Role duration	21 person months over project years 2 to 6 inclusive.
I: Starting Date	Q2 of project year 2.
J: Deliverables	1. Successful implementation of the Environmental Management and Monitoring Plan (EMP) for every GOL Category 1 subproject, or Environmental Codes of Conduct for non-qualifying subprojects, in the officer's province. 2. Provincial Quarterly Environmental Monitoring Reports.
K: Outputs	The officer will contribute as follows to the Project outputs in their province: 1. Environmental safeguarding of all subprojects are implemented and monitored as per the requirements of the Subproject EMP and as per the provisions of the Project Administration Manual (PAM).
L: Tasks	SRIWSM Outputs 1 and 3: As directed by the National Environmental Safeguards Consultant, to undertake the following tasks. 1. Participate in training seminars provided by the Loan Implementation Consultant's team. 2. Support the Loan Implementation Consultant's team in undertaking the field studies and consultations necessary for future subprojects. 3. Co-ordinate the implementation of the EMP or Code of Conduct for every subproject in the province. Work with the relevant subproject stakeholders to support them in fulfilling their obligations under the plans and codes. 4. Undertake active on-site monitoring throughout the construction period of the subproject infrastructure. This should involve at least two site visits per week while the contractor is mobilised to ensure that it is fully compliant with the requirements of this EMP . 5. Undertake regular on-site monitoring during the infrastructure operation period until the termination of the project in the province. This should involve one site visit per month to ensure that the WUG's management of the new infrastructure is fully compliant with the requirements of this EMP . 6. Monitor the subproject areas that are the target of activities under these outputs, to determine whether there are any unexpected negative environmental impacts caused by the upgraded rural infrastructure. 7. Report findings to the Provincial Steering Committee and DG-PAFO. 8. Implement practical demonstrations of environmental mitigation actions as necessary to assist the subproject stakeholders in fulfilling the environmental safeguards as needed. 9. Assist project stakeholders in the collection of additional environmental data, particularly relating to meteorology and hydrology. 10. Undertake environmental sampling as necessary to ensure that safeguards are in place or to quantify lapses affecting air, water or soil.

	11. Complete the quarterly monitoring of the subprojects using the formats in the EMP to compile Provincial Quarterly Environmental Monitoring Reports from Q2 of year 2 onwards.

Appendix 2. Responsibilities of the Provincial Agriculture and Forest Office

Provincial Irrigation Section of the PAFO – Planning Phase		
No.	**What you Must Do**	**Why You Must Do It**
1.01	1. Full consent to the subproject must be sought through standard consultative processes. 2. Full and fair compensation according to the provisions in the Land Acquisition and Resettlement Framework to be applied .	To compensate people for losses of land or other property to infrastructure.
1.02	1. Subproject landtake is to be minimised. 2. Landtake is to use land that is already degraded, to the greatest extent possible. 3. If previously undisturbed forest must be used (not planned as part of the design), the subproject would be changed to a different environmental category and would no longer be eligible for SRIWSM financing.	To compensate for the loss of land of importance for biodiversity.
1.03	1. Care is to be used to interpret as well as possible the best available data for the subproject catchment. 2. A significant margin is to be allowed to ensure that infrastructure is likely to be resilient under current climatic conditions. 3. An additional margin is to be allowed to ensure that infrastructure remains resilient under possible future more intense or prolonged rainfall events. 4. Specially designed protection measures such as bio-engineering must be incorporated into designs as a matter of course. 5. Engineering designs must not be approved without adequate provision of protection against high flood conditions. 6. In very dry periods, released flows from the intake must be monitored to ensure that the minimum agreed environmental base flow is always provided downstream of the intake.	To protect infrastructure from high flood levels in an uncertain climate setting.

Provincial Irrigation Section of the PAFO – Planning Phase		
No.	**What you Must Do**	**Why You Must Do It**
1.04	1. All available rainfall and flow data for the river catchment must be collected and assessed to provide a working model of average monthly flows throughout the year. 2. A hydrological gauging station must be established on the subproject catchment, upstream of the headworks, to help define acceptable dry season minimum flows. The proximity and flows of tributary streams close downstream from the proposed headworks must also be assessed. 3. A survey must be undertaken which establishes the cumulative minimum water needs of other existing users, plus ecological requirements. 4. A calculation must then be made as to the offtake that can be allowed. 5. Where no flow data exist, initial minimum flows of at least 30 percent of the estimated monthly average flow must be used as the abstraction criterion. 6. Offtake regimes must be refined as more data become available.	To minimise the disruption of hydrological flows by offtake from rivers.

PAFO and DAFO Watershed Management, Agriculture and Forestry Teams – Planning Phase		
No.	**What you Must Do**	**Why You Must Do It**
1.05	1. An assessment must be made of the quality of water at the headworks and if there is doubt about water quality, then the subproject should be abandoned as a candidate for SRIWSM funding.	In case water supplies polluted by upstream land management practices do not comply with national standards for surface water.
1.06	Discussions on creating a catchment land use plan should be initiated prior to construction. The plan should be both socio-economically beneficial and environmentally sound, in that its primary objective would be upstream catchment protection to ensure that the subproject irrigation scheme is safeguarded in terms of water supply and limited sediment supply.	So that upstream land uses do not cause a decline in the quality and quantity of water available for the irrigation scheme.

Provincial Project Implementation Team of the PAFO – Construction Period		
No.	**What you Must Do**	**Why You Must Do It**
2.02	1. At a pre-mobilisation site meeting, the contractor must demonstrate a full understanding of the requirements of the EMP. 2. All of the sub-plans listed below must be created, reviewed, improved if necessary and accepted for approval. 3. The contractor must demonstrate that he is fully responsible for all subcontractors' adherence to the provisions of the EMP, and that he has formally ensured this.	To ensure that environmental damage of any form does not result from the poor understanding of subproject requirements by the contractor and subcontractors.
2.17	1. Instructions on managing the infrastructure must be provided to the end users before handover. 2. The operating instructions must be explained to the Water User Group. 3. Before handover, the operating instructions must be finalised and the EMP requirements included.	To ensure that subsequent users fully understand how to manage the subproject works.

Provincial Irrigation Section of the PAFO – Operation Period		
No.	**What you Must Do**	**Why You Must Do It**
3.01	1. Once scheme operation commences, the gauged river flows and water offtake volumes must be reassessed. These, plus any complaints from downstream users, must be used to recalculate the allowable offtake. 2. The scheme must then be revised accordingly.	To ensure that there is no disruption of downstream hydrological flows due to offtake from river.
3.03	1. See if water shortages occur, which would show that the assumptions of water flow made during subproject design were wrong. This is likely to be due to a lack of flow data at design stage. 2. The minimum flow release must be recalculated, based on User needs and the latest data on river flow. 3. Water use by the subproject scheme must be reviewed against what is actually available. 4. A revised scheme management plan must be introduced, implemented, monitored and adjusted until it resolves the problem.	So that the extraction of water from a river does not cause a decline or loss of aquatic biodiversity, or leave downstream users short, if the subproject irrigation scheme requires more water than is available.

PAFO and DAFO Watershed Management, Agriculture and Forestry Teams – Operation Period		
No.	**What you Must Do**	**Why You Must Do It**
3.02	1. The catchment land use plan initiated before project implementation (see 1.06) should be continued indefinitely to ensure that the scheme is safeguarded throughout its operational life. The plan's primary objective is upstream catchment protection to ensure that the subproject irrigation scheme is safeguarded in terms of water supply and limited sediment supply. 2. Arrangements for implementation of the plan must be maintained.	So that upstream land uses do not cause a decline in the quality and quantity of water available for the irrigation scheme.

Appendix 3. Responsibilities of the Contractor

The subproject civil works contractor is responsible for the following actions during the construction phase.

Contractor – Construction Phase		
No.	**What you Must Do**	**Why You Must Do It**
2.00	1. Appoint qualified Environmental, Health and Safety Officer to manage site safety and implementation of EMP and GRM requirements. 2. Prepare subproject specific Construction EMP (CEMP) confirming how EMP requirements will be implemented. 3. EHS Officer to provide induction, training and toolbox talks for all Contractor staff and other site visitors. 4. EHS Officer to liaise with affected persons and local community 5. EHS Officer to implement and monitor any required corrective actions and resolution of issues raised through the GRM. EHS Officer to report monthly to PPIT on implementation of EMP and GRM.	To ensure Contractor fulfils their contractual requirements to: provide and maintain a safe and hygienic working environment; implement, monitor and report on subproject EMP and GRM requirements effectively.
2.01	6. The removal of vegetation and creation of bare surfaces must be minimised to essential areas only. 7. Vegetation clearance and earthworks may only be undertaken during the months of October to April. 8. Temporary sediment settling ponds built using strong stone or timber check dams (not bamboo or fabric silt fences) must be constructed to trap sediment from all earthworks that have unprotected surfaces at any time during the months of April to October inclusive. 9. Borrow areas, camp sites, temporary access tracks etc. must be fully rehabilitated back to a condition that is fully protected against soil erosion. 10. Bio-engineering surface protection must be planted on all bare earthworks during the months of May to July.	To avoid water course pollution from releases of silt from excavations and earthworks during construction, and from poorly finished earthworks following construction.
2.03	1. No tree over 200 mm diameter at breast height (1.5 metres above the ground) may be cleared unless the design drawings specifically require it. 2. The contractor's site clearance plan must be limited to the agreed work site boundaries and must be approved by the PPIT 's environmental representative before any clearance may be commenced.	So that the clearance of vegetation does not lead to the unnecessary removal of trees and other plants.

Contractor – Construction Phase		
No.	**What you Must Do**	**Why You Must Do It**
2.04	1. Contractors must provide a plan in advance to provide irrigation water into existing supply channels, which must be approved by the project implementing agency and the Water User Group. 2. If it is not possible to avoid temporary closure, then full and fair compensation is to be paid for loss of crops as a consequence.	To avoid temporary closures of irrigation systems during construction.
2.05	1. Soil from excavations should be re-used in designs wherever possible. 2. Where soil is excess to engineering requirements and is treated as spoil, it must be disposed of in the nearest available approved location, and stabilised and protected from rainfall using bio-engineering measures.	To ensure the safe disposal of soil from excavations such as irrigation canals.
2.06	1. Earthworks must be halted during periods of strong winds. 2. Heavily used access tracks must be sprayed with water during dry periods. 3. On all unmetalled surfaces, construction traffic must be limited to 30 kmh within 250 metres of habitation and 80 kmh elsewhere. 4. Loads of dust-making materials must be covered. 5. Crushers must be fitted with water sprays to prevent dust emissions.	To minimise the release of dust into the atmosphere from excavations and other construction activities.
2.07	1. Vehicles and machines must be in a good condition and serviced regularly, to ensure minimal emissions. 2. All vehicles and machines must comply with the Lao PDR emissions standards.	To minimise the release of noxious gases into the atmosphere.
2.08	1. Contractors must not exceed statutory noise levels at any time. 2. Work sites within 500 metres of habitation: (a) must not operate during the hours of darkness or on holidays; and (b) must have noise-abatement measures installed for other periods.	To minimise noise nuisance from construction activities.
2.09	1. Land for use by any contractor or subcontractor must be agreed by both the PPIT and the local community authority before the contractor may have access. 2. Full and fair compensation is to be paid for loss of crops or other assets before the contractor may have access to the land. 3. The contractor must have a land restoration plan, which must have been implemented to the satisfaction of both the PPIT and the landowner before the contractor's final bill may be paid.	To ensure that the temporary use of land for construction does not affect livelihoods or leave it damaged.

Contractor – Construction Phase		
No.	**What you Must Do**	**Why You Must Do It**
2.10	1. Contractors and subcontractors are required to use the maximum local labour possible. 2. If a significant number of staff and workers (i.e. more than 20) are to be brought into the subproject site, then the contractor must provide a management plan and code of conduct for the staff and workers, that is approved by the local community authority.	To minimise the disruption to local communities due to an influx of temporary labour.
2.11	1. The noise and dust reduction measures listed above must be adhered to. 2. Safety measures for machine operation must be defined and approved by the project implementing agency. 3. Machine operators and workers must be trained and certificated in the safe use of machines.	To minimise the effects on both workers and local society from the operation of construction machines.
2.12	1. The contractor must prepare a plan for the management of hydrocarbons, which must be approved by the PPIT before the contractor is permitted to mobilise to site. 2. Fuel and oil must be transported in properly designed vehicles meeting national standards. 3. Fuel and oil must be stored at least 50 metres from a water body, in covered and bunded locations, and dispensed under strict controls. 4. Vehicle and machine parking and service areas must have impermeable surfaces and the outlet drains must be fitted with oil traps. 5. Contractors must have spill clean-up equipment on site, and persons always present who know when and how to use it. 6. The contractor must have a land restoration plan that includes hydrocarbon facilities, which must have been implemented to the satisfaction of both the project implementing agency and the landowner before the contractor's final bill may be paid. 7. Any subcontractor must comply with the same rules, at the contractor's liability.	To avoid the pollution by hydrocarbons from construction plant.

Contractor – Construction Phase		
No.	**What you Must Do**	**Why You Must Do It**
2.13	1. The contractor must prepare a plan for the management of wastewater, which must be approved by the PPIT before the contractor is permitted to mobilise to site. 2. "Black" wastewater from sanitation facilities must be led to a properly constructed septic tank and soakaway. 3. "Grey" wastewater from washing and cooking facilities must be led to a septic tank or to a specially built reed bed filtration system. 4. Oil-contaminated water from workshops and fuel stores must be collected and taken to an approved municipal waste management facility. 5. The contractor must have a land restoration plan that includes wastewater facilities, which must have been implemented to the satisfaction of both the PPIT and the landowner before the contractor's final bill may be paid. 6. Any subcontractor must comply with the same rules, at the contractor's liability.	To avoid the pollution from construction site wastewater, from camps and other work sites.
2.14	1. Solid waste must be recycled wherever possible. 2. Non-recyclable solid waste must be sent to an official landfill site. 3. The contractor must have a land restoration plan that includes solid waste, which must have been completed to the satisfaction of both the PPIT and the landowner before the contractor's final bill may be paid.	To avoid pollution from solid waste materials.
2.15	1. Work sites must be clearly demarcated using barrier tape and all non-project personnel excluded. 2. All staff, workers and visitors to construction sites must be issued with appropriate personal protective equipment. 3. All staff, workers and visitors to construction sites must be briefed on safe working procedures for that site. 4. Every construction site must have a first aid kit and at least two persons always present who are trained and competent to use it.	To avoid injuries to workers and others.
2.16	1. All small cultural sites (such as small shrines and graves) must be protected by the contractor during works periods. 2. A plan for the protection of cultural sites must be approved by the PPIT . 3. Once construction is complete the surrounding of such sites must be restored to their pre-construction condition.	To minimise the disruption of cultural sites.

Contractor – Construction Phase		
No.	**What you Must Do**	**Why You Must Do It**
2.17	1. Instructions on managing the infrastructure must be provided to the end users before handover. 2. The operating instructions must be explained to the Water User Group. 3. Before handover, the operating instructions must be finalised and the EMP requirements included.	So that subsequent users fully understand how to manage the subproject infrastructure.

Appendix 4. Responsibilities of the Water User Group – Operation Period

Water User Group – Operation Period		
No.	**What you Must Do**	**Why You Must Do It**
3.04	1. All flood protection works must be maintained as per the design of the subproject, or any subsequent engineering works. 2. Any flood damage must be reviewed and appropriate measures designed for resolution. 3. Occasional minor flood damage should normally be resolved by using appropriate measures. 4. The use of civil engineering structures (i.e. concrete or gabion works) may be required in the event of serious damage from exceptional floods.	To prevent flood damage to headworks and the erosion of canal banks, either from flood surges or normal flows.

Appendix 5. Surface Water Quality Standards

Government of Lao PDR National Environmental Standards (2017)
10. Surface Water Quality Standards

Class 2: Water quality for aquatic animal conservation, fisheries and water sports.
Class 3: Water quality for agriculture, livestock and other uses.

No.	Substances	Symbol	Unit	Standard Value		Method of Measurement
				Class 2	Class 3	
1	Colour, Odour and Taste	-	-	n'	n'	Description
2	Temperature	t	°C	n'	n'	Thermometer
3	Potential of Hydrogen	pH	-	6-8	5-9	Electronic pH meter
4	Dissolved Oxygen	DO	mg/l	6.0	5.0	Azide Modification
5	Electro-conductivity	EC	µS/cm	≤ 1000	≤ 2000	EC meter
6	COD	COD	ml/l	5-7	7-10	Potassium Dichromate Digestion; Open Reflux or Closed Reflux
7	Total Coliform Bacteria	Coliform Bacteria	MPN/100 ml	5000	20000	Multiple Tube Fermentation
8	Faecal Coliform Bacteria	Faecal Bacteria	MPN/100 ml	1000	4000	
9	Total Suspended Solids	TSS	mg/l	≤ 25	≤ 40	Glass Fibre Filter Disk
10	Phosphate	PO_4	mg/l	0.5	1.0	Ascorbic Acid
11	Ammonium Ion	NH_4^+	mg/l	≤ 1.5	≤ 3.0	Kjeldahl
12	Nitrate-nitrogen	NO_3-N	mg/l	5.0	5.0	Cadmium Reduction
13	Ammonia-nitrogen	NH_3-N	mg/l	0.5	0.5	Distillation Nezzlerization
14	Phenols	C_6H_5OH	mg/l	0.005	0.005	Distillation, 4-Amino antipyrene
15	Copper	Cu	mg/l	1.5	1.5	Atomic Absorption Direct Aspiration
16	Nickel	Ni	mg/l	0.1	0.1	
17	Manganese	Mn	mg/l	1.0	1.0	
18	Zinc	Zn	mg/l	1.0	1.0	
19	Cadmium	Cd	mg/l	0.003	0.003	
20	Chromium, Hexavalent	Cr^{6+}	mg/l	0.05	0.05	
21	Lead	Pb	mg/l	0.01	0.01	
22	Mercury	Hg	mg/l	0.001	0.001	Atomic Absorption Cold Vapour
23	Arsenic	As	mg/l	0.01	0.01	Atomic Absorption Direct Aspiration, ICP
24	Cyanide	CN^-	mg/l	0.07	0.07	Pyridine-Barbituric Acid
25	Alpha Radioactivity	α	Becquerel/l	0.1	0.1	Geiger Counter
26	Beta Radioactivity	β	Becquerel/l	1.0	1.0	
27	Organochlorine Pesticide	-	mg/l	0.05	0.05	Gas Chromatography
28	Dichlorodiphenyl-trichloroethane (DDT)	$C_{14}H_9Cl_5$	µg/l	1.0	1.0	
29	Alpha-Benzene Hexachloride (BHC)	αBHC ($C_6H_6Cl_6$)	µg/l	0.02	0.02	
30	Dieldrin	$C_{12}H_8Cl_6O$	µg/l	0.1	0.1	

31	Aldrin	$C_{12}H_8Cl_6$	µg/l	0.1	0.1	
29	Heptachlor and Heptachlor Epoxide	$C_{10}H_5Cl_7$, $C_{10}H_5Cl_7O$	µg/l	0.2	0.2	
30	Endrin	$C_{12}H_8Cl_6O$	µg/l	None	None	

Appendix 6. Project Environmental Guidelines

The Government of Lao PDR National Environmental Standards (2017) will be used as the reference points for the areas that they cover. The list below gives the additional guideline standards that must be followed on all SRIWSM subprojects. If new standards are gazetted by the government during the project implementation period, then they shall take precedence if they are stricter.

Soil

- All bare surfaces (including roadsides and drains but excluding road running surfaces) shall be protected using bio-engineering measures that shall be implemented during the months of May to July each year. The SRIWSM bio-engineering guidelines will be followed.
- Agrichemicals shall only be used that are not on the Government of Lao PDR lists of prohibited substances under the Regulation on the Control of Pesticides in Lao PDR (Regulation No 2860/MAF, 11 June 2010) and the Decree on Pesticide Management: (Decree No. 258/GOV, 24 August 2017).

Vegetation

- No tree of more than 200 mm diameter at breast height (1.5 metres above the ground) shall be cleared unless the design drawings specifically require it.
- Other vegetation shall be cleared only within agreed site boundaries or in connection with agreed subproject activities.
- Fire shall not be used as a means of clearing vegetation or for the disposal of cleared vegetation.

Agrichemical Use

- Each cropping system shall be integrated within Lao Gap certification Systems
- Where required PRT provided by the crop protection centre staff of PAFO
- Where warranted IPM training programs provided by PAFO

Water

- The National Environmental Standard (2017) for water quality shall apply in every case.
- A vegetated band of at least 50 metres should be maintained between any areas of disturbance and any water course. Exceptions are made only where irrigation headworks and road crossings must necessarily be closer.
- Irrigation headworks shall utilise the minimum amount of cleared land. During and after construction, the surface drainage from all earthworks shall be directed via sediment traps to ensure that runoff water is clear at the point of discharge into a flowing watercourse.
- Road crossings shall be at 90 degrees to a water course. Properly designed and constructed culverts and bridges shall be used. Road drainage shall be provided and sediment traps shall be installed to ensure that road runoff water is clear at the point of discharge into a flowing water course. Alignments should be at 90 degrees to the water course within a band of 50 metres on each side unless the terrain or an obstruction prevents this.
- All weirs and other obstructions in rivers, streams and canal channels must have provision for native migratory fish to pass.

Animals

- All subproject staff, workers and beneficiaries shall be issued with a list of rare, threatened and endangered species in the area around the subproject, which shall not be hunted, traded or eaten. Such a list shall be included in each subproject IEE and shall be based on the regional data held by the International Union for the Conservation of Nature (IUCN) Red List.

Air

- The National Environmental Standard (2017) for air quality shall apply in every case.
- On all unmetalled surfaces, construction traffic shall be limited to 30 kmh within 250 metres of habitation and 80 kmh elsewhere.
- Dust emissions shall be minimised by spraying water during dry weather and using other site-specific measures.
- Vehicle and machine engines shall be stopped when stationery.

Storage

- No storage of oil, fuel or chemicals is permitted within 50 metres of a water body.
- All stores shall be covered with full rain protection.
- Oil and fuel stores shall have impermeable bunds capable of retaining 150 percent of the stored volume indefinitely.

Hazardous Materials

- Fuels, oils, cement, fertilisers and pesticides shall be included in the category of hazardous materials.
- All hazardous materials shall be stored in secure compounds, with rain protection and bunding in case of spills and leakages.
- Every site where hazardous materials are stored or used shall have spill clean-up equipment and staff trained in its use.
- Fuel handling areas shall be bunded and all drainage water directed through oil traps. Sediment from oil traps shall be sent for disposal at a waste disposal facility authorised for the handling of hydrocarbon waste.

Solid Waste Management

- All work sites shall be provided with sanitary facilities. These may be pit latrines or water-based toilets with septic tanks and subsurface soakaways.
- Solid waste shall be recycled where facilities exist.
- Where solid waste cannot be recycled, it shall be sent to an approved landfill site.
- Fire shall not be used as a means of disposing of waste.

Society

- The National Environmental Standard (2017) for noise and vibrations shall apply in every case.
- There shall be no night-time working (i.e. between sunset and sunrise) within 500 metres of habitation.

Construction Site Safety

- All construction sites shall be delineated with barrier tape and non-project personnel excluded at all times.
- All staff and workers shall wear appropriate personal protective equipment (PPE) at all times that they are on a work site.

- The minimum for all personnel is: reflective vest; safety helmet; and safety boots.
- Other PPE such as gloves, eye protection, ear protection, etc. shall be used according to the work performed or underway nearby in the site.