



**Lao People's Democratic Republic**  
**Peace Independence Democracy Unity Prosperity**



**Ministry of Public Works and Transport**  
**Department of Water Supply**



**Scaling-Up Water Supply, Sanitation, and Hygiene Project**

**IDA Project No.: SWSSHP (P-164901)**

**Jointly Implemented by the Ministry of Public Works and  
Transport & the Ministry of Health of Lao PDR**

**ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN**  
**FOR WATER SUPPLY SYSTEM (WSS)**  
**IN PHONGSALY PROVINCE.**

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## Table of Contents

<b>1.</b>	<b>INTRODUCTION .....</b>	<b>3</b>
<b>2.</b>	<b>POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK .....</b>	<b>5</b>
2.1	RESPONSIBLE AGENCIES .....	5
2.2	LAO PDR ENVIRONMENTAL AND SOCIAL LEGISLATION FOR WATER SUPPLY .....	5
2.3	WORLD BANK SAFEGUARDS POLICIES .....	6
2.3.1	World Bank Safeguard Policies Triggered for the Project.....	6
2.3.2	Environmental, Health, and Safety (EHS) Guidelines .....	6
<b>3</b>	<b>DESCRIPTIONS OF THE PROPOSED INVESTMENTS.....</b>	<b>7</b>
3.1	SERVICED AREAS AND GENERAL SYSTEM LAY OUT. ....	7
3.2	DESCRIPTIONS OF THE WSSs AND THEIR ELEMENTS.....	11
3.3	WATER SOURCES.....	13
3.3.1	Namly WSS in Samphan District.....	13
3.3.2	Sinxay WSS in Khoua District .....	13
3.3.3	Sophon WSS in May District.....	14
3.3.4	Longnai Kao WSS in Bountai District .....	14
3.4	WATER INTAKES.....	15
3.4.1	Site Selection, Intake Locations.....	16
3.4.2	Intake Structures .....	17
3.5	RAW WATER TRANSMISSION PIPELINES.....	19
3.6	WATER TREATMENT PLANTS .....	19
3.7	WATER SUPPLY SERVICE OFFICE.....	25
3.8	DISTRIBUTION NETWORK.....	26
3.9	ACCESS ROADS, POWER SUPPLY TO THE WTPS.....	27
<b>4</b>	<b>ENVIRONMENTAL AND SOCIAL BASELINE CONDITIONS.....</b>	<b>28</b>
4.1	TOPOGRAPHY .....	28
4.2	HYDROLOGY AND SURFACE WATER QUALITY .....	28
4.3	GEOLOGY.....	31
4.4	AIR QUALITY AND NOISE .....	32
4.5	BIOLOGICAL RESOURCES .....	32
4.6	PHYSICAL CULTURE RESOURCE .....	34
4.7	INFRASTRUCTURE AND PUBLIC SERVICES .....	34
4.8	ETHNIC GROUPS .....	36
4.9	NAMLY WSS SPECIFIC CONDITIONS .....	36
4.9.1	Land Cover and Land use.....	36
4.9.2	Water Use.....	37
4.9.3	Demographic and Socio-economic conditions.....	37
4.9.4	Site Specific Conditions–Namly WSS, Samphanh district.....	38
4.10	SINXAY WSS SPECIFIC CONDITIONS .....	42
4.10.1	Land use.....	42
4.10.2	Water Use.....	42
4.10.3	Demographic and Socioeconomic Conditions .....	42
4.10.4	Site Specific Conditions– Sinxay WSS in Khoua District .....	44
4.11	SOPHUN WSS SPECIFIC CONDITIONS .....	48
4.11.1	Land use.....	48
4.11.2	Water Use.....	48
4.11.3	Demographic and Socioeconomic Conditions .....	49
4.11.4	Site Specific Conditions – Sophun WSS in Mai District .....	50
4.12	LONGNAI KAO WSS SPECIFIC CONDITIONS .....	55
4.12.1	Land use.....	55
4.12.2	Water Use.....	55
4.12.3	Demographic and Socioeconomic Conditions .....	55
4.12.4	Site Specific Conditions – Longnai Kao WSS .....	57
<b>5</b>	<b>POTENTIAL ENVIRONMENTAL AND SOCIAL IMPACTS AND RISKS .....</b>	<b>61</b>

5.1	POSITIVE IMPACTS AND BENEFITS .....	61
5.2	ENVIRONMENTAL IMPACT DURING THE CONSTRUCTION PHASE.....	61
5.2.1	Pre-Construction and Construction impact and Risks .....	61
5.2.2	Type and Site-specific Construction Impacts and Risks.....	68
5.3	ENVIRONMENTAL IMPACTS AND RISKS DURING THE OPERATION PHASE .....	69
5.3.1	Impacts on Hydrology and Water Usage.....	69
5.3.2	Generation of backwash water and sludges at water treatment plants.....	69
5.3.3	Occupational Health and Safety of Workers.....	69
5.3.4	Community Health and Safety.....	69
5.3.5	Landslide Risks.....	70
5.3.6	System Failure Risks.....	70
5.3.7	Raw Water Quality and Quantity Security .....	70
<b>6</b>	<b>ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN.....</b>	<b>70</b>
6.1	MITIGATION MEASURE .....	70
6.1.1	Detailed Design .....	70
6.1.2	Environmental and Social Codes of Practices (ESCAP) and construction requirements.....	76
6.1.3	Mitigation Measures required During Operation Phase .....	134
6.2	INSTITUTIONAL ARRANGEMENTS .....	135
6.2.1	PMU Roles and Responsibilities.....	135
6.2.2	Construction Supervisors (CSC) Roles and Responsibilities.....	135
6.2.3	Contractors' Safeguard Responsibilities.....	135
6.3	MONITORING AND REPORTING REQUIREMENTS.....	136
<b>7</b>	<b>INFORMATION DISCLOSURE, CONSULTATION AND PARTICIPATION .....</b>	<b>137</b>
<b>8</b>	<b>GRIEVANCE REDRESS MECHANISM.....</b>	<b>139</b>
8.1	TYPE OF GRM.....	140
8.2	GRIEVANCE RESOLUTION PROCESS .....	140
<b>9</b>	<b>ANNEXURES.....</b>	<b>143</b>
	ANNEX 1 ENVIRONMENTAL AND SOCIAL ELIGIBILITY SCREENING .....	143
	Annex 1.1 Environmental and Social Eligibility Screening WSS Namly Cluster .....	144
	Annex 1.2 Environmental and Social Eligibility Screening WSS Sinxay Cluster .....	145
	Annex 1.3 Environmental and Social Eligibility Screening WSS Sophun Cluster .....	146
	Annex 1.4 Environmental and Social Eligibility Screening of WSS LongnaiKao Cluster.....	147
	ANNEX 2 TYPICAL PIPELINE ALIGNMENTS WSS. ....	148
	Annex 2.1 Typical Pipeline Alignments of WSS Namly Cluster .....	149
	Annex 2.2 Typical Pipeline Alignments of WSS Sinxay Cluster Cluster .....	153
	Annex 2.3 Typical Pipeline Alignments of WSS Sophun Cluster .....	159
	Annex 2.4 Typical Pipeline Alignments of WSS Longnai-Kao Cluster .....	165
	ANNEX 3. DRAFT TEMPLATE FOR CONSTRUCTION ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (C-ESMP) .....	170
	ANNEX 4. DRAFT TEMPLATE FOR MONTHLY ENVIRONMENTAL, HEALTH AND SAFETY (ESHS) MONITORING REPORT.....	182

## List to Tables

Table 2-1 List of WB safeguard policies triggered for the project. ....	6
<b>Table 3-1- Key parameters of the proposed WSS in Phongsaly Province.....</b>	<b>11</b>
<b>Table 3-2 Number of valves will be installed in the raw water transmission pipelines.....</b>	<b>19</b>
Table 3-3 Key Parameter of WTPs .....	22
Table 3-4 Clean Water Reservoir Dimensions.....	23
Table 3-5 type of and length of distribution pipes. ....	26
Table 4-1 Summary of the flow discharge in Houay Ly (30 April 2022) .....	29
Table 4-2 Summary of the flow discharge in Houay Phea (1 <sup>st</sup> May 2022) .....	30
Table 4-3 Summary of the flow discharge in Houay Yei (2 <sup>nd</sup> May 2022) .....	30
Table 4-4 Summary of the flow discharge in Houay Viey (28 <sup>th</sup> April 2022).....	30
<b>Table 4-5- Summary of Water Quality Analysis Result .....</b>	<b>30</b>
Table 4-6 Number of household access to toilet in the WSSs core service area .....	35
Table 4-7 Ethnic group in WSSs Project area in Phongsaly Province .....	36
Table 4-8– Site Specific Conditions in Namly WSS.....	38
Table 5-1.1 Summary Impact on land and existing objects on land WSS Namly Cluster in Phongsaly Province.....	41
Table 4-9 Site Specific Conditions in Sinxay WSS, Khoua District.....	44
Table 5-1.2 Summary Impact on land and existing objects on land WSS Sinxay Cluster in Phongsaly Province.....	47
Table 4-10 Site Specific Conditions in Suphun WSS in Mai District.....	50
Table 5-1.1 Summary Impact on land and existing objects on land WSS Sophun Cluster in Phongsaly Province.....	54
Table 4-11 Site Specific Conditions in Longnai Kao WSS in Bountai District .....	57
Table 5-1.1 Summary Impact on land and existing objects on land WSS Longnai Kao Cluster in Phongsaly Province.....	60
Table 5-1 Summary Impact on land and existing objects on land WSS in Phongsaly Province.....	63
Table 6-1 Application of Environmental Checklist for Detail Design stage for 4 clusters of WSS Namly, Sinxay, Sophun and Longnai Kao WSS .....	72
Table 6-5 Environmental and Social Code of Practice (ESCOP) .....	77
Table 6-6 Site-Specific mitigation measure for pipe installation.....	87
Table 6-7 Site-specific Mitigation measures .....	91
Table 6-8 the mitigation measure for the operation phase.....	134
Table 7-2 Summary of Main Components raised during the Public Consultation ...	138

Table 8-1 List of contact persons at the provincial and district levels .....	142
Table 2-1 Project Overview, Snapshot of Project Progress.....	183
Table 3-1 Summary Training Activities .....	184
Table 3-2 Compliance with ESMP Requirements (Environmental Permeance) .....	185
Table 3-3 Issue for Further Action.....	185
Table 3-4 Health and Safety Issue.....	185

### List of Figures

Figure 3-1 Location map of Phongsaly province and four WSSs.....	7
Figure 3-2 General lay out of Namly WSS in Samphanh District.....	8
Figure 3-3 Location map and general layout of Sinxay WSS in Khoua District.....	9
Figure 3-4 General lay out of Sophun WSS in Mai District.....	9
Figure 3-5 General lay out of Longnai Kao WSS in Bountai District .....	10
Figure 3-6 A view of Catchment Area of Houay Ly.....	13
Figure 3-7 A View Catchment Area of Houay Phea.....	14
Figure 3-8 A View Catchment Area of Houay Yei.....	14
Figure 3-9 A view of Houay Vieu Catchment Area.....	15
Figure 3-10 Aerial picture of water intake of Namly (a), Sinxay (b), Sophun (C) and Longnai Kao (d).....	16
Figure 3-11 The proposed location of water intake of Namly WSS .....	16
Figure 3-12 The Proposed Location of water intake of the Sinxay WSS.....	16
Figure 3-13 The Proposed Location of water intake of the Sophun WSS.....	17
Figure 3-14 The Proposed Location of water intake of the Longnai Kao WSS .....	17
Figure 3-15 Plan of Wier Intake.....	18
Figure 3-16 Cross Profile-Weir and Tyrolean Intake.....	19
Figure 3-17 Layout of WTP facilities.....	20
Figure 3-18 Layout of Water Treatment Plant and Existing Land Use of Namly WSS .....	20
Figure 3-19 Layout of Water Treatment Plant and Existing Land Use of Sinxay WSS .....	20
Figure 3-20 Layout of Water Treatment Plant and Existing Land Use of Sophun WSS .....	20
Figure 3-21 Layout of Water Treatment Plant and Existing Land Use of Longnai Kao WSS.....	21
Figure 3-22 The process of water treatment plant.....	21
Figure 3-23 Hydraulic Diagram .....	22

Figure 3-24 Water Treatment Plant Plan .....	23
Figure 3-25 Clean water tank .....	24
Figure 3-26 Figure of Chemical House .....	24
Figure 3-27 Sludge lagoon.....	25
Figure 3-28 Water Supply Office.....	26
Figure 3-29 Typical of Excavation for water pipes network. ....	27
Figure 3-30 Master Plan-Layout 22kV Distribution Line for Namly WTP .....	27
Figure 3-31 Master Plan-Layout 22kV Distribution Line for Sinxay WTP .....	27
Figure 3-32 Master Plan-Layout 22kV Distribution Line for Sophun WTP .....	28
Figure 3-33 Master Plan-Layout 22kV Distribution Line for Longnai Kao WTP....	28
Figure 4-1 The average monthly rainfall from the year 2016 to 2020 at Phongsaly Satation.....	29
Figure 4-2 A synthetic map of hydrogeological groups and major aquifer units (textures).....	29
Figure 4-3 The project location in relation to the nearest protected areas.....	32
Figure 4-4 Land use at proposed WTP and Water Intake of Namly WSS .....	33
Figure 4-5 Land use at proposed WTP and Water Intake of Sinxay WSS.....	33
Figure 4-6 Land use at proposed Water Intake and WTP of Sophun WSS.....	34
Figure 4-7 Waste dumping along the roadsides near Namly village.....	36
Figure 4-8 Land Cover and Land Use in Namly Village (2023) .....	37
Figure 4-9 Land Cover and Land Use in Sinxay Village .....	42
Figure 4-10 Land Use in Sophun and Sopnao Village .....	48
Figure 4-11 Land Cover and Land Use in Longnai Kao, Longnaimai and Bornoy village.....	55
Figure 7-0-1 Photos taken at public consultation meeting in Namly and Sinxay .....	139

## ABBREVIATIONS

AMSL	:	Above Mean Sea Level
CCL	:	Comité de Coopération avec Laos (a French Non-Governmental Organization)
C-ESMP	:	Contractor's Environmental and Social Management Plan
CLTS	:	Community-Led Total Sanitation
CMU	:	Component Management Unit
CWSS	:	Community Water Supply System
DHHP	:	Department of Hygiene and Health Promotion
DMA	:	District Metering Area
DONRE	:	District Natural Resources and Environment Department
DPWT	:	Department of Public Works and Transport
DWS	:	Department of Water Supply
EC	:	Electronic Conductivity
EPL	:	Environmental Protection Law
ES	:	Environmental and Social
ES COP	:	Environmental and Social Codes of Practices
ESHS	:	Environmental, Social, Health and Safety
ESMF	:	Environmental and Social Management Framework
ESMP	:	Environmental and Social Management Plan
ESS	:	Environmental and Social Screening
HGN DP	:	Health Governance and Nutrition Development Project
HH	:	Households
HMIS	:	Health Management Information System
ICT	:	Information and Communication Technologies
IEE	:	Initial Environmental Examination
Lao PDR	:	Lao People's Democratic Republic
M&E	:	Monitoring and Evaluation
MOH	:	Ministry of Health
MONRE	:	Ministry of Natural Resources and Environment
MPWT	:	Ministry of Public Works and Transportation
Nam Saat	:	National Center for Environmental Health and Water Supply
NGPES	:	National Growth and Poverty Eradication Strategy
NSEDP	:	National Social Economic Development Plan
NTU	:	Nephelometric Turbidity Units
O&M	:	Operation and Maintenance
ODF	:	Open Defecation Free
OP/BP	:	The World Bank's Operational Policy/Bank Procedure
PDO	:	Project Development Objective
PH	:	Potential of Hydrogen
PIUs	:	Project Implementation Units
PMU	:	Project Management Unit
PNP	:	Provincial Nam Papa
PONRE	:	Provincial Natural Resources and Environment Department

PSC	:	Project Steering Committee
RP	:	Resettlement Plan
SBCC	:	Social and Behavior Change and Communications
SDG	:	Sustainable Development Goal
SF	:	Sanitation Facilities
SWSSHP	:	Scaling-Up Water Supply, Sanitation and Hygiene Project
TDS	:	Total Dispersible Soluble
UXO	:	Un Exploded Ordinance
VDC	:	Village Development Committee
WASH	:	Water Supply, Sanitation and Hygiene
WSP	:	Water and Sanitation Program
WSS	:	Water Supply System (Nam Papa)
WTP	:	Water Treatment Plant

## 1. Introduction

1. The Scaling-Up Water Supply, Sanitation and Hygiene Project (SWSSHP, the Project) supports the multi-sector convergence on nutrition. The Project budget is US\$25 million, funded by the Government of Lao PDRs and the World Bank. SWSSHP is implemented by the Ministry of Public Works and Transport (MPWT) and the Ministry of Health (MOH). A Project Management Unit (PMU) has been established in the Department of Water Supply (DWS) under the MPWT and a Component Management Unit (CMU) has been established in the Department of Hygiene and Health Promotion (DHHP) under the MOH.

2. The SWSSHP aims to provide access to improved water supply, sanitation and hygiene services in selected rural and peri-urban areas. The Project has four components, including: (1) Delivery of infrastructure and sustainability of water supply and sanitation, (2) Sustainability of community water supply, sanitation, and hygiene support, (3) Implementation support and sector development, and (4) Contingency emergency response. The project has been implemented in 12 districts of four provinces located in the northern mountainous region of Lao PDR including Phongsaly, Oudomxay, Houaphan and Xiengkhouang provinces. The Project planned to support Water Supply Systems (WSS) in 12 Clusters and 62 Community Water Supply Systems (CWSSs, of very small scale), and 90 sanitation facilities (SF) at existing schools and health centers. For Phongsaly province, 4 WSSs, 20 CWSS in 22 villages and 66 SF were proposed.

3. The Project's Environmental and Social Management Framework (ESMF) was prepared during Project preparation. Accordingly, Environmental and Social Screening (ESS) was conducted for the WSS subprojects. Meanwhile, Environmental and Social Codes of Practices (ESCOPs, introduced in the ESMF) has been/will be applied for the construction of smaller Community Water Supply Systems (CWSS) and SF.

4. ESS was conducted by the Project Implementation Units (PIUs) based on two ESS checklist forms in the ESMF. The results of ES screenings for the 4 WSSs (Namly, Sinxay, Sophun and Longnai Kao Clusters) in Phongsaly province are summarized below.

- None of the proposed WSS in Namly cluster in Samphanh District, Longnai Kao cluster in Bountai District, Sinxay cluster in Khua District and Sophun cluster in Mai District are in the Negative List (Annex 4) of ESMF. The main elements of each proposed WSS (such as water treatment plant and office, access roads, raw water intake and clean water distribution pipes) are not located in protected areas. Therefore, four WSSs are eligible for receiving financing (for more refer to annex-1 screening forms).
- As the siting of the WSS facilities (intakes, WTP, pipelines, access roads etc.) already avoided residential houses and existing structures, no resettlement of houses would be required. However, the construction of the Water Supply System will result in a permanent impact on the private agricultural land of 3 households (HH), including one affected households (AHs) in the Namly cluster (cardamom garden) and two AHs in the Longnai Kao WSS cluster (one rubber garden and one fallow land). There are permanent impact on rubber trees of three AHs in the Sophun WSS cluster. A total of 6 households (HH) will be permanently impacted by the construction activities of Nam Papa. Of these, 5 HH—including 3 HH in the Sophun WSS cluster and 2 HH in the Longnai Kao WSS cluster—will be permanently affected by the joint construction of an access road to the Water Treatment Plant (WTP) and the WTP construction site. Additionally, 1 HH in the Namly WSS cluster will be permanently impacted solely by the construction of the WTP. However, among those affected households only one household has land title of the affected plot (Namly village), and two affected plots in Longnai Kao village have

land tax documents. While other affected households have occupied the public land with no tax payment, no land use right certificate for rubber tree garden. The affected crops and trees will be compensated if there is no voluntary donation to the project.

- During the implementation of the WSS subproject, 76 households (HH) across four WSS clusters will experience temporary impacts on their agricultural land due to the laying of raw water pipelines. The affected villages include Namly (32 HHs), Sinxay (9 HHs), Sophun (17 HHs), and Longnai Kao (18 HHs). Consultations were held with the potentially affected households during village meetings. During these consultations, the households provided their consent for the pipeline to pass through their agricultural land. To minimize disruption to their agriculture land, the contractor has committed to laying the pipelines along the borders of the fields whenever possible, avoiding placement through the middle of the fields and after laying out of the pipeline land will be leveled to original condition.
- As part of a clean water pipeline project, 32 households in four villages across three WSS clusters (Namly, Sinxay, and Sophun) will experience temporary impacts:
  - Namly WSS Cluster: 10 households (Namly village)
  - Sinxay WSS Cluster: 13 households (Sinxay village)
  - Sophun WSS Cluster: 13 households (9 HHs in Sophun village and 4 HHs in Sopnao village)
- These impacts involve disruptions to the extended concrete slabs in front of houses and shops. Consultations with the affected households were conducted, and consent was given for the pipeline installation through their concrete floors. The contractor will take measures to minimize disruptions by laying the pipelines along the Right of Way (ROW) of the road and avoiding concrete floors whenever possible. If any households are affected during construction, the contractor will restore the concrete floors to their original condition.
- There will be temporary environmental and social (ES) impacts and risks during the construction period of each WSS. The potential impacts and risks include ground disturbance leading to reduced or loss of some vegetation cover and trees, nuisances to communities related to generation of dusts, noise, and exhaust emissions, occupational and community health and safety risks, generation of wastes and excavated materials, traffic disturbance and increased traffic safety risks, community disturbance due to construction activities, and increased erosion/landslide risks especially on steep topography. Most of the potential ES impacts and risks during the construction phase are anticipated to be localized, temporary and short term, at low to moderate levels. These ES risks and impacts should be manageable by the measures incorporated into project detail design and construction practices (readily known and available in the form of Environmental and Social Codes of Practices – ESCOPs) and site-specific mitigation measures to be determined based on specific baseline conditions and types of construction activities. During operation phase, there will be occupational health and safety risks, and waste/wastewater will be generated. These can be managed through engineering design of the WTP and operational procedures.

5. The impacts of the construction of the Namly, Sinxay, Sophun, and Longnai Kao water supply subprojects are primarily temporary and minor. However, there are permanent impacts on 6 affected households (AHs), including 2 with agricultural land and crops, 1 with fallow land, and 3 impacted solely by rubber trees. An Abbreviated Resettlement Action Plan (ARAP) will be developed to monitor compliance with the entitlement matrix. The siting of WSS facilities avoids residential houses and existing structures, eliminating the need for resettlement.

6. Screening results confirmed that the Project is classified as Environment Category B (according to OP/BP 4.01). In accordance with the ESMF, an Environmental and Social Management Plan (ESMP, this document) is prepared for the four Water Supply Systems (WSS) in Phongsaly Province.

7. The ESMP in language understandable to the local communities will be disclosed at public accessible places in project areas before construction is started and communities will be informed accordingly. Relevant parts of the ESMP (particularly the mitigation measures, contractors' responsibilities) will be included in the Construction Bidding Documents and contractual documents.

## **1 Policy, Legal and Administrative Framework**

### **1.1 Responsible Agencies**

8. MPWT has been traditionally mandated with the planning and development of urban water supply and sanitation systems, it also increasingly takes care of water supply systems for rural clusters. Survey and design of gravity-fed piped water supply systems being increasingly transferred to DWS and with time, increasing numbers of water supply systems are moving under the purview of the water utilities, or Provincial Nam Papa (PNP). The development of community water supply systems (CWSS) also comes under the PNP. The focus of MOH will be on the reduction of open defecation, promotion of sanitation and hygiene, water quality improvement, and collection and validation of sector information.

### **1.2 Lao PDR Environmental and Social Legislation for Water Supply**

9. The Key government legislation applicable to the project includes the following.
- Environmental Protection Law (2012) EPL specifies necessary principles, rules and measures for managing, monitoring, restoring and protecting the environment from pollution. The aim is to protect the public, natural resources and biodiversity, and to ensure the sustainable socio-economic development of the nation.
  - The Law on Water and Water Resources (2017)
  - The Law on Water Supply (2009)
  - Forestry Law (2007)
  - Wildlife and Aquatic Law (2008)
  - Land Law (2003)
  - Ministerial Instruction No. 8029
  - Drinking Water Quality Standards
  - Decree #84 on Compensation and Resettlement of People Affected by Development Projects (2016)
  - Technical Guidelines on Compensation and Resettlement of People Affected by Development Project (2005)
  - Decree on the Preservation of Cultural, Historical and Natural Heritage (1997)

This decree requires that any person who discovers archaeological relics or a cultural site must inform the provincial and district offices within three days.

- Guideline on Consultation with Ethnic Groups (2013)
- Decree 333 on Protection Forest (2010)

10. Screening Process of the investment project and activities is the first step in Environmental Impact Assessment process and the key step to determine whether the Investment Projects and Activities as proposed need any Environmental Impact Assessment. The screening can be conducted by the project proponent by applying the list of Investment Projects and Activities and by the Natural Resource and Environment authorities. Since the WSS consists in minor civil construction work, Provincial Department of Natural Resource and Environment (PONRE) joined the site investigation in early state. PONRE confirmed that IEE is not required for those WSSs but the PMU/PIU shall submit the EMP to PONRE for approval and their monitoring.

### 1.3 World Bank Safeguards Policies

#### 1.3.1 World Bank Safeguard Policies Triggered for the Project

11. The Water Supply and Sanitation Project is classified as Category B status as it may involve minor adverse impacts on local environment and communities. The Project will trigger up to five of the World Bank safeguard policies as presented in Table 1-1.

*Table 1-1 List of WB safeguard policies triggered for the project.*

	WB Safeguard Policies	Triggered	Safeguard instruments
1	Environmental Assessment OP/BP 4.01	Yes	ESMF/ESMP/ECOP
2	Natural Habitats OP/BP 4.04	No	
3	Forests OP/BP 4.36	No	
4	Pest Management OP 4.09	No	
5	Physical Cultural Resources OP/BP 4.11	Yes	Chance Finds in ESMP/ECOP
6	Indigenous Peoples OP/BP 4.10	Yes	EGDF/EGDP
7	Involuntary Resettlement OP/BP4.12	Yes	RPF/RAP/ARAP/ESMP
8	Safety of Dams OP/BP 4.37	No	
9	Projects on International Waterways OP/BP7.50	Yes	The World Bank, on behalf of, and at the request of the Lao PDR government has notified the Mekong riparian counties including China, Vietnam, Myanmar, Thailand and Cambodia.
10	Projects in Disputed Areas OP/BP 7.60	No	

#### 1.3.2 Environmental, Health, and Safety (EHS) Guidelines

12. MPWT will take note of the Environmental, Health, and Safety (EHS) requirements for Water and Sanitation projects. It is a technical reference document with general and industry-

specific examples in the guideline provided as Good International Industry Practice. The EHS Guidelines contain the performance levels and measures that are generally considered to be achievable in new facilities by existing technology at reasonable costs. Application of the EHS Guidelines to existing facilities may involve the establishment of site-specific targets, with an appropriate timetable for achieving them.

13. The World Bank Group’s Environmental, Health, and Safety Guidelines (EHSG) and industry-specific Good International Industry Practice will also be applicable to the proposed investments where relevant. These guidelines can be accessed from the following links:

[http://www.ifc.org/wps/wcm/connect/topics\\_ext\\_content/ifc\\_external\\_corporate\\_site/ifc+sustainability/our+approach/risk+management/ehsguidelines](http://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/ifc+sustainability/our+approach/risk+management/ehsguidelines)

<https://documents1.worldbank.org/curated/en/157871484635724258/pdf/112110-WP-Final-General-EHS-Guidelines.pdf>

## 2 Descriptions of the Proposed Investments

14. Four water supply systems (WSS) have been proposed for Phongsaly Province, with one WSS for each cluster as outlined below :

- Namly cluster in Samphanh District.
- Longnai Kao cluster in Bountai District.
- Sinxay cluster in Khua District; and
- Sophun cluster in Mai District.

The locations of Phongsaly province and four districts in the project are shown in the maps below.



Figure 2-1 Location map of Phongsaly province and four WSSs.

Details about the four Cluster WSS are provided below.

### 2.1 Serviced Areas and General System Lay out.

15. The Namly WSS in Samphanh District will provide safe water to the households, health care centers and schools in Namly Village which is locate along the Nation Road No.1A leading

to the border with China, approximately 61km from the Samphanh district (northeastern region) and 52km from the Bountai district (Northern region). It has 215 households and 1,242 people (by January 2021). The layout of core service area and the system's general is shown in the **Error! Reference source not found.2**.

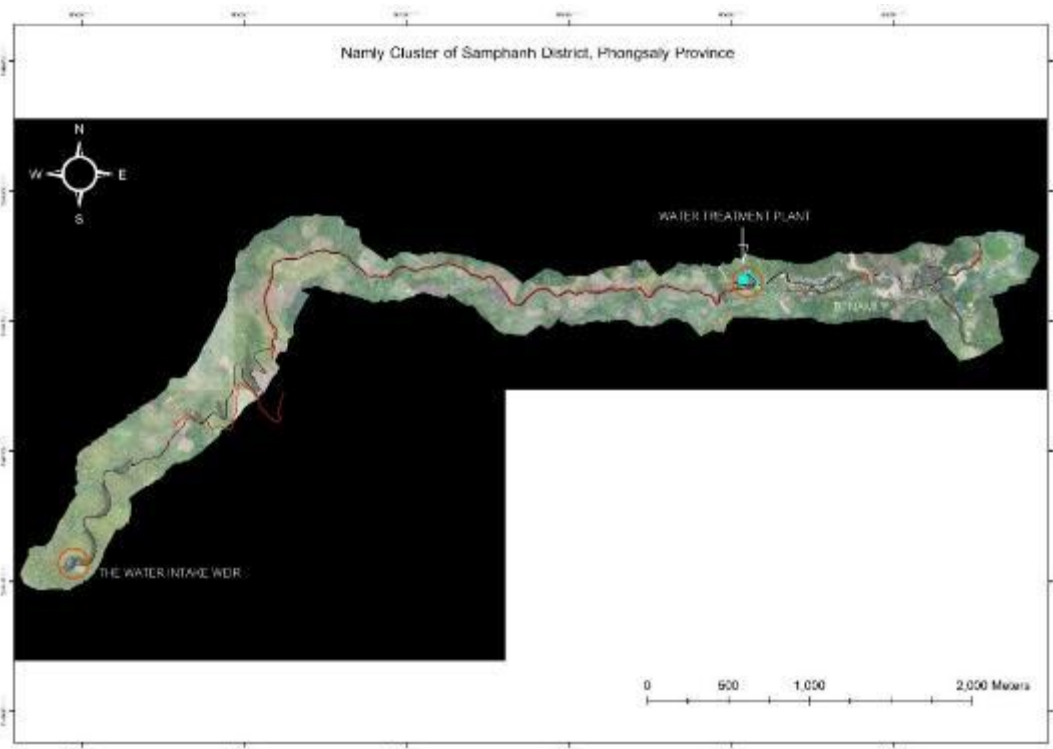


Figure 2-2 General lay out of Namly WSS in Samphanh District

16. The Sinxay WSS in Khoua District will supply safe water to the households, health care centers and schools in two villages namely Ban Sinxay and Ban Paknamnoy. The combined of these two villages is 218 households and 851 people (recorded in Jan. 2021). The core service project area is located in the easternmost of Khoua District, approximately 45Km to the southeast of La District in Oudomxay Province. The layout of the core service area and the system's general layout is shown in the **Error! Reference source not found.3**.



Figure 2-3 Location map and general layout of Sinxay WSS in Khoua District

17. The Sophun WSS in Mai District will supply safe water to the households, health care centers and schools in two villages namely Ban Sophun and Ban Sopnao. The combined population of these two villages is 1,153 people in 220 households and (recorded in Jan. 2021). The WSS core serviced area is located along the laterite road leading to the Boutai district in the northeast and to the Namor district of Oudomxay province in the southwest. The layout of the core service area and the system’s general layout is shown in the **Error! Reference source not found.4**.

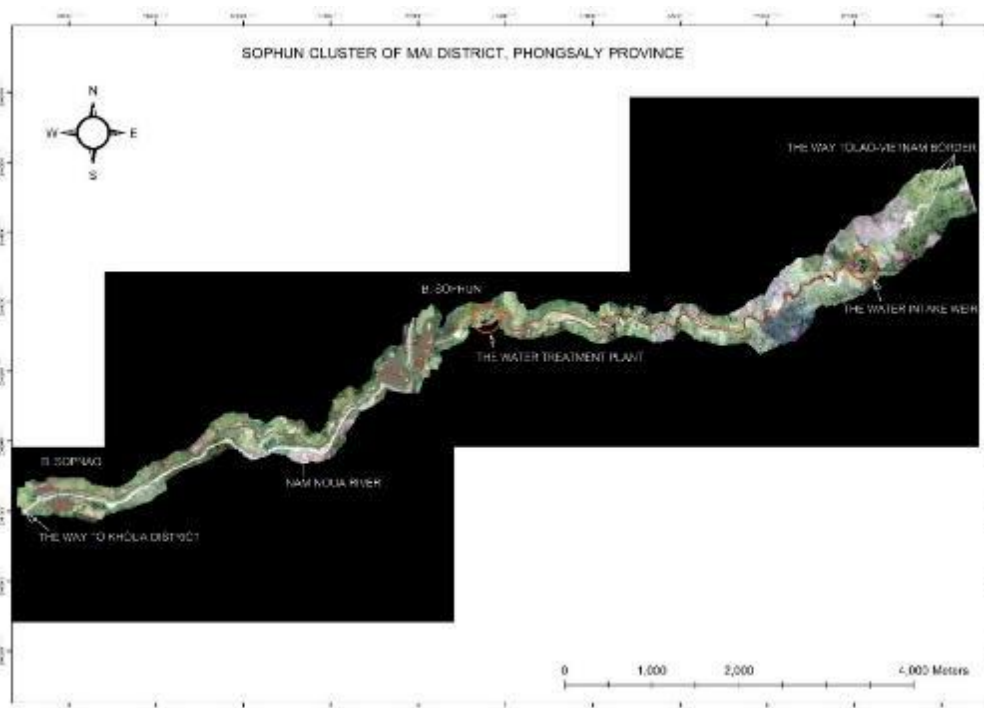


Figure 2-4 General lay out of Sophun WSS in Mai District

18. The Longnai Kao WSS in Bountai District will provide safe water to the households, health care centers and schools in three villages namely Longnai Kao , Bounoy, and LongNai-Mai. The total population of three villages is 1,443 people in 242 households (recorded in Jan. 2021). The core service area is located 26Km from Bountai District (north-eastern region) and 118Km from Phongsaly District. The layout of the core service area and the system’s general layout is shown in the **Error! Reference source not found.5**.

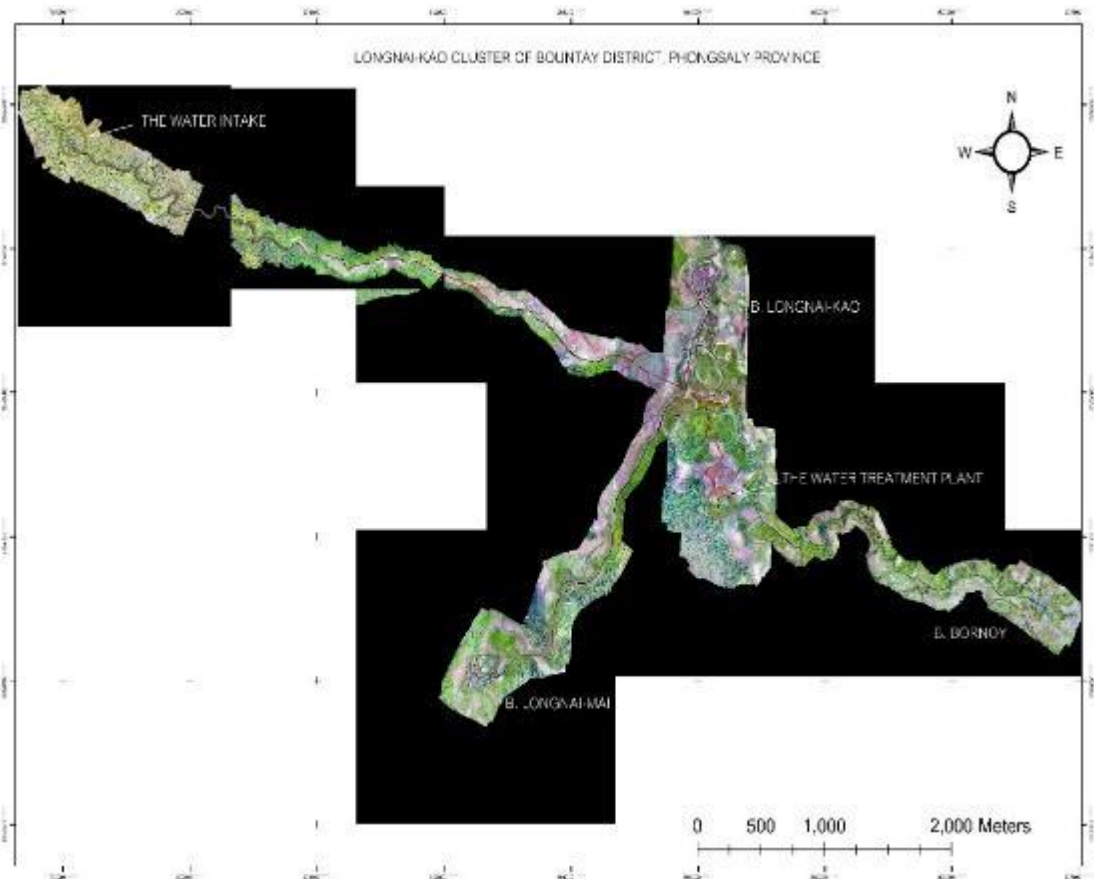


Figure 2-5 General lay out of Longnai Kao WSS in Bountai District

19. There are existing rural supply schemes (Nam Lin) in these villages. They are gravity-fed water supply schemes without any water treatment. The existing water supply is insufficient to meet the water demand for the full year due to the small sizes of the existing pipeline system, leakages issues, and low water quantity at source during the dry season.

20. **Connection Policy.** Households that apply to connect during the construction period will not be required to pay any up-front connection charges for the metered connection. This measure will assist poor and low-income groups to get the benefit of the piped water supply system, encourage new connections. Marketing and awareness campaigns will inform communities about the Project’s connections policies and the benefits of connecting to piped water supply. The expected numbers of new domestic service connections during construction phase of Namly WSS in Samphanh District are 215 HHs; Sinxay WSS in Khoua district are 218 HHs; Sophun WSS in Mai District are 220 HHs and Longnai Kao WSS in Bountai District are 242 HHs.

## 2.2 Descriptions of the WSSs and their Elements

21. Each WSS comprises of the following key elements:
- A Water Intake, to be built on the brook of the proposed water source.
  - Transmission pipelines, to transmit raw water from the water intake to the water treatment plant.
  - A Water Treatment Plant (WTP) with treatment units, office and laboratory.
  - Distribution pipelines, to transmit clean water from the WTP to the head points in the serviced villages.
  - Household connection pipes, to connect households with the head points.
  - Ancillary work items, such as access roads and power supply.
22. The key parameters of each system are listed and described below.

**Table 2-1- Key parameters of the proposed WSS in Phongsaly Province**

Element (from source to taps)	Namly WSS, Samphanh District	Sinxay WSS, Khoua District	Sophon WSS, Mai District	Longnai Kao WSS, Bountai District
<b>1. Water Sources</b>	Houay Ly	Houay Phae	Houay Yei	Houay Viev
<b>2. Water Intakes</b>	Elevation: 898m X= 194928; Y = 2346515	Elevation: 485m X= 211494 Y =2333994	Elevation:478m X= 276975 Y =2344422	Elevation: 908m X= 799068 Y = 2354715
<b>3. Raw transmission pipes (HDPE) from intake to WTP</b>	7.45 km HDPE-DN90	2.863 km HDPE-DN90	6.398 km HDPE-DN90	7.352 km HDPE-DN110
<b>4. Water Treatment Plan (WTP)</b>	Elevation: 805mamsl. X= 199066; Y = 2348250 Land Area: 3,873M <sup>2</sup>	Elevation: 445mamsl. X= 212889 Y = 2335920 Land Area: 6,325m <sup>2</sup>	Elevation: 415mamsl X= 272734 Y = 2343754 Land Area: 1,804m <sup>2</sup>	Elevation: 849mamsl X= 804167 Y = 2352189 Land Area: 4,500m <sup>2</sup>
Capacity (m <sup>3</sup> /d)	170	150	160	200
Ground levelling at the WTP required?	Yes	Yes	Yes	Yes
Treatment Units (static mixer, steel clarifier tank, steel filter tank, steel reservoir, valve, pipe, and fitting)	Yes	Yes	Yes	Yes
Chemical dosing system (tanks, dosing pumps, mixers, valves, check valves, pipes, and fittings)	Yes	Yes	Yes	Yes
Capacity of clear water reservoir	60 m <sup>3</sup>	50 m <sup>3</sup>	55 m <sup>3</sup>	70 m <sup>3</sup>

Element (from source to taps)	Namly WSS, Samphanh District	Sinxay WSS, Khoua District	Sophon WSS, Mai District	Longnai Kao WSS, Bountai District
Construction of power supply and a control cabinet for the WTP included?	Yes	Yes	Yes	Yes
Drainage system	Yes	Yes	Yes	Yes
Inlet and outlet pipes and fittings	Yes	Yes	Yes	Yes
Back wash water tank	No	No	No	No
<b>5. Service Offices</b>	X= 271804; Y=2348394 Land Area: 800M <sup>2</sup>	X= 214640; Y=2335335 Land Area: 1,600M <sup>2</sup>	X= 271804; Y=2343198 Land Area: 1,150M <sup>2</sup>	X= 803929; Y = 2353315 Land Area: 800M <sup>2</sup>
<b>6. Distribution pipes (HDPE)</b>	6.78 km DN110 DN90 DN63 DN50	12.606 km DN160 DN110 DN90 DN63 DN50	10.902 km DN110 DN90 DN63 DN50	15.48 km DN110 DN90 DN63 DN50
<b>7. Household Connection Pipes</b>	4.30 km DN25 (215 HH connections)	4.360 km DN25 (218 HH connections)	4.40 km DN25 (220 HH connections)	4.84 km DN25 (242 HH connections)
<b>8. Office with separate rooms for storage, chemicals and operators</b>	Yes	Yes	Yes	Yes
<b>9. Basic laboratory equipment</b>	Yes	Yes	Yes	Yes
<b>10. Ancillary Items</b>				
Access Road	New access road, Length L =147m Width: B = 5m	New access road Length L =475m Width B = 5m	New access road Length L = 112m Width B = 5m	New access road Length L = 670m Width B = 5m
Power Supply	Yes, 50kVA transformer	Yes, 50kVA transformer	Yes, 50kVA transformer	Yes, 50kVA transformer
Serviced Areas and Serviced Population	1.Namly  <u>Population:1,242</u>	1.Sinxay  <u>Population: 851</u>	1.Sophon 2.Sopnao  <u>Population:1,153</u>	1.Longnai Kao 2.Longnai Mai 3. <u>Bornoy</u> <u>Population:1,443</u>

23. More detailed descriptions are provided below.

## 2.3 Water Sources

### 2.3.1 Namly WSS in Samphan District

24. The Houay Ly is a small brook, flows through steep, forested terrain, agricultural farms and the villages north of the Nam Ly village. The catchment area of Houay Ly is about 8.42km<sup>2</sup>. The stream has a high flow rate in dry season, which means a high degree of groundwater inflow to the river. The map showing the catchment of the Houay Ly brook is shown in the Figure 2-6 below. Houay Ly location allows transmission of raw water to the WTP by gravity feed.

25. The flow rate in Houay Ly is low during the dry season especially from December to April. The measured of the flow rates were conducted two times during the dry season on 7<sup>th</sup> January 2021 and 30<sup>th</sup> April 2022. Measured flow rates were 2,346 m<sup>3</sup>/d on 7<sup>th</sup> January 2021 and 4,747 m<sup>3</sup>/d on 30<sup>th</sup> April 2022. The amount of water withdrawn (designed capacity of the drinking water supply system 170m<sup>3</sup>/d) is much lower than the amount of water available in this brook.



Figure 2-6 A view of Catchment Area of Houay Ly

### 2.3.2 Sinxay WSS in Khoua District

26. Houay Phea Brook is a tributary of the Nam Noi River which in turn is a tributary of the Nam Phak River. Originally from the mountain, the Houay Phea Brook flows along the valleys through agricultural farms and then discharges to the Nam Noi River above the Sinxay village. The distance from the proposed intake site to the downstream (Nam Noi River) and original water source is approximately 6.5 km and about 6 km respectively. The Houay Phea brook's catchment area is 10.8 km<sup>2</sup>, recharged by many channels from the mountain valley. The map showing the catchment of the Houay Phea brook is shown in the Figure 2-7 below. Houay Phea Brook water quantity and quality meets the demands, and the proposed location of the water intake allows gravitational feed to the WTP.

27. The flow rate in Houay Phea is low during the dry season, especially from December to April. Measurements of the flow rates were conducted two times during the dry season on 17<sup>th</sup> January 2021 and 1<sup>st</sup> May 2022. Measured flow rates were 3,222m<sup>3</sup>/day on 17<sup>th</sup> January 2021 and 8,998 m<sup>3</sup>/day on 1<sup>st</sup> May 2022. The amount of water withdrawn (designed capacity of the drinking water supply system 150m<sup>3</sup>/day) is much lower than the amount of water available in this brook.



Figure 2-7 A View Catchment Area of Houay Phea

### 2.3.3 Sophun WSS in May District

28. Houay Yei originated from the mountain with a catchment area of about 22 km<sup>2</sup> (Figure 2-8). The Houay Yei's with abundant water quantity was selected as the source for the proposed Sophun WSS in May District. The average width of the river is about 8.5 m. The map showing the catchment of the Houay Yei brook is shown in the Figure 2-8 below. The Houay Yei Brook water quantity and quality meets the demands, and the proposed location of the water intake allows gravitational feed to the WTP.

29. The flow rate in Houay Yei Brook of Sophun cluster is low during the dry season, especially from December to April. The measurements of flow rates were conducted 2 times during the dry season on 11<sup>th</sup> January 2021 and on 2<sup>nd</sup> May 2022. Measured flow rates were 16,374m<sup>3</sup>/day on 11<sup>th</sup> January 2021 and 10,873m<sup>3</sup>/day on 2<sup>nd</sup> May 2022. The amount of water withdrawn (designed capacity of the drinking water supply system 160m<sup>3</sup>/day) is much lower than the amount of water available in this brook.



Figure 2-8 A View Catchment Area of Houay Yei

### 2.3.4 Longnai Kao WSS in Bountai District

30. The Houay Viev is a small brook from a natural source and flows through steep, forested terrain in the northwest of the Longnay-Kao village. Houay Viev Brook was selected as the raw water source for the Longnai Kao cluster WSS in Bountai District. The brook is 7.45km long and has a catchment area of 4.43 km<sup>2</sup>. The map showing the catchment of the

Houay Viev brook is shown in the Figure 2-9 below. The Houay Viev brook location allows transmission of raw water to the WTP by gravity feed.

31. The flow in Houay Viev of Longnai Kao Cluster WSS is low during the dry season especially from December to April. The measurements of the flow rates were conducted 2 times during the dry season on 16<sup>th</sup> January 2021 and 28<sup>th</sup> April 2022. Measured flow rates were 3,120 m<sup>3</sup>/day on 16<sup>th</sup> January 2021 and 1,738m<sup>3</sup>/day on 28<sup>th</sup> April 2022. The amount of water withdrawn (designed capacity of the drinking water supply system 200m<sup>3</sup>/day) is much lower than the amount of water available in this brook.



Figure 2-9 A view of Houay Viev Catchment Area

## 2.4 Water Intakes

32. The locations of the proposed water intakes were selected taking into account their proximity to the proposed Water Treatment Plan (WTP) and most suitable location for weir construction. Currently the three are bushes and small trees surrounding the proposed intake sites.



(a)



(b)



(c)



(d)

*Figure 2-10 Aerial picture of water intake of Namly (a), Sinxay (b), Sophun (C) and Longnai Kao (d).*

#### 2.4.1 Site Selection, Intake Locations

33. Namly WSS in Samphanh District. The proposed water intake is located on the Houay Ly on communal land in Ban Namly, at coordinate of X=194928 and Y=2346515. The ground elevation is 898mamsl, 93m above the WTP. The estimated length of the raw water transmission pipeline is 7.45Km.



*Figure 2-11 The proposed location of water intake of Namly WSS*

34. Sinxay WSS in Khoua District. The proposed water intake site is on Houay Phea in communal land, southeast of Sinxay village, at the coordinate X= 211494 and Y =2333994. It is 2.8 km from the proposed WTP location. The ground elevation is 485mamsl, 40m above the WTP.



*Figure 2-12 The Proposed Location of water intake of the Sinxay WSS*

35. Sophun WSS in Mai District. The proposed water intake site is on the embankment upstream of the Houay Yei in communal land, northwest of Sophun village, at the coordinate X= 276975 and Y =2344422. It is 6.4km from the proposed WTP location. The ground elevation is 478mamsl, 63m above the WTP.



Figure 2-13 The Proposed Location of water intake of the Sophun WSS

36. Longnai Kao WSS in Bountai District. The proposed water intake site is on the embankment upstream of the Houay Viev in communal land, northwest of the Longnay-Kao village, at the coordinate X= 79906 and Y=2354715. It is about 7.4km from the proposed WTP location. The ground elevation is 908mamsl, 59m above the proposed WTP.



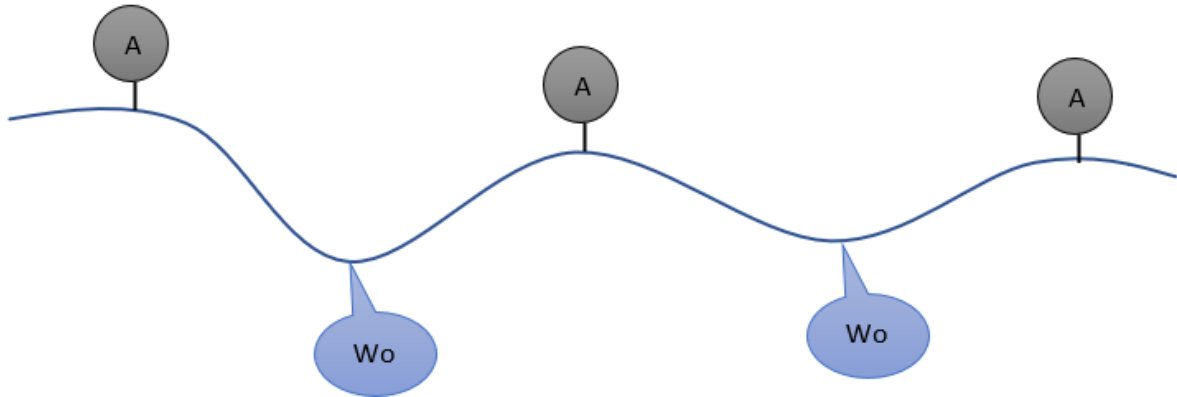
Figure 2-14 The Proposed Location of water intake of the Longnai Kao WSS

#### 2.4.2 Intake Structures

37. The proposed intakes of Namly, Sinxay, Sophun and Longnai Kao WSSs are similar. The reinforced concrete intake for collecting raw water from the stream with designed capacity (of 7.91m<sup>3</sup>/hr for Namly, 11.04m<sup>3</sup>/hr for Sinxay, 15.9 m<sup>3</sup>/hr for Sophun and 10m<sup>3</sup>/h for Long Nam-Kao, respectively).

A spillway will be built to block the stream, allowing water to flow up and down as needed for the intake system. The level of the weir is 20 cms higher than the spill way which allows the water released by gravity to the spill way. This will help control the water flow and ensure efficient direction into the intake structure. The spillway may also help regulate the water level in the stream, preventing flooding or other water management issues. The width of the collection wall is 1.0 m. During the rainy season, excess water will flow through the spillway located next to the water inlet. The width of the spillway will be determined by the width of the stream. To prevent garbage and floating materials from entering, both coarse and fine screens will be used. The coarse screen, made of stainless-steel bars, has a size of 25 mm with a spacing of 20 mm between the bars and dimensions of BxH=1.0x1.2 m. The fine screen, also made of stainless-steel bars, has a size of 2 mm with a spacing of 2 mm between the bars and dimensions of BxH=1.0x1.0 m. A DN80 pipe will be used to lead raw water to the WTP, with a velocity of 0.46 m/s and a head loss of 3.43 m/km. The intake will use a galvanized steel pipe connected to an HDPE raw water pipeline DN90. A stop valve DN80 will be installed for management and operation, and a DN50 pipe with a stop valve will be installed at the bottom of the water collection compartment to discharge sludge when necessary. The gate will be regularly opened to flush the sediment trapped. During dry season, this gate will be slightly opened to ensure the water will flow to downstream. For

coarse/floating materials, screening structure (refer to 3D design, Fig 3-15 and Fig 3-16) are included to protect the floating materials/debris before flowing into the chamber. Residual sediment might be settled in the chamber. The DN50 galvanized pipes are included to flush those residual sediment in the chamber. The design of the weir is illustrated in Figures below. Velocity of 0.46 m/s is appropriate. The design of the pipelines includes installing air release valves (A) at the highest level. Additionally, washouts (Wo) will be installed at the lowest level. These washouts serve the purpose of drainage and allow for cleaning out any sludge that may accumulate in the pipelines.



38. Typically, the Operations and Maintenance (O&M) team is responsible for monitoring the effluent flow rate to the Water Treatment Plant (WTP) every hour using a water meter. If the water quantity is lower than expected, it indicates a potential issue either at the intake or within the pipeline. In the case of pipeline-related issues, the O&M team must initiate cleaning procedures, starting from the intake and extending all the way to the WTP.

39.

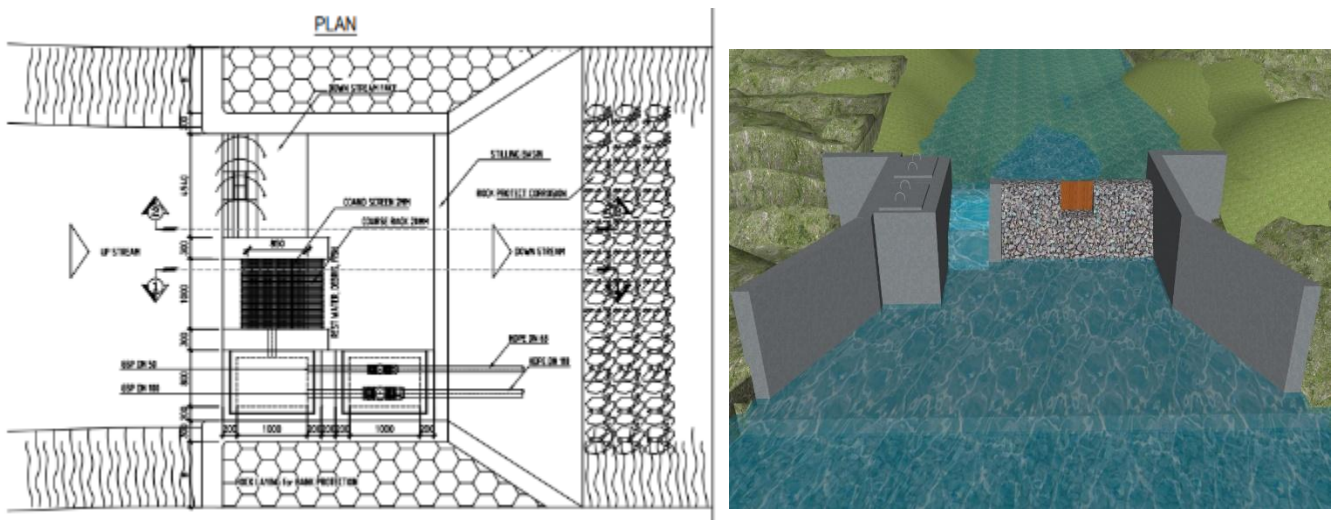


Figure 2-15 Plan of Wier Intake

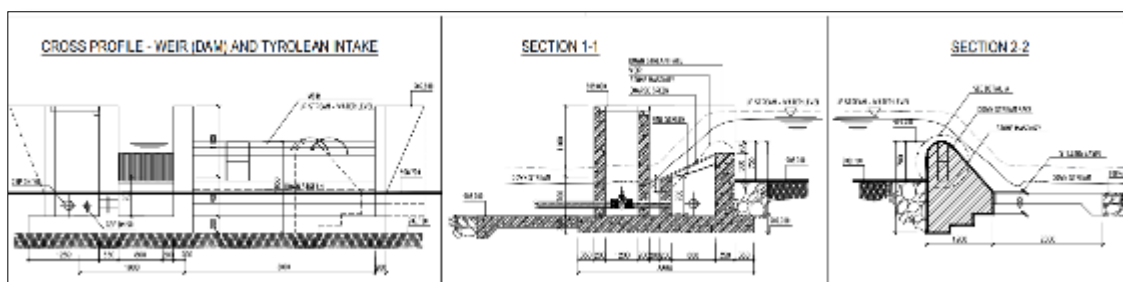


Figure 2-16 Cross Profile-Weir and Tyrolean Intake

## 2.5 Raw Water Transmission Pipelines

40. Raw water transmission pipeline will be laid out underground at a depth of 0.7 to 1.2 meters from the intake to the WTP by DN90-HDPE (Namly, Sinxay and Sophun WSS) and DN110-HDPD (Longnai Kao WSS) gravity pipeline. Air release valves of DN25 will be installed at the highest points and blow-off valves will be installed at the lowest points of the raw water transmission pipeline. Stop valve will be installed to manage the operation of the pipeline with valve pressure management chambers on the route. The number of valves type will be installed in the transmission pipelines of each system are shown in the Table 2-3 below.

Table 2-2 Number of valves will be installed in the raw water transmission pipelines.

No	WSS	Length (m)	Air release valves	Blow-off valves	Management Valve Chambers
1	Namly	7,450	14	10	8
2	Sinxay	2,863	9	10	6
3	Sophun	6,398	21	21	3
4.	Longnai Kao	7,352	24	24	3

## 2.6 Water Treatment Plants

41. Each Water Treatment Plant (WTP) consist of: (i) a mixing/flocculation and vertical sedimentation tank; (ii) filtration tank; (iii) clean water reservoir/clean water tank, (iv) operation building/chemical house; and (v) a sludge lagoon will be located on the top of hill (at the elevation 805mls for Namly, 445aml for Sinxay, 415aml for Sophun and 849aml for Longnai Kao). The total land area allocated for each Water Treatment Plant (WTP) in the locations of Namly, Sinxay, and Sophun is 2,500 m<sup>2</sup> (50 m x 50 m). In contrast, the Water Treatment Plant (WTP) within the Longnai Kao Water Supply System (WSS) cluster encompasses a larger area of 3,600 m<sup>2</sup>. These WTP sites are generally accessible via a walking trail, providing ease of access on foot. However, accessing the WTP of the WSS in Sinxay involves an additional challenge, as it requires crossing a river. During the rainy season, this river crossing can only be achieved by boat, adding a layer of complexity to reaching the WTP sites. The proposed locations for the above facilities are in the fallow land owned by village (public land). These sites were chosen based on land availability and proximity to the proposed water intakes. The layouts of the proposed WTPs are presented in Figure 2-18 to Figure 2-21 below:



- A. Water treatment plant
- B. Chemical and control house
- C. Storage and guard house

Figure 2-17 Layout of WTP facilities.

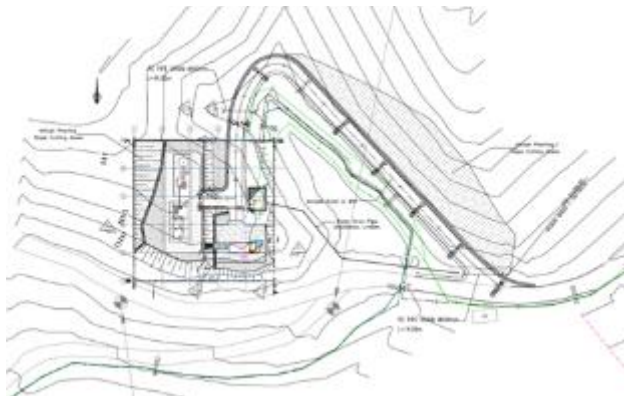


Figure 2-18 Layout of Water Treatment Plant and Existing Land Use of Namly WSS

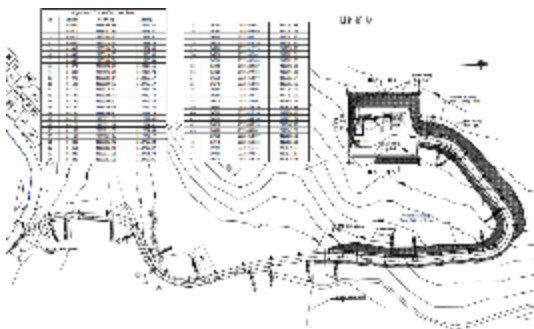


Figure 2-19 Layout of Water Treatment Plant and Existing Land Use of Sinxay WSS



Figure 2-20 Layout of Water Treatment Plant and Existing Land Use of Sophun WSS



Figure 2-21 Layout of Water Treatment Plant and Existing Land Use of Longnai Kao WSS

42. The WTPs of four clusters have been designed with the objectives of meeting the drinking and domestic use of water demands. The design capacity of the WTP Namly cluster is 170m<sup>3</sup>/day, Sinxay Cluster is 150m<sup>3</sup>/day, Sophun Cluster is 160m<sup>3</sup>/day and Longnai Kao Cluster is 200m<sup>3</sup>/day. The water treatment process of the four WTPs are the same as described below.

43. **Water Treatment Processes.** Raw water flows into the clarifier at the top of the mixing and sedimentation tank. Depending on the raw water quality, flocculants and/or coagulants (alum dosage Al<sub>2</sub>(SO<sub>4</sub>) H<sub>2</sub>O 10 – 30 mg/l or 5 – 10 mg/l PAC) are added to help settle down the solids at the bottom of the tank. Clearer water flows up through the plates to the filtration tank where water will flow through sand or other granular substances. Turbidity will be removed at this step. Then chlorine is added to the filtered water for disinfection to remove the bacteria and other harmful organisms. Clean water will be stored in a reservoir (clear water tank). The solids settled at the bottom of the clarifier will be drained into a sludge thickening tank for additional settling. Then the sludge typically gets thickened further in the sludge lagoon for final dewatering.

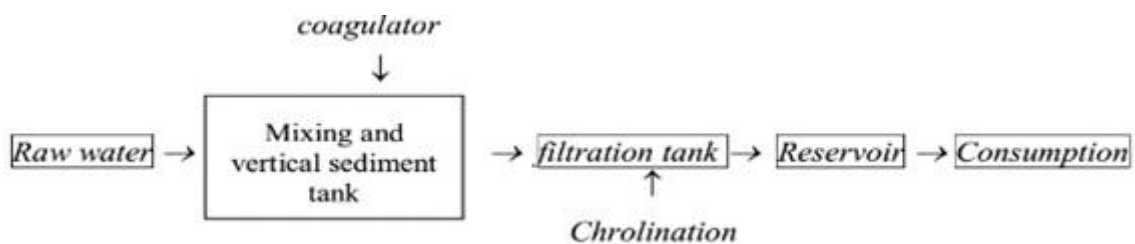


Figure 2-22 The process of water treatment plant.

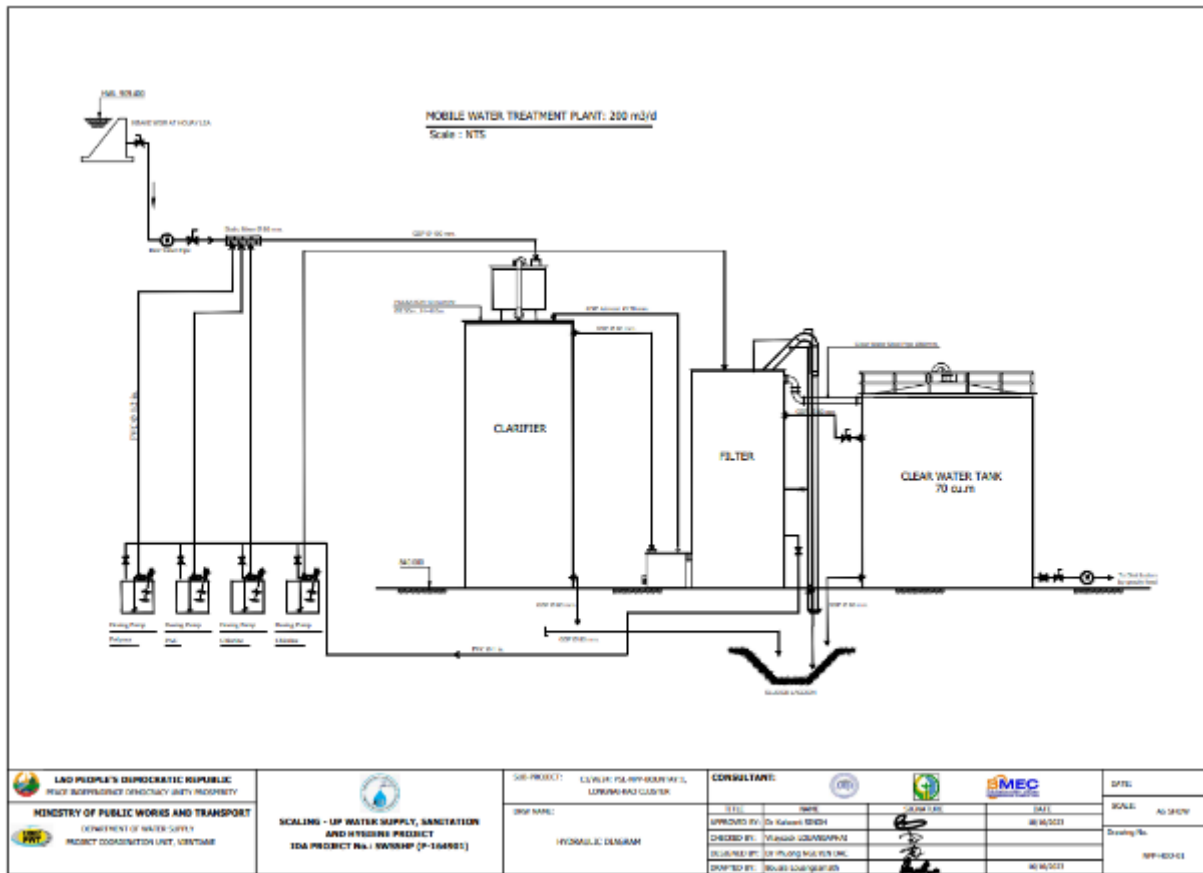


Figure 2-23 Hydraulic Diagram

44. The key technical features of water treatment process are summarized in Table 2-3 below.

Table 2-3 Key Parameter of WTPs

Component	Functions	Design capacity
Alum mixing	Rapid alum mixing with raw water	<ul style="list-style-type: none"> <li>Alum dosage Al<sub>2</sub>(SO<sub>4</sub>)<sub>3</sub>.18H<sub>2</sub>O 10 - 30 mg/l or 5 - 10 mg/l PAC</li> <li>Mixing method: Hydraulic</li> <li>Location: mixing equipment</li> <li>Mixing time: 1 - 2 minutes</li> </ul>
Vertical sedimentation	<ul style="list-style-type: none"> <li>Sedimentation of coagulant created in the flocculation tank.</li> <li>Turbidity &lt; 30 NTU</li> </ul>	<ul style="list-style-type: none"> <li>Gravity Filter tank size (DxH): 1,200x4,500 mm.</li> <li>Velocity 0.3 - 0.72 m/minute</li> </ul>
Rapid filter	Filter water discharged from sedimentation tanks	<ul style="list-style-type: none"> <li>Filter material: 1 layer, crystal sand, d = 0.7 mm - 1.6 mm</li> <li>Thickness: 0.8 -1.2 m</li> <li>Filter velocity: 6-9 m/h</li> <li>Backwash method: Water</li> </ul>
Disinfection	Water disinfection	<ul style="list-style-type: none"> <li>Dosage: Chlorine 1 - 2mg/l</li> <li>Contact time &gt; 30 minutes</li> </ul>

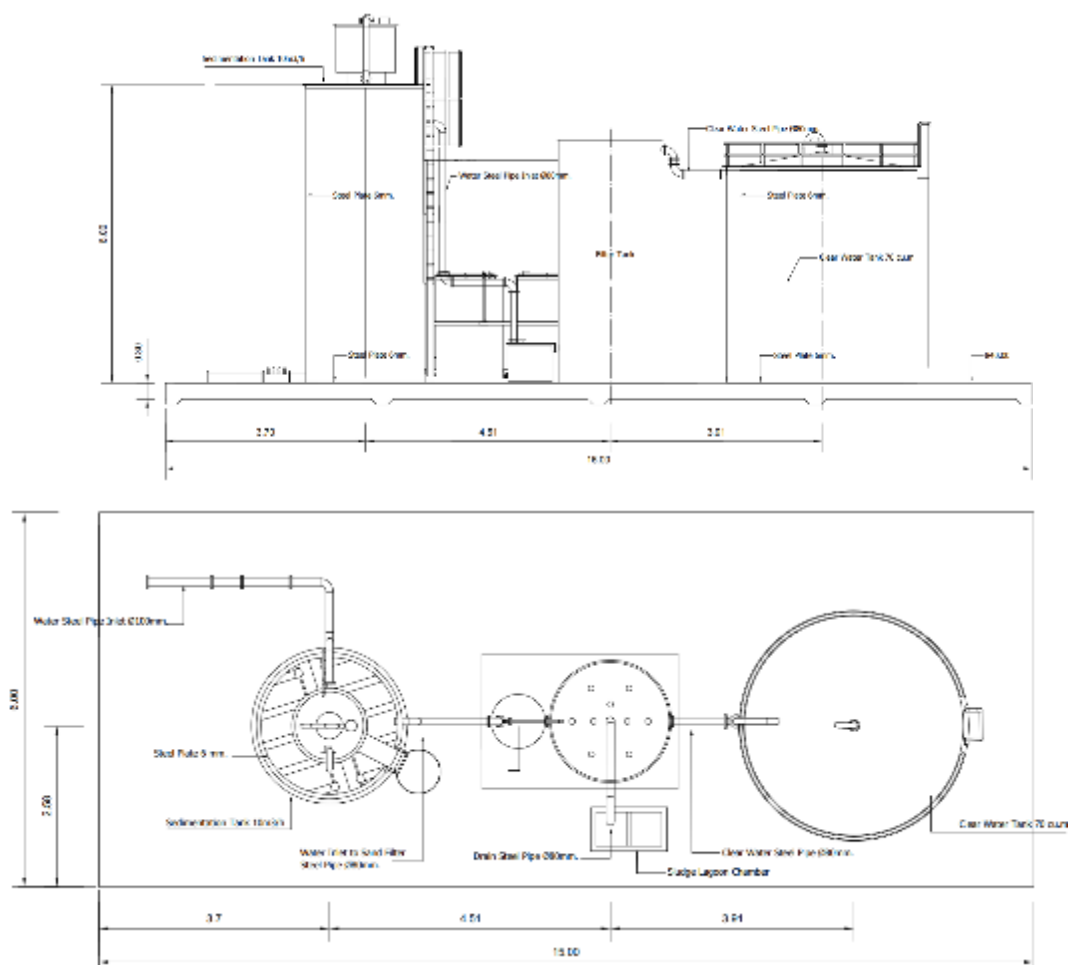


Figure 2-24 Water Treatment Plant Plan

45. **Clean Water Reservoir (Tanks).** The required total volumes of the clean water tank at each WTP are at 30% of the WTP capacity day. The clean water tank is pre-casted. On the ground clean water tank is setting on slope towards the drainage outlet minimum of 1%. The roof shall slope from the reservoir center towards the edges a minimum of 2%. The access manholes shall have a concrete up-stand 200 mm high to prevent rainwater from entering the reservoir. Access ladders or step irons of stainless steel to the reservoir wall shall be provided at each manhole. The diagram below shows the proposed design of the clean water tank.

Table 2-4 Clean Water Reservoir Dimensions

No	WSS	Diameter (m)	Hight (m)	Volumes (m <sup>3</sup> )
1	Namly	3.5	4.0	60
2	Sinxay	3.5	4.0	50
3	Sophun	4.0	4.0	55
4.	Longnai Kao	4.5	4.0	70

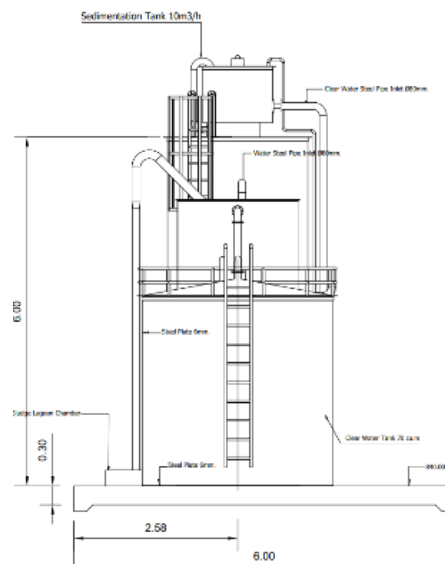


Figure 2-25 Clean water tank.

46. **Operation Houses/Chemical House.** The Operation House at each, dimensions at 7.6 m x12.9 m x5.1m (BxLxH), is divided into 03 separate rooms (Chemical dispensing room; Chemical storage room and operation room). The diagram below shows the proposed design of the Operation House.

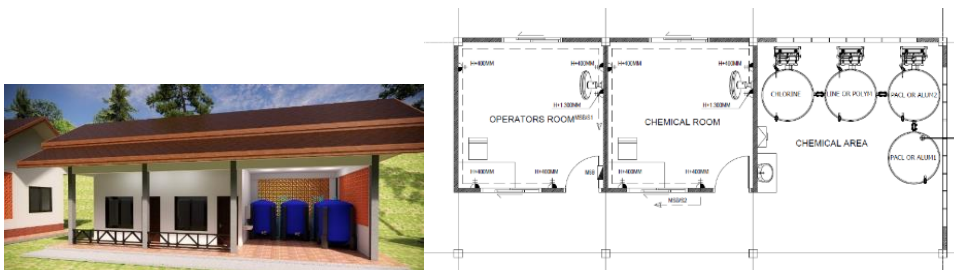


Figure 2-26 Figure of Chemical House

47. **Laboratories** The basic laboratory will be setup in the operation house with basic water quality analysis equipment such as turbidity and residual chlorine meter; multiparameter water quality meter for measuring pH, EC, TDS and temperature, HI-96727 color of water portable Photometer, four station Portable Floc Tester, beaker 600ml, 1000ml and 2000ml, PP Cylinder 100, 250, 500, 1000ml, wash bottle LDPE LP 250ml and test tube brush. Consumables: pH combination buffer solution kit, pH Electrode storage solution, free Chlorine Reagent, DPD Method. There are 7 water quality parameters that will be monitored every 4 hours include Turbidity, Chlorine, pH, EC, TDS, temperature and Color. Refer to O&M Guidelines of Nam Papa, the O&M staff of PNP test 7 parameters every 4 hours. CMU conducts the 6 monthly water quality analysis of 23 parameters for Water Supply System (Nam papa) as per the MOH standard.

48. **Sludge lagoons.** Alum is widely used as a coagulant and flocculating agent for water treatment, making the water easier to clean. The size of sludge lagoon at each site is 35m<sup>3</sup> (5X7X1) meter. The amount of sludge produced at each site will be 14.85 kg/day (110mg/l) or about 1,750 kg in 4 months period which can be stored in the sludge lagoons of 35m<sup>3</sup>. At each 4 months interval the sludge lagoon will be full and cleaned. Sludge is a nontoxic residue of the water treatment process. The sludge accumulated at the sludge lagoon will be kept in the sludge lagoon and sucked up and transported to a disposal site at an interval of every 4 months

interval. The volume of sludge generated from the treatment of surface water in both proposed WTPs is small. Therefore, a drying field was not proposed, instead, the sludge will be kept in the sludge lagoon and sucked up and transported to a disposal site every 4 months interval. Disposal sited for the disposal of Sludge identified at the waste dumping site of the village. Sludge from the lagoon could also be used for the filling of nonfood gardens. The sludge generated will be transported and disposed of at the waste dumping area. The locations of the disposal site will be selected based on consultation with local authority.

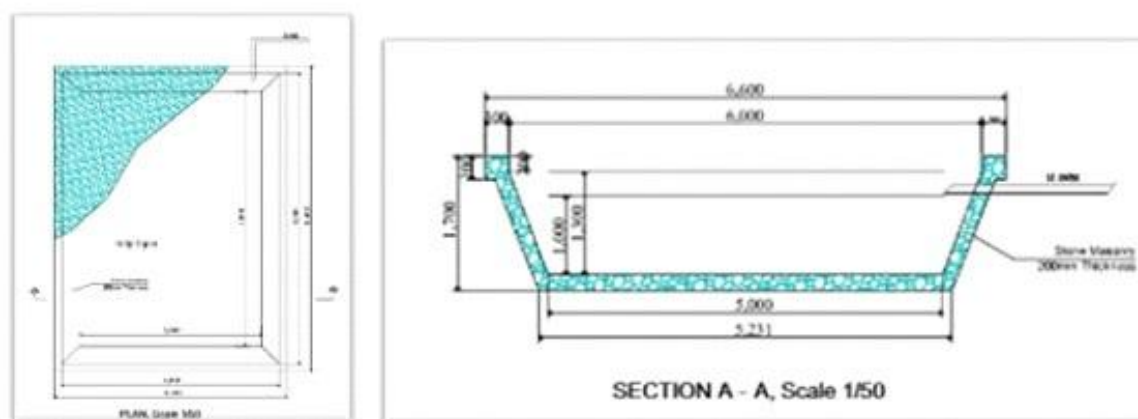


Figure 2-27 Sludge lagoon.

## 2.7 Water Supply Service Office.

49. The proposed locations for Water Supply Service Offices are in the fallow land owned by village (public land). These sites were selected based on land availability and customer accessibility in the total land area 800m<sup>2</sup> each for the Namly and Longnai Kao WSS; 1,600 m<sup>2</sup> for Sinxay WSS and 1,150 m<sup>2</sup> Sophun WSS. Currently land is fallow land at all of the 4 sites belong to the village communal land. In Sinxay Water Supply Service Office will be built on the government land belonging to the Agriculture Technical Centre. Location of the water supply service office given in the table below:

Items	Namly CWSS, Samphanh District	Sinxay CWSS, Khoua District	Sophun CWSS, Mai District	Longnai Kao CWW, Bountai District
Water Supply Service Offices	X= 271804; Y = 2348394 Area: 800m2	X= 214640; Y = 2335335 Area: 1,600m2	X= 271804; Y = 2343198 Area: 1,150m2	X= 803929; Y = 2353315 Area: 800m2

50. Each office features an identical design and dimensions. The structure consists of a concrete frame and brick walls. The roof is constructed with sheet metal, supported by a steel truss system. The water supply office measures 9 meters in width, 12 meters in length, and 7 meters in height. The foundation comprises single reinforced concrete feet combined with reinforced concrete bracing beams.



Figure 2-28 Water Supply Office

## 2.8 Distribution Network

51. The distribution network will be supplied by gravity flow from the proposed clean water reservoir located at WTP site to the serviced areas (Namly Village in Samphan District; Sinxay Village in Khoua District, Sophun and Sopnao Village in Mai District; and Longnai Kao, Longnai-Mai and Bornoy village in Bountai District). The capacity of the distribution network is designed to cater for the population of the service area up to the year 2048. Service pipelines are calculated according to the volume distribution and the number of serviced households. The routing of service pipelines is based on the density of populations and distribution of residential areas.

52. The denoted diameters (DN) of the distribution pipelines are from 65 to 110 mm. Most of the pipes will be installed at depth of 0.5m underground, along the sidewalk, approximately 0.5 – 1.5m from the houses to avoid affecting the existing infrastructure. Appurtenances such as gate valves, district metering area (DMA) water meters, air valves, wash-out valves, etc. will be provided to facilitate the efficient operation and maintenance of the system.

Table 2-5 type of and length of distribution pipes.

Type of pipes	Unit	Namly	Sinxay	Sophun	Longnai Kao
HDPE pipes	m	6.78 km DN110 DN90 DN63 DN50	12.606 km DN160 DN110 DN90 DN63 DN50	10.902 km DN110 DN90 DN63 DN50	15.48 km DN110 DN90 DN63 DN50
HDPE pipes	m	4.30 km DN25	4.36 km DN25	4.40 km DN25	4.84 km DN25
HH Connections	Nos	215	218	220	242

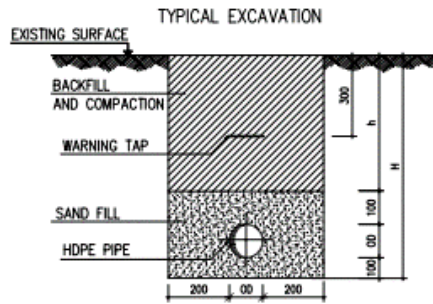


Figure 2-29 Typical of Excavation for water pipes network.

**2.9 Access Roads, Power supply to the WTPs**

53. Gravel access road (5 m wide) to the WTP will be constructed with necessary structures such as culverts, side drains, retaining walls etc. The estimated length of access road is approximately 147m in Namly WSS, 475m in Sinxay WSS, 112m in Sophun WSS and 698 m in Longnai Kao WSS.

54. A Transformer of 50KVA from national grids electric will be installed to ensure the efficiency power supply to WTP and will not interfere with the existing power supply of the villagers. 22kV distribution line of each water supply system will run along the side of the access road, the master plan-layouts show in Figure 2-30 to Figure 2-33

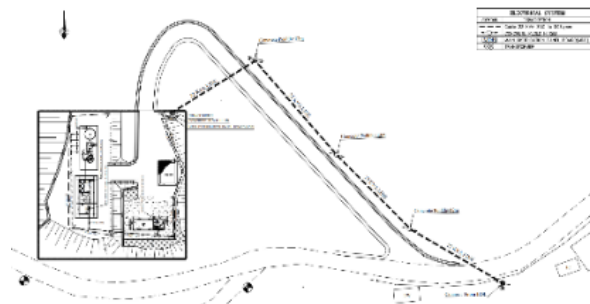


Figure 2-30 Master Plan-Layout 22kV Distribution Line for Namly WTP

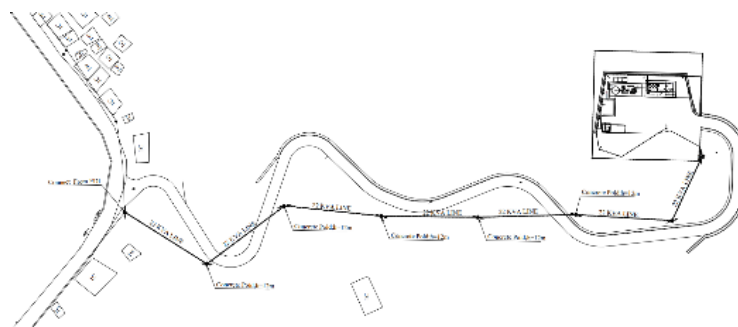


Figure 2-31 Master Plan-Layout 22kV Distribution Line for Sinxay WTP

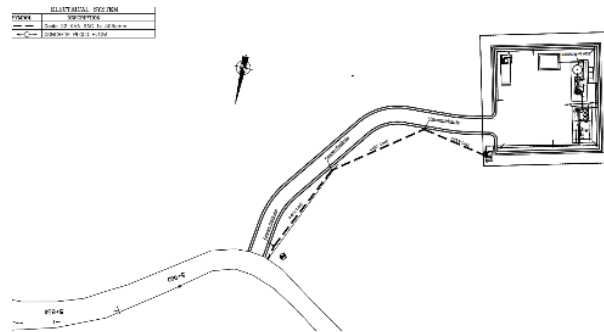


Figure 2-32 Master Plan-Layout 22kV Distribution Line for Sophun WTP

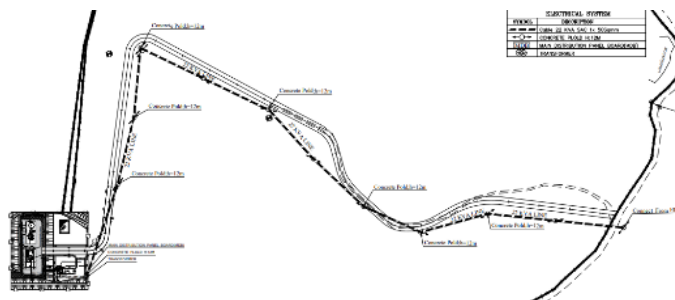


Figure 2-33 Master Plan-Layout 22kV Distribution Line for Longnai Kao WTP

### 3 Environmental and Social Baseline Conditions

#### 3.1 Topography

55. The topography of Lao PDR can be divided into four physiographic regions: the mountain range, the undulated plain, the plateau, and the low alluvial land along the Mekong River. All four WSSs in the mountain ranges. Namly Cluster is in the mountain range in the northeastern of Lao PDR, forming deep V-shaped valley, steep slope and some of the flat land, the elevation is above 760mamsl. Sinxay Cluster is in the mountain range in the northeastern of Lao PDR, forming deep V-shaped valley, steep slope and some of the flat land, the elevation is above 400mamsl. Sophun Cluster is in the mountain range in the northeastern of Lao PDR, forming deep V-shaped valley, steep slope and some of the flat land, the elevation is above 390mamsl. Longnai Kao Cluster is in the mountain range in the northeastern of Lao PDR, forming deep V-shaped valley, steep slope and some of the flat land, the elevation is above 950mamsl.

#### 3.2 Hydrology and Surface water quality

56. Samphanh, Mae, Khoua and Bountai district area is part of several small rivers which are the tributaries of the Nam Ou River. The average annual rainfall of Phongsaly Province (average of 5 years) was 2,056.64mm. The highest average rainfall was 509.24 mm recorded in the month of August and the minimum average rainfall was 6.8mm recorded in month of February as given in the graph below.

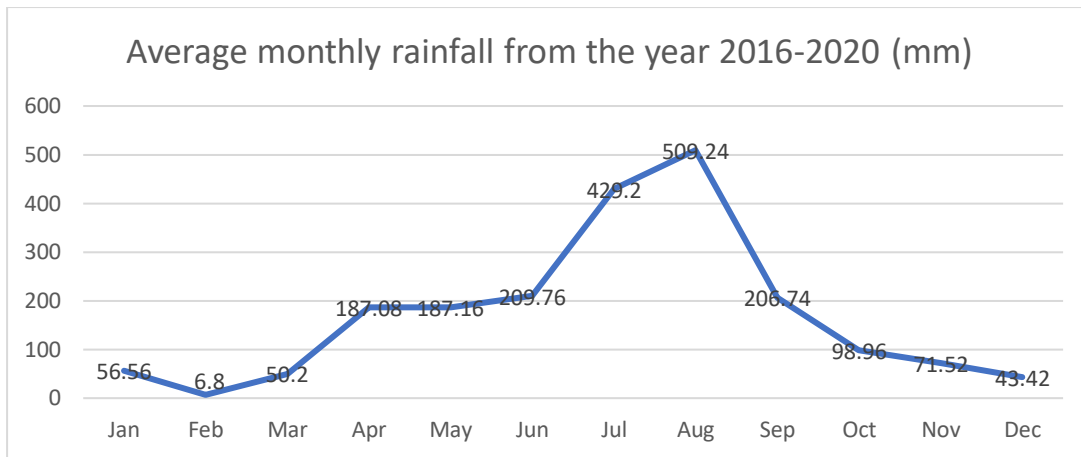


Figure 3-1 The average monthly rainfall from the year 2016 to 2020 at Phongsaly Satation.

57. Based on consultation with the villagers at Namly, Sinxay, Sophun, Sopnao, Longnai Kao , Nongnai-May and BorNoy Village in January 2021 and April-May 2022, it was confirmed that the brooks have water all year round . Proposed water intake locations are also situated near water springs and the brooks have never dried up.

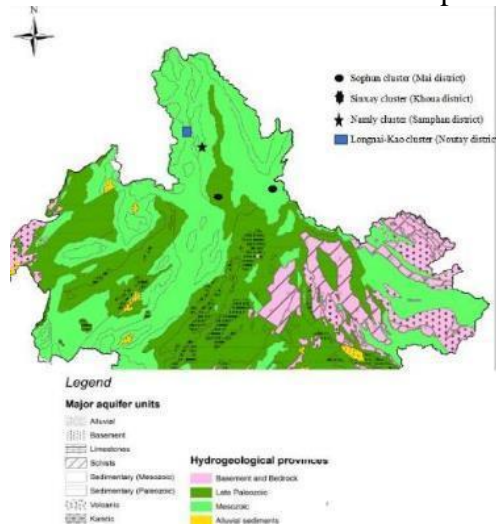


Figure 3-2 A synthetic map of hydrogeological groups and major aquifer units (textures)

58. **Namly WSS.** The flow rates of Houay Ly measured on 30th April 2022 (dry season) at two points near the proposed intake sites (Point No.1 and Point No.2, each monitoring site are located approximately 900m from each other) were 15,02 m<sup>3</sup>/d, and 4,469m<sup>3</sup>/d respectively, with an average value of 4,747 m<sup>3</sup>/d (Table 3-1). It is much greater than the demand for the project area (170m<sup>3</sup>/d).

Table 3-1 Summary of the flow discharge in Houay Ly (30 April 2022)

#	Measurement Point	Flow rate		
		(l/s)	(m <sup>3</sup> /h)	(m <sup>3</sup> /d)
1	Point No.1	58.2	209.4	5,025
2	Point No.2	35.7	186.2	4,469
<b>Average</b>		<b>46.9</b>	<b>197.8</b>	<b>4,747</b>

59. **Sinxay WSS.** The flow discharges of Houay Phea were measured on 1st May 2022 at the two points of the Houay Phea were 10,407m<sup>3</sup>/d, and 7,589 m<sup>3</sup>/d respectively, with an

average value of 8,998 m<sup>3</sup>/d (**Error! Reference source not found.**). It is much greater than the demand for the project area (150m<sup>3</sup>/day).

*Table 3-2 Summary of the flow discharge in Houay Phea (1<sup>st</sup> May 2022)*

#	Measurement Point	Flow rate		
		(l/s)	(m <sup>3</sup> /h)	(m <sup>3</sup> /d)
1	Point No.1	120.5	433.6	10,407
2	Point No.2	87.8	316.2	7,589
	<b>Average</b>	<b>104.1</b>	<b>374.9</b>	<b>8,998</b>

60. **Sophun WSS.** The flow discharges measured on 2nd May 2022 at Point No.1 and Point No.2 of the Houay Yei were 10,873 m<sup>3</sup>/d, 12,757 m<sup>3</sup>/d, respectively with an average value of 11,815 m<sup>3</sup>/d (Table 3-3**Error! Reference source not found.**). It is much greater than the demand for the project area (150m<sup>3</sup>/day).

*Table 3-3 Summary of the flow discharge in Houay Yei (2<sup>nd</sup> May 2022)*

#	Measurement Point	Flow rate		
		(l/s)	(m <sup>3</sup> /h)	(m <sup>3</sup> /d)
1	Point No.1	126	453	10,873
2	Point No.2	148	532	12,757
	<b>Average</b>	<b>137</b>	<b>492</b>	<b>11,815</b>

61. **Longnai Kao WSS.** The flow discharges measured on 28th April 2022 at Point No.1 and Point No.2 of the Houay Viev were 1,849m<sup>3</sup>/d, 1,626m<sup>3</sup>/d, respectively with an average value of 1,738m<sup>3</sup>/d (Table 3-4). It is much greater than the demand for the project area (200m<sup>3</sup>/day).

*Table 3-4 Summary of the flow discharge in Houay Viev (28<sup>th</sup> April 2022)*

#	Measurement Point	Flow rate		
		(l/s)	(m <sup>3</sup> /h)	(m <sup>3</sup> /d)
1	Point No.1	21.4	77.0	1,849
2	Point No.2	18.8	67.8	1,626
	<b>Average</b>	<b>20.1</b>	<b>72.4</b>	<b>1,738</b>

62. Raw water quality samples were collected at the same date of the water flow rate at the proposed intake location by Phanthamit Analytical Lab Co., Ltd. The results of water quality analysis are summarized in **Error! Reference source not found.** below. The quality of water at all four water sources is good with almost all parameters in the range of the allowance limitations except for turbidity, coliform bacteria, and total bacteria above the limitation. This can be standard treatment which involves sedimentation, filtration, and disinfection only.

*Table 3-5- Summary of Water Quality Analysis Result*

#	Parameters	Unit	Standard	Houay Ly 30/4/2023	Houay Phea 1/5/2023	Houay Yei 2/5/2023	Houay Viev 28/4/2023
1	Chloride	mg/L as Cl <sup>-</sup>	< 250	ND	35.0	ND	ND
2	Color	Pt. Co	< 5	1.5	5.86	2.18	3.31
3	Fluoride	mg/L as F <sup>-</sup>	< 1.5	0.15	ND	0.11	0.14

#	Parameters	Unit	Standard	Houay Ly 30/4/2023	Houay Phae 1/5/2023	Houay Yei 2/5/2023	Houay Viev 28/4/2023
4	Hardness	mg/L as CaCO <sub>3</sub>	< 300	96	112	87.4	175
5	Iron	mg/L	< 0.3	0.25	<0.10	ND	ND
6	M-Alkalinity	mg/L	-	108	112	85.8	194
7	Nitrate	mg/L as NO <sub>3</sub>	< 50	ND	ND	ND	1.44
8	pH		6.5-8.5	8.3	8.3	8.1	8.4
9	Sulfate	mg/L as SO <sub>4</sub>	<250	ND	8.93	7.23	7.63
10	Turbidity	NTU	<5	11.7	6.28	1.09	6.42
11	Arsenic	mg/L	<0.01	<0.0020	<0.0020	<0.0020	<0.0020
12	Coliform Bacteria	MPN/100mL	-	27	230	33	45
13	E. coli	MPN/100mL	0	ND	ND	ND	20
14	Total Bacteria	Colonies/cm <sup>3</sup>	-	1,900	1,000	11,000	1,800
15	Taste		Acceptable	Non- Objectionable	Non- Objectionable	Non- Objectionable	Non- Objectionable
16	Odor		-	Odorless	Odorless	Odorless	Odorless

63. Data in the table above shows that the quality of raw water is good with almost all parameters are within the allowable limits, except Turbidity, Coliform Bacteria and Total Bacteria were higher than standard. The amount of heavy metals found in analysis were much lower than the Ministry of Health of Lao PDR standard limits at all raw water sources. Turbidity levels in Houay Ly, Houay Phase and Houy Viev were 11.7 NTU, 6.28 NTU and 6.42 NTU respectively, which is slightly above the standard limit of 5 NTU. Houay Phae detected the highest concentration of coliform bacteria, which measured 230 MPN/100 mL. Meanwhile, the highest count of total bacteria was observed in Houay Yei, with 11,000 colonies/cm<sup>3</sup>. These can be addressed with standard treatment of sedimentation, filtration and disinfection.

### 3.3 Geology

64. Almost all of the project area is in the Northern of the Lao PDR, the geological of this area is divided into four water-bearing systems: Basement, Mesozoic aged sedimentary, Paleozoic aged sedimentary and Karstic system.

65. **Nam Ly WSS** is on the line separate the Sukhothai folder belt and Loei fold belt structure, Mesozoic ages rock is the highest proportion than others group, the rocks are sandstones, whilst Late Paleozoic ages rocks account for a small proportion group in this area, the feature of this group is limestones with different rock contents. In addition, the other rocks are sandstones and shales; they are not very hard and decompose quickly.

66. **Sinxay WSS.** The geological map illustrates that Sinxay cluster is in the Loei fold belt structure. Mesozoic aged rocks are a higher proportion than other groups; the rocks are sandstones and siltstones, while Late Paleozoic aged rocks account for a small proportion group in this area. The feature of this group is limestone with different rock contents. In addition, the other rocks are sandstones and shales; they are not very hard and decompose quickly.

67. **Sophun WSS.** The geological map illustrates that the Sophun cluster is in the Loei fold belt structure, Mesozoic age rocks account for the highest proportion of the area, the rocks are sandstones and siltstones, whilst Late Paleozoic age rocks occupied a small proportion is limestone with different rock contents. In addition, the other rocks are sandstone and weakly consolidated shale.

68. **Longnai Kao** . The geological map illustrates that the Longnay-Kao cluster is on the line separates Sukhothai folder belt and Loei fold belt structure, Mesozoic ages rock is the highest proportion of others, the rocks are sandstones, whilst Late Paleozoic ages rocks account for a small proportion group in this area, the feature of this group is limestones with different rock contents. In addition, the other rocks are sandstones and shales; they are not very hard and decompose quickly.

### 3.4 Air quality and Noise

69. There are no records on noise and air quality in the project area. Air quality in the project area is generally good since there are no industries producing discharges/emissions and emissions from vehicular exhaust are not significant (low traffic density). The main cause of air quality reduction is the dust from vehicles when passing unsealed roads during the dry season. This is an intermittent problem with a minor effect over a limited area of 5 to 10 meters either side of the road.

70. The project sites are relatively far from activities generating noise. There are no industries within the proposed project sites so the existing ambient noise levels can be considered very low. There are no sensitive receptors in the proximity of the proposed site of the WTP and water intake and other components.

### 3.5 Biological Resources

71. According to IBAT (Integrated Biological Assessment Tool), there are 35 natural protected areas in Laos. The proposed WSSs are not located in any protected areas, the nearest protected areas, Phou Den Den in the Northeast is far from the project area.



Figure 3-3 The project location in relation to the nearest protected areas.

72. The forest at the upstream catchment area of the water sources (small stream) are naturally grown forest trees and communities are not pursuing agricultural operations in the catchment areas with a view to ensure the availability of water. There is no information about the existence of any known biological important (rare/endangered/vulnerable) fauna and flora species in the proposed intake area and the WTP. The existing vegetation covering these areas are mostly vines, shrubs, small trees with a diameter of about 3-20 cm, bamboo, wild banana. There are a few aquatic species in the water source such as frogs, crabs, Dwarf snakehead fish (Pa Kung), and some small local freshwater fish species.



Figure 3-4 Land use at proposed WTP and Water Intake of Namly WSS

73. WTP site of Namly WSS cluster is located on village community land. The water Intake site of Namly WSS cluster is located in the community forest. Currently both of the sites have bushes, vines, ferns, bamboo and small trees. 480 m<sup>2</sup> area (cardamom garden) of the WTP site of Namly cluster belong to one HH, Mr. Alor in Namly Village who requested compensation of the affected portion by upgrading or leveling the remaining part of the affected plot.



Figure 3-5 Land use at proposed WTP and Water Intake of Sinxay WSS.

74. WTP site of Sinxay WSS cluster is located on government land. Currently there are bushes at the sites and agriculture service station grow corn in this land. The water Intake site of Sinxay WSS cluster is located in community forest. Currently the water intake site has bushes, vines, ferns, bamboo and small trees.



Figure 3-6 Land use at proposed Water Intake and WTP of Sophun WSS

The WTP site of Sophun WSS cluster is located on village community land but there are impact on 20 private rubber trees in the communal area belong to three HHs including Mr. Khamnoh (6 rubber trees), Mr. Phanpik (4 rubber trees) and Mr. Bounpheng (10 rubber trees) in Sophun Village who voluntarily donated of the affected rubber trees. The water Intake site of Sophun WSS cluster is located in the community forest. Currently both of the sites have bushes, vines, ferns, bamboo and small trees.



Figure 3-1 Land use at proposed Water Intake and WTP of Longnai Kao WSS

75. WTP site of Longnai Kao WSS cluster is located on village community land of the access road to the WTP of Longnai Kao WSS cluster. There is permanent impact on 2 private land and rubber trees belong to two HHs including Mr. Khamxay (630 m<sup>2</sup> rubber garden and 6 rubber trees), and Mr. Yot (600 m<sup>2</sup> fallow land) in Longnai Kao village who voluntary donated of the affected land and rubber trees. The Water Intake site of Longnai Kao WSS cluster is located in the community forest. Currently both intake and WTP sites have bushes, vines, ferns, bamboo and small trees.

76. The transmission and distribution pipelines will pass along the embankments of some agricultural land (predominantly rice field, rubber tree plantation and corn fields), and garden land/plantations with economical values rather than biological values. The primary flora species in these areas include bushes, grasses, vines, bamboo, shrubs and small trees. Fauna species along the pipeline route include insects, ants, wasps, rats, and other small natural creatures.

### 3.6 Physical Culture Resource

77. The proposed project sites contain no historical artefacts or significance, there are no known archaeologically significant sites. If there is a requirement for spiritual and cultural ceremonies the cost for such ceremonies should be included in the contract.

### 3.7 Infrastructure and Public Services

78. **Power Supply.** All households in four clusters are connected to the national electricity grid and sufficient for their power demand.

79. **Common Diseases and Health Care Service.** Common Disease in this subproject area is including flu, diarrhea. Apart from that there is the seasonal problem of dengue fever. There

is no existing health care center in Sinxay project area. The healthcare center in Namly has (X) patient bedrooms and 3 nurses, that in Sophun Village with 4 patient bedrooms and 5 nurses, and that in Longnai Kao has 7 patient bedrooms and 6 nurses. Sinxay village has no health center and people of the Sinxay village to Latxang health center which is located about 7 kms away from Sinxay village.

#### 80. *Education Facilities/Schools.*

- Namly village in Samphan district, there is one Primary school with 7 classrooms and one lower secondary school with 11 rooms.
- Sinxay Cluster in Khoua district, there are two primary schools with six classrooms and one lower secondary school with eight classrooms.
- Sophun Cluster in Mai district, there is one secondary school with a dormitory (4 bedrooms), one primary school with five classrooms and one lower secondary school with eight classrooms in Sophun village. In Sopnao village, there is one primary school with 2 classrooms.
- Longnai Kao Cluster in Bountai district, there is one primary school building with five classrooms and one lower secondary school with 11 classrooms in Longnai Kao Village. In Longnai-Mai village, there is one primary school building with 2 classrooms and in Bornoy village, there is one primary school building with two classrooms.

81. *Sanitation, Waste and Wastewater Management.* The sanitation, waste and wastewater management in the WSSs core service area is very poor. There are no drainage systems, no wastewater management infrastructure, and no landfill facilities. Solid waste is burned and scattered around village areas and alongside roads. Rainwater and wastewater are discharged to backyard gardens before entering water bodies. However, the amount of solid waste and wastewater generated is small. All households in Longnai Kao and Longnai-Mai Villages have access to the toilets. The table below shows the number and percentage of household has the toilet. Dumping sites for the sludge generated from sludge lagoons will be identified in collaboration with the village authorities.

*Table 3-6 Number of household access to toilet in the WSSs core service area*

No	Village	Total HHs	HHs has a toilet	% HH has toilet
1	Namly	219	149	68
2	Sinxay	143	113	79.2
3	Sophun	150	143	95.3
4	Sopnao	78	75	96.1
5	Longnai Kao	154	154	100
6	LongNai-Mai	52	52	100
7	Bornoy	39	32	82



Figure 3-7 Waste dumping along the roadsides near Namly village.

### 3.8 Ethnic Groups

82. **Namly Cluster** has five ethnic groups, the majority is Khmu (87%), the other 13% of the ethnic are included Akka (3,6%), Lao Lum (2.2%), Hor (2.1%) and Phounoi (1.2%).

83. **Sinxay Cluster** has three ethnic group, Lao is covered about 63%, follow by Khmu shares about 27% and Para is shared about 10%.

84. **Sophun Cluster** has two villages namely Suphun and Sopnao village. Both villages have five ethnics, Lao shares about 42%, Tai shares about 40%, Khmu shares 12% and the Other 6% of ethnic are Phounoy and Hmong.

85. **Longnai Kao Cluster** has three villages namely Longnai Kao , Longnai-Mai, Borno Village. There are ten ethnics, the majority is Khmu (31%), follow by Yang shares about 24%, Lao shares about 23%, Tai shares about 11% and the other 11% of ethnic are Akha, Phounoy, Hor, Hmong, Para and Lue.

Table 3-7 Ethnic group in WSSs Project area in Phongsaly Province

No.	Village	Population		Lao		Khmu		Tai		Akkha		Phounoy		Hor		Para		Hmong		Yang		Leu	
		T	F	T	F	T	F	T	F	T	F	T	F	T	F	T	F	T	F	T	F	T	F
<b>Namly Cluster</b>																							
1	Namly	1,047	542	23	12	951	496	0	0	38	16	13	7	22	11	0	0	0	0	0	0	0	0
	Total	1,047	542	23	12	951	496	0	0	38	16	13	7	22	11	0	0	0	0	0	0	0	0
<b>Sinxay cluster</b>																							
1	Sinxay	674	356	424	233	182	93	0	0	0	0	0	0	0	0	68	30	0	0	0	0	0	0
	Total	674	356	424	233	182	93	0	0	0	0	0	0	0	0	68	30	0	0	0	0	0	0
<b>Sophun cluster</b>																							
1	Sophun	814	314	142	73	139	69	467	239	0	0	17	10	0	0	0	0	49	24	0	0	0	0
2	Sopnao	344	175	344	175	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total	1,158	489	486	248	139	69	467	239	0	0	17	10	0	0	0	0	49	24	0	0	0	0
<b>Longnai-Kao Cluster</b>																							
1	Longnai-Kao	762	391	0	0	4	1	0	0	0	0	8	5	0	0	0	0	0	0	729	375	21	10
2	Longnai-Mai	284	141	0	0	0	0	0	0	4	3	9	6	0	0	0	0	0	0	267	132	0	0
3	Borno	196	95	0	0	2	2	0	0	8	5	185	87	0	0	0	0	1	1	0	0	0	0
	Total	1,242	627	0	0	6	3	0	0	12	8	202	98	0	0	0	0	1	1	996	507	21	10
	Grand Total	4121	2023	933	493	1278	661	467	239	50	24	232	115	22	11	68	30	50	25	996	507	21	10

### 3.9 Namly WSS Specific Conditions

#### 3.9.1 Land Cover and Land use.

86. The information of land use in Namly village was obtained by interviewing village authority. Several land cover and distinct land use types occur in Namly village with a total land area of 3,159 ha, including residential land, paddy field, village protection forest, village production forest, agriculture land, fallow land, sacred forest and cemetery. Village protection forest covers the largest area approximately 910 ha, followed by industrial tree plantation with 607 ha. The forest is located in two areas. One part of the village forest is adjacent to the village, while the other is approximately 4 kilometers away. The part of the village forest near the village is about 400 meters from the construction site. **Error! Reference source not found.** shows the distinct land use type in Namly Village.

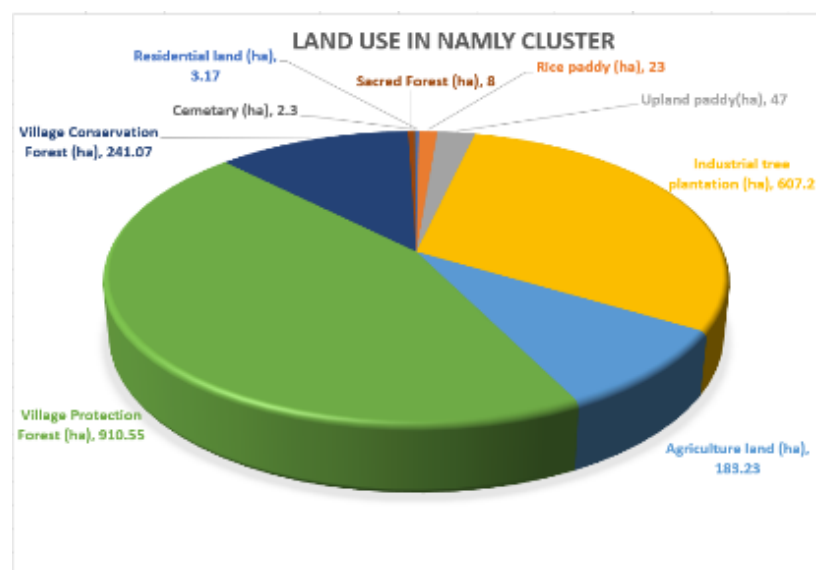


Figure 3-8 Land Cover and Land Use in Namly Village (2023)

### 3.9.2 Water Use

87. Currently, the villager access to the rural water supply system (Nam Lin/Nam Saat, 2013 by Lao Government) which supplies water to the households directly by gravity system without any treatment processes. However, the water amount is insufficient to provide the service areas for the whole year. The cause is the sizes of the existing pipe system are less than the demand, leakage and the quantity of water is relatively low in the dry season.

### 3.9.3 Demographic and Socio-economic conditions<sup>1</sup>



88. Samphanh district has 63 villages with a total population of 26,236 people of which 12,768 people are women, 6,559 people are living in the urban area and 17,677 people are living in the rural area. The typical livelihood is based on rice crops, livestock, commerce, and services. The key economic activities are in agriculture, livestock, commerce and Nontimber Forestry Product (NTFPs) collection. The poverty rate is 49.02%, total gross domestic product (GDP) is 172,690,000 million Kips in the year 2019 and GDP per capita is approximately 824 USD.



89. Namly village has 215 households, with a total population of 1,242 people. Gender ratio is 2.05 male per female. The local economy is based on agriculture and trade. The main income is from rice crop cultivation, animal raising (cows, pigs and poultry), NTFPs collection, state employee and trade. The sample survey on occupation in the village shown that 10% of male and female heads of households were district government officials, 5% were traders and 15% were workers. Namly village also has restaurants, guesthouses and retail shops. The villages are linguistically and ethnically homogeneous, with all heads of households being fluent in the national language. The survey also showed that 25% of households have been living above the poverty line and 75% of households have been living under the poverty line.





<sup>1</sup> Source: Field data collection by Mr. Keophet, Social Safeguard Specialist

### 3.9.4 Site Specific Conditions–Namly WSS, Samphanh district

Table 3-8– Site Specific Conditions in Namly WSS

Work Item	Existing Conditions	Photos
Water Source and Water Intake	<p>Houay Ly is a small brook. Along the stream, there are some small bushes, vines, shrubs, small trees with diameters ranging from about 3 to 20 centimeters, bamboo, and some rocks in the streambed. Additionally, there are barren spots between the bushes where contractors can place construction materials. Aquatic species in Houay Ly is not abundant only few fish species found in this stream.</p> <p>Water intake is located on Houay Ly downstream of spring water</p> <p>The water intake site can be accessed via a walking trail, and there are no local houses in the vicinity of the water intake, ensuring a pristine and undisturbed environment around the area.</p>	
Raw Water Pipeline	<p>The length L = 7.45Km</p> <p>Raw water pipelines will be laid along the brook, through the valley, crossing fallow communal land, private agriculture land of 32 households or running along the roadside. Some sections are well covered with vines, bushes, banana and other trees etc.</p> <p>A comprehensive list of the 32 households whose agricultural land may be temporarily affected by the laying of the Raw Water Pipeline is provided in the ARAP.</p> <p>These households have been consulted during the village meeting to discuss the WSS subproject. The potentially affected households in Namly village have given their consent for the pipeline to pass through their agricultural land. Documentation of the village consultation meeting is provided in the ARAP.</p> <p>However, the raw water pipeline will be laid underground at a depth of 0.7 to 1.2 meters. The width of pipe trenches ranges from 0.5 to 0.8 meters. The Contractor will lay out the pipelines along the border of the field and avoid laying out the pipelines in middle of the field to the extent possible.</p> <p>Some cardamom plantations may be affected. The contractor will use manual labour to avoid plants and if any plant is uprooted, farmers will plant the cardamom plants to other place and compensation will be paid as per the entitlement in the ARAP.</p>	

Work Item	Existing Conditions	Photos
Access road to WTP	<p>The length L=147m, width B=5m</p> <p>The existing ground elevation at beginning to the end point is from 792 mamsl to 802mamsl. The slope gradient is 7%.</p> <p>Part of the agricultural land or 480 m<sup>2</sup> of the total land area of 14,800 m<sup>2</sup> of one household (Mr Alo, Akha ethnic) in the Namly WSS cluster will experience permanent impacts due to the construction of the Water Treatment Plant (WTP) and the access road to the WTP. The entitlement of this affected household is detailed in the ARAP.</p>	
Water Treatment Plant site	<p>Land area =3,873 square meters, Location: X= 199066; Y = 2348250</p> <p>The WTP site is on communal land. The site and its surroundings are well covered with small trees, vines and shrubs.</p> <p>The WTP is border with village fallow land in the north, National Road 1B in the south and east, cardamom plantation land in the west.</p> <p>Consent from the community on land donation has been developed and signed, ensuring that all necessary agreements are in place. In the event that any trees are located on the WTP site, the farmers have agreed to use them for fuelwood and other purposes. Additionally, cardamom plants currently situated on the site will be transplanted by the farmers to other suitable locations. This arrangement ensures that the community benefits from the resources while accommodating the needs of the WTP project.</p> <p>The ground elevation is from 802mamsl to 818mamsl. The slope gradient is 36%.</p>	

Work Item	Existing Conditions	Photos
Water Supply Service Office	<p>The service office will be located in an area of 800M<sup>2</sup> at location X=271804; Y=2348394.</p> <p>Northern side: adjacent to agriculture land</p> <p>Southern side: adjacent to the village communal land</p> <p>Earthen: adjacent to the village communal land</p> <p>Western: adjacent to the village communal land and a brook</p>	
Clean Water Distribution Pipes	<p>The length L = 6.78Km</p> <p>The main pipeline will be laid along roadsides. The depth of the pipe trench is 0.7-1.2m and the width is 0.5-0.80m.</p> <p>The contractor will lay out the pipeline in the gap between the road and the front of the houses, thereby avoiding any impact on the concrete floors of the houses. During the construction period, the contractor will pay special attention to prevent any damage to the concrete structures of the houses located adjacent to the road. However, the concrete floors in front of <b>10 houses</b> along the roadside may be temporarily affected by the clean water pipe layout. If any impact occurs on the floors of the households, the contractor will repair the concrete floors to their original condition. This will be done if the floors are affected during the trench digging for laying out the pipeline, which will be approximately 50 cm deep. The laying of the pipelines will not impact the livelihood or income of the households during the construction period.</p> <p>These households have been consulted during a village meeting and have agreed to allow the pipeline to pass in front of their houses, including their concrete floors. Documentation of the village meeting is provided in the ARAP.</p> <p>There are shops near the water connection pipelines that may also be temporarily affected during the construction phase. These shops will benefit from the Water Supply System (WSS) during the operational phase. Alignment drawings have been adjusted to avoid impact on shops structure or extension parts. However, the contractor will</p>	  


Work Item	Existing Conditions	Photos
	<p>implement precautionary measures by making necessary arrangements to allow customers to access the shops, ensuring no impact on the income of the shopkeepers.</p> <p>The project has supported the construction of WASH (Water, Sanitation, and Hygiene) facilities for schools in the Namly Cluster. Water connections will be provided to all public facilities, including schools and any existing health centers.</p>	
Powerlines for the WTP	<p>The electrical poles will be located along the side way of the access road to the WTP.</p> <p>The electricity poles will be located along the side way of the access road to the WTP that will not have any impact.</p>	

Table 3-9.1 Summary Impact on land and existing objects on land WSS Namly Cluster in Phongsaly Province

Facilities	Affected Households (HH)	Agricultural Land (m <sup>2</sup> )	Residential Land (m)	Communal land (m <sup>2</sup> )	Others (specify)
Intake	-	-	-	-	-
Raw Water Pipeline	32	Temporary	-	Temporary	-
Water Treatment Plan	1	480	-	3,100	Cardamom of 1 household
Access Road to WTP and 22kV Distribution Line	-		-	600	
Water Supply Office	-			800	-
Clean water distribution pipeline	10	Temporary	Temporary	Temporary	Concrete yard in Road's ROW
<i>Ancillary sites (access roads, dumping sites etc.) for all WSS</i>	Disposal sites will be selected based on consultation with local authorities				

### 3.10 Sinxay WSS Specific Conditions

#### 3.10.1 Land use.

11. The information of land use in Sinxay village was obtained by interviewing village authorities. The village's total land area is 2,791ha, including residential land, paddy field, village protection forest, village production forest, agriculture land, fallow land, sacred forest and cemetery. Agriculture land is 816 ha or 30%, followed by industrial tree plantation with 725ha or 26%, Village Protection Forest is 478ha and Village Production Forest is 367ha. the Figure 3-9 is shown the distinct land use types of type in Sinxay Village.

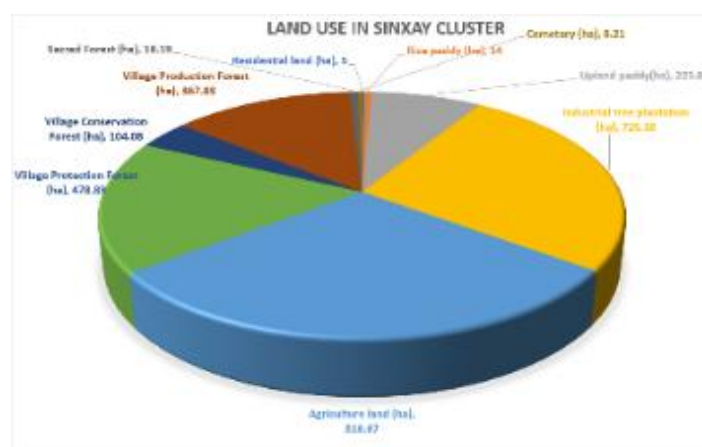


Figure 3-9 Land Cover and Land Use in Sinxay Village

#### 3.10.2 Water Use

90. The Sinxay village has been supplied with clean water since 1994 by Kavacker. This system only included pipeline network and without treatment. Water is inadequate all year around; supply does not meet water demand. Communities, schools, and village offices use the same water supply system. People use water for their living like cooking, bathing, washing clothes, feeding pets, etc. Nearly 70% of the families in the villages use drinking water from the potable water (big bottles). The rest use drinking water directly from the taps and some HH boil the water before drinking.

#### 3.10.3 Demographic and Socioeconomic Conditions <sup>2</sup>

91. Sinxay village has 218 households, with a total population of 851 people (recorded in Jan. 2021) and 1,592 people (estimated in 2038 - the Project's target year), corresponding to a population growth rate of 2%.

92. The village economy is based on agriculture, livestock, and trade. The primary income is rice cropping, husbandry (buffalo, cows, pigs, goat, and poultry), NTFPs collection, state employee, handcraft, and business/service. There are other sources of income from the shops, restaurants, bus stop and guesthouses in Sinxay village. The survey indicated the occupation in the village: 2% of the total population were districted government officials, 7% of the total population were workers, 10 % of the total population were business, and 81% of the total


<sup>2</sup> Source: Field data collection by Mr. Keophet, Social Safeguard Specialist



population were farmers. Moreover, in the investigation, 85% of households are upper the poverty line, and 15% are under the poverty line.




### 3.10.4 Site Specific Conditions– Sinxay WSS in Khoua District

93. The existing site-specific conditions at the Sinxay WSS system are described below.

Table 3-10 Site Specific Conditions in Sinxay WSS, Khoua District

Work Item	Descriptions	Photos
<p>Water source and water intake</p>	<p>Houay Phea is a small brook, lined the small bushes, vines, shrubs, small trees with diameters ranging from about 3 to 20 centimeters, bamboo. There are rocks, gravel and stones in the streambed and along the stream bank.</p> <p>The water intake will be located in the Houay Phea brook, which is situated near Houay Phea village. It is important to note that Houay Phea village is not a beneficiary of this subproject. Currently, the water at the intake site is utilized by the residents of Houay Phea village for various purposes, including gardening and other domestic uses. The construction of the Water Supply System (WSS) will be carefully planned and executed to ensure that it does not interfere with these existing water uses. The availability of water in Houay Phea brook during the dry season is approximately 7,589 cubic meters per day. The proposed extraction rate for the Sinxay Water Supply Cluster is only 150 cubic meters per day. This extraction rate is minimal compared to the total water availability, representing only a small fraction of the total water flow. Consequently, the water extraction for the Sinxay Water Supply Cluster will not adversely impact the current water uses in Houay Phea village. The residents will continue to have sufficient water for their gardening and other needs, ensuring that the subproject will not disrupt their daily lives or activities.</p> <p>Consultation meeting with the villagers of Huaye Phae has been organized and villagers are agreed to allow use of the water from Huaye Phae village. Copy of the minutes of meeting with the Huaye Phae village are provided in the ARAP.</p> <p>The water intake site can be accessed via a walking trail, and there are no local houses in the vicinity of the water intake, ensuring a pristine (in its natural state and unpolluted,) and undisturbed environment around the area.</p>	

Work Item	Descriptions	Photos
<p>Raw Water Transmission pipes from intake to WTP Alignment</p>	<p>The length L = 2.86Km with HDPE DN 90mm.</p> <p>The raw water transmission pipe from the intake to the water treatment plant will be laid downstream of Houay Phea Brook passes the agriculture land of 9 households. Some sections of the raw water pipelines will pass through the side of walking trail which runs along hills on one side and valley at the other side.</p> <p>The raw water pipeline will be laid underground at a depth of 0.7 to 1.2 meters. The width of pipe trenches ranges from 0.5 to 0.8 meters. The Contractor will lay out the pipelines along the border of the field and avoid laying out the pipelines in the middle of the field to the extent possible.</p> <p>A comprehensive list of the 9 HHs of Sinxay village whose agricultural land may be temporarily affected by the laying of the Raw Water Pipeline is provided in the ARAP.</p> <p>These households have been consulted during the village meeting to discuss the WSS subproject. The potentially affected households have given their consent for the pipeline to pass through their agricultural land during the village meeting. Documentation of the village consultation meeting is provided in the ARAP</p>	 <p>The photos show the pipeline route through a rural landscape. The top-left photo shows a dense forest. The top-right photo shows a pipeline running through a field with trees. The bottom-left photo shows a field with a path. The bottom-right photo shows a hillside with a path.</p>
<p>Access road to WTP</p>	<p>The length L=475m, width B=5m</p> <p>The new access road from nation road No. 2E (Namnoy junction to Banyor road) will be constructed on village land and cross the stream. There are houses along the roadside and some sections is covered by grass, bushes and vines.</p> <p>The ground elevation from the starting point to the end point is from 366 to 410mamsl. The slope gradient is approximately 11%.</p>	 <p>The photos show the access road. The left photo shows a dirt road winding through a field. The right photo shows a dirt road crossing a stream with houses in the background.</p>

Work Item	Descriptions	Photos
Water Treatment Plant site	<p>Land Area = 6,325 square meters</p> <p>Location: X= 212889; Y = 2335920</p> <p>The proposed WTP will be located on the Forestry Technical Service Office’s land which is surrounded with the annual crops land such as rice, corn and cassava. There are bushes, bamboo, ferns and grasses at the WTP site.</p> <p>The existing ground elevation is from 410 to 425mamsl. Slop gravity is approximately 38%.</p>	
Water Supply Service Office	<p>The service office will be located in an area of 1,600M<sup>2</sup> at location X=214640; Y=2335335.</p> <p>Northern side: Close to a road</p> <p>Southern side: Close to the village communal land</p> <p>Earthen side: Close to a road and the village communal land</p> <p>Western side: Close to a road</p>	
Clean Water Distribution Pipeline	<p>The length L = 12.6Km.</p> <p>The contractor will lay out the pipeline in the gap between the road and the front of the houses, thereby avoiding any impact on the concrete floors of the houses. During the construction period, the contractor will pay special attention to prevent any damage to the concrete structures of the houses located adjacent to the road. However, the concrete floors of <b>13 houses and shops</b> along the roadside may be temporarily affected, as the pipeline will mostly pass in front of these houses and there is almost no gap between the road and house except the drainage channel.</p> <p>If any impact occurs on the floors of the households, the contractor will repair the concrete floors to their original condition. This will be done if the floors are affected during the trench digging for laying out the pipeline, which will be approximately 50 cm deep. The laying of the pipelines will not impact the livelihood or income of the households during the construction period.</p>	


Work Item	Descriptions	Photos
	<p>These households have been consulted during a village meeting and have agreed to allow the pipeline to pass in front of their houses, including their concrete floors. Documentation of the village meeting is provided in the ARAP</p> <p>There are shops near the water connection pipelines that may also be temporarily affected during the construction phase. These shops will benefit from the Water Supply System (WSS) during the operational phase. However, the contractor will implement precautionary measures by making necessary arrangements to allow customers to access the shops, ensuring no impact on the income of the shopkeepers.</p> <p>The project has supported the construction of WASH (Water, Sanitation, and Hygiene) facilities for schools in the Namly Cluster. Water connections will be provided to all public facilities, including schools and any existing health centers.</p>	
Powerlines for the WTP	<p>Length L = 350 meters</p> <p>The electrical poles of 22kV will be located along the side way of the access road to the WTP. There is no plantation on the way of the powerline</p>	

Table 3-11.2 Summary Impact on land and existing objects on land WSS Sinxay Cluster in Phongsaly Province

Facilities	Affected Households (HH)	Agricultural Land (m <sup>2</sup> )	Residential Land (m)	Communal land (m <sup>2</sup> )	Others (specify)
Intake	-	-	-	-	-
Raw Water Pipeline	9	Temporary	-	-	-
Water Treatment Plan	-	-	-	6,325	-
Access Road to WTP and 22kV Distribution Line	-	-	-	-	-
Water Supply Office	-	-	-	1,600	-
Clean water distribution pipeline	13	Temporary	Temporary	Temporary	cement slab in Road's RoW
Ancillary sites (access roads, dumping sites etc.)	Disposal sites will be selected based on consultation with local authorities				

### 3.11 Sophun WSS Specific Conditions

#### 3.11.1 Land use.

12. Several land cover and distinct land use types occur in Sophun and Sopnao village, the total village area of 7,468ha, including residential land, paddy field, village protection forest, village production forest, agriculture land, fallow land, sacred forest and cemetery. Upland paddy field is largest area approximately 1,538ha or 38%, follow by village conservation forest approx. 975ha or 24%, village production forest is approximately 622 ha or 16% and Agriculture land Approx. 367ha or 14%, the Figure 3-10 **Error! Reference source not found.** is shown the distinct land use types in both Villages.

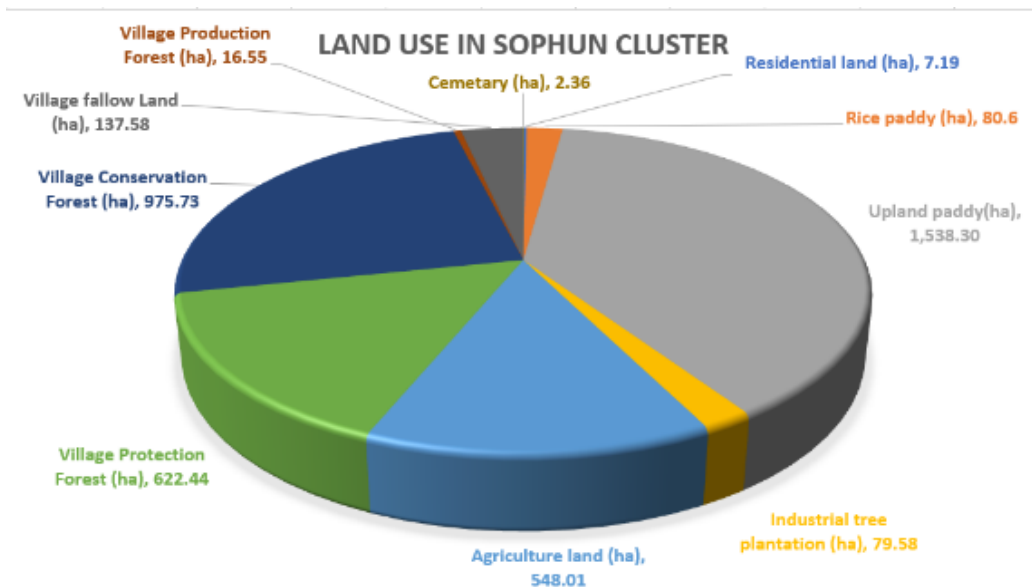


Figure 3-10 Land Use in Sophun and Sopnao Village

#### 3.11.2 Water Use

94. The service areas covered the households at Sophun and Sopnao villages, healthcare centers, and schools. Villagers have been accessing to the rural water supply system (Nam Lin/Nam Saat) since 2016 which is provided by the Lao government (UNDP-PRF). This system has only elementary pipeline schemes without treatment works with two water sources as the Houay Khom and Houay Za Brook, inadequate water during the dry season is due to insufficient supply and water supply is relatively lesser than the demand. The communities, the health center, schools, and village office use the same water system. People use water for purposes such as cooking, bathing, washing clothes, feeding pets, etc. Nearly 70% of the families in the villages drink water from potable water (Plastic Bottle for potable water). The rest of the drinking water is taken directly from taps and sometimes they use boiled water before drinking.

### **3.11.3 Demographic and Socioeconomic Conditions <sup>3</sup>**

95. The core area covers 343 households of Sophun and Sopnao villages, 343 households, with a total population of 1,153 people (recorded in Jan. 2021) and 2,066 people (estimated in 2038 - the Project's target year), corresponding to a population growth rate of 2%.



96. The village economy is based on agriculture and trade. The primary income is rice cropping, animal breeding (buffalo, cows, pigs, goat, and poultry), NTFPs collection, state employee, handcraft, and business/service. The survey indicated the occupation in the two villages: 5% of male and female heads of households are district government officials, 4% of total heads of households are commercials, 94% of heads of households are farmers. The two villages are linguistically and ethnically homogeneous, with all homes being fluent in the national language. According to the investigation, 44% of households are upper poverty line, and 56% are below the poverty line.




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<sup>3</sup> Source: Field data collection by Mr. Keopphet, Social Safeguard Specialist

**3.11.4 Site Specific Conditions – Sophun WSS in Mai District**

Table 3-12 Site Specific Conditions in Sophun WSS in Mai District

Work Item	Descriptions	Photos
Water Source and Intake	<p>Houay Yei is a small stream, lined the small bushes, vines, shrubs, small trees with diameters ranging from about 3 to 20 centimeters, bamboo. There are rocks and gravels in the streambed and along the stream bank.</p> <p>The water intake will be located in the in Houay Yie.</p> <p>The water intake site can be accessed via a walking trail, and there are no local houses in the vicinity of the water intake, ensuring a pristine (in its natural state and unpolluted,) and undisturbed environment around the area.</p>	
Raw Water Transmission Pipeline Alignment	<p>The length L = 6.398Km</p> <p>Raw water pipelines will pass through the community land. Some sections will traverse the rocky hill along the Houay Yei, following the community pathway to the farmland, and passing through the paddy land area of 17 households in Sophun village.</p> <p>The raw water pipeline will be laid underground at a depth of 0.7 to 1.2 meters. The width of pipe trenches ranges from 0.5 to 0.8 meters</p> <p>The Contractor will lay out the pipelines along the border of the field and avoid laying out the pipelines in middle of the field to the extent possible.</p> <p>A comprehensive list of the <b>17 households</b> of Sophun village whose agricultural land may be temporarily affected by the laying of the Raw Water Pipeline is provided in the ARAP</p> <p>These households have been consulted during the village meeting to discuss the WSS subproject. The potentially affected households have given their consent for the pipeline to pass through their agricultural land in the village meeting. Documentation of the village consultation meeting is provided in the ARAP</p>	

Work Item	Descriptions	Photos
Access road to WTP	<p>The length L=112m, width B=5m</p> <p>The existing ground elevation is from 412 to 420mamsl. The slope gradient is about 7%.</p> <p>The existing pathway to the proposed location of WTP is unpaved and narrow. This pathway will be upgraded to be the access road from the village to WTP.</p>	
Water Treatment Plant site	<p>Land Area = 1,804 square meters</p> <p>The ground elevation is from 415 to 424mamsl. The slop gradient is 41%.</p> <p>The proposed WTP will be located on communal land (Village Land) which is covered with small trees, vines and shrubs. However, rubber trees of 3 HHs that encroached that communal land have agreed to cut the 20 affected rubber trees with any charge to the project (Mr. Bounpheng : 10 trees, Mr. Khamnor : 6 trees, and Mr. Phanphik 4 trees).</p> <p>The WTP is border with the bamboo forest and orchard in the north and south, with rubber plantation on the east and west.</p>	
Water Supply Service Office	<p>The service office will be located in an area of 1,150M<sup>2</sup> at location X=271804; Y=2343198.</p> <p>Northern side: Adjacent to the village common land</p> <p>Southern side: Adjacent to the village common land</p> <p>Eastern side: Adjacent to the village office</p> <p>Western side: Adjacent to a district road</p>	

Work Item	Descriptions	Photos
Clean Water Distribution Pipeline	<p>The length L = 10.9Km</p> <p>There are houses along National Road No. 2E. Some sections of the pipeline will be laid out along the right-of-way, while other parts will pass through the concrete extension yards of 9 HH comprising of Sophun village and 4 HH of Sopnao village. The contractor will repair the floor to its original condition.</p> <p>The contractor will lay out the pipeline in the gap between the road and the front of the houses, thereby avoiding any impact on the concrete floors of the houses. During the construction period, the contractor will pay special attention to prevent any damage to the concrete structures of the houses located adjacent to the road. However, the concrete floors of 9 houses of Sophun village and 4 HH of Sopnao village along the roadside may be temporarily affected, as the pipeline will mostly pass in front of these houses and there is almost no gap between the road and house except the drainage channel.</p> <p>In Sophun village, the SEARECC project has planned to undertake the widening of the main access road to improve transportation and infrastructure. To ensure that this development proceeds smoothly, the Project Management Unit (PMU) initiated consultations with SEARECC project representatives at MPWT. During these discussions, it was emphasized that coordination with the contractor responsible for the Water Supply System (WSS) is crucial. The PMU will work closely with both the SEARECC project team and the contractor to ensure that all necessary precautions are taken. One key aspect of this coordination involves the placement of marking posts along the designated areas for the widening of road. These marking posts will serve as guides to indicate the exact location where the pipeline will be laid out.</p> <p>Additionally, the PMU will collaborate with the local office of the Department of Public Works and Transport (DPWT) to supervise the marking process. This coordinated effort is intended to prevent any accidental damage to the pipelines during the road widening activities. By laying out the distribution pipeline with careful planning and precise marking, the project aims to protect the integrity of the water supply infrastructure while achieving the desired improvements to the road network.</p>	


Work Item	Descriptions	Photos
	<p>If any impact occurs on the floors of the households, the contractor will repair the concrete floors to their original condition. This will be done if the floors are affected during the trench digging for laying out the pipeline, which will be approximately 50 cm deep. The laying of the pipelines will not impact the livelihood or income of the households during the construction period.</p> <p>These households have been consulted during a village meeting and have agreed to allow the pipeline to pass in front of their houses, including their concrete floors. List of the 9 households of Sophun village and 4 households of Sopnao village is given in the ARAP.</p> <p>Documentation of the village meeting is provided in the ARAP.</p> <p>There are shops near the water connection pipelines that may also be temporarily affected during the construction phase. These shops will benefit from the Water Supply System (WSS) during the operational phase. However, the contractor will implement precautionary measures by making necessary arrangements to allow customers to access the shops, ensuring no impact on the income of the shopkeepers.</p> <p>The project has supported the construction of WASH (Water, Sanitation, and Hygiene) facilities for schools in the Sophun Cluster. Water connections will be provided to all public facilities, including schools and any existing health centers.</p>	
Powerlines for the WTP	<p>Length L = 100 meters</p> <p>The electrical poles of 22kV will be located along the side way of the access road to the WTP.</p>	

Table 3-13.1 Summary Impact on land and existing objects on land WSS Sophun Cluster in Phongsaly Province

<b>Facilities</b>	<b>Affected Households (HH)</b>	<b>Agricultural Land (m<sup>2</sup>)</b>	<b>Residential Land (m)</b>	<b>Communal land (m<sup>2</sup>)</b>	<b>Others (specify)</b>
Intake	-	-	-	-	-
Raw Water Pipeline	17	Temporary	-	Temporary	-
Water Treatment Plan			-	3,204	
Access Road to WTP and 22kV Distribution Line	3		-		Rubber Trees
Water Supply Office	-	-	-	1,150	-
Clean water distribution pipeline	13	Temporary	Temporary	Temporary	Concrete yard in Road's RoW
<i>Ancillary sites (access roads, dumping sites etc.)</i>	Disposal sites will be selected based on consultation with local authorities				

### 3.12 Longnai Kao WSS Specific Conditions

#### 3.12.1 Land use.

97. Several land cover and distinct land use types occur in Longnai Kao, Longnai-Mai and Bornoy village, the total village area of 7,468ha, including residential land, paddy field, village protection forest, village production forest, agriculture land, fallow land, sacred forest and cemetery agriculture land is largest area approximately 889 ha or 32%, follow by village production forest approx. 560ha or 20%, fallow land approx.372ha or 14%, Industrial Plantation Land approx. 309ha or 11% and village conservation forest Approx. 285 ha or 10%, the other 27% are including village production forest, residential land, paddy field, sacred forest and cemetery. the Figure 3-11 is shown the distinct land use types in four Villages.

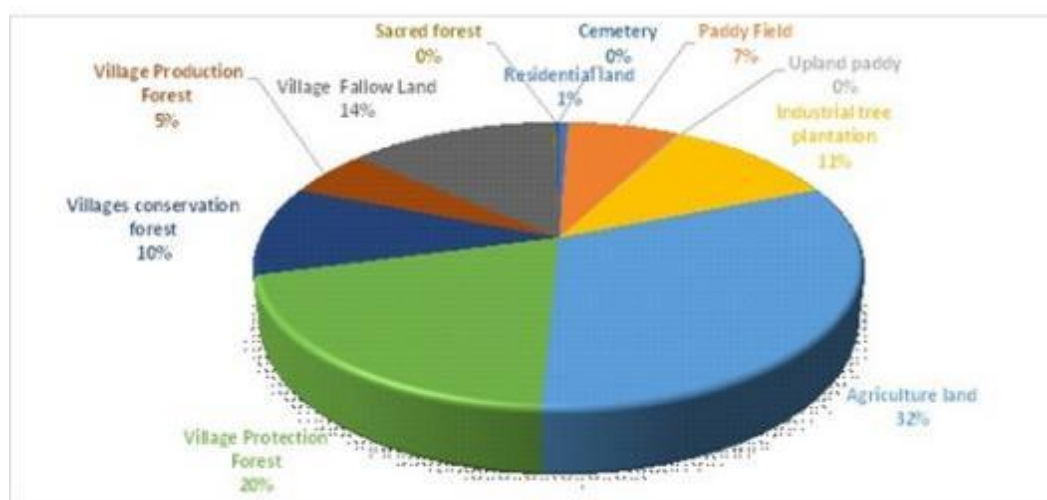


Figure 3-11 Land Cover and Land Use in Longnai Kao , Longnaimai and Bornoy village.

#### 3.12.2 Water Use

98. Villagers of Longnay-Kao village have been accessing to Nam Saat (gravity water supply system) without treatment since 2009 by Alex Japan Project, villagers of Longnai-mai have been accessing to Nam Saat System without treatment since 2007 by themselves and villagers of Bornoy village have been accessing to Nam Saat Systems since 2007 by World Bank. However, during the dry season water supply is insufficient due to the capacity of the water pipe to meet the water flow requirement. In addition, the use of water along both sides of the river for the agricultural purposes and the impact of climate change has contributed the shortage of water supply for household use.

99. Communities, health centers, schools, and villages use the same water system. People use water for their livelihoods, such as cooking, bathing, washing clothes, feeding pets, etc. Nearly 70% of families in villages drink portable water. The rest drink water directly from taps and some HH boil the water before drinking.

#### 3.12.3 Demographic and Socioeconomic Conditions <sup>4</sup>

100. The Bountai district has 64 villages with a total population of 26,784 people of which, 6,696 people living in the urban area, and 20,088 people living in the rural area, there are

<sup>4</sup> Source: Field data collection by Mr. Keophet, Social Safeguard Specialist



13,128 women. Careers: rice crops, livestock, commerce, and services. The potential of economic: agriculture, livestock and commerce, and NTFPs collection. The ratio of poverty is 54.28%, the total gross domestic product ratio (GDP) is 344,690,000 million Kips in the year 2019, and the GDP per capita is approximately 1,746 USD.




101. The core area covers 3 villages (Longnay-Kao, Longnai-mai and Bornoy) which have 242 households with a total population of 1,443 people, including local authorities, students, and travelers (recorded in 2021). The annual population growth rate of 2.2% per annum is used for this district respectively for 2023-2038. Therefore, the estimated population for water supply design is 2,089 people (year 2023).




102. The economy of the villages is based on agriculture and trade. The main income is from rice cropping, animal breeding (cows, pigs, and poultry), NTFPs collection, state employee, and trade. The sample survey showed occupation in the one village: 10% of male and female heads of households are the districted government officials, traders are at 5% of total heads of households, workers are at 15% of total heads of households and most of heads households are farmers. The villages are linguistically and ethnically homogeneous, with all heads of households being fluent in the national language. According to the investigation, only 25% of households are above the poverty line while 75% of households are below the poverty line.

### 3.12.4 Site Specific Conditions – Longnai Kao WSS

Table 3-14 Site Specific Conditions in Longnai Kao WSS in Bountai District

Work Item	Descriptions	Photos
Water Source and Intake	<p>Houay Viev is a small stream, lined with small bushes, vines, shrubs, and small trees ranging in diameter from about 3 to 20 centimeters and bamboo. There are rocks, gravel and stone in the streambed and along the stream bank.</p> <p>The proposed water intake is in Houay Viev on village fallow land of LongNai Mae village Currently water is being used for small gardens and construction of WSS will not impact the existing water uses.</p> <p>The water intake site can be accessed via a walking trail, and there are no local houses in the vicinity of the water intake, ensuring a pristine (in its natural state and unpolluted,) and undisturbed environment around the area.</p>	
Raw Water Transmission Pipeline Alignment	<p>The length L = 7.35Km</p> <p>Raw water pipelines will be laid along the brook, through the valley, crossing fallow land, agriculture land of 18 HH and running along the roadside. Some sections are well covered with vines, bushes, banana and other trees etc.</p> <p>The raw water pipeline will be laid underground at a depth of 0.7 to 1.2 meters. The width of pipe trenches ranges from 0.5 to 0.8 meters</p> <p>The Contractor will lay out the pipelines along the border of the field and avoid laying out the pipelines in middle of the field to the extent possible.</p> <p>A comprehensive list of the 18 households whose agricultural land may be temporarily affected by the laying of the Raw Water Pipeline is provided in the ARAP.</p>	

Work Item	Descriptions	Photos
	<p>These households have been consulted during the village meeting to discuss the WSS subproject. The potentially affected households have given their consent for the pipeline to pass through their agricultural land in the village meeting. Documentation of the village consultation meeting is provided in the ARAP.</p>	
Access road to WTP	<p>The length L=670m, width B=5m</p> <p>The ground elevation from starting point to the end point is from 732 mamsl to 836mamsl. The slope gradient is 16%.</p> <p>Most of access road to the WTP will be constructed on the community land. The construction of the access road to the WTP will pass through private land plots of Mr. Khamxay and Ms. Teang (630 m<sup>2</sup>) for the rubber tree plantation, and Mr. Yot and Ms. Ly (600 m<sup>2</sup>) (fallow land) in Longnai-Kao village</p>	
Water Treatment Plant site	<p>Land Area = 4,500 square meters,</p> <p>The WTP is on communal land which is bordered with the bamboo forest and cultivated land in the north, south, east and west.</p> <p>The existing ground elevation is from 836 to 849mamsl. The slop gradient is up to 52%.</p>	

Work Item	Descriptions	Photos
Water Supply Service Office	<p>The service office will be located in an area of 800M<sup>2</sup> at location X=803929; Y=2353315.</p> <p>Northern side: Adjacent to house of local people                      Southern: Adjacent to house of local people                      Earthen: Adjacent to the district road                      Western: Adjacent to house of local people</p>	
Clean water distribution Pipelines	<p>The length L = 15.48 Km</p> <p>There are houses along the road in the villages of the core service area. The pipeline will be laid out along the right-of-way of the road.</p> <p>No HH will be affected by the laying out of clean water pipeline.                      The system will also supply water to the school in the village.</p>	 


Work Item	Descriptions	Photos
Powerlines for the WTP	<p>Length L = 100 meters</p> <p>The electrical poles of 22kV will be located along the side way of the access road to the WTP.</p>	

Table 3-15.1 Summary Impact on land and existing objects on land WSS Longnai Kao Cluster in Phongsaly Province

Facilities	Affected Households (HH)	Agricultural Land (m <sup>2</sup> )	Residential Land (m)	Communal land (m <sup>2</sup> )	Others (specify)
Intake	-	-	-	-	-
Raw Water Pipeline	18	Temporary	-	-	-
Water Treatment Plan	-	-	-	4,500	-
Access Road to WTP and 22kV Distribution Line	2	-	-	1230	Rubber garden and tree, and fallow land
Water Supply Office	-	-	-	800	-
Clean water distribution pipeline	-	Temporary	Temporary	Temporary	-
<i>Ancillary sites (access roads, dumping sites etc.)</i>	Disposal sites will be selected based on consultation with local authorities				

## 4 Potential Environmental and Social Impacts and Risks

### 4.1 Positive Impacts and Benefits

103. The subprojects will provide direct and indirect benefits for all people living and working in the beneficiary villages. Principal benefits include a secure and continuous supply of safe and clean water. The WSSs will also provide stable drinking water that could contribute to improving community health, water supply is more reliable in both quality and quantity and would meet the demands for processing food, cleaning, washing etc.

### 4.2 Environmental Impact During the Construction Phase

104. Construction activities that may be undertaken for the proposed subprojects would include land clearing, setting up site offices and camps, mobilization of workers, machines and construction materials including the pipes to the sites, ground levelling, transportation of construction materials and wastes to and from the construction sites, excavation and grading, pipe installation and backfilling, disposal of excavated soil, road construction/rehabilitation, construction and installation, commissioning etc. . During construction phase, there will be common construction impacts and risks, and specific impacts and risks related to existing baseline conditions at the construction site and typical construction activities.

#### 4.2.1 Pre-Construction and Construction impact and Risks

105. Pre-construction and Construction impact and risks are listed below.

##### A. Pre-Construction Impacts and Risks

- (i) Impacts on land and objects on land due to site clearance, some structures may need to be relocated.
- (ii) Safety risks for the workers and machines during site clearance and excavation if unexploded objects (UXO) remain at the sites.

##### B. Construction Impacts and Risks

- (i) Generations of dust, noise, solid waste and wastewater.
- (ii) Increased Erosion/landslide and sedimentation risks.
- (iii) Biological impacts associated with reduced vegetation cover and trees due to ground disturbance.
- (iv) Traffic disturbance and increased traffic safety risks.
- (v) Damages to existing infrastructures, such as existing roads
- (vi) Social disturbance due to construction.
- (vii) Community health and safety risks.
- (viii) Occupational health and safety risks
- (ix) Chance Find
- (x) Site-specific impacts and risks

The above impacts and risks are discussed in more detail below:

##### A. Pre-Construction Impacts and Risks

- (i) *Impacts on land and existing structures on land and community assets.*

106. Land and existing objects on land affected are summary. Detail measurement survey (DMS) has been conducted by PIU in assistance with PIA-Non-key staff. The details of land and other assets will be impacted, and compensation budget are described in ARAP.

#### **Namly WSS:**

- Intake: No impact on private land or property.
- Raw water pipeline: The agricultural land of 32 households in Namly village will experience a temporary impact during the construction phase.
- Water treatment plan (WTP): No impact on private land or property.
- Access road to WTP and 22kV distribution line: The permanent impact on private land owned by 1 household with the total impacted area of 480 square meters and there are cardamom trees and galangal will be impacted by construction of 22kV distribution line.
- Water Supply Office: No impact on private land.
- Clean water pipeline: The joined concrete extension yard with the right of way of the main road 10 households will have a temporary impact during the construction phase.

#### **Sinxay WSS**

- Intake: There is no impact on private land or property.
- Raw water pipeline: The agricultural land of 9 households in Sinxay village will experience a temporary impact during the construction phase.
- Water treatment plan (WTP): There is no impact on the private land or property.
- Access road to WTP and 22kV distribution Line: There is no impact on private land and property.
- Water Supply Office: There is no impact on the private land or property.
- Clear water distribution pipeline: The joined concrete extension yard with the right of way of the main road of 13 households will have a temporary impact during the construction phase.

#### **Suphun WSS**

- Intake: There is no impact on the private land and property.
- Raw water pipeline: The paddy land area of 17 households in Sophun village will experience temporary impact during the construction phase. This is because the pipeline will be buried underground at a depth of 0.7 to 1.2 meters, and afterward, the land will be restored to its original condition.
- Water Treatment Plant (WTP): Impact to rubber trees of 3 households who encroached communal land to grow rubber trees.
- Access road to WTP and 22kV distribution Line: Impact to rubber trees of the same 3 households as above. However, rubber trees of 3 HHs that encroached that communal land have agreed to cut the 20 affected rubber trees with any charge to the project (Mr. Bounpheng : 10 trees, Mr. Khamnor : 6 trees, and Mr. Phanphik 4 trees).
- Water Supply Office: There is no impact on the private land or property.
- Clear water distribution pipeline: There are concrete extension yard of total 13 HHs comprising of 9 HHs in Sophun and 4 HHs in Sopnao villages will have temporary impact during the construction phase.

**Longnai Kao WSS**

- Intake: There is no impact on the private land or property.
- Raw water pipeline: The farmland, paddy rice area and a rubber plantation land will have temporary impact during the construction phase. The agricultural land of 18 households in Longnai Kao village will experience a temporary impact during the construction phase.
- Water treatment plan (WTP): There is no impact on the private land or property.
- Access road to WTP and 22kV distribution Line: Two private land plots will be permanent affected from the construction of Mr. Khamxay and Ms. Teang (630 m<sup>2</sup>) for the rubber tree plantation, and Mr. Yot and Ms. Ly (600 m<sup>2</sup>) (fallow land) in Longnai-Kao village.
- Water Supply Office: There is no impact on the private land or property.
- Clear water distribution pipeline: no temporary impacts on the front houses.

Table 4-1 Summary Impact on land and existing objects on land WSS in Phongsaly Province

Facilities	Affected Households (HH)	Agricultural Land (m <sup>2</sup> )	Residential Land (m)	Communal land (m <sup>2</sup> )	Others (specify)
<b><i>Namly WSS</i></b>					
Intake	-	-	-	-	-
Raw Water Pipeline	32	Temporary	-	Temporary	-
Water Treatment Plan	1	480	-	3,100	Cardamom bushes
Access Road to WTP and 22kV Distribution Line	-	-	-	660	
Water Supply Office	-	-	-	800	-
Clean water distribution pipeline	10	Temporary	Temporary	Temporary	Concrete yard in Road's ROW
<b><i>Sinxay WSS</i></b>					
Intake	-	-	-	-	-
Raw Water Pipeline	9	Temporary	-	-	-
Water Treatment Plan	-	-	-	3325	-
Access Road to WTP and 22kV Distribution Line	-	-	-	-	
Water Supply Office	-	-	-	1,600	-
Clean water distribution pipeline	13	Temporary	Temporary	Temporary	Concrete yard in Road's RoW
<b><i>Sophun WSS</i></b>					
Intake	-	-	-	-	-
Raw Water Pipeline	17	Temporary	-	Temporary	-
Water Treatment Plan	-	-	-	3,204	Rubber Trees of 3 HHs
Access Road to WTP and 22kV Distribution Line	3	-	-	-	
Water Supply Office	-	-	-	1,150	-

Facilities	Affected Households (HH)	Agricultural Land (m <sup>2</sup> )	Residential Land (m)	Communal land (m <sup>2</sup> )	Others (specify)
Clean water distribution pipeline	13	Temporary	Temporary	Temporary	Concrete yard in Road's RoW
<b>Longnai Kao WSS</b>					
Intake	-	-	-	-	-
Raw Water Pipeline	18	Temporary	-	-	-
Water Treatment Plan	-	-	-	4,500	-
Access Road to WTP and 22kV Distribution Line	2	-	-	1,230	Rubber garden, rubber tree and fallow land of 2 HHs
Water Supply Office	-	-	-	800	-
Clean water distribution pipeline	-	Temporary	Temporary	Temporary	-
<i>Ancillary sites (access roads, dumping sites etc.) for all WSS</i>	Disposal sites will be selected based on consultation with local authorities				

*Remark: The ARAP has been prepared in a separate document for project policy on minimizing the impacts and compensations/supports to the Project affected Households.*

### **(ii) Safety risks related to UXO**

107. There will be safety risks for the workers and machines during site clearance and excavation if there are unexploded objects (UXO) remains at the sites. This risk is manageable. At the end of the detail design stage, the PMU recruited a contractor to carry out UXO clearance at project sites. UXO clearance will be completed before the start of construction work. The construction sites will be handed over to the contractors only after the completion of the UXO clearance.

## **B. Construction Impacts and Risks**

### **(i) Impacts on Air Quality**

108. The potential sources of air pollution during the construction stage include dust from earthworks, it is concentrated mostly in areas within a 50 meter in radius of the disturbed ground, mostly from excavation activities. Fugitive emissions will be generated from the operation of construction equipment and machineries, vehicles working in the area (mainly at the WTP site, along the access road and the pipeline alignments) and along the transport routes; Most of the emissions will be in the form of coarse particulate matter and will settle down in close vicinity of the work sites. Dust generation will be the most during ground levelling and excavations at the WTP sites and along their access roads, however, the potential impacts are expected to be localized, short-term, and reversible. The workers at the sites and the small number of residents living near construction sites or the access roads would be most affected by dust. This impact can be mitigated by the use of personal protective equipment (PPE) and the application of other measures, such as carrying out construction in stages and covering the materials as part construction practices. These are specified in the Environmental and Social Codes of Practices (ESCP) presented in the Environmental and Social Management Plan (ESMP) section of this report.

***(ii) Increased level of Noise and Vibration.***

109. Construction activities may cause noise, and vibration impacts for a short duration. Noise and vibration are sourced from the operation of equipment such as jackhammer for the excavation of paved roads to create pipe trenches before installation, pile driving during for foundation construction at the water treatment plant sites. Ambient noise levels in these areas may reach 88dBA at about 15m away from the operating equipment. Along the haul roads, the average ambient noise level will also experience an acute increase because of increased vehicular traffic. The movement of vehicles also generate noise and vibrations along the road. Noise and vibrations mostly affect the workers. Noise and vibrations can be mitigated by the measures highlighted in ESCOP.

***(iii) Generation of Solid wastes and Wastewater*****Excavated Soil**

110. Earth work will include clearing of vegetation, grading of the access road, ground levelling at the WTPs, and excavation at pipe trenches along the transmission and distribution pipelines and other facilities. It is estimated that the total volume of excavated materials is 24,969 m<sup>3</sup> for Namly WSS, 47,510 m<sup>3</sup> for Sinxay WSS, 23,461 m<sup>3</sup> for Sophun WSS and 63,206 m<sup>3</sup> for Longnai Kao WSS. It is anticipated that the topsoil, which will be stripped and removed, can be reused for garden land, and the subsoil could be utilized for backfilling or ground levelling. The disposal sites need to be identified after construction contract signing.

**Construction Waste**

111. Other than excavated materials, the inert waste that will be generated during the works will consist mainly of scrap wood and metal, cement bags, aggregates, and concrete debris. These wastes are mostly generated at the WTP construction site and some at the water intake, representing no direct health impacts. They can be disposed of approval site; the scrap metal and wood can be collected for recycling.

**Domestic Waste and wastewater**

112. Domestic waste will be mostly generated at the worker's camp. Domestic waste is not anticipated to be a significant volume as only small temporary camps will be established at the sites near the WTPs. There will not be camps for the worksites for the intake, transmission and distribution pipelines. It is projected that the temporary camps will generate an estimated 0.4 to 0.5 kg/person/day or about 8 to 10 Kg/day (Max. 20 workers) and would mainly of consist plastic/ glass/paper food containers or packaging materials, residues from food processing wastes. Wastewater also will be generated from workers camps and offices. The volume is anticipated to be small.

113. If not properly managed, domestic waste and wastewater may cause nuisance to the public, attract vermined thus affect public health, leachate may cause air/soil/water pollution. Therefore, domestic waste and wastewater need to be collected and properly disposed of.

114. ESCOP and Workers Codes of Conducts includes the measures for domestic waste and wastewater management.

**Hazardous materials**

115. Oil, gas, paints, and some chemicals will be used during construction phase for the operations of machines and vehicles or construction of the water intakes, the WTPs, administration office, chemical house, fences etc. Hazardous wastes generated at the construction sites may include containers of paint and solvents, used batteries, waste oil, rags and other materials contaminated with oil or chemicals. Although the volume is anticipated to

be small, this type of waste is highly detrimental to the environment and public health. These materials must be segregated from the general solid waste, collected and disposed appropriately following ESCOP.

***(iv) Increased Erosion/Landslide and Sedimentation Risks***

116. Ground disturbance during the construction of facilities such as the intake, WTP, Office, access road, water pipelines, may result in erosion at disturbed ground areas. The causes of these risks include site clearance, excavation, earthworks and grading that turns covered surface to barren soil. Erosion potential is also enhanced by the heavy rains. Erosions would lead to the concentration of sediments and further siltation in rivers beds and water bodies. Erosions on slopes and steep areas may eventually lead to landslides, especially after durable rainfalls. Landslides may threaten the stability of existing infrastructure, they may collapse. Landslides may also lead to damage and even loss of properties and human lives down the slopes.

117. The construction of water intakes would take place on and nearby waterways. The size of the water intake is small, and construction duration is short. Therefore, it is expected that the incremental sediment risks will be small.

118. Excavation will take place at the WTP and along the pipeline's alignment. There are some houses down slope of the WTP in La district, if landslide happens it may cause damages to household's properties and even loss of human lives. Therefore, construction must be taken with care and strictly follow the approved construction methods. Along the pipeline alignment, excavation would mostly be small scale, typically 0.5 to 1.5 m deep, 40 cm to 80cm wide, depending on the size of pipelines. Ground disturbance and loss of vegetation cover would also lead to increased erosion potentials at these sites. When construction is taking place close to existing structures such as houses or shops, soil subsidence may lead to damage to the existing structures. This risk can be prevented by proper construction methods, protecting the excavated areas and new slopes by supports.

119. As the project areas have steep topography, landslide risk is high. Erosion and sedimentation risks can be mitigated by avoiding earthworks in rainy season, carrying out excavation in stages, and ground levelling as soon as possible. Engineering design and cost estimation should cover the measures to protect slopes and adequate drainage on slope recover the disturbed vegetation cover, avoid siting the heavy load work items (such as clear water reservoir) right on top of any slope, and catchment management as well as other measures listed in the ESCOP.

***(v) Traffic disturbance and Increased traffic safety risks***

120. Pipe laying will cause temporary disturbances to access to properties. Construction activities implemented at roadside such as excavation of pipe trench, temporary loading of the pipes, construction materials and wastes, would disturb local traffics and caused increased traffic safety risks. Particularly the installation of the pipes at road crossings or construction activities along narrow roads may lead to a temporary blockage or closure of roads and hamper movement of vehicles and people in the community. Currently traffic along the transportation route is low, disturbance to traffic is expected to be low. However, traffic safety risks would be higher during traffic peak time near schools, health care centers or other public centers. Similarly, there will also be increased traffic safety risks at the intersection between the main road and the access roads to the WTP. Traffic disturbance and safety risks would be temporary, moderate and manageable by appropriate construction schedules, methods and site management measures.

**(vi) Biological Impacts and Risks**

121. *Tree cutting, vegetation clearance.* The water intake is located in waterway near village production forest, the construction of the weir at the intake of two WSSs will not require cutting of the trees. Shrubs in limited areas may be removed. However, land clearance including tree cutting may be required for opening temporary access to the intake at some sections. The vegetation cover in those areas are small trees with a diameter less than 10cm and bush. Tree cutting and vegetation removal may also be required for the construction of the access road to the WTP, at the WTP sites and number of sections along the transmission and distribution pipelines. This impact is unavoidable but can be minimized through the siting of the pipeline alignment and limiting the disturbed areas to a minimum.

122. *Risks to wildlife.* There may be some wildlife in the project areas where bushes exist. During the construction phase, the workers may hunt or catch the birds, the fish or other wildlife. They may also cut or cause damage to the trees outside the boundary of construction sites. The workers may also be engaged in illegal trade or consumption of wildlife. Careless behaviors of the workers when handling or using flammable materials such as fuels may pose forest fire risks. As the number of workers is very small and mostly are local laborers, it is expected that the risks to wildlife caused by construction activities are moderate.

123. Impacts and risks to biological resources in general and wildlife in particular will be addressed through ESCOP, Workers Codes of Conducts and specific mitigation measures.

**(vii) Social Disturbance**

124. The proposed WSSs are of small size, not requiring large number of labor force. Therefore, the mobilization of the workers to the project site and their interactions with local communities are not expected to create competition for the local resources between the migrant labor force and local communities.

125. Pipe trench excavation, pipe laying, temporary loading of the pipes, construction materials and wastes will cause temporary disturbance to daily activities of local communities and accessibility to their properties, and some schools. Particularly at pipe road crossings, construction activities along narrow roads may lead to a temporary blockage or closure of roads and hamper movement of vehicles and people in the community.

126. On the other hand, dust, noise, pollution, traffic disturbance, safety risks caused by construction may lead to some tensions in communities at some levels.

127. The ESCOP and Workers Codes of Conducts will help to mitigate or address social disturbance. In addition, local labor will be given priority to be hired for manual work in the project during the construction phase. Since these are small construction projects, the workers will be hired locally except for the technical engineers and skilled workers. About 15-20 local labor will be hired for each site which can generate additional income for the local community.

**(viii) Occupational Health and Safety**

128. During the construction phase, the implementation of the works may result in hazards to the health and safety of workers, such as.

- Tripping, falling from height or slippery surfaces, while carrying heavy loads or moving from lower to higher areas and vice versa.
- Workers are attacked by harmful insects such as bees, snakes, etc. when working near the bush or forested land.

- Accidents happen during operation of machines and equipment (including welding machines), handling of bulky work items including the pipes and pre-casted objects of the WTP or caused by landslides.
- Electrical failures.
- Hazards caused by gas or oil spills lead to fires.
- Materials and equipment fall from high above.
- Exposure to extreme weather conditions for long duration: heat from sunlight, heavy rains etc.
- Working in risky conditions (narrow space, dark, near open space high above, etc.)
- Exposure to pollution (dusts) or hazardous materials (gas, oils, paints etc.)
- Lack of access to clean water, safe food or adequate sanitation facilities when living in project area.
- Contract water-borne diseases (dengue fever, diarrhea etc.) or Sexual transmitted diseases if the works engage in “social evils” such as prostitutions.
- Social disorder if the workers quarrel, fight, or engage in gambling, drug addicts, prostitution etc.
- OHS risk is at a moderate level and manageable through ESCOP, Codes of Conducts and site-management measures. The ESCOP will include mitigating requirements.

**(ix) Community Health and Safety**

129. During construction phase, local communities may be exposed to health and safety risks, such as.

- Falls in open holes or pipe trenches, especially at sections passing along roads, in front of houses, shops or schools.
- Exposure to the operation of construction plants (trucks, cranes, etc.) or vehicular movements in the area or heavy equipment, the handlings of the bulky construction materials such as the HDPE pipes, the power poles, the pre-casted tanks or other parts of the WTP.
- Expose to unsafe electrical wires, gas, hazardous materials stored or spilled at and surrounding the construction sites.
- Pollution by dust, waste and wastewater. Refer also to ESCOP.

**(x) Chance Find**

130. There are no known historical or archaeological sites within the proposed two-cluster water supply subprojects footprint. However, there is a risk that artifacts may be exposed during excavation. Chance Find Procedures specified in the ESCOP will be applied to address such circumstances.

**4.2.2 Type and Site-specific Construction Impacts and Risks**

131. The construction impacts and risks would be higher at some locations, depending on the types of typical construction activities (such as pile driving or welding) to be carried out, and the sensitiveness of project locations (whether it is in bush land, near school/health care centers or other public accessible sites, on the road, etc.).

132. Type-specific impacts and risks may include disruption of water flow during intake construction, traffic disturbance or disruptions due to excavation of trenches for pipeline installation, occupational health and safety risks during the installations of power poles and

lines or bulky items at the WTPs, etc. These specific impacts and risks are listed in the ESMP (Section 6), together with the mitigation measures.

### **4.3 Environmental Impacts and Risks During the Operation Phase**

#### **4.3.1 Impacts on Hydrology and Water Usage**

133. As mentioned in Section 3.3.1, the measured flow rates measured in dry season at the proposed intake on the Houay Ly was at 4,747 m<sup>3</sup>/day, much higher than the proposed capacity of the WPT, at 170m<sup>3</sup>/day. The design capacity of the Sinxay WSS in Mai district is 150m<sup>3</sup>/day, accounts for 1,7% of the flow rate in water source measured in dry season of 2022, which was at 8,998 m<sup>3</sup>/day. The design capacity of the Sophun WSS in Khoua district is 160m<sup>3</sup>/day, accounts for 1,7% of the flow rate in water source measured in dry season of 2022, which was at 11,815m<sup>3</sup>/day. The design capacity of the Longnai Kao WSS in Bountai district is 200m<sup>3</sup>/day, accounts for 1,7% of the flow rate in water source measured in dry season of 2022, which was at 1,738 m<sup>3</sup>/day. Therefore, it is anticipated that the proposed WSS systems would not cause any noticeable changes in stream hydrology or downstream water usage.

#### **4.3.2 Generation of backwash water and sludges at water treatment plants.**

134. WTP will produce inert silt and sediment as a by-product which may contain traces of water treatment chemicals (aluminum salt or alum). Sediments generated from the pre-sedimentation process are very small, average of 15.6kg/days at each WTP. While those from the filtration process are insignificant in volume. The WTP design included a sludge lagoon for temporary storage of sludge generated from the water treatment process. Sediment volumes will be large during the wet season due to high suspended solids content in the river water, but low during the dry season. Aluminum is suspected to be causing Alzheimer disease. Hence sludge will be disposed of in predetermined landfill sites to avoid health hazards and prevent it entering the food chain. Warning should be made not to allow dumping of WTP sludge to crop/agricultural land. Loading such materials on timber plantation is fine.

#### **4.3.3 Occupational Health and Safety of Workers**

135. Water treatment will involve the use of PAC alum, Polyacrylamide (PAA) coagulant auxiliary agent, disinfection solution and chlorine. Therefore, the works will expose to hazards risks during chemical handling. The risk is particularly present during chlorination because chlorine is a reactive chemical that is hazardous to skin and eyes in case of accidental spill or leak.

136. These risks are manageable through detailed design by the provision of wash basins in the operation house, and a separate room for chemical storage.

137. The workers also move between lower to higher areas within the WTP (to the top of the treatment tanks) or walk near deep areas {clear water reservoir for example}. There will be safety risks during such movements. Warning and protection measure as well as providing safe working bridges/ladders would be required in the design of the proposed WTPs.

#### **4.3.4 Community Health and Safety**

138. As the proposed WTPs are built on steep topography, rainfall in the project area is relatively high and durable. Under the impacts of rain and socio-economic activities along these sites, land slide risks do exist along the access road to the WTP, at the WTP and the slopes surrounding above the WTPs. The layout design of the WTPs should take into account these risks and apply necessary arrangements and measures to mitigate the risks. Monitoring of land slide risks during the operation phase would also be necessary.

#### 4.3.5 *Landslide Risks*

139. As the proposed WTPs are built on steep topography, rainfall in the project area is relatively high and durable, Under the impacts of rains and socio-economic activities along these sites, land slide risks do exist along the access road to the WTP, at the WTP and the slopes surrounding above the WTPs. The layout design of the WTPs should take into account these risks and apply necessary arrangements and measures to mitigate the risks. Monitoring of land slide risks during the operation phase would also be necessary.

#### 4.3.6 *System Failure Risks*

140. The operation of WTP requires electrical usage thus it may cause overload in the existing power supply system and lead to power failure. To avoid this risk, the design of the WSS included a 50 KVA transformer to supply power for the WTP operations.

141. Pollution due to chemical spills may also happen during the transportation, handling of chemicals or during the operation of the treatment units. This risk will be considered during the detail design and mitigation measures such as safe storage area, leakage detection systems should be proposed.

#### 4.3.7 *Raw Water Quality and Quantity Security*

142. **Water quality:** Currently the water quality of both water sources is generally good (see section 4.2). The quality of the raw water may deteriorate if there are detrimental human activities such as farms, agricultural areas, use of pesticide/fertilizers/chemical substances in the upstream catchment area or upstream of intake locations. This may affect the efficiency of WTP and the resulting quality of the treated water. The PIU and PNP shall be continuously coordinate with the village authorities in the WSS service area regarding community activities in the catchment area to monitor catchment activities that may contribute to the contamination of raw water and advise them not to use any chemical which may potentially affect the water.

143. There is no proposed future development that could also have impacts on water quality in the area.

144. There are no other water usage activities around the Houay Ly brook, Houay Phea, Houay Yei and Houay Viey that might have impacts on water usage. Note that the measurement of water supply (see section 4.2) shows that water supply is sufficient, and water taken at water intake is only minor (based on above sections).

## 5 **Environmental and Social Management Plan**

145. The Environmental and Social Management Plan (ESMP) includes the following key contents.

- Mitigation measures.
- Monitoring requirements.
- Monitoring program and reporting requirements; and
- Institutional Arrangements

### 5.1 **Mitigation Measure**

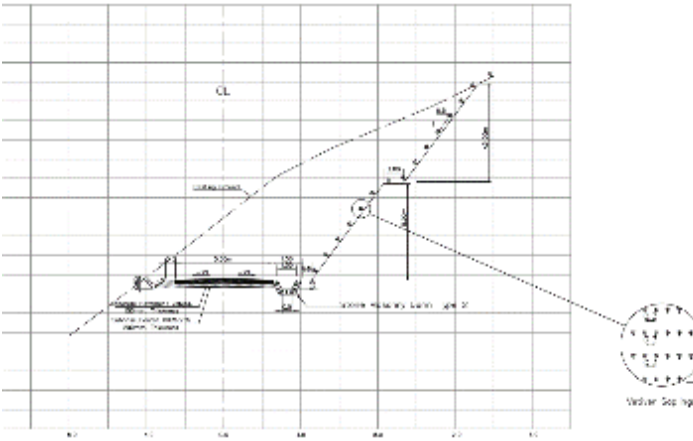
#### 5.1.1 *Detailed Design*

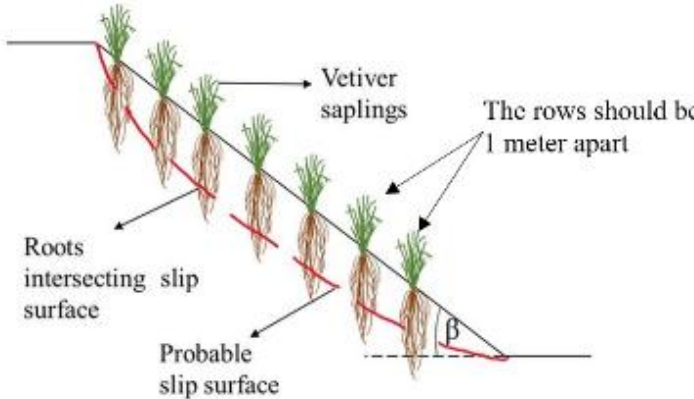
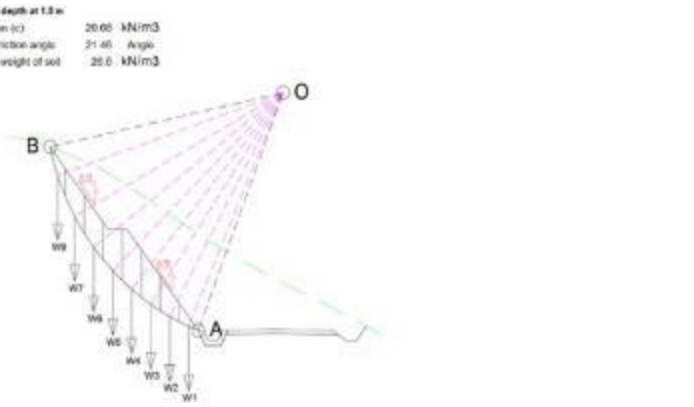
146. Environmental check list has been developed for the Project for the detail design consultants to use during detail design stage in order to avoid or minimize some impacts and risks of construction and operational phases. The application of that check list during


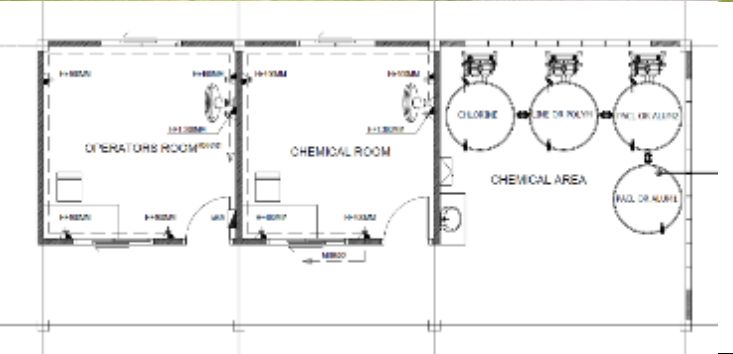
engineering design and the preparation of cost estimations of the four WSSs are explained in Table 5-1 to **Error! Reference source not found.** below.

147. The roads affected by excavation of pipe trenches will be reinstated by the contractors. The construction bidding document/contract covers the costs for the reinstatements of the affected roads.

Table 5-1 Application of Environmental Checklist for Detail Design stage for 4 clusters of WSS Namly, Sinxay, Sophun and Longnai Kao WSS

Potential Risks, Impacts, Issues	Detail Design Mitigation Measures/Check Lists	Detail Design
<b>Water Treatment Plants (WTP)</b>		
<p>Traffic Safety Risks along access road during construction and operation phases</p>	<ul style="list-style-type: none"> <li>Design of the access roads to the proposed WTP includes measures to ensure traffic safety along the road, especially at the curves, along steep slopes and at the junction between the existing main road and the access road to the WTP.</li> <li>Side drainage along the road to ensure sufficient drainage capacity and avoid slope failure.</li> </ul>	<ul style="list-style-type: none"> <li>The design: Class 5 of the STD of the road design, 5 m of wide, the length is 147 m of Namly, 475 m of Sinxay, 112 m of Sophun and 670 m of Longnai Kao WSS clusters. A side of the road have the drainage system. The radius of the curve is 20m, and the radius of junction curves is 5 m,</li> <li>The drainage system has sufficient capacity to drain the water out of the water shade area, the section of canal (0.5 x 1 x 0.5m) As the figure below.</li> </ul> 
<p>Land slide, erosion risks that affect the safety and stability of the treatment units and down slope communities</p>	<ul style="list-style-type: none"> <li>WTP plant lay out taking into consideration the land areas to be disturbed, areas loss of vegetation cover and trees, the volume of earth works/ground disturbance and stability of structures with high loads such as clean water storage reservoirs.</li> <li>Plant lay out include greening and landscaping to minimize barren ground surface and erosion risks.</li> </ul>	<ul style="list-style-type: none"> <li>The slope at access road and water treatment plant are as given below: <ul style="list-style-type: none"> <li>Namly: 7.77%</li> <li>Sinxay: Average 7.36% (Maximum 22.48)</li> <li>Sophun: 2.59%</li> <li>Longnae Kao: Average 2.59% (Maximum 19.95)</li> </ul> </li> <li>The design, cutting a hill and creating a slope to protect against landslides for the construction of the road, according to the geotechnical survey team is conducted to assess the soil type, slope stability, and potential risks of landslides. Based on the survey results, the slope design is created to ensure stability and safety. The site is then cleared of vegetation, rocks, and debris before excavation begins. Heavy machinery and proper excavation techniques are used to excavate the hill, the slope will plant the vetiver grass along the roadway to stabilize the hillside. Drainage systems such as culverts or ditches will be installed to divert water away from the road and prevent erosion. After the slope is constructed, it is regularly monitored to ensure stability and safety.</li> </ul>

Potential Risks, Impacts, Issues	Detail Design Mitigation Measures/Check Lists	Detail Design
	<ul style="list-style-type: none"> <li>• Design considers slopes stabilization measures at, surrounding the WTP and along the access roads.</li> <li>• Foundation design considers the static and dynamic loads (water required treatment, operational substance and etc) to avoid failures from operation.</li> </ul>	<p style="text-align: center;"><b>Detail Design</b></p>  <ul style="list-style-type: none"> <li>• The cutting slope are safety and stability, the bearing capacity of soil is 2.4 kg/cm<sup>2</sup> (the average of 3 Drilling holes)             <ol style="list-style-type: none"> <li>1. Analyze the stability of soil for the access road, No potential of the land slide</li> <li>2. Analyze the stability of soil for WTP, No potential of the land slide</li> </ol> </li> </ul> <p style="font-size: small;">Soil layer depth at 1.5m              Cohesion (c) 20.00 kN/m<sup>2</sup>              Internal friction angle 21.46 Angle              Bulk unit weight of soil 20.0 kN/m<sup>3</sup></p> 
<p>Safety for the workers</p>	<ul style="list-style-type: none"> <li>• Ensure deep and high locations are protected with handrails.</li> <li>• Ensure the design of working bridges, ladders, handrails are convenient and safe for the workers.</li> </ul>	<ul style="list-style-type: none"> <li>• The design is considered to provide convenience and safety for workers.</li> </ul>
<p>Occupational Health and Safety</p>	<ul style="list-style-type: none"> <li>• There are washing basins and septic tank toilets for the operators;</li> </ul>	<ul style="list-style-type: none"> <li>• Yes, washing basins and septic tank toilets is already in BOQ for construction (see detail in the Bidding document and snapshot below)</li> <li>• Chemical storage area is separated from other operations, have sign boards for warning and a sink</li> </ul>

Potential Risks, Impacts, Issues	Detail Design Mitigation Measures/Check Lists	Detail Design
	<ul style="list-style-type: none"> <li>The chlorine storage area/ disinfection unit Include leakage detection equipment and auto spray;</li> <li>O&amp;M include evacuation plan                             <ul style="list-style-type: none"> <li>Plan to manage/store/dispose the excavated soils during the site preparation and construction phase..</li> </ul> </li> </ul>	<p>for washing the hand when contact with the chemicals.</p> <ul style="list-style-type: none"> <li>Soil disposal plan is already prepared see table above and in the ESMP</li> </ul>  
<p>Safety for the workers and community during operation</p>	<ul style="list-style-type: none"> <li>Fences, warnings to restrict access to the WTP sites during both construction and operation phases</li> </ul>	<ul style="list-style-type: none"> <li>Fences and warning signs have already been designed and will be installed/constructed during construction.</li> </ul>
<p>Pollution Control</p>	<ul style="list-style-type: none"> <li>The size of sludge Lagoon is adequate to prevent spills downslopes. Allocate drying yard/designated areas for sludge drying before transportation out of the WTP;</li> <li>Do not allow reuse of sludge for filling food crop land (as it contains Al – a heavy metal that</li> </ul>	<ul style="list-style-type: none"> <li>The sludge amount will be kept in the sludge lagoon and sucked up and transported to a disposal site every 2-3 months. The sludge will be transported and disposed of at approved site.</li> <li>The selected contractor shall work with the PMU/PIA and relevant local authorities to identify disposal sites for the topsoil and unused excavated materials.</li> </ul>

<b>Potential Risks, Impacts, Issues</b>	<b>Detail Design Mitigation Measures/Check Lists</b>	<b>Detail Design</b>
	was considered to cause Alzheimer's disease).	
<b>Pipelines and Power systems</b>	<ul style="list-style-type: none"> <li>• Refine alignments to avoid, minimize impacts and risks on residential land, disturbance to existing housing structures and private properties as much as possible</li> </ul>	

### **5.1.2 Environmental and Social Codes of Practices (ESCOP) and construction requirements**

148. The mitigation measures specified in this section are applicable to construction phase and included in the construction bidding documents.

149. The construction contractors are required to implement or comply with all mitigation measures presented in this subsection during the execution of the contract. After contract signing, the successful bidder (the contractor) is required to prepare a Contractor's Environmental Management Plan (C-ESMP) to submit to PMU for review and clearance prior to construction commencement. The C-ESMP shall.

- Include statements to comply with the Project's safeguard requirements;
- detail the ESCOP and Codes of Conduct;
- Detail other mitigation measures (including the preparation of site-specific mitigation measures such as camp and site office arrangements, drainage, erosion control and land slide prevention measures, vegetation management, fire prevention, safety for the workers and the publics etc.) to ensure that all construction impacts and risks are managed or addressed properly during construction phase;
- include copy on the license of the equipment and construction plants that the contractors plan to use during contract execution;
- be updated to address the issues arisen during construction phase, if any

150. After contract signing, the contractors would be required to coordinate with the construction supervisors and the PMUs to conduct additional consultations with local authorities, get their advice on the disposal sites of topsoil and excavated materials from earth works. Application of appropriate mitigation measures at the disposal sites and along with the access to the disposal sites would also be required. These need to be specified in the Contractor's Environmental and Social Management Plans (C-ESMP).

Table 5-2 Environmental and Social Code of Practice (ES COP)

Impacts/Risks	Mitigation Measure	Responsibility	
		Implementation	Supervisor/approval
<b>1. Soil Erosion and Sedimentation</b>	<ul style="list-style-type: none"> <li>Excavation works shall be scheduled during the dry season to the extent practical to avoid carrying out excavation works during heavy rainfall periods.</li> <li>Construction activities shall be carefully planned to minimize disturbed areas and to preserve existing vegetation, which minimizes the potential of removing existing trees that protect soil from erosion.</li> <li>Diversion structures, such as earth dikes and drainage swales, shall be installed along paved surfaces, the top of slopes and below areas where runoff starts to concentrate, to divert off-site water runoff during construction and limit the exposure of disturbed sediments to moving water.</li> <li>Silt traps/sedimentation basins/settlement pond to capture and detain construction site runoff shall be installed.</li> <li>Slope failure protection should be considered during construction and after construction (operation).</li> <li>All works at or near the river must be rehabilitated immediately, to minimize the risk of bank erosion and soil being washed into the river.</li> <li>The contractor will be prohibited from quarrying materials directly from any river. Construction materials will be procured from Government-permitted sources/ suppliers only.</li> <li>Construct silt traps, deviation channels, mounting barriers or trenches around the stockpiles of materials.</li> </ul>	Contractor	Social Safeguard and -Environment Specialists; PMU and PIU
<b>2. Air Quality reduction, dust generation</b>	<ul style="list-style-type: none"> <li>Spray water on access roads and construction sites during dry weather conditions to control dust emission, particularly roads near residences and through the town core area.</li> <li>Impose speed limits on construction vehicles.</li> <li>Excavation work will be avoided in periods of high wind.</li> <li>The contractor will comply with a 10 km/h speed limit when in the community area.</li> <li>Transport of materials that may generate dust shall be covered with canvass or similar.</li> <li>Install temporary fens or barriers around the subproject facility construction site.</li> <li>The burning of site clearance debris (trees, undergrowth) or construction waste material is prohibited.</li> <li>Keep the stockpile of aggregate material covered to avoid suspension or dispersal of fine soil particles during windy days or disturbance from stray animals.</li> <li>Regularly maintain the construction machines to ensure they are in good condition.</li> </ul>	Contractor	Social Safeguard and -Environment Specialists; PMU and PIU
<b>3. Noise and Vibration</b>	<ul style="list-style-type: none"> <li>Limit construction activities, particularly operation of noise/vibration generating equipment at night.</li> <li>Position any stationary equipment that produces high noise levels such as diesel generators as far as practical from sensitive receptors.</li> <li>Install temporary fens or barriers around the subproject facility construction site especially near schools, healthcare stations and houses.</li> <li>Require drivers to minimize honking and to comply with speed limits of 10 km/h when driving in community area.</li> <li>Provide information to community on schedule of construction activities through billboard/signs.</li> <li>Avoid using equipment that may result in high levels of vibrations</li> </ul>		
<b>4. Impacts and risks to biodiversity</b>	<ul style="list-style-type: none"> <li>The contractors will prohibit activities such as cutting wood for cooking, harvesting and hunting, or wildlife trade.</li> <li>Cutting of trees will be undertaken as per approved design and only upon approval of relevant authorities. Avoid the</li> </ul>	Contractor	Social Safeguard and -Environment

Impacts/Risks	Mitigation Measure	Responsibility	
		Implementation	Supervisor/approval
	<p>cutting of trees as much as possible and minimize damage to native vegetation.</p> <ul style="list-style-type: none"> <li>The width of roads and paths to the intakes and the WTPs, will be kept to a minimum, only to accommodate the construction.</li> <li>The use of vehicles/equipment will be kept to a minimum to reduce the land acquisition required. Manual labor will be utilized in sloping terrain where use of heavy equipment would cause unnecessary damage. Steep exposed slopes will be graded and covered with bush and grass to minimize erosion.</li> <li>Implement landscaping and planting of trees/vegetation, using native plant species for greening at the WTP site</li> </ul>		Specialists; PMU and PIU
<b>5. Impact and Risks on Private and community assets</b>	<ul style="list-style-type: none"> <li>Build access roads to minimum necessary width.</li> <li>installation of pipelines within the Right-of-Way when feasible. Protect slopes where excavation potentially affect existing housing/shop structures.</li> </ul>	Contractor	Social Safeguard and Environment Specialists; PMU and PIU
<b>6. Disruption to traffic and pedestrians' access to properties</b>	<ul style="list-style-type: none"> <li>Conduct a trees survey within the subproject area.</li> <li>Cutting of trees will be undertaken as per approved design and only upon approval of relevant authorities. Avoid the cutting of trees as much as possible and minimize damage to native vegetation.</li> <li>For trees that need to be cut off on private land, the owner will be compensated in cash by the PIU in accordance with the approved Land Acquisition and Compensation Plan.</li> <li>The width of roads and paths to the intakes and the WTPs, will be kept to a minimum, only to accommodate the construction.</li> <li>The use of vehicles/equipment will be kept to a minimum to reduce the land acquisition required. Manual labor will be utilized in sloping terrain where use of heavy equipment would cause unnecessary damage. Steep exposed slopes will be graded and covered with bush and grass to minimize erosion.</li> <li>Implement landscaping and planting of trees/vegetation, using local or endemic tree and plant species at WTP site</li> </ul>	Contractor	Social Safeguard and Environment Specialists; PMU and PIU
<b>7. Risks on Relics and artifacts exposure Chance Find Procedures</b>	<ul style="list-style-type: none"> <li>The Contractor will ensure that the workforce is briefed that in the event of accidental finds relics they should immediately cease any works in the area and promptly report the find to their supervisor.</li> <li>If the contractor discovers archeological sites, historical site, remains and objects, including graveyards, and/or individual graves during excavation or construction, the Contractor will carry out the following steps<sup>5</sup>: <ul style="list-style-type: none"> <li>Stop the construction activities in the area of the chance find;</li> <li>Delineate the discovered site or area;</li> <li>Secure the site to prevent any damage or loss of removable objects. In cases of removable antiquities or sensitive remains, a night guard shall be arranged until the responsible local authorities, or the National Culture Administration take over;</li> <li>Notify the project engineer, supervisor (CSC), and/or PSC who in turn will notify the responsible local authorities and the provincial Culture Department immediately (within 24 hours or less);</li> <li>Responsible local authorities and the provincial Culture Department would be in charge of protecting and preserving the site before deciding on subsequent appropriate procedures. This would require a</li> </ul> </li> </ul>	Contractor	Social Safeguard and Environment Specialists; PMU and PIU

<sup>5</sup> Refer to the Table 6-3 Environmental and Social Codes of Practices is based on ESMP

Impacts/Risks	Mitigation Measure	Responsibility	
		Implementation	Supervisor/approval
	<p>preliminary evaluation of the findings to be performed by the archeologists of</p> <ul style="list-style-type: none"> <li>▪ National Culture Administration. The significance and importance of the findings should be assessed according to the various criteria relevant to cultural heritage; those include the aesthetic, historic, scientific or research, social and economic values.</li> <li>▪ Decisions on how to handle the finding shall be taken by the responsible authorities and the provincial Culture Department. This could include changes in the layout (such as when finding an irremovable remain of cultural or archeological importance) conservation, preservation, restoration and salvage;</li> <li>▪ Implementation for the authority decision concerning the management of the finding shall be communicated in writing by relevant local authorities; and</li> <li>▪ Construction work could resume only after permission is given from the responsible local authorities or the provincial Culture Department concerning safeguard of the heritage.</li> </ul>		
<b>8. Generation Solid Waste</b>	<ul style="list-style-type: none"> <li>• Excavated material will be utilized to backfill the trench and/or ground leveling at the construction sites such as the WTP, access roads and pipe trenches. The contractor is required to properly reinstate the excavated trench after completion of pipe laying.</li> <li>• Surplus excavated material/cut soil from construction of the WTP will be used as backfill material for low-lying areas that have been identified by the village authority.<sup>6</sup></li> <li>• Non-hazardous construction waste shall be disposed of at a designated disposal site with the necessary environmental compliance certificate, as agreed with District Authorities.</li> <li>• The contractor will segregate solid waste into hazardous and non-hazardous waste on a daily basis, and then further segregate into recyclable and non-recyclable waste. Recyclable waste includes plastic bottles, cans, and metal. Non-recyclable waste is likely to include wrappings, packaging, and construction waste. The waste fractions will be stored temporarily in bins or in fenced-off and covered enclosures.</li> <li>• The contractor will bring recyclable waste to the local recycling dealer or shop - if there is one. If there is no local recycling dealer, the recyclables (still segregated) shall be brought to the waste disposal site as specified by the District Authorities for possible recycling by dealers operating there or disposed together with non-recyclable waste at that site.</li> <li>• Disposal of waste (that is not recycled) is only allowed at the solid waste disposal site specified by the District Authorities.</li> <li>• Open burning or burial of any form of waste or materials is strictly prohibited both onsite and offsite.</li> <li>• Littering of waste is strictly prohibited</li> </ul>	Contractor	Social Safeguard and Environment Specialists; PMU and PIU
<b>9. Occupational Health and Safety</b>	<p>The Contractor will appoint a Site Manager or his/her representative with the appropriate qualifications in environmental and occupational health and safety associated with the implementation of the ECOP, the Labor Management Plan and Environmental, Health and Safety of IFC (<a href="http://www.ifc.org/ehsguidelines">http://www.ifc.org/ehsguidelines</a>).</p> <p><b>Site sanitation</b></p> <ul style="list-style-type: none"> <li>• The contractor will install the Worker Camp in an area far enough from water sources, houses and sensitive areas and in consultation with the community;</li> </ul>	Contractor	Social Safeguard and Environment Specialists; PMU and PIU

<sup>6</sup> Refer to table 6-3 Environmental and Social Codes of Practices is based on ESMP

Impacts/Risks	Mitigation Measure	Responsibility	
		Implementation	Supervisor/approval
	<ul style="list-style-type: none"> <li>The contractor will be responsible for reinstatements of temporary disturbed areas by camp and site offices work completion.</li> <li>Provide an adequate number of latrines and other sanitary arrangements at the site and work areas, and ensure that they are cleaned and maintained to a hygienic standard;</li> <li>The contractor should make separate arrangements for men and women workers.</li> <li>Provide garbage receptacles at the construction site and camps, which will be periodically cleared to prevent the outbreak of diseases and maintain hygiene; and</li> <li>Collect and treat camp wastewater before discharge into the environment. There is no existing wastewater treatment in this area, but it is proposed to make the septic tank system at worker camp to collect, treat camp wastewater before discharge.</li> </ul> <p><b>Occupational Safety</b></p> <ul style="list-style-type: none"> <li>Provision of first-aid facilities readily accessible by workers.</li> <li>Contractors should include an emergency management plan in case of an accident, and safety drills. Workers must be made aware of the emergency management plan.</li> <li>Provisions of personal protection equipment (PPE), such as safety boots, helmets, gloves, protective clothing, goggles, and ear protection, in accordance with relevant health and safety regulations for workers. All workers must be trained in the use of the required equipment.</li> <li>Wearing PPEs while working on-site will be a mandatory requirement for workers.</li> <li>Posting of safety signs/reminders in strategic areas within the construction area.</li> <li>Installation of sufficient lighting at night.</li> <li>Contractors should provide training to the workers for awareness and measures to prevent sexually transmitted diseases (STD).</li> </ul> <p><b>Food Safety</b></p> <ul style="list-style-type: none"> <li>Provide a clean and sufficient supply of fresh water.</li> <li>Inspect and supervise food hygiene in canteens on site regularly. Canteen workers must have valid health permits.</li> <li>If food poisoning is discovered, implement effective control measures immediately to prevent it from spreading.</li> </ul> <p><b>Disease prevention and safety awareness</b></p> <ul style="list-style-type: none"> <li>Construction workers must have a physical examination before starting work on site. If an infectious disease is found, the patient must be isolated for treatment to prevent the disease from spreading.</li> <li>Provide induction and training by local health departments on the prevention and management of communicable diseases.</li> <li>Implement STIs/HIV/AIDS and other communicable diseases awareness and prevention programs.</li> <li>Provide training on the specific hazards associated with the work, as well as training on basic sanitation and health care issues, and general health and safety.</li> </ul> <p><b>Security:</b></p> <ul style="list-style-type: none"> <li>Regular attendance and a controlled time keeping of all employees;</li> <li>Restriction of un-authorized persons to the residential and work areas;</li> </ul>		

Impacts/Risks	Mitigation Measure	Responsibility	
		Implementation	Supervisor/approval
	<ul style="list-style-type: none"> <li>Restriction of carrying weapons and control hunting by employees; and</li> </ul> Provision of boundary walls/fence with proper exits to the camp		
<b>10. Community Health and Safety</b>	<ul style="list-style-type: none"> <li>Install barricades/barriers and sturdy plate covers in open excavations during non-working time.</li> <li>The contractor must install the physical barrier to limit access to the construction site.</li> <li>Install signs at construction sites warning people of potential dangers.</li> <li>Erect construction billboards, which include construction contents, schedule, responsible person and complaint phone number, at the entry to each construction site and construction staging area.</li> <li>Construction works with noise and dust will be prohibited during the nighttime.</li> <li>Liaise with PIU to inform the community about the upcoming construction work and important precautions to protect the community.</li> <li>Coordinate with Village Authority Committee and share the work plans and number of workers who will stay in the camp.</li> </ul>	Contractor	Social Safeguard and Environment Specialists; PMU and PIU
<b>11. Disposal of Sludge generated from sludge lagoon</b>	<ul style="list-style-type: none"> <li>The selected contractor shall work with the PMU/PIA and relevant local authorities to identify disposal sites for the sludges and get approval/agreement with landowner before dumping.</li> <li>The disposal site should be empty and lower land that needs to fill up and it shall be located far enough from water sources, residential areas and sensitive areas.</li> <li>Do not located in forest areas, cultivation areas and other sensitive areas.</li> <li>Do not allow reuse of sludge for filling food crop land.</li> <li>Do not dump the sludge in the natural water sources/natural drainage courses.</li> <li>Do not located within the</li> <li>Install barrier and safety warning signs around the disposal area.</li> <li>Land levelling shall be completed before handover to landowner.</li> </ul>	PNP staff	DPWT

151. In addition to the ESCOP above, the Contractors will be required to follow strictly the EHS rules below:

***Site EHS Rules:***

- EHS orientation session before starting work;
- Wearing of personal protective equipment (gloves, helmets, safety shoes, dungarees, goggles, etc.);
- Follow the message and instruction displayed on EHS notice boards installed on site;
- Promptly reporting all accidents to the concerned authority;
- Maintain appropriate barricades as required;
- Vehicles must be driven at a safe speed, observing speed limits of 30km/h and designated routes as mentioned in Contractor’s Mobility Map;
- Drivers must have a valid driving license for the class of vehicle they are operating;
- Vehicles shall only be parked in designated parking area; and
- Mine clearance of the project investment area.

***Health and Hygiene:***

- Provision of adequate medical facilities to the staff;
- Provision of cooling and heating facilities to the staff; and
- Provision of drainage, sewerage and septic tanks in camp area.

***Security:***

- Regular attendance and a controlled time keeping of all employees;
- Restriction of un-authorized persons to the residential and work areas;
- Restriction of carrying weapons and control hunting by employees; and
- Provision of boundary walls/fence with proper exits to the camp.

***WORKERS CODES OF CONDUCTS***

152. Each employee shall be informed of the Code of Conduct and bound by it while in the employment of the Client or its Contractors. The Code of Conduct shall be available to local communities at the project information centers or other places easily accessible to the communities.

153. The Contractor is responsible for providing appropriate training to all staff according to their level of responsibility for environmental, health and safety matters.

*The Code of Conduct* shall address the following measures (but not limited to them):

- All of the workforces shall abide by the laws and regulations of the Lao PDR;
- Illegal substances, weapons and firearms shall be prohibited;
- Pornographic material and gambling shall be prohibited;
- Fighting (physical or verbal) shall be prohibited;

- Creating nuisances and disturbances in or near communities shall be prohibited;
- Disrespecting local customs and traditions shall be prohibited;
- Smoking shall only be allowed in designated areas;
- Maintenance of appropriate standards of dress and personal hygiene;
- Maintenance of appropriate standards hygiene in their accommodation quarters;
- Residing camp workforce visiting the local communities shall behave in a manner consistent with the Code of Conduct; and
- Failure to comply with the Code of Conduct, or the rules, regulations, and procedures implemented at the construction camp will result in disciplinary actions.

*Security.* Some security measures shall be put into place to ensure the safe and secure running of the camp and its residents. Some of these security measures include:

- The list of workers must be registered to local authorities in accordance with existing regulations of Lao PDR;
- Children under 14 years of age will not be hired under the Project;
- Adequate, day-time night-time lighting shall be provided;
- Control of camp access. Access to the camp shall be limited to the residing workforce, construction camp employees, and those visiting personnel on business purposes;
- Prior approval from the construction camp manager for visitor's access to the construction camp;
- A perimeter security fence at least 2m in height constructed from appropriate materials;
- Provision and installation in all buildings of firefighting equipment and portable fires extinguishers.

154. Any construction worker, office staff, Contractor's employees or any other person related to the project found violating these prohibitions will be subject to disciplinary actions that can range from a simple reprimand to termination of his/her employment depending on the seriousness of the violation.

**Prohibitions:**

155. The following activities are prohibited on or near the subproject sites:

- Cutting of trees for any reason outside the approved construction area;
- Hunting, fishing, wildlife capture, or plant collection.
- Buying of wild animals for food;
- Having caged wild animals (especially birds) in camps;
- Poaching of any description;
- Explosive and chemical fishing;
- Disturbance to any thing with architectural or historical values;
- Building of fires;
- Use of unapproved toxic materials, including lead-based paints, asbestos, etc.; Use of firearms (except authorized security guards);
- Use of alcohol by workers in office hours;

- Driving in an unsafe manner in local roads;
- Washing cars or machinery in streams or creeks;
- Maintenance (change of oils and filters) of cars and equipment outside authorized areas;
- Creating nuisances and disturbances in or near communities;
- Disposing garbage in unauthorized places;
- Indiscriminate disposal of rubbish or construction wastes; Littering the site;
- Spillage of potential pollutants, such as petroleum products;
- Collection of firewood;
- Urinating or defecating outside the designated facilities; and
- Burning of waste and/or cleared vegetation.

## **MANAGEMENT REQUIREMENTS OF CONSTRUCTION SITES AND WORKERS CAMPS**

156. The contractor will be responsible to comply with, but not limited to the following:

- Temporary workers' camps will be required to accommodate 5-6 engineers and skilled workers at each site.
- Camp will be installed at the site of allocated land for the WTP.
- After the construction is completed, the temporary camp will be unfabricated and the sites will be cleaned.
- The contractor shall install the Worker Camp in an area far enough from water points, houses and sensitive areas in consultation with the community. Good quality sanitary equipment should be installed in the Worker Camp.
- The contractor shall manage all activities in compliance with laws, rules and other permits related to site construction regulations and will protect public properties. Degradation and demolition of private properties will be avoided. Paying compensation to damage to the public facilities and/or private property will be required.
- The contractor is responsible for the protection of the local environment against dust, air, noise, vibration, exhaust fuels and oils and other solid residues generated from the work site. The contractor shall manage waste properly and do not burn it on site and will also provide proper storage for construction materials, organize parking and displacement of the machines in the site. Used oil and construction waste materials must be appropriately disposed and adequate waste disposal and sanitation services will be provided at the construction site next to the generated area. In order to protect soil, surface and ground water the Contractor must avoid any wastewater discharge, oil spill and discharge of any type of pollutants on soils, in surface or ground water, in sewers and drainage ditches.
- The contractor shall be responsible for maintaining good hygiene, safety, and security of the work sites, including protection of health and safety of staff and workers. The contractor will prevent standing water in open construction pits to avoid potential contamination of the water table and the development of a habitat for disease-carrying vectors and insects.
- The contractor shall be prohibited from quarrying material directly from the river.
- The contractors shall procure construction materials from government-permitted sources/suppliers only.
- During construction, the contractor must be taking serious action to control dust by using water or through other means and the construction site will be cleaned on a daily basis.
- The Contractor will work with local authority and management local traffic effectively and ensure traffic access of road safety of local residents and road users during the works. Speed limits at work sites and community areas will be applied to all vehicles and cars. All vehicles and their drivers must be identified and registered and the drivers are properly trained.

- Install barriers and safety warning signs on road sections and if necessary, deploy traffic aids/flag persons at affected locations. Information boards at blocked roads will provide information about the temporary closure of roads, schedule of works and the traffic-rerouting plan.
- The contractor should install signaling of work, ensure no blockage of access to households during construction and/or provide alternative access.
- The contractor must immediately rehabilitate the excavated areas and any damaged road and path sections.

### **House Keeping**

157. The Contractor will follow a ‘good housekeeping’ policy at all times. This will include, but not necessarily be limited to the following:

- Ensure considerate site behavior of the Contractor’s staff;
- Open fires will be prohibited at all times;
- Ensure that appropriate provisions for dust control and road cleanliness are implemented;
- All site areas will be kept in clean and tidy condition, rubbish and food waste will be removed frequently;
- Wheel washing facilities will be brushed or sprayed clean frequently;
- Storage sites, fixed plant and machinery, equipment and temporary buildings will be located to limit adverse environmental effects
- Frequently inspect, repair and re-paint as necessary all site hoardings to comply with the local conditions and local regulations, all flying post/board is to be removed as soon as reasonably practicable and within 24 hours of notice;
- Adequate toilet facilities will be provided for all site staff;

### **Working Hours**

158. Core working hours will be from 08:00 to 16:00 on weekdays and 0800 to 1300 on weekends. Individual site requirements which differ from the above will be considered on a site-by-site basis. Noisy operations shall not take place outside these hours without prior approval from delegated agencies and local authorities.

159. In the case of work required in response to an emergency (or which if not completed would be damaging and unsafe), the relevant local authority will be advised as soon as is reasonably practicable of the reasons for and likely duration of such works.

### **Workers Camps**

160. *Workers’ Camp and Site Installation Requirement.* Potential sites of workers’ camps must be discussed with and proposed by local communities and authorities during consultations and prior to their establishment. If additional camps and ancillary construction sites are selected, for following criteria must be used:

- minimize the land occupation;
- Site offices shall be located at least 200 meters from any existing residential settlements
- Camp facilities should not be located in steep slopes;
- Site offices and camps be located at least 100 meters from any watercourses and be operated so that no pollutants enter watercourses. Camp areas shall be located to allow effective natural drainage;

- The workforce shall be provided with safe, suitable and comfortable accommodation. They have to be maintained in clean and sanitary conditions;
- In every site adequate and suitable facilities for washing clothes and utensils shall be provided and maintained for the use of contract labor employed therein;
- Potable water for human consumption shall be provided at camps, site offices.
- Adequate sanitation facilities (toilets and washing areas) shall be provided for workers to use. Toilets should be provided with adequate supplies of running water, soap, and toilet paper. Such facilities shall be conveniently accessible and shall be kept in clean and hygienic conditions;
- At every construction camp, there must be at least one septic tank. The wastewater from the tank shall not be discharged into any watercourses. The wastewater shall be periodically transported away by a water tank to the nearest treatment plant;
- *Medical Facilities.* A medical and first aid kit shall be provided at each camp area. All consumables in the first aid kit should be checked and recharged regularly.

### **Concrete mixing**

- Concrete mixing stations will minimize the land occupation.
- Concrete mixing must be done on impermeable ground, waste and wastewater containing cement must be collected through drains with slurry sump on-site before being discharged into the receiving source.
- The concrete mixing station must be at least 200 meters away from residential houses or other sensitive buildings such as Buddhist pagodas, churches, temples, school gates, medical facilities and public agencies.

### **Earthworks, Cuts and Fill Slopes Management**

161. Earthworks, cuts and fill slopes shall be carefully managed to minimize negative impacts on the environment.

- All earthworks shall be properly controlled, especially during the rainy season.
- The Contractor shall always maintain stable cut and fill slopes and cause the least possible disturbance to areas outside the prescribed limits of the works.
- The Contractor shall complete cut and fill operations to final cross-sections at any one location as soon as possible and preferably in one continuous operation to avoid partially completed earthworks, especially during the rainy season.
- In order to protect any cut or fill slopes from erosion, in accordance with the drawings, cut off drains and toe-drains shall be provided at the top and bottom of slopes and be planted with grass or other plant cover. Cut off drains should be provided above high cuts to minimize water runoff and slope erosion.
- The Contractor shall use the excavated material from for filling unless the CSC consider the material unsuitable for filling;
- Any excavated cut or unsuitable material shall be disposed of in designated disposal areas as agreed to by the CSC;

## SITE-SPECIFIC MITIGATION MEASURES

### Spoil Disposal Sites

162. If the Contractor proposes any disposal site during the construction phase, they have to be approved by PIA and relevant local authorities. The contractor should ensure that these sites are:

- not located within designated forest or cultivated areas, or any other properties;
- do not impact natural drainage courses;
- where there is no future landslide,
- do not impact endangered/rare flora.

163. Under no circumstances shall the contractor dispose of any material in environmentally sensitive areas. The final use of the disposal site shall be approved by the local government.

164. Besides the requirements for the location of spoil disposal sites, the following actions shall be put into place:

- Post a speed limit sign at the entrance of the disposal site;
- Provide a notice stating, “Only authorized persons are allowed”, limiting access by unauthorized persons to the disposal site;
- Topsoil will be reserved and loaded in separate areas for reuse at the end of the disposal operation as cover material for the rehabilitation of the disposal site.
- If the disposal site is located near a river or water course, a retaining wall and/or interception ditch or settling ponds shall be built prior to the initiation of the construction activities. The surface runoff shall be retained and settled first before allowed discharge into the receiving water;
- A drainage ditch shall be built around the disposal site to control surface runoff to ensure that no localized flooding would happen in the areas surrounding the disposal sites; Sediments in runoff passing the excavated materials will be trapped before the flow enter any water bodies.
- After being tipped down, disposal waste piles must be levelled and rolled out to mitigate dust emission, erosion, and washing off by wind and water as well as to limit safety risks;
- Disposal sites close to patches of agricultural land will be limited in size to avoid damages to crops;

### 165. Minimize potential impacts along pipelines

ES COP will be applied to pipeline installation contracts. Additional measures will be applicable at specific locations are listed in the table below:

*Table 5-3 Site-Specific mitigation measure for pipe installation*

No.	Site Characters	Issues/Risks	Mitigation measures
1	<ul style="list-style-type: none"> <li>▪ Construction takes place near an existing house</li> </ul>	<ul style="list-style-type: none"> <li>▪ Block or disrupt access to house</li> <li>▪ Damages to the house structure (land slide at foundation)</li> </ul>	<ul style="list-style-type: none"> <li>▪ Provide temporary access to the house</li> <li>▪ Install support in the pipe trenches at sections near the house foundation</li> <li>▪ Back fill the pipe trenches as soon as possible</li> </ul>

No.	Site Characters	Issues/Risks	Mitigation measures
2	<ul style="list-style-type: none"> <li>▪ Construction takes place within 50 m from a school or health care centers</li> </ul>	<ul style="list-style-type: none"> <li>▪ Safety for the school students, patients and medical staff</li> <li>▪ Health impacts due to dust and noise</li> </ul>	<ul style="list-style-type: none"> <li>▪ Avoid loading construction materials and waste within 20m from school gate and health centers;</li> <li>▪ Remove the waste from the site in parallel with excavation/pipe installation;</li> <li>▪ Place warning signs and speed limit at 10 km/h at this section</li> <li>▪ Create safe temporary path if access is disrupted</li> <li>▪ Backfill as soon as the pipe installation is completed</li> <li>▪ Clean up the road at end of working shifts</li> <li>▪ water the road section passing the school and health care center if the weather is hot and dry, windy</li> <li>▪ Avoid parking trucks, loading and unloading materials and wastes during peak traffic hours</li> </ul>
3	<ul style="list-style-type: none"> <li>▪ Construction at road crossing</li> </ul>	<ul style="list-style-type: none"> <li>▪ Traffic disruptions, traffic safety risks</li> </ul>	<ul style="list-style-type: none"> <li>▪ Carry out construction at night time, if possible, ensure adequate lighting</li> <li>▪ Coordinate with local authorities to divert traffic flow if necessary</li> <li>▪ Inform the public in advance if construction takes place at nighttime</li> <li>▪ Backfill, reinstate the affected roads fully before traffic is resumed in daytime</li> </ul>
4	<ul style="list-style-type: none"> <li>▪ Construction takes place along roadside</li> </ul>	<ul style="list-style-type: none"> <li>▪ Traffic disruptions, traffic safety risks</li> </ul>	<ul style="list-style-type: none"> <li>▪ Avoid construction activities at peak hours</li> <li>▪ Install speed limit signs at 10km/h at the two ends of construction section</li> <li>▪ Minimize the volumes of materials and wastes loaded along roadside at each time</li> <li>▪ Backfill, reinstate the affected roads fully as soon as possible (related costs have been included in the BOQ)</li> <li>▪ Contractor must install speed limit sign, provision all safety insures before start of construction by the contractor as per the provision of the ESMP.</li> </ul>
5	<ul style="list-style-type: none"> <li>▪ Construction take place on or passing private land</li> </ul>	<ul style="list-style-type: none"> <li>▪ Disturbance to owner's daily activities</li> <li>▪ Safety risks</li> <li>▪ Dust, nuisance</li> <li>▪ Damages to private properties and crops</li> </ul>	<ul style="list-style-type: none"> <li>▪ Inform landowner and get agreement on construction schedule in advance</li> <li>▪ Treat landowner with respects</li> <li>▪ No construction at lunch and nighttime</li> <li>▪ Minimize disturbed areas</li> <li>▪ Do not load materials and wastes on vegetated areas, load on barren land</li> </ul>

No.	Site Characters	Issues/Risks	Mitigation measures
			<ul style="list-style-type: none"> <li>▪ Create safe temporary path if access is disrupted</li> <li>▪ Clean up, reinstate the site completely before departure</li> </ul>

#### 166. **Safety during Power System Construction (poles, wires and transformers)**

The following ESH guidelines for power distribution construction will be followed:

- Testing structures for integrity prior to undertaking work;
- Safety belts and Rope shall be used
- Implement fall protection measures in climbing protection measures.
- Provide adequate work-positioning device system for workers.
- When operating power tools at height, workers should use a backup safety strap;
- Signs and other obstructions should be removed from poles or structures prior to undertaking work;
- An approved tool bag should be used for raising or lowering tools or materials to workers on structures.

#### 167. **Minimize potential impacts and risks on vegetated land**

- Contractors work with the PIA and supervising consultants as well as local authority to refine and confirm the pipeline alignment to avoid cutting trees when possible;
- Disturbance to the ground will be kept minimal. Establish the boundary of construction materials;
- Use suitable size transportation means and apply manual excavation method to avoid or minimize mass cutting of big trees along alignment during pipeline installation;
- Carry out manual excavation and pipe installation, if necessary, in order to avoid cutting or damage to the trees.
- The biomass to be cleared are collected and loaded tidily at or near the construction sites in ways that they can be of beneficial usage for community later on if appropriate;

The following activities are prohibited on or near the subproject sites:

- Cutting of trees for any reason outside the approved construction area;
- loadings of machines and materials on vegetated areas, causing damages to the trees
- Hunting, fishing, wildlife capture, or plant collection.
- Buying of wild animals for food;
- Having caged wild animals (especially birds) in camps;
- Poaching of any description;
- Explosive and chemical fishing;
- Building of fires if not authorized;
- Use of unapproved toxic materials, including lead-based paints, asbestos, etc.;
- Collection of firewood;
- Urinating or defecating outside the designated facilities; and
- Burning of waste and/or cleared vegetation.

Workers will be fully protected from harmful insects by the provision of adequate PPEs




The contractor shall ensure that:

- Workers wear adequate protective clothing during vegetation clearance, trained to use equipment safely before executions;
- Reinstatement of vegetation cover according to the design as soon as possible

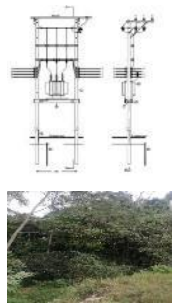

Encourage community monitoring on contractor's compliance.


Table 5-4 Site-specific Mitigation measures

**Namly Water Supply System in Samphan District**


Element	Photos, maps	Descriptions	Impacts, Risks	Specific Mitigation Measures
1. Access to the WTP from main road.	  	<p>L = 180m; W = 5m on steep slopes, gradients 7.77%</p> <p>Total 19,700 M<sup>3</sup> land will be excavated of which 12,502M<sup>3</sup> excavated materials will be transported to the disposal sites</p>	Erosion and landslide risk on slopes.	<ul style="list-style-type: none"> <li>Shape the cut and fills to reduce land slide risks</li> <li>Excavating the hillside to the engineered slope to minimize the potential for slope failure during road construction.</li> <li>Planting the native plants including vetiver grasses cover on slopes according to design as soon as possible.</li> <li>Minimize disturbed area to minimize erosion risks, avoiding overcutting of trees or over-removal of vegetation</li> <li>Install temporary barriers in front of the three houses and schools during ground levelling.</li> <li>Increase the frequency of water spraying on access roads during transportation of excavated material to disposal site</li> </ul>
		<p>There are vines, cardamom bush and very small trees. There may be ant, butterflies, mosquito, mole cricket mosquito, some birds like sparrow.</p>	Overcutting of trees or removal of vegetation cover	<ul style="list-style-type: none"> <li>Conduct a tree survey and inventory of trees with a diameter greater than 20 cm and submit the results to the PIU/PMU for approval before cutting.</li> <li>Pegging/Fencing the construction area before starting construction work.</li> <li>Clearance outside of the approved construction area is prohibited.</li> </ul>
			Safety risks for the workers due to harmful insects	<ul style="list-style-type: none"> <li>Provide adequate PPEs to the workers, advise them be observant to harmful insects.</li> <li>Educate workers to wear the long sleeves, long pants, and insect repellent to minimize exposure.</li> <li>Educate workers about insect hazards, prevention measures, and emergency procedures.</li> <li>Provide anti-mosquito/insect spray to workers and advise them to use it</li> </ul>
		<p>At the junction with the main road, traffic density is low. Traffic count in a day: 2 pickup trucks, 13 bicycles and motorcycles and 4 tractors.</p>	Traffic safety risks at junction with the main road	<ul style="list-style-type: none"> <li>Install signs about construction site, speed limit and warning signs at the junction with village road.</li> <li>Arrange flag man to guide traffic when project vehicle density is high or trucks carrying bulky items enter the project sites.</li> <li>Provide sufficient lighting at night at this spot</li> <li>Increase the frequency of water spraying on access roads during transportation during the dry condition.</li> </ul>




Element	Photos, maps	Descriptions	Impacts, Risks	Specific Mitigation Measures
		Access road will pass through 1 private land of Mr Alor of 480 m <sup>2</sup>	The loss of production land necessitated by the construction of the access road	<ul style="list-style-type: none"> <li>• Provide compensation through land leveling, as detail in ARAP.</li> </ul>
		56,158 M <sup>3</sup> filling materials and granular materials will be transported to the WTP sites.	<p>Traffic and safety risks along the road, especially during class opening and school over times</p> <p>Truck trips will cause dusts and traffic safety risks</p>	<ul style="list-style-type: none"> <li>• Measures to control traffic during construction: <ul style="list-style-type: none"> <li>- Place warning signs on the main road and road access to the Water Treatment Plant (WTP).</li> <li>- Scheduling Truck Movement to avoid truck movement during school opening and closing times to ensure the safety of children.</li> <li>- Set and enforce speed limits on the access road to control vehicle speed.</li> <li>- Provide training for truck drivers to ensure they are aware of safety protocols and road regulations.</li> <li>- Arrange for flag men to direct traffic when trucks are coming in and out of the construction site.</li> <li>- Water the roads regularly to minimize dust.</li> <li>- Install flashing lights so that truck drivers can observe houses during dark hours, ensuring better visibility and safety.</li> <li>- Schedule pile driving activities during times that will minimize disruption to nearby residents and businesses.</li> </ul> </li> <li>• Measures for and safety risks reduction during construction: <ul style="list-style-type: none"> <li>- Restrict access to the construction site to authorized personnel only.</li> <li>- Ensure all workers wear appropriate personal protective equipment (PPE), such as helmets, gloves, safety boots, and reflective vests.</li> <li>- Provide comprehensive safety training for all workers, including hazard recognition and emergency procedures.</li> <li>- Conduct regular refresher courses to</li> <li>- Place clear and visible safety signs around the construction site to warn of potential hazards.</li> <li>- Use barrier tape or fencing to mark off dangerous areas.</li> <li>- Install guardrails, safety nets, and personal fall arrest systems where there is a risk of falling from heights.</li> <li>- Ensure that ladders and scaffolding are secure and meet safety standards.</li> </ul> </li> </ul>


Element	Photos, maps	Descriptions	Impacts, Risks	Specific Mitigation Measures
				<ul style="list-style-type: none"> <li>- Keep the construction site clean and free of debris to prevent tripping hazards.</li> <li>- Equip the site with first aid kits and ensure that trained first aid personnel are always available.</li> </ul>
<p>2. Power Supply for the WTP</p>		<p>22kV distribution lines will be built along the access road to connect to the grid network. A 50 KVA hanging transformer will be installed.</p>	<p>Safety risks for the workers</p>	<ul style="list-style-type: none"> <li>• Testing structures for integrity prior to undertaking work;</li> <li>• Safety belts and Rope shall be used</li> <li>• Implement fall protection measures in climbing protection measures.</li> <li>• Provide adequate work-positioning device system for workers.</li> <li>• When operating power tools at height, workers should use a backup safety strap;</li> <li>• Signs and other obstructions should be removed from poles or structures prior to undertaking work;</li> <li>• An approved tool bag should be used for raising or lowering tools or materials to workers on structures.</li> </ul>
<p>3. The WTP</p>		<p>Land area = 2,500m<sup>2</sup> (50x50m)</p> <p>The WTP site is on communal land. The site and its surroundings are well covered with small trees, vines and shrubs. There may be ants, butterflies, mosquito are observed.</p> <p>The WTP is border with village fallow land in the north, National Road 1B in the south and east, cardamom plantation land in the west</p>	<p>Damage to existing trees and crop land surrounding the WTP site.</p> <p>Dust, noise and vibration impact to households. Dust generation from earth works and during transportation of large volumes of granular materials</p>	<ul style="list-style-type: none"> <li>• Conduct the tree survey and inventory of trees with a diameter greater than 20 cm and submit the results to the PIU/PMU for approval before cutting.</li> <li>• Pegging/Fencing the construction area before starting construction work.</li> <li>• Clearance outside of the approved construction area is prohibited.</li> <li>• Minimize disturbed area to minimize erosion risks, avoiding overcutting of trees or over-removal of vegetation</li> <li>• Limit construction activities, particularly operation of noise/vibration generating equipment at night.</li> <li>• Position any stationary equipment that produces high noise levels such as diesel generators as far as practical from sensitive receptors.</li> <li>• Install barricades/barriers and sturdy plate covers in open excavations during non-working time.</li> <li>• Increase the frequency of water spraying during dry condition.</li> <li>• Excavation work will be avoided in periods of high wind and rainy weather.</li> <li>• Truck must be covered during transportation of excavated soil;</li> <li>• Workers must wear masks at the site</li> <li>• The burning of site clearance debris (trees, undergrowth) or construction waste material, unauthorized fire setting is prohibited.</li> </ul>


Element	Photos, maps	Descriptions	Impacts, Risks	Specific Mitigation Measures
		<p>The ground elevation point is from 802mamsl to 818mamsl. Slope gradient is 36%. Excavated soil 13.542 m<sup>3</sup> and back fill 6.158 m<sup>3</sup></p>	<p>Safety risks for the workers if harmful insects attack them</p> <p>Erosion and landslide risk due to steep topography</p>	<ul style="list-style-type: none"> <li>• Provide adequate PPEs to the workers, advise them be observant to harmful insects.</li> <li>• Monitor compliance to Codes of Conduct, especially with regards to fuel handling and fire setting.</li> <li>• Educate worker to wear the long sleeves, long pants, and insect repellent to minimize exposure</li> <li>• Educate workers about insect hazards, prevention measures, and emergency procedures.</li> <li>• Provide anti-mosquito/insect spray to workers and advise them to use it</li> </ul> <ul style="list-style-type: none"> <li>• Provide information to community on schedule of construction activities through billboard/signs</li> <li>• Fence off the construction site with gate</li> <li>• Install barricades/barriers and sturdy plate covers in open excavations during non-working time.</li> <li>• Install signs to limit access to the construction site.</li> <li>• Excavating the hillside to the engineered slope to minimize the potential for slope failure during road construction.</li> <li>• Planting the vetiver grass on slopes according to design as soon as possible.</li> <li>• Minimize disturbed area to minimize erosion risks, avoiding overcutting of trees or over-removal of vegetation</li> <li>• Construct silt traps, deviation channels, mounting barriers or trenches around the stockpiles of materials</li> <li>• Load materials and waste within the WTP boundary, prevent spills to garden land or nearby water sources.</li> <li>• Topsoil will be reserved and loaded in separate areas for reuse at the end of the disposal operation as cover material for the rehabilitation of the disposal site</li> <li>• Create, maintain temporary drainage channels and sedimentation traps within and surrounding the WTP boundaries;</li> <li>• Monitor erosion risks daily. Take appropriate actions with additional mitigation measures to prevent erosion/land slide when risks are identified;</li> </ul>

Element	Photos, maps	Descriptions	Impacts, Risks	Specific Mitigation Measures
			Truck trips will cause dusts and traffic safety risks	<ul style="list-style-type: none"> <li>• Drivers are requested to follow regulations on speed limit</li> <li>• Spray water on access road and construction sites during dry weather conditions to control dust emission, particularly roads near residences and through the town core area</li> </ul>
		Water for construction will be taken from the nearby stream, drinking water will be purchased from local suppliers	Safety risks for the workers	Follow safety rules for construction of power system specified in this ESMP
4. Nam Papa Water Supply Office		The proposed location is an empty plot of land in Namly village.	Safety risks for the workers and community.	<ul style="list-style-type: none"> <li>• Provide information to community on schedule of construction activities through billboard/signs.</li> <li>• Fence off the construction site with gate.</li> <li>• Install barriers and signs to limit access to the construction site.</li> <li>• Provide adequate PPEs to the workers, advise them to be observant to harmful insects.</li> <li>• Conduct a pre-construction survey of nearby structures to document their condition and identify any pre-existing vulnerabilities.</li> <li>• Monitor compliance to Codes of Conduct, especially with regards to fuel handling and fire setting</li> </ul>
			Dust during excavation	<ul style="list-style-type: none"> <li>• Install barricades/barriers and sturdy plate covers in open excavations during non-working time.</li> <li>• Regularly spray water on excavation sites and roads to keep dust levels down.</li> <li>• Erect dust barriers or screens around the excavation area to contain and reduce dust spread.</li> <li>• Schedule and limit dust-generating activities during times when wind speeds are lower to reduce dust dispersion.</li> </ul>


Element	Photos, maps	Descriptions	Impacts, Risks	Specific Mitigation Measures
			Vibrations from pile driving (if any) for foundation construction	<ul style="list-style-type: none"> <li>• Conduct a pre-construction survey of nearby structures to document their condition and identify any pre-existing vulnerabilities.</li> <li>• Utilize modern pile driving equipment designed to minimize vibrations.</li> <li>• Establish buffer zones around sensitive areas and limit pile driving activities within these zones.</li> <li>• Schedule pile driving activities during times that will minimize disruption to nearby residents and businesses</li> </ul> Monitor compliance to Codes of Conduct, especially with regards to fuel handling and fire setting.
5.Raw Water Transmission Pipelines		<p>The length L = 7.45Km</p> <p>Raw water pipelines will be laid along the brook, through the valley, crossing fallow communal land, private agriculture land of 32 households or running along the road side. Some sections are well covered with vines, bushes, banana and other trees etc.</p> <p>The raw water pipeline will be laid underground at a depth of 0.7 to 1.2 meters. The width of pipe trenches ranges from 0.5 to 0.8 meters.</p>	<p>Obstructions to cultivation activities</p> <ul style="list-style-type: none"> <li>- Construction activities may damage existing crops and disrupt planting schedules.</li> <li>- Soil erosion due to excavation can lead to loss of fertile topsoil.</li> <li>- Encountering rocks, roots, or existing underground utilities can cause delays and require additional excavation.</li> <li>- Improper installation or soil conditions can lead to pipeline damage or leaks.</li> <li>- Open trenches and heavy machinery pose safety risks to farm workers and livestock.</li> </ul> <p>Safety risks for the workers and the farmers</p>	<ul style="list-style-type: none"> <li>• Avoid, minimize ground disturbance during peak cultivation period;</li> <li>• Support farmers to transport materials and products if construction affect accessibility to agricultural land;</li> <li>• Disturbance to the ground will be kept minimal. Establish the boundary of construction materials</li> <li>• Carry out manual excavation and pipe installation, if necessary, in order to avoid or minimize cutting or damages to the trees.</li> <li>• Coordinate with farmers to schedule pipeline work during off-peak agricultural seasons and compensate for crop damage.</li> <li>• Use erosion control measures such as silt fences, temporary vegetation, and mulching.</li> <li>• Conduct thorough subsurface investigations and plan routes to avoid obstacles.</li> <li>• Ensure proper installation techniques as mentioned in the particular technical specifications</li> </ul> <ul style="list-style-type: none"> <li>• Workers will be fully protected from harmful insects by the provision of adequate PPEs</li> <li>• Implement safety protocols, use appropriate signage, and restrict access to construction areas.</li> </ul>

Element	Photos, maps	Descriptions	Impacts, Risks	Specific Mitigation Measures
6.Distribution Pipelines		<p>The length L = 6.78Km</p> <p>The main pipeline will be laid along roadsides. The depth of the pipe trench is 0.7-1.2m and the width is 0.5-0.80m.</p> <p>There are 10 houses along the roadside, the pipeline will affect cement slabs in front of houses. The system will also supply water to the school and health center in the village.</p>	Block or disrupt access to house	<ul style="list-style-type: none"> <li>• Carry out construction in stages to minimize community exposure to open pipe trenches</li> <li>• Provide temporary access to the roadside house where access are disturbed</li> <li>• Install support in the pipe trenches at sections near the house foundation</li> <li>• Back fill the pipe trenches as soon as possible</li> <li>• Create safe temporary path if access if disrupted</li> </ul>
			Health impacts due to dust and noise	<ul style="list-style-type: none"> <li>• Avoid loading construction materials and waste within 20m from school gate and health centers, markets or any popular public accessible locations;</li> <li>• Remove the waste from the site in parallel with excavation/pipe installation;</li> <li>• Top soil will be reserved and loaded in separate areas for reuse at the end of the disposal operation as cover material for the rehabilitation of the disposal site.</li> <li>• Clean up the road, watering dusty areas during working shifts, water the road section passing the school and health care center if the weather is hot and dry, wind.</li> <li>• Place warning signs and speed limit at 10 km/h along road sections where construction is on-going;</li> <li>• Protect temporary materials and waste loads to prevent spills;</li> </ul>
			Traffic disruptions, traffic safety risks	<ul style="list-style-type: none"> <li>• Place warning signs and speed limit at 10 km/h along road sections where construction is on-going</li> <li>• Avoid laying out of the pipeline in the front yard. Contractor should layout the pipeline in Right of Way (ROW) between the road and front year. If there any damage to the front yard, contractor should repair it to original condition</li> <li>• Backfill as soon as the pipe installation is completed</li> <li>• Avoid parking trucks, loading and unloading materials and wastes during peak traffic hours</li> </ul>

Element	Photos, maps	Descriptions	Impacts, Risks	Specific Mitigation Measures
			<p>Damages to private properties and crops</p>	<ul style="list-style-type: none"> <li>• Fully reinstate the excavated area as soon as possible.</li> <li>• Avoid, minimize ground disturbance during peak cultivation period;</li> <li>• Disturbance to the ground will be kept minimal. Establish the boundary of construction materials</li> <li>• Carry out manual excavation and pipe installation, if necessary, in order to avoid or minimize cutting or damages to the trees.</li> </ul>
			<p>Safety risks for the workers and villagers</p>	<ul style="list-style-type: none"> <li>• Reinforce community about construction schedules two days in advance;</li> <li>• Request families to keep their children away from construction sites;</li> <li>• Inform the public in advance if construction takes place at night time;</li> <li>• Requires the workers strictly follow the Codes of Conducts</li> <li>• Protect temporary materials and waste loads to prevent spills;</li> <li>• place warning signs and reflective bands to restrict unauthorized access to construction areas;</li> <li>• Transport the excavated materials away within 24 hours since excavation.</li> <li>• Do not park vehicles or temporarily load materials in front of the market and shops unless construction is on-going at these sites.</li> </ul>
			<p>Damage to the front concrete yard of the people</p>	<ul style="list-style-type: none"> <li>• Fully reinstate the excavated front concrete yard as soon as possible.</li> <li>• Avoid, minimize ground disturbance during peak cultivation period;</li> <li>• Disturbance to the ground will be kept minimal. Establish the boundary of construction materials</li> <li>• Carry out manual excavation and pipe installation, if necessary, in order to avoid or minimize cutting or damages.</li> </ul>
7. Disposal Site		<p>The selected contractor shall work with the PMU/PIA and relevant local authorities to identify disposal sites for</p>	<p>Local risks</p>	<ul style="list-style-type: none"> <li>• Post a speed limit sign at the entrance of the disposal site;</li> <li>• Provide a notice stating “Only authorized persons are allowed”, limiting access by unauthorized persons to the disposal site;</li> </ul>



Element	Photos, maps	Descriptions	Impacts, Risks	Specific Mitigation Measures
		the topsoil and unused excavated materials	Erosion and sedimentation of disposal materials into the creek or the houses nearby spoil disposal site.	<ul style="list-style-type: none"> <li>• Top soil will be reserved and loaded in separate areas for reuse at the end of the disposal operation as cover material for the rehabilitation of the disposal site.</li> <li>• a retaining wall and/or interception ditch or settling ponds shall be built prior to the initiation of the construction activities. The surface runoff shall be retained and settled first before allowed discharge into the receiving water;</li> <li>• A drainage ditch shall be built around the disposal site to control surface runoff to ensure that no localized flooding would happen in the areas surrounding the disposal sites; Sediments in runoff passing the excavated materials will be trapped before the flow enter any water bodies.</li> <li>• Disposal sites close to patches of agricultural land will be limited in size to avoid damages to crops.</li> </ul>
			Dust and noise	<ul style="list-style-type: none"> <li>• Use appropriate containers and covers for transporting waste to the disposal site to prevent spillage and scattering.</li> <li>• After being tipped down, disposal waste piles must be levelled and rolled out to mitigate dust emission, erosion, and washing off by wind and water as well as to limit safety risks.</li> </ul>
8. Water Intake		Along the stream, there are some small bushes, vines, shrubs, small trees with diameters ranging from about 3 to 20 centimeters, bamboo, and some rocks in the streambed. There are barren spots between the bushes	Temporary disrupt stream flow	<ul style="list-style-type: none"> <li>• install a temporary culvert to maintain stream flow during intake construction.</li> </ul>
			Over disturbance to stream bed	<ul style="list-style-type: none"> <li>• Do not exploit construction materials (gravels from stream bed) on-site</li> </ul>
			Water pollution risks	<ul style="list-style-type: none"> <li>• Carry out construction with care to minimize dropping of mortars into the stream.</li> <li>• Properly positioned waste stores, training of site staff on the importance of maintaining a tidy site, and ensuring that everyone does their bit to comply with all applicable site rules and legislation.</li> <li>• Fuel storage tanks should be positioned far from any watercourse or surface water drains, and from access points and traffic routes.</li> </ul>
			Fish, wildlife caught by the workers	No fish/wildlife catching, keeping allowed

**Sinxay Water Supply System in Khua district**

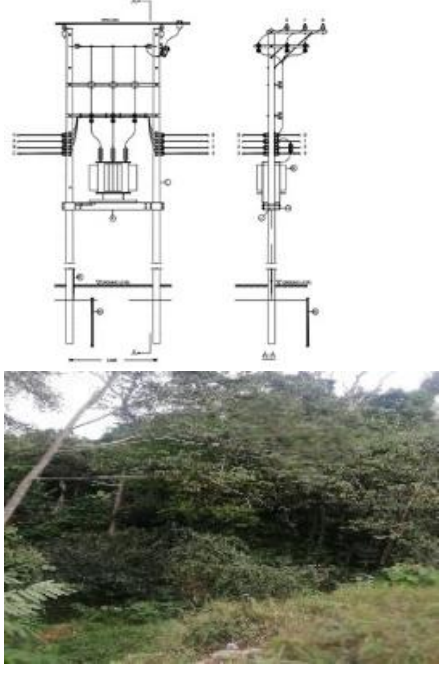
Element	Photos, maps	Descriptions	Impacts, Risks	Specific Mitigation Measures
1. Access to the WTP from main road		<p>There is no existing access road. New road to be built: L = 475m; W = 5m, on steep slopes, gradients 7.36% Maximum: 22.5%</p>	Erosion and landslide risk on slopes	<ul style="list-style-type: none"> <li>• Shape the cut and fills to reduce land slide risks</li> <li>• Excavating the hillside to the engineered slope to minimize the potential for slope failure during road construction.</li> <li>• Planting the vetiver grasses cover on slopes according to design as soon as possible.</li> <li>• Install temporary barriers in front of the three houses and schools during ground levelling.</li> <li>• Minimize disturbed area to minimize erosion risks, tree cutting and removal of vegetation cover;</li> <li>• Shape the cut and fills to reduce land slide risks.</li> <li>• Establish vegetation cover on slopes according to design as soon as possible.</li> </ul>
		<p>There are grasses, vines, bushes, plants, trees, ant, butterflies, birds, mosquito observed along the alignment</p>	Tree cutting, removal of vegetation cover	<ul style="list-style-type: none"> <li>• Minimize disturbed area to minimize erosion risks, tree cutting and removal of vegetation cover;</li> <li>• Conduct a tree survey and inventory of trees with a diameter greater than 20 cm and submit the results to the PIU/PMU for approval before cutting.</li> <li>• Pegging/Fencing the construction area before starting construction work.</li> <li>• Clearance outside of the approved construction area is prohibited.</li> <li>• No wildlife catching/hunting allowed</li> </ul>
			Safety risks for the workers due to harmful insects	<ul style="list-style-type: none"> <li>• Provide adequate PPEs to the workers, advise them be observant to harmful insects</li> <li>• Educate worker to wear the long sleeves, long pants, and insect repellent to minimize exposure</li> <li>• Educate workers about insect hazards, prevention measures, and emergency procedures.</li> <li>• Provide anti-mosquito/insect spray to workers and advise them to use it.</li> </ul>

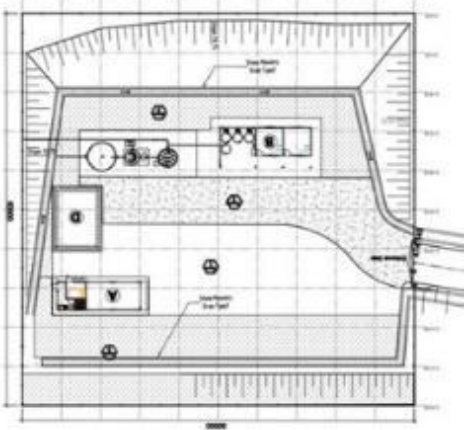


Element	Photos, maps	Descriptions	Impacts, Risks	Specific Mitigation Measures
		<p>At the junction with the main road, traffic density is low. Traffic count in a day: 4 Buses, 5 trucks, 10 Cars, pickup trucks: 18, 28 bicycles and motorcycles, 4 tractors.</p>	<p>Traffic safety risks at junction with the main road</p>	<ul style="list-style-type: none"> <li>• Place warning signs at the junction with the main road, provide lighting at night at this spot</li> <li>• .</li> <li>• Place Construction Site, speed limit signs before the entrance to the access road</li> <li>• Install signs about construction site, speed limit and warning signs at the junction with village road.</li> <li>• Arrange flag man to guide traffic when project vehicle density is high or trucks carrying bulky items enter the project sites.</li> <li>• Provide sufficient lighting at night at this spot.</li> <li>• Increase the frequency of water spraying on access roads during transportation during the dry condition</li> </ul>
		<p>Total 45,914 M<sup>3</sup> land will be excavated of which 40,908M<sup>3</sup> excavated materials will be g transported to the disposal sites</p> <p>5,006 M<sup>3</sup>filling materials and granular materials will be transported to the WTP sites.</p>	<p>Truck trips will cause dusts and traffic safety risks</p>	<p>Measures to control traffic during construction:</p> <ul style="list-style-type: none"> <li>- Place warning signs on the main road and road access to the Water Treatment Plant (WTP).</li> <li>- Scheduling Truck Movement to avoid truck movement during school opening and closing times to ensure the safety of children.</li> <li>- Set and enforce speed limits on the access road to control vehicle speed.</li> <li>- Provide training for truck drivers to ensure they are aware of safety protocols and road regulations.</li> <li>- Arrange for flag men to direct traffic when trucks are coming in and out of the construction site.</li> <li>- Increase the frequency of water spraying on access roads during transportation during the dry condition</li> <li>- Install flashing lights so that truck drivers can observe houses during dark hours, ensuring better visibility and safety.</li> <li>- Schedule pile driving activities during times that will minimize disruption to nearby residents and businesses.</li> </ul> <ul style="list-style-type: none"> <li>• Measures for and safety risks reduction during construction: <ul style="list-style-type: none"> <li>- Restrict access to the construction site to authorized personnel only.</li> </ul> </li> </ul>

Element	Photos, maps	Descriptions	Impacts, Risks	Specific Mitigation Measures
				<ul style="list-style-type: none"> <li>- Ensure all workers wear appropriate personal protective equipment (PPE), such as helmets, gloves, safety boots, and reflective vests.</li> <li>- Provide comprehensive safety training for all workers, including hazard recognition and emergency procedures.</li> <li>- Conduct regular refresher courses to</li> <li>- Place clear and visible safety signs around the construction site to warn of potential hazards.</li> <li>- Use barrier tape or fencing to mark off dangerous areas.</li> <li>- Install guardrails, safety nets, and personal fall arrest systems where there is a risk of falling from heights.</li> <li>- Ensure that ladders and scaffolding are secure and meet safety standards.</li> <li>- Keep the construction site clean and free of debris to prevent tripping hazards.</li> <li>- Equip the site with first aid kits and ensure that trained first aid personnel are always available.</li> </ul>
		<p>Khoua Agriculture Office (AO) is on the left-hand side of the proposed access road. No electricity and water networks along the road</p>	<p>Social conflicts between the contractors and AO Officers</p>	<ul style="list-style-type: none"> <li>• Inform AO Officers about construction schedule in advance</li> <li>• Load materials and wastes on barren land, prevent spills to garden land.</li> </ul>

Element	Photos, maps	Descriptions	Impacts, Risks	Specific Mitigation Measures
		<p>Along both sides of the access road is a demonstration garden of Khoua AO with banana trees, corn, and seasonal crops. Ants, butterflies, and mosquitoes were observed.</p>	<p>Excavated soils, construction wastes and materials may fill up garden land, damage crops</p>	<ul style="list-style-type: none"> <li>• Minimize disturbed areas, avoid damaging trees and vegetation cover</li> <li>• Top soil will be reserved and loaded in separate areas for reuse at the end of the disposal operation as cover material for the rehabilitation of the disposal site.</li> <li>• A retaining wall and/or interception ditch or settling ponds shall be built prior to the initiation of the construction activities. The surface runoff shall be retained and settled first before allowed discharge into the receiving water;</li> <li>• A drainage ditch shall be built around the disposal site to control surface runoff to ensure that no localized flooding would happen in the areas surrounding the disposal sites; Sediments in runoff passing the excavated materials will be trapped before the flow enter any garden land.</li> <li>• Load materials and wastes within the WTP boundary, prevent spills to garden land.</li> </ul>
		<p>The access road includes a section crossing the Nam Noy stream, which is 16m wide, but there is no existing bridge. Cars, pickup trucks, and trucks can only pass the stream during the dry season. In rainy season, people can cross the stream on a temporary bridge</p>	<p>Safety risks for the workers and construction plants when crossing the river.</p> <p>Traffic and safety risks along the road, especially during class opening and school overtime.</p>	<ul style="list-style-type: none"> <li>▪ The contractor is required to establish and maintain safe stream crossing in both dry and rainy seasons.</li> <li>▪ Project Investments should consider accessibility all year around during operation phase for the workers, and vehicles to transport materials and waste to and from the WTP.</li> </ul> <ul style="list-style-type: none"> <li>• Measures to control traffic during construction: <ul style="list-style-type: none"> <li>- Place warning signs on the main road and road access to the Water Treatment Plant (WTP).</li> <li>- Scheduling Truck Movement to avoid truck movement during school opening and closing times to ensure the safety of children.</li> <li>- Set and enforce speed limits on the access road to control vehicle speed.</li> <li>- Provide training for truck drivers to ensure they are aware of safety protocols and road regulations.</li> <li>- Arrange for flag men to direct traffic when trucks are coming in and out of the construction site.</li> <li>- Water the roads regularly to minimize dust.</li> </ul> </li> </ul>

Element	Photos, maps	Descriptions	Impacts, Risks	Specific Mitigation Measures
				<ul style="list-style-type: none"> <li>- Install flashing lights so that truck drivers can observe houses during dark hours, ensuring better visibility and safety.</li> <li>• Measures for and safety risks reduction during construction: <ul style="list-style-type: none"> <li>- Restrict access to the construction site to authorized personnel only.</li> <li>- Ensure all workers wear appropriate personal protective equipment (PPE), such as helmets, gloves, safety boots, and reflective vests.</li> <li>- Provide comprehensive safety training for all workers, including hazard recognition and emergency procedures.</li> <li>- Conduct regular refresher courses to</li> <li>- Place clear and visible safety signs around the construction site to warn of potential hazards.</li> <li>- Use barrier tape or fencing to mark off dangerous areas.</li> <li>- Install guardrails, safety nets, and personal fall arrest systems where there is a risk of falling from heights.</li> <li>- Ensure that ladders and scaffolding are secure and meet safety standards.</li> <li>- Keep the construction site clean and free of debris to prevent tripping hazards.</li> <li>- Equip the site with first aid kits and ensure that trained first aid personnel are always available.</li> </ul> </li> </ul>


Element	Photos, maps	Descriptions	Impacts, Risks	Specific Mitigation Measures
2. Power Supply for the WTP		150 m 22KV power lines will be built along the access road to connect to the grid network. A 50 KVA hanging transformer will be installed.	Safety risks for the workers	<ul style="list-style-type: none"> <li>▪ Testing structures for integrity prior to undertaking work;</li> <li>▪ Safety belts and Rope shall be used</li> <li>▪ Implement fall protection measures in climbing protection measures.</li> <li>▪ Provide adequate work-positioning device system for workers.</li> <li>▪ When operating power tools at height, workers should use a backup safety strap;</li> <li>▪ Signs and other obstructions should be removed from poles or structures prior to undertaking work;</li> <li>▪ An approved tool bag should be used for raising or lowering tools or materials to workers on structures.</li> </ul>
3. At the WTP site		Land area = 2500 m <sup>2</sup> , communal land, in the middle of Khoua AO's demonstration field (cultivation land, only bush and small trees, no big trees, there may be some snake, bees, ants, insects, small birds etc.). No invasive plant species identified.	<p>Damages to existing trees and crop land surrounding the WTP site</p> <p>Safety risks for the workers if harmful insects attack them</p>	<ul style="list-style-type: none"> <li>• Minimize disturbed areas, avoid damaging trees and vegetation cover</li> <li>• Conduct the tree survey and inventory of trees with a diameter greater than 20 cm and submit the results to the PIU/PMU for approval before cutting.</li> <li>• Pegging/Fencing the construction area before starting construction work.</li> <li>• Clearance outside of the approved construction area is prohibited.</li> <li>• Provide adequate PPEs to the workers, advise them be observant to harmful insects.</li> <li>• Monitor compliance with the Codes of Conduct, especially with regards to fuel handling and fire setting.</li> </ul>

Element	Photos, maps	Descriptions	Impacts, Risks	Specific Mitigation Measures
	  	<p>Ground elevation is from 405 to 425 m, slopes gradients is 40%.</p> <p>Total excavation volume is 45,914 m<sup>3</sup>, reuse 5,006 m<sup>3</sup> for backfilling. 40,908 m<sup>3</sup></p>	<p>Erosion and landslide risk due to steep topography</p> <p>Dust generation from earthworks and during transportation of large volumes of granular materials.</p> <p>Traffic safety risks during transportation</p>	<ul style="list-style-type: none"> <li>• Educate workers to wear long sleeves, long pants, and insect repellent to minimize exposure.</li> <li>• Educate workers about insect hazards, prevention measures, and emergency procedures.</li> <li>• Provide anti-mosquito/insect spray to workers and advise them to use it.</li> </ul> <ul style="list-style-type: none"> <li>• Create, maintain temporary drainage channels and sedimentation traps within and surrounding the WTP boundaries;</li> <li>• Monitor erosion risks daily. Take appropriate actions with additional mitigation measures to prevent erosion/land slide when risks are identified;</li> <li>• Establish vegetation cover on slopes according to design as soon as possible</li> <li>• Excavation work will be avoided in periods of high wind and rainy weather.</li> <li>• Construction silt traps, deviation channels, mounting barriers or trenches around the stockpiles of materials.</li> </ul> <ul style="list-style-type: none"> <li>• Truck must be covered during transportation of excavated soil;</li> <li>• Workers must wear masks at the site.</li> <li>• Drivers are requested to follow regulations on speed limits.</li> <li>• Spray water on access roads and construction sites during dry weather conditions to control dust emission, particularly roads near residences and through the town core area.</li> <li>• The burning of site clearance debris (trees, undergrowth) or construction waste material, unauthorize fire setting is prohibited.</li> </ul> <p>Keep the stockpile of aggregate material covered to avoid suspension or dispersal of fine soil particles during windy days or disturbance from stray animals.</p> <ul style="list-style-type: none"> <li>• Measures to control traffic during construction:             <ul style="list-style-type: none"> <li>- Place warning signs on the main road and road access to the Water Treatment Plant (WTP).</li> </ul> </li> </ul>

Element	Photos, maps	Descriptions	Impacts, Risks	Specific Mitigation Measures
				<ul style="list-style-type: none"> <li>- Scheduling Truck Movement to avoid truck movement during school opening and closing times to ensure the safety of children.</li> <li>- Set and enforce speed limits on the access road to control vehicle speed.</li> <li>- Provide training for truck drivers to ensure they are aware of safety protocols and road regulations.</li> <li>- Arrange for flag men to direct traffic when trucks are coming in and out of the construction site.</li> <li>- Water the roads regularly to minimize dust.</li> <li>- Install flashing lights so that truck drivers can observe houses during dark hours, ensuring better visibility and safety.</li> <li>• Measures for and safety risks reduction during construction: <ul style="list-style-type: none"> <li>- Restrict access to the construction site to authorized personnel only.</li> <li>- Ensure all workers wear appropriate personal protective equipment (PPE), such as helmets, gloves, safety boots, and reflective vests.</li> <li>- Provide comprehensive safety training for all workers, including hazard recognition and emergency procedures.</li> <li>- Conduct regular refresher courses to</li> <li>- Place clear and visible safety signs around the construction site to warn of potential hazards.</li> <li>- Use barrier tape or fencing to mark off dangerous areas.</li> <li>- Install guardrails, safety nets, and personal fall arrest systems where there is a risk of falling from heights.</li> <li>- Ensure that ladders and scaffolding are secure and meet safety standards.</li> <li>- Keep the construction site clean and free of debris to prevent tripping hazards.</li> <li>- Equip the site with first aid kits and ensure that trained first aid personnel are always available</li> </ul> </li> </ul>

Element	Photos, maps	Descriptions	Impacts, Risks	Specific Mitigation Measures
		Water for construction will be taken from the nearby stream, drinking water will be purchased from local suppliers	Safety risks for the workers	Follow safety rules for construction of power system specified in this ESMP.
4. Nam Papa Water Supply Office		The proposed location in Sinxay village	Safety risks for the workers and community.	<ul style="list-style-type: none"> <li>• Provide information to community on schedule of construction activities through billboard/signs.</li> <li>• Fence off the construction site with gate.</li> <li>• Install barricades/barriers and sturdy plate covers in open excavations during non-working time.</li> <li>• Install barriers and signs to limit access to the construction site.</li> <li>• Limit construction activities, particularly operation of noise/vibration generating equipment at night.</li> <li>• Provide adequate PPEs to the workers, advise them to be observant to harmful insects.</li> </ul>
			Dust during excavation	<ul style="list-style-type: none"> <li>• Load materials and waste within the construction site boundary, prevent spills to garden land or nearby water sources.</li> <li>• Regularly spray water on excavation sites and roads to keep dust levels down.</li> <li>• Erect dust barriers or screens around the excavation area to contain and reduce dust spread.</li> <li>• Schedule and limit dust-generating activities during times when wind speeds are lower to reduce dust dispersion.</li> </ul>


Element	Photos, maps	Descriptions	Impacts, Risks	Specific Mitigation Measures
			Vibrations from pile driving (if any) for foundation construction	<ul style="list-style-type: none"> <li>• Conduct a pre-construction survey of nearby structures to document their condition and identify any pre-existing vulnerabilities.</li> <li>• Utilize modern pile driving equipment designed to minimize vibrations.</li> <li>• Establish buffer zones around sensitive areas and limit pile driving activities within these zones.</li> <li>• Schedule pile driving activities during times that will minimize disruption to nearby residents and businesses.</li> <li>• Monitor compliance with the Codes of Conduct, especially with regards to fuel handling and fire setting.</li> </ul>
5.Raw Water Transmission Pipelines		<p>The length L = 2.86Km with HDPE DN 90mm.</p> <p>The raw water transmission pipe from the intake to the water treatment plant will be laid downstream of Houay Phea Brook passes the fallow land, agriculture land of 9 households and along the roadsides. Some sections of the roads run along hills on one side and valley at the other side.</p>	Obstructions to cultivation activities.	<ul style="list-style-type: none"> <li>• Conduct thorough subsurface investigations and plan routes to avoid obstacles.</li> <li>• Avoid, minimize ground disturbance during peak cultivation period;</li> <li>• Support farmers to transport materials and products if construction affect accessibility to agricultural land;</li> <li>• Disturbance to the ground will be kept minimal. Coordinate with farmers to schedule pipeline work during off-peak agricultural seasons and compensate for crop damage</li> </ul>

Element	Photos, maps	Descriptions	Impacts, Risks	Specific Mitigation Measures
		<p>The depth of the raw water pipe trench excavation is 0.7-1.2m and the width is 0.5-0.8m</p>	<p>Safety risks for the workers and the farmers</p> <ul style="list-style-type: none"> <li>- Construction activities may damage existing crops and disrupt planting schedules.</li> <li>- Soil erosion due to excavation can lead to loss of fertile topsoil.</li> <li>- Encountering rocks, roots, or existing underground utilities can cause delays and require additional excavation.</li> <li>- Improper installation or soil conditions can lead to pipeline damage or leaks.</li> </ul>	<ul style="list-style-type: none"> <li>• Establish the boundary of construction materials</li> <li>• .</li> <li>• Use erosion control measures such as silt fences, temporary vegetation, and mulching.</li> <li>• Ensure proper installation techniques as mentioned in the particular technical specifications</li> <li>• Implement safety protocols, use appropriate signage, and restrict access to construction areas.</li> </ul>
6.Distribution Pipelines		<p>The length L = 12.6Km. The distribution network will be installed in Sinxay village, along the roadside to the houses and shops. Water will be supplied to the households and school. Cement slabs of 13 HHs of 427 meters will be</p>	<p>Block or disrupt access to house.</p>	<ul style="list-style-type: none"> <li>• Reinform community about construction schedules two days in advance; Request families to keep their children away from construction sites;</li> <li>• Create safe temporary path if access if disrupted</li> <li>• Backfill as soon as the pipe installation is completed</li> <li>• Provide temporary access to the roadside house where access is disturbed</li> <li>• Back fill the pipe trenches as soon as possible</li> </ul>

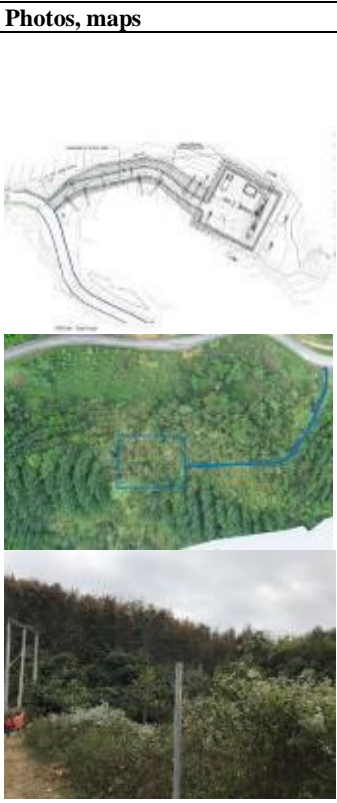



Element	Photos, maps	Descriptions	Impacts, Risks	Specific Mitigation Measures
			<p>Damage to private properties and crops. Damage to the front concrete yard of the people</p>	<ul style="list-style-type: none"> <li>• Avoid laying out of the pipeline in the front yard. Contractor should layout the pipeline in Right of Way (ROW) between the road and front year. If there is any damage to the front yard, the contractor should repair it to its original condition.</li> <li>• Fully reinstate the excavated area as soon as possible.</li> <li>• Disturbance to the ground will be kept minimal. Establish the boundary of construction materials</li> </ul>
			<p>Safety risks for the workers and villagers</p>	<p>Carry out manual excavation and pipe installation, if necessary, in order to avoid or minimize cutting or damage to the trees. Requires the workers strictly follow the Codes of Conducts Place warning signs and reflective bands to restrict unauthorized access to construction areas; Do not park vehicles or temporarily load materials in front of the market and shops unless construction is on-going at these sites</p>
7.Disposal Sites		<p>The selected contractor shall work with the PMU/PIA and relevant local authorities to identify disposal sites for the</p>	<p>Local risks.</p>	<ul style="list-style-type: none"> <li>• Post a speed limit sign at the entrance of the disposal site.</li> <li>• Provide a notice stating, “Only authorized persons are allowed”, limiting access by unauthorized persons to the disposal site.</li> </ul>

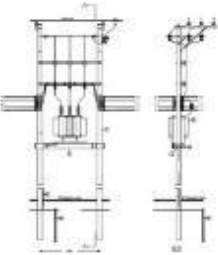

Element	Photos, maps	Descriptions	Impacts, Risks	Specific Mitigation Measures
		topsoil and unused excavated materials.	Erosion and spills of disposal materials into the creek or the houses nearby the construction site	<ul style="list-style-type: none"> <li>• Topsoil will be reserved and loaded in separate areas for reuse at the end of the disposal operation as cover material for the rehabilitation of the disposal site.</li> <li>• A retaining wall and/or interception ditch or settling ponds shall be built prior to the initiation of the construction activities. The surface runoff shall be retained and settled first before allowed discharge into the receiving water.</li> <li>• A drainage ditch shall be built around the disposal site to control surface runoff to ensure that no localized flooding would happen in the areas surrounding the disposal sites; Sediments in runoff passing the excavated materials will be trapped before the flow enter any water bodies.</li> <li>• Disposal sites close to patches of agricultural land will be limited in size to avoid damages to crops</li> </ul>
			Dust and noise	<ul style="list-style-type: none"> <li>• Use appropriate containers and covers for transporting waste to the disposal site to prevent spillage and scattering.</li> <li>• After being tipped down, disposal waste piles must be levelled and rolled out to mitigate dust emission, erosion, and washing off by wind and water as well as to limit safety risks.</li> </ul>
8. Water Intake		The water intake will be located in the in Houay Phea	Temporary disrupt stream flow.	<ul style="list-style-type: none"> <li>• Install a temporary culvert to maintain stream flow during intake construction.</li> </ul>
		Along the stream, there are some small bushes, vines,	Over disturbance to stream bed	<ul style="list-style-type: none"> <li>• Do not exploit construction materials (gravels from stream bed) on-site.</li> </ul>



Element	Photos, maps	Descriptions	Impacts, Risks	Specific Mitigation Measures
		<p>shrubs, small trees with diameters ranging from about 3 to 20 centimeters, bamboo, and some rocks in the streambed. There are barren spots between the bushes</p>	<p>Water pollution risks</p> <p>Unnecessary disturbance to stream side vegetation.</p> <p>Fish, wildlife caught by the workers</p>	<ul style="list-style-type: none"> <li>• Carry out construction with care to minimize dropping of mortars into the stream.</li> <li>• positioned waste stores, training of site staff on the importance of maintaining a tidy site and ensuring that everyone does their bit to comply with all applicable site rules and legislation.</li> <li>• Fuel storage tanks should be positioned far from any watercourse or surface water drains, and from access points and traffic routes.</li> </ul> <ul style="list-style-type: none"> <li>• Load materials and equipment on barren soil, not on vegetated areas.</li> </ul> <ul style="list-style-type: none"> <li>• No fish/wildlife catching, keeping allowed</li> </ul>

**Sophon Water Supply System in Mai district**


Element	Photos, maps	Descriptions	Impacts, Risks	Specific Mitigation Measures
1. Access Road to the WTP from main road		<p>No existing access, new road L = 112m, W = 5m, Slope: 2.587% will be built. Ground elevation is from 412 to 421 m mamsl, slope gradient is 7.93%. No existing infrastructure or houses along the access road</p>	<p>Damage to the trees and vegetation along the access road, in the plantation outside the construction boundary.</p>	<ul style="list-style-type: none"> <li>Minimize disturbed areas, avoid damaging trees and vegetation cover</li> <li>Pegging/Fencing the construction area before starting construction work.</li> <li>Clearance outside of the approved construction area is prohibited.</li> <li>No wildlife catching/hunting allowed.</li> </ul>
		<p>On the left-hand side of the main road to the WTP, there is a villager's rubber plantation, and on the right-hand side, there is a light forest and bamboo trees. Village land, covered by grass, bush and small trees (less than three Centre meter), vines. Wild animals only ant, butterflies, birds, mosquitoes are observed.</p>	<p>Forest fire risks at the plantation due to workers' careless behaviors</p>	<ul style="list-style-type: none"> <li>The burning of biomass and timber is not permitted at this site.</li> <li>Monitor compliance with Codes of conduct, especially the use of fuels, to prevent fire risks.</li> </ul>
			<p>Erosion and landslide risk on slopes.</p>	<ul style="list-style-type: none"> <li>Inform households about the construction schedule in advance.</li> <li>Minimize disturbed areas to minimize erosion risks, tree cutting and removal of vegetation cover.</li> <li>Shape the cut and fills to reduce land slide risks.</li> <li>Establish vegetation cover on slopes according to design as soon as possible.</li> <li>Install temporary fens or barriers around the subproject facility construction site.</li> <li>Construct silt traps, deviation channels, mounting barriers or trenches around the stockpiles of materials.</li> </ul>
			<p>Safety risks for the workers if harmful insects attack them</p>	<ul style="list-style-type: none"> <li>Provide adequate PPEs to the workers, advise them to be observant to harmful insects.</li> <li>No wildlife catching/hunting allowed.</li> <li>Educate worker to wear the long sleeves, long pants, and insect repellent to minimize exposure</li> <li>Educate workers about insect hazards, prevention measures, and emergency procedures.</li> <li>Provide anti-mosquito/insect spray to workers and advise them to use it</li> </ul>
		<p>Traffic density in a day at the junction with the access road of the WTP is low: Pickup trucks: 3, Bicycles and motorcycles: 18, Trucks: 6, Tractors: 4</p>	<p>Traffic safety risks, traffic disturbance at the junction (curvy section)</p>	<ul style="list-style-type: none"> <li>Place warning signs at the junction with village road, provide lighting at night at this spot.</li> <li>Construction Site, speed limit signs before the entrance to the access road.</li> </ul>


Element	Photos, maps	Descriptions	Impacts, Risks	Specific Mitigation Measures
		<p>Total 17,217 M<sup>3</sup> land will be excavated of which 10,331M<sup>3</sup> excavated materials will be g transported to the disposal sites</p> <p>56,88M<sup>3</sup>filling materials and granular materials will be transported to the WTP sites.</p>	<p>Truck trips will cause dusts and traffic safety risks</p> <p>Traffic and safety risks along the road, especially during class opening and school over times</p>	<ul style="list-style-type: none"> <li>▪ Spray water on access roads and construction sites during dry weather conditions to control dust emission, particularly roads near residences and through the town core area.</li> <li>▪ Impose speed limits on construction vehicles.</li> <li>▪ Transport of materials that may generate dust shall be covered with canvass or similar.</li> <li>▪ Require drivers to minimize honking and to comply with speed limits of 10 km/h when driving in community areas.</li> </ul> <p>Provide information to community on schedule of construction activities through billboard/signs.</p> <ul style="list-style-type: none"> <li>• Measures to control traffic during construction: <ul style="list-style-type: none"> <li>- Place warning signs on the main road and road access to the Water Treatment Plant (WTP).</li> <li>- Scheduling Truck Movement to avoid truck movement during school opening and closing times to ensure the safety of children.</li> <li>- Set and enforce speed limits on the access road to control vehicle speed.</li> <li>- Provide training for truck drivers to ensure they are aware of safety protocols and road regulations.</li> <li>- Arrange for flag men to direct traffic when trucks are coming in and out of the construction site.</li> <li>- Water the roads regularly to minimize dust.</li> <li>- Install flashing lights so that truck drivers can observe houses during dark hours, ensuring better visibility and safety.</li> </ul> </li> <li>• Measures for and safety risks reduction during construction: <ul style="list-style-type: none"> <li>- Restrict access to the construction site to authorized personnel only.</li> <li>- Ensure all workers wear appropriate personal protective equipment (PPE), such as helmets, gloves, safety boots, and reflective vests.</li> <li>- Provide comprehensive safety training for all workers, including hazard recognition and emergency procedures.</li> <li>- Conduct regular refresher courses to</li> <li>- Place clear and visible safety signs around the construction site to warn of potential hazards.</li> <li>- Use barrier tape or fencing to mark off dangerous areas.</li> <li>- Install guardrails, safety nets, and personal fall arrest systems where there is a risk of falling from heights.</li> </ul> </li> </ul>


Element	Photos, maps	Descriptions	Impacts, Risks	Specific Mitigation Measures
				<ul style="list-style-type: none"> <li>- Ensure that ladders and scaffolding are secure and meet safety standards.</li> <li>- Keep the construction site clean and free of debris to prevent tripping hazards.</li> <li>- Equip the site with first aid kits and ensure that trained first aid personnel are always available.</li> </ul>
		Rubber trees of 3 HHs that encroached that communal land have agreed to cut the 20 affected rubber trees with any charge to the project (Mr. Bounpheng: 10 trees, Mr. Khamnor : 6 trees, and Mr. Phanphik 4 trees).	Rubber trees may be affected	<ul style="list-style-type: none"> <li>▪ Conduct consultation with rubber tree owner before start clearance work;</li> <li>▪ Get agreed with rubber trees owner be for cutting trees.</li> <li>▪ Minimize disturbed areas, avoid damaging trees and vegetation cover</li> <li>▪ Pegging/Fencing the construction area before starting construction work.</li> <li>▪ Clearance outside of the approved construction area is prohibited</li> </ul>
2.Power Supply for the WTP		110 m 22KV power lines will be built along the access road to connect to the grid network. A 50 KVA hanging transformer will be installed.	Safety risks for the workers	<ul style="list-style-type: none"> <li>▪ Testing structures for integrity prior to undertaking work.</li> <li>▪ Safety belts and Rope shall be used.</li> <li>▪ Implement fall protection measures in climbing protection measures.</li> <li>▪ Provide adequate work-positioning device system for workers.</li> <li>▪ When operating power tools at height, workers should use a backup safety strap.</li> <li>▪ Signs and other obstructions should be removed from poles or structures prior to undertaking work.</li> <li>▪ An approved tool bag should be used for raising or lowering tools or materials to workers on structures.</li> </ul>
3.WTP site		Land area: 2,500m <sup>2</sup> (50x50m), on communal land. The ground elevation is from 414 to 424 m mamsl, slope gradient is 20%.	Erosion and land slide risks due to steep topography	<ul style="list-style-type: none"> <li>▪ Fence off the construction site with gates.</li> <li>▪ Install barricades/barriers and sturdy plate covers in open excavations during non-working time.</li> <li>▪ Shape the cut and fills to reduce land slide risks</li> <li>▪ Excavating the hillside to the engineered slope to minimize the potential for slope failure during road construction.</li> <li>▪ Planting the vetiver grasses cover on slopes according to design as soon as possible.</li> <li>▪ Minimize disturbed area to minimize erosion risks, avoiding overcutting of trees or over-removal of vegetation</li> <li>▪ Install temporary barriers in front of the three houses and schools during ground levelling.</li> <li>▪ Construct silt traps, deviation channels, mounting barriers or trenches around the stockpiles of materials.</li> </ul>

Element	Photos, maps	Descriptions	Impacts, Risks	Specific Mitigation Measures
		<p>It is fallow land, no crops, no plantation, there are only vines, bushes, small trees, bamboo trees and bush. Ant, butterflies, mosquitoes were observed. snake, bees, ants, insects, small birds, etc. No invasive plant species identified.</p>	<p>Safety risks for the workers if harmful insects attack them.</p>	<ul style="list-style-type: none"> <li>▪ Provide adequate PPEs to the workers, advise them be observant to harmful insects.</li> <li>▪ Educate worker to wear the long sleeves, long pants, and insect repellent to minimize exposure</li> <li>▪ Educate workers about insect hazards, prevention measures, and emergency procedures</li> <li>▪ Provide anti-mosquito/insect spray to workers and advise them to use it.</li> </ul>
		<p>The site is bordered by community land (bamboo forest and orchard) in the north and south, with private rubber plantation in the east and west.</p>	<p>Damages to trees in community land and rubber plantation next to the WTP site</p>	<ul style="list-style-type: none"> <li>▪ Pegging/Fencing the construction area before starting construction work.</li> <li>▪ Clearance outside of the approved construction area is prohibited.</li> <li>▪ Install the physical barrier to limit access to the construction site.</li> <li>▪ Install signs at construction sites warning people of potential dangers.</li> </ul>
			<p>Dust generation from earthworks and during transportation of large volumes of granular materials.</p>	<ul style="list-style-type: none"> <li>▪ Provide information to community on schedule of construction activities through billboard/signs.</li> <li>▪ Spray water on access roads and construction sites during dry weather conditions to control dust emission, particularly roads near residences and through the town core area.</li> <li>▪ Impose speed limits on construction vehicles.</li> <li>▪ Transport of materials that may generate dust shall be covered with canvass or similar.</li> <li>▪ Require drivers to minimize honking and to comply with speed limits of 10 km/h when driving in community areas.</li> </ul>
		<p>Total excavation volume 17.217 m<sup>3</sup> back fill volume 6.886 m<sup>3</sup>, disposal volume 10.331 m<sup>3</sup></p>	<p>Traffic safety risks during transportation</p>	<ul style="list-style-type: none"> <li>• Place warning signs on the main road and road access to the Water Treatment Plant (WTP).</li> <li>• Scheduling truck movement to avoid truck movement during school opening and closing times to ensure the safety of children.</li> <li>• Set and enforce speed limits on the access road to control vehicle speed.</li> <li>• Provide training for truck drivers to ensure they are aware of safety protocols and road regulations.</li> <li>• Arrange for flag men to direct traffic when trucks are coming in and out of the construction site.</li> <li>• Water the roads regularly to minimize dust.</li> <li>• Install flashing lights so that truck drivers can observe houses during dark hours, ensuring better visibility and safety.</li> </ul>

Element	Photos, maps	Descriptions	Impacts, Risks	Specific Mitigation Measures
			Vibrations from pile driving (if any) for foundation construction	<ul style="list-style-type: none"> <li>• Conduct a pre-construction survey of nearby structures to document their condition and identify any pre-existing vulnerabilities.</li> <li>• Utilize modern pile driving equipment designed to minimize vibrations.</li> <li>• Establish buffer zones around sensitive areas and limit pile driving activities within these zones.</li> <li>• Schedule pile driving activities during times that will minimize disruption to nearby residents and businesses.</li> <li>• Monitor compliance with Codes of Conduct, especially with regards to fuel handling and fire setting.</li> </ul>
		Water for construction will be taken from the nearby stream, drinking water will be purchased from local suppliers	Safety risks for the workers	Ensure that adequate water supply is provided for the workers to use
4. Nam Papa Water Supply Office		The proposed location Sophun village	Safety risks for the workers and community	<ul style="list-style-type: none"> <li>• Provide information to community on schedule of construction activities through billboard/signs.</li> <li>• Fence off the construction site with gate.</li> <li>• Install barricades/barriers and sturdy plate covers in open excavations during non-working time.</li> <li>• Install barriers and signs to limit access to the construction site.</li> <li>• Limit construction activities, particularly operation of noise/vibration generating equipment at night.</li> <li>• Construct silt traps, deviation channels, mounting barriers or trenches around the stockpiles of materials.</li> <li>• Provide adequate PPEs to the workers, advise them to be observant to harmful insects.</li> <li>• Regularly spray water on excavation sites and roads to keep dust</li> </ul>
			Dust during excavation	<ul style="list-style-type: none"> <li>• levels down.</li> <li>• Erect dust barriers or screens around the excavation area to contain and reduce dust spread.</li> <li>• Schedule and limit dust-generating activities during times when wind speeds are lower to reduce dust dispersion.</li> </ul>

Element	Photos, maps	Descriptions	Impacts, Risks	Specific Mitigation Measures
			Vibrations from pile driving (if any) for foundation construction	<ul style="list-style-type: none"> <li>• Conduct a pre-construction survey of nearby structures to document their condition and identify any pre-existing vulnerabilities.</li> <li>• Utilize modern pile driving equipment designed to minimize vibrations.</li> <li>• Establish buffer zones around sensitive areas and limit pile driving activities within these zones.</li> <li>• Schedule pile driving activities during times that will minimize disruption to nearby residents and businesses.</li> <li>• Monitor compliance to Codes of Conduct, especially with regards to fuel handling and fire setting.</li> </ul>
5.Raw Water Transmission Pipelines		<p>Raw water pipelines will pass through the community land. Some sections will traverse the rocky hill along the Houay Yei, following the community pathway to the farmland, and passing through the paddy land area of 17 households in Sophun village.</p> <p>The raw water pipeline will be laid underground at a depth of 0.7 to 1.2 meters. The width of pipe trenches ranges from 0.5 to 0.8 meters</p>	<p>Obstructions to cultivation activities</p> <ul style="list-style-type: none"> <li>- Construction activities may damage existing crops and disrupt planting schedules.</li> <li>- Soil erosion due to excavation can lead to loss of fertile topsoil.</li> <li>- Encountering rocks, roots, or existing underground utilities can cause delays and require additional excavation.</li> <li>- Improper installation or soil conditions can lead to pipeline damage or leaks.</li> </ul> <p>Open trenches and heavy machinery pose safety risks to farm workers and livestock.</p>	<ul style="list-style-type: none"> <li>• Avoid, minimize ground disturbance during peak cultivation period;</li> <li>• Support farmers to transport materials and products if construction affect accessibility to agricultural land;</li> <li>• Disturbance to the ground will be kept minimal. Establish the boundary of construction materials</li> <li>• Coordinate with farmers to schedule pipeline work during off-peak agricultural seasons and compensate for crop damage.</li> <li>• Use erosion control measures such as silt fences, temporary vegetation, and mulching.</li> <li>• Conduct thorough subsurface investigations and plan routes to avoid obstacles.</li> </ul> <ul style="list-style-type: none"> <li>• Carry out manual excavation and pipe installation, if necessary, in order to avoid or minimize cutting or damage to the trees.</li> <li>• Ensure proper installation techniques as mentioned in the particular technical specification.</li> </ul>


Element	Photos, maps	Descriptions	Impacts, Risks	Specific Mitigation Measures
			Safety risks for the workers and the farmers	<ul style="list-style-type: none"> <li>Workers will be fully protected from harmful insects by the provision of adequate PPEs.</li> <li>Implement safety protocols, use appropriate signage, and restrict access to construction areas.</li> </ul>
6. Distribution Pipelines		<p>The length L = 10.9Km</p> <p>There are houses along National Road No. 2E. Some sections of the pipeline will be laid out along the right-of-way, while other parts will pass through the concrete extension yards of 9 households in Sopnun and 4 households in Sopnao village.</p> <p>The system will also supply water to the school in the village.</p>	Block or disrupt access to house	<ul style="list-style-type: none"> <li>Reinform community about construction schedules two days in advance;</li> <li>Provide temporary access to the roadside house where access are disturbed</li> <li>Remove the waste from the site in parallel with excavation/pipe installation;</li> <li>Topsoil will be reserved and loaded in separate areas for reuse at the end of the disposal operation as cover material for the rehabilitation of the disposal site.</li> <li>Create a safe temporary path if access is disrupted.</li> <li>Back fill the pipe trenches as soon as possible.</li> </ul>
			Safety risks for the workers and villagers	<ul style="list-style-type: none"> <li>Reinform community about construction schedules two days in advance;</li> <li>Request families to keep their children away from construction sites;</li> <li>Carry out construction in stages to minimize community exposure to open pipe trenches</li> <li>Install support in the pipe trenches at sections near the house foundation</li> <li>Avoid loading construction materials and waste within 20m from school gate and health centers, markets or any popular publicly accessible locations</li> </ul>
			Health impacts due to dust and noise	<ul style="list-style-type: none"> <li>Place warning signs and speed limit at 10 km/h along road sections where construction is on-going</li> <li>Clean up the road, watering dusty areas during working shifts water the road section passing the school and health care center if the weather is hot and dry, windy</li> <li>Protect temporary materials and waste loads to prevent spills.</li> </ul>
7. Disposal Sites		The selected contractor shall work with the PMU/PIA and relevant	Local risks.	<ul style="list-style-type: none"> <li>Post a speed limit sign at the entrance of the disposal site.</li> <li>Provide a notice stating, “Only authorized persons are allowed”, limiting access by unauthorized persons to the disposal site.</li> </ul>



Element	Photos, maps	Descriptions	Impacts, Risks	Specific Mitigation Measures
		local authorities to identify disposal sites for the topsoil and unused excavated materials.	Erosion and sedimentation of disposal materials into the creek or the houses nearby the construction site	<ul style="list-style-type: none"> <li>▪ Topsoil will be reserved and loaded in separate areas for reuse at the end of the disposal operation as cover material for the rehabilitation of the disposal site.</li> <li>▪ a retaining wall and/or interception ditch or settling ponds shall be built prior to the initiation of the construction activities. The surface runoff shall be retained and settled first before allowed discharge into the receiving water.</li> <li>▪ A drainage ditch shall be built around the disposal site to control surface runoff to ensure that no localized flooding would happen in the areas surrounding the disposal sites; Sediments in runoff passing the excavated materials will be trapped before the flow enter any water bodies.</li> <li>▪ After being tipped down, disposal waste piles must be levelled and rolled out to mitigate dust emission, erosion, and washing off by wind and water as well as to limit safety risks.</li> <li>▪ Disposal sites close to patches of agricultural land will be limited in size to avoid damage to crops.</li> </ul>
			Dust, noise	<ul style="list-style-type: none"> <li>▪ Use appropriate containers and covers for transporting waste to disposal site to prevent spillage and scattering.</li> <li>▪ After being tipped down, disposal waste piles must be levelled and rolled out to mitigate dust emission, erosion, and washing off by wind and water as well as to limit safety risks.</li> </ul>
8. Water Intake		The water intake will be located in the in Houay Yie.	Temporary disrupt stream flow.	<ul style="list-style-type: none"> <li>▪ install a temporary culvert to maintain stream flow during intake construction.</li> </ul>
		Houay Yei is a small stream, lined the small bushes, vines, shrubs, small trees with diameters ranging from about 3 to 20 centimeters, bamboo. There are rocks and gravels in the streambed and along the stream bank.	Over disturbance to stream bed Water pollution risks	<ul style="list-style-type: none"> <li>▪ Do not exploit construction materials (gravels from stream bed) on-site.</li> <li>▪ Carry out construction with care to minimize dropping of mortars into the stream.</li> <li>▪ Properly positioned waste stores, training of site staff on the importance of maintaining a tidy site and ensuring that everyone does their bit to comply with all applicable site rules and legislation.</li> <li>▪ Fuel storage tanks should be positioned far from any watercourse or surface water drains, and from access points and traffic routes.</li> </ul>

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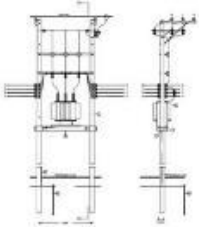
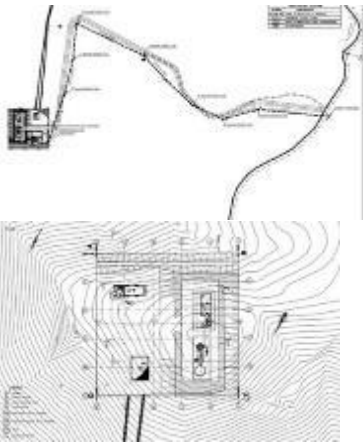

Element	Photos, maps	Descriptions	Impacts, Risks	Specific Mitigation Measures
			Unnecessary disturbance to stream side vegetation.	<ul style="list-style-type: none"><li>▪ Load materials and equipment on barren soil, not on vegetated areas.</li></ul>
			Fish, wildlife caught by the workers	<ul style="list-style-type: none"><li>▪ No fish/wildlife catching, keeping allowed</li></ul>




**Longnai Kao Water Supply System in Bountai district**

Element	Photos, maps	Descriptions	Impacts, Risks	Specific Mitigation Measures
1. Access to the WTP from main road		<p>L = 697.55m; W = 5m. The access road follows the existing path.</p> <p>The ground elevation is from 732.25 to 836 m amsl. Slopes gradient: Average: 2.587%, maximum: 19.952%</p> <p>Total 54,800 M<sup>3</sup> land will be excavated of which 41,783M<sup>3</sup> excavated materials will be g transported to the disposal sites</p>	<p>Traffic safety risks when locals are also using this road.</p> <p>Overloaded trucks may cause damages to the existing road</p> <p>Erosion and landslide risk due to steep topography</p>	<ul style="list-style-type: none"> <li>▪ Inform households about the construction schedule in advance.</li> <li>▪ Place Construction Site, speed limit signs before the entrance to the access road.</li> <li>▪ Require drivers to minimize honking and to comply with speed limits of 10 km/h when driving in community areas.</li> <li>▪ Provide information to community on schedule of construction activities through billboard/signs</li> <li>▪ Avoid using equipment that may result in high levels of vibrations.</li> <li>▪ Place warning signs at the junction with village road, provide lighting at night at this spot.</li> </ul> <ul style="list-style-type: none"> <li>▪ Provide information to community on schedule of construction activities through billboard/signs</li> <li>▪ Fence off the construction site with gate</li> <li>▪ Install barricades/barriers and sturdy plate covers in open excavations during non-working time.</li> <li>▪ Install signs to limit access to the construction site.</li> <li>▪ Excavating the hillside to the engineered slope to minimize the potential for slope failure during road construction.</li> <li>▪ Planting the vetiver grass on slopes according to design as soon as possible.</li> <li>▪ Minimize disturbed area to minimize erosion risks, avoiding overcutting of trees or over-removal of vegetation</li> <li>▪ Construct silt traps, deviation channels, mounting barriers or trenches around the stockpiles of materials</li> <li>▪ Load materials and waste within the WTP boundary, prevent spills to garden land or nearby water sources.</li> <li>▪ Topsoil will be reserved and loaded in separate areas for reuse at the end of the disposal operation as cover material for the rehabilitation of the disposal site</li> <li>▪ Create, maintain temporary drainage channels and sedimentation traps within and surrounding the WTP boundaries;</li> <li>▪ Monitor erosion risks daily. Take appropriate actions with additional mitigation measures to prevent erosion/land slide when risks are identified;</li> </ul>


Element	Photos, maps	Descriptions	Impacts, Risks	Specific Mitigation Measures
			Safety risks for the workers if harmful insects attack them.	<ul style="list-style-type: none"> <li>▪ Provide adequate PPEs to the workers, advise them to be observant to harmful insects.</li> <li>▪ Monitor compliance to Codes of Conduct, especially with regards to fuel handling and fire setting.</li> <li>▪ Educate worker to wear the long sleeves, long pants, and insect repellent to minimize exposure</li> <li>▪ Educate workers about insect hazards, prevention measures, and emergency procedures.</li> <li>▪ Provide anti-mosquito/insect spray to workers and advise them to use it.</li> </ul>
			Forest Fire Risks	<ul style="list-style-type: none"> <li>▪ The burning of biomass and timber is not permitted at this site.</li> <li>▪ Monitor compliance to Codes of conduct, especially the use of fuels, to prevent fire risks.</li> </ul>
	Traffic safety risks at the curvy junction		<ul style="list-style-type: none"> <li>▪ Inform households about the construction schedule in advance.</li> <li>▪ Place Construction Site, speed limit signs before the entrance to the access road</li> </ul>	
	<p>Cardamom, and bushes along both sides of the access road, Ants, butterflies, birds, and mosquitoes were observed.</p> <p>The construction will pass through private land plots of Mr. Khamxay and Ms. Teang (630 m<sup>2</sup>) for the rubber tree plantation, and Mr. Yot and Ms. Ly (600 m<sup>2</sup>) (fallow land) in Longnai-Kao village.</p>	Damages to the trees and vegetation along the access road, in the plantation near the construction boundary	<ul style="list-style-type: none"> <li>▪ Conduct the tree survey and inventory of trees submit the results to the PIU/PMU for approval before cutting.</li> <li>▪ Pegging/Fencing the construction area before starting construction work.</li> <li>▪ Minimize disturbed areas, avoid damaging trees and vegetation cover.</li> <li>▪ Clearance outside of the approved construction area is prohibited.</li> <li>▪ Minimize disturbed area to minimize erosion risks, avoiding overcutting of trees or over-removal of vegetation</li> </ul>	
13,017 M <sup>3</sup> filling materials and granular materials will be transported to the WTP sites	Dut and Noise	<ul style="list-style-type: none"> <li>▪ Spray water on access roads and construction sites during dry weather conditions to control dust emission, particularly roads near residences and through the town core area.</li> <li>▪ Impose speed limits on construction vehicles.</li> <li>▪ Excavation work will be avoided in periods of high wind.</li> <li>▪ The contractor will comply with a 10 km/h speed limit when in the community area.</li> </ul>		


Element	Photos, maps	Descriptions	Impacts, Risks	Specific Mitigation Measures
		<p>Low daily traffic density at the junction with the existing road: Pickup trucks: 1, Bicycles and motorcycles: 15, Tractor: 3</p> <p>There may be minor risk due to curves.</p>	<p>Traffic and safety risks along the road, especially during class opening and school over times</p>	<ul style="list-style-type: none"> <li>• Measures to control traffic during construction: <ul style="list-style-type: none"> <li>- Place warning signs on the main road and road access to the Water Treatment Plant (WTP).</li> <li>- Scheduling Truck Movement to avoid truck movement during school opening and closing times to ensure the safety of children.</li> <li>- Set and enforce speed limits on the access road to control vehicle speed.</li> <li>- Provide training for truck drivers to ensure they are aware of safety protocols and road regulations.</li> <li>- Arrange for flag men to direct traffic when trucks are coming in and out of the construction site.</li> <li>- Water the roads regularly to minimize dust.</li> <li>- Install flashing lights so that truck drivers can observe houses during dark hours, ensuring better visibility and safety.</li> </ul> </li> <li>• Measures for and safety risks reduction during construction: <ul style="list-style-type: none"> <li>- Restrict access to the construction site to authorized personnel only.</li> <li>- Ensure all workers wear appropriate personal protective equipment (PPE), such as helmets, gloves, safety boots, and reflective vests.</li> <li>- Provide comprehensive safety training for all workers, including hazard recognition and emergency procedures.</li> <li>- Conduct regular refresher courses to</li> <li>- Place clear and visible safety signs around the construction site to warn of potential hazards.</li> <li>- Use barrier tape or fencing to mark off dangerous areas.</li> <li>- Install guardrails, safety nets, and personal fall arrest systems where there is a risk of falling from heights.</li> <li>- Ensure that ladders and scaffolding are secure and meet safety standards.</li> <li>- Keep the construction site clean and free of debris to prevent tripping hazards.</li> <li>- Equip the site with first aid kits and ensure that trained first aid personnel are always available.</li> </ul> </li> </ul>

Element	Photos, maps	Descriptions	Impacts, Risks	Specific Mitigation Measures
2. Power Supply for the WTP		670 m 22KV power lines will be built along the access road to connect to the grid network. A 50 KVA hanging transformer will be installed.	Safety risks for the workers	<ul style="list-style-type: none"> <li>▪ Testing structures for integrity prior to undertaking work.</li> <li>▪ Safety belts and Rope shall be used.</li> <li>▪ Implement fall protection measures in climbing protection measures.</li> <li>▪ Provide adequate work-positioning device system for workers.</li> <li>▪ When operating power tools at height, workers should use a backup safety strap.</li> <li>▪ Signs and other obstructions should be removed from poles or structures prior to undertaking work;</li> </ul>
2. WTP site	 	Land area: 2,500m <sup>2</sup> (50x50m), on communal land. The ground elevation is from 836 to 849mamsl, slope gradient is 26%. Currently covered with small trees and bushes. It is currently village land, covered by vines, bush, small tree and big trees (less than 50 Centre meter). There may be some snakes, bees, ants, insects, small birds, etc. No invasive plant species identified.	Landslide risks.	<ul style="list-style-type: none"> <li>▪ Fence off the construction site with gates.</li> <li>▪ Install barricades/barriers and sturdy plate covers in open excavations during non-working time.</li> <li>▪ Install the physical barrier to limit access to the construction site.</li> <li>▪ Install signs at construction sites warning people of potential dangers.</li> <li>▪ Install temporary fens or barriers around the subproject facility construction site</li> <li>▪ Require drivers to minimize honking and to comply with speed limits of 10 km/h when driving in community areas.</li> <li>▪ Provide information to community on schedule of construction activities through billboard/signs.</li> <li>▪ Construct silt traps, deviation channels, mounting barriers or trenches around the stockpiles of materials.</li> <li>▪ Load materials and wastes within the WTP boundary, prevent spills to garden land.</li> </ul>
			Safety risks for the workers if harmful insects attack them.	<ul style="list-style-type: none"> <li>• Provide adequate PPEs to the workers, advise them to be observant to harmful insects. Educate worker to wear the long sleeves, long pants, and insect repellent to minimize exposure</li> <li>• Educate workers about insect hazards, prevention measures, and emergency procedures.</li> <li>▪ Provide anti-mosquito/insect spray to workers and advise them to use it</li> </ul>
		The WTP is located on communal land, border with Mr. Khamxay's cultivated land in the north, with Mr. Boun Onlouang's cardamom plantation in the south, with the	Extensive dust during earthworks may affect the growth of crops nearby.	<ul style="list-style-type: none"> <li>▪ Establish vegetation cover on slopes according to design as soon as possible.</li> <li>▪ Excavation work will be avoided in periods of high wind.</li> <li>▪ The burning of site clearance debris (trees, undergrowth) or construction waste material is prohibited.</li> </ul>


Element	Photos, maps	Descriptions	Impacts, Risks	Specific Mitigation Measures
	  	<p>rice fields of Mr. Kham Gnoth in the west and Mr. Chankeo's cultivated land of Mr. Bounchanphaeng, Mr. Phonkhou, and Mr. Tha in the east</p> <p>Total excavation volume 54,800 m<sup>3</sup>, Back fill volume 13,017 m<sup>3</sup> 41,783 m<sup>3</sup> of waste will be dumped in the approval disposal site</p>	<p>Obstructions to farming activities of private landowners nearby.</p> <p>Excavated materials fill up cropland nearby.</p> <p>Dust generation from earthworks and during transportation of large volumes of granular materials.</p> <p>Traffic safety risks during transportation</p>	<ul style="list-style-type: none"> <li>▪ Keep the stockpile of aggregate material covered to avoid suspension or dispersal of fine soil particles during windy days or disturbance from stray animals.</li> <li>▪ Support farmers to transport materials and products if construction affects accessibility to agricultural land.</li> <li>▪ Use erosion control measures such as silt fences, temporary vegetation, and mulching</li> </ul> <ul style="list-style-type: none"> <li>▪ Spray water on access roads and construction sites during dry weather conditions to control dust emission, particularly roads near residences and through the town core area.</li> <li>▪ Drivers are requested to follow regulations on speed limits.</li> <li>▪ Trucks must be covered during transportation of excavated soil.</li> </ul> <ul style="list-style-type: none"> <li>• Measures to control traffic during construction: <ul style="list-style-type: none"> <li>- Place warning signs on the main road and road access to the Water Treatment Plant (WTP).</li> <li>- Scheduling Truck Movement to avoid truck movement during school opening and closing times to ensure the safety of children.</li> <li>- Set and enforce speed limits on the access road to control vehicle speed.</li> <li>- Provide training for truck drivers to ensure they are aware of safety protocols and road regulations.</li> <li>- Arrange for flag men to direct traffic when trucks are coming in and out of the construction site.</li> <li>- Water the roads regularly to minimize dust.</li> <li>- Install flashing lights so that truck drivers can observe houses during dark hours, ensuring better visibility and safety.</li> </ul> </li> <li>• Measures for and safety risks reduction during construction: <ul style="list-style-type: none"> <li>- Restrict access to the construction site to authorized personnel only.</li> <li>- Ensure all workers wear appropriate personal protective equipment (PPE), such as helmets, gloves, safety boots, and reflective vests.</li> <li>- Provide comprehensive safety training for all workers, including hazard recognition and emergency procedures.</li> <li>- Conduct regular refresher courses to</li> <li>- Place clear and visible safety signs around the construction site to warn of potential hazards.</li> <li>- Use barrier tape or fencing to mark off dangerous areas.</li> </ul> </li> </ul>

Element	Photos, maps	Descriptions	Impacts, Risks	Specific Mitigation Measures
				<ul style="list-style-type: none"> <li>- Install guardrails, safety nets, and personal fall arrest systems where there is a risk of falling from heights.</li> <li>- Ensure that ladders and scaffolding are secure and meet safety standards.</li> <li>- Keep the construction site clean and free of debris to prevent tripping hazards.</li> <li>- Equip the site with first aid kits and ensure that trained first aid personnel are always available.</li> </ul>
		Water for construction will be taken from the nearby stream, drinking water will be purchased from local suppliers	Safety risks for the worker	Follow safety rules for construction of power system specified in this ESMP.
3. Nam Papa Water Supply Office		The proposed location is an Longnai Kao village	Safety risks for the workers and community	<p>Provide information to community on schedule of construction activities through billboard/signs.</p> <p>Fence off the construction site with gate.</p> <p>Install barricades/barriers and sturdy plate covers in open excavations during non-working time.</p> <p>Install barriers and signs to limit access to the construction site.</p> <p>Provide adequate PPEs to the workers, advise them to be observant to harmful insects.</p> <p>Construct silt traps, deviation channels, mounting barriers or trenches around the stockpiles of materials.</p> <p>Monitor compliance with Codes of Conduct, especially with regards to fuel handling and fire setting.</p>
			Dust during excavation	<p>Load materials and waste within the construction site boundary, prevent spills to garden land or nearby water sources.</p> <p>Regularly spray water on excavation sites and roads to keep dust levels down.</p> <p>Erect dust barriers or screens around the excavation area to contain and reduce dust spread.</p> <p>Schedule and limit dust-generating activities during times when wind speeds are lower to reduce dust dispersion.</p>

Element	Photos, maps	Descriptions	Impacts, Risks	Specific Mitigation Measures
			Vibrations from pile driving (if any) for foundation construction	<ul style="list-style-type: none"> <li>Limit construction activities, particularly operation of noise/vibration generating equipment at night.</li> <li>Conduct a pre-construction survey of nearby structures to document their condition and identify any pre-existing vulnerabilities.</li> <li>Utilize modern pile driving equipment designed to minimize vibrations.</li> <li>Establish buffer zones around sensitive areas and limit pile driving activities within these zones.</li> <li>Schedule pile driving activities during times that will minimize disruption to nearby residents and businesses.</li> </ul>
5.Raw Water Transmission Pipelines		<p>The length L = 7.35Km</p> <p>Raw water pipelines will be laid along the brook, through the valley, crossing fallow land, agriculture land or running along the roadside. Some sections are well covered with vines, bushes, banana and other trees etc.</p> <p>The raw water pipeline will be laid underground at a depth of 0.7 to 1.2 meters. The width of pipe trenches ranges from 0.5 to 0.8 meters.</p> <p>Raw water pipelines will pass through the community land, the edge of paddy land of 18 HHs in Longnai Kao village.</p>	<p>Obstructions to cultivation activities</p> <ul style="list-style-type: none"> <li>Construction activities may damage existing crops and disrupt planting schedules.</li> <li>Soil erosion due to excavation can lead to loss of fertile topsoil.</li> <li>Encountering rocks, roots, or existing underground utilities can cause delays and require additional excavation.</li> <li>Improper installation or soil conditions can lead to pipeline damage or leaks.</li> </ul> <p>Safety risks for the workers and the farmer.</p> <ul style="list-style-type: none"> <li>Open trenches and heavy machinery</li> </ul>	<ul style="list-style-type: none"> <li>Avoid, minimize ground disturbance during peak cultivation period;</li> <li>Support farmers to transport materials and products if construction affect accessibility to agricultural land;</li> <li>Disturbance to the ground will be kept minimal.</li> <li>Establish the boundary of construction materials</li> <li>Carry out manual excavation and pipe installation, if necessary, in order to avoid or minimize cutting or damage to the trees.</li> <li>Coordinate with farmers to schedule pipeline work during off-peak agricultural seasons and compensate for crop damage.</li> <li>Use erosion control measures such as silt fences, temporary vegetation, and mulching.</li> <li>Conduct thorough subsurface investigations and plan routes to avoid obstacles.</li> </ul> <ul style="list-style-type: none"> <li>Workers will be fully protected from harmful insects by the provision of adequate PPEs</li> <li>Ensure proper installation techniques as mentioned in the particular technical specifications</li> </ul>

Element	Photos, maps	Descriptions	Impacts, Risks	Specific Mitigation Measures
			<p>pose safety risks to farm workers and livestock.</p>	<ul style="list-style-type: none"> <li>▪ Implement safety protocols, use appropriate signage, and restrict access to construction areas.</li> </ul>
6.Distribution Pipelines		<p>The length L = 15.48 Km</p> <p>There are houses along the road in the villages of the core service area. The pipeline will be laid out along the right-of-way of the road.</p> <p>The system will also supply water to the school in the village</p>	<ul style="list-style-type: none"> <li>• Block or disrupt access to house</li> <li>• Health impacts due to dust and noise</li> <li>• Traffic disruptions, traffic safety risks</li> <li>• Damages to private properties and crops</li> <li>• Safety risks for the workers and villagers</li> <li>• Damage to the front concrete yard of the people</li> </ul>	<ul style="list-style-type: none"> <li>• Reinform community about construction schedules two days in advance;</li> <li>• Request families to keep their children away from construction sites;</li> <li>• Carry out construction in stages to minimize community exposure to open pipe trenches</li> <li>• Provide temporary access to the roadside house where access is disturbed</li> <li>• Install support in the pipe trenches at sections near the house foundation</li> <li>• Back fill the pipe trenches as soon as possible</li> <li>• Avoid loading construction materials and waste within 20m from school gate and health centers, markets or any popular publicly accessible locations;</li> <li>• Remove the waste from the site in parallel with excavation/pipe installation; Topsoil will be reserved and loaded in separate areas for reuse at the end of the disposal operation as cover material for the rehabilitation of the disposal site.</li> <li>• Place warning signs and speed limit at 10 km/h along road sections where construction is on-going</li> <li>• Avoid laying out of the pipeline in the front yard. Contractor should layout the pipeline in Right of Way (ROW) between the road and front yard. If there any damage to the front yard, contractor should repair it to original condition</li> <li>• Create safe temporary path if access if disrupted</li> <li>• Backfill as soon as the pipe installation is completed</li> <li>• Clean up the road, watering dusty areas during working shifts</li> <li>• water the road section passing the school and health care center if the weather is hot and dry, windy</li> <li>• Avoid parking trucks, loading and unloading materials and wastes during peak traffic hours</li> <li>• Inform the public in advance if construction takes place at nighttime</li> <li>• Requires the workers strictly follow the Codes of Conducts</li> <li>• Protect temporary materials and waste loads to prevent spills;</li> </ul>

Element	Photos, maps	Descriptions	Impacts, Risks	Specific Mitigation Measures
				<ul style="list-style-type: none"> <li>place warning signs and reflective bands to restrict unauthorized access to construction areas;</li> <li>Transport the excavated materials away within 24 hours since excavation;</li> <li>Fully reinstate the excavated road as soon as possible.</li> <li>Do not park vehicles or temporarily load materials in front of the market and shops unless construction is on-going at these sites.</li> </ul>
7. Disposal Sites		The selected contractor shall work with the PMU/PIA and relevant local authorities to identify disposal sites for the topsoil and unused excavated materials.	Local risks.	<ul style="list-style-type: none"> <li>Post a speed limit sign at the entrance of the disposal site.</li> <li>Provide a notice stating, “Only authorized persons are allowed”, limiting access by unauthorized persons to the disposal site.</li> </ul>
			Erosion and pills of disposal materials into the creek or the houses nearby the construction site	<ul style="list-style-type: none"> <li>Topsoil will be reserved and loaded in separate areas for reuse at the end of the disposal operation as cover material for the rehabilitation of the disposal site.</li> <li>A retaining wall and/or interception ditch or settling ponds shall be built prior to the initiation of the construction activities. The surface runoff shall be retained and settled first before allowed discharge into the receiving water.</li> <li>A drainage ditch shall be built around the disposal site to control surface runoff to ensure that no localized flooding would happen in the areas surrounding the disposal sites; Sediments in runoff passing the excavated materials will be trapped before the flow enter any water bodies.</li> <li>Disposal sites close to patches of agricultural land will be limited in size to avoid damage to crops.</li> </ul>
			Dust and noise	<ul style="list-style-type: none"> <li>Use appropriate containers and covers for transporting waste to the disposal site to prevent spillage and scattering.</li> <li>After being tipped down, disposal waste piles must be levelled and rolled out to mitigate dust emission, erosion, and washing off by wind and water as well as to limit safety risks.</li> </ul>
8. Water Intake		Houay Viey is a small stream, lined with small bushes, vines, shrubs, and small trees ranging	Temporary disrupt stream flow.	<ul style="list-style-type: none"> <li>install a temporary culvert to maintain stream flow during intake construction.</li> </ul>

Element	Photos, maps	Descriptions	Impacts, Risks	Specific Mitigation Measures
		<p>in diameter from about 3 to 20 centimeters and bamboo. There are rocks, gravel and stone in the streambed and along the stream bank.</p> <p>The proposed water intake is in Houay Viev on village fallow land</p>	<p>Over disturbance to stream bed</p> <p>Water pollution risks</p> <p>Unnecessary disturbance to stream side vegetation.</p> <p>Fish, wildlife caught by the workers</p>	<ul style="list-style-type: none"> <li>• Do not exploit construction materials (gravels from stream bed) on-site.</li> <li>• Carry out construction with care to minimize dropping of mortars into the stream.</li> <li>• Properly positioned waste stores, training of site staff on the importance of maintaining a tidy site and ensuring that everyone does their bit to comply with all applicable site rules and legislation.</li> <li>• Fuel storage tanks should be positioned far from any watercourse or surface water drains, and from access points and traffic routes.</li> </ul> <p>Load materials and equipment on barren soil, not on vegetated areas.</p> <ul style="list-style-type: none"> <li>• No fish/wildlife catching, keeping allowed</li> </ul>

### 5.1.3 Mitigation Measures required During Operation Phase

The mitigation measures below will be implemented by the WTP operators.

Table 5-5 the mitigation measure for the operation phase

Operation Phase				
Item	Issues	Mitigation measure	Implement	Supervisor
Generation of backwash water and sediments at water treatment plants	The moisture content of the sludge in sludge lagoon is about 95%, the amount of sludge is: 15.95 kg/day	<ul style="list-style-type: none"> <li>The sludge amount produced during the treatment of surface water in the WTP in this cluster is small. Therefore, a drying field is not anticipated within the WTP, instead, the sludge amount will be kept in the sludge lagoon and sucked up and transported to a disposal site every 2-3 months. Sucking up and transporting the sludge by special vehicles need to be stipulated in a contract with a local sanitation company. The sludge shall be disposed of at a special area assigned for sludge in an allocated and agreed disposal site.</li> </ul>	PNP	
Flooding	Flooding around the WTP area and access roads from rainfalls	<ul style="list-style-type: none"> <li>Side drainage along the road to ensure sufficient drainage capacity and avoid flooding. Side drainage should be sufficient to drain generated surface runoff from rainfall to avoid flooding around the WTP area.</li> </ul>		
Occupational Health and Safety		<ul style="list-style-type: none"> <li>Training of staff and allocation of responsibility to ensure that materials are properly handled.</li> <li>The dose of chemicals applied to the water for treatment will be adjusted according to the actual operation of the water treatment plant</li> </ul>	PNP	
Community health and safety		<ul style="list-style-type: none"> <li>The facilities that will be constructed will be properly fenced off and secured to restrict access and intrusion of unauthorized personnel. Watchmen/security personnel will be hired to secure the facilities on a 24 hour basis. This would minimize the safety risks to the community</li> </ul>	PNP	
Raw Water Quality		<ul style="list-style-type: none"> <li>The PIU and PNP shall continuously coordinate with the village authorities regarding community activities in the catchment area to monitor watershed activities that may contribute to the contamination of raw water.</li> <li>The PIU and PNP shall be continuously coordinate with the village authorities conduct and maintain communication campaigns on watershed protection, land use planning.</li> <li>Laboratory testing equipment and training will also be provided to allow the PNP to conduct regular monitoring of raw and treated water quality parameters.</li> </ul>		

## 5.2 Institutional Arrangements

### 5.2.1 PMU Roles and Responsibilities

168. PMU will be responsible for monitoring the overall subproject implementation, including environmental compliance of the subproject. Specifically, the PMU will:

- closely coordinate with local authorities in the participation of the community during subproject preparation and implementation.
- monitor and supervise ESMP implementation including incorporation of ESMP into the detailed technical designs and bidding and contractual documents.
- ensure that an environmental management system is set up and functions properly.
- be in charge of reporting on ESMP implementation to the relevant authorities.

### 5.2.2 Construction Supervisors (CSC) Roles and Responsibilities

- On behalf of the PMU, the CSC will review and approve safeguard documents and reports submitted by the contractors.
- Be responsible for the regular supervision and monitoring of all construction activities and to ensure that the Contractor complies with the requirements of the contract and ESCOP. Prepare monthly ESHS monitoring reports and submit them to the PMU.

### 5.2.3 Contractors' Safeguard Responsibilities

169. The contractor shall comply with and implement the mitigation measures proposed in the Project's Social and Environmental Management Plan to prevent damage and nuisance to the environment and local communities. In particular, the Contractor is responsible for implementing or complying with the measures and requirements stated in the Environmental and Codes of Practices (ESCOP) and specific mitigation measures. The contractor is responsible for self-monitoring the implementation of these mitigation measures.

170. The contractor's responsibilities include, but not limited to the following:

- After contract signing, the successful bidder (the contractor) is required to prepare a Contractor's Environmental Management Plan (C-ESMP) to submit to PMU for review and clearance prior to construction commencement. The contents of C-ESMP should cover: (i) general information about the contractors and commitments on complying with safeguard requirements; (ii) ESCOP, Codes of conducts, other ESHS requirements, detail about specific measures and actions (including detail maps, diagrams) that the contractor plan to implement or comply with; (iii) proposals about ESHS training for their workers; (iv) Proposed staff assigned to ESHS responsibility. The C-ESMP will be updated to address the issues arisen during construction phase, if any.
- Throughout the construction period, the contractor of each package will submit monthly environmental, social, health, safety (ESHS) compliance progress reports to the PIU, copy furnished to the PMU. The contractor should highlight the summary of the progress of construction, ESHS activities undertaken within the reporting period to implement the measures outlined in the ESMP, record any community complaints received and how the complaint was resolved.
- Assign staff to be responsible for ESHS aspects at construction sites and facilitate inspection missions.
- Conduct ESHS briefings for the workers including ESCOPs, Codes of Conducts, specific mitigation measures.

- Coordinate with PMU/PIA to inform local authorities and communities about construction schedules and impact mitigation requirements.
- Implement or comply with ESCOP, specific mitigation measures, Codes of Conducts and other relevant requirements on environmental, social, health and safety (ESHS) specified in the ESMP.
- Prepare monthly ESHS compliance monitoring report and submit it to construction supervisors.
- Implement additional mitigation or corrective measures as guided by the Construction Supervisors or PMU.
- Prepare Incident Report, if applicable

### 5.3 Monitoring and Reporting Requirements

171. Contractors' ESHS performance at construction sites will be directly monitored and supervised by the Site Construction Supervision Engineer who will prepare monthly ESHS monitoring report for submission to PIU (Draft template provided in Annex 3 of this ESMP).

172. At subproject/provincial level, PIU/DPWT staff, together with district and village authorities will be responsible for monitoring the implementation of mitigation measures as approved in the ESMP. Monitoring information together with other information collected from various stakeholders together with observations of project activities will be reported monthly to the DPWT using standard reporting forms. Monthly monitoring reports from PIU/DPWT will be included.

- List of consultations held, including locations and dates, name of participants and occupations.
  - Main points arising from consultations including any agreements reached.
  - A record of grievance applications and grievance redress dealt with.
  - Number of construction supervision reports that include assessment of contractor's compliance with safeguards in accordance with ECOP.
  - Number of trainings of community groups in environmental and social issues (if any)
- Contractor's monitoring and reporting responsibilities.

173. The PIU will consolidate the results of the monthly environmental monitoring through a quarterly progress report that will be submitted to the PMU which is based at the Department of Water Supply of the MPWT. The quarterly report will summarize the significant findings and measures undertaken to address any adverse environmental impacts during construction and also present any unforeseen environmental impacts and suggested remedial actions for the next monitoring period. Copies of the relevant progress and ESHS reports will be shared with relevant authorities and the World Bank.

## 6 Information Disclosure, Consultation and Participation

174. Public Consultation sessions were held many times during the project feasibility study. The objectives of consultation are to generate public awareness by providing information about a sub-project to all stakeholders, particularly the sub-projects affected people (PAPs); cut-off-date; entitlements and provide opportunity to the stakeholders to voice their opinions and concerns on different aspects of the project. The consultations were conducted to discuss with the stakeholders the proposed project and also to elicit the environmental concerns/issues of the community on the proposed subproject. See details of participant registration and minutes of meetings in the ARAP. After public consultation, separate meetings have been carried out with the individual heads of the potential affected households to inform them about the preliminary result of the detailed measurement survey, their affected structures and their entitlements.

**Table 7.1** Summary of the date and participants of public consultation meeting in each village

Date	Location	Participants			
		Agency	Total	Female	Ethnic
10/08/2023	Sinxay	Village Authority, villagers, PIU, PMU staff	28	10	Akha\ Khmu\ Phounoy\ Laol Tai
10/08/2023	Sobnao	Village Authority, villagers, PIU, PMU staff	22	2	Lao Tai
12/08/2023	Namly	Villagers	68	8	Akha\ Khmu\ Phounoy\ Laol Tai 10/08/2023
01/02/2024	Longnai Kao	Village Authority, villagers, PIU, PMU staff	43	1	Yang
01/02/2024	Longnai Mai	Village Authority, villagers, PIU, PMU staff	39	13	Yang
01/02/2024	Bornoi	Village Authority, villagers, PIU, PMU staff	11	2	Phounoy
08/10/2024	Sinxay	Village Authority, villagers, PIU, PMU staff	76	36	Akha\ Khmu\ Phounoy\ Laol Tai
09/10/2024	Longnai Kao	Village Authority, villagers, PIU, PMU staff	43	1	Yang

10/10/2023	Longnai	Village Authority, villagers, PIU, PMU staff	70	4	Yang
10/10/2023	Namly	Village Authority, villagers, PIU, PMU staff	85	16	Akha\ Khmu\ Phounoy\ Laol Tai
11/10/2024	Bornoi	Village Authority, villagers, PIU, PMU staff	37	1	Phounoy
12/10/2024	Sobnao	Village Authority, villagers, PIU, PMU staff	36	11	Lao Tai
12/10/2024	Sophun	Village Authority, villagers, PIU, PMU staff	46	7	Khmu\ Thaideang
Total			604	112	

Source: field survey for village social and economic data, August 2023 and February 2024

175. In addition, after the completion of the conceptual design, meeting was carried out with the provincial and district grievance committee as well as technical staff of the provincial PIU and central PMU to review the preliminary Inventory of Loss (IoL), collected in May 2023 and the updated IoL resulting from final conceptual design prior to carrying out the second DMS in August 2023. Table 6-1 summarizes the main comments that were raised during the village consultation meetings.

*Table 6-1 Summary of Main Components raised during the Public Consultation*

Comments	Response
<b>I. Water system design and Civil work</b>	
The design should avoid the impact on existing structures	<p>The water supply system design has been prepared to avoid adverse impacts as much as possible on the existing structures in the village.</p> <p>The pipeline laying design has been prepared to lay out the pipeline underground at a depth of 0.7 to 1.2 meters pass the agricultural land area to avoid any adverse impact.</p> <p>The sensitive section along the residential area will be closely monitored during the civil works.</p>
Must be close monitoring of civil works during the construction phase in order to	Construction Supervision Consultant have been hired under the PIA to monitor environmental and social impacts and inspect the quality of the civil works.

avoid impacts on the structures especially the houses along the main water pipeline	In addition, grievance committees have been set up at the village, district and provincial and central level to help with grievance redress procedures during the pre and construction phases.
Training must be provided to the villagers on safety issues and signs should be installed at appropriate construction sites.	ESMP has been developed, and it will cover occupational health and community health and road safety. The Contractor will be responsible in ensuring trainings/workshops to the workers as well as community members are being organized.
<b>II. Compensation</b>	
Access constraints to houses during the civil works	The AHs will be provided with temporary access during the civil works and access to houses will be restored after its completion.
The villagers are willing to contribute minor resettlement impacts because they want to have better access to clean water in their villages	Willingness in the voluntary contribution is highly appreciated but the project has a compensation approach that agreed by the government in the resettlement policy framework.  This issue will be reported to the provincial and district grievance committees and consulted with relevant legal frameworks and the relevant standard of WB.



Figure 7-6-1 Photos taken at public consultation meeting in Namly and Sinxay

## 7 Grievance Redress Mechanism

176. Part VI of Decree 84/GoL requires the Project to establish an effective mechanism for grievance resolution. A well-defined grievance redress and resolution mechanism will be established to resolve grievances and complaints in a timely and satisfactory manner. The objective of the grievance redress mechanism is to resolve complaints as quickly as possible and at the local level through a process of conciliation; and, if that is not possible, to provide clear and transparent procedures for appeal. All affected persons will be made fully aware of their rights, and detailed grievance redress procedures will be publicized through effective public information campaign.

177. The grievance mechanism is based on key principles that will protect the rights and interest of project participants; ensure that their concerns are addressed in a prompt and timely manner, and that entitlements are provided in accordance with GoL and Bank safeguard policies. PIU/DPWT will ensure that communities directly affected by the Project have a full understanding of the GRM and ways to access it especially on (i) the concept of compensation for any involuntary acquisition of land and/or assets and (ii) ensuring environmental and social mitigation measures in the ESMP's are implemented as planned. APs are entitled to lodge

complaints regarding any aspect of the environmental and social impacts associated with the Project. The AP's complaints can be made verbally or in written form to the GRC or, alternatively, raise his/her voice in a public or individual meeting with project staff.

## 7.1 Type of GRM

178. Complainers are entitled to lodge complaints regarding any aspect of the project. Any affected person will be able to submit grievance if they believe a practice is having a detrimental impact on the community, the environment, or on their quality of life. Eligible grievances or complaints are included.

- Negative impacts on a person or a community (e.g. financial loss such as from loss of water, loss of roadside trees, health and safety issues, nuisances, etc.).
- Dangers to health and safety or pollution of the environment.
- Hazards due to construction activities (e.g. noise, dust, disruption of access, etc.)
- Impacts on social infrastructure.
- Failure to comply with standards or legal obligations.
- Improper conduct or unethical behaviour of contractor leading to nuisance of affected person(s).
- Misuse of funds and other irregularities.
- Grievances due to land acquisition, resettlement, compensation, relocation and unaddressed losses.
- Complaints related to gender issues.

## 7.2 Grievance Resolution Process

179. Complaints can be made verbally or in written form. It is recognized that in many cases, complainants do not have the writing skills or ability to express their grievances verbally, however, complainants are encouraged to seek assistance from family members or village heads, to have their grievances recorded in writing and to ensure that where disputes do occur and all the details have been recorded accurately enabling all parties to be treated fairly. In the case of verbal complaints, a written record of the complaint will be made during the first meeting with the complainant. Complainants who present their complaints within the prescribed procedures will be exempt from all administrative fees incurred. In addition, complainants who lodge complaints and appeals to district courts will be provided with free legal representation. The procedures for the grievance resolution process for the subproject are detailed below.

Stage 1: In the first instance, APs will address complaints on any aspect of compensation, relocation or unaddressed losses to the Village Grievance Redress Committee (VGRC) or other designated village grievance officers that will include the ethnic elderly who is well respected in the village. The VGRC will organize a meeting with the complainants to resolve the issue using its traditional methods of conciliation and negotiation; the meeting will be held in a public place and will be opened to other APs and villagers to ensure transparency. The VGRC aims at clarification and amicable solution agreed with the subproject.

Stage 2: If after 10 days of lodging the complaint, no understanding or amicable solution can be reached or no response is received from the Village Grievance Redress Committee, the complainant can bring the complaint to the District/Provincial GRC. The District/Provincial GRC will be involved to meet with the complainant and VGRC to discuss the complaint and provide a decision at mutual arrangement within 15 days of receiving the appeal.

Stage 3: If the AP is still not satisfied with the decision of the PGRC, or in the absence of any response within the stipulated time, the complainant can submit his/her grievance to the

Department of Water Supply. The DWS will act on behalf of the MPWT. It may consider seeking external opinion on this matter and the appeal must be resolved within 20 days of receiving the appeal.

**Stage 4:** As a last resort, the AP may submit his/her case to the Court of Law. The complaint will be lodged with the Court of Law; the decision of the Court will be final.

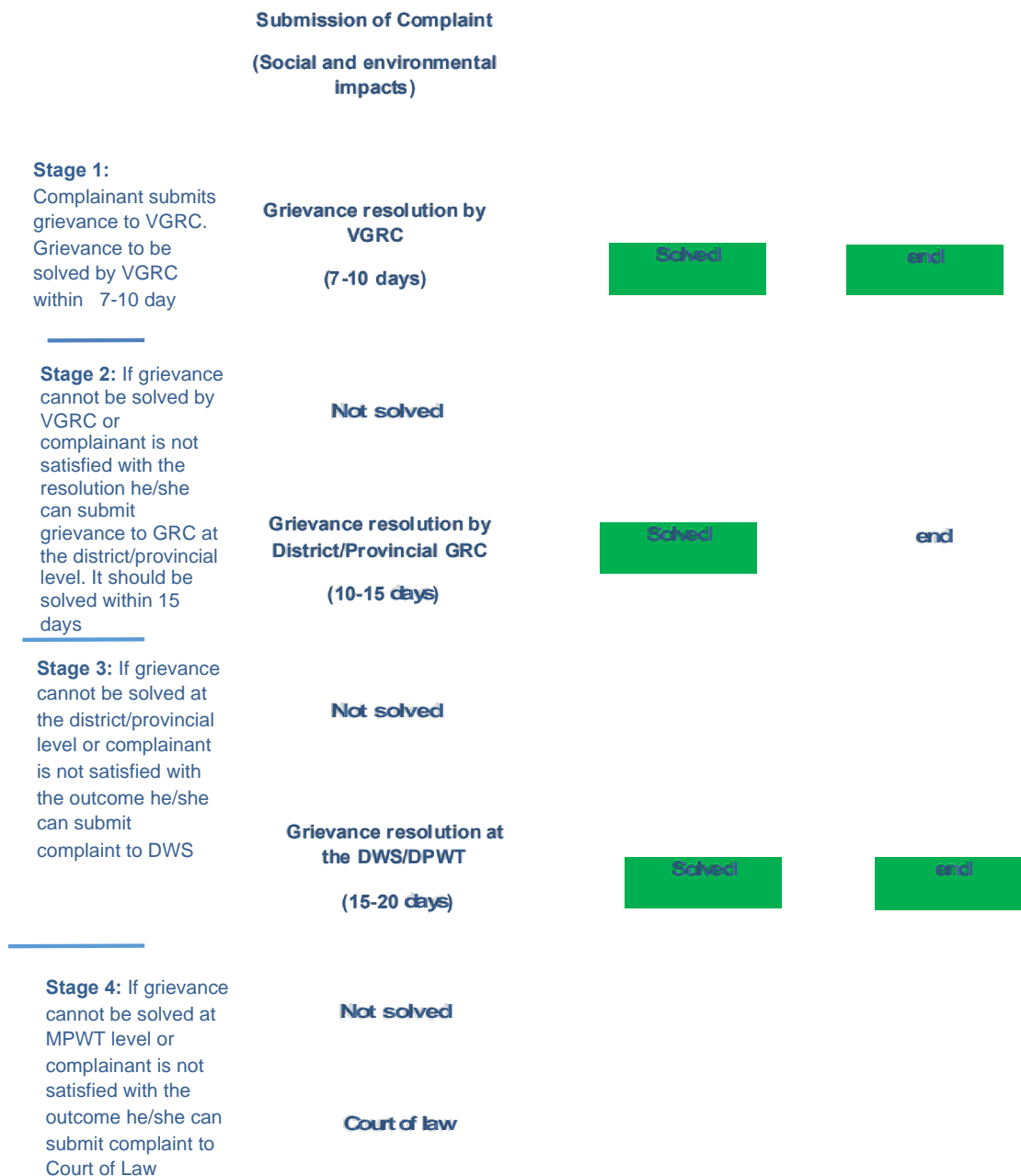


Figure 7-1 GRM Procedure

13. The list of contact person for grievance procedures is summarized in the following Table.

*Table 7-1 List of contact persons at the provincial and district levels*

No.	Name	Position	Phone
Phongsaly Province			
1	Mr. Khaokham Southammavong	Phongsaly DPWT	02023909222
2	Mr. Maody Siththikhoun	Samphanh district, PWT Office	02091199331
3	Mr. Oudeth Manyvong	Khoua district, PWT Office	02028765430
4	Mr. Chommany Vilavong	Mai district, PWT office	02055033435
5	Mr. Khamsean	Bountai district, PWT office	02097777568

180. People can also submit their grievances directly to the centralized GRM hotline of the project at 020 5836 8779.

181. The communities and individuals who believe that they are adversely affected by a WB supported project may submit complaints to existing project level grievance redress mechanism or the WB's Grievance Redress Service (GRS). The GRS ensures that complaints received are promptly reviewed in order to address project-related concerns. Project affected communities and individuals may submit their complaints to the WB's independent Inspection Panel which determines whether harm occurred, or could occur, as a result of WB non-compliance with its policies and procedures. Complaints may be submitted at any time after concerns have been brought directly to the WB's attention, and Bank Management has been given an opportunity to respond. For information on how to submit complaints to the World Bank's corporate Grievance Redress Service (GRS), please visit [www.worldbank.org/grs](http://www.worldbank.org/grs). For information on how to submit complaints to the World Bank Inspection Panel, please visit [www.inspectionpanel.org](http://www.inspectionpanel.org)

## 8 Annexures

### Annex 1 Environmental and Social Eligibility Screening

Screening for Eligibility based on the Project's Negative list.

The project's negative list—meaning activities that are prohibited from receiving financing—

- i. Water treatment, water supply, sewage treatment or other works with serious adverse effects on wetlands or natural waterways, through pollution or hydrological changes.
- ii. Significant conversion or degradation of natural habitat or where the conservation and/or environmental gains do not clearly outweigh any potential losses.
- iii. Use of pesticides on the World Health Organization's Hazardous Pesticides List.
- iv. Works which would adversely affect significant cultural property, including archaeological and historical sites.
- v. Purchase or lease of land which has unclear titles.
- vi. Trade in wildlife and wildlife products is prohibited under the CITES convention.
- vii. Release of genetically altered organisms into the natural environment.
- viii. Radioactive products
- ix. Purchase of asbestos-containing products.
- x. Purchase and or trade in weapons.
- xi. Activities are likely to create adverse impacts on ethnic groups within the village and/or in neighboring villages or unacceptable to ethnic groups communities living in a village of mixed ethnic composition.









## **Annex 2 Typical Pipeline Alignments WSS.**

As the number of drawings are large, this annex only shows samples of pipeline layout maps which proves that the alignment fully avoided existing structures, houses and shops.

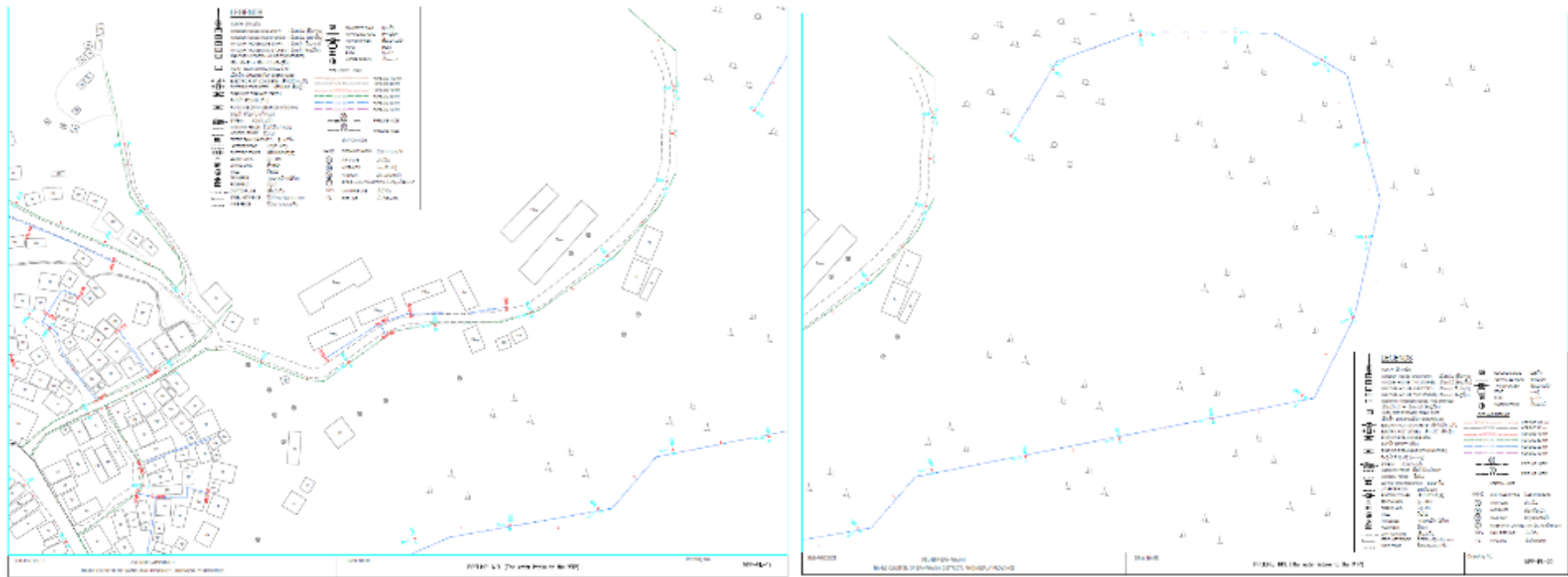
Annex 2.1 Typical Pipeline Alignments of WSS Namly Cluster

**LEGENDS**

	NORTH ທິດເໜືອ		
	WOODEN HOUSE (ONE STORY) ເຮືອນໄມ້ (ຊັ້ນດຽວ)		CONCRETE SLAB ປູເບຕົງ
	WOODEN HOUSE (TWO STORIES) ເຮືອນໄມ້ (ສອງຊັ້ນ)		ASPHALTED ROAD ທາງປູຢາງ
	MASONRY HOUSE (ONE STORY) ເຮືອນຫໍ່ (ຊັ້ນດຽວ)		TRANSFORMER ຫໍ່ແປງໄຟຟ້າ
	MASONRY HOUSE (TWO STORIES) ເຮືອນຫໍ່ (ສອງຊັ້ນ)		POND ໜອງ
	MASONRY-WOODEN HOUSE (TWO STORIES) ເຮືອນວິນລາ + ເຮືອນໄມ້ (ສອງຊັ້ນ)		WATER SPRING ນ້ຳອອກບໍ່
	HUTS, RICE STORAGE, SMALL SHOP ເລົ່າເຂົ້າ, ຮ້ານຂາຍເຄື່ອງ ຂະໜາດນ້ອຍ		TRAVERSE ຈຸດວາງເຄົ້າ (ມິກັດ)
	ELECTRIC POST (CONCRETE) ເສົາໄຟຟ້າ ເບຕົງ	<b>PIPE AND FITTINGS</b>	
	ELECTRIC POST (STEEL) ເສົາໄຟຟ້າ ເສົາເຫຼັກ		HDPE OD 225 mm
	ROAD SIDE DRAINAGE (EARTH) ຮ່ອງນ້ຳ ຂ້າງທາງ (ດິນ)		HDPE OD 180 mm
	ROAD SIDE DRAINAGE (ROCK MASONRY) ຮ່ອງນ້ຳ ຂ້າງທາງ (ກີບິນຜູ)		HDPE OD 180 mm
	STREAM ຫ້ວຍ/ແມ່ນ້ຳ		HDPE OD 110 mm
	MASONRY FENCE ຮົ່ວກໍ່ເປັນກໍ່ແຜງ		HDPE OD 90 mm
	WOODEN FENCE ຮົ່ວໄມ້		HDPE OD 75 mm
	LATERITE ROAD ທາງດິນແດງ		HDPE OD 63 mm
	ELECTRIC TOWER ເສົາໄຟຟ້າແຮງສູງ		HDPE OD 50 mm
	BENCHMARK ຫຼັກ BM		HDPE OD 40 mm
	BUSH ຝຸ່ມໄມ້		PIPELINE NODE
	GRASS LAND ທົ່ງຫຍ້າ		PIPELINE NODE
	TREE ຕົ້ນໄມ້		STATION NODE
	RICE FIELD ທົ່ງນາ		DISTANCE MARKS ໄລຍະການໝາຍ
			AIR VALVE ປະຕູລົມ
			HYDRANTS ກ້ອກດັບເລີງ
			WASHOUT ປະຕູລະບາຍນ້ຳ
			RIDER MAIN CONNECTION ຫໍ່ແຈກນ້ຳສະອາດ
			MAIN PIPE LINE ຫໍ່ນ້ຳຕົບ
			PIPE LINE ຫໍ່ນ້ຳສະອາດ

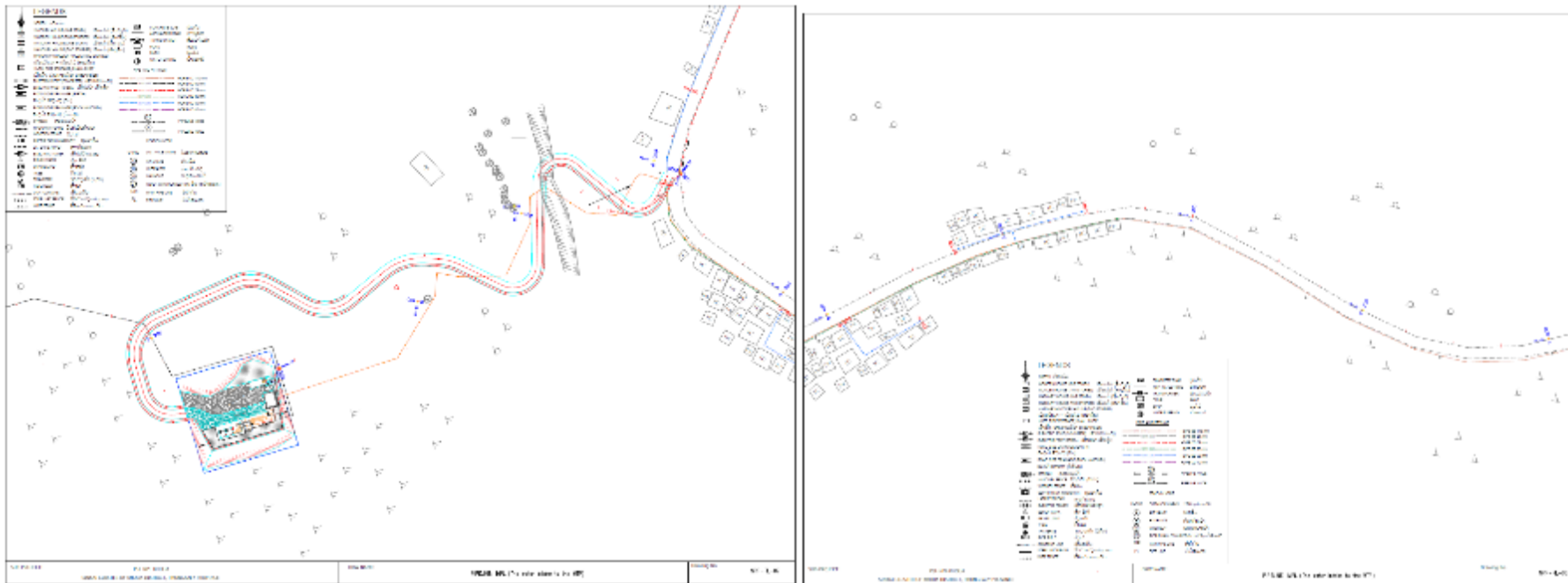


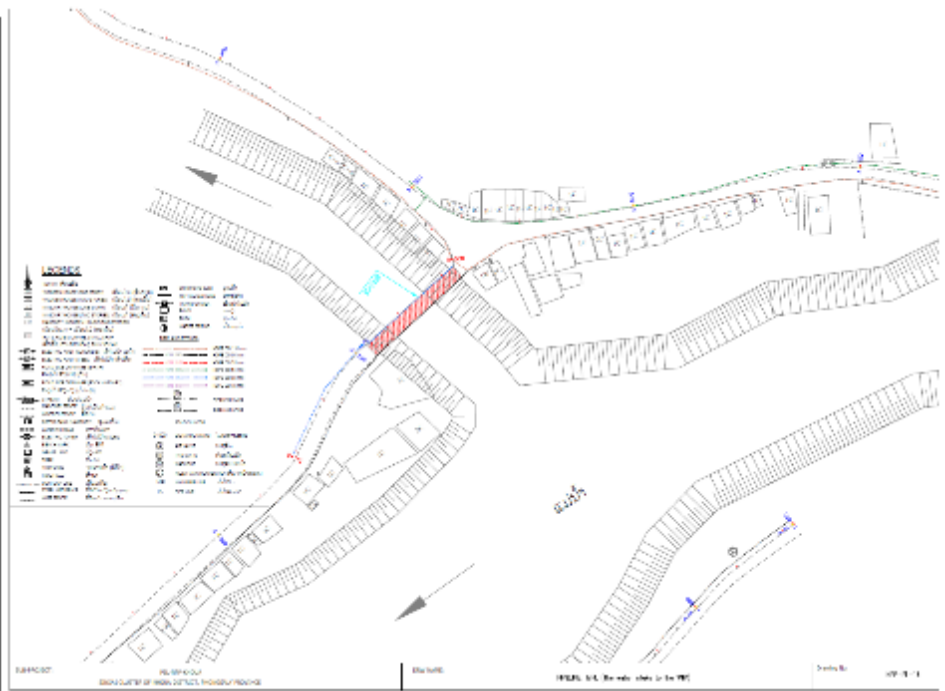
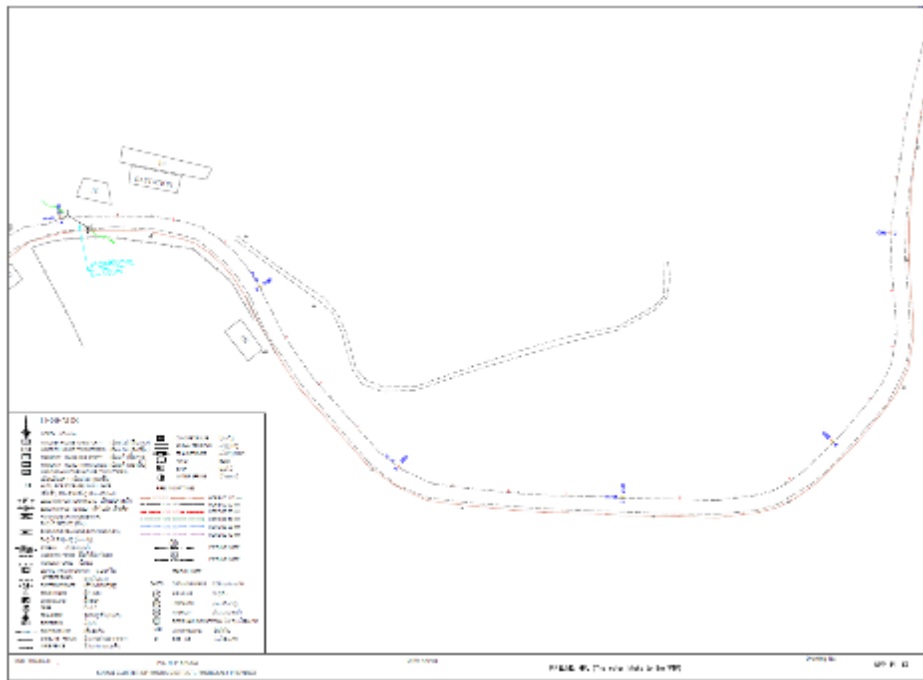




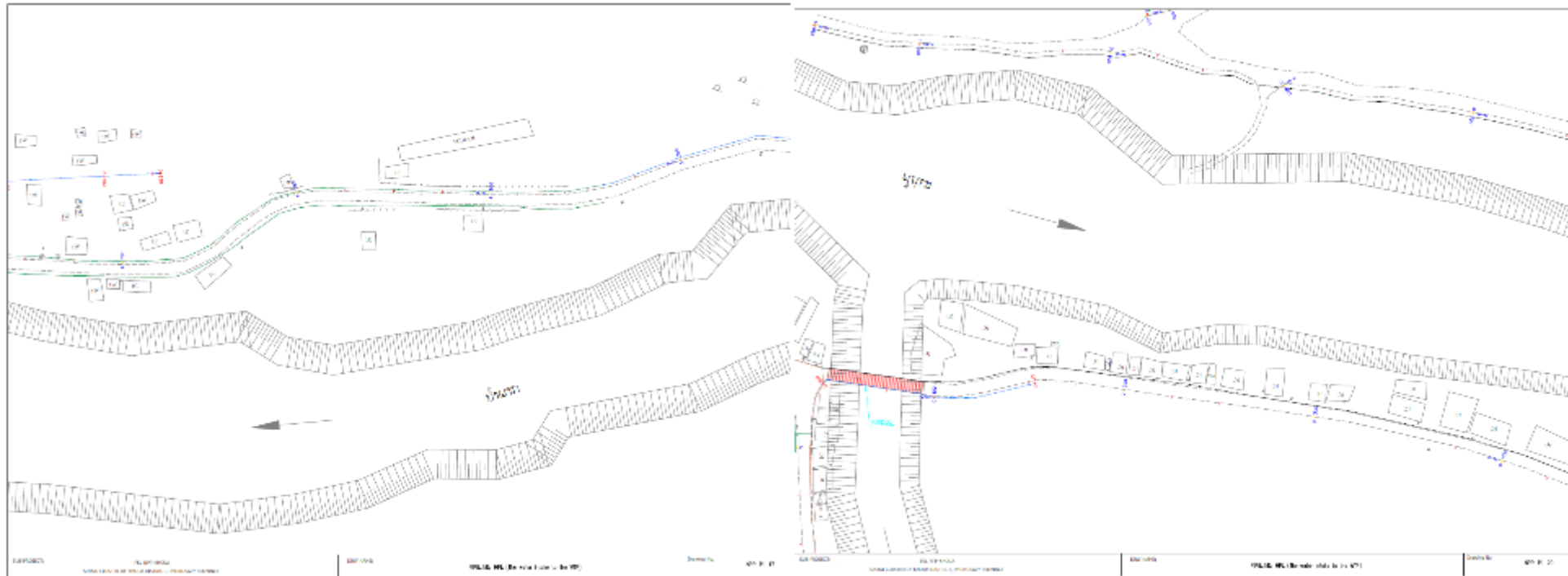
Annex 2.2 Typical Pipeline Alignments of WSS Sinxay Cluster Cluster

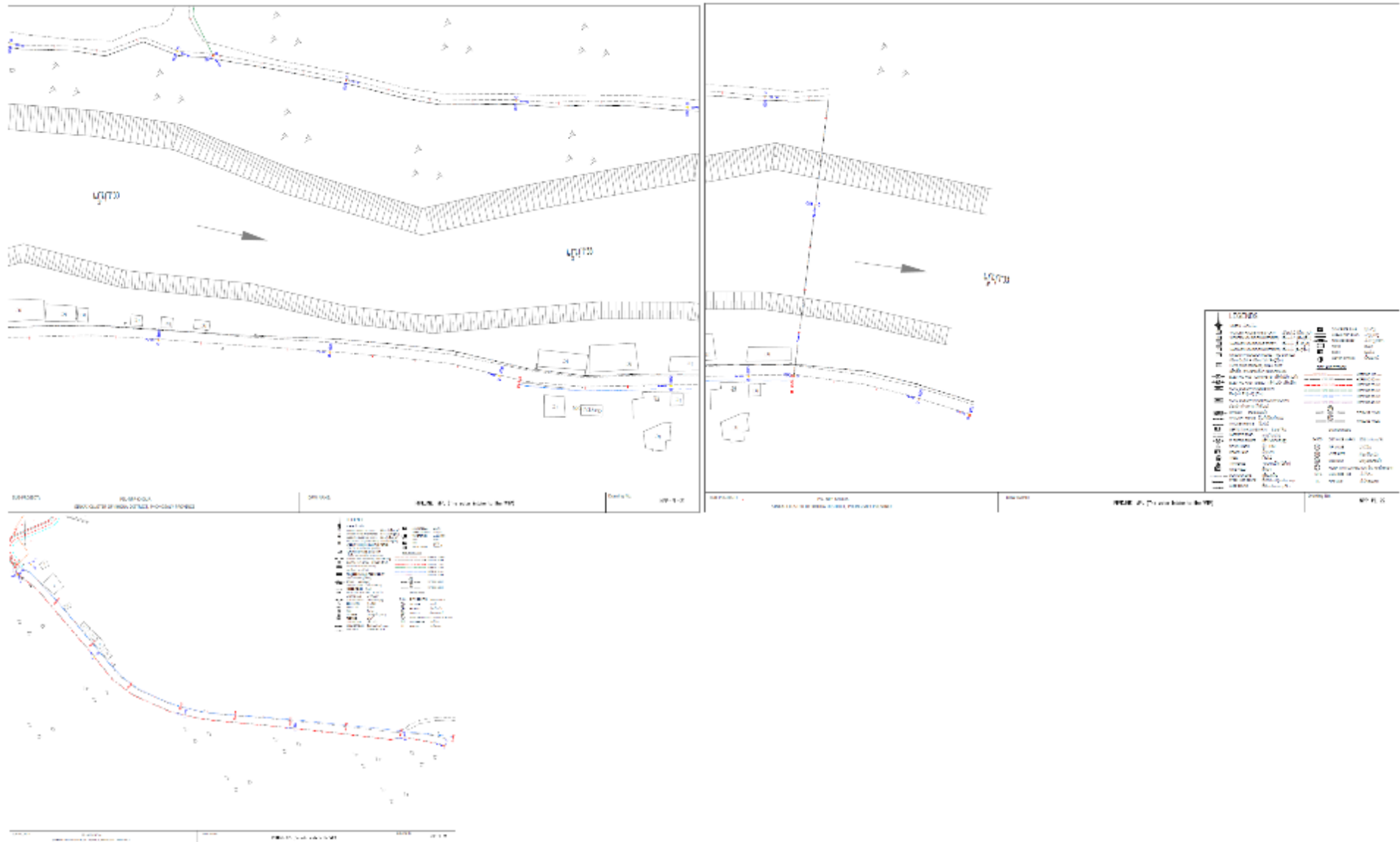
LEGENDS		
	NORTH	ທິດເໜືອ
	WOODEN HOUSE (ONE STORY)	ເຮືອນໄມ້ (ຊັ້ນດຽວ)
	WOODEN HOUSE (TWO STORIES)	ເຮືອນໄມ້ (ສອງຊັ້ນ)
	MASONRY HOUSE (ONE STORY)	ເຮືອນຫີ່ (ຊັ້ນດຽວ)
	MASONRY HOUSE (TWO STORIES)	ເຮືອນຫີ່ (ສອງຊັ້ນ)
	MASONRY+WOODEN HOUSE (TWO STORIES)	ເຮືອນວິນລາ + ເຮືອນໄມ້ (ສອງຊັ້ນ)
	HUTS, RICE STORAGE, SMALL SHOP	ເລົ່າເຂົ້າ, ຮ່ານຂາຍເຄື່ອງ ຂະໜາດນ້ອຍ
	ELECTRIC POST (CONCRETE)	ເສົາໄຟຟ້າ ເບຕົງ
	ELECTRIC POST (STEEL)	ເສົາໄຟຟ້າ ເສົາເຫຼັກ
	ROAD SIDE DRAINAGE (EARTH)	ຮ່ອງນ້ຳ ຂ້າງທາງ (ດິນ)
	ROAD SIDE DRAINAGE (ROCK MASONRY)	ຮ່ອງນ້ຳ ຂ້າງທາງ (ກີ່ຫີນຜູ)
	STREAM	ຫ້ວຍ/ແມ່ນ້ຳ
	MASONRY FENCE	ຮິ່ວກໍ່ເປັນກໍ່ແຜງ
	WOODEN FENCE	ຮິ່ວໄມ້
	LATERITE ROAD	ທາງດິນແດງ
	ELECTRIC TOWER	ເສົາໄຟຟ້າແຮງສູງ
	BENCH MARK	ຫຼັກ BM
	BUSH	ຝຸມໄມ້
	GRASS LAND	ທົ່ງຫຍ້າ
	TREE	ຕົ້ນໄມ້
	RICE FIELD	ທົ່ງນາ
	CONCRETE SLAB	ປູເບຕົງ
	ASPHALTED ROAD	ທາງປູຢາງ
	TRANSFORMER	ໝໍ້ແປງໄຟຟ້າ
	POND	ໜອງ
	WATER SPRING	ນ້ຳອອກບໍ່
	TRAVERSE	ຈຸດວາງເຄົ້າ (ຝັກັດ)
PIPE AND FITTINGS		
	HDPE OD 225 mm	
	HDPE OD 180 mm	
	HDPE OD 150 mm	
	HDPE OD 110 mm	
	HDPE OD 90 mm	
	HDPE DN75 mm	
	HDPE OD 63 mm	
	HDPE OD 50 mm	
	HDPE OD 40 mm	
	PIPELINE NODE	
	STATION NODE	
	DISTANCE MARKS	ໄລຍະການໝາຍ
	AIR VALVE	ປະຕູລົມ
	HYDRANTS	ກ້ອນດັບເລີງ
	WASHOUT	ປະຕູລະບາຍນ້ຳ
	RIDER MAIN CONNECTION	ທໍ່ແຈກນ້ຳສະອາດ
	MAIN PIPE LINE	ທໍ່ນ້ຳຕົ້ນ
	PIPE LINE	ທໍ່ນ້ຳສະອາດ







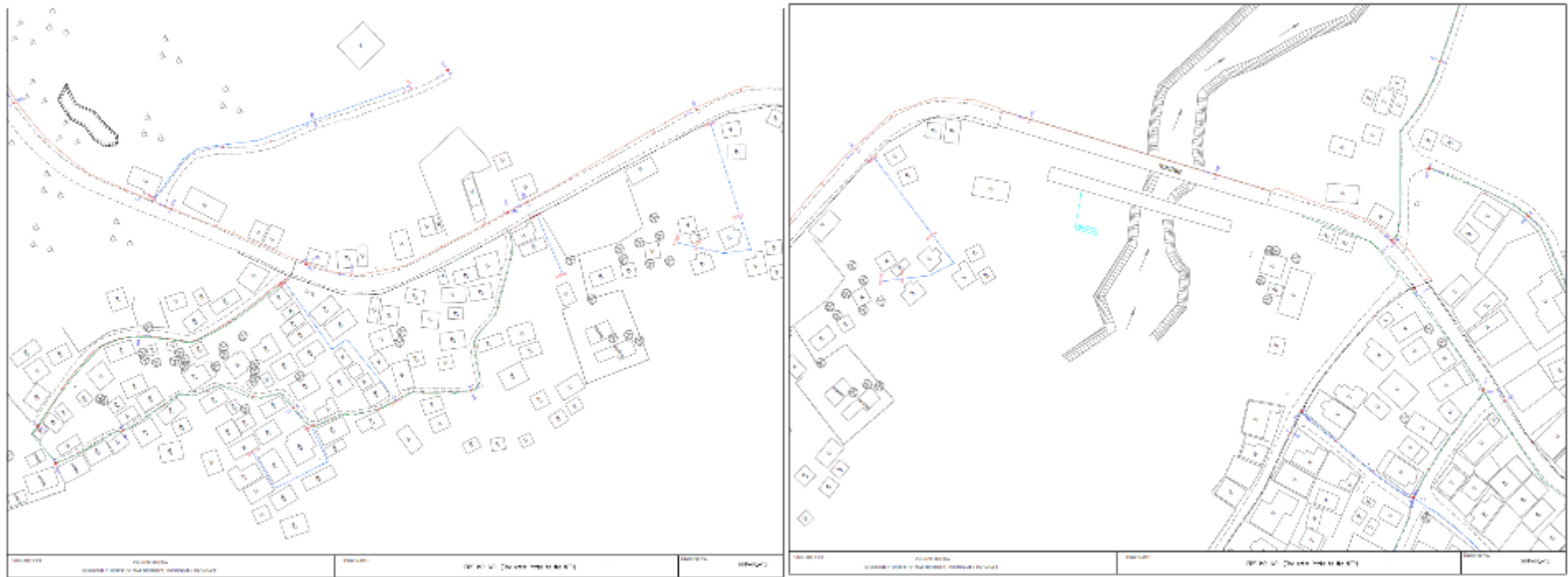




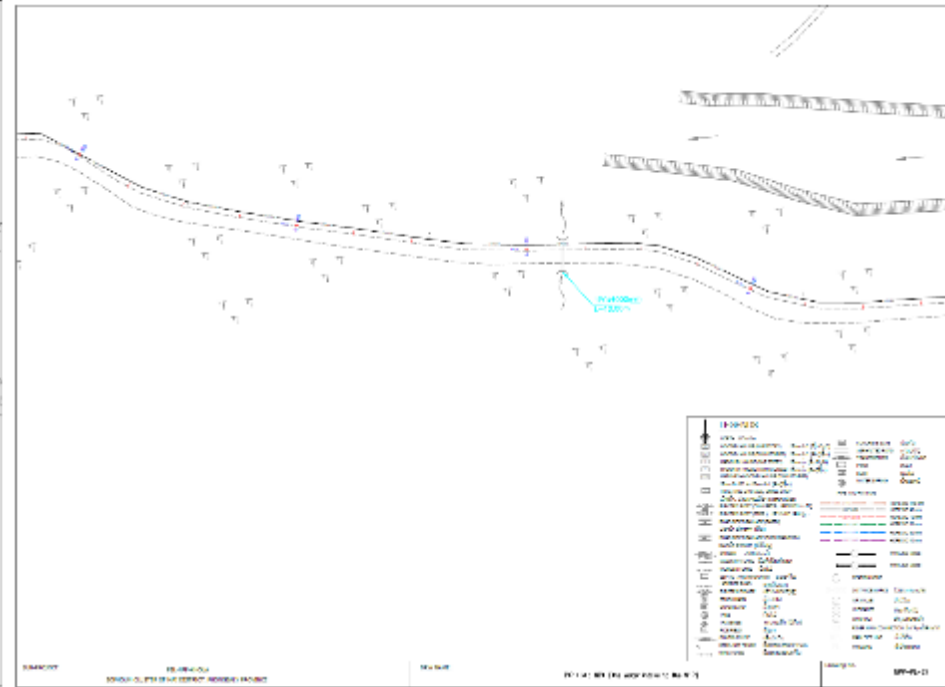
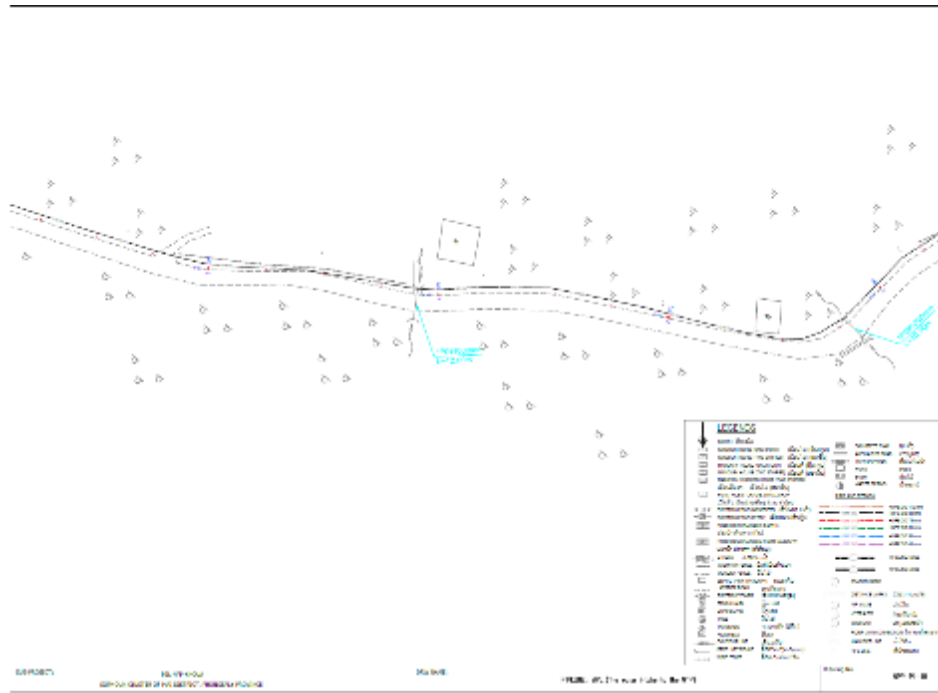
Annex 2.3 Typical Pipeline Alignments of WSS Sophon Cluster

LEGENDS		
	NORTH	ທິດເໜືອ
	WOODEN HOUSE (ONE STORY)	ເຮືອນໄມ້ (ຊັ້ນດຽວ)
	WOODEN HOUSE (TWO STORIES)	ເຮືອນໄມ້ (ສອງຊັ້ນ)
	MASONRY HOUSE (ONE STORY)	ເຮືອນຫີ່ (ຊັ້ນດຽວ)
	MASONRY HOUSE (TWO STORIES)	ເຮືອນຫີ່ (ສອງຊັ້ນ)
	MASONRY+WOODEN HOUSE (TWO STORIES)	ເຮືອນວິນລາ + ເຮືອນໄມ້ (ສອງຊັ້ນ)
	HUTS, RICE STORAGE, SMALL SHOP	ເລົ່າເຂົ້າ, ຮ່ານຂາຍເຄື່ອງ ຂະໜາດນ້ອຍ
	ELECTRIC POST (CONCRETE)	ເສົາໄຟຟ້າ ເບຕົງ
	ELECTRIC POST (STEEL)	ເສົາໄຟຟ້າ ເສົາເຫຼັກ
	ROAD SIDE DRAINAGE (EARTH)	ຮ່ອງນ້ຳ ຂ້າງທາງ (ດິນ)
	ROAD SIDE DRAINAGE (ROCK MASONRY)	ຮ່ອງນ້ຳ ຂ້າງທາງ (ກີ່ຫີນຜູ)
	STREAM	ຫ້ວຍ/ແມ່ນ້ຳ
	MASONRY FENCE	ຮິ້ວກໍ່ເປັນກໍ່ແຜງ
	WOODEN FENCE	ຮິ້ວໄມ້
	LATERITE ROAD	ທາງດິນແດງ
	ELECTRIC TOWER	ເສົາໄຟຟ້າແຮງສູງ
	BENCH MARK	ຫຼັກ BM
	BUSH	ຝຸມໄມ້
	GRASS LAND	ທົ່ງຫຍ້າ
	TREE	ຕົ້ນໄມ້
	RICE FIELD	ທົ່ງນາ
	CONCRETE SLAB	ປູເບຕົງ
	ASPHALTED ROAD	ທາງປູຢາງ
	TRANSFORMER	ໝໍ້ແປງໄຟຟ້າ
	POND	ໜອງ
	WATER SPRING	ນ້ຳອອກບໍ່
	TRAVERSE	ຈຸດວາງເຄົ້າ (ຝັກັດ)
PIPE AND FITTINGS		
	HDPE OD 225 mm	
	HDPE OD 180 mm	
	HDPE OD 150 mm	
	HDPE OD 110 mm	
	HDPE OD 90 mm	
	HDPE DN75 mm	
	HDPE OD 63 mm	
	HDPE OD 50 mm	
	HDPE OD 40 mm	
	PIPELINE NODE	
	STATION NODE	
	DISTANCE MARKS	ໄລຍະການໝາຍ
	AIR VALVE	ປະຕູລົມ
	HYDRANTS	ກ້ອນດັບເລີງ
	WASHOUT	ປະຕູລະບາຍນ້ຳ
	RIDER MAIN CONNECTION	ທໍ່ແຈກນ້ຳສະອາດ
	MAIN PIPE LINE	ທໍ່ນ້ຳຕົ້ນ
	PIPE LINE	ທໍ່ນ້ຳສະອາດ







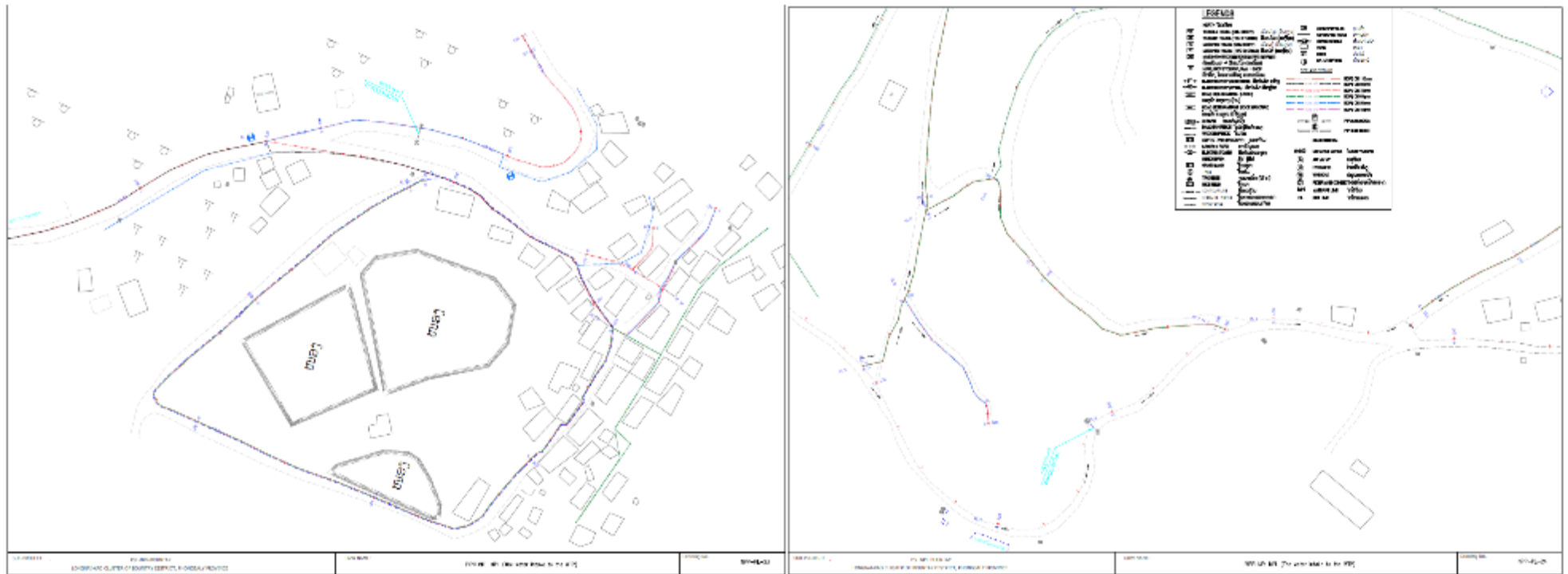


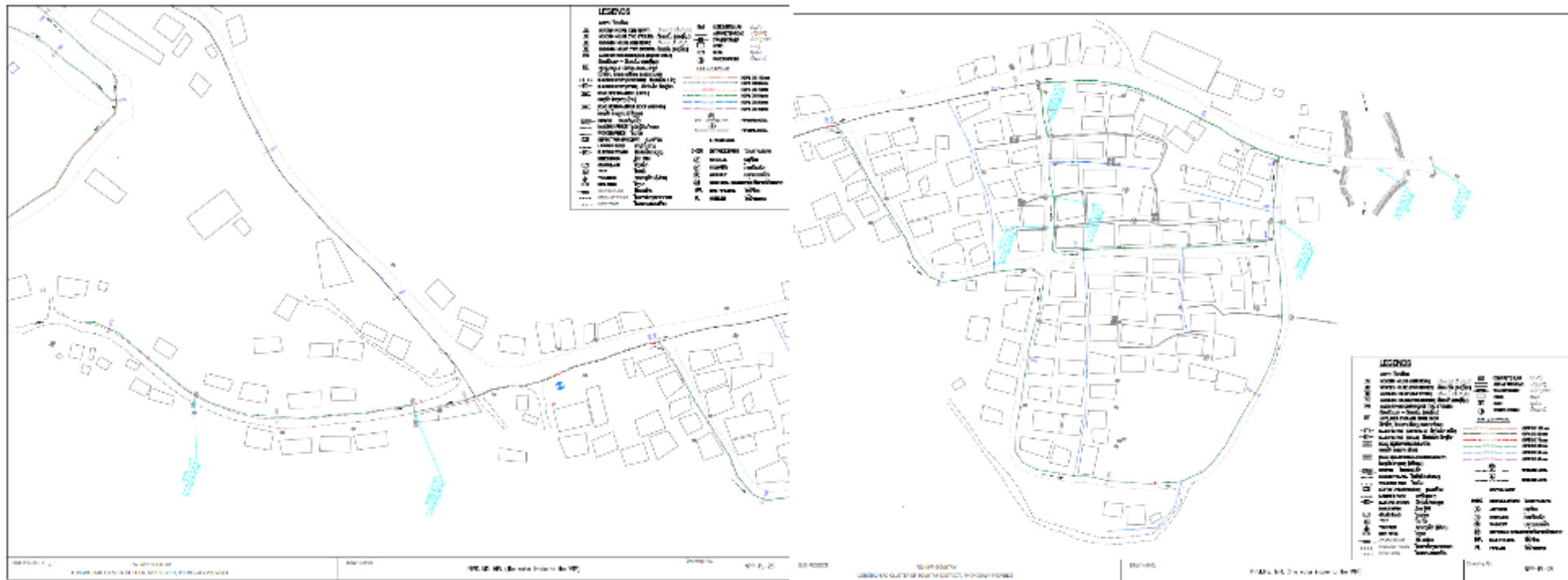


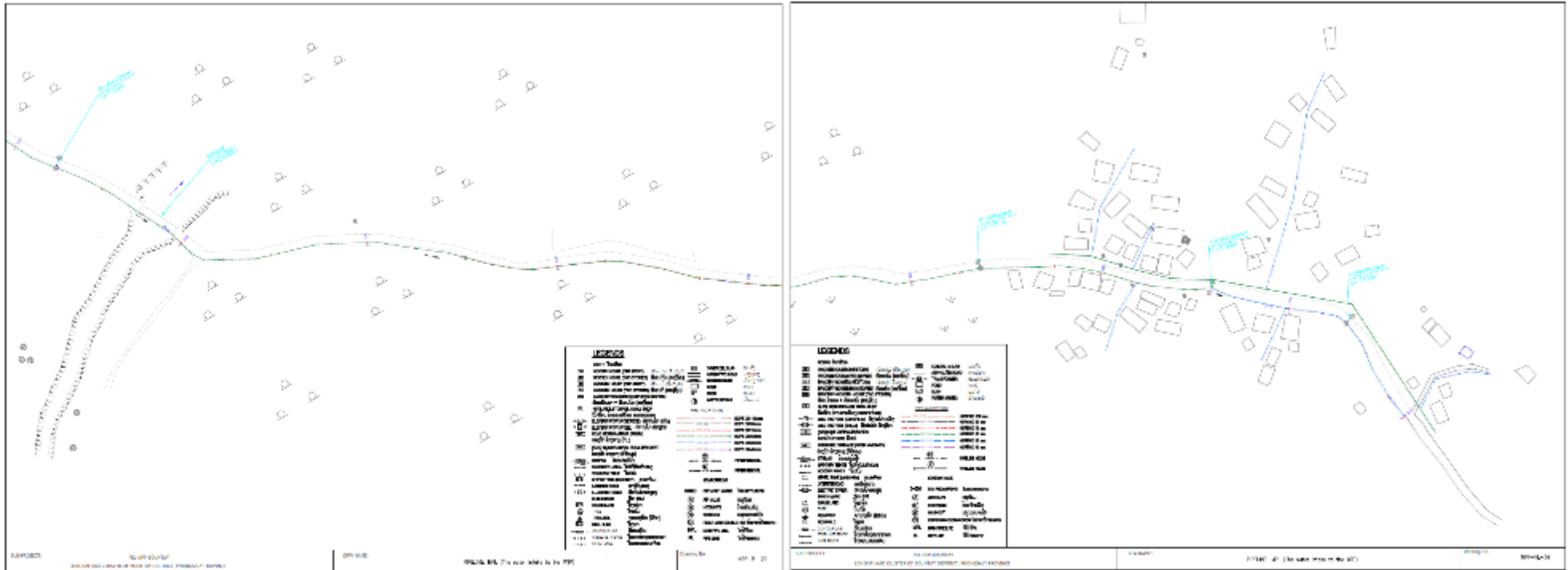
Annex 2.4 Typical Pipeline Alignments of WSS Longnai-Kao Cluster

LEGENDS		
	NORTH	ທິດເໜືອ
	WOODEN HOUSE (ONE STORY)	ເຮືອນໄມ້ (ຊັ້ນດຽວ)
	WOODEN HOUSE (TWO STORIES)	ເຮືອນໄມ້ (ສອງຊັ້ນ)
	MASONRY HOUSE (ONE STORY)	ເຮືອນຫໍ່ (ຊັ້ນດຽວ)
	MASONRY HOUSE (TWO STORIES)	ເຮືອນຫໍ່ (ສອງຊັ້ນ)
	MASONRY+WOODEN HOUSE (TWO STORIES)	ເຮືອນວິນລາ + ເຮືອນໄມ້ (ສອງຊັ້ນ)
	HUTS, RICE STORAGE, SMALL SHOP	ເລົ່າເຂົ້າ, ຮ່ານຂາຍເຄື່ອງ ຂະໜາດນ້ອຍ
	ELECTRIC POST (CONCRETE)	ເສົາໄຟຟ້າ ເບຕົງ
	ELECTRIC POST (STEEL)	ເສົາໄຟຟ້າ ເສົາເຫຼັກ
	ROAD SIDE DRAINAGE (EARTH)	ຮ່ອງນ້ຳ ຂ້າງທາງ (ດິນ)
	ROAD SIDE DRAINAGE (ROCK MASONRY)	ຮ່ອງນ້ຳ ຂ້າງທາງ (ກໍ່ຫີນຜູ)
	STREAM	ຫ້ວຍ/ແມ່ນ້ຳ
	MASONRY FENCE	ຮົ່ວກໍ່ເປັນກໍາແພງ
	WOODEN FENCE	ຮົ່ວໄມ້
	LATERITE ROAD	ທາງດິນແດງ
	ELECTRIC TOWER	ເສົາໄຟຟ້າແຮງສູງ
	BENCH MARK	ຫຼັກ BM
	BUSH	ຝຸມໄມ້
	GRASS LAND	ທົ່ງຫຍ້າ
	TREE	ຕົ້ນໄມ້
	RICE FIELD	ທົ່ງນາ
	CONCRETE SLAB	ປູເບຕົງ
	ASPHALTED ROAD	ທາງປູຢາງ
	TRANSFORMER	ໝໍ້ແປງໄຟຟ້າ
	POND	ໜອງ
	WATER SPRING	ນ້ຳອອກບໍ່
	TRAVERSE	ຈຸດວາງເຄົ້າ (ຝັກັດ)
PIPE AND FITTINGS		
	HDPE OD 225 mm	
	HDPE OD 180 mm	
	HDPE OD 160 mm	
	HDPE OD 110 mm	
	HDPE OD 90 mm	
	HDPE DN75 mm	
	HDPE OD 63 mm	
	HDPE OD 50 mm	
	HDPE OD 40 mm	
	PIPELINE NODE	
	STATION NODE	
	DISTANCE MARKS	ໄລຍະການໝາຍ
	AIR VALVE	ປະຕູລົມ
	HYDRANTS	ກ້ອນດັບເຜິງ
	WASHOUT	ປະຕູລະບາຍນ້ຳ
	RIDER MAIN CONNECTION	ທໍ່ແຈກນ້ຳສະອາດ
	MAIN PIPE LINE	ທໍ່ນ້ຳຕົບ
	PIPE LINE	ທໍ່ນ້ຳສະອາດ









**[ PROJECT NAME]**

**P164901**

**[ PROVINCE ]**

**CONTRACTOR'S ENVIRONMENTAL AND SOCIAL  
MANAGEMENT PLAN (C-ESMP)**

*{each contractor prepare one C-ESMP for each WSS system}*

**Contract Package: [Code]**

**District/Villages: [ ]**

**Name of Contractor: [ ]**

**Month [ ] Year [ ]**

### GENERAL INFORMATION

<b>1. Contract Package</b>	[contract code] [Scope of work]
<b>2. Contractor</b>	<b>Contractor [name]</b> Address: [ ] Representative: [name]                      Position: [ ] Mobile Phone:                                      Email:
<b>3. Contract Duration</b>	Contract signing date: Start Date [ ]    End Date [ ] (Total days: )
<b>4. Contractor's reviewer</b>	
<b>5. Issuance Date</b>	
<b>6. PMU/CSC Reviewer)</b>	
<b>7. Date of Approval</b>	
<b>8. Distributed to</b>	

## CONTRACTOR'S COMMITMENT

We are [name of contractor], the entity that will execute the [code and name of contract package, work content] of the [name of Project].

At required by the Project, herewith we submit the **Contractor's Environmental and Social Management Plan (C-ESMP)** for the above-mentioned contract package for consideration and approval by the CSC/PMU.

We know that there are potential environmental, health and safety risks and negative impacts at the constructions sites and at places disturbed by the construction activities. There are also the risks of social impacts and disturbances to the local communities and the public caused by construction activities and the labour influx. We are committed to comply with the Project's ESMP requirements, the Environmental, Social, Health and Safety provisions stated in the bidding documents and construction contract. We also commit to fully implement measures to mitigate impacts and manage environmental, social, health and safety risks as highlighted in this C-ESMP throughout the implementation of this package.

## CONTRACTOR'S REPRESENTATIVE

[sign]

TABLE OF CONTENTS

**ILEGAL BASIS**

The Contractor's Environmental and Social Management Plan (C-ESMP) of the Contract package [Code] has been prepared based on Lao's laws and legal regulations as listed in the Project's Environmental and Social Management Framework and the approved Environmental and Social Management Plan (ESMP) prepared for [ name ] Province. This plan will also comply with the Environmental, Social, Health and Safety (ESHS) requirements specified in the bidding document.

[specify if there is any updated legislations. Delete this paragraph is there is no update]

**II CONTRACTOR'S POLICIES ON ESHS**

[Describe and list the objectives and policies on ESHS the contractor has been applying to the works the contractor is performing and/or will perform when implementing the contract]

**III WORK CONTENTS OF THE CONTRACT PACKAGE**

Contents of work **Package** [name and scope of work under the contract]

**3.1 Construction Location:**

Contract Package [Code and name] will be constructed in the area of [name the province, district, communes and villages]. The location map of the project area are shown in **Figure 1**.

[ add maps showing the location of all work and ancillary work items, including the water intake, water treatment plants and access roads, transmission and distribution pipelines, worker's camps and accommodation, parking and storage areas, disposal sites etc. ]

**Figure 1 – Project Locations****3.2 Basic Technical Information**

[Provide key technical parameters and diagrams of EACH work item as relevant].

**3.2.1 Resources Mobilised and Emissions****Table 1 - Machinery and equipment**

Item	Quantity	Status
Excavator		
Crane		
....		

**Table 2 – Workers Mobilised**

Site	Total	Male	Female	Local Labors
Intake				
WTP and Ancillary Works				
Pipelines				
Office				

**Table 3 – Workers Accommodations**

Site	Rent/Install	Descriptions and photos
Intake		[provide information about locations, size, arrangements for electricity/ water supply/ drainage/sanitation, safety instruments such as first aid kits, portable fire prevention bottles etc.]
WTP and Ancillary Works		
Pipelines		
Office		

**Table 4 – Earthworks**

	Location	Filling	Excavation	Reuse	Disposal
1	Intake				
2	WTP sites				
3	Pipelines				
4	Office				

**Table 5 -Source of Filling Materials**

	Location	Licensed/Agreements	Descriptions
1	Intake		
2	WTP sites		
3	Pipelines		
4	Office		

**Table 6 - Disposal Option**

	Location	Licensed/Agreements	Descriptions
1	Intake		
2	WTP sites		
3	Pipelines		

**Transportation Routes**

Ancillary work items and arrangements as relevant:

- Electricity and Water Supply at the construction site
- Workers's accommodation
- Disposal Sites

**3.2.2 Water Intake**

[Drawing showing the structure, the layout showing the construction site, camps, parking and storage areas, flow diversion, etc. and photos showing the locations and existing conditions with layout)

Location:

Construction duration: [from dd/mm/yy.... To dd/mm/yy ]

Accessibility from the main road

[describe how to access to the water intake site from the main road]

**3.2.3 Water Treatment Plant and Access Road, Power lines and Substation**

[Drawing showing the structure, the layout showing the construction site, camps, parking and storage areas, flow diversion, etc. and photos showing the locations and existing conditions with layout)

Location:

Construction duration: [from dd/mm/yy.... To dd/mm/yy ]

Accessibility from the main road

[describe how to access to the water intake site from the main road]

Ancillary work items and arrangements as relevant:

- Electricity and Water Supply at the construction site

### 3.2.4 WTP Office

[Drawing showing the structure, the layout showing the construction site, camps, parking and storage areas, flow diversion, etc. and photos showing the locations and existing conditions with layout]

Location:

Construction duration: [from dd/mm/yy.... To dd/mm/yy ]

Ancillary work items and arrangements as relevant:

- Electricity and Water Supply at the construction site

### 3.2.5 Pipelines System (Transmissions and Distribution)

[Drawing showing the pipeline alignment, camps, parking and storage areas, flow diversion, etc. and photos showing the locations and existing conditions with layout]

Location:

Construction duration: [from dd/mm/yy.... To dd/mm/yy ]

[Map, photos of the dumping area and transportation route ]

### 3.2.6 Licenses and Agreements

**[List the types of licenses and agreements contractors required to obtain]**

## III ENVIRONMENTAL AND SOCIAL IMPACTS AND RISKS, MITIGATION MEASURES

### 4.1. Main Physical Activities

**Table 7 – Physical Interventions**

	Location	Main Physical Activities (in sequence and duration)
1	Intake	
2	WTP sites	
3	Pipelines	
4	Office	

### 4.2 Common Construction Activities

[List the main construction activities the contractor will perform (e.g. site clearing, camping, temporary warehouses, mobilizing machinery workers and supplies, earthworks, casting piles, drilling, piling, piling, piling, beaming, etc., finishing, returning, cleaning] depending on the characteristics of each package. Such activities will help clarify/guide the source of impact and the types of possible impacts]

The main construction activities that will take place during the construction phase include [below are just examples, let's update]:

- Vegetation clearing, clearing of premises
- Build camps, construction site offices, pile casting yards, ...
- Mobilize machinery and workers to the construction site
- Earthworks
- Blocking the flow of construction, Construction and installation of works
- Crane loading and unloading temporary gathering of materials (rainwater drainage pipes, earthworks, stones, sand ...)
- Transporting waste to landfills...

#### 4.2 General Impact and mitigation measures

Referring to the ESMP, the Contractor has identified the socio-environmental impacts and risks of the package as below [the contractor reviews and re-examines the general impact list, below is just a suggestion]:

- Generation of dust, exhaust gases, odors, noise, vibration
- Generation of solid waste from excavated soil, dredged sludge, construction waste and domestic waste from camps
- Risks of water pollution due to increased turbidity, grease, e coli from stormwater runoff and wastewater emission
- Sedimentation and local waterlogging
- Impacts and risks at quarries and borrowed land mines such as loss of vegetation and vegetation cover, soil slippage, erosion, safety risks, etc.
- Disturbance, damage to vegetation and greenery cover
- Disturbances and increased traffic safety risks
- Damage existing infrastructure and/or disrupt related services
- Social disturbances, local insecurity and order related to worker concentration
- Risks to community and workers
- There may be cultural, historical, archaeological artifacts revealed during earthworks.

For the general impacts of construction activities listed above, the construction unit will organize the implementation of measures to reduce MXSA impacts and risks in accordance with the Environmental Codes of Practice (ECOPs) and require workers to comply with the Code of Conduct presented in Table 4 below.



4.3. Site specific and Type specific Mitigation Measures

[prepare with reference to ESMP and construction progress ]

Table 9 – Site/Type Specific Mitigation Measures at Intake

	Location	Photos	Existing Conditions and Risks	Mitigation Measures
1				

Table 10 – Site/Type Specific Mitigation Measures at WTP

	Location, main construction activity	Photos	Existing Conditions and Risks	Mitigation Measures
1				

Table 11 – Site/Type Specific Mitigation Measures along Access Road

	Location, main construction activity	Photos	Existing Conditions and Risks	Mitigation Measures
1				

Table 12 – Site/Type Specific Mitigation Measures at Office

	Location, main construction activity	Photos	Existing Conditions and Risks	Mitigation Measures
1				

Table 13 – Site/Type Specific Mitigation Measures along Transmission Pipelines

	Location, main construction activity	Photos	Existing Conditions and Risks	Mitigation Measures
1				

	Location, main construction activity	Photos	Existing Conditions and Risks	Mitigation Measures

Table 14 – Site/Type Specific Mitagation Measures along Distribution Pipelines

	Location, main construction activity	Photos	Existing Conditions and Risks	Mitigation Measures
1				

Others .....

**Camps**

ESHS issues that may arise in relation to workers include (hereinafter are only suggestions);

- Generation of solid waste and domestic wastewater from camps. If waste and wastewater are not managed well, it can cause odors, water pollution, soil pollution, affect aesthetics in the area, and cause health risks for workers and local people.
- Risks of accidents and fires related to the use of electricity and fuel for daily life and cooking.
- Risk of social disturbance, insecurity and order in the locality if workers behave inappropriately
- Health risks for workers if conditions at the accommodation are not satisfactory (due to pollution, water quality, insects/viruses/bacteria; workers are at risk of contracting infectious diseases if they lead unhealthy lifestyles or participate in social evils such as gambling, prostitution, etc drug....

To manage and minimize the above impacts and risks, the contractor will arrange accommodation for workers as follows.

*Camp Layout*

[include photos of camp locations and show shack locations on maps and diagrams of the layout of ancillary items to ensure MXSA

Describe how sleeping spaces, kitchens, toilets, showers, water and electricity are arranged, drainage, sanitation, temporary storage and solid waste collection in encampment areas, fire extinguishers, medicine cabinets/first aid bags - focusing on ESHS assurance criteria

*Training for workers on ESH (in living and construction)*

- Describe a training plan for workers on ESHS that the contractor will implement

**Temporary material gathering yard**

Here are just suggestions

The main impacts and risks in the temporary gathering area include safety risks to the community during loading and unloading and temporarily gathering bulky components, risks of leakage and explosion of fuels such as gasoline ... The following mitigation measures will be applied: (description and inclusion in photographs, diagrams, etc.)

List, include in diagrams and describe the layout of mitigation measures such as barriers, warnings, signs, assignments of people on duty ... (description and inclusion in photos, diagrams...)

**Pile Casting Yard**

Here are suggestions, contractors see for finalization

---

The main impacts and risks at the pile casting site include safety risks to the community while loading and unloading piles, rainwater runoff carrying sand and grease, risks of leakage and explosion of fuels such as gasoline, etc. The Contractor shall apply the following mitigation measures:

List, include in diagrams and describe the layout of mitigation measures such as barriers, warnings, signs, assignments of people on duty ...

### **Transportation Route**

List the names of the main routes that the transport vehicles will pass through during the construction of the package, describe the current condition of the road and the traffic situation on those routes, clearly state whether there are any sensitive locations on the route (schools, markets, dispensaries...).

#### **Location of transport routes and sensitive structures on the route**

Then assess the impact and propose mitigation measures

Suggest:

If transported by road: Increased traffic density will increase dust content and emissions. If the vehicle load is greater than the road load, it will cause damage to existing bridges and roads. The risk of traffic accidents, the impact of dust and noise from transport vehicles will also be higher in areas passing through markets, schools and medical facilities. The contractor may therefore undertake to limit the speed when passing through these sections, and to avoid rush hour traffic through those sections

If transported by road, the main impacts will include disturbances and increased risks to water traffic safety, especially at night;

## **Annex 4. Draft Template for Monthly Environmental, Health and Safety (ESHS) Monitoring Report**

(to be used by Construction Supervisors)

**Project Name**

**Province ....**

**ENVIRONMENTAL, SOCIAL, HEALTH AND  
SAFETY (ESHS)  
MONTHLY MONITORING REPORT**

---

**Reporting Period: Month... Year...**

**Prepared by:**

**Date of Submission to PMU/PIA:**

**Reviewed/Approved by:**



	Involuntary Resettlement	
<b>Status of C-ESMP</b>	<i>{Read and delete: State if the C-ESMP has been drafted/ approved or updated etc.) and date}</i>	
<b>Reporting period:</b>		
<b>Last report date:</b>		
<b>Contract Sign and End date</b>		
<b>Construction Start Date</b>		
<b>Key sub-project activities since last report:</b>	<p><i>{Read and delete: This section should include, among others, the following:}</i></p> <ul style="list-style-type: none"> <li>• Contract awarding</li> <li>• Progress of Work (% physical completion)</li> <li>• Status of Safeguard Approvals / Permits / Consents*</li> <li>• Note if a CAP is currently being implemented or not</li> </ul>	
<b>Report prepared by:</b>		

### 3. C-ESMP Implementation Monitoring

#### 3.1 Training on ESHS

*{Read and delete: Provide brief on training on ESHSs have been conducted during this report period}*

Table 8-2 Summary Training Activities

Date	Contents/Topics covered	Delivered by	Number of Participants, organization

#### 3.2 Status of C-ESMP Implementation and Compliance

*Read and delete: Summarize main mitigation/protection measures implemented in the reporting period.*

7. xxx

8. xxx

*{Read and delete: Include C-ESMP table or updated C-ESMP table if applicable. Assess compliance of environmental management activities with the ESMP. For that purpose, include additional columns entitled "Compliance Status", "Comment or Reasons for Non-Compliance", and "Issues for Further Action". Example is provided below.}*

#### Compliance with EMP Requirements (Environmental Performance

Table 8-3 Compliance with ESMP Requirements (Environmental Permeance)

EMP Requirements	Compliance Status (Yes, No, Partial)	Comment or Reasons for Non-Compliance	Issues for Further Action
Use environmental impact as main heading and EMP as listing (see example below)	Use ESMP list as basis for rating/evaluating compliance (see example below)		
<b>Pollution Control Measures</b>			

Table 8-4 Issue for Further Action

Issue	Required Action	Responsibility Timing	and Resolution
<b>Old Issues from Previous Reports</b>			
List of C- ESMP measures or activities not completed (last column of previous table)			
<b>New Issues from This Report</b>			

### 3.4 Health and Safety

*{Read and delete: Provide narrative of occupational and community health and safety issues that occurred during the reporting period. Any accident involving injury or death of workers or community members must be reported. Include investigation report of DOLISA as attachment to the report. Provide details in the Table below.}*

- 9.     xxx
- 10.    xxx

Table 8-5 Health and Safety Issue

Issue	Required Action	Responsibility Timing	and Resolution
<b>Old Issues from Previous Reports</b>			

<b>New Issues from This Report</b>			

### 3.5 Inspection, Meeting with Stakeholder

*{Read and delete: List the inspects, meetings with various stake holders, their feedbacks and follow up actions}*

11. xxx
12. xxx

### 4. Public Consultation and Information Disclosure

*{Read and delete: Describe public consultation activities during the reporting period. Confirm compliance with consultation plan defined in the ESMP and the RP(s), or justify deviation from these plans. Present planned consultation activities in next reporting period. Use Tables as appropriate.}*

- Field Visits (sites visited, dates, persons met)
- Public Consultations and meetings (Date; time; location; agenda; number of participants disaggregated by sex and ethnic group, not including project staff; Issues raised by participants and how these were addressed by the project team)
- Press/Media Releases
- Material development/production (e.g., brochure, leaflet, posters)
- Information disclosure

13. xxx
14. xxx

### 5. Grievance Redress Mechanism

*{Read and delete: Describe mechanisms established to address and redress public complaints and grievances related to social and environment safeguards. Summarize grievances received, if any, and measures implemented to redress them. Provide evidence of functional/operational GRM:*

1. letter that states that the GRM has been established and is operational, included as an attachment- the list of GRM members at each level, the PMU focal person for GRM and an implementation budget has been allocated.
2. Statements and supporting documents that GRM focal points have been mobilized and functioning in their role.
3. Pamphlet/Leaflet and Project Information Booklet that has the GRM steps explained and GRM focal point contact numbers handed out to all AHs and available at village halls. Evidence includes photos, distribution/attendance list and handout.

4. Evidence of consultation/verbal dissemination of the GRM to AHs and public consultation. Attach presentation materials, minutes of meetings, photos and attendance sheets.
  5. Photos of signage within the community and near construction sites with clear indication of first point of contact.
  6. Photos/scan of record keeping system is established and functioning such as grievance ledgers with entries.
- Number of new grievances, if any, since last monitoring period: \_\_\_\_
  - Number of grievances resolved: \_\_\_\_
  - Number of outstanding grievances: \_\_\_\_

Type of Grievance	Details (Date, person, address, contact details, etc.)	Required Responsibility and Timing	Action and Resolution
<b>Old Issues from Previous Reports</b>			
<b>New Issues from This Report</b>			

## 6. Conclusion

*{Read and delete: Highlight important results from the implementation of C-ESMP monitoring; recommendations to improve C- ESMP management, implementation, and monitoring; key activities planned in next reporting period}.*

15. xxx

16. xxx

## 7. Appendix

### 7.1 Construction Site Photos

*{Read and delete: add the photos of the construction site at all typical locations of each package with comments on the measures that have been implemented well and measures to be overcome. These photos must be returned to .jpeg and limited in capacity}*

### 7.2 Incident Reports

*{Read and delete: must be prepared as soon as possible after an incident has happened and attach to the monthly reports. Provide details about:*

- *Affirming any violation to current legislation or international treaties.*

- *Any fatal accident or serious accident.*
- *Serious impacts or damage to personal property such as traffic accidents, damage to people's houses, roads and other incidents.*
- *Seriously polluting surface or groundwater.*
- *Any allegations related to sexual harassment or sexual misconduct, child abuse, child labor, or other violations involving children*

### **7.3 Consent/permits**

### **7.4 Others**