NAM NGIEP 1
POWER COMPANY

Nam Ngiep 1 Hydropower Project

Quarterly Environment Monitoring Report
Second Quarter of 2021

April to June 2021

A	13 December 2021				Final
A0	01 October 2021	Hendra WINASTU	Wanidaporn RODE	Khamlar PHONSAVAT	To ADB and LTA for Review
REV	DATE	AUTHOR	CHECKED	APPROVED	MODIFICATION DETAILS

Accessibility	
☑	Public
☐	Internal
☐	Confidential

Document No.

NNP1-O-J0905-RP-002-A

Table of Contents

Table of Tables

Table of Figures

ABBREVIATIONS / ACRONYMS

AIP	Annual Implementation Plan
ADB	Asian Development Bank
BAC	Biodiversity Advisory Committee
BOF	Biodiversity Offset Framework
BOMC	Biodiversity Offset Management Committee
BOMP	Biodiversity Offset Management Plan
CA	Concession Agreement between the NNP1PC and GOL
CAP	Corrective Action Plan
COD	Commercial Operation Date
CVC	Conventional Vibrated Concrete
CWC	Civil Works Contract
EC	Electrolytic Conductivity
EIA	Environmental Impact Assessment
EMMR	Environmental Management and Monitoring Reports
EMO	Environmental Management Office of ESD within NNP1PC
EMU	Environmental Monitoring Unit
EMWC	Electrical-Mechanical Works Contract
EPF	Environmental Protection Fund
ESD	Environmental and Social Division of NNP1PC
ESMMP	Environmental and Social Monitoring and Management Plan
GOL	Government of Lao PDR
GIS	Geographic Information Systems
HMWC	Hydraulic Metal Works Contract
HR	Human Resources
IEE	Initial Environmental Examination
IMA	Independent Monitoring Agency
INRMP	Integrated Natural Resources Management Plan
ISP	Intergraded Spatial Planning
kV	kilo-Volt
LTA	Lender's Technical Advisor
MAF	Ministry of Agriculture and Forestry
MEM	Ministry of Energy and Mines, Lao PDR

MOM	Minutes of Meeting
MONRE	Ministry of Natural Resource and Environment, Lao PDR
MOU	Memorandum of Understanding
NCR	Non-Compliance Report
NNP1PC	Nam Ngiep 1 Power Company Limited
OC	Obayashi Corporation
ONC	Observation of Non-Compliance
OSOV	Owners' Site Office and Village
PAFO	Provincial Department of Agriculture and Forestry
PONRE	Provincial Department of Natural Resource and Environment, MONRE
RCC	Roller Compacted Concrete
SIR	Site Inspection Report
SMO	Social Management Office of ESD within NNP1PC
SMART	Spatial Monitoring and Reporting Tool
SOP	Standard Operating Procedure
SS-ESMMP	Site Specific Environmental and Social Monitoring and Management Plan
TOR	Terms of Reference
TSS	Total Suspended Solids
UAE	United Analysis and Engineering Consultant Company Ltd.
WMF	Watershed Management Fund
WMP	Watershed Management Plan
WRPC	Watershed and Reservoir Protection Committee
WRPO	Watershed and Reservoir Protection Office
WWTS	Wastewater Treatment System

1 EXECUTIVE SUMMARY

The quarterly environment monitoring reports of Nam Ngiep 1 Hydropower Project provides information and analysis of compliance with the environmental and social obligations of the Project stipulated in the Concession Agreement between the Nam Ngiep 1 Power Company (NNP1PC) and the Government of Lao PDR (GOL), and as required by environmental legislation of the Lao PDR, the ADB Safeguard Policy Statement and IFC Performance Standards. The Company ensures compliance with these requirements through implementation of project specific sub-plans, programmes and activities prepared as part of the Environmental and Social Management and Monitoring Plan for the Operation Phase (ESMMP-OP).

During Q2 2021, the 11 ISO committee members and other 13 assigned staffs have fully completed the ISO14001:2015 training. The preparation and review of the ISO 14001:2015 documentation by co-working with the ISO consultant was completed on 30 June 2021. Most of the mandatory documents were drafted and have been under reviewing. The ISO14001:2015 Internal Audit is expected to be conducted at all work sections by the assigned Internal Audit team in July 2021 and it is still the target to obtain certification of compliance with ISO14001:2015 by September 2021.

EMO received seven Detailed Work Program (DWP) & Site Specific Environmental and Social Management and Monitoring Plans (SS-ESMMPs), and one working drawing for review and approval. One Observation of Non-Compliance (ONC) was active during the reporting period of Q2 2021. This ONC was carried over from Q1 2021 and has been resolved. EMO did not issue any new Observation of Non-Compliances (ONCs) or Non-Compliance Reports (NCRs) during Q2 2021.

The construction of the wastewater treatment system modification and improvement at OSOV1 and OSOV2 were still on-going by the Soulignet Choummanitham Construction Sole Co., Ltd. (SCC). The status of construction progress was about 70% and expected to be completed within the contractual timeframe of 31 July 2021.

During Q2 2021, EMO continued to monitor the progress of revegetation at the LILAMA10 camp site and at the Phouhomxay Village irrigation canal spoil disposal site that the EMU did not accept during their site visited in January 2021 due to the low percentage of vegetation cover and the EMU had therefore requested additional measures to be carried out. NNP1PC issued two Site Inspection Reports (SIRs) to the relevant Contractors responsible for the Phouhomxay Village Irrigation Canal Rock and Spoil Disposal area and LILAMA10 camp requesting them to implement additional measures to assure effective revegetation of the decommissioned sites. The local contractor for the Phouhomxay Village Irrigation Canal Rock and Spoil Disposal area completed a corrective action by adding topsoil on the site to aid the natural growth. The international contractor for LILAMA10 camp refused to take additional counter measures and claimed that the site was disturbed before their temporary occupancy for setting-up their sub-contractor camp. Due to unclear contract terms, EMO decided to hold the site for another wet season for the vegetation growth. However, the percentage of vegetation cover in Q2 2021 increased when compared with the previous quarter. It is expected that the percentage of vegetation cover will meet the expected 70% after the wet season of 2021.

The selection of the new local waste collection contractors for the project's waste and landfill operation, and the communities' waste and Houay Soup landfill operation were completed. One-year service contracts were signed with the two local contractors on 05 April 2021. The project waste and community waste collection and landfills operation were resumed on 12 April 2021 by two selected local contractors. A total of 64 m^3 solid waste from NNP1 project sites and camps was disposed of at the NNP1 Project Landfill, an increase of 9.9 m^3 compared with Q1 2021. A total of 75.6 m^3 solid waste from Phouhomxay, Thahuea and Hat Gniun villages was disposed of at the Houay Soup Landfill. A total of 2,519 kg recyclable waste was recorded at the Community Waste Bank, same as the previous quarter.

The environmental flow requirements have been monitored in accordance with the ESMMP-OP and the monitored results fully complied with the requirements, except for the thalweg water depth measurements that indicated occasional depths below the required 0.5 m at 5.7 km from the re-regulation dam during periods with a discharge of about 27 m^3/s from the Re-regulation Dam.

During Q2 2021, the concentration of dissolved oxygen (DO) at the surface level in R05 (Main Reservoir immediately upstream of the main dam) ranged between 4 mg/L and 8 mg/L, Nam Ngiep Upstream station (NNG01) and Nam Chian (NCH01) had DO levels above 6 mg/L. In addition, the DO concentrations in Nam Xao and Nam Houay Soup on 07 April, 05 May, 18 May, 25 May, 02 June and 23 June 2021 were also less than 6 mg/L.

The DO concentrations at the surface level in the Re-regulation Reservoir (R07) were between 0.6 and 4.8 mg/L.

The DO levels in Nam Ngiep downstream the Re-regulation Dam were between 1.7 mg/L and 8.7 mg/L for the first few kilometres and gradually increasing to about 3 mg/L or above 6 mg/L after the following 25 km.

The depth profile monitoring during the period indicates formation of oxyclines in the main reservoir at R4 and R5 at varying depths.

Most of the activities under NNP1 WMP and NC-NX BOMP during Q2 2021 were postponed following the Prime Minister (PM) Order No.15/PM dated 21 April 2021, PM Order No. No. 528/PM dated 20 May 2021, PM Order No. 595/PM dated 4 June 2021, and PM Order No. 671/PM dated 19 June 2021 on the country wide lockdown as preventive measures against COVID-19. The only activities that continued during this lockdown period included the construction of Xaysomboun WRPO sub-office at Ban Huayxay, forest patrol in Bolikhamxay Province, and patrolling and snare removal in the NC-NX offset site.

The fish catch monitoring for Q1 2021 in Nam Ngiep Watershed was dominated by *Oreochromis niloticus* and *Scaphiodonichthys acanthopterus*, and the species groups of Hampala, Poropuntius and *Sikukia gudgeri* and *Amblyrhynchichthys truncates.* While species group of *Barbonymus gonionotus* and Hypsibarbus, Hampala, *Sikukia gudgeri* and *Amblyrhynchichthys*, Poropuntius and Mastacembelus dominated in Q2 2021. They are classified as Least Concern (LC) according to the IUCN Red List, except *Scaphiodonichthys acanthopterus* and *Sikukia gudgeri* is classified as Data Deficient species (DD).

2 INTRODUCTION

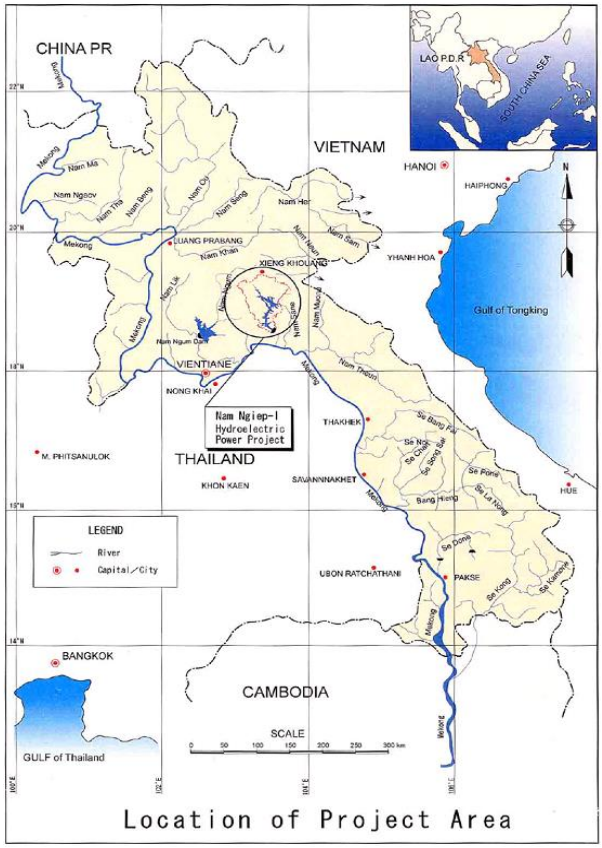
The Nam Ngiep originates in the mountains of Xiengkhuang Province, flowing through Khoun District into Thathom District of Xaysomboun Province, through Hom District and into Bolikhan District of Bolikhamxay Province. The Nam Ngiep meets the Mekong River just upstream from Pakxan in Bolikhamxay Province.

Two dams and power stations were constructed along the Ngiep River in Bolikhamxay. At the main dam site, a primary power station generated around 1,546 GWh of electricity for export to Thailand and release water to a regulating pond where a second dam and power station generate around 105 GWh of electricity for local use.

The Project Commercial Operation Date was achieved on 05 September 2019.

This Quarterly Environment Report provides a summary of environmental monitoring activities and mitigation actions during **Q2 2021**. The report is published on the Company website (https://namngiep1.com/).

Related construction Site Specific Environmental and Social Monitoring and Management Plans (SS-ESMMPs) are also publicly disclosed on the Company website as required under the Concession Agreement.



3 ENVIRONMENTAL MANAGEMENT AND MONITORING

The environmental management and monitoring activities reported in this section document implementation of the relevant sub-plans and programmes of the Environmental and Social Management and Monitoring Plan for the Operation Phase during Q2 2021.

3.1 ENVIRONMENTAL MANAGEMENT SYSTEM (EMS)

During Q2 2021, the 11 ISO committee members and other 13 assigned staffs have fully completed the ISO14001:2015 training. The preparation and review of the ISO 14001:2015 documentation by co-working with the ISO consultant was completed on 30 June 2021. Most of the mandatory documents were drafted and have been under reviewing. The ISO14001:2015 Internal Audit was expected to be conducted at all work sections by the assigned Internal Audit team in July 2021 and it is still the target to obtain certification of ISO14001:2015 by September 2021.

The progress on establishing the EMS according to ISO14001:2015 follows the tentative work plan as shown in **Table 3-1**.

TABLE 3-1: *ENVIRONMENTAL MANAGEMENT SYSTEM WORK PLAN*

Item	ISO14001:2015 Work Plan	Year 2020		Year 2021			
		Q3	Q4	Q1	Q2	Q3	Q4
1	Continue to prepare EMS documents (8 Standard Operating Procedures are completed)						
2	**NNP1PC Environmental Policy announcement**						
3	NNP1PC ISO Committee establishment						
4	Training relevant staff on: - Requirement and Interpretation of ISO14001:2015 - Organization Context and Risk Management for ISO14001 - ISO14001:2015 Document Information - ISO14001:2015 Internal Audit						
5	Implement the EMS procedures and processes						
6	ISO14001:2015 Internal Audit						
7	Implement the corrective actions and preventive actions according to the Internal Audit						
8	Management Review by NNP1PC Management						
9	ISO 14001:2015 Assessment and Certification Audit – **Stage 1 Audit** (***remote audit*** on the documentation review)						
10	Implement the corrective actions and preventive actions according to the Stage 1 Audit						
11	ISO 14001:2015 Assessment and Certification Audit – **Stage 2 Audit** (***on-site audit***)						
12	Implement the corrective actions and preventive actions according to the Stage 2 Audit						
13	**Certify of ISO14001:2015 upon successful completion of the audit**						

	Completed activities
	Delayed activities and re-scheduled
	Original plan activities

3.2 CONTRACTOR SS-ESMMPS

During Q2 2021, the Environmental Management Office (EMO) of NNP1PC received seven Detailed Work Program (DWP) & Site Specific Environmental and Social Management and Monitoring Plan (SS-ESMMP), and one working drawing for review and approval.

Six of these submitted documents were cleared and two documents are under review as shown in **Table 3-2** - more details can be found in **Appendix 1**.

TABLE 3-2*: DOCUMENTS REVIEWED DURING Q2 2021*

Document Name	Rev. 1	Rev. 2	Rev. 3	Approved
DWP & SS-ESMMP for routine Maintenance and Repairing Works	√			√
DWP & SS-ESMMP for Project's Solid Waste Management and Landfill Operation	√	√		√
DWP & SS-ESMMP for Community Solid Waste Management and Houy Soup Landfill Operation	√	√		√
DWP & SS-ESMMP for WWTS Improvement and Modification	√	√		√
DWP & SS-ESMMP for Supply and Installation of Stolen Part at Main Dam Gate	√	√	√	Under review
Working Drawing for OSOV's WWTS improvement and Modification	√	√		√
DWP & SS-ESMMP for Remedial Grouting work at Main Dam	√	√	√	Under Review
DWP & SS-ESMMP for Improvement of Irrigation System and Tractor Roads at PHX Village	√			√

3.3 RESULTS OF COMPLIANCE INSPECTIONS AT CONSTRUCTION SITES

During Q2 2021, EMO conducted weekly independent site inspections and bi-weekly joint site inspections at a total of 25 sites. These included two sites under rehabilitation as previously commented by the EMU, four main operation sites, two transmission lines, six temporary contractor camps, six construction sites, three villages waste generation and two landfills. A decrease of 15 monitoring sites compared with Q1 2021.

EMO continued to coordinate with EDL for a joint site inspection of the 115 kV transmission line, and the inspections were conducted during 05 – 09 April 2021. EMO received the official joint site inspection report prepared by EDL with no significant environmental and social issues observed during the quarterly joint site inspection. Some minor observations recorded included:

- Gully erosion for the tower's foundation of tower No.1 and No.2.
- 28 trees were observed in a potential risk of falling down (11 rubber trees – Hevea brasilinsis and 17 commercial trees – Eucalyptus camaldulensis) then they were removed (cut) by the EDL team. These trees are in the compensated transmission line right of way.

The joint site inspection of the 230 kV transmission line with EGAT has not been confirmed yet. The latest inspection of the 230 kV transmission line was conducted during October - November 2020.

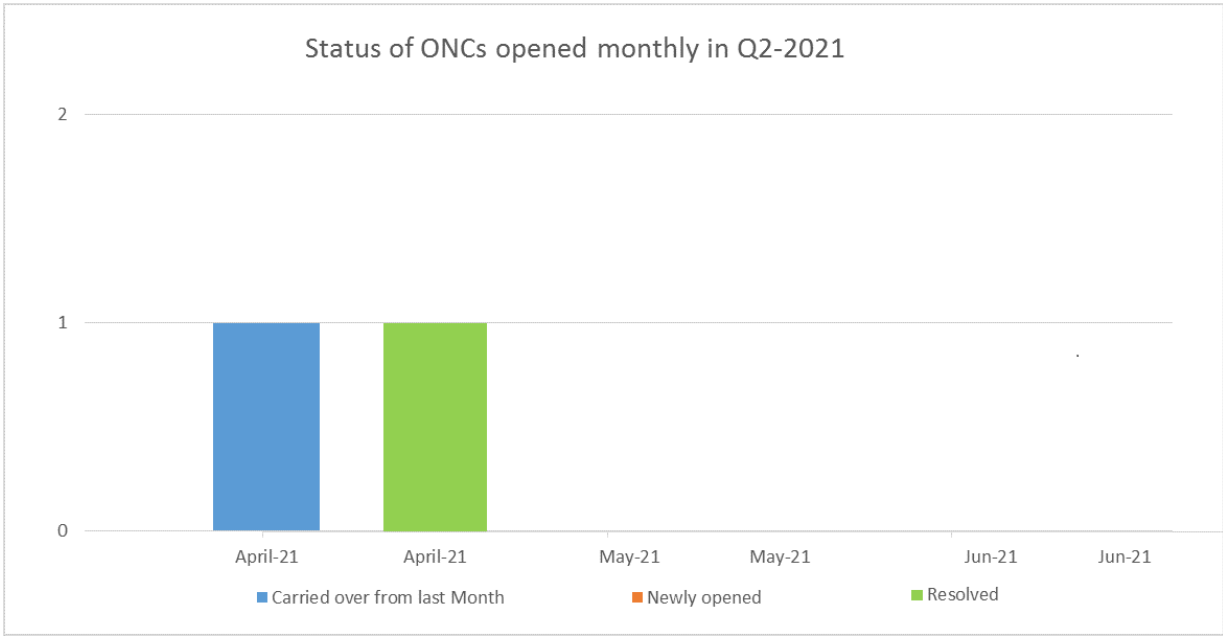
One Observation of Non-Compliance (ONCs) was active during the reporting period of Q2 2021. This ONC was carried over from Q1 2021 and has been resolved. EMO has not issued any new Observation of Non-Compliances (ONCs) or Non-Compliance Reports (NCRs) during Q2 2021.

The status of Non-Compliance Reports (NCRs) and ONCs are summarized in **Table 3-3** and **Figure 3-1**. The progress of corrective actions is presented in **Appendix 2**.

TABLE 3-3: *STATUS OF NON-COMPLIANCE REPORT DURING Q1 2021*

Status	ONC	NCR-Level 1	NCR-Level 2	NCR-Level 3	Incident Report
Carried over ONC/NCR from the previous quarter	1	0	0	0	0
Newly opened ONC/NCR	0	0	0	0	0
Total No. of ONC/NCR	1	0	0	0	0
Resolved ONC/NCR	1	0	0	0	0
Unresolved ONC/NCR carried forward to the next quarter	0	0	0	0	0

FIGURE 3-1*: STATUS OF ONCS DURING Q2 2021*



PHOTOGRAPH 1: JOINT SITE INSPECTION WITH EDL AT TL 115 KV

PHOTOGRAPH 2: JOINT SITE INSPECTION AT WWTS CONSTRUCTION SITE OF OSOV2

PHOTOGRAPH 3: BI-WEEKLY JOINT SITE INSPECTION AT CONTRACTOR'S TEMPORARY CAMP (RENT HOUSE)

PHOTOGRAPH 4: SITE INSPECTION AT THE WWTS CONSTRUCTION SITE OF OSOV1

3.4 RESULTS OF SITE DECOMMISSIONING AND REHABILITATION

During Q2 2021, EMO continued to monitor the progress of revegetation at the LILAMA10 camp site and at the Phouhomxay Village irrigation canal spoil disposal site that the EMU did not accept during their site visited in January 2021 due to the low percentage of vegetation cover and the EMU had therefore requested additional measures to be carried out. NNP1PC issued two Site Inspection Reports (SIRs) to the relevant Contractors responsible for the Phouhomxay Village Irrigation Canal Rock and Spoil Disposal site and LILAMA10 camp requesting them to implement additional measures to assure effective revegetation of the decommissioned sites. The local contractor for the Phouhomxay Village Irrigation Canal Rock and Spoil Disposal area completed a corrective action by adding topsoil to aid the natural growth. The International contractor for LILAMA10 camp refused to take additional counter measures and claimed that the site was disturbed before their temporary occupancy for setting-up of their sub-contractor camp. Due to unclear contract terms, EMO decided to hold

the site for another wet season for the vegetation natural growth. However, the percentage of vegetation cover at the site increased when compared with the previous quarter. It is expected that the percentage of vegetation cover will meet the expected 70% after the wet season of 2021.

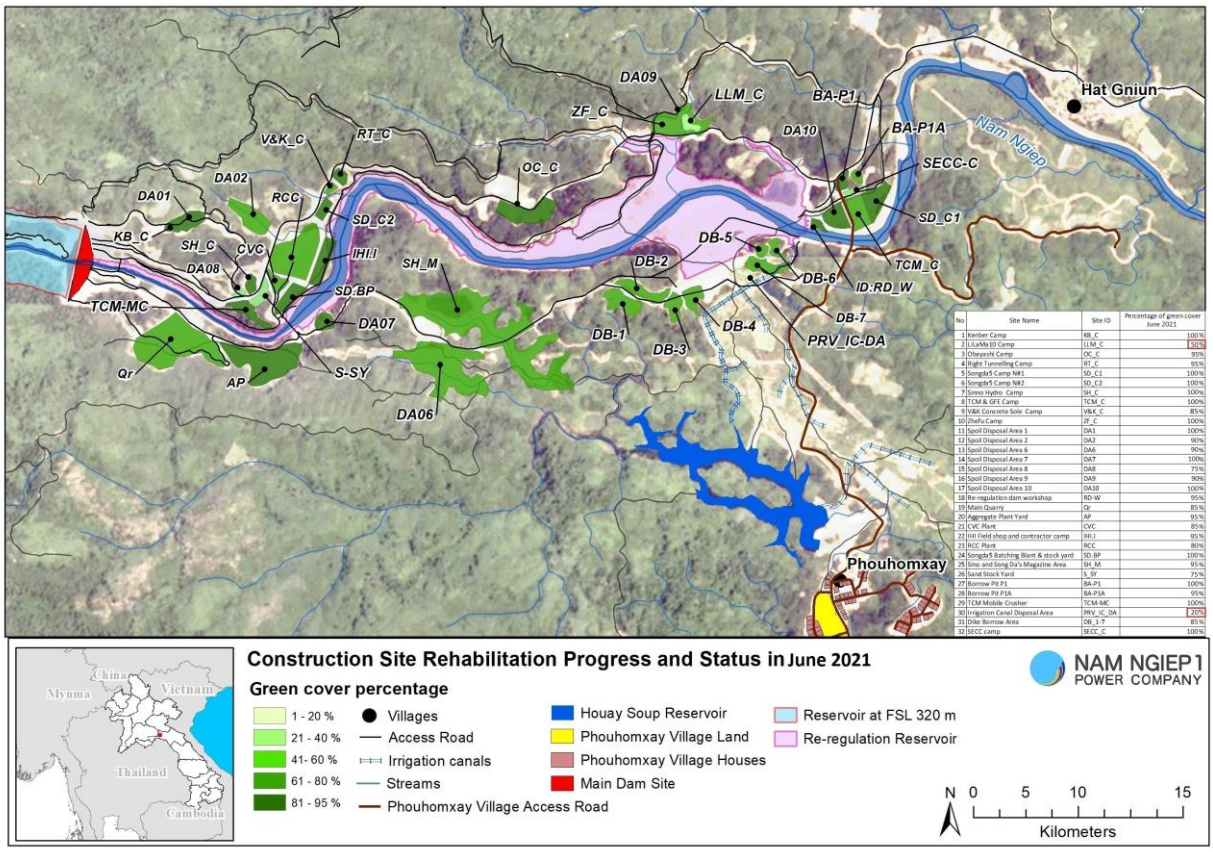
The status of site rehabilitation and revegetation is summarized in **Table 3-4** and the revegetated sites are shown in **Figure 3-2** with the relevant photographs.

TABLE 3-4: *SUMMARY STATUS OF CONSTRUCTION SITES REHABILITATION AS OF JUNE 2021*

No	Site Name	Status of Decommissioning	Percentage of Vegetation Cover Evaluation				
			Jun-2020	Sep-2020	Dec-2020	Mar-2021	Jun-2021
01	TCM & GFE Camp	Completed	70%	90%	90%	90%	100%
02	Spoil Disposal Area 7	Completed	-	98%	98%	98%	100%
03	Spoil Disposal Area 9	Completed	-	75%	75%	75%	90%
04	Spoil Disposal Area 10	Completed	80%	95%	95%	95%	100%
05	Borrow Pit P1	No need for decommissioning	-	95%	95%	95%	100%
06	Borrow Pit P1A	No need for decommissioning	-	80%	80%	80%	95%
07	TCM Mobile Crusher	Completed	-	90%	90%	90%	100%
08	Dike Borrow Areas	No need for decommissioning	-	75%	75%	75%	85%
09	SECC camp	Completed	-	90%	90%	90%	100%
10	KENBER Camp	Completed	80%	95%	95%	95%	100%
11	LILAMA10 Camp	Completed	5%	20%	40%	45%	50%
12	Obayashi Camp	Completed	80%	90%	90%	90%	95
13	Right Tunnelling Camp	Completed	70%	90%	90%	90%	95
14	Songda5 Camp N#1	Completed	90%	98%	98%	98%	100%
15	Songda5 Camp N#2	Completed	80%	95%	95%	95%	100%
16	Sino Hydro Camp	Completed	80%	95%	95%	95%	100%
17	V&K Concrete Sole Camp	Completed	50%	70%	70%	70%	85%
18	Zhefu Camp	Completed	60%	75%	75%	75%	100%
19	Spoil Disposal Area 1	Completed	80%	90%	90%	90%	100%

No	Site Name	Status of Decommissioning	Percentage of Vegetation Cover Evaluation				
			Jun-2020	Sep-2020	Dec-2020	Mar-2021	Jun-2021
20	Spoil Disposal Area 2 & main dam workshop	Completed	60%	75%	75%	75%	90%
21	Spoil Disposal Area 6	Completed	70%	75%	75%	75%	90%
22	Spoil Disposal Area 8	No need for decommissioning	40%	60%	60%	60%	100
23	Re-regulation dam workshop	Completed	80%	85%	85%	85%	95%
24	Main Quarry	Completed	50%	70%	70%	70%	85%
25	Aggregate Plant Yard	Completed	80%	85%	85%	85%	95%
26	CVC Plant	Completed	60%	70%	70%	70%	85%
27	IHI Field shop and contractor camp	Completed	70%	85%	85%	85%	95%
28	RCC Plant	Completed	50%	70%	70%	70%	80%
29	Songda5 Batching Plant & Stock yard	Completed	80%	95%	95%	95%	100%
30	Sino and Song Da's Magazine Area	Completed	70%	80%	80%	80%	95%
31	Sand Stock Yard	No need for decommissioning	-	60%	60%	60%	75%
32	Irrigation Canal Spoil Disposal Area *Phouhomxay Village*	No need for decommissioning	-	5%	10%	15%	20%

FIGURE 3-2: *REVEGETATION SITES MAP DURING Q2 2021*



No	Site Name	Site ID	Percentage of green cover June 2021
1	Kenber Camp	KB_C	100%
2	LLaMa10 Camp	LLM_C	50%
3	Dhayanh Camp	OC_C	95%
4	Right Tunnelling Camp	RT_C	95%
5	Songda5 Camp NR1	SD_C1	100%
6	Songda5 Camp NR2	SD_C2	100%
7	Simo Hydro Camp	SH_C	100%
8	TCM & GFE Camp	TCM_C	100%
9	V&K Concrete Sole Camp	V&K_C	85%
10	ZheFu Camp	ZF_C	100%
11	Spoil Disposal Area 1	DA1	100%
12	Spoil Disposal Area 2	DA2	90%
13	Spoil Disposal Area 6	DA6	90%
14	Spoil Disposal Area 7	DA7	100%
15	Spoil Disposal Area 8	DA8	75%
16	Spoil Disposal Area 9	DA9	90%
17	Spoil Disposal Area 10	DA10	100%
18	Re-regulation dam workshop	RD-W	95%
19	Main Quarry	Qr	85%
20	Aggregate Plant Yard	AP	95%
21	CVC Plant	CVC	85%
22	Int Field shop and contractor camp	IHI.I	95%
23	RCC Plant	RCC	80%
24	Songda5 Batching Blant & stock yard	SD_BP	100%
25	Simo and Song Da's Magazine Area	SH_M	95%
26	Sand Stock Yard	S_SY	75%
27	Borrow Pit P1	BA-P1	100%
28	Borrow Pit P1A	BA-P1A	95%
29	TCM Mobile Crusher	TCM-MC	100%
30	Irrigation Canal Disposal Area	PRV_IC_DA	20%
31	Dike Borrow Area	DB_1-7	85%
32	SECC camp	SECC_C	100%

The photos below presented the different of green colour and vegetation covering compare between Q1 2021 and Q2 2021.

PHOTO OF THE FORMER LILAMA10 CAMP	
PHOTOGRAPH 1: Q1 2021	PHOTOGRAPH 2: Q2 2021
	
AERIAL PHOTO OF THE PHOUHOMXAY VILLAGE'S IRRIGATION CANAL SPOIL AND ROCK DISPOSAL AREA	
PHOTOGRAPH 3: Q1 2021	PHOTOGRAPH 4: Q2 2021
	

3.5 WASTE MANAGEMENT AT THE CONSTRUCTION SITES

3.5.1 General Waste Management

During Q2 2021, a total of 64 m^3 solid waste from NNP1 project sites and camps was disposed of at the NNP1 Project Landfill, an increase of 9.9 m^3 compared with Q1 2021.

EMO contacted the selected and authorised recycle waste company to come and take the recycle waste and hazardous waste for disposal and elimination. The authorised company (Panitha Export-Import Sole Co., Ltd.) is scheduled to come and take the recycle waste and hazardous waste by early July 2021.

No recyclable waste was sold during the reporting period. The amount of accumulated recyclable waste is shown in **Table 3-5**.

TABLE 3-5: *AMOUNTS OF RECYCLABLE WASTE DURING Q2 2021*

Source and Type of Recyclables		Unit	Total in Q2 2021 (A)	Sold (B)	Remaining Amount (A - B)
Construction activity					
1	Scrap metal	kg	0	0	0
Sub-Total 1		**kg**	**0**	**0**	**0**
Operation camp					
2	Plastic bottle	kg	93	0	93
3	Aluminium	kg	50	0	50
4	Paper/Cardboard	kg	108	0	108
5	Glass	kg	205	0	205
Sub-Total 2		**kg**	**612**	**0**	**612**
Grand Total 1+2		**kg**	**612**	**0**	**612**

3.5.2 Hazardous Waste Management

The amounts of hazardous waste and hazardous materials that were collected, stored and disposed of during Q2 2021 are shown in **Table 3-6.** No disposal of hazardous waste during the reporting period**.** The remaining waste will be collected, treated and also disposed of by Panitha Export-Import Sole Co., Ltd.

TABLE 3-6: *HAZARDOUS MATERIAL AND HAZARDOUS WASTE RECORDED DURING Q2 2021*

No.	Type of Hazardous Material	Unit	Total in Q2 2021	Used/ Disposed	Remaining
01	Diesel	Litre	11,924	10,200	**1,724**
02	Gasoline	Litre	1,159	789	**370**
03	Lubricant (Turbine oil)	Litre	7,836	10	**7,826**
04	Colour paint	Litre	250	8	**242**
05	Tinner	Litre	8	0	**8**
06	Grease oil	Litre	160	0	**160**
07	Gear Oil	Litre	474	4	**470**
08	Chlorine Liquid	Litre	163	160	**3**
09	Chlorine Powder	Kg	65	0	**65**
10	Fire Extinguisher (18Kg)	Unit	0	0	**0**
11	Sika	Litre	7	0	**7**
	Type of Hazardous Waste				
12	Used Oil (Hydraulic + Engine)	Litre	4,467.7	0	**4,467.7**
13	Used oil mixed with water	Litre	150	0	**150**
14	Empty used oil drum/container (drum 200L)	Unit	21	0	**21**
15	Contaminated soil, sawdust and textile material	Unit	2.51	0	**2.51**
16	Used oil filters	M3	0	0	**0**
17	Used tyre	Piece	18	0	**18**

No.	Type of Hazardous Material	Unit	Total in Q2 2021	Used/ Disposed	Remaining
18	Empty used chemical drum/container (drum 20L)	Unit	0	0	**10**
19	Lithium-ion batteries	Unit	0	0	**0**
20	Lead acid batteries	Unit	5	0	**5**
21	Empty paint and spray cans	Can	139	0	**139**
22	Halogen/fluorescent bulbs	Unit	280	0	**280**
23	Empty cartridge (Ink)	Piece	195	0	**195**
24	Clinic Waste	Kg	3.5	0	**3.5**

3.5.3 Animal Fodder (Pig Feed) Collection Programme

During Q2 2021, the collection of food waste from the Owner's Site Office and Village (OSOV1) by local villagers for feeding their animals was suspended due to the COVID-19 restrictions with lockdown of OSOV1 which NNP1PC had extended until 04 July 2021. EMO has considered an alternative option where the villagers could pick up the food waste at the Houay Soup Landfill; however, the villagers could not be reached. EMO plans to meet with the villagers after 04 July 2021 to discuss the matter.

3.5.4 Community Solid Waste Management and Recycling Programme

The trading of recyclable materials at the Community Recycle Waste Bank during Q2 2021 is summarized in **Table 3-7.**

TABLE 3-7: *AMOUNTS OF RECYCLABLES SOLD AT THE COMMUNITY RECYCLE WASTE BANK*

Type of Waste	Unit	Remaining in Q1 2021	Purchased/ Collected in Q2 2021	Sold	Disposed	Remaining in Q1 2021
Plastic bottle	kg	35	0	0	0	35
Aluminum	kg	0	0	0	0	0
Paper/Cardboard	kg	126	0	0	0	126
Glass	kg	2,358	0	0	0	2,358
Scrap metal	kg	0	0	0	0	0
Total	**kg**	**2,519**	**0**	**0**	**0**	**2,519**

On 05 April 2021, NNP1PC signed a one-year service contract with a local registered contractor for the community waste management and operation of Houay Soup Landfill. On 12 April 2021, the new local waste collection contractor resumed to carry out landfill operations which include daily and weekly waste cover, repairing the damaged perimeter fence at the landfills, grass mowing, storage cleaning and clean up sediment in the open ditches around the leachate ponds.

3.5.5 Houay Soup Landfill

During Q2 2021, approximately 75.6 m^3 of solid waste was collected from Thaheua, Hat Gniun and Phouhomxay villages and transported to Houy Soup Landfill for disposal. The basic landfill

maintenance was carried out which included fixing the fence, cleaning up the open ditches and mowing grass.

3.6 Reservoir Operations

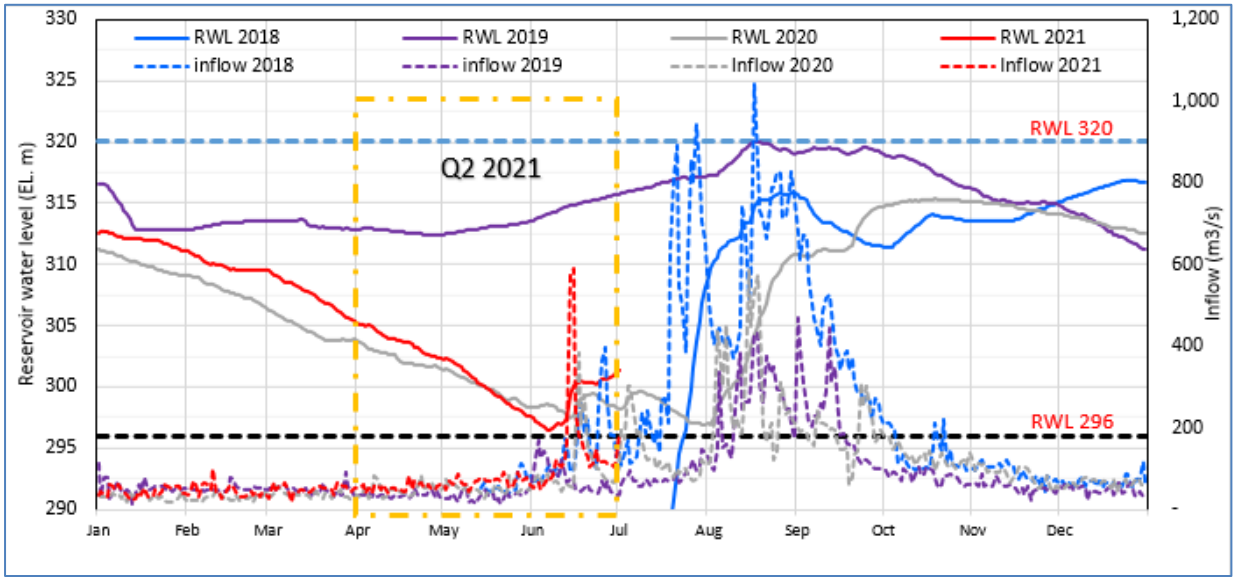
3.6.1 Main Reservoir

The water level in the main reservoir and inflow to the reservoir since May 2019 are displayed in **Figure 3-3**.

During Q2 2021, the mean daily inflow to the main reservoir was 88 m^3/s. The minimum daily inflow was 38 m^3/s, maximum daily inflow was recorded at 587 m^3/s, and 25th percentile of 54 m^3/s and 75th percentile of 89 m^3/s.

During Q2 2021, the water level in the main reservoir fluctuated with 8.72 m from El. 305.22 m asl. to El. 296.40 m asl. The water level decreased with about 8.8 m from El. 305.22 m asl on 01 April 2021 to El. 296.40 m asl on 07 June 2021, whereafter the water level has increased with 4.95 m to El. 301.35 m asl. at the end of Q2 2021.

Figure 3-3: ***Water Level and Inflow for the Main Reservoir***



3.6.2 Environmental Flow Requirements (EFRs) for the Operation Phase

NNP1PC has monitored compliance with the Environmental Flow Requirements (EFRs) stipulated in the CA, Annex C, Clause 53 (g) and as further modified in the Environmental Flow Assessment Report of July 2014 approved by MONRE. The EFRs have been monitored in accordance with the monitoring programme outlined in the ESMMP-OP 2019 (Vol. II, Part 2 on Subplan 1 on Reservoir and River Health Management).

The results of the EFR compliance monitoring during Q2 2021 are summarized in **Table 3-8**.

TABLE 3-8: *SUMMARY OF EFRS COMPLIANCE MONITORING IN Q2 2021*

No	EFRs in the Downstream of the Re-regulation dam	EFRs compliance
1	Min flow 27 m^3/s at all times	100% of observations comply
2	Thalweg water depth at least 0.5 m in the entire reach from immediately downstream of the Re-regulation dam until 5.2 km downstream the dam (measured at cross-sections where visual observations or boat navigation indicate shallow waters)	Three measurements at some measuring points located 5.7 km from the Re-regulation Dam did not comply during the period of the dam discharged about 27 m^3/s
3	Maximum rate of change (both rise and fall, separately) in stage of 0.6 m per hour	100% of hourly fluctuations comply
4	Maximum fluctuation in stage of 1.7 m over 24-hour (this requirement is about range and determines the maximum difference in stage height over 24-hour periods)	100% of 24-hour fluctuations comply
5	Maximum fluctuation in stage of 1.7 m over 7-days (this requirement is about range and determines the maximum difference in stage height over 7-day periods)	All 7-day fluctuations comply

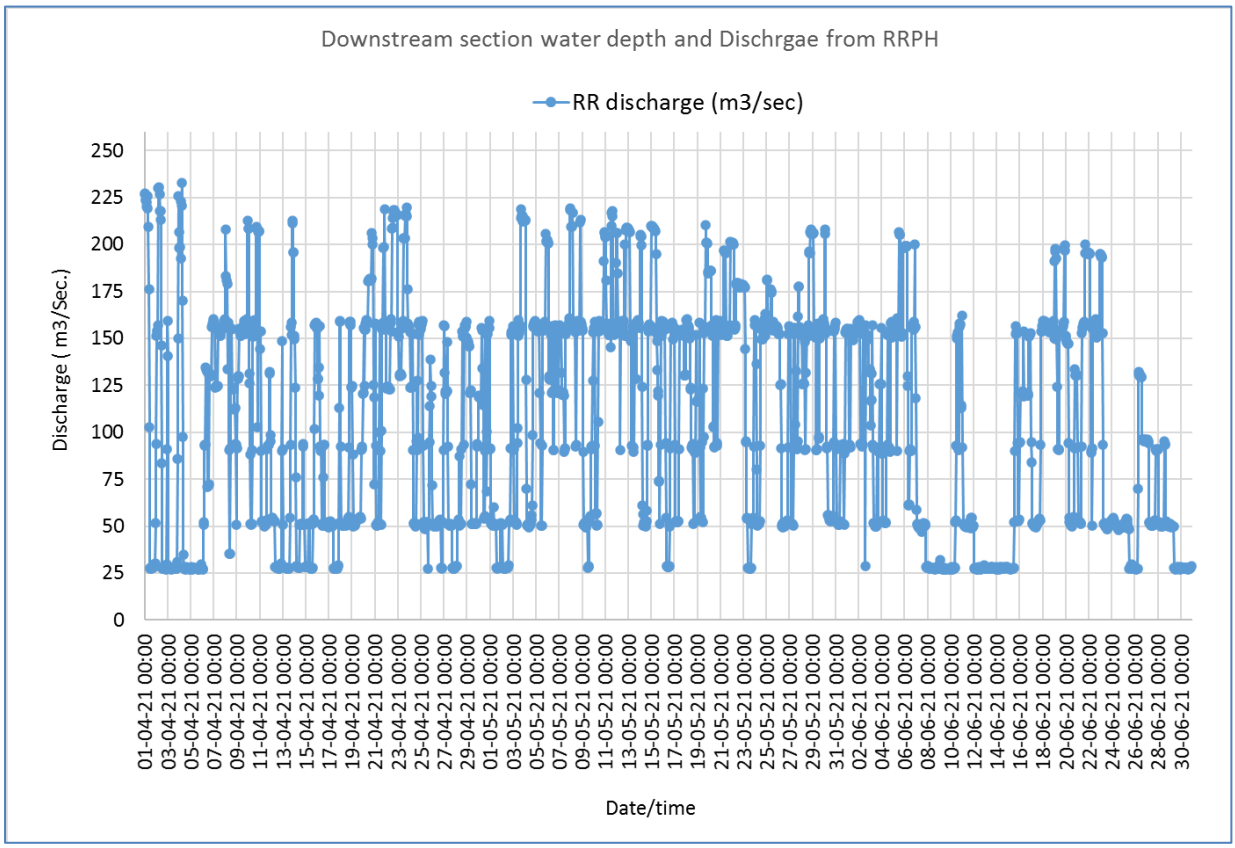
3.6.2.1 Minimum Flow Requirements

The discharge monitoring data for the re-regulation dam during Q2 2021 indicates that the minimum flow requirement of 27 m^3/s has been met at all times. The Re-regulation Dam discharge graph can be found in **Figure 3-4.**

During Q2 2021, the mean discharge from the re-regulation dam was about 97 m^3/s in April 2021, and about 127 m^3/s and 83 m^3/s in May and June 2021 respectively.

The changes in the discharge from the re-regulation dam were informed in advance to the RMU and to the heads of the downstream villages, who then announced the changes to the communities over the village speaker systems. There was no complaint related to the flow discharges or fluctuation levels downstream the Re-regulation dam during the reporting period.

FIGURE 3-4: *DISCHARGE FROM THE RE-REGULATION DAM DURING Q2 2021*



3.6.2.2 Minimum Water Depth

Since 18 July 2018, NNP1PC has carried out weekly monitoring of river depths at 19 locations downstream the re-regulation dam as shown on **Figure 3-5.** These locations represent cross-sections with possible shallow water depths at low discharge rates.

The monitoring is undertaken to confirm compliance with the water depth requirements in the Concession Agreement, Annex C, and the approved Environmental Flow Assessment (at least 0.5 m measured immediately downstream the re-regulation dam).

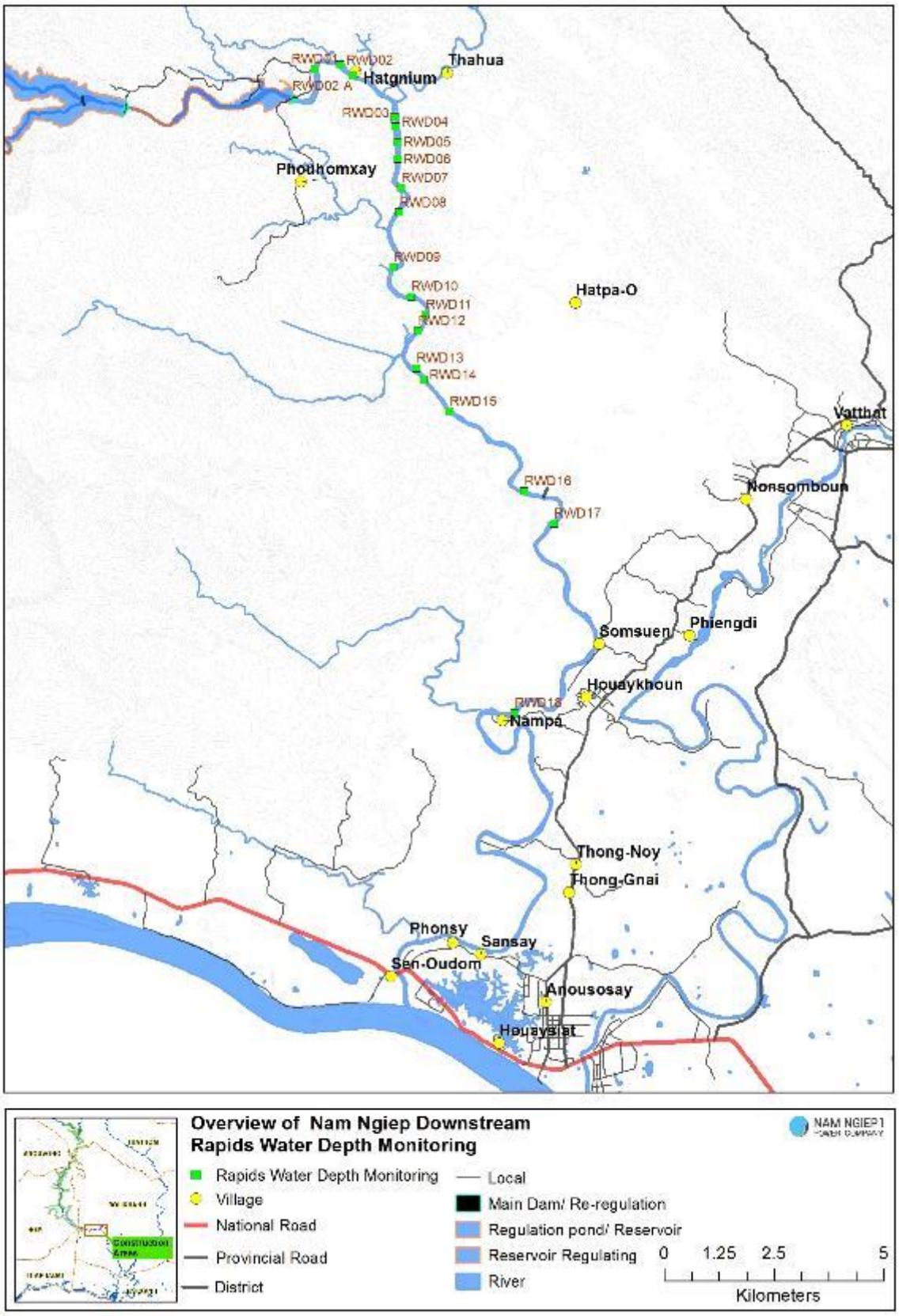
Starting in December 2020, the water depths were measured across the river channel where visual observations or boat navigation indicate shallow waters to ensure that the measurements represent the river thalweg.

The results of the monitoring are presented in **Table 3-9**. During Q2 2021, three measurements at some measuring points until RWD05 located within 5.7 km downstream of the re-regulation dam had a depth of less than 0.5 m during times when the Re-regulation Dam discharged about 27 m^3/s but none of them were found to be difficult to navigate. There were no complaints from villagers about difficulties navigating the river downstream the Re-regulation dam during the reporting period.

TABLE 3-9: *RIVER DEPTH MEASUREMENTS IN NAM NGIEP DOWNSTREAM THE RE-REGULATION DAM*

Station ID		RWD 01	RWD 02	RWD 02.a	RWD 03	RWD 04	RWD 05	RWD 06	RWD 07	RWD 08	RWD 09	RWD 10	RWD 11	RWD 12	RWD 13	RWD 14	RWD 15	RWD 16	RWD 17	RWD 18
Distance from Re-regulation Dam (km)		1.55	2.43	2.97	4.9	5.2	5.66	6.16	7.13	8.01	9.97	11.31	12.08	12.62	14.1	14.49	15.77	19.76	21.58	30.09
Date	Discharge (m3/s)	Depth (m)	Depth (m)	Depth (m)	Depth (m)	Depth (m)	Depth (m)	Depth (m)	Depth (m)	Depth (m)	Depth (m)	Depth (m)	Depth (m)	Depth (m)	Depth (m)	Depth (m)	Depth (m)	Depth (m)	Depth (m)	Depth (m)
7-Apr-21	154.7	1.73	1.61	1.72	1.84	1.87	1.52	1.85	1.89	1.97	1.8	1.82	1.92	1.9	2	2.25	2.4	2.35	2.45	2.1
12-Apr-21	27.9	0.54	0.42	0.52	0.6	0.65	0.37	0.66	0.68	0.78	0.63	0.65	0.77	0.67	0.85	1	1.2	1.25	1.35	0.95
20-Apr-21	159.3	1.62	1.5	1.6	1.67	1.72	1.35	1.67	1.73	1.83	1.63	1.64	1.85	1.7	1.87	2.08	2.25	2.2	2.4	1.95
28-Apr-21	87.2	0.87	0.78	0.88	0.95	1	0.62	0.95	1	1.05	0.85	0.88	1.02	0.86	1.1	1.22	1.5	1.38	1.55	1.04
5-May-21	120.9	0.88	0.83	0.93	0.98	1.05	0.75	1.1	1.17	1.24	1.2	1.23	1.35	1.3	1.62	1.7	2	2.1	2.3	1.9
14-May-21	50.3	0.73	0.68	0.78	0.73	0.9	0.6	0.95	1.02	1.09	1.05	1.08	1.2	1.15	1.48	1.64	1.84	1.96	2.23	1.8
18-May-21	150.7	1.53	1.48	`1.58	1.53	1.7	1.5	1.75	1.82	1.89	1.85	1.88	1.9	1.85	2.08	2.14	2.34	2.46	2.63	2.3
25-May-21	176	1.65	1.6	`1.7	1.64	1.8	1.58	1.83	1.9	1.97	1.93	1.96	1.98	1.93	2.16	2.22	2.42	2.52	2.67	2.33
2-Jun-21	93.19	1.71	1.6	1.7	1.81	1.82	1.5	1.8	1.84	1.92	1.75	1.77	1.85	1.83	1.9	2.06	2.15	2.16	2.21	1.9
9-Jun-21	27.5	0.45	0.4	0.5	0.58	0.64	0.43	0.67	0.7	0.83	0.72	0.76	0.89	0.82	1	1.16	1.37	1.42	1.53	1.1
16-Jun-21	153.66	1.7	1.62	1.73	1.83	1.85	1.54	1.85	1.93	1.97	1.85	1.88	1.98	2	2.05	2.3	2.45	2.48	2.53	2.15
23-Jun-21	51.4	0.7	0.65	0.75	0.71	0.87	0.58	0.93	1.05	1.07	1.03	1.05	1.15	1.1	1.43	1.6	1.8	1.92	2.2	1.78
30-Jun-21	27.3	0.52	0.47	0.55	0.65	0.7	0.44	0.72	0.75	0.85	0.76	0.8	0.92	0.83	1	1.2	1.4	1.45	1.55	1.15

FIGURE 3-5: ***LOCATION MAP OF RIVER DEPTH MONITORING POINTS***



3.6.2.3 Stage Height Fluctuations

The requirements on stage height fluctuations constitute a rise or a fall in water elevation and include two aspects:

1. A requirement on the rate of change which is set at 0.6 m per hour.
2. Requirements on the range in fluctuations over 24-hour periods and 7-day periods respectively, which is set at a maximum of 1.7 m for both periods. In other words, the range requirements determine the maximum difference in stage height over 24-hour periods and 7-day periods respectively.

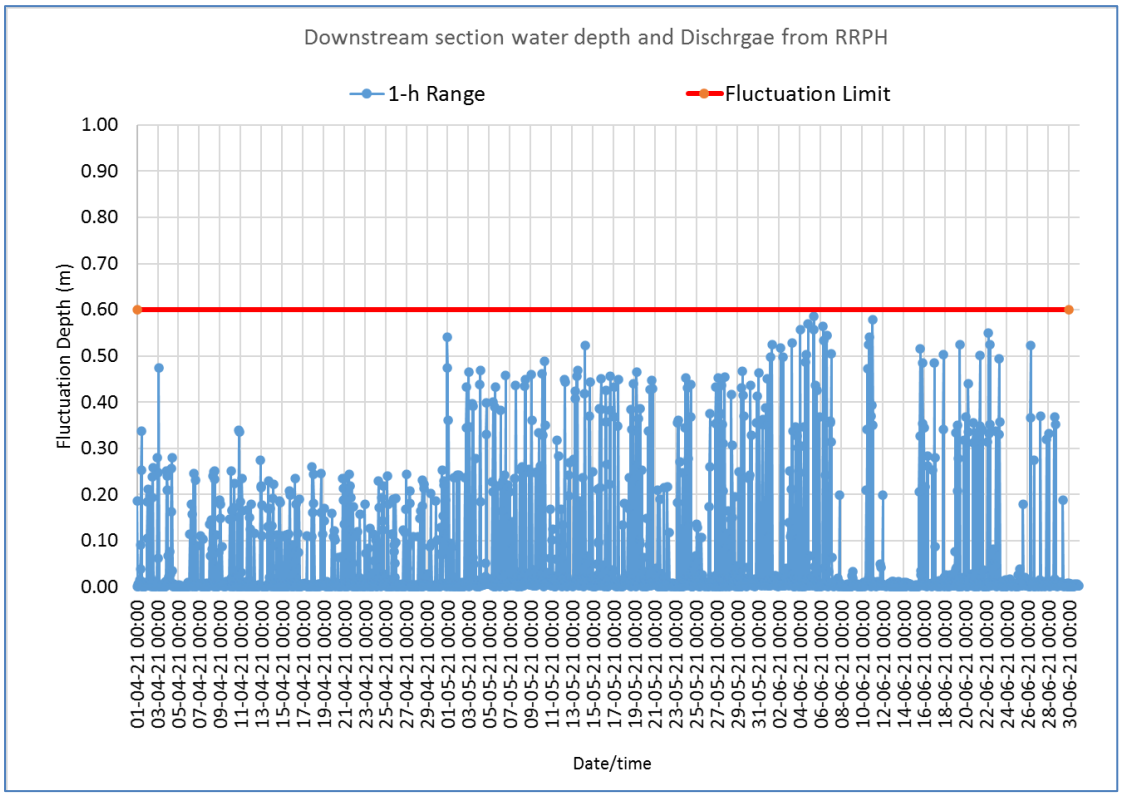
For the 0.6 m in 1-hour maximum fluctuation EFR, the cumulative rises and falls are calculated from the hourly water level recordings.

Compliance with the 24-hour maximum fluctuation EFR is determined by calculating the difference between the maximum and the minimum stage height over each 24-hour period. In the same way, the 7-day maximum fluctuation EFR, is determined by calculating the difference between the maximum and the minimum stage height over each 7-day period. There is no compulsion for the Company to meet the stage height fluctuation EFRs after a high flow event passes over the Re-regulation dam spillway.

In practice, meeting stage height fluctuation EFRs are managed through controlling the rate of change in discharge from the re-regulation dam/powerhouse. This is done using established rating relationships between stage height and discharge, as set out in the Re-regulation dam operation manual. These relationships are regularly checked and revised as necessary, as they would change whenever the channel morphology changes due to significant erosion or deposition.

During Q2 2021, the maximum rate of change of 0.6 m over 1-hour was complied with for 100% of the hourly fluctuations. The results are presented in **Figure 3-6**.

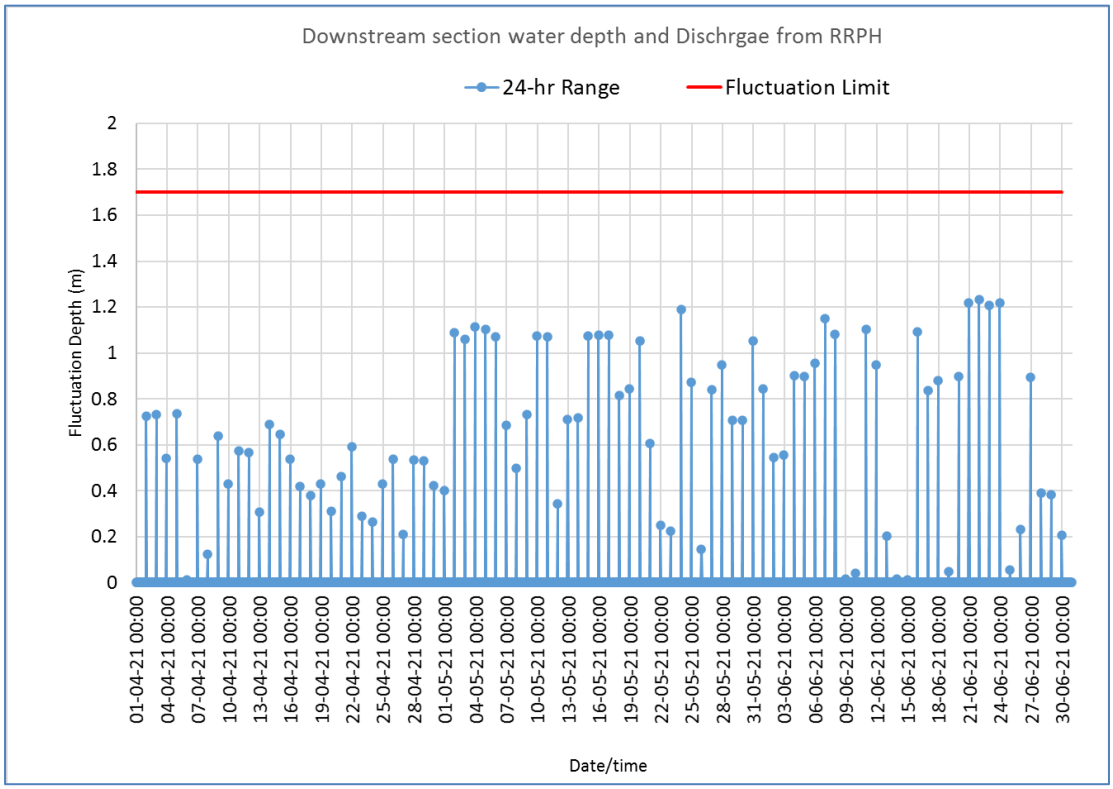
FIGURE 3-6: *HOURLY STAGE HEIGHT FLUCTUATIONS DURING Q2 2021*



During Q2 2021, the maximum range in stage of 1.7 m over 24-hour was complied with for all 24-hour periods (00:00 – 23:00). The results of the monitoring are presented in

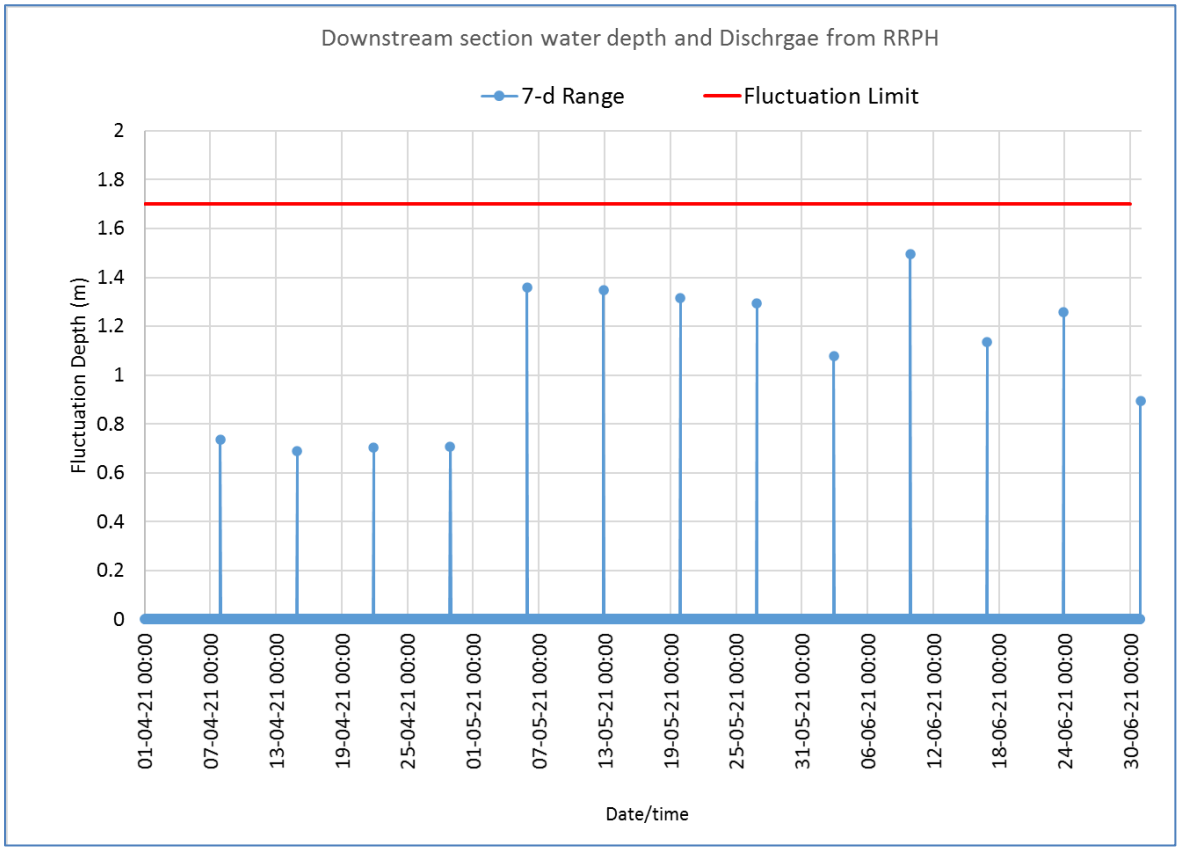
Figure 3-7.

FIGURE 3-7: *24-HOUR STAGE HEIGHT DIFFERENCE (M) DURING Q2 2021*



During Q2 2021, the maximum range in stage of 1.7 m over 7-days was complied with for all 7-day periods. The results are presented in **Figure 3-8**.

FIGURE 3-8: *7-DAY STAGE HEIGHT DIFFERENCE (M) DURING Q2 2021*



3.7 WATER QUALITY MONITORING

Due to the COVID-19 preventative measures imposed by the Lao Governments since 20 April 2021 to the end of June 2021, the water samples were analysed at the NNP1 Project Environmental Laboratory only for TSS, BOD_5, *E.coli* bacteria, faecal coliform and total coliform and no water samples were shipped to the UAE Laboratory in Thailand. Therefore, there are no results for COD, ammonia-nitrogen, total nitrogen, TKN, TOC, phytoplankton biomass, total phosphorus, and oil and grease in this reporting month.

3.7.1 Surface Water (River) and Depth Profile Water Quality

Descriptions of each monitoring station, surface water and depth profile water quality monitoring parameters, and the location of sampling map can be found in **Appendix 3** and all surface water quality data for Q2 2021 are listed in **Appendix 5.1.**

In addition, no water quality monitoring in upper main reservoir (R1, R2 and R3) and Nam Phouan due to the security concern in the area.

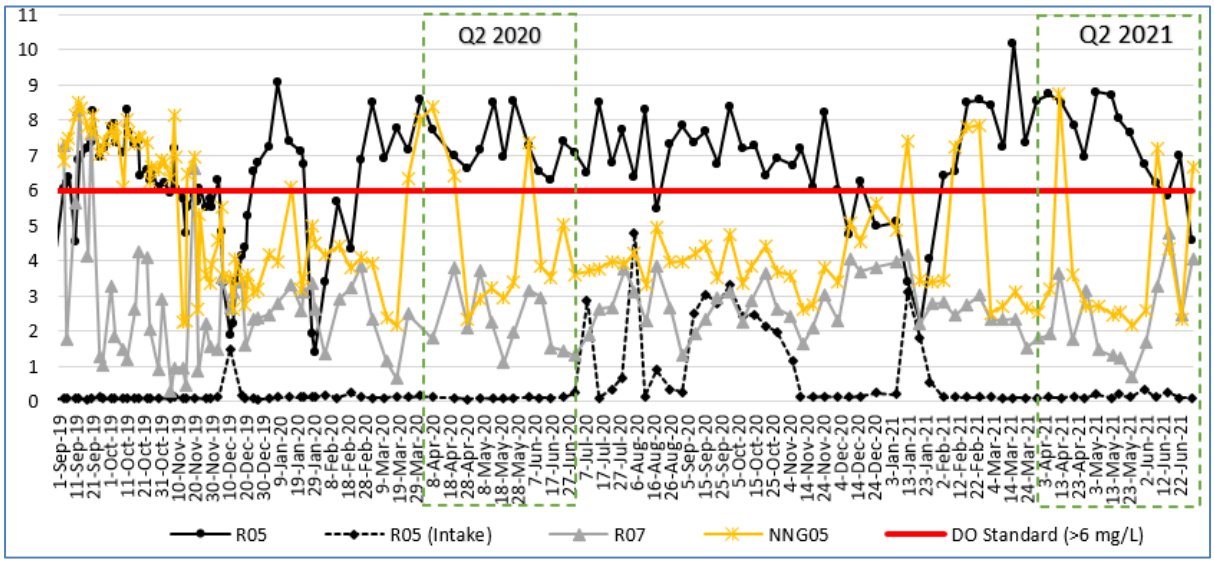
Dissolved Oxygen (DO)

The results of DO measurements for the station immediately upstream of the main dam (R5 – surface and intake bottom sill at 276 m asl.) and station R7 in the re-regulation dam (surface) and immediately downstream of the re-regulation dam (NNG05) are presented in **Figure 3-9,** and the full set of surface water quality data are shown in **Table 3-10.** During Q2 2021, as the water level in the reservoir fell, the depth to the intake centre line decreased from about 25

m at the start of Q2 2021 to 16 m in early June 2021 and the rose slightly to [**] at the end of June 2021.

The water temperature and DO depth profiles in the main reservoir at R05 during Q2 2020, Q1 2021 and Q2 2021 are presented in **Figure 3-10** to **Figure 3-12.**

FIGURE 3-9: *DISSOLVED OXYGEN IMMEDIATELY UPSTREAM AND DOWNSTREAM OF THE MAIN DAM*



Main Reservoir

Figure 3-12 presents the water quality depth profiles time-series in the Main Reservoir from September 2018 to June 2021, the graphs clearly show seasonal variations in water temperatures and a deepening of the thermocline during periods with cooler water leading to a corresponding deepening of the oxycline.

The depth profiles monitoring during Q2 2021 indicates formation of oxyclines in the main reservoir at stations of R4 and R5 at varying depths.

When comparing Q2 2021 with Q2 2020, shows a similar thermocline and oxycline. The mean DO concentration in the upper 7 m was about 7 mg/L similar to Q2 2020 and slightly higher than Q1 2021.

At R5 (the station closest to the main dam), as the water temperatures increased over the course of the first 3 weeks of April 2021, the thermocline deepened to a depth of about 8.5 m, and over the course of the month, the DO levels in the upper 8 m dropped from about 9 mg/L to 6.7 mg/L.

As the water temperatures increased over May and June 2021, the thermocline gradually moved to a depth interval of 6.5 m to 9.5 m with an average DO concentration of 7.0 mg/L in the upper 5 m varying between 4.1 mg/L and 9.2 mg/L.

Sharp decreases in DO concentrations to levels at or below 2 mg/L were measured at depths between 6.5 m and 14 m - well above the top of the water intake to the turbines.

In R5, at the level of the water intake, the DO concentrations were less than 0.34 mg/L during Q2 2021.

R4 showed a similar pattern of depth to the thermocline and the oxycline as R5 during Q2 2021.

Anoxic conditions in the main reservoir (R05) were found at depths between 15 m and 100 m in April 2021, between 18 m and 100 m in May 2021, and between 15 m and 100 m in June 2021.

Re-regulation Reservoir (R6 and R7)

There was no indication of a thermocline at R6 and R7 in the re-regulation reservoir (except R7 in the last two weeks of June 2021), because the re-regulation reservoir behaves more like a river than a lake.

The DO concentrations at R6 were fairly constant over the course of the quarter with an average DO concentration over the entire water column of 1.6 mg/L, and only slightly higher DO concentrations in the first 2 weeks of June 2021 with an average DO concentration of 3 mg/L. A similar pattern was found at R7. The water quality in the Re-regulation Reservoir represented by R6 and R7 generally matches with the water quality in R5 at or near the intake level, although the DO concentrations in R6 and R7 occasionally were slightly higher than the corresponding DO concentrations at or near the intake level in R5. However, it should be noted that the actual flow patterns and movements of water from R5 to the intake is not known and is likely rather complex with circulation patterns or other complex water movements near the intake, which adds uncertainties to correlating water quality data at or near the intake depth at R05 in the main reservoir with water quality data in the Re-regulation Reservoir.

Nam Ngiep Upstream and Tributaries

The Nam Ngiep Upstream station, NNG01, R1 in the upper end of the Main Reservoir, and the reservoir tributaries Nam Chian (NCH01) had DO concentrations above 6 mg/L.

Downstream Stations

During Q2 2021, the discharge from the re-regulation dam mainly went through the turbine; however, during the monitoring missions on 12 April, 09 June and 30 June 2021, the discharge went through the gate.

During periods with gate discharge, the downstream DO levels were above 6 mg/L (the National Surface Water Quality Standard) due to the aeration generated by the turbulence at the gate.

During periods with turbine discharge, over the course of Q2 2021, the downstream DO levels were generally below the National Surface Water Quality Standard of 6 mg/L. The DO levels correspond quite well with the pattern in the re-regulation reservoir. At NNG05 about 1.8 km from the re-regulation dam the monthly average DO concentration (during periods with turbine discharge) decreased slightly from 3 mg/L in April 2021 to 2.4 mg/L in May 2021 and increased back to 3 mg/L in June 2021. At NNG07 located 25 km from the dam, the monthly average DO concentration dropped from 5.4 mg/L in April 2021 to 4.2 mg/L in May and then to 5 mg/L in June. In NNG08, the DO concentrations were fairly constant around a quarterly average DO concentration of 5.4 mg/L with levels generally between 5 mg/L and 6 mg/L and only one sample below 5 mg/L (4.7 mg/L).

No dead fish was observed in Nam Ngiep downstream during Q2 2021.

NNP1PC is in the process of compilating all monitoring information for the design of additional aeration system to improve the DO level at downstream.

FIGURE 3-10: ***MAIN RESERVOIR DISSOLVED OXYGEN AT THE END OF Q2 2021***

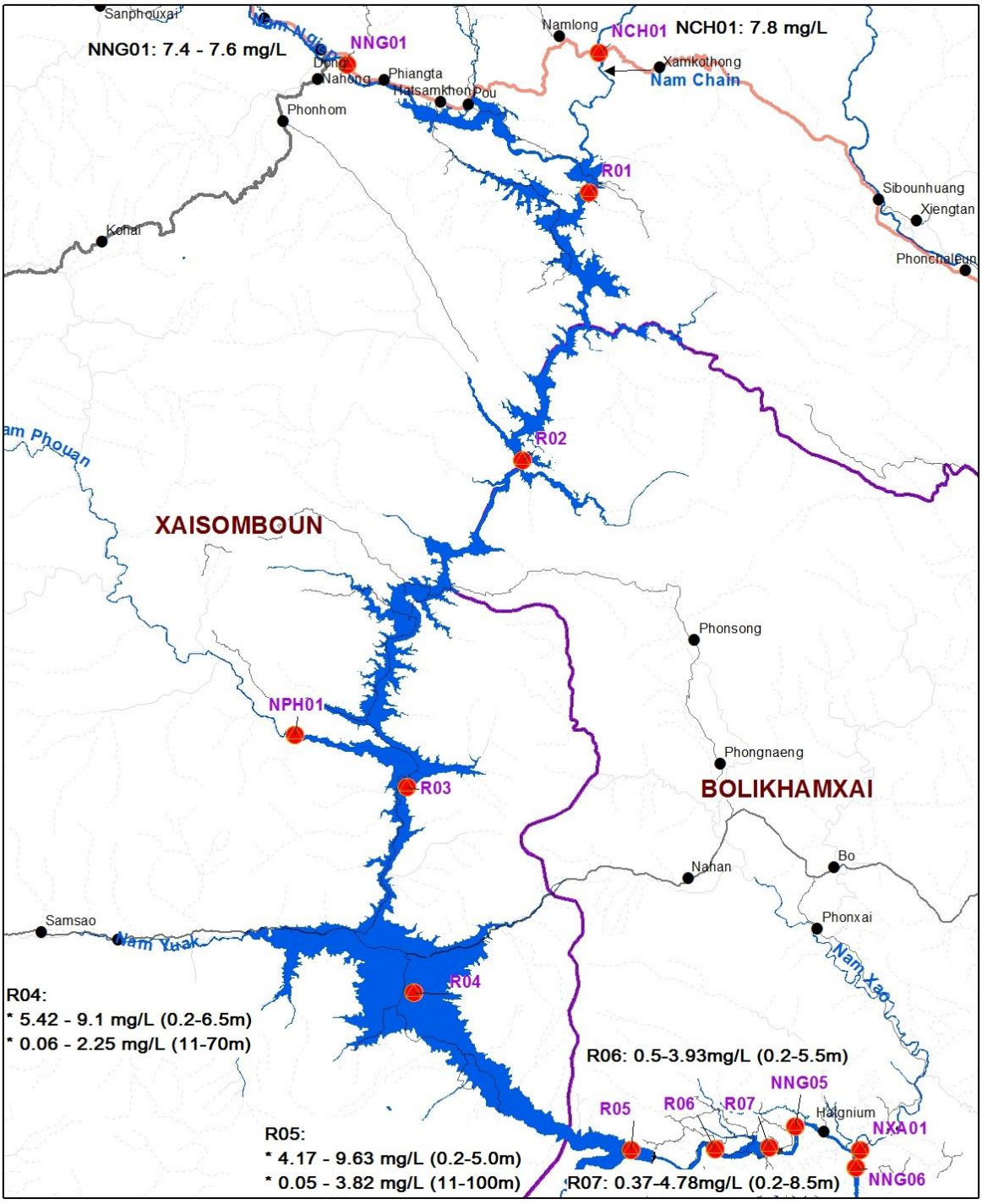
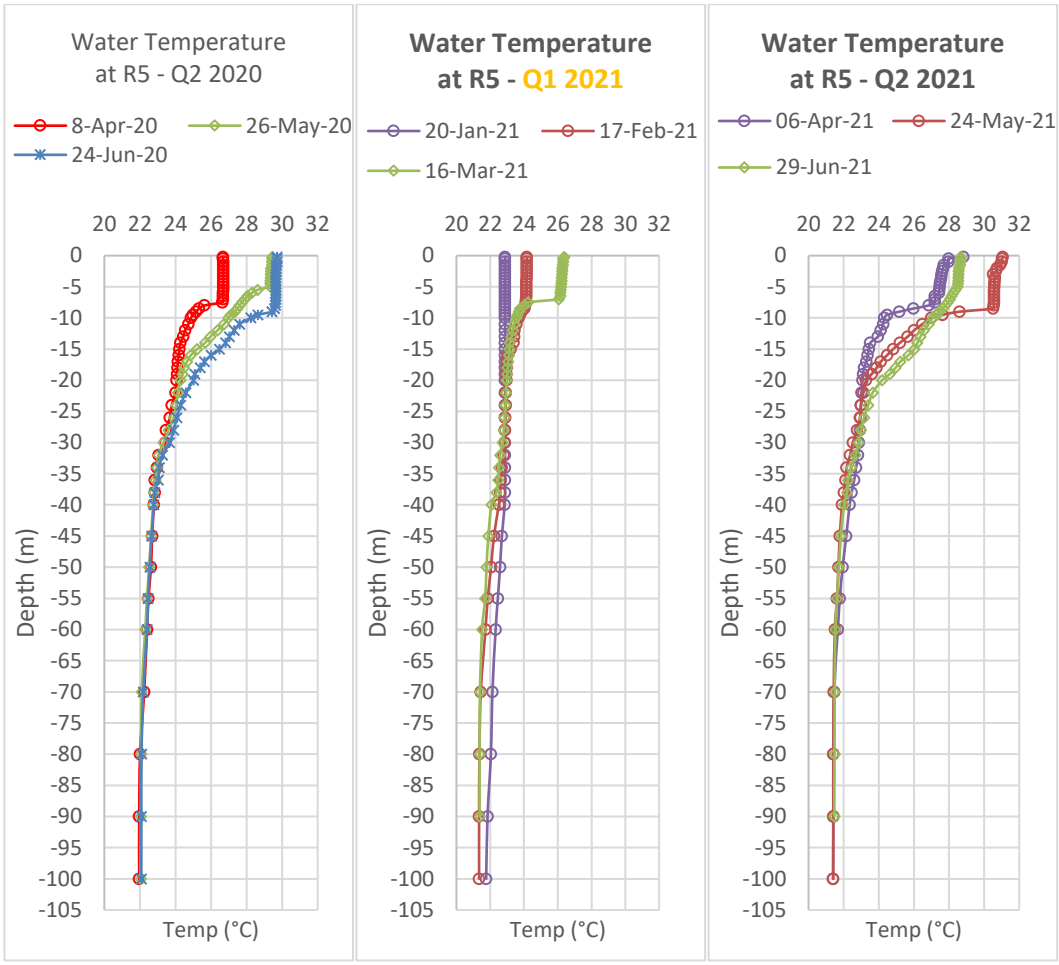


FIGURE 3-11: ***WATER TEMPERATURE AND DISSOLVED OXYGEN – DEPTH PROFILES IN THE MAIN RESERVOIR IMMEDIATELY UPSTREAM OF THE MAIN DAM (R5)***



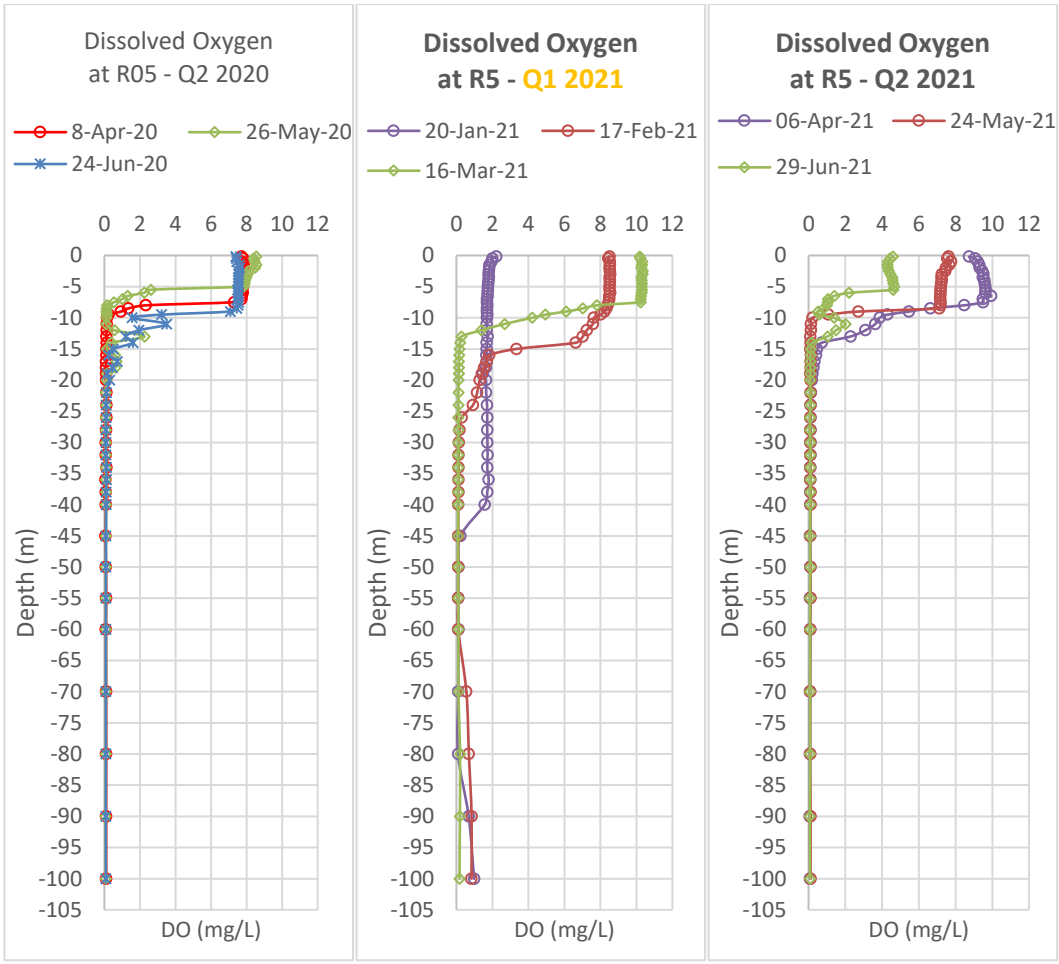

Dissolved Oxygen at R05 - Q2 2020
8-Apr-20
26-May-20
24-Jun-20
Depth (m)
DO (mg/L)
Dissolved Oxygen at R5 - Q1 2021
20-Jan-21
17-Feb-21
16-Mar-21
Depth (m)
DO (mg/L)
Dissolved Oxygen at R5 - Q2 2021
06-Apr-21
24-May-21
29-Jun-21
Depth (m)
DO (mg/L)

FIGURE 3-12: ***WATER TEMPERATURE AND DO DEPTH PROFILES IN THE MAIN RESERVOIR (R4 AND R5), WITH POSITION OF INTAKE AT THE ACTUAL WATER LEVEL DURING SEPTEMBER 2018 – JUNE 2021***

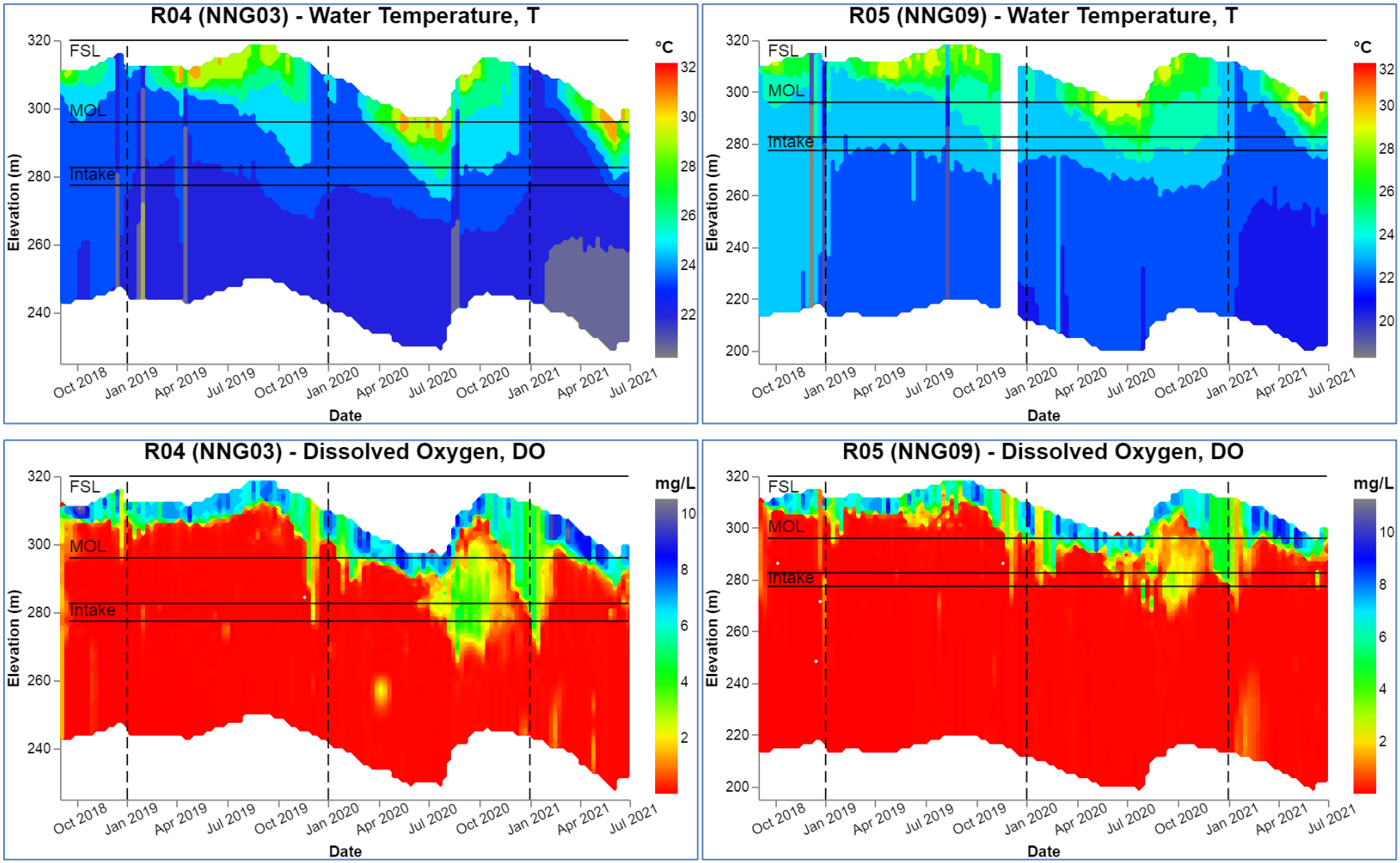


TABLE 3-10: ***DO (MG/L) RESULTS OF SURFACE WATER IN MAIN RESERVOIR, RE-REGULATION RESERVOIR, NAM NGIEP AND ITS MAIN TRIBUTARIES MONITORED IN Q2 2021***

(NATIONAL SURFACE WATER QUALITY STANDARD FOR DISSOLVED OXYGEN: ≥6 MG/L)

Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
5-Apr-21	7.61												7.81			
6-Apr-21					8.66	8.73										
7-Apr-21							0.94	1.92	3.2	3.89	5.69	6.73			5.45	5.22
12-Apr-21							3.76	3.65	8.73	7.03	6.51	7.11			8.84	7.5
13-Apr-21					7.98	8.52										
20-Apr-21							2.03	1.75	3.6	3.8	5.23	6.2				6.66
21-Apr-21					7.86	7.86										
27-Apr-21					6.95	6.96										
28-Apr-21							1.43	3.14	2.69	3.29	6.41	7.03			6.5	6.24
4-May-21					8.87	8.8										
5-May-21							1.81	1.46	2.7	2.8	4.01	5.04			4.7	4.48
13-May-21					8.55	8.72										
14-May-21							1.02	1.3	2.47	2.98	4.83	5.51			6.22	6.06
17-May-21					8.14	8.05										
18-May-21							0.89	1.25	2.52	3.28	4.22	5.48			4.38	4.88
24-May-21					7.52	7.63										
25-May-21							0.92	0.69	2.16	4.56	3.7	4.65			4.62	4.27
1-Jun-21					6.16	6.74										
2-Jun-21							2.51	1.67	2.58	2.89	4.85	5.36			3.36	4.82
8-Jun-21					6.26	6.21										
9-Jun-21							2.27	3.28	7.19	6.61	6.67	6.49			6.43	6.42
15-Jun-21					5.88	5.85										
16-Jun-21							3.93	4.78	4.32	4.54	5.16	5.63			6.13	6.48
22-Jun-21					7.12	6.98										
23-Jun-21							1.06	2.46	2.35	3.00	5.16	5.42			5.71	6.58
28-Jun-21	7.38												7.88			
29-Jun-21					7.29	4.59										
30-Jun-21							1.44	4.07	6.67	6.06	6.27	5.81			6.24	6.38

Ammonia Nitrogen

Since 2014, the Ammonia Nitrogen concentration in the Upper Nam Ngiep River and its tributaries have been below the detection limit (<0.2 mg/L). In Q2 2021, Ammonia Nitrogen complied with the National Surface Water Quality Standard (<0.2 mg/L) in all monitored stations.

TABLE 3-11: ***AMMONIA NITROGEN (MG/L) RESULTS FOR THE SURFACE WATER IN NAM NGIEP AND ITS MAIN TRIBUTARIES MONITORED IN Q2 2021***

(NATIONAL SURFACE WATER QUALITY STANDARD FOR AMMONIA NITROGEN: <0.2 MG/L)

Station Code	NNG 01	R01	R02	R03	R04	R05	R06	R07	NNG 05	NNG 06	NNG 07	NNG 08	NCH 01	NPH0 1	NXA 01	NHS 01
5-Apr-21	<0.2												<0.2			
6-Apr-21					<0.2	<0.2										
6-Apr-21 Bottom					0.21	<0.2										

Biochemical Oxygen Demand (BOD_5)

Since 2014, the Biochemical Oxygen Demand (BOD_5) values in the Nam Ngiep River and its tributaries have generally been below the detection limit (< 1 mg/L) with some measurements exceeding the National Surface Water Quality Standard (< 1.5 mg/L). The results for Q2 2021 indicate BOD levels in compliance with the Standard except Nam Xao (NXA01). NNP1PC is in the process of compilating all monitoring information for the design of additional aeration system to improve the BOD level at downstream.

TABLE 3-12: ***BOD_5 (MG/L) RESULTS FOR THE SURFACE WATER IN NAM NGIEP AND ITS MAIN TRIBUTARIES MONITORED IN Q2 2021***

(NATIONAL SURFACE WATER QUALITY STANDARD FOR BOD_5: <1.5 MG/L)

Station Code	NNG 01	R01	R02	R03	R04	R05	R06	R07	NNG 05	NNG 06	NNG 07	NNG 08	NCH 01	NPH 01	NXA 01	NHS 01
5-Apr-21	<1												<1			
6-Apr-21					<1	<1										
6-Apr-21 Bottom					<1	<1										
7-Apr-21							4.92	2.16	1.25	<1	<1	<1			<1	<1
13-May-21					<1	<1										
13-May-21 Bottom					<1	<1										
14-May-21							<1	1.18	<1	1	<1	<1			2.28	<1
8-Jun-21					<1	<1										
8-Jun-21 Bottom					<1	<1										
9-Jun-21							<1	<1	<1	<1	<1	<1			<1	<1

Chemical Oxygen Demand (COD)

The COD measurements in Q2 2021 are presented in **Table 3-13**.

TABLE 3-13: ***COD (MG/L) RESULTS FOR THE SURFACE WATER IN NAM NGIEP AND ITS MAIN TRIBUTARIES IN Q2 2021 (NATIONAL SURFACE WATER QUALITY STANDARD FOR COD: < 5 MG/L)***

Station Code	NNG 01	R01	R02	R0 3	R0 4	R05	R06	R07	NNG 05	NNG0 6	NNG 07	NNG 08	NCH 01	NPH 01	NXA 01	NHS 01
05-Apr-21	12.9												13.5			
07-Apr-21							13.1	13. 9	9.8	19.6	10.6	15			16.3	13.7

Faecal Coliform Bacteria

The results of the faecal coliform analyses in Q2 2021 are presented in **Table 3-14**.

Faecal coliform complied with the standard in all stations during the Quarter 2 2021, except in Nam Chian [NCH01] in April 2021, Nam Ngiep downstream [NNG07 and NNG08], Nam Xao [NXA01] and Nam Houaysoup [NHS01] in June 2021.

TABLE 3-14: ***FAECAL COLIFORMS (MPN/100 ML) RESULTS IN NAM NGIEP AND ITS MAIN TRIBUTARIES IN Q2 2021 (NATIONAL SURFACE WATER QUALITY STANDARD FOR TOTAL COLIFORMS: <1,000 MPN/100 ML)***

Station Code	NNG 01	R01	R0 2	R0 3	R0 4	R0 5	R0 6	R0 7	NNG0 5	NNG 06	NNG 07	NNG0 8	NCH 01	NPH0 1	NXA0 1	NHS0 1
5-Apr-21	350												1,60 0			
6-Apr-21					0	0										
6-Apr-21					0	0										
7-Apr-21							0	5	0	5	22	170			130	140
13-May-21					0	0										
13-May-21					0	0										
14-May-21							0	13	8	11	70	130			240	240
8-Jun-21					4	0										
8-Jun-21					0	0										
9-Jun-21							0	8	540	920	1,600	1,600			1,600	1,600

Total Coliform Bacteria

The results of measurements for total coliform bacteria are presented in **Table 3-15.** The results indicate a similar pattern and same tendency as for faecal coliform bacteria. There were no exceedances of the National Surface Water Quality Standard (<5,000 MPN/100 mL) for total coliform bacteria.

TABLE 3-15: ***TOTAL COLIFORMS (MPN/100 ML) RESULTS IN NAM NGIEP AND ITS MAIN TRIBUTARIES IN Q2 2021***

(NATIONAL SURFACE WATER QUALITY STANDARD FOR TOTAL COLIFORMS: <5,000 MPN/100 ML)

Station Code	NNG 01	R01	R02	R03	R04	R05	R06	R07	NNG 05	NNG 06	NNG 07	NNG 08	NCH 01	NPH 01	NXA 01	NHS0 1
5-Apr-21	1,600												1,600			
6-Apr-21					2	0										
6-Apr-21 Bottom					0	0										
7-Apr-21							0	8	220	79	240	1,600			1,600	140
13-May-21					0	2										
13-May-21 Bottom					0	0										
14-May-21							0	79	49	40	350	170			240	920
8-Jun-21					4	13										
8-Jun-21 Bottom					2	0										
9-Jun-21							23	23	920	1,600	1,600	1,600			1,600	1,600

3.7.2 Compliance Monitoring of Effluents from Camps

A total of 03 sites discharged effluents in Q2 2021, including 02 camps (OSOV1 and OSOV2) and at the Wastewater Treatment System of the Main Powerhouse**.** The effluent monitoring location sites can be found in **Figure 3-13.** The effluent camp EF14 was connected with EF13 and treated as EF13.

The results are described in **Table 3-16** and the full data set is in **Appendix 5.2**.

The status of compliance as of 30 June 2021 can be summarized as follows:

- Non-compliance with TSS, COD, Ammonia-Nitrogen, Total Nitrogen and Total Phosphorus for Wastewater Treatment Systems in Main Powerhouse (EF19);
- Non-compliance with BOD5, Ammonia-Nitrogen, Total Nitrogen, Faecal Coliform and Total Coliform for Wastewater Treatment Systems in OSOV2 Camp (EF13);
- Non-compliance with BOD5, Total Nitrogen, Faecal Coliform and Total Coliform for Wastewater Treatment Systems in OSOV1 (EF01).

FIGURE 3-13: ***LOCATION OF EFFLUENT MONITORING POINTS***

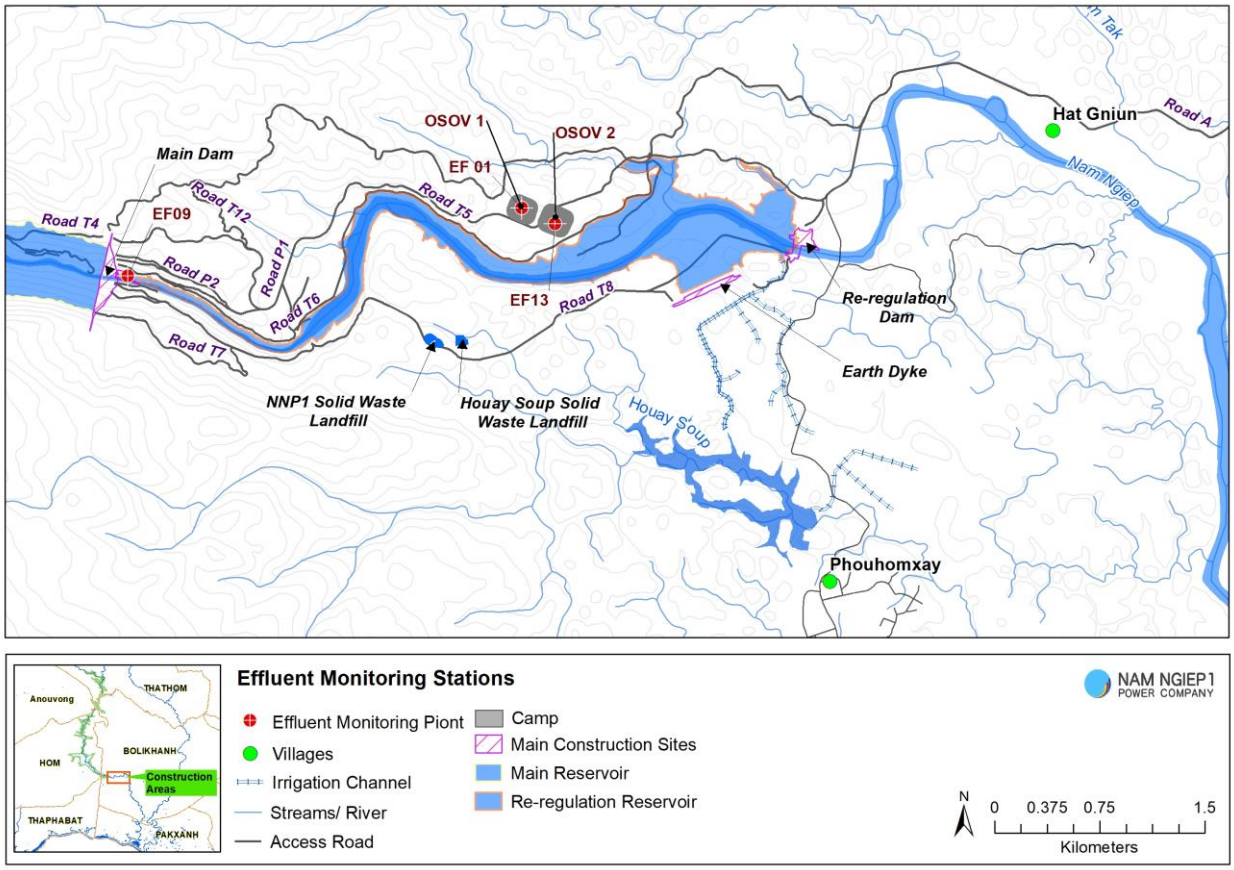


TABLE 3-16: *RESULTS OF THE EFFLUENT WATER QUALITY MONITORING OF THE CAMPS IN Q2 2021 (NON-COMPLIANCE PARAMETERS ONLY)*

		Site Name	OSOV1	OSOV2	Main Powerhouse
		Station Code	EF01	EF13	EF19
Date	Parameters (Unit)	Guideline in the CA			
01-Apr-21	TSS (mg/L)	<50	<5	16.2	
19-Apr-21	TSS (mg/L)	<50	<5	12.2	200
06-May-21	TSS (mg/L)	<50	11.3	<5	39.3
20-May-21	TSS (mg/L)	<50	14.95	7.2	
04-Jun-21	TSS (mg/L)	<50	12.66	7.4	
14-Jun-21	TSS (mg/L)	<50	6.4	13.7	54.9
01-Apr-21	BOD_5 (mg/L)	<30	<6	<6	
19-Apr-21	BOD_5 (mg/L)	<30	<6	<6	9.3
06-May-21	BOD_5 (mg/L)	<30	12.96	41.58	7.26
20-May-21	BOD_5 (mg/L)	<30	29.49	<6	
04-Jun-21	BOD_5 (mg/L)	<30	32.99	<6	
14-Jun-21	BOD_5 (mg/L)	<30	17.23	26.4	<6
01-Apr-21	COD (mg/L)	<125	<25	81	
19-Apr-21	COD (mg/L)	<125	<25	25	313
01-Apr-21	NH_3-N (mg/L)	<10.0	5	17.3	
19-Apr-21	NH_3-N (mg/L)	<10.0	2	18.4	22.3
01-Apr-21	Total Nitrogen (mg/L)	<10.0	11.8	28	
19-Apr-21	Total Nitrogen (mg/L)	<10.0	5.41	22	28
01-Apr-21	Total Phosphorus (mg/L)	<2	1.38	1.35	
19-Apr-21	Total Phosphorus (mg/L)	<2	1.38	1.76	6.41
01-Apr-21	Total coliform (MPN/100 mL)	<400	7	0	
19-Apr-21	Total coliform (MPN/100 mL)	<400	14	0	0
06-May-21	Total coliform (MPN/100 mL)	<400	16,000	35,000	240
20-May-21	Total coliform (MPN/100 mL)	<400	16,000	0	
04-Jun-21	Total coliform (MPN/100 mL)	<400	54,000	0	
14-Jun-21	Total coliform (MPN/100 mL)	<400	13,000	35,000	0
01-Apr-21	Faecal Coliform (MPN/100 mL)	<400	0	0	
19-Apr-21	Faecal Coliform (MPN/100 mL)	<400	2	0	0
06-May-21	Faecal Coliform (MPN/100 mL)	<400	16,000	35,000	79
20-May-21	Faecal Coliform (MPN/100 mL)	<400	16,000	0	
04-Jun-21	Faecal Coliform (MPN/100 mL)	<400	54,000	0	
14-Jun-21	Faecal Coliform (MPN/100 mL)	<400	7,900	24,000	0

TABLE 3-17: *COMPLIANCE STATUS OF EFFLUENT DISCHARGE FROM THE CAMPS IN Q2-2021*

Site	ID	WWTS	Key Non-Compliance Issues[1] in Q2-2021	Corrective Actions
OSOV 1 (Owner's Site Office and Village)	EF01	Septic tanks (kitchen and black water) and wetland (grey water), discharge: 70 m^3/day	- BOD_5 (<30 mg/L): Non-compliance in 1 out of 6 samplings. Q2 mean 16 mg/L. - Total Nitrogen (<10 mg/L): Non-compliance in 1 out of 2 samplings. Q2 mean 8.6 mg/L. - Total coliform (<400 MPN/100 mL): Non-compliance in 4 out of 6 samplings. Q2 mean 16,500 MPN/100 mL. - Faecal coliform (<400 MPN/100 mL): Non-compliance in 4 out of 6 samplings. Q2 mean 15,600 MPN/100 mL.	A local contractor was selected to implement WWTSs Improvement starting in April 2021. The WWTSs improvements will be completed in August 2021.
OSOV 2 (ESD Camp)	EF13	Septic tanks (kitchen and black water) and wetland with chlorination system (grey water)	- Ammonia-nitrogen (<10 mg/L): Non-compliance in all 2 samplings. Q2 mean 17.8 mg/L. - Total nitrogen (<10 mg/L): Non-compliance in all 2 samplings. Q2 mean 25 mg/L. - BOD_5 (<30 mg/L): Non-compliance in 1 out of 6 samplings. Q2 mean 13 mg/L. - Total coliform (<400 MPN/100 mL): Non-compliance in 2 out of 6 samplings. Q2 mean 11,667 MPN/100 mL. - Faecal coliform (<400 MPN/100 mL): Non-compliance in 2 out of 6 samplings. Q2 mean 9,833 MPN/100 mL.	As above.

[1] The values in brackets indicate the applicable standard

Site	ID	WWTS	Key Non-Compliance Issues[1] in Q2-2021	Corrective Actions
Main Powerhouse	EF19	Septic tanks (grey and black water), biofilm tank and chlorination tank.	- Ammonia-nitrogen (<10 mg/L): Non-compliance in the single sampling. Q2 mean 22.3 mg/L. - Total Nitrogen (<10 mg/L): Non-compliance in the single sampling. Q2 mean 28 mg/L. - Total Phosphorus (<2 mg/L): Non-compliance in the single sampling. Q2 mean 6.4 mg/L. - COD (<125 mg/L): Non-compliance in the single sampling. Q2 mean 313 mg/L. - TSS ((50 mg/L): Non-compliance in 2 out of 3 sampling. Q2 mean 98 mg/L	As above

3.7.3 Groundwater Quality Monitoring

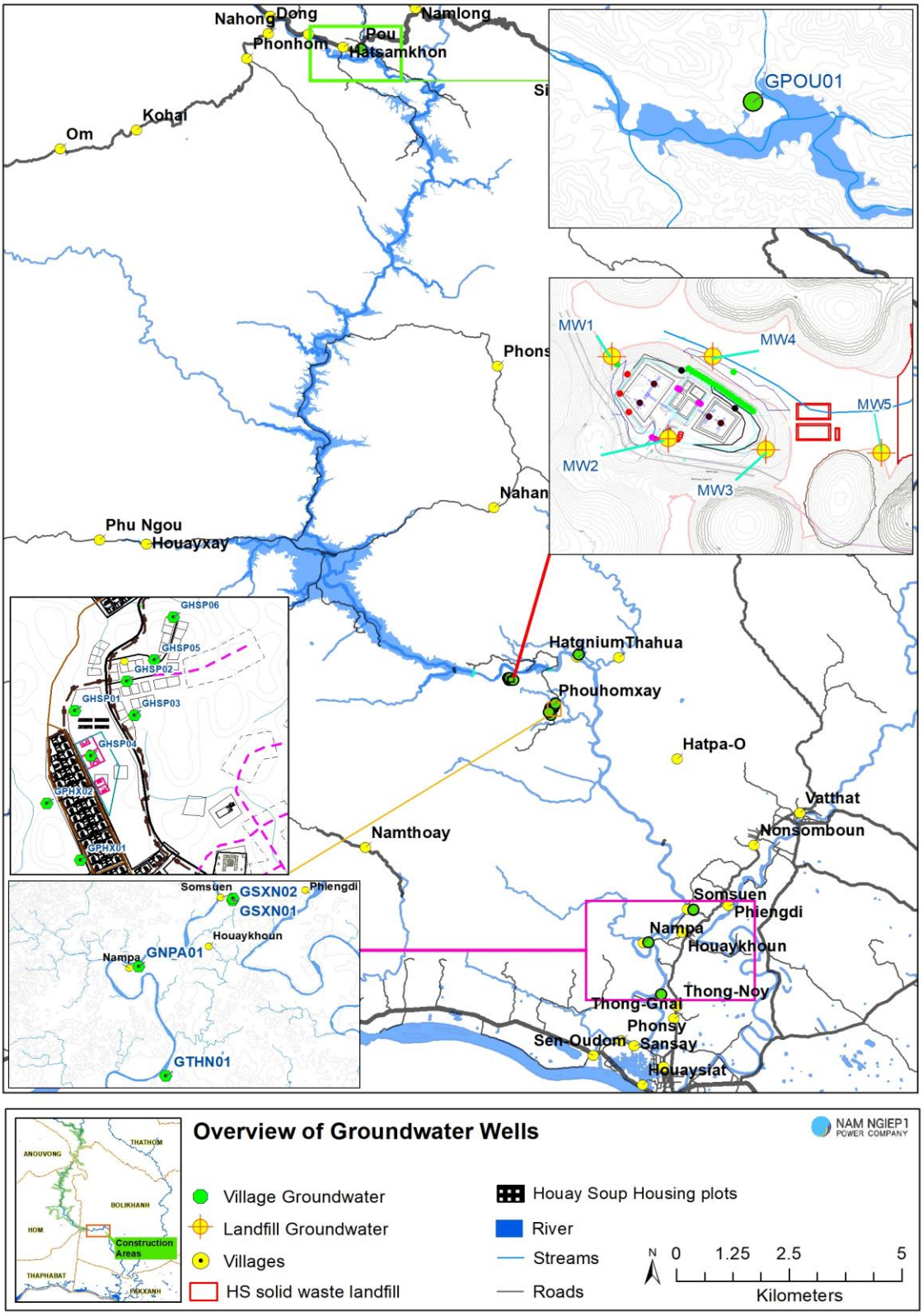
During Q2 2021, a total of six boreholes at Somseun, Nam Pa, Thong Noy, Pou Villages (one borehole in each village) and Phouhomxay Village (two new boreholes – commencing in June 2020) have been monitored for the following parameters:

a. Monthly*:* pH, DO (%), DO (mg/L), Conductivity (µs/cm), Temperature (°C), Turbidity (NTU), Faecal Coliform (MPN/100 mL) and *E. coli* (MPN/100 mL);

b. Annually: Arsenic (mg/L), Total Iron (mg/L), Magnesium (mg/L), Fluoride (mg/L), Total Hardness (mg/L), Nitrate (mg/L), Nitrite (mg/L) and Lead (mg/L).

The groundwater sampling locations are displayed in **Figure 3-14** and the groundwater monitoring data is presented in **Appendix 5.3.**

FIGURE 3-14: *GROUNDWATER SAMPLING LOCATIONS*



Key findings from the groundwater quality monitoring are summarized as the follows:

Thong Noy Village: all monitored parameters complied with the standard, except faecal coliform and *E.coli* in all Q2 2021 samples.

Somsuen Village: all monitored parameters complied with the standard, except faecal coliform and *E.coli* (April and June 2021).

NamPa Village: all monitored parameters complied with the standard, except faecal coliform and *E.coli* in all Q2 2021 samples.

Pou Village: all monitored parameters complied with the standard, except faecal coliform and *E.coli* in May and June 2021 samples.

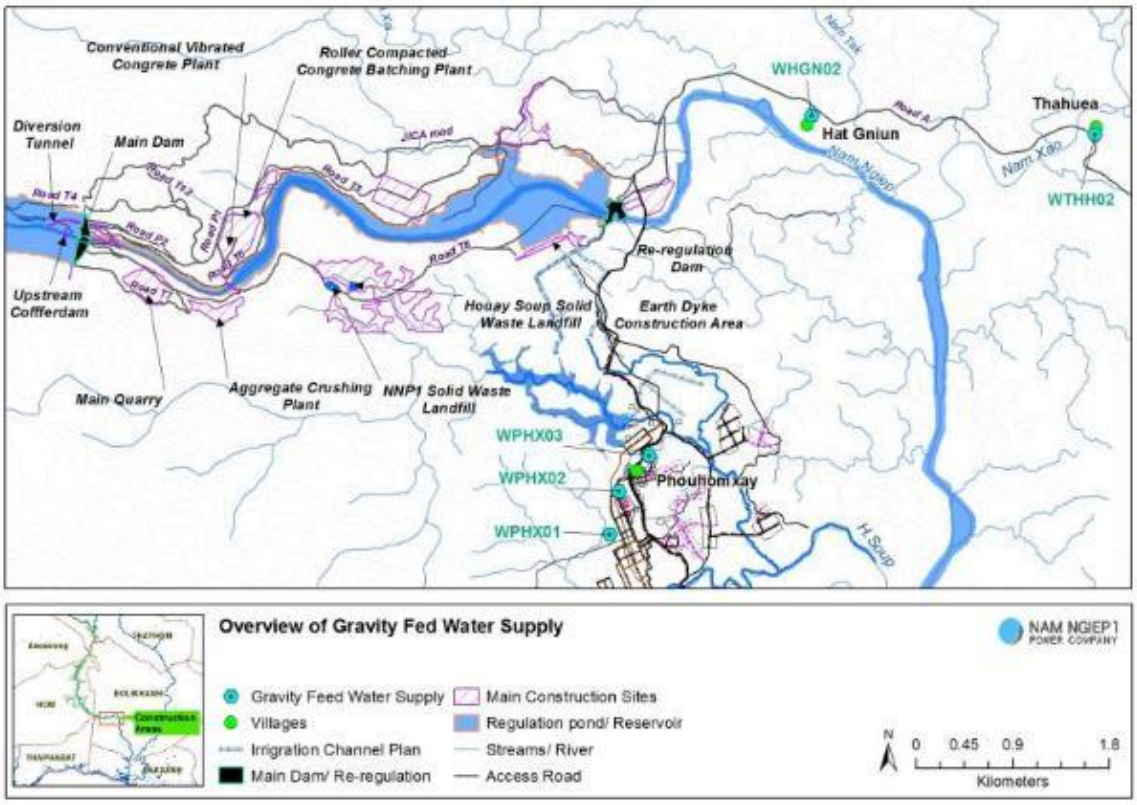
Phouhomxay Village: pH, faecal coliform and *E.coli* bacteria at GPHX01 in Q2 2021 samples, and pH at GPHX02 did not comply with the relevant standard. All other parameters complied with the standard.

The villagers were advised to boil water before drinking. This advice is in accordance with the Law on Hygiene, Disease Prevention and Health Promotion No 01/NA of 10 April 2001, which states that domestic water supply for daily use is not required to be readily drinkable but would normally have to be boiled or otherwise treated before it would be suitable for drinking.

3.7.4 Gravity Fed Water Supply (GFWS) Monitoring

The monitoring of the GFWS aims to assess the quality of water that is being used for bathing and washing by villagers at Hat Gniun, Thahuea and Phouhomxay villages. The gravity fed water supply system at Phouhomxay Village has been in use since December 2017. Commencing in October 2020, two new boreholes in Phouhomxay Village were put in use as a source of water supply instead of the previous gravity fed water supply system.

FIGURE 3-15: *OVERVIEW OF GRAVITY FED WATER SUPPLY*



Water samples were taken from the taps for analysis during the reported period and selected results are shown in **Table 3-18.** The full set of data is presented in **Appendix 5.4.**

TABLE 3-18*: THE GFWS MONITORING RESULT IN Q2 2021*

Date	Parameter (Unit)	Site Name	Thaheua Village	Hatngiun Village	Phouhomxay Village	
		Station	WTHH02	WHGN02	WPHX02	WPHX03
		Guideline				
23-Apr-21	*E. Coli* (MPN/100 mL)	0	17	27	33	14
24-May-21		0		920	49	17
18-Jun-21		0	8	130	79	49
23-Apr-21	Faecal coliform (MPN/100 mL)	0	17	34	33	49
24-May-21		0		920	79	17
18-Jun-21		0	11	130	79	49

Thahuea Village (WTHH02): all parameters complied with the standard, except faecal coliform and *E.coli*.

Hat Gniun Village (WHGN02): all parameters complied with the standard, except pH (April 2021) faecal coliform and *E.coli*.

Phouhomxay Village (WPHX02-tap water at primary school; and **WPHX03**-tap water at the villager's house**):** all parameters complied with the standard, except faecal coliform and *E.coli* in all Q2 2021 samples and pH in May 2021 sample. Note here that during sampling of tap water in Phouhomxay Village, surface water from Houay Soup Stream was still supplied into the system and the samples likely represent a mixture of surface water and groundwater from the boreholes *(GPHX01 and GPHX02),* which may explain the bacteria contamination in the tap-water at Phouhomxay.

As observed in the field during water sample collection, livestock is roaming around in the water intake areas which may have contributed to the presence of Faecal Coliform Bacteria and *E.coli* in GFWS samples. The villagers generally use tap water for washing and cleaning. They were informed about the monitoring results and were advised to boil water before drinking. This advice is in accordance with the Law on Hygiene, Disease Prevention and Health Promotion No 01/NA of 10 April 2001, which states that domestic water supply for daily use is not required to be readily drinkable but would normally have to be boiled or otherwise treated before it would be suitable for drinking.

3.7.5 Landfill Leachate Monitoring

The landfill leachate monitoring was not conducted at NNP1 Project Landfill and Houay Soup Solid Waste Landfill due to the ponds were dried-up.

3.7.6 Compliance of water quality monitoring

During Q2 2021, the non-compliance issues relating to water quality monitoring were observed and summarized in **Table 3-19**.

TABLE 3-19*: NON-COMPLIANCES RELATING TO WATER QUALITY MONITORING IN Q2 2021*

No	Non-compliance Issues	Corrective Actions	Status
1	Dissolved Oxygen (DO) in the Nam Ngiep River downstream the Re-regulation Dam was lower than the National Surface Water Quality Standard (6 mg/L)	- NNP1PC is still in the process of compiling all monitoring information for the design of additional aeration system to improve the DO level downstream the Re-regulation Dam in Nam Ngiep River. - Preliminary studies have been conducted on feasibility of installation, approx. cost and also the adverse impact on the power generation.	- A proper action to resolve the issue has not yet been finalized. - A trial to operate the labyrinth Spillway at the Re-regulation Dam is scheduled in September 2021 to see the improvement of DO values downstream and possibility to operate the spillway routinely.
2	Effluents discharged from the Wastewater Treatment Systems (WWTS) at OSOV1, OSOV2 and the Man Dam exceeded the National	The systems were studied and NNP1PC management agreed on improvement and modification as follows: - **OSOV1** – new construction of the 2nd wetland pond to be a concrete type for a longer-term	- A contractor has been hired for WWTS improvement and modification. The works commenced since April 2021.

No	Non-compliance Issues	Corrective Actions	Status
	Effluent Standard Guideline in some parameters	service and full maintenance by replacing the filtering system of 2 wetland ponds and their piping; - **OSOV2** – new construction of the Sequencing Batch Reactor (SBR) system to replace the under-designed wetland pond; - **The Main Dam** – modifying the piping system to extend the treatment time of wastewater including the automatic Chlorine dosing system installation.	- The works is now on-going as scheduled and expected to be completed by the end of August 2021.
3	Groundwater quality monitored for the communities (Phouhomxay, Nampa, Thong Noy, Somseun, and Pou Village) were not complied with the National Groundwater Quality Standard for drinking purpose on Faecal Coliform and E.*coli* parameters	- A full inspection of water supply systems in Somseun, Nam Pa and Thong Noy Village was conducted in September 2020 by NNP1PC team including consulting with the Village Water Use Committee (VWUC) and also interviewed some consumers (detailed in Q4 2020 Report). - Potential contamination sources of coliform were identified and recommendations on water supply system maintenance and operations were provided to the involved parties. - The villagers were informed about the monitoring results and were advised to boil water before drinking in accordance with the Law on Hygiene, Disease Prevention and Health Promotion No 01/NA of 10 April 2001, which states that domestic water supply for daily use is not required to be readily drinkable but would normally have to be boiled or otherwise treated before it would be suitable for drinking.	- The villagers were advised/encouraged to boil water before drinking.
4	Gravity Fed Water Supply monitored for the communities (Thaheua, Hatngiun, and Phouhomxay Village) were not complied with the National Drinking Water Quality Standard on Faecal Coliform and E.*coli* parameters	- Site observations were conducted during the routine water sampling; it was observed that livestock was roaming around the water intake areas and feces from birds may also contributed to the presence of bacterial contamination. - The villagers were informed about the monitoring results and were advised to boil water before drinking.	- The villagers generally use tap water for washing and cleaning, and were encouraged to boil water before drinking.

4 WATERSHED AND BIODIVERSITY MANAGEMENT

4.1 WATERSHED MANAGEMENT

4.1.1 Implementation of Watershed Management Plan

The construction of the sub-office for Xaysomboun WRPO at Ban Houay Xay, Hom District under the approved AIP2020 continued to progress during Q2 2021. EMO conducted field inspection on 18 June 2021.

Bolikhamxay WRPO conducted forest patrols at the end of March to early April 2021 and found illegal farming within NNP1 watershed. EMO has informed and coordinated with SMO team and relevant GOL offices at the end of April 2021 for them to follow-up and take action.

The camera-trap installation within NNP1 watershed TPZ area was re-scheduled to Q4 2021 subject to the agreement about the accommodation allowance for the field work in the forest area.

The training needs assessment on the capacity of WRPO and GOL staff related to land-use and forest management under component 1 of the approved WMP was finalized in April 2021. The training course will be provided by the Bolikhamxay Agriculture and Forestry College scheduled for Q3 2021.

The procurement of a Short-term Individual Consultant to support implementing the Action Plan on Sustainable Livelihood Opportunities under component 6 of the approved WMP was concluded in the third week of June 2021. The Consultant will start the work from July 2021.

4.1.2 Preparation of Annual Implementation Plan (AIP) 2021

The EMO Team followed up with Bolikhamxay WRPO and noted that they have submitted the draft AIP2021 to DOF-MAF at the end of March 2021. The EMO Team followed up with DOF-MAF in the middle of April 2021 and noted that they are still reviewing the draft AIP2021 of Bolikhamxay WRPO and will discuss further with both WRPOs about the allowance issue.

DOF-MAF provided their comments on the 5-year plan of both WRPOs on 21 May 2021 and these were discussed with EMO at the end of May 2021. Further review and improvement on the draft AIP2021 of Bolikhamxay WRPO will be made after the conclusion of 5-year plan. Xaysomboun WRPO was not able to finalize their draft AIP2021 because there was no final decision yet about allowances.

An online meeting on the WMP's 5-year budget plan 2021-2025 was organized on 9 June 2021. The meeting was attended by 24 participants including representatives from DoF, Xaysomboun PAFO/WRPO, Bolikhamxay PAFO/WRPO, EMO and BSP-WCS. Some of the key discussion points are summarized as follow:

- The participants agreed on the budget allocation referring to the WMP's 5-year budget plan 2021-2025 totalling USD 6,713,733 comprised of USD 1,600,839 from CA budget, USD 3,433,966 from NNP1PC's NNL budget, and USD 1,678,928 from ADB's NNL budget.
- The allowance of 150,000 kip/day/person will be provided for patrolling work, field survey or any field works in the area where accommodation service is not available until the Financial

Management Manual (FMM) is ready. The FMM is expected to be ready and implemented in Q4 2021.

- WRPOs of BLX and XSB in coordination with relevant agencies can develop a short-term action plan as necessary for reservoir fishery management while waiting for the agreement of role and responsibilities of different parties at the provincial, district and village levels and finalization of the FCMP.
- DOF-MAF, Xaysomboun and Bolikhamxay WRPO to prepare the AIP 2021 for the remaining period (July-December 2021) and submit the plan to NNP1PC. The AIP 2021 should be realistic and implementable. WRPOs can review and improve the recommended plans that were sent to WRPOs for developing the AIP 2021 in order to shorten the time for preparation.
- Any budget allocation and revision of the approved plan shall be consulted and acknowledged by NNP1PC in written form.
- Bolikhamxay PAFO to submit official letter requesting advance procurement of one vehicle for WRPO in 2021 and submit it together with the AIP 2021 to NNP1PC for review and further consultation with ADB.
- BSP-WCS confirmed their availability to support WRPOs in preparing the annual implementation plan under Biodiversity Protection Component prior submission the plan to NNP1PC and ADB.

Bolikhamxay WRPO submitted the revised plan to EMO on 14 June 2021 and the plan has been under review until the end of June 2021. Xaysomboun WRPO will submit the revised plan in July 2021.

4.2 BIODIVERSITY OFFSET MANAGEMENT

4.2.1 Implementation of Biodiversity Offset Management Plan

Progresses on the implementation of activities by Component are described below:

a. Component 1 - Spatial Planning and Regulation

NC-NX BOMU confirmed that they still could not finalize the TPZ boundary demarcation in the remaining village, Ban Vangphieng of Viengthong district due to the unavailability of NC-NX BOMU and relevant GOL staffs. The site visit is re-scheduled to Q3 2021.

b. Component 2 – Enforcement

The results of patrolling in the second quarter 2021 are as follow:

Team	Patrolling Area/distance	Observations/Actions Taken
1	**25 April – 14 May 2021** TPZ highest priority area including Nam Sone and Nam Chang (16 days covering a 66.5 km distance of forest patrol and 24.37 km distance of road patrol) **21 May – 10 June 2021**	**25 April – 14 May 2021** The team did not encounter any threats during patrolling. **21 May – 10 June 2021**

Team	Patrolling Area/distance	Observations/Actions Taken
	Nam Ma TPZ high priority area including Nam Ma, Nam Pang, Nam Mong and mountain ridges (15 days covering a 62.9 km distance of forest patrol) **20 June – 9 July 2021** Nam Ma TPZ high priority area including Nam Ma, Nam Pang, Nam Mong and mountain ridges (15 days covering 75.78 km distance of forest and 12.17 km distance of road patrol)	The team encountered and destroyed two old fishing camps located at Nam Ma and an old hunting camp located at Nam Mong. **20 June – 9 July 2021** The team found and destroyed a fresh hunting camp located at Nam Sone.
2	**9 April – 5 May 2021** TPZ high priority area including Nam Houng, Nam Kapa, Nam Somfard and streams and surrounding Na Gnang sub-station including Nam Houng and Nam Kha Gna upstream. (16 days covering a distance of 76.57 km of forest patrol) **12 May – 2 June 2021** Nam Ma TPZ high priority area including Nam Ma, Na Sagna and Nam Kapong. (16 days covering a 74.77 km distance of forest patrol)	**9 April – 5 May 2021** • The team observed two plots of forest clearing for livestock raising located in the upstream of Nam Kha Gna and Nam Tong (inside CUZ) with a total area of approximately 0.7 ha. • The team encountered and destroyed a fishing camp at Nam Houng. • The team issued a written warning to four Na Gnang villagers who were fishing illegally at Nam Houng (inside TPZ priority area). The illegal fishing gears such as two spears, two dive masks and a fishing net were seized. **12 May – 2 June 2021** • The team observed three separate plots of Marijuana plantations with three old huts located at the upstream of Nam Kapong (inside TPZ higher priority area). • The team found an ammunition and heard gunshot (Gap Gun) at the upstream of Nam Kapong (near three plots of Marijuana plantations). • The team encountered and destroyed a fresh hunting camp at Nam Kapong and a small fresh fishing camp at Nam Ma.

Team	Patrolling Area/distance	Observations/Actions Taken
	11 – 30 June 2021 Nam Houng TPZ high priority area including Nam Houng, Nam Somfard, Nam Lak, Houy Bon and Houy Kanang. (15 days covering 88.26 km distance of forest patrol)	**11 – 30 June 2021** The team encountered and destroyed three fresh hunting camps at Nam Houng and found a place made by wood for hunting purpose close to Nam Houng.
3	**9 April – 4 May 2021** TPZ highest priority area including Nam Sone, Houy Xai Gnai, Nam Chouan, Houy Xai Noi, Houy Poung and mountain ridges (16 days covering a 86.38 km distance of forest patrol and 14 km distance of road patrol)	**9 April – 4 May 2021** The team encountered and destroyed a fresh hunting camp located close to Nam Chouan.
	12 May – 2 June 2021 TPZ highest priority area including Nam Xi, Nam Chouan and mountain ridges (15 days covering a 69.3 km distance of forest patrol and 6.5 km distance of road patrol)	**12 May – 2 June 2021** The team encountered and destroyed two old hunting camps located close to Nam Chouan.
	11 June – 03 July 2021 TPZ highest priority area including Nam Sone, Nam Chuan, Houy Xai Gnai, Houy Xai Noi and Houy Poung (16 days covering 58.52 km distance of forest patrol and 18.96 km of road patrol)	**11 June – 03 July 2021** The team encountered and destroyed a small fresh hunting camp located at the upstream of Houy Xay Gnai and found 10 large spring snares located close to Nam Xi.
4	**9 April – 4 May 2021** TPZ highest priority area including Nam San, Houy Payang and mountain range between Nam San and Nam Chang (13 days covering a 53.95 km distance of forest patrol and 12.27 km distance of road patrol)	**9 April – 4 May 2021** The team observed a walking track and a fireplace for fishing at Nam San.

Team	Patrolling Area/distance	Observations/Actions Taken
	12 May – 2 June 2021 TPZ highest priority area including Nam San and south of Nam San Mountain ridges (15 days covering a 49 km distance of forest patrol)	**12 May – 2 June 2021** The team encountered and destroyed a fresh fishing camp at Nam San.
	11 June – 03 July 2021 TPZ highest priority area including Nam San and Nam Chang (16 days covering 54.12 km of forest patrol and 12.32 km of road patrol)	**11 June – 03 July 2021** The team did not encounter any threats during patrolling.

FIGURE 4-1: ***MAP OF PATROLLING TRACK FROM APRIL-JUNE 2021***

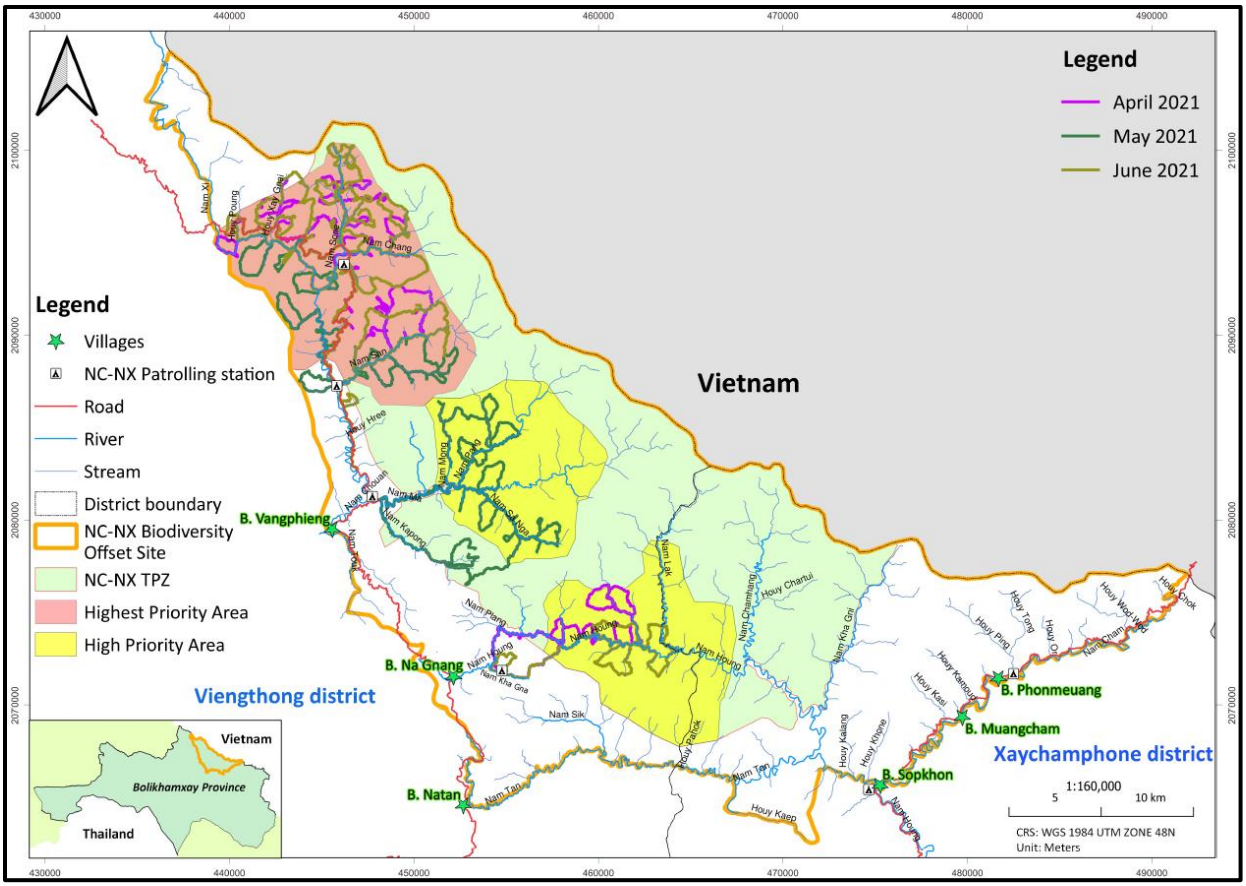


FIGURE 4-2: *MAP OF THREATS FROM APRIL-JUNE 2021*

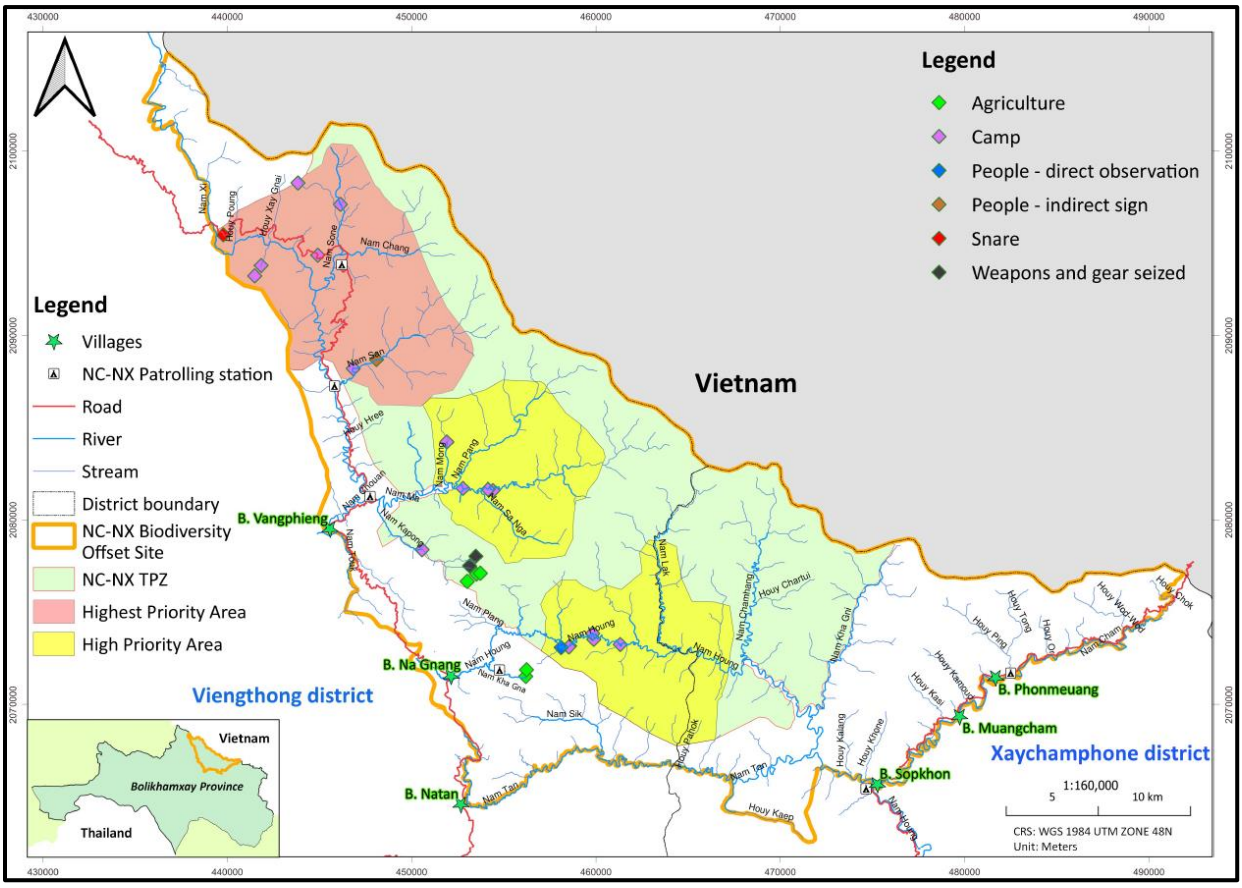


FIGURE 4-3: ***HUNTING CAMP FOUND BY TEAM 3 AT NAM CHOUAN IN APRIL 2021***

FIGURE 4-4: ***FISHING CAMPS FOUND BY TEAM 1 LOCATED AT NAM MA IN MAY 2021***

FIGURE 4-5: ***FRESH HUNTING CAMP FOUND BY TEAM 2 LOCATED AT NAM KAPONG IN MAY 2021***

FIGURE 4-6: ***FRESH FISHING CAMP FOUND BY TEAM 2 AT NAM HOUNG IN JUNE 2021***

FIGURE 4-7: ***LARGE SPRING SNARE ENCOUNTERED BY TEAM 3 LOCATED CLOSE TO NAM XI***

c. Component 3 – Conservation Outreach

BSP presented the results from outreach training and the plan to conduct the outreach campaign at the village level during the monthly meeting on 07 April 2021. EMO and NC-NX BOMU provided more comments to BSP for consideration and further revision especially for the activities identified in the 5-years outreach plan as well as the agenda and materials for the 2021 outreach campaign.

BSP is working on the activities identified for the 5-year plan, the agenda and materials for the 2021 outreach campaign while EMO is producing the NC-NX demarcation and TPZ sign installation/placement as part of the materials for the campaign. Due to the COVID-19 preventive and control measures, the activity will be further postponed to after the rainy season.

d. Component 4 – Conservation linked livelihood

The Lao version of CDP was finalized on 22 February 2021 and submitted to NC-NX BOMU for their final review. The Lao CDP was reviewed by relevant GOL offices between March to June 2021. NC-NX BOMU informed that the review of Lao version of CDP was completed in the second week of June 2021. NC-NX BOMU requested EMO to provide explanation to Bolikhamxay PAFO on the comments from relevant agencies. The meeting was scheduled for July 2021. The English version of CDP which was already reviewed and approved by ADB and IAP in June 2021 will be further refined based on the final Lao version of CDP.

NC-NX BOMU agreed with EMO recommendation that the snare removal activities could be implemented as scheduled during the COVID-19 lockdown, because the activities are not within the COVID-19 outbreak or risk areas. The first snare removal field work was conducted from 21 May to 04 June 2021 led by one BOMU staff and one Viengthong DAFO staff and implemented by six village Snare Removal Team members. The team focused on the TPZ highest priority area including Thongnachang and Nam Sone Mountain ridge areas. The second snare removal field work was started on 20 June 2021 and is expected to be completed in July 2021. The team focuses in the TPZ highest priority area including Nam Chouan, Houy Xai Gnai, Nam Sone Mountain ridges and Pak Namchang.

e. Component 6 – Biological Monitoring

EMO and BSP developed the TOR for specific surveys between Feb-Mar 2021. The TORs were discussed and reviewed by ADB and IAP between April-May 2021. The TOR is being reviewed by NNP1 ESD management.

BSP has updated the biological monitoring matrix and shared it to ADB, IAP, and EMO on 14 May 2021. The matrix reviewed by EMO team and the comments were provided to BSP in the week of 24 May 2021.

4.2.2 Preparation of Annual Implementation Plan (AIP) 2021

The workshop among EMO, NC-NX BOMU, and BSP to clarify the comments on AIP2021 and finalize the activity schedule and budget partition in quarterly basis that was originally scheduled on 07 April 2021 was postponed to May 2021. It refers to the advice from Bolikhamxay PAFO management following the GOL preventive measures nationwide for COVID-19 issued on 21 April

2021 that limit travelling and face-to-face interaction as well as the unreadiness for BOMU team and relevant GOL office to organize online meetings.

EMO communicated with NC-NX BOMU in May 2021 on the AIP 2021 timing or budget revision and suggesting two options:

1. Revise the time schedule to only 6 months (Jul-Dec 2021) and remove the budget for some of the activities during period Jan-Jun 2021 and the activities which will they will not be able to implement in 2021;
2. Keep the timing and budget for the 12 months period but with the time schedule from Jul 2021-Jun 2022.

EMO, NC-NX BOMU, and BSP-WCS organized an online discussion to finalize the BOM AIP2021 on 3 June 2021 focussing on the activities, budget, and timeline that will only cover the implementation period from July to December 2021.

BOMU informed on 5 June 2021 that they still do not agree with an allowance of 150,000 LAK/day/person for any field works until there is an official notification from DOF-MAF and an official letter from NNP1PC management and ADB.

NNP1PC Management is requesting for a meeting with General Director of DOF-MAF and BLX Provincial Vice Governor to seek the guidance on the allowance issue. In case that it could not be settled easily and to avoid further delays then NNP1PC will recommend GOL to separate the budget/activities that NNP1PC, ADB, BSP and BOMU can agree upon so that the fund disbursement and the related activities can go-ahead, while the remaining items are being resolved.

5 FISHERY MONITORING

Three species groups and two species dominated the fish catch by weight in Q1 2021 and five species group dominated in Q2 2021 as listed in **Table 5-1** and **Table 5-2.** All species are classified as Least Concern (LC) according to the IUCN Red List of Threatened Species [2], except *Scaphiodonichthys acanthopterus* and *Sikukia gudgeri* is classified as Data Deficient species (DD).

[2] The IUCN Red List of Threatened Species is the world's most comprehensive inventory and classification of threatened species. The Red List classifies species into nine groups: Extinct (EX), Extinct in the wild (EW), Critically endangered (CR), Endangered (EN), Vulnerable (VU), Near threatened (NT), Least concern (LC), Data deficient (DD), and Not Evaluated (NE). The term "Threatened" includes Critically Endangered, Endangered, and Vulnerable.

TABLE 5-1: *FISH SPECIES DOMINATING THE FISH CATCH IN Q1 2021*

Species	Lao Name	Fish Catch (kg)	IUCN Red List Classification
Hampala dispar, Hampala macrolepidota	ปาสูด	427	LC
Poropuntius normani, Poropuntius laoensis,Poropuntius carinatus	ปาจาด	401	LC
Oreochromis niloticus	ปานิน	302.7	LC
Sikukia gudgeri, Amblyrhynchichthys truncatus	ปาขาวซาย	225.2	DD, LC
Scaphiodonichthys acanthopterus	ปาม้อม	175.4	DD

TABLE 5-2: *FISH SPECIES DOMINATING THE FISH CATCH IN Q2 2021*

Species	Lao Name	Fish Catch (kg)	IUCN Red List Classification
Barbonymus gonionotus, Hypsibarbus malcomi, Hypsibarbus vernayi, Hypsibarbus wetmorei	ปาปาก	531.5	LC
Hampala dispar, Hampala macrolepidota	ปาสูด	384.2	LC
Sikukia gudgeri, Amblyrhynchichthys truncatus	ปาขาวซาย	303.2	DD, LC
Poropuntius normani, Poropuntius laoensis,Poropuntius carinatus	ปาจาด	276.3	LC
Mastacembelus armatus, Mastacembelus favus	ปาหูาด	175.7	LC

The recorded catch of Threatened species (IUCN Red List classification) in Q1 2021 and Q2 2021 are presented in ***Table 5-3*** and ***Table 5-4.*** The list includes four species that are classified as Vulnerable species (VU) in Q1 2021 and three Vulnerable species in Q2 2021.

TABLE 5-3*: THREATENED SPECIES OF Q1 2021 FISH CATCH*

Species	Lao Name	Fish Catch (kg)	IUCN Red List Classification
Cirrhinus cirrhosus	ปาแกง/ปาบอมจัม	5	VU
Cyprinus carpio	ปาไม	43.8	VU
Scaphognathops bandanensis	ปาอวมไฝ/ปาป่วม	36.3	VU
Tor sinensis	ปาแดง	69.1	VU

TABLE 5-4*: THREATENED SPECIES OF Q2 2021 FISH CATCH*

Species	Lao Name	Fish Catch (kg)	IUCN Red List Classification
Cyprinus carpio	ปาไน	21.5	VU
Scaphognathops bandanensis	ปาอวนไฝ/ปาป่วน	35.9	VU
Tor sinensis	ปาแดง	98.8	VU

The occurrence of Threatened species in the fish catch by quarter since the start of species identification in Q3 2015 is displayed in **Table 5-5**.

TABLE 5-5: *OCCURRENCE OF THREATENED SPECIES IN THE FISH CATCH*

Species	Q3 2015	Q4 2015	Q1 2016	Q2 2016	Q3 2016	Q4 2016	Q1 2017	Q2 2017	Q3 2017	Q4 2017	Q1 2018	Q2 2018	Q3 2018	Q4 2018	Q1 2019	Q2 2019	Q3 2019	Q4 2019	Q1 2020	Q2 2020	Q3 2020	Q4 2020	Q1 2021	Q2 2021
Bangana behri	+	+	+	+	+	+	+	+	+			+	+	+		+								
Cirrhinus cirrhosus	+	+	+	+	+	+	+	+	+		+	+	+	+	+	+	+		+	+	+		+	
Cyprinus carpio	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		+	+	+	+	+	+	+	+
Datnioides undecimradiatus *																+								
Epalzeorhynchos munense												+												
Luciocyprinus striolatus	+	+	+	+			+	+	+	+			+	+										
Pangasianodon hypophthalmus	+																							
Probarbus jullieni	+	+	+			+		+	+	+		+		+			+	+			+	+		
Probarbus labeamajor				+	+			+																
Scaphognathops bandanensis	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Tor sinensis	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
**Datnioides undecimradiatus* was caught in Mekong by DS households																								

Species abundance and occurrence is based on the 7-day reported catch from the DCL survey in Q1 2021 and Q2 2021. The catch is divided in 3 areas including above the main dam, below the main dam and Mekong area. Main biodiversity indicators in Q1 2021 and Q2 2021 for above dam, below dam and Mekong area are presented in **Table 5-6** and **Table 5-7.**

TABLE 5-6*: MAIN BIODIVERSITY INDICATORS FOR Q1 2021*

Biodiversity Indicators	Mekong	Below dam	Above dam
Total species and groups	41	45	46
Single species	33	30	31
Species groups	8	15	15
Top 15 species (% total catch weight)	90.44%	85.31%	85.66%
Proportion for species groups	18.98%	58.88%	47.15%
Diversity index (Shannon)	2.6305	2.9201	2.9271

TABLE 5-7: *MAIN BIODIVERSITY INDICATORS FOR Q2 2021*

Biodiversity Indicators	Mekong	Below dam	Above dam
Total species and groups	45	45	48
Single species	34	30	31
Species groups	11	15	17
Top 15 species (% total catch weight)	84.89%	86.19%	88.40%
Proportion for species groups	23.26%	70.66%	57.26%
Diversity index (Shannon)	2.9844	2.7145	2.8682

The mean daily fish catch per household from July 2015 to June 2021 are displayed in **Figure 5-1** and the mean fish catch per household per fishing day in Q1 and Q2 from 2016 to 2021 are shown in **Table 5-8** and **Table 5-9.**

FIGURE 5-1: *MEAN DAILY FISH CATCH PER HOUSEHOLD FROM JULY 2015 TO JUNE 2021*

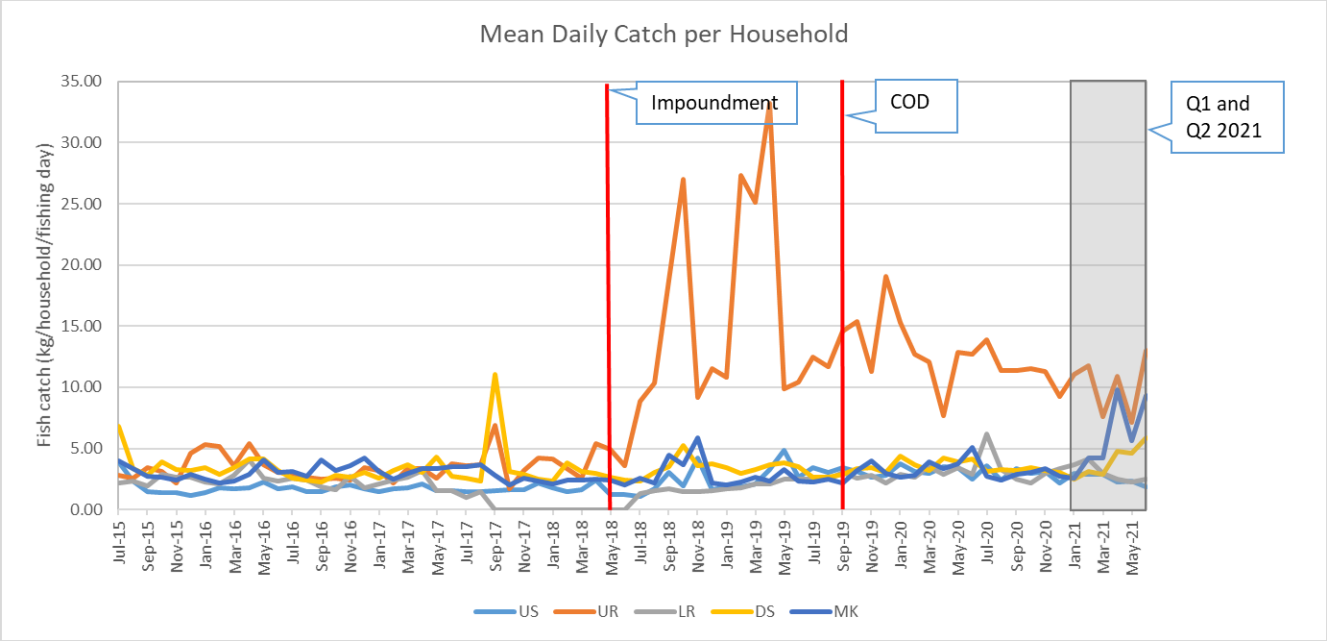


TABLE 5-8*: MEAN DAILY FISH CATCH PER HOUSEHOLD IN Q1 FROM 2016 TO 2021*

Fishing Zone	Q1 2016 (kg)	Q1 2017 (kg)	Q1 2018 (kg)	Q1 2019 (kg)	Q1 2020 (kg)	Q1 2021 (kg)
Upstream	1.62	1.64	1.62	1.95	3.27	2.92
Upper reservoir	4.70	2.90	3.36	21.08	13.35	10.15
Lower reservoir	2.37	2.40	NA	1.85	3.01	3.58
Downstream	3.26	3.16	3.08	3.19	3.75	2.83
Mekong	2.36	2.86	2.32	2.30	3.11	3.63

TABLE 5-9*: MEAN DAILY FISH CATCH PER HOUSEHOLD IN Q2 FROM 2016 TO 2021*

Fishing Zone	Q2 2016 (kg)	Q2 2017 (kg)	Q2 2018 (kg)	Q2 2019 (kg)	Q2 2020 (kg)	Q2 2021 (kg)
Upstream	1.92	1.73	1.61	3.59	3.13	2.14
Upper reservoir	4.05	3.21	4.66	17.85	11.06	10.34
Lower reservoir	2.98	2.09	NA	2.37	3.08	2.41
Downstream	3.85	3.35	2.65	3.67	4.10	5.06
Mekong	3.31	3.39	2.30	2.65	4.06	8.23

The survey results in Q1 2021 found that tributaries and streams are the main fishing habitat for lower reservoir and downstream zone, while the main fishing habitat in upstream, upper reservoir and Mekong zones are Nam Ngiep, reservoir, and Mekong respectively. In Q2 2021, the main fishing habitats for the upstream and downstream fishing zones is Nam Ngiep, while the main fishing habitats for the upper reservoir, lower reservoir and Mekong fishing zones are the reservoir, tributaries and streams and Mekong River respectively. The proportion of fishing habitats in Q1 2021 and Q2 2021 are displayed in **Table 5-10** and **Table 5-11.**

TABLE 5-10*: PROPORTION OF THE CATCH REPORTED BY MAIN HABITATS (%) IN Q1 2021*

Habitats	US	UR	LR	DS	MK
Mekong	0.00%	0.00%	0.00%	15.16%	88.03%
Nam Ngiep	55.19%	24.06%	0.00%	25.66%	0.00%
Nam Xan	0.00%	0.00%	0.00%	1.75%	0.00%
Reservoir	0.00%	69.88%	26.87%	0.00%	0.00%
Tributary and stream	44.16%	5.66%	69.70%	52.21%	0.00%
Wetland	0.65%	0.41%	3.43%	5.22%	11.97%
Others	0.00%	0.00%	0.00%	0.00%	0.00%

TABLE 5-11*: PROPORTION OF THE CATCH REPORTED BY MAIN HABITATS (%) IN Q2 2021*

Habitats	US	UR	LR	DS	MK
Mekong	0.00%	0.00%	0.00%	10.24%	84.99%
Nam Ngiep	54.71%	7.63%	0.00%	58.36%	2.38%
Nam Xan	0.00%	0.00%	0.00%	0.00%	0.00%
Reservoir	0.00%	85.22%	15.96%	0.00%	0.00%
Tributary and stream	41.19%	6.91%	66.10%	22.94%	1.30%
Wetland	4.10%	0.24%	17.94%	1.89%	11.33%
Others	0.00%	0.00%	0.00%	6.56%	0.00%

Total reported fish and OAA catch (proportion of OAA) for the same 7-day period in Q1 and Q2 from 2016 to 2021 are shown in **Figure 5-2** and **Figure 5-3.**

FIGURE 5-2: *PROPORTION OF OAA TO THE TOTAL REPORTED NUMBER OF FISH AND OAA FOR A 7-DAY PERIOD BY FISHING ZONE IN Q1 FROM 2016 TO 2021*

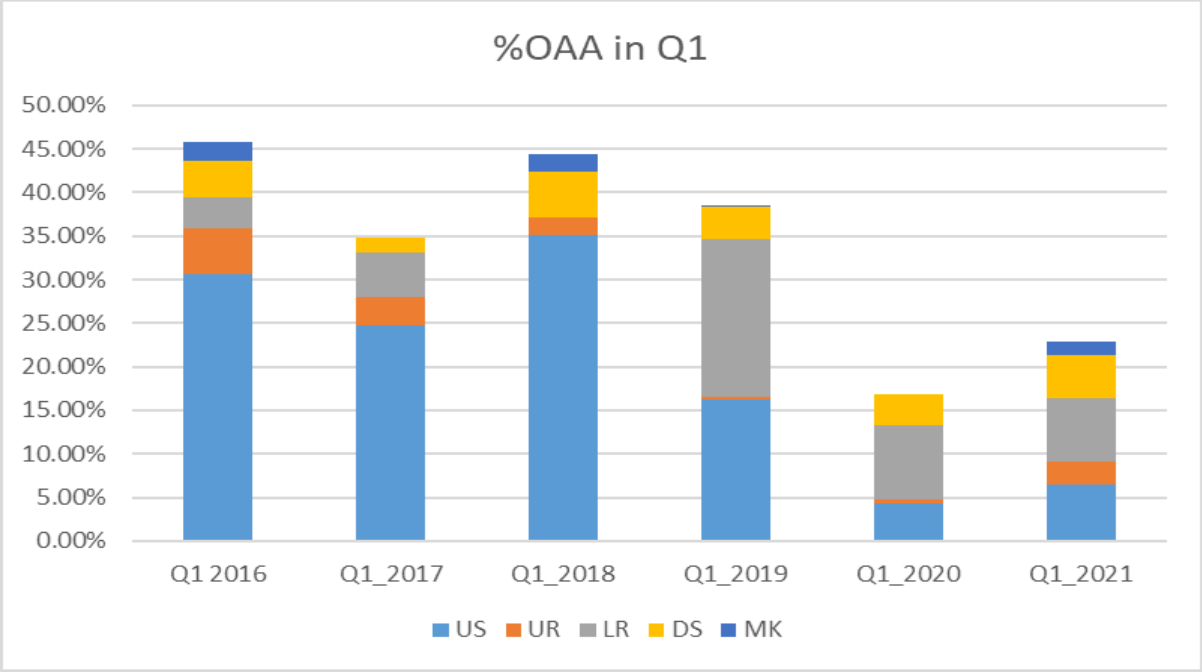
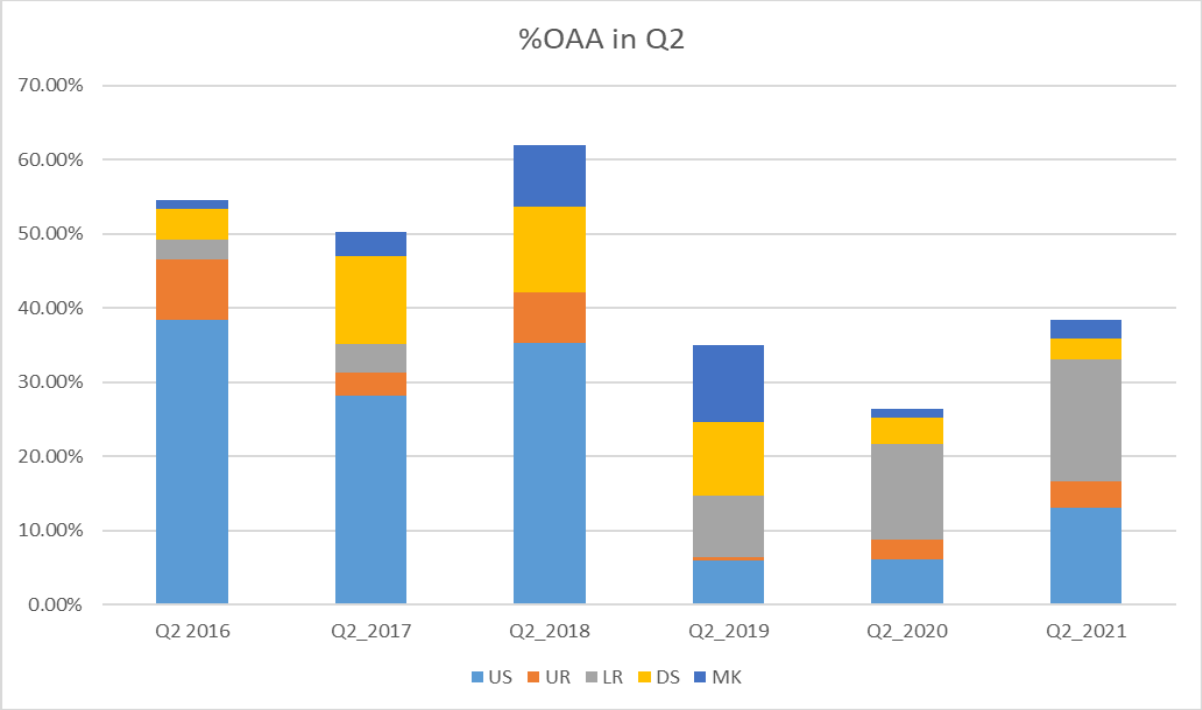


FIGURE 5-3: *PROPORTION OF OAA TO THE TOTAL REPORTED NUMBER OF FISH AND OAA FOR A 7-DAY PERIOD BY FISHING ZONE IN Q2 FROM 2016 TO 2021*



6 Health and Safety

6.1 Related to NNP1PC Health and Safety

A summary of the safety incidents reported during the Construction Phase (up to the end of August 2019) are provided in the *Q4 2020 Environmental Monitoring Report (October to December 2020)*.

A summary of the safety incidents reported during the Operation Phase (September 2019 to June 2021) are provided in **Table 6-1.**

Table 6-1: *Safety Incidents Reported during the Operation Phase (September 2019 to June 2021)*

Type of Incidents	LTI	RI	NM	PD	FI	MVI	Total
No. of Incidents in June 2021	0	0	0	0	0	0	0
Cumulative Total Incidents to 30 June 2021	0	0	0	0	0	0	**0**

LEGEND:
- LTI - Lost Time Incident
- RI - Recordable Injury
- NM - Near Miss
- PD - Property Damage
- FI - Fire Incident
- MVI - Motor Vehicle Incident

During Q2 2021, there was no incident or accident occurred.

6.2 Related to COVID-19

Based on WHO COVID-19 situation report for Lao PDR dated 28 April 2021, Lao PDR was experiencing an increase in COVID-19 cases, with 453 cases reported from 20-27 April, of which 435 were locally acquired (but most of which were epidemiologically linked to importation).
The Prime Minister (PM) Order No. 15/PM dated 21 April 2021 was issued for the Prevention, Control and Preparedness for the COVID-19 and the implementation and enforcement have been extended four times through the PM Order No. 462/PM dated 5 May 2021, PM Order No. 528/PM dated 20 May 2021, PM Order No. 595/PM dated 4 June 2021, PM Order No. 671/PM dated 19 June 2021, PM Order No.1036/PMO dated 19 August 2021, PM Order No. 1094/PMO dated 31 August 2021, and PM Order No. 1177/PMO dated 15 September 2021 respectively.

6.2.1 NNP1PC COVID-19 Measures

NNP1PC has implemented the COVID-19 preventive measures since 2020 in line with the guidelines within the country, WHO, and international labour Organization (ILO). The general protocol being implemented includes:

1. Paramedics stationed at the site clinic at OSOV have started screening and checking body temperature of all staff, consultants and contractors at OSOV1 and OSOV2 once per day and twice a day for those on self-quarantine, The details about when, where and how often the screening will take place will be announced separately;
2. A mask will be provided to each staff per week and more as appropriate for high-risk staff who need to be working with local communities/contact with external stakeholders;
3. If a member of staff family comes back from a trip overseas of those listed as COVID-19 infected country, the staff must be self-quarantined for 14 days to monitor symptoms and by working from home or taking annual leave (and stay at home for self-isolation);
4. If a staff have any of the COVID-19 symptoms (i.e., dry cough, high fever, difficult breathing, sweats, chills, headaches) or have high temperature or flulike symptoms, they must contact their immediate supervisor and seek medical help immediately (clinic at OSOV or nearest medical centre) or by calling the hotline no. 166 or +85620 54066777;
5. If their medical case is found to be of the definition of COVID-19, they will be immediately removed from the site (site-based staff) and referred to the medical treatment facility in Vientiane Capital that is equipped to treat COVID-19;
6. If staff have any other sickness with a qualified medical certificate that it is not COVID-19, they can take sick leave or work in the office with proper protection (face mask and practice personal hygiene);
7. Refrain from meeting with staff and external stakeholders of more than 20 people. If such a meeting is necessary, alternative ways of communications e.g., telephone conference, Skype or other online platforms is recommended;
8. When visiting community members or contractors, wear a mask and keep your distance from another person at least one 1.5 meter apart;
9. Alcohol-based hand gel will be continued to be provided in all NNP1PC offices;
10. Common areas e.g., offices, canteens, bathrooms and kitchens will be thoroughly cleaned with alcohol (disinfectant liquid);
11. All staff must practice personal hygiene and take preventive measures as per above strictly;
12. All staff are asked to follow and implement NNP1PC and GOL preventive measures that have and to be issued periodically; and
13. These measures are also applicable for NNP1PC contractors and subcontractors and they shall take these as if they are their own measures.

Following the latest PM Order No. 1177/PMO dated 15 September 2021 and its extensions, NNP1PC have implemented the lock down for site-based operation (OSOV1 and OSOV2) until 30 September 2021 with the following protocol:

1. Subject to prior approval of respective DMD by filling out the Site Access Form attached herewith, staff and contractors currently residing in OSOV 1 and OSOV 2 as well as in Hat Gniun Village are allowed to travel outside of the camp and Hat Gniun village to buy daily essentials or foods in Pakxan or Bolikhan Districts ONLY. While they are living or being in the community outside the camp, they need to avoid direct interactions with local communities, congested areas such as enclosed markets with limited air ventilation and keep social distancing at least one meter. They are not allowed to join/hold social functions or group

drinking outside or in the resided Village and they must implement COVID-19 Countermeasures of the Government strictly;

2. Subject to prior approval by respective DMD and COVID-19 Committee, staff can be allowed to return home for annual leave or to work from home if their residences are not in a Red Zone (Seal-off area);
3. The residents of OSOV1 and OSOV2 can interact with one another and dining in the canteen are allowed but precautionary measures such as social distance at least one meter and personal hygiene shall be practiced. Different dining time between OSOV1, OSOV2 and Contractor (such as EGAT O&M and Kenber) will be organized to reduce congestions in the canteen;
4. All sport events are allowed onsite;
5. Even though there is a lockdown of both camps, essential activities such as operation and maintenance of power facilities, water quality monitoring, social and environmental activities and others must be continued where permissible by GOL and communities by following strict GOL preventative measures such as wearing face masks both in the offices and outside, sanitizing hands/equipment and keeping a distance of at least 1.5 m;
6. Staff/consultants who are performing these activities outside of the site area apart from the Main and Re-regulation dams/powerhouses, dyke, road, T/L line must obtain approval by the DMD of each division in advance at least 1 hour before departure/arrival by filling out form attached herewith for presenting to the security guard at the main exit;
7. Contractors performing work around the Project areas including Powerhouse maintenance, grouting work, concrete work, waste collection, road and other small site maintenance/monitoring may not need to obtain Authorized Site Access Form as long as their works are acknowledged by respective DMDs. They have to maintain no direct contact with staff in these camps and strictly work in their responsible areas. If interaction is unavoidable, social distancing of at least of 2 meters shall be insured and mask wearing is a must;
8. During the extended lockdown period, the residents of both camps can leave their respective site in case of emergency such as accidents, health and family related issues and other requests as found reasonable by respective management. Staff must obtain prior consent from their managers and approval from the respective DMD-TD or DMD-ESD;
9. Food and essential items to be delivered to the site for camp residents must be loaded at the main entrance and these will be collected and sterilized by the respective team before distribution. Materials for construction activities can be transported into site directly as long as there is no direct contact with any camp residents;
10. Social events/gathering in case of need inside the camp area are allowed but mask-wearing and social distancing of at least one meter must be ensured; and
11. During the lockdown period, the Administration team in the Vientiane Office will provide support to procure personnel essential needs and delivered to the main entrance gate of OSOV and these will be picked up by the site ADM and then delivered to the staff.

In the 9th extended lockdown period, the following preventive measures for staff and Contractors inside and outside the Project areas are to be implemented at all times as follows:

1. Relevant Division to ensure that their contractors' staff working inside and outside the Project areas are regularly checked for body temperatures and use of face masks/hand gel in their camps and work outside. No new workers from known infected areas are allowed to enter. If any of their staff travel to the community-based infected Provinces to purchase materials/goods, they have to implement the same measures as NNP1PC staff, i.e., perform 14 days self-isolation for those with no/one vaccine shot and 7 days for those that have completed 2 shots but less than one month;
2. Paramedics stationed at the site clinic at OSOV have to continue with the screening and checking body temperature of all staff, consultants and contractors at OSOV1 and OSOV2 once per day and twice a day for those on self-quarantine;
3. A mask will be provided to each staff per week and more as appropriate for high-risk staff who need to be working with local communities/contact with external stakeholders;
4. If a member of staff family comes back from a trip overseas of those listed as COVID-19 infected country or from Red Zone in Laos, the staff must be self-quarantined for 14 days to monitor their symptoms by working from home or taking annual leave (and stay at home for self-isolation);
5. If staff or Contractors are found to have any of the COVID-19 symptoms (i.e., dry cough, high fever, difficult breathing, sweats, chills, headaches) or have high temperature or flulike symptoms, they must contact their immediate supervisor and seek medical help immediately (clinic at OSOV or nearest medical centre) or by calling a hotline no. 166 or +85620 54066777;
6. If their medical case is found to be of the definition of COVID-19, they will be immediately removed from the site (site-based staff) and referred to the medical treatment facility in Vientiane Capital that is equipped to treat COVID-19;
7. If staff have any other sickness with a qualified medical certificate that it is not COVID-19, they can take sick leave or work in the office with proper protection (face mask and practice personal hygiene);
8. Meeting with staff and external stakeholders not more than 20 people are allowed but preventive measures must be observed such as keeping social distance at least 1 meter, taking body temperature, wearing mask and washing hands with alcohol-based gel. If physical meeting could be avoided, alternative ways of communications e.g., telephone conference, Skype or other online platforms is recommended;
9. When visiting community members or GoL staff, wear a mask and keep your distance from another person at least 1.5 meter apart;
10. Alcohol-based hand gel will be continued to be provided in all NNP1PC offices;
11. Common areas e.g., offices, canteens, bathrooms and kitchens will be thoroughly cleaned with alcohol (disinfectant liquid);
12. All staff and Contractors must practice personal hygiene and take preventive measures as per above strictly;
13. All staff and Contractors are asked to follow and implement NNP1PC and GOL preventive measures that have and to be issued periodically; and
14. These measures are also applicable for NNP1PC, Contractors and subcontractors and they shall take these as if they are their own measures.

6.2.2 Overview of NNP1PC COVID-19 Measures related to NNP1PC project implementation and monitoring program

<table>
<tr><td colspan="2">Workplace risk assessment</td></tr>
<tr><td colspan="2">• The exposure risk for NNP1PC entities (employee, consultant, contractor, sub-contractor) during the increased COVID-19 cases which was started in April 2021 is defined based on the WHO Guideline (2020)[3] that is “medium exposure risk”.
• The medium exposure risk means that jobs or work tasks with close, frequent contact with the general public, or other co-workers, visitors, clients or customers, or contractors, but that do not require contact with people known to be or suspected of being infected with COVID-19. In areas where COVID-19 cases continue to be reported, this risk level may be applicable to workers who have work-related frequent and close contact with the general public, visitors, or customers in high-population-density work environments (e.g., food markets, bus stations, public transport, and other work activities where physical distancing of at least 1 m may be difficult to observe), or work tasks that require close and frequent contact between co-workers. In areas without community transmission of COVID-19, this scenario may include frequent contact with persons returning from areas with community transmission.</td></tr>
<tr><td>Risk</td><td>Preventive measures</td></tr>
<tr><td>Job or work tasks with close or frequent contact in the area where COVID-19 continue to be reported or contact with persons returning from area with community transmission</td><td>• Implement the lockdown for site-based operation (OSOV1 and OSOV2) with specific protocol as mentioned in the section of “NNP1PC COVID-19 Measures”. The lockdown started from 23 April 2021 until 30 September 2021 with possible extension following the country guideline on COVID-19 measures (PM Order No. 1177/PMO dated 15 September 2021)
• During the lockdown, the staffs were also encouraged to be well updated on the situation within their work-related places and hometown to reduce non-essential travel as much as possible; to implement the self-quarantine for at least 14 days after returning from their work-related places and home town with the COVID-19 low-risk of community transmission; and to be part of country COVID-19</td></tr>
</table>

[3] Annex to Considerations for public health and social measures in the workplace in the context of COVID-19. WHO (10 May 2020)

	vaccination program that rolled out in the nearby medical facilities, and. • In the case of infection as mentioned within "NNP1PC COVID-19 measures then the staff will be immediately removed from the site and referred to the medical treatment facility in Vientiane Capital that is equipped to treat COVID-19.
Impact on NNP1 project and OHS	Mitigation
• The country wide lockdown measures following PM Order No. 15/PM dated 21 April 2021 is being implemented since 21 April 2021 impacting the continuation some project implementation activities.	• The project activities within the project area with COVID-19 low-risk of community transmission continues to progress such as Dam operation and maintenance work; EMO environmental monitoring work within the NNP1 reservoir; or SMO livelihood centre operation. • Any implementation and monitoring activities that does not require field work will be performed through an online platform such as the discussion on the preparation of Annual Implementation Plan (AIP) 2021 under watershed and biodiversity management or monthly meeting with NC-NX BOMU. • Close coordination with relevant GOL committees in case that some restrictions are lifted by local authorities that will allow the continuation of some field activities. For example: Bolikhamxay and Xaysomboun Provincial authority eased the travelling restriction from or to the respective provincial administrative area in early of June 2021 and some of NNP1 ESD program could be resumed such as livelihood development activity, social monitoring, fishery monitoring, etc..; Bolikhamxay PAFO and NC-NX BOMU agreed with the proposal from EMO Team to allow NC-NX patrolling work to continue during the country wide lockdown because the NC-NX offset site is within the COVID-19 low-risk community transmission. • Any continuation of project implementation and monitoring activities

	especially for the field work must comply NNP1PC COVID-19 measures and any with applicable guidelines.
• The site lockdown between April to September 2021 might impact phycological state of site residents	• NNP1PC COVID-19 measures during this lockdown allow the site residents to leave their respective site in case of emergency such as accidents, health and family related issues and other requests as found reasonable by respective management. • NNP1PC COVID-19 measures during this lockdown period allow for social events/gathering but for less than 20 people with mask-wearing and social distancing of at least one meter must be ensured.

Lockdown schedule	Impact on NNP1PC project implementation and monitoring activities		
	TD	SMO	EMO
21 April – 20 May 2021 (Ref: Prime Minister (PM) Order No.15/PM dated 21 April 2021)	No impact on the overall power generation and maintenance work.	To be reported in the SMO Quarterly Progress Report (Q2 2021).	• No monthly and quarterly visit by EMU. • No impact on EMO environmental monitoring program except for some water quality testing parameters that needs to be performed the analysis in Thailand. • EMO fishery monitoring program was postponed during this lockdown period. • Most of the activities under EMO watershed and biodiversity program are postponed. The only activities that continue during this lockdown period include the

			construction of Xaysomboun WRPO sub-office at Ban Huayxay as well as patrolling and snare removal in the NC-NX offset site.
20 May – 04 June 2021 (Ref: PM Order No. No. 528/PM dated 20 May 2021)	No impact on the overall power generation and maintenance work.	To be reported in the SMO Quarterly Progress Report (Q2 2021).	• No monthly and quarterly visit by EMU. • No impact on EMO environmental monitoring program except for some water quality testing parameters that needs to be performed the analysis in Thailand. • EMO fishery monitoring program resumed during this lockdown period. • Most of the activities under EMO watershed and biodiversity program are postponed. The activities that continue during this lockdown period include the construction of Xaysomboun WRPO sub-office at Ban Huayxay as well as patrolling and snare removal in the NC-NX offset site.
04 June – 19 June 2021 (Ref: PM Order No. 595/PM dated 4 June 2021)	No impact on the overall power generation and maintenance work.	To be reported in the SMO Quarterly Progress Report (Q2 2021).	• No monthly and quarterly visit by EMU. • No impact on EMO environmental monitoring program

			except for some water quality testing parameters that needs to be performed the analysis in Thailand. • EMO fishery monitoring program was postponed during this lockdown period. • Relevant GOL committees in Xaysomboun and Bolikhamxay confirmed that the implementation activities under watershed and biodiversity monitoring could resume during this lockdown period. The activities that continue during this lockdown period include the construction of Xaysomboun WRPO sub-office at Ban Huayxay as well as patrolling and snare removal in the NC-NX offset site.
19 June – 04 July 2021 (Ref: PM Order No. 671/PM dated 19 June 2021)	No impact on the overall power generation and maintenance work.	To be reported in the SMO Quarterly Progress Report (Q2 2021).	• No monthly and quarterly visit by EMU. • No impact on EMO environmental monitoring program except for some water quality testing parameters that needs to be performed the analysis in Thailand.

			• EMO fishery monitoring program was postponed during this lockdown period. • Relevant GOL committees in Xaysomboun and Bolikhamxay confirmed that the implementation activities under watershed and biodiversity monitoring could resume during this lockdown period. The activities that continue during this lockdown period include the construction of Xaysomboun WRPO sub-office at Ban Huayxay as well as patrolling, snare removal in the NC-NX offset site, and forest patrol by Bolikhamxay WRPO.

7 External missions and visits

According to the GOL and the Company COVID19 lockdown measures, there was no external mission or visit during Q2 2021.

The action priorities recommended by ADB and IAP during the virtual mission in December 2020 are listed for further follow up as follows:

No	Requested/Recommended Actions	Status as of 30 June 2021
1	Conclusion of the Environment and Social LTA Contract extension.	Pending - ADB shared the drafted LTA's ToR for NNP1PC consideration on 19 February 2021, the TOR was reviewed by NNP1PC.
2	Hiring of a new EMO staff and provide the job descriptions of EMO key positions.	**Completed** – the vacant position of Biodiversity Management Senior Officer was filled in early

No	Requested/Recommended Actions	Status as of 30 June 2021
		January 2021. The job descriptions of EMO key positions were shared to ADB on 01 April 2021.
3	Provide a timeline of next steps to resolve the issue of low oxygen levels/feasibility study.	Pending – the timeline was shared to ADB on 01 April 2021 with some information of the feasibility studies but the issue has not yet been solved. NNP1PC will submit study results on countermeasures against the downstream low DO issue by Q4 2021.
4	Submit the draft GOL AIP2021 of WRPOs and BOMU for ADB review and approval as soon as possible.	Pending – related to the disagreement between the GOL and NNP1PC on the request for additional accommodation allowance for the patrol teams, the approved BOM AIP2021 by ADB in February 2021 has not yet finalized and approved for implementing by BOMU, as well as the WM AIP2021 of BLX and XSB WRPO were not yet submitted to NNP1PC for further sharing with ADB for review and approval.
5	Analysis of Fish Monitoring Data up to 2020 by a Fishery Expert.	**Completed** – the Biennial Fisheries Report 2020 (analysis of data collected during 2015 to 2020) written by an external Fishery Expert was shared with ADB on 01 April 2021.
6	Provide the Transmission Lines (TLs) monitoring report which was planned to conduct by EGAT in Q4 2020.	**Completed** – the Site Inspection Report of 230 kV TL was shared with ADB on 26 March 2021. The inspection of 115 kV was scheduled to be conducted by EDL in April 2021 and the summary of findings are shared in this Q2 2021 Report.
7	Provide the latest dam safety report.	**Completed** – the report was shared with ADB in Dec 2020.
8	Provide the landslide monitoring report.	Pending – NNP1 conducts visual inspection of reservoir slope every month. The results of landslide inspection will be shared by the end of December 2021.
9	Provide the rehabilitation plans agreed with the Government.	**Completed** in Dec 2020 and prepared for the GOL inspection in Jan 2021.
	H&S and Emergency Plans	
10	Provide the Organization Chart for H&S Team and identifying first aiders.	**Completed** in Dec 2020
11	Provide the updated H&S plans that include relevant measures on navigation safety and incident response.	Pending - the H&S plan is still under review and updating. The completion date is postponed to Q3 2021.

No	Requested/Recommended Actions	Status as of 30 June 2021
12	Revise the Emergency Preparedness and Response Plan (EPRP) for the project operations, including an update on associated training and emergency drills performed.	Pending - the plan, including the drills, is still under updating. The completion date is postponed to Q4 2021.
13	Revise/update the Emergency Action Plan (EAP), engagement with the emergency authorities, and perform desktop and field test.	Pending - the updated version of EAP was done in April 2021 and submitted to DEM-MEM, the drill/test are underway for NNP1 staff for completion by December 2021.
14	Revise/update the Emergency Evacuation Plan (EEP) including an update on associated training and drills performed.	Pending - The EEP is under updating by the external consultant and the drills for downstream villagers are planned to be conducted during this wet season. The updated EEP will be shared with relevant GOL agencies including the National and local Disaster Preparedness and Responses Committee, MEM and MONRE at local levels. This is planned to be completed by this year if consultation meetings are allowed by GOL.
	Watershed Management and Biodiversity Offset Management Program	
15	Analyse patrol information notably snare encounter rates in the highest priority area of NCNX. Based on results, either quickly evolve patrolling effort in NCNX to be highly concentrated in the highest priority area or produce clear case-specific justification to depart from the BOMP.	**Completed** - already discussed with BSP for further actions.
16	Implement law enforcement activities in Sub-catchment to full capacity as soon as possible.	**Completed** – already discussed with BSP for further actions
17	Determine effects of proposed boundary changes to Sub-catchment Totally Protected Zones and take appropriate follow-on actions.	**Completed** – already discussed with BSP for further actions
18	Finalize and implement NC-NX Community Development Plan.	Pending – the plan was improved per ADB and IAP comments and submitted to GOL for their final review and approval.

The status of the requested/recommended actions will be followed up and updated in the next quarterly report.

APPENDICES

APPENDIX 1: STATUS OF DOCUMENTS REVIEW AND APPROVAL DURING Q2 2021

No	Site name	Document Name	Contractor / Subcontractor	Approval Status by EMO/NNP1 (date)	Detailed Site Information	Monthly Construction & Operation Status as of 30 June 2021
1	OSOV1, OSOV2, Main dam and re-regulating dam	**DWP & SS-ESMMP for routine Maintenance and Repairing Works**	PKC Construction Co., Ltd.	1st submission on 01 April 2021. No objection with no comment on 09 April 2021	Operation sites facilities maintenances/ repairing	In progress
2	NNP1PC's Operation sites and Project Landfill	**DWP & SS-ESMMP for Project's Solid Waste Management and Landfill Operation**	Nilun Turnkey Construction Co., Ltd	2nd submission on 14 May 2021 No objection with no further comment on 31 May 2021	Project waste collection and operation of Project Landfill	In progress
3	Host village, Resettlement village and Houy Soup Landfill	**DWP & SS-ESMMP for Community Solid Waste Management and Houy Soup Landfill Operation**	Thanoukham Construction Development Co., Ltd	2nd submission on 16 May 2021. No objection with no further comment on 31 May 2021.	Road maintenance	In progress
4	OSOV1, OSOV2 and Main Powerhouse	**DWP & SS-ESMMP for WWTS Improvement and Modification**	Soulignet Choummanitham Construction Sole Co., Ltd	2nd submission on 15 June 2021. No objection with no further comment on 23 June 2021.	Construction of WWTS improvement and modification	In progress
5	Main Dam	**DWP & SS-ESMMP for Supply and Installation of**	WHESSOE Lao Sole Co., Ltd	3rd submission on 30 June 2021. Under review	Supply and Installation of main	Waiting for mobilization

No	Site name	Document Name	Contractor / Subcontractor	Approval Status by EMO/NNP1 (date)	Detailed Site Information	Monthly Construction & Operation Status as of 30 June 2021
		Stolen Part at Main Dam Gate			6dam gate's stolen parts	
6	OSOV1, OSOV2 and Main Powerhouse	**Working Drawing for OSOV's WWTS improvement and Modification**	Soulignet Choummanitham Construction Sole Co., Ltd	2nd submission on 15 June 2021. No objection with no further comment on 23 June 2021.	Improvement and modification of WWTS at OSOV1, OSOV2 and Main Powerhouse	In Progress
7	Main Dam	**DWP & SS-ESMMP for Remedial Grouting work at Main Dam**	KENBER Geotechnics (Thailand) Co., Ltd	2nd submission 27 June 2021. Under review	Remedial of grouting works at Main Dam body	Under mobilizing
8	Phouhomxay Village's Paddy Field Irrigation System	**DWP & SS-ESMMP for Improvement of Irrigation System and Tractor Roads at PHX Village**	Thanongxay Development Construction and Consultant Co., Ltd (TDC)	1st submission on 17 June 2021. No objection with no comment on 17 June 2021	Improvement of irrigation's sub-canal system and tractor roads to grazing lands.	In progress

APPENDIX 2: ENVIRONMENTAL MONITORING CORRECTIVE ACTIONS DURING Q2 2021

Issue ID	Inspection Date	Site Name	Issue/Description	Action Required/ Recommendation	Deadline	Latest Follow- up Date	Status
ONC_AM-0003	28.02.2020	OSOV	Issued to ADM to improve the second wetland pond similarly to the first wetland pond. (Based on the LTA's recommendation made during the mission in August 2019 to improve the OSOV's WWTS)	ADM shall carry out a basic improvement of the second wetland pond similarly to the first wetland pond.	12.03.2020	26.04.2021	**Resolved** The selected qualified contractor was contracted for a 3.5 months construction contract and commenced the work of WWTS improvement and modification on 20 April 2021. As of 30 June 2021, the general progress is 60%. According to the contract, the work is scheduled to be completed by 31 July 2021.

APPENDIX 3: SITE CODES, LOCATIONS, MONITORING PARAMETERS AND ITS MAP OF THE RESERVOIR AND SURFACE WATER QUALITY MONITORING

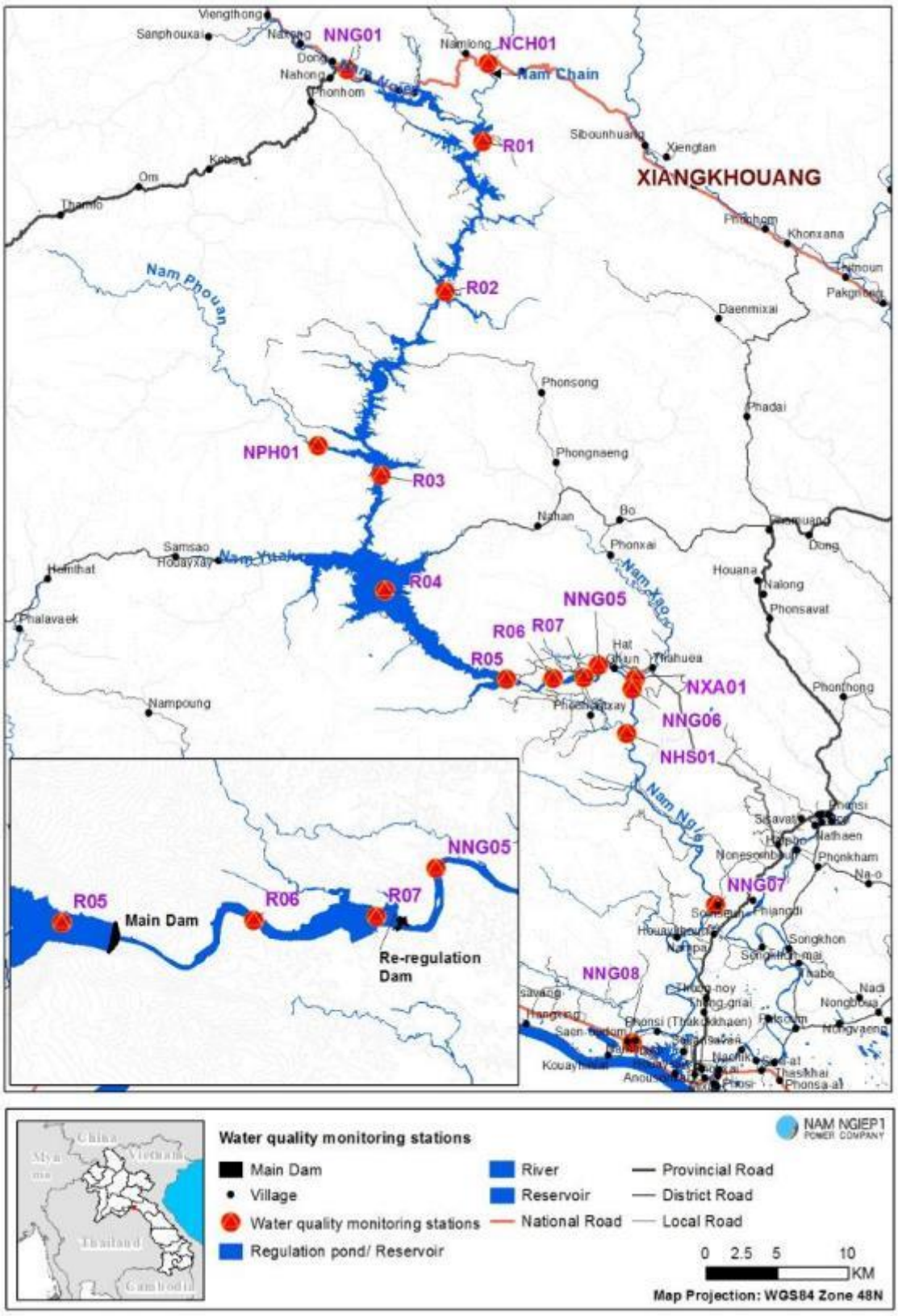
SITE CODES AND LOCATION STATION FOR RESERVOIR AND SURFACE WATER QUALITY MONITORING

Site Code	Location station	Zone
NNG01	Nam Ngiep Upstream of Ban Phiengta	Upstream Project Construction Site
R01	Main reservoir upstream main dam approx. 50 Km.	
R02	Main reservoir upstream main dam approx. 35 Km.	
NNG02/R03	Nam Ngiep Upstream of Nam Phouan Confluence / Main reservoir upstream main dam approx. 21 Km.	
NNG03/R04	Nam Ngiep Downstream of Ban Sopyouak / Main reservoir upstream main dam approx. 13 Km.	
NNG09/R05	Nam Ngiep Upstream Main Dam / Main reservoir upstream main dam approx. 0.5 Km	
NNG04 / R06	Nam Ngiep Downstream RT Camp (Middle Re-regulation Reservoir)	Within Project Construction Site
R07	Reservoir Upstream Re-Regulation Dam	
NNG05	Nam Ngiep Upstream of Ban Hat Gniun	Downstream Project Construction Site
NNG06	Nam Ngiep Downstream of Nam Xao Confluence	
NNG07	Nam Ngiep at Ban Somsuen	
NNG08	Nam Ngiep at the Bridge of Road 13	
NCH01	Nam Chiane at the Bridge of Road 1D	Tributaries Upstream of Project Construction Site
NPH01	Nam Phouan Upstream of Nam Ngiep Confluence	
NXA01	Nam Xao Upstream of Nam Ngiep Confluence	Tributaries Downstream of Project Construction Site
NSH01	Nam Houay Soup Upstream Nam Ngiep Confluence	

MONITORING FREQUENCY FOR RESERVOIR AND SURFACE WATER QUALITY PARAMETERS

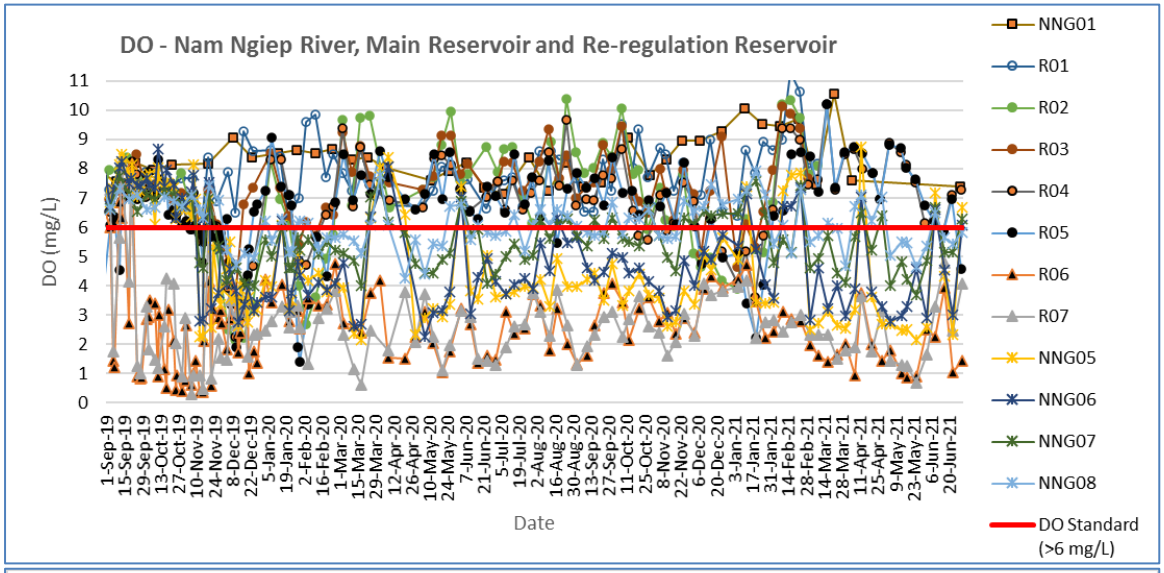
Frequency of Monitoring	Parameters (Unit)	Monitoring Sites
Weekly	pH, DO (%), DO (mg/L), Conductivity (µs/cm), TDS (mg/L), Temperature (°C), Turbidity (NTU).	- Main Reservoir: R01, R02, R03, R04, R05; - Nam Ngiep downstream: NNG05, NNG06, NNG07 and NNG08; - Tributaries: Nam Phouan [NPH01], Nam Xao [NXA01] and Nam Houay Soup [NHS01].
Fortnightly	pH, DO (%), DO (mg/L), Conductivity (µs/cm), TDS (mg/L), Temperature (°C), Turbidity (NTU)	All stations
Monthly	TSS (mg/L), BOD_5 (mg/L), COD (mg/L), NH_3-N (mg/L), NO_3-N (mg/L), total coliform (MPN/100 mL), faecal coliform (MPN/100 mL), Hydrogen sulphide (mg/L), Phytoplankton biomass, TOC and TKN.	As per ESMMP-OP.

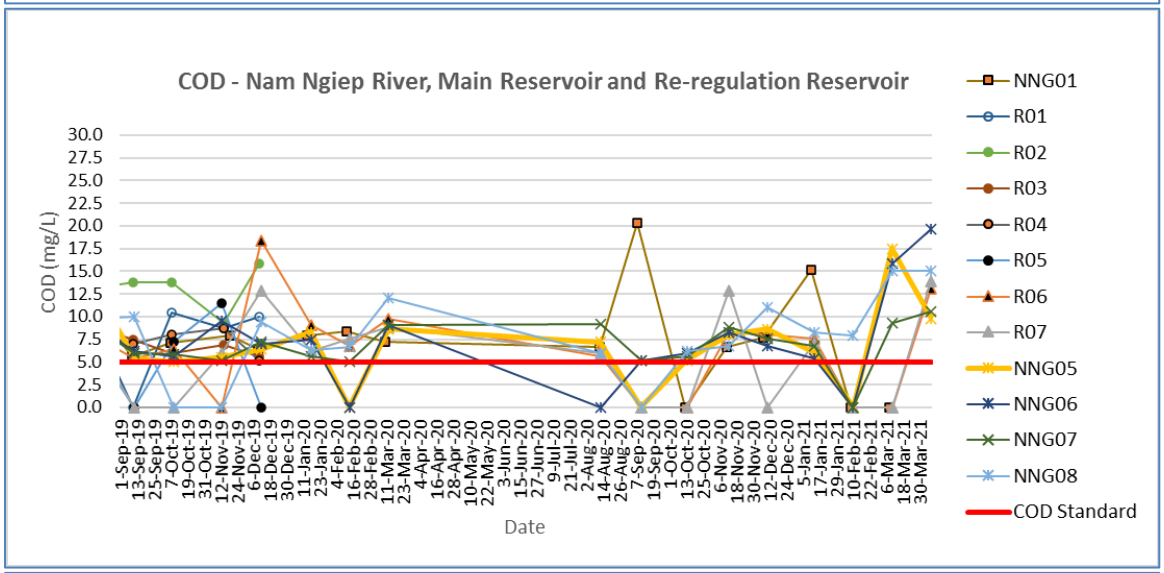
RESERVOIR AND SURFACE WATER QUALITY MONITORING LOCATIONS

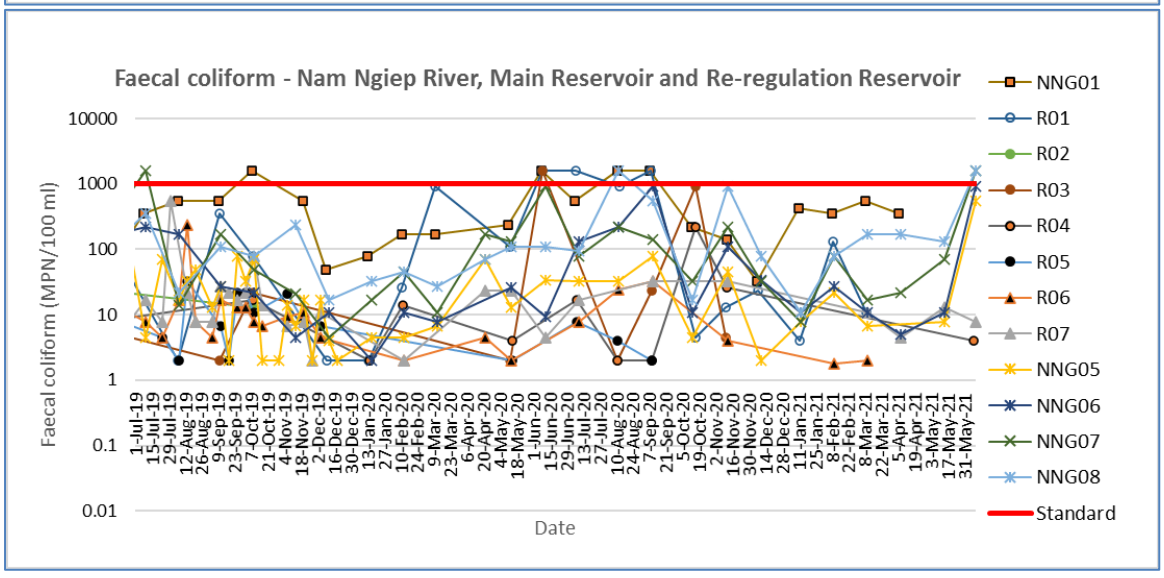


APPENDIX 4: KEY TRENDS OF WATER QUALITY MONITORING FROM JANUARY 2020 TO END OF JUNE 2021 (ONLY PARAMETERS THAT EXCEEDED THE STANDARDS)

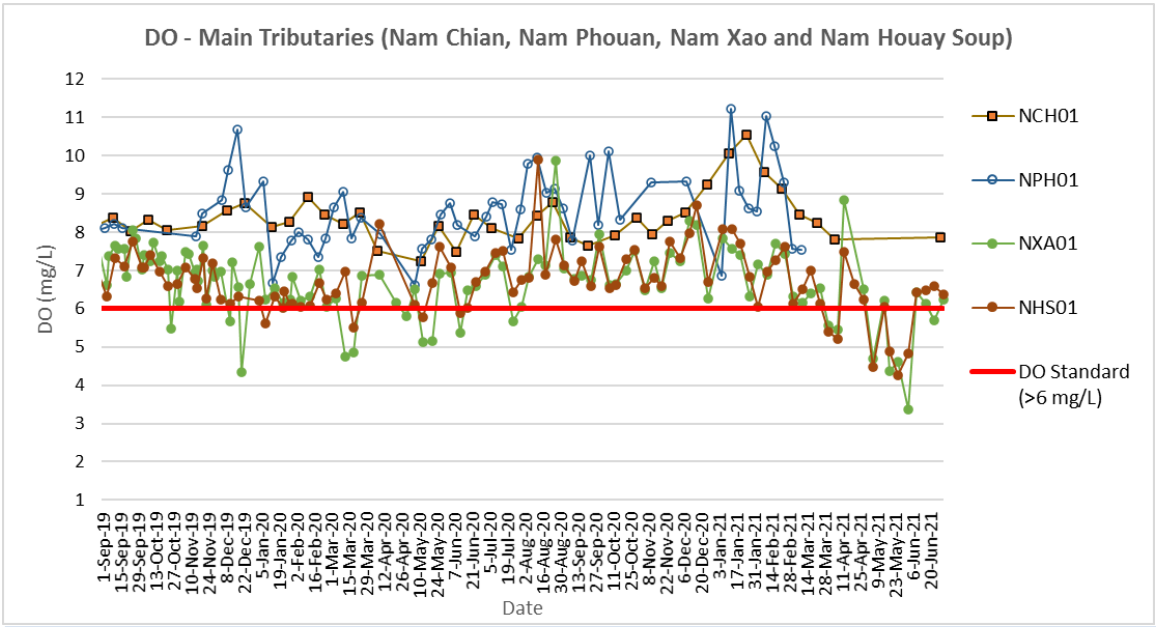
NAM NGIEP SURFACE WATER

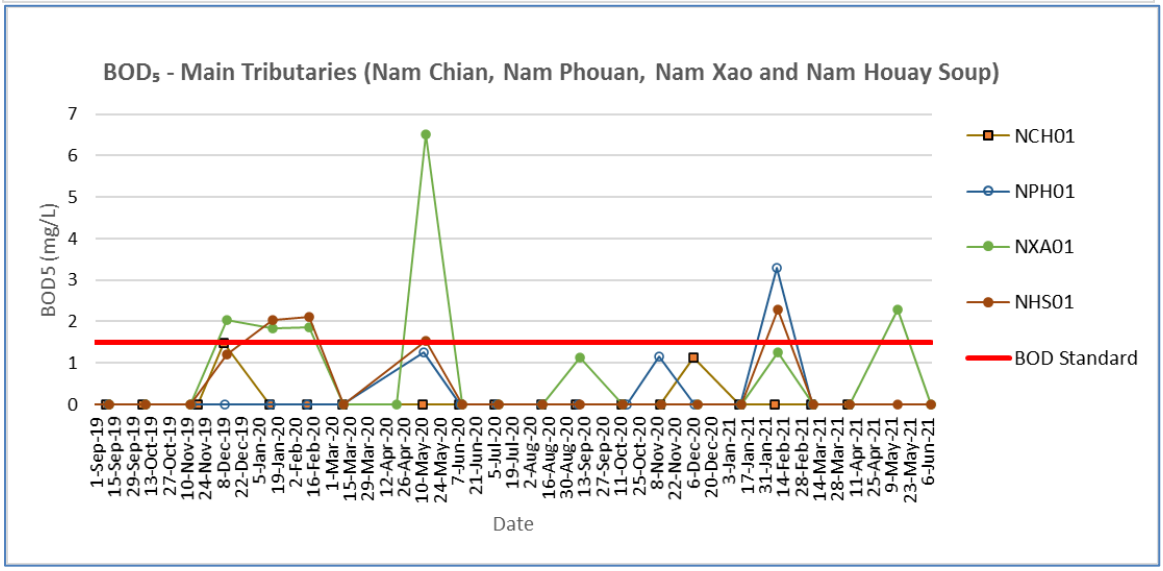


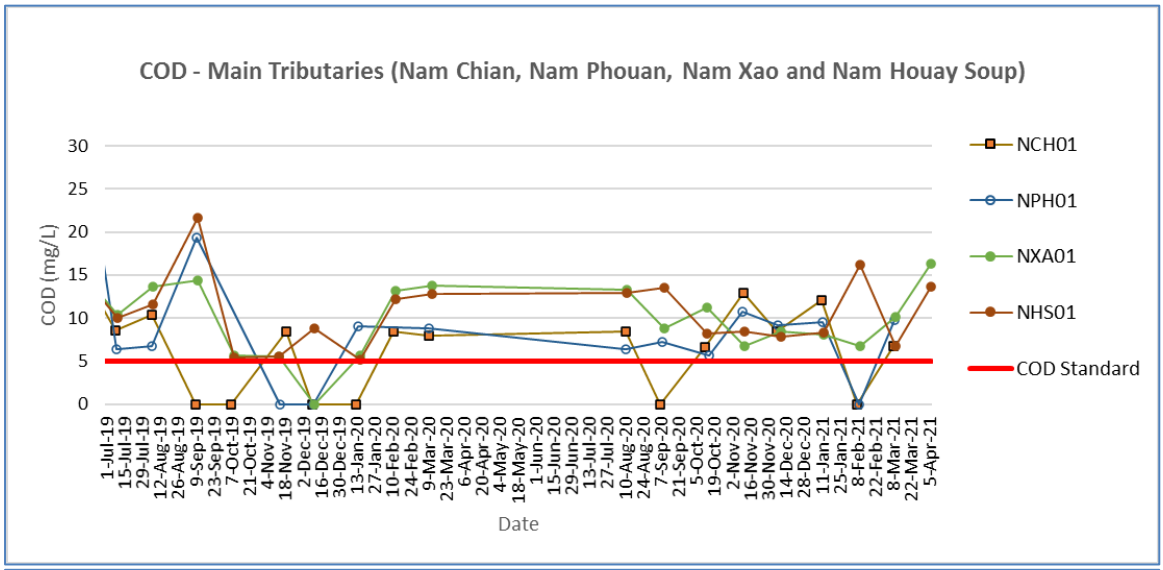


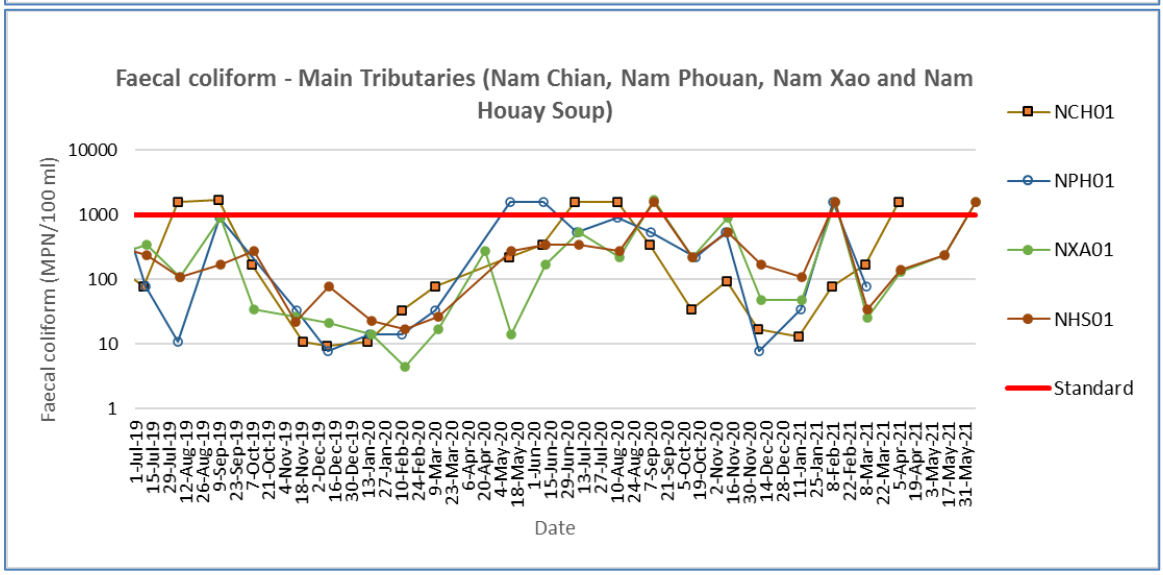


Key Water Quality Parameters for the Nam Ngiep Tributaries: Nam Chian, Nam Phouan, Nam Xao, Nam Houay Soup

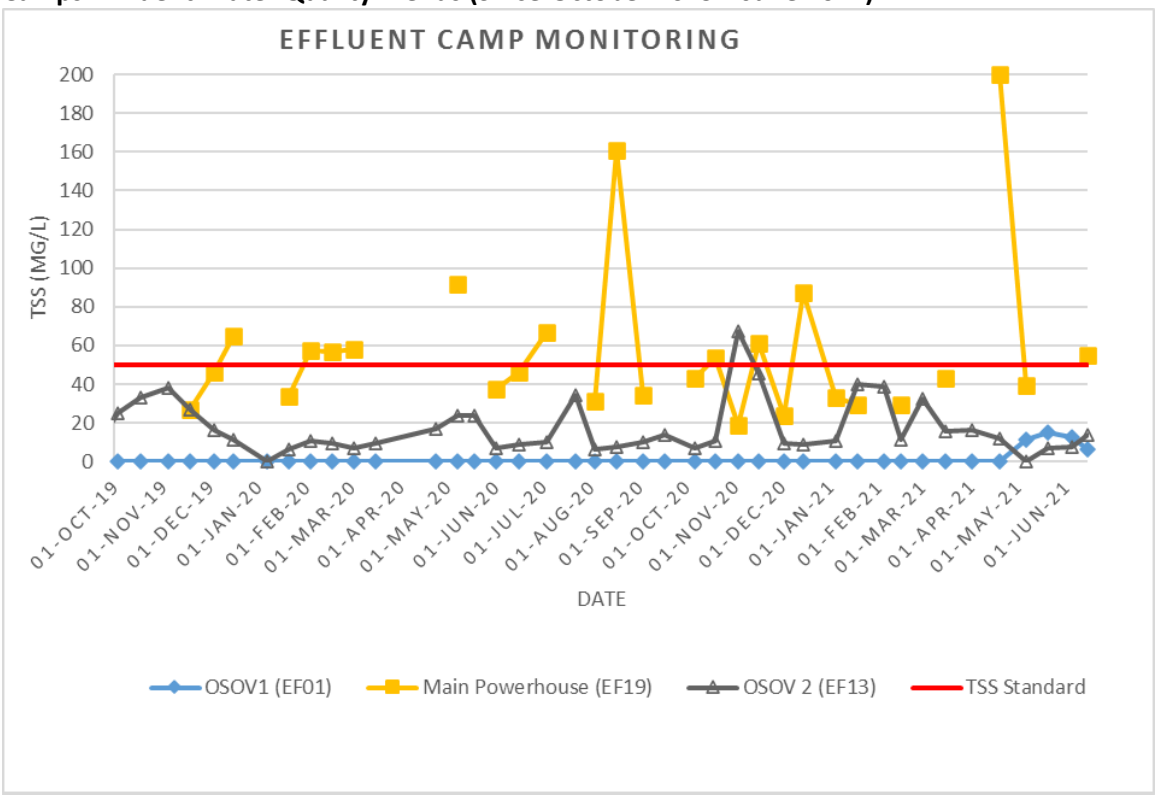


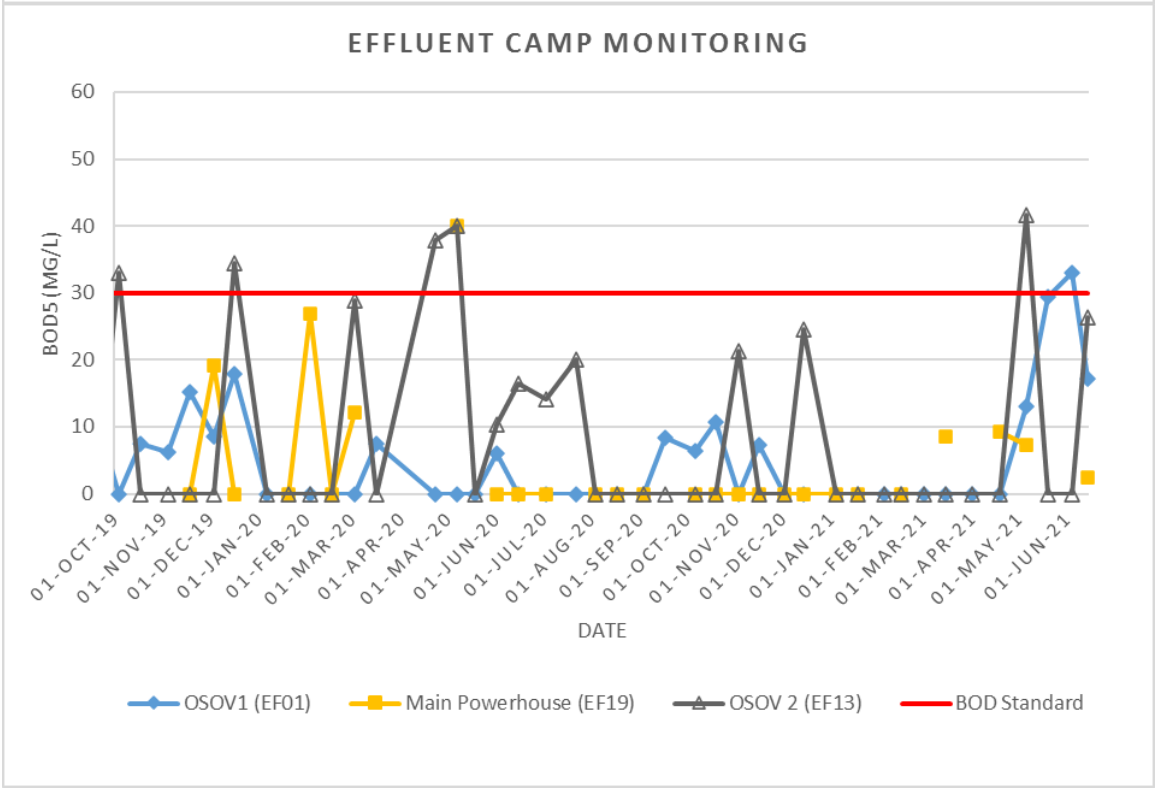


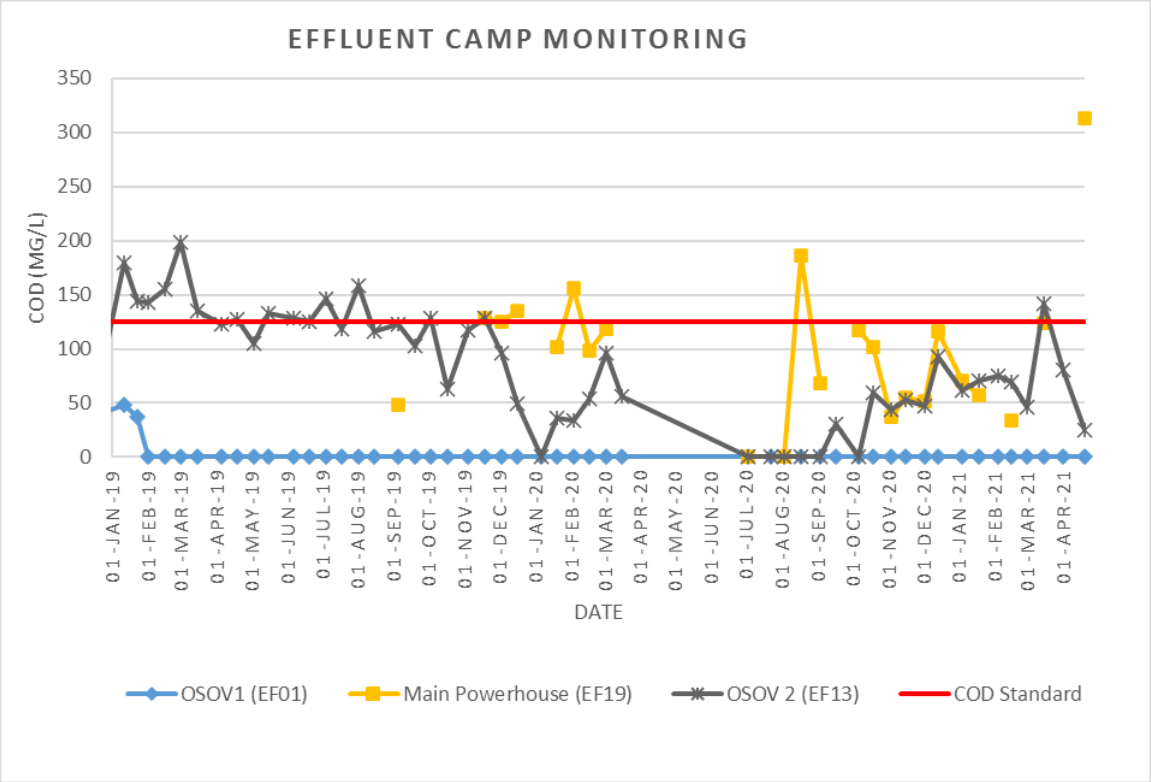

COD - Main Tributaries (Nam Chian, Nam Phouan, Nam Xao and Nam Houay Soup)
COD (mg/L)
30
25
20
15
10
5
0
1-Jul-19
15-Jul-19
29-Jul-19
12-Aug-19
26-Aug-19
9-Sep-19
23-Sep-19
7-Oct-19
21-Oct-19
4-Nov-19
18-Nov-19
2-Dec-19
16-Dec-19
30-Dec-19
13-Jan-20
27-Jan-20
10-Feb-20
24-Feb-20
9-Mar-20
23-Mar-20
6-Apr-20
20-Apr-20
4-May-20
18-May-20
1-Jun-20
15-Jun-20
29-Jun-20
13-Jul-20
27-Jul-20
10-Aug-20
24-Aug-20
7-Sep-20
21-Sep-20
5-Oct-20
19-Oct-20
2-Nov-20
16-Nov-20
30-Nov-20
14-Dec-20
28-Dec-20
11-Jan-21
25-Jan-21
8-Feb-21
22-Feb-21
8-Mar-21
22-Mar-21
5-Apr-21
Date
NCH01
NPH01
NXA01
NHS01
COD Standard

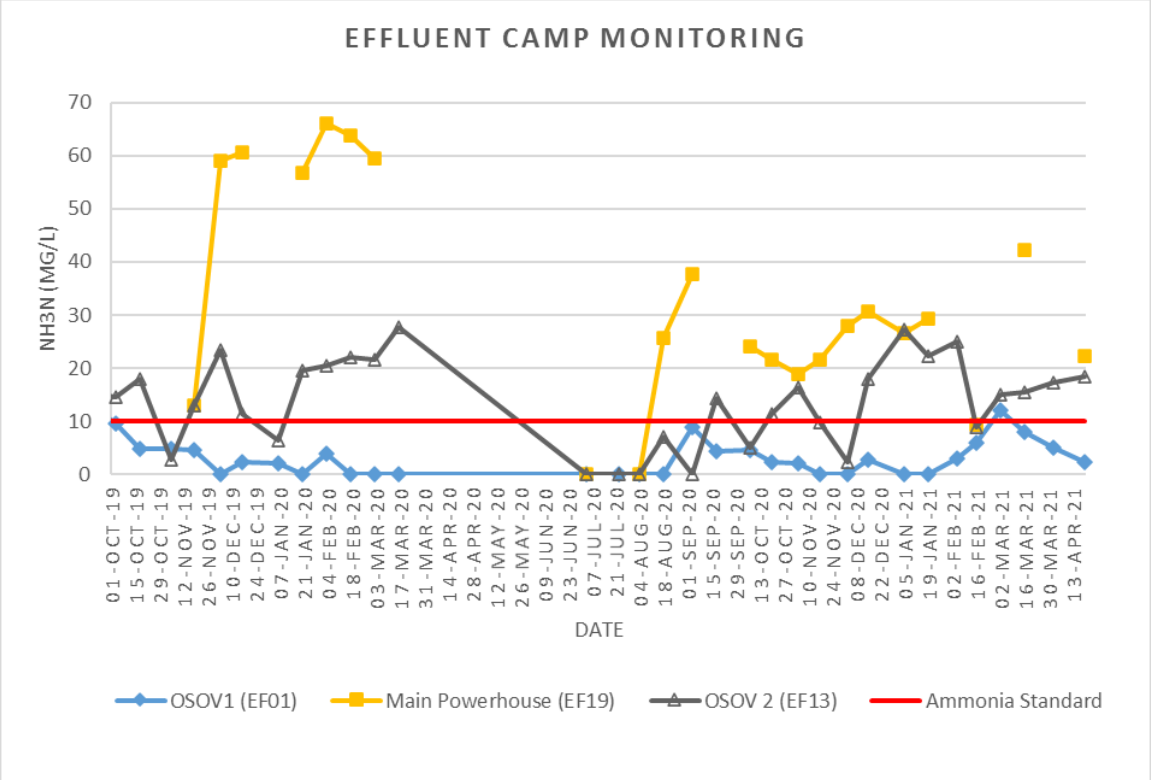

Faecal coliform - Main Tributaries (Nam Chian, Nam Phouan, Nam Xao and Nam Houay Soup)
Faecal coliform (MPN/100 ml)
10000
1000
100
10
1
1-Jul-19
15-Jul-19
29-Jul-19
12-Aug-19
26-Aug-19
9-Sep-19
23-Sep-19
7-Oct-19
21-Oct-19
4-Nov-19
18-Nov-19
2-Dec-19
16-Dec-19
30-Dec-19
13-Jan-20
27-Jan-20
10-Feb-20
24-Feb-20
9-Mar-20
23-Mar-20
6-Apr-20
20-Apr-20
4-May-20
18-May-20
1-Jun-20
15-Jun-20
29-Jun-20
13-Jul-20
27-Jul-20
10-Aug-20
24-Aug-20
7-Sep-20
21-Sep-20
5-Oct-20
19-Oct-20
2-Nov-20
16-Nov-20
30-Nov-20
14-Dec-20
28-Dec-20
11-Jan-21
25-Jan-21
8-Feb-21
22-Feb-21
8-Mar-21
22-Mar-21
5-Apr-21
19-Apr-21
3-May-21
17-May-21
31-May-21
Date
NCH01
NPH01
NXA01
NHS01
Standard

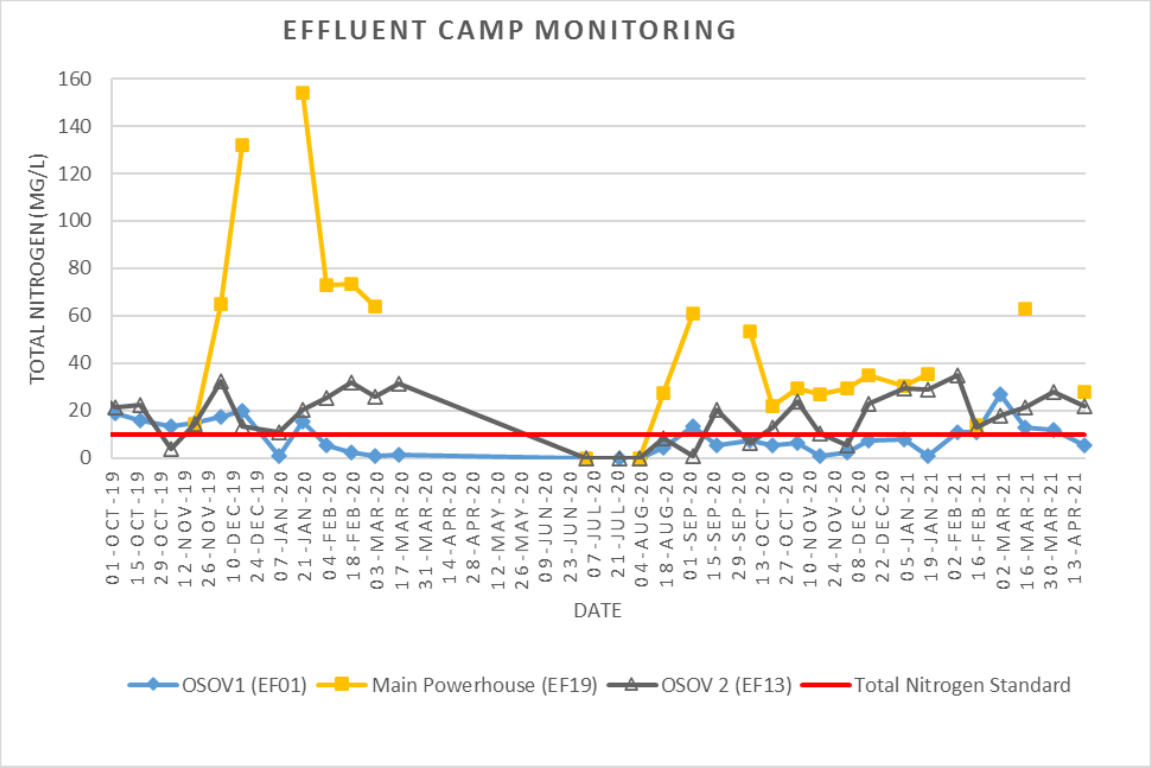
Camps' Effluent Water Quality Trends (Since October 2019 – June 2021)

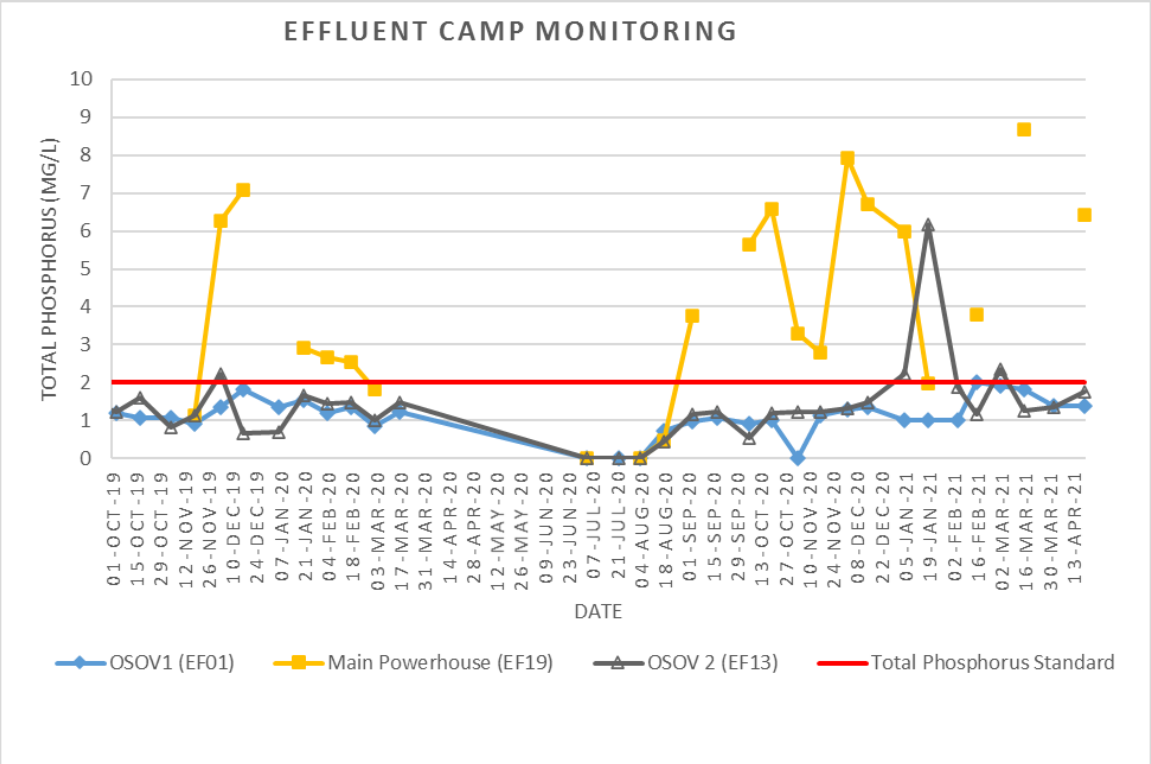


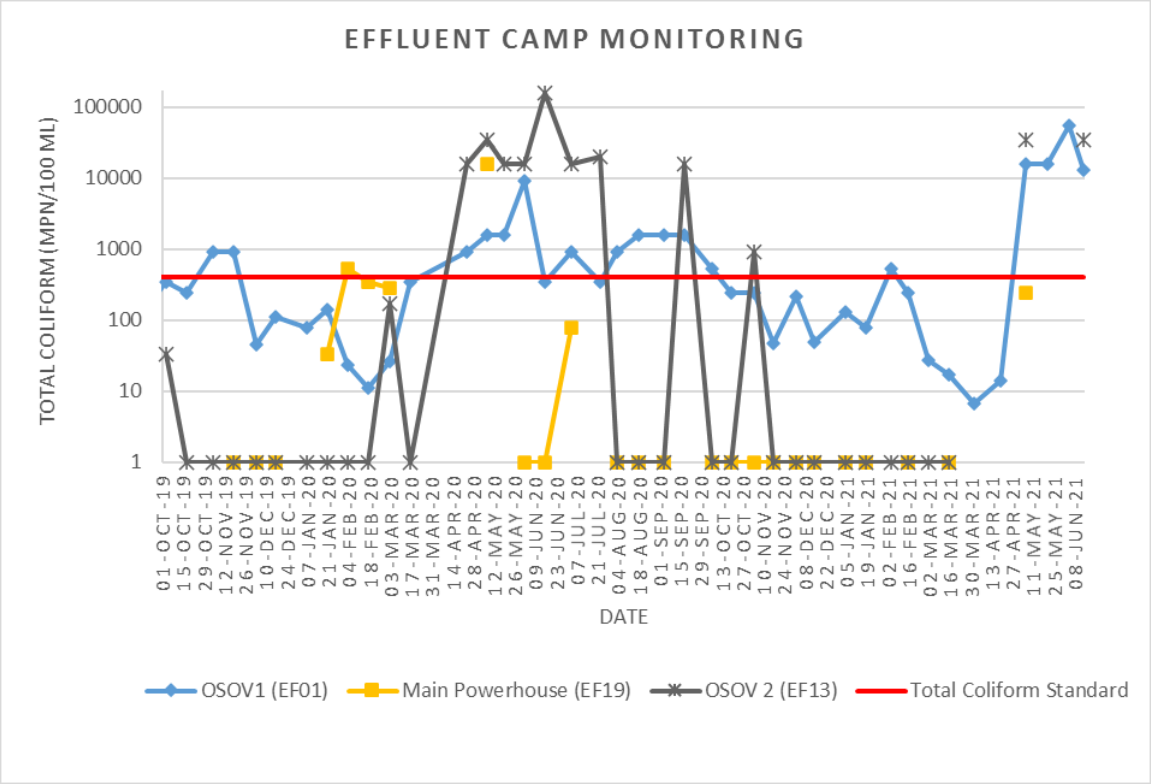



EFFLUENT CAMP MONITORING
COD (MG/L)
350
300
250
200
150
100
50
0
01-JAN-19
01-FEB-19
01-MAR-19
01-APR-19
01-MAY-19
01-JUN-19
01-JUL-19
01-AUG-19
01-SEP-19
01-OCT-19
01-NOV-19
01-DEC-19
01-JAN-20
01-FEB-20
01-MAR-20
01-APR-20
01-MAY-20
01-JUN-20
01-JUL-20
01-AUG-20
01-SEP-20
01-OCT-20
01-NOV-20
01-DEC-20
01-JAN-21
01-FEB-21
01-MAR-21
01-APR-21
DATE
OSOV1 (EF01)
Main Powerhouse (EF19)
OSOV 2 (EF13)
COD Standard


EFFLUENT CAMP MONITORING
NH3N (MG/L)
70
60
50
40
30
20
10
0
01-OCT-19
15-OCT-19
29-OCT-19
12-NOV-19
26-NOV-19
10-DEC-19
24-DEC-19
07-JAN-20
21-JAN-20
04-FEB-20
18-FEB-20
03-MAR-20
17-MAR-20
31-MAR-20
14-APR-20
28-APR-20
12-MAY-20
26-MAY-20
09-JUN-20
23-JUN-20
07-JUL-20
21-JUL-20
04-AUG-20
18-AUG-20
01-SEP-20
15-SEP-20
29-SEP-20
13-OCT-20
27-OCT-20
10-NOV-20
24-NOV-20
08-DEC-20
22-DEC-20
05-JAN-21
19-JAN-21
02-FEB-21
16-FEB-21
02-MAR-21
16-MAR-21
30-MAR-21
13-APR-21
DATE
OSOV1 (EF01)
Main Powerhouse (EF19)
OSOV 2 (EF13)
Ammonia Standard


EFFLUENT CAMP MONITORING
TOTAL NITROGEN (MG/L)
160
140
120
100
80
60
40
20
0
01-OCT-19
15-OCT-19
29-OCT-19
12-NOV-19
26-NOV-19
10-DEC-19
24-DEC-19
07-JAN-20
21-JAN-20
04-FEB-20
18-FEB-20
03-MAR-20
17-MAR-20
31-MAR-20
14-APR-20
28-APR-20
12-MAY-20
26-MAY-20
09-JUN-20
23-JUN-20
07-JUL-20
21-JUL-20
04-AUG-20
18-AUG-20
01-SEP-20
15-SEP-20
29-SEP-20
13-OCT-20
27-OCT-20
10-NOV-20
24-NOV-20
08-DEC-20
22-DEC-20
05-JAN-21
19-JAN-21
02-FEB-21
16-FEB-21
02-MAR-21
16-MAR-21
30-MAR-21
13-APR-21
DATE
OSOV1 (EF01)
Main Powerhouse (EF19)
OSOV 2 (EF13)
Total Nitrogen Standard


EFFLUENT CAMP MONITORING
TOTAL PHOSPHORUS (MG/L)
10
9
8
7
6
5
4
3
2
1
0
01-OCT-19
15-OCT-19
29-OCT-19
12-NOV-19
26-NOV-19
10-DEC-19
24-DEC-19
07-JAN-20
21-JAN-20
04-FEB-20
18-FEB-20
03-MAR-20
17-MAR-20
31-MAR-20
14-APR-20
28-APR-20
12-MAY-20
26-MAY-20
09-JUN-20
23-JUN-20
07-JUL-20
21-JUL-20
04-AUG-20
18-AUG-20
01-SEP-20
15-SEP-20
29-SEP-20
13-OCT-20
27-OCT-20
10-NOV-20
24-NOV-20
08-DEC-20
22-DEC-20
05-JAN-21
19-JAN-21
02-FEB-21
16-FEB-21
02-MAR-21
16-MAR-21
30-MAR-21
13-APR-21
DATE
OSOV1 (EF01)
Main Powerhouse (EF19)
OSOV 2 (EF13)
Total Phosphorus Standard


EFFLUENT CAMP MONITORING
TOTAL COLIFORM (MPN/100 ML)
100000
10000
1000
100
10
1
01-OCT-19
15-OCT-19
29-OCT-19
12-NOV-19
26-NOV-19
10-DEC-19
24-DEC-19
07-JAN-20
21-JAN-20
04-FEB-20
18-FEB-20
03-MAR-20
17-MAR-20
31-MAR-20
14-APR-20
28-APR-20
12-MAY-20
26-MAY-20
09-JUN-20
23-JUN-20
07-JUL-20
21-JUL-20
04-AUG-20
18-AUG-20
01-SEP-20
15-SEP-20
29-SEP-20
13-OCT-20
27-OCT-20
10-NOV-20
24-NOV-20
08-DEC-20
22-DEC-20
05-JAN-21
19-JAN-21
02-FEB-21
16-FEB-21
02-MAR-21
16-MAR-21
30-MAR-21
13-APR-21
27-APR-21
11-MAY-21
25-MAY-21
08-JUN-21
DATE
OSOV1 (EF01)
Main Powerhouse (EF19)
OSOV 2 (EF13)
Total Coliform Standard

APPENDIX 5: WATER QUALITY MONITORING DATA
APPENDIX 5-1: SURFACE WATER QUALITY MONITORING – Q2 2021

		River Name	Nam Ngiep												Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup
		Zone	Location Refer to Construction Sites												Location Refer to Construction Sites			
			Upstream/Main Reservoir						Within / Re-regulation Reservoir		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
5-Apr-21	pH	5.0 - 9.0	7.35												7.55			
6-Apr-21	pH	5.0 - 9.0					6.76	6.82										
7-Apr-21	pH	5.0 - 9.0							6.44	6.56	6.38	6.62	6.29	6.18			7.31	7.1
12-Apr-21	pH	5.0 - 9.0							6.6	6.77	6.55	6.88	7.12	7.12			7.48	7.16
13-Apr-21	pH	5.0 - 9.0					6.73	6.58										
20-Apr-21	pH	5.0 - 9.0							6.19	6.27	6.41	6.57	6.67	6.58				7.4
21-Apr-21	pH	5.0 - 9.0					6.49	6.73										
27-Apr-21	pH	5.0 - 9.0					6.49	6.78										
28-Apr-21	pH	5.0 - 9.0							6.46	6.73	6.49	6.58	6.49	6.39			7.15	6.88
4-May-21	pH	5.0 - 9.0					6.55	6.45										
5-May-21	pH	5.0 - 9.0							6.49	6.95	6.51	6.78	7.12	6.85			7.22	7.13
13-May-21	pH	5.0 - 9.0					6.96	7										
14-May-21	pH	5.0 - 9.0							6.82	6.88	6.89	7.03	6.94	7.23			7.14	7.26
17-May-21	pH	5.0 - 9.0					7.09	6.5										
18-May-21	pH	5.0 - 9.0							6.48	6.42	6.68	6.89	6.84	7.05			7.1	7.23
24-May-21	pH	5.0 - 9.0					6.46	6.51										
25-May-21	pH	5.0 - 9.0							6.54	6.48	6.57	6.82	6.6	6.48			7	6.97
1-Jun-21	pH	5.0 - 9.0					6.85	6.67										
2-Jun-21	pH	5.0 - 9.0							6.98	7.17	7.52	6.86	6.86	7.12			6.98	6.96

		River Name	Nam Ngiep												Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup
		Zone	Location Refer to Construction Sites												Location Refer to Construction Sites			
			Upstream/Main Reservoir						Within / Re-regulation Reservoir		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
8-Jun-21	pH	5.0 - 9.0					6.67	6.65										
9-Jun-21	pH	5.0 - 9.0							6.75	6.81	6.88	6.97	7.09	6.85			7.14	7.24
15-Jun-21	pH	5.0 - 9.0					6.74	6.5										
16-Jun-21	pH	5.0 - 9.0							6.52	6.4	7.02	6.98	6.7	6.63			7.21	7.1
22-Jun-21	pH	5.0 - 9.0					6.86	7.02										
23-Jun-21	pH	5.0 - 9.0							7.79	6.97	6.65	6.65	6.95	6.78			7.11	7.08
28-Jun-21	pH	5.0 - 9.0	6.64												7.56			
29-Jun-21	pH	5.0 - 9.0					6.95	7										
30-Jun-21	pH	5.0 - 9.0							6.62	6.71	6.96	6.94	7.25	6.99			7.07	7.21
5-Apr-21	Sat. DO (%)		100.4												96.6			
6-Apr-21	Sat. DO (%)						111.3	113.1										
7-Apr-21	Sat. DO (%)								10.9	22.3	37.2	46	67.9	80.9			76	65.7
12-Apr-21	Sat. DO (%)								44.8	45.7	105.5	86.1	80.8	88.9			120.5	97.6
13-Apr-21	Sat. DO (%)						102.8	109.6										
20-Apr-21	Sat. DO (%)								24.3	20.6	42	45.2	63.4	76.6				78.6
21-Apr-21	Sat. DO (%)						101.9	102.1										
27-Apr-21	Sat. DO (%)						90.9	91										
28-Apr-21	Sat. DO (%)								16.9	38.2	32	39.8	77.8	87.7			89.1	74.8
4-May-21	Sat. DO (%)						117.9	115.9										
5-May-21	Sat. DO (%)								21.4	17.1	32.1	34	49.5	62.4			60.7	57.9
13-May-21	Sat. DO (%)						115.1	116.8										
14-May-21	Sat. DO (%)								11.9	15.4	29.7	35.8	59.1	67.7			74.6	77

		River Name	Nam Ngiep												Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup
		Zone	Location Refer to Construction Sites												Location Refer to Construction Sites			
			Upstream/Main Reservoir						Within / Re-regulation Reservoir		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
17-May-21	Sat. DO (%)						110.5	108.4										
18-May-21	Sat. DO (%)								10.6	15	30.3	39.9	51.6	67.4			58.3	59.8
24-May-21	Sat. DO (%)						101.2	102.3										
25-May-21	Sat. DO (%)								11.1	8.4	26	54.9	44.8	57.2			60.3	54.5
1-Jun-21	Sat. DO (%)						83.9	91.5										
2-Jun-21	Sat. DO (%)								30.7	20.5	31.7	35.9	61	67.7			42.6	64.4
8-Jun-21	Sat. DO (%)						84	82.4										
9-Jun-21	Sat. DO (%)								32.8	39.7	87.5	81.6	82.1	80.2			81.1	79
15-Jun-21	Sat. DO (%)						76	75.6										
16-Jun-21	Sat. DO (%)								47.6	58.2	52.6	55.3	63.3	69.5			77.3	80.7
22-Jun-21	Sat. DO (%)						96.1	93.8										
23-Jun-21	Sat. DO (%)								12.7	29.8	28.2	36.7	63.5	67.2			77.2	84.4
28-Jun-21	Sat. DO (%)		88.9												93.5			
29-Jun-21	Sat. DO (%)						96.4	59.3										
30-Jun-21	Sat. DO (%)								17.3	50.5	81.2	74.4	78.2	71.9			75.8	78.6
5-Apr-21	DO (mg/L)	>6.0	7.61												7.81			
6-Apr-21	DO (mg/L)	>6.0					8.66	8.73										
7-Apr-21	DO (mg/L)	>6.0							0.94	1.92	3.2	3.89	5.69	6.73			5.45	5.22
12-Apr-21	DO (mg/L)	>6.0							3.76	3.65	8.73	7.03	6.51	7.11			8.84	7.5
13-Apr-21	DO (mg/L)	>6.0					7.98	8.52										
20-Apr-21	DO (mg/L)	>6.0							2.03	1.75	3.6	3.8	5.23	6.2				6.66
21-Apr-21	DO (mg/L)	>6.0					7.86	7.86										

		River Name	Nam Ngiep												Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup
		Zone	Location Refer to Construction Sites												Location Refer to Construction Sites			
			Upstream/Main Reservoir						Within / Re-regulation Reservoir		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
27-Apr-21	DO (mg/L)	>6.0					6.95	6.96										
28-Apr-21	DO (mg/L)	>6.0							1.43	3.14	2.69	3.29	6.41	7.03			6.5	6.24
4-May-21	DO (mg/L)	>6.0					8.87	8.8										
5-May-21	DO (mg/L)	>6.0							1.81	1.46	2.7	2.8	4.01	5.04			4.7	4.48
13-May-21	DO (mg/L)	>6.0					8.55	8.72										
14-May-21	DO (mg/L)	>6.0							1.02	1.3	2.47	2.98	4.83	5.51			6.22	6.06
17-May-21	DO (mg/L)	>6.0					8.14	8.05										
18-May-21	DO (mg/L)	>6.0							0.89	1.25	2.52	3.28	4.22	5.48			4.38	4.88
24-May-21	DO (mg/L)	>6.0					7.52	7.63										
25-May-21	DO (mg/L)	>6.0							0.92	0.69	2.16	4.56	3.7	4.65			4.62	4.27
1-Jun-21	DO (mg/L)	>6.0					6.16	6.74										
2-Jun-21	DO (mg/L)	>6.0							2.51	1.67	2.58	2.89	4.85	5.36			3.36	4.82
8-Jun-21	DO (mg/L)	>6.0					6.26	6.21										
9-Jun-21	DO (mg/L)	>6.0							2.27	3.28	7.19	6.61	6.67	6.49			6.43	6.42
15-Jun-21	DO (mg/L)	>6.0					5.88	5.85										
16-Jun-21	DO (mg/L)	>6.0							3.93	4.78	4.32	4.54	5.16	5.63			6.13	6.48
22-Jun-21	DO (mg/L)	>6.0					7.12	6.98										
23-Jun-21	DO (mg/L)	>6.0							1.06	2.46	2.35	3	5.16	5.42			5.71	6.58
28-Jun-21	DO (mg/L)	>6.0	7.38												7.88			
29-Jun-21	DO (mg/L)	>6.0					7.29	4.59										
30-Jun-21	DO (mg/L)	>6.0							1.44	4.07	6.67	6.06	6.27	5.81			6.24	6.38
5-Apr-21	Conductivity (µs/cm)		112												41			

		River Name	Nam Ngiep												Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup
		Zone	Location Refer to Construction Sites												Location Refer to Construction Sites			
			Upstream/Main Reservoir						Within / Re-regulation Reservoir		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
6-Apr-21	Conductivity (µs/cm)						68	68										
7-Apr-21	Conductivity (µs/cm)								78	77	75	75	73	72			141	48
12-Apr-21	Conductivity (µs/cm)								74	73	72	74	73	72			138	56
13-Apr-21	Conductivity (µs/cm)						68	67										
20-Apr-21	Conductivity (µs/cm)								75	75	74	76	74	73				62
21-Apr-21	Conductivity (µs/cm)						67	67										
27-Apr-21	Conductivity (µs/cm)						68	67										
28-Apr-21	Conductivity (µs/cm)								74	72	73	73	76	73			128	67
4-May-21	Conductivity (µs/cm)						67	67										
5-May-21	Conductivity (µs/cm)								74	75	74	78	73	72			129	57
13-May-21	Conductivity (µs/cm)						67	67										
14-May-21	Conductivity (µs/cm)								76	73	75	77	74	73			152	59
17-May-21	Conductivity (µs/cm)						67	67										
18-May-21	Conductivity (µs/cm)								82	80	82	81	79	78			151	67
24-May-21	Conductivity (µs/cm)						70	70										
25-May-21	Conductivity (µs/cm)								84	82	83	83	81	81			159	71
1-Jun-21	Conductivity (µs/cm)						71	71										
2-Jun-21	Conductivity (µs/cm)								82	81	81	81	80	79			99	46
8-Jun-21	Conductivity (µs/cm)						69	68										
9-Jun-21	Conductivity (µs/cm)								83	81	81	78	60	55			102	25
15-Jun-21	Conductivity (µs/cm)						71	69										
16-Jun-21	Conductivity (µs/cm)								67	65	67	68	71	65			103	32

		River Name	Nam Ngiep												Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup
		Zone	Location Refer to Construction Sites												Location Refer to Construction Sites			
			Upstream/Main Reservoir						Within / Re-regulation Reservoir		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
22-Jun-21	Conductivity (µs/cm)						71	70										
23-Jun-21	Conductivity (µs/cm)								82	80	83	86	80	79			153	37
28-Jun-21	Conductivity (µs/cm)		83												31			
29-Jun-21	Conductivity (µs/cm)						71	71										
30-Jun-21	Conductivity (µs/cm)								85	75	81	89	63	52			140	16
5-Apr-21	Temperature (°C)		27.3												23.4			
6-Apr-21	Temperature (°C)						28.34	28.82										
7-Apr-21	Temperature (°C)								23.08	23.14	23.33	23.84	24.3	24.71			28.13	27.1
12-Apr-21	Temperature (°C)								24.54	27.42	24.9	25.67	26.36	27.15			31.77	28.86
13-Apr-21	Temperature (°C)						28.42	28.38										
20-Apr-21	Temperature (°C)								23.36	23.34	23.72	24.1	24.66	26.05				28.26
21-Apr-21	Temperature (°C)						28.78	28.87										
27-Apr-21	Temperature (°C)						29.31	29.37										
28-Apr-21	Temperature (°C)								23.45	25.04	24.21	24.67	25.87	26.82			27.46	26.44
4-May-21	Temperature (°C)						30.07	29.72										
5-May-21	Temperature (°C)								23.53	23.46	24.29	24.92	26.06	26.23			28.9	28.49
13-May-21	Temperature (°C)						31.01	30.57										
14-May-21	Temperature (°C)								24.16	24.23	24.39	24.91	25.52	25.82			30.96	27.65
17-May-21	Temperature (°C)						31.51	31.04										
18-May-21	Temperature (°C)								24.28	24.53	24.48	25.15	25.43	26.07			30.33	28.4
24-May-21	Temperature (°C)						30.58	31.06										
25-May-21	Temperature (°C)								24.55	24.55	24.53	24.86	24.99	25.77			29.82	27.9

		River Name	Nam Ngiep												Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup
		Zone	Location Refer to Construction Sites												Location Refer to Construction Sites			
			Upstream/Main Reservoir						Within / Re-regulation Reservoir		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
1-Jun-21	Temperature (°C)						31.74	31.66										
2-Jun-21	Temperature (°C)								25.58	25.88	25.94	26.15	27.3	27.6			28.18	30.08
8-Jun-21	Temperature (°C)						30.77	30.17										
9-Jun-21	Temperature (°C)								25.36	25.43	25.61	25.95	25.94	26.05			27.2	25.74
15-Jun-21	Temperature (°C)						28.81	28.78										
16-Jun-21	Temperature (°C)								25.12	25.3	25.31	25.49	25.68	26.45			27.25	27.12
22-Jun-21	Temperature (°C)						31.02	30.89										
23-Jun-21	Temperature (°C)								25.07	25.67	25.3	25.77	26.06	26.38			31.22	28.22
28-Jun-21	Temperature (°C)		24.73												24.03			
29-Jun-21	Temperature (°C)						29.69	28.67										
30-Jun-21	Temperature (°C)								24.74	65.65	25.4	25.71	26.62	26.81			27.66	24.68
5-Apr-21	Turbidity (NTU)		22.32												2.54			
6-Apr-21	Turbidity (NTU)						1.48	1.58										
6-Apr-21	Turbidity (NTU)-bottom						1.31	1.17										
7-Apr-21	Turbidity (NTU)								0.49	2.44	2.48	4.81	4.21	6.8			3.83	2.35
12-Apr-21	Turbidity (NTU)								2.75	3.45	2.47	2.8	3.76	4.36			3.2	1.99
13-Apr-21	Turbidity (NTU)						2.34	2.59										
27-Apr-21	Turbidity (NTU)						0.96	0.68										
28-Apr-21	Turbidity (NTU)								0.72	1.64	1.89	1.8	1.85	2.04			2.14	2.48
4-May-21	Turbidity (NTU)						0.68	0.78	0.76	0.88	1.06	3.16	2.08	2.71			1.69	2.46
5-May-21	Turbidity (NTU)																	
13-May-21	Turbidity (NTU)						1.02	0.66										

		River Name	Nam Ngiep												Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup
		Zone	Location Refer to Construction Sites												Location Refer to Construction Sites			
			Upstream/Main Reservoir						Within / Re-regulation Reservoir		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
13-May-21	Turbidity (NTU)-bottom						0.76	0.45										
14-May-21	Turbidity (NTU)								0.83	1.34	1.06	1.22	1.28	1.9			1.04	1.61
17-May-21	Turbidity (NTU)						0.89	0.74										
18-May-21	Turbidity (NTU)								0.77	1.06	1.32	1.28	1.66	2.54			1.69	2.17
24-May-21	Turbidity (NTU)						1.32	0.97										
25-May-21	Turbidity (NTU)								0.88	1.39	1.51	1.56	1.58	2.17			1.6	2.56
1-Jun-21	Turbidity (NTU)						1.04	0.92										
2-Jun-21	Turbidity (NTU)								0.93	1.97	1.83	1.06	1.36	2.54			2.38	4.46
8-Jun-21	Turbidity (NTU)						1.18	1.08										
8-Jun-21	Turbidity (NTU)-bottom						0.96	1.06										
9-Jun-21	Turbidity (NTU)								1.85	11.9	22.9	32.2	26.2	27.3			54.1	23.9
15-Jun-21	Turbidity (NTU)						1.35	1.19										
16-Jun-21	Turbidity (NTU)								1.24	1.32	1.84	2.98	4.08	3.3			14	2.54
22-Jun-21	Turbidity (NTU)						0.79	0.68										
23-Jun-21	Turbidity (NTU)								1.12	1.4	1.16	1.44	1.57	2.01			4.34	3.29
28-Jun-21	Turbidity (NTU)		18.9												12.8			
29-Jun-21	Turbidity (NTU)						1.02	0.88										
30-Jun-21	Turbidity (NTU)								6.03	4.55	2.7	5.58	5.66	10.03			9.6	23.15
5-Apr-21	TSS (mg/L)		45.77												5.8			
6-Apr-21	TSS (mg/L)						<5	<5										
6-Apr-21	TSS (mg/L)-bottom						<5	<5										
7-Apr-21	TSS (mg/L)								<5	<5	31	32.53	22.4	47.7			<5	<5

		River Name	Nam Ngiep												Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup
		Zone	Location Refer to Construction Sites												Location Refer to Construction Sites			
			Upstream/Main Reservoir						Within / Re-regulation Reservoir		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
13-May-21	TSS (mg/L)						<5	<5										
13-May-21	TSS (mg/L)-bottom						<5	<5										
14-May-21	TSS (mg/L)								<5	<5	<5	<5	<5	9.73			<5	<5
8-Jun-21	TSS (mg/L)						<5	<5										
8-Jun-21	TSS (mg/L)-bottom						<5	<5										
9-Jun-21	TSS (mg/L)								<5	17.4	58.14	50.25	75.14	57.67			87.9	26.84
5-Apr-21	BOD_5 (mg/L)	<1.5	<1												<1			
6-Apr-21	BOD_5 (mg/L)	<1.5					<1	<1										
6-Apr-21	BOD_5 (mg/L)-bottom						<1	<1										
7-Apr-21	BOD_5 (mg/L)	<1.5							4.92	2.16	1.25	<1	<1	<1			<1	<1
13-May-21	BOD_5 (mg/L)	<1.5					<1	<1										
13-May-21	BOD_5 (mg/L)-bottom						<1	<1										
14-May-21	BOD_5 (mg/L)	<1.5							<1	1.18	<1	1	<1	<1			2.28	<1
8-Jun-21	BOD_5 (mg/L)	<1.5					<1	<1										
8-Jun-21	BOD_5 (mg/L)-bottom						<1	<1										
9-Jun-21	BOD_5 (mg/L)	<1.5							<1	<1	<1	<1	<1	<1			<1	<1
7-Apr-21	COD (mg/L)	<5.0	12.9						13.1	13.9	9.8	19.6	10.6	15	13.5		16.3	13.7
6-Apr-21	NH_3-N (mg/L)	<0.2	<0.2				<0.2	<0.2							<0.2			
6-Apr-21	NH_3-N (mg/L)-bottom						0.21	<0.2										
6-Apr-21	NO_3-N (mg/L)	<5.0	0.17				<0.02	<0.02							0.13			
6-Apr-21	NO_3-N (mg/L)-bottom						<0.02	<0.02										
5-Apr-21	Faecal coliform (MPN/100 mL)	<1,000	350												1,600			

		River Name	Nam Ngiep												Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup
		Zone	Location Refer to Construction Sites												Location Refer to Construction Sites			
			Upstream/Main Reservoir						Within / Re-regulation Reservoir		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
6-Apr-21	Faecal coliform (MPN/100 mL)	<1,000					0	0										
6-Apr-21	Faecal coliform (MPN/100 mL)-bottom						0	0										
7-Apr-21	Faecal coliform (MPN/100 mL)	<1,000							0	5	0	5	22	170			130	140
13-May-21	Faecal coliform (MPN/100 mL)	<1,000					0	0										
13-May-21	Faecal coliform (MPN/100 mL)-bottom						0	0										
14-May-21	Faecal coliform (MPN/100 mL)	<1,000							0	13	8	11	70	130			240	240
8-Jun-21	Faecal coliform (MPN/100 mL)	<1,000					4	0										
8-Jun-21	Faecal coliform (MPN/100 mL)-bottom						0	0										
9-Jun-21	Faecal coliform (MPN/100 mL)	<1,000							0	8	540	920	1,600	1,600			1,600	1,600
5-Apr-21	Total Coliform (MPN/100 mL)	<5,000	1,600												1,600			
6-Apr-21	Total Coliform (MPN/100 mL)	<5,000					2	0										
6-Apr-21	Total Coliform (MPN/100 mL)-bottom						0	0										
7-Apr-21	Total Coliform (MPN/100 mL)	<5,000							0	8	220	79	240	1,600			1,600	140
13-May-21	Total Coliform (MPN/100 mL)	<5,000					0	2										
13-May-21	Total Coliform (MPN/100 mL)-bottom						0	0										
14-May-21	Total Coliform (MPN/100 mL)	<5,000							0	79	49	40	350	170			240	920
8-Jun-21	Total Coliform (MPN/100 mL)	<5,000					4	13										
8-Jun-21	Total Coliform (MPN/100 mL)-bottom						2	0										
9-Jun-21	Total Coliform (MPN/100 mL)	<5,000							23	23	920	1,600	1,600	1,600			1,600	1,600

		River Name	Nam Ngiep												Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup
		Zone	Location Refer to Construction Sites												Location Refer to Construction Sites			
			Upstream/Main Reservoir						Within / Re-regulation Reservoir		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
6-Apr-21	TKN (mg/L)		<1.5				<1.5	<1.5							<1.5			
7-Apr-21	TOC (mg/L)		3.93						1.27	1.21	1.49	1.61	1.58	1.58	1.98		2.6	2.56
6-Apr-21	Phytoplankton Biomass (g dry wt/m^3)						2	2.8										
6-Apr-21	Phytoplankton Biomass (g dry wt/m^3)-bottom						4.2	2.8										
6-Apr-21	Total Phosphorus (mg/L)		<0.01				<0.01	<0.01							<0.01			
6-Apr-21	Total Phosphorus (mg/L)-bottom						<0.01	<0.01										
6-Apr-21	Total Dissolved Phosphorus (mg/L)						<0.01	<0.01										
6-Apr-21	Total Dissolved Phosphorus (mg/L)-bottom						<0.02	<0.01										
6-Apr-21	Hydrogen Sulfide (mg/L)						<0.02	<0.02										
6-Apr-21	Hydrogen Sulfide (mg/L)-bottom						<0.02	<0.02										

APPENDIX 5-2: EFFLUENT CAMP MONITORING RESULTS – Q2 2021

		Site Name	OSOV1	OSOV2	Main Powerhouse
		Station Code	EF01	EF13	EF19
Date	Parameters (Unit)	Guideline			
01-Apr-21	pH	6.0 - 9.0	6.79	6.92	
19-Apr-21	pH	6.0 - 9.0	6.28	6.92	6.55
06-May-21	pH	6.0 - 9.0	6.55	7.73	6.84
20-May-21	pH	6.0 - 9.0	6.26	7.52	
04-Jun-21	pH	6.0 - 9.0	6.76	7.82	
14-Jun-21	pH	6.0 - 9.0	6.87	6.74	6.85
01-Apr-21	Sat. DO (%)		56.1	74.4	
19-Apr-21	Sat. DO (%)		57.3	51.2	42.1
06-May-21	Sat. DO (%)		18.1	4.8	86.1
20-May-21	Sat. DO (%)		19.1	20.4	
04-Jun-21	Sat. DO (%)		28.7	6.21	
14-Jun-21	Sat. DO (%)		44.3	19.2	79.4
01-Apr-21	DO (mg/L)		4.39	5.41	
19-Apr-21	DO (mg/L)		4.51	3.92	3.13
06-May-21	DO (mg/L)		1.42	0.37	6.45
20-May-21	DO (mg/L)		1.46	1.55	
04-Jun-21	DO (mg/L)		1.89	1.22	
14-Jun-21	DO (mg/L)		3.5	1.51	6.01
01-Apr-21	Conductivity (µs/cm)		454	522	
19-Apr-21	Conductivity (µs/cm)		452	921	1,006
06-May-21	Conductivity (µs/cm)		553	482	1,054
20-May-21	Conductivity (µs/cm)		597	914	
04-Jun-21	Conductivity (µs/cm)		492	630	
14-Jun-21	Conductivity (µs/cm)		297	383	1,113
01-Apr-21	Temperature (°C)		27.93	30.2	
19-Apr-21	Temperature (°C)		27.64	28.32	31.2
06-May-21	Temperature (°C)		28.35	27.73	30.43
20-May-21	Temperature (°C)		29.35	29.15	
04-Jun-21	Temperature (°C)		29.02	27.22	
14-Jun-21	Temperature (°C)		27.06	28.14	29.72
01-Apr-21	Turbidity (NTU)		1.8	19.39	
19-Apr-21	Turbidity (NTU)		0.47	7.11	36.7
06-May-21	Turbidity (NTU)		2.26	2.84	7.27
20-May-21	Turbidity (NTU)		3.97	22.1	
04-Jun-21	Turbidity (NTU)		11.2	9.01	
14-Jun-21	Turbidity (NTU)		2.13	4.4	14.7
01-Apr-21	TSS (mg/L)	<50	<5	16.2	

		Site Name	OSOV1	OSOV2	Main Powerhouse
		Station Code	EF01	EF13	EF19
Date	Parameters (Unit)	Guideline			
19-Apr-21	TSS (mg/L)	<50	<5	12.2	200
06-May-21	TSS (mg/L)	<50	11.3	<5	39.3
20-May-21	TSS (mg/L)	<50	14.95	7.2	
04-Jun-21	TSS (mg/L)	<50	12.66	7.4	
14-Jun-21	TSS (mg/L)	<50	6.4	13.7	54.9
01-Apr-21	BOD_5 (mg/L)	<30	<6	<6	
19-Apr-21	BOD_5 (mg/L)	<30	<6	<6	9.3
06-May-21	BOD_5 (mg/L)	<30	12.96	41.58	7.26
20-May-21	BOD_5 (mg/L)	<30	29.49	<6	
04-Jun-21	BOD_5 (mg/L)	<30	32.99	<6	
14-Jun-21	BOD_5 (mg/L)	<30	17.23	26.4	<6
01-Apr-21	COD (mg/L)	<125	<25	81	
19-Apr-21	COD (mg/L)	<125	<25	25	313
01-Apr-21	NH_3-N (mg/L)	<10.0	5	17.3	
19-Apr-21	NH_3-N (mg/L)	<10.0	2	18.4	22.3
01-Apr-21	Total Nitrogen (mg/L)	<10.0	11.8	28	
19-Apr-21	Total Nitrogen (mg/L)	<10.0	5.41	22	28
01-Apr-21	Total Phosphorus (mg/L)	<2	1.38	1.35	
19-Apr-21	Total Phosphorus (mg/L)	<2	1.38	1.76	6.41
01-Apr-21	Oil & Grease (mg/L)	<10.0	<1	4	
01-Apr-21	Total coliform (MPN/100 mL)	<400	7	0	
19-Apr-21	Total coliform (MPN/100 mL)	<400	14	0	0
06-May-21	Total coliform (MPN/100 mL)	<400	16,000	35,000	240
20-May-21	Total coliform (MPN/100 mL)	<400	16,000	0	
04-Jun-21	Total coliform (MPN/100 mL)	<400	54,000	0	
14-Jun-21	Total coliform (MPN/100 mL)	<400	13,000	35,000	0
01-Apr-21	Faecal Coliform (MPN/100 mL)	<400	0	0	
19-Apr-21	Faecal Coliform (MPN/100 mL)	<400	2	0	0
06-May-21	Faecal Coliform (MPN/100 mL)	<400	16,000	35,000	79
20-May-21	Faecal Coliform (MPN/100 mL)	<400	16,000	0	
04-Jun-21	Faecal Coliform (MPN/100 mL)	<400	54,000	0	
14-Jun-21	Faecal Coliform (MPN/100 mL)	<400	7,900	24,000	0
01-Apr-21	Effluent Discharge Volume (L/mn)		5	4	
19-Apr-21	Effluent Discharge Volume (L/mn)		4	3	1600
06-May-21	Effluent Discharge Volume (L/mn)		4	3	1500
20-May-21	Effluent Discharge Volume (L/mn)		6	6	
04-Jun-21	Effluent Discharge Volume (L/mn)		20	6	
14-Jun-21	Effluent Discharge Volume (L/mn)		6	5	1650

		Site Name	OSOV1	OSOV2	Main Powerhouse
		Station Code	EF01	EF13	EF19
Date	Parameters (Unit)	Guideline			
01-Apr-21	Chlorination Dosing Rate (mL/mn)			30.00	
19-Apr-21	Chlorination Dosing Rate (mL/mn)			39.00	400
06-May-21	Chlorination Dosing Rate (mL/mn)			5.00	375
20-May-21	Chlorination Dosing Rate (mL/mn)			40.00	
04-Jun-21	Chlorination Dosing Rate (mL/mn)			7.00	
14-Jun-21	Chlorination Dosing Rate (mL/mn)				410
01-Apr-21	Residual Chlorine (mg/L)	<1.0		0.26	
19-Apr-21	Residual Chlorine (mg/L)	<1.0		1.76	0.98
06-May-21	Residual Chlorine (mg/L)	<1.0		0.02	0.57
20-May-21	Residual Chlorine (mg/L)	<1.0		0.98	
04-Jun-21	Residual Chlorine (mg/L)	<1.0		0.95	
14-Jun-21	Residual Chlorine (mg/L)	<1.0		0.06	0.82

APPENDIX 5-3: GROUNDWATER QUALITY MONITORING RESULTS – Q2 2021

		Site Name	Phouhomxay Village		Somseun Village	Nampa Village	Thongnoy Village	Pou Village
		Station	GPHX01	GPHX02	GSXN01	GNPA01	GTHN01	GPOU01
Date	Parameter (Unit)	Guideline						
02-Apr-21	pH	6.5 - 9.2			7.17	6.96	6.76	
05-Apr-21	pH	6.5 - 9.2						6.65
23-Apr-21	pH	6.5 - 9.2	6.1	6.15				
24-May-21	pH	6.5 - 9.2	6.08	6.27				
25-May-21	pH	6.5 - 9.2			6.69	7.06	6.51	
18-Jun-21	pH	6.5 - 9.2	6.42	6.66	7.0	6.85	6.79	
02-Apr-21	Sat. DO (%)				52.4	92.4	79.6	
05-Apr-21	Sat. DO (%)							80.7
23-Apr-21	Sat. DO (%)		44.4	35.9				
24-May-21	Sat. DO (%)		39.2	33.5				
25-May-21	Sat. DO (%)				85.1	93.3	74.3	
18-Jun-21	Sat. DO (%)		47.5	44.8	12.5	92.6	83.3	
02-Apr-21	DO (mg/l)				4.02	6.99	6.08	
05-Apr-21	DO (mg/l)							5.83
23-Apr-21	DO (mg/l)		3.62	2.95				
24-May-21	DO (mg/l)		2.97	2.54				
25-May-21	DO (mg/l)				6.07	6.8	5.39	
18-Jun-21	DO (mg/l)		3.87	3.52	5.67	7.2	6.44	
02-Apr-21	Conductivity (µS/cm)				361	397	424	
05-Apr-21	Conductivity (µS/cm)							29
23-Apr-21	Conductivity (µS/cm)		207	425				
24-May-21	Conductivity (µS/cm)		138.1	213				
25-May-21	Conductivity (µS/cm)				196.8	205.4	219.6	
18-Jun-21	Conductivity (µS/cm)		223	443	362	384	392	
02-Apr-21	Temperature (°C)				29.42	29.87	29.35	
05-Apr-21	Temperature (°C)							29.7
23-Apr-21	Temperature (°C)		25.88	26.63				
24-May-21	Temperature (°C)		27.6	27.5				
25-May-21	Temperature (°C)				31.4	29.9	30.5	
18-Jun-21	Temperature (°C)		26.48	28.07	28.01	28.33	28.95	
02-Apr-21	Turbidity (NTU)	<20			2.17	1.97	2.44	
05-Apr-21	Turbidity (NTU)	<20						4.64
23-Apr-21	Turbidity (NTU)	<20	1.23	0.69				

		Site Name	Phouhomxay Village		Somseun Village	Nampa Village	Thongnoy Village	Pou Village
		Station	GPHX01	GPHX02	GSXN01	GNPA01	GTHN01	GPOU01
Date	Parameter (Unit)	Guideline						
24-May-21	Turbidity (NTU)	<20	0.99	0.63				
25-May-21	Turbidity (NTU)	<20			0.64	0.58	0.61	
18-Jun-21	Turbidity (NTU)	<20	2.44	0.83	1.51	1.02	1.32	
02-Apr-21	Fecal coliform (MPN/100 mL)	0			6.8		49	
05-Apr-21	Fecal coliform (MPN/100 mL)	0						240
23-Apr-21	Fecal coliform (MPN/100 mL)	0	0	0				
24-May-21	Fecal coliform (MPN/100 mL)	0	4	0	0	4.5	240	
18-Jun-21	Fecal coliform (MPN/100 mL)	0	13	0	11	2	350	
02-Apr-21	Fecal coliform (MPN/100 mL)	0			6.8	240	49	
05-Apr-21	E.coli Bacteria (MPN/100 mL)	0						240
23-Apr-21	E.coli Bacteria (MPN/100 mL)	0	0	0				
24-May-21	E.coli Bacteria (MPN/100 mL)	0	4	0	0	4.5	240	
18-Jun-21	E.coli Bacteria (MPN/100 mL)	0	7.8	0	11	2	130	

APPENDIX 5-4: GRAVITY FED WATER SUPPLY MONITORING RESULTS – Q2 2021

		Site Name	Thaheua Village	Hatngiun Village	Phouhomxay Village	
		Station	WTHH02	WHGN02	WPHX02	WPHX03
Date	Parameter (Unit)	Guideline				
23-Apr-21	pH	6.5 - 8.5	6.77	6.45	7.02	6.85
24-May-21	pH	6.5 - 8.5		7.03	6.39	6.47
18-Jun-21	pH	6.5 - 8.5	6.97	7.06	7.26	7.02
23-Apr-21	Sat. DO (%)		78.2	93.8	85.2	74.7
24-May-21	Sat. DO (%)			94.8	85.2	101.4
18-Jun-21	Sat. DO (%)		92.9	105.8	85.5	77
23-Apr-21	DO (mg/L)		6.16	7.38	6.63	5.83
24-May-21	DO (mg/L)			6.71	6.3	7.08
18-Jun-21	DO (mg/L)		7.19	8.25	6.71	5.96
23-Apr-21	Conductivity (µS/cm)	<1,000	70	107	57	72
24-May-21	Conductivity (µS/cm)	<1,000		52	71.2	74.9
18-Jun-21	Conductivity (µS/cm)	<1,000	68	93	66	67
23-Apr-21	Temperature (°C)	<35	27.67	27.49	28.2	28.21
24-May-21	Temperature (°C)	<35		31.7	31	30.3
18-Jun-21	Temperature (°C)	<35	28.79	28.18	28.06	28.54
23-Apr-21	Turbidity (NTU)	<10	0.67	1.26	0.46	0.55
24-May-21	Turbidity (NTU)	<10		1.25	0.91	0.7
18-Jun-21	Turbidity (NTU)	<10	2.11	1.35	1.07	1.5
23-Apr-21	Faecal Coliform (MPN/100 mL)	0	17	34	33	49
24-May-21	Faecal Coliform (MPN/100 mL)	0		920	79	17
18-Jun-21	Faecal Coliform (MPN/100 mL)	0	11	130	79	49
23-Apr-21	E.coli Bacteria (MPN/100 mL)	0	17	27	33	14
24-May-21	E.coli Bacteria (MPN/100 mL)	0		920	49	17
18-Jun-21	E.coli Bacteria (MPN/100 mL)	0	8	130	79	49